Plastics Pioneer Interview Tapes (1952-1969) Transcripts

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Chapter 1. The Plastics Pioneers Association, Inc. (PPA) History

PPA Started with the Society of the Plastics Industry (SPI) / Plastics Industry Association

The PPA's history started with the Society of the Plastics Industry (SPI). The SPI's first meeting was held on July 30, 1935 when 75 men gathered at the Buckwood Inn in Shawnee for golf and socializing. The formal organization formed on May 24, 1937. The SPI rapidly grew through the individual and collective efforts of the resin supplies, machinery builders, and processors in the business. The organization saw large increases in meeting attendance of individuals and representatives of companies heavily engaged in the World War II effort in the early 1940's.

SPI Growth Presents a Problem and an Opportunity

The growth presented a bit of a problem to some of the members of SPI, who were finding it more and more difficult to socialize with their compatriots at the national meetings because of the increasing number of "newcomers" there. In late 1942, Herbert Spencer proposed the formation of an "Old Timers" branch of SPI who would meet socially, for less than serious purposes, during SPI's annual meetings.

Letters were sent to all the individual member of SPI soliciting membership in the group, specifying the term of 15 years of service in the plastics industry as a criterion for membership, and at their next annual meeting in May, 1943, the Directors of SPI approved the formation of the group, to be designated Plastics Pioneers. An informal organizational meeting was held to draw up a set of rules regarding the make-up of the organization, membership requirements, and conduct of the meetings, and Spencer was named Chairman.

Several years later, Spencer was quoted as describing the Plastics Pioneers as "…the men who have contributed so much to the progress of the industry; men who remember the days when they looked for plastic application that met material limitations rather than material that met the applications. They are the men who remember many little everyday annoyances that were headaches, but annoyances that made for better understanding, respect and liking (for each other) – even among competitors. So the old timers, the Pioneers, are organized to honor those of long service to the industry. It is, in a sense, a fraternal organization that facilitates a special get-together of old friends in the plastics business."

The Plastics Pioneers Association formally became an affiliate of SPI in 1948 with a constitution and by-laws.

PPA Matures over the Years

Membership in PPA was originally limited to 75 men who had completed 15 years of service to the plastics industry, and who were members of SPI. The term of involvement in the industry was later extended to 25 years, and the association with SPI was changed to be that the member had to be an SPI member – or employed at one time by an SPI member company. Limited membership grew to 100, then 200 and now (year unknown) stands at 250, exclusive of inactive and honorary members.

Mary Whitlock, long time business associate and widow of Founding member Carl Whitlock, became the first woman member of PPA in 1983. The term of service to the industry has been reduced to 20 years; and the affiliation with SPI and the requirement of employment by an SPI member company was dropped in 2000 to retain the association's emphasis on social, rather than business gatherings.

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Preserving Our History –The Tapes

PPA members recognized early on that they had an obligation to posterity to preserve the history of the plastics industry, and in 1952 many members made audio tapes of their own personal recollections of the early days of the industry, including many informal and sometimes humorous asides. These tapes are now archived by the Smithsonian Institute and Syracuse University. The Plastics History & Artifacts Committee (PHAC) of PPA continued the effort, collecting recollections of current members to "fill in the blanks" from 1953 to 1969. The PHAC was led from its inception by Glenn Beall, and Wendy Hoenig took over as chairperson upon Glenn's death in late 2025.

In 2025, the tapes were transcribed into text using a variety of tools and techniques including an Artificial Intelligence tool made by Otter.com. The document has the following chapters:

- History of the PPA and the tapes.
- A summary of the process used to transcribe the tapes.
- A background of the transcribers.
- One paragraph summary of each tape, generated with an artificial intelligence tool.
- Outlines of each tape generated with an artificial intelligence tool.
- Transcripts of each tape with a detailed Table of Contents that lists individual speaker content with a referenced tape time index where the content is found.

Improving the Transcripts

It is hoped the transcripts encourage additional content about the speakers and their companies to be shared with the Plastics Hall of Fame. If you have additional insights, stories and / or corrections please email them to: admin@plasticshof.org.

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Chapter 2. Transcribing the Tapes

Chuck DiMeglio began researching his great-grandfather, G. Victor Sammet, Sr., around 2016. One of the many Internet searches he conducted led him to the Smithsonian Institute where he found a reference to the Plastics Pioneers Association Interviews summary detailed by Wendy Shay. A few years later he purchased an audio CD of his great-grandfather's tape. The tape also included recordings of colleagues G. Victor Sammet, Sr. worked with at Northern Industrial Chemical, Company (Northern or NIC) which he co-founded in 1907.

As Chuck listened to the tape, he found that the tape cut off soon after his great-grandfather had finished reading a letter from Bart Schlesinger, the co-founder of Northern, which detailed the start of the company. Fortunately, Syracuse University Libraries had a second copy donated from the estate of Harry Dubois. This copy contained the full recording.

Chuck enrolled the help of his son, David, to transcribe the recordings of G. Victor Sammet, Hans Wanders, Fred Meacham and Gordon Brown. David, a chemistry major, a classically trained pianist with perfect pitch and excellent typist, spent many hours transcribing the interviews. Scratchy and poor sound quality added complexity to the task. Hans Wanders' recording illustrates some of the challenges. Hans mentioned a company he founded. David and his father listened to the section of the tape many times to try and get a correct spelling – with no success.

Based on his research, Chuck submitted an application for consideration to the Plastics Hall of Fame for G. Victor Sammet, Sr. In 2024 G. Victor Sammet was inducted into the Plastics Hall of Fame. Chuck was subsequently "volunteered" to serve on Plastic Hall of Fame committees including History and Events.

Chuck worked with Wendy Hoenig, chairman of the Plastics Hall of Fame Historical Committee at the time, to develop a better way to transcribe all the tapes using AI technologies. Wendy selected Otter AI as the transcription tool. The tool summarized each tape into a paragraph, outlined each tape and provided transcripts. Wendy edited the transcripts – correcting spelling mistakes and obvious errors. A time-consuming process. The tool got a lot right – but also got a lot wrong. One thing that Otter got right – the name of Hans Wanders' company. Based on the correct spelling, valuable research was able to be conducted about the Rawson Molding Company.

Chuck then exported the summaries, outlines and transcripts out of the Otter tool and into text files and then into Microsoft Word. Otter AI generated transcripts were mostly run-on text with no paragraphs. Chuck broke the text into logical paragraphs and corrected many more errors, some of which were highlighted by Microsoft Word. One other issue - some of the recordings were letters read by a moderator – so, the actual work was sometimes attributed to the speaker not the letter writer by the AI tool.

Chuck corrected many names and misspellings through numerous sources including internet searches, PPA history documents and rolls, and George Victor Sammet, Jr.'s address book. Chuck also time indexed, in the Table of Contents, each major topic discussed by each speaker for the ten tapes. The Table of Contents allows the user to jump to the exact position of the transcript by hitting the ctrl-key and left clicking the mouse. In addition, the user can listen to a specific speaker's topic listed by advancing the tape / recording to the time listed.

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Chapter 3. Backgrounds of the Transcribers

Wendy Hoenig

Wendy Hoenig is a results-oriented, global business and technology leader. Her direction, mentorship, and ability to choose winning technologies made major contributions to the plastics industry during her tenure at The Dow Chemical Company. There, she held multiple leadership and executive positions in North America and Europe from 1986 to 2010, including Global Business and R&D Director for Ventures and Business Development for the Performance Plastics & Chemical businesses and Vice President of R&D for Dow Coating Solutions.

She and her global team launched new businesses and product lines that now contribute over $1 billion in sales to Dow. Hoenig led the early-stage market development of INSITE Technology for medical, automotive, and packaging use. Later, she led the commercialization of INSPIRE™ Performance Polymers, Bluewave™ Polyolefin Dispersions, INCLOSIA, which is now leveraged for solar panels, and INFUSE™ Olefin Block Copolymers for films and elastomeric applications.

Hoenig was awarded the 2018 Women Breaking the Mold award from Plastics News and the 2018 Rice University Outstanding Engineering Alumni Award for these career achievements. For Leadership, she received the Dow Regional Genesis Award for outstanding people development. She and her Dow teams received four R&D 100 Awards. More recently, she and her team at Peak Nano were recipients of a 2021 R&D 100 Award, a 2022 Silver Edison Award, and a 2023 Gold Edison Award. She holds 16 US patents and has been published in more than 20 industry publications.

As part of her mentoring, Hoenig served on the External Advisory Board for Rice University Brown School of Engineering and was President of the Rice Engineering Alumni Board. She is a current member of and was President of the Plastics Pioneers Association from 2023-2025, which provides scholarships to students. She is a past member of the Georgia Tech external advisory board for engineering and the National Paint & Coatings Science & Technology Committee.

Hoenig founded H&H Business Development in 2010, a consulting firm that provides technology and business assessments for private equity, venture capital, and start-ups. As part of the business model for H&H, she serves as an officer at start-ups to assist with commercialization. She launched carbon nanotubes for elastomers at Molecular Rebar Design and recently retired from Peak Nano, where she helped commercialize nanolayer films for optics and capacitors.

Hoenig was elected to the Plastics Hall of Fame in 2024, serves as Secretary of the organization, and is on the Board of Directors. She is also a member of the Plastics Pioneers Association, is Immediate Past President, and is the chairperson of the Plastics History and Artifacts Committee.

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Chuck DiMeglio and the Sammet Line

Academically, Chuck earned undergraduate engineering degrees, an accounting certificate and an MBA all from the University of Virginia. He has held professional certifications from the American Institute of Certified Public Accountants and the Project Management Institute. He spent his career working in business and information technology strategy, design, and development across a broad range of industries and functions.

Chuck researched and nominated Plastics Hall of Fame members George Victor Sammet, Sr. and Hans Wanders. He currently serves on the Plastics Hall of Fame History and Events committees.

Chuck is one of five Sammet-line generations that have contributed money, time and / or expertise to Plastics Industry Association. The contributors include:

George Victor Sammet, Sr., Chuck's great-grandfather, graduated from MIT with a chemistry degree in 1901. He was mentored by Arthur A. Noyes. During his senior year he became a founding member and first president of MIT's Senior Chemistry Society, established to collaborate and knowledge-share between faculty, students and business leaders.

After graduation, he and Noyes collaborated on several projects and publications including the first published Physical Chemistry education materials in the US. He presented with Noyes in Berlin at the 1903 World Chemistry Conference. Coincidently, Dr. Baekeland presented at the same conference at about the same time and location discussing silver in photographic paper. G. Victor Sammet, Sr., an avid photographer, may have attended Dr. Baekeland's presentation. A few years later, G. Victor Sammet, Sr. was influenced and inspired by Dr. Baekeland's Bakelite paper.

After the conference, G. Victor Sammet, Sr. continued to the University of Leipzig where he studied under Robert Luther and Nobel laureate Wilhelm Ostwald. Ostwald lists G. Victor Sammet, Sr.'s Chemistry PhD dissertation as one of the top eight of the 125 he evaluated over his academic career. While studying in Leipzig G. Victor Sammet, Sr. belonged to the intellectual and social British American Club; serving a term as president.

Soon after graduation in 1906 he co-founded Northern Industrial Chemical Company (Northern) with Bart Schlesinger, an MIT chemistry classmate. Both led the company for about 50 years. The company initially started producing margarine coloring capsules filled with annatto seed extract concentrate. The margarine coloring business provided, for many years, capital to research phenols and to expand Northern molding production capabilities. The butter and margarine industries waged many lobbying battles over the years. In 1908 G. Victor Sammet lobbied, in a letter to the US Ways and Means Committee, to remove what he perceived as an unfair annatto seed extract tariff. G. Victor Sammet, Sr. understood early in his career the importance of industry lobbying that would carry over to the plastics industry.

In 1931 G. Victor Sammet, Sr. was selected as the accounting chairman for the National Electric Manufactures Association, Molded Insulation Section – a predecessor organization to the Society of Plastics Industry (SPI). He also chaired the Uniform Cost Accounting Committee.

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In 1937 G. Victor Sammet, Sr. provided the first substantial funding to start the SPI. Later in the year he signed the SPI's original Articles of Incorporation and was named interim SPI President. He was a charter member of the SPI and the Plastics Pioneers Association. He encouraged many of the Northern executives to actively participate in both organizations – several were charter members of both. Hans Wanders, a fellow Plastics Hall of Fame member and long-time Northern executive, was a charter member of the SPI and PPA where he served 12-years as the PPA's founding treasurer and 21-years as the PPA's founding secretary.

In 1952 G. Victor Sammet, Sr. and several other Northern executives shared their recollections of the early days in Plastics and the founding of Northern in the PPA tape recordings.

In 2025 G. Victor Sammet, Sr. was elected to the Plastics Hall of Fame.

George Victor Sammet, Jr., Chuck's grandfather, in the late 1920's was a self-taught banjo player with a radio show while working at General Electric in a management development program. George V. Sammet, Jr.'s musical accomplishments were particularly noteworthy given he was mostly deaf and required hearing aids his entire life. After marrying in the early 1930's he joined Northern starting at the bottom – cleaning the factory floor. He eventually worked his way up through production control, purchasing and human resources to Executive Vice President. For over 15 years George V. Sammet, Jr. taught Production Control courses at local Boston colleges.

During World War II George V. Sammet, Jr. formed the Industrial Relations Association, Inc. to develop a closer relationship between governmental agencies and industry leaders. He was the first national president. He also took the lead in promoting the new organization which worked with the plastics industry among others critical to the war effort.

In 1950 George V. Sammet, Jr. was appointed SPI chairman for the annual national conference held in co-operation with the Harvard Business School. The conference was attended by 400 SPI members representing 539 plastic company members in the United States, Canada and 13 foreign countries.

In 1951 George V. Sammet, Jr. was elected director of the SPI's New England chapter.

In the early 1950's he worked with Charlie McCormick to successfully develop and execute at Northern's Boston factory the Multiple Management Program similarly implemented at the McCormick Spice Company aimed at reducing union labor tensions and improving labor relations.

Priscilla Sammet, Chuck's mother, a retired lawyer and Certified Financial Planner (CFP), provided historical documents, insights, and editing to this document, and other documents detailing the history of Northern, her father, and her grandfather. As a teenager, she spent many days at the Northern factory on Elkins Street. She also recalls many conversations her father had with Gordon Brown and other SPI leaders.

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David DiMeglio, Chuck's son, G. Victor Sammet Sr.'s great-great-grandson, transcribed several of the PPA tape interviews including those of George Victor Sammet, Sr., Bart Schlesinger, Hans Wanders, and Gordon Brown. David was recognized as the Outstanding Senior in Chemistry at the University of Virginia with additional recognition from the American Chemical Society. As an undergraduate chemistry major he developed unique chemical dyes used in deep tissue imaging. He currently is a medical student at the University of Virginia with interests in clinical applications of artificial intelligence. David has published several articles in chemistry and medical journals and presented at several local, national, and international conferences.

Northern Industrial Chemical Company in the Movies

The Whistle at Eaton Falls, a social drama film, was released in 1951, featuring Lloyd Bridges and Dorothy Gish. In addition, Ernest Borgnine debuted his big-screen acting career in the film. The movie highlights a fictitious plastics manufacturing plant in New Hampshire with labor relations issues post-World War II. Producer Louis de Rochemont created the film as a semi-documentary. Many scenes, including the factory scenes, were filmed at Northern's Elkins Street factory located in Boston. Northern experienced labor strife and a strike similar to the movie's strife and strike. Many of the factory's employees were featured in the movie. The movie's factory owner was referred to as "the old man" – a name also given to G. Victor Sammet, Sr.

The film, long forgotten, sat in a vault deteriorating for decades. As his first film, Ernest Borgnine's death brought new interest and life to the film. An extensive restoration of the film was undertaken. In 2022 the film was re-released in a DVD format – available on Amazon.

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Chapter 4. Alphabetic Listing of Recorded Plastics Pioneers

Name	Companies	Plastic Hall of Fame Link
Albany, J. Frank	Gem Wide Corporation, Albany Albion Realty Corporation	
Backscheider, N. A.	Recto Molded Products, President	
Behr, Fred	Pacific Novelty Corporation / DuPont, Ben Hur Products/EB Kingman	
Boehmer, George H.	Celluloid / Celanese Corp., Charter member PPA	
Brannon, R.E. "Bob"	Redmanol, Bakelite Mold and Material Sales	
Brown, Alan	Bakelite Corporation, Vice President, Advertising and Public Relations	
Brown, Gordon	Bakelite Vice President	Brown, Gordon - Plastics Hall of Fame
Brown, Gordon	Discusses Eastman Cellulose Ester Plastics and Molding Methods	Brown, Gordon - Plastics Hall of Fame
Cavanaugh, Lionel	Standard Tool Company of Leominster, President & Treasurer	
Cleaves, Emery	New Jersey Button Works, Robert Heller and Associates	
Cole, Alan	Modern Plastics Trade Magazine Development	
Crane, P. Willard	Cincinnati Milling Machine Company, Vice President	
Cullom, Bill	Celluloid Corporation, Rexall Chemical Company, SPI Chicago	
Dubois, J. Harry	General Electric DuPont	DuBois, J. Harry - Plastics Hall of Fame
Estabrook, Jr., F. Reed	Northern Industrial Chemical Co., Gorham Co. Brook Molding Company	Estabrook, Jr., F. Reed - Plastics Hall of Fame
Francisco, Louis	General Manager PNR division, American Cyanamid	
Frederick, Donald S.	Rohm & Haas	
Gold, Oscar	Rothschild Keno Company, Rex Novelty, Arthoplastics Novelty Incorporated	
Grebe, John J. (Dr.)	Dow Chemical	Grebe, Dr. John J. - Plastics Hall of Fame
Grote, Walter F.	Grote Manufacturing Company, note: First Injection Molding Machine	Grote, Sr., Walter F. - Plastics Hall of Fame
Hantz, B. Frank	American Insulator Corporation	
Higgins, Siegfried	Williamson and Company, Condensite Company	
Hobson, Edwin L	Bakelite Corp., Quartermaster General, Monsanto, Gearing Plastics Co.	Hobson, Edwin L. - Plastics Hall of Fame
Kevel, John J.	General Sales Manager, Plastics Technology (Trade magazine)	
Kinnear, Ronald "Chick"	The Albany Billiard Ball Company	
Kluwerth, C. William	Original Founder and Consultant to Plastics World	
La Rose, W. T.	W. T. La Rose and Associates, Senior Vice President	
Landis, Stuart	Celanese Corporation of America	
Lester, William Morris	Pyro Plastics Corp., Precision Castings Co., Commonwealth Plastics	Lester, William M. - Plastics Hall of Fame
Lichtenberg, Charles	Monsanto, retired Vice President, Resinox Corporation	
Makeever, M.M.	Makalot Corporation	
Mannovill, Al	Apollo Manufacturing Company	
Meacham, Fred C.	Northern Industrial Chemical Company	
Mellon, Bill	Discussed by Sandy Brown, Mellon Company	
Meyer, Garson	Eastman Kodak Company, Chief Chemist, Camera Works	
Mills, Elmer E.	Northern Industrial Chemical Co., Norton Labs, Elmer E. Mills Corp., Dir. SPI	

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Moore, Sam	Inter Chemical Corporation	
Moxness, Sven	Honeywell	
Norris, Jr., Charles A. "Chick"	Bakelite Company, Assistant General Sales Manager	
O'Connor, D. J.	Formica Company, Founder	
Powell, G. M.	Union Carbide Corporation, Associate Director	
Randolph, Alan F.	Arlington Company, DuPont	
Rohm, Walter	Charles Burrows Co., Viscoloid Co., DuPont	
Rossiter, John J.	Unknown	
Sammet, Sr., George Victor	Northern Industrial Chemical Company, Co-Founder, President	Sammet Sr., Dr. G. Victor - Plastics Hall of Fame
Schenck, Lloyd G.	Boonton Molding	
Schlesinger, B. E. (Bart)	Northern Industrial Chemical Company, Co-Founder, Treasurer	
Scribner, George	Boonton Molding Company, President, Past President SPI	Scribner, George K. - Plastics Hall of Fame
Shaw, Frank	Transfer Molding Leader	Shaw, Frank H. - Plastics Hall of Fame
Slater, John G.	Tennessee Eastman Plastics	Slater, John C. - Plastics Hall of Fame
Spencer, Herb	Durez Plastics and Chemicals, Advertising and Publicity	
Swanson, J. G.	Dies and Machinery Consultant	
Taber, Harry	Discussed by Sandy Brown, Independent Laboratory	
Tinerholm, Arthur R.	Holman Manufacturing Co., Specialty Insulation Manufacturing Co., G.E.	
Vaunt, C.W.	Bakelite a Division of Union Carbide, General Sales Manager	
Wanders, Hans	Northern Industrial Chemical Company, Rawson Molding	Wanders, Hans - Plastics Hall of Fame
Wilson, James S.	Best Way Products Company	
Wokeck, E.O.	Banger Plastics Incorporated	
Plastic Hall of Fame Member		
Syracuse University Biography		

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Chapter 5. PPA Tapes – Otter AI Summaries

Tape 1, 1952 Shawnee (AC1235-RCD0001)

The Plastics Pioneers Association meeting at Shawnee Inn in 1952 featured discussions on the early development of plastics. Stuart Landis recounted Celanese's early injection molding efforts in 1927, initially using hand-operated machines. Sandy Brown discussed the first extrusion of thermosetting resins in 1912 by Harry P. Taber. Alan Brown highlighted significant milestones in the Bakelite Corporation's history, including the first light opera broadcast on radio and a symposium on industrial design in 1932. Frank Shaw detailed the development of transfer molding, which became a crucial method for thermosetting materials. Alan Cole shared the history of trade publications in the plastics industry. Walter Rohm discusses John Wesley Hyatt, Thermoplastics and Lucite. Dr. John J. Grebe discussed the evolution and impact of styrene and SARAN in the plastics industry.

Tape 2 (AC1235-RCD0002)

Garson Meyer discussed the early use of Bakelite in camera parts at Eastman Kodak, noting a 1915 Kodak camera's durability. Fred Meacham highlighted his contributions, including Bakelite buttons for the Navy and automobile distributor caps. Herb Spencer detailed Durez Plastics' history, including its 1921 founding and 1938 acquisition of phenol production rights. Hans Wanders described developing the first semi-automatic rotary molding press. M.M. McKeever recounted founding the Makalot Corporation, overcoming initial challenges, and producing significant molded parts. Charles (Chic) A. Norris Jr. shared the development of welding molds, crediting Lloyd Baldwin for repairing over 30,000 molds. B. E. Schlesinger discusses developing Roxite, a phenol resin avoiding Dr. Baekeland patent in 1908 at Northern Industrial Chemical. G. Victor Sammet discusses Roxite, margarine coloring and the development of a car ignition housing and Beetle dinnerware.

Tape 3 (AC1235-RCD0003)

Ronald Kinnear recounted the history of the Albany Billiard Ball Company and the Niagara Insul-Bake Specialty Company, highlighting the early use of celluloid and the shift to cast resin. Clint Vaunt discussed major milestones in the compression molding industry, including tableting, discharging, transfer molding, and high-frequency heating. George Scribner detailed the evolution of phenolic molding, the development of injection molding, and the introduction of melamine dinnerware. Gordon Brown shared the formation of the Society of Plastics Industry (SPI) and its growth. Sandy Brown and Lionel Cavanaugh discussed the development of plastic caps and the advancements in die and tool manufacturing for plastics.

Tape 4 (AC1235-RCD0004)

James S. Wilson discussed his career in the plastic industry, highlighting his role in developing children's records and fully automatic injection molding machines. He recounted the transition from shellac to phenolic materials and the challenges of producing phenolic parts. Wilson also

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mentioned the development of a 300-ounce injection molding machine and the introduction of styrene records. J.G. Swanson shared his experiences in molding and preforming, emphasizing the economic benefits of preform machines. Gordon Brown detailed the early development and applications of cellulose acetate plastics, including safety glass and aircraft glazing. Dr. Donald S. Frederick discussed the commercial and technical advancements of acrylic polymers, their applications in various industries, and the contributions of Otto Haas.

Tape 5 (AC1235-RCD0005)

The meeting discussed the history and development of Rohm & Haas and Formica. Rohm & Haas, formed in 1909, initially focused on leather and textile chemicals, with significant growth in acrylics post-World War II. Notable figures included Dr. Hollander, who developed the first organic insecticide. Formica, founded in 1913, initially faced patent disputes but eventually succeeded with phenolic resins. Key figures like DJ O'Connor and Jack Cochran were instrumental in developing decorative laminates and expanding the business. Formica's sales grew from $900K in 1923 to nearly $4 million in 1924. The company's innovations included using melamine resins and significant contributions to the plastics industry.

Tape 6 (AC1235-RCD0006)

P. Willard Crane recounts the development of safety glass sheeting in the 1920s and 1930s, detailing the evolution of extrusion techniques and materials. Initially, they used nitrocellulose solutions to create sheets, overcoming challenges with solvent removal and thickness variations. Dubois describes the transition from cellulose acetate to cellulose nitrate, and the development of a continuous extrusion process using a Quimby pump and specialized equipment. He also discusses the refinement of polyvinyl butyral (PVB) sheeting, which required innovative solutions for handling and embossing. The narrative highlights the technical and operational challenges faced during the Great Depression and the subsequent growth of the plastics industry.

Tape 7-1 (AC1235-RCD0007-01)

J Harry Dubois discusses the development of vinyl chloride copolymer resins for solution coatings, leading to the introduction of plasticized polyvinyl chloride and high molecular weight copolymers. He highlights the creation of "plastisols" and their rapid adoption by the Navy. Dubois also recounts the history of plastics in Leominster, Massachusetts, detailing its evolution from comb manufacturing to celluloid and cellulose acetate production, and the impact of injection molding. He mentions the development of high-frequency preheaters for thermoset molding and the use of polyester resins for military applications.

Tape 7-2 (AC1235-RCD0007-02)

The meeting discussed the contributions of various pioneers in the plastics industry. Siegfried Higgins developed phenolic materials and molding techniques. F. Reed Estabrook discusses beryllium copper molds for plastics. Elmer E. Mills pioneered injection molding and developed innovative equipment. George H. Boemer contributed to celluloid and cellulose acetate

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developments. John G. Roster, despite health challenges, was a successful plastics operator. William Morris Lester designed injection molding machines. Edwin L. Hobson developed reinforced polyester and plastics body armor. These innovators significantly advanced the plastics industry.

Tape 8 (AC1235-RCD0008)

The meeting discussed historical developments in the plastics industry, focusing on early innovations and significant figures. C. William Kluwerth's role in Bakelite's advertising in the 1920s was highlighted, along with the first all-plastic chair molded by Simmons in 1927. The Grote Manufacturing Company was credited as the first to import and use injection molding machines in the U.S., starting in 1922. E.O. Wokeck's account detailed the development of the first all-plastic chair and the challenges faced in the plastics industry. The discussion also covered advancements in molding techniques, quality control, and the evolution of plastic molding plants. Arthur R. Tinerholm, founder of Holman Manufacturing Company, discusses his early days in plastics (continued on tape 9).

Tape 9 (AC1235-RCD0009)

Arthur R. Tinerholm recounts his experiences in the early days of plastic injection molding, detailing various challenges and innovations. He describes the misapplication of materials, such as Tenite 2, and the subsequent improvements in materials and engineering. He highlights the development of nylon molding, the introduction of electronic preheating, and the significant increase in production efficiency with electronic preheaters. The speaker also mentions the founding of Holman Manufacturing, its growth, and the successful production of complex parts, including military and commercial components. He concludes by predicting a future where plastic will surpass metal in industrial applications.

Tape 10 (AC1235-RCD0010)

Bill Cullom, a manufacturer's representative in the plastics industry, detailed his career history at the Bowl Peak Country Club in 1968. He began with the Celluloid Corporation in 1936, developing pre-packaged fresh fruits and vegetables in Philadelphia. In 1945, he invented heat-sealing cellulose acetate film. Cullom co-founded the Society of Plastics Engineers in Chicago in 1941 and later established a manufacturer's representatives business in New York City. He consulted for American Machine and Foundry and Resistiflex Corporation. From 1961 to 1966, he was the European Marketing Manager for Rexall Chemical Company. Cullom emphasized the industry's evolution, noting historical milestones and technological advancements.

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Chapter 6. PPA Tapes – Otter AI Outlines

Tape 1, 1952 Shawnee (AC1235-RCD0001)

Overview

The Plastics Pioneers Association meeting at Shawnee Inn in 1952 featured discussions on the early development of plastics. Stuart Landis recounted Celanese's early injection molding efforts in 1927, initially using hand-operated machines. Sandy Brown discussed the first extrusion of thermosetting resins in 1912 by Harry P. Taber. Alan Brown highlighted significant milestones in the Bakelite Corporation's history, including the first light opera broadcast on radio and a symposium on industrial design in 1932. Frank Shaw detailed the development of transfer molding, which became a crucial method for thermosetting materials. Alan Cole shared the history of trade publications in the plastics industry. Walter Rohm discusses John Wesley Hyatt, Thermoplastics and Lucite. Dr. John J. Grebe discussed the evolution and impact of styrene and SARAN in the plastics industry.

Early Injection Molding Developments by Stuart Landis

- Stuart Landis discusses Celanese Corporation's early injection molding efforts, noting they were the first to do so in the U.S.
- Celanese acquired the Celluloid Corporation and American Salon Company, which had German patents and processes from Dr. Eichengren.
- Landis describes the first injection molding experiments in 1927, using hand-operated machines and small charges of thermoplastic powder.
- Celanese initially aimed to perfect the process and license it, but later dropped the patent claim due to rapid industry growth.

First Extrusion of Thermosetting Resins by Sandy Brown for Harry P. Taber

- Sandy Brown recounts the early extrusion of phenolic thermosetting resins by Harry P. Taber in 1912, using materials from the Condensite Company.
- Taber produced extruded rods and a four-foot-long piece with a one-millimeter hole, but the project failed due to lack of interest and high costs.
- Brown mentions Shaw's later efforts in Detroit, which also failed due to lack of markets and the rise of thermoplastics.
- The discussion highlights the challenges and failures in the early development of the plastics industry.

Significant Milestones in the Plastics Industry by Alan Brown

- Alan Brown shares his experiences with the Bakelite Corporation, introducing new resins and formulas for various industrial and consumer applications.
- He recounts significant milestones, including the first light opera broadcast on WEAF radio in 1923, which improved the quality of radio programming.
- Brown describes the first symposium on industrial design in 1932, which brought together designers to redesign products using plastics, leading to the introduction of modern designs.

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- He also mentions the development of a fully automatic compression molding press for the Chicago World's Fair in 1933, which demonstrated the manufacturing process of Bakelite molding materials.

Transfer Molding by Frank Shaw

- Frank Shaw explains the concept and development of transfer molding, which was first conceived in 1926 and reduced to commercial production in the 1930s.
- The method involved pressure casting thermosetting plastic materials into closed molds, and it was licensed to over 150 commercial and experimental plastic processes.
- Transfer molding was particularly useful during World War II and saw significant improvements with the introduction of infrared and high-frequency preheating.
- Shaw notes that the basic patents have expired, but the industry continues to use the process without royalty.

Development of Trade Magazines in the Plastics Industry by Alan Cole

- Alan Cole recounts the history of trade magazines in the plastics industry, starting with the first publication, Plastics, in 1926.
- The publication was initially small and modestly successful, but it was sold in 1929 to the Gilmore family, who struggled to keep it going during the Great Depression.
- Cole describes how the publication was later acquired by Breskin Publications in 1934, which renamed it Modern Plastics.
- The publication grew significantly, both in circulation and advertising revenue, and is now international in scope.

Historical Contributions by Walter Rohm

- Walter Rohm shares his extensive experience in the plastics industry, starting with his work as a draftsman for the Charles Burrows Company in 1907.
- Rohm highlights the contributions of John Wesley Hyatt, who invented celluloid and developed many other patents, including the Hyatt roller bearing.
- Rohm describes the development of molding equipment and molds for thermoplastics and thermosetting plastics, and his work with the Viscoloid Company and DuPont.
- He notes the transition from compression molding to injection molding with the introduction of Lucite and other plastics, which significantly improved efficiency and cost.

Technical Developments by Dr. John J. Grebe

- Dr. John J. Grebe discusses the development of styrene and its commercial production by The Dow Chemical Company.
- Grebe explains the initial interest in alkyl benzenes for thermal heat transfer fluids and the subsequent development of styrene monomer from ethyl benzene.
- The company's success in producing styrene was facilitated by other laboratory developments, such as the bromine from sea water and the sale of acid for oil wells.

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- Grebe highlights the importance of copolymerization in improving the quality of polystyrene and the development of styrene-butadiene latex for war-time applications.

SARAN and Other Plastics Developments

- Grebe briefly mentions the development of SARAN, which is now a significant selling plastic, operating at around 36 million to 50 million pounds annually.
- He emphasizes the interrelated nature of various plastics developments and the role of the laboratory in advancing the industry.
- The discussion concludes with a reflection on the importance of laboratory research and the significant contributions of various individuals and companies to the plastics industry.

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Tape 2 (AC1235-RCD0002)

Overview

Garson Meyer discussed the early use of Bakelite in camera parts at Eastman Kodak, noting a 1915 Kodak camera's durability. Fred Meacham highlighted his contributions, including Bakelite buttons for the Navy and automobile distributor caps. Herb Spencer detailed Durez Plastics' history, including its 1921 founding and 1938 acquisition of phenol production rights. Hans Wanders described developing the first semi-automatic rotary molding press. M.M. McKeever recounted founding the Makalot Corporation, overcoming initial challenges, and producing significant molded parts. Charles (Chic) A. Norris Jr. shared the development of welding molds, crediting Lloyd Baldwin for repairing over 30,000 molds. B. E. Schlesinger discusses developing Roxite, a phenol resin avoiding Dr. Baekeland patent in 1908 at Northern Industrial Chemical. G. Victor Sammet discusses Roxite, margarine coloring and the development of a car ignition housing and Beetle dinnerware.

Early Applications of Phenolic Resins in Camera Equipment

- Garson Meyer introduces himself as the chief chemist of the Eastman Kodak Company, Camera Works division.
- Meyer discusses the early use of phenolic resins in camera equipment, specifically a Kodak Special camera cataloged in 1915.
- The camera used Bakelite, which was developed by Dr. Baekeland and purchased by Eastman Kodak.
- Meyer describes the manual molding process used in 1915, including the use of gas-heated molds and hand-molding techniques.

Advancements in Molding Techniques and Material Usage

- Meyer explains that the cycle time for molding in 1915 was about 15 minutes, while modern methods could achieve a cycle time of about five minutes.
- He notes that modern methods use multiple cavity molds, which significantly increases production efficiency.
- Meyer highlights the durability of the early Bakelite parts, which are still in good condition despite the camera's age.
- Interviewer Fitzgerald praises the early commercial use of Bakelite and its impact on the industry.

Fred Meacham's Contributions to Plastics Development

- Fred Meacham introduces himself as with the Northern Industrial Chemical Company and discusses his early career in plastics.
- Meacham recounts his work with the Arlington Company and the Mineralized Rubber Company, where he produced Bakelite buttons and automobile distributor caps.
- He describes the development of Bakelite storage battery cases and other early applications of plastics in various industries.

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- Meacham notes the significant improvements in plastics production methods, such as the use of thermoplastics and injection machines.

Herb Spencer's Role in the Plastics Industry

- Herb Spencer introduces himself as in charge of advertising and publicity for Durez Plastics and Chemicals.
- Spencer provides a history of Durez, including its founding in 1921 and the development of phenol formaldehyde resins.
- He discusses the company's growth and the introduction of new processes and materials, such as the exclusive rights to a phenol manufacturing process.
- Spencer shares his personal journey in the plastics industry, including his role in developing new markets and the formation of the Pioneers group.

Hans Wanders' Innovations in Molding Techniques

- Hans Wanders introduces himself as vice president of the Northern Industrial Chemical Company and discusses his early work with the Rawson Molding Company.
- Wanders describes the development of the first semi-automatic rotary molding press for producing wall switch plates.
- He recounts his trip to Germany to investigate new molding processes using ground horn and dried blood, which were ultimately deemed impractical for the U.S. market.
- Wanders also mentions his involvement in designing domestic and commercial lighting fixtures for Graybar, which are still in use today (1952).

M.M. McKeever's Challenges in the Plastics Industry

- M.M. McKeever shares his experience in developing the Makalot Corporation, which started with a failed partnership with a German chemist.
- He describes the challenges of producing phenolic resins and molding compounds during the Great Depression.
- McKeever credits his wife, Viola B. Pompe, for her significant contributions to the company's success.
- He highlights the company's achievements, including the production of large and complex molded parts for various industries.

Charles A. Norris Jr.'s Contributions to Welding Molds

- Charles A. Norris Jr. introduces himself as Assistant General Sales Manager at the Bakelite Company.
- Norris recounts his early work with George Scribner and the development of welding molds for the plastics industry.
- He describes the successful welding of a tool steel mold, which marked the beginning of the art of welding molds.
- Norris credits Lloyd Baldwin for his significant contributions to the industry, including the repair of over 30,000 molds.

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B. E. Schlesinger, Treasurer, Northern Industrial Chemical Company

- Developing Phenol Resin Avoiding Dr. Baekeland Patent, Roxite (1908)
- Organic Compound, Red Gum from Tasmania

G. Victor Sammet's Early Work in Plastics

- G. Victor Sammet shares his early work founding the Northern Industrial Chemical Company and the development of Roxite, a molding compound.
- He describes the company's self-funding for molding compound research and molding expansion from another business producing margarine coloring (1907).
- Sammet recounts the development of a heat-resistant molding material called Roxite, which was used for ignition coil housings on cars among other things.
- He highlights the company's expansion and the introduction of new molding techniques and materials, such as Beetle for tableware.

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Tape 3 (AC1235-RCD0003)

Overview

Ronald Kinnear recounted the history of the Albany Billiard Ball Company and the Niagara Insul-Bake Specialty Company, highlighting the early use of celluloid and the shift to cast resin. Clint Vaunt discussed major milestones in the compression molding industry, including tableting, discharging, transfer molding, and high-frequency heating. George Scribner detailed the evolution of phenolic molding, the development of injection molding, and the introduction of melamine dinnerware. Gordon Brown shared the formation of the Society of Plastics Industry (SPI) and its growth. Sandy Brown and Lionel Cavanaugh discussed the development of plastic caps and the advancements in die and tool manufacturing for plastics.

Early Days of the Plastic Industry: Ronald Kinnear's Recollections

- Ronald Kinnear discusses his company, the Albany Billiard Ball Company and the Niagara Insul-Bake Specialty Company.
- He recounts the history of the Celluloid Company, founded by John Hyatt and his grandfather, Peter Kinnear, in 1868.
- The Celluloid Company faced initial challenges but eventually found success with costume jewelry.
- Kinnear mentions the involvement of Marshall Leopard in moving the company to Newark and its subsequent growth.

Evolution of the Billiard Ball Business and Plastic Industry

- Kinnear explains the continued use of nitrocellulose in billiard balls and the shift to cast resin.
- He describes the impact of World War I on the billiard ball business and the acquisition of the Niagara Insul-Bake Company.
- Kinnear highlights the diversification of the company to use various plastics and the establishment of the Niagara Insul-Bake Company.
- He reflects on his contributions to the Society of Plastics Industry (SPI) and his role as president.

Formation and Growth of the Society of Plastics Industry

- Kinnear recounts the early days of the SPI, initially a social group, and its formal organization in Shawnee.
- He mentions his role as vice president and the impact of World War II on the organization's direction.
- Kinnear credits the hiring of William T. Crews as executive secretary as a significant contribution.
- He reflects on his collaboration with Interviewer Fitzgerald and the growth of the SPI into a substantial organization.

Clint Vaunt's Contributions to the Plastic Industry

- Clint Vaunt discusses his role at the Bakelite Company and his contributions to the compression molding industry.

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- He highlights the development of tableting, discharging from the mold, and transfer molding.
- Vaunt mentions the introduction of high-frequency heating in 1941 and its impact on large-scale molding.
- He recounts the development of the first molded clock case and the first large radio cabinet in the United States.

George Scribner's Insights on Phenolic Molding

- George Scribner discusses his role as president of the Boonton Molding Company and the company's focus on phenolic molding compounds.
- He recounts the development of injection molding and the challenges faced in the early days.
- Scribner highlights the introduction of melamine dinnerware and its impact on the industry.
- He reflects on the expansion of the company's inventory and the importance of finding new markets for plastics.

R.E. "Bob" Brannon's Experience in Plastic Molding

- R.E. "Bob" Brannon shares his experience as a salesman and manager at the Bakelite Corporation.
- He recounts the development of plastic washing machine agitators and the challenges faced in replacing aluminum.
- Brannon highlights the long-term effort required to establish plastic agitators as a standard in the industry.
- He reflects on his current work in developing new phenolic molding materials for kitchen cabinets and furniture.

Gordon Brown's Role in the Plastic Industry

- Gordon Brown discusses his role at the Bakelite Company and the development of resin-bonded plywood for airplanes just after WWI.
- He recounts the collaboration with the Forest Products Laboratory and the use of phenolic resins.
- Brown reflects on his father’s involvement with Thomas Edison and the development of phenolic records.
- He shares the history of the SPI and his role in its formation and growth.

Bill Mellon Contributions to Collapsible Tubes as described by Sandy Brown

- Sandy Brown recounts the development of plastic caps for collapsible tubes and the collaboration with Bill Mellon.
- He highlights the challenges faced in the early days and the eventual resumption of plastic cap production.
- Brown reflects on the growth of the plastic caps industry and its impact on the market.
- He shares his insights on the use of various plastics in the production of collapsible tubes.

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Lionel Cavanaugh's Experience in Die and Tool Manufacturing

- Lionel Cavanaugh discusses his role at the Standard Tool Company and the development of dies for plastic products.
- He recounts the early days of celluloid manufacturing in Leominster and the transition to plastic materials.
- Cavanaugh highlights the development of injection molding dies and the challenges faced in producing accurate dies.
- He reflects on the growth of the die and tool industry and its impact on the plastic industry.
- He discusses Leominster, Massachusetts's Plastics History.

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Tape 4 (AC1235-RCD0004)

Overview

James S. Wilson discussed his career in the plastic industry, highlighting his role in developing children's records and fully automatic injection molding machines. He recounted the transition from shellac to phenolic materials and the challenges of producing phenolic parts. Wilson also mentioned the development of a 300-ounce injection molding machine and the introduction of styrene records. J.G. Swanson shared his experiences in molding and preforming, emphasizing the economic benefits of preform machines. Gordon Brown detailed the early development and applications of cellulose acetate plastics, including safety glass and aircraft glazing. Dr. Donald S. Frederick discussed the commercial and technical advancements of acrylic polymers, their applications in various industries, and the contributions of Otto Haas.

James S. Wilson's Career and Early Experiences

- James S. Wilson discusses his current company, Best Way Products Company, which manufactures children's records in polystyrene composition.
- He mentions his other company, M & W Company, which provides engineering services and develops fully automatic equipment for the record industry.
- Wilson recounts his early career as a tool maker with the General Electric Company in Schenectady, New York, starting in 1918.
- He describes his transition from ceramic division to the shellac compound division, where he worked on key switches for electric setups.

Transition to Phenolic Materials and Early Challenges

- Wilson explains the shift from shellac to phenolic materials around 1924, starting with changing key switches from shellac to phenolic buttons.
- He details the initial use of common cavity molds for pouring phenolic powder and the subsequent development of preform dies to reduce rejects.
- Wilson recalls the challenges faced with producing phenolic parts in brown materials, including mold sticking and gumming up surfaces.
- He highlights the importance of adapting work to the characteristics of each plastic material.

Development of Larger Injection Molding Machines

- Wilson discusses his role at Watson Stillman Company in 1942, where he introduced larger injection molding machines to compete with smaller machines from competitors like Reed Prentice Company.
- He describes the development of a 28-ounce machine, which was later boosted to 28 ounces to increase profitability.
- Wilson mentions the progression to larger machines, culminating in a 300-ounce machine with a 1500-ton clamp.
- He emphasizes the need for fully automatic machines due to labor conditions and the ongoing development in the plastic industry.

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J.G. Swanson's Career and Contributions

- J.G. Swanson shares his experience with the Kellogg Switzer Sports Supply Company, where he developed a design for a receiver cap to adapt to new materials like Bakelite.
- He describes his work at the Dayton Insulating Die Company, where he used the first free form machine for making Navy buttons during World War I.
- Swanson discusses the development of flash type molds and the challenges of overheating materials during the curing process.
- He highlights his contributions to the Central States, including developing molds with side pins and semi-automatic machines for making watch cases and headset parts.

Early Applications and Advancements in Acrylic Plastics at Eastman Kodak

- Gordon Brown recounts the early uses of Eastman cellulose plastic, including compression molded combs and injection molded combs in the USA.
- He mentions the development of the non-solvent method for manufacturing cellulose acetate plastic, which was adopted by the industry.
- Brown discusses the first applications for acetate, such as dentures, phonograph records, and safety box toes, and notes that none of these are currently acetate applications.
- He highlights the significant role of acetate in automotive applications, including dash control knobs for Ford in 1934 and telephone housings in 1935.

Dr. Donald S. Frederick's Career and Contributions

- Dr. Frederick discusses his education in chemistry and his graduate work at the University of Illinois, where he worked on polymers of sulfur dioxide and olefins.
- He recounts his experience studying in Germany at the University of Munich, where he learned German and took advanced courses in chemistry.
- Dr. Frederick describes his early career with Rohm & Haas, where he worked on commercial development of acrylics and brought back processes from the German company.
- He highlights the development of Plexiglas sheet and its commercial success in safety glass and other applications.

Commercial and Technical Developments of Plexiglas

- Dr. Frederick explains the early commercial applications of Plexiglas, including safety glass and leather coatings.
- He describes the process of making Plexiglas sheet, including the use of glass cells and carefully controlled polymerization in liquid baths.
- Dr. Frederick discusses the development of Plexiglas sheet for aircraft glazing and the establishment of a fabricating operation in South Gate, California.
- He highlights the importance of outdoor durability and the development of weather-stable colors for Plexiglas sheet.

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Expansion into New Markets and Technological Advancements

- Dr. Frederick discusses the expansion of Plexiglas into new markets, including illuminated signs, industrial applications, and architectural uses.
- He mentions the development of opaque and translucent colors for outdoor applications and the importance of stable pigments.
- Dr. Frederick highlights the growth of Plexiglas in the automotive industry, including lenses for lights, speedometers, and decorative applications.
- He discusses the potential for larger architectural applications and the challenges of fireproofing acrylic materials for outdoor use.

Future Prospects and Personal Reflections

- Dr. Frederick discusses the future prospects for acrylics in fibers, films, and architectural applications.
- He highlights the potential for acrylic films to protect other substrates outdoors and the importance of transparency and outdoor weatherability.
- Dr. Frederick reflects on the personal qualities of Otto Haas, founder of Rohm & Haas, including his intensity, hard work, and sincerity.
- He describes Haas as a driver who expected high standards from those he worked with and reduced complex issues to simple terms.

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Tape 5 (AC1235-RCD0005)

Overview

The meeting discussed the history and development of Rohm & Haas and Formica. Rohm & Haas, formed in 1909, initially focused on leather and textile chemicals, with significant growth in acrylics post-World War II. Notable figures included Dr. Hollander, who developed the first organic insecticide. Formica, founded in 1913, initially faced patent disputes but eventually succeeded with phenolic resins. Key figures like DJ O'Connor and Jack Cochran were instrumental in developing decorative laminates and expanding the business. Formica's sales grew from $900K in 1923 to nearly $4 million in 1924. The company's innovations included using melamine resins and significant contributions to the plastics industry.

Formation and Early Development of Rohm & Haas

- Donald S. Frederick explains the formation of Rohm & Haas in 1909 as a partnership between Haas and Rohm, with the American company getting ahead in acrylic chemistry in the 30s and 40s.
- The company initially focused on leather chemicals and textile chemicals, with the first commercial acrylics developed in the early 30s.
- Chemical research became important to Mr. Haas early on, with Dr. Hollander hired before 1920 to work on leather chemicals and organic insecticides.
- In 1920, Rohm & Haas acquired Charles Lennigan and Company, a heavy chemical company in Philadelphia, but this division was less important to the overall business.

Mr. Haas's Personal Habits and Company Practices

- Mr. Haas visited the plant on the edge of Philadelphia every Tuesday and the plant in Bristol, Pennsylvania every Wednesday, maintaining a meticulous appearance and personal habits.
- He was a stickler for cleanliness in the plants and research laboratories, ensuring the labs were cleaned up on his visit days.
- One chemist at the plant made distilled water every Wednesday afternoon to keep his glassware clean for Mr. Haas's inspection.
- Mr. Haas knew many of the people in the early days and was meticulous in his personal habits and cleanliness standards.

Development of Acrylics in Dentistry and Medical Applications

- Donald S. Frederick discusses the use of acrylics in artificial dentures, teeth, and fillings, highlighting their resistance to fluids and food materials in the mouth, as well as their moldability, tastelessness, and odorlessness.
- Acrylics were found to be the standard for dentures in the mid-30s and are still widely used today.
- Acrylics are also used in prosthetics, replacement sockets in joints, and skull plates, among other medical applications.

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- The conversation shifts to the use of acrylics in various medical applications, including prosthetics and dental work.

Development of Formica and Early Challenges

- DJ O'Connor recounts his first contact with phenol formaldehyde resins and their development at Westinghouse Electric Company, where he was a process engineer.
- DJ O'Connor urged his superior to investigate the possibilities of using these resins in electrical insulation, leading to contact with Dr. Baekeland.
- Westinghouse and General Electric were already working on phenol formaldehyde resins, and DJ O'Connor's team made motors for the Panama Canal gates, which failed due to the catalyst used by Baekeland.
- DJ O'Connor and his team developed the first laminated flat sheet using Bakelite resins, which was later used as the basis for a suit against Formica by Westinghouse.

Formica's Early Successes and Challenges

- DJ O'Connor and his team started Formica in April 1913, making tubing, commutator rings, and other small parts in hand presses.
- They negotiated with Boomer and Barshet to purchase a hydraulic press for making sheet material, which was used for industrial laminates.
- Westinghouse and Continental Diamond Fiber brought patent suits against Formica in the 1920s, but Formica won every suit in the District Court and Court of Appeals.
- DJ O'Connor recounts the development of decorative laminates, with Jack Cochran developing the urea resins that made decorative materials more stable and reliable.

Formica's Growth and Innovations

- Formica's sales grew significantly in the 1920s, with sales in 1923 being $900K and nearly $4 million in 1924.
- In 1925, the company reorganized and issued 180,000 shares of stock, selling 10% of it to the public at $16.50 a share.
- Formica developed decorative laminates, with Jack Cochran receiving the Hyatt award for his work on urea resins.
- The company faced challenges during the Depression but continued to innovate, developing new applications and materials.

Formica's Role in World War II and Post-War Growth

- During World War II, Formica produced airplane pulleys, fuse tubes, bomb burst tubes, and other war materials, doing $20 million worth of business.
- Post-war, Formica focused on decorative laminates, with significant growth and the development of the Evendale facility.
- George Clark, a key engineer at Formica, played a significant role in the company's development and was later president of SPI.

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- Formica's sales grew significantly, with the company doing close to $70 million in business by the 1950s.

J Harry Dubois' Career in Plastics

- J Harry Dubois recounts his career at General Electric, starting in the student engineering training program and working on refrigeration research.
- He developed laminated plastics for various applications, including iron handles, adding machine housings, and soap dispensers.
- Dubois worked on the development of the Toledo scale housing, which put Plascon into business, and faced challenges with mold construction and discoloration.
- He also worked on the Rolls Royce Magneto during World War II, solving problems with rubber molding and developing a new magneto using melamine.

Innovations and Challenges in Plastics Molding

- Dubois describes the development of transfer molding and the challenges of building presses and molds during World War II.
- He highlights the ingenuity of molders in using improvised materials and methods to meet production needs.
- Dubois emphasizes the importance of reading trade journals and staying informed about new developments in the plastics industry.
- He recounts his experiences with various molders and the innovations they developed, such as quick-change unit mold sets and large-scale extrusion of phenolic materials.

Development of Laminated Glass Inner Layers

- Willard Crane recounts his work at DuPont, focusing on the development of inner layers for laminated glass.
- He describes the challenges of using celluloid sheeting for laminated glass, including issues with dirt, haze, and waviness.
- Crane used a polarizing microscope to inspect the sheeting and found that stardust particles were the source of haze.
- He developed methods to improve the clarity of celluloid sheeting, including treating it with hydrochloric acid and washing it in iron-free water.

Improvements in Laminated Glass Quality

- Crane's improvements in celluloid sheeting helped establish laminated glass in the market.
- He concluded that significant improvements in quality and economics were necessary for the business to succeed.
- The nitrating operation for safety glass was moved to a plant with water of lower iron content to address the issue of iron contamination.
- Crane's work led to significant improvements in the quality and durability of laminated glass, making it a reliable product for various applications.

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Tape 6 (AC1235-RCD0006)

Overview

P. Willard Crane recounts the development of safety glass sheeting in the 1920s and 1930s, detailing the evolution of extrusion techniques and materials. Initially, they used nitrocellulose solutions to create sheets, overcoming challenges with solvent removal and thickness variations. Dubois describes the transition from cellulose acetate to cellulose nitrate, and the development of a continuous extrusion process using a Quimby pump and specialized equipment. He also discusses the refinement of polyvinyl butyral (PVB) sheeting, which required innovative solutions for handling and embossing. The narrative highlights the technical and operational challenges faced during the Great Depression and the subsequent growth of the plastics industry.

Development of Safety Glass and Initial Experiments

- P. Willard Crane recounts his summer of 1929, where he and colleagues enjoyed New York Philharmonic concerts and dined at restaurants serving prohibition-era drinks.
- During a concert, Crane's mind drifted to the safety glass problem, leading to the idea of using nitrocellulose solution with low viscosity.
- Crane proposed the idea to Ellen Randolph on the way home, suggesting a nitrocellulose solution that could be filtered through a dense medium and extruded into a cold bath.
- Ben Fields showed interest in the venture, and they began experiments, initially producing a three-inch wide sheet using different bath compositions.

Advancements in Extrusion Techniques

- P. Willard Crane describes the construction of a pilot plant capable of making a full-size sheet of 20 inches, which was a significant test due to its cost and complexity.
- The initial experiments were successful, but they faced challenges with gas pressure devices and the need for continuous solvent removal.
- They developed a Quimby pump with double interlocking screws, which provided a uniform flow despite experts' doubts.
- The extruded sheet contained thickness variations, leading to optical distortions, and they built trays for continuous solvent removal.

Improving Solvent Removal and Sheet Quality

- Crane explains the use of saturated sodium chloride for the extrusion bath and solvent removal, which improved the process significantly.
- The hot brine process reduced solvent removal time from 10-12 days to four and a half hours, making continuous production possible.
- They faced issues with stretching and shrinking in dryers, which Ben Fields solved by regulating tension automatically.

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- Problems with slitters and winders led to the development of a primitive calipering device to measure sheet thickness variations.

Overcoming Thickness Variations and Calipering Devices

- Crane details the construction of a more elaborate calipering device using dial gages and light spring pressure.
- The orifice blades were fitted with more precise means to control the flow, and differential screws were developed.
- The final calipering device used an optical lever with mirrors and projectors to measure thickness accurately.
- Despite improvements, abrupt thickness variations still caused waves in the lamination, leading to further investigations.

Discovering and Addressing Surface Imperfections

- Crane describes the discovery of small surface imperfections on the sheet-forming blades, which correlated with waves in the lamination.
- They developed a new stoning procedure to remove grinder marks and imperfections, which was later adopted as a standard.
- Cellulose acetate was beginning to be used as a safety glass inner layer, which flowed more easily during lamination.
- The results from the number one machine were promising, leading to the construction of a semi-works unit for commercial production.

Challenges with Commercial Production and Innovations

- Crane discusses the construction of the number two machine, which had a fan-shaped extrusion chamber for uniform heating.
- The machine faced issues with distortion and thickness variations, requiring compensation adjustments.
- They developed complex trays with multiple passes of sheet to ensure uniform thickness.
- The number two machine was capable of producing cellulose acetate sheet of commercial quality, but problems still needed solutions.

Developing Continuous Extrusion Processes

- Crane explains the pilot plant experiments to make the process continuous, using a screw conveyor and Quimby pump.
- The final design for the number two machine was based on laboratory work, operating well with no major problems.
- They learned about screw extruders and their effects on plastics materials, which were later applied to other plastics.
- The number two machine was brought to run cellulose acetate sheeting up to 48 inches wide, with excellent quality.

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Transition to Cellulose Nitrate and New Challenges

- Crane describes the transition to cellulose nitrate, which required a more elaborate wet solvent removal stage.
- They faced issues with drives and bearings in the solvent removal tanks, which were solved by using external bearings and drives.
- Corrosion problems led to the replacement of MonEl sheet with stainless steel, which solved the issue completely.
- They developed new compositions for safety glass inner layers, including acetyls made by reacting polyvinyl acetate with aldehydes.

Innovations in Polyvinyl Butyral Sheeting

- Crane discusses the development of polyvinyl butyral (PVB) sheeting, which had different physical characteristics from cellulose acetate and nitrate.
- They constructed a new number one machine for experimental runs, learning to extrude and handle the rubbery, sticky sheet.
- The wet part of the process was challenging due to the sheet's slippery nature, requiring roughened rolls and rubber squeeze rolls.
- The final solution involved embossing rolls with a grit-blasted pattern, which reduced the sheet's stickiness and made it handleable.

Expansion and Future Prospects

- Crane reflects on the growth of the plastics industry, from limited uses in the 20’s and 30’s to its current widespread applications.
- He expresses optimism about the future of plastics, noting their unlimited potential and the rapid advancements in materials and techniques.
- The recording concludes with a series of dictations from other plastics pioneers, each sharing their experiences and contributions to the industry including:
    - Al Mannovill of Apollo Manufacturing
    - Charles Lichtenberg of Resinox
    - N. A. Backscheider of Recto Molded Parts
    - B. Frank Hanz of American Insulator Corporation
    - Oscar Gold, Rothschild of Keno, Rex Vovelty and Arthoplastics Novelty Companies
    - Fred Behr, Pacific Novelty Corporation, DuPont and Ben Hur Products
    - Alan F Randolph of Arlington Company and DuPont
    - Emery Cleaves of New Jersey Button Works, Robert Heller & Associates
    - J. Frank Albany of Gem Wide Corporation and Albany Albion Realty Corporation.

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Tape 7-1 (AC1235-RCD0007-01)

Overview

J Harry Dubois discusses the development of vinyl chloride copolymer resins for solution coatings, leading to the introduction of plasticized polyvinyl chloride and high molecular weight copolymers. He highlights the creation of "plastisols" and their rapid adoption by the Navy. Dubois also recounts the history of plastics in Leominster, Massachusetts, detailing its evolution from comb manufacturing to celluloid and cellulose acetate production, and the impact of injection molding. He mentions the development of high-frequency preheaters for thermoset molding and the use of polyester resins for military applications.

Development of Vinyl Chloride Copolymer Resins

- G.M. Powell discusses his work on vinyl chloride copolymer resins for solution coatings, led by Arthur K Doolittle.
- The resins were used in American beer cans, leading to commercial success.
- Challenges in finding suitable solvents were addressed by introducing methyl isobutyl ketone.
- Techniques for making ultra-fine particles and improving adhesion were developed.

Commercial Interest in Plasticized Polyvinyl Chloride

- By the early 1940s, there was significant commercial interest in plasticized polyvinyl chloride.
- High molecular weight polymers and copolymers made dispersion techniques easier.
- Dr. R. W. Quarrels and Mr. C.I. Spaceard worked on non-solvent processes for making usable dispersions.
- Emulsion polymerization techniques were emphasized, leading to the development of organosols.

Introduction of Plastisol

- G.M. Powell and John F Suter coined the term "plastisol" for plasticized resin pastes.
- The term became widely accepted in the industry.
- Plastisols were used for military applications, including filling voids between conductors in degaussing cables.
- Rapid acceptance and commercialization of plastisols led to significant production at the Bakelite plant.

Historical Overview of Plastics in Leominster

- John J Kevell reviews the history of the plastics industry in Leominster, Massachusetts.
- Leominster's role in the plastics industry is highlighted, with over 83% of wage earners employed in plastics.
- The city's contribution to vocational education in plastics is noted.
- The history of comb making in Leominster, starting with Enoch Noyes in the 1760s, is detailed.

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Transition from Horn to Celluloid

- The transition from horn to celluloid in the 1860s made plastics fabrication easier.
- Leominster became the center of celluloid fabrication in the U.S.
- Celluloid was used for various products, including toys, cutlery handles, and optical frames.
- The development of cellulose acetate as a safer alternative to celluloid is discussed.

Injection Molding and Automotive Applications

- The development of injection molding by Foster Grant Company is highlighted.
- Injection molding allowed large-scale production of plastics.
- The automotive industry's use of plastics increased significantly.
- The growth of Foster Grant as a major molder and material supplier is noted.

High Frequency Heating of Thermoset Molding Compounds

- W T La Rose discusses the development of high frequency heating for thermoset molding compounds.
- The process significantly reduced cure times and improved quality.
- The first high frequency heater was built by La Rose while employed at General Electric.
- The technology was adopted by various molding plants, including Specialty Insulation Manufacturing Company.

Sven Moxness, Honeywell

- Discusses bleeding live stem into material to improve cycle times.

Early Plastics Development and Patents

- Lloyd G Shank recalls his early association with Bakelite at the Boonton Rubber Company.
- Bakelite was used for utility items like auto magnetos and insulation purposes.
- The development of Bakelite parts for radios is noted.
- Shank's collection of early plastics materials and products is highlighted.

Development of Polyester Resins

- Sam Moore discusses the development of polyester resins during World War II.
- The resins were used as replacements for drying oils in porous castings.
- The use of styrene monomer and special alkyd resins was patented.
- Post-war developments included the use of polyester resins in fiberglass laminates.

Phenolic and Vinyl Plastic Printing Plates

- Siegfried Higgins discusses his work on phenolic and vinyl plastic printing plates.

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- The development of phenolic asbestos and cotton external contracting brake linings is mentioned.
- Higgins' involvement in the development of rubber and phenolic laminated materials is noted.
- His collection of early plastics materials and products is praised.

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Tape 7-2 (AC1235-RCD0007-02)

Overview

The meeting discussed the contributions of various pioneers in the plastics industry. Siegfried Higgins developed phenolic materials and molding techniques. F. Reed Estabrook discusses beryllium copper molds for plastics. Elmer E. Mills pioneered injection molding and developed innovative equipment. George H. Boemer contributed to celluloid and cellulose acetate developments. John G. Roster, despite health challenges, was a successful plastics operator. William Morris Lester designed injection molding machines. Edwin L. Hobson developed reinforced polyester and plastics body armor. These innovators significantly advanced the plastics industry.

Siegfried Higgins' Contributions to the Plastics Industry

- J Harry Dubois discusses Siegfried Higgins' involvement in the plastics industry since 1911, including his role in the development of phenolic asbestos, cotton, and rubber phenolic laminated materials.
- Higgins' patents include phenolic metrics and compression molding phenolics, observed at the Stokes River Company, Trenton, New Jersey.
- The hydraulic press used by Higgins in 1918 was heated by circular blocks of iron, which provided erratic heat to the mold.
- Higgins has a significant collection of early plastics materials, products, and magazines, showcasing his long-term involvement in the industry.

Reed Estabrook's Discusses Beryllium Copper Molds

- J Harry Dubois mentions Reed Estabrook's work with the Graham Company, pioneering beryllium copper molds for plastics.
- Estabrook's early job involved molding a phenolic hair dryer housing with coal powder, which was later finished with a beryllium casting.
- Beryllium copper became popular for molds, and the Shaw process improved the art of making molds, extending their use.
- Estabrook introduced plastics into novelty fields, particularly in the Catholic Church and for decorative buttons.

Elmer E. Mills' Early Plastics Developments

- Elmer E. Mills started selling radio dials and sockets made of phenolic resins in 1926 for a northern industrial chemical company.
- In 1932, Mills represented Norton Laboratories in the Chicago area, soliciting custom molding business, using cellulose acetate.
- Mills started the Elmer E. Mills Corporation in 1937, focusing on new and different products, often being the first to mold new materials.
- During World War II, Mills worked closely with the services, producing parts for the proximity fuse and atomic energy programs, and designing complex molds for the M 52 fuse.

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George H. Boehemer's Career in Plastics

- George H. Boehemer joined the accounting department of the original celluloid company in 1919, transferring to sales in 1912.
- Boehemer was assigned to various offices, including Chicago, Leominster, and New York, and became General Sales Manager of the plastics division in 1932.
- Boehemer retired in 1939 due to health conditions but returned during the war to manage the plastics division in Washington, DC.
- Notable contributions include the idea of transparent windows in packages and the creation of the Plastics Pioneers in Chicago.

John G Rossiter's Achievements and Challenges

- Ruth Rossiter, wife of John G Rossiter, discusses his critical illnesses and surgery, which affected his ability to respond to pioneering reports.
- Roster's early years in plastics involved friendships with notable figures like Dr. Baekeland and Dr. DeForest.
- Rostsiter's company took the largest order ever from Betty Crocker of General Mills, involving Bisquick cutters and Skippy bowls.
- Despite his health challenges, Roster's drive and success in the plastics industry are highlighted.

William Morris Lester's Contributions to Injection Molding

- William Morris Lester started the Precision Castings Company, developing injection molding machines and molds.
- Lester's machines were the first commercial injection molding machines built in the U.S., and his designs were widely copied.
- In 1945, Lester designed special small automatic injection equipment for Pyro's exclusive use, which became the basis for automation in the industry.
- Lester entered a five-year consultant agreement with Owens Illinois to update and automate their injection molding departments.

Edwin L Hobson's Research and Development in Plastics

- Edwin L Hobson was a sales engineer for the Bakelite Corporation from 1937 to 1941, supplying technical service on phenolics and polystyrene.
- Hobson pioneered many uses of reinforced polyester fiberglass and developed plastics body armor, vinyl-coated nylon fabrics, and PVC paste.
- He introduced the first commercial usage of polyethylene film and designed the M1 helmet liner and Amazon coatings.
- Hobson served as Sales Manager of Monsanto's thermal plastic molding combine division and later as Vice President of Marketing for Gearing Plastics.

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Tape 8 (AC1235-RCD0008)

Overview

The meeting discussed historical developments in the plastics industry, focusing on early innovations and significant figures. C. William Kluwerth's role in Bakelite's advertising in the 1920s was highlighted, along with the first all-plastic chair molded by Simmons in 1927. The Grote Manufacturing Company was credited as the first to import and use injection molding machines in the U.S., starting in 1922. E.O. Wokeck's account detailed the development of the first all-plastic chair and the challenges faced in the plastics industry. The discussion also covered advancements in molding techniques, quality control, and the evolution of plastic molding plants. Arthur R. Tinerholm, founder of Holman Manufacturing Company, discusses his early days in plastics (continued on tape 9).

Bakelite's Role in Electrical Industry Advertising

- J Harry Dubois discusses C. William Kluwerth's role in Plastics World and his involvement in the electrical industry.
- Bakelite used to endorse annual multi-page glossy paper inserts in Electrical World, with Bakelite using the first and last pages on the center spread.
- Dubois mentions his job of getting industrial customers to take pages in the inserts, including manufacturers of industrial switches, twin light sockets, and molded lighting fixtures.
- Bakelite secured thousands of reprints of the inserts for direct mail use, with Alan Brown being a key figure in Bakelite's advertising efforts.

Development of the First All-Plastic Chair

- J Harry Dubois introduces E. O. Wokeck of Banger Plastics Incorporated, who discusses the first all-plastic chair molded in 1927 by the Simmons Company.
- Dubois describes his involvement with the Simmons Company in 1927 under the direction of Mr. McCullough, who had been employed by the Ford Motor Company.
- The chair required eight separate molds, produced at a total cost of $50,000, and was made of a rag-filled phenolic compound with the exception of the seat frame.
- Dubois notes that the chair was never put into production due to its weight, but he kept a prototype in constant use.

Grote Manufacturing Company's Injection Molding Innovations

- Dubois credits the Grote Manufacturing Company as the first to import the Bucha hand machine from Germany and the first injection molder in the United States, starting in 1922.
- Walter F. Grote, president of the company, provides details on the first injection molding machine built in the United States, which was automatic and not a crude hand-operated machine.
- Grote mentions the company's experience with hand machines since 1922 and their license to DuPont in 1933, which included the sale of hydraulic machines.
- Dubois concludes that the Grote Manufacturing Company was the first to import the Bucha machine and the first injection molder in the United States.

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Founder of Holman Manufacturing Company's Early Molding Experiences

- Arthur R. Tinerholm, founder of Holman Manufacturing Company, discusses his first contact with molding in 1919, molding commutator rings with shellac and mica.
- The process involved three operations: crimping one edge of the ring, forming and setting the shellac, and holding the ring in shape until it cooled.
- Arthur R. Tinerholm left the manufacturing industry in 1923 and returned to it in 1927, marketing a molding material called Colasta.
- Colasta was a phenolic formaldehyde molding compound, and Tinerholm describes the innovative methods and equipment used by Clinton Bateholts to mold various parts.

Challenges and Innovations in Molding Plastic Parts

- Arthur R. Tinerholm recounts the challenges of molding large parts, such as a daybed end, and the innovative methods used to achieve successful production.
- The molding process involved using a loading board to place the material in the mold, cooling the mold with water, and ejecting the part after it cured.
- Arthur R. Tinerholm describes the difficulties of marketing colasta due to the primitive equipment used by molders at the time.
- Despite the challenges, Arthur R. Tinerholm continued to innovate, developing methods to improve production efficiency and quality.

Transition to General Electric and Further Innovations

- Arthur R. Tinerholm discusses his transition to General Electric (GE) in 1938, where he worked in the plastic engineering department.
- He describes the use of Hennepin air presses and injection presses for molding parts, including the first shoe heels for women.
- Arthur R. Tinerholm emphasizes the importance of setting up standards of quality to maintain good customer relations.
- He recounts a specific example of setting up quality control for shoe heels, which led to improved production and customer satisfaction.

Innovations in Large-Scale Molding and Quality Control

- Arthur R. Tinerholm describes the molding of large housing parts for urea materials, which required specialized equipment and methods.
- He recounts a problem with static electricity affecting light fixture rings and the temporary solution developed by the laboratory.
- Arthur R. Tinerholm discusses the challenges of molding large parts, such as a coffee grinding machine cover, and the innovations developed to achieve successful production.
- He emphasizes the importance of quality control and the development of specialized fixtures to ensure the parts met the required tolerances.

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Transition to Taunton and Continued Innovations

- Arthur R. Tinerholm discusses the transition of equipment to Taunton and his role in heading up the engineering for commercial customers for injection parts.
- He recounts a specific example of developing a plastic part for an Ediphone dictating machine, which he turned down due to concerns about after shrinkage.
- He emphasizes the importance of continuous innovation and adaptation to meet the evolving needs of the plastic molding industry.

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Tape 9 (AC1235-RCD0009)

Overview

Arthur R. Tinerholm recounts his experiences in the early days of plastic injection molding, detailing various challenges and innovations. He describes the misapplication of materials, such as Tenite 2, and the subsequent improvements in materials and engineering. He highlights the development of nylon molding, the introduction of electronic preheating, and the significant increase in production efficiency with electronic preheaters. The speaker also mentions the founding of Holman Manufacturing, its growth, and the successful production of complex parts, including military and commercial components. He concludes by predicting a future where plastic will surpass metal in industrial applications.

Injection Molding Challenges and Solutions

- Arthur R. Tinerholm discusses the lack of design choice on materials and the arrival of an injection mold from Front, Mass.
- The Edison Park tool room was not ready, but the mold produced attractive parts.
- A severe complaint about the Edison Park led to a meeting with key executives and engineers.
- The compound company recommended Tenite 2 material, which caused issues with threaded mouthpieces.

Improvements in Plastic Injection Molding

- The injection molding business grew significantly due to improved materials and engineering knowledge.
- The cosmetic industry reached close to 500,000 per year, with main presses running around the clock.
- During the war, metal parts became scarce, leading to the use of polystyrene and acrylic compounds for lipstick closures and compacts.
- A special cooling method was developed for a heavy plunger to pass the tidal wind test.

Nylon Molding and Compression Molding Solutions

- Nylon molding compound was introduced, reducing drying time from 48 hours to 12 hours.
- The first production of molded parts using nylon molding powder was successful but faced issues with moisture absorption.
- Compression molding helped solve problems with an airspeed housing for Navy aircraft.
- The housing passed the leak test by placing it in cooling water right after molding.

Transition to Specialty Manufacturing Company

- Arthur R. Tinerholm took over management of the molding plant in Hoosick Falls, NY, dealing with a tough union.
- The introduction of W.T. La Rose's electronic preheaters increased production by 30%.
- The company produced aircraft blocks and distributor casts for Delco Remy and American XXX Company.

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- The tough union led to a year and a half delay in ironing out rough stocks.

Post-War Transition and New Business Ventures

- The company received 90% of its work from existing customers after the war ended.
- Arthur R. Tinerholm solved the wire bank problem for the telephone company by molding spacers separately.
- The company built up sales by solving leakage problems and providing injection molding services.
- Arthur R. Tinerholm founded his own business, Holman Manufacturing Company, with an order for two injection molds.

Holman Manufacturing Company's Success

- The company received an order for 100,000 parts before it had a name or equipment.
- The first part rendered itself to fully automatic production, designed as such.
- The company needed another injection machine and bought a 12-ounce Watson press.
- Arthur R. Tinerholm visited Watson's plant, where he saw pinpoint gating samples, which advanced production.

Innovative Designs and Customer Solutions

- The company designed a ring display box for Denison Manufacturing Company, using compressed air to blow off knock-on marks.
- The company produced a light meter cover for GE, using pinpoint gating to print 12 divided sections.
- The company supplied a window for a cigar vending machine, made of polystyrene with 1000 vents.
- The company built up a thermoset department during the Korean War, subcontracting work for GE.

Quality and Customer Reputation

- The company had a total loss and unpaid bills amounting to $343 over more than 21 years.
- The company's quality inspection department alerted to any rejected parts, maintaining high standards.
- The company received an inquiry from a large customer for a scope 741, automatic thermo truck molding machine.
- A director's meeting was held to approve the purchase, involving a significant amount of money.

Future of the Plastic Industry

- The plastic industry is expected to use more tons of plastic material in all metals, including steel.
- The screw feed for both thermoplastic and thermal flux will increase industrial use of plastic parts.

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- Arthur R. Tinerholm has played a small but significant role in the development of the plastic industry.
- The industry's growth has been fascinating and rewarding, keeping Arthur R. Tinerholm busy physically and mentally.

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Tape 10 (AC1235-RCD0010)

Overview

Bill Cullom, a manufacturer's representative in the plastics industry, detailed his career history at the Bowl Peak Country Club in 1968. He began with the Celluloid Corporation in 1936, developing pre-packaged fresh fruits and vegetables in Philadelphia. In 1945, he invented heat-sealing cellulose acetate film. Cullom co-founded the Society of Plastics Engineers in Chicago in 1941 and later established a manufacturer's representatives business in New York City. He consulted for American Machine and Foundry and Resistiflex Corporation. From 1961 to 1966, he was the European Marketing Manager for Rexall Chemical Company. Cullom emphasized the industry's evolution, noting historical milestones and technological advancements.

Bill Cullom's Career Overview

- Bill Cullom introduces himself as a manufacturer's representative selling plastic machinery for injection molding, extrusion, and rotational molding.
- He began his career with the Celluloid Corporation in 1936, running the first Isoma injection molding machine in the U.S.
- In 1949, he was involved in starting early applications of pre-packaged fresh fruits and vegetables in Philadelphia.
- Cullom developed a heat-sealing technique for cellulose acetate film in 1945 and co-founded the second section of the Society of Plastics Engineers in Chicago in 1941.

Early Employment and Achievements

- Cullom left the Celanese Corporation in 1949 to start a manufacturer's representatives business in New York City, which he sold in 1953.
- He was a supplier for Carlon Products, present at the installation of the first polyethylene pipe for potable water in Torrington, Connecticut.
- Between 1953 and 1961, he was a consultant to American Machine and Foundry, working on a thin glass paper impregnated with Teflon for high-temperature electrical insulation.
- Cullom also worked with Resistiflex Corporation on Teflon-reinforced tubing for aircraft and hydraulic hose applications.

European Marketing and Business Establishment

- From 1961 to 1966, Cullom served as the European Marketing Manager for Rexall Chemical Company, handling products like polyethylene, low-density polyethylene, polypropylene, and polystyrene.
- He established agents in all countries of free Europe, the Mediterranean coast area of Africa, and the Republic of South Africa.
- Cullom's work involved both engineering and establishing distributor organizations.
- Rexall discontinued their export efforts in 1966, leading Cullom to establish his current business selling injection machines.

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Historical Context and Industry Evolution

- Cullom reflects on the history of the plastics industry, tracing it back to the second Egyptian dynasty and their use of lac for decorative purposes.
- He mentions styrene monomer recorded in Berliner's lab notes of the 1830s and a 1940s industry leader's skepticism about polystyrene molding powder.
- Vertical integration in the 1940s was initially met with skepticism, but it ultimately benefited the industry.
- Cullom notes that while early techniques became complex, many have been simplified and revised to resemble their original, simpler forms.

Foreign Leadership and Technological Advancements

- Cullom highlights Central Europe's use of unplasticized PVC during World War II and South Africa's early 1960s experience with high-density polyethylene blow-molded milk bottles.
- The South African Board of Health approved the interchangeability of these bottles with glass on milk filling lines.
- Despite inducements, the public in Johannesburg did not return the bottles, leading to the project's discontinuation.
- Cullom concludes by emphasizing the U.S.'s technological edge and relative freedom compared to other regions.

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Chapter 7. Tape Transcripts with Timing Indexes

Tape 1 (AC1235-RCD0001), Shawnee Inn, Shawnee Delaware, September, 1952

Stuart Landis, Celanese Corporation of America

Interviewer Fitzgerald:

(1:30) This recording is being made at a meeting of the Plastics Pioneers Association held at the Shawnee Inn, Shawnee, Delaware on September 18th, 19th and 20th, 1952. What we hope to do is to gather from the veterans who are assembled here something of their experience and accomplishments in building this new and enlarged and vital industry. And for that purpose, we propose to interview several of our members. The first gentleman whom we're going to talk to is Mr. Stuart Landis. Mr. Landis, would you please give us your name and your connections in the industry?

Stuart Landis:

(2:30) Mr. Fitzgerald, my name is Stuart Landis. Until recently, I was Vice President and charge of the plastics division of Celanese Corporation of America since July 1 retired.

Interviewer Fitzgerald:

I believe you want to talk to us, and are going to tell us something about the very early days of the injection molding development. Is that right?

Developing the First Actual Injection Molding in the USA (2:54)

Stuart Landis:

(2:54) Well, I think that I might contribute something to the record, in view of the fact that I believe Celanese Corporation was the first to do any actual injection molding in this country, neither I nor anyone in Celanese, should take any individual credit for it, but it happened this way. Celanese was in the acetate business making artificial silk, and wanted to get into the plastics business. They thought that celluloid could do the job and acquired the Celanese acquired a controlling interest in the Celluloid Corporation.

Shortly before that, they had bought the American Salon Company, which was a paper company with certain patent rights and processes which originated in Germany, built chiefly around the inventions and discoveries of one Herr Dr. Eichengren, and many in the industry will recall the Eichengren patent. As a result of this, we acquired two very small injection machines made by Eckert Ziegler. The first ones, I believe. They were hand operated in every way, the wheel which controlled the screw which applied the pressure. The material reminded me of a freight car. What was this date? This was 1927, Arnold, in fact, it was 25 years ago this month, that we made our first experiments.

The thermoplastic powder, which of course, was acetate in our case, was put into the hopper by a teaspoon that was about the size of the charge, and the mold was heated by a tiny gas flame, which went out if the wind blew the wrong way. And we, with great diligence and patience, were able to finally mold a few small bobbins used in the electrical industry from one of several molds which we acquired from the Germans.

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Of course, it looked good, and I think the foresight of Celanese was very well taken in that today we know this as a great and marvelous industry, but in the early days, Celanese thought that they had control of the operation. And their desire was to perfect it and then license everyone. As a result of this policy, we made many enemies in the industry because an idea of this kind propagates very rapidly, and it wasn't long before many companies on both sides of the Atlantic were attempting to make injection machines and get into injection molding. The result, in the end, was that the Celanese Corporation dropped the claim to being owners of the original patent and gave any rights that they may have had for the industry.

Interviewer Fitzgerald:

(6:41) That first charge, Mr. Landis, that spoonful what was that? About a ounce, half ounce, about a half an ounce. And as indicating the progress of the industry, what is the maximum charge that they can put in an injection molding machine today?

Stuart Landis:

Well, I don't know what's been discovered since my retirement, Arnold, but I think that they now have shots up to 30 pounds, whereabouts, don't they, Lionel?

Interviewer Fitzgerald:

Well, that's remarkable evidence of the small start and the wonderful progress that's been made in this industry and one phase of it over the last 25 years.

Stuart Landis:

25 years. I think it is remarkable, Arnold.

Interviewer Fitzgerald:

Do you have any more to add? No? Thank you very much for your contribution.

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Harry Taber Discussed by Sandy Brown (8:10)

Interviewer Fitzgerald:

(8:10) Sandy Brown is sitting in a comfortable chair in front of the microphone and is going to talk to us about the first extrusion of thermosetting residence. Incidentally, we are indebted to Sandy for this recording equipment, and I'm sure that all Pioneers join me in extending him our thanks. Now, Sandy, will you tell us about your work in the thermosetting field?

Condensite Corporation Provides Material for First Extruded Phenolic Thermosetting in 1912 (8:38)

Sandy Brown:

(8:38) Thank you. Arnold, I had nothing to do with the work whatever. But 1912 there was an engineer in Wilmington, Delaware, named Harry P. Taber who had a laboratory conducting various kinds of experimental work. And he came to the Condensite Company and got some material from us. And a few weeks later, he came back with some of the most unusual pieces of extruded thermosetting material we ever saw. He had extruded rods as large as three inches in diameter, and the most amazing piece of all was one that was one half inch in diameter and had a one millimeter hole exactly centered through its entire four foot length. With a finish on the outside. He wouldn't let anyone in his factory. We did our best to help him try to sell some of his products, but our industry was at that time, so much in its infancy that nobody showed any interest. Because all he wanted to get for this material was $10 a pound, and the project folded up. I don't know what became of Harry P. Taber, but I am certain that that was the first example of extruded phenolic thermosetting materials in the United States.

Interviewer Fitzgerald:

(10:10) Did you mention the date on that Sandy?

That was 1912.

Well, since that time, has anyone picked up that experiment and proved it and made it practicable?

Sandy Brown:

There was a chap by the name of Shaw that had an extrusion machine in Detroit.

Interviewer Fitzgerald:

Who we'll hear from later.

Sandy Brown:

Oh, was he here?

Interviewer Fitzgerald:

Oh, I was thinking of Frank.

Sandy Brown:

(10:32) No, this was Trim, and he put on quite a demonstration. He built us several machines, and I don't know how many people he licensed. For a while, I believe he got an income from it, but I think within about two years' time, the project folded up again because of the fact that there wasn't any markets for

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it. In addition to which it was too expensive, particularly in few of the fact that the thermoplastics were coming onto the market.

Interviewer Fitzgerald:

Well, that's interesting, and it just goes to show that you can't build an industry without doing a lot of work that doesn't pay out, doesn't it?

Sandy Brown:

That's quite true, and it goes for any it goes for any industry.

Interviewer Fitzgerald:

Thank you very much, Mr. Brown, that's pretty cool.

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Alan Brown, Bakelite Corporation, Vice President, Advertising and Public Relations

Interviewer Fitzgerald:

(11:25) Alan Brown, Sandy's younger brother and the best golf player in the Brown Brothers family, has some interesting information to give us from his experiences in the industry over the past years. Alan, will you take over?

Introduces New Bakelite Corporation Resins and Formulas Used in Electrical Wiring, Cameras, Radios and Others, 1920's (11:42)

Alan Brown:

Well, having supervised the advertising and publicity of the Bakelite Corporation since its inception, it has been my privilege to have introduced many of the new resins and formulas developed by our research and manufacturing departments, and to have assisted our customers in the initial introduction of numerous industrial and consumer articles made from these plastic materials. Among the more significant developments was the introduction of oil soluble Bakelite resin. 254, the pink varnish industry, the luxe seen denture resins, the heat Tronic bowling, polystyrene, polyethylene materials to mention but a few.

Some of the uses made from our materials, which we helped to introduce to the public for the first time, included electrical wiring, devices, cameras, musical instruments, signs, buttons, closures, smokers, articles, hardware, printing plates and many others too numerous to mention. In looking back over the years, there were a number of incidents that occurred which I believe were significant milestones in the growth of the plastic industry because of the ultimate effect on the industry and the public as a whole. I will try to record two or three of these as I remember them.

The Radio Industry (13:14)

The first deals with the radio industry. During the year 1923 the radio industry had reached the threshold of its growth and was beginning to attract a great deal of public attention. Some of the early broadcasting programs suffered from an excessive amount of advertising by the sponsor, with a result that there was an increasing amount of criticism by the public of commercialism in radio. We, as suppliers of plastic materials to the infant radio industry, were very much concerned about this trend.

We discussed the problem with some of the radio broadcasting officials, and this finally resulted in a proposal by station WEAF which was then located at the Olien Hall at 42nd Street, that we sponsor a program of light opera. First, because opera had never been broadcast before, and they thought it would help to improve the caliber of entertainment, and that furthermore, by reducing the commercial portions of the program to an absolute minimum, we could then demonstrate to potential sponsors the manner in which a program should be organized. Through the good offices of William Menson, manager of WEAF, we negotiated to broadcast a series of light operas.

During these negotiations, there was one or one or two amusing incidents which reveal the state of the radio business during its infancy. The studio and office of WEAF in the Olien building was in one room. At one end was the manager's desk, and at the other end a raised platform with a piano on it where the artist broadcast through an extremely crude form of microphone. The room was covered with Turkish rugs in order to improve the acoustics.

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During our conversation, the telephone bell rang, and it was the man at the controls informing us that there was an excessive amount of static in the studio, which turned out to be our conversation. A few days after this, I was asked to listen to the auditions of a number of basses, tenors, contraaltos, and sopranos. Never having been to the opera and knowing nothing about music, I was about as well qualified to judge opera singing as a native of darkest Africa. My favorite form of music being barbershop quartet singing.

But shortly after this, a long haired Austrian orchestra leader arrived in my office insisting that he be allowed to demonstrate his claims of having the best orchestra in the city to accompany opera singers. To prove his case, he had brought along part of his orchestra and insisted upon running through a number of passages from Faust and the Barber of Seville, much to the confusion of the office personnel. We believe this series of broadcasts had a favorable effect, as we were told by the station management that it established a precedent in the proper use of commercials and thus led to better programming, which in turn resulted in a rapid growth of the radio industry and increasing use of plastics in numerous component parts of the radio sets, from dials to cabinets.

First Symposium on Industrial Design (16:50)

We believe another significant event was the first symposium on industrial design that we helped organize. During the depression in the year 1932, the country was in the depths of a Great Depression. People were hoarding their money, and sales were at an all-time low. We felt that if we could get some manufacturers to redesign some of their products taking advantage of the many attributes of plastic materials that they could make the public dissatisfied with what they had; thus encouraging them to spend some of their hoarded dollars and start the business cycle moving in the opposite direction.

There were a number of designers who were leaders in their respective fields, such as stage design, package design, some even in the field of fine arts. Most of these designers had been adversely affected by the depression and were looking to industry as a possible outlet for their talents. We called a meeting of these designers in our New York offices and spent several days discussing the problems of the designers in the plastic industry.

Included in this group were such well known designers as Helen Dryden, Gustav Jensen, Norman Bel Geddes, Laurel Guile, John Vassus, Joseph Sonow, Lucian Bernard, Donald Deske, George Switzer, Simon Debosier, Henry Dreyfuss and George Secia. A photograph of this group is here with submitted together with illustrations of some of the products that they designed as a result of this meeting. We made them a proposition that if they would redesign certain articles utilizing plastics to the satisfaction of the manufacturer of these items, we, in turn, would advertise the articles and feature the designers names in order to not only encourage the consumer to buy these articles to but to persuade other manufacturers to do likewise.

This series of meetings resulted in the introduction of a number of consumer articles made from plastics, which we believe were the forerunners of a great number of industrial and consumer articles that have since been produced of plastics. Many of these articles in modern designs that were both attractive and functionally more efficient. Included in this group were the Micarta Trays by George Switzer, Acousticon by Joseph Sonow, the Taylor Stormer guide by Walter Dormanti, the modern telephone receiver by Gustav Jensen, and office furniture by Lucian Bernard. We also believe, born out

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by subsequent events that this symposium on design helped bring greater recognition to the industrial design profession. For we see the results of their work reflected in almost everything we use today.

Development of a Fully Automatic Compression Molding Press (19:57)

A third incident was the development of a fully automatic compression molding press. During the installation of the Chicago World's Fair in 1933 the Bakelite Corporation was asked to install an exhibit in the Hall of Science demonstrating the various steps of the manufacture of Bakelite molding materials. Dr. Irving Lee Muscat, in charge of the chemistry exhibit at the fair, suggested that we build an automatic molding press in order to demonstrate the conversion of molding materials into a finished part.

I pointed out to them that no such device had ever been made and that therefore we did not know whether it was practical or not. Dr. Muscat pointed out that they were trying to build a dynamic exhibit, and wanted to make use of animated displays wherever possible in order to make it interesting to the public. He urged us to undertake the building of such a press, and we accepted the challenge. I made a number of rough sketches to illustrate what the fair authorities wanted. And when I returned to the Bakelite Company, I proposed that we hold a competition with a suitable prize for the most practical ideas among the members of our organization.

Drawings submitted by Godfrey Charles Gunderson of our engineering staff, won the first prize, and with the aid of an expert tool maker named Edward Alexander Ferran, the two men produced in our machine shop the first fully automatic press used for the compression molding of phenolic materials. This press is still operating and is now installed in the Bakelite exhibit in the Museum of Science and Industry in Chicago, Illinois. A copy of the patent covering the design of this press, together with a photograph of the press itself, is here with submitted. We believe that this is a significant milestone in view of the subsequent use of automatic press equipment throughout the industry.

Interviewer Fitzgerald:

(22:09) Here we have further evidence of the thought, planning and resourcefulness that have gone into the building of the plastic industry to its present size. By the way, Alan, I don't think we got into the record your official position, did we? No, I guess not. Would you put it in here? Please?

Allan Brown:

My position is vice president of the Bakelite Company in charge of advertising and public relations.

Interviewer Fitzgerald:

Thank you very much.

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Frank Shaw, Transfer Molding Leader

Pressure Casting Thermosetting Plastic Material into a Closed Mold, 1926 (22:40)

Interviewer Fitzgerald:

(22:40) Next, we're going to hear from Frank Shaw, who is generally regarded as the daddy of transfer molding. Frank, will you tell us something about this rather outstanding development.

Frank Shaw:

Well, transfer molding has been called by many other names, you know. But to me, fundamentally, it was a method of taking a thermosetting plastic material and by pressure casting, put it into a closed mold. Now it has been termed injection, plunger, check, and finless pressure casting, but I still think the transfer is the proper term.

Interviewer Fitzgerald:

Well, if I remember correctly, the industry regarded this such an important development that you were awarded the Hyatt award here a few years ago. So it would seem, from that standpoint, that the story needs to be elaborated on just a little more.

Frank Shaw:

(23:52) Well, its conception occurred in 1926. That was many years before injection machines for thermoplastics were imported from Germany or made in the United States. It was reduced to commercial production when our Navy Department required a firing pin of metal and plastic components with dimensional tolerances of zero.

Interviewer Fitzgerald:

Well, go ahead. Have you got something more on that? Technique of it?

Frank Shaw:

(24:20) Well, after several years, patents were issued, starting in 1933 and many subsequent patents have been issued. Sean Slater Company of Irvington, New Jersey assignees of the patents proceeded to license over 150 commercial and experimental plastic processes in the United States and Canada and were retained by others in foreign countries to promote its use and application.

Interviewer Fitzgerald:

In other words, this was such an important development that it interested the industry generally in certain types of work.

Frank Shaw:

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I would say so the description of the process and equipment and textbooks and publications are sufficient without any further application.

Interviewer Fitzgerald:

Did this result in an economy and certain types of building?

Frank Shaw:

(25:06) In my opinion, very much so. During World War Two, it was the solution to problems beyond the scope of conventional practices. And with the introduction of infrared and high frequency preheating, substantial gains were affected, press cycle time, speed of cure and pressure requirement were reduced over 50%.

Interviewer Fitzgerald:

Well, that sounds very interesting. Supposing you proceed with anything further you have.

Frank Shaw:

Well, today we have full automaticity as applied to transfer methods, and in many instances, it has equal the rapidity of injection molding of thermoplastics. After 17 years, most of the basic patents have expired.

Interviewer Fitzgerald:

But the industry is continuing to use the process without royalty?

Frank Shaw:

That's correct.

Interviewer Fitzgerald:

Have you anything further to add?

Frank Shaw:

Only that the raw material manufacturers and equipment suppliers should be credited with making it a highly efficient method of molding thermosetting materials.

Interviewer Fitzgerald:

Well, here we have another record of an important development that is contributed importantly to building this great plastic industry. Thank you, Frank.

Thank you. Applause.

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Alan Cole, Modern Plastics, Trade Magazine Development

History of a Plastic Industry Trade Magazine Development Starting in 1926 (26:30)

Interviewer Fitzgerald:

As industries are developed and grow. As a rule, one or more trade publications are developed and expand along with the industry. This has been the experience of the plastics industry. Alan Cole is now going to give us a history of the development of trade magazines in the plastics business. Alan, would you state the company you're connected with in your position, please?

Alan Cole:

(26:59) Well, I'm the vice president and the general manager of Modern Plastics, which is owned and operated by the Breskin Publishing Company.

Interviewer Fitzgerald:

And now, out of your long experience, will you tell us something about the early developments and the subsequent developments in trade magazines?

Alan Cole:

(27:17) Well, there have been many conflicting ideas about when the very first plastics publication was started in this country. But since I was there and part of it at the time and at the moment, I think I can really shed some authentic light on it. The year was 1926 and like many such things, the inspiration for the first public, first plastic publication was more chance. It was actually an accident. It developed from a chance remark that was dropped by a chap by the name of Irving Goldberg, who, at that time was fabricating pen barrels of celluloid.

I, at that time, was associated with another fellow by the name of Sylvan Hoffman. The company was Hoffman publications, and during the course of conversation, Irving Goldberg remarked that there was no plastic publication in existence. We didn't even know what plastics were at the time. But it sounded good, and we investigated and decided that very possibly, there was an opportunity to start a magazine. And from this meager beginning, the first publication was started in September of 1926. The publication at that time was simply called Plastics.

We ran it. It grew very, very slowly, very modestly from a humble beginning. Its first editor was a chap by the name of Karl Marx, who was a chemical patent attorney that we acquired from Washington, as the only man that we could find at that time who knew anything about plastics or what they were and had a sufficient technical background and writing ability. He became the editor. We ran the publication then for a period of three years, or until 1929. Even then, we didn't realize what we had or what the potentials of the publication were. It was very small and doing very small business.

Magazine Sold in 1929 to Mr. Gilmore

But in the spring of 1929 a trade paper broker walked into our office with another gentleman with him by the name of Gilmore. Mr. Gilmore announced that he had a son who was going to graduate from the Harvard School of Journalism in that fall, and he wanted to give him a publication as a graduating present so he could be in business for himself immediately. He wanted to know if Plastics were for sale. Well, we say, didn't know what we had and anything that we had was for sale for the right price.

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And we went out to lunch that day to the Columbia Club. During the course of that luncheon, an agreement was made and a check on deposit, and the amount of $20,000 changed hands. The publication was thereupon sold for $60,000 that represented about the gross amount that the publication was doing then from all sources of income. So it was sold in the spring of 1929 and passed into the hands of the Gilmore family.

Then, of course, came the debacle of the fall of 1929 when Wall Street broke and the Great Depression hit us. Everybody went broke, and we lost track of it for a while, because we were going broke, along with everybody else, but the little plastic publication was all that Gilmore had, and he struggled valiantly to keep it going, but he just lost his advertising one after the other. And finally, it became impossible for him to operate it any longer. He had no money left. And in order to make the thing and himself survive, he actually gave it away to a chap by the name of Billy Haynes who ran a chemical publication at that time called Chemical Markets.

I believe he gave it away in order to get a job managing it. People were doing desperate things then, and he ran it for a meager salary for several years when people were doing everything just to continue to stay alive. Meanwhile, Hoffman Publications had almost dissolved. I had moved away and joined the Breskin Publications, who, at that time, had Modern Packaging.

1934, A New Beginning (27:17)

Well, 1931 and 32 passed. Things got a little bit better and along toward 1933 and 34 in discussing the future of our business with Charles Breskin, we decided that we wanted a new publication. And both of us at that time were still very keenly interested in the whole field of plastics, and we did believe that there was a great industry coming, which was in its birthing stages at that time.

We agreed that we were going to go back into the plastics field, and if we couldn't buy the paper from the then owner, who was Billy Haynes, we would start one ourselves. In fact, we went so far at that time as to make up a complete dummy, which was done in Fortune size. But after a very short period of negotiation, Billy Haynes, who himself didn't know what he had and hadn't paid anything for it, agreed to sell it back to Breskin.

We paid Haynes in 1934 exactly $11,000 for the publication, and I again became associated with it eight years after I had started it. The first editor when it came back into the Breskin organization was a chap by the name of Earl Lugi, who, after left to become the dean of the first plastics Institute or school on the Pacific coast. Earl Lugi has since died. But the publication came back, as I say, and because we, at that time, owned Modern Packaging, to keep the family name, we changed the name from Plastics. And it had gone through another change. It was then called Plastics and Plastic Products, but we changed the names, as I said, to keep the family resemblance to Modern Plastics.

And that is the true story of the way the publication started. Of course, since then, it has grown with the industry. It is today international in scope, and boasts a circulation of over 20,000, and I doubt if you could buy it today for the same $11,000.

Interviewer Fitzgerald:

(34:06) What was the circulation when the Breskin Publications took it over?

Alan Cole:

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About 3,000. I recall very well it was about 3,000 and it had about 1100 paid.

Interviewer Fitzgerald:

And the advertising space sold has increased perhaps greater in proportion than the circulation. Is that correct?

Alan Cole:

Well, I can tell you very definitely at the time it was sold by Hoffman to Gilmore, the advertising, the yearly advertising revenue was about $35,000 to $40,000.

Interviewer Fitzgerald:

Well, that gives us a pretty complete story from the origin of the very small magazine through the development of a large one, and it has indeed kept pace for the industry. Have you anything more you want to add, Alan.

Alan Cole:

No, I think that's about the story of the true background.

Interviewer Fitzgerald:

Thank you very much.

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Walter Rohm, Charles Burrows Co., Viscoloid Co., DuPont

Interviewer Fitzgerald:

(35:25) Next, we're going to hear from one of the real old timers in the industry, Walter Rohm. In the course of many years, Walter has had a wide experience in many phases of the molding and development of the plastic group. And Walter in your own way, will you outline some of your interesting experience in history?

Starts as a Charles Burrows Company Draftsman, (35:48)

Walter Rohm:

(35:48) I was born September 4th, 1886. I served a four year machinist apprenticeship from 1902 to 1906. From 1907 to 1909, I was employed as a draftsman by the Charles Burrows Company, 141 Commerce Street, North New Jersey, where John W. Hyatt maintained his office, and I served as his draftsman also. Since John Wesley Hyatt had anticipated the principles of injection molding about 80 years ago, and he also invented celluloid, which was the forerunner of the present day thermoplastics, a few words regarding this remarkable man should not be amiss.

Discusses Charles Wesley Hyatt (37:34)

John Wesley Hyatt was born at Starkey, New York, November the 28th 1837. He had a common school education, plus one year at Eddie Town Seminary, where he excelled in mathematics. He went to Illinois at 16 years of age to become a printer, which trade he followed for 10 years. While at Albany as a journeyman printer, he working in his spare time, discovered and patented celluloid in 1870 as a substitute for ivory for pool and billiard balls. He was financed by Mr. Kinnear, Grandfather Ronald Kinnear, the present head of the Albany Pool and Billiard Ball Company and Niagara Hensel bake Specialty Company.

Hyatt moved to Newark, New Jersey in 1872 and located on Mechanic Street, now known as Edison Place, in a two story building near the center of town. He engaged the services of Charles Burrows, Sr. to build a machinery for making celluloid. Hyatt occupied one floor and Burrows the other. But after a disastrous fire, the city officials would not allow the manufacture of celluloid at the old location, and the celluloid company moved to the outskirts of Newark, which was then farm and meadowland.

Most people know or remember Hyatt as the inventor of celluloid, but do not know of his many other patents, including the Hyatt roller bearing patented in 1891. Of the 238 patents held jointly or individually by Hyatt, these two are his outstanding inventions. But just to mention a few others, he had the knife sharpener (1875), a ball turning lathe (1870), school slates (1875), bone silicate, a plastic consisting of bone and silica, patented in 1878. A lock stitch sewing machine with 50 needles for heavy machine belling in 1900. A machine for straightening and cold finishing steel shaft in 1901.

In 1881, Mr. Hyatt took up the problem of water purification and filtration, many paper and Woolen Mills, as well as cities, adopted his filters, and he introduced them in Europe in 1887. He built a filtration plant for the city of New Orleans in 1886 and lost a fortune doing so. He is an illustration of a man of great tenacity and purpose, designed, built and patented in 1891 a sugar cane Crusher, which, when tested, initially ran for about five minutes before breaking down. From this run, the percentage of juice extraction was so high that the result in refuse or bagasse was dry enough to burn. Based on this test, he worked for 20 years to perfect the machine, and previous to the time of his death in 1920 he refused to

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admit failure, and inserted a proviso in his will that his son was to spend an additional sum of money before calling quits.

The remarkable thing about Hyatt's patents is that not one of them has any reference to the printing industry in which he served his apprenticeship. So much for the father of the plastics industry.

When I started as a draftsman for the Charles Burrows company in 1907, Charles F. Burrows had succeeded his father, who had passed on. At that time, the only Plastics of any consequence were peroxylin plastics such as celluloid, fibroid, pyriline, zylenite and so forth, shellac mixtures and hard rubber. Because Burrows was a pioneer in building hydraulic equipment and molds for peroxyline plastics, and later on, for Bakelite, and since Hyatt had his office with Burrows, customers came from all over the world to obtain advice and purchase equipment.

Moves on to the (DuPont) Viscoloid Company, 1917 (40:00)

I left the Charles Burrows Company in 1909 and went to the Middle West. In 1917 I was employed by the Viscoloid Company in Leominster, Massachusetts, later to become the DuPont Viscoloid Company. My father, John C. Rohm, was Chief Engineer at the Viscoloid Company for 28 years, and had been chief engineer for the Celluloid Company for 21 years, so that at the time of his retirement, he had 49 years of service in this field. In 1919 I returned to the Charles Burrows Company as Chief Engineer. Henry J. Cash, Sr. was superintendent, but in 1921 he left. And with Chris Kers formed the Kers-Cash Company in Dayton, Ohio.

Charles Burrows was the inventor of the rodless press, tilting head press, angle molding press and several types of directly heated and mounted molds for semi-automatic operation for thermoplastics and thermosetting plastics. From 1919, onward, there was a steady improvement in the quality of the phenolics, in the ureas, the molding equipment and molds for molding them, with a constant addition of new companies entering this field.

The Burrows Company, which succeeded the Charles Burrows Company, was liquidated in 1932, and the assets taken over by the Watson Stillman Company. From 1934 to 1935, I was a plastics consultant for AC Spark Plug Company, and developed molding equipment and molds for compression molding spark plugs from a ceramic base and phenolic binder. This method was later superseded by injection molding.

Joined DuPont Company Research Department to Develop Lucite, 1935 (41:26)

In 1935 I joined E. I DuPont Nemours and Company Research Department, plastics division, Arlington, New Jersey to help develop Lucite and promote the commercial use of same. In 1937, I was transferred to technical service, a branch of the sales department as a field service engineer. The first commercial molder of Lucite was the Gorham Company. In 1937 they molded the chem playing card box, which was compression molded.

In 1938 Norton laboratories compression molded the first Lucite parts for the Hudson automobile and later the seven Lucite rods, which were across the face of the Wurlitzer Jukebox, used for decorative and lighting effect. Other automotive items such as hood emblems, horn buttons, dials and buttons followed in quick succession and were compression molded by Reynolds Spring Company, Electric Auto Light Company, General Industries, Northern Industrial Chemical Company, Chicago Molded Products Company, American Insulator Company, and Inland Manufacturing division of General Motors. Kers

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Cash Company were first to mold capsule holders for Eli Lilly, and JC Stimson of Chicago was first to mold reflectors of Lucite.

With the introduction of an injection grade of Lucite in 1939 the compression molding of Lucite, which required alternate heating and chilling and a large number of cavities for small items, soon gave way to injection molding, which was faster and more economical. Today in 1952, probably 95% of all Lucite items are injection molded by all of the previously mentioned compression molders and a host of molders listed in the SPI directory. Fuller Brush Vulcanized Rubber, Hughes Autograph Brush, and Prophylactic were the first to mold thick cross sections in Lucite for brush backs.

All reflectors are presently injection molded as are hood ornaments, panels, dials and so forth. Previous to World War Two, DuPont had developed an injection grade of nylon molding powder and a grade of polyethylene molding powder. Also these two molding powders were allocated during the war and used only for items essential to the war Afrin at the present time, molded nylon and polyethylene are finding an ever expanding field, especially in items for industrial use.

Interviewer Fitzgerald:

(43:51) Well Walter, the information you've given us will be a welcome addition to the writing the history of the plastic industry, and particularly the details you gave us about Mr. Hyatt, who was the original inventor, and Mr. Burrows, who did such a fine job in developing machinery. Tell me, aren't you retired now?

Walter Rohm:

I was retired in October the 1st, 1952.

Interviewer Fitzgerald:

But still doing a little consulting work?

Walter Rohm:

I'm actively employed three days a week by the Bolton Molding Company, and do consulting work in my spare time.

Interviewer Fitzgerald:

Well, thank you very much, Walter.

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Dr. John J. Grebe, Dow Chemical

Newer Plastic Development at Dow Chemical (45:00)

Interviewer Fitzgerald:

We're now going to hear from a gentleman who has participated in a very successful way in the technical development of some of the newer plastics. Dr. John J. Grebe. Dr. Grebe, would you tell us the company you're associated with and the position you hold there?

Dr. John J. Grebe:

I'm with The Dow Chemical Company, and right now I am the research counselor, very broad in general, in its nature.

Interviewer Fitzgerald:

Well, I believe your company has done an outstanding job in the development of styrene. And would you be good enough to give us a little history of that and any comments you may wish to make on the development growth of that particular kind of plastic.

Styrene Gets Going, 1926 (45:44)

Dr. John J. Grebe:

(45:44) As you well know, styrene isn't a new thing. It's 100 years old, but styrene didn't really get going in a big way until at the beginning of this last war. So the history is rather up and down. One of the interesting things that developed, that brought this all about, really, was the study of top thermal heat transfer fluids. We found that while diphenyl oxide was a very good material, it had a rather high melting point. And in looking around for lower melting point materials, but still have fairly high boiling point, they ran into the alkyl benzenes, polyethyl benzenes, benzene cumene, in other words, and things of that type. And those were particularly interesting because they were so stable thermally at the same time that they had low melting points.

But they never got quite the low cost in these that we would like, nor the high boiling point that was wanted. So that was our first contact with those. And that was started about 1926-27. Then later, when the depression hit us pretty hard as everybody else, we wanted to know what we might do with the resources and the processes and facilities and know how that we'd accumulated over the years. So we made a chart. I laid out on one axis all of the materials and the raw materials that we had, particularly in some of the intermediates and on the other chart, other access the processing techniques and facilities that we had that might go with these materials.

After filling in a few of the spaces to show the fellows what I was after, I asked them in the laboratory to each go through the whole list and fill in every space with as many new things as possible. Forgetting the

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old because we knew the old would naturally be filled in by the fact that they were selling them. And Bob Grasbach, one of the men who had had quite a various background experience, was the one who suggested that we really make some of these alkyl benzenes that we've been looking and studying before. And that was a very favorable sort of a thing.

We immediately decided that that was to be done. So, he had experience in the Friedel-Craft reactions and made some ethyl benzene, purified it, and everything looked very fair. Next, we also have had, in the meantime, experience in cracking Ethane to ethylene, also oil and kerosene, by the use of very high temperature steam. Steam at around 1400 centigrade, mixed with the hydrocarbon, with the crack to ethylene, acetylene and things of that type, propylene, butylene. And that process, which I had worked out just a couple of years before, was used to then to crack the ethyl benzene to vinyl benzene to styrene monomer. And it really worked out really very well. We thought so much of it that we started using all sorts of catalysts.

Found that charcoal was a very good catalyst, and of course, later discovered that the Germans had independently developed some of this themselves. All this would never have been done if it hadn't been for the fact that, in spite of the Depression, we were making very good money on a number of developments that started in the laboratory. Such as the bromine from sea water and the sale of acid for treating oil wells, and of course, the resulting increase in oil production in Michigan, which gave us a decrease in fuel cost for the company, which amounted to as much as $1,000 a day.

That's the kind of a thing that gave us the leeway to spend money on this crazy thing that nobody could prove to be of any value, because all the examples of polystyrene that had been made were either entirely out of question from the point of view of price, because they were made from phenyl ethyl alcohol, or they were no good.

Interviewer Fitzgerald:

How long the time elapsed between your first laboratory experiments and the date in which your company went into commercial production of styrene?

Dr. John J. Grebe:

Seven years.

Interviewer Fitzgerald:

Seven years. And do you happen to know the annual consumption of approximate annual consumption of styrene for last year?

Dr. John J. Grebe:

Oh, it's so way up to 200 million pounds or thereabouts,

New Styrene Types (50:58)

Interviewer Fitzgerald:

(50:58) So that it is one of the highest selling plastics today, and due to its fine working qualities and it's enabling industry to make a lot of things out of plastics which they have not been able to make before. Now have you anything further you want to say on the styrene?

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Dr. John J. Grebe:

Well, we might mention the really new developments in polystyrene that have been coming along since the important thing that we got into immediately was improving the quality of the styrene polymer by copolymerization. For example, the village had to have something tougher and stronger. And of course, in '38 and '43 we went through quite a range of those materials, particularly the methyl styrene and vinyl cyanide copolymers with vinylidene chloride. It really worked out well, especially when early in the war the styrelized latex was developed in order to produce the formers that were formed films and drying direct from the water emulsion.

Interviewer Fitzgerald:

Well, I think this is going to give posterity a pretty good idea of some of the things involved in developing new plastic. Now your company has also developed another outstanding product in SARAN. Would you comment on that, please?

Saran (52:28)

Dr. John J. Grebe:

SARAN was a byproduct of the development of our ethylene process in making ethylene actually makes propylene and butylene, another comonomer which when chlorinated gave us a nice mixture of something that nobody had any use for. So going went ahead and tried to produce a ultra-ethylene, or perchlorethylene, high temperature chlorination. And as a biographer, quite unwanted and troubled them. At first, we found a material that polymerized on distillation and handling, which we discovered to be the unsymmetrical dichloroethylene, or the now called RAM. The material was rather hard to polymerize. In fact, we had the two it by sending cowboys out into the sun, and then it was polymerized. We paid a month. But even the very first of this fellas that we agglomerated in the laboratory and put them under pressure and then heated in front of an existing orphan, heated with a soldering iron, we were able to make ultra-strong, fine crystallized, oriented plastic.

Interviewer Fitzgerald:

That too has developed into the large selling plastic in the millions of pounds. Has it not?

Dr. John J. Grebe:

Well, it has operating at around 36 million or 50 million a year, now very rapidly, because it is low cost.

Interviewer Fitzgerald:

Well, we have about two minutes left on this reel. Have you got anything you'd like to add is in that two minutes?

Dr. John J. Grebe:

Well, I think it's hard to mention that how all these things are so interrelated, how improbable it is that any one of these things could have come along without the other. The laboratory was called the Physics laboratory. Just because I happened to be a physicist and I came to Midland in 1974, but actually it turned out to be anything we used physical proof or another people did for our analytical and measure techniques. But actually, at the end, it turned out to be a Plastics laboratory too.

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Interviewer Fitzgerald:

Well, that's a fine addition to the point we're making here. Thank you very much.

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Tape 2 (AC1235-RCD0002)

Garson Meyer, Chief Chemist Eastman Kodak Company, Camera Works

Plastics in Cameras (0:13)

Interviewer Fitzgerald:

(0:13) We now come to gentlemen in the course of our recording who has spent a great many years in the industry and is tentatively associated with the utilization of plastics in camera, in cameras and Mr. Garson Meyer, Mr. Meyer, will you state your company and your position with it? Please?

Garson Meyer:

(0:32) Yes, sir. I'm chief chemist of the Eastman Kodak Company, Camera Works division at Rochester, New York, and our interest in plastics lies largely in the photographic equipment. We have been discussing this morning just what constitutes a pioneer in the industry. And I think I have here an example which may illustrate an early application of phenolic resins in a piece of photography equipment. We certainly want to hear about that. I have here a 1A Autographic Kodak special, which we actually cataloged in 1915.

I, at that time, was working at the Camera Works during the summer months while I was going to school, and actually molded some of these side panels personally. Our interest of that in 1915 was stimulated largely by the close association that existed at that time between Dr. Baekeland and Mr. Eastman. You probably will recall that the Eastman Kodak Company purchased from Dr. Baekeland, the patents for Velox paper. And with the funds that Dr. Baekeland received at that time began, he began experimenting to find the resin, which we now know as Bakelite. And because of that close association,

Mr. Eastman became interested to see whether we could use the phenolic resins in our camera products. Before we applied Bakelite to this particular part, we were using a die cast resin, and we had to develop a press from existing equipment we then had in the plant. We used an old hydraulic press. The molds were gas heated at the time, we had individual molds, hand molds, the powder was sprinkled into the bottom of the mold, and we then placed a piece of impregnated paper over the powder and placed our inserts on the paper, and then powdered some more, sprinkled some more powder on the surface, and molded in that manner.

You will note that we took advantage of the intrinsic beauty of the phenolic resin itself, rather than trying to simulate the leather which was the case in so many other applications where we felt that we had to try to indicate that phenolic resins were a substitute for something else. In this case here, we actually use a geometric design, and as you see, have evolved a rather good looking product.

Interviewer Fitzgerald:

(3:44) How long did it take you to make one molding?

Garson Meyer:

As I recall, the cycle at that time was about 15 minutes for a single for a single molding.

Interviewer Fitzgerald:

Have you any idea how many of those could be turned out for a minute by modern methods.

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Garson Meyer:

Well, my guess would be the cycle today for a job similar to this would probably be in the neighborhood of possibly five minutes complete cycle. And we would use multiple cavity molds, of course, six or eight cavities instead of the single cavity at that time.

Interviewer Fitzgerald:

This must have been one of the earliest commercial uses of Bakelite. Was it not?

Garson Meyer:

(4:31) As I know it is one of the very early applications of a good sized commercial molded piece. And you'll note that this camera that I hold in my hand has been in good use since 1915 as shown by the wear on the leather and other parts, and yet the molded parts are rather still in excellent shape. They're true, they still have a good sheen. And with all really the better part of the entire cameras, it looks as we look at it now.

Interviewer Fitzgerald:

(5:11) So, it's a wonderful example of the durability of that product even as it was made in the earliest stages. It is Mr. Fitzgerald, well now guys from I presume, having started way back in that date with the phenolic powders. You have continued your research work in utilizing other plastics in the camera field.

Garson Meyer:

Yes, we have, and that's rather interesting. I had occasion just the other day to look up some statistics. Back in 1945 we were using approximately 30 tons of plastics in the industry in our plants. Today, we're using 600 tons of plastics in our plant, which is quite a growth from the early days of 1915 when this was our only application.

Interviewer Fitzgerald:

(5:59) Splendid example of the way the industry has grown and the degree to which camera as one article has been able to increase its use of this product. Have you anything else you'd like to add in connection with this, Garson?

Garson Meyer:

No, not at this time. I thought this would be an interesting example of an early application of the commercial use of phenolic resins.

Interviewer Fitzgerald:

Well, you're absolutely right. It is interesting, and thank you very much for relating it.

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Fred C. Meacham, Northern Industrial Chemical Company of Boston

Interviewer Fitzgerald:

(6:59) Through imagination, initiative, and a sound knowledge of the molding technique on some of the early plastics, Fred C. Meacham, next on our list, developed many new items in the early days of plastics. Mr. Meacham, will you tell us who you're with and what your position is, please.

Fred C. Meacham:

I'm with the Northern Industrial Chemical Company of Boston, and I run their New York office for them, and I have for 24 years now.

Interviewer Fitzgerald:

Well now, will you reach back in the early days of your memory and tell us of some of the important developments in your career and development of plastics that is?

Mineralized Rubber Company Producing First Bakelite Buttons for the Navy, 1915 (7:42)

Fred C. Meacham:

Well, in 1913 I had my first contact with plastics with the Arlington Company in Arlington, New Jersey molding and forming and machining celluloid. In 1915 I was with a company in Newark called the Mineralized Rubber Company, where we produced, as far as I know, the first Bakelite buttons. These were the standard Navy buttons, and exactly like those now used, we made many 1000s of gross of them.

Interviewer Fitzgerald:

Has the technique of making buttons changed considerably since you first introduced it?

Fred C. Meacham:

Only in the use of tableting of the material and the molding of the holes all the way through. In those days, we had to drill the four holes partially through, and we used a single loading charge in a in a plate mold with a mass of cavities in one filling chamber.

Molds First Car Distributor Caps and Battery Storage Cases, 1916 / 1917 (8:50)

In 1916, we made the first, as far as I know, or very nearly, the first automobile distributor caps of a phenolic material for the Connecticut Electric Company.

And in 1917, we made what I think is the first Bakelite storage battery case.

Interviewer Fitzgerald:

(9:16) Excuse me, just a minute, but the use of plastics in both of those items has reached enormous proportions. That's right, there, isn't it? That's right. They were widely used today, very important developments and created a very large market for this battery box

Fred C. Meacham:

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Battery Case for Experimental Torpedo & First Radio Parts for WWI (9:31)

I made for the Sperry gyroscope company. And it was used in an experimental electric torpedo. And since that time, that torpedo has been developed and is a really remarkable piece of work. During the next few years, it is hard to say whether or not the parts we produce were the first, but we did make, during the war, the First World War, many radio parts for the Navy and individual manufacturers.

Distributor Caps and First Gear Shift Lever Knobs, Radiator Caps, Spark Plugs (10:03)

We made many distributor caps for Liberty Motors and I believe, the first gear shift lever knobs were made about 1918. We also made many radiator caps and other items used on automobiles. In 1920 approximately, I made what I believe to be the first Bakelite parts for electrical hardware to replace shellac, which was widely used at that time. The Hemco Twin light Plug was probably the first item so made. The use of Bakelite was suggested by my having seen a shellac plug in a store window in the hot sun. The heat had so softened the shellac that I could crush this plug in my hand, and this was all the argument I needed to sell the Hemco Electric Company on the use of a phenolic material for these parts.

Interviewer Fitzgerald:

(11:00) Go ahead and rest up, though, please.

Fred C. Meacham:

Well, from 1917 to 1928, I ran a Bakelite molding division, as we call it, for the National Lead Company. And we used Bakelite, Redmanol, and Condensite, and later Durez. We also molded some shellac and cold molded parts. In 1928 I sold the National Lead Company plant to the Hemco Electric Company for whom I had made these electrical hardware plugs. And it is now the present plant, or a considerable part of the present plant of the Bridgeport plant of the Bryant Electric Company.

Interviewer Fitzgerald:

Well, that's an interesting account of some of your outstanding experiences. Do you find conditions today quite different in the utilization of plastics than there were in the old days?

Fred C. Meacham:

More than 15 times Improved Speed of Material Curing (12:01)

Well, there are many things made today that we couldn't possibly have made in those days because of the limitations of the material. One of the biggest things I think, that has enhanced the value of plastics is the speed of curing that you have today and the use of thermoplastics and their speed of production. I was talking with a friend this morning about a second part, which is still manufactured. And back in 1920 I made that same piece. It was an electrical plug, and I used to figure that we had to cure that part 15 minutes. And this friend, who is now making this same piece of practically the same piece, said that he runs it on a cycle of 50 to 55 seconds. And of course, that would cut the price and make things very much more available.

Interviewer Fitzgerald:

Well, it's improvements like that, that one or the other, as is being recorded here, have served to build and build until the industry now is in the very large volume of production and use.

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Fred C. Meacham:

Well, it's that, and the fact that the material suppliers have so vastly improved their material and made it possible for Molders to get large and rapid production without a lot of trouble.

Interviewer Fitzgerald:

Then equal progress hasn't there in the machines and dies?

Fred C. Meacham:

Oh yes, oh yes. We have automatic machines today, and the injection machines, which were unknown in those days, and they have, of course, increased the speed of production.

Interviewer Fitzgerald:

(13:38) Well, Fred, thanks very much. You've made a nice presentation.

Fred C. Meacham:

Thanks very much. It's been a pleasure.

Gordon Brown:

(13:40) This is Gordon Brown correcting the record to a certain extent we don't want to cast undo aspersions on shellac composition. Fred Meacham has a hand like a bunch of bananas, and back in the days when he describes being able to squeeze that shellac socket in his hands. He used to make a regular practice of squeezing my hand, bones and all, into a sort of a jelly mass. (Laughter)

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Herb Spencer, Durez Plastics and Chemicals, Advertising and Publicity

Interviewer Fitzgerald:

Plastics Pioneer Organizer (14:18)

(14:18) The man who was really responsible for the organization of the Pioneers group is our next speaker. Speaker, I refer to Herb Spencer. Herb, will you tell us who you went and what your position is, please?

Herb Spencer:

Well, I'm in charge of advertising and publicity for Durez Plastics and Chemicals.

Interviewer Fitzgerald:

You've been with Durez a great many years, and I'm sure that out of your experience, you can tell us some interesting things about your company and perhaps other new developments.

Durez in Search of a Plastic Molding Compound, 1921 (14:51)

Herb Spencer:

Well, Durez was founded in 1921. However, earlier work in a home at 90 Wind Avenue in Woodside, New Jersey was done by Harry Mason Dent and an associate, much to the detriment of the house. Dent was endeavoring to find a plastic molding compound suitable for the use as a type phase in which research he became familiar with the American, earlier and earlier European chemist work in phenol formaldehyde resins.

In 1921, with greater horizons in mind, the business was moved to North Tonawanda, to be near their source of raw material supply and the essential need of capital which was offered. In 1926, opened the gateway to the picture and plan that then had struggled through about nine years and General Plastics Incorporated was founded, and the Present plant site occupied. Quite the sensation of the new enterprise was the resin kettles installed, which were large enough to house a Model T, and stories got around that if they let go, the whole town would go along with them. However, they never did, though several dust explosions blew out the windows. Dent had been convinced that there was an opportunity to manufacture plastic material on a mass production basis, and believed that if adequate volume could be secured, production costs would be greatly reduced and new markets opened in the present ones expanded.

Purchased Exclusive Rights to Manufacture Phenol from Benzoyl (16:41)

In 1938, the company purchased from Dr. F. Roche, GmBH, a German Corporation, the exclusive rights in the United States to a process for the manufacture of phenol from benzoyl and a plant for utilization of the new process was completed in '41. In '39, the name of the corporation was changed from General Plastics to Durez Plastics and Chemicals, Inc. The desire being to get the name of the product as a part of the name of the corporation.

Prior to 1947 the company obtained its formaldehyde from outside sources, but completed its own plant for the manufacture of the material later in that year. In the spring of '51 the company completed its basic research laboratory at Leroy, New York and secured properties in Chicago and in the Pittsburgh area for future expansion.

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Interviewer Fitzgerald:

(17:42) Well, now with that interesting information about your company, I'm going to ask you something about yourself personally.

Herb Spencer:

Well, me. I came to plastics in 1926 joining the Durez organization, which was then very small. There were two in sales beside myself. My principal responsibility was to secure new markets for phenolic molding compounds. But in those days, no one was a full time specialist in our organization. We all pitched in and did whatever was most essential from day to day, six and seven days. In fact, one of my youngsters asked her mother on a Saturday morning if was that was the day that other men came home early.

One of the earlier, earlier markets was the closures for toothpaste and bottles. I thought we discovered it and was enthused about it because it was the only thing I'd found where we could make the same user repeat the use of our material. Years later, I found that Frank Shaw of Shaw Insulator and Ken Maxie of Mack Molding had preceded us in the development of closures, though no one had appreciated the magnitude of the market, and no other outfit pushed all phases of packaging to the extent that we did.

I covered the entire East and West Coast, regardless of the West Coast reputation for cordiality was threatened with being tossed out of a second story window. And the less drastic indications of hostilities, such as, "I don't give a damn, I won't use your plastic caps in 100 years", but he does. Today had too early but slow developments. Well, the use of plastics by the business machine manufacturers for large housing and in cameras. Although when Eastman was sold, the trend changed. Here, we wanted more than the small parts that were molded from phenolics, we wanted housings. Outstanding in all of this was acceptance by the public of the Eastman Baby Brown with a display in their 50 stars, bringing in orders for nearly a half a million cameras in less than two months.

First Resin Bonded Plywood Made (20:13)

One day in talking to a printer and finding the trouble he had with suitable wood, unsuitable wood for electro type backs, we decided to see what could be done. We used sawdust or machine chips and made a satisfactory back from the point of accuracy and the ability to withstand moisture and distortion. But, well, this was but it was impossible for the electro typer to drive tacks into them, and they raised particular deviltry with cutting equipment. We went from this to strawberry boxes.

I believe this was the first resin bonded plywood made, and which soon outgrew the strawberry box as a source of raw material, became a one of the large markets for per third or four or five years. In the 20s, the industrial designer was little known, and those in the field, comparatively few. These men realized the possibilities in better packaging, and I the value that they could contribute to plastics. We worked cooperatively with them, and in time, put on one, if not the first, TV show sponsored by a manufacturer of raw materials.

Early SPI Days and the Start of the Plastics Pioneers, 1942 (21:30)

I was active in the early days of SPI, and went through the whole phase, and by request, presented a long time plan and program with Earl Luci, on which the comment was, we asked for a program not a Bible. I became a Director during the presidency of Donald Dew and later Alan Fauci. And in order to Copyright © Plastic Pioneers, Plastics Hall of Fame, Smithsonian Institute, Syracuse University, Wendy Hoenig, Chuck DiMeglio. All Rights Reserved.

help keep SPI alive in the early days, through the months in which there were little or no activity suggested and then started the SPI paper called Voice.

This was the time when we were meeting in the Berkshire Country Club at Lenox, Massachusetts in '38 and was a one man job until Bill Cruse came to headquarters and a more formal organization took over. At the Westchester Country Club at Rye in October 1942, Mr. K. E. Stenberg complained that all that all there were present was a lot of young fellows that he couldn't find and he couldn't find his friends. This started a thought, which I checked with Chick Kinnear, then President and Bill Cruse, and we decided to see if we could find sufficient old timers to get together.

Interviewer Fitzgerald:

(22:52) Well, that's fine, but we must hear more about how this Pioneer group were organized and the part that you played in it, and the part that any other members played in it, if you recall it.

Herb Spencer:

(23:09) Well, I do, to a certain extent, the first gathering of Pioneers were comprised of four people. We went from that to an informal group, of which I became chairman. And in Chicago, in '41 or 2, formed the formal organization and appointed a committee to draw up bylaws and regulations.

Interviewer Fitzgerald:

Who was associated with you and that who were the other three or four men?

Herb Spencer:

Oh, there's Ron Kinnear, Bill Cruse, Mr. Stenberg, and two others who I off hand, do not recall.

Interviewer Fitzgerald:

(24:00) But you acted as the head of this organization, either formally or informally for many years.

Herb Spencer:

I was its first president, yes, and you continued for several years. I continued through two times, and there was great efforts made repeatedly by one George Scribner, to make me permanent chairman or president for life. But through getting officers elected and appointing committees, I was able to see that we changed that around from year to year.

Interviewer Fitzgerald:

(24:28) I heard through the underground channels, I heard you was somewhat of a poet, and that you had a little piece of poetry in connection with the Pioneer group, if you have we certainly should record it.

Well, I tell you, I thought this morning, if this meeting would be an opportune time, and if I was struck to talk, I could use this. Pioneers, you perfectly priceless old things. I'm fiercely bucked up. At the sounds that I see your Jolly old chaps in your baggy tweeds and this priceless history that we haven't got. It jolly well bucks a chap up that doesn't not. It's to be so delightfully bright, so amazingly, right, that one feels as one feels if one were out for a night. But there's a tang in the air, if you know what I mean, and the

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regalement, as it were, is intoxicatingly keen. So we'll have that jolly old thing history, you know, we'll have it as an honor as the bird on the wing. So topping old chaps, you know what I mean? I say it's time I was hanging my jolly old hat. So, making a long story short and all that, the theme of my song is the theme, oh, by Job, I do not know what! Oh, Cheerio!

Interviewer Fitzgerald:

(26:03) Thank you very much, Herb. That's a fine sentiment.

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Hans Wanders, Northern Industrial Chemical Company, Rawson Molding

Interviewer Fitzgerald:

(26:45) Another one of our Pioneer members who did some very effective work in the early days in expanding the use of plastics, and who in fact, has continued to do effective work up to this time in expanding the utilization of these products is Hans H. Wanders. Hans, will you state your company in your position, please?

Developed First Semi-Automatic Rotary Molding Press at Rawson Molding, pre-1927 (27:09)

Hans Wanders:

(27:09) I am connected with the Northern Industrial Chemical Company of Boston, and have been there since 1927 as vice president. Previous to that, I owned my own molding company, the Rawson Molding Company of Waltham, Mass. This company was taken over by the Northern Industrial Chemical Company in 1927.

While at Rawson Molding Company, I developed and built what I believe is the first semi-automatic, automatic rotary molding press. This place had six stations and was built especially for the production of wall switch plates. Patent application was filed February 14, 1927 and the patent granted May 7, 1929. Various articles were produced on this machine quite successfully that later on, with the increase in molding speeds of the molding compounds, the machine proved to be too slow, and the general production went back to multiple cavity molds, again, taking it away from this semi-automatic molding machine.

Investigates German Molding Process Utilizing Ground Horn and Dried Blood (28:53)

While at Rawson molding company, I became acquainted with a new process which had been developed in Germany utilizing ground horn and also dried blood. I was asked to go to Germany to investigate these processes for New York and Pennsylvania interest. That my findings were that the processes were not practical for the United States, principally on account of excessive labor required in their production. The process was an interesting one, as it used ground horn. The horn was ground to a very fine powder then loaded into multiple cavity molds. These molds were made from aluminum plate stock and somehow heat treated and chrome plated. The molds were used in multiple platen hydraulic presses.

The loading was comparatively slow, and also the design application to simulate regular horn for the secondary operation, which required the molds to open again and then being closed. After the horn was pressed into shape, naturally, was still quite brittle that the bottom button so produced were

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treated in a formaldehyde bath for about 48 hours, and washed afterwards and then went through a very elaborate polishing, tumble barrel polishing operation.

Part it produced was very satisfactory, good looking and stable. But altogether too costly for the American market using American labor. They also were producing combs made from dried blood, which were also treated in a formaldehyde bar after forming. The process was not taken over by the United States.

Interviewer Fitzgerald:

(31:40) Well. Thank you very much, Hans. If we have a minute more, do we?

Hans Wanders:

Graybar Domestic and Commercial Light Fixtures, Late 1920's (31:45)

No, I think we're almost finished on this, really, but I could say something else about some light fixtures that we designed or were designed and used, if that would be of interest to you. Previous to my association with Northern Industrial Chemical Company, I had part in designing a complete line of domestic and commercial lighting fixtures. While the commercial fixtures did not find a ready market, the commercial fixtures, which were designed 25 or 26 years ago are still being sold and used today by the Gray Bar Electric Company of New York.

Interviewer Fitzgerald:

I'm glad you used the last minute to add that item. Thanks again for your contribution.

Hans Wanders:

You're welcome.

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M.M. Makeever, Makalot Corporation

Interviewer Fitzgerald:

(32:49) Now we are going to hear from one of the youngest, old men in the Pioneer group. I refer to our good friend, M.M. McKeever, correction. Recently, Mac celebrated his 83rd birthday. He is still young in spirit, alert mentally and vigorous physically. Mac, what was your company?

M.M. Makeever:

The Makalot Corporation.

Interviewer Fitzgerald:

I believe you developed and organized that company. And supposing you tell us something about what you went through in the course of your experience.

M.M. Makeever:

(33:36) Sometimes strange things happen when you seem to have faith for a business partner. Take the story of my association with the plastic industry. For instance, it was a cold winter day in 1924 when a man came into my office armed with credentials and imposing evidence that he was a German chemist. He displayed some amber colored beads, which he said could be made profitably from a molding compound that he claimed to be able to produce from a certain type of resin. Several interviews later, I decided to take a flyer.

Months and months went by and no beads and no molding powders had been produced. I was in the awkward position of the farmer who was driving an ox team. He tied the rope around his body, and while opening the gate to get the oxen, they ran away, dragging him as they went. His friends told him that he should not have tied himself to the oxen. He replied, they hadn't drugged me more than 100 yards before I realized I had made a mistake. I realized that I had made a mistake when I became aware that I had tied onto the bead man's glowing promises to the extent of over $60,000.

During this era of the bead man, other chemists were consulted to see if they the needed information could be supplied. These included men from Harvard, Yale, MIT and others. It turned out to be my good fortune to hire a young laboratory technician to assist the bead man whose sister was interested in chemistry. As this young lady drove her brother home from the lab each day, she had to listen to his wail that no compound was produced today. She offered to go back to her brother's laboratory after hours and make some experiments. In the comparatively short time, she was making better plastic materials than any of those who had been trying to help me. I got rid of my amber bead expert, who afterwards admitted that there was no money to be made in production that it had to be made out of the fellow who thought he was going to produce.

Lubricant Industries formed to Manufacture Phenolic Resins, 1925 (37:04)

The expert continued on that theory and a pain backing of more than $200,000 after he left me. That from those who were smarter than I was, and still no beads or molding powders. Many of the older members of the plastic industry know this young lady, lady Viola B Pompe, who saved the wreck, became the first lady of plastics and my wife. A company was formed to manufacture phenolic resins and molding compounds in March 1925 under the name of the Lubricant Laboratories, Incorporated.

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On June 25, 1929 the name of the company was changed to the Makalot Corporation of Delaware, which company was reorganized June 6, 1932 under the laws of Arizona.

Renamed Makalot Corporation and Sold to Interlake Chemical Company, 1945 (37:30)

On February 2, 1945, the Makalot Corporation, with all of its properties and interest, was sold to the Interlake Chemical Corporation of Cleveland, Ohio, and Mrs. McKeever and I were employed as consultants for a period of five years. As I look back over the early struggles of the business, I recall many occurrences that could have been humorous, had the situation not been so difficult, serious and practically hopeless. I remember arriving at the plant one day to find that our bead expert had Viola squatting on the floor with a blowtorch in her hand trying to make resin in a 50 gallon kettle, the formula for which no one but the bead man was supposed to know. Oh, yes, the bead man had another accomplishment too. He'd buy useless equipment and receive a big rake off from the suppliers.

Viola had been working many nights in the plant alone, and she had made some interesting progress, but her day really came when the beat man became ill and was forced to be absent for about 10 days during which time Viola produced some very encouraging results. More Good luck.

The representative of a wood flower manufacturer called on us to find out why we had not bought more wood flour. I asked him if he cared to go through our plant, and he replied that he would be very glad to do anything that would help the sale of his wood flour. When we arrived at the plant, it so happened that Viola had a small batch of molding powder ready to test. The wood flour man took me aside and said, it is positively wonderful what that girl is doing, the kind of wood flour she is using, and he stated that it was all right for making linoleum. But for molding powder, we should have their 42S or 4DG, and with that, we should be able to make a good material as there was on the market. He wired for two bags, and lo and behold, he was right.

A short time after I got rid of the bead man I received, then I received another jolt. Complaints about resin fumes brought us an order to vacate. The owners of the building were, no doubt justified, as we did not know how to control the fumes. Sawdust was not the only problem in those days. Chemicals sold by brokers in small quantities were not up to par. We received a barrel of formaldehyde, which turned out to be parawax. One of the workmen accidentally dropped his screwdriver in the barrel of parawax. We returned it to the broker for exchange adjustment, and I'll be darned if they didn't send back to us the very same barrel with the screwdriver still in it.

During the time the bead man was with us, he could always dig up some Bakelite when it was necessary to send out a sample. When the orders came in, he, of course, could not produce. The information regarding the making of plastics was very closely held and did not get into the books. The chemists I had working on the side were little better than the bead man. When we finally got to producing moldable materials, our competitors were able to produce all that was required in the trade, and for some time, the only material we could sell was something that would work better than the material the molder was using.

It wasn't an easy thing to break into an industry during the depression of 1929 and the lean years which followed. Competition was very keen. I often heard that competitive salesman had admitted that McKeever actually got an order for a drum of Makalot. The plastic business, however, commenced to grow larger and more difficult articles were being attempted, and when a molder had trouble, he would

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finally be willing to try mud. And that is how Makalot without prestige or strong financial backing, got its chance.

The Pilot Radio Cabinet and Other Difficult Extrusion Moldings (42:34)

Some difficult molding jobs were responsible were for Makalot becoming recognized as a worthwhile producer of phenolic plastics, the game well, fire alarm boxes, long gray bar stems, the universal winder, then the largest and most difficult extrusion molding that had been done. The pilot radio, the largest radio cabin that had been molded at that time, are some of them. This pilot radio cabinet was kept on display for the chemists and exports of one of the large plastic manufacturers to show that it was possible to mold such a large piece. The row light escalators, cigarette flexible molded case was another new development.

KEM Phenolic Plastic Molding Material during WWII (43:25)

The American Bush vertical distributor, where the problem of shrinking and cracks around inserts was solved by Makalot. And this opened a new field for the extruding of phenolic plastics. During World War Two, with the government restrictions and allocation of phenol, and from Allied, the greater part of civil civilian molding was stopped. And Makalot came to the rescue with a new molding compound "KEM" - keep 'em molding. 1000s of parts were made from KEM where no phenol was used and only a small percentage of formaldehyde.

The widely distributed Chesterfield cigarette trays weighing 19 ounces were molded of KEM containing no phenol and less than two ounces of formaldehyde. KEM was responsible for keeping many of the molders going during that critical time. KEM was used in extruding the long bomb boosters and for various moldings using the new jet process, also all standard molding methods. In 1939 Makalot received the award in Modern Plastics competition for supplying the material for the large agitator, previously made of aluminum alloy weighing 22 pounds. But with a 23 inch diameter, it was produced with Makalot using 14 pounds, as previously stated.

The Makalot business was sold to the Interlake chemical Corporation of Cleveland in February 1945. The new company with a $5 million capitalization, jointly owned by the Interlake Iron Corporation of Cleveland and National Steel Company of Pittsburgh started in the plastic business with Makalot with customers from Shanghai, China to Barcelona, Spain and from Canada to Mexico in the Latin Americas, including Argentina, Brazil, Uruguay, Paraguay and Peru. In Australia and New Zealand, and from the Pacific across the United States to Portland Maine. And all this was accomplished from the almost fatalistic, false, and dark originally given us by the bead man.

However, the great sacrifices and efforts which had been made to build the company into a prominent place in the plastic industry was fated to come to an end on March 6, 1948 when a dust explosion destroyed the Makalot plant and the buildings, within a very short time, killing five of the employees of life and 30 were sent to the hospital. A number of them have since died, and some have either partial or permanent injuries due to this unfortunate catastrophe, the company, the Interlake Chemical Company, was not permitted to rebuild its plan. Thus ended the saga of Makalot Plastics.

Interviewer Fitzgerald:

(46:58) Well, Mac, you did a fine job in successfully meeting the many obstacles that confronted you in developing the Makalot Corporation. But really your outstanding achievement was winning Viola as your Copyright © Plastic Pioneers, Plastics Hall of Fame, Smithsonian Institute, Syracuse University, Wendy Hoenig, Chuck DiMeglio. All Rights Reserved.

wife. We of the Pioneer group, salute her as the first lady in plastics, tell her that she has our affection, esteem, and respect, and we're delighted if she joins you in attending this meeting. Thank you very much.

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Charles A. “Chick” Norris, Jr, Bakelite Company, Assistant General Sales Manager

Welding Molds (47:53)

Interviewer Fitzgerald:

Now we are going to listen to Charles A. Norris, Jr talk about the development of welding molds. Chick, will you tell us what company you with in your position, please?

At present, I'm with the Bakelite Company, and am the Assistant General Sales Manager.

Interviewer Fitzgerald:

And then how will you proceed with your discourse on welding molds?

Recommended Making Plastics Pioneer tapes to Document History of Plastics Industry (48:20)

Well, first of all, I should like to say how gratifying it is to see that the suggestion which I made at Swanston two years ago that the history of the plastics industry be recorded while those who played such an important part in making it were still alive, and that is being done now is indeed, as I said before, very gratifying.

Interviewer Fitzgerald:

Well, I didn't know that you made that suggestion, but I'm delighted to know that you did make it, and that your idea has been carried off.

(48:53) As a matter of fact, when I made the suggestion, our good friend Chick Kinnear tried to pipe me down and said, give him another drink. We're not here for any serious business. Having been born and brought up in Boonton, New Jersey, I of course, have been interested in the plastics industry since an early age. But in the 1920s, I had an opportunity to work with and for George Scribner in his newly formed gluten molding company. In those days, we were just beginning to use pre-forms, and we had two pre-forming presses which had been made by the Arthur D Colton Company in Detroit.

The frames were cast iron, and while they were sufficiently rugged to withstand the pre-forming process of wood flour filled materials, such was not the case when we got into the asbestos filled materials and the thin pre-forms used for heater plugs. The frames on both of these machines broke and over in a little town three miles from Boonton named Parsippany, was a welder Lloyd Baldwin.

We called in Lloyd Baldwin, and he repaired these presses and did a really outstanding job. Shortly thereafter, one of our hand molds from which we were producing parts for the Mitchell specialty company in Philadelphia, who, in turn, were making ignition switches for Chevrolet. This mold broke and not having all the necessary fundamentals of metallurgy, I immediately thought the thing to do is to take it over to Lloyd Baldwin and ask him to weld it. My position was something like the bumblebee. According to all the laws of aerodynamics, the bumblebee can't fly, but he doesn't know it, so he flies, and that was my situation.

Repairing Molds by Welding Tool Steel (51:26)

As far as this mold was concerned. Lloyd Baldwin examined the mold and asked the question, this is tool steel, isn't it? And I said, yes, it is. And he said, you can't weld tool steel. And I said, why? He said, Well, I don't know exactly why, but everything I've ever read, everything that the metallurgists have told me and indicate you can't weld tool steel. I appeal to his sense of exploration, and I said, Lloyd, if you've

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never tried, you honestly don't know you can't weld it. He agreed that was so. And so we undertook to weld this mold, and it turned out to be successful.

That mold was in operation for several years after the new mold had been made, and it was most fortunate that it was successful, because from there, the art of welding molds has been perfected by Baldwin and also others.

Today, not only the molders, but the tool makers send this individual molds from all over the country to be repaired. I saw Lloyd Baldwin within the last three weeks, and he told me that since he has been keeping a record of the molds which he has welded, he has repaired over 30,000 molds for the plastic industry. This amounts to hundreds of 1000s of dollars of saving to the members of the industry, and I feel it is one of the outstanding accomplishments of this individual, and has added greatly to the broadening of the plastics industry. That's my story, Arnold.

Interviewer Fitzgerald:

Well, thank you very much, Chick, for this interesting account of the development of welding molds. It'll make a valuable addition to the recordings which we are carrying on here at the present time.

I also think that Lloyd Baldwin might be a candidate for the Pioneers! Splendid. Thank you.

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B. E. Schlesinger, Treasurer, Northern Industrial Chemical Company, Co-Founder, Treasurer

(54:13) Mr. G. Victor Sammet is now going to read some comments, which we expected Mr. B. E. Schlesinger, treasurer of the Northern Industrial Chemical Company, to deliver personally. And in addition, Vic is going to add some comments of his own out of his experience in the plastic industry. Vic first tell us your company, please.

Northern Industrial Chemical Company.

Interviewer Fitzgerald:

Well, that's fine, and now will you proceed?

Developing Phenol Resin Avoiding Dr. Baekeland Patent, Roxite (1908)

B.E. Schlesinger (read by G. Victor Sammet):

(54:42) It is strange that a casual meeting with someone may change the course of one's life. This happened to me in 1907 on a steamer sailing from Melbourne to Hobart in Tasmania. At that time, I was traveling for the Merrimack Chemical Company introducing an insecticide around the world. On this steamer, a man asked what I did, and I told him that I was a chemist. He said that they had a fossil resin in Tasmania for which there was no use, and wanted to know whether I could find some use for it. I told him that I would be back in the states in about a year, and I would be glad to see what could be done if he would send me 100 pounds. When I got back, sure enough, the box from Tasmania was waiting for me.

Organic Compound, Red Gum from Tasmania

About this time. GV Sammet and I got together and worked on several research problems. We had a pretty good phenol resin compound when Dr. Baekeland came out with his patents. This, of course, was most discouraging to us. However, we had previously noticed that the stuff in the box, which was gum accroides, or commonly known as red gum, reacted with formaldehyde. Our only chance was to see what we could do with this material. Twenty-four hours later, we had a molding compound that did not conflict with the doctor's patents. The compounding of this molding powder was simple, and we made a great many carloads, all in small batches, as the material had to be used within about six hours.

We used most of this material on a coil housing that went on Chevrolet and overland cars. We started making these housings in $25 presses, constructed of cast iron plates, bolts and hand jacks. Later, we

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were told that we must turn out 1000 housings per day. This equipment, of course, was not practical for large quantities, so we put in hydraulic presses in South Boston in 1916 where we are still located.

This compound was called Roxite, as our plant was in Roxbury. It fulfilled a certain use until the cold molded parts came in. Then Roxite did not fit in the picture, as it was not as cheap as cold molded and not as strong as Bakelite. Its use was, however profitable, enabled us to expand our plant and get into the molding business.

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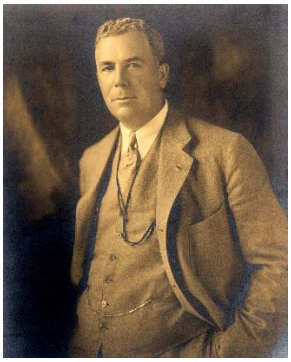
George Victor Sammet, Sr., Northern Industrial Chemical Company, Co-Founder, President



Interviewer Fitzgerald:

That's the letter you were to read. And now I think you have some additional comments. Do you not?

Started Manufacturing Vegetable Coloring Material, Self-funded Plastics Research and Molding Expansions, 1907 (57:09)

G. Victor Sammet:

Yes, indeed, elaborating on Mr. Schlesinger's this story, I might add that our company, the Northern Industrial Chemical Company, was incorporated in 1908 to manufacture vegetable coloring matter for only a margin. We had a small plant in a frame building in South Boston with practically no facilities as a matter of interest. We use tons of material which had to be hoisted on hand elevators. For our manufacturing butter color.

Searching to Develop Tanglefoot Equivalent for use with Pesticides, 1907 (57:36)

We also were doing experimental work on trying to develop an equivalent of Tanglefoot for the Merrimac Chemical Company to be sold in conjunction with their insecticide, which Mr. Schlesinger was taking his trip around the world for.

Working with Resins and Formaldehyde (57:39)

In this work, we were working with all kinds of resins, which brought us in touch with a concern in Cambridge, Massachusetts, the C. P. Levering Company, who were molding weatherproof electric light sockets for outdoor use. They used many different kinds of resins, which afforded a source of supply to us for our experimental work. They compounded these resins on rubber rolls with asbestos powder. This they took from the rolls in the form of sheets. Later, these sheets were heated on steam tables and softened material placed in cold-molds, and pressed over brass-threaded sockets and hand-operated toggle presses. This crude procedure excited our interest in insulating compounds.

As chemists, we were familiar with the reaction of phenol and formaldehyde, which led us to try the reaction with various resins, some of which had higher phenols as constituents. Here is where the red gum, which Mr. Schlesinger mentioned, came in. We found that this gum, when mixed with asbestos, and a small amount of alkali, and sprayed with formaldehyde, produced a mixture which could be molded under heat and pressure and removed from the hot mold. The resulting molded piece had a reasonably good finish and was heat-resisting. It did contain moisture from the formaldehyde, so, to

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complete the process, it had to be baked for several hours and then immersed in hot linseed oil to reduce the porosity created by baking.

Editor Note: The Smithsonian Tape Ends at 57:35. The Remainder of the tape was transcribed from a Syracuse University Copy.

Car Ignition Housing Development and Molding for WWI (57:42)

Just about this time, the Connecticut Telephone and Electric Company, of Meriden, Connecticut, were developing an ignition system which required a coil housing under the hood of the car and therefore required this housing to be made of material which would not soften under heat. This housing was a tube 6 inches long, about 2½ inches in diameter, with brass inserts molded in one end, which was solid. The wall thickness was ⅛ in. This crude molding material of ours, which we called Roxite, was the only material at the time which would flow such a distance and produce a heat-resisting tube.

As Mr. Schlesinger stated, we produced thousands of these in crudely constructed presses using hand jacks for pressure and heating the molds on two-burner gas stoves. In 1916, the Connecticut Company received a large contract for Overland Cars, and we moved to South Boston, where we are presently located, and put in 30 hydraulic presses with 8-inch ramps. These presses were purchased from the Adamson Machine Company in Akron, Ohio. The need of the Overland people was so urgent that even though it was in World War I, they had an express car attached to a passenger train to get the presses to us with the least possible delay. This launched us in the molding business.

In about 1918, we started new custom molding items using Bakelite. About 1927, we took over the Rawson Molding Company and the Graybar Lighting Fixture Business, about which Mr. Wanders has previously made a recording.

Beetle and Melamine for Tableware, 1930 (57:30)

Then, about 1930, the American Cyanamid Company held a luncheon in the Ambassador Hotel in New York, which was sponsored by the British Cyanamid Company, who had developed a urea-formaldehyde compound which they called “Beetle.” The first applications of Beetle were for tableware, and Kurtz-Kasch and Northern Industrial Chemical Company were the first producers of plastic tableware in this country made from Beetle. American Cyanamid undertook the merchandising. Later, all the molds were turned over to us, and many of these molds are still in use today, using melamine instead of Beetle.

Interviewer Fitzgerald:

(1:01:00) Thank you for your contribution.

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Tape 3 (AC1235-RCD0003)

Ronald “Chick” Kinnear, the Albany Billiard Ball Company

Interviewer Fitzgerald:

(0:33) Ronald Kinnear familiarly known to his friends as "Chick", has some interesting recollections of the early days in the plastic industry, which we're now going to record. But first Chick, what is your company?

Ronald Kinnear:

The Albany Billiard Ball Company and the Niagara Insul-Bake Specialty Company, which is the plastic division of the Albany Billiard Ball Company.

Chick’s Grandfather, Peter Kinnera, Connection to John Hyatt as Co-Founders of The Hyatt Billiard Ball Company with Eventual Name Change to Albany Billiard Ball Company, 1868 (0:45)

Interviewer Fitzgerald:

Now, believe that you or your father has some interesting connections with the original Hyatt who invented Celluloid.

Ronald Kinnear:

(1:07) That's right, 84 years ago, John Hyatt lived in Albany, where my grandfather, the late Peter Kinnear, resided, and they were great friends. And Mr. Hyatt having a very inventive turn of mind, was endeavoring to get a substitute for ivory to be used in the manufacture of billiard balls. He and his experiments were successful, and he and my grandfather formed the Hyatt Billiard Ball Company in 1868 and immediately thereafter changed the name to the Albany Billiard Ball Company. They produced composition billiard balls quite successfully, and ran along that way for about four years. Until he discovered that this material or compound could be used for other things. They then coined the word celluloid, and my grandfather used to tell me with a great deal of pride when that word went in the dictionary.

Formation of the Celluloid Company (1:45)

So those two gentlemen and three other Albanians formed the original Celluloid Company, Number 46 Mueller Avenue, Albany, which was my grandfather's home, with an original incorporator and director. They started a plant in Albany, but they were ran into a good many misfortunes, principally because of the hazardous nature and the several fires that they had. They finally struck on an article that they could make, which was the first one that ever made any money for the Celluloid Company, what is now known as costume jewelry. For some unknown reason, they called it South American jewelry. Nobody knows why, and that's the first time they ever made any money.

Well, they didn't do very well in those days, and they ran out of sufficient capital. So finally, they interested a man in New York by the name of Marshall Leopard, who was a great friend of mine. You know well, he was more or less a promoter, and he took hold of the Celluloid Company in Albany and provided sufficient capital and moved it down to Newark. That is the history of the Celluloid Company. You all know it from there on.

Interviewer Fitzgerald:

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Well, that certainly is interesting. And you continue to use this type of material in your Billiard Ball business?

Ronald Kinnear:

(4:15) Of course, there have been good many improvements, but we still use nitrocellulose in certain types of balls. Although, in recent years, we're now making them out of cast resin.

Interviewer Fitzgerald:

This billiard ball business is a little bit fascinating to some of us. Is it a business that has grown quite rapidly? Is it quite stable?

Ronald Kinnear:

It has its ups and downs and during the First World War, it hit its all-time low. So that, in order to keep the organization together, I looked around and finally located in the Niagara Falls, New York, a plastic molding company. It was named Niagara Insul-Bake Company because it was in Niagara. So I purchased that and bought it to Albany. Now it's been running there ever since. Of their plastic division, you use other types of plastics. Yes, we use all the plastics now, and same as all the other job chambers.

SPI President and Early SPI History (5:22)

Interviewer Fitzgerald:

You have contributed very generously of your time in the development of the Society of Plastic Industry. I recall so well when you were president, and even before that, I know you served on important committees and helped to line up the organization. I think it would be interesting to have in this recording something of your recollections of the formation of the present type of the Society of Plastics Industry.

Ronald Kinnear:

Well, it was, for many years, more a social group, and there weren't many of us, maybe 30 or 40. We'd meet twice a year and play golf, talk over our common problems. We've finally organized right here in Shawnee and incorporated.

Interviewer Fitzgerald:

Right here in Shawnee?

Ronald Kinnear:

(6:07) Right in this building where we are now. The chairman of that meeting, where it was formally organized with Prescott Heidi Cooper as the first President. I served, then as vice president for several years, until the Second World War came along, and I was sitting with you and Charles Higgins of Hercules Powder of Hot Springs, Virginia, when the board of directors was meeting, and they came out and drafted me for President - I was sitting with you at the time.

Well, that was a time when we were just getting into the defense effort so called. And then it became a question whether we should continue with a social organization or really get down and do some constructive work. And we chose the latter, of course, and the Society of the Plastic Industry has grown

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by leaps and bounds. I think if I made any contribution, the best one, the one I'm the most proud of, was when I hired William T Cruse as executive secretary.

Interviewer Fitzgerald:

That was, that was indeed a fine selection, and he's taking the ball and run with it ever since he has, and the industry in general has always appreciated the outstanding contribution you made to getting that well organized working and it's now grown into a large and substantial organization. Hasn't it?

Ronald Kinnear:

(7:42) Yes, it has, Arnold, thank you, and I can remember with a great deal of pleasure when you headed up the PMMA, well, and I headed up the SPI, and we got together and worked together up in Westchester, Biltmore, and early on, we went places, I think.

Interviewer Fitzgerald:

Now Chick, can you think of anything else that you'd like to put on this audio?

Ronald Kinnear:

No, I can't contribute anything to this recording, except those few little reminiscences of the history wild.

Interviewer Fitzgerald:

(8:11) Well, it was very nice of you to do it, and we appreciate very much having you make this contribution. Thank you.

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C.W. Vaunt, Bakelite a Division of Union Carbide, General Sales Manager

Interviewer Fitzgerald:

(9:02) Mr. C. W. Vaunt now comes on the scene. We call him Clint. He has had a long experience in the industry, and is going to outline to us his thoughts and comments on certain interesting developments which he has observed and witnessed. First, Clint, tell us your company, your position, please.

Clint Vaunt:

The Bakelite Company, a division of Union Carbide and Carbon Corporation, General Sales Manager,

Interviewer Fitzgerald:

Fine. And now will you proceed with your discussion?

Clint Vaunt:

Major Milestones of Compression Molding Industry (9:39)

(9:39) The major milestones in the expansion of the compression molding industry, in my opinion, involved the following of which I can say I was an observer and promoter. Under no conditions do I claim to have originated the ideas.

1. Tableting (9:57)

First tableting. Introduced approximately 1922 became prominent between 1924 to1926, this enabled the molder to economically prepare a charge and reduce the volume to load into a mold. It resulted in smaller mold cavity, which meant a lower mold cost.

2. Discharging (10:25)

Second, discharging, compression, phenolic molded parts hot from the mold originated approximately 1923. When I took my training, all parts were cooled prior to discharge. In July 1924 I reported the Remy Electric Company, and was completely surprised to see them discharge from the mold with no cooling, practically everything they were molding. This reduced the cost by reducing the cycle. It is one of the major factors for making phenolic molding practical from an economic point of view.

3. Transfer Molding (11:09)

Three, transfer molding. From my point of view, Frank Shaw is the one to talk on this subject, and he has but I must mention it, what is a major development. My first observation of the technique was at Shaw Insulator Company in 1927. One of the first items in large production was the eagle pencil. This was an automatic pencil with a ribbon thread. The design was such that approximately four inches of lead were available to the writer. This technique made possible the use of long inserts, fragile inserts, and the holding of closer dimensions.

This was the technique followed in the manufacture of the M 52 fuse during the war, and also the technique for which Mr. Frank Shaw received the Hyatt award for high frequency heating. 1941, this technique was developed in the laboratories of the Bakelite Company and has made practical molding of very large pieces as well as very thick ones. A minor importance relating to specific end uses.

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First Molded Clock (12:26)

To the best of my knowledge, the first molded clock case was produced experimentally by borrowing an ammeter case mole from the Weston Electrical Instrument Company. A forced plug of soft steel was made so as to accommodate an assembly of a New Haven Clock at a cost of $90 which I personally paid out of my own pocket. I bought 100 New Haven clocks, assembled them in the cases, and sold the clocks to our employees in Bakelite, recovering the money invested in the force plug. I gave a clock to the local manager of the New Haven Clock Company in New York. They became enthused about it, and a short time, put into production an almost identical copy, which was a sales success.

First Large Radio Cabinet (13:17)

The first large radio cabinet in the United States, and for that matter, the first radio cabinet, according to my recollection, was in 1927. After trying to interest the then leading manufacturers of radio sets, Mr. Isadore Goldberg of Pilot Radio and Tube, agreed to proceed. In a 48 hour period, the cabinet was designed, the mold design and a French oil mill machinery press with a 54 inch adjustable daylight and some 28 inch stroke was purchased. The press was special, but it's my recollection, it was delivered in six weeks. The mold was built by John Hole of Newark Die Company. Special materials were developed by Bakelite, and the first load in the press produced a good cabinet. Other radio cabinets followed in rapid succession.

Interviewer Fitzgerald:

Well, Clint, whatever else you may have contributed, I'm sure you did contribute encouragement and enthusiasm to these men with whom you were working. You always impart that. Thank you very much.

Clint Vaunt:

(14:23) Thank you, Art.

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George Scribner, Past President SPI, President Boonton Molding Company

Interviewer Fitzgerald:

(14:59) George Scribner, one of the dynamos of the industry, past president of the SPI. Forty years in the business, he must have some very interesting things to tell us. Just what he's going to say, I don't know because you never know what George is going to say. But first, George, I can anticipate one thing - what is your company?

George Scribner:

I am the president of the Boonton Molding Company of Boonton, New Jersey.

Interviewer Fitzgerald:

(15:27) Did you originate that company? And

Started Boonton Molding out of Sheer Desperation (15:33)

George Scribner:

I started that company out of sheer desperation, because after I left my job with or got fired from the Boonton Rubber Manufacturing Company, having received no anxious telegrams which indicated that people were glad that I was done at liberty. So I either have to go work for the A&P or go back into the molding.

Interviewer Fitzgerald:

So you got a job as president, then nobody could fire you.

George Scribner:

Best way I know to become president of the county is to start one yourself.

Interviewer Fitzgerald:

Well now, I know in your long experience, there are several things you can comment on which will be interesting and valuable to record here, and you just use your own judgment as to what you should talk about. What's the first item?

Father Started Company Reclaiming Rubber. Developed Rubber Based Molding Compound Composed of Sulfur and Asbestos, Before Bakelite (16:08)

George Scribner:

Well, I think without waving my gray beard around, I should go back to the perhaps before Dr. Baekeland started his efforts to tame the phenolic reaction. And say that my father started a company in

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Boonton which reclaimed rubber from shoes and the various rubber products of the time. And in the course of doing that, he got a liquid solution of rubber in naphtha, which was then practically given away. And he conceived the idea of mixing sulfur with this rubber, again, mixing asbestos in it, drying it, and coming up with the molding compound.

Well, he died in 1898 and up to that time, he'd only succeeded in molding very coarse and rough pieces in multiple tiered presses which we use for insulation. Not much insulation was required in those days. The company gradually passed out of the hands of the family, and Dick Seabree came in about 1905 and took charge of it, trying to rebuild it. It so happened that Dick Seabree, through a friend by the name of Anthony, found out that a certain Dr. Baekeland, along about 1907, had developed a new and unusual resin, which the doctor called Bakelite, and which had the characteristics of rubber and sulfur. Meaning that by the application of heat, it softened first and could be pressed into a shape and then hardened and became practically infusible.

Well, Dick immediately thought of his rubber sulfur asbestos combination, and he got some of this resin from Dr. Baekeland, and he mixed in some his standard asbestos mixture, molded in the same molds, and lo and behold, he came out with a molded piece which had far better qualities than the old rubber or asbestos mixture, which is called vulcanized asbestos. From that point on, he started to explore the possibilities.

Dr. Baekeland Not Interested in Molding Business (18:30)

And Dr. Baekeland was not particularly interested in the molding business. He had conceived of his development of this phenol formaldehyde resin as a varnish or something which would resemble amber in cigarette holders or cigar or pipe bits. And he was quite willing for Dick to take over the whole molding business which didn't seem to be very attractive. In fact, Dick wound up with a contract with the Bakelite Corporation, which gave him complete control, provided he would buy, and this I'm picking from memory is, say, 100,000 pounds of the Bakelite resin per year.

Unfortunately, Dick could not find at that time very many people who wanted the precision molded parts. The West Town Electrical Instrument Company was one of the first. And you could put a week's production for west town in a derby hat, because they were instrument makers, and most of their parts were very small bushings / insulating pieces of that sort. Therefore Dick over the passage of years, never actually did succeed in buying 100,000 pounds of Bakelite resin per year. But it's interesting to look at those times and figure how things come together.

Precision Molded Parts Grows (20:00)

Before Dr. Baekeland made his, what he thought was a varnish, there was really no demand for precision molded parts. The telephone business was quite satisfied, in their small way, with machined rubber. There was practically no automobile business, and nobody had thought of the mass production of things. And suddenly, out of the various valleys into the main river comes demand for telephones, a demand for automobiles. That comes later, DuPont, Ducote, Du Pont resins, or whatever, though, what is the official name the DuPont resin that they painted those things where they could get a car through in a matter of hours instead of days. And one of the contributions to the ignition was Bakelite.

Impact on Car Industry and Electricity (20:40)

You wouldn't have had a car today if you hadn't had a phenolic resin by which millions of parts could be duplicated cheaply, and it had just as much of a contribution to what is the stream of civilization, is

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anything else we've ever seen. And so they all come together, and up rises the automobile and the telephone and precision measurements and electricity. We didn't know in the early days that have any use for electricity.

So Dick gradually developed the molding business. The counters developed the laminating business, and out of that rose our present molding industry. Well, it's very interesting to look back at the various customers that were developed, and I can only talk from the Boot and Rubber Manufacturing Company. They built Atwater Kent up into a nice business.

And the tendency was, at the time, if any company bought Hughes more than seven or eight presses in their operation in a custom molder shop, very shortly, they'd go off and start their own molding business. So we the Atwater Kent business grew up into their own private molding operation. Northeast Electric. We had General Motors, and they all passed out.

There have been some rumors that the raw material people were not tall enough to see them. People with plenty of money developed their own captive molding industries, instead of struggling along with the smaller molders, such as most of us were, and have been for a long time. But the thing rapidly expanded, and

Pulling Phenolic Resin Hot from a Mold (23:00)

I would say one of the most outstanding things has been touched upon by Clint Vaunt that was the development of a phenolic resin which could be pulled from the molds hot. That changed the whole picture after I went into my own molding business. I remember in 1923 we had a very large, loving cup base, which we were having a great deal of difficulty with. We've overestimated our prices and our timing, our costs and everything. We had to cool it, we'd get one piece every half hour which we had not anticipated or priced.

And suddenly Condensite, to my memory, came up with a material which did not have to be cooled. And suddenly again, we could leave it in the press, keep the press hot, open it and out she would come without any blisters. And that really solved our problem on big pieces.

So far as my personal experience is concerned, I went with the Boot and Rubber Manufacturing Company in 1913 having graduated from Princeton with a BA, which meant a lot of Greek and Latin, and the all the gut courses that were available. When I reported, they said they had no customers that talked to either Greek or Latin, and I ought to learn something else.

So I went to Columbia and took a quick two year course in electrical engineering, and worked with them until about 1920. When they didn't seem to be doing much, and I thought they should be doing more. And they sent me on a six weeks trip through the West to get some business. When I came back with no orders, they said, See now, let's see you get your own payroll together.

And I walked back to the house without a job. And as I said, before, you know, if nothing seemed to happen in this country. No headlines, no telegrams, nobody cared. The only way I could see to exist from then on was to be my own employer, which has been more or less successful and quite damaging to the internal intestinal arrangements at times.

Interviewer Fitzgerald:

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(24:39) Well, your business was really established on phenol formaldehyde, wasn't it?

George Scribner:

(24:44) Our business was established entirely on phenolic molding compounds, and ran that way until, well, up until the early 30s or late 1920s when urea came in, and then we dabbled. With the thermoplastic materials which were at that time only to be made by chilling and heating and chilling in compression methods.

First Pioneers of Injection Molding Because of Poor Compression Molding Results with Cellulose Acetate (25:00)

I think we were the first pioneers in injection molding, because long about 1934 we were thoroughly disgusted with the compression molding of cellulose acetate, and we wrote a letter to a concern in England, the Shaw Company, asking them if we could buy an injection press. They came back and said that they thought we'd better buy it from the Hydraulic Press Manufacturing Company who had their American patents.

We wrote Hydraulic Press, and they said, yes, they had the rights, but they'd never made one, but they'd be very glad to do so. The first press that they sent us, and it cost us $1,800 was a two ounce press. It had hand wedges to hold it together and it had a hand operated injection proposition, which was completely out of this world. From then on, for the next three years, every six months, we'd received a circular from them saying that improved upon that we couldn't use what we had, but they had an improved version.

Dinnerware (26:22)

We bought the next version, and that didn't work. And gradually they came out, until finally we have now our self-contained presses, which arrived on the scene about 1936. I think the most sensational development in plastics today is the introduction of melamine on a price basis, which would allow to be used in dinnerware, because it has all the qualities that we've been looking for years, we've made sporadic attempts to make dinnerware out of beetle out of ureas, because they had the color that wasn't enough. They didn't have the ability to stand up against the washing procedures or the heat necessary in ordinary use of dinnerware.

In the last starting about 1948 the American Cyanamid Company, having a surplus of melamine molding compound in their hands or facilities to make it, got the bright idea that they also had all the qualities necessary for commercial and home use dinnerware. And that is the biggest thing that has come along in molding.

Interviewer Fitzgerald:

(27:36) George, there's one point before we close. You started with one molding powder. How many do you use now, roughly?

George Scribner:

(27:36) I should say we are using about 12 different basic molding compounds in injection and compression. And I should say that our normal inventory covers very close to 100 different numbers, including the colors, the flows and the variations of those 12 molding compounds.

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Interviewer Fitzgerald:

In other words, that expansion has required you to do a tremendous amount of research work to develop the new techniques necessary to successfully work the newer plastics.

George Scribner:

Yes, in our research work is not only devoted to the development of new techniques in the use of these plastics, but we have to, as molders, find the markets for these players. That's true, the raw material, people may come to us with a new plastic that has a whole group of new characteristics, and they calmly say, what can we use it on?

That is the biggest problem that the molders have at the present time, of snapping into a new market. And in most cases, the bar molders are the ones to find the new market, which is quite natural because the raw material manufacturers only have a limited contact. You take 700 molders, and each one of whom have 100 customers. That's 7000 possibilities, and each customer has a problem that we don't even know about.

Interviewer Fitzgerald:

(28:58) Well, it's been a very interesting discussion, and as we're apparently approaching the end of this reel, why? Let me thank you, George Scribner, for your contribution. I did want to touch on your fine work with SPI, but apparently we do not have the opportunity here. We do have a minute. All right, you were you did give a lot of your time to SPI, didn't you?

George Scribner:

Why? Yes,

Interviewer Fitzgerald:

You gave it a great boost.

SPI Involvement (29:26)

George Scribner:

(29:26) I finally got into the SPI and probably stuck my neck out many times as the representative of the molders because I thought the molders were a very essential element in the plastics industry, and I thought they had the right to throw their weight around. If I've hurt anybody's feelings at any time by talking too loudly, it was because I felt that I was talking for the molders, who have been a very essential element in building up this plastics industry. Without them, the raw material people would have been struggling.

Interviewer Fitzgerald:

(30:04) I checked that, and I come from the raw material family. Without the molders, we would not get anywhere. Thank you very much, George, for this contribution. George, I find that there's still about two minutes to run and Miss Hansen and I are from New England, and we want to use it up. What about this tableware, Boontonware, that you have developed has grown into a big thing, hasn't it?

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Additional Dinnerware Background (30:34)

George Scribner:

(30:34) Why, yes. That tableware developments, particularly the connection with Boontonware is very interesting. It started out with the chain store line of tableware made by Hemco and was about 16th of an inch in thickness. We came into the picture, and we probably went too far on the other side, we went pretty close to a quarter of an inch in thickness.

The first reaction to that was that it was sort of a Bowery thick China effect. It would not be acceptable. But as a matter of fact, it's brought up an interesting point of view, and that is that if you put a hamburger on a thin piece, you have the feeling that the hamburgers gonna fly away before you can eat it. If you put it on a thicker piece, regardless of the fact that it may look a little bit bulky, you feel as though you could work with it. And people accept Boonton wear as the Tiffany of the trade. It's shown by the demand around the country, which we can't keep up to. I think that Melimac or Melamine tableware is here to stay and has an enormous market, but I wouldn't advise anyone else to go into it.

Unknown speaker:

(31:47) We're very glad to get this PS.

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R.E. “Bob” Brannon, Redmanol, Bakelite Mold and Material Sales

Interviewer Fitzgerald:

(32:01) Another little Pioneer here at Shawnee who have had a long and wide experience in observing and participating in new developments is Mr. R. E. Brannon. Bob, will you tell us your company and your position, please?

R.E. “Bob” Brannon:

Well, I have been started out as a salesman for the old Redmanol Company in 1923 and continued such until 1940 when I became manager of mold and material sales for the Bakelite Corporation.

Interviewer Fitzgerald:

Well, that covers a broad and interesting period when many new developments took place. Now, won't you select one or two out of your experience and tell us something of what occurred.

Washing Machine Agitator (32:43)

R.E. “Bob” Brannon:

(32:43) Well, one of the most outstanding and applications that was developed in the Chicago area when I was there was the adoption of plastics for the washing machine agitator. These agitators previously had been made out of aluminum, and we had developed in our Bloomfield laboratory a shock resistant flock filled molding material that had good water resistance. It gave me the idea that we could go back and re tackle a job and which we had failed previously. So we asked our operating committee for enough money to build a mold for samples.

We took this mold to the Thor Company in Chicago, and used their laboratory for nine months, from four o'clock in the afternoon until eight o'clock the following morning to test the agitators. At after this nine months test, we decided that our BM 13080 should be satisfactory for agitator work. At which time we then sent to 33 washing machine manufacturers four washing machine agitators molded called BM 13080. Some of these washing machine manufacturers put these agitators in test.

The Mr. Morganstern of the 1900 Corporation, ran his agitator continuously for 700 days before he decided that it would be satisfactory for an agitator to replace aluminum. The only argument we have in asking them to change from aluminum to plastics was that the plastic agitator was not affected by the soap and remained smooth while the aluminum agitator was corroded and in usage became sharp. And as a result, cut more lint off the clothes than would the plastic agitator. A patent had been taken out by the Metals Company.

Their main claim being that the plastic agitator removed 90% less lint around the aluminum agitator. After, it took almost three years after the first samples were sent out, before the first mold was built. Naturally, people in an industry of this type are slow to change. The Maytag Company having their own die casting plant were reluctant to discontinue the use the use of this plant, but eventually switched over 100%, and since 1939, practically every Washing Machine Company are using the plastic agitator. Most of them 100%, and at the present time, there's approximately 120 molds in existence for producing agitators of various types.

Interviewer Fitzgerald:

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(36:15) Well, I was going to ask you how long it took, and you already have told me that, but I think that indicates the long, hard work that goes into even the single development. That indicates the effort that has been required to build this plastic industry to its present proportion. Don't you think so?

That is true, and we're experiencing the same thing at the present time, since I'm spending all of my time since June in 1952 on the development of new phenolic molding material applications, primarily amongst the kitchen cabinet and furniture field.

Interviewer Fitzgerald:

(36:56) It occurs to one on molding power as old as phenolics, and considering the amount of work you have done, how much future potential is in these new developments?

Projects Positive Future for Phenolics (37:05)

R.E. “Bob” Brannon:

Well, in my opinion, a phenolics have been neglected as far as new applications are concerned during the past eight or nine years, because of shortages of phenol and other raw materials. With proper pushing and searching for applications, I think it can grow in proportion to the rapid growth of the polystyrene in the last few years.

Interviewer Fitzgerald:

Well, I think that is undoubtedly true. Now, Bob, is there anything else that you would like to relate at this time in connection with your experience?

R.E. “Bob” Brannon:

Well, the only other thing I would like to mention is that I have fun and work hard. This is a good place to do it.

Interviewer Fitzgerald:

(37:50) I think we would say, Amen to that. Thank you very much.

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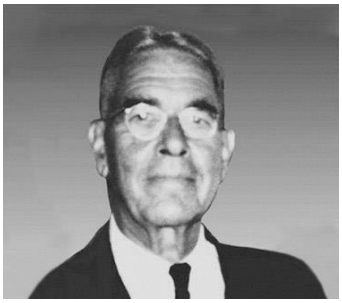
Gordon Brown, Bakelite Vice President



Interviewer Fitzgerald:

(38:28) We've heard from sandy brown, and we've heard from Alan Brown, and now we're going to hear from the kid of the family of these three famous Brown Brothers who have contributed so much to the development of the plastic industry. Even though I call him a kid, he dates back a great many years, and I know has some interesting recollections in his experience in the phenolic and other types of plastic industries. Now, Gordon, would you give us your company in your position, please?

Post World War I Aircraft Industry Innovations with Phenolic Resins (38:58)

Gordon Brown:

I am vice president of the Bakelite Company. I wanted to tell you about what I believe to be the first resin bonded plywood made in the United States. Right after World War One, a number of the aircraft companies were using resin bonded wood, both as wing coverings and structural members, and the glue used was not satisfactory.

Consequently, the Forest Products Laboratory were seeking improvements, particularly improved glue that would withstand high temperature and humidity combined. We got the idea that we could use the Phenolic resin. At that time, I was with the Condensite Company. Our molding materials were made from a Novolac, which was then dissolved in alcohol, and later to this was added hexametha (sp?). This varnish was normally mixed with wood flour and then dried in a vacuum dryer to make a molding material.

I procured some samples of veneer from the Forest Products Laboratory and coated it with this heat reactive varnish and let it dry overnight in our press room on top of a press where the temperature was probably around 90 degrees Fahrenheit. This was then molded in the regular molding material operation the next day, except that we used a lower pressure, but about 350 degrees Fahrenheit on the press and 200 pounds per square inch on the wood.

These pallets were sent out to Forest Products Laboratory, and they became very excited about the material, because for the first time in all their tests, they had uniform wood failure, even on the wet strength samples. It was the first time that they had ever tested any wet wood and found the strength higher than with the dry wood.

They recommended that we work with the Forest Products Laboratory, who were then using blood albumin glue, which was the highest grade glue at the time. But Forest Products were hesitant to go into any such operation because alcohol was used in the glue, and they were afraid of the explosive circumstances that might arise in their woodworking plant. Later on, of course, when the phenolic resins

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were developed using water as the dispersing agent, phenolic resins became a very large bond for plywood.

Interviewer Fitzgerald:

Am I correct in understanding that either you or your brothers was associated with Thomas Edison in the early days in some development work?

Gordon's Father, Kirk Brown, Working with Thomas Edison on Recording Sound, Formation of Condensite Corp. (42:00)

Gordon Brown:

Well, Condensite grew out of the Edison business. Thomas Edison was loath to make a disc machine. He claimed that the only proper way to record sound was on a senator because it had a uniform speed, and it had various other advantages, the details of which I'm not acquainted with. But his business was being very seriously affected by the inroads of the Victor Company with their disc machine.

The discs were efficient in storage, and the public were buying them, and the public were refusing to buy the cylinders. So the Edison organization, unknown to Thomas A Edison, decided that they would put out a disc machine and put out a very fine one. And so the various jobs were assigned to different people around the plant.

The superintendent of the cabinet plant was charged with making the very finest cabinet that could possibly be made. And the motor producer was charged with making a motor where they never have to replace a spring. Springs were regularly replaced those in those days on the hand wound machines, and finally, their Chemist, Walter Ellsworth, was charged with finding a material from which a record could be made that would withstand the wear of a diamond or sapphire point.

They conceived that they would have great competitive advantage if the customer didn't have to change needles. He went into chloronathalenes and developed hard waxes. He went into all kinds of natural wax combinations. And at about that time, which was along about 1907 or 08, Baekeland made his disclosures on the phenolic resins.

So Ellsworth started to work with phenolic resins and developed the so called two-step process, where he completed a reaction to make a novolac and then added a secondary reacting material to it to make the so called Two Step heat-hardenable resin.

On the basis of those patents, the Condensite Company was formed, and my father was the one who put that together. My father, Kirk Brown. I went to work in 1911 because he had found me smoking Pall Mall cigarettes, and told mother she wasn't to give me any more spending money. And told to me, said, if you want to smoke cigarettes, you can earn the money. I offer you a job at the factory of the dollar a day. So I went to work and became a combination office boy and factory hand at $1 a day, and was later dignified by being put on the payroll of 12 and a half cents an hour.

Interviewer Fitzgerald:

That's interesting. Your description of the work in the Edison Laboratories is interesting too. Tell me, are phenolics still used in records? No modifiers to phenolics?

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Gordon Brown:

No, to the best of my knowledge, records today are made of so called shellac composition, which has all kinds of cheap compounds and vinyl compounds and styrene compounds. But to the best of my knowledge, the phenolic record was a temporary article of commerce.

Interviewer Fitzgerald:

Let's switch over to the SPI which you are President, I believe, and see if you can't tell us something about the work and organization there.

The Formation of the Society of Plastics Industry (SPI) / Plastics Industry Association (45:49)

Gordon Brown:

In 1932 to 33 the molding industry, which was then not known as the plastics industry. They were actually there were Bakelite molders. I was very conscious of that fact at the time, because as a salesman for Condensite, I was forced to visit one Bakelite department after another. And I remember how it used to gripe me to have to go into a department name for our competitors. But that was only natural, because Dr. Baekeland had invented this new material, which was bringing about a rapid expansion of the then infant molding industry.

There have been at least three attempts between 1910 and 1932 to establish a molders Association. They have all failed. The last was a division of the National Electric Manufacturers Association, and George Scribner was the last chairman of that group. They had been inactive for some time, and George Scribner himself was rather pessimistic about what benefits might be secured by having a public Association. All their efforts had been fruitless.

I knew that there were a number of unsatisfactory situations in the molding business, and that it was most desirable to have some sort of a public agency which would permit our customers, the molders, to get together. I had been playing golf one day with George Scribner and Don Kendall of the Mack Molding Company.

And after golf, I remarked that it was a pity that we couldn't have larger groups in our industry getting together in this agreeable manner. And asked George why he didn't activate his NEMA section. He expressed discouragement, where, but I asked him if he had any objections, if I did, and he said, No, go ahead.

SPI Initial Meetings (48:32)

So the next day, I thought over the problem and decided that these previous associations had always come apart because they had tried to do too much. They always had very elaborate plans for all sorts of activities typical of trade associations. Then, because they were small businesses in which the proprietor was salesman, factory manager, treasurer and everything else, they seldom did them. I organized a meeting at the Buckwood Inn, Shawnee on Delaware in July, and I don't know exactly what year it was. I think it was 1933

Interviewer Fitzgerald:

(49:16) In this same building?

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Gordon Brown:

In this same building, and I remember we chose Monday and Tuesday because it was they were off days and we could get the place cheap. And then I sent an announcement, not just to the molders, but to everyone who constituted a part of the industry, including our competitors. That was an unheard of thing at the time, because competitors were in the habit of tearing at each other's throats, and we never socialized.

But at any rate, we had a successful meeting with about 75 people at Shawnee, and those who attended were so pleased with the meeting that they decided they'd like to have another meeting. Very soon. So that fall, there was a meeting organized at Lenox, Massachusetts, at the - what did they call the Berkshire Hunt and Country Club? Those meetings were followed by similar meetings.

There was another in the next year at Shawnee, and I think there were at least two others at the Berkshire Hunt and Country Club. At the last one of those, after dinner, when everyone was in very hilarious mood, I was called upon to make a speech. Whereupon, through much shouting and cheering, my speech consisted of asking them if they wanted to perpetuate these meetings and formalize them through having an association to the extent that they would put up $5 each in cash to act as a nucleus for such an association.

Jim Neal of the Norton laboratories, who sat across the table from me, immediately put his $5 down, and I started to write names in my notebook as I collected the money. Finally, when I got down to about 15, someone asked me if I was going to put up my own five, and I put my own name down and took five out of my bankroll.

Victor Sammet of Northern Industrial Chemical Provides First Substantial Funding (51:20)

After that meeting, I went to Boston, and during my visit with Victor Sammet at the Northern Industrial Chemical Company, he advised me that it would take much more than $5 per individual to establish the sort of an association I was thinking of, and that it was futile to endeavor to have a proper trade association unless the companies put up real money. He said, they should put up at least $100 apiece. I replied, will you give me $100 right now, he said, sure, so I took his $100. And then, as I visited one customer after another, I collected $100 as I went for rounds.

I have forgotten just how many I collected the $100 from but by the following spring, in May of 1937, I had collected some $1200 or $1,500 and secured a certificate of incorporation. I'd given this association the name of the Society of the Plastics Industry, and arranged for the organization meeting prior to the big meeting at shortly that May. That was held the night before the get together and dinner, so that we could present the regular officers and the Certificate of Incorporation and the bank account to those who were elected President, Vice President. The President was President Heidi Cooper, the Vice President, Ronald Kinnear and the Secretary and Treasurer, Bill Kelly of the Chicago Molded Products Company. Ronald Kinnear was of the Albany Billiard Ball Company, whose associate company, the Niagara Insul-Bake Company were one of the original molders of the phenolic materials.

Interviewer Fitzgerald:

(53:26) That's a very interesting background that you have there. And I think it's quite fitting, and it was very pleasing to your friends and associates when you were on by being elected to the presidency of it. Does that take quite a lot of time now?

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Gordon Brown:

It's no longer a simple social get together. It takes a great deal of time to be the president of the Society today for it is no longer just a molders organization. We now have many different facets of the plastics industry because of the many different characteristics of plastics that had been produced in the interim.

Rapid Growth and Valuable Industry Executive Support of the SPI (54:12)

Interviewer Fitzgerald:

Well, of course, the industry has expanded so much in addition to molding you now so many types of fabricating that the customers, a lot of the members have multiplied. I don't know how many you have at present. How many do you have?

Gordon Brown:

There were 743 members of the SPI at the last count, and these included fabricators and final film fabricators of reinforced plastic made from glass laminates and the regular line of laminates made from all sorts of fabrics of paper and cloth, and of course, injection molders, compression molders and fabricators of acrylic materials.

Interviewer Fitzgerald:

(54:59) Well, this association has really been built up now on a good firm foundation with a capable and energetic organization, and is functioning very satisfactorily.

Gordon Brown:

It functions satisfactorily because the energetic, dynamic plastic industry contribute their individual efforts to make it go. The association operates on a budget of over $200,000 per annum, but that is a small item of the costs of operating. The costs of operating this association are very much larger than that, because they consist of the efforts of high priced executives of the various plastic units who contribute their efforts and the efforts of their associates and their laboratory facilities to the work of the society. The Society long since ceased to be just a trade association, it is also a technical group that has done much constructive work in the fixing of standards in order to improve the quality of goods that go on the market.

Interviewer Fitzgerald:

When one reads the list of the various committees and see as the personnel of those committees, it certainly supports your view that the industry in general is putting their shoulder to the wheel and helping to maintain this society and helping it to serve the industry. If you want anything else Gordon that you'd like to add to?

Gordon Brown:

(56:32) No, that is all.

Interviewer Fitzgerald:

Thank you very much.

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Bill Mellon of Mellon Company Discussed by Sandy Brown (57:09)

Interviewer Fitzgerald:

(56:57) We have asked Sandy Brown, who has recorded once before to return and tell us about the development of caps or collapsible tubes. Sandy, will you tell us that story, please?

Sandy Brown:

Bill Mellon of the Mellon Company, manufacturers of talcum baby powder, was a Cornellian that I had met when I had been school. I hadn't seen him for a number of years because he graduated ahead of me, and during World War One, we were having lunch one day in the Washington restaurant.

Condensite Plastic Cap for Metal Shaving Cream Tube (57:30)

And he told me that they were putting a new shaving cream on the market and that the price of tin had gone up to $2 a pound, and would become a strategic material.

And therefore their production was very much limited, in addition to which they were having some difficulty with the metallic cap sticking to the tube. So I suggested that he use Condensite. He wanted to know where he could have these made. And I told him that Wright Work Assurance or another company were capable of doing this job. So I got a hold of Frank Shaw and introduced him to Bill, and Frank made the first caps, so far as I know, for collapsible tubes by punching from what we termed a plastic sheet, pre-forms that were then placed in a flash mold, and he made many 1000s of these caps for Bill Mellon.

After the war ended, the price of tin went down. Frank had been getting two and a half cents apiece for the caps, and Bill decided that he'd return to tin. And it was seven or eight years after that before the production of caps for collapsible tubes, made from phenolics was resumed by the industry on a large scale.

Interviewer Fitzgerald:

(58:57) That's very large there is a very large business on plastic there today, and various kinds of plastics are used, are they not?

Sandy Brown:

Yes, it consumes a tremendous amount of phenolic materials and also polystyrene. And I believe at the present time, they're starting to make some from polyethylene.

Interviewer Fitzgerald:

Well, that's very interesting. We're glad to have that addition to you, Sandy, thank you.

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Lionel Cavanaugh, President & Treasurer, Standard Tool Company of Leominster

Interviewer Fitzgerald:

(59:38) The tremendous progress and growth of the plastic industry would never have been realized had not the manufacturers of dies, dies, tools and so forth, made equal progress in the art of manufacturing these necessities, in molding and fabricating plastics. Mr. Lionel Cavanaugh has had a vast experience in this field, and is now going to record for us. And first, Mr. Cavanaugh, will you tell us your company, please?

Lionel Cavanaugh:

Mr. Fitzgerald, my company is the Standard Tool Company of Leominster, which I'm the President and Treasurer.

Interviewer Fitzgerald:

And now out of your experience, once you look back and tell us something of the progress in this particular field.

Lionel Cavanaugh:

Well, my experience in plastics goes back even before establishing my company in 1911 as a young man, I worked in plants in Leominster that manufactured various products from plastics then known as celluloid. This was a nitro cellulose product.

Interviewer Fitzgerald:

What were the first things you made dies for?

First Plastic Die Uses: Combs and Barrettes (1:01:00)

Lionel Cavanaugh:

I think the first things that we made dies for were switching die that was used for producing comb backs, Spanish comb backs. These dies were used in hydraulic presses, which embossed the design on the back of the comb, and then we made a set of piercing tools that pierced the holes. This method eliminated a great deal of the hand work that used to have to be done by jig sawing or sawing with fret saws to cut out the design and the embossing eliminated the hand carving on these combs. This was quite a definite step in the producing of combs, barrettes, and similar items at a very reduced cost and expanded that type of manufacture in Leominster.

Interviewer Fitzgerald:

Tell us something about making a die, doesn't it have to be extremely accurate, and doesn't it require great skill?

Lionel Cavanaugh:

Yes, it does. The dies today, of course, have to be produced very accurately, and regardless of the size, the parting line of the die has to be within, at least within 1,000th of an inch.

Interviewer Fitzgerald:

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I presume they've made great progress in increasing the capacity of dies as the years have gone by, have they not?

Lionel Cavanaugh:

Well, I recall that the first injection molding dies that we worked on were small. You could put them in your side pocket, whereas today, injection molds might weigh a ton or more.

Interviewer Fitzgerald:

(1:02:55) Well, even going back to dies for actual plastic sheet stock, you used to have single characters. Didn't you for combs? And didn't they make many multiple cavity dies when they molded combs from sheet stock?

Lionel Cavanaugh:

Yes, they did. I presume, Mr. Fitzgerald, you referred to what we call dressing combs. Yes, those molds, had five or six cavities. It was a compression mold. It used to emboss the shape in the backs of the blanks, and then the teeth were cut in. In another operation with a comb cutting machine, or a twinning machine, as they were called in Scotland.

Interviewer Fitzgerald:

You come from a very interesting town and a town that has held a prominent place in the plastic industry for many years. Leominster. Tell us just a little about the early days in those towns, in your town, and the changes that have taken place in the fabrications of molding and plastics. That will you please?

Leominster, Massachusetts Plastics History (1:04:02)

Lionel Cavanaugh:

Well, I think Mr. Fitzgerald that in the early days that Leominster, Massachusetts was considered the center of the celluloid or the plastic trade. And even today it's, it's very prominent. I believe in in plastics. But in the early days, much of the work was done by hand, and it required skilled artisans, skilled laborers, skilled Jig-sawers. I think that some of the first men that worked on plastics came well, let me correct that please the first was on horn and shell. And in the library in Leominster, you will find articles that were made of shell and of horn, and some of the early workers were imported from Scotland and England. Later on, celluloid took the place of the shell and the horn, and my experience goes back to those days.

Interviewer Fitzgerald:

That's interesting. Now we've digressed just a little won't you resume on anything you have to tell us on the die and tool industry,

Lionel Cavanaugh:

I don't know as we had any firsts in plastics, but I do think we had a part in the producing of the first molds for injection molding. Some of the first molds that we made were made for the Eklund Ziegler and the isomer machines. These molds were very small, but still had to be made quite accurately. Later on,

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we made molds for the early made American injection molding machines. One first might be the pre plasticizer that we made for a two ounce American made injection molding machine. This plastic pre plasticizer, as I remember, was made in about 1936 and pre plasticizing of material for standard molding machines is becoming increasingly popular and increases the range of the standard machines. I do believe that molds has kept abreast of the development of raw materials. Most of the molds have to be designed and built for each product taking into consideration the type of material and the end use of same.

Interviewer Fitzgerald:

With the large variety of plastics that's been developed in the last few years, you must have to make quite a variety of dies in order to get a good molding job for them.

Lionel Cavanaugh:

(1:07:15) Well, that is true, Mr. Fitzgerald, we do make a wide variety of dies. The interesting part of mold making is that we don't know many weeks in advance. Just what we're going to have to produce. Every day seems to present a new problem. I believe I said earlier that the first molds you could put in your side pocket, whereas today there's molds being made for the liner of refrigerators that these molds weigh in excess of a ton, but still they have to be just as accurately made as the smaller ones.

Interviewer Fitzgerald:

Do you got anything more that you'd like to add Lionel?

I think this vinyl gives a general idea of my part in the early days of plastics, and it has been a very interesting work. Tomorrow usually brings a new problem.

Interviewer Fitzgerald:

(1:08:22) I realize that. We're very grateful to you for making this recording for us.

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Tape 4 (AC1235-RCD0004)

James S. Wilson, Best Way Products Company

Interviewer Fitzgerald:

(0:30) James S. Wilson is our next speaker, and Jim has had a wide experience and the manufacturer of dyes of various kinds and machinery of various kinds utilized for the plastic industry. Jim, what is your present company?

James S. Wilson:

My present company is the Best Way Products Company of Rahway, New Jersey, and we devote all of our time to the manufacture of children's records in the polystyrene composition. We also operate another company known as the M & W Company, where we have an engineering service and a development set up for the manufacture of fully automatic equipment for the record industry. These machines are built and rented to the record industry on a royalty basis.

Interviewer Fitzgerald:

Well, now why don't you reach back in your experience and relate some of the interesting incidents that have occurred?

Initially Started as Tool Maker Apprentice with General Electric in 1918 (1:30)

James S. Wilson:

Well, this whole industry is the most interesting field I could imagine anybody serving their time at or in. Rather, I started out as a tool maker an apprenticeship in 1918 with the General Electric Company in Schenectady, New York. At that time, I was thrilled with the idea of becoming a tool maker and producing molds, principally at that time for the ceramic division of the company.

Shellac Division Evolved to Phenolic Materials around 1924 (2:30)

Later, I moved from the ceramic division in mold making to what was then not known as a plastic division. It was the shellac compound division of the company. There, we molded the shellac key switches for the old time electric setup. And as the years rolled by, I would estimate it to be about 1924 possibly, that we started to convert from shellac into the phenolic materials, first changing the key switch from a shellac button to phenolic button.

Phenolic Powder and Cavity Molds (2:48)

The molds then were what we called common cavity molds, where the powder, the phenolic powder, was poured in, in a very crude way, into a common cavity and pressed in hand molds at that time to produce the key in a phenolic material. Later, when the Big Light Company made further developments, we had the brilliant idea, of course, I don't believe we could be called the originators of it, of changing from powder into a pre-form to reduce our rejects. The first pre-form dies that we made were single cavity, hand operated molds, and it was a tedious job. Then as we progressed, we had made the purchase of one of the first pre-forms machines. Our main headache at that time was we were perfectly capable of producing phenolic parts in black, but when we got into the brown materials, we had our

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time was sticking of molds and gumming up surfaces. And many times we'd have a mold out and polished four and five times a week.

Interviewer Fitzgerald:

That is when you began to learn that each plastic had its characteristics and you had to adapt your work to it wasn't it?

James S. Wilson:

Producing a Complete Refrigerator Door in Plastics, 1928 (4:46)

That's right. And today, when we hear of all these tremendous machines, which I had a big part in introducing, we think we're pretty well advanced. But I recall in about 1928, we originally made the effort to produce a complete refrigerator door in plastics. At that time we were we used an emulsion with paper of the urea type, and I recall the day we made our first attempt.

We were using a multiple platen rubber press, and we slid this mold in between two hot platens with a mixture of emulsion in it, and proceeded to close the mold and watching it very carefully until just a fraction of a minute before the closing time the we generated quite a volume of steam, and we blew the emulsion from between the dies. And really were covered with this horrible smelling mixture. That evening, I went to the theater with my wife before going home, and she was wondering all during the performance what that horrible smell was. And I had to admit, I'm leaving the theater not to spoil her evening's entertainment that I was the one who smelt like the stable boy due to this experiment.

Interviewer Fitzgerald:

Quite amusing. Well, now, did you participate, you say, in the development of the larger injection molding machines that are used so extensively today.

James S. Wilson:

Big Molding Machine Development, 1942 (6:42)

Yes. In 1942 I came with the Watson Stillman Company as manager of their plastic machinery division. In looking over the industry the other competitors that we had mainly Reed Prentice Company at that time were covering the field with a machine of an eight ounce variety, which was commonly used by all molders at that time. And they had tooled this machine up to such an extent that it was pretty tough competition to sell. So I thought the easiest and laziest way to make a business was to do something a little bit differently and introduce larger machines instead of trying to compete in the small machine field.

So our first big machine was a 24 ounce, and after we started manufacturing it, we'd put too much steel into it, and our selling price wasn't enough to give the company a profit. So instead of calling it a 24 ounce, we just boosted it to 28 ounces and called it a 28 ounce machine, and raised our price accordingly. These were the first big machines that were in actual production. And from that we worked along to the point that on my leaving the company, just a year ago, we had made a 300 ounce machine that would produce parts of such a magnitude that nobody had ever dreamt of trying in the early days. This 300 ounce machine had a 1500 ton clamp and the earlier machines are certainly dwarfed by this tremendous piece of equipment.

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Development of the Fully Automatic Molding Machine For Records out of Styrene Instead of Vinyl and Shellacs (9:01)

With the machine experience I gained at Watson Stillman, I decided that there was a need for fully automatic machines, and there still is a tremendous need for it, due to the labor conditions we have in this field and in all other fields. So with my associates, we designed a fully automatic injection molding machine for the production of records. This was also our development, with the able assistance of the Bakelite Corporation in producing a record from a styrene composition, instead of the commonly used vinyl and shellacs of the old days. This field is growing, just as all other fields in the plastic industries are and we're just dreaming and working to the end that many, many other items will be converted into the plastic field.

Interviewer Fitzgerald:

I'm very sure that it will, with the aid and assistance of men like yourself and those who were recorded previously. Have you anything you'd like to add to that?

James S. Wilson:

No, there's nothing that I can recall now that would be of any interest to those who might listen to this in later years.

Interviewer Fitzgerald:

Well, thank you very much, Jim.

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J. G. Swanson, Dies and Machinery Consultant

Interviewer Fitzgerald:

(10:02) We are continuing our discussion about dies and machinery in the plastic industry, and we're now going to hear from another veteran, Mr. J. G. Swanson. Mr. Swanson, what is your company, please?

J. G. Swanson:

I have no company. I do consulting work and things of this kind, but I'm trying. Business has been working for other people developing these things.

Interviewer Fitzgerald:

Well, that's very good. I'm sure. Now a lot of your experience certain, you have some interesting things to relate on the progress of machinery, tools and so forth in this industry.

Progression of Machinery and Tool Starting in 1913 (11:29)

J. G. Swanson:

(11:29) I'll start by taking you back in the neighborhood of 1913 with the Kellogg Switzer Sports Supply Company, we decided to change from rubber and shellac receiver shells to a so called Bakelite at that particular time, and we called in one of our old rubber molds and tried to mold a cap for this receiver shell, and we found out that we were unable to unscrew those threaded plugs that was all right for rubber.

But in the new material, it had to be cured and cooled at that particular time, and we found it impractical to un-turn those things, so we had to develop a little flat sides on the round part of this receiver cap, which ultimately became a Kellogg design on that purpose. And in the time as we went out, Mr. Burrows installed semi-automatic presses and so forth between after 1913.

The Pencil Barrel Mold / Plunger Development (12:35)

And one of the highlights of this thing, among many developments as it was, one of the pioneers was the making of a pencil barrel mold that stands out, I believe, as a progress at that time. We made 16 of the barrel shapes into the form of what we call a plunger today. We dropped the powder among the pins that formed the inside of the hole, and we pressed those four down. Withdrew those parts of the mold with core plungers, and placed them under an air chamber which cooled them and ejected them from the silver at that time, which I believe is being used today in many cases.

First Use of Free Form Machine to Make a Navy Button Blank (13:35)

And I left there in 1916 between 1916 and 1919 I was in Dayton, Ohio at the old Dayton Insulating Die Company, which is now Kerns Cash Company. And in the interim there, we used the first free form machine, to my knowledge, as forming the blank to making Navy buttons for the First World War there. And in that particular time, we were forced to make molds from a solid block of steel, shaping the holes that we call cavities today to the outline of the particular part to be molded. And we placed a top and bottom force on that and we poured powder into those cavities and put the mold together with the powder in there, and gave it a long cure, and still had to cool it before we could withdraw the parts.

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Interviewer Fitzgerald:

(14:26) This pre-forming development was extremely important, wasn't it, and hasn't it resulted in a considerable economy and increase in rapidity of production?

J. G. Swanson:

That has, to my knowledge, been very important, and I have spent a lot of time in doing that. But I would like to bring out one more point on this particular mold construction, as I'd like to follow that along a little bit too. In other words, we put the powder in these molds, and we found out having, in some cases, gas as a medium of heat. We would overheat the material, and thinking that we did not have enough material in the cavity to form the piece, we would add to that. And we used to break a lot of molds because we were really setting the material up before pressure.

Radio Set Pre-Shaped Charge, 1919 (15:30)

And as a result of that the flash type mold become a very beneficial mold to us at that time, because we didn't have to make it out of this steel. So that brings us up to about 1919, when we had that large rush of radio parts that everybody was making a radio set, and we had plenty of chances to check the advancement of the flash type mold. And as a have a flash type mold, it was necessary to make some sort of a pre-shaped charge, which was a pre-form to us. But in going through this, we found there was no machines of a large enough capacity as a pre-form machine to give us the pre-forms that we would need in this expansion of same. So that was eventually done by Colton casting his frames from steel instead of cast iron.

Molds with Side Pins (16:27)

We also developed molds there that molded with side pins. Take a watch case, headset part had a side hole for the core to come out. We used to force the core pin in there and move that hole all semi automatically set up as a semi-automatic machine. And that was, at that time, considered a fairly good advancement in the Central States, where I was at the time. In 1923 to 1927, I went to Elyria, Ohio, the International Insulating Corporation, part of the General Photograph Manufacturing Company at that time, and now named the General Industries.

And in that plant, we inherited this plant from Springfield Mass, and it was primarily purchased with the idea of making shellac records. But we found that equipment was absolutely unsuitable, so we went into trade molding of shellac parts, and also the phenolic parts, well in the development, or I mean, in that having that shellac mold experience, we stuck more primarily with a flash mold, but we had, at that time, what we call a sheet Bakelite that was uncured, and we piled that onto the cavity and molded it similarly to the shellac. And in this particular interim, we inherited a lot of these old toggle presses that were mechanically operated with a bunch of gears and crank and a clutch. And after a serious accident, we took out the mechanism and laid an air cylinder in there, which I believe is the baby of our present air operated toggle presses. That takes us up to '27, and as I say, impressive. We did press some records in Elyria, but the shipment was finally shipped back to the General Phonograph Manufacturing Company in Newark.

Then from there, I worked with Ford in developing their plant as a consultant, because at Elyria, we were big producers of parts for Ford's automobile at that time. And one thing in there that was quite interesting from my own personal satisfaction was that after a serious siege of controversy and

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discussion for the engineers at the Ford plant, I went back to Elyria and had a drawing made of a press with a mold installation. And I'm happy to say that later on, that was taken up as a policy against the fact that they had decided to pick up the powder method with a big loading chamber and so forth as a policy, which, as I say before, has been discontinued. Then I come from there and I went with Ford for a few weeks. And then come on to Boonton Molding to give them a lift in doing away with hand molding and getting into the semi-automatic molding.

And also, at the same time, developing further the complication of the film machine by putting holes in the pre-forms that I could lay over pins that were sticking up in a mold and generally broke off with a hard pill. And in this Elyria experience, we got into preheating of pre-forms on steam tables, and we found out that was a very decided advantage over any of the cold materials. And with this, what we might call improved press, with an air cylinder and a female operator. We got about the same price as we did downstairs with a male operator on a 25 cavity mode. So that was interesting.

In the meantime, I went with the Celluloid Corporation pioneering lumberith, and gained a lot of knowledge and experience there. In 1931 to 41 I set up Leviland Molding Plant, and since that time, I have set up three other plants. And so that constitutes my experience. It could be much more elaborate, have I the time to do so.

Interviewer Fitzgerald:

(21:29) Well, it's a good addition to of all the recordings we have here, and we appreciate very much you're coming and doing this for us, Mr. Swanson, thank you.

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Gordon Brown Discusses Eastman Cellulose Ester Plastics and Molding Methods

A few years ago at Shawnee on the Delaware at a meeting of the plastics pioneers, tape recordings were made by several of those present of early events in the plastics industry. Unfortunately, no one was at the meeting from Eastman, but Gordon Brown has kindly provided us the opportunity to make a tape recording of some of the early events in the field of the cellulose ester plastics.

Eastman Cellulose Plastic and Combs, 1932 (22:23)

Eastman cellulose plastic was made an offer to the trade in 1932 just before the era of injection molding. One of the first uses was for compression molded combs. One hesitates to think of what might have happened to all thermoplastics were they now susceptible to forming only by compression.

Strangely enough, one of the first injection applications in the USA was also for combs in an Eckert Ziegler injection machine imported by Foster Grant Company incorporated back in 1932. Possibly an Eckert machine acquired by Mr. M. A. Love at French Ivory Products in Toronto, a company subsequently purchased by M. Wintrobe and Sons limited may have antedated the Foster Grant machine by a matter of months. Both came from Germany.

Eastman's Non-Solvent Method of Manufacture Boosted the Use of Cellulose Acetate Plastic for Dentures, Phonograph Records and Safety Box Toes (23:38)

Irrespective of the method of forming, the big boost to cellulose acetate plastic came through Eastman's development of the non-solvent method of its manufacture, a method which was subsequently adopted by the industry. Some of the first applications were for dentures, phonograph records and safety box toes. It is interesting that none of these are currently acetate applications. The dentures are made from methyl methacrylate and the phonograph records from vinyl compositions.

Eastman Makes a Very Expensive Thermoplastic Mold & Machine Inspiring Injection Molding (24:21)

One of the first jobs for tonight, acetate was film cores for the parent organization, Eastman Kodak Company. It represented probably one of the most expensive molds ever made for thermoplastics on the basis of original construction, and certainly on the basis of maintenance. One of the largest fields for acetate over the years has been for decorative and functional appointments for automobiles, which started with the first dash control knob for Ford in 1934. In 1934, Eastman sponsored the building of a very large injection molding machine by E. W. Bliss Company, which was not a commercial success, but furnished the inspiration for the manufacture of the first successful U.S. manufactured injection molding machines by the Hydraulic Press Manufacturing Company.

Molding Golf Tees (25:29)

The first HPM machine was demonstrated to the trade at Mount Gilead using Taenite acetate. The mold made golf tees and had four cavities. The casting weighed about one quarter ounce. On the basis of the demonstration, some 15 people ordered machines only to find out the unsuspected fact that the capacity of the machine was only one quarter ounce, and the items, most of them planned to make, weighed more than one quarter ounce. To increase this capacity, a pre heater, which was just a heated tube with a plunger without any torpedo, was attached to the machine and demonstrated on the machine which Kodak had bought at Rochester.

At luncheon in Rochester, it is recalled that one of the purchasers of the machine rose to state that it seemed that HPM and Eastman had got them to Mount Gilead to buy a machine, and now had invited them to Rochester to sell them an attachment, which they hoped would make the machine work.

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Steering Wheels and the First Telephone Housings, 1935 (26:53)

In 1935 Chevrolet sold about 100,000 accessory steering wheels molded from Taenite acetate. In 1935 the first telephone housings were molded from Taenite acetate, which ultimately became the largest single application for Taenite after the development of Taenite butyrate in 1938.

In 1941 Eastman defended the injection molding industry against a patent which purported to dominate the basic process of injection molding that is the process of forcing of plastic material heated to a viscous condition, into the closed cavities of a relatively cool mold. Eastman had guaranteed a number of the companies who were using Taenite to defend them, and did defend Amos Thompson Company, the antecedent of the present Amos Molded Plastics. In a suit brought under the Bucha patent, the US counterpart of a German patent, by the Grow Light Company of Belleville, Kentucky.

WWII Foot Tubs, Bayonets, Bus Shades, Army Bugles, Jeep and Tank Steering Wheels from Taenite (28:12)

During the war, Taenite butyrate was used by compression molding for making army foot tubs, which, after the conclusion of hostilities were sold as baby bathtubs. Bayonet scabbards were formed by compression reinforced by fabric. One of the largest and last compression molding jobs was bus shades. Injection molded military applications included army bugles and Jeep and tank steering wheels. Before the war, acetate was the injection molding material. With the end of the war, large quantities of styrene, one of the chemicals used in making synthetic rubber became available as polystyrene plastic, and took from acetate substantially the entire market in combs, toys, costume jewelry, and cosmetic appointments. It was less expensive, more dimensionally stable, lower priced, but quite brittle. Nevertheless, acetate has continued to advance. New applications continue to arise for this first of the injection molding thermoplastics, as evidenced by the tremendous new use in women's shoe heels, even in the last 18 months.

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Donald S. Frederick (February 22, 1968), Rohm & Haas

Interviewer John R. Lawrence:

(30:21)….It was performed in San Diego, California on February 22 1968 the interview was conducted by John R Lawrence, editor of Plastics World Magazine. The interview was with Dr. Donald S. Frederick. Dr. Frederick spent his entire business career from 1934 until his retirement in 1967 with the Rohm & Haas Company. The Rohm & Haas Company was a leader in the development of acrylic chemistry in the United States. Dr. Frederick was the first winner of the John Wesley Hyatt award in 1942. The next voice you hear will be that of Dr. Frederick.

Donald S. Frederick:

(31:15) Well, I majored in chemistry in college and then went into graduate work at the University of Illinois, 1931 to 34 and I worked on polymers there. I actually worked on polymers of sulfur dioxide and olefins, and hence became interested in polymer chemistry through my graduate work under Dr. Marvel.

Interviewer John R. Lawrence:

Well, he's an old name in the industry.

Donald S. Frederick:

He's one of the leading American researchers and academic researchers in polymers. He's done a lot of work in the mechanism of all kinds of polymers. He retired from Illinois, and he's now at the University of Arizona, and heads a group there, and does a lot of government work on synthetic rubbers and other types of polymers. Still does.

Interviewer John R. Lawrence:

Well, then you indicate your opportunity to go abroad there in your junior year.

Donald S. Frederick:

Yes, in my junior year in college, I had a fellowship Institute international education, which enabled me to go to University of Munich for a year. And under the European university system, I couldn't take anything but chemistry. I took one course in physics. But other than that, it's all chemistry. So a lot of chemistry during that one year, and also learned German.

Interviewer John R. Lawrence:

You had only a smattering knowledge of German, I suppose, before that?

Donald S. Frederick:

Two years in college German.

Interviewer John R. Lawrence:

You made it a practical asset at that time.

Donald S. Frederick:

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Yes, well, I had to learn German over there because all my coursework was in German. I lived with German family. Spoke no English, so I had to get proficient in German.

Interviewer John R. Lawrence:

Well, then, how did you put this knowledge to work? After you graduate? Did your graduate work?

Rohm & Hass Company Sends Frederick to Germany to Research Acrylic, 1934 (32:45)

Donald S. Frederick:

Well, in '34, I graduated in June, and went to work immediately for the Rohm & Haas Company in Philadelphia. And after working there about a year and a half, Mr. Haas, who is head of the company, asked me if I would go to Germany to bring back some technical information in the acrylic field from the German Rohm & Haas Company of which he was also a founder. And I was chosen for this really, because I could get along in German at that time. And then after so I brought back some processes, particularly the process for Plexiglas sheet from the German company. And then shortly thereafter, I was assigned to start the commercial development

Interviewer John R. Lawrence:

Well, let's go back into the some of the original work on the acrylic family of polymers. Where was this originally done? Where was the original work done? How far?

The History of Acrylics (33:45)

Donald S. Frederick:

Well, the original work on acrylics. And actually the first ones worked on were the acrylates and not the methacrylate. I think Colbaum in Germany did some of the early work back in the 1880s and then Von Pechman, at the University of Tiebingen, did some work in synthesis of the monomeric esters. And then he had the Dr. Otto Rohm worked on the acrylates for his doctoral thesis at Tiebingen. I believe the thesis was published in 1901. And then after that, there wasn't much work done in this field, until Rohm, German pronunciation Rohm, as we said, United States started doing some work in his own laboratory. He had founded a company with Otto Haas in Germany to make industrial chemicals, but the early chemicals they made were products for the leather industry, and had nothing to do with the acrylates or methacrylates.

Rohm and Hass Development of Safety Glass, 1920's (34:10)

But between 1912 and 1920 Rohm started working in the acrylate field, trying to develop a commercial synthesis. And then in the 20s, he hired Dr. Walter Bauer as a chemist, and his work was successful. And he got some of the early patents in the acrylate field making the acrylate esters from ethylene cyanohydrate. And the first commercial application that they developed was using the flexible acrylate polymers as an inner layer in safety glass. Up until that time, safety glass had been made by cementing cellulose nitrate sheet between two glass sheets. This gave a very rigid break, and they saw that the acrylates were tough and flexible and transparent and light stable, so they put them between two sheets of glass and made the first flexible break laminated glass.

Interviewer John R. Lawrence:

Did they have a safety glass in the United States at that time based on it?

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Donald S. Frederick:

Yes, based on cellulose nitrate, nitrate, and cellulose nitrate. And then shortly thereafter, I guess this was in the 30s, they started to use some cellulose acetate in safety glass in this country.

Interviewer John R. Lawrence:

But neither of them were really tough enough to do the job that we think of today?

Donald S. Frederick:

(36:07) No, they didn't have as long as toughness temperature range. They were they would get much more brittle at low temperatures, or if you plasticize them enough to be flexible low temperatures, they would be soft at the higher temperatures

Interviewer John R. Lawrence:

Was work on the acrylate family being done in other parts of Europe during that period?

Donald S. Frederick:

Not as far as I know. Not up until the early 1930s.

Interviewer John R. Lawrence:

Well, how about in England?

Donald S. Frederick:

Well in the 30s, they started working. I think this was because Dr. Rohm gave some rights on his safety glass to an English safety glass company. I believe it was called Triplex Safety Glass Company, and through some connection which they had with ICI, ICI started working in the field at that time too. I think ICI concentrated on the methacrylates, whereas up until the late 20s or early 30s, Rohm had concentrated on the acrylates. And about the same time, Bauer, in Rohm's laboratory did start working on the methacrylates too.

Interviewer John R. Lawrence:

Well, now, when you went to Germany in 1929 and came back, started with the Rohm & Haas Company, was this the first time that work on commercial work on the acrylates had been done at Rohm & Haas?

Donald S. Frederick:

No. I started with Rohm & Haas in '34 but the company had been working on the acrylates for four or five years prior to that time. Acting on information which they had gotten from the German company. They had a technical exchange of information with the German company at that time.

Interviewer John R. Lawrence:

What was their commercial objective for that?

Donald S. Frederick:

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Well, the first product to be developed commercially over here too was called plexigum, and it was used as an inner layer in safety glass. Whereas this had started out originally as an acrylate polymer, by 1934 this had changed over pretty largely to a to a plasticized polyethylmethacrylate polymer.

Interviewer John R. Lawrence:

Well you went over to Germany then, in 1936, and spent about six months?

Donald S. Frederick:

Several months.

Interviewer John R. Lawrence:

(38:25) And were you just getting up to date on all their technology, or did you have a particular objective?

Donald S. Frederick:

Well, all their technology in general, but particularly the process of making methylmethacrylate cheap, which they already called Plexiglas in Germany at that time.

Cast Sheets of Plexiglas, 1933-1934 (38:46)

Interviewer John R. Lawrence:

How long have they been making a cast sheet of Plexiglas?

Donald S. Frederick:

Oh, I guess on a small scale, for a couple of years. Probably goes back to '33-'34.

Interviewer John R. Lawrence:

Well, then what were some of the early applications that followed your return at the Rohm & Haas company. How did they exploit not just your trip to Germany, but what did they do from 1936 to exploit acrylic chemistry a little bit further?

Donald S. Frederick:

(39:11) Well, I mentioned the safety glass, and this did become a commercial success. There were two users of plexigum in this country, Libby Owens Ford on a small scale, in the American Window Glass Company on a substantial scale. About this time, polyvinyl buteral was being developed, and since it had a greater toughness over a longer temperature range, it eventually took over almost all the safety glass field. Now it's been supplanted to a large extent, by tempered glass with no plastic use no inner layer used at all. Another early application of the acrylates was using the polymer in emulsion form as a finish for leather.

These products were known as the primals, and they have continued to be used for this purpose. Of since the early 1930s been quite successful. There were some other coating applications of solutions of the acrylate polymers, but these were not very large. Then, starting in 1936 the Rohm & Haas Company in Philadelphia started making and selling Plexiglas sheet. I was transferred from the laboratory into commercial development, and it was really the first Plexiglas salesman.

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Interviewer John R. Lawrence:

Did you follow these same general procedures that in manufacturing Plexiglas sheet that were used in Germany?

Donald S. Frederick:

Yes, particularly in the early days. We just picked up what they had done and carried it on. Later, there were a lot of changes in the methods and other developments.

Interviewer John R. Lawrence:

Now, I guess a great deal of that technology is still confidential in nature. But, and I'm not really certain how much of this you've talked about openly, how much the general industry is aware of the technique used by Rohm & Haas. Maybe you could say a little bit about some of the first techniques that were used in casting Plexiglas, and whether some of the things that you did were just a duplicate of the German work, or perhaps whether you had some original concepts that were added here in this country.

Initially Tried Duplicating German Work (41:20)

Donald S. Frederick:

Well, as I mentioned originally, we just tried to duplicate the German work. The casting method consisted, then and still does, to a large extent, of making cells from glass sheets which are separated by a compressible spacer. In the early days, those spacers were nothing but string coated with gelatin. Now, there's been lots of improvements on this, of course, over the years. And originally they used window glass, and later plate glass, and now to a large extent, tempered glass is used because it is much safer. But the monomer is poured into these cells and then polymerized in carefully controlled, carefully temperature controlled ovens or baths, liquid baths. Because the polymerization is exothermic, you have to heat it up to start up. Then you have to take the heat out after it gets started, and the glass sheets are then separated from the solid polymer after the polymerization is completed. Well, that runs from a few hours for thinner sheets, 16th inch, up to days for sheets two or three inches thick.

Interviewer John R. Lawrence:

Well, then you kind of changed hats there, after getting the technology worked out and a commercial process and going, you went into the marketing right aspects. What were some of the first commercial uses for Plexiglas?

Plexiglas First Uses Include Aircraft Glazing, Gun Turrets, Observation Domes & Noses, and Radar Housing (43:01)

Donald S. Frederick:

The first commercial uses were in glazing aircraft, for windows, windshields. And then very shortly thereafter, as World War II came along, for gun turrets and observation domes and noses and radar housings and so on.

Interviewer John R. Lawrence:

I imagine some of the same background and technology was used in Germany for glazing their aircraft.

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Donald S. Frederick:

Yes, I think it was. No question about that. And actually, the Japs got into it too before the war was over.

Interviewer John R. Lawrence:

That's interesting. Where did their acrylic technology come from?

Donald S. Frederick:

I suppose they got it from the Germans.

Interviewer John R. Lawrence:

Well, then we launched the acrylics in this country into commercial use and as leather coatings, as safety glass, inner layer material, and then finally, as the cast sheet material. When did the molding aspect come into play here? When was the first acrylic molding material made?

First Acrylic Made, 1938 (44:02)

Donald S. Frederick:

I think that was about 1938 that we made the first acrylic.

Interviewer John R. Lawrence:

So that was part of the original polymer work?

Donald S. Frederick:

(44:11) Yes, we were, we were actually working on this before I went to Germany in 1936. I remember I took some compression molded tumblers with me from Philadelphia to Germany to show him what we had done in 1936 early 1936.

Interviewer John R. Lawrence:

Were those first polymers made by emulsion polymerization, made for molding material work?

Donald S. Frederick:

No, I think those, those polymers were actually cast and then just granulated and remolded kind of a bulk polymerization process. Yes.

Interviewer John R. Lawrence:

Where did the name of Plexiglas come from?

Donald S. Frederick:

This was coined by Dr. Rohm. I think word plexi is of Greek origin, meaning flexible, and glas is glass in German. So this was due to the transparency of methacrylates. He combined the two and called it Plexiglas.

Interviewer John R. Lawrence:

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Well, now there you spent a good portion of your career with Rohm & Haas in the marketing aspects. It might be interesting to describe some of the early work in opening up new markets for not only Plexiglas, but all of the acrylic materials.

Donald S. Frederick:

Well, I mentioned the safety glass, which would be the first commercial endeavor. Here, we worked with two major safety glass producers. We made the polymers and we carried out the assembly the safety glass and so on in their pilot plants. There was a lot of going back and forth between these companies and Rohm & Haas at that time.

And then when we got into Plexiglas, I mentioned the first application was for aircraft. Up until that time, they'd been using glass, some cellulose nitrate and cellulose acetate to a slighter extent. At that time. Most of these materials had been used in the form of flat sheets or slightly curved sheet just bent cold, without any thermoplastic forming. And we found quite early that of course, we could use the thermoplastic properties of Plexiglas to deform and stretch and blow curved sections, and that these would be very important to aircraft. But since there was no one set up to do this at that time, we decided we had do it ourselves. So we set up a fabricating operation and made aircraft parts here. From 1936 on, through World War II.

Interviewer John R. Lawrence:

You had two plants. I believe.

Donald S. Frederick:

(47:00) We actually built a plant on the west coast in South Gate, California, which we operated during the war and sold at the end of the war. And there weren't many important applications then during the first three or four years, other than aircraft.

New York World's Fair Demonstrates Plexiglas with First Major Translucent Plexiglas General Motors Sign (47:18)

I remember the World Fair in New York came along in 1939 I believe it was, and we tried to show new possibilities for Plexiglas there. We had some boat applications and quite a few architectural applications and the number of industrial ideas which we demonstrated at the World Fair. The first major Plexiglas sign was up there in the General Motors exhibit. They had a big sign made of translucent sheets of Plexiglas with light sources behind them.

Interviewer John R. Lawrence:

Seems to me there were some demonstrations of piping light at the fair?

Donald S. Frederick:

Yes, there were. That wasn't very never did become very important commercially, but it was technically a very interesting thing, that you could pipe line through curved rods and tubes and so on due to the high transparency of the methyl methacrylate?

Interviewer John R. Lawrence:

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How about competition? Then, with acrylic materials in this country, how soon was it before another company came in with a similar material?

Donald S. Frederick:

Well, DuPont, having a technical interchange agreement with ICI, got the knowhow from the British, and I believe they were starting to make some sheets in the late 30s, and also making Lucite molding powder at that time. They didn't call it Lucite at first. I forget the name of they did have for it now. Pothalite at one time, it was called Pothalite. And then it had another trade name for the molding material, before they hit on, you know, Lucite.

Fabricated Aircraft Glazing Industry Involvement (48:58)

Interviewer John R. Lawrence:

Well, now you indicated that Rohm & Haas fabricated glazing for aircraft during the war. Did DuPont get involved?

Donald S. Frederick:

(48:58) On a smaller scale. They, they, they started considerably later than we did, but they started to fabricate too. And then both of us taught others to do this, and brought other people into the picture. And there were several commercial fabricators - Steiner Brothers in New York City, Swedlo here on the West Coast, we taught the Armstrong Clark and Livion Ford how to fabricate, and actually had them as our subcontractors. We got the business from the aircraft companies, and they did the fabrication. And there were a number of other companies. Goodyear aircraft was fabricating.

Interviewer John R. Lawrence:

Well then after the war, there was a great interest in finding commercial applications for acrylic, the big volume that come during the war, but then it all slacked off. What did you look at for markets at that time?

Post War Illuminated Signs First Plexiglas Market (49:51)

Donald S. Frederick:

(49:51) Well, the first major market for Plexiglas that developed after war was in illuminated signs. We'd had work going on this right along, but we concentrated on the war effort and didn't do much. Couldn't do much with it. We did have to develop a line of opaque and translucent, weather stable colors for this outdoor application, but these were developed fairly quickly, and this has become the biggest single commercial application for acrylic sheet.

Interviewer John R. Lawrence:

Now, of course, in signs, as well as in aircraft glazing, the outdoor durability of acrylics is important. This is one of the more or less inherent values of acrylics. But how much work was done to enhance this basic property to make them fully satisfactory for outdoor weathering? Was this an important area of study?

Donald S. Frederick:

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Well, not on the basic polymer itself. The polymer itself is very stable. But there was a lot of work to be done on the pigments to be used.

Interviewer John R. Lawrence:

So you had to be careful of the additives and pigments that they didn't detract from the basic weathering characteristics.

Donald S. Frederick:

Or that they weren't unstable themselves. I mean, a lot of pigments are not very stable to outdoor exposure.

Interviewer John R. Lawrence:

Then what other markets became important as you went along, besides signs?

Plexiglas Early Industrial Applications (49:51)

Donald S. Frederick:

Well, for the sheet, there were a lot of industrial applications, glazing in plants, safety guards on machinery. Lighting fixtures became quite an important use. Translucent diffusers for fluorescent light sources became quite important, and then a number of architectural uses began to be developed. I mentioned glazing, which is architectural, of course, but decorative applications for colored materials, and more recently, now, domed and cylindrical type enclosures, skylights on buildings, quite large enclosures are being used now for complete swimming pools or for large shopping areas, that sort of thing.

Interviewer John R. Lawrence:

When did the first architectural applications come along in the early 50s? Was it?

Donald S. Frederick:

Well, there were some, some back in the 40s, actually, but, but really in the 50s, they began to develop.

Interviewer John R. Lawrence:

Now, I guess one of the more spectacular applications was the dome at the Expo '67 in Canada.

Donald S. Frederick:

Yes, that was the largest single application I think there's ever been for acrylic sheet.

Interviewer John R. Lawrence:

Although, perhaps the dome on the Astrodome they called in Houston, and the stadium there in Houston was a rather how far into the future now, how far do you think architects might go in glazing large areas? Have we seen as large an area, or is there some possibility that we might go even larger?

Donald S. Frederick:

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(53:18) I think it's possible to go even larger. Of course, you have to have a framework. The material is not completely self-sustaining. One drawback of acrylics in many of these architectural applications, which hasn't been overcome completely yet, is that it will support the acrylics will support combustion, and although they can be fireproof, as far as I know, there is not a fireproofing formulation that doesn't detract from the outdoor stability, weather ability of the acrylics. So I don't think there is a fireproof material which can be used for continuous outdoor exposure.

If that could be developed, this would greatly increase the use of acrylics, not only in glazing and domes and that sort of thing, but even for the outside surfacing of buildings where you wouldn't use transparency necessarily, but would probably use opaque or translucent materials. Could light them if you wanted to, but you would be using the permanent weatherability of the product, and not its transparency, and not so much other properties.

Interviewer John R. Lawrence:

Now, an important market for acrylics is in automotive. When did the first automotive applications start?

Acrylics in the Automotive Industry, Starting in the Late 1930's (54:33)

Donald S. Frederick:

They started in the in the late 1930s. This is on the molding side, mainly where lenses for lights, speedometers, instruments, decorative applications such as horn buttons and other decorative medallions began to be used, and that has been a major the largest single use of the molding material.

Interviewer John R. Lawrence:

I see. At one time, I believe it was the Ford Company used a formed dome in the roof of cars.

Donald S. Frederick:

Yes. That was one model for a year. Used a smoky colored roof.

Interviewer John R. Lawrence:

Was that? How did that work out? Was it not a popular model, or were there some technical problems involved in it being discontinued?

Donald S. Frederick:

Well, it wasn't as popular as some of the other models, and I think one of the technical problems was the heat buildup inside the car through the partially transparent roof. There was talk of using shades and so on. And this application isn't completely dead. There have been a lot of work done on recent years putting metallic flakes in the material to reflect the heat and light.

Interviewer John R. Lawrence:

Well now we see in some of the station wagons nowadays, a vista dome station wagon has a viewing strip. Is that acrylic?

Donald S. Frederick:

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I think that's glass. I think that's tempered glass.

Interviewer John R. Lawrence:

How about the abrasion resistance in an automobile? Was that any problem?

Donald S. Frederick:

Not on an application where you don't have to drive through or by seeing through the plastic part. I think windshields and probably rear windows would never be a success because of the abrasion problem, but something such as the top even the side windows, there are Jeep enclosures made commercially of acrylics. Now.

Interviewer John R. Lawrence:

Now, we've been concentrating on Plexiglas, but this is only one member of the acrylic family. What about some of the developments in the other areas of acrylic chemistry? What were some of the other areas?

Acrylics in Textile Finishes and Paints (56:49)

Donald S. Frederick:

We mentioned coatings earlier, particularly leather finishes, those have continued and are still important commercially. Textile finishes came along in the early days too. The acrylics can be used to modify the hand of textile products to they're used with other polymers in these no press finishes, crease resistant finishes. Another very large application has been in paints, both exterior and interior paints, where the colorless durability of these polymers and their good adhesion to various surfaces has made them very useful. They're used to a large extent in water based interior and exterior paints. The water based exterior paints are growing rapidly today, still, and there's a lot of room for further marketing there.

Interviewer John R. Lawrence:

Now, how about in textiles and synthetic textiles? The public is generally familiar with the acrylic fibers, but these are not really the same family of acrylics, in some sense that Rohm & Haas has been active in.

Donald S. Frederick:

No. In fibers, acrylic refers to fibers containing polyacrylonitrile, and the acrylics I've been talking about in the plastics and coating and so on field are the esters of acrylic and meth acrylic acid, the acrylates and the methacrylate's.

Interviewer John R. Lawrence:

Do you think that there may be a future for this family of polymers in the fiber field? Is there some possibility that there's an area of chemistry yet to be exploited.

Donald S. Frederick:

Well, we haven't touched at all on the copolymers which can be made from the acrylates and methacrylates, and these are very important in a lot of fields. In fact, a lot of the things that I've already

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mentioned are actually copolymers of the two. Acrylates have been used to a large extent as a copolymer constituent with other monomers in fibers for quite a long time. I think there is a good possibility that fibers may be developed that will have as their main constituents' acrylate or methacrylate derivatives. I don't believe there are any commercially available today, but I think this is this is quite possible in the long run, as new groups are put on these polymers and more work is done on developing fibers from them.

Interviewer John R. Lawrence:

Now, flexible films are an important type of plastics nowadays. What has been done with acrylic material in in the flexible film category?

Films (58:43)
Donald S. Frederick:

Well, this is a new field of acrylics. Rohm & Haas is beginning to develop it. Now, it is hoped that, again, they're transparency and outdoor weatherability will make them useful films to be used in protecting other substrates out of doors. Of course, a lot of plastic film is used on metal siding these days, and this is a big potential for the acrylics again.

Interviewer John R. Lawrence:

Well, now this would be a kind of a premium type of film, price wise, I guess it would be some little while before it would compete with polyethylene, for example, in greenhouse coverings.

Donald S. Frederick:

Yes, I think so. And it may not even be as suitable as polyethylene for that, that sort of thing. It is hard to make thin, tough acrylic films, which can be self-supporting, but as a protective film or other substrates, they can probably be used thinner than the other products that have been employed. And hence, although they may be more expensive per pound than some of them, per square foot, they probably will not.

Interviewer John R. Lawrence:

Something like DuPont Kevlar?

Kevlar (1:01:05)
Donald S. Frederick:

Kevlar or even polyvinyl chloride which is used on covering metal siding and other substrates. Another field of the acrylics we haven't mentioned at all here, which has had some commercial importance, is entirely different. And this is oil additives, where the polymers themselves are used to level out the viscosity of lubricating and hydraulic oils over a long temperature range. The multi brand oils that are sold very widely now are mainly based on these acrylic additives, which makes it possible to use the same oil in winter and summer.

Interviewer John R. Lawrence:

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And this has been an appreciable use of the products. Are there any other things as you're looking to the future, the areas that you feel that the acrylic families may work into and be an important contributor?

Donald S. Frederick:

(1:01:58) Well, we've mentioned fibers and films. I think they'll, they'll play a part in both of these areas that what they're doing now is very small, but I think that they will become much more important in those fields. I think in the architectural field, in the long run, they will become far more important than they are.

Interviewer John R. Lawrence:

Of course, we've been talking about Rohm & Haas Company in all of this discussion, but Mr. Haas was the American founder of the Rohm & Haas Company, and you had a great deal of contact with Mr. Haas through the years. What can you tell us about some of the personal things of Mr. Haas? We know he's the American founder of the Rohm & Haas Company, and you had a great deal of contact with Mr. Haas through the years. What can you tell us about some of the personal things of Mr. Haas that the general public is not necessarily completely familiar with? We know that he was a great businessman and entrepreneur, but what was he as a man to work for and work with on a daily basis?

Mr. Haas Background (1:02:18)
Donald S. Frederick:

Well, Mr. Haas did not have any technical training. In fact, he didn't even finish high school. He went to work at an early age, and he didn't start his own business until he was in his 30s, I believe. He, however, lived to a ripe old age, well up in his 80s, and worked until a few weeks before he died. Hence, he had a long business career, even though he started late. He was a very intense person, very hard worker. He had few interests outside his work. He was a driver. He worked he worked hard himself and expect people who worked with him to work just as hard. He was very intent on whatever item he happened to be working on at any one time. He would drive and push until that was completed. He was a very sincere, very honest man, really, in many ways, a very simple man. He reduced everything to the simplest terms.

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Tape 5 (AC1235-RCD0005)

Donald S. Frederick (February 22, 1968), Rohm & Haas (continued)

Mr. Haas Background, Continued, Acrylic Chemistry (0:34)

Donald S. Frederick 0:34

And finishes and the various other types of other chemicals. But having kept in close touch with his friend Dr. Rohm when he began to develop the acrylates into commercial products, Mr. Haas then brought them over here and poured a lot more effort, money and research time into them, and was actually done in Germany, so that in the 30s and 40s, the American company got, really got ahead of the German company in acrylic chemistry. Let's say when was the American company formed? Then 1909. It was formed as a partnership between Haas and Rohm over here, I think, had been founded in Germany as a company over there in 1907, I believe.

Interviewer John R. Lawrence 1:24

So it's principal products for leather chemicals, up until what point?

Donald S. Frederick 1:28

Up until, well, leather chemicals through World War One. Then textile chemicals were added right at the end the World War One. (Pause) And then some then resins, through a company, Resins Products and Chemical Company was formed jointly with another German company, the Albert company, and then in the early 30s, the started working on the acrylics, but they didn't add much to the sales or profits of the company until the 40s, actually.

Importance of Chemistry at Rohm & Haas (2:08)

Interviewer John R. Lawrence 2:08

For now, chemistry is the whole backbone for the Rohm & Haas Business. When did chemical research become important to Mr. Haas?

Donald S. Frederick 2:20

Oh, quite early. Even back during World War One, he was beginning to hire research chemists. Dr. Hollander, who was the first chemist for the company, started work before 1920 actually. Worked on leather chemicals, and then he had the idea for organic insecticides and developed the first organic insecticide in the world, which became commercial in the 1930s

Rohm & Haas Joint Companies and Acquisitions (2:49)

Interviewer John R. Lawrence 2:49

Well now, as the company grew, were there any acquisitions along the way in those early years?

Donald S. Frederick 2:58

While I mentioned it wasn't acquisition, the forming of a joint company, Resins Products and Chemical Company with the German Albert company that was in the late 20s. But in 1920 itself, Rohm & Haas Company acquired Charles Lennigan and Company, which was a heavy chemical company in Philadelphia, producing sulfuric, hydrochloric to nitric acid and a range of inorganic chemicals. It was

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one of the early inorganic companies in the United States, founded by Charles Lennigan way back in the 18, early 1800s but this was not a very important part of the of the Rohm & Haas business, this heavy chemical business, and today it's even less important.

Mr. Haas, a Stickler on Cleanliness 3:40

Interviewer John R. Lawrence 3:40

When I was a former employee of Rohm & Haas, I remember there were many, many stories the things that Mr. Haas did within the company, and you spent a lot of time with him personally. Are there any particular incidents that you think are somewhat interesting about Mr. Haas, or in some cases perhaps a little amusing?

Donald S. Frederick 4:02

Well, one thing that repeated with him, he visited the plant on the edge of Philadelphia every Tuesday, and the plant in Bristol, Pennsylvania every Wednesday. And he did this for many, many years, and he'd walk through a good part of the plants and through the research laboratories and so on. He knew many of the people. He knew exactly everyone in the early days, of course. And he was a meticulous man himself, as far as his appearance and personal habits are concerned. And he was a stickler on cleanliness in the plants and research laboratories. And so on Tuesday, the Philadelphia plant Labs had to be cleaned up, and on Wednesday, the Bristol plant Labs had to be cleaned up. So much so that there was one chemist who worked in the lab, when I did who in order to keep his glassware clean made nothing but distill water. Every Wednesday afternoon, he had nice big setup there, and all he did was distill water so Mr. Haas would see his equipment clean and sparkling. (Pause)

Dr. Frederick, Winner of John Wesley Hyatt Award (5:22)

Interviewer John R. Lawrence 5:22

Dr. Frederick, you were the winner of the John Wesley Hyatt award. Could you explain just what that award is or was, and what year you got it, and for what you received it?

Donald S. Frederick 5:34

Well, it was an award established by the Hercules Powder Company. It was as it was called, then, to be given annually for an outstanding achievement and outstanding contribution to the plastics industry. I was fortunate enough to get the first award, which was given in 1941 for developing, in part, the application of acrylic plastics in aircraft. The award was decided by a panel of judges, most of whom were outside the plastics industry. And the award was continued for a number of years. Early days, it was given as a separate function. Later, I believe it was given at some of the SPI gatherings, but in recent years it has not been given.

Artificial Dentures, middle 1930's (6:48)

One interesting application of the acrylics we haven't mentioned, which puts probably more people in the country in touch with acrylics than anything else, is their use in artificial dentures and in actually in making teeth and fillings. Use is made here of the stable properties of the acrylics, resistance to all the fluids and food materials in the mouth, as well as their aging characteristics and their moldability. And of course, they're tasteless and odorless. So in the middle 30s, it was found that acrylics could be used in making dentures. And they are, I believe, the by far the widest used plastic in dentures today, of course,

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number of metals are used in dentures and appliances, but in among the plastics, the acrylics are standard for dentures, and a number of artificial teeth and fillings are also made from the acrylics now.

Interviewer John R. Lawrence 8:00

How about in other medical applications? Aren't they used for prosthetics?

Donald S. Frederick 8:04

They are used for prosthetics, for replacement of sockets in joints, and been used for skull plates and a number of other applications, such as this.

Interviewer John R. Lawrence 8:18

Very interesting. (Pause)

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Louis Francisco, General Manager PNR division, American Cyanamid

DJ O'Connor, Founder, Formica Company

William T. Cruse 8:35

And I'm going to speak a little informal, a little formally, because we are speaking for the record. This is William T Cruse, vice president of the Society of the Plastics Industry, speaking. Louis Francisco, Louis, what's your title with American Cyanamid now?

Louis Francisco 8:55

General Manager PNR division (Plastics & Resins).

The Development of Formica (8:59)

William T. Cruse 8:59

Louis Francisco, General Manager of the Plastics & Resins division of the American Cyanamid company and I are here with Mr. DJ O'Connor who founded the Formica Company at his home in Palm Beach, Florida. We are making this significant recording of all things on Washington's Birthday, is that right? It's a great pleasure to be here, believe me. DJ, everyone in the plastic industry knows you developed Formica, the first decorated laminate. You indeed founded an industry. About when did you undertake the research that led to the development of Formica?

DJ O'Connor 9:44

Dr. Baekeland's Patent and Westinghouse (9:44)

If you don't mind, I'd like to go back to my first contact with phenol formaldehyde resins and their development. I was a process engineer in the Westinghouse Electric Company at Pittsburgh, in charge of the testing and purchasing and recommendations of varnishes, resins, fibers, and papers and all inorganic materials that were used in the electrical industry. I read in the American Chemical Society journal an article about the development that Dr. Baekeland had made and the patents that he had secured in 1907.

In 1910 I call this article to the attention of my superior, Mr. C E Skinner, who was head of the research engineering division of Westinghouse. No doubt he was already familiar with the situation, but I urge that we investigate the possibilities of using some of this resin in electrical insulation of motors, generators, transformers and so forth. Mr. Skinner made a trip to Yonkers and contacted Dr. Baekeland and asked him why he had not called on Westinghouse. Dr. Baekeland said, I went to Schenectady three months ago, and they threw me out. So I thought I'd get the same kind of a reception In Westinghouse.

William T. Cruse 12:05

How interesting. Did you know that, Louis?

Louis Francisco 12:08

Yeah

William T. Cruse 12:09

What year was that, DJ?

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DJ O'Connor 12:11

1910. The reason that General Electric was not interested was that Dr. Steinmetz was already working on a development of phenol formaldehyde, and also had applied for some patents.

William T. Cruse 12:32

Was that Dr. Steinmetz the famous scientist?

Insulation of Armature and Motor Coils (12:35)

DJ O'Connor 12:35

Yeah. Baekeland appointed Mr. Rossi, I can't think of him, Mr. Lou Rossi, as his special representative to handle the development with the Westinghouse. And the Westinghouse Company was then in possession of a process called the Hafley process, which was a development of a Swiss engineer. The Hafley process was a method of making tubes and mica build up mica sheets for insulation of armature and motor coils, as well as for parts in Transformers and circuit breakers and so forth. The method of making the tubes was to apply shellac to a Swedish craft paper, roll up on a mandrel under pressure, and then allow them to heat and pressure, then allow the mandrel and the tube to cool and strip it. And it was a firm, solid tube, but it was subject to softening from heat, as the melting point of shellac was quite low. We immediately began to try to substitute Bakelite resin for shellac, in tubing and in other items, particularly we made motors for the we submitted motors for this, and for the Panama Canal gates and they were all dipped in Bakelite resin. The armatures were dipped in Bakelite resin.

William T. Cruse 14:54

How interesting. Back in 1910, or 11, you made the armatures for the motors that went to Panama Canal.

DJ O'Connor 15:04

We submitted them. GE submitted them. Alice Hammer submitted them. Westinghouse lost out because the motors all short circuited. And it was found that the catalyst used by Baekeland in the resin was a caustic soda which absorbed moisture. And they all failed. So that was the first discovery that Bakelite, as it was first developed was not suitable for a coil dipping resin. Further developments were made by Baekeland, which overcome these, which overcame, those difficulties. Do you want to stop the thing a minute? (Pause)

The First Laminated Flat Sheet (16:19)

The first laminated flat sheet was made in the Westinghouse land by rolling out the two Hickley machines and applying the Bakelite resin to the crack. Cooling and stripping the tube from the mandrel, cutting it down the side and flattening out the tube and placing it in between the plates of a mica press. Nothing much was thought about this, but later on, it developed that Dr. Baekeland thought it was a very good idea, and he applied for a patent using the process of making the two from flat.

DJ O'Connor 17:25

After that development, Westinghouse realized each move in this industry was important, so we engineers were instructed to apply for patents any development that we thought was worthwhile. I

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applied for a patent on the manufacturer of laminated plastic using a two-step process, and this patent was later used as the basis of a suit against Formica by Westinghouse in 1923 or 24. Development continued at the Westinghouse Company, and it was found feasible to coat the craft paper in a treating machine and then cut it into sheets and build it up laminations and make sheet material. My boss said, what are you gonna do with it?

We found lots of applications. One was with the Western Electric where they used many 1000s of pounds in automatic telephone development. But Westinghouse decided that they did not wish to market the material. Therefore, a friend of mine, who was sales manager in the repair and insulation department, decided that we would try our hand on manufacturing it ourselves and see what we can do in marketing. There was another manufacturer in the field, Continental Diamond Fiber Company, who had developed, in their own laboratory, practical duplicate of Bakelite. Later on, Continental Fiber withdrew from manufacture of the resin and bought their material from Baekeland. So there were three of us buying Bakelite resins to make laminated materials - the Westinghouse, Continental Fiber, and Little Formica. Little Formica was started in April, 1913.

Millions of Commutator Rings Made (20:02)

DJ O'Connor 20:02

Herbert Faber, who was in the sales department of the Westinghouse Company and myself, obtained some financial help from a Kentucky banker, and we started on Second and Main Street in Cincinnati on April 15, 1913. We had no seat press, but we made tubing. We made commentator rings, we made other small parts in small hand presses that we developed ourselves. We built up quite a little business in the automobile starting, lighting and ignition companies. Chalmers Automobile Company, one of the early pioneers in the automobile business, and one of the early pioneers in the electrical starter used our commutator blocks. Later on, Northeast Electric Company, who then supplied the Dodge Company, and later on became part of the Delco Remy Company, bought millions of commutator rings from us and other parts, such as coil caps and commutators segments.

First Small Presses Operated by Hand then Hydraulics (21:27)

William T. Cruse 21:27

DJ, in those days, the presses that you made, were they operated with hydraulic pressure?

DJ O'Connor 21:35

The first small presses we made for making commutator rings and small parts were operated by hand.

William T. Cruse 21:42

By hand. Manually operated.

DJ O'Connor 21:45

And later on in 1914 we decided that we would make sheet material. We negotiated with the Boomer and Barshet Company to purchase a 36X24 press, a hydraulic press.

William T. Cruse 22:11

And that was for the manufacture of then industrial laminates only, right?

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DJ O'Connor 22:16

We didn't manufacture it. We decided we were going to manufacture it. When Baekeland heard that, or I'm wrong, when Westinghouse heard that, they went to Baekeland, and they said, you've got to put Formica out of business. So Baekeland sent Mr. Hilton Swan to see me. We had a conference in the Seton hotel in Cincinnati. Mr. Swan treated me to a champagne dinner. He was a great host, and then he gave me the good news that he was sorry that Bakelite could not sell us resins and varnishes for making flat sheets. We could make tubes and rings and other molded parts, but we could not make flat sheets. We decided that we had to have flat sheets to stay in the business.

Three Important Developers of Phenol Formaldehyde Synthetic Resin (23:21)

At that time, there were three important developers of phenol formaldehyde synthetic resin. And most important was the Baekeland. And the second was Dr. Eylesworth, who was formerly with Edison, and at the time was the chief chemist of the Condensite Company of America. And the third was a development by the Carbon Brothers, furniture manufacturers of Chicago, Illinois, who founded a fellowship at McGill University and at the Pittsburgh Carnegie Institute to develop a stain proof heat proof varnish for furniture. Dr. L V Redman was put in charge of the development, and he got his doctor's degree on doing this very development. His process was different from Baekeland's in that instead of using phenol and formaldehyde and caustic catalyst, he used phenomol and hexa-methylene tetramine, which is a combination of formaldehyde and ammonia. And in that way, they claimed they did not infringe the Bakelite patent. I made a trip to Chicago, contacted the Carbon Brothers and Dr. Baekeland. We immediately made an arrangement. And Baekeland took the next train to Cincinnati.

William T. Cruse 25:05

Uh, Redman.

DJ O'Connor 25:06

Redman took the next train to Cincinnati and brought a gallon of varnish with him. It was during the war, and I had a hard time carrying it on the train. They were afraid it was a bomb. But we got our press from Boomer and Barthe, and on the fourth of July 1915 we made the first sheet of laminated Formica made from retinol resins. Our development after that was gradual but continuous. Our financial difficulties were many. Bakelite, Redman and all was owed so much money that their accountant stole and they couldn't give us any more credit. Dr. Redman paid a visit to Cincinnati, and instead of collecting $10,000 that we owed him, he agreed to give us $10,000 more credit

William T. Cruse 26:15

Good salesman, DJ.

DJ O'Connor 26:19

The Navy and Insulating Materials (26:19)

From then on our business developed. In 1915 the Navy would not approve any insulating material, laminated insulating material that was not based on Bakelite. Baekeland was a member of the Navy advisory board. We went to the Bureau of Standards and had Formica tested. It took about six or eight

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months to test it, and they gave us a fine report that our product was just as good, insulation resistance, moisture resistance, and every other product as the laminated material was made from Bakelite.

Radio Manufacturers Grows Rapidly, 1924 (27:16)

So Dr. Lee Forrest was the first important radio manufacturers to recognize this fact, and he gave us a good start. The radio business then developed quite rapidly. And in 1924 we did a business of several million dollars in radio panels and some panels and other insulating parts for radio.

William T. Cruse 27:47

What was the name of the DeForest Company? Was it the DeForest radio company? Where was their plant?

DJ O'Connor 27:53

It was somewhere in New Jersey, and also one in California. They had two plants. He developed a tube, you know, the DeForest tube.

William T. Cruse 28:05

Well, he was the first, I guess, with the tube, wasn't he?

DJ O'Connor 28:08

I think he was, yeah.

William T. Cruse 28:11

How interesting. That was in 1924, right Louis?

Louis Francisco 28:15

Well, '24 as I remember, was the height of the radio.

DJ O'Connor 28:21

No, we started in 1918 with the Bureau of Standards. In fact, was before that. It was before the war was over, because we got specified on some.

William T. Cruse 28:34

Made it on the basis of a radio tubes.

DJ O'Connor 28:38

No, on radio installations or panels.

William T. Cruse 28:41

Oh, the panels. I see for the manufacturer of the radio.

DJ O'Connor 28:44

Deforest was the manufacturer of the commercial radio. For ships and long distance transmission.

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William T. Cruse 29:05

That's interesting.

DJ O'Connor 29:05

I haven't got a date here, but you can, if you get a copy of that book, you'll find it in there. But it was somewhere around 1921 or 22. Our Spring Grove Avenue plant became too small, and we bought a plant in Winton Place.

Louis Francisco 29:31

You should make it clear that you moved from Main Street to Spring Grove Avenue.

DJ O'Connor 29:35

I think I mentioned from Main Street to Spring Grove Avenue 1914.

William T. Cruse 29:41

1914. As early as that. Now where was that? Main and Second?

William T. Cruse 29:47

Yes, Main and Second, and you moved from Main and Second out to Spring Grove?

DJ O'Connor 29:56

3642 Spring Grove Avenue. Then we moved from there. And it was 1921 or 22 we moved from there to the plant that we bought. We were coming into having a little credit then, and we bought a plant several acres in Winton Place, right on Mill Creek and Spring Grove Avenue. (Pause) There we started with the Bureau of Standards in 1915.

William T. Cruse 30:40

And you got the approval for installation?

DJ O'Connor 30:43

We got the approval about 1916 or 17. 1917 we did $75,000 sales. And 1919 we did $175,000 in sales.

William T. Cruse 30:59

Well, that was the radios used on by all types of naval craft during the World War One?

DJ O'Connor 31:06

Yes, they would. But the big radio business was the individual domestic radio business in 1923 and 24 and 25.

William T. Cruse 31:20

That was during the period of Atwater Kent? Yes.

DJ O'Connor 31:26

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Atwater Kent, Colin B Kennedy, and Freed Eyesman and one was still in Philadelphia. Phil Cole. Yeah, right. Crosley.

William T. Cruse 31:41

Crosley was in in that period, I guess, one of the leading manufacturers of domestic radio.

DJ O'Connor 31:47

He was in quantity, in quantity out, not in quality. Atwater Kent probably was the leading manufacturing quality. Colin B Kennedy made a very fine set, but it was an expensive set, right, right?

Louis Francisco 32:08

Federal Bell and Telegraph was pretty big.

Automobile Generator Gears, 1921 (32:12)

DJ O'Connor 32:12

Yeah, that's right. Buffalo. A little before and during the time that we were busy making money and putting out our product for use in radio sets, the gear business developed. Again, Westinghouse, Mr. Conrad, Frank Conrad, one of their engineers, applied for a patent on the use of Canvas based material in gears in automobile generators and starters, and he received a patent. Our lawyers told us the patent was not valid, so we made gear material and Continental Diamond Fiber, I mean Continental Fiber, made gear material. Westinghouse brought a suit against us, I think, in 1921.

It was a very interesting suit. It was based on the Conrad patent, the use of Canvas based material in the making of a gear. General Electric had several observers sit through the trial and the judge, John Welpeck, gave the decision in our favor and said the Conrad patent was not valid because of prior art, and they cited The General Electric Miller patent, which was based on compressed cotton fiber without any resin in it. So Westinghouse was out, and GE was in.

General Electric licensed Westinghouse and Continental Diamond Fiber in our cell and we built up a substantial gear business in the automobile, tiny gear field. At one time, we made as many as 6000 gears a day. We made them for Ford, for Jack Benny's Maxwell. For Buick and for Stevens Motorcar Company, Chevrolet, and many others. It became very competitive, although it was our Lifesaver during the Depression period. Ford gave us $90,000 worth of business a month during 1931, and we had very little business outside of that. (Scratches on tape).

William T. Cruse 35:40

....as well as cut the gears in your plant at Spring Grove Avenue, didn't you?

DJ O'Connor 35:48

No, we didn't cut any gears. We manufactured the sheet stock from which gears could be cut, and we manufactured molded gear blanks, but we did no gear cutting. I see you supplied that to other the manufacturers did that themselves, I see, and the replacement people did that.

William T. Cruse 36:08

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That was the beginning of what the industrial laminates business, in a way, wasn't it? For gears.

DJ O'Connor 36:15

Well, laminate was always important.

William T. Cruse 36:20

Basis of the industrial or the electric of the laminated business?

Decorated Laminated Material (36:24)

DJ O'Connor 36:24

The gear business became very large, yes, but it became very competitive, and we withdrew from it when the prices were so low that we couldn't make any money. And just about that time, Arm Traver went to Boston Tech / MIT and employed one of the best men that they could get, Jack Cochran. He was he was getting his master's degree at the time, yes, yes, and he came with us as a researcher. And Jack Cochran is responsible for the development of the decorated, laminated material. He received the Hyatt award given by Hercules powder and presented to him by President Truman. I think it was around late 40s or early 50s.

William T. Cruse 37:38

So then it was Jack Cochran, actually, who did the work?

DJ O'Connor 37:41

It was Jack Cochran who did the early development on the of course we did a little before that. Yeah, but he was the most capable one, and he was the one that really developed the first to use the urea resins, which we obtained from American Cyanamid. Then, let's see if I got that date here?

William T. Cruse 38:08

Yes. DJ, just a minute, we're coming to the end of this reel, and we're getting into important history, and I'd rather get that on the next reel. So just a second. Oh, could I suggest a date for you? If you don't have it there in 1938.

William T. Cruse 38:31

Well, I'm sorry I can't join you for lunch, but as I say, I've committed myself to go up to Lost Tree with Al Collins.

William T. Cruse 38:41

It's a good golf course,

DJ O'Connor 38:42

So I understand, so I understand

William T. Cruse 38:46

That's a way out hell of way long ways out, but it's a good course.

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William T. Cruse 38:51

This is delicious scotch, delicious scotch.

DJ O'Connor 38:55

What did a say it was, White Label?

William T. Cruse 38:59

Very good. Are you ready - at your convenience? (Pause)

DJ O'Connor 39:34

Sales in 1923 were $900K and in 1924 were nearly $4 million. 1924 that was the year Formica made a very important acquisition. Mr. Louis Francisco, 1924.

Louis Francisco 39:55

January. 1924

William T. Cruse 39:58

Where had Mr. Francisco been prior to that date? College. Where did he go to college?

Louis Francisco 40:06

Miami, University in Oxford, Ohio.

DJ O'Connor 40:08

Right up 40 miles north of us, wasn't it? Yeah.

William T. Cruse 40:08

What did you put him in the New York office?

DJ O'Connor 40:14

I should say not, we shoved him in the factory.

William T. Cruse 40:19

Because I first met Louis was in the inspection department.

Louis Francisco 40:22

Well, I started off buffing panels for Treat Eismon, and that's why I always remember Treat Eismon, but you gave good early training, DJ.

DJ O'Connor 40:36

In 1925, the company was in comfortable financial position and had declared substantial dividends. There were only three stockholders at that time, so we decided that in order to make our stock more saleable, and in case we ever wanted to use it or borrow on it, we would reorganize the company. And it

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was done through W E Hutton & Company in Cincinnati, and we issued 180,000 shares of stock. And it we decided to sell 10% of it to the public. So there were 18,000 shares of stock sold in 1925 at $16.50 a share.

Louis Francisco 41:47

And may I add that I got 56 of those, and I still have them.

William T. Cruse 41:55

Don't you regret you didn't buy more at the time, Louis?

Louis Francisco 41:58

That's all I did.

DJ O'Connor 42:02

Well, there were only 18,000 shares, and it was all sold the first day it was offered.

William T. Cruse 42:09

Wonderful, DJ. Well, then by that time the decorative laminating business was coming along?

DJ O'Connor 42:14

No, there was no decorative laminate at that time. We just in the in the beginning developmental. Now to say that we were the originators of decorative material is not correct. Westinghouse developed what they call inlaid panels, metal inlays black background and used a metal foil to produce designs and decorations on the surface. And they definitely went into the decorative business.

William T. Cruse 42:21

Did they then call those materials micardite?

DJ O'Connor 42:50

They called it micardite.

William T. Cruse 42:57

Well then actually micardite predated Formica as the material of commerce. Is that correct?

DJ O'Connor 43:02

Well. But we went in on a different basis. We went in we didn't think much of this metal inlay. We went in on the basis of color, and that's when Jack Cochran developed the urea. And by the time that Queen Mary was built, Westinghouse was supplying the Rome and Bowdoin Company, the British ship suppliers, micardite for The Queen Mary. But they decided again, they were not going to go into that business. They withdrew from it. I had some good friends in Westinghouse that called me up, and I immediately got in touch with Rome Bowden. Major Rome came to Cincinnati and worked with Jack Cochran and developed what we call the - what was that first one, pearl?

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Louis Francisco 44:20

Well, the first one that you're speaking of, we called mother of pearl.

DJ O'Connor 44:25

Yeah, that was the one. And that was really developed by the ship suppliers, engineer and Jack Cochran. And we supplied a couple of $100,000 worth of Formica to the Queen Mary, and that is the first big publicity we got. About the same time, we supplied an enormous quantity of Formica to the library of the new Library of Congress annex, where they used it for all kinds of panels, desks, petitions. And it's still there. It's a monumental building in Formica still.

Phenolic Resins Changing Colors (45:03)

William T. Cruse 45:03

Well, I've always regarded of all the plastic materials, that Formica was the classic plastic that could be used in buildings of the monumental type. Well, then it straightened me out a little bit on this face of the history. So Formica made a metal inlays, but they only use phenolic resins. And with Cochran, who conceived the idea of using urea.

DJ O'Connor 45:04

Yeah, and the metal inlays were all made with phenolic resin resins, and they changed color.

William T. Cruse 45:35

When they exposed to ultraviolet light.

Louis Francisco 45:38

Am I not correct in saying that we made three finishes with phenolic marble?

DJ O'Connor 45:47

Yeah. We did make some, some phenolic decorative, but it was not too successful. We made a black of course, and the marble, a black marble, and a green marble, yeah.

Louis Francisco 46:01

And we made a wood finish for - what was that outfits name in the east?

DJ O'Connor 46:11

The restaurant?

Louis Francisco 46:12

No, the radio company, and we made Circassian walnut for them. We made Circassian walnut from a lithograph sheet.

DJ O'Connor 46:30

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It was just at that time that Cochran started his development, and that was the buildup of the decorative business.

William T. Cruse 46:43

Right, because the decorated the urea materials made it possible for them to make a color one.

DJ O'Connor 46:50

The urea was not sufficiently stable. It also changed color somewhat. It also was not completely burn proof and while it was tremendously better than a phenolic, it was not the ideal material. Griffith from the American Cyanamid Company, came to us in 1938 with melamine resin, and they told us that they were going to work with us. And they did, and they worked with Cochran did a wonderful job and he developed the translucent sheet right, which could go over the surface. And from then on, we really made progress in the decorative business.

Melamine (46:50)
William T. Cruse 46:50

Right. It was the, really was the melamine type resin that made it.

DJ O'Connor 48:02

It made decorative a permanent material. Yes, it may decorative a reliable material and the material that we could stand back up.

William T. Cruse 48:11

Right. Matter of fact, Melamine is still the standard material, a standard resin used to manufacture quality laminates, isn't it?

DJ O'Connor 48:22

100% Formica applied for several patents on the decorative in 1930 and 1931 and 1932. And our sales were very low at that time. That was during the Depression, and the Ford Motor Company with their Deer business really kept us going.

William T. Cruse 48:50

A lifesaver.

DJ O'Connor 48:56

From the time we developed the decorative, our progress was quite rapid, and in the pre-war years or well, I mean, in the war years plus, we made all airplane pulleys and fuse tubes, bomb burst tubes, and all kinds of material. We did $20 million worth of business, all in war material. Decorative was put aside, but after 1945 decorative made great strides. So much so that by 1950 we needed more space. 1950 we started the Evendale development. I don't have the figures, but I think we have over a million square feet up there now, don't we?

Louis Francisco 50:07

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I don't remember the figures either, but even more than the original plant.

DJ O'Connor 50:11

We made all the industrial material at Winton Place and all the decorative was made at Evendale.

William T. Cruse 50:21

I was out at the Evendale site when they were preparing it to lay the foundation with George Clark. Which reminds me, George Clark served as president of SPI in 1947 and 1948 and I believe he was then the Vice President of Engineering at Formica. And DJ, I can't think of.

DJ O'Connor 50:46

What did I say about Cochran? George Clark came with Formica two or three years after Jack Cochran.

Louis Francisco 51:00

He came in 1927.

DJ O'Connor 51:03

Cochran was 24 and he was 27 and became, of course, a development engineer. Fabor was beginning to weaken at that time, and he was quite ill from heart, and he didn't take any active part in the business. So, I put George Clark in charge of the factory for several years. He became a manufacturing engineer. Then his health broke down. He spent a year almost down here in Florida, yes, yes, yes, yes. Then he came back, and we said, now we'll put you in charge of the engineering department. And we made him a chief engineer, and he was one of the most versatile and one of the most creative engineers we ever had.

George Clark, SPI President (52:07)
William T. Cruse 52:07

Well, I tell you, you made a big contribution to the plastics industry in allowing George to serve as president of SPI, and it was during George's tenure that SPI got serious about its engineering responsibilities. Prior to that time, we hadn't the industry hadn't paid too much attention to standards, the development of standards. It was accurate.

William T. Cruse 52:34

Well, DJ, we're moving on here to the end of this.

Westinghouse Insisted that Baekeland Put Us Out of Business. But Baekeland had Put Us in Business. Legal Battles and Patents (52:34)
DJ O'Connor 52:38

I'd like to go back to the 1920's. Westinghouse insisted that Baekeland put us out of business. But Baekeland had put us in business. He had put Redman out of business because he refused to sell us Bakelite. And Redman now was quite a powerful outfit. They had the general insulate for mold and insulation, and several other companies for mold and insulation, and they had us in Formica, and it was quite a vendor.

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But still, the Westinghouse and the Continental Diamond Fiber and the Bakelite Corporation all brought patent suits against us in the 1920s. Westinghouse had four suits against us. Continental Diamond had one suit against us. And Bakelite had two suits, one against the General Insulate Company, and one against Whopper Electric Company, who was our customer. We won every suit in the District Court. We won every suit in the court of appeals. Then Westinghouse decided to bring one suit to the Supreme Court. That was the suit where they sued us on my patent that I had taken out when I was in Westinghouse company, and they brought a motion of estoppel, which is a legal term because I was the so called inventor of the product while I was with Westinghouse, and then I used it when I was with the Formica. The legal term was supposed to stop me from defending that suit.

Mr. Honorable William H. Taff was Justice of the Supreme Court at that time, and he gave Westinghouse a ribbing. I called them they were trying to put small business out of the commission, and said they had no right to stop us from defending the suit. The patent was invalid, and that was all there was to it.

William T. Cruse 55:09

Very interesting, and that was the patent that they had...

DJ O'Connor 55:13

After that, when Carnell and Westinghouse used to write all their customers says, don't buy from for market, they're going to be out of business. After that, we started get advertising people and advertise the fact that we'd won all these patents and little for marker was the favorite.

William T. Cruse 55:38

Good enough. Well, that one patent that they were interested in was that that was the patent where they used the tube. And

DJ O'Connor 55:45

No, no, that was begun. Oh, that, in a way, saved the day, because all these other patents that Westinghouse had were invalid because of his prior path, but the pattern that they sued us on and tried to stop us from defending was my patent for making laminated Bakelite cheese, but the two step process,

William T. Cruse 56:14

Or the two stage resins, what with two stage resins, a

DJ O'Connor 56:19

And no, it was a true step. It was too precious, but it wasn't an important patent. It was just one of those patents that they told us all, but they thought they could get us on that and stop us from making the material, because they could stop us from defending ourselves.

William T. Cruse 56:40

EJ, I guess I haven't spent a more interesting two hours, and I can't remember when, as I was thinking about coming over here and thinking about getting together for this meeting, I said to myself, there are a couple of questions at my G I was going to ask you, are you enjoying retirement? You ever have a yen

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to get back in harness? Would you like to be out at Spring Grove once in a while dealing with the responsibility?

DJ O'Connor 57:08

So damn glad to be retired. I can't tell you how happy I am. 50 years in the business, and I did all that I wanted, and I keep in touch. They send me reports from Formica. They send me reports from cyanomen. Dan tells me everything that goes on. I'm a consultant for Cyan they're lucky. Dan pay me a salary. Dan is the only one that consults with me, but he used to get in touch with me quite often. Wonderful about the former day. I don't know anything about the wrestling, but the former game, Dan has done a marvelous job with for my and with assignment two.

William T. Cruse 57:55

Oh, he has. I can't tell you how I regret that unfortunate accident, Jimmy

DJ O'Connor 58:04

The rest in the 1950s is just the development of a business. Last year they did close to 70 million. I think 65,000,060 odd.

William T. Cruse 58:16

Yeah. What year was it you sold to cyan in? What year did you sell the cyanomen? Oh, 1956 Well, DJ, thanks so much for taking this time. I'm awful

DJ O'Connor 58:32

Sorry they can't join us for

William T. Cruse 58:33

Once. Oh, I'm terribly sorry

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J Harry Dubois, General Electric, DuPont

J Harry Dubois Background and Phenolic Laminated in Refrigerators (58:40)

J Harry Dubois 58:40

This recording is made by J Harry Dubois of Watch on New Jersey. After a June graduation in electrical engineering, I entered the student engineering training program at General Electric Company in July, being one of the few with advanced thermodynamics as a specialty, I was assigned to the refrigeration research. Here, the job assignment was the study and selection of materials for the refrigerator, breaker strip with the laminated plastics, wood, Masonite and rubber being principal potential materials. Phenolic laminated quickly proved its superiority after we learned how to seal in the odor with a paint. This gave me a 1927 start in plastics. In a subsequent training program at the plastics laboratory, I was told we had only dark colors available, and probably would never be able to develop stable light colors and materials other than celluloid.

Selling Plastics, New Applications: Adding Machine Housing, Water Pump Bearings & Others (59:49)

Sales work in the Chicago area started in 1928 and armed with a big bag of samples, I actually followed the smoke stacks with missionary calls. Many prospective customers had not yet heard of plastics, and it was easy to gain attention. In many cases, the initial contact would bring in up to a dozen others to see the products and hear the story. It was a field day for plastics promotion, and GE offered laminated, hot and cold molded plastics, plus glass bonded Mica. This opportunity led to many new applications, such as iron handles, adding machine housings, the Toledo scale case, shoe heels, soap dispensers, tool handles, thermostat housings, roll neck and water pump bearings.

Laminated Tube Shaped Cup Handles, 1928 (1:00:39)

The development of the Toledo scale housing, which put Plascon into business, was a major experience, since the largest press and pre heater of its time had to be developed. Mold construction problems resulted from unexpected hardening distortion, plus the solution of flow lines, and all of these problems were pioneering and represented serious delays. Fuzz from the drums was a source of discoloration, which had us puzzled for weeks. West Bend Aluminum wanted a low cost insulating handle for their aluminum cups and molded handles were too costly.

Then in 1930 for a 10 cent cup, I suggested a laminated tube shaped as a handle that could be sliced. One of their engineers asked for a sample of 1/32 laminated for heat tests, and when it came back a month later, he had shaped this hard laminate into the desired configuration. This was doing the impossible, and no one in our laboratory could figure out how he did it. And he would not tell us. This was the first post formed laminate. We did not learn how to do it until years later, by immersion in hot lead.

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Training Programs during the War (1:02:00)

The war brought on many training programs which needed textbooks and plastics, resulting in an agreement to write a general textbook for American technical society. About that time, I was sent to Fort Wayne to assist our war production effort. To meet the expanding needs for mold designers, we grabbed high school graduates with drafting training for potential mold designers. The draft board then grabbed them just about the time they could begin to work with good supervision from Wayne Pribble this continuing problem of training mold designers pushed us into writing plastics mold engineering to simplify our training needs. This recorded for the first time a proven practice in the art of mold making and brought to the attention of the newcomers the serious phases of mold design problems. It is significant that the book has become a Bible among the mold designers. It is also interesting to note that I had several letters from the old timers who raised the devil because I was giving away the secrets of the plastics industry.

My interest, however, in presenting these data was to elevate the knowhow of the newcomers and to bring it in line with the accumulated facts. We were all suffering badly from ignorance, and ignorance resulted in fantastically low mold prices because the newcomers had no conception of what it took to build a mold that would withstand the rugged requirements of daily mold production. I am satisfied that this work did a great deal to straighten out the tool costs and reduced the losses that the old timers were taking as they were forced to meet the competition from people who did not know exactly what constituted a good production mold.

Building the Rolls Royce Magneto and Warfare Applications (1:03:53)

After the bombing of Coventry, we undertook to build the Rolls Royce Magneto, this was a critical period when the Royal Air Force had to stand off the Luftwaffe, and planes without magnetos were useless. The British had used rubber, so we followed their prints in mold building, but soon learned the prints had not been changed, as molds had been altered. This was a most serious crash program. Men worked every day as long as they could take it, seven days a week, molds were completed in jig time, and the compounding of rubber, molding, and vulcanizing became another nightmare.

Finally, in desperation, we cable the problem to the British requesting step by step processing data. The answer was given by a transatlantic phone call, which enabled us to solve our problems and get going. About a week later, we received a cable, "Do not use the data given unless you agree to pay a penny and a half a pound royalty." No comment is needed, after all, a tremendous effort to get the RAF in the air.

You may be sure that a new Magneto was designed quickly thereafter to use melamine instead of rubber. Early in the war, a short circuit and submarine burned the phenolic insulation and the toxic fumes there from asphyxiated the men. This initiated another crash conversion from phenolic to melamine. Every drum of melamine at that time presented a new problem, and the work was touch and go with new daily problems to solve. Other very interesting wartime problems included the M 52 fuse, the T 44 firing pin, the flame thrower cartridge, aircraft carburetor venturi, sound powered telephones and the frangible bullet.

Transfer Molding (1:05:46)

J Harry Dubois 1:05:46

An initial assignment in 1944 enabled me to visit all the principal molder in the USA as a consultant on transfer molding. The amazing inventiveness and make do of the various molders in building presses

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without time, money, or suitable priorities for the war effort was outstanding. I beams, railway car, junk, axles and so forth were used to make good operating presses, punch press and die casting machines were converted, advanced processing, unique mold designs and construction methods were found here and there, in isolated locations where the engineer was not inhibited by previous practice. A single operation, a small room with a haywire press in Denver was turning out high quality mill approved products.

Honeywell at Minneapolis had in operation what is believed to be the first of the Quick Change unit mold sets, designed and built in their tool room. They were holding impossible tolerances, not having been told that it couldn't be done.

In Sheboygan at Plastics Engineering Company, Gus Holmgren and Harry Schaefer were extruding rag filled phenolic to produce a five inch ID, one quarter inch wall Bazooka barrel in 20 foot lengths, generally considered to be impossible at that time. RC had built a battery of transfer injection machines where I can run Buchold designs using air cylinders, pipe and rod stock molds, where split wedge design and each machine has a small cup for loading the acetate in the electrically heated tube. They worked fine.

Large Rotary Presses (1:07:47)

One Cutler Hammer were running two 60-station rotary air presses fed with spherical pills. This was one of the first big rotary presses, and it was reported to have saved $40,000 in 1943. Their head demonstration of the jet process in 1945 was most enlightening. One very important message learned from this effort was the danger of being too well informed, and the necessity for reading the trade journals completely each month to see the expanding horizons. It was obvious from this study that too many molders' experience was ingrown and they were limited by blindness to external developments.

Injection Molding Observations (1:08:34)

Most of the pioneering and real developments were coming from Die Casting engineers, ceramicists, metallurgists, machine builders and completely uninhibited newcomers to the industry. Many of the old time molders fought the introduction of injection machines. I heard one Foreman say, we have enough headaches without that gadget, speaking of a German injection machine that stood in the crate for a year before it was tried out. It worked so well that he said, let's try it with Bakelite. So another year was lost, waiting for a replacement of the cylinder.

I dropped in to see Jules Getz one day in Chicago, who is doing an injection job for a friend in need. It is quite a shock to see him shaking Woolworths dade (?) dies in the hopper to achieve the desired car match, and it worked fine. Elmer Mills invited me in to see his new injection machines, and I went away wondering where he would find enough thermoplastic work to keep them busy. We were all so close to the limitations of the thermosets and their markets that we just did not see the potential for the thermoplastics at the start. After we did get religion, then we had a field day digging into all the previously rejected programs that could not be solved with thermosets. But.

So we soon learned to evaluate each new thermal plastics and make a market survey of applications it could serve and then run fast to all the prospects. The first go around was Lush. As the competition grew, prices dropped and profits depended on a constant flow of new applications. The injection machine greatly increased the number of captive molding departments losing work to custom shops when volume increased to interesting proportions, such as the history of custom molding.

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My final assignment at GE was the post war planning for the plastics department. It was obvious that there was no future for GE and custom work, and the plan pointed to materials only with molding to be done by internal departments as needed. My post war planning at GE led me to move over to Shawn Slater as vice president sales and engineering.

New Spray Bottle (1:10:55)

During this period, we converted an obsolete plant into an ultra-modern facility and sold it to the minority stockholders, Hartford Empire then moved me over to plaques as manager new product development. Why? Development the fitments and closures for the new spray bottle. This was a fear field day of IDEA expansion and pioneering into virgin territory, every new job for the plastics bottle presented a new opportunity in fitments and methods.

During that period, the customers were virtually standing in line to take away from us plastics bottles. It often such a large field in marketing that the cosmetic industry pretty well ran wild with ideas and the urge to be first in their field. One of the particularly interesting experiences at plaques Corporation was the association with Jim bailey, who pioneered many of the modern extrusion methods and the plastics bottle.

Jim was probably the most outstanding idea man that I had met during my entire plastics career, and he certainly gave the plastics industry a tremendous boost by his developments and methods for fabricating the thermoplastics. His stroke machine was one of the first large machines for vacuum forming. His slipper dies facilitated the making of very large thermoplastic slugs, the oriented polystyrene development solved many of the problems and put polystyrene into a major marketing era for packaging products.

Of course, the development of the plastics bottle stands on its own feet. J. Harry Dubois.

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P Willard Crane, Vice President, the Cincinnati Milling Machine Company

J Harry Dubois - reading a letter from P. Willard Cane (1:13:20)

The next story is from Willard crane, a vice president of the Cincinnati Milling Machine Company and formerly with the DuPont Company. His narrative deals with the development of the inner layer sheeting for laminated glass. He states that it was dictated from memory. And some of the dates may not be exactly right, but covers the 10 year period from 1928

DuPont Work (1:13:53)

I went to work for the DuPont Viscoloid company in Arlington, New Jersey in October 1928 I took the first job because it was DuPont, but also because it was an old plant with antiquated technology, and there seemed to be better opportunities for the young technical man than the shiny new rayon plants I had been visiting and where I had a number of job offers. Rayon was a glamor product. Then Arlington, at that time, was exclusively a celluloid plant, which turned out sheeting in various gages and in a wide variety of colors and patterns.

The other industrial products were rods and tubes made by extrusion with old fashioned hydraulic stuffers. There was also a so called article department which made combs, brushes, mirrors and other toilet articles and toothbrush handles from celluloid sheeting. At that time, laminated safety glass had just been introduced in the automotive industry, and this was viewed as an excellent potential market for celluloid sheeting. The laminates consisted of transparent celluloid. Heating of the highest quality which could then be produced. This was a beer between two plates of 1/8 inch glass using gelatin as an adhesive, since the gelatin was sensitive to moisture, the edges of the laminations had to be sealed with an asphalt combination.

Celluloid Sheeting as an Optical Product, Laminated Glass (1:15:18)

J Harry Dubois 1:15:18

The use of celluloid sheeting as in an optical product this kind was stretching the capabilities of the old celluloid process quite far. Principal problems, in addition to dirt in the sheeting, were a milky haze which appeared when the laminate was illuminated at an angle on Stardust, which showed up as tiny Points of Light.

Another problem was waviness in the finished laminate. The true cause of these defects were not known. Elaborate precautions were taken in mixing, filtering, pressing, sheeting, seasoning, vaporizing and inspection to keep the product as clean and free from contamination as possible. People handling the sheeting were dressed in white uniforms, caps and wore white cotton gloves. Attempts were made to clean the air in what was a rather antique heating and ventilating system being fresh out of a doctoral and post-doctoral physical chemist like laboratory in Germany, I determined to attack some of these problems from a strictly scientific viewpoint.

The laboratory in those days was fairly primitive and not very well equipped, which was not at all unusual for plant laboratories in those days, I managed to get approval to spend the princely sum of $1,500 on good microscope equipment, including a slit Ultra microscope. It was not long before this investment began to pay out. The Stardust showed up very clearly to be improperly nitrate fibers of sanctuary cellulose which were not dissolved or only partially dissolved in the camp for alcohol during mixing, the Star Dust was found to be plainly visible in polarized light.

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I made use of the principle by setting up a projecting polarizing microscope in the inspection department of the plant. This was made of machine steel pieces so that it could withstand rough treatment. In the production area, any part of a sheet or full size could be projected on a screen, which was divided into squares. The number of stardust particles per square could be counted and limits set for passing or rejecting the sheeting the haze had to be judged by means of a set of reference standards.

The yields of good sheeting were extremely low and would often be 30 to 35% the other major problem with the celluloid inner layer only became evident after the laminated had been used in the car for some time, exposure to sunlight gradually changed the color from very pale, pale blue to yellow, and in bad cases, to brown. Thus was imperative to bring about some improvements in this natural weakness of the celluloid. I attacked the haze problem from many different angles. One of these was an attempt to coagulate the particles to filterable sizes by using anions of high valence.

One day, I rejoiced to find that aluminum salts, particularly aluminum chloride, when added to a hazy nitrocellulose camphor solution and alcohol, cleared up the haze almost completely. This seemed to be the coagulating fact that I had been looking for further work, however, showed that it was not the aluminum but the acidic property of aluminum chloride, which caused the large improvement in clarity, I find that hydrochloric acid worked even better than aluminum chloride. Still further work led to the conclusion that the haze was caused by iron oxide, which was being dissolved in the acidic solution. The source of the iron was then traced to the nitrocellulose.

The next step was to treat nitrocellulose with acid, following by washing in iron free water, this made beautifully clear cellulite outdoor exposure. Samples with this substantially iron free sheeting showed it to be far less affected by outdoor exposure than was the commercial product. The iron in the Nitro cellulose was found to come from the water used to wash it in the plant. Attempts to remove the iron content of the water available at Arlington turned out to be economically unfeasible. As a result, the night trading operation for safety glass and later for all products, was removed to the plant in Leominster Mass, which had water of far lower iron content.

These improvements helped establish laminated glass in the market, but only improvement the quality somewhat. I concluded that if this were really going to be a business, a really significant improvement in quality and in the economics of the process was necessary. The question, of course, was how.

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Tape 6 (AC1235-RCD0006)

P Willard Crane, Vice President, the Cincinnati Milling Machine Company (Continued)

Solving the Safety Glass Problem with Extruded Sheets for Car Windshields, 1929 (0:00)

J Harry Dubois 0:00 - reading a letter from P. Willard Cane

I did a good deal of thinking about this in the summer of 1929 some of us in the laboratory fond of music, and used to go to the summer concerts of the New York Philharmonic Orchestra Louis on Stadium in New York. Those were the days of prohibition, which numerous restaurants in New York had found a way of ignoring, and we usually had dinner in such a restaurant before the concert.

One evening in the late summer area, Alan Randolph and I had dinner in one of those places where they served martinis with a bit of Pernod in tea cups and red wine known as Cafe Rouge in coffee pots. We then went to the concert, which featured a foreign guest conductor. For some reason that might have been the Cafe Rouge, my mind kept wandering away from music back to the safety glass problem, and the solution began to take shape. This was an evolution of the rayon processes with which it was familiar.

On the way home to Montclair on the De Camp bus, which was the accepted form of transportation those days, I proposed to Alan Randolph that we make up a nitrocellulose solution of sufficiently low viscosity when heated so that it could be filtered through a relatively dense medium. This solution would then be extruded through a slit like orifice, directly into a bath of cold liquid, which would immediately begin hardening the sheeting and removing the solvent. Short time later, I placed an order for the first extrusion unit, this consists of adjustable orifice blades which were mounted on the front plate of a five inch by eight inch shed of a celluloid block press.

About that time, I disclosed my ideas to Ben Fields, who expressed great interest in this new venture, and it was agreed that we'd worked together on it, which we did most successfully for several years. Our initial experiments were surprisingly successful. A sheet three inches wide, was extruded into a series of different baths using a variety of compositions. We soon learned that by diluting the usual celluloid mix with certain solvents, heating the composition to reduce the viscosity, and chilling the sheet in a cold bath as it emerged from the orifice, we could produce samples of nice looking smooth sheet. The next step was a 12 inch sheet using the block press for extrusion pressure.

This pressure was not very uniform, so another unit was built, which consisted of a cylinder that could be filled with a composition which was then extruded by means of nitrogen pressure. This worked well enough so that it was decided to build a pilot plant capable of making a full size sheet of 20 inch width. This was the real test, since small laminates did not seem to be reliable indications of the quality of the extruded product. This larger unit also was designed to use nitrogen pressure.

As this equipment began to take shape, it looked enormous and was beginning to cost, what to us, in those days, was real money. I believe the first project was for $8,000. As it was being built, I used to look at it and think, if this doesn't work, I'm really through here, and I'll have a tough time finding a job. It was 1931 and times were bad. Ben Fields used to kid me by looking at the new growing structure and shaking his head and saying, Crane's folly. The unit demonstrated, beyond all doubt that it was possible to extrude a promising looking wider sheet. However, the gas pressure device gave us too short a run to stabilize condition.

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We also needed a means of handling the extruded sheets and removing the solvent from them more or less continuously. Various means of furnishing the extrusion pressure were investigated and rejected. Finally, we took a large step forward by trying a Quimby pump, which had double interlocking screws and close tolerances. Normally, experts on nitrocellulose and celluloid predicted that we would be blowing up the pump if we tried to handle our viscous nitrocellulose gel through it. We took the chance and found it worked beautifully, furnishing a nice, even metered flow.

This was a solution to any various variations in thickness, lengthwise, maintaining uniform thickness across the sheet was a different matter. The extruded sheet contained a series of hills and valleys running lengthwise and represented not more than a few 1000 of an inch in thickness. This was enough to distort the glass after lamination and cause a so called wave, which showed up as optical distortion. These waves in the sheet plagued us for a number of years, and turned out to be one of the major problems. For removing the solvent from the sheet continuously, we built a series of trays which were long, very shallow tanks through which the sheeting was drawn by means of driven rolls. These trays, like the rest of the pilot unit, were constructed very simply, largely from pencil sketches. The trays were sided up of galvanized iron sheet.

The driven rolls were made of wood with brass shafts and plain cast iron bearings, and were driven by wooden sheaves and sewing machine belts. Units of this kind went together quickly, were relatively simple to change and cost little. Principal advantage was the flexibility and a greater saving of time, both initially and when all alterations were required. By that time, we had found saturated sodium chloride to be the best and most economical solution for the extrusion bath and for removing the solvent. This brine was cooled by means of a coil buried in cracked ice. The brine in the trays was originally run at room temperature.

Later on, an elaborate series of laboratory experiments showed that the solvent removal rate could be improved tremendously by gradually heating the salt solution as the sheet progressed through the machine until it reached essentially 180 degrees Fahrenheit at the end of the process. Before that, the air seizing process used on the conventional celluloid sheeting for safety glass required 10 or 12 days. The hot brine process reduced this to four and one half hours, and made the continuous production of celluloid sheeting a reality. For a cellulose acetate a lower temperature of 100 degrees to 120 degrees F were found to be adequate.

After the sheet emerged from the brine baths, most of the solvent had been removed. However, some water had diffused into the sheet and had to be removed by air drying. This was done by running the sheet continuously through a hot air oven over rolls and vertical passes. Difficulties with stretching and shrinking the sheet in these dryers cause all kinds of trouble until Ben Fields hit on the idea of driving only the bottom set of rolls and regulating the tension on the sheet by means of a speed control on the pinch rolls, which drew the finished sheet out of the dryer at the end.

As soon as any pass in the dryer tended to become tight, the bottom roll would begin to drive it forward and automatically relieve the tension. Thus, the regulation of tension in the dryer became completely automatic, we had trouble with slitters and winders, since none were available which would handle this particular material without some alteration. Initially, none of the cellulite sheeting made in our pilot unit could pass the automotive standards for waves. The lamination made from it all contained bands of distortion which ran across the windshield and were noticeable as the driver moved his head up and

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down. This was a real problem, since the cellulose nitrate composition did not flow during the laminating process, and the glass had to conform to the exact contour of the sheet.

Improving the Thickness Variation (7:15)

Thus, the study of means of improving the thickness variation became a major effort. One of the first steps in this direction was the construction of a primitive calipering device for measuring variations in thickness across the sheet. Before that, it only been possible to measure and plot the thickness of the finished product, which was far too light to make any adjustment at the point of extrusion. The problem here was the sheet just after extrusion was still quite soft and rubbery, and its thickness could not be measured by any ordinary mechanical device. Since no commercial instruments for doing this were available, a method had to be developed. First crude calipering device consisted of a very light rider, which rode on the surface of a soft, freshly formed sheet just after extrusion, and actuated a hinge pointer, which was calibrated to give a rough indication of the thickness. This worked well enough so that a more elaborate system was constructed in which dial gages with very light spring pressure were actuated by the rider. A series of these at short intervals across the sheet gave a reasonably good picture of the thickness variation, and served the purpose for a number of months.

The orifice blades between which the sheet was extruded were gradually fitted with more and more precise means of bending them to control the flow. Ben Fields eventually developed some differential screws which worked beautifully by making an adjustment and noting the effect of this on the caliper device, it's possible to produce what the latter showed to be a very uniform sheet. The final calipering device was far more sensitive than the previous ones and made use of an optical lever. The riders were hinged and fitted with small mirrors. These moved beams of light from a series of fixed projectors, which produced a line of spots of light on a screen, indicating the thickness at close intervals across the sheet. This permitted very precise measurement of the moving sheet, even with the best calipering device, cellulose sheeting still contains some abrupt variations in thickness of one half 1,000th or less, which caused waves in the lamination.

The waves were found to persist in one location were often between the units of the calipering device, which did not reveal their presence. Thus, something was interfering with even flow across the width of the blades. The key to the problem was discovered by making careful thickness profiles of the finished sheet. The orifice blades which had produced a sheet were carefully examined with a low power microscope, and the locations of any visible surface imperfections were noted. These were also plotted. When the plots of the waves and surface imperfections were compared, a good correlation resulted. The imperfections were small and or right minute, rough places on the sheet forming surface, the blades, which were visible only were when magnified.

Our practice had been to grind the sheet forming surfaces on a surface grinder and then smooth them with crocus cloths. A new process was developed, in which the edges were carefully stoned by hand until no grinder marks or their imperfection were visible under a microscope. A variety of stoning procedures were tried, one which produced the best results was adopted as a standard. For some time, even after the process was in operation commercially, Ben Fields and I were the only ones who could perform a satisfactory hand stoning job on the blades.

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Machine #1, Cellulose Nitrate vs. Cellulose Acetate, 1931 (10:31)

Many of the basic problems were worked out on the original number one machine, which was located in an old building across from the laboratory. We learned and demonstrated the process for both cellulose nitrate and cellulose acetate there. Cellulose acetate was beginning to be used around 1931 as a safety glass inner layer. We found it could be extruded into satisfactory sheeting far more easily than cellulose nitrate. The big difference, however, was that it tended to flow during lamination, so waviness was not nearly as much of a problem. Results obtained on the number one machine were soon promising enough to warrant building the first semi-works unit for commercial production.

Machine #2, DuPont Engineering Designs and Constructs for Commercial Production, Quimby Pump (11:08)

Design and construction of this unit was placed in the hands of the DuPont engineering department in Wilmington. The design was done at the low point of the depression as one of the few jobs the engineering department had to work on. Since they had let most of their designers go, much of the design work was done by supervisors who had not worked a drafting board for some time, and this resulted in some interesting problems in assembling the various units as they began to arrive at Arlington. They were astonished to find we had no drawings of the number one machine. Instead, we worked closely with a draftsman on the number two design of what was to be called the plus two machine.

The number two machine had a fan shaped extrusion chamber, which was used in which the plastics material passed between heated plates for some distance on its way to the extrusion blade. This was done to ensure uniform heating, and thus more uniform flow at the point of extrusion. This was necessary since the mixing and filler extrusion composition from the lower plate was handled in metal barrels and was blown into the Quimby pump with nitrogen pressure. Thus it was difficult to maintain an even temperature, even though the barrels were stored in an oven before using and surrounded by heated air as they were being emptied, the passage between heated plates in the extrusion chamber helped correct such temperature differences.

These wide, flat heating surfaces, however, had a disadvantage in that the extrusion pressure acting on the large areas produced sufficient forces to distort the chamber. As a result, the orifice tended to open up toward the center, resulting in a sheet which was thicker in the center than at the edges. This thickness difference was also aggravated by the fact that the edges of the long passage of the extrusion chamber acted to hold back the flow there, so that the Kanban moved forward more rapidly at the center. These effects then had to be compensated for by closing the extrusion blades at the center to obtain a sheet of uniform thickness.

The amount of compensation varied with the extrusion pressure. In order to get the solvent out of the sheeting at a commercially acceptable speed, we had to abandon the single pass trays and develop much more complex ones, which contained seven passes of sheet, each one above the other. These had to track perfectly, or the sheet would fold at the edges. Control of tension was also a real problem. If the sheet became slack, attempted to wind up on the rolls and tear. Although this number two semi-works machine was capable of producing cellulose acetate sheet of an acceptable commercial quality. It also served to show that there were still many problems connected with the process which required a solution. While a number two machine was turning out rolls of sheeting on a semi commercial basis, pilot plant experiments were underway to make the process a continuous one.

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The extrusion composition was mixed as before and subjected to vacuum until a proper consistency was obtained. Then it was fed into a screw conveyor, which in turn fed a Quimby pump, which forced it through plate and frame filler presses equipped with wool felt as a filtering medium. This was fine enough to remove all objectionable dirt, so that it was then necessary to take only reasonable precautions against contamination ahead of this point, after the filter, the material passed through a closed system, the first step was to extrude it downward in the form of fine strands into a vacuum chamber to remove any bubbles of air from the bottom of the vacuum changer, a screw conveyor forced it into the Quimby pump, which also served as a metering device just ahead of the extrusion chamber.

The final design for the number two machine was based on a great deal of laboratory work on a smaller scale and operated very well from the beginning with no major problems. The result was an extruded sheet essentially free from contamination and bubbles. The flow through the extrusion orifice was improved because the temperature and the mixing were far more uniform throughout in 1932 there was essentially no plastic extruded by means of screw extruders.

We visited the manufacturers of rubber extruders and found they knew practically nothing about designing of plastic, of equipment for plastics, particularly for the relatively low viscosity material which we were using. Thus, we had to learn experimentally the effects of the pitch and depth of the flights uniform flights were compared with those of decreasing pitch and those of varying depth.

A number of experimental screws were cut and recut before satisfactory results were obtained. The things which we learned about screws during this work were later applied to the extrusion of other plastics, materials such as polyethylene and nylon. Since we had decided that a screw was one of the very best ways of pumping and metering plastics, materials of a wide range of viscosities. The number two machine was finally brought to the point where it was running cellulose acetate sheeting up to 48 inches wide, with excellent quality on a commercial basis. Control of gage arrow is not sufficiently good for making cellulose nitrite sheeting without waves.

The feasibility of this had been demonstrated on number one machine on a narrow width, and we were confident that we could build a machine to handle cellulose nitrate with a much more elaborate wet solvent removal stage. This was all based on many series of experiments conducted in the laboratory and on the number one machine, with all of the new problems which seem to come up daily, coupled with management's desire to get some other product in the field, Ben fields and I found ourselves working approximately 12 hour shifts, plus an hour on each end for consultation and discussion. Sometimes the work stretched out even longer. In this case, we'd have midnight suppers of lamb chops cooked over a Bunsen burner. Lamb was around 29 cents a pound during the Depression.

We also acquired a bed, which was set up in a remote corner of an unused building next door. This, I am afraid, did not yield a very good turn on the investment, since there didn't seem to be very much time to use it. However, one night, Ben Fields was feeling quite tired, decided to get a couple hours sleep, lay down on the bed, which was concealed by a low partition. Sometime later, the night watchman came through the building. Ben mistook him for someone coming to get him because someone had gone wrong with the process. He jumped out of bed just as the guard passed. The guard was completely shaken by all this, since he thought he was seeing a ghost, saw the job at its lighter as well as its more serious side.

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Nylon Monofilaments and Tennis Racquet Strings (17:51)

Just about the time that the number two machine was beginning to run with fewer problems, Ben Veals developed some respiratory problems. He had to give up the long shift work, he returned to process development on an R and D scale, and successfully developed the processes for nylon monofilaments in the form of level and tapered bristle and tennis racket strings, plus some processes in the methyl methacrylate area.

The Depression (18:17)

In his place, we pressed brother Charlie into service, who became an extrusion expert, not only on safety glass inner layer, but on polyethylene and nylon wire coating and paper coating, because we were still in depth of the depression at the time, construction work was finished, many of the excellent machinists and other fine workmen who had been assembled by the construction superintendent were glad to take jobs with us as operators, so we had an intelligent and loyal crew who were more than capable of taking care of repairs or other nations required to keep things going.

Most people today have no concept of the seriousness of those times and the hopelessness of the situation in which many people found themselves. We were very pleased to have jobs in spite of the long hours, and happy to provide jobs for a number of others as a result of our technical success.

J Harry Dubois 19:14

In those days, I had the opportunity of being not only chemist, engineer, designer and production superintendent, but also a technical service man samples of the sheeting from the number one machine and experimental runs from number two and number three machines were sent to Pittsburgh Plate glass company and to Libby Owens Ford for evaluation in full sized windshields and side lights. I would then go out often with one of the old time salesmen to follow the lamination of this material in the plant or in the laboratory equipment.

I always enjoyed this first hand contact with the application of the product and the solving of problems, which often came as a result. It was also a pleasure to see an old time master salesman like Charlie Leach deal with the people involved and smooth out any rough. Spots which developed, friendships developed, which have lasted many years.

Machine #3 is Built, Running Cellulose Acetate and Cellulose Nitrite Sheeting (20:05)

The next step was to build a number three machine, which was the first real commercial unit. The starting point here was a large mixer, especially designed for the purpose and equipped with a gate on the bottom through which the mix could be discharged directly into a closed system, the mixer was equipped with a recording watt meter and a recording temperature device, which were used for checking the viscosity of the mix before discharging it.

In order to obtain even closer control, we also developed a plastic which extruded a sample of each mix through a capillary at a constant rate and at a constant temperature, the consistency of the mix was judged by measuring the extrusion pressure just ahead of the capillary. This worked beautifully. Along with the watt meter installation, essentially solved any problems in variations in viscosity in order to accommodate the larger flows in the filtration steps, it was necessary developed special stainless steel plate and frame filter presses which would handle a relatively high viscosity mix at good rates of flow.

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A novel design was developed. The screw conveyors, Quimby pumps and vacuum chamber were essentially same as those which had been developed earlier. The extrusion chamber, however, was quite different. The new design was based on a series of experiments with the number one machine using extrusion chambers of different designs. The long fan shaped chamber, which tend to distort and made adjustments of the orifice blades difficult, was replaced by a short Chamber of an extremely different design, stiffened by the use of heavy C shaped ribs. The Office on this was 80 inches wide, designed to produce a 48 inch finish sheet at the higher speeds for which the machine was designed. The trays or tanks for extracting the solvent contained seven passes of sheeting, each 50 feet long. All the rolls were driven, and the drive was so designed that any slack in any of the passes was automatically transferred to the next lower one and necessary to proceeding tank, which was located just below it.

Since the machine was designed to run both cellulose acetate and cellulose nitrite sheeting, the temperature in the brine could not be varied. It could be varied from around 40 degrees at the extrusion or first to around 200 degrees in the last tank. A DC drive was used to obtain very close control of sheet transporting roles and the pumping and extrusion rates. Mechanical speed changers were also used at the pumping and in order to extend the range of the DC drive, this number three machine was quite versatile and ran originally on cellulose acetate with only minor problems. It was then run for a time on a formulation of highly plasticized cellulose nitrate, which had been developed by the laboratories of the Pittsburgh Plate glass company as an answer to several problems with cellulose acetate, which carried somewhat lower cost. With this, with this formulation, problems with waviness and the finished lamination reappeared.

Measuring Waviness Distortion (23:12)

No reliable method for measuring the various degrees of waviness existed at that time. One merely looked for through the lamination angle 35 or 40 degrees. To determine whether or not distortion was present, we developed a method for our own use which worked very well. A screen containing alternate black and white vertical lines was photographed through the lamination at two or three different angles. Samples were taken at regular intervals from the production runs were photographed in this way, this not only indicated any changes in the degree of waviness with time, but the photographs could also be compared directly with those of the light spots on the calipering device at the time that the photograph section of the sheet passed under it through careful attention of adjustment of Office blades and very particular hand honing of the blades before installation, were able to keep the waviness of the nitrate sheeting within acceptable limits.

We then had sharpened up our skills on this highly plasticized cellulose nitrate material. I was anxious to go back and try the regular cellulose camp for formula, which we had run successfully on the number one machine for Saturday intervals, but had never tried on a large scale. There was a great opportunity to this among most of my associates in research and in management, since they felt it was doomed to failure and would be a waste of time and money.

Our General Manager, after hearing out both sides, agreed that we could go ahead with a trial on the smallest scale, which would either approve or disprove the point the run was made. After a considerable period of preparation, efficient quantity of satisfactory sheeting was obtained to demonstrate beyond a doubt that the process was feasible. After that, substantial quantities of cellulose nitrate were run commercially for Pittsburgh.

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One problem which developed, particularly during these runs with cellulose nitrate, was the drives and bearings of the rolls in the solvent removal tanks. The rolls were chain driven and the bearings were ball bearings made of Monel. All of these were submerged in the solution of saturated sodium chloride, which also contained some plasticizer and solvent extracted from the sheet. When we began to heat the brine to handle cellulose nitrate, various lubrication problems, aggravated by slight corrosion, began. Some of the Monel bearings were replaced experimentally by Ligno Vitae bushings which worked quite well mechanically.

However, the natural resin, which is present in a high percentage of this wood, leached out in the hot brine and caused blue spots in the finished sheeting. Final solution was to bring the drives through the sides of the tank and use external bearings and drives. There were also miscellaneous corrosion problems. After continuous runs over a period of months some of the solvent removal tanks began to leak. Investigation disclosed that the Monel sheet with which they were lying had developed a few isolated, clean looking holes, which appeared as though they had been punched through the sheet. There was no sign of corrosion anywhere else. This particular corrosion was traced to the combination of contaminants built up by the brine during its travels, and it was found necessary to replace the Monel liners within canal. This solved that problem completely.

New Safety Glass Inner Layer Compositions Reducing Rigidity and Head Injuries (26:30)

While all this was going on, we had another group working on new compositions for safety glass, inner layers, cellulose nitrate and cellulose acetate. Laminations represented a vast improvement over plate glass, their safety hour diminished at low temperatures since the inner layer became more brittle, they also required edge sealing to prevent separation there after exposure to weather, cellulose nitrate and addition, required the use of an adhesive in order to bond it to the glass. These inner layers also tend to give very rigid laminations, which could result in head and other injuries, even though the lamination did not shatter on impact.

Ethyl cellulose and many other materials were tried in addition to new approaches in plasticizing the old materials. The best compositions turned out to be acetyls made by reacting polyvinyl acetate with aldehydes. These, when properly plasticized, formed stretchable sheeting, which was considerably less rigid on impact when laminated, it also had the advantage of retaining its strength at lower temperatures and would stand the impact of a half-pound ball dropped from height of 20 degree feet at zero degrees Fahrenheit. It was self-adhesive and did not require edge sealing. Literally hundreds of experiments were run with different compositions, including other astrals and a variety of plasticizers.

Pittsburgh Plate Glass Company Establishes Fellowship at Mellon Institute for Improved Layer (27:57)

Meanwhile, a Pittsburgh Plate Glass Company had established a fellowship at Mellon Institute for developing an improved layer. They also found polyvinyl acetals to have the greatest overall promise, and developed an excellent composition with polyvinyl buterol and a special plasticizer called Three GH made from a glycol and a side chain hexoic acid. This composition was finally adopted for the inner layer shipped to Pittsburgh.

We meanwhile had found dibutyl-subastate to be an excellent plasticizer, which was used in sheetings for Libby Owens Ford. Both composition were given lengthy exposure tests in Florida, Pittsburgh, Toledo and Arlington, before they were released for commercial use. The inner layer, resulting from these compositions, was a rubbery one with entirely different physical characteristics from the stiff cellulose

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acetate and cellulose nitrate products. It also had a sticky surface which would adhere to almost any surface with which it came in contact when it was laid out on a sheet of glass as required for the original layup for the glass plastic laminates and laminating plants, it tended to stick badly on contact.

J Harry Dubois 29:12

Thus it could not be moved around until it was in register with the shape of the glass. To us, this new composition brought with it two major problems, one, the difficulty of making and handling this stretchy, sticky sheeting in our equipment, and two, making the sheeting handleable in the customer's operation. We were fortunate in that the basic principles of our process and the design of the equipment gave us great flexibility in converting from one material to another. This had already been demonstrated through the successful production of cellulose acetate and cellulose nitrate in the same equipment.

However, there were still a number of problems that we worked on with a new polyvinyl butyl material to do this and to develop a commercial process. Quickly, we constructed an entirely new number one machine for making an experimental. Sheet around 20 inches wide. We also designed and built some smaller units which could be used for exploratory experiments. Excellent use was made of this equipment, learning how to extrude and handle a rubbery, sticky sheet which was later named butocyte.

All kinds of problems developed. For example, the wet part of the process, the sheet was slippery so that it was difficult to drive it with smooth rolls, and these were finally roughened by sand blasting. Rubber squeeze rolls were also necessary in some spots to control slippage in the hot air drying step. However, the sheeting tended to stick tightly to the rolls and other equipment, and it was necessary to use a powdered material on the surface to prevent such sticking. Sodium Bicarbonate worked well. Was relatively inexpensive and can be removed easily by washing the main difficulties we have solved after a time and the specifications for engineering changes in the number three machine were developed and in the design of the number four machine.

One major problem, however, remained, and that was to make the surface sufficiently less sticky so that could be moved around on the glass in the laminating process, chemical treatments were tried, but none of these were wholly successful, since they either ordered the surface of the sheet enough to interfere with Its adhesion to the glass, or they resulted in hazy blemishes or other optical problems in the laminations. The most promising lead was found to be the use of embossing rolls to form a surface having greatly reduced amount of contact with the glass. This was done by softening both surface of the sheeting by blowing steam on them and then passing the sheet between a pair of pattern embossing rolls spaced just a few 1000s of an inch apart.

Initially, this was a very critical and fussy operation. A number of people marveled at it worked at all. The nature of the pattern on the roll turned out to be a major importance. Number of patterns used for embossing leather and other materials were tried and rejected. The best solution turned out to be a grit blasted pattern produced on the rolls under very carefully controlled conditions. Grit, type and size, pressure and depth of the pattern all turned out to be essential contributors to the final success. The heating of the sticky sheet just before it entered the nip of the rolls, and the cooling via mist spray just as it emerged from the real roles required careful attention. This embossing problem was the most difficult of all of the problems connected with the conversion of BUTY sheeting.

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The final solution was not clear until just before the remodeled machine was ready to run, even then, there were only another few of us who could make it work successfully. And I can remember spending a number of 12 hour shifts nursing it along a second production machine, the number four, which was basically the same as number three with some assignments, was then built this and the number three turned out all the commercial product for over 20 years and were shut down only when the Arlington plant was sold.

Polaroid Application (33:05)

One interesting phase of this process development was the application knowledge we had gained on extrusion of sheet to the extrusion of the first continuous sheet for use by Edwin Land at Polaroid for making sheet polarizers. This was an essential un-plasticized cellulose acetate sheet, which was extruded into a bath of chilled kerosene or air. Much of the knowledge and experience gained was later applied to the extrusion of thin polyethylene nylon sheeting, and another version of the process was used to extrude cellulose acetate compositions onto a polished drum in a process for casting a film for photographic use at an accelerated rate.

All this was written by P Willard crane, now a vice president of the Cincinnati milling Machine Company, and was dictated on this tape by J Harry DuBois.

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Al Mannovill, Apollo Manufacturing Company

J Harry Dubois (33:56)

The following tapes were all dictated from letters which were received from plastics pioneers in lieu of tapes. The next record. Record is that of Al Mannovill, M, A, N, O, V, I, L, L, of the Apollo Manufacturing Company in the Bronx, New York.

Making Jewelry and Buttons out of Casein Sheets, Late 20's (34:39)

Al Mannovill (read by J Harry Dubois):

Going back to the late 20s, we were making jewelry, as well as buttons out of casein sheets, which had to be cut, tumbled, phrased and polished. Around the middle of the 30s, they discovered the knowledge, which was commonly known as Catalan material, and the same thing applied there, as with casein only, instead of cutting it out of the sheets it was cut out of rods.

The Catalan Corporation then developed the idea for making arbors for belt buckles, which meant all we had to do was slice it off in the thickness we wanted. Phrase the different designs and tumble and polish. They also went into making forms out of lead and casting material for radio cases. This became quite an item, especially when they went into the model. Effects such as wine and dark green turned out to be quite beautiful in the middle 30s.

Thimbles (35:28)

I was my fortunate to have one of the first injection machines in America, a two ounce Eckert Ziegler, and the first thing that we molded was thimbles. To be honest with you, we still are molding thimbles. The first button mold I made was for an injection machine was a sailboat. And from that time on, many, many styles with cut-outs having elaborate carvings were made. And the button business became quite an item. From the button business, I naturally went into custom molding and into housewares.

An All Plastic House? (35:59)

Looking back, I can see a terrific growth in the plastics business. Not alone, have we started to crawl, walk and run. We are going full speed. Is one of these pictures to me that I can see in the very near future, a house, really, of all plastics, the limitations are in are endless. Where will we go? I cannot say. I don't believe any man alive can tell where the end will be with plastics. It has such great possibilities. When one looks back and sees the limited uses that plastics had in the 20s and 30s, and the stride that has been made since then, not alone. The perfection of materials, the perfection of molding techniques and the unlimited size, it sort of staggers one's imagination as to what the future may hold. As a pioneer, it's been my pleasure to see this growth.

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Charles Lichtenberg, retired Vice President, Resinox Corporation & Monsanto

Charles Lichtenberg (36:57)

The next recording is by Charles Lichtenberg, retired Vice President of Resinox Corporation, and also assistant to the General Manager of Monsanto chemical company, who writes as follows:

History of Resinox (37:15)

As you know, I have been associated with the plastics business since 1930 at which time The Resinox Corporation was formed. A brief history of this company with which I was connected. From the beginning follows the Resinox Corporation. Were formed in 1930 by commercial solvents Corporation and Corn Products Refining Company, each of whom possessed a 50% ownership commercial solvents the first American manufacturer of synthetic wood alcohol.

Looking Beyond Food Uses for Corn (37:42)

Envision the upgrading of this product into formaldehyde, a basic resin raw material. And Corn Products, the largest manufacturer of corn syrup, look for other than food uses for this plentiful product, this promise seemed to be in the offering when corn products came into the ownership of some patents on sugar resin. Initial research found the sugar resins lacking in desirable properties and to keep the enterprise going.

During the Depression, early 30s, phenol from Allied Resin Manufacturers was started in a small, rented building in Metuchen, New Jersey. The kettles and other equipment were second hand, and the plan was to manufacture the resin from purchased phenol and formaldehyde, the latter upgraded from commercial solvents methanol, and then market the resin to those few molders who were equipped to roll it into molding compound. Molders unequipped to perform this operation, purchased phenol formaldehyde molding powder from the then two principal suppliers, the Bakelite Corporation and General Plastics Company, later to become the Durez company.

Manufacture Molding Powders in Competition with Bakelite and Durez, 1932 (38:50)

By 1932 surveys indicated the supplying of resin of molders would not because relatively few molders were equipped to process the resin into molding powder, provide adequate sales volume to justify the venture. And, at this time, the decision was made to manufacture and sell molding powders in competition with Bakelite and Durez.

During this early period, George Lewis, formerly of General Plastics Company, was in charge of manufacturing, but he left shortly after Molding Powder Manufacturers started to form his own company, Varkham Chemical Company. At this time, manufacturing was taken over by Kenneth Irey, and research was handled by Lawrence Deving, both of whom stemmed out of commercial solvents. Charles Gabriel, a vice president of commercial solvents, head of the company as president and I operated sales, selling a new, unknown product against strong competition during the early 30s was difficult, but progress was upward, real.

Upward movement, however, did not get underway until mid-34 when a Resinox molding powder offered foreclosure manufacture demonstrated higher torque strength than anything on the market. At that time, sales pyramided and the production of molding powder expanded so that new production facilities were needed. Whereupon the plant was moved to Edgewater New Jersey, and manufacturing was conducted in a portion of the corn products plant at that location.

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Rapid Growth Required Unavailable Financing, Company Sold to Monsanto, 1938 (40:20)

By 1938 the Resinox manufacturing facilities were again being strained, and a new plant with much greater capacity was needed at this junction, both parent companies felt they could not finance the roughly $3 million expansion. It was decided early in 1939 to sell the operation.

Monsanto Chemical Company had purchased the Fiiberloid Corporation at Indian Orchard, Massachusetts, a manufacturer of thermoplastic materials, in May 1938. And in May 1939 the late Edgar Queenie agreed to buy the Resinox Corporation, combining it with the Fiberloid Corporation to form the plastics division of Monsanto chemical company. This division, now in 1968 is one of the world's largest suppliers of resins, molding, power, film and other plastics products. And all indications point to greater growth in the coming years.

End for Charles Lichtenberg, formerly the Monsanto and Resinox companies.

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N. A. Backscheider, President Recto Molded Products

N. A. Backscheider (41:26)

The next dictation is done for Mr. N. A. Backscheider, B, A, C, K, S, C, H, E, I, D, E, R, president of Recto Molded Products, Cincinnati, Ohio, who gives us an outline as follows:

Molding with Redmanol, Bakelite and Condensite. Molded Model T Timers and Other Car Parts, Radios and Dentures (41:30)

Started plastic molding in February 1919, using Redmanol, later used Bakelite and Condensite. Made an electrical rectifier for Model T Ford car to charge a battery. Also made Ford Model T timers with Redmanol body and Formica T rack molded bases for crystal radios. Also parts for CORDEL radio, who operated WKRC, made plastics printing plates, also plastic dentures with porcelain teeth embedded.

J Harry Dubois (42:17)

End of dictation for N. A. Backscheider, familiarly known as Beck Nick N, I, C, K, who is very active in the Plastics Pioneers, the Society of the Plastics Industry and the Society of Plastics Engineers.

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B. Frank Hantz, American Insulator Corporation

B. Frank Hantz (42:40)

The next recording is for Mr. B. Frank Hantz, H, A, N, T, Z of American Insulator Corporation, New Freedom, Pennsylvania, who recites as follows:

Developed Cold Molding Materials (42:50)

We have been in business for 50 years, and during that time, we have had many experiences which just seem every day to us, and at the time was not very important. Maybe they are important today. And if you could give me some suggestions, be happy to respond immediately. Of course, we have had the usual experiences over the years of developing cold molding materials and then manufacturing phenolic compounds of our own. In fact, we still do to a very limited extent. Injection molding came along, and as you know, our latest adventure since 1949 has been the production of reinforced polyester, fiberglass, molded parts.

J Harry Dubois 43:33

And that's the end of the recording for B Frank Hantz

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Oscar Gold, Rothschild Keno Company, Rex Novelty, Arthoplastics Novelty Incorporated,

J Harry Dubois 43:40

The next recording is made for Oscar gold of Hyattsville, Maryland.

First Button Out of Nitro Cellulose (43:48)

I started in the plastics industry in 1907. The firm I was working for Rothschild Keno Company made the first button out of nitro cellulose, the only plastic at that time. In 1909 the same firm produced buttons out of casein for the first time.

First Frame for Ladies Hand Bags from Cellulose Acetate, 1927 (44:06)

In 1923 I became Sales Manager for Rex Novelty Incorporated, where, to the best of my knowledge, we made the first frame for ladies hand bags out of cellulose acetate in 1927. In 1930 I took a line of bag frames to England and sold the ladies handbag manufacturers there, making it a first.

First Large Manufacturer of Jewelry Made out of Cast Phenolic, 1933 (44:26)

In 1933 I started the Arthoplastics Novelty Incorporated, and we became the first large manufacturer of jewelry made out of cast phenolic. In 1936 we fabricated the first radio cabinets out of cast phenolic molded and distributed by Monsanto Chemical Company to Emerson radio, RCA and Theta.

First Acrylic Handbag Frames and Umbrella Handles, 1938 (44:49)

In 1938 we introduced the first jewelry ladies handbag frames and umbrella handles made out of acrylic.

Manufactures Lucite Telegraph Keys Presented to Presidents Roosevelt & Truman, 1939 and 1940 (44:56)

In 1939 Western Union asked us to make a telegraph key out of Lucite that they wanted to present to President Franklin D Roosevelt in the White House. We manufactured it by hand out of a heavy piece of stock that du Pont supplied us with. President Roosevelt liked it so much that he took it home. And when Mr. Truman became president, he requested one. And again, once again, we were asked by Western Union to make a duplicate for him, which we did in 1940.

Develops an Imaginary Map of all the Plastics in Existence, 1940 (45:27)

We were asked by Fortune magazine to execute an imaginary map of all the plastics in existence up to that time. For they were devoting part of the October 1940 issue to plastics, which we did. And it was a tremendous success, ~~leaving~~ receiving hundreds of letters from all over the world, asking permission to use the map.

I have liquidated the Arthoplastic Novelty Incorporated in 1949 keeping the corporation dormant, and moved to suburb of Washington, DC, where I could be near my children. This year, 1968 we liquidated Arthoplastic plastic completely. I said, instead of we being sole stockholder of the corporation,

J Harry Dubois 46:12

And this is the end of the recording for Oscar gold operator,

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Fred Behr, Pacific Novelty Corporation / DuPont, Ben Hur Products/EB Kingman

J Harry Dubois 46:20

This next recording is made for Fred Behr, B, E, H, R, of Long Beach, New York.

The Viscoloid Company, 1916 (46:28)

I started in 1916 with Pacific Novelty Company, which was affiliated with Viscoloid Company, Leominster, Mass. and was purchased by DuPont in 1926. This firm manufactured celluloid combs, brushes, toilet articles and toys. In addition to rods and sheeting, I was assistant buyer and designer.

Starts Ben Hur Products, Produces First Hair Roulette and Ponytail Clip (46:45)

In 1924 we started the firm of Ben Hur Products and became the leading hair accessory firm. I created and manufactured the first hair roulette, which locked itself into the hair I designed and manufactured the first plastic hair band. I also created the first ponytail clip.

In 1932 the firm of Ben Hur Products Inc. was purchased by EB Kingman Company of Leominster, Mass. First we produced combs, barrettes, knitting needles and so forth out of plastic sheeting. In 1936 we bought our first injection molding machine. EB Kingman Company molded blanks and Revlon Love Pat compacts. We also did work for Western Electric and extrusion.

When a retired 1960 E. B. Kingman company had 18 molding machines.

This is the end of dictation for Fred Baer of Pacific Novelty Company.

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Alan F. Randolph, Arlington Company / DuPont

The next dictation is for Mr. Alan F Randolph of Wilmington, Delaware.

When I took my first job with the Arlington Company, it had recently been bought by DuPont. It became the nucleus of the plastics department of DuPont. My first boss was Jasper E. Crane, son of one of the small group who had owned the Arlington Company. In 1945 at a dinner of the 25-year club of Arlington plant, Mr. Crane was a speaker on the history of the Arlington Company. If this would be of interest to you, I could lend you my mimeograph copy. Period for the record, we will get this mimeograph COPY and use it operator. That's the end of dictation for Alan F Randolph.

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Emery Cleaves, New Jersey Button Works, Robert Heller and Associates

J Harry Dubois 48:54

The next dictation is for Mr. Emery Cleese, C, L, E, A, V, E, S, who records as follows:

CEO of New Jersey Button Works, 1929 (49:00)

I entered the plastics business in July 1929 when I became Chief Executive Officer of the New Jersey Button Works, a company found in the 1870s by Andrew Brodersen and Chris Brodersen. Chris was Neil Brodersen, father. Although the company was primarily manufacturing ocean pearl buttons and novelties, it also manufactured casein pants buttons, for which it obtained the casein and cured rod form from Christensen.

Christensen later formed the button Corporation of America, engaged primarily in its own production of casein buttons. In 1932 when the casein pants button business began to taper off in favor of zippers, I was joined by Al Maniville, and we began the production of cast phenolic resin buttons. A couple of years later, we made an arrangement with Thomas Mason, of the old Thomas Mason Manufacturing Company, which had imported four of the first Eckert and Ziegler injection molding machines bought into this country after a few years, this arrangement was terminated in 1938 when I saw all the New Jersey button works to the Excelsior Manufacturing Company.

Subsequently, I joined the management consulting firm of Robert Heller and Associates in Cleveland, and among other assignments, made a study of the celluloid manufacturing company, which had just been bought by Celanese Corporation to form the nucleus of the plastics department after World War Two, I became associated with Celanese Corporation. Had something to do with the marketing and trade relation of the Celanese plastics division. End of dictation for Emory.

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J. Frank Albany, Gem Wide Corporation, Albany Albion Realty Corporation

J Harry Dubois 50:37

The next recording is for Mr. J, Frank, F, R, A, N, K, now of the Albany Albion Realty Corporation.

Hi, I am in the midst of making up a tape recording covering the many facets of my past work in plastics, at this time, I have many finished Island brochure and pamphlets of the work done by Gem Wide Corporation, of which I was the founder. In 1932 there are many interesting items that perhaps can be used in the display at the Smithsonian Institution. I wish to advise that one of the pictures covering the World's Fair at New York City has been placed in the capsule in Oglethorpe University in Washington.

And that is the end of the dictation for J Frank.

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Tape 7-1 (AC1235-RCD0007-01)

G. M. Powell, Associate Director, Union Carbide Corporation

J. Harry Dubois 0:08

Ah, this is reel three of the plastics pioneer series. The information on this reel was dictated by J. Harry Dubois, for the individuals who sent in typewritten histories instead of sending in the tapes. The first one on this series will Mr. G. M. Powell Associate Directory, Union Carbide Corporation, Charleston, West Virginia.

John Wesley Hyatt Award Winner, 1949 (0:50)

G. M. Powell:

In my own case, since my membership in the Plastics Pioneers Association is honorary and stems from my receiving the John Wesley Hyatt award for the year 1949 covering my work in introducing a vinyl dispersion resins, I'll confine my remarks largely to the that topic.

Development of Vinyl Chloride Co-Polymer at Carbide and Carbon Chemicals Corp, Mid-1930's (1:12)

Back in the mid-30s, several of us under the leadership of Mr. Arthur K Doolittle, were working in the laboratories of the then Carbide and Carbon Chemicals Corporation in South Charleston, West Virginia, on the development of the vinyl chloride co-polymer resins for use in solution coatings.

American Can Company Lines New Beer Cans with Resin, 1936 (1:31)

This led, in 1936 to the adoption of an approximately 86 slant 14 vinyl chloride slant vinyl acetate copolymer for lining American Can Company's new beer cans, and the beginning of real commercial success for these resins.

At that time we were working on these solution cosines. We were keenly aware of the problems in finding suitable solvents to dissolve these resins, and even had to introduce methyl isobutyl ketone commercially to have a strong medium boiling solvent for our lacquers. We thought of handling these resins as finely divided dispersions in water or organic non solvents, probably encouraged by Mr. Doolittle in this and of taking advantage of their thermoplasticity to fuse them into films by heating.

We tried various techniques for making the ultra-fine particles. We knew we'd have to have for this approach, but had no commercial facilities with which to follow up. We constituted instead, upon introducing a carboxyl modified copolymer to give us better adhesion in our solution coatings and then on a back hydrolyzed copolymer containing alcohol groups to gain wider compatibility and reactivity.

By the early 1940s much commercial interest had developed in plasticized polyvinyl chloride and plasticized, high molecular weight, high vinyl chloride content. Copolymers, as you know, these were calendared into films and sheeting or into fabrics, were extruded onto wire, in some cases, were actually dissolved in Methyl Ethyl Ketone and knife coated onto cloth for military uses.

We renewed our efforts to find practical dispersion techniques, and soon found that the much higher molecular weight polymers and copolymers made our task simpler. Dr. R. W. Quarrels and Mr. C.I. Spaceard at our Mellon Institute fellowship, worked out methods for making usable dispersion from carbides, non-solvent process, copolymer, v, Y, n, w, but these generally prove too cumbersome in practice.

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Emulsion Polymerization Techniques (3:50)

Meanwhile, at South Charleston, working with Mr. T. Mullen, Mr. W. H. Mc Knight and others, we put emphasis on using resin made by emulsion polymerization techniques, and found that we could obtain organelle soil dispersions of considerably more promising using these again, we had to face the problem of finding commercial scale facilities for manufacturing such resins.

Fortunately, under pressure of wartime demand, Carbide built an emulsion polymerization facility to make resin for electrical insulation uses. The product, unfortunately never really met the stringent requirements for these uses. But again, fortunately, we found that the dry resin from this process called VYNU, then could be pebble milled in combinations of swelling and non-swelling diluents and plasticizers to make high solids organelle from which excellent coatings could be obtained by baking.

With this success, we dropped work on latest latexes and hydrosols so. And concentrated on vinyl resin organelles, as we promptly dubbed them. The groups at South Charleston and Pittsburgh worked out a number of viscosity, composition relationships for a variety of combinations of solvents and non-solvents in general, we established that for each combination, there was an optimum proportion of active solvent to hydrocarbon to obtain minimum viscosity, stable dispersions from which good films could be obtained.

Some solvents, we found, gave extremely narrow composition ranges for minimum organelle viscosity, while others, usually weaker solvents, gave much broader minimum viscosity ranges, besides the solvent slant non-solvent ratios for minimum viscosity shifted a good bit depending on the nature of both components.

When a plasticizer such as the di-two-ethyl-hexythalate was used as the active solvent, then a balance between swelling and non-swelling hydrocarbons was needed for a minimum viscosity, viscosity composition charts of these systems were published in the journals and distributed also in company literature, and constituted, in my opinion, a significant contribution by Carbide to the industry.

At that time, we had heard something about work by others on resin, plasticizer pastes which contain no volatiles, but which could be knifed or spread then fused into usable coatings. The samples we saw and those we prepared ourselves from available resin were pretty crude. Later, we tried making our new organelle of the VYNU resin on a three roller mill instead of in a ball mill, and soon found that we could make excellent smooth dispersions that contained only diacetyl phthalate plasticizer and no volatiles. These pastes were much superior to any others we had seen in discussing plans for a commercial introduction of these resins for use in resin plastics are pastes with my coworker, Mr. John F. Suter, one day in 1943 we grouped for a suitable name to call these pastes.

Carbide and Plastisol (7:21)

As I recall it, he proposed plastic soles to go with organisols, and we immediately adopted this. We publicized the name plastic soil widely, and soon it became generally accepted and used by industry. It became so generally accepted that some forgot its origin. Hence, I'd like to ask that in your history, you give Carbide full credit for coining the word plastisol and donating it to the public domain.

Navy Influence on Plastisol Usage during War for Mine Detection (7:52)

We got into the plastisol business rapidly under wartime pressure from the Navy. Mr. J. E. Brister of our new market development group heard of the Navy's interest in filling the voids between conductors in

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the de glossing cables put around ships to avoid detonating magnetic mines, and asked about our new plastic soles. We prepared a gallon sample of a composition containing antimony oxide as fire retardant, calcium carbonate filler and super sublime blue lead stabilizer pigment, and submitted this to a cable manufacturer who made up a cable for a test by the Navy.

Before long, the word came back that this was just what they wanted, and they asked us how soon we could begin supplying about a million pounds a year of the composition just as we submitted it, we never have had before since such rapid acceptance and commercialization of a single initial sample. The scene soon shifted to the Bakelite plant at Bound Brook, where we installed three roller mills and got into production in short order. Obviously, others took over and made significant contributions to our success.

BF Goodrich Company, First Stir-in Resins for Plastisols (9:05)

Later U.S. patent 2427507, issued in September of 1947, to Paul and Brister on this end use. We promoted to organizations and plastisols for cloth coatings and a technical bulletin issued in 1944 and published a paper in December 1946 in the official digest by Powell and Quarles, combining describing these techniques more fully and suggesting their broad utility, the carbide resin. Production was soon sold out as uses grew, others entered the field and made significant advances, notably the B F Goodrich Company with the first stir-in resins for plastisols.

J Harry Dubois 10:01

These later developments are well documented in an SBI Handbook Chapter issued in June 1952 and elsewhere. Both plastisols and organisols are continuing to grow in commercial importance, and improved resins continue to appear to help this process along. In retrospect, we thought we were being really reckless in the new predictions we made, both as to the total potential sales volume and multiplicity of end uses for these products, but events since have proved us very conservative.

And this ends the dictation by GM Powell, associate director South Charles, West Virginia plant of Union Carbide

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John J. Kevel, General Sales Manager, Plastics Technology (Trade magazine)

J Harry Dubois 11:00

The next recording is the history of plastics in Leominster as written by John J kevel, who was presently serving as General Sales Manager for plastics technology a trade magazine. This was presented to the Historical Society on May 10, 1957.

History of Plastics in Leominster, MA

John J. Kevel:

It is a privilege to have the opportunity of reviewing with the Historical Society of Leominster, the typically American success story, which is represented by the history of the plastics industry. Here, as a native son, I naturally view with pride Leominster's contribution to any major industrial activity. Historical Accuracy is not violated by the statement that Leominster has played a more significant role in the establishment progress of plastics in the United States than any other single community or area.

Furthermore, as we shall see, products and techniques developed in Leominster have been for many years and continue to be important factors in plastics expansion abroad today, approximately 60 firms are more than one half the city's industrial establishments are engaged in some phase of the plastics industry. Over 83% of the wage earners in Leominster. Nearly 6,000 people have employment directly or indirectly related to plastics.

Since the advent of injection molding in 1931 the growth of plastics throughout the country has, of course, outstripped the growth in this section, with the result that a Leominster can no longer claim to be the center of plastics in the United States. However, today, one must go to the large cities such as New York or Chicago to find areas where processing capacity consumption of plastics, or production of tooling and machinery for plastics, is greater than in Leominster, a unique combination. Companion accomplishment is Leominster is pioneering in the important field of vocational education in plastics, designed to provide a steady supply of trained workers and thus maintain Leominster's preeminence in the plastics parade.

Leominster Plastic Roots Begin in Newburyport, MA with Enoch Noyes Making Combs out of Cattle Horn and Tortoise Shell, 1760 (13:19)

Strangely enough, the history of plastics in Leominster begins not in Leominster, but in West Newberry, near Newburyport, Massachusetts. There Enoch Noyes, the first comb maker in America, made combs by hand from cattle horn and tortoise shell around 1760. Enoch Noyes primitive skills gained from his family's trade experience in England were passed down through generation of the Noyes clan, and they eventually established substantial comb manufacturing businesses in Newburyport and West Newberry as well as Binghamton, New York.

One of Enoch Noyes first apprentices, Obadiah Hills moved to Leominster from West Newberry in 1774 in the kitchen of his Pleasant Street farmhouse, part of which still stand. Obadiah began to manufacture combs around 1775 the comb industry had become so promising in the Massachusetts colony that in 1774 the provincial Congress recommended to the people the encouragement of horn Smiths as homemakers were called Leominster's, first comb maker.

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Obadiah Hills later returned to Newburyport, but brother Smith hills and Silas Hills carried on the business. Gradually other West Newbury artisans came here, Joseph Tenney, Edward Lowe, John Chase, other early Leominster comb makers were John Kendall, Jonathan Johnson and James Bozell, who worked shell and ivory as well. Was horn into combs, and also was the first known specialist in making tools and machinery for comb manufacturing.

In 1793 there are about 20 people in Leominster operating comb enterprises. Profits were small, but these men averaged $1 per day, actually more lucrative than farming. Most of them did some farming also, as in most handicraft trades, the apprentice system was the only entry of comma to comb making during these early days in the book comb making in America, which the late Bernard W Doyle had compiled and privately printed in 1925 to commemorate the 150th anniversary the founding of the comb industry in Leominster.

This interesting account is given of The Apprentice system, its rigorous requirements approach the borderline of slavery. For it bound one by legal indenture to serve and obey a master and be faithful to him in all things. An apprentice was expected to work every day, holidays excepted, from the middle of September to the middle of March. Usually, he was allowed two-terms of schooling each three-months long. He must not be out after nine. Should attend church service twice on Sunday and spend Saturday evening preparing for Sunday school. In some cases, he was given a stint allowed to do overwork. This was his only chance to earn a little spending money, and was considered a special favor.

The opportunity usually came during the long winter evenings, when he could grind the back and teeth of the high top comb, which was in great demand on the old foot wheel, standing on one foot and kicking out the power with the other while his hands manipulated the comb. A skillful youth could earn nine pence, then 12 and a half cents between the hours of six and nine o'clock.

Some of the more generous employers gave their apprentices $30 a year with which to buy clothes, such apprentices were able to blossom out in the height of fashion, to the envy of the less fortunate, were often seen with darn patch trousers and an extra patch on their well-worn cowhide boots.

The indenture that bound the apprentice to certain duties also bound the master to certain obligations. He must treat his apprentice kindly, look after his moral character, and give him what was known as Freedom suit. At his majority, the food of an apprentice was of the plaintiffs, consisting chiefly of Pan Doughty, as a deep apple pie, then called Indian pudding, rye cake, salt pork, bacon and occasionally clams, salt shed and other fish. Rigid economy was the pale of prevailing idea.

It is curious that this economical trait in some of the early comb makers of West Newbury led to the passage of a resolution limiting the number of times a week that salmon could be served to the apprentices. There was good reason for it, as in those days, the Merrimack River abounded in salmon. And since the fish was plentiful and cost little, many employers will want to overestimate the value of salmon as a daily food.

Deacon Charles hills, son of Silas hills, was the most prominent comb maker of the second generation in Leominster after the war of 1812 he conducted a comb business for 30 years in a shop known as the horsepower building on Pleasant Street. Part of this shop still stands and serves as a dwelling. Power came from a horse walking a treadmill in the basement of the shop, and this arrangement was considered very progressive for its day.

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It is interesting to note that business transactions at this time were conducted more by barter than by cash. Comb makers in selling to stores, for example, would receive a credit on the store for the purchase of their needs. Most of you are familiar with Kendall lane, which lies along the banks of the stream directly back of Main Street. The rather undignified name of cat Alley was given to this area over 100 years ago, and the name persists until this day.

Here in the mid-1800s many, eventually prominent comb firms had their beginnings. Some of these were Tenney and Porter W D, Ireland Company, Aldrich Cook, Patton and Metcalf look, Tilton and company during this time, the James H Carter factory stood near where St Mark's Church now is employing water power from Monosock Brook dammed at this point.

Jonas Colburn, inventor of cotton balls for polishing combs, operated on Pleasant Street what was considered to be one of the best equipped comb shops of the area where he invented comb making machinery widely used for a number of years. He was killed in an accident in his factory in 1873. Mr. Damon, developed many labor saving devices during this period and turned over to his son George, a thriving business. This firm eventually became Luck Damon and Company, and then Damon Howell Company, one of the first to manufacture horn hairpins. Mr. Howell later founded the Howe Hairpin Company in 1902 and later went into partnership with EB Kingman, who had organized EB Kingman Company in 1888. As you know, E. B. Kingman Company still enjoys robust health.

J Harry Dubois 20:27

Other prominent home makers of this period were Charles L, Joslin, E, gay Adams, Benjamin F Bludget, Gardner and Augustus Moore. The Moore brothers surrounded their factory with a collection of dwellings and stores for the workers, some of these buildings still stand the area known then and now as Morse hollow. Edward B Tilden and George H Cook founded the Tilton cook company in 1878 at the same location where the plant, now one of the larger factories in Leominster, still does business under the leadership of George H Cook Jr, son of the original founder.

Hydraulic Press Using Horn (20:57)

Tilt and Cook was the first company to use a hydraulic press in pressing horn. These combs, hairpins and bandeau were made by Tilton Cook in the early 1900s how the Nicholson, an expert in horn, came to Leominster in the late 1800s from England, the business which he started, continued to use horn for combs and cutlery handles for many years.

Founding of the Viscoloid Company, 1901 (21:25)

The Patton Manufacturing Company was founded in 1879 and by 1897 was one of the largest factories in town with a capital of $50,000. Alexander S Patton was president. B W Doyle, treasurer and P H Watson secretary. In 1901 Mr. Patton and Mr. Doyle, together with Ludwig Strass of New York and Paul Rea of Paris, founded the Viscoloid Company. This company eventually acquired other small firms, became the outstanding factor of its kind in the world.

Samuel Foster and the Foster Grant Company, 1911 (21:55)

A foremost Viscoloid designer, whose name remains in a preeminent position in Leominster’s plastic role of honor, was Mr. Samuel Foster, who later founded the Foster Grant Company, now headed by his son Joseph Foster. This clock with a carved celluloid case was done by Mr. Foster in 1911. In 1925 the Viscoloid Company was purchased by the DuPont Company and employed upwards of 2,000 people.

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This unit is now the plastics product division of poly chemicals department of DuPont. Being limited to horn tortoise shell and ivory, each of which was available only in pieces of comparatively small area, imposed severe restrictions on plastics fabrication.

John Wesley Hyatt Developed Cellulose Nitrate and Founded the Celluloid Manufacturing Company, 1868 (22:41)

In 1868 John Wesley Hyatt developed cellulose nitrate plastic and founded the Celluloid Manufacturing Company, later to become the plastics division of the Celanese Corporation of America and Newark New Jersey. Celluloid, as this grand for of all plastics was called, was superior in all respects to horn and became available in large area sheets, rods and tubes in unlimited colors and variegated effects. It was quite natural.

Leominster becomes Center of Celluloid Fabrication and Combs (23:11)

Leominster, with its existing facilities for horn fabrication, rapidly became the center of celluloid fabrication in this country. More and more comb shops sprang into being were the result that Leominster became known as the comb city. However, the versatility of celluloid was such that Leominster factories began turning out many other articles, as toys, cutlery handles, optical frames, buttons and novels.

Miss. Harriet Raymond advertising manager of the Southern East plastics division, has kindly loaned us a collection of fascinating cellulite memorabilia. Despite the great trend to celluloid, some horn manufacturing persisted in Leominster during I can recall in the 20's. Observing the fabrication of horn cutlery handles in the Good You factory on Colburn Street.

Extreme Flammability of Celluloid (24:09)

Extreme flammability of celluloid constituted a definite hazard, and there were many serious fires during these years. Eventually, another plastic was developed, which compared favorably to celluloid, and was slow burning. This plastic, cellulose acetate, gradually replaced celluloid for many fabricating operation in Leominster, although the Standard Peroxloid Company, founded in 1907 by William Lane and J Philip Leger, continue to manufacture celluloid, one of the few suppliers of this plastics in the country today.

Rapid Growth from 1900 to 1920 (24:43)

The era from 1900 to 1920 saw Leominster have its greatest expansion in plastics. Automatic equipment developed here was sold and imitated throughout the world. It's possible that more people were employed in plastics in the town during that period than even. Now, since there was less automation at the time, more hands were needed. Many of these workers were real artists, as is evidenced by the beautiful, jeweled Spanish combs and dressing combs which they created.

Bobbed Hair and the Depression, Catastrophes for Leominster (25:12)

The late 20s saw two genuine catastrophes hit the plastics industries in Leominster. The first was bobbed hair, which obviously very completely removed the need for most of the elaborate hair ornaments which women wore up to that time. The other disaster which struck our city was the depression of the late 20s and early 30s. Many shops closed their doors forever. Others struggled with reduced staffs. Unemployment and hardship were widespread. It is a tribute to the vitality of the plastics industry in Leominster that has survived these wind blows, although many of the fortunes which had been made in plastics before 1920 were severely curtailed.

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Injection Molding and Foster Grant (25:52)

One of the important technological advancements in the plastics industry up to the present time took place mainly in Leominster. This was the development of the injection molding process. Although skilled machinists in our city and elsewhere had perfected tools and equipment to fabricate sheets, rods and tubes on volume basis, most operations were still largely manual, injection molding changed all this and changed it with dramatic suddenness.

The Foster Grant company Incorporated, previously mentioned, had been in business since 1919, making combs, buttons and hair ornaments from horn and celluloid. Mr. Joseph Foster and Mr. Abram Goodman of this company had heard of the successful injection molding operation in Germany. Foster Grant engineers designed a machine based on the German counterpart who would operate with cellulose acetate molding compound. You will recall we previously mentioned cellulose acetate in sheet form, the same plastic later was available in powder form, which, when subjected to heat and pressure, became flowable, and when forced into a mold and cool, took the form of the mold.

Foster Grant stubbornly persevered despite discouraging setbacks in their attainment of New Horizons and plastics became the first processor in the United States to engage commercially in injection molding operation. This company has continued to develop significant improvements in this and other phases of plastics processing. The amazing growth of Foster Grant is eloquently testament to what can be accomplished be an industrial America under our system of free enterprise with the right combination of courage, brains, initiative and persistence, with over 80 molding machines, Foster Grant is today one of the largest, if not the largest, molders in the world.

It has claimed that Foster Grant is the world's largest manufacturer of sunglasses. The company is only, truly is the only truly integrated molder in business today, manufacturing its principal raw material, which is polystyrene, and preparing to manufacture for molded parts sheets and film a new variety of a nylon plastic. It would appear that Foster Grant will gradually advance beyond the traditional function of Leominster's, plastics processors and become a nicely important basic material supplier.

Injection Molding Launches Plastics Not as a Substitute, but as Basic Materials (28:12)

Injection molding made possible large scale production, taking plastics out of the gadget and novelty class and launching plastics not as substitute but as basic materials in their own right, practically all the fabricators who are in a position to do so obtain injection molding equipment, and today the city boasts all sizes and types of plants, from one and two machine operations to giants such as Commonwealth Plastics and Foster Grant the variety of plastics goods flowing from Leominster multiplied tremendously, is incorrect.

The term Leominster, the comb city, is possible. The term pioneer plastic city, recently suggested by Mr. Smith of the Leominster Chamber of Commerce, is more appropriate, because it does not imply that Leominster's plastics production is confined to combs, and because it points up the unique historical position occupied by Leominster.

Mold and Tool Makers (29:06)

Down through the years of manufacture molds and machinery for fabricating plastics has become a vital essential to the industry. Leominster mold and tool makers have earned the respect and admiration of all in plastics who depend upon the mold maker's art. The new plan of the Standard Tool Company,

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claimed throughout the industry as achieving a new peak in tool making facilities, is an establishment of which Leominster may well be proud.

Tools dies and machine from the Standard Tool Company, as well as from Guy B Harvey Company, Modern Tool and Die Company and many other local mold and dye shops are used throughout the world. Wherever plastics are processed, there's a greater concentration of Leominster's to mold and die, making skills that can be found anywhere. So important is Leominster are becoming the plastics industry that several material suppliers maintain New England sales headquarters here. Among them are the Eastman Chemical Company, Celanese Corporation and Nixon Nitration Works.

WR Grace Company (30:04)

The material our molded compound segment of plastics, has attracted the WR Grace and Company, the firm with which I have just become affiliated. Most of us are familiar with the dominant position Grace has established in general trading.

J Harry Dubois 30:21

Since 1952 Grace was evolved through aggressive internal development and timely external acquisitions a chemical operation, making Grace an important factor in the field, 10th largest chemical producer in the United States, the Dewey and Army Chemical Company division of Cryovac Company division, both of nearby Cambridge Mass are well known members of the Grace Chemical Group.

A new unit of this group is a polymer chemicals division whose new plant in Baton Rouge, Louisiana will begin shortly commercial production of Grace's high density polyethylene plastics. It is of interest to note that our neighbor in Baton Rouge is a styrene monomer plant, a Foster Grant company. We are confident that Leominster plastic manufacturers will find wrecks, of material of unusual potential. We have been neglecting an important aspect of the history of plastics here, if we did not point out Leominster's, influence on plastic establishment in surrounding communities, such as Fitchburg, Clinton, Boston and Worcester. Personnel on many of these firms originally hailed from Leominster.

It's the end of the History of plastics in Leominster by John J Kevel.

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John G Slater, Tennessee Eastman Plastics

J Harry Dubois 31:51

Selling Tenite, 1932 (31:51)

When I joined the Tennessee Eastman Plastic sales department during the summer of 1932 I became the second man in the sales effort. Mr. Spencer E Palmer had been active in trying to develop applications for Eastman's cellulose acetate material, which later became known as Tenite, the eastern part of the United States. My responsibility was to develop markets for this material in the central and western part of the United States and Canada.

At the time, Eastman cellulose acetate was developed it represented a major breakthrough in cellulosic plastics. Previously, all cellulosic plastics had been made by the old nitrocellulose process, which involved the useless solvent and a skived sheet. This had very definite limitations with respect to quantities available, uniformity of quality and time required for producing and shipping materials. Because of these limitations, the material made and sold under the trade name of Lumerith had not been too successful in market development.

In the early 30s, another very definite limiting fact was due to the fact that there were only thermal setting materials available which were molded by the compression molding techniques. Since the mold cellulosics, of this process involved a longer cycle the heating and chilling of the mold for each cycle, thermoplastic materials such as acetate were definitely limited with respect to process ability by the then used techniques. I distinctly recall that was necessary everywhere to compare cellulosic thermoplastic materials with phenolic and urea compression molding materials, due the fact that the basic molding netted techniques and changes were necessary, requiring longer cycles and personnel training.

Convincing Buyers that Thremoplastics were a Desirable Material (33:45)

From a standpoint of engineering and molding, it was a difficult job to convince people that thermoplastics were indeed desirable materials. Mr. Spencer E Palmer, then sales manager of Eastman, recognized the distinct limitations in the then used equipment of processing plastics, Eastman Chemical products, hired a couple of die casting engineers, I remember, by the name of Pack and Moran, to develop a machine which would handle thermoplastic materials in the general order of metals or die castings. This would enable the thermoplastic nature of materials to become an advantage rather than a disadvantage, as was the case in thermosetting equipment than in use.

Eastman Develops the First Injection Molding Machine in the Country, a Monster (34:28)

Eastman spent a very sizable amount of money and developed probably the first injection molding machine in the country. It was certainly a monster, and a replica of it was shown on the medallion used

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to represent Eastman's 25th anniversary in plastics. The only injection equipment used in the country at that time, as I recall, were the Eckert Ziegler machine imported from Germany, and the isomer machines also from Germany. These were small, one ounce capacity machines, but they did illustrate the principle that. Thermal plastic materials could be very advantageously processed by what was later known as the injection molding technique.

I recall attending the first demonstration of the one ounce machine built in this country by HPM in Mount Gilead, Ohio. People came from all around the country, from such plants as Chicago Molded Plastics, Mac Molding, Die Molding, American Insulator, General Industries and others. It was interesting to hear the comments about the future of injection molding that was represented by this machine.

Later, modifications to the machine, such as a pre-plasticized tunnel so forth, were developed. Reid Prentice, followed soon with a small injection molding machine of low capacity. From the middle 30s to the late 60s, a dramatic growth in injection molding machine capacity, from one ounce to 2500 - 3,000 ton clamping capacity had been very dramatic and certainly a major contribution to extraordinarily rapid growth of the plastics industry.

Cellulose Acetate for Auto Interior Appointments (35:56)

Back to Detroit and cellulosic materials, we were able to interest the automotive people using cellulose acetate for many interior appointments, such as window regulator knobs, escutcheons, radio knobs, instrument panel control knobs, lenses, steering wheels and so forth. These were made for several years by compression molding and supplied and variegated color effects as well as plain colors. Actually, the first large cellulosic jobs were developed in the automotive industry, and the success of these applications were a major contribution in the advancement of thermoplastic molding materials.

During the period of the 30's, cellulose acetyl was a primary injection molding thermoplastic used in volume. It eventually found its way into many non-automotive applications, such as toothbrush handles, sporting goods and many other parts.

Acetate Butyrate Introduced to Overcome Cellulose Acetate Difficulties, late 30's to early 40's (36:49)

In the late 30s and early 40s, cellulose acetate butyrate was introduced to overcome some of the difficulties experienced by cellulose acetate in certain jobs, such as steering wheels, cellulose acetate lacked the desirable aging characteristics and the weather ability required for many jobs, although we have been successful in selling it in the first production cellulosic wheels, beginning about 1935 where it was first used in accessory wheel for Chevrolet Hudson motor and certain other jobs. The latter on production wheels. Acetate was never completely satisfactory, due to the physical properties required of the application and its failure to maintain its properties while aging.

Cellulose Acetate Steering Wheels, early 40's (37:29)

Cellulose acetate butyrate overcame these difficulties to a large extent in steering wheels, and came the major steering wheel material since its introduction the early 40s. World War Two helped by offering a major proving ground for butyrate and steering wheels. It was approved by the military for use in jeep and army vehicle, truck wheels, these applications that received epsilon tests in all kinds of climatic and temperature conditions as a result of the successful use in the army vehicles during World War Two, butyrate became the major material for automotive steering wheels and later in many other applications as armrests, extrusions and cherry appointments and so forth. It continues to be widely

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used in many applications, such as automotive parts, toothbrush handles, tools, packaging, sports applications, street lights and so forth.

Thermoplastic Extrusion Grows, late 30's (38:22)

In the late 30s, the Detroit Maycoid Corporation located in Detroit, developed a process for dry extrusion of thermoplastic materials. We did much work with them on our cellulosic materials, resulting in the applications such as furniture and so forth. Maycoid worked in the development of the extrusion process for plastics with the nice little rubber machinery people, they were successful in finding way to protect their work. And as a result of this development, Nyseral Rubber was able to sell extrusion equipment to other companies.

The extrusion process grew very rapidly and has resulted in the wide use of thermoplastic materials and such applications as wire covering, pipe extrusions, various profile shapes, chill roll, sheet and film extrusions, paper coatings and so forth. The growth extrusion process originated by Detroit Maycoid, under the direction of Mr. Jack Gould and Mr. G Hendry senior, certainly has been a major contributing factor in the growth of the plastics industry. The major growth in the plastics industry has occurred since World War Two.

Polystyrene Replaces Cellulose Acetate (39:30)

Polystyrene was not a large factor as a plastics material prior to the war. After the war, as a result of large capacity built up for styrene monomer and the know-how came by many plants in processing this material. It wasn't long until styrene was offered at lower prices than cellulose acetate. It moved into many markets and was misused in many places, resulting in plastics being condemned because of brittleness in. And other properties resulting from the misapplications.

Polyethylene Use Grows, Replace Wax Paper in Milk Cartons (40:04)

Polyethylene developed in England and made in this country in limited quantities. From 1945 to 1950 demonstrated that it could offer much in the way of potential for film, paper coating, wire coating and injection molding materials. Originally priced at $1 a pound. But 1950 had dropped to 60 or 70 cents a pound.

Eastman received the last certificate of necessity from the government to build a polyethylene plant before it could get on stream. In 1955 there seemed to be no further material shortages. I recall talking to Mr. G Scott, Vice President of the pure pack division of Accelo Corporation, bought coating a milk carton stock with polyethylene, replacing the wax coating they were then using, which had the disadvantage of flaking off into the milk. Mr. Scott pointed out that when the price of polyethylene got down to about 32 cents a pound, it would then be economically feasible for them to make the switch. Polyethylene was that in the 40 cent price range, price has dropped considerably for paper coating and the milk carton application has grown from nothing to several 100 million pounds a year.

The automotive industry has increased its uses of plastic from its beginning were the phenolic electrical parts in the early 30s and the cellulosic knobs to the point where it now uses between 70 and 80 pounds of plastic per car.

J Harry Dubois 41:32

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The plastics they've used include vinyl, impact polypropylene, polymer, acetate, butyrate acrylic for lenses, phenolics, polycarbonates, polyethylenes, astrals, nylon and other the automotive industry represents one of the most diversified and fast growing markets for plastics.

At this time, during the some 38 years, I have been privileged to represent Eastman, the sale of plastics. They have grown from the very humble start of early 30s to a large volume general purpose and engineering type materials. We believe that the future of plastics, the automotive industry, as well as other industries, still appears to be very bright. My business life has been spent in plastic covering the days of the early missionary development work to the present time, when many plastics are committed, considered to be commodities.

End of the dictation for John G Slater.

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W T La Rose, senior president of W T La Rose and Associates

J Harry Dubois 42:33

The next memorandum is from W T La Rose, senior president of W T, La Rose and Associates, incorporated.

High Frequency Heating of Thermoset Molding Compounds at Union Carbide (42:46)

In 1943 while working at Specialty Insulation Manufacturing Company, Hoosick Falls, New York, the president of that company brought up the matter of high frequency heating of thermoset molding compounds he had read of the experimental work done in this area at Union Carbide, by Dr. M E Hart. Mr. Clinton Bateholts, the president of Specialty Insulation Manufacturing Company, was a most energetic and dynamic individual.

Consequently, when he learned of the work done at Union Carbide and the possibility of considerably reducing cure time, his interest was very high at this time, I was in the employ of General Electric Company, connected in New York, and was in regular contract with Mr. Bateholts for the purpose of attaining certain component parts that specialty was producing for General Electric Company.

General Electric Researches High Frequency Heating (43:36)

Being connected with GE company it was logical for me to be asked to look into more details of high frequency heating, and especially could purchase a piece of equipment from General Electric Company. One inquiry to the industrial heating division at Schenectady, he was learned that high frequency heating equipment was quite expensive and not available from GE at that time. Further, it was advised that this type of heating would be too expensive to compete with steam tables, infrared or small electric ovens, then being used in certain areas to preheat thermoset plastic compounds.

Reporting back to Mr. Bateholts, his reaction was that he'd like to have a high frequency heater, regardless of price at the time, the writer could offer no suggestions on the matter. However, in a day or two, I suggested that specialty insulation issue a purchase order to cover a high frequency heater with a price left open. The order was issued and work started on design, developing and building a model high frequency heater of approximately 1000 volts heating capability. Designing and building a modeling heater was the most trying and difficult task, not being free during the regular work week due to regular employment at GE Company, if necessary, do all work evenings and weekends. In addition to working hours and being a problem, the need for a small, compact eviction heater was a must.

Available space between most molding presses at specialty was approximately 15 inches. Consequently, the heater must be no more than 14 inches wide. At first thought, this requirement seemed impossible. As work and development progressed over several weeks, it became clear that a small heater could be built. After two models were built and scrapped, the third heater was finished at a size, 26 and one half inches high, 12 and a half inches wide, 26 inches depth. By this time was early 1944. Unfortunately, Mr. Bateholts was stricken in December 1943 and died.

High Frequency Heating Reduces Cure Time from 42 to 6 Minutes (45:53)

Taking over as president, especially Mr. Douglas Bateholts's son and Mr. Arthur Tinerholm, as company manager, still continued a high interest in high frequency heater ideas. By spring of 1944 the first production tests were made on actual molding jobs. First molding job at specialty with preheating by high frequency was tested on a 26 ounce rag filled material, single cavity mold. The end of two days of

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testing, it was determined by Mr. Tinerholm that the cure time of 42 minutes could be reduced to six minutes. In addition, percent of rejects was reduced from approximately 20% to practically nothing. Also, quality the part was definitely improved.

Needless to say, that other molding jobs were tested using RF heating, and each in its turn, resulted most advantageously. It was undecided by specialty that they needed 10 more RF preheaters as quickly as possible. All this time, now nearly a year, the writer had been regularly employed a GE company and handling the RF preheater work nights and weekend. It goes without saying that the prospect of building 10 more preheaters was not a welcome one.

In fact, I stated to Mr. Bateholts, that it was impossible for me to carry on. After further discussion, we decided to request a leave of absence from GE for 12 months to build the 10 preheaters and then go back to GE. At GE, it was not possible to arrange a leave of absence due to World War activities, manpower shortage, and so forth. Upon reporting this to specialty, it was most disappointing.

US Air Force Influences During WWII and the B-52 (47:40)

Now the US Air Force Inspectorate especially came into the picture being fully aware of the increased productivity and quality of component parts made possible by Rf preheating, he contacted the writer draft board and arranged for me to leave GE to pursue building preheaters for specialty and still retain a deferred draft classification. So happened that the first part tested that specially with RF preheaters, was one in short supply by the US Air Force used in the B-52 bomber program. Anything that could be done to get more parts was a must.

The writer left GE in February 1944 and work proceeded on the first five preheaters. They were designed so that they could be wheeled around the molding shop and also to heat twice as much molding material, 2,000 watts heating capability. As the high frequency preheaters were completed for Specialty Insulation Manufacturing Company and were put into operation the molding room, it became clearer and clearer that this kind of heating would revolutionize the thermoset molding industry. Cure time was so drastically reduced, thereby increasing productivity and profit, while also improving quality.

In a matter of year or two, the small, efficient, high frequency preheaters made it first, but especially on the way into other molding plants such as Northern Industrial Chemical Plastics Manufacturers, Watertown Manufacturing, General Electric Company, Pittsfield, Coon and Jacob Company and so forth. As a result of Special Insulation Manufacturing Company having an initial interest and making use of a new concept of preheating W T La Rose and Associates, Incorporated was found to manufacture high frequency preheating equipment for the plastics molding industry.

Now, 25 years later, we're still supplying the thermoset molding industry and have developed a full line of automatic preheaters in addition to the original line of equipment. Business volume has continued to grow each year, requiring approximately 125 people who staff our organization. The basic line of high frequency heating equipment with some modifications, has found its way into other industries such as shoe manufacturing, grinding wheels, paper drying in the baking industry, all of this because Mr. Clinton Bateholts wanted a high frequency heater to speed up his molding operation. The next 25 years hold tremendous promise for even more dramatic improvements in high frequency heating equipment for not only the thermoset molding field, but also in many areas of the thermoplastics field, especially injection molding and extrusion and casting. End for W, T La Rose, Sr.

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Sven Moxness, Honeywell

J Harry Dubois 50:36

Bleeding Live Steam into Material with Phenomenally Improved Cycle Times (50:36)

At this point I want to put into the record the development of steam preheating, which occurred about the same time, probably as a result of interest in high frequency preheating. Sven Moxness, working at Minneapolis, Honeywell, set up ovens and bleeding live steam into the material, and was able to get phenomenally improved cycles. This was particularly true of the cloth filled materials. It appeared that the moisture was driven out during transfer molding, and this had been a previous bottleneck to any form of wet compound molding, the steam preheating served a purpose during that particular era. However, it was crowded out by the better results and a better quality of product achieved by the use of high frequency preheating be made.

The foregoing was dictated by Du Bois from memory.

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Lloyd G Schenck, Boonton Molding

J Harry Dubois 51:39

The next recording was written by Lloyd G shank, S, C, H, E, N, C, K of Lufkin, Texas.

Your acknowledgement letter meant a great deal to me personally, because the reference to plastics on your letterhead unlocks some pleasant nostalgic memories of my early days in Boonton, New Jersey, during the years of 1921 to 1927 early in 1921 when I got paid out of the Navy, and like so many others, considered New York the hub of the universe, I answered and got a stenographer job with a Boonton Rubber Manufacturing Company. Thereafter, until I got itchy feet, I had the most wonderful association with Richard Dick Seaberry, Charles Scribner, who had Dan Parks, was later to start up the Boonton Molding Company.

Before I left, Dick Seabury had begun pioneering and radio development work, attracting such men as Dr. Hall and Dr. Ballantyne, who were perfect as a start of the Ballantyne transformer and many other inventions and developments that resulted in formation of radio frequency laboratories, I'm not sure, but as I recall, Dick Seaberry worked with Dr. Baekeland in his early experiments and perfection of Bakelite. Bakelite, in those days, was gradually taking over in such utility items as auto-magnetos and insulation purposes, because of its ease of molding and durability in comparison with the machining of hard rubber parts.

The Start of the Radio Industry (53:26)

Anyway, at the start, there were no radios, but as they became experimental, the Boonton Rubber Company pioneered in perfecting Bakelite parts for the new industry. And I recall the wonderful days of FAD, Andrea, Atwater, Kent, Magnavox and other speaker manufacturers and the countless dials and parts developed and turned out at the plant, there was nothing decorative about Bakelite in those days, just utilitarian uses. As far as I know, black, brown and a combination, mixed, as I remember it, with asbestos.

Our molds were made by the most wonderful skilled organization of craftsmen in Newark, and I wish I could remember their names. Dick Seabury seemed to have the knack of attracting engineers and chemists who shared his faith in Bakelite, and in those early days, they tackled just about anything. This letter is prompted partly by the fact that a few days ago, I ran across two old Boonton and Rubber Company test plates made some time during the very early 20s of Bakelite to test, I imagine, some sort of electrical insulating or current leakage test. My wife periodically throws out old items and papers that I have tried to hoard over the years, and I don't know how she happened to overlook these old test plates. Anyway, I thought you might like to see these.

The main thing is the word Bakelite and plastic does have special significance for me because of my early association of Boonton and with some of those who helped prove its practicability and diversity.

The end of the memorandum from Lloyd G shank.

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Sam Moore, Inter Chemical Corporation

J Harry Dubois 55:06

The next memorandum is written by Sam Moore of the Inter Chemical Corporation, Clifton New Jersey.

Sam Moore

Aircraft Engine Parts and Polyester Resin (55:11)

Our work began during the early part of World War Two, with the assignment to find replacements for drying oils, particularly tongue or China wood oil which was no longer being imported. This was very important to the war effort, particularly as it related to the projects we were undertaking on the use of in plate making porous castings. United States government, you may recall, wanted to increase the usage of magnesium metal for military aircraft and whenever possible, as a replacement for aluminum.

In the case of aircraft engine parts, it was difficult to make castings which were completely free of micro porosity. As a result, these were being sealed with vegetable oils, which becoming short in supply. The search for replacement finally led us to the use of styrene monomer and a special maleic alkyd resin, which we call today a polyester resin. This is described in more detail in the attached free print from the March 14, 1946, issue of the Iron Age.

United States Patent Office granted us a patent on some of the formulations accepted by the Government. Patent number 2566739, vinyl monomer composition stabilized against the deleterious effects of copper and copper compounds.

Toward the end of World War Two, we began to hear about concurrent work with polyester resins for such things as armor plate radar domes and aircraft field tank liners. All that from this direction, of course, was considered highly classified. It was not until the end of the war that we were fully aware of the relationship of polyester resins which we were manufacturing, those used making fiberglass laminates, Pittsburgh Plate Glass, American Sign of Continental Can and others were involved in the development of the fiberglass laminates mentioned.

Decorated Reinforced Plastics (57:18)

We, of course, continued our development work, and along with these manufacturers and others who had entered the field, became a supplier for making decorative laminate reinforced plastics. Composite division of SPI was then known as the low pressure laminating division of SPI. There was great interest in the use of these low pressure laminating and molding resins, and it was quite natural that the suppliers and fabricators worked together to form the low pressure laminating division Owen's Corning fiber glass deserves considerable credit for this early pioneering effort, for their tremendous promotional work had a definite catalyzing effect.

J Harry Dubois 58:10

End of report by Sam Moore, presently manager market development inter chemical Corporation, Clifton New Jersey.

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Tape 7-2 (AC1235-RCD0007-02)

Siegfried Higgins, Williamson and Company, Condensite Company, 1969

J Harry Dubois 0:00

The recording is by Siegfried Higgins, a Williamson and Company Caldwell New Jersey.

First Phenolic Asbestos, Cotton, External Contracting Brake Linings and More (0:12)

Siegfried Higgins (read by J Harry Dubois)

Mr. Higgins started the Condensite Company of America 1911 and has been associated with the plastics industry continuously. He is presently employed in this year, 1969 this has included Production Development, service and sales activities. Mr. Higgins has been involved in the development of the first phenolic asbestos, cotton, external contracting brake linings, rubber, phenolic laminated materials, vinyl plastic printing plates and phenolic metrics, materials used for rubber and plastic printing plates.

Compression Oddity for Heating Molds (0:50)

All of these development patents were granted and the writer was a patentee, or co-patentee. An oddity in compression molding phenolics was observed at the Stokes river company Trenton New Jersey. Here, the heat and hydraulic press was supplied by circular blocks of iron two inches thick, which were heated on a coal fire adjacent to the press. The iron blocks were placed on either side of the steel mold and serve to heat the mold sufficiently, but erratically, to cure the phenolic molding material. This was a common procedure for molding hard rubber parts at the time 1918.

J Harry Dubois 1:32

I personally like to add that SIG Higgins has a very nice collection of early plastics, materials, products and magazines. He is doing an amazing job after being in the business for 60 years.

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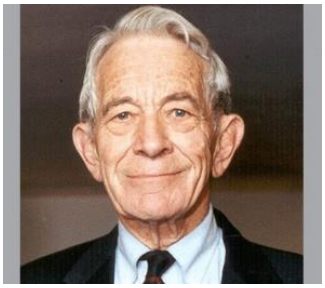
F. Reed Estabrook, Jr., Northern Industrial Chemical Co., Gorham Co., Brook Molding Company



J Harry Dubois 2:19

The next recording is from F. Reed Estabrook, Jr., now of the Brook Molding Corporation, Norwood, Massachusetts. Reed Estabrook came into the Gorham Company about the time I left in 1937

Gorham Company Pioneering Beryllium Copper Molds, Hair Dryer Housing an Early Application (2:45)

F.Reed Estabrook, Jr (read by J Harry Dubois):

The Gorham Company of Providence, Rhode Island pioneered beryllium copper molds for plastics. However, they were just ahead of the extensive use of injection molding and transfer molding so that the work was only partially successful at that time, because the lands and compression molds would not stand up when made of beryllium copper. One of the early jobs done in beryllium copper was a large molded phenolic hair dryer housing which weighed four pounds. It was molded with coal powder. At the time, the beryllium casting, which formed the cavity, weighed several 100 pounds, and was contoured.

Ultimately, the beryllium casting fell apart, was placed by a meenite casting, which finished off the order the Gorham work with beryllium copper did introduce plastics into many novelty fields, particularly in the Catholic Church, replica items and for highly decorative buttons. Since that time, of course, beryllium copper has become a very popular material for molds, and the Shaw process greatly improved the art of making molds and extended the use of these materials.

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Elmer E. Mills, Northern Industrial Chemical Company, Norton Laboratories, Elmer E. Mills Corp., Director SPI

J Harry Dubois 5:03

Our next record comes from Elmer E. Mills of Highland Park, Illinois, as a manufacturer's representative.

Sells Phenolic Resin Radio and Socket for Northern Industrial Chemical, 1926 (5:12)

Elmer E. Mills (read by J Harry Dubois):

I first sold radio dials and sockets made of phenolic resins about 1926 for Northern Industrial Chemical Company of Boston, Massachusetts, about 1928 I represented Norton laboratories in the Chicago area, soliciting custom molding business in 1932.

Isoma Injection Machines and Custom Injection Orders, 1932 (5:29)

One of my firms, Erie Resistor Corporation of Erie, bought some isoma injection machines, and I then started solicitation of custom injection orders. The only material available was cellulose acetate, and people were completely ignorant about the advantages and shortcoming of this material. It was a thrilling experience to find an application as everyone we sold was a new wedge in a different area.

Founded Elmer E. Mills Corporation, 1937 (5:58)

In 1937 I started Elmer E. Mills Corporation, and we continue to find new and different products to make and also make it a point to be the first to mold the new materials as they were developed. Our shop was a production laboratory for many material suppliers.

Molding a Glass Insert, 1937 (6:16)

In 1937 a prospective customer wanted a bezel for a radio dial, and the problem was how to fasten the glass so it would not vibrate. I suggested that we mold it in as an insert, and we tried it, and it worked. However, better methods were discovered later.

Built the First Automatic Unscrewing Mold (6:33)

Also believed that we built the first automatic unscrewing mold for a plastic part in later years. I conceived a method and a machine for the production of plastics bottles or other hollow articles, and it is still is the efficient production equipment for these shoes. Of course, there have been many improvements and new materials in this field.

WWII Proximity Fuse, Atomic Energy Programs and the Army Bugle, WWII (6:35)

During World War Two, I worked very closely with the parts, with the services, and made parts for the proximity fuse, atomic energy programs, and we built additions to our equipment to produce the army bugle.

Most Complicated Mold for Automatic Injection Molding of the M-52 Fuse (7:19)

We also, at the same time, designed and built probably the most complicated mold for the automatic injection molding of the M-52 fuse. Only samples were made as thermal setting. Resins were preferred as a molder. Our motto was, if we have a material that will do the job, well, we will find a way to make it. I believe we were the first to mold and extrude Saran methacrylate, spinal, styrene nylon and others. And each time we did this, we learned something.

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SPI Director, Chairman for Committee for National Defense, President Chicago SPI and others (7:49)

I was the director of SPI, chairman of the committee for national defense, president of the Chicago section of SPI, as well as a member of SB and Plastics Pioneers. Regarding a backward look at the history, all that it indicates to me is that the future of the industry is limited by the ingenuity, imagination and courage of those who are engaged in it. The plastics industry is no different from any other in that it has a very large percentage of followers, copiers and run of the mill, ordinary people. However, if there are few innovators and people with imagination and courage, the limit is impossible to estimate.

J Harry Dubois 8:47

And that's the end of dictation by Elmer E. Mills

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George H. Boehmer, Celluloid / Celanese Corp., Charter member PPA

J Harry Dubois 8:51

The next record comes from George H. Boehmer of Dunnendon, Florida, who states:

Joins Celluloid Accounting Department, 1909 (8:59)

George H. Boehmer (read by J Harry Dubois):

I joined the accounting department of the original Celluloid Company, February 1909, when celluloid was the only plastics product.

Sales at Celluloid Corporation, 1912-1927 (9:06)

I was transferred to sales department correspondence in 1912. In 1920, I was assigned to Chicago office as assistant manager, Midwest territory. In 1922 I was assigned to Leominster office as manager of New England territory.

In 1926 I was assigned to the New York office as sales director of the sheet division. In 1927 Celluloid was taken over by Celanese. In 1932 I was made General Sales Manager of the plastics division, which included chemical sheets, rods, tubes, toilet ware, and so forth. In 1939, I retired at age of 50 because of a health condition.

Assigned to Washington DC for Historical Developments, WWII (9:45)

In 1943 to 1946 on a temporary basis, I was assigned to Washington DC office during the war, in charge of the plastics division in the historical developments, the development of cellulose acetate and non-flammable plastic by Celanese. Noteworthy contribution was the idea of transparent windows in packages to allow visibility of products and retail stores without handling. The Hicock Company was first to use it somewhere around 1928.

Charter Member Plastics Pioneers (10:15)

Among the memorable events, the creation in Chicago, of the Plastics Pioneers, of which I am a charter member, also development of many new and different plastics.

J Harry Dubois

This is the end of dictation for George, a bomber.

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John J. Rossiter

J Harry Dubois 10:32

Another interesting letter comes from Ruth Rossiter, the wife of John G Rossiter.

Ruth Rossiter for John Rossiter (reading by J Harry Dubois)

John was a well-known and very successful operator of plastics during the 30s and 40s. John Rossiter has had several critical illnesses and surgery the last two years, but thankfully, the same drive that contributed to his business success was a large factor in his recovery. However, a vascular incident last July, before he had recovered from surgery, January took a great toll, and his convalescence is taking much longer than we had expected. I felt very sorry that he couldn't reply to the pioneering reports.

Friends with Dr. Baekeland, Dr. DeForest, Brown Brothers and Others (11:24)

His context, in the beginning years of plastics embraced friendships with Dr. Baekeland, Dr. DeForest, the Brown Brothers, Chris Kurz, Henry Cash, Harry Dent, William Cruse and many others. During these years, materials processing and applications have so developed that now, apparently nothing is impossible with plastics, quite a change from hand-polishing and finishing in the 20s.

Largest Order – Bisquick Cutters and Skippy Bowls for Premiums by Betty Crocker, General Mills (11:47)

I believe that Betty Crocker of General Mills, an order that John took, was the largest ever taken. Those were the days of Bisquick cutters and Skippy bowls given as premiums.

J Harry Dubois 12:03

That's the end of memorandum from John roster.

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William Morris Lester, Pyro Plastics Corp., Precision Castings Co., Commonwealth Plastics

J Harry Dubois 12:08

Next memorandum is from William Morris Lester, familiarly known as Bill Lester.

William Morris Lester (read by J Harry Dubois):

Started Precision Casting Company (12:18)

Formerly a Pyro Plastics Corporation, Union New Jersey. Later, after he sold Pyro plastics to Gateway Sporting Goods Company and staying on as president, Bill Lester started The Precision Castings Company, an equipment and methods development engineer in Syracuse, New York. Additional experience was getting at the Leominster Die and Machine Company where he was in charge of designing die casting and dies.

Manger Commonwealth Plastics Corporation Developing Injection Molding Machines (13:00)

In 1935 became General Manager of Commonwealth Plastics Corporation, Leominster, Massachusetts. He started this company, designed, and developed injection molding machines. These injection machines were the early commercial machines built in this country. Around the success, this business evolved, developed basic design for molds for injection molding and machines which have been copied in many cases.

In 1945 designed special small automatic injection equipment for Pyros exclusive use. These machines were the basis for automation of many leading molders. In March 1958 Bill Lester entered, due to five year consultant agreement with Owens Illinois to update and automate their injection molding departments. During this period he supplied them with Pyro automatic equipment.

Die Casting Patents (14:06)

He has patents on die casting machine, goose neck operating means for die casting pumps, pressure casting machine, molding machines, pressure casting machine class mold for plastic rings having annulus and motif.

J Harry Dubois 14:38

End of memorandum from Bill Lester.

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Edwin L Hobson, Bakelite Corp., Quartermaster General, Monsanto, Gearing Plastics Co.

J Harry Dubois 14:45

The next memorandum is from Edwin L Hobson of Cranford, New Jersey. You

Bakelite Sales Engineer, 1937 (14:45)

Edwin L Hobson (read by J harry Dubois)

Hobby was a sales engineer for the Bakelite Corporation from 1937 to June 1941 and supplied technical service on phenolics and polystyrene.

Chief of Plastics Research and Development, Pioneer Uses of Reinforced Polyester Fiberglass, Plastic Body Armor, Commercialized Vinyl Coated Nylon Fabrics, Introduced PVC Paste and Others (15:04)

In 1941 he became chief of the plastic section research and development branch, the Quartermaster General Washington, DC, where he pioneered many uses of reinforced polyester fiberglass. Conceived the basic theory and developed plastics body armor, commercialized vinyl coated nylon fabrics. Introduced PVC paste to USA, conducted initial development and first commercial usage of polyethylene film, designed and perfected m1 helmet liner. Developed Namzon coatings, including army water cans, camouflage and food cans.

Monsanto Sales Manager, Thermal Plastic Molding: Polystyrene, Crystal Styrene (15:40)

He later served as the Sales Manager of Monsanto's thermal plastic molding combine division, having both product and field sales management responsibility. Monsanto's limited post war market entry with polystyrene through the initial growth period the innovation of dry coloring techniques for crystal-styrene. He rejuvenated and obsolescent low cost product. He was director of sales of plastics products for Monsanto from 1952 to 63 and expanded new material markets in from 1963 to 66.

VP Marketing for Gearing Plastics Company (16:45)

Mr. Hobson was vice president marketing for Gearing Plastics Company where the business was expanded considerably with the large movement in the industrial markets for polystyrene, polyethylene, polypropylene, nylon vinyl chloride, in so forth from

At the present time, he's Mr. Hobson serves as a consultant on plastics, resins, compounds and products on long range plans, current problems and so forth.

J Harry Dubois 17:34

End of record of John Hobson.

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Tape 8 (AC1235-RCD0008)

C. William Kluwerth, Original Founder and Consultant to Plastics World

J Harry Dubois 0:01

The next report is from C. William Kluwerth, who is presently consultant to Plastics World, and who was the original founder of Plastics World, later sold to Connor's publication during the 1920s

Started on Advertising Staff of Electrical World, Bakelite a Big Customer (0:21)

Bill Kluwerth (read by J Harry Dubois):

Bill Kluwerth was on the advertising staff of Electrical World a McGraw Hill Publication, New York City. At the time, the Electrical industry was by far the major market for plastics. Electrical World was the principal medium for advertising, In addition to regular full page advertisements and 116 inch page space holders, Bakelite used to endorse an annual multi-page glossy paper insert of 16 to 24 pages in Electrical World. Bakelite would use the first and last pages on the center spread. One of my jobs was to get their industrial customers to take pages in the inserts. Manufacturers of industrial switches, twin light sockets, molded lighting fixtures and so forth. Bakelite would then secure 1000s of reprints of the inserts for direct mail use. Alan Brown was the spark plug at Bakelite, among other plastics manufacturers in Electrical World were Garfield Manufacturing Company, American Insulator Company and Shaw Insulator Company.

I'll read from a typical advertisement of January 5, 1927, Bakelite, laminated insulation is unharmed by constant outdoor service. Magnetos designed for farm tractors and engines must be so rugged in all their parts that they will withstand neglect and exposure to all sorts of weather. Insulating materials used must resist moisture and retain their dielectric strength, even when exposed to wild fumes and extremes of heat and cold, because Bakelite laminated meets every requirement it is used for important insulation parts in the farm engine. Magneto made by the Hercules Manufacturing Company Indianapolis, Indiana. Bakelite laminated is available in sheets, tubes and rods and in the wide variety of sizes under the following trade names, Formica, Spalding, Micarta, Phenolite, and Fibro Dialectal.

J Harry Dubois 2:38

End of record of Bill Kluwerth.

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E.O. Wokeck, Banger Plastics Incorporated

J Harry Dubois 2:40

This record is from E. O Wokeck of Banger Plastics incorporated Banger, Michigan.

E.O. Wokeck (read by J Harry Dubois):

First All Plastic Chair, 1927 (2:47)

I am closing here with two prints of the first all plastic chair, which has been molded back in 1927 by the Simmons Company, who are producers of institutional furniture, mattresses and so forth, and were formerly located in Kenosha, Wisconsin. I decided to be the first company to build plastics furniture.

I have been in plastics business myself since 1914. I was employed by the Simmons Company in the early part of 1927 under the direction of Mr. McCullough, who had been employed by the Ford Motor Company. The plastic division was developed, and the chair was one of our first projects.

It required eight separate molds, which are produced at a total cost of $50,000 at that time, the material which was produced at the Simmons plant was a rag filled phenolic compound, the color being green. All parts were made of this phenolic compound, with the exception of the seat frame, which necessitated hardwood in order to match the upholstery. Five of these chairs were sent out to various individuals for tests. The Chair shown the photo is the one which was still in my position and has been in constant use since it was produced. However, due the weight involved in this chair, it was never put into production.

Cooling Material after Molding to Prevent Exploding Castings, 1914 (4:11)

My personal conduct with the plastics industry dates back to 1914 with a Belden Manufacturing Company. In those days, they were all hand-dyes and the material after molding had to be cooled in a cooling press to prevent the casting from exploding when taking them out of the mold.

J Harry Dubois (4:38)

End of record E.O. Wokeck

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Walter F Grote, Grote Manufacturing Company, First Injection Molding Machine

J Harry Dubois (4:42)

First Injection Molding, 1922 (4:42)

In all the foregoing Arabic records of the pioneers, many people have claimed to be first with injection molding machines in this country. Communication were so poor, we know that many people really thought they were the first, although a very careful investigation leads me, at this time, to the conclusion that the Grote (G-R-O-T-E) Manufacturing Company, Madison, Indiana, was actually the first and I read from my report written by Walter F Grote, president.

Walter F Grote (read by J Harry Dubois)

Following the first publication of our story on the thermoplastics explosion, which reads as follows, I have your letter in the enclosures. We have pictures of the Buckholz hand machine and the first injection molding machine building in the United States, which was automatic and not a crude hand operated machine. We already had experience with hand machines since 1922.

DuPont License for Hydraulic Machines, 1933 (5:42)

Also, I have and will send you copies of letters concerning our license to DuPont in 1933. The machines sold to DuPont in '33 were hydraulic, and another forward step by our company. When the DuPont officials visited our plant in Bellevue, Kentucky in 1933 they saw an operation of hydraulic machines. These machines on our floor were in operation, were built prior to 1933 and they operated successfully. Otherwise DuPont would not have bought similar machines from us. You mentioned.

Walter F Grote 6:25

Buckholz Machines, 1922 (6:25)

This was followed by a letter of June 24 wherein Walter Grote encloses a photograph showing the Buckholz machines that were imported from Germany in 1922 by Mr. William D Grote, Senior. This is earlier than any other date that I have found in connection with the early use of injection molding machines in this country.

First Automatic Injection Molding Press Operated by Compressed Air, 1933 (6:53)

He also included a photograph showing the first automatic injection molding press operated by compressed air and a successful operation. In 1929 a photograph was included showing the first hydraulically operated Automatic Injection molding press built in the year 1933. This 1933 machines were sold to DuPont Buckholz Company in 1933.

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From all studies, therefore, I must conclude that the Grote Manufacturing Company, which was formerly known as the Grotlite Company, was the first to import the Buckholz machine from Germany, and the first injection molder in the United States, Starting in 1922.

J Harry Dubois 8:09

End of Grote Story. For the benefit of other students of the Art Kunstoffe, the German magazine volume 55 March, 1965, pages, 173 to 180, covers a very good historical development of plastics processing techniques, including much early data and photographs of machinery and developments

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Arthur R. Tinerholm, Holman Manufacturing Company, Specialty Insulation Manufacturing Co., General Electric

Founder of Holman Manufacturing Company, Incorporated. Custom rollers, thermo setting and thermoplastic compounds. Presently, chairman of the board and treasurer.

First Molded with Commentator Rings for Automobile Motors, 1919 (9:24)

My first contact with molding started in the latter part of 1919, when the concern that I was with molded commentator rings with shellac and mica. Mica plate was milled the desired thickness, cut on a band, saw to the proper shape, spliced on opposite ends. This pre-form was then placed on a steam plate, spliced in, then placed in the mold. So three operations performed and three fairly large Arbor presses. The first arbor press crimped one edge of the ring. The second, which was heated with a gas flame, formed and set the shellac. The third auto press held the ring in shape until it cooled.

These small rings were used for automobile spider motors, and even in those days, were produced in quantities of 75 per 150,000 pieces per season. For the larger commentator rings, molded for street car motors and a pool placed on a cone shaped steam heated steel cones and a cover also steam heaters was lowered and clamped in position. Then cooling water was run into the mold, and after five minutes, secured cooled part was removed from the mold. These parts were made in substantial quantities for the street car industry was very active at this time.

Markets Colasta Moding Material for Clinton Bateholts, Purchased Patent from Mr. Carter 1927 (11:00)

I left the manufacturing industry in about 1923 and went into selling and did not run into plastic again until 1927. At that time, I was engaged by Clinton Bateholts to market a molding material called Colasta. Mr. Bateholts got a molding plant containing about 100 presses, which must have been one of the largest of its time in 1927. Colasta was a phenolic formaldehyde molding compound, I believe he purchased, purchased the patent from the inventor of Mr. Carter of Boston.

Bateholts 1st Interest Making Bright Colored Compounds in Advanced Machine Shop (11:39)

Mr. Bateholts, first interest in the material was the possibility of making bright colored compounds. He was one of one of the pioneering geniuses in the business. He had a machine shop where he built his own presses which had quick acting low pressure and then high pressure for the final squeeze. He built his own high and low water pressure system. In 1927, his 50 ton presses would close in four to five seconds. He bought one of the first two RAM presses. He also built a circular press with five stations.

Molding Gunstocks with Tenito and Inductive Goggles with Colasta (12:19)

He made all kinds of thermo setting materials, and also some thermoplastic materials. One of the largest thermoplastic pieces he molded was a gunstock of regulation size, made of Tenito (sp). He melted intake in place milled side holes in the parts by using small, high pressure hydraulic frames. The holes were made at the end of various angles. Also, it seemed that whatever his customer wanted, he would work out some way to do it. 1000s of inductive goggles were made from Colasta that were impregnated with cross paper impregnated.

The semi-curved paper was slammed into cymbals and then cut on a band saw with a proper pre-form. The floods were formed over removable rings. The parts of the mold which formed the cut out spaces in the goggles were on a hydraulic overhead RAM and were retracted before the pieces removed from the mold. The parting lines were moved on flexible sand valves and the sanded sections were varnished to produce a smooth attractive finish.

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Inductive Equipment and Magneto Materials, WWII (13:33)

Hard, long wearing cams were also produced from the treated paper material and had wide use in inductive equipment. Colasta 56 was a famous hard rubber based Magneto material, which was so largely used on delcoremi and American biased Magneto heads and blocks during the Second World War. A German formula was purchased to the chemist to go with it perfect fit in our laboratory. The chemist was unable to work out a solid strategy, working compound and left.

However, the foundation was there, and the formula was changed. The main change was the addition of some glycerin, solid anhydride resin, which I have personally made at the request of Mr. Bateholts. There were many tons of this material used during the war period. After spending about two weeks in the factory watching all the different parts which were being molded out of Bakelite and Colasta material, I began became very enthusiastic about taking up the sale of Colasta. It looked as though it should be very easy.

Selling Colasta, Large Bed Mold, 1927 (14:49)

There are about 40 molding plants east of the Mississippi. And I started making rounds. This was in 1927 and some of the molding plants that they grouped into very important businesses, but only one or two presses, the molders were all hand molds, and the closing time of process was in the order of 20 to 30 seconds. Tools were made from semi-automatic molds and for soft closing presses, some heated their molds in gas ovens. Some had xxx in the molds. Others used chisel and hammer, and that was quite primitive and crude compared to the setup and who we saw.

The general use of our materials up front was not possible, as the material before the mold closed. However, we did sell a few pounds for some of the molders found. But by mixing the xxx and the Bakelite together that the larger mold pieces were easier to eject from the mold and less off to break or crack.

On one of my trips, I went to Valpraser, Indiana to see some friends living there. They told me about a large mold that took place in one of the Chicago Micah company's large presses. I went over to see it, and it was indeed a large, beautiful mold. They were trying to mold the end of a day bed, which took over 17 pounds of material. They had had no success, and had been trying various grades of Bakelite over a period of several months. I was to be allowed to try and make some pieces out of Colasta material.

I sent a drawing with a mail to our office and asked them to make a suitable powder loading board. I also bought them to send a messenger with pipe wrenches and pipes to put cooling water on the mold. The press took 30 seconds to close. We piped cooling water to the bottom of mold, which allowed us to cool it down some before it was loaded. The press took 30 seconds to close. We loaded the material in our loading board and closed the press to a point where we could withdraw the loading board a distance of about six inches, dropped the material in the mold, move the material out a little, turned the steam on the bottom of the mold, closed the mold, which took about eight seconds, and cured the part 30 minutes. The part ejected from the mold real easy and was a good part.

The mold was a beautifully engraved and it made a part for the Feminist Sub Company for a day bed end. And both sprayed it with different colored paints, and it made a very attractive looking part. After some shipping and rough handing, they just follow not to go into it, for busting at that time, for dropping the mold of teeth from the back of a truck onto a concrete floor. If it landed on the log, load, the load

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would break. Of course, the wooden bed ends would also break under similar conditions. The effect to market, the effort correction, the effort to market collapse in 1927 and 1928 was not too successful, except for bright colored materials for buttons.

There was also a disadvantage of molding of our molding plant being in competitions with the customers for Colasta. The material was too quick going fueling for equipment used by the molders at that time, of course, we continued to use several tons a week at the molding plant in Hoosick Falls. It was, however, quite an expensive experience to visit all these embryo molding plants, some of which grew into very soluble operations.

Selling Molded Parts for the Hoosick Falls Molding Plant, Metal to Plastic Parts 1928, (18:51)

Arthur R. Tinerholm 18:51

The latter fall of 1928, I changed to selling molded parts of the Hoosick Falls Molding Plant, putting emphasis on new applications. One of the folks I ran into was a company in Indiana making control for electric refrigerators. The housings were made of metal and had to be carefully inflows from the switch mechanism. The housing was the first part they had had changed from metal to plastics. Later another metal parts have changed to plastics, and inside of a year and a half, we had 22 molds running around the clock making various parts of this company. This is only one example of many which was happening in the industry, which was quickly built up, the plastic molding industry and other plots, principally compression molding.

Halts Sales Work, Studies Plant Production, Becomes Plant Superintendent 1929 (19:43)

In 1929 the factory was full of work, and I was asked to halt my sales efforts for the time being. This gave me an opportunity to wrap and study just what was going on in the factory to hasten and augment the study, I dropped in on the third shift, 11pm to. 7am and for six months, ran various molds, as well as someone out on the third shift and usually on a mold in which the production was badly needed. The factory superintendent left, and I was asked to take his place, which I accepted.

Heating Pre-Form Molds with Willian La Rose Heaters Cut Curing Time (20:20)

Almost all of the molds were pre-forms. We had at that time three methods of preheating, namely, placing the pre-forms on Canvas, on a steam plate. Each press had a steam plate alongside of it, placing the pre--forms on large screens in between large electric lamps later on. Of course, infrared lamps were used also. Those electric properties were not important.

The pre-forms were placed in an oven filled with saturated steam. These methods cut down the cure time, thereby materially increasing the production and decreasing the cost. In about 1944 these preheating methods were superseded by electric pre heaters.

We believe we purchased the first 18 machines built by William La Rose and Associates. This was a big improvement, and substantially cut the cost by increasing the production, usually by our methods, double the when general purpose compound was used. Four to five times of production was like stock material or micro fold material. Going back to 1928 and 1929 there were many innovations in molding and production methods. Under Custom and the molded part for Swan bike cam action pins in the mold.

One in particular, which I recall, is an electric light fabric with seven undercuts. This is a very, very clever design mold. The cam pins had to be exceptionally long as the undercuts were quite close together.
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After few slight adjustments, it worked very well and ran in production for a fairly good sized order, about 100,000 parts.

As helpful, comparatively inexpensive at that time, the hopper was used on parts of the number of inserts to be molded in the parts the hopper to set the inserts on a loading board, of which there were two, one in the press, curing and one being loaded. The insert loading board had to be very accurately constructed in the tool room, and where possible, the insert pins were slightly tapered on the ends to help position the insert when the mold was closing. The inserts had to be well made clean and the ID held to close promises.

Ensuring Quality, Leveling Production with Distributor Caps, Rotors and More (23:13)

To ensure receiving the quality we required, Mr. Bateholts bought an insert company and moved it into the Falls. He retained half ownership so he could drive and maintain the quality he desired. To level out the hills and valleys of production Mr. Bateholts hired the company for the sale of replacement distributor caps and rotors, also then with belt and radio components, electric wall plates, Bucha light pockets and so forth.

Electric Clocks and Radio Loudspeakers (23:43)

He also started a company which manufactured electric clocks with plastic cases in color. These were all successful and helped keep the molding plant busy. He also started a practice for loudspeakers for the radio industry. Unfortunately, this burned down after about three years of activity.

Toilet Seats (24:09)

He moved the Toilet Seat Company from Pennsylvania. Almost all of the seats sold were made of wood covered with their cellulose, sprayed material in beautiful colors. Mr. Bateholts built the toilet seat mold and molded the parts with a special core, which could be removed after molding with hot steam, making these toilet seats very light and very strong. In finishing the molded parts, he built various file tumbling equipment, broke wet and dry sanding equipment, no wild sort of tools and fixtures for extra biting and cutting.

The cost of another part, he built some special presses with steel hubs and extra-large posts. So that he could use additional pressure boosters, which he built to tame up to 4000 pounds per square inch pressure to handle special jobs. He also built his own harbing press. During 1929 and 1930 they were employed in his various activities about 350 to 400 employees.

Mr. Bateholts Tireless with a Photographic Mind (25:27)

Mr. Bateholts was tireless. He was in his office about 7:30 AM and was busy and taught until 10 or 11pm at night. By 1931 he had built over 4,000 molds and with his photograph, photogenic mind knew the number of each mode, how it was built, how many qualities it contained, and so forth, and who it was built for. This pioneer in the classics was the most ingenious, hardworking man, and worked six-days a week with no regular vacation. I have always considered it a privilege to work for him, and only left him because I became ill and my doctor ordered me to obtain some outside work. This was in 1933. He was a tough, hard man to follow, and you had to be well to keep up with him.

Returns to Sales with General Electric, Observes Hennepin Air Presses, 1938 (26:17)

I returned to my second vocation of selling when 1938 I received a telephone call from the plastic department in Tipfield for the General Electric Company. They had heard of my experience in the plastic Copyright © Plastic Pioneers, Plastics Hall of Fame, Smithsonian Institute, Syracuse University, Wendy Hoenig, Chuck DiMeglio. All Rights Reserved.

field and wanted to interview me for positions in the plastic engineering department, I was curious and agreed to call on the manager and assistant manager the following days, after about one hour of interviewing and questioning, they were satisfied with my qualifications and made me an offer, which I accepted.

I was to stay for two or three weeks from the Pittsfield plant and then moved to Fort Wayne, Indiana traffic department. Fort Wayne plastics plant was the only one GE had in the west at that time. They had a very aggressive, good sales department in Chicago, and the plant was very busy running around the clock.

It was here that I saw the first Hennepin air presses in action, there was a battery of eight presses. These were quick closing and turned out quantities and all the parts. There were also a nine on flex and stem and injection press.

First Women's Shoe Heels (27:35)

Some of the first shoe heels for women were made in this machine of acrylic molding compounds. These were made for St Louis, Shoe Company. In looking over the files on this job, I noticed a great many complaints in return, all due to the fit of a metal, leather covered D lens. I asked our plant manager to have an engineer from there, from the customer, to set up a standard of quality. This was done, and I had some go, and no gold s made for the slaps and the heels, where the heels fitted. As usual, we kept six of the approved two heels, and their engineer took six pack tour is too factory.

We ran off an order of 1,000 heels in three different colors. They were really beautiful molded parts, and of course, the flap for gage 100%. About two weeks later, our manager came out to my desk and said the shoe company was on the phone and wanted to return the heels due to the slaps being too wide, I asked to talk to our customer, and then I explained to him that the slaps had been gaged 100% and were exactly like the sample just engineered crew. I asked him if he would put the metal foot, which fitted into the flap. He did this while I held the phone and then found the metal components were undersized, so they took the mold apart when we had no further complaints on filing shipments.

Importance of Standards and Quality Control, Motor Parts (29:20)

Setting up standards I found to be very important for good customer relations. I did this with every job that I handle. I will cite one more example. We were running 312 40 Mills on an automatic plastic part. It was the height of the automotive season, and the molds were running around the clock six days a week. We received a telephone call from our Chicago office stop all production that the interest would not get into place on the last shipment of parts, I went to press room to pick up a full load of motor parts from each mold. I found that no change had taken place, and the sample inserts we had fit perfectly.

I tried to go through our sales office with this information to the customer, but could not reach the sales manager. So. I had visited the factory we were making these parts for, and knew the engineers. I telephoned. He said he would check and call me back. About an hour later, he telephone and said that a new guy had been made for the insert, which was the stamping, but to keep running so blast and thank me for not stopping them all the parts were urgently needed.

So our method of quality control paid off. Another job worth mentioning was when I when I was in Fort Wayne was the molding of very large housing of urea materials. It was molded on a 1000 or 1500 ton press, and was in a room separate from the regular press room. Was one of the largest molding houses

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molded in production up to that time, both it ran smooth, smoothly. While I was in Fort lane, I did not have too much to do with this particular molded part. I should mention the excellent work which was being done in the finishing department.

They did a great deal of tumbling. However, on some ivory molded handles for the Hotpoint for electric stove, they put a lot of hand cleaning the farming in the finishing room, came to me with a problem, and we worked it out together. The tumbling barrel they were using had a supporting rod through the center. The barrels we had and who we saw were built in our own machine shop and had no rod through the center, but was supported by bearings on each end. We wrapped some felt paper on the grab, held it in place with twine, and then filled the barrel with, molded parts, wooden pegs and a number of square pieces of one half inch felt. We tumbled them only about five minutes. Some of the parts passed inspection without any more work being done on them. But overall, it was the cleaning time on these handles cut to about 1/3.

Pittsfield Plastic Molding Plant – One of the Finest Setups (32:03)

I was at Fort Wayne. I was at Fort Wayne for about one and a half years. I was then transferred back to the GE Pittsfield plastic molding plant. This was one of the finest setups of any molding plant I've ever seen. There were about 250 compression presses and two injection molding machines. It was fully equipped in all ways. Defined tool room, an art department, due to which, in two or three years, had several injection machines running around the clock for the cosmetic industry, a cone clothing department, the department for building jigs and fixtures, a metal repair department, which will fall for was necessary, a very well supplied finishing department, an excellent inspection department, a large engineering department, an adequate receiving and shipping department. It was very well organized, and it was a pleasure to work there.

I worked there from 1939 to 1941 just the experience I'd had with injection work at Fort Wayne. I handled the engineering on all up, wide commercial work, work. I soon found that I had to be there until 10 or 11, o'clock at night, when the molds were being sampled. I stayed and pictured overnight to see how the molds I designed were working out. The injection material used was mostly polystyrene, and it varied from bag to bag. The temperature controls had to be changed with each cell, so these controls were placed right back of their operator, so without losing your cycle, you could turn quickly and adjust the heat on the sanders at this point, we knew about bending the mold, but it was a number of years later that pinpoint gating was developed.

Poly-phylene and Static (33:53)

Material varied so much the Monsanto engineer was usually present to see how the material behaved and was able to come up with some decided improvements over a period of time. One of the pitfalls we felt into was making round by every cylinder rings about one and a half inches high and about three inches in diameter. These were put together in clusters serving your light fixtures, and were used in some of the large railroad stations in the west and some office buildings. These are really very attractive pictures when they were shipped out, but soon complaints started to come in.

Poly-phylene picked up static, and the static picked up dirt, and soon the beautiful ivory fixtures were covered with dust. The pictures could be cleaned off, but in two or three days, the dust was back on the fixture. Our laboratory came up with a temporary solution by adding some glycerin in the clean water the rains would stay clean for several weeks, but this was not very satisfactory, and we stopped getting

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orders for light fixture rings. This was indeed a misapplication in the early days of plastic parts, which looked like very good application. Took some time to work out the map until the park ran smooth in production.

Coffee Grinding Machine Problems (35:16)

For example, we were making a very large cover for coffee grinding machine made with cotton flat material, one of those real large plastic parts, which was noted at that time. Bob came to me and put the photo on the desk one morning and asked me to delve into the problem that straighten out the many complaints we're receiving from the customers. We had multiple 1000 parts, and I asked the fact that let me know when they were ready to start the job. It ran in 1000 ton trucks, but one week later, I was notified that they were set up and ready to mail parts. The first thing I noticed was the absence of a shrink fixture performing. Foreman told me that the part was so large that was not practical to make a shrink fixture for it. I went down to the machine shop talk with foreman, Allan Sweet (SP), another Plastics Pioneer, and told him he would have to make a few changes in the shrink fixture he had made for the coffee, dining houses, housing. He was proud of his work, and came with me to look at the picture.

While we were walking towards the press room, I explained to him that the stops would have to slide in so that as the large part cooled and became small in size, it would be supported in the part until the part ended up against the final position of the stop. We came up across, and I pointed to the table and asked, well, what he thought of the fixture? None there. He said, I'll fix that fixture. And about three days later, it was ready, and the part made a room nice and square. I took a couple foot to the finishing room.

There was an upstanding file from the parts, which had to be ground off and kept squares. The foreman said the part was so crooked from the press room that it was impaled to grind off the flash and keep it square. But he was hand sitting, hand filing the flag. I showed him the two parts I had with me, and he said that if the part came like the sample, he could scroll them off on a vertical what standard? However, he said that he would have to nest it in a sliding fixture to compensate for the paper on the side, I suggested a go and no go measuring fixture to guide the joiners so that the parts would come within the drawing tolerances in height.

We ran off 1,000 parts and about four, four weeks later, my boss dropped a letter on my desk. It was from the president of the company to whom we saw the large covers he said that at last, they were receiving perfect pieces from us, and to kindly thank the person responsible for changing a very unsatisfactory housing into a part that was good. And within drawing tolerances, there were many innovations in outstanding plastic spots made in Pittsfield, and I am sure they will be covered by some of the Plastics Pioneers who were present at that time.

Top Plant Broken Up for Navy Work (38:30)

Top management decided that they had to break up the large, most efficient molding plant to use the building for Navy work. So they tried to move the equipment to Taunton masters. Injection mold machines had been moved and they had brought seven more new machines. They asked me to go to Taunton and head up the engineering for commercial customers for injection parts. Just before we went to Taunton, my boss after drawing on my desk of a proposed plastic part made of Tenite 2 for an Edi-phone dictating machine. I turned it down because of the after shrinkage in butyrate in those days and

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because of the section of material hole in the throated ring mouthpiece was very much heavier than the throated ring you.

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Tape 9 (AC1235-RCD0009)

Arthur R. Tinerholm, Holman Manufacturing Company, Specialty Insulation Manufacturing Co., General Electric (Continued)

Arthur R. Tinerholm 0:09

We had no choice of design on materials. I left for the plastic department in Front, Mass. and about two months later, an injection mold arrived. They didn't fix their tool room at the Edison Park. It was a very well built mold and produced very attractive looking parts.

Edison Ediphone Dicta-phone Threaded Mouthpieces Falling Off (0:37)

About nine months later, I was asked down to the Edison Company in New Jersey that a very severe complaint had been received regarding the Edison Park. The Chairman of the meeting was the vice-president. He had with him his chief engineer, purchasing agent and Chief Inspector. They were also the salesman and engineer from the compound company. They had delivered the Ediphone dicta-phone equipment to customers all over the world. The threaded mouth pieces were falling off of the mated threaded piece. They want to know what they could do to correct this condition. How did the print look me? Which was sent in with his truck for quotation in the class of Tenite 2. This took the heat off of us and put it back to the compound company who had recommended this material.

To the parts in the field, we worked out a simple method of shrinking the rings by placing a cloth on an upright 75 watt lighted lamp bulb and leaving the ring on from five seconds to 20 seconds, whichever was necessary. But we just ended the order for these parts. This is one of the many misapplications of plastic injection molded parts. At the beginning of this industry, there were so many misapplications that were about put an end to the business before it got started. This was due to lack of knowledge and material views and also lack of engineering knowledge and capability. But as time went on, the materials improved and the injection molding business grew by leaps and bounds. Was very interesting to be in at the beginning of this business.

The Cosmetic Business Develops (2:26)

The cosmetic business developed a ton, soon reached close to 500,000 per year mark. The main presses were soon running around the clock. Sweated cosmetic boxes were unscrewed automatically in the mold. Electrical covers were what the production called for were run in 20-30 molds. The art department picture designed the cap so that there was a ring designed on the top of the cap, which enabled the mold to be properly vented. During the war, metal parts became scarce, and we made the lipstick closures out of polystyrene. We also made some beautiful compacts using acrylic compounds and rolled these stamping protective designs on the covers.

WWII Military Applications (3:15)

There were a few military applications for the war effort. One of the outstanding parts reloaded out of Palestine was a cone shaped cover for an instrument used on the nice flying plane, which prevented the pilots from shooting down their comet plane. This cover was about six to six inches high, two and a half inches diameter, small end, about four inches diameter, at the large end. It was necessary to cool this heavy plunger in the mold to run production. The wall thickness was about three. We found that drilling several V cooling holes was not sufficient when running production. So we built a special cord off plunger, which was extended beyond the length of the molded piece. Earlier, we used a quick water disconnect, so at least we were able to run the mold continually by keeping the cooling water

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circulating. Another problem with this part was that it had to stand the tidal wind test. So worked out in the evening process by heating the molded parts in an oven to about 170 degrees for about one hour. This relieved the stream set up in the molding process, and the part passed.

Another part, not a spectra, but I believe at first we molded the entire lipstick container, the crack, the style three, which was turned out the mold automatically, and the lipstick cup. We molded several 100,000 of these stuff for the cosmetic companies in New York City.

DuPont and Tenite 2, Drying Time Cut from 48 to 12 Hours (5:01)

It was while I was at Cotton, at the DuPont Company, brought out a nylon molding compound. We had a small, fourth quality injection mold making small, close tools one of our customers out of Tenite 2. It took two days baking oven to dry the varnished wire around on the spool. Nylon withstood a much higher heat. My customer wanted to move 5000 nylon to test. It cut the drying to 12 hours, instead of 48 hours.

I was asked to take the mold down to Arlington, New Jersey, to the DuPont laboratory, where there was a setup to make the samples. The engineer in charge had the mold set up under the injection machine. When they made the first load, he asked me to stand back 10 or 12 feet from the machine. The mold was vented for Tenite 2 materials, and when the feeding plungers went forward and the material shot out of the mold and long, stringy fibers.

First Production using Nylon Powder (6:03)

When I returned to Canton I had a face of the mold ground-off until the vents were only about a half 1000 feet. The mold worked all right that, and the DuPont laboratory ran off about 100 pieces for a customer to test. After about three weeks of testing, our customers changed the part drawing to nylon and asked us to run off 50,000 spools, which we did.

According to DuPont engineer, this was the first production of molded parts using nylon molding powder. I got to report, however, that this application is not successful. The spools used in some were used in some small, delicate instruments. The nylon spools absorbed too much moisture and throughout the calibration. The instruments all have to be recalled and the tools remolded with Tenite 2.

Navy Plane Air Speed Housing (7:04)

Occasionally, my experience in compression molding helped solve some of the problems arising in this field. One in particular, which I remember, was an air speed housing loaded for a very good customer. It had a rather large insert in the center of the cup shaped housing. The housings were used on Navy aircraft, and the drawing specified a pressure leak test underwater. There were two other suppliers besides our plant, and only about 1/10 for housing was passed the leak test.

This became very serious, but it was because it was holding up delivery of the aircraft to the Navy. We had had a similar problem when I was working at the molding plant in Hoosick Falls, where we were molding apart out of shellac, which had a heavy insert in the center of the piece, all the parts cracked upon cooling, until we placed them in cooling water right after the molding. This caused a metal insect to final shrinkage before the molded materials. We therefore tried the same process with the speed indicator housing, and were more than pleased when the parts passed the leak test. We had set up a leak test in the press room laboratory, so we obtained our answer right away.

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We made of 100 parts, and I left after dinner when the parts were ready to take the parts up to our customer. It was about 10 o'clock PM, when I arrived there, and they were waiting to run the parts through their testing equipment. The parts have to test 100% and we had a very pleased customer. So much so that they asked our top management to have me handle the engineering on all their work.

Clint Bateholts Passes On, Son Asks Tinerholm to Return to Hoosick Falls, 1943 (8:58)

In 1943 Clint Bateholts passed on, at the funeral, his son Douglas asked me to return to Hoosick Falls to manage the molding plant. After taking over for about a week, I accepted his offer. When I turned in my resignation, I was asked by the management in Pittsfield to stay on for six weeks, to go over all the work I was handing, I had to agree, as I had been very thoroughly treated while working for the General Electric plastic department.

Dramatic Electronic Preheating, 1941 (9:28)

In 1941 while I was at Taunton, I ran into my first experience of electronic preheating. It was quite a dramatic occurrence. I spent my weekend when possible at my house, traveling by bus and train due to shortage of gasoline on this particular return trip, before the train reached Springfield, the conductor came through the car, calling my name. He had a telegram from my boss telling me to get off at Springfield Mass. and to be in Schenectady the next morning, at nine o'clock for a very important meeting. However, I had no change of clothes with me, and there was a midnight train out of Boston for Schenectady.

I continued on much of this concern of the conductor and arriving at Schenectady with clean clothes and so forth. I went to the designated office contained in my instructions and told to wait for the rest of the members who were going to attend the meeting. One was coming from Chicago, one from Bridgeport and one from New York. It was during the war, and we had to have special passes to the restricted area where the meeting was going to be held, even at that, the door was locked, and I thought it must be very special and important to warrant all the security.

An Electronic Heated Hot Dog Dispenser (10:50)

We entered the room and found what a working model of a dispensing machine had dispensed hot dogs and rolls. The interesting part to me was the fact that the heating was done with an electronic heater. The hot dog was cooked in 10 seconds and was piping hot and thoroughly cooked. It opened my eyes to the possibility of preheating pre-form molded parts electronically. This was a very small electronic heating unit. The ones being developed that time were very large, taking up a great deal of space and therefore not too practical for the usual press room. It was two years later, 1944 that W La Rose and Associates, could develop a practical, small electronic heaters, which again, was a turning point in a thermal molding business.

Improving Specialty Insulation Company with a Tough Union and Heaters, 1944 (11:46)

In the early fall of 1944 I had transferred my efforts to the management of Specialty Insulation Company in Hoosick Falls, NY. It was not by far the most the same plant that I had known as superintendent several years back. A number of the same employees were there, but there was a tough CIO union to deal with.

They had geared to production so that the floor workers could earn top wages by placing a ceiling on the number of parts produced per ship. The faster workers had their quota finished in about four hours. This was during the war when some parts were very badly needed. It was a discouraging situation, but was

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somewhat offset by the event of a small compact but powerful W. T. La Rose electronic preheaters. I believe we purchased the first 18 machines which he produced enabled us to increase the production of the press room about 30% to the same number of presses when adding the pre pre-form equipment, we were able to get the re-timing on most of the work. This also helped to up the production, probably adding another 10% to our press room capacity.

Tremendous Production Gains with Preheaters: Aircraft Blocks, Auto Distributors (13:01)

This is just one example of what a tremendous gain in the production of thermosets, electronic preheaters brought about. It reduced the cost and made better molded parts. I was at the Specialty Manufacturing Company this time for a little over three years, with the 56 Colasta material, we played an important part in the production of aircraft blocks and distributor cast for both Delco Remy of General Motors and the American XXX Company. We were really loaded with work running around the clock, three shifts, six days per week. Both of these corporations told us that the 56 Colasta materials tested better than any other material available. It took about a year and a half due to the tough acting Union.

It took about a year and a half before all the rough stocks were ironed out as the press operators and finishing operators were earning from 25 to 30 cents an hour more than anybody else in the field. I was able to hold the line on wages for the three years I was at Specialty. I was not concerned with the war work for it was triggered on cost plus.

Post War Competitiveness (14:16)

But after the war was over, we had to be reasonably competitive to keep the plant busy. I hired referrals managed during the war to contact all our customers regarding orders for regular work when the war ended. We found our customers very receptive and were eager to get started on their mold for civilian production as soon as the war ended. When the war ended, we received telegrams xxxx up 90% of the work. We were ready and had no one in place for war work, so we only lost about one week in the transition.

Also a number of accounts which I had handled, engineer Taunton approached us with the woodwork problems. I will mention one part which had been turned down by several update up, correction, reputable molders. It was the wire bank of the telephone company. This wire being consisted of 32 wires with spacers known on the wire every inch and a quarter, as it was for an automatic battle. No blue flags could remain on the wires. And also, there was an all over an overall tolerance total of 8000 from the positioning of the end spacers. We solved this satisfactory to our customers by molding the spacers separately, making up a very accurate spacing fixture and liquid cementing the spacers and position on the wires. There was a considerable cost savings, as there was no clean of the wires required. Customers very pleased, and gave us considerable additional parts to make for them.

Lack of Injection Molding Investment Creates Holman Manufacturing Opportunity (16:04)

The company for which I had solved the leakage problem on the airspeed housing for the Navy, then had follow-up inquiries on such parts. We were able to build up our sales considerably. Then they asked me why I didn't go into the injection from a flat from the business, as they had a lot of work. They took place with us, if we had the equipment. I told them that I knew my present employers were not interested in investing additional money for equipment. Frankly, xxx complained barely to me when I bought equipment to keep the plant up to date and this, and thus a money maker.

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Also I had been there a little over three years, I felt very dissatisfied and uneasy about the attitude of the heirs, and expressed it to our sales manager, who was a friend of mine, and whom Howard, Howard. On his next trip, he came back with an order for two injection molds, an order for 100,000 of each part made out to me. Their faith in me was so extraordinary it was just the push I needed to find to found my own business. I ordered a 12 ounce block from Stoneman injection press that was the biggest size they made in those days.

I ordered the mold from a very fine tool shop, and by the time I was ready to step out, especially my mold had been delivered. Two days later, the press arrived. We set it up in three days, made samples and took the samples to the customer for approval at the end of the week. We had a means to wait for the inspection report. In about two hours, the chief inspector came and said, that is it, the first time that samples are submitted for approval, and both of them passed without any deviations.

As far as far as I know, the Holman Manufacturing Company Incorporated was the first to receive an order of this magnitude before it had a name or equipment to produce the part. It was an auspicious start. One of the parts rendered itself to fully automatic production, and the mold was designed as such. This was in 1947 I do not know whether very many parts were running fully automatic at that time.

It was not long before we needed another injection machine. And we bought another 12 ounce Watson xxxx. One of our injection cylinders become plug tight, and I had to take it down to Watson plant and located in Roseville, New Jersey, and wait for it. While there were one of the salesman asked me to come in his office that he had something he wanted to show me. This xxxx plant, they had several injection machines running with various types of gating. They had several running with pinpoint gating.

Arthur R. Tinerholm 19:00

For a number of samples of all sizes and pipes made with pinpoint gating. I was really amazed at the result. It was a big step in advance, and did a great deal to speed up the production and sale of injection molded parts.

Ring Display Box (19:34)

Arthur R. Tinerholm 19:34

Another interesting part we molded at that time was a ring display box for Denison Manufacturing Company in Framingham, Massachusetts. We had to furnish the design and submitted about a dozen different designs before they accepted one of them. We had Bill Petzold, assistant, George Talbot, do the artistic designing. He had left GE and had his own business in Mount Vernon, New York.

Denison would not allow us to have any knock on marks on the bottom the cover, nor would they allow us to grind them off. So we rigged up a method of automatically blowing them off with compressed air. This could well be a first in 1947. We had used to make it since several times. The Denison ring box contained four cavities, two covers and two boxes.

First Light Meter (20:26)

We made a light meter cover grill for GE in West Lynn. When asked to quote on it, we had turned it down because it called for a polystyrene material and had a wall thickness of 15,000 and no paper. It

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was not considered practical to most firing in 15,000 wall thickness at that time. Our customer would not take no for an answer, so we asked for 1,000 paper on each side of the wall. There were 12 divided sections in the park by building the mold so that all 12 sections could be printed, and took pinpoint gates above two of the woods, we were able to produce good parts. The first order was for 10,000 parts, and I believe we made about 100,000 parts altogether. Our customer told us that it was the first light meter made in this country.

Window for a Cigar Vending Machine (21:23)

Another first we supplied the window for a cigar vending machine for a customer in New Jersey. The window was made of 125,006 polystyrene 8 inches in length, four inches in width. 10 points needed and with 1000 and a half vents, one inch wide space, 1/8 around the part, all around the piece. This is not we were successful in producing good pieces. This was not a big runner. We made about 5,000 pieces total. I tried to persuade the customer not to make the parts out of polystyrene, but he does not believe the static of polystyrene and attraction of dust would be detrimental.

Thermosets (22:08)

Not being satisfied by having all our eggs in one basket and having so much experience in thermosets, we started to build up a thermoset department. We started with 100 and 150 ton stroke compression thread. It's why we did because during the Korean War, Palestine was in very short supply, and we could only buy 1/10 the amount we required. Fortunately for us, the GE plastic department was way behind in delivery of their orders and needed some kind of subcontractors. So they moved in six of their xxx sub presses, plus mold orders to run the presses around the clock, six days a week. This work continued for about two years. They rated their some subcontractors for service quality, and know how, I believe they reached 16 motors before they finish, finished subcontracting, and we were very pleased to learn that we were at the top of the list.

We had no reduction apart during the two years, we subcontracted their work. As far as we were concerned, this was another first. During the two year period we built up our former sub department and this continued until we now have 22 compression presses running in size from five ton to 300 tons. About 15 years ago, I decided I need an understudy.

After considering several applications, we employed an ME RPI graduate. It was a fortunate and wise move. His employment, before he had come to us, was working up standards and specifications for plastic for one of our arsenals. He fit in very well with our customers, our engineers and also our employees. He is now president of our company, and is a tremendous help in the activities of our business.

Mrs. Tinerholm Contributions Including Quality Assurance (24:03)

I would be remiss I did not mention the help that my French born wife has been to me during the main business activities over the years. Mrs. Tinerholm, was vice president, second secretary of the corporation has been credit manager, headed up the office and was in charge of the housekeeping in the plan. As credit manager over more than 21 years, our total loss and unpaid bills amounted to $343 which could be some kind of a first. She instilled such a degree of loyalty among our employees and pride and good work that no rejected parts were put in the box at the press and our finishing department and inspection department are alerted to such an extent that our returns from customers over the years are so minuscule that our accountants are not considered not to lift in our annual report.

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This could be, well be a first, with all of millions of dollars we have shipped out over the years. We've had the highest degree of quality assurance. Also another first, I believe, after we had been in business for about 10 years searching agent of one of our largest customers, telephoned asking if we would be interested in purchasing a scope 741, automatic thermo truck molding machine. If so, they had a mold or would into us for a three year run, we looked at all the particulars write the machine, delivery time, and the personal information about the molded parts, what they could file for and so forth. He wanted an answer as soon as possible. I asked him to hold the phone.

Turned to Mrs. Tinerholm on and said, we need to hold a director's meeting. Explained what the telephone call was all about, did a little figuring out across the molded parts while my wife looked up our cash balance. But from now we're ahead in approval, I turned to the phone and slept with our customer's proposition. It could well be a first in the shortest directors meeting involving the amount of money it called for.

General Electric Connections (26:19)

Due to my connections with the General Electric Company, the majority of our work was obtained from the various departments GE federal, the eastern part of the US and for Puerto Rico and Canada. Our reputation for doing the more difficult jobs, plus our reputation for service and quality moved a great many molds in without solicitation. One year, we had 40 molds sent into us. On some we had to make slight changes. A few substantial changes had to be made before we could run them.

3M and Anti-Missiles, Epoxy Molding Compound (26:53)

About three years ago, we had a first we made the parts for 3M in Schenectady. The 3Ms have a sizable molding department out in the west. They were holding a meeting in their molding department to see what could be done to speed up production of some epoxy vacuum flown parts they were making for Western Electric. It was a part for the anti-missile missiles that was being built for tests in the Pacific Ocean. They're way behind schedule. The man from Schenectady was at the meeting, and he had been at our plant about two weeks before, and seen us mold some parts out of an epoxy molding compound. So he spoke up and said that he thought he knew a company who would mold the parts. It was decided to send us an inquiry with drawings and ask for quotations. The inserts were all in one piece, about 20 inches long and gold plated.

We received the order for the mill, and at this time, I ordered a small special blasting machine from England because I knew we had to vent the part where the weather contacts stuck out, of a mold to start, and that we could expect some flash from the venting. And as the inserts were gold plated, we could not remove the flash with a knife. The blasting equipment arrived two days before the molds were finished. We had a group in our plant to watch the sampling of the mold from Chicago, North Carolina, Springfield, Mass and Schenectady. We had no difficult in molding the part, and the thin stone of xx was easily removed by the blaster. There were two different sizes to mold apart, and we molded 10,000 each side. Western Electric finished the directional equipment in plenty of time, and the test in the South Pacific came off on time and was successful.

The Future of Plastics (28:47)

What is going to happen in the future in the plastic business, it is very difficult to prognosticate? All we feel is that the time will come and not too far away, when more tons of plastic material will be used in

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all the metals, including steel, the screw feed for both the thermoplastic and thermal flux will tremendously increase the industrial use of plastic parts, making better parts and less costly parts.

My connection with the plastic industry has been fascinating and fairly rewarding, and has kept me very busy, not only physically but mentally also. I am grateful to have played a part, although, albeit a small part, in the development of this tremendously fast growing industry.

The end.

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Tape 10 (AC1235-RCD0010)

Bill Cullom, Celluloid Corporation, SPI Chicago, Rexall Chemical Company

Speaker 1 0:07

Hello, 12341234, this is a recording at the Bowl Peak Country Club in September 1968 meeting of the Plastics Pioneers Association. One of our guests this morning is going to be interviewed, and I'm going to ask him to give his name, his present affiliation and previous associations with the plastics industry.

Sells Plastic Machinery for Injection Molding Extrusion for Blown Objects with Rotational Molding, 1968 (0:44)

Bill Cullom 0:44:

I am Bill Cullom, C, U, double, l, o, m, at the present time, I am a manufacturer's representative selling plastic machinery for injection molding extrusion for the manufacture of blown objects and plastic thermoplastic materials Made by rotational molding. I also handle ancillary equipment used by plastic processing plants.

Started with Celluloid Corporation, 1936 (1:34)

I started my plastic experience with the Celluloid Corporation in 1936. After an indoctrination period, which included running the first or second Isoma injection molding machine operating in the United States, I was transferred to the packaging division whose primary products were cellulose acetate films and sheeting.

Prepackaged Fresh Fruits & Vegetables with Heat Sealing Cellulose Acetate Film, 1945 (2:24)

In 1949 correction in 1937 I was instrumental in starting early applications of prepackaged fresh fruits and vegetables in the Philadelphia area. This work was done with the local wholesale receivers throughout the Dock Street area of Philadelphia, and in conjunction with the large converters such as Mill Print, Shelmar and Dobeckman. In 1945 I developed a means of heat sealing cellulose acetate film. The technique was basically covering the heating elements with Teflon film.

In 1941 with Ed Kelly, John Buckner, Warren Cooper, we started the second section of the Society of Plastics Engineers in Chicago.

Returning to a chronological sequence of employment in the industry in '49 I left the Celanese Corporation, who had bought out Celluloid and started a manufacturer's representatives business in New York City, which I sold in 1953. That business continues today.

Polyethylene Pipe, 1949 (4:46)

In 1949 one of my suppliers was Carlon Products of Cleveland, who were one of the early manufacturers of polyethylene pipe, and in that conjunction connection, I was present when my Eastern wholesale distributor installed the first polyethylene pipe for potable water in a well in the Torrington Connecticut area.

American Machine and Foundry Consultant: Glass Paper and Teflon (5:34)

Between '53 and '61, I was a consultant to American Machine and Foundry, in conjunction with a very thin glass paper, which they had developed. This glass paper was made on a Fortinear machine and was then Teflon impregnated. Its prime markets were to be for thin, high temperature electrical insulation and some filtration applications. The product was too expensive, and the business was discontinued.

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During the same period, Resistiflex Corporation, in conjunction with their Teflon reinforced tubing used for aircraft and other hydraulic hose applications.

Between 1961 and 1966, I was the European Marketing Manager for Rexall Chemical Company. Their primary products were polyethylene, low density polyethylene, polypropylene and polystyrene. During this period, I established agents in all countries of free Europe, all of the Mediterranean coast area of Africa, the Republic of South Africa, but spent little time because of the small markets in Equatorial Africa. Listen, this work involved engineering as well as establishment of the distributor organization.

Selling Injection Machines from One Ounce to 70 Ounces, 1966 (8:29)

Rexall discontinued their export efforts in 1966 when I established my present business, selling injection machines from one ounce and 35 ton clamp capacity up to 70 ounce, 700 ton. My primary suppliers are Beloit Corporation, who bought DeMatia about five years ago, and McNeil Corporation of Akron, Ohio.

"Plastics" in the Second Egyptian Dynasty (9:32)

Plastics are considered a fledgling industry by many, but under broad interpretation of what is a plastic, our industry can be traced back to the second Egyptian dynasty. That civilizations knowledge of lac, the natural secretion of small animals left on the bark of twigs. Together with paint and lac used for decorating, finger and toenails, etc., were a flourishing business when the Sphinx were being built. In

Polystyrene Molding Would Not Amount to Anything (10:52)

Berliners' lab notes of the 1830s styrene monomer was recorded. Interestingly, one of our industry leaders in the 1940s stated that, in his opinion, polystyrene molding powder would not amount to anything. Vertical integration in the 1940s upset many in the industry, and there were those who forecast that the major suppliers, particularly in the packaging segment of the industry, who had involved, who were involved in vertical integration, would lose all of their business. As we know, the opposite occurred.

From Simple to Complex and Back to Simple (11:53)

The state of our aught has progressed mightily during my three score years' experience and as with industry generally, the earliest techniques became very complicated with the passage of time and improvements. But then, or at this time, many of these complicated processes are slightly revised and simplified, coming back to something approximating the originally simplified process of the '20s and '30s.

Floating Toys to Vacuum Forming, 1900 (13:07)

An example are floating toys, which in the 1900s were made by preheating nitrate sheets. Two of these sheets were put in a female mold and expanded by the introduction of hot air, assisted by cold water running through channels in a perforated mold. With variations of this system is the vacuum forming business of the 1960s.

Unites States World Edge is our Freedom (14:05)

Sales engineering in all of our states, the countries of Free Europe and two thirds of Africa, indicate that we have no edge on technology. Our edge is in United States and our relative freedom. Our plant size advantage is eroding as other areas approach commercial union and as their GNP expands.

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Returnable but Non-Returned Milk Bottles (14:55)

Two examples of foreign leadership. In my opinion, include Central Europe's use, made necessary during the Second World War, of un-plasticized PVC, and the Republic of South Africa's experience in the very early 1960's with high density polyethylene, returnable blown milk bottles. The last story in summary, is that from a health standpoint, the Republic's Board of Health, people were very happy the bottles could be run interchangeably with glass on their milk filling lines. But the public in Johannesburg, primarily where these bottles were first introduced, would not return them, even though many inducements were offered, and the milk companies could not afford the cost without at least 20 trips from a bottle. So the project was dropped.

That's all.

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