July 7, 1964 C. H. WATTS ETAL 3,139,656

PATTERN FOR INVESTMENT MOLD AND MOLD MADE THEREFROM

Filed Oct. 6, 1961

2 Sheets-Sheet 1

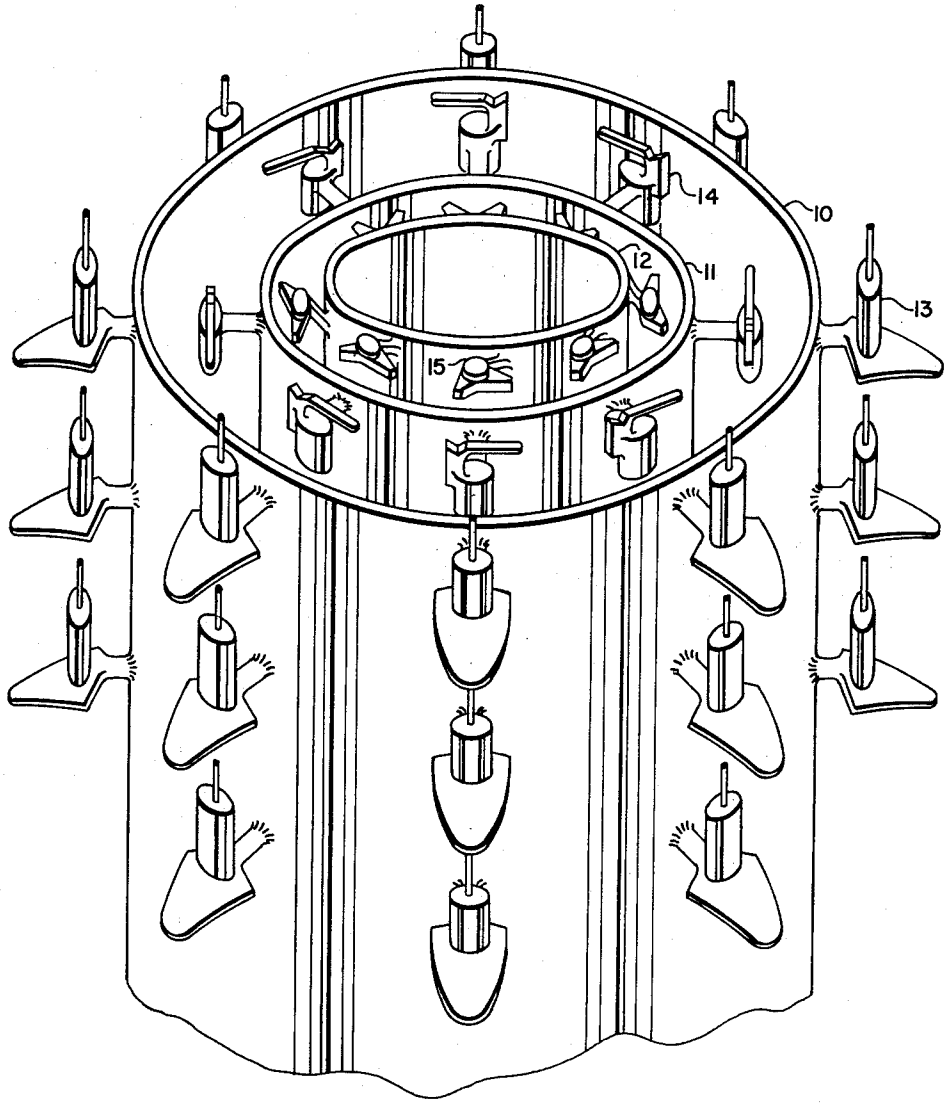


FIG.- I

INVENTOR.
CLAUDE H. WATTS
ROBERT R. MILLER
BY Watts Edgerton Pyle & Fisher

ATTORNEYS

July 7, 1964 C. H. WATTS ETAL 3,139,656

PATTERN FOR INVESTMENT MOLD AND MOLD MADE THEREFROM

Filed Oct. 6, 1961

2 Sheets-Sheet 2

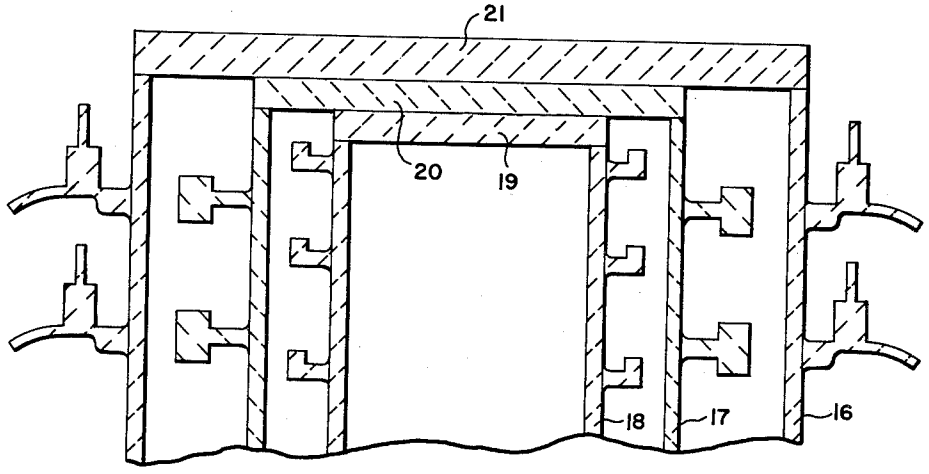


FIG.-2

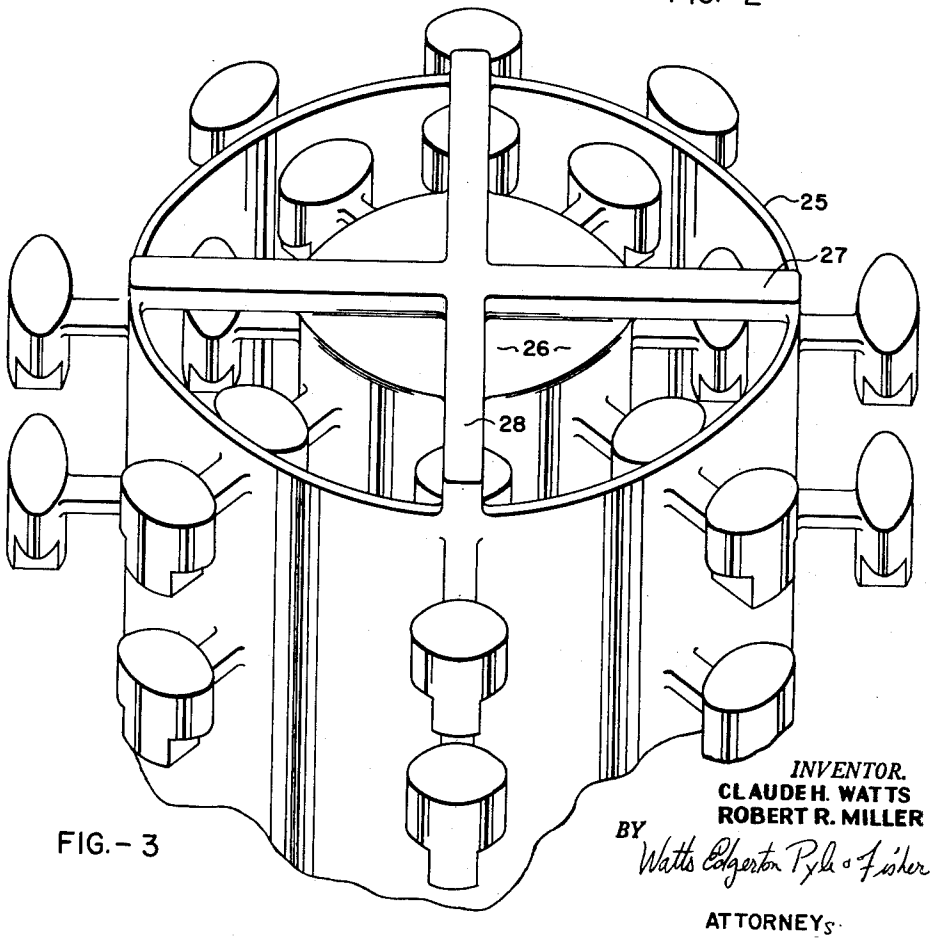


FIG.-3

INVENTOR.
CLAUDE H. WATTS
ROBERT R. MILLER
BY Watts Edgerton Pyle & Fisher
ATTORNEYS.

United States Patent Office 3,139,656 Patented July 7, 1964

3,139,656

PATTERN FOR INVESTMENT MOLD AND MOLD MADE THEREFROM

Claude H. Watts, Lyndhurst, and Robert R. Miller, Cleveland, Ohio, assignors to Precision Metalsmiths, Inc.,

Filed Oct. 6, 1961, Ser. No. 143,374
2 Claims. (Cl. 22—134)

This invention relates to the art of making precision metal castings by the lost pattern method, generaly referred to as "lost wax" method, and relates more specifically to an improved form and arrangement of sprue and pattern pieces to achieve an improved casting procedure and result.

Further, this invention develops further the basic principles previously discovered, taught, and claimed in an application filed March 30, 1961, Serial No. 99,587, now issued as U.S. Letters Patent No. 3,015,138.

For those not fully skilled in the precision casting art, and particularly with the art as it is practiced by the shell mold technique, it is recommended that the specification of the parent application referred to above be read as a prologue to this specification.

The principal object of this invention is to provide a controlled balance of thermal gradient in a tubular form sprue system.

A further principal object of this invention is to produce a greater efficiency in the production of usable cast workpieces in a given size set-up, and in relation to waste sprue and riser material.

A still further object of this invention is to enable the casting of several different metals in the same tree set-up.

Other objects and a fuller understanding of this invention may be had by referring to the following specification and claims, taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a fragmentary end portion perspective view of a wax pattern set-up, inverted from the casting position to show a plurality of nested cylindrical sprue set-up trees;

FIGURE 2 is a section through the area of junction of three nested cylindrical sprues, formed into a common pouring cup; and,

FIGURE 3 is a view corresponding to FIGURE 1, showing the use of a solid sprue nested within a cylindrical sprue.

The preferred embodiment of the invention as illustrated in the three figures of the drawing will rely upon the reader's knowledge and skill in the art, and upon the complete specification of the Patent No. 3,015,138. In that specification, the reader is taught the principles of using a sprue form having closely spaced walls arranged such that the inner wall surface defines a passageway through the sprue and the passageway is at least one-third the cross section of the sprue. Preferably, as shown in the drawings of the parent case and the present case, the sprue is fully cylindrical in form. Hence, this type of sprue is becoming known colloquially in the trade as the "hollow" sprue, or sometimes "cylindrical" sprue.

It has been found that the cylindrical sprue in addition to its advantages of reduced waste material in the runner system, provides greater capacity in a given set-up. One obvious reason for greater capacity is the fact that there is a greater exterior surface upon which patterns may be attached. The greater the diameter of the sprue the greater will be the outside surface and hence the greater the number of workpieces which may be attached thereto.

The use of a large diameter hollow cylindrical sprue procedures an area internally of the sprue which is substantially unused. As pointed out in the parent patent, it is possible to employ the inner surface of the hollow sprue and hence have workpieces projecting inwardly as

well as outwardly. This doubles, usbstantially, the capacity from the given sprue. However, the placement of workpieces on the inner surface is not without its problems. First among the problems, is the problem of physical placement of the pattern on the surface. It is difficult for workmen to reach into a small interior for such attachment purposes.

Furthermore, as also set forth in the parent patent, the basic invention produces a thermal gradiant which was quite unexpected. In spite of the lack of a bulk of metal in the hollow cylindrical sprue, there is a definite heat gradient which permits the workpieces to solidify first followed by solidification in the gating system. Mutual radiation of the inner wall surfaces appears to be largely contributory to this phenomena.

In this continuation of the invention, it has been discovered that advantages can be taken both of the space within the larger cylindrical hollows sprues and of the radiation factor spoken of. That is, as shown very effectively in FIGURE 1, more than one additional smaller hollow cylindrical sprue may be nested within a larger sprue and this base employed to produce more cast pieces. Reference to FIGURE 2 will show the means of attaching the top portions of the sprues into a common pouring cup in order to feed the three sprues from one location.

The increased efficiency with respect to time and waste material is immediately recognized from this illustration. There is no particular saving for the workman placing patterns upon the surface of the three sprues, but each tree set up must be handled several times in producing an invested condition, or a shell mold, and the casting room must preheat the mold before the metal is cast and prepare the metal for casting. In these latter steps one operation will produce three castable tree set ups rather than merely one.

However, at least two rather unexpected and surprising benefits have been obtainable by carrying forth the logical use of the illustrated concept. First, with reference to the thermal gradient referred to previously, it has been found that the types of metals which require more reduced cooling rates or shapes and forms of pieces that will benefit by a slower cooling rate, may be placed internally and thus benefit from the later solidification of metal. From the standpoint of mere multiplicity of cast pieces, it is useful to nest the sprues also whenever metal cooling rate is not a factor.

A still further surprising result has been obtainable as the second advantage. This second result is the fact that as many different metals may be cast as there are individual tree set-ups nested together. If this seems surprising at first, reference to FIGURE 2 will remove the question from the reader's mind. Note that there are three disc members employed to build up a composite heat removable pattern to form a cup. These three discs are referred to by reference characters **19**, **20**, and **21**. Those skilled in forming precision casting molds will understand the use of such discs to form pouring cups.

Visualize, therefore, the investment or shell formation around the entire wax pattern set up of FIGURE 2 and the wax removed by volatilization. Under such circumstances there is provided a pouring cup having three distinct pouring levels where the discs **19**, **20**, and **21** now reside. Hence, a metal which should be held at a higher temperature for a longer period of time may be poured in the central area and allowed to flow into the central passageway formed by the inner sprue **12**. When this system is filled, the pouring can be stopped and a second metal poured directly on top and allowed to flow out and fill the passageway formed by the intermediate sprue **11**. Finally, the third metal may be poured upon the top of the second and will run out to the edges and fill the passageway formed by the exterior sprue **10**. Because of the

quick formation of a slight skin over the surface of each metal as the pouring stops and before the next pouring can begin, and because of the fact that the runner system below is filled and only violent, sloppy pouring techniques would displace such metal, there is no tendency to intermix, regardless of specific gravity differences of the various metals.

Returning now to FIGURE 1, this figure is in the inverted position from that which it will occupy when metal is to be cast and illustrates the exterior cylindrical sprue **10** with interior nested sprues **11** and **12**. Workpieces **13**, **14**, and **15** are chosen to illustrate a selection of three different types of workpieces in increasingly smaller size. Of course, such size relationship and difference is not a necessity, but is chosen for illustrative purposes only.

In the FIGURE 3 an alternative structure is illustrated wherein an exterior hollow sprue **25** is provided with a nested solid type sprue **26**. In this instance, because of the greater weight interior of the hollow sprue, crossed brace bars **27** and **28** are provided. It must be borne in mind that when using cross brace bars as illustrated in FIGURE 3, the entire set up must be poured of the same metal, because these cross bars will act as connecting runners when they are removed along with the wax patterns and sprues.

Finally, it has been found that by the use of nested interior tree set ups, additional heat retention can be provided in any degree desirable. If a mere single hollow cylindrical sprue does not provide a sufficient heat retention for a given casting problem, an interior sprue of any needed mass may be provided to hold a greater amount of heat for a greater period of time. Thus, not only it is possible to benefit a particular cast piece by placing it in the interior of a sprue, but an exterior sprue may be benefited by the use of an interior sprue to provide a greater mass for heat retention.

Therefore, the invention is based upon the principles set forth in the parent patent and in addition provides not only the balancing of heat retention for the purpose of controlling the gradient, the production of more workpieces per given set-up for efficiency, but also makes possible the casting of different metals in the same set up for the dual purpose of enabling the operator to take advantage of heat gradient as related to a particular metal and to enable the casting of small quantity pieces without making a special set up and casting operation for a short order.

Although this invention has been described in its preferred form with a certain degree of particularity, it is to be understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A disposable pattern set-up suitable for use in making a refractory mold, said set-up comprising a first tubular sprue having closely spaced inner and outer wall surfaces, a first pouring cup pattern at one end of said sprue, a plurality of expendable patterns extending from said outer surface of said first sprue, a second sprue coaxially disposed within said first sprue, a plurality of expendable patterns extending from said second sprue in spaced relation to the inner wall surface of said first sprue, and a second pouring cup pattern at one end of said second sprue, said pouring cup patterns being positioned one below the other to jointly define a pouring cup in the mold having two pouring levels wherein a different sprue passageway communicates with each level.

2. A refractory mold suitable for casting molten material comprising a first tubular sprue passageway, a plurality of pattern cavities around said first passageway and in communication therewith, a second tubular sprue passageway surrounded by said first sprue passageway, a plurality of pattern cavities between said passageways and in communication with said second passageway, and a pouring cup having upper and lower pouring levels in respective communication with said first and second sprue passageways.

References Cited in the file of this patent

UNITED STATES PATENTS

1,291,390	Brookbent	Jan. 14, 1919
1,358,435	Frank	Nov. 9, 1920
3,015,138	Watts	Jan. 2, 1962