

Cast resin may be turned, turned, drilled or otherwise shaped and fabricated into finished components. Typical operations may be from about left, cutting rods on an abrasive wheel; center, turning a rod on a turret lathe; right, pattern being cut from flat stock with a jig-saw. (Photos courtesy Catalin)

FABRICATING CAST PHENOLICS

by S. M. COAN

ALTHOUGH COMPRESSION MOLDING IN SOME form is almost as old as civilization, the fabrication of cast resins is a comparatively new industry, and quantity production has been developed during the past ten years.

The advantages of cast resins are numerous. Almost every imaginable color can be obtained, and the color and mottle exist throughout the material. Plain, mottled, opaque, translucent and transparent materials are available. Arbors, being simple, can be constructed within a very short time, and material requires but from four to twelve days for curing, depending on color and base. Deliveries of finished parts, can therefore, be made within less time than usually required for the production of molds used for other plastics.

A well equipped fabricating plant has departments devoted to all of the various operations, and is so laid out that articles going through production travel from machines used on initial operations to final polishing, inspection and shipment without unnecessary handling. If the parts are to be turned from solid rods, the maximum number of pieces which can be produced from an individual rod must be calculated with allowance for cutting off, flash and end of rod that is to be held in the collar when final piece is being turned. An order is placed with the raw material suppliers for the correct number of rods in color and size required, and when these rods are received and checked, it is first necessary to remove, by a fast grinding operation, any rough flash that may extend beyond the greatest diameter at end of rod, so that difficulty will not be encountered when feeding through the screw machine. Automatic screw machines are sometimes used, and have the advantage of speed and low labor cost if volume is large. Their disadvantage lies in the fact that cast rods average 20 in.

in length and are tapered slightly. Unless rods are centerless ground to remove this taper, trouble is sometimes encountered with the feed. Quite often a longer piece of material must be allowed for the last part to be turned. As most runs are not over several thousand pieces of a design, hand screw machines prove satisfactory. They can be set up quickly and expensive forming tools are not required. Ball bearing centers and automatic die heads for threaded parts are almost a necessity. All forming operations, usually done on brass or other metals, can be accomplished if machines are operated at correct speed and tools are properly designed. Forming tools made of brass and of steels of various hardnesses, give good results.

Samples and small lots can be most economically turned on a hand lathe with hand tools. Hand lathe operators are usually skilled men with quite often many years' experience turning similar parts from older plastics. They make their own chucks of bronze, aluminum or wood, and can chuck and center the part to be turned in a fraction of the time required by an unskilled operator with conventional tools and equipment. In the production of bracelets, for example, it has been found advantageous to heat the cylinders for a short time by immersion in hot water. The entire cylinder is placed on a mandrel and the maximum number of bracelets that can be obtained from a cylinder can be turned before the material cools.

A combination of line shafting and unit drives is probably most economical. Some special machines must have their own motors in order to insure constant high speed and belt tension. The plant should be so arranged that failure of any one motor will not delay production more than a few minutes. Ball (Please turn to page 122)

Liquid phenolic being poured into lead molds which give it the approximate shape of its finished form

These are pipe stems being removed from the lead molds after days of hardening at controlled temperature

A few touches on a buffing wheel complete a pipe stem superior to amber (Photos courtesy Bakelite)

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(Continued from page 29) Heating hangers and short constant tension drives give excellent results. A blower system is essential and usually every machine is equipped with an adjustable connection that will facilitate removal of dust, fumes and shavings.

Castings in special shapes that are not to be turned are cut into blanks of correct thickness by means of cut-off machines having thin abrasive wheels which travel at high speed. Each machine must be equipped with a fresh water connection, as a constant flow of clean water is absolutely necessary. A heating unit on the water feed line raises the temperature of the water during the winter months, and prevents the operators' hands from becoming cramped. Each machine must also be piped to remove the water, which is never used over again, and blower connections are also installed to eliminate fumes. Wheels are relatively inexpensive, and with proper care require infrequent changing. They are sharpened by cutting brass pipe or copper tubing with the water supply shut off.

The button industry particularly, uses slicing machines that cut button blanks from rods or buckle castings with no waste. Rods are heated by immersion, and the operation is almost entirely automatic. If, however, close tolerances are required, better results can be obtained by means of abrasive wheels.

Very large parts and samples can be readily cut on a band saw. Saws should be of the metal cutting hard edge type, and number of teeth per inch and set determine smoothness of cut. Automatic saw sharpening equipment has proved its worth, as saws that have been resharpened give better results than when new, and saw cost is reduced as much as 90 percent. If parts are sawed, they must be surfaced on a belt or disc sanding machine before being finished. Sanding belts, traveling at fairly high speed, give very good results. If finished surface is to be flat, conventional type of machines are used, but belts traveling over two pulleys and unsupported in the center are found of great advantage when removing small projections on rounded surfaces or performing other operations when a flat surface is not desired.

Pen bases and similar articles are beveled on beveling machines or shapers, having ball bearing spindles. Bronze alloy, brass and steel cutters are used. Cutters should be sharpened only by one skilled in this type of work, and absence of vibration is also important. If tools are improperly sharpened or spindle is not true, the work may chip.

Irregular shapes, samples and small quantities of production parts can be easily jig-sawed. Saws are usually made by the jig-saw operator, as he is thus able to select the number of teeth and set required for a smooth surface. Outline of parts to be sawed may be scratched on the surface of the sheet or a printed pattern pasted to the surface with water soluble glue. If a number of parts are to be cut, several sheets are pinned together. Oiled paper inserted between the sheets lubricates the saw and helps to obtain a smoother surface. Many letters and

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strength as

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sawing style
to be set
years of

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exception
contain.



Castings of this sort are accomplished with phenolic resins, either in lead or rubber molds. Radio cabinets and other small cast housings are increasing in popularity because of the transparency cast resins afford. This statuette of Venus was cast of Crystle in a rubber mold by The Marblette Corporation.



signs are made in this manner, and all that is necessary is an inexpensive paper pattern. Very good results are obtained by using cast-in-glass sheets, which have a glass smooth surface, and the letters thus require no polishing after they are sawed.

Small parts may also be blanked from sheets, and this method is often employed by the jewelry trade, as a supply of sheets in various colors and thicknesses may be kept on hand and immediate delivery made to the customer, regardless of style changes. However, it is much more economical to fabricate parts of this type from castings, having outline shape of finished article, as there is a minimum amount of waste.

Jewelry parts and similar articles can be readily carved. A ball bearing spindle is generally used with either small steel, bronze or brass cutters or shaped abrasive wheels. Skillful operators can carve hundreds of pieces with almost no variation in design. Each machine is equipped with a number of shaped wheels, and wheels may be quickly and easily changed. Original designs are quite often worked out by the operator as expensive tools, dies or patterns are not necessary.

Turned parts, having center holes, are drilled while being turned, while castings and odd shaped parts are easily drilled with the usual type of high speed vertical drill, having its own motor or driven from a line shaft.

Cast resins can be easily tapped on vertical or horizontal tapping machines. Standard taps are used, and greater strength is obtained by using fairly coarse threads. Tapped holes should be checked with plug gages, as the abrasive action of the material causes wear. Drive screws and self-tapping screws eliminate the necessity of tapping, and are extensively used for attaching jewelry findings and other small metal parts.

Although milling cutters can be used when slotted sections are necessary, better results are obtained with special machines equipped with grinding wheels of correct grit and hardness. A constant flow of fresh water on the wheel and the work eliminates "burning" and dust, and helps to provide a smooth surface. Wheels have a much longer life if sufficient water is used.

If parts must be formed, electric steam tables slightly soften the material so that it may be bent to correct shape. Parts may also be softened by immersion in hot water or by dry heat.

When all machining operations have been completed, articles are ready for finishing. Small parts and those not requiring a high luster can be tumbled in wood or wood and steel barrels. There are several concerns that manufacture these barrels and supply formulas for finishing cast resins.

Larger parts and those on which sharp corners and edges must be retained should be hand finished throughout. There are several methods, one of the most common being an ashing process, followed by finishing on a cotton buff. A thick mixture of fine pumice and water is applied to the wheel with a wooden paddle, and when the work is held against the wheel, all tool marks and sand marks are removed. Another method, used principally in the pyroxylin fabricating sections of the country, consists of a wheel composed of carpet disks traveling in a solution of water and sifted anthracite ashes.

The final finish and high gloss that brings out the beauty of the material is secured by polishing on a cotton buff. One section of the wheel's face is not coated with polishing compound, and when parts have been buffed, they are wiped on this dry section. Air cooled wheels have been developed that enable the operator to highly finish the article without danger of friction "burning." After parts are polished, they are placed in racks or boxes and carefully handled to avoid scratching. They are now ready to be inspected, counted and shipped.

Cast resins have entered the radio field and manufacturers of radios claim improved tone, increased sales appeal and greater strength. Designs may be simple, as the beauty of the material alone commands instant attention. Transparent and opaque bowling balls are rapidly winning favor with expert bowlers. In addition to their beauty, it is said that the greater "liveliness" of the material enables the bowler to obtain higher scores. Bowling balls are cast in glass molds. The glass is destroyed when the ball has been cured, and the fabricator removes the neck, turns them to accurate dimensions and finishes them by hand. They are sold at a price that compares favorably with competitive materials.

Streamlined housings have been made for office appliances and similar articles. They lend a new touch of beauty and design to otherwise drab equipment. Parts are made for huge trucks and toy electric trains, chromium and copper gift articles, lamps and modern furniture. Producers of raw material, manufacturers and fabricators look forward with optimism to a period of development that will far exceed that which has occurred during the past decade.

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