
Le Roi
(The King)
LEROY - Controlled Lettering Products
A Manufacturing History

by: Joe Soper

KEUFFEL & ESSER COMPANY

SALISBURY PRODUCTS DIVISION --- LEROY MANUFACTURING OVERVIEW

FOREWORD

The story of Keuffel & Esser is a story of a family and a company whose products served as the tools necessary for engineers, architects and technicians to build and innovate with accuracy. The wide range of K&E products was the cornerstone for an untold number of technical advancements both in the United States and overseas.

The company was founded in 1867 in New York by Wilhelm J. D. Keuffel and Herman Esser. The gentlemen had emigrated from Germany and initially their firm was a distributor of engineering products made in Europe. Having ambitions beyond being the middleman between the manufacturer and the consumer, W. J. D. Keuffel initiated production of hard rubber triangles in their sales office in 1870, and established a small shop for making T-squares and triangles on Dutch Street, New York in 1871. Needing more space and looking for lower lease costs, K&E, in 1875, moved its emerging manufacturing operation across the Hudson to Hoboken, NJ, where it rapidly expanded to a significant industrial complex and concentrated its research and manufacturing over the next 75 years. By the time of its 40th Anniversary, the central administrative offices also were transferred to larger quarters in Hoboken in a newly constructed Office/Factory building at 3rd and Adams Streets.

The product range came to extend over many thousands of items. It covered drafting, reproduction and graphic charting media, drawing instruments, drafting machines and lettering equipment, drafting room furniture, planimeters, surveying and optical metrology instruments, field equipment, measuring tapes, and a broad line of slide rules for which K&E became famous throughout the engineering profession. All products reflected the founder's business philosophy: "The best; first, last and always."

An address by Carl M. Bernegau[1] on the occasion of K&E's 75th Anniversary in 1942 recounted: "In 1880 our founder brought the first lot of European made slide rules to this country and this rather simple looking article became of great importance to the engineering profession. Keuffel & Esser Co. realized that it had to manufacture this article in the U.S. and devoted a great deal of time and effort to the development of this important aid to the engineering profession. It constructed its own slide rule dividing engines of greatest accuracy, made a very scientific study of the materials entering into the construction of these instruments and developed a number of important slide rule patents which made Keuffel & Esser Slide Rules almost a tradition among engineers in America".

The Company's geographic expansion started on the sales/marketing side with the opening of a branch in Chicago in 1891, followed by company branches in St. Louis, San Francisco[2], Montreal, Detroit, Los Angeles and Seattle. Distributors were appointed throughout the U.S. and in many foreign countries. As early as 1892, there existed a complete Spanish language catalogue. Geographic diversification for manufacturing operations started in the 1950s with the transfer of measuring tape manufacturing lines to Cape May Court House in southern New Jersey. New research and development space was needed in Hoboken for the newly formed optical metrology division; upgrading of certain manufacturing operations could be accomplished better at new locations, and there were some cold war concerns about having all manufacturing concentrated adjacent to New York in case of an attack on this key city.

The Salisbury and Taconic plants arose in the course of this diversification and modernization activity along with a new distribution center in Teterboro, New Jersey and surveying instrument manufacture to Kennebunkport, Maine. Changing demographics to the suburbs also made Hoboken a more difficult location for attracting highly qualified administrative and technical research staff. The demographic shift and a need for substantial modernization of the aging Hoboken facility resulted in the move to a new administrative and research headquarters in Morristown, New Jersey in 1969.

It is in the period of this changing corporate environment, that Joseph Soper joined K&E and chronicles an important segment of K&E history. The Salisbury facility clearly was an important plant for Keuffel & Esser. His story shows how innovation and process improvement continued to be emphasized in the late stage of the history of the slide rule. The disruptive moves in and out of Salisbury reflected a desire to put to productive use the Hoboken facility that had been vacated by the move of many functions to Morristown. After this attempt had failed, the Hoboken factory buildings in Hoboken were sold to a developer who converted the solidly constructed office and fac-

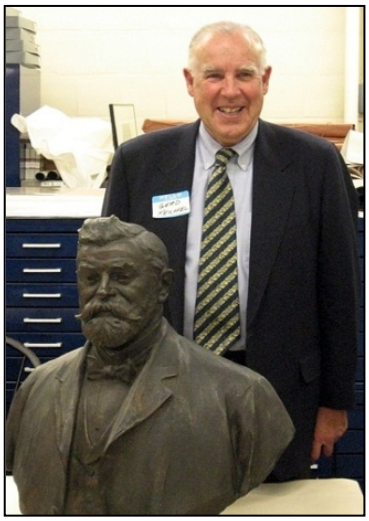
tory floors into attractive low income housing units under an applicable Federal program.

Herman Esser returned to Germany with his wife in 1902. After his departure, the company was wholly owned by the Keuffel family who took the firm public in 1965. By the early 1980's it became clear that the company needed major investments in new technologies to continue to prosper. The slide rule had been replaced by the calculator by 1976, and K&E had no proprietary electronic products for the market. Similarly, the surveying business was moving to the use of lasers and electronics, and K&E needed more leading edge technology than internal research and development had produced. Thirdly, the use of paper products and drafting equipment was declining with the advent of CAD/CAM. When the firm was purchased by Kratos in 1983, it was expected that their expertise would be an impetus for a leading edge restructuring. Throughout its more than 100 year history with the company, the Keuffel family was very proud of the firm and its products. Many family members were employed by K&E - some for a lifetime and others, like me, for summers during college.

Today, with the interest in the history of technology, the slide rules and other products that were manufactured by K&E have become collectors' items. The fact that these pieces are generally in working order points to the thoroughness of the development and manufacturing process of which the Keuffel family has always been very proud. This book accurately details the work that went into making the quality products of K&E and illustrates the model of excellence and diligence that the company and the family expected.

1 Carl Bernegau, a son-in-law of W. J. D. Keuffel, was President of K&E from 1942 – 1946.

2 The San Francisco Branch was destroyed by the 1906 earthquake and rebuilt in 1907.



Gerd H. Keuffel
Former K&E Board of Director's Member
Great grandson of Wilhelm J. D. Keuffel

INTRODUCTION – Joe Soper

A few words are in order about my background with K&E. I joined the Keuffel & Esser Company in November 1966. During my first month at the Hoboken facility I was on Orientation where I spent some time in each department to gain an overview of the various products the company manufactured. I was then transferred to the Salisbury Products Plant; a K&E owned company located in Lakeville, Connecticut. My employment lasted through several changes in K&E ownership until December 1995, when I chose to retire after 29 years with the company. I was then employed as a consultant to Azon/K&E for the next six months to help with the transfer of ownership of the Salisbury operation to a plastic molding company near Binghamton in upstate New York.

At the time of the sale, the Salisbury operation was essentially the Leroy Products Line. The purchasing company was not allowed to use the K&E logo or Keuffel & Esser name; it was allowed to use only the trademark name “Leroy”. The Salisbury Plant was the last K&E hardware manufacturing location in the company. All other hardware plants were either sold off or closed over a period of years. I started as a Department Supervisor, was promoted to Plant General Foreman, Production Manager and finally Plant Manager for the last ten years of my employment with the company.

Over the years I had taken many photographs in the Salisbury Plant and have personal experience to pass on to collectors and anyone interested in the Keuffel & Esser Company and their products. This format offers the opportunity to include many full color images without the expense of a printed document.

The Salisbury Products Plant was one of several K&E manufacturing facilities spread around the country; a few were larger and more important than our small location. I was 34 when I joined K&E and most managers were older than I was at that time. I suspect most are gone now and much manufacturing history about this outstanding company may now be lost. It is my hope that people who have hands on experience in other areas of K&E manufacturing will be able to add to this effort and get down on paper their experiences for historical purposes.

The Civil War ended in1865, the Keuffel & Esser Company organized only two years later in 1867. Slowly the new company began to manufacture the tools necessary to survey and map the western expansion of our country, all the way to the Pacific. It is interesting to note that during the early history of the Keuffel & Esser Company many of the tools manufactured in New York City and Hoboken, New Jersey were basic drafting instruments; T-squares, Triangles, French-curves, Lettering templates, Flex-curves, scales, slide rules etc., all used in engineering, map making and design work. A few of these same tools were still being manufactured by the K&E Salisbury Products Company in Connecticut, right up to the time of its closing in 1995!

The Keuffel & Esser Company was renowned for its slide rules in the United States; however it was a different story outside the U.S. where K&E slide rules were less well known and had a smaller share of the market. K&E slide rules have become a serious collectable, indeed, all slide rules wherever produced are sought after by collectors, especially by people who have actually used them in college and in their careers. Slide rules were a challenging and very interesting product to produce in our plant; however, Leroy was the product that had the greatest return at Salisbury.

In this narrative I will try to give a manufacturing overview of this interesting product which had a life span of over 60 years, rivaling the slide rule line at K&E. How many other design concepts can make that claim today? Nowadays before a product even hits the market a replacement design is already on the drawing board. The Leroy Controlled Lettering line was well known the world over and made significant contributions to corporate's bottom line.

Judging by the volume of Leroy products appearing on eBay nowadays it seems they have also become collectables. Salisbury produced over 500 different Standard Templates plus an untold number of "special" templates in various designs and languages along with many different tools required to use the templates which are probably still sitting in drawers and cabinets all around the world. This variety makes Leroy very attractive for collectors. Because of this growing interest in collecting Leroy and other K&E products I felt it was a good time to pull together this information on the Leroy line as some background for collectors.

In this Leroy narrative I have no intention of cataloging in detail all of the many hundreds of individual components produced by the Salisbury Plant, but rather, give an overview of the facility, now dating back over 60 years – the way things were done "way back then". Mr. Clark McCoy has included a complete set of catalogs covering all the Leroy products on his site. As many may know Clark is very active in the Oughtred Society and has served in several important positions on the board, he has very generously offered to include this narrative on his Keuffel & Esser website.

Thank you for this opportunity Clark – Joe Soper

In the early years the Keuffel & Esser Company was fond of naming new product lines with exotic labels; *Paragon*, for drafting instruments, *Helios*, for reproduction papers & films, *Monarch*, for printed forms etc., *Phoenix*, for tracing cloth. Apparently this was true for the very early *Le Roi*, French for (The King), lettering products as well.

In 1970, the K&E Salisbury Products operation returned to Lakeville, Connecticut after an unsuccessful move to Hoboken, New Jersey a year earlier. The Salisbury operation manufactured all the Standard Leroy components for that product line before the move. When the operation returned to Lakeville, it included the balance of the Leroy operations along with custom template engraving, which was still being done in Hoboken. The buildings in Hoboken were to be sold after the offices and Research & Development sections were moved to the new K&E Corporate Headquarters in Morristown, NJ. At this time I was the Plant General Foreman at the Lakeville, CT location.

The custom engraving equipment included at least 50 large blueprint storage drawers filled with many hundreds of custom master engravings going back to the very beginning of the Leroy product line around 1935. The drawers also contained a large amount of junk accumulated over many years. I was cleaning out the drawers, cataloging and rearranging the masters, some made of early celluloid that had crumbled with age and had to be discarded. During this process I came across a scattering of very old and deteriorating celluloid templates with the logo imprint

“Le Roi” (The King). I was involved with the Leroy product line during most of my 29 years with K&E and never again saw examples with this particular imprint. Celluloid is composed essentially of cellulose and camphor, frequently a very unstable compound. Either the imprint “Le Roi” was changed very early in the game or perhaps the templates simply did not survive in the field, I really don’t know. I did however run across many old templates stamped with “Le Roy”. I suspect the average American user did not take a fancy to the French spelling Le Roi, K&E compromised and changed it to Le Roy for a time and then to Leroy. Honestly, when I first started with the company in 1966 I often wondered who this Leroy fellow was and if he was still being paid a royalty for his invention.

All Leroy engraving required an engraving master which was then used to engrave templates for the marketplace. These production masters were engraved in 1/8 inch sheet steel and then case hardened to resist stylus wear over many years of use. A stylus is the tool used to trace the master which in turn moves the engraving cutter to actually engrave the template. The “custom” engraving masters referred to the special masters designed to customer requirements. For instance, a manufacturer designs and produces a product in various shapes and sizes, their draftsmen would use special symbols and lettering when drafting prints to build this product. Since the draftsman is likely to use many unique symbols and lettering to make the necessary drawings it would save many hours of his time if he had a Leroy template with these symbols and text to work with, thus shortening the drawing time considerably.

A special master was usually engraved in soft, sheet butyrate or celluloid since it required freehand engraving, an art form which is a time consuming process and quite expensive. After the special master was made and an order of templates engraved, the one-time cost of the master was included in the final price for this first order and then belonged to the customer. The special master would then be given to the customer or stored at the plant for future orders, hence the many hundreds of masters in the storage drawers.

A LITTLE LEROY BACKGROUND

In the United States through World War II, students in mechanical drawing classes across the country were instructed in the use of a freehand lettering style for adding text their drawings; just after the war I attended these classes myself in high school. These lettering styles varied widely and in many cases students would modify the lettering according to their own sense of what this lettering should look like, adding their own flourishes to the look. Some of the lettering was really beautiful and very stylistic; unfortunately some of the lettering was virtually unreadable. Clearly there was a need for some standards across the country and the world for that matter.

When the United States entered WW II, demand for manufacturing drawings just exploded, the urgent need for drawings were such that the draftsmen were instructed to skip the inking step, pencil was acceptable. Remember-there were no Computer-Aided Design gadgets back then. Everything was pretty much done on a drawing

board using T-squares, triangles, French curves and a slide rule instead of a calculator. Companies doing business with the government during the war effort formed whole departments employing dozen's perhaps even hundreds of draftsmen and it was at this time a need to standardize the text was realized, various mechanical means of adding text to drawings were adopted, assuring text would be uniform regardless of the individual skills of the draftsman. Ornate lettering was dropped in favor of a more simplified and legible text, a text that would survive extreme reduction and still be legible for microfiche and other microfilming methods used in aperture cards for filing etc.

After the war, about 1950 the GSA (General Services Administration) was formed and one of its many functions was to oversee manufacturing contracts and procurement for government work. The agency recognized the need for setting specifications for lettering templates. Where engineering drawings had to be made, they required uniformity of lettering on all the drawings produced. When K&E first got into the Leroy business they set very stringent internal manufacturing specifications for the early 3240 series templates. That included engraving height, width, depth of engraving as well as style and the construction of the Leroy base material. When I transferred to the K&E Salisbury Plant in 1966 I was told the GSA chose the Keuffel & Esser Company's Standard (Gothic) Leroy template style as the standard for all engineering drawings submitted to the government. Not only did the GSA require the lettering style of Leroy, they also adopted the manufacturing specifications and materials used by K&E as the specifications for any other manufacturer desiring to produce templates for the government, giving K&E a leg up on the competition - a significant advantage!

In the following chapters I will show how the K&E Salisbury Products Division, after receiving the complete Leroy manufacturing operation, responded to the huge increase in demand for this product between the years 1956 and 1995 when the production operation was sold to a plastic molding company in up-state New York.

LEROY PRODUCTION IN HOBOKEN

When the Leroy line was introduced in the mid 1930's, the only material available at the time that K&E felt was suitable for forming the template blanks was celluloid. White pigmented celluloid sheet was used by K&E as a surface lamination on their mahogany slide rules, clear celluloid sheet was used to fabricate the drafting tools, triangles, French curves, T-squares, etc., produced by the company going back to the turn of the century. This experience manufacturing celluloid products allowed K&E, working with their celluloid supplier, to fabricate a sheet material composed of a thick black pigmented center layer sandwiched between two thin sheets of white pigmented celluloid. Just how they laminated these three sheets together I don't know. The later PVC (polyvinyl chloride) sheet materials were laminated using heat and high pressure to bond the sheets together. I'm not sure that process would work with the highly flammable celluloid, although the 1954 edition of the K&E Drafting & Reproduction Catalog mentions that the Leroy template material at that time was three layers of laminated material. Perhaps this laminated sheet material was purchased ready-made directly from the Celluloid Company located only a few miles away in Newark, NJ and was a proprietary process.

MAKING THE LEROY BLANKS IN HOBOKEN

To minimize friction and the potential for fires when working with the sheet celluloid, instead of sawing the sheets to a rough template size a shearing press was used to shear the sheet into slightly oversized Leroy blanks. The blanks would then be clamped on edge in a fixture; about 20 at a time and milled against a high speed vertical multi-tooth cutter spindle to regulate (smooth) the edges. After the first pass the blanks were flipped in the fixture and the second edge was regulated. This milling step was done using an air jet to cool the work. The machine was constructed on an old surface grinding machine equipped with an electro-magnetic base to hold the milling fixture and was used in Hoboken for many years. I don't have an image of this machine to include here. This machine was then transferred to the Salisbury plant along with the following two additional machines in the images below, the tailpin grooving machine and the end rounding machine.

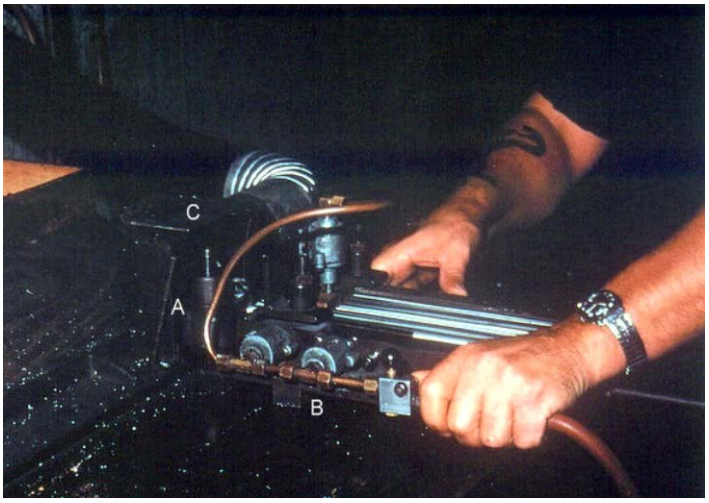
Despite all the precautions to avoid fires while working with celluloid, fires did occur from time to time and were controlled by the installation of water spray heads located in all the chip removal ducting. Several machines called cyclone collectors would draw the air and chips through the ducts located on the chip producing machines and then spin the chips from the air and allow the chips to collect in containers where they could be disposed of. These spray heads were similar to the sprinkler heads installed in buildings and would be triggered by heat. Obviously, making Leroy engraving blanks in Hoboken was both time consuming and not without fire risk.

After the rough, slightly oversized blanks were regulated on both edges to finished dimensions it was necessary to check the blanks for rockers to cull out any blanks that would rock when ends were alternately pressed. No sense adding additional labor to the blanks only to have to scrap them later. These blanks were cut from a large sheet of material which would have stresses introduced during the laminating process. A few of the blanks would bow slightly, almost the same way pieces of wood would show signs of bowing when cut from a large sheet. When the draftsman was sliding the template back and forth on the straight edge inking the text with the scriber, the last thing he would want to experience is to have the line of characters bob up and down as he was adding text to his drawing.

At the Keuffel & Esser Company Leroy templates were considered precision instruments and were very carefully manufactured, every step in the process was monitored and all this attention showed up in the retail prices. In the 1954 catalog the retail price for the smallest standard template, the 3240-80CL, a 9.5 inch template, was $8.40. In 2014 dollars it would be over $70.00 allowing for inflation, very expensive by any standard. In 1956 the Salisbury Products plant acquired this manufacturing operation from the Hoboken Facility.

After both edges of the template blanks were regulated and inspected for rockers it was necessary to introduce the tailpin groove into both sides of the blank. This was done using a vertical, high speed spindle fitted with a horizontal, 2 inch diameter 6 tooth cutter and cooled with a jet of air. This machine to the left was also used in Hoboken and transferred to the Salisbury Plant. Grooving the blanks was a slow process since the blanks could only be grooved one at a time. The blanks were hand fed into the cutter slot below the operator's right hand, they would then be picked up by rubber rollers and feed through the tailpin

machining cutter and removed with the left hand into a tray. The blanks would then have to be flipped and grooved on the second side.



The final step to finish the blanks prior to engraving was to end-round the corners of the blanks which was done using a fixture clamping about 20 blanks at a time and manually feeding the clamped blanks against a form cutter also air cooled. Actually this machine was never improved upon and was used at Salisbury just as it was used in Hoboken and was able to keep up with demand.

[A] – High speed vertical form cutter, carbide faced. This cutter rounded both corners on one end of the blanks. After the first pass the blanks were un-clamped and turned end to end and clamped again for another pass against cutter.

[B] – This is the clamping fixture which holds the blanks for end rounding. After the blanks are placed in the fixture and aligned, a knob is pulled up and air pressure cylinders clamp down on the top of the blanks as well as side clamps which hold the stack while sliding the fixture holding the stack of blanks against the rotating cutter.

[C] – Is the enclosure with suction hose attached for removing chips from the building.

After 1956 when the Salisbury Products Plant received the Leroy operation from Hoboken, the tailpin grooving machine, as well as several other Leroy machines received proved inefficient for manufacturing Leroy templates. When the demand for Leroy started expanding, Salisbury had to find a better way to produce the template blanks, at least for the 9.5”, 12” and 15” sizes which were by far the bulk of sales. As you will see, this led to a serious effort to design more efficient machines at Salisbury, a remarkable accomplishment for such a small facility.

When the Leroy operation was transferred to the Salisbury Plant in 1956, Hoboken was just beginning to use Tenneco Corporation’s polyvinyl chloride (PVC) engraving sheet material for Leroy blanks in place of celluloid. I will revisit this material in the next chapter. Using PVC instead of celluloid greatly reduced the fire risk.

LEROY BLANK MAKING AT SALISBURY

At the time I joined K&E in 1966 the Tenneco Company was making the vinyl Leroy base material for the Salisbury plant to K&E specifications, that was many years ago, not sure the company is still in this business today. When Tenneco formed the sheet vinyl for K&E no softeners were used in the formula; we wanted a completely rigid sheet for our purpose, not a supple sheet. Salisbury bought tons of the finished Leroy stock at a time. This type of engraving stock was used commercially to make engraved signs and nameplates but was not held to the tolerances required for Leroy templates.

Tenneco produced sheets of black and white vinyl close to .010” thick in their process. Ten .010” thick sheets of the black vinyl were sandwiched between two .010” sheets of white vinyl to produce a final nominal thickness of .120". I should add at this point that this same process was used by Tenneco to produce blank material for both our K-12 beginners slide rule (solid white) and the Flex-curves (solid black) that Salisbury Products manufactured, although much thicker than the Leroy template material.

Tenneco, working with the K&E Engineering Department worked out a procedure for stacking the layers to produce the uniform thickness K&E required. To compensate for minor variations in thickness they had Tenneco flip every other layer over, similar to making a sheet of plywood. The resulting stack would be very close to our standard of .120" for Leroy templates. To bring the stack of sheets to our required thickness the operators would insert as many .002" thick clear vinyl shims between the black sheets as necessary to reach our specifications. These clear sheets were always buried in the middle of the black layers; we didn't want it near the top or bottom of the finished sheet. When the entire stack was the right thickness measured with a paper micrometer, it was placed in a press, using heat and high pressure, the whole stack of sheets was laminated into one piece. The finished sheet had polished surfaces and was about 24" x 52". The sheets of laminate were then slip-sheeted with blank newsprint paper to prevent scratching and placed in a flat carton, 20 sheets to a carton. This is the way we received the material at our plant. This rigid vinyl material was very tough, able to withstand lots of abuse from high school kids and still perform as intended. With some Leroy templates it is possible to see these clear vinyl shims if you hold the template on edge up to a bright light source the shims will show up when the light passes through the material.

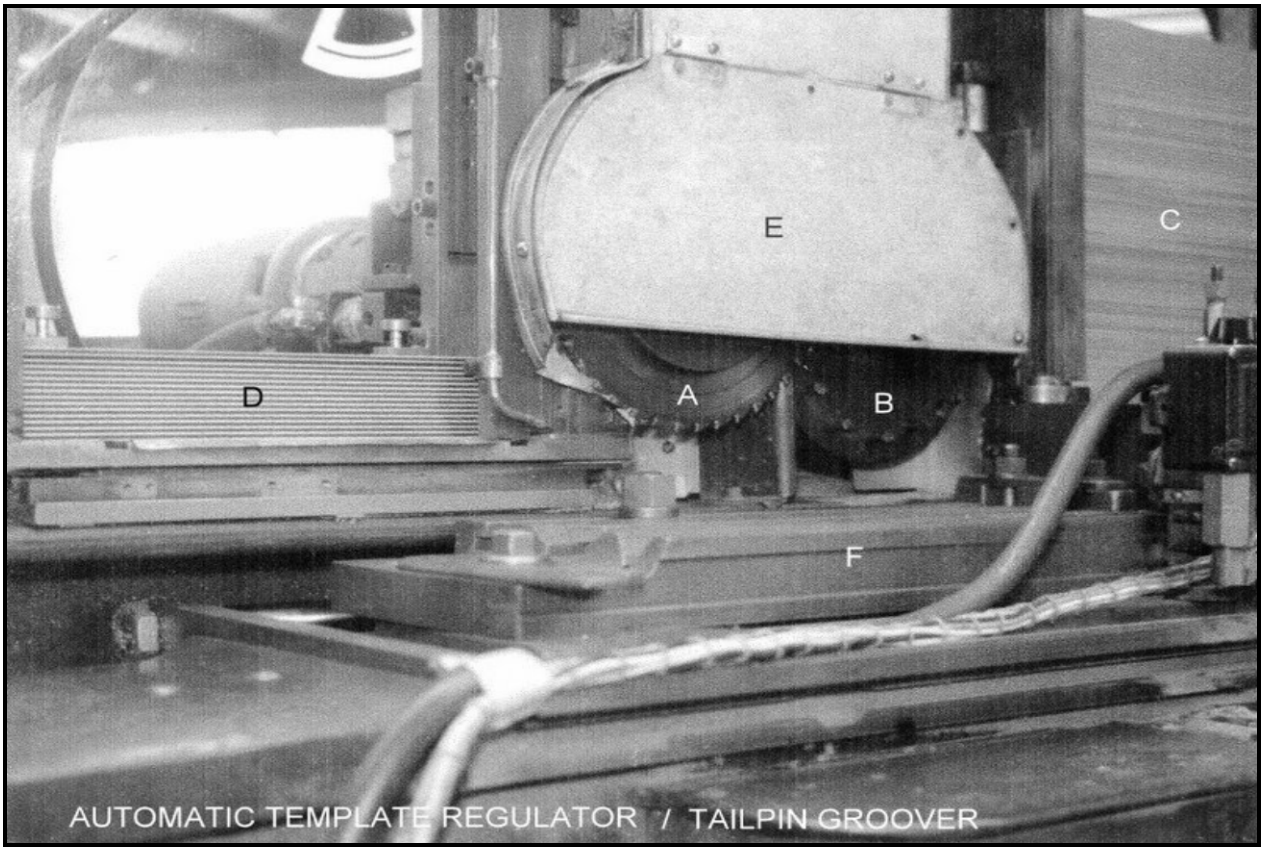
When we received a shipment of engraving stock from Tenneco, we had to take the finished sheets and cut them to a workable template size. We had a large under-the-table saw that was designed and built in the Salisbury plant not long after Leroy manufacturing was transferred from Hoboken.

This automated table saw (left) cut the vinyl sheets to rough template blanks. The operator is in the process of stacking six sheets of vinyl onto the table and removing the protective paper slip-sheets as he works. The table saw was then pre-programed to automatically cut up the stack into any blank size required, slightly larger than the finished template. These rough cut template blanks were placed in tote boxes and taken to the next operation for regulating (smoothing). The PVC material was not flammable and could be sawn in stacks of six sheets at a time rather than the slow one sheet at a time shearing method used with celluloid sheets in Hoboken. This change resulted in labor savings and was the second change in the plant to make Leroy production more efficient. Many more changes would be coming. Note the stack of cartons behind the operator; these are the cartons containing the sheets of vinyl packed 20 to the carton as received from the Tenneco Company.

By the time the Leroy operations were moved to the Salisbury plant carbide machine tooling came into general use allowing our under-the-table saw blades to be sharpened on diamond wheels, these carbide tipped blades would stay sharp 4 or 5 times longer than the tool steel used in Hoboken. This was true of all cutting tools used in the plant, saw blades, form cutters, milling tools, engraving cutters etc., saving many hours each day in tool sharpening, another change for efficiency in the Salisbury operation.

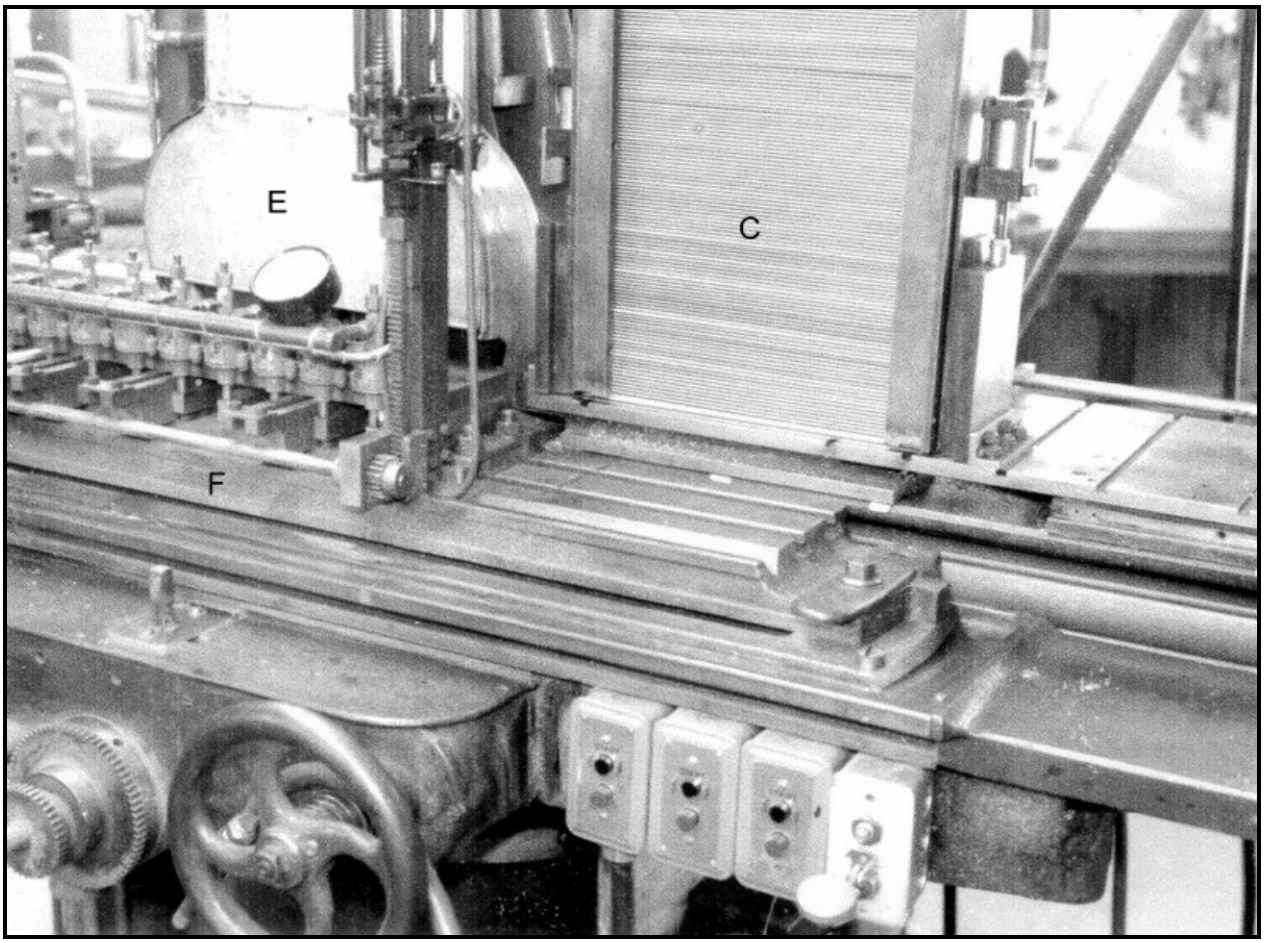
This machine was built on a used Bath Universal Grinder, designed and assembled in the Salisbury plant in our own small R&D machine shop. This machine is the third improvement over the LEROY production methods as used in Hoboken. The first being the major change from celluloid to the PVC base material, the second change was the use of the under-the-table saw to

produce the raw blanks. This third improvement, a very ingenious machine design ran every working day for over 40 years, including a two year period when we ran it around the clock to keep up with demand. It was still running when the Leroy line was sold in 1995! The machine was able to stay ahead of all Leroy production requirements for the three most popular size blanks, 9.5", 12" and 15" lengths. In this image the operator has loaded the hopper on the right with raw sawn blanks from the previous sawing operation which were loaded into tote boxes. As the blanks are finished on one side they are placed in other boxes until the run is completed. After all the blanks in the order are finished one side, the machine will be set-up for the other side and the blanks will be finished. The boxes will then be moved to the end-rounding set up which is the last operation to finish the blanks before engraving, which will be discussed in the next chapter.

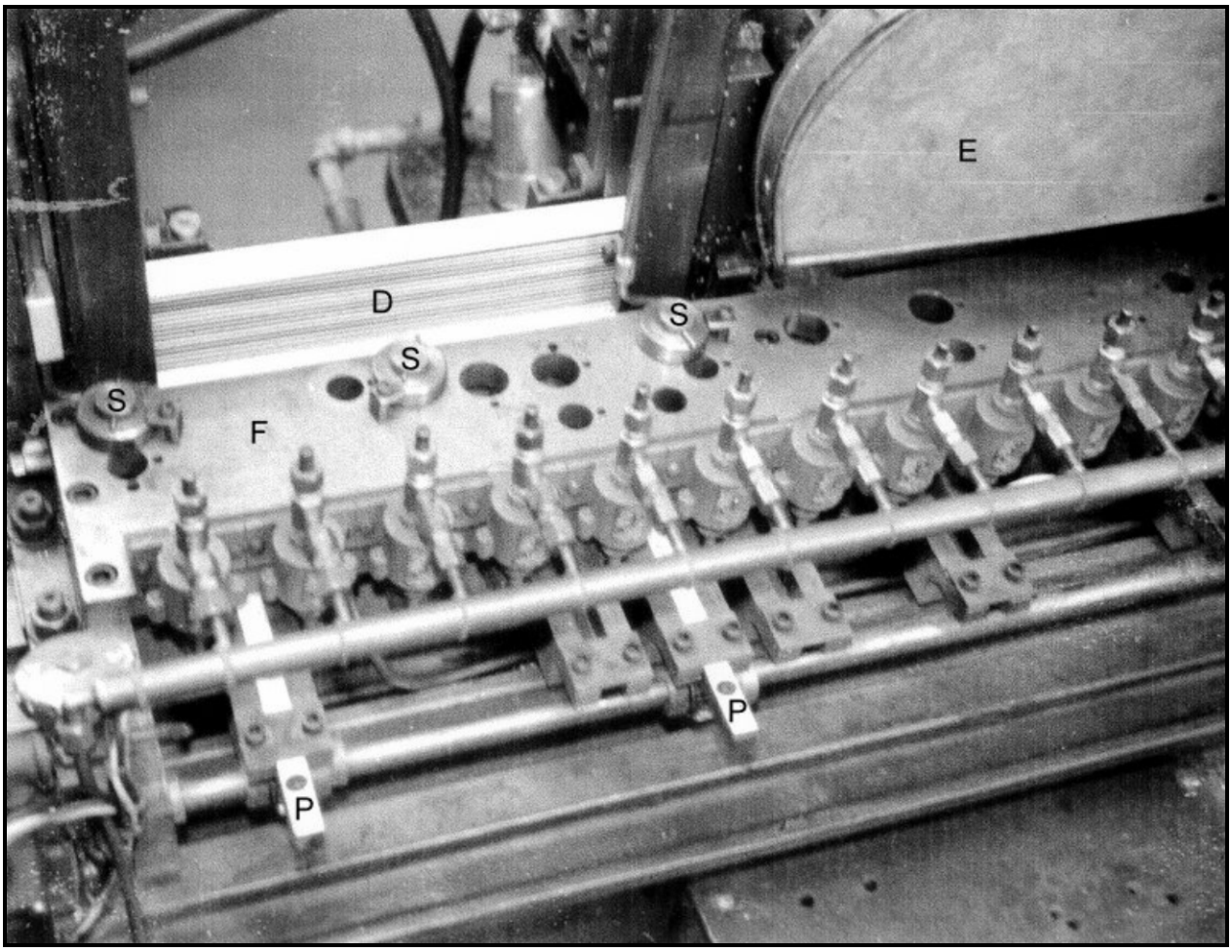


In this image, view 1, the raw Leroy blanks from the sawing operation are loaded into hopper [C] and they are ejected, one at a time, into a set of jaws which are mounted on the reciprocating table [F] which is at the extreme right. The jaws close, grasping a single template blank, as the table moves from right to left. The blank first encounters a regulating head [B] where the edge of the blank is finished and then to a grooving cutter [A] which saws a tailpin groove into the top surface of the blank. Finally, at the left extremity of the table travel the jaws open and the finished blank is ejected into the receiving hopper [D]. The table reverses and the open jaws then travel toward the

right to accept the next template from hopper [C] and repeats the cycle automatically. The machine will continue to cycle automatically for about 20 minutes when the operator will again fill hopper [C] and empty hopper [D]. During this process the operator is free to work at another station nearby and keep an eye on the hoppers. The enclosure marked [E] is connected to the chip removal ducts and the chips are sucked from the machine out of the building into the cyclone chip collectors outside.



In the above image, view 2, the reciprocating table [F] has received the oversize, sawn blank from hopper [C] and has moved to the left through the regulating head and is passing below the grooving cutter. Behind hopper [C] two stack clamps grasp the pile of blanks and lift them about 1/4" leaving one blank in position to allow two push rods to slide the bottom template blank into the clamping jaws. After the jaws close on blank and the table starts to move to the left the stack is again lowered ready for the next cycle.



In the above image, view 3, the template blank in the jaws has been edge regulated and grooved for the tailpin. At the extreme left, the same type of stack clamps have lifted the pile of blanks [D] making room for the clamping jaws to open and the two push rods marked [P] slide the blank under the pile of blanks and retract, the pile is then lowered and the cycle begins again. The push rods as shown on the left are the same as the push rods located behind the hopper [C] which load the blank into the jaws on the table [F] but can't be seen in the image. Notice in the above image there are three pins marked [S] inserted into the clamping area which act as stops when the blank is inserted in the open jaws. The center pin is .002”further forward in the line which allows the inserted blank to be bowed slightly around the center pin before the clamping jaws close. When the blank is machined a .002”reverse bow is machined into the template blank which allows the finished template to rest on the two end points against whatever straight edge is used during lettering. As I mentioned previously nothing is more annoying for a draftsman then to use a lettering template which rocks from end to end while it is being used, this set-up helps to prevent that from happening. We stopped inspecting Leroy blanks for rockers when this machine came on line, another time saver.

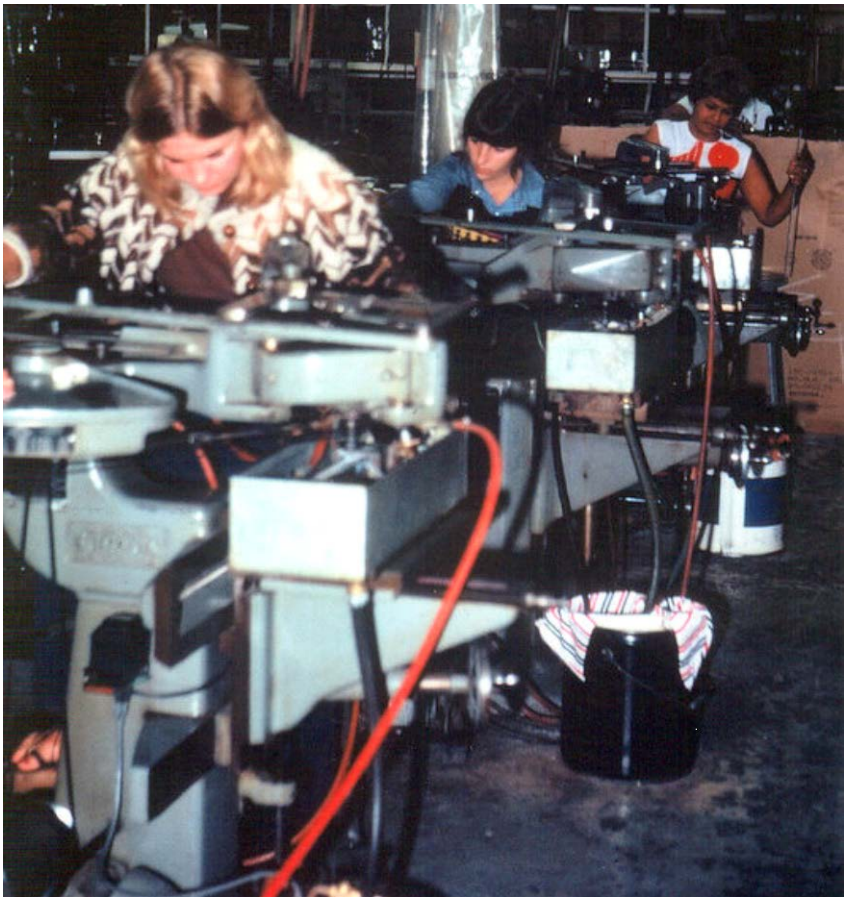
The quantity of templates processed at any given time usually amounted to about five to six thousand in the lot. This was especially true for the 9.5”length which was the most used size followed by the 12” and 15” lengths. This lot of blanks was machined completely on one side before changing over to machine the other side.

BEFORE WE MOVE ON TO THE ENGRAVING DEPARTMENT

In addition to K&E two other companies, competitors in the marketplace, were involved with the Leroy Controlled Lettering product line. First there was the “Koh-I-Noor” Rapidograph Company in Bloomsbury, New Jersey. Koh-I-Noor supplied us with all our reservoir pens, and other sundry items. These pens were exactly the same as their own pens but were marked with the K&E logo. In turn K&E supplied Koh-I-Noor with all of their templates marked with the Koh-I-Noor logo. The main difference in the templates was the tailpin groove, which was along the bottom edge of each of the K&E templates. This was not included on the Koh-I-Noor templates and they had to be used on an extruded aluminum holder with a tailpin groove. This was one feature Koh-I-Noor always wanted but K&E never allowed the tailpin groove to be integrated into the Koh-I-Noor templates.

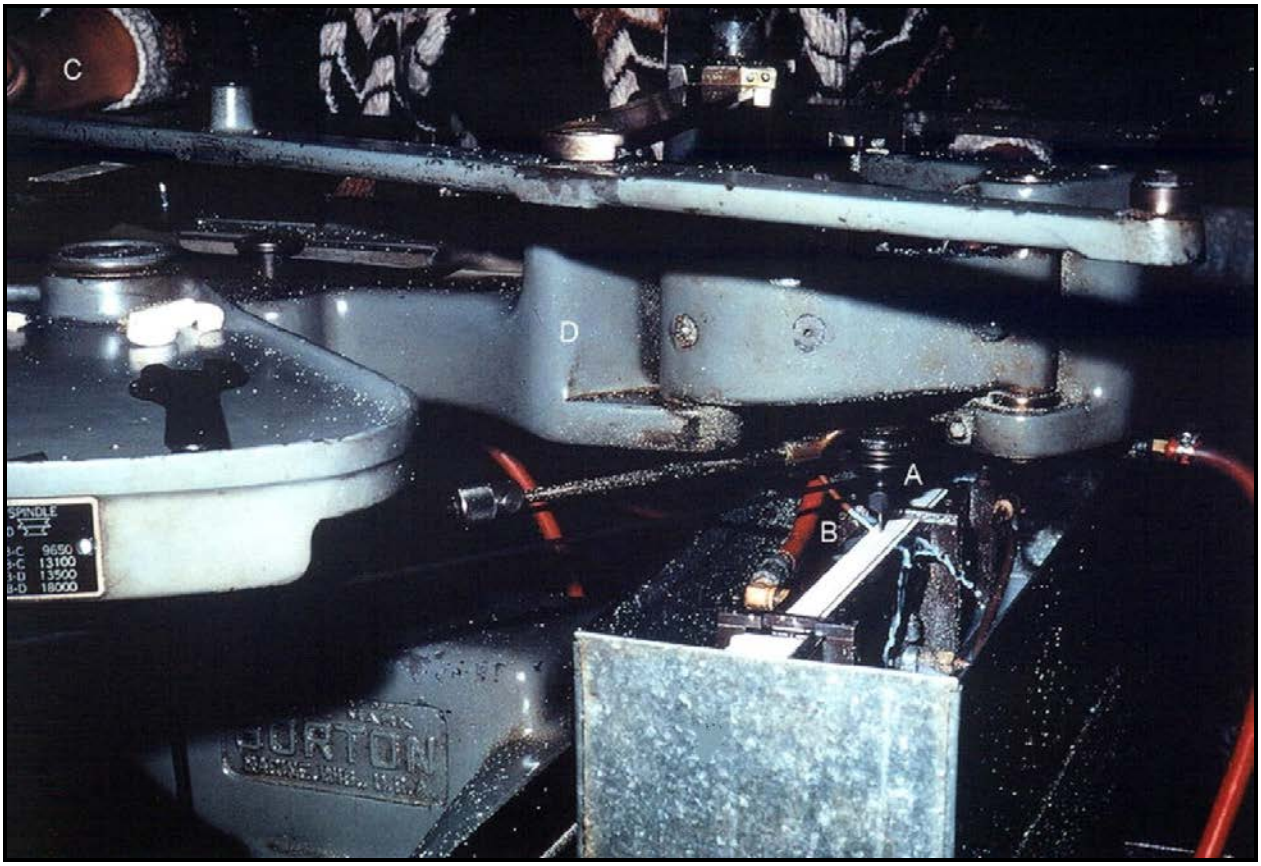
The second company involved with the Leroy product line was a company by the name of “Letterguide”; this company was located in Auburn, Nebraska. Like Hoboken, they used only single spindle engraving machines for producing templates. They produced their own line of lettering templates similar to K&E but stamped with their logo. We would supply Letterguide with all of the vinyl blanks they needed for their own production since they did not have the facilities for making the blanks. In turn Letterguide engraved many of the short run templates found in the K&E Leroy catalog for us. We simply stamped our logo and company name on these templates and packaged them. In addition, the 61 0020 adjustable scriber was their invention and K&E paid a royalty to Letterguide for each scriber we produced as our own with our markings on it. Letterguide also used the very same scriber with their name on it. K&E supplied all the parts that went into their scriber, the only difference in addition to printing their logo on the base, was that several of the parts were black; K&E parts were blue.

SALISBURY LEROY ENGRAVING



In this image three engraving operators are working on single-spindle, Gorton P1-2 engraving machines in the Salisbury Products Plant. When the Salisbury Plant received the Leroy operation from Hoboken in 1956 they received 13 of these machines. This model machine was the only type used in Hoboken for Leroy production and was sufficient for the market requirements at that time. The Gorton P1-2 machine was fully adjustable and would accept all sizes of Leroy blanks. One thing to remember here is that these machines would only allow engraving a single template face at a time, most templates required engraving on both front and back. Leroy engraving production was very labor intensive when the operation was first received at the Salisbury Plant.

As you will see, from 1956 through 1969, as Leroy sales grew, manufacturing improvements were made at the Salisbury plant. In fact, as Slide Rule manufacturing at the Salisbury Plant began to seriously decline in the early 1970's, we actually produced our last slide rule in 1976. Leroy products took its place in the plant and actually required additional employee's to handle the work load, what a happy coincidence for us working at Salisbury Products.



[A] – Cutter spindle in which the engraving cutter is clamped. The actual engraving cutter is carbide which is an improvement over the tool steel used in Hoboken.

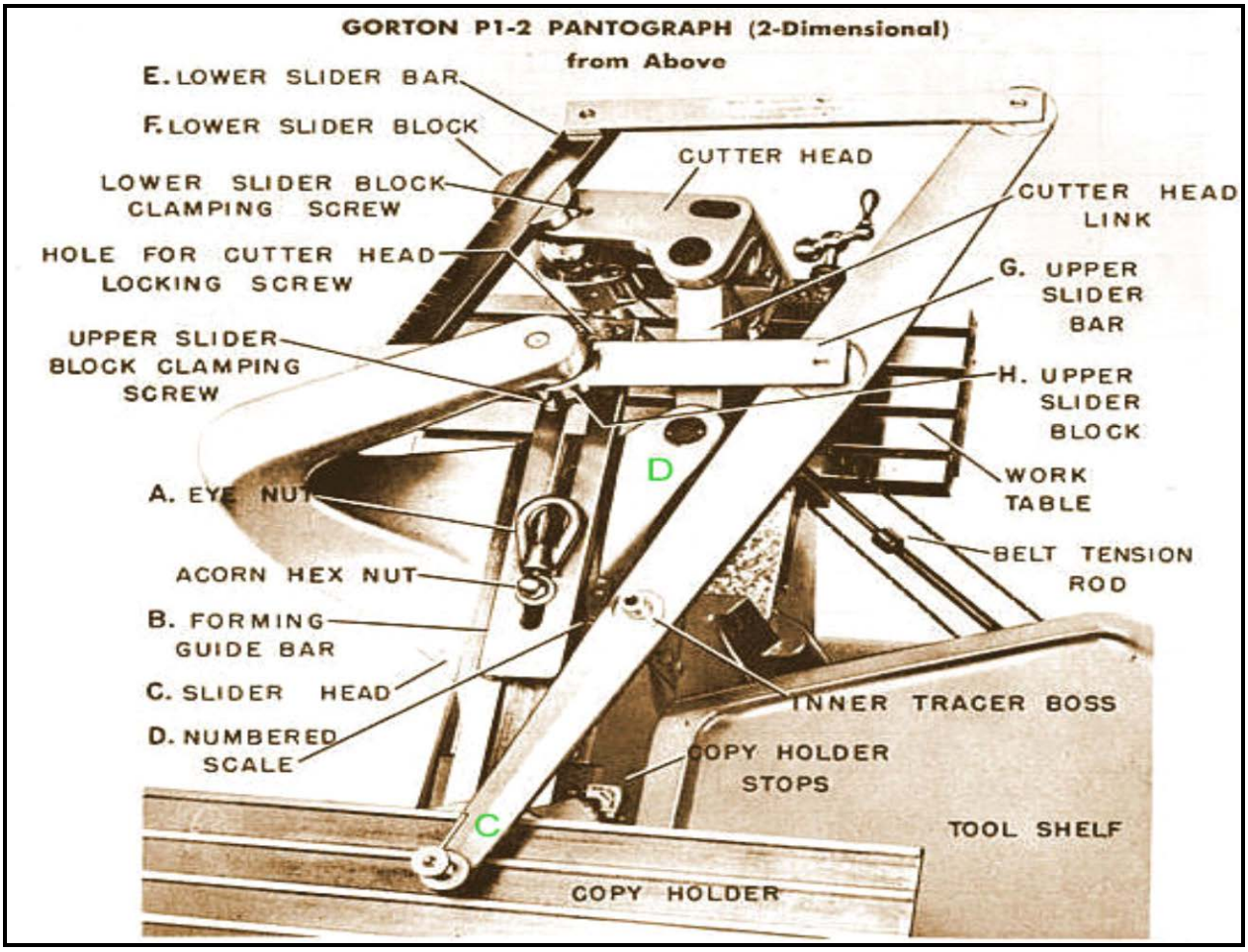
[B] – Coolant-lubricant tubing which directs a stream of coolant at the point of engraving. Because of the high speed of the cutter, without this coolant-lubricant the cutter would not only melt the PVC and ruin the template, but also shorten the life of the cutter.

[C] – Operator's right hand grips the stylus holder and migrates the stylus through the engraving master which then guides the engraving cutter (A) through the Leroy blank in the holding fixture as each letter, number or symbol is engraved in the blank.

[D] – Fixed pivot point around which the pantograph assembly moves. The pantograph is adjustable for various sizes of templates & masters and would be set accordingly.

The pan surrounding coolant spray allows the coolant to collect and return to the pail next to the machine where the chips are filtered out and the circulating pump in the pail then re-cycles the coolant. Operator's left hand operates a lever to raise and lower engraving cutter into the Leroy blank which is clamped in the chucking device. As

each symbol is engraved the operator lifts the cutter and moves the stylus to the next symbol on the master and then lowers the cutter, engraves that symbol and repeats the process until the template is finished.



This image is from a Gorton P1-2 set-up manual showing the adjustable pantograph settings. These machines were capable of engraving any size Leroy template from the 25 inch length down to the shortest 9.5 inch length. The [E] lower slider bar and [G] the upper slider bars are engraved with setting scales. Both [F] the lower slider block and [H] upper slider block are equipped with clamping screws for setting reduction ratios. The engraving master was mounted on the copy holder and was larger than any scale reduction setting; the machine was never used for enlarging the master size. Setting ratios would be marked on the master for all the reduction sizes of Leroy templates for that particular font. The green letters D & C are there to orient this image with the image above. In general, the higher the reduction ratio the better the quality of engraving on the Leroy template, most of the engraving masters were about 30” long allowing for the maximum reach of the operator's arm and still be comfortable.

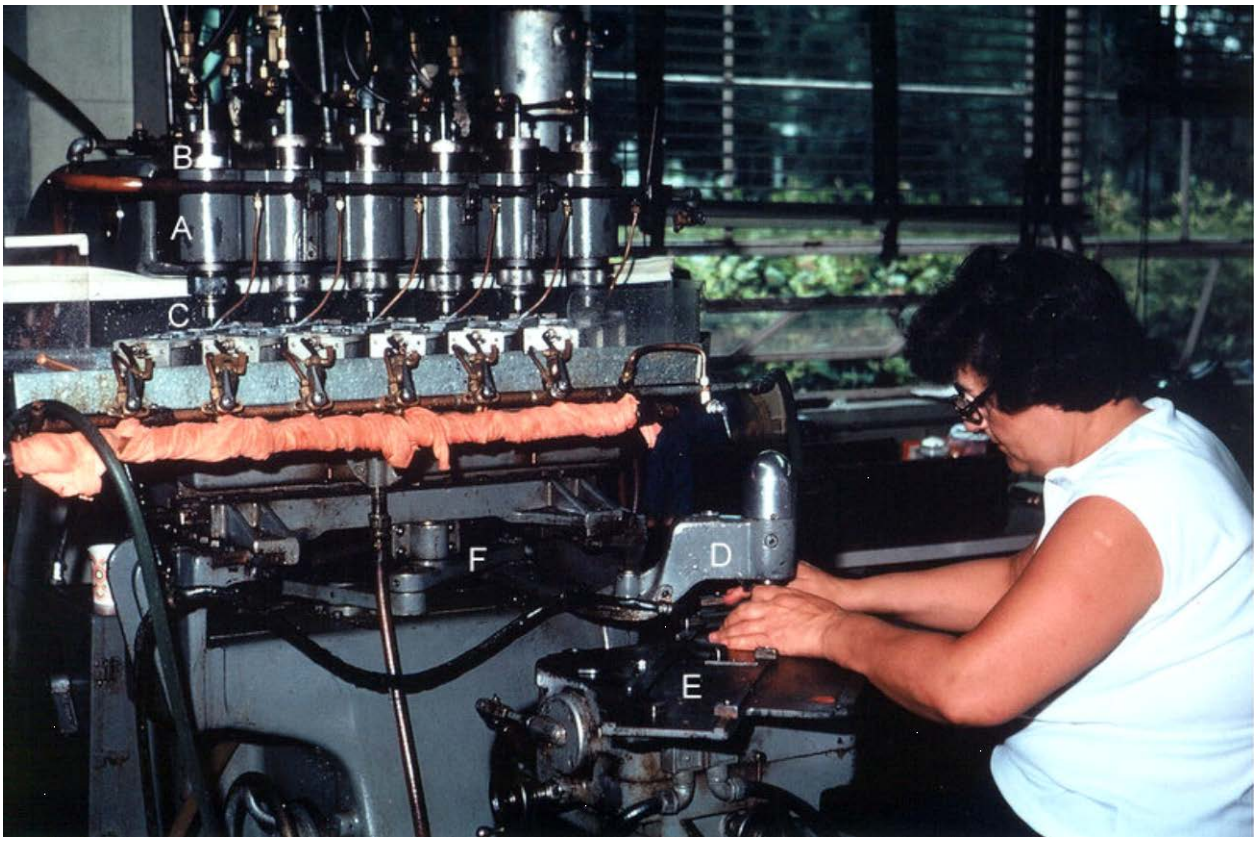
DEVELOPING MULTI-SPINDLES – PART 1

After the Leroy operation was moved to the Salisbury Plant from Hoboken and based on sales projections from Marketing, management must have foreseen the need to expand engraving capacity. The manufacturing floor space at the Salisbury location totaled no more than 10,000 square feet. At least half the space was dedicated to other products in the plant including slide rule manufacturing. Additional single spindle engraving machines did not appear to be the answer.

The Plant Manager and part owner of the Salisbury Plant at the time was a gentleman by the name of Fred Leubuscher, a very resourceful person. He felt they had to find a way to get more engraving capacity per square foot of floor space and at the same time reduce the labor content in the engraving process. The Gorton Company made all the engraving machines now located in the plant so Fred approached them about building a machine that would engrave several templates at a time. The company resisted the idea by saying that the precision built into their single-spindle machine, a carefully balanced drive belt system to cancel out any vibrations, could not be replicated on a machine with multiple spindles. Each of the spindles would require drive belts which would add more vibrations in the body of the machine and would be a nightmare to damp out.

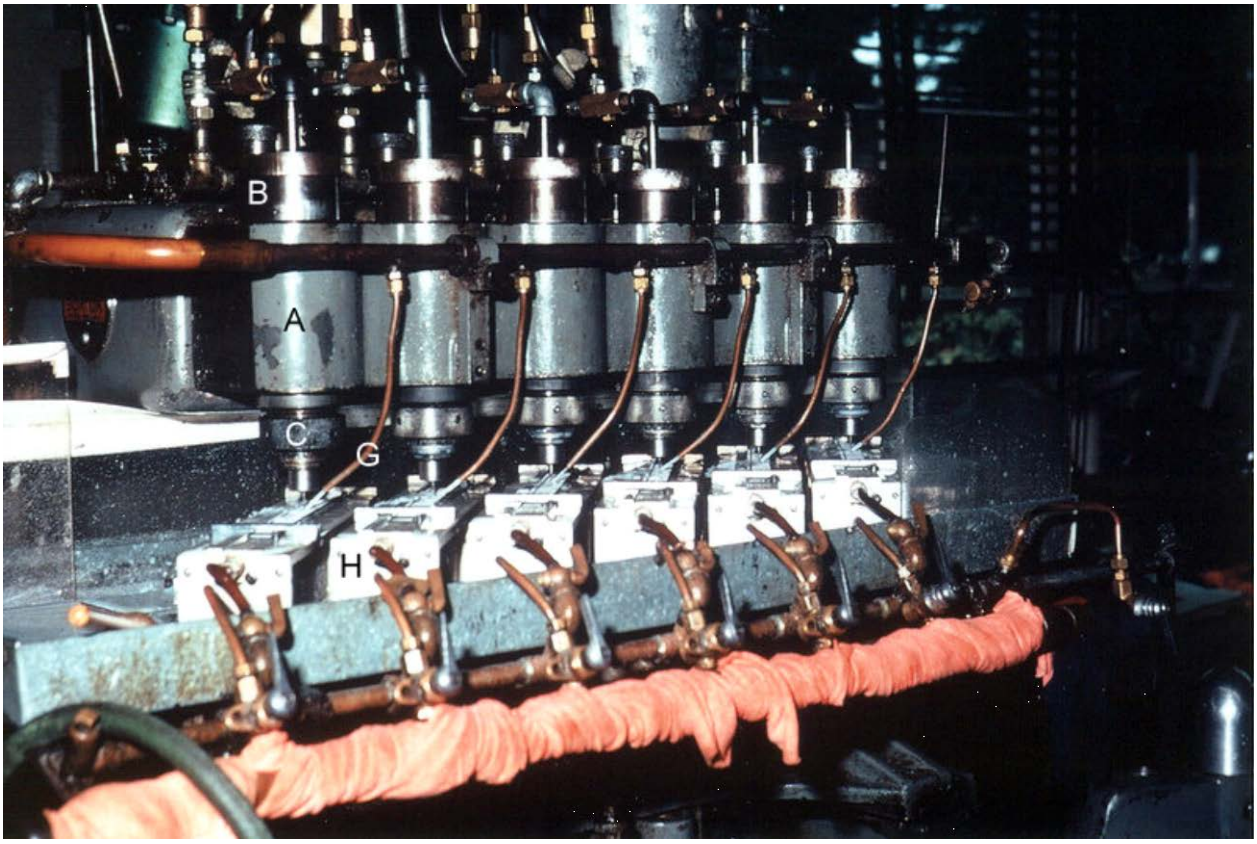
Fred persisted and finally Gorton agreed, however they wanted certain commitments from K&E. They would build a machine equipped with six spindles built to K&E engineering specifications. If the machine did not perform as well as expected, K&E would still absorb the costs. After much consultation with Hoboken engineering and getting the OK from upper management, Salisbury committed to the prototype machine. Only one was ordered at a very high price, Gorton would make money and K&E would take the risk, not a bad deal for Gorton.

Engineering in Hoboken, working with Gorton engineers designed a machine utilizing a massive cast iron body which they reasoned would help minimize any vibrations set up by the belt drives. The machine was built and Gorton was correct, the vibrations did degrade the engraving quality. Much gloom and handwringing was evident in the plant until Fred started thinking outside the box, which was his forte. He wondered why belt driven spindles were the only way to achieve quality engraving, why not use air driven turbine spindles fitted with chucks to hold the carbide cutters. Well, long story short, he was successful in locating a company that made precision air spindles. The new six-spindle machine was stripped of its belt driven spindles and fitted with the new air spindles. After some time working out the bugs with this new set-up, the machine worked very well, producing quality engraving – well done Fred Leubuscher!



This new Gorton engraving machine (above) was also based on the principle of the pantograph, although it was not adjustable for different reduction ratios. Instead of using one master and then adjusting the machine settings to reduce the size of engraving from one oversize master such as the single-spindle machines were designed to do, this concept was different. The new six-spindle machine was set to a fixed 5:1 ratio, not adjustable, instead it was designed to use different size masters, one 5:1 master for each template size required. At [E] is the table for holding the master. At [F] is the preset pantograph assembly below the moving platform holding the template clamping chucks. With this machine design, instead of moving the spindle holding the engraving cutter to engrave the symbols, the cutter spindles remained stationary and the chucks holding the template blanks were moved.

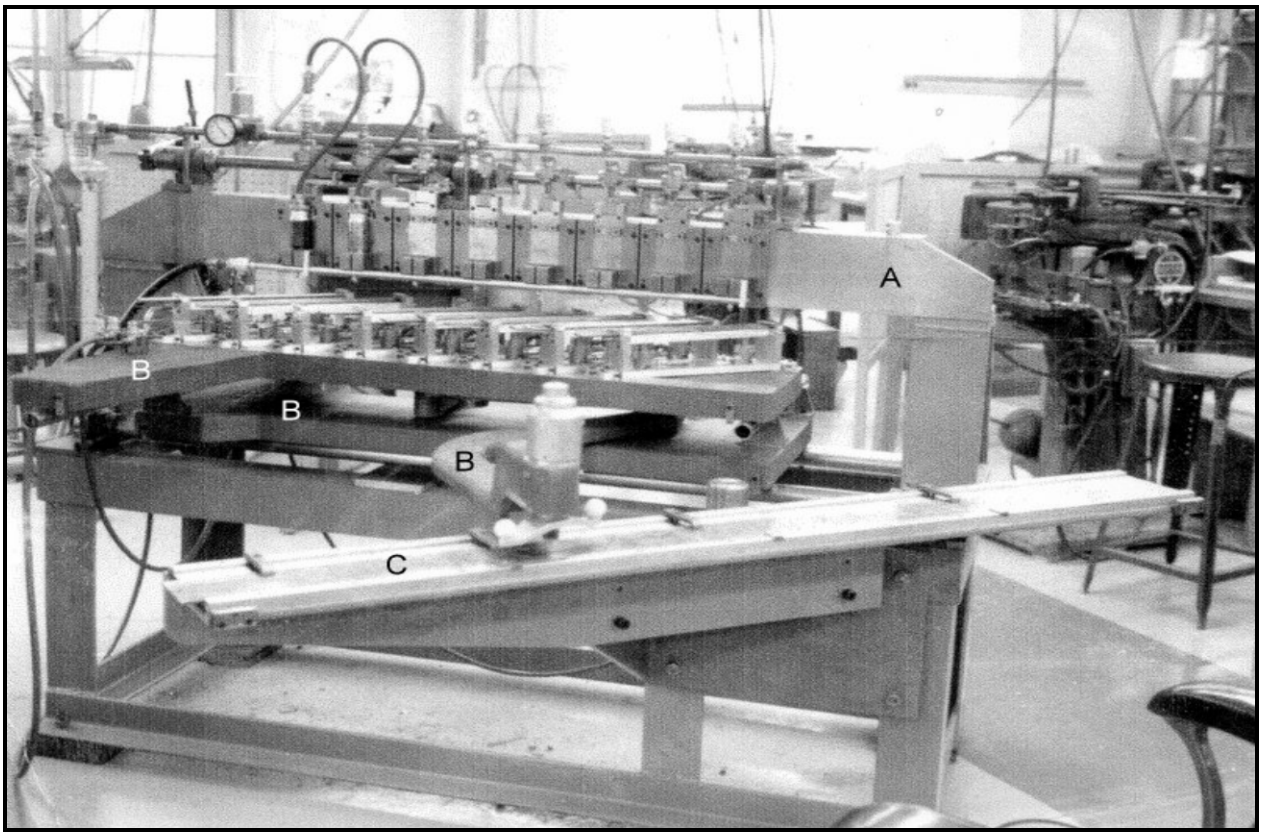
The means of raising and lowering the cutter spindles during the engraving cycle was located on the large stylus holder (D) above the operator's hands. Built onto this holder were two knobs for controlling the stylus and two levers, one operated by each thumb. The operator then moves the stylus through the master using both hands. The lever to lower the cutters was actuated by one hand and to raise the cutters the other hand would actuate its lever. This was unlike the single-spindle machines where the right hand moved the stylus and the left hand lifted and lowered the engraving cutter. Both the single-spindles and this multi-spindle machine were made of iron castings.



In this detail image, [A] is one casting holding all six air spindles; this heavy casting is raised and lowered with an assisting air cylinder. This up and down motion is controlled by the operator while moving from letter to letter during the engraving cycle. When any engraving cutter breaks or needs sharpening, the operator stops engraving for a moment while a service technician removes the entire spindle with the cutter from the machine. The engraving operator is then able to continue engraving without that spindle while it is being serviced. When the spindle is ready it can be re-inserted, locked in position and the operator can just continue with the engraving cycle. At [B] is the adjusting collar for setting the depth of engraving which is a critical setting. At [C] is the locking collar after setting the depth. [G] Is one of six coolant/lubricant tubes, like the single-spindle machines a metal tray surrounds the engraving chucks to collect the spray and direct the coolant with the chips into a container where it is filtered and recycled into the system. At [H] are the six chucks which hold the templates during engraving. These chucks are lowered after the engraving cycle, the engraved templates are removed and chucks are blown off removing engraving residue. A new set of six template blanks are loaded into the chucks, a single lever is actuated turning on vacuum pressure to hold the Leroy blanks in the chucks as they are raised and clamped in the chuck and another engraving cycle started.

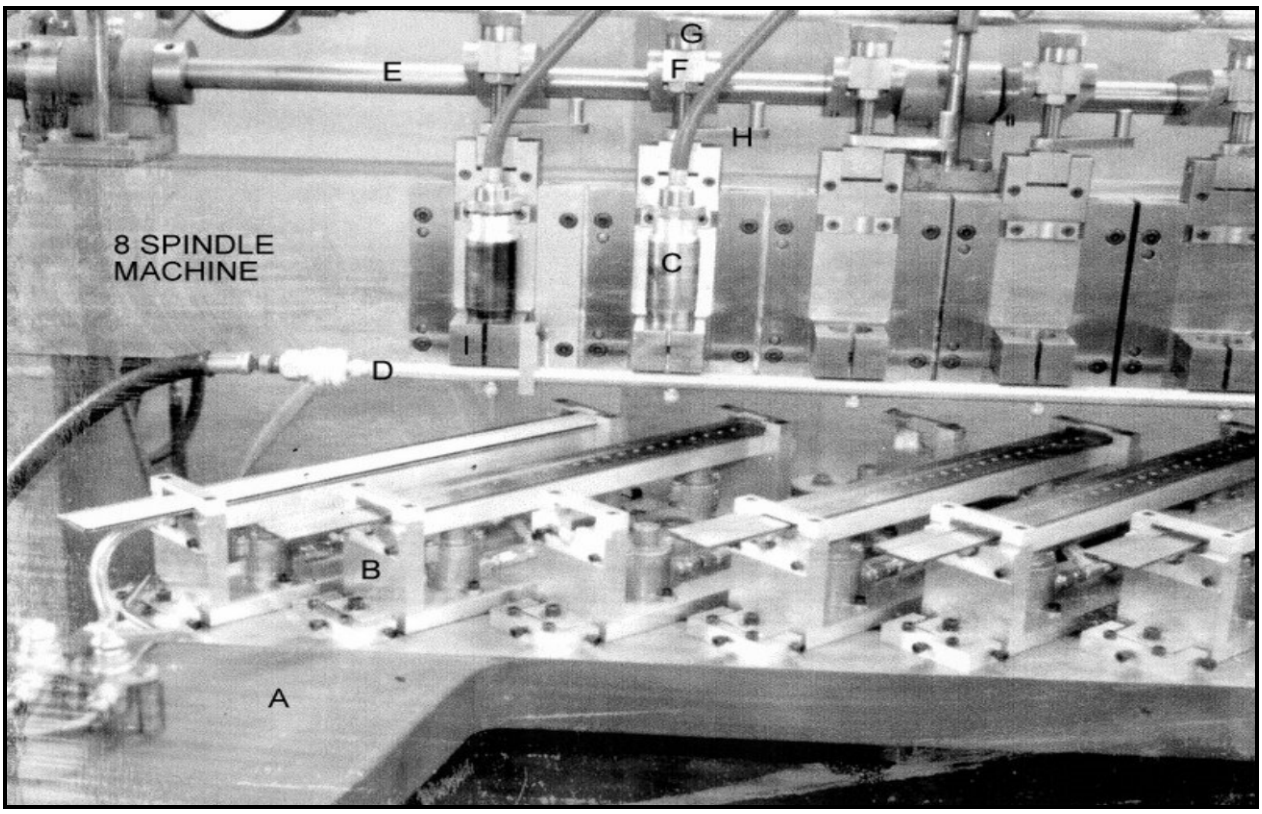
DEVELOPING MULTI-SPINDLES – PART TWO

Well, the new 6 spindle machine turned out to be an excellent performer, reducing the unit cost of engraving a template by over 75%. You guessed it – Fred Leubuscher was on a roll, he reasoned that by using the air turbine spindle concept Salisbury could go it alone and design and build an even more efficient multi-spindled machine internally. The 6 spindle machine allowed the plant to retire three single-spindle machines which were returned to Hoboken freeing up floor space. After consulting with Engineering in Hoboken and working with our in-house machinist and design draftsman it was decided to attempt an 8 spindle machine.



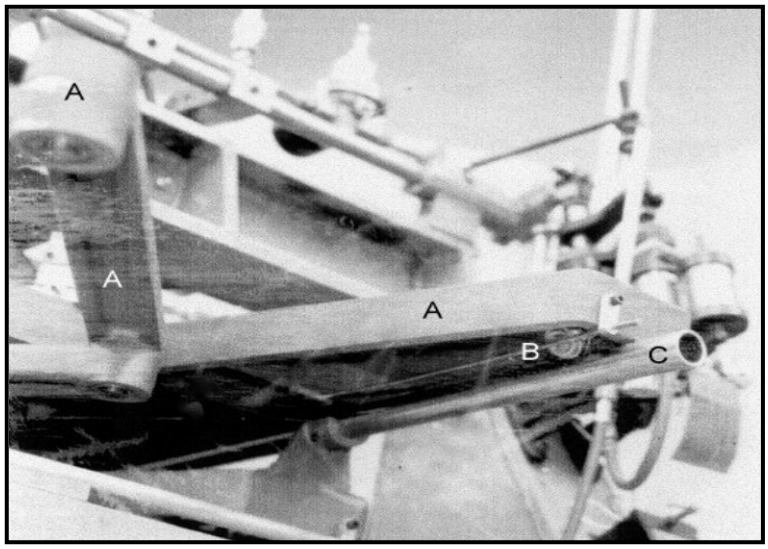
One of the more important findings when the 6 spindle was built was the effort the engraving operator had to make to overcome the inertia of the heavy, cast iron mass of the 6 spindle machine during the movement of the stylus through the master. This problem was addressed by lightening the moving parts of the new 8 spindle machine under construction (above). The three moving castings marked [B] were cast in magnesium and the template chucks were machined from aluminum and clear anodized, a coating to prevent the aluminum from marking the white vinyl surface of the templates. [A] The non-moving steel beam on which the spindle holders are mounted. [C] Table to clamp the masters on when engraving.

[A] Magnesium base casting, (below) all the template chucks are mounted on this base. As you can see there is no coolant pan below the chucks, which will be fitted later. The main frame of the machine supporting the moving magnesium castings is built of welded steel construction, instead of expensive iron castings. The horizontal beam with the marking [8 Spindle Machine] on which the engraving cutters mount is a ground, fixed steel channel-beam. Each of the 8 cutter spindles are lifted and lowered by a large air cylinder mounted on the side of the machine turning the shaft [E]. Adjustable arms off the shaft at [F] control the depth each cutter makes and are adjusted by the operator. [G] Micrometer depth setting knobs. [H] Locking lever.



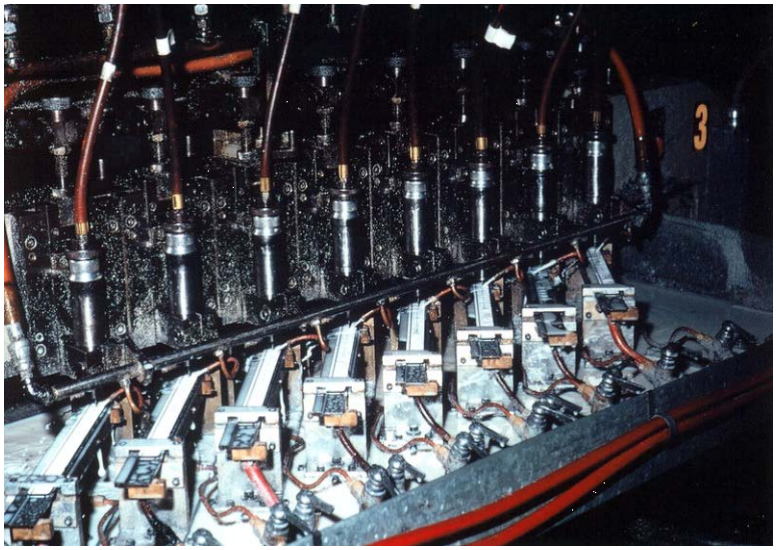
The template clamping chucks [B] have a series of holes across the top face; these holes are connected to a vacuum source which holds each template in place as the clamp is raised by two small air cylinders located under each moving chuck. When the template chuck is actuated, and raised up, the template is firmly held by the bridges located on each end of the chuck. All the templates are inserted into the chucks and then one lever is actuated to turn on the vacuum and lift and clamp all 8 template blanks. By lifting the template blanks against the two bridges the chuck is registering to the top surface of the blank for engraving. Registering to the top surface of the blank was important to minimize engraving depth problems as a result of slight variations in the thickness of the PVC template material. Consider that the fine line engraving was only about .012” deep, and the thickness of the white vinyl was only about .010” thick. Only a couple thousandths to work with before the engraving will

not penetrate into the black core and the engraving will then have white engraving instead of the black contrast in the engraving – not what we wanted! Each chuck can be fine-tuned for position using micro adjustable clamps at the base of each chuck assembly. At [C] an air spindle is clamped into position with one cap screw through the slotted portion at [I]. At [D] this coolant-lubricant main feed pipe has fittings above each chuck for attaching the tubing for directing the coolant to the cutter at the point of actual engraving.



Back of the 8 Spindle Machine viewed from below. (left)
[A] Moving magnesium base and pantograph assembly. These moving parts glide on ground, stainless steel tubing [C] mounted below the base. At [B] two cam followers in a V configuration roll on the steel tubing for an almost frictionless motion which greatly aids the engraving operator while moving the stylus through the master.

To the left and below are two views of the 8 Spindle machine in use. This second version of a multi-spindle machine built in-house was an outstanding performer. This machine was so precise that it was reserved for engraving only the smallest size templates, 40C through 80CL in fineline only. While we were adding to our capacity for producing Leroy templates, demand for the product continued to strain our capacity to meet Marketing projections, we had to continue to build more engraving machines to stay ahead of demand.



After the 8 spindle was finished the next project was a 13 spindle machine built on the same design as the 8 spindle. After placing this 13 spindle machine on line for several months someone figured out that there was enough room on the moving platform for an additional four spindles, two added to each side of existing template chucks. Hoboken R&D paid us a visit and studied the idea and agreed that it was feasible. So, we added the extra spindles. The machine performed very well as a 17 spindle (below) and it was used only for standard line engraving, not fineline. Didn't take long before the Salisbury plant contracted an outside machine shop to copy this machine and build another 17 spindle machine. Now with the second 17 spindle, without counting the few single-spindle machines left in the plant, we had 48 spindles pumping out Leroy templates and for the first time felt comfortable with the demand for Leroy around the world.

13 Spindle machine with added 4 spindles making it a 17 spindle machine.

When working on the single spindle machines the operator would stand or sit on a stool to operate the machine. The table, for holding the engraving master was on the right at a comfortable height for the operators arm, not comfortable for a left handed person. For the multi-spindle machines, since they were much larger machines, the table for holding the master was just high enough for the operator to sit in a rolling desk chair with the knees under the holder so that they could roll side to side as they engraved. The master holder on the seventeen spindle machine was about five feet long and would accommodate an engraving master up to four feet in length.

A normal engraving cycle on a multi-spindle machine would go like this: assuming the last “load” of engraved templates has been removed. The operator would take an air hose and blow off each chuck which would have coolant and engraving residue on the surface, the chucks would at this point be in the down position. Then she would count out 17 templates, assuming the 17 spindle machine was being used, from a tote box located alongside her machine inserting one template at a time into each chuck. When all the chucks have been loaded she would then actuate a single lever which would turn on the vacuum to secure the blanks and air pressure to the lifting cylinders, all the chucks would then rise up at once against the bridge stops, the engraving position and the coolant would start flowing at each cutter.

Now she would sit down and holding the stylus arm slide her chair to the left or the “a” end of the master, place the stylus into the “a” character. She would then press the micro switch on her left control arm and the beam would lower into engraving position. The operator would then migrate through the “a” character twice, once clockwise and then counter clockwise. At this point she would then press her right micro switch and the beam with the cutters would rise up out of the templates. She would then move to the “b” character and does the same thing, and so on until all the characters on the master have been engraved. At this point she would park the stylus in a hole at the end of the master. She would then stand up, actuate the lever in the opposite position and all the chucks would lower and the coolant would stop flowing.

She would then pick up the air hose and blow off all the templates in the chucks to remove the engraving residue and excess coolant. The next step was to slide out each template into her hand until all 17 were removed. At this point she would go through the inspection procedure, that load of templates would be placed into another work in process tote box and the process repeated until the run was finished.

The spindles holding the engraving cutters were air driven turbine type, running at about 18-20,000 RPM. These turbine spindles were capable of running at up to 80,000 RPM. If they were run much faster than 20,000 RPM the engraving cutter would start to melt the vinyl template, it was impossible to properly cool the cutters. Initially each spindle speed was set using a hand held strobe light which we found to be the best way to control the speed accurately. Once the spindle speed was set to optimum that spindle would be the mated to that position in the machine. If the

spindle was moved to another machine or position, this setting method would be repeated.

Even with all this engraving capacity I remember a two year time period, in the mid 1970's where we had to run the engraving department three shifts around the clock, six days a week, to just keep up with demand. This demand was mainly for the 61 0300 series templates, produced on the multi-spindle machines, eleven of these templates were used in the 61 2901 set, the largest set we produced as well as sold individually. At one point Marketing advised us to back off making the 61 2901 sets, we had over 10,000 sets (110,000 templates) sitting in the K&E Distribution Center inventory in Teterboro, New Jersey. Before the year was out Salisbury had to resume producing these sets, inventory was getting low!

To put everything in perspective, the Leroy product line had the highest profit margin of any other single product in the entire K&E Company, all plants. The main reason that the Leroy products carried the largest profit margin was the labor time factor involved. Engraving one template at a time on the single spindle machines was many times longer than when the same templates were engraved on a multi-spindle machine. The seventeen spindle machine for example would yield 17 templates in a little more time than it took to engrave one template on the single spindle machine.

As the Salisbury Plant designed, built and installed the multi-spindled machines, the F.A.P. (Factory Authorized Price) was lowered to reflect the labor savings. At all the K&E manufacturing locations when their budget was submitted for the coming year, labor and material costs were to be based on the plant breaking even on the year-end Profit & Loss Statement. Marketing then had to set the profit margins for each product. The margin was not changed for Leroy and of course the profit margin was very large indeed. None of our competition could even come close to challenging K&E in the market place; they were still using only the old single-spindle machines. When I was working for K&E in 1975, if memory serves, I believe it cost us about 90 cents, material and labor to produce a 61 0300-80CL template which K&E retailed for about $10.00. During the 1970's the bottom line at K&E was hurting, sales were in a slump. What a time period for Leroy to add to the bottom line the substantial profits from this outstanding product.

ENGRAVING SUPPORT

We covered the production of LEROY blanks and the evolution of engraving machines at the Salisbury plant in contrast to the early Hoboken engraving. Now we will look at the actual activities supporting the engravers and their machines. Most important would be the engraving cutter support. During each shift cutters would dull or break and need sharpening and usually one person on each shift was responsible for this activity.

In the left image, an operator is sharpening a carbide, multi-spindle cutter on a Gorton grinder which is fitted with a 500 grit (fine) diamond wheel. The cutter is sharpened while still chucked in the air spindle, notice the air hose attached. We found this method saved time and the cutter runs truer than when the cutter is removed from the spindle, sharpened and re-chucked in the spindle.

In the image below on left, the operator is sharpening a single-spindle cutter; notice there is no air hose involved. On a single spindle machine, the engraving process would stop until the cutter was changed and the new cutter engraving inspected. Sharpening an engraving cutter was a delicate process requiring a keen eye and a steady hand, not many people were able to learn to do this work. These Gorton grinders were made by the same company that made our Gorton P1-2 single-spindle engraving machines. During the sharpening process a suction hose would remove the grinding dust and collect it in a small cyclone device, this diamond/carbide residue was collected and sold to a company that had a process to recover the diamond dust from the carbide dust, the diamond dust was then reused in other industrial applications. The grinders shown in the image were for single-spindle cutter sharpening. On the machine to the right [A] is the precision fixture in which the cutter is chucked, it moves on three axis's, allowing the operator to fine grind the carbide cutter to its finished profile. At [B] is main drive spindle for attaching different grit diamond wheels. When starting with a raw carbide .125" dia. blank it was necessary to use a 300 grit (rough) diamond wheel to start the shaping process, then the wheel was changed to a fine grit to finish the sharpening. The Gorton grinders were made by the same company that made the P1-2 single-spindle engraving machines. In this image the operator is sharpening a single-spindle cutter, notice there is no air hose attached. On a single

spindle machine a stock of sharp carbide cutters were always on hand, as they dulled or broke the operator would change the cutter and place the dull or broken one in a box which would then be picked up and re-sharpened during the day. On a single spindle machine, the engraving process would stop until the cutter was changed and the new cutter engraving inspected. Sharpening an engraving cutter was a delicate process requiring a keen eye and a steady hand, not many people were able to learn to do this work.

In the image below left a sharpened, multi-spindle cutter is being checked out on a Shadow Graph profile projector in a dark space before being put back into the engraving machine. At [A] the air spindle is positioned in a V shaped cradle to center the spindle. At [B] a bright light source is projected through a lens which aligns the light into parallel rays, this light then projects the profile of the sharpened cutter tip down to the bottom of the housing where it bounces the image off an enlarging mirror and back to the underside of a glass plate at a 100:1 ratio. The projected image is only about .050”of the tip of the cutter, the only part of the cutter that really does the engraving in the template blank. At [C] the operator is moving a frosted glass plate with etched grid lines over the projected image and reading the angles and tip of the cutter, you may be able to make out the grid lines if you enlarge the image. When the profile is aligned properly, she then holds the etched glass plate stationary and rotates the cutter chuck and she can then see on the grid how well the cutter is sharpened. She will check sev-

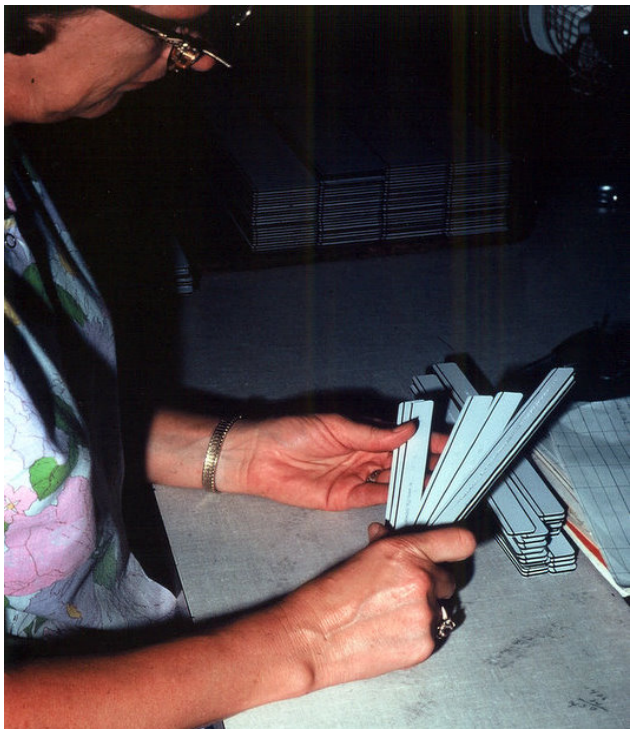
eral angles on the cutter before returning the spindle to the engraving machine. A single-spindle cutter is also checked out on this same set-up. The only change required is a different V shaped cradle to center the .125" cutter. Engraving depth of the cutter in the PVC blank rarely exceeds .020" The depth for fine-line engraving was kept at about .012 to .014 inch, this was just breaking through the .010" thickness of the white layer of the PVC blank, this was necessary to not lose the islands on very tiny engraving such as the 61 0300-40C. The regular engraving depth for larger size templates could range from about .014 to .020 inch.

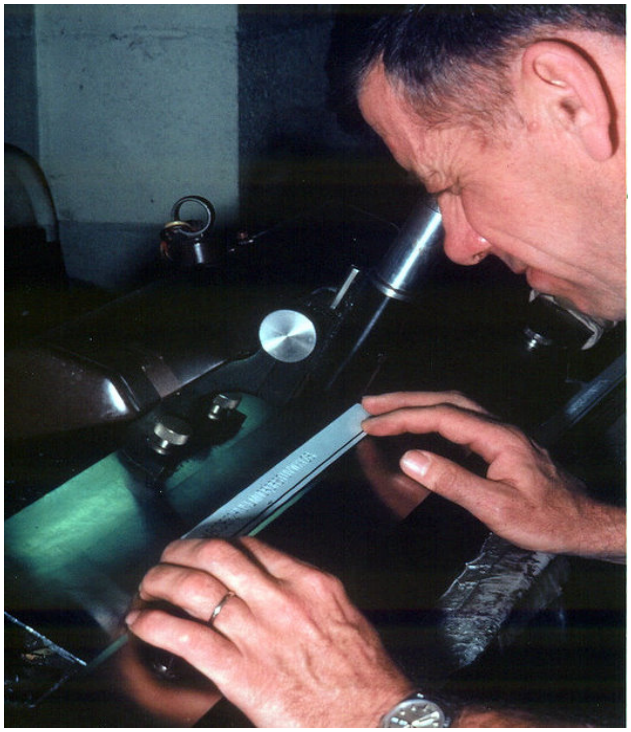
During each engraving cycle on the multi-spindle machines one template from each load had to be checked on this fixture, a different template each time. The reticle in the microscope was etched with several lines to show the tolerances. The template was placed on the fixture against a parallel straight edge and slid across the straight edge under the microscope. The operator could see if the bottom of the engraving passed between the etched tolerances, assuring the engraving would be parallel to the bottom of the template. If the engraving passed this test the template would be flipped and the reverse side engraving also checked. It was very important that each side of the template met these tolerances. The draftsman would use both sides of the template for his lettering, all the lettering had to land on the same base line. If this test showed a problem steps had to be taken to correct the problem before restarting the engraving process. As for the single-spindle machines, every tenth template had to be checked the same way.

The last step was to check the "fit" of the engraving during the engraving process. It was very important to be sure that the engraved line in the templates would have a snug fit to either the fine line or the regular line tracer pin mounted in the scriber used for lettering. Each engraving operator in the plant was given a personal set of Leroy scribers fitted with "go"- "no go" pins, these pins were made of carbide and were ground to the exact tolerances called for in the specs. The pins were clamped in the position where the tracer pin would be located. The "go" scribers were painted green, the "no go" scribers were painted red.

They were used in this manner: the template was placed on the table top and the green scriber pin was inserted in the engraving in several places just as if they were going to trace with it. If the green scriber moved smoothly in the engraved line the en-

graving was OK, if the green scriber hung up or “dragged” in the engraving, the engraving cutter had to be reground, it had worn too small. The red scriber was then tried, if the red scriber moved easily through the engraved line, without “drag” then the engraving cutter was too large and had to be removed and reground. If the red scriber dragged in the engraving, the cutter was not too large. This proved to be a fast and simple test for the operator to perform and worked well in the department. Of course a different set of test scribers were used to check the standard line and the fine line engraving. These in process checks were done repeatedly by the engraving operators during the shift on all of the engraving machines multi and single spindle.





In the above image at left, the engraving inspector would continuously inspect templates after the engraving is finished. Any templates that failed to meet this overall visual inspection were scrapped. After this inspection the templates would be stacked in tote boxes and moved to the next station for cleaning. The blanks still had some engraving debris along with the coolant/lubricant in the engraved letters. This would be scrubbed out at the cleaning station.

In the image at right, a Quality Control inspector will also do a roving inspection during the day on all products being manufactured in the plant as well as the incoming materials for manufacturing. This inspector was on the Salisbury payroll but also answered directly to the Quality Assurance Department at Corporate. He had the authority to stop any operation in the plant if he feels the quality does not meet K&E standards. The operation will not resume until he brings the problem to the plant management and a solution is worked out.

FINISHING LEROY TEMPLATES

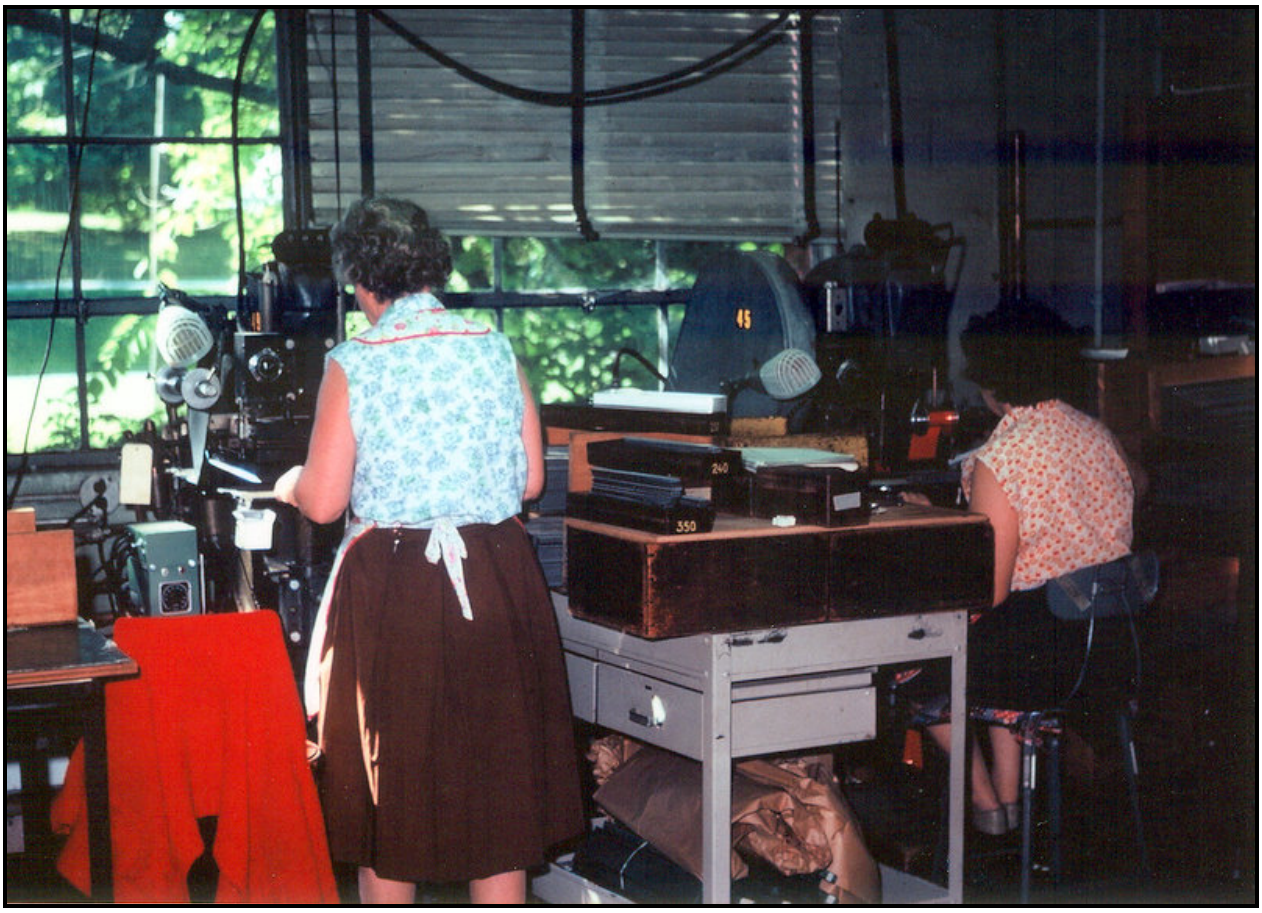
After final inspections all engraved templates had to be cleaned to remove engraving coolant/lubricant and fine debris from the engraved lines. This was done by hand using nylon brushes with .007 diameter bristles. The fine bristles would be able to get down into the fine line engraving to loosen particles left over from the engraving process without scratching the vinyl surface. This scrubbing was done in a tray in right image with Isopropyl Alcohol which would not only dissolve the lubricant film but also evaporate rapidly. Scrubbing was a fast process, just had to be sure to run the brush over all the engraving in a small circular motion.

After scrubbing both sides of the templates in the tray, they are then fed through an opposing air knives device in left image, under the plastic shield in front of the operator. The air jets blow off the alcohol and particles left in the engraving. A large duct carried off the alcohol mist away from the operator to the outside of the building.

THE ROLL LEAF STAMPING SECTION

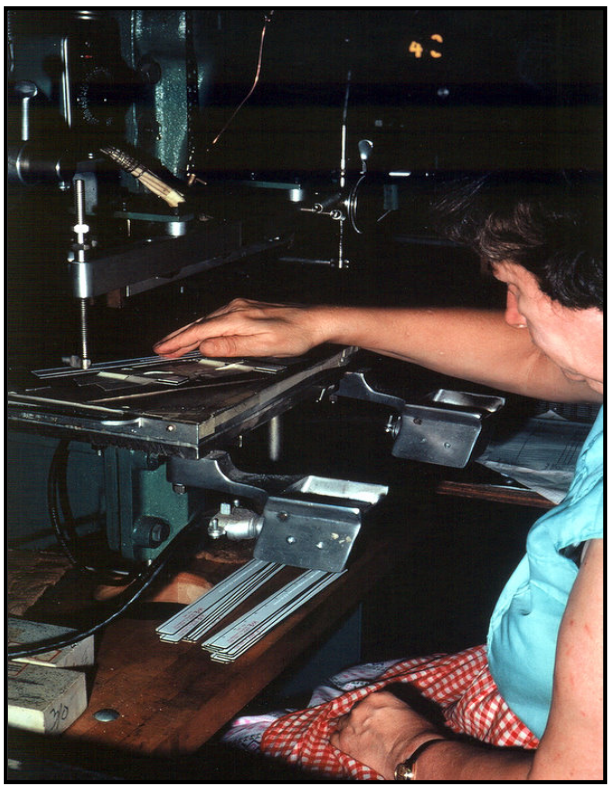
After the template cleaning the Leroy templates are moved to the stamping area below where the K&E logo, catalog number information and letter spacing guide will be hot roll leaf stamped. The operator on the right was stamping the logo information; notice the red roll leaf set-up. Four stamping presses in this section were able to keep up with stamping all the Leroy work along with stamping triangles, French curves, Flex-

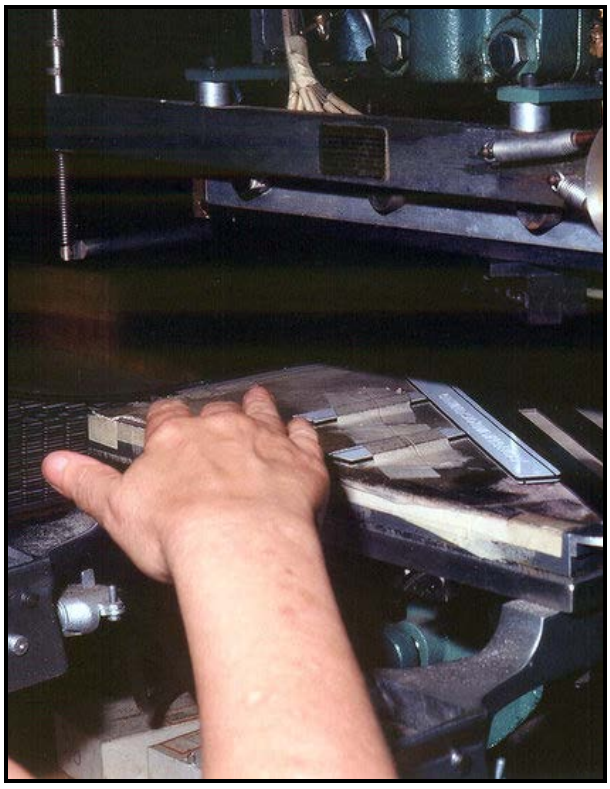
curves and the beginners slide rule. This was a very busy area, just about all the production in the plant passed through this section including a few slide rules.



All the Standard Leroy templates, 9.5” 12” & 15” which were by far the largest volume, had hardened steel block stamping dies made to simplify set-up. These dies had all the information required for the red logo set up and made for a very fast set-up change between the various catalog sizes. Matching lettering spacing dies were also very easy to include in the set-up. The balance of the template catalog items including all the larger template sizes along with any special templates required setting type in order to do the stamping and was a little more complicated for changeovers. Below are two detail images of the operator feeding the stamping machine. The setups for stamping were temporary and would be changed for each size template stamped, hence all the tape.

Images below show an operator stamping the black spacing scale; this scale was required on all the standard Leroy templates. The scale was very useful for a person lettering a line of text on a document; it was an easy way to center the text on the page.





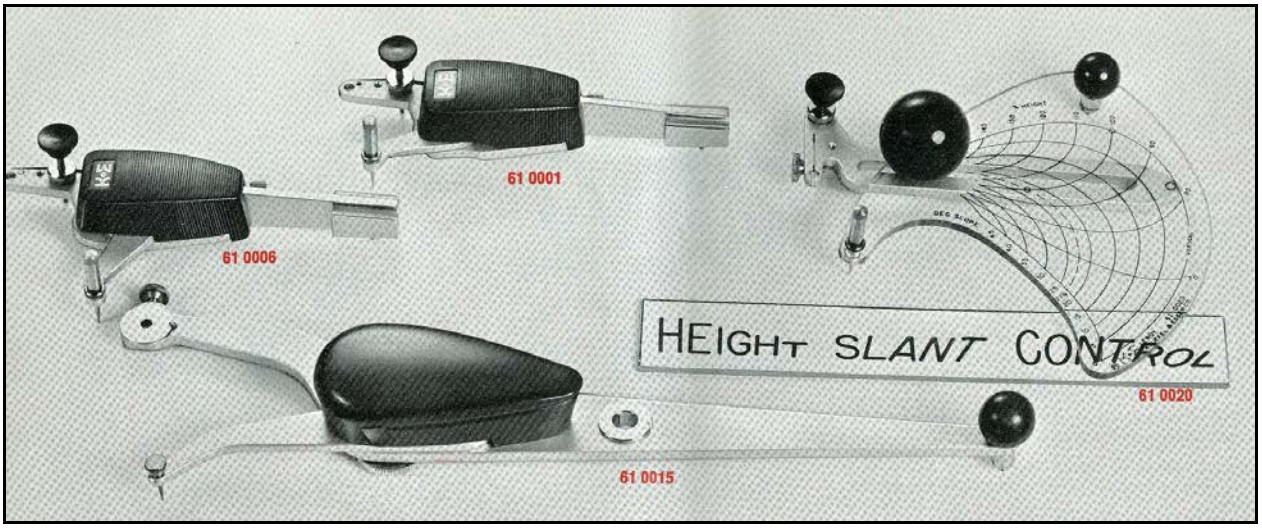
Because we are covering the stamping of Leroy templates I thought I would digress a bit. Always a question for the Salisbury Plant – “when will you guy’s produce left-handed scribers, templates and lettering sets?” We heard this lament from our many distributors over and over again. There was a genuine concern by K&E Marketing that perhaps one day the GSA would insist that we make equivelant products for left handed draftsmen or lose government orders for Leroy which were considerable. About 15% of the general population are left handed, possibly this same ratio applied to draftsmen and, understandably, they felt they should be offered left handed Leroy products.

Over the 29 years I was involved with Leroy I saw several attempts at using the the same parts used in our standard scribers to “cobble-up” a usable left-handed scriber and none were practical. Considering the tooling changes required to produce new parts for left handed scribers as well as the changes to our assembly machines along with having to stock and distribute all the various left handed products seemed un-satisfactory, another solution had to be found.

Somewhere along the line someone had an idea, an awkward idea for sure. What if we shifted all the engraving on a template to the right and then stamped the catalog information to the left to allow tailpin space for a scriber and place the template below the straight edge instead of on top of the straight edge, would a left-handed draftsman be able to use our standard scriber below the template instead of above the template?

The idea worked, though I'm sure using a scriber and template in this manner would be somewhat uncomfortable but the idea was offered and accepted by the distributers and we put this left-handed template configuration in our line for all the standard templates. Now left handed draftsmen were able to use all of the standard Leroy instruments, no need to change anything other than the location of the engraving on the templates.

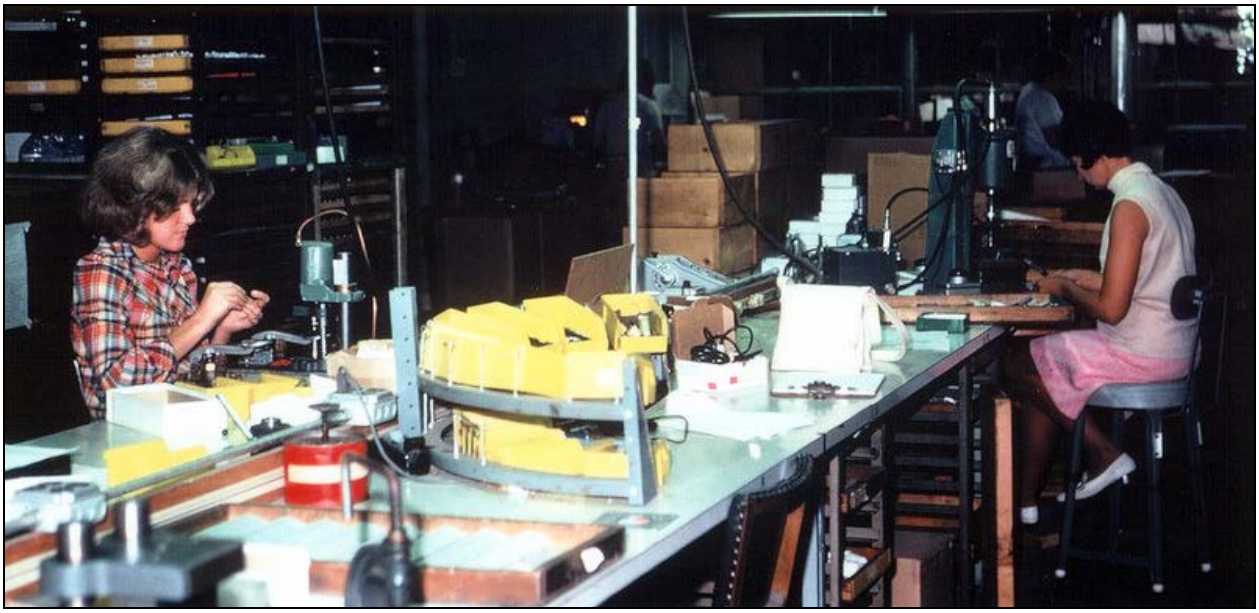
LEROY SCRIBERS



Above are images of the most popular Leroy scribers produced at K&E Salisbury. The 61 0001 fixed scriber & 61 0006 adjustable scriber accounted for the overwhelming number of scribers shipped, many thousands each month. These same scribers fitted with a KIN logo were produced for the Koh-I-Noor company for use with their templates. The 61 0015 & (61 0010) not shown in image were produced in much lower quantities, perhaps in the hundreds each month. The 61 0015 shown is an adjustable version, the 61 0010 was a fixed scriber, non-adjustable; meaning the arm holding the tracer pin could not be moved. The 61 0020 height/slant/control scriber was produced in small numbers. This unique scriber was designed by the Letterguide Co., and produced by K&E Salisbury. We paid a royalty for each scriber we sold under the K&E name and also made the same product for Letterguide with their name on the device.

I remember seeing the calculations for the last scriber design we made in the plant, the 61 0005 above. One of the Engineering math guys in in Hoboken filled three pages of office paper with calculations to lay out the three points of this new scriber with the adjustable tracer pin arm in different positions for manufacturing. That surprised

me, a non-math guy, that many calculations for a rather simple device for tracing a 15 degree left slanted engraved line on a Leroy template to achieve a vertical line on drafting paper. The geometry of the three points of the scriber, the pen point; tracer pin and the tailpin of any scriber form an obtuse triangle. If you place any scriber in a template as though you were going to letter with it and move it slowly through several engraved lines and observe that all three points moved at the same time, no fixed point, a rather complicated movement. Not such a simple device after all. I really didn't appreciate the design math involved until I saw these pages.



This is the bay where all our scribers were assembled. Employees that worked in this area were all cross trained and able to move around from one task to another without any difficulty. On the left, resting on the table top are many trays with scribers in process, in various stages of assembly. With three stations working on the same scribers at different stages of production the orders moved through the plant quite fast.

All the basic parts for our scribers were purchased from outside venders. Most came from the K&E location in Kennebunkport, Maine. This plant was a well-equipped machining facility that produced the surveying instrument line. Although we did not make these basic parts in our plant we did all the finishing, like drilling and tapping holes, mounting springs, inserting pins and posts etc. to prepare the parts for assembly. All incoming parts had to pass quality inspections by our in-house inspector before they were placed in inventory. When production control sheets were released to the floor for a run of scribers the Inventory Control person would make hand entries on spreadsheets to continually set reorder points for each part. No computer control of parts inventory here, no computers back then.

Here the operator was assembling parts and using a staking machine in front of her to attach the grey tailpiece to the body of the scriber by forcing the two parts together and riveting the assembly. At the same time the two pen clamp levers were attached with a roll pin. This is the 61 0004 scriber. Below the assembled pen clamps were reamed to assure a good pen clamping action.

In the image above the operator is finishing the run of 61 0004 scribers. The scribers will then be inserted into various Leroy sets we make, boxed or blister packed for store display racks. We did not inventory finished goods in the plant; they were always shipped to our Distribution Center in Teterboro, NJ.

On the left an operator is assembling 61 3010 Tracer Pins, this was pretty much a daily task. We would order the nickel silver parts in lots of 100,000 pieces and never seemed to get far ahead of demand. Although used in every scriber we made it seemed that we produced far more then what was needed for the scribers produced. We were sure some got lost or broken and had to be replaced but not at this rate. We later discovered that the professional Leroy users found out that if they honed the scribe points on crocus cloth, an abrasive cloth, they could custom fit a tracer pin to each template they had. They would then keep the tracer pin with that particular template in their Leroy sets.

All accessories for Leroy were also made in this area; to the left an operator assembling the 61 3100 Height and Slant adapter for scribers, to the right the Leroy Pen Holder for use in our Leroy sets and sold separately. Only a couple of the many items needed for special purposes in the Leroy system.

AN INTERESTING SCRIBER CONFIGURATION

While on the subject of scribers, I would like to explain how we in the plant were able to generate an engraving master with a 15 degree left slant goes as follows. Let's take an example; a customer would like to have a template made bearing his signature so someone in his office could sign a document when he was not around. This type of signature template was a very common request. Rubber stamps with his signature were not acceptable, not personal, too fake looking. But a Leroy template would allow a person to reproduce his signature faithfully using ordinary pen ink, a very real looking signature. Obviously this template would have to be kept in a secure place.

We would ask the customer to sign a lined paper several times until he was satisfied with the look of his signature. Then cut out the one signature he liked. He would send this signature to us; we would send it out to have a negative Photostat made, enlarged exactly ten times the size. When we received the Photostat a carefully drawn center line was added to the signature, the enlargement had quite thick lines and it was necessary to reduce this to one thin line.

Producing a 15 degree left slanted drawing of the signature is an interesting process. Using a Leroy scriber with a vertical engraved line on a template would cause the drawn line to reproduce with a 15 degree right slant, or italic. In order for the geometry of the scriber to produce a vertical line it would be necessary to make an engraving master with a 15 degree left slant. If you take the Photostat with the drawn centerline and use this drawing as your starting point you can introduce a 15 degree left slant using a special type of scriber. The scriber we used was probably made way

back at the beginning of the Leroy era. This scriber was oversized, 10 to1 actually, 10 times the size of a standard 61 0004 scriber.

The Photostat with the centerline would be taped on a large drawing table, a line from the paper on which the signature was made is also on the Photostat and that line is positioned parallel to the tailpin groove on an overlong Leroy template which is also attached to the drawing table. Now using this oversized scriber by placing a tracerpin in the pen holder location and a lead holder into the tracerpin holder location the scriber would introduce a 15 degree left slant when the person using the scriber carefully traced the center line on the Photostat with the tracer pin.

The resulting pencil drawing was then glued to a sheet of butyrate material a little larger than the drawing with rubber cement. An X-Acto knife was then used to carefully cut through the drawing and into the butyrate sheet, the paper drawing is then removed from the butyrate with a rubber cement solvent. Now a penholder with an attached V grooving cutter is very carefully dragged through the knife cut in the butyrate sheet and leaves a fine V groove. Done carefully, this second cutting would create a small but clean V groove where the knife cut was originally.The resulting groove is sufficient to enable the engraver, using a stylus with a V point, to use this engraving as the custom master to produce the desired Leroy template the customer ordered. If this custom master needed to be used many times then it would have to be grooved much deeper which would require several passes with the V grooving cutter which would of course take more time. The person doing this kind of work would need artistic abilities and lots of patience.

LEROY PACKAGING

Leroy products were packaged in many forms; by far most templates were simply bulk packed, slipped into plastic pouches, bundled into packages of 144 and shipped to our Central Distributors in Teterboro, NJ. Almost all K&E products were sent there for distribution to our retail stores. All items packed in Leroy sets were available either boxed or blister packed individually for stores to hang on displays. That includes all pens, ink, pencils, scribers etc. The one exception to shipping to Teterboro were several large resellers in metropolitan areas around the U.S. and Canada where the sheer volume of K&E product dictated direct shipping to avoid unnecessary handling.

We produced several Leroy sets at Salisbury, 61 2901 being the complete set, and our best seller, which had all components. Other sets with varying parts were 61 2906, 2911, 2916 & 2921. We even supplied empty cases so customers could purchase only those components that suited their requirements.

The old Doric starter set was made of wood with spaces routed out to accommodate several parts for college students. Unfortunately these sets did not contain actual Leroy components; they were filled with another type of lettering parts that would not mix well with Leroy parts.

Marketing, working with the Salisbury plant made a special effort to accommodate college students with a better starter set that was economical and would get the students started using genuine Leroy products. The starter case was a blow molded plastic sliding case that would contain enough components for the student to accomplish basic lettering projects in school.

On the left I was discussing the new case with my boss when we received the first shipment. We both felt the case was a little flimsy and wondered if it would go over well in the field. The case was much less expensive and I guess that was the idea, to reduce the cost to students.

On the left is an image of our Leroy set packing station. All the components for any set we made are stored in bins and loaded into a case as it is slid across the table. We used this station to pack a run of these new starter sets for a promotion that Marketing had started; the response was great, the starter sets sold out! We were both surprised and delighted. We then set up a separate station to pack the starter sets below left so as not to interfere with the large set packing.

I hope this Leroy history gives collectors an overview of this fine K&E product. Sadly, I could not include every variation made over the long history of this line. Mr. Clark McCoy has included a complete set of Leroy catalogs on his site for research. – Joe Soper

Another weekly Leroy shipment ready to go!