June 27, 1972 C. F. TODD 3,673,039

METHOD OF PREPARING POURING SPOUT

Original Filed Oct. 15, 1968

Fig. 1

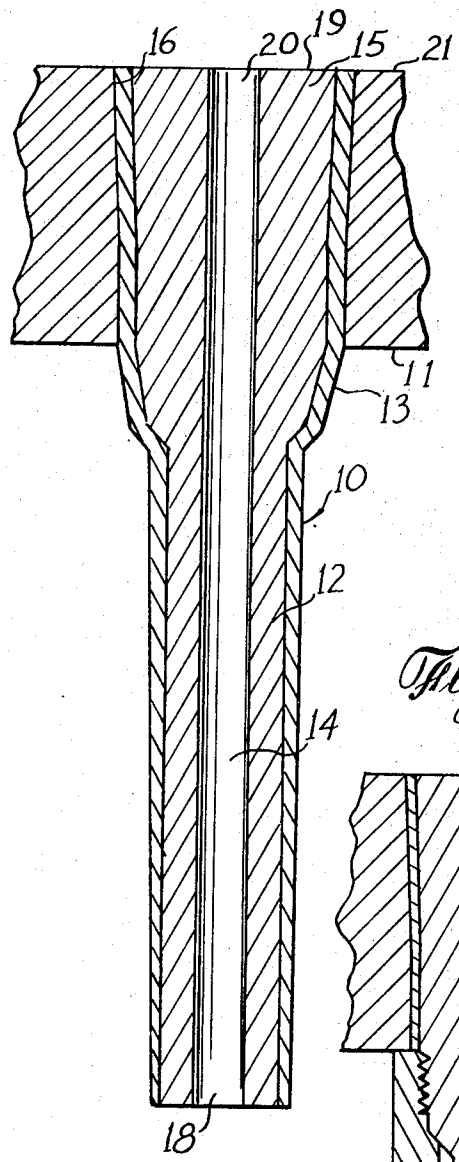


Fig. 2

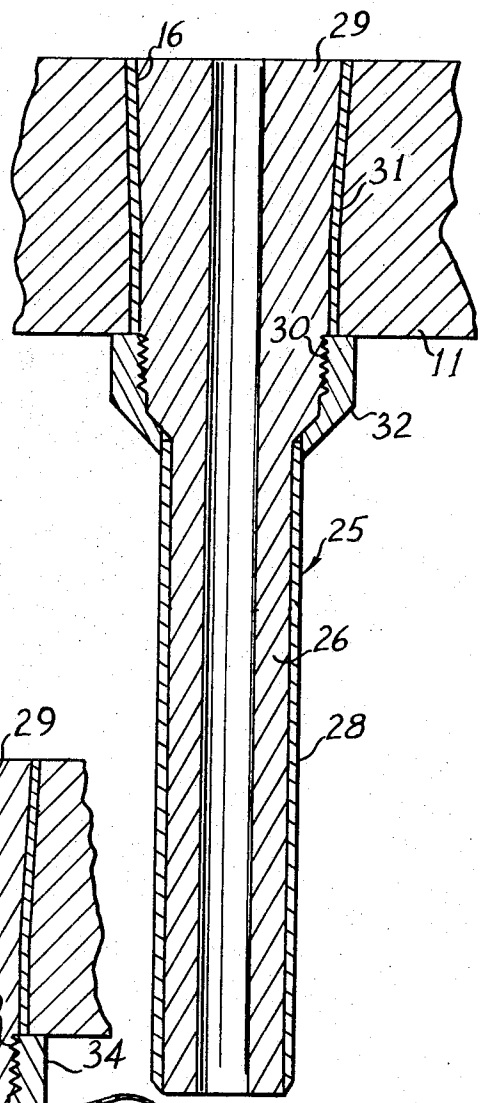
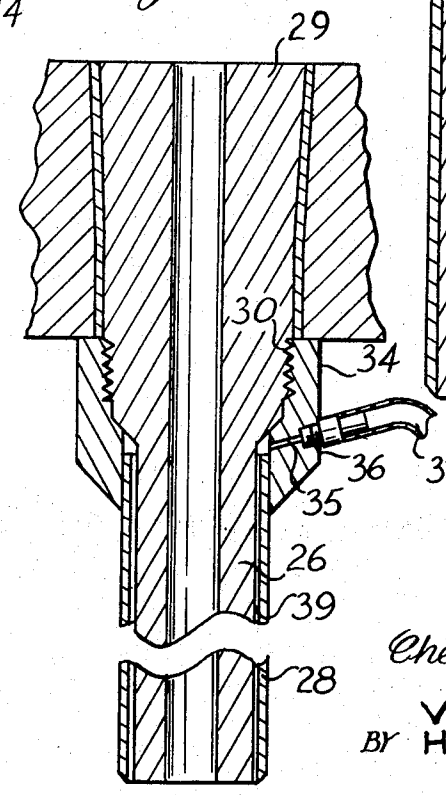


Fig. 3



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METHOD OF PREPARING POURING SPOUT

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Int. Cl. B65d 25/48

U.S. Cl. 156—293 1 Claim

ABSTRACT OF THE DISCLOSURE

A long life pouring spout for pouring molten metal in a continuous casting system, wherein the body of the spout is fabricated of graphite and an insulating shield suurrounds the pouring spout and prevents air from contacting the outside surface of the pouring spout.

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a division of copending application Ser. No. 767,729, filed Oct. 15, 1968.

BACKGROUND OF THE INVENTION

In a continuous casting system for casting metal, molten metal is poured from a pouring pot into a channel formed by the groove in the periphery of a rotating casting wheel and an endless metal band surrounding a portion of the periphery of and moving with the casting wheel. A pouring spout delivers the molten metal from the pouring pot which is spaced away from the casting wheel to an area immediately adjacent the intersection of the casting wheel and the endless band. In the past, pouring spouts have been fabricated of various materials including graphite and silicon carbide which can withstand the elevated heat required in a molten metal system and can also be formed with substantially thin wall construction, which is necessary to guide the molten metal to the intersection of the casting wheel and endless band.

While pouring spouts of this construction have been utilized for a number of years, the life of a typical pouring spout is short, usually between two and four hours of pouring time. The pouring spout must be preheated to a temperature level approximately equal to the temperature of the molten metal before the casting operation starts, and the molten metal flowing through the pouring spout maintains the temperature of the pouring spout at this high level. The elevated temperatures of the pouring spout cause the graphite material of the pouring spout to oxidize and generally deteriorate. Since the molten metal generally fills the inside opening of the pouring spout, the major portion of the deterioration of the pouring spout occurs from its outside surface, due primarily to oxidation of the graphite.

While some attempts have been made to change the composition of the pouring spout to other materials to increase its pouring life, no satisfactory remedy for the short life span of a pouring spout has been developed.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a pouring spout for pouring molten metal from a pouring pot into the groove of a casting wheel, wherein the pouring spout is protected about its outside or exposed surface from oxidation and the resulting deterioration. The outside surface of the pouring spout is covered with mortar, or a tubular shield fabricated of stainless steel or a similar material, to prevent the air from directly contacting the outside surface of the pouring spout. Also, an inert gas can be applied to the pouring spout, between the pouring spout and its shield, to surround the pouring spout with the inert gas.

Thus, it is an object of this invention to provide a pouring spout in a molten metal casting process which is durable and long lasting.

Another object of this invention is to provide a pouring spout which is protected from oxidation.

Another object of this invention is to provide a pouring spout which is inexpensive to construct, easy to connect to the pouring pot of a metal casting machine, and which lasts for an extended period of time during the pouring process.

Other objects, features an advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross sectional view of a pouring spout as it extends from a pouring pot of a casting system, with a layer of mortar applied to the surface of the pouring spout.

FIG. 2 is a cross sectional view, similar to FIG. 1, but showing the pouring spout having its external surface substantially covered by a metallic shield.

FIG. 3 is a cross sectional view of a pouring spout, similar to FIGS. 1 and 2, showing a metallic sleeve surrounding the external surface of the pouring spout, and a gas supply conduit communicating with the area defined between the outside surface of the pouring spout and the inside surface of the metal sleeve.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in more detail to the drawings, in which like numerals indicate like parts throughout the several views, FIG. 1 shows pouring spout assembly **10** which is connected at its upper end to pouring pot **11**. Pouring spout assembly **10** includes graphite spout **12** and mortar covering **13**. Graphite spout **12** is generally tubular in configuration and includes inner conduit **14** which extends from end to end, and upper support shank **15** which extends into pouring pot **11**.

Pouring pot **11** defines an opening **16** in its bottom surface, which is inwardly tapered throughout at least a portion of its length. Support shank **15** is shaped in a similar manner in that it is larger at its upper end and inwardly tapered downwardly along its length. Mortar **13** is applied to the outside surface of pouring spout **12**, substantially over its entire outside or exposed surface. Mortar **13** is applied generally in a uniform surface about spout **12**, with possibly a smaller thickness about the lower opening **18** of spout **12**. Mortar **13** is of a class that includes a large percent of silicon dioxide, smaller percents of aluminum trioxide, lithium oxide and alkaline earth, with additives including ferrous oxide, copper oxide, magnesium oxide and titanium oxide. One specific mortar which has been found suitable is Adamant fire brick cement, produced by Resco Products, Inc., and comprises: 84.4 percent silicon dioxide, 6.5 percent lithium oxide, 5.25 percent aluminum oxide, 2.6 percent alkaline earth, .73 percent titanium oxide, .28 percent ferrous oxide, .08 percent magnesium oxide, and .07 percent copper oxide. This particular mortar is able to withstand temperatures up to 3000 degrees F., which is much higher than the temperatures of molten copper or molten aluminum.

Mortar **13** is applied to upper support shank **15** of pouring spout **12** by hand, and when the mortar is at a suitable viscosity, pouring spout **12** is inserted into opening **16** of pouring pot **11**, from inside pot **11**, by wedging pouring

spout assembly **10** down through tampered opening **16**. The taper of the upper portion of support shank **15** of pouring spout **12** and of opening **16** of pouring pot **11** is such that the downward movement of the pouring spout is limited, and the upper surface **19** about the upper opening **20** of inner conduit **14** is seated at a level where it is substantially coincident to the plane of the inner surface **21** of pouring pot **11**. The portion of mortar **13** surrounding support shank **15** functions to seal and bond support shank **15** to the opening **16** of pouring pot **11**. Mortar **13** is then applied to the portion of the pouring spout which protrudes from the pouring pot so that the remaining portion of the external surface of pouring spout **12** is sealed from the atmosphere.

After pouring spout assembly **10** has been inserted through the opening of the pouring pot, it should be allowed to dry from two to four hours, if time permits. If enough time is not available for properly drying the mortar, the heat from the pouring pot **11** will suffice for the purpose of drying the mortar.

Under some conditions it may be desirable to apply fire clay to support shank **15** of pouring spout **12**, and mortar to the protruding portion of the spout. Furthermore, it may be desirable to apply the mortar to the protruding portion of the pouring spout before it has been inserted into pouring pot **11**. In either case, mortar **13** can be applied by hand without significant difficulty.

Before molten metal is allowed to flow through pouring spout assembly **10**, the pouring spout should be preheated to a temperature approximately equal to the temperature of the molten metal to prevent the initial metal flow through the pouring spout from solidifying before it reaches the casting wheel. After the molten metal is allowed to flow through pouring spout assembly **10** the preheating function can be terminated since the molten metal will maintain the temperature of the pouring spout. After the pouring of molten metal begins, the mortar surrounding the pouring spout insulates the pouring spout from the atmosphere and functions to reduce heat loss from the pouring spout, and the hazzard of the molten metal freezing in the pouring spout.

If the mortar **13** surrounding pouring spout **12** should become cracked or otherwise chipped or damaged during or before the pouring operation, mortar **13** can be repaired without terminating the pouring operation by merely applying an additional mortar to the cracked or damaged portion of the assembly. In this manner, the pouring spout does not have to be removed from the casting machine and the casting operation does not have to be terminated to maintain the pouring spout in an oxygen-free environment.

FIG. 2 shows a pouring spout assembly **25** which includes a pouring spout **26** which is generally similar in configuration to pouring spout **12** of FIG. 1, and a stainless steel shield **28** surrounding pouring spout **26**. Shield **28** is sized so that it fits tightly about the outside surface of pouring spout **26**. Support shank **29** of pouring spout **26** includes a threaded portion **30** which is positioned immediately below pouring pot **11**. Internally threaded collar **32** is connected to the upper end of shield **28** and threaded onto the threads of pouring spout **26**. Collar **32** engages the bottom surface of pouring pot **11**, and functions to hold shield **28** on pouring spout **26** and to positively maintain pouring spout **26** in its proper position with respect to pouring pot **11**. Fire clay or mortar **13** surrounds shank **29** of spout **26**, to seal shank **29** to the opening **16** of pouring pot **11**.

The arrangement of FIG. 2 is such that the outer surface of pouring spout **26** is shielded and virtually sealed from the atmosphere, so that the outside surface of pouring spout **26** will not oxidize due to oxygen of the atmosphere freely contacting its hot outside surface.

As is best shown in FIG. 3, collar **32** can be modified as collar **34**, by positioning aperture **35** in collar **34** so that it communicates with the upper end of pouring spout **26**,

adjacent the threaded portion **30** of shank **29**. Fitting **36** communicates at one of its ends with aperture **35**, and at the other of its ends with conduit **38** which is connected to a source of inert gas under pressure. Shield **28** is sized so as to leave a small annular space **39** between the inside surface of shield **28** and the outside surface of pouring spout **26**. Thus, the pressurized inert gas will flow through conduit **38**, fitting **36**, and aperture **35** to annular space **39**, whereupon it surrounds the outside surface of pouring spout **26**. The presence of inert gas in annular space **39** is such that the oxygen in this space is removed from the vicinity of pouring spout **26**. Thus, no oxygen is present at the outside surface of pouring spout **26** to cause oxidation of the pouring spout.

The stainless steel shields **28** of FIGS. 2 and 3 are telescoped over the protruding ends of their pouring spouts after the pouring spouts have been inserted into the opening **16** of pouring pots **11**. Shields **28** are constructed so that the lower end of a pouring spout protrudes beyond the ends of the shields. Thus, the end portion of the pouring spout will be exposed to the atmosphere, while the upper portion of the pouring spout will be protected. Since the lower end of the pouring spout will dissipate even when a protective shield surrounds this portion of the pouring spout due to oxygen contacting the extreme end of the pouring spout and due to the molten metal flowing through the pouring spout, it is better to allow the lower end of the pouring spout to protrude from the shield, since otherwise the lower end of the pouring spout would be dissipated inside of the shield. Furthermore, it is not detrimental to the pouring function to have a portion of the lower end of the pouring spout foreshortened or dissipated.

In the case where the pouring spout is protected by mortar the mortar can extend down to the lower end of the pouring spout since the mortar will crumble and dissipate with a corresponding dissipation of the pouring spout without detrimental effect on the resulting cast metal.

While the average life span of an unprotected graphite pouring spout is from two to four hours of pouring time, a pouring spout protected as disclosed herein will survive an average of eight hours pouring time, with some pouring spouts surviving over fourteen hours pouring time. Thus, it should be obvious the invention disclosed herein provides an improved pouring spout for casting molten metal, that the longer life of the pouring spout reduces the cost of construction of the spout and the labor required to replace worn spouts. Furthermore, less down time is experienced in the casting machine.

While the pouring spout has been disclosed as being fabricated of graphite, silicon carbide and clay graphite pouring spouts have been successfully used in continuous casting apparatus, and mortar and stainless steel shields can also be utilized with pouring spouts of this type. Furthermore, it is anticipated that various other materials can be utilized as pouring spouts and to protect pouring spouts. The basic requirement is that the protective material adhere to or be positionable closely adjacent the outside surface of the pouring spout to prevent circulation of oxygen adjacent the outer surface of the pouring spout, or that a space be provided between the protective shield and the other surface of the pouring spout to drive oxygen away from the outside surface of the pouring spout.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claim.

I claim:

1. A method of preparing a pouring spout in a molten metal casting system wherein a pouring spout extends from a pouring pot toward a casting system the method comprising applying a bonding material to the shank of the pouring spout, inserting the shank into the pouring

pot in such a manner that the pouring spout extends from and communicates with the pouring pot, applying a coating of mortar to the exterior surface of the pouring spout, and curing the mortar.

References Cited

UNITED STATES PATENTS

3,279,003	10/1966	Yates	222—566
3,284,860	11/1966	Gurak	222—566

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