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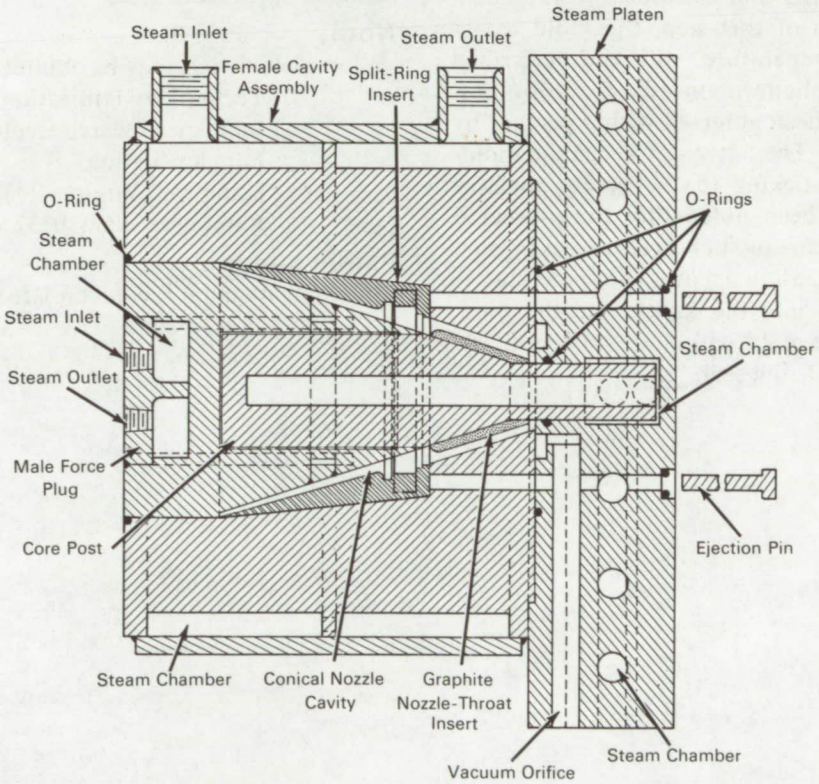
NASA TECH BRIEF

Improved Molding Process Ensures Plastic Parts of Higher Tensile Strength



A single molding process has been developed to ensure that plastic parts (of a given mechanical design) produced from a conventional thermosetting molding compound will have a maximum tensile strength. The process, specially developed for molding an asbestos–phenolic rocket motor nozzle incorporating a molded-in-place graphite insert, can also be used for other thermosetting compounds to produce parts with improved physical properties.

A steel compression mold of unique design, illustrated for molding the asbestos–phenolic rocket motor nozzle, is employed in the improved heat–vacuum–compression molding process. The mold has chromium plated cavity surfaces which are arranged to be heated from ambient temperature to 300°F within 60 seconds. Heating is accomplished by admitting steam into the mold assembly through three separate inlets. Ducting within the mold components

(continued overleaf)

provides for rapid and thorough distribution of the steam. If for any reason, such as between mold loadings, it becomes necessary to cool the mold, water can be admitted to the system in place of the steam.

The mold is prepared for use in a number of steps involving ultrasonic degreasing; application of a releasing agent to all cavity surfaces; baking the assembled, closed mold for 2 hours at maximum temperature (300° F); and spray coating with a mold release. On completion of the preparatory steps, the mold is positioned on the press, and steam and vacuum lines are connected.

The initial step in the loading procedure consists of coating the core post with wax. The preformed graphite nozzle-throat insert is positioned on the waxed core post and potted in place with an epoxy resin. The core post with graphite insert is then placed in the mold cavity and assembled to the steam platen. On completion of this step, the mold cavity is loaded, at room temperature, with the prescribed weight of asbestos–phenolic molding compound, which had previously been admixed with 1 percent by weight of zinc stearate. The latter salt keeps the molding compound from sticking to the cavity surfaces of the mold. (It had been noted that the untreated molding compound tends to stick even to cavity surfaces coated with a releasing agent.) The force plug is then carefully inserted into the cavity, and the press is "inched" so that the mold will close sufficiently to engage the force-plug O-ring seal.

The filled, assembled mold is placed under vacuum (3 mm of mercury) for 30 minutes and checked for air leaks. If there is no leakage, steam at 50 psig is admitted into the mold until the mold temperature reaches 250° F, but no higher. The steam is then turned off, and the mold assembly is permitted to heat-stabilize for 3 minutes. At the end of this period, the mold is closed under automatic compression, which for the asbestos–phenolic compound is between 2000 and 3000 psi. Steam at 125 psig is admitted into the mold assembly, which is then permitted to dwell for 1 hour at 325° F. At the end of the dwell, the press is switched to manual control and opened. The core post is then removed and the molded nozzle ejected. The split ring inserts are carefully separated from the ejected nozzle, which is then post-cured by baking in a circulating hot air oven in accordance with a prescribed temperature cycle.

Note:

Complete details may be obtained from:

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No patent action is contemplated by NASA.

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