Aug. 8, 1961 T. OPERHALL ET AL 2,994,931

MOLD ELEMENT AND METHOD FOR MANUFACTURE OF SAME

Filed Sept. 12, 1958

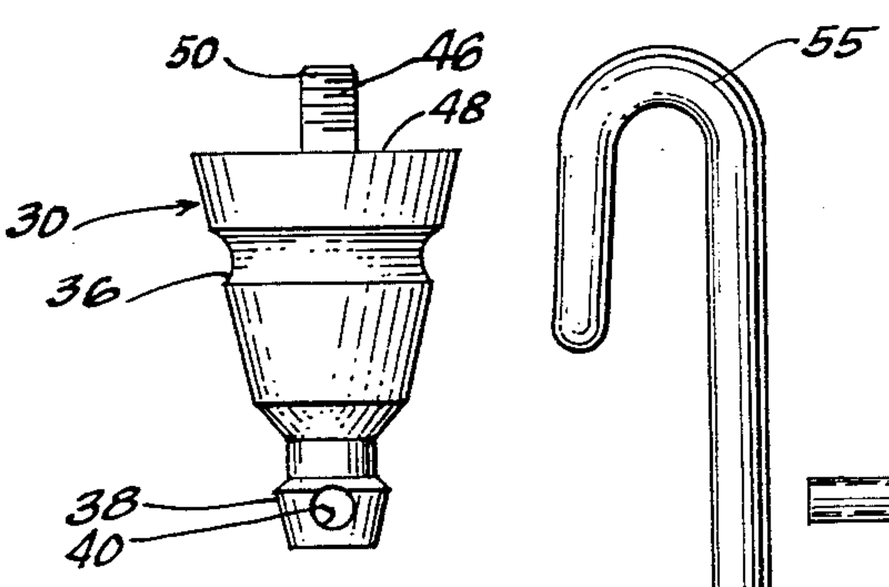

FIG. 1

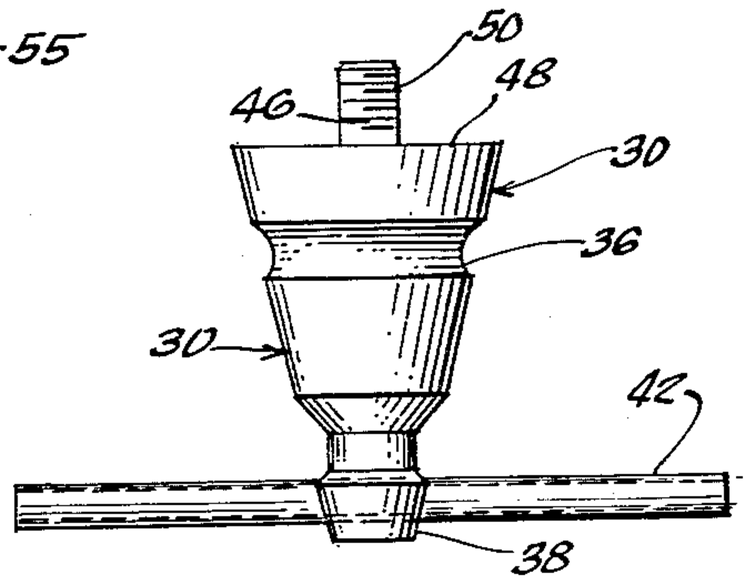

FIG. 2

FIG. 3

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United States Patent Office

2,994,931
Patented Aug. 8, 1961

2,994,931

MOLD ELEMENT AND METHOD FOR MANUFACTURE OF SAME

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Filed Sept. 12, 1958, Ser. No. 760,668
10 Claims. (Cl. 22—158)

This invention relates to the art of metal casting and it relates more particularly to the method of preparing a monolithic shell of ceramic material about a cluster of patterns of wax or other disposable material for use as a mold in which molten metal is cast.

The application is addressed to the process wherein a cluster of patterns of wax or other disposable material is dipped in a liquid or fluid binder composition containing a finely divided ceramic flour to provide a base adapted to receive inorganic ceramic particles for building up a stucco coat which imparts strength and mass integrity to the mold. A series of such dip coats and stucco coats are built up on the pattern until a monolithic shell mold is produced having sufficient strength to withstand the forces existing when molten metal is poured into the mold, with or without investment of the mold. Prior to metal pouring, the cluster having the built-up layers of dip coat composition and stucco is fired to eliminate the wax and to mature the ceramic materials in the production of a monolithic mold into which the molten metal may be cast to produce the finished products. The mold is disintegrated upon removal of the casting after the poured metal has solidified.

The dip coat solids and stucco built up on the surfaces of the cluster of wax patterns adds greatly to the weight of the cluster. As a result, innumerable problems arise in the handling of the cluster for immersion in the dip coat compositions, in the suspension of the cluster in space for receiving the stucco as the stucco is rained down from above, and for setting the stuccoed cluster aside for drying in preparation for the next series of operations. Such added weight lends to the difficulty of handling and turning the cluster in the dip coat and stuccoing steps and it increases the possibility of damage and breakage of the patterns, especially when it is considered that the wax patterns in and of themselves have very little strength and the applied stucco and dip coat compositions do not add strength until fired.

Thus it is an object of this invention to provide a means to facilitate the handling of the cluster during its preparation and during the operational steps and it is a related object to provide means embodied within the cluster to strengthen the cluster for support during the processing operations.

More specifically, it is an object of this invention to produce a cluster of wax patterns embodying a hanger means by which the cluster can be supported and carried to enable more efficient handling with less danger to its parts.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing in which—

FIG. 1 is an elevational view of an insert employed in the practice of this invention;

FIG. 2 is a side elevational view of the insert shown in FIG. 1 with the supporting cross rod therein in position of use, and

FIG. 3 is an elevational view showing the elements employed in the practice of this invention in position of use in the formed wax cluster.

Referring now to the drawing for a description of the invention, the numeral **10** indicates a cluster of wax

patterns **12** wherein the patterns are vertically disposed between a top runner **14** and a bottom runner **16** to provide an interconnected relation. One or more vertically disposed connecting runners **18** are usually provided through the central portion of the cluster for connecting the crucible portion **20** with the bottom runner **16** for direct flow of molten metal therethrough during metal pouring.

The crucible **20**, in the form of a funnel-shaped member, is located at the top of the cluster with the end **22** of the crucible of smaller dimension in communication with the runner **14** for direct flow of the molten metal during metal pouring into the openings left by the runners and from the runners into the mold cavities left by the wax patterns **12** to produce the castings.

The foregoing is a brief and schematic description of the general arrangement which has been employed to the present in the preparation of clusters on which a monolithic shell is built up on the surfaces thereof by the application of a series of dip coats and stucco coats. It will be understood that deviation in the details of the construction of the cluster will occur from a cluster for molding one part to clusters for molding other parts because of differences in the shape and dimension of the patterns. However, common to such clusters is the use of the crucible portion into which the metal is poured and the use of laterally extending and vertically extending runners which communicate the crucible portion with the patterns for channeling the flow of molten metal into the mold cavities during metal pouring.

It will be apparent, from the brief description, that the weight of the cluster is often carried by the runners. Not infrequently, the runners are of such dimension and construction as to be incapable of supporting the entire weight of the cluster. Under such circumstances, either special precautions must be taken to handle the cluster in the processing to build up the layers of stucco and in maturing the stuccoed layers or otherwise the cluster would be subject to damage or destruction due to the failure of one or more of the parts to support the load.

In accordance with the practice of this invention, a means is embodied in the fabrication of the cluster to reinforce and strengthen the load carrying parts of the cluster so as to enhance the stability of the cluster for handling in use. The means employed to reinforce elements of the cluster to strengthen the cluster operates also to enable the incorporation of a means for supporting the cluster in suspension so as to enable racks to be employed in drying the coatings applied to the cluster thereby to conserve on equipment and space and to enable conveyor means to be employed in processing the cluster or in moving the clusters from one station to another. The concepts embodied in the practice of this invention make it possible to convert the molding process from a significantly manual operation to one which parallels a continuous operation wherein any of the steps can be carried out mechanically and in a predetermined sequence to conserve on labor and materials and to reduce the time and cost factors in mold preparation.

For this purpose, a metal insert **30** is embedded as a core in the crucible **20** of wax that is employed. The metal insert is preferably formed to a frusto-conical shape corresponding generally to the shape of the crucible but it is of smaller crosswise dimension than the crucible to enable the metal insert to be surrounded with a wax layer **34** of substantial thickness. Annular ribs **36** which may extend outwardly, but which preferably extend inwardly as grooves in the outer wall of the insert, are provided to establish an interlocking relationship between the wax layer **34** and the insert **30** so that the insert will become a composite part of the wax crucible to operate as a reinforcement.

The insert 30 is provided with an integral end portion 38 which extends downwardly from the lower end of the crucible of smaller dimension for a distance beyond the level of the crosswise extending runner 14 at the top of the cluster.

An opening 40 is provided in the extension and the opening is dimensioned to enable an elongate member in the form of a rod or tube 42 of a relatively strong material to extend lengthwise therethrough. The rod 42 is formed of a high strength material which is capable of being disposed of at the temperature conditions existing for the removal of the wax patterns. For this purpose, the rod 42 can be formed of a synthetic resinous plastic, such as polystyrene, polymethylmethacrylate, polyalkylacrylates, and the like thermoplastic resinous materials which are capable of flow at the elevated temperature conditions existing or are capable of being burned out at such temperatures. While polystyrene or the polyacrylates are preferred, use can also be made of other thermoplastics such as polyethylene, polyvinyl acetate, polyvinyl acetal, or cellulose ethers or esters, such as ethyl cellulose, cellulose acetate, and the like.

The rod 42 is dimensioned to have a cross-section less than the cross-sectional dimension of the runner 14 so that a layer of wax 44 can be formed about the rod for use in effecting joinder with the remainder of the elements of the cluster, as in previous construction, and it is dimensioned to have a length slightly less than the length of the runner for substantially the same reason.

The insert is formed with a shaft 46 of smaller diameter extending upwardly from the center beyond the outer end face 48 of the insert. The end portion of the shaft is formed with screw threads 50 to enable attachment of a hanger rod 52 which may have screw threads 53 at one end for engagement with the shaft 50 and a hook 55 at the other end to provide a means for suspension of the cluster on racks or carriers or to provide a handle by which the cluster may be carried for immersion into the dip coat compositions or for positioning the cluster beneath the dispenser for the application of stucco.

In fabrication, the insert 30 with the rod 42 in the desired relation in the opening can be mounted in a suitable mold for embedding the insert and rod in the wax coatings 34 and 44 to provide a crucible and runner structure corresponding to that which previously has been employed but which is now materially strengthened and reinforced by the insert and rod embedded securely within the wax system. The other elements including the runner 16, patterns 12 and down-part 18 can be joined one to another and the formed crucible in the usual manner for forming the cluster. From all outward appearances, the cluster will be the same as that previously fabricated but the cross bar or runner 14 will have a strength sufficient to carry the load without danger of breakage or separation and the crucible simultaneously will embody means by which the assembled unit can be carried or suspended during subsequent processing to form the monolithic shell.

After the required number of dip coats and stucco coats have been built up on the surfaces of the cluster and the lip of the crucible has been ground down to remove stucco, the stuccoed cluster can be inverted in the usual manner in a heating chamber for firing the shell and eliminating the cluster of wax patterns and the like and for maturing the ceramic material forming the remaining monolithic shell. As the wax is heated up to a flowable state, the wax about the insert will be eliminated to enable the insert to fall gravitationally from the mold after the cross bar or rod 42 has been disposed of. As previously pointed out, the latter is formed of a heat disposable material which is either reduced to a flowable consistency at the elevated temperatures existing and/or is burned from the mold. Thus the cross bar is eliminated or is otherwise rendered ineffective so that the insert will fall from the crucible into a suitable receiver which enables re-use in another cycle of operation.

It will be understood that the insert may be of a shape differing from that described. For example, it can be rectangular, oblong or of other cross-section, but it is desirable to make use of an insert having a shape generally corresponding to that of the crucible for more uniform reinforcement. Instead of using ridges or grooves to establish an anchorage between the insert and the wax coatings, other means for anchorage may be employed, such as pins, projections, inserts, and the like, or even roughness in the surface of the insert.

Similarly, the cross bar may be varied in cross-section between a square, rectangle, oval, or other polygonal section to a circular rod or tube. It is preferred to make use of a tubular member because of the greater rigidity available while at the same time requiring less material from the standpoint of weight and cost.

It will be understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

We claim:

1. A cluster of a plurality of patterns about which a ceramic shell is formed for use in a lost wax process of metal casting comprising a horizontally disposed top runner dimensioned to extend crosswise of the cluster, a plurality of patterns directly connected to the runner to depend downwardly therefrom in laterally spaced apart relation in continuous communication with said runner, a crucible contiguous with the runner and extending upwardly from an intermediate portion thereof for continuous communication therebetween, all of the foregoing elements being formed of a heat disposable material, a metal insert embedded within said crucible and having a portion thereof aligned crosswise with the runner, a relatively rigid and structurally strong rod formed of a heat disposable material dimensioned to have a length corresponding to the length of the runner and embedded therein to form a part thereof, means supporting the rod from the lower end portion of the metal insert, and means in the upper portion of the insert from which the cluster is suspended.

2. A cluster as claimed in claim 1 in which the crucible has a portion which is aligned crosswise with the runner to form a part thereof.

3. A cluster as claimed in claim 1 in which the crucible is in the shape of a funnel having the end of smaller dimension adjacent the runner.

4. A cluster as claimed in claim 1 in which the metal insert is shaped to correspond with the crucible and is of smaller cross-section than the crucible so as to be embedded within the crucible with a substantial thickness of heat disposable material all around.

5. A cluster as claimed in claim 1 in which the crucible is in the shape of a funnel and in which the metal insert is of frusto-conical shape with the end of smaller dimension in the corresponding end of smaller dimension of the crucible.

6. A cluster as claimed in claim 1 in which the rod is formed of a length of synthetic resinous material and the patterns, crucible and runner are formed of a wax.

7. A cluster as claimed in claim 1 in which the rod is in the form of a tube of thermoplastic resin.

8. A cluster as claimed in claim 1 in which the means supporting the rod from the insert comprises an insert having a portion aligned crosswise with the runner having an opening extending in alignment with the central portion of the runner and dimensioned to correspond with the cross-section of the rod and through which the rod extends for support by the insert.

9. A cluster as claimed in claim 1 which includes a hanger rod removably secured to the crucible to extend upwardly therefrom for suspension of the crucible.

10. A cluster as claimed in claim 1 which includes means for anchoring the insert in the crucible comprising grooves extending horizontally about the insert for

engagement with the heat disposable material received therein.

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