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Vacuum Forming of Thermoplastic Sheet Results in Low-Cost Investment Casting Patterns

The problem: Thin-walled metal objects of various shapes can be made by a number of methods, such as electroforming, machining, stamping, and investment casting. In research and development work where precision metal parts are required for trial runs and to test various cast alloys for particular shapes, investment casting has become the preferred method. In the conventional method, the wax or plastic patterns which are required are made with metal dies and female molds. These steps for limited runs are expensive and time consuming.

The solution: A plastic (e.g., cellulose acetate butyrate) pattern of the thin-walled object to be cast is simply and quickly made by vacuum forming of a sheet of the thermoplastic material around a mandrel conforming to the shape of the finished object. This pattern is then used to prepare an investment mold with a ceramic slurry as in the conventional investment casting process.

Notes:

1. After investing the plastic pattern with the ceramic slurry in a flask, the flask and contents are fired in a furnace to burn out the plastic pattern completely. The molten metal is preferably centrifugally cast in the resulting mold. These steps, of course, follow standard investment casting procedure.
2. The thickness of the metal part is determined by the thickness of the plastic pattern, with allowances made for plastic deformation in the vacuum forming operation.
3. The several steps involved in the method of casting thin-walled metal shapes are given in the following reference: "Thermoforming + Investment Process = Ultrathin-Wall Castings," by A. E. Clarke, Jr., in *Product Engineering,* February 27, 1961, pp 42–44.

Patent status: NASA encourages the immediate commercial use of this invention. It was invented by a NASA employee and a patent application has been filed. Inquiries concerning license rights may be made directly to the inventor, A. E. Clarke, Jr. at Ames Research Center, Moffett Field, California.

Source: Ames Research Center (ARC-7)