July 14, 1970 C. H. WATTS 3,520,349

SPRUE CONSTRUCTIONS FOR USE IN INVESTMENT CASTING

Filed Sept. 25, 1967

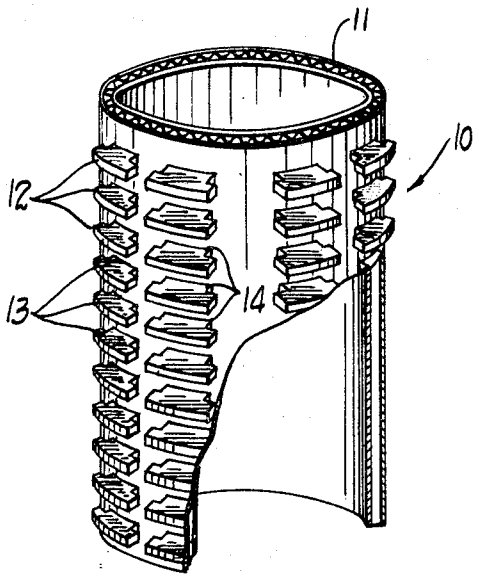


Fig. 1

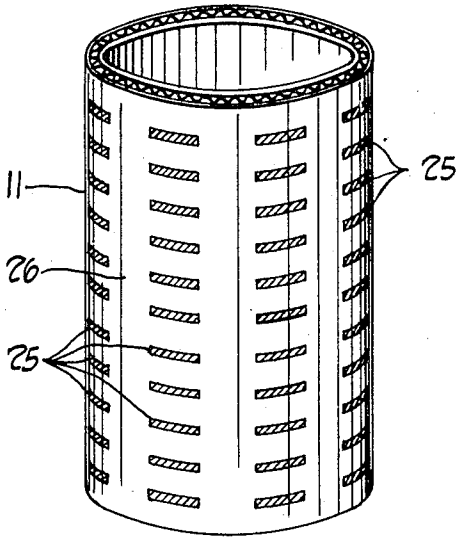


Fig. 3

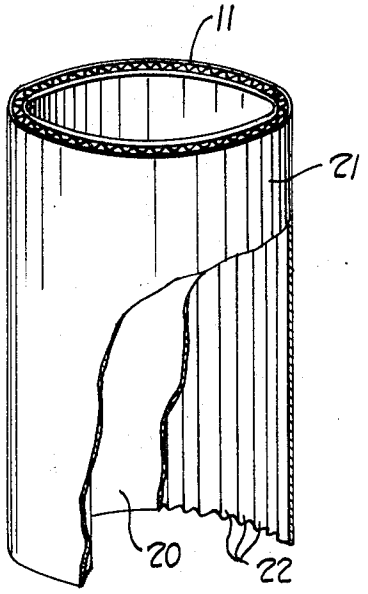


Fig. 2

INVENTOR.
CLAUDE H. WATTS

BY Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

United States Patent Office

3,520,349
Patented July 14, 1970

3,520,349

SPRUE CONSTRUCTIONS FOR USE IN INVESTMENT CASTING

Claude H. Watts, Lyndhurst, Ohio, assignor to Precision Metalsmiths, Inc., Cleveland, Ohio, a corporation of Ohio

Continuation-in-part of application Ser. No. 530,488, Feb. 28, 1966. This application Sept. 25, 1967, Ser. No. 670,066

Int. Cl. B22c 7/02

U.S. Cl. 164—244 10 Claims

ABSTRACT OF THE DISCLOSURE

A sprue construction for use in the lost pattern process of investment casting, characterized by visible markings for locating the positions of patterns to be attached thereto.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 530,488 filed Feb. 28, 1966 by Claude H. Watts and entitled "Investment Casting," now Pat. No. 3,433,-627, issued May 13, 1969.

BACKGROUND OF THE INVENTION

This invention relates generally to the lost pattern processes of investment casting, and more specifically to the formation of a sprue for use in the lost pattern process.

In the lost pattern process, a pattern assembly, commonly referred to as a "set-up" or "tree," is prepared by attaching a plurality of workpiece patterns to a suitable sprue member. The workpiece patterns, which are replicas of the parts to be cast and include the necessary gates, are made of an expendable material, such as wax, a synthetic resin or a combination of wax and synthetic resin. The setup or tree is coated or invested with a suitable refractory material which is allowed to harden to form the mold. Thereafter, the set-up or tree is removed from the mold by a procedure which includes destroying the workpiece patterns, such as by subjecting the mold to heat, in order to form the mold cavities.

A typical procedure which is followed in forming the set-up or tree involves the steps of softening the end of each pattern gate and the wax on the outside of the sprue member at selected locations, as by use of a heated wax welding tool. The gate end of each pattern is pressed tightly against the sprue member to embed the pattern gate into the wax. These operations are repeated until the desired number of patterns have been attached in rows extending around and along the length of the sprue member.

The location of the several patterns on the sprue member is critical. From the standpoint of obtaining the maximum yield of castings from a mold, it is desirable to use a large number of patterns in a set-up. On the other hand, the patterns cannot be so close together as to prevent the mold from being properly formed. For example, ceramic shell molds are made by dipping the set-up or tree into a slurry, sanding the slurry-coated set-up with coarse refractory particles and then drying the coating to form a hard layer. These operations are repeated until a refractory shell of the desired thickness has been built

up around the set-up. When the patterns of the set-up are too close together on the sprue member, it may be impossible to obtain a satisfactory uniform coating of the slurry over the patterns. Further, a substantial amount of slurry may be retained between closely spaced patterns to form thick wall sections which are difficult to dry properly so as to prevent cracking when the mold is subsequently heated, such as during the pattern removal operation or when the mold is fired prior to casting.

The exact locations of the patterns on the sprue member depends on several factors, including the size and complexity of the patterns, the size of the mold and the sprue, the size of the gate required for each pattern, and the metal from which the parts are to be cast. Because of the criticality involved in forming the set-up or tree, the operation has required skilled and experienced personnel. The operation also has been extremely tedious and time-consuming. These problems have become particularly acute in the light of recent developments in the lost pattern process which have made it possible to cast several thousand parts in a single mold, thus necessitating the use of large set-ups having many patterns.

The invention of copending application Pat. No. 3,433,-627 makes it possible to calculate the number of parts which can be cast in a mold using a sprue member of a given diameter and the proper positions of the patterns on the sprue member, thus providing for efficient layout and production control. The preferred embodiment of the invention disclosed in application Pat. No. 3,433,627 comprises two layout scales, one of which is proportioned to the circumference of the particular sprue member to be used in making the mold and the other of which is proportioned to the length of the sprue member. Using these scales, the layout engineer is able to calculate the required spacing of the patterns and the precise location at which the gates of the patterns should be connected to the sprue member. A calculating device comprising similar scales for determining where the patterns should be located on a sprue member is disclosed in commonly assigned copending application, Ser. No. 625,416 of Robert R. Miller, filed Mar. 23, 1967 and entitled "Coordinate Calculator." In both Pat. No. 3,433,627 and copending application Ser. No. 625,416, there is also disclosed the concept of providing a sprue member having circumferential and longitudinal grid lines on its outer surface. The spacing of these lines corresponds to the spacing of the markings or graduations of the two layout scales. Since the proper positions of the patterns are determined in advance by use of the layout scales, it is possible for the person making the set-up or tree precisely to position the patterns on the sprue member by counting the number of grid lines between each pattern.

SUMMARY OF THE INVENTION

A purpose of the present invention is to provide a new sprue construction which makes it possible for a person making a set-up or tree to attach the workpiece patterns with greater accuracy and in less time than has been possible in the past. More particularly, it is a purpose of this invention to provide a new sprue construction which has visible, pattern-locating markings and which is especially adapted for use in connection with the inventions disclosed in copending application Ser. No. 625,416 and Pat. No. 3,433,627.

The new sprue construction includes visible, pattern-locating markings which are spaced apart both circumferentially and longitudinally of the sprue member in accordance with the predetermined positions of the patterns to be attached thereto. In the specifically disclosed embodiment, the pattern locating markings are printed on a sheet of perforated paper which is wrapped around the tubular body of the sprue member. The paper is coated with a layer of wax having a sufficient thickness that it can be melted in selected areas by the conventional procedure for attachment of the gate ends of the patterns. When making a set-up or tree, the operator merely softens the wax in the areas of the visible markings and the ends of the pattern gates. The gate ends of the patterns are then pressed against the sprue member in the locations of the visible markings. The provision of the visible markings makes it possible to attach the patterns quicker and with more dependable accuracy than when using the conventional sprue members which have not been provided with any means for locating the patterns. The assembly of a set-up or tree can also be carried out faster and more conveniently than when using a sprue member having circumferential and longitudinal grid lines, since the operator is not required to count the grid lines in order to locate the patterns.

Other advantages and a fuller understanding of the invention will be had from the following detailed description when taken in conjunction with the accompanying drawing.

DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective, diagrammatic view with portions broken away of an exemplary pattern set-up or tree assembly employing a tubular sprue member;

FIG. 2 is a perspective view of the sprue member of FIG. 1 with portions broken away; and

FIG. 3 is a perspective view of a completed sprue member made according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and to FIG. 1 in particular, the exemplary set-up is generally designated by reference numeral **10**. The set-up **10** is comprised of a central tubular sprue member **11** and a plurality of workpiece patterns **12** projecting from the outside wall of the sprue member.

In accordance with conventional practice, the workpiece patterns **12** may be formed of an expendable material, such as wax, a synthetic resin, or a wax and synthetic resin composition. Each of the patterns **12** includes a main portion **13** which defines the shape of the part to be cast in metal and a gate **14** which has its root end attached to the wall of the sprue member.

The sprue member **11** is preferably in the form of a hollow cylinder. As shown most clearly in FIG. 2, the sprue member may be comprised of a tube **20** made of cardboard or other relatively stiff material, and a corrugated cardboard sleeve **21** which surrounds the tube **20**. Preferably, the sleeve **21** has axial corrugations **22** only in its inner surface, while the outer wall surface of the sleeve is smooth. The preferred corrugated structure of the sleeve **21** is such that the tube **20** can be easily removed from the sleeve after the set-up **10** has been used to form a mold. It is to be understood that the described construction of the body of the sprue member **11** can be varied and that the illustrated structure is not limiting of the invention. For example, the body of the sprue member **11** may be an injection molded wax tube. According to another conventional practice, the sprue member **11** may comprise a metal tube coated with wax.

In accordance with this invention, the outside of the sprue member **11** is provided with visible markings **25** (FIG. 3) which are spaced around and along the length

of the sprue member in rows. If desired, the shape of the markings **25** may conform to the cross-sectional shape of the pattern gates that are to be attached to the sprue member.

The markings **25** may be imposed on the sprue member **11** in several different ways. A preferred technique is to provide a sheet of perforated paper **26** on which the markings **25** are stamped or otherwise printed. The paper **26** is wrapped around the body of the sprue member **11** and is secured in place by any suitable means, as by tape, adhesive or the like. Alternately, it is possible to print the markings **25** directly on the smooth outer surface of the corrugated sleeve **21**.

The illustrated sprue construction **11** is formed by placing the corrugated sleeve **21** around the rigid cardboard tube **20** and wrapping the paper **26** around the sleeve. This assembly is then provided with an outer cylindrical wall formed by a thin coating of a low melting point wax (not shown). The wax acn be coated on the paper **26** by rotating the sprue member on a horizontal axis in a molten wax bath. The thickness of the wax coating which is formed is sufficient to permit the patterns to be secured to the sprue member. Preferably, the thickness of the wax coating is in the range of from about $\frac{1}{32}$ of an inch to about $\frac{1}{16}$ of an inch.

In use the operator locally heats and softens the wax coating directly over each of the markings **25**. The ends of the pattern gates are then pressed into the softened wax against the sprue member. It will thus be seen that the patterns can be precisely positioned around the sprue member **11** in the desired locations with a minimum amount of effort and time by the person making the set-up.

Many variations and modifications of the invention will be apparent to those skilled in the art in the light of the foregoing detailed disclosure. Therefore, it is to be understood that, within the scope of the appended claims, the invention can be practiced otherwise than as specifically shown and described.

What is claimed is:

1. A pattern set-up for use in the lost pattern process of investment casting comprising a sprue member and a plurality of patterns extending from the sprue member and attached thereto, said sprue member having visible pattern-locating markings which are spaced apart and which delineate the locations of the patterns.

2. A pattern set-up for use in the lost pattern process of investment casting comprising a sprue member and a plurality of patterns extending from the sprue member and attached to the sprue member around its outside and along its length, said sprue member comprising a cylindrical body and a plurality of visible, pattern-locating markings which are spaced apart and which delineate the locations of the patterns.

3. A pattern set-up for use in the lost pattern process of investment casting comprising a sprue member and a plurality of patterns extending from the sprue member and attached thereto, said sprue member comprising a tubular body and a plurality of visible, pattern-locating markings which delineate the positions of the patterns attached thereto, said markings being spaced apart and disposed in at least one row.

4. A pattern set-up for use in the lost pattern process of investment casting comprising a sprue member and a plurality of patterns extending from the sprue member in at least one row and attached thereto, said sprue member comprising a cylindrical body, a sheet of material wrapped around said body, said sheet of material having visible, pattern-locating markings which are spaced apart and which delineate the positions of the patterns attached to the sprue member, and a layer of heat softenable material coating said sheet.

5. A pattern set-up as claimed in claim **4** wherein said sheet of material is perforated.

6. A pattern set-up as claimed in claim 4 wherein said body portion is tubular.

7. A pattern set-up as claimed in claim 4 wherein said pattern markings conform in shape to the portions of the patterns attached to the sprue member.

8. A pattern set-up as claimed in claim 4 wherein said pattern markings are in rows and extend circumferentially and longitudinally of said sprue member.

9. A pattern set-up for use in the lost pattern process of investment casting comprising a sprue member and a plurality of patterns extending from the sprue member and attached thereto in rows around the outside of the sprue member and along its length, said sprue member comprising a tubular body, a sheet of material wrapped around said tubular body, said sheet of material including printed, pattern-locating markings which are spaced apart and which delineate the locations of the patterns attached to said sprue member, said markings being arranged in rows and extending circumferentially and longitudinally of said sprue member, and a layer of wax coating said sheet.

10. A pattern set-up as claimed in claim 9 wherein the shape of said markings corresponds to the shape of the portions of the patterns attached to said sprue member.

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J. SPENCER OVERHOLSER, Primary Examiner

R. S. ANNEAR, Assistant Examiner

U.S. Cl. X.R.

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