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Perspex Jars for Pathological Museums

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During the past 10 years "perspex" has become the accepted material for constructing jars for the display of pathological specimens. While it is now possible to embed specimens in solid blocks of transparent plastic, the jar containing fluid continues to be the popular choice. The elasticity of the material allows the jar to be completely filled with fluid giving an effect of solidity, and the specimen can easily be removed for further histological examination at any time.

A plastic jar to be satisfactory should be easy to make, remain free from leakage, and be perfectly rectangular so as to take full advantage of the optical properties of the material.

Many of the early difficulties in construction have been due to failure of cemented joints, since the nature of the material makes it almost impossible to obtain machined surfaces of sufficient accuracy to employ simple butt joints. The method to be described has avoided these difficulties and the jars have stood rough usage for up to 10 years without evidence of breakage.

For permanent joints in large containers which are submitted to considerable stress, the makers recommend their cold welding process. In this process the joint is filled with a methacrylate dough which is then polymerized by exposure to ultra-violet light. The resulting join has similar properties to the parent material (Imperial Chemical Industries Ltd., Plastic Division, I.S. Notes, 343 and 141).

Method of Construction and Materials

The method depends on the use of rebated joints for the body of the jar. This type of joint enables the solvent to correct minor irregularities in the cut edges and checks any tendency for the plastic sheet to bend while the cement is hardening. In order to obtain sufficient accuracy, the pieces for the jar are first cut out roughly with a band saw and then trimmed accurately to size by removing a thin shaving with a trimming cutter. In this way heat distortion is reduced to a minimum.

Since perspex is a bad conductor of heat, the cutting tools should be sufficiently heavy to conduct the heat away from the cutting edges. The use of fine-toothed slitting saws should be avoided.

Perspex is supplied in convenient stock sheets measuring 3×4 ft., and three thicknesses cover most requirements for the usual museum jar size: 3/16 in. for the body of the jar, 1/4 in. for the top and bottom, and 1/16 in. for the specimen supporting panels, which may be clear, opaque, or coloured as required.

The milling equipment is mounted on a bench with a working top made of 1/4 in. duralumin plate 4×2 ft.

It has been found more convenient to use separate cutters accurately adjusted for each operation than a standard type milling machine which requires resetting for each operation (Fig. 1).

Standard high-speed steel milling cutters give satisfactory results and can be easily reground or replaced. For large-scale production special cutters for plastics would be more suitable.

Cutters.—The descriptions of the cutters required for the four separate milling operations are as follows:

Panel Trimming.—Side and face cutter, diameter 4 in., width $\frac{1}{4}$ in., hole 1 in., mounted with $\frac{5}{16}$ in. of the cutter protruding through a slot in the centre of the bench top. The position of the face of the cutter is marked by a line inscribed on the surface of the bench, and this is used in conjunction with an adjustable straight-edge guide.

Rebate Cutting.—Side and face cutter, diameter 3 in., width $\frac{1}{4}$ in., hole 1 in., mounted on a fixed straight-edge guide above the bench with $\frac{3}{32}$ in. clearance between the cutter and the bench top, and the cutter protruding $\frac{5}{32}$ in. beyond the guide.

Specimen Panel Groove.—Side and face cutter, diameter 3 in., width $\frac{3}{32}$ in., hole 1 in. Mounted in place of the rebate cutter with back spacing washers to locate the groove in the desired position.

Corner Rounding.—Corner rounding cutter (single), diameter $2\frac{1}{2}$ in., radius of circle $\frac{3}{16}$ in., hole 1 in., mounted in a right-angled trough guide made of $\frac{1}{4}$ in. duralumin plate, and adjusted to cut a full quarter circle from the corners of the jar.

The cutters are mounted on high-speed mandrels carried in ball races and driven by V belts and pulleys. The trimming and rebate cutters are driven through a countershaft by a 0.4 h.p. 2,850 r.p.m. motor controlled by a foot switch. The corner rounding cutter has an independent motor, since the countershaft was not conveniently placed in this instance. All cutters are provided with safety guards detachable for cleaning.

Cementing and Fixing Joints.—Chloroform is the most convenient laboratory solvent for cementing. The edges to be fixed are first soaked in the solvent for two to three minutes and then held together with a light, even pressure. It is important to localize the action of the solvent to the joint, and this is done by resting the edge of the panel on a piece of plate glass and applying the solvent with a Pasteur pipette. The adjacent surfaces

FIG. 1.—Photograph of the milling bench. The rebate cutter is on the left. The adjustable straight-edge and trimming cutter towards the centre, and the corner rounding cutter on the right.

FIG. 2.—The holding frame, showing two panels pressed together by weighted bars. The edges of the larger panel are rebated. (The glass plates in the trough have been masked with black paper to avoid reflections.)

FIG. 3.—The trimming cutter, from which the safety guard has been removed to show the inscribed line and the adjustable straight-edge.

of the panel are protected from the action of chloroform vapour by the application of strips of "sellotape." After softening the edges of two panels, they are lightly pressed together and placed in a frame which holds them in the correct position until the cement has hardened. The holding frame (Fig. 2) consists of a right-angle trough 2 ft. long and 1 ft. deep, made of $\frac{1}{2}$ in. ply board and lined by $\frac{1}{4}$ in. glass plates to give smooth flat surfaces. Weighted bars are placed on the free edges of the panels so as to bring the cemented edges together with a light, even pressure, at the same time holding them at right angles. The joint is sufficiently firm for removal after 10 to 15 minutes.

The need for accuracy in cutting the panels cannot be overemphasized. Irregularities cannot be made good either by prolonged soaking in solvent or by the local application of cramps.

Sequence of Operations.—First cut out roughly from the stock sheet the four panels for the front, back, and two sides of the jar.

Set the adjustable straight edge approximately 1 16 in. wider than the required size and trim one edge of a pair of panels (Fig. 3). Reset the straight edge to the exact size and trim the opposite edges of the panels. Trim the other pair of panels. The top and bottom edges of the panels are not trimmed at this stage. Cut the rebates on the edges of the front and back panels. This cutter should remove a strip $\frac{5}{32}$ in. wide and $\frac{3}{32}$ in. deep (Fig. 4).

Cut the locating grooves for the specimen supporting panel on the inner surfaces of the side panels of the jar.

Wash the panels in warm soapy water to remove grease and dust. Apply "sellotape" along the edges to be cemented.

Soak the edge of a side panel and the rebated edge of a front or back panel in chloroform for two to three minutes, place in the holding frame and adjust the weighted bars to give a firm, even pressure. After 15 minutes repeat with the other pair of panels. The four free edges of the two pairs of panels are now soaked in solvent and reassembled in the holding frame. In this case pressure is applied to the uppermost joint by a weighted bar of right angle section. The body of the jar is now complete, and the joints are allowed to consolidate by the evaporation of excess solvent. Consolidation may be hastened by placing the jar in an oven at 30 °C. overnight. Protective tapes are removed from the inner surfaces of the jar.

The irregular top and bottom edges of the jar are now cut off square on the band saw. Any saw marks are removed by lightly rubbing on fine glass paper attached to a flat glass plate.

The corners are rounded with the corner rounding cutter (Fig. 5). Top and bottom panels are cut slightly oversize from $\frac{1}{4}$ in. sheet. The top has a $\frac{1}{8}$ in. filling hole drilled in one corner, the bottom is preferably made of opaque white "perspex" to improve light reflection and to prevent scratch marks from showing through.

The bottom edges of the jar are soaked in chloroform, placed on the bottom panel and held in place with a suitable weight until fixed.

FIG. 4.—The rebate cutter; note the length of the mandrel and retaining screw, which allows the panel groove cutter to be placed at the required distance from the guide.

FIG. 5.—The corner rounding cutter, on which the right-angle trough ensures an accurate cut.

The top edge of the jar is soaked in solvent and the panel carrying the specimen slipped into locating grooves cut in the sides of the jar. The jar is then filled with mounting fluid to within $\frac{1}{2}$ in. of the top and the top panel placed in position. When the joint has hardened, the jar is topped up with fluid and the filling hole sealed with a perspex plug dipped in solvent. Trapped air bubbles are often troublesome and may be freed with the aid of a suction pump.

The top and bottom edges are passed over the corner rounding cutter and the filling plug smoothed off with a fine file.

The machined corners are rubbed down with fine glass-paper and the resultant matt surface polished with metal polish and finished with "perspex" polish No. 3.

Mounting the Specimen.—Specimens are conveniently mounted on a separate "perspex" panel before being placed in the jar. They may be attached by looped threads passed through double holes (pierced in the panel with a hot wire) and tied at the back of the preparation. It may be convenient to cut shaped holes in the panel to accommodate solid projections in some specimens, or to suspend the specimen in a rectangular frame,

and $\frac{1}{16}$ in. is a suitable thickness for most supporting panels, which may be clear or coloured as required.

The panel or frame carrying the specimen is positioned in the jar by sliding it into shallow vertical grooves which have previously been cut in the inner surfaces of the side panels. When the jar is filled with fluid the supports become almost invisible.

Illustrations.—It is sometimes instructive to include a photomicrograph, clinical photograph, radiograph, or explanatory diagram with the specimen, and these may be mounted on an opaque white panel slipped into grooves behind the specimen panel. If photographic prints are soaked in chloroform for a few minutes, sufficient solvent is taken up by the paper backing to enable the print to be stuck to the plastic surface. The photographic emulsion is not affected by the usual glycerine mounting solutions.

Labelling.—Museum jars are usually provided with reference numbers. Paper labels printed on a small hand press are inexpensive and reasonably satisfactory. They may be attached to the jar after dipping in chloroform and given a protective coat of varnish. Engraved labels are more permanent. With the aid of a small bench type engraving machine, labels may be cut out of $\frac{1}{16}$ in. white perspex and pressed into a corresponding recess cut in the front of the jar. These labels, being flush with the surface of the jar, are easily cleaned, and can be prised out of the recess and replaced in the event of a change of number being necessary.