

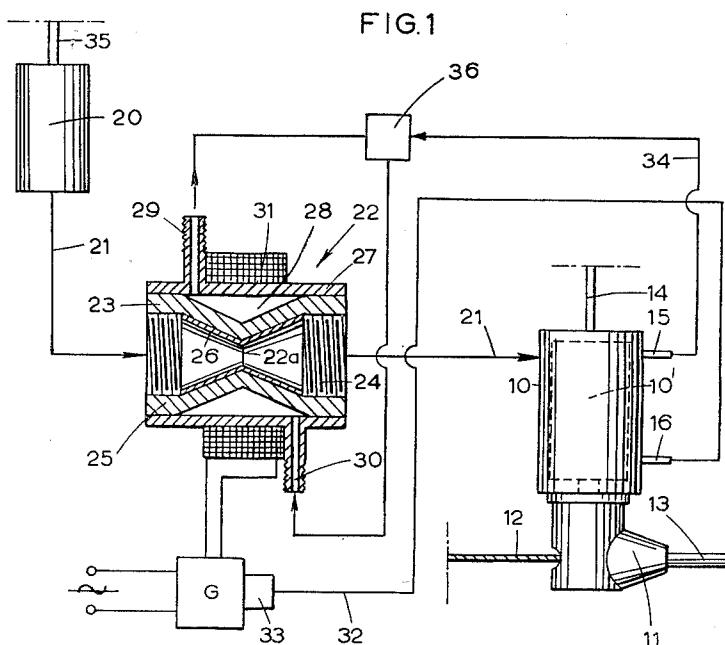
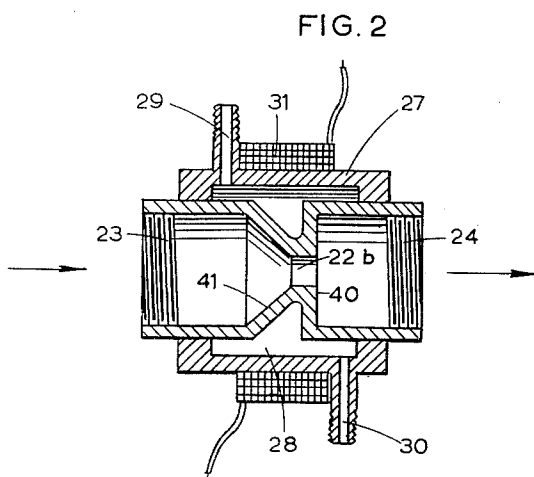
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VALVE FOR LIQUID METAL

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VALVE FOR LIQUID METAL

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The present invention relates to metallurgical plants for dealing with metals in the molten state, in particular aluminium, of the type in which the container of an apparatus for utilising molten metal, for instance a press for extruding sheaths on electric cables, is supplied from a crucible or furnace through a duct provided with a shut-off valve.

In cases of the above-mentioned type, while the transfer of lead (often used as sheathing material) does not show particular difficulties, both on account of its relatively low melting temperature and of its features in the molten state, the conveyance of molten aluminium through ducts provided with valves has always given rise to serious difficulties, in particular owing to the corrosive action of molten aluminium on steel or other metals. These difficulties further increase when the transfer must be carried out under pressure, and this relates in particular to the valves, which in such conditions cannot work regularly or function for a reasonable period.

The present invention aims at improving metallurgical plants of the above-described type, by providing a novel structure of the valve, together with means for its operation.

According to the present invention, in a plant as above referred to the valve is constituted by a throttled passage made of a material which, at least on its inner surface is resistant to the corrosive action of molten metal, surrounded by a cooling jacket, this jacket being in turn surrounded by an inductive heating winding supplied from a high-frequency alternating current generator controlled by a detector of a predetermined minimum level of the molten metal in the said container in such a manner as to connect the generator to the heating winding when the level in the container is a minimum.

By way of example one form of plant in accordance with the invention will now be described with reference to the accompanying drawing, in which:

FIGURE 1 illustrates schematically in partly sectional elevation a plant for the extrusion of aluminium sheaths on electric cables, and

FIGURE 2 illustrates in axial section an alternative form of the valve used in the plant shown in FIGURE 1.

Referring to FIGURE 1, the reference numeral 10 indicates a press for the extrusion of aluminium to form the sheath of an electric cable, comprising a container 10' communicating with an extrusion head 11. An electric cable 12 is moved forward through the head 11 which applies a sheath 13. The press forms no part of the present invention and may be of any suitable construction.

The molten metal in the container 10' is extruded by gas pressure fed through a pipe 14 at the top of the container. The latter contains moreover level detectors 15 and 16, respectively intended to provide indication of the maximum and minimum level of the molten metal in the container 10' and to exercise a controlling function accordingly.

The molten aluminium is supplied to the press from a crucible or melting furnace 20 through a duct 21 where-in a shut-off valve 22 is inserted. The duct 21 is made of steel, capable of withstanding the internal pressure, and is provided with a lining of a material not subject to corrosion by the molten metal, for instance of graphite.

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The valve 22 comprises an inner steel sleeve, having a threaded inlet end 23, a threaded outlet end 24 and a portion 25 in the shape of a double convergent-divergent cone 22a, forming the above-mentioned throttle.

The inner surface of the portion 25 must be protected against corrosion; to this end it may be completely made of a metal not subjected to corrosion by the molten metal, for instance, titanium, but it may be advisable to make it of steel or other metal and to line it with a metal, such as titanium, or with a suitable non-corrodible enamel 26, for instance of chromium boride or aluminium oxide or like material which may be applied by spraying or other method.

The sleeve 25 is fitted in a fluid-tight manner in a cylindrical bushing 27, so that between the double-cone portion and the bushing there is formed an annular chamber 28, into which open two tubular connections 29, 30 (preferably in zones diametrically opposed and longitudinally offset) as shown in the drawing.

Around the central portion of the bushing 27 there is a winding 31, whose extremities are connected to a generator G, which feeds the winding 31 with alternating current at a frequency generally ranging between about 500 and 500,000 Hertz, as is usually done in heating and melting processes of metals by induction. The generator G is controlled through a line 32 by the minimum level detector 16 and is moreover provided with a timing device 33, preferably adjustable, which automatically disconnects the generator after a stated period of time from its connection with the detector 16. The maximum-level detector 15 is connected through a line 34 to further auxiliary equipment 36 for cooling fluid, whose function will be described hereafter.

Flow of molten aluminium through the duct 21 and the valve 22 to the container 10' of the press 10, may be carried out in various ways. According to a first possibility, the metal may simply flow by gravity, the furnace or crucible 20 being located sufficiently higher than the press 10 and the gas pressure in the container 10' being released when the detector 16 indicates the minimum level. According to a further possibility, the crucible 20 may be fluid-tight, being provided with a duct 35 to supply a gas at a pressure higher than the pressure existing in the container 10' during the extrusion process. In this case the minimum-level detector 16 could control the admission of compressed gas to the crucible 20 through the duct 35. Finally, a still further possibility would be that of releasing the pressure from the container 10' and applying pressure to the crucible, in which case the detector 16 would control a change-over valve between the source of compressed gas on the one hand and the crucible and the press on the other.

When the molten metal has reached in the container 10' the maximum predetermined level, the detector 15 operates a fluid-cooling system 36, whose circuit includes the annular chamber 28 with its connections 29 and 30. At the same time, the same detector 15 acts preferably also on the feeding system of the compressed gas so as to equalise, at least approximately, the pressures acting on the molten metal in the duct 21. In this way the molten metal in the throttle of the valve 22 is soon solidified by virtue of the cooling fluid passing through the chamber 28, so forming in the valve a solid plug of biconical shape. By this means, the crucible 20 is separated from the press 10 and may be filled again with molten metal; alternatively, in case of a furnace, it may be filled with aluminium ingots to be melted. At the same time the press carries out the extrusion function, so that the level of the liquid metal in the container 10' progressively decreases till it reaches the predetermined minimum. This fact is indicated by the detector 16, which automatically introduces the generator G with its timing device 33.

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The generator excites the inductive winding 31, so that the solid plug in the valve 22 is melted, and then the device 33 disconnects the generator. The above-described feeding cycle is then repeated.

The conicity of the portion 25 of the valve 22 depends upon the pressures involved and must be in any case so arranged that the extrusion pressure existing in the container 10' may not cause the expulsion of the plug through the throttle towards the furnace or crucible 20.

The valve illustrated in FIGURE 2 differs from the above-described form chiefly in that the throttle 22b is defined at its outlet by a flat transverse wall 40, whilst at its inlet the frusto-conical shape 41 has been maintained. In this case the part of the solid plug formed between the throttle 22b and the outlet end 24 bears against a transverse wall, so that the working pressure of the press 10 can be increased to a certain degree without fear of the rearward expulsion of the plug through the throttle 22b.

What we claim and desire to secure by Letters Patent in the United States is:

1. Valve control means for dealing with a corrosive metal in the molten state, and being of the type wherein stoppage of the flow of the said metal is effected by solidifying a mass thereof in the valve; said control means comprising in combination a member having a passage extending therethrough and providing adjacent and substantially aligned inlet and outlet portions, the part of said inlet portion which communicates with said outlet portion being progressively constricted in the direction of said outlet portion whereby to provide a flow throttle, said member at least at the site of said passage being formed of a material which is resistant to the corrosive action of said metal, and heating means for the metal carried by said member and surrounding said passage.

2. Valve control means for dealing with a corrosive metal in the molten state and being of the type wherein stoppage of the flow of the said metal is effected by solidifying a mass thereof in the valve; said control means comprising in combination a member having a throttled passage provided by frusto-conical walls which converge toward each other, said member being made of a material which, at least on its inner surface, is resistant to the corrosive action of the said metal, a jacket surrounding and spaced from said member, and an electrical inductive heating coil surrounding said member.

3. Valve control means for dealing with a corrosive metal in the molten state, and being of the type wherein

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stoppage of the flow of the said metal is effected by solidifying a mass thereof in the valve; said control means comprising a member having a throttled passage having its inlet end provided by the diametrically enlarged end portion of a frusto-conical wall, the outlet end of said passage defined by a flat transverse wall, said member being made of a material which, at least on its inner surface, is resistant to the corrosive action of the said metal, a jacket surrounding and spaced from said member, and an electrical inductive heating coil surrounding said member.

4. Valve control means for dealing with a corrosive metal in the molten state and being of the type wherein stoppage of the flow of the said metal is effected by solidifying a mass thereof in the valve; said control means comprising a member having a passage extending therethrough, said passage providing adjacent frusto-conical inlet and outlet portions which converge toward one another whereby to provide a flow throttle, said member at least at the site of said passage being formed of a material which is resistant to the corrosive action of said metal, and heating means for the metal carried by said member and surrounding said passage.

5. Valve control means for dealing with a corrosive metal in the molten state, and being of the type wherein stoppage of the flow of the said metal is effected by solidifying a mass thereof in the valve; said control means comprising a member having a passage extending therethrough having adjacent inlet and outlet portions, the part of said inlet passage portion which is immediately adjacent said outlet portion being constituted by a frusto-conical wall tapering inwardly in the direction of said outlet portion, a flat transverse wall in said passage and providing the entry to said outlet passage portion, whereby to provide a flow throttle, said member at least at the site of said passage being formed of a material which is resistant to the corrosive action of said metal, and heating means for the metal carried by said member and surrounding said passage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,644,820	Gresham	July 7, 1953
2,667,178	Fred	Jan. 26, 1954
2,723,108	Butler	Nov. 8, 1955
2,904,063	Wall	Sept. 15, 1959
2,919,710	Lantz	Jan. 5, 1960