Feb. 6, 1968 W. J. CURRY, JR 3,367,189

APPARATUS FOR PREPARING METAL TEST SAMPLES FROM MOLTEN METAL BATHS

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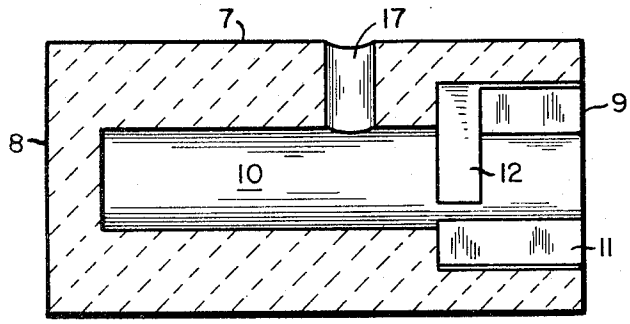


Fig. 1

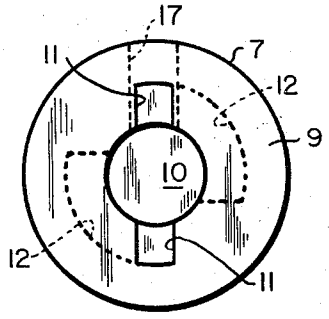


Fig. 2

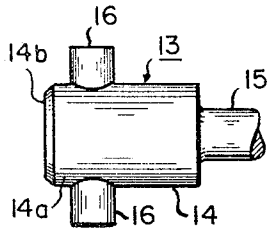


Fig. 3

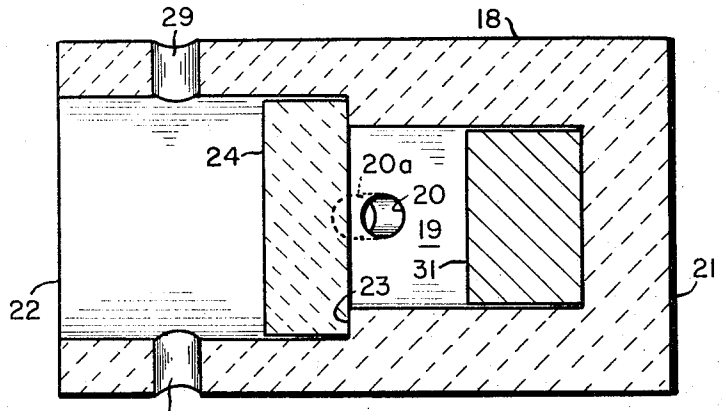


Fig. 4

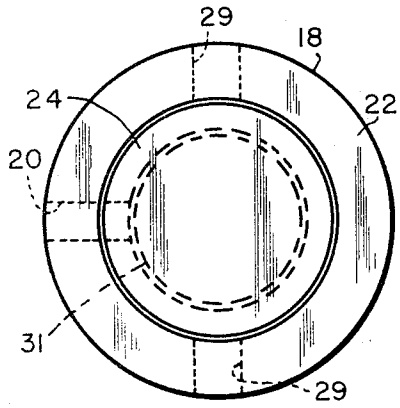


Fig. 5

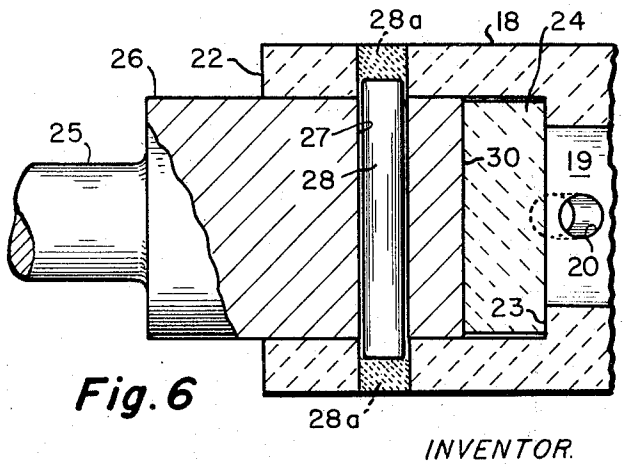


Fig. 6

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APPARATUS FOR PREPARING METAL TEST SAMPLES FROM MOLTEN METAL BATHS

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ABSTRACT OF THE DISCLOSURE

A molten metal sampling apparatus having an elongated hollow body of refractory material secured at one end to a handle and having a filling passageway in a side of the body for the flow of molten metal to fill the body which is the desired size of the sample to be taken and which may contain a chilling plug.

For many years it has been the custom in the steel and other metal industries to obtain samples of molten metal during processing for testing and analysis of physical and chemical properties. An operator has dipped a hand ladle into a molten bath or molten metal has been poured into a hand ladle, following which the molten metal in the ladle has been poured into molds of the desired size and shape, which, when air cooled, produced samples of the desired size and shape for chemical and physical analysis, particularly physical analysis.

I have invented method and apparatus whereby this sampling operation is completed more quickly than has heretofore been the practice. My invention is useful whenever it is important that test samples be obtained quickly, and it is, therefore, particularly useful in obtaining samples from basic oxygen furnaces.

Broadly described, my invention comprises the use of a mold of refractory material which is secured to the end of a handle so that it can be dipped into a bath of molten metal and which, when mounted on the end of a handle, is a closed hollow body having a filling passageway through which molten metal will flow to fill the body when it is dipped into a molten metal bath.

The mold is dipped into a bath filled with molten metal. The metal flows into the mold and solidifies within the mold while the mold is in the bath. After the mold has been filled, it is withdrawn and broken to free the solidified metal. The interior of the mold has the desired size and shape of a sample to be used for testing so that a sample is immediately available when the refractory mold is broken.

In the accompanying drawings I have illustrated certain presently preferred embodiments of my invention in which:

FIGURE 1 is a longitudinal section of a mold embodying my invention;

FIGURE 2 is an end view of the mold shown in FIGURE 1;

FIGURE 3 is a partial side view of a handle used to maneuver the mold shown in FIGURES 1 and 2;

FIGURE 4 is a longitudinal section of a modified form of mold embodying my invention;

FIGURE 5 is an end view of the mold shown in FIGURE 4; and

FIGURE 6 is a partial longitudinal section of a handle to be secured to the mold shown in FIGURE 4 and of the mold together with a key for joining the handle and the mold.

Referring to FIGURE 1 of the drawings, the apparatus which I have invented for preparing metal test samples comprises a mold in the form of a hollow body **7** of refractory material, for example, refractory clay, which is preferably in the form of an elongated hollow cylinder

closed at one end **8** and open at the other end **9**. The interior **10** of the mold body has the size and shape of a test sample which is to be obtained.

The open end **9** has longitudinally extending slots **11** and inner circumferentially extending slots **12** which form bayonet slots whereby a handle **13** (see FIGURE 3) may be secured to the open end of the mold. As shown in FIGURE 3, the handle **13** has an end portion **14** which has a diameter the same as the interior **10** of the mold and an elongated handle portion **15**. The end portion **14** of the handle has bayonet lugs **16** which cooperate with the slots **11** and **12** to form a bayonet joint whereby the handle is secured to the open end **9** of the mold **7**. An end portion **14***a* of the enlarged portion **14** extends forwardly of the lugs **16** and has a beveled edge **14***b* to facilitate positioning of the portion **14** within the mold **7**. The end portion also assists in closing the open end **9** by the handle when the bayonet lugs **16** are inserted into the slots **11**, and the handle is turned so that the lugs **16** slide in the slots **12** to secure the handle to the mold **7**.

The mold has in its side an access passageway **17** through which molten metal will flow into the interior **10** of the mold when the mold is dipped into a bath of molten metal as is later described.

FIGURE 4 is a longitudinal section of a modified form of mold embodying my invention. The mold **18** is in the form of an elongated hollow cylindrical body of refractory material having an interior **19** which has the size and shape of the test samples to be taken from the bath. A filling passageway **20** is in the side of the mold for the flow of molten metal from the bath into the interior **19** when the mold is dipped into a bath. As shown by the dotted lines **20***a* in FIGURE 4, the passageway is sloped toward the handle at an angle of approximately 75 degrees with the central axis of the mold to facilitate the flow of molten metal into the mold.

The mold has a closed end **21** and an open end **22**. The open end **22** has a diameter larger than the diameter of the interior **19** of the mold to form a shoulder **23**. A handle for maneuvering the mold is secured to the open end **22**, and when in position, holds a cylindrical plug **24** of refractory material against the shoulder **23** to close the interior **19** of the mold.

Referring to FIGURE 6, a handle **25** has an enlarged end **26** of a diameter to fit closely within the open end **22** of the mold. The enlarged end has a diametrically extending passageway **27** through which a pin **28** is passed after the enlarged end **26** has been inserted in the open end **22** of the mold. This pin **28** extends into two diametrically opposed openings **29** in the sides of the open end **22** and thereby secures the handle to the mold, and a portion **30** of enlarged portion **26** which is forward of the pin **28** holds the plug **24** against the shoulder **23** of the mold. The pin **28** extends only part way into the passageway **29** and the ends of the pins are covered with high temperature cement **28***a* to hold the pin in position and prevent metal in the bath from adhering to the ends of the pins.

To obtain a test sample, an operator secures a mold to a handle and dips the mold into the molten bath. The mold may be dipped vertically into the molten bath or it can be immersed at an angle to the vertical. When the mold is dipped into the bath at an angle, the filling passageway is positioned vertically, and the end of the handle can be bent at an angle of 90 degrees to give an indication of the test mold position. If the metal bath has a slag covering, the mold may be turned to point the filling passageway downwardly while the mold is being passed through the slag and then again turned so that the passageway extends upwardly.

Because the mold is made of refractory material, the

temperature of the inside of the mold is considerably below the temperature of the molten bath, when the mold is inserted in the bath, and therefore the molten metal being sampled solidifies almost instantly upon entry into the mold. When the mold has been filled it is withdrawn from the bath, and it can be immediately broken to produce a test sample having the size and shape desired for chemical and physical analysis and testing.

In order to expedite the chilling of the molten metal which flows into the mold, I may provide a cylindrical copper plug **31** which is placed adjacent the closed end **21** of the mold as shown in FIGURE 4. To further expedite chilling of the metal, I may make the ceramic plug **24** also of copper.

From the foregoing, it is apparent that I have invented method and apparatus for preparing test samples from molten metal baths which produce the samples much more quickly than has heretofore been done. In a single operation, test samples are prepared which have the desired size and shape for physical testing and which also can be used for chemical analysis. The molds are readily attached to a handle whereby they can be dipped into a molten bath, and they can be manufactured at low cost so that their breaking to free the test samples constitutes only a very small part of the cost of the entire test procedure.

While I have described certain presently preferred embodiments of my invention, it is to be understood that they may be otherwise variously embodied within the scope of the appended claims.

I claim:

1. Apparatus for preparing metal test samples from molten metal baths which comprises,

(A) an elongated hollow body of non metallic refractory material closed at one end, and open at the other end,

(B) a handle for maneuvering the body into and out of metal baths,

(C) means at the open end of said body for securing the handle to the body, the handle extending into the open end to close it, and

(D) a filling passageway in a side of the body and between the ends of the body for the flow of molten metal into the body when it is dipped into a bath of said metal.

2. Apparatus for preparing metal samples as described in claim **1** in which the means for securing the handle to the body comprises bayonet slots in the body and bayonet lugs on the handle, the slots and lugs cooperating to complete a bayonet joint and the end of the handle closing the open end of the body.

3. Apparatus for preparing metal samples as described in claim **1** in which the means for securing the handle to the body comprises diametrically opposed openings in the sides of the body adjacent said open end, a transverse opening in the handle, and a pin extending through the opening in the handle and into the openings in the sides of the body when all openings are axially aligned.

4. Apparatus for preparing metal samples as described in claim **1** and having a refractory plug positioned at the end of the handle for closing the open end of said body.

5. Apparatus for preparing metal samples as described in claim **1** and having a copper plug positioned at the end of the handle for closing the open end of said body.

6. Apparatus for preparing metal samples as described in claim **1** and having a copper plug positioned adjacent the closed end of said body for chilling molten metal entering said body when it is dipped into a molten bath.

7. Apparatus for preparing metal samples as described in claim **1** in which the interior of the elongated hollow body conforms in size and shape to the desired test sample.

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