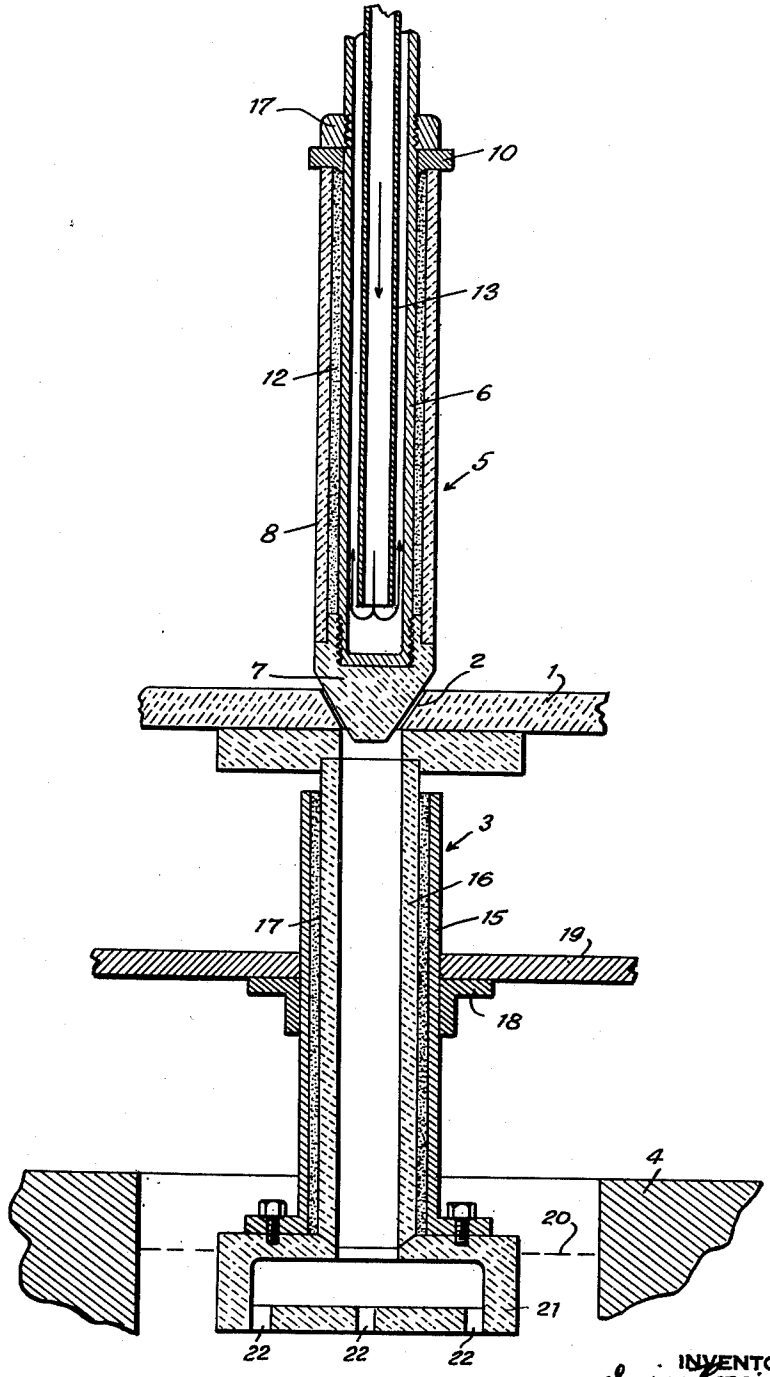
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APPARATUS FOR CONDUCTING MOLTEN METAL

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APPARATUS FOR CONDUCTING MOLTEN METAL

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1 Claim. (Cl. 22—57.2)

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This invention relates to the continuous casting of metals and pertains particularly to apparatus for conducting the molten metal from a reservoir to the mold in which the metal is cast, and for controlling the flow therethrough.

In the casting of non-ferrous metals such as aluminum, copper, brass and the like in which the temperatures of the molten metal are relatively low, i. e. below 2000° F., the problem of conducting the molten metal and controlling the flow thereof is relatively simple of solution because of the availability of metals and refractories capable of withstanding such temperatures. In the casting of steel, however, the problem is much more difficult, for metals and refractories which are entirely adequate to handle non-ferrous metals are unsuited to withstand the higher temperatures of molten steel.

It is an object of the present invention to provide apparatus for conducting molten steel from a reservoir to a casting mold and for controlling the flow therethrough which shall be capable of withstanding the temperatures of moten steel for considerable periods of time.

It is a further object of the invention to provide a composite metal-refractory structure having a layer of finely divided, i. e. powdered or fine granular refractory located between the metal and refractory parts adapted to provide a seal in the event of fracture of the solid refractory.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawing, in which,

The figure is a vertical cross section through the apparatus.

Referring to the drawing, the floor 1 of the rservoir in which the molten metal is maintained in molten condition is provided with an aperture 2 through which the molten metal flows through a conduit 3 which conducts the molten metal to the casting mold 4. The flow of molten metal through the aperture 2 is controlled by a valve 5.

The present invention has to do with the construction of the conduit 3 and valve 5 in order to enable these to withstand the temperatures of molten steel for considerable periods of time. For this purpose a composite metal-refractory structure is proposed as hereinafter described.

The valve 5 comprises a tubular metal shell 6 with walls heavy enough to provide the required mechanical strength. The lower end of the shell carries a plug 7 of refractory material which

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seats against the aperture 2 and may be adjusted with respect thereto.

The shell 6 supports and is surrounded by a refractory tubular sleeve 8, arranged substantially concentrically therewith and spaced therefrom and seated on the plug. The upper end of the sleeve 8 is held in place by the washer 10 and nut 11 threaded on the shell 6. The space between the shell 6 and sleeve 8 is filled with powdered or granular refractory material 12.

The interior of the shell 6 is cooled by suitable cooling fluid such as water or air, for example. Preferably the cooling fluid is introduced through a tube 13, circulating in the direction shown by the arrows.

With this construction, the metal shell 6 is constantly cooled by the cooling fluid and retains its strength as a supporting member for the refractory tube 8. Furthermore, the cooling effect on the plug 7 reduces the effect of the molten steel thereon, without, however, causing molten metal to freeze on the plug.

The combination of the refractory tube 8 and the layer of powdered or granular refractory material 12 serves to prevent the freezing of molten metal on the outer surfaces, and has been found exceptionally satisfactory for this purpose, not only because of the good insulating value of the finely divided refractory, but also because the combination provides a structure which can continue to operate satisfactorily even though the sleeve 8 may crack due to thermal shock. In the event of cracking, the influx of molten metal will be stopped by the powdered or granular refractory acting as a seal.

A similar principle of construction is employed in the conduit 3 in which a tubular supporting member 15 of metal, preferably steel, is spaced from the refractory conducting tube 16 by a layer of powdered or granular refractory material 17. The conduit is supported in any suitable manner, as by the flanged collar 18 secured to a suitable support 19. Ordinarily the metal tube 15 is cooled sufficiently by radiation and convection, although it may be additionally cooled by air blast or water jacket, if desired.

Again, as in the case of the valve 5, even in the event of cracking of the refractory tube 16, the escape of molten metal will be prevented by the powdered or granular refractory material 17 acting as a seal.

The powdered or granular refractory material 12 and 17 above referred to should be of a type having a fusing temperature higher than the

melting point of steel. Powdered or granular magnesia, zirconia, silica or alumina are examples of satisfactory materials. This powdered or granular material should be placed in the spaces provided in loose, discrete form, i. e. without the use of binder of any kind.

In some cases, the molten metal may be discharged directly from the bottom of the tube **16**, but it is usually advisable to use a distributor at the bottom of the tube to break or direct the flow of molten metal. In the present embodiment such a distributor is shown, comprising an enlarged head **21** of refractory material secured to the flanged end of the tube **15**. The molten metal flows into the mold **4** through apertures **22**. The usual level of molten metal in the mold is indicated by the numeral **20**.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claim.

We claim as our invention:

In an apparatus for the continuous casting of steel, a fluid cooled valve for controlling the flow of molten metal from a furnace to a casting mold comprising, a refractory tube, a metal

shell within and supporting said refractory tube but spaced therefrom, a layer of finely divided refractory material in loose, discrete form filling the space between said tube and shell, said finely divided refractory material having a fusing temperature higher than the melting point of steel and serving as a seal in the event of cracking of said tubular member of refractory material, and a refractory plug supported on the lower end of said shell, and means for circulating cooling fluid within said metal shell.

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