Jan. 20, 1959 G. A. PAGONIS 2,869,370

COMBINED VALVE AND MOLTEN METAL SAMPLING DEVICE

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Fig. 1.

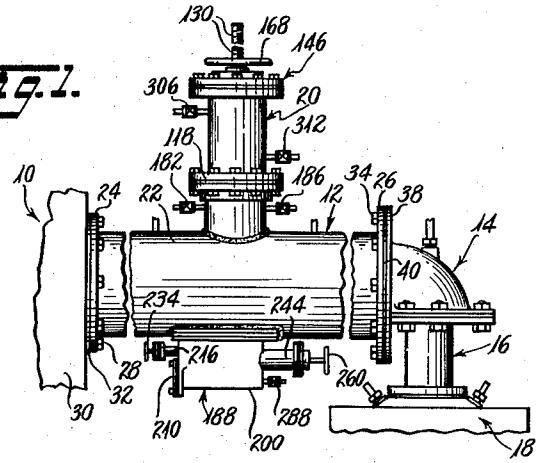
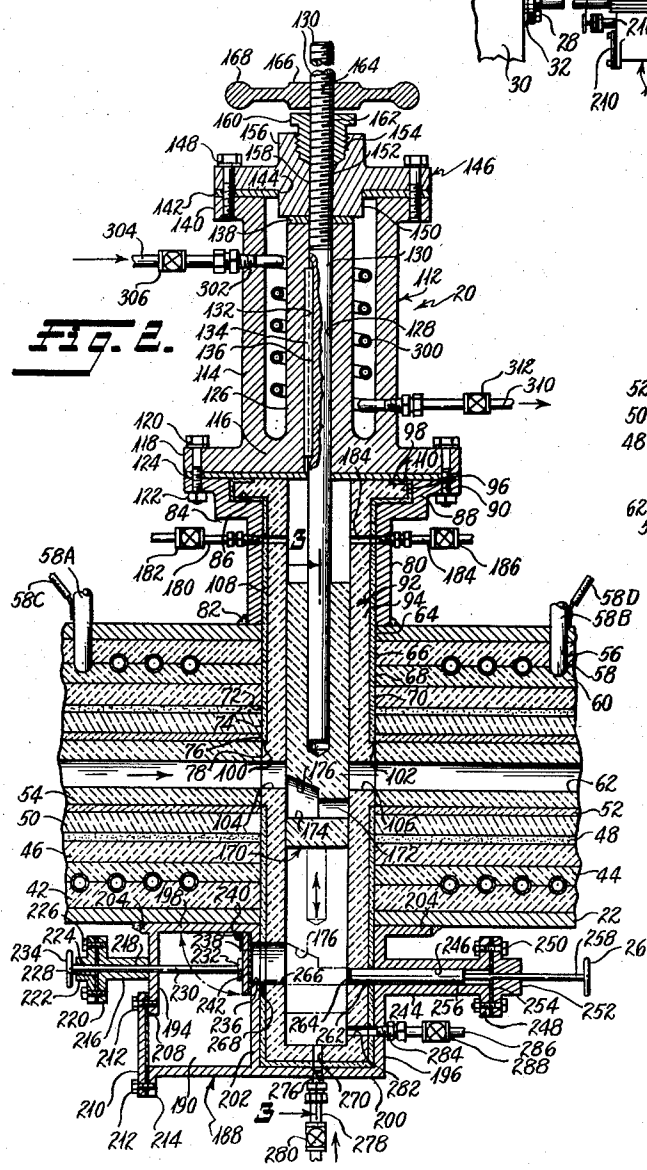


Fig. 2.



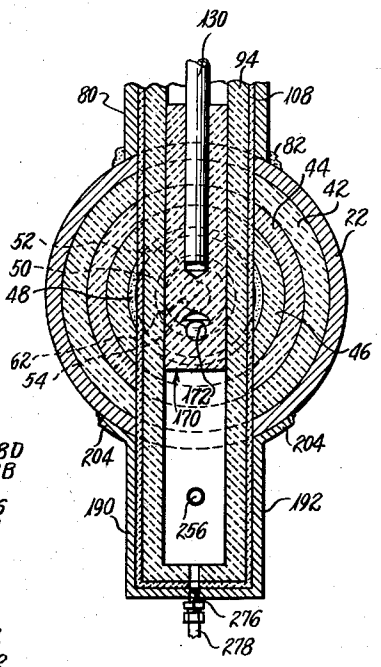


Fig. 3.

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COMBINED VALVE AND MOLTEN METAL SAMPLING DEVICE

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Application September 13, 1956, Serial No. 609,583

15 Claims. (Cl. 73—422)

This invention relates to fluid flow control apparatus and, more specifically, the invention pertains to a combined valve and molten metal sampling device wherein the control apparatus is especially designed for use in conjunction with the apparatus disclosed and described in my co-pending application, Serial No. 505,887, entitled "Process and Apparatus for Treating Titanium and Other Metals," and the instant invention comprises a continuation-in-part thereof.

As has been set forth in my co-pending application, metallurgists have long been cognizant of the great difficulty industrial concerns face in preparing titanium and other similar metallic alloys which will continuously meet government specifications. Prior to my above-mentioned co-pending application the prior art and the present day known processes and apparatus for alloying titanium and similar metals could not produce, from batch to batch, an alloy having the same composition, homogeneous uniformity and grain refinement. This is due to the fact that prior art apparatus made very little or no provision to prevent contamination of the alloy, nor have means been provided to take test samples of the alloy as it is processed through various stages.

To take test samples of an alloyed metal while in its molten condition within a crucible is, today, a painstaking task and even when a sample is taken the same may not show the true composition of the metal within the crucible upon analysis. This results from the contamination of the metal from the ambient atmosphere or from other exterior sources.

Thus, even in the practice of the invention disclosed in my co-pending application wherein multi-crucible apparatus is utilized under controlled conditions, the transit of the molten metal from one crucible to another or to an ingot mold through valve controlled conduits did not provide for sampling from stage to stage prior to its discharge into the ingot mold.

It is therefore, one of the primary objects of this invention to provide in combination, a valve for controlling the flow of molten metals between two or more vessels wherein the valve includes means for taking a test sample of the metal at any stage of its alloying treatment for the purpose of analysis before permitting the molten metal to pass from one stage to another.

Another object of this invention is to provide a combined valve and sampling device of the type described above together with means for deriving the sample alloy under a condition of an inert atmosphere or vacuum, and allowing the sample to cool to its stable solid condition before exposing the same to the ambient atmosphere for subsequent analysis.

A still further object of this invention is to provide in a compound conduit extending between two vessels, a liner formed of a refractory material such as, for example, molybdenum trioxide which when introduced into the field of an induction heating device will increase the eddy current effect on the metal passing through the conduit and thereby increase the turbulence of the metal. This further insures the homogeneous consistency of the alloy.

Other and further objects and advantages of the present invention will become more evident from a reading of the following specification when read in conjunction with the annexed drawings, in which:

Fig. 1 is a fragmentary side elevational view illustrating the interposition of a valve constructed in accordance with this invention between a crucible and an ingot mold.

Fig. 2 is a medial longitudinal cross-sectional view of the control valve shown in Fig. 1; and

Fig. 3 is a cross-sectional view of the control valve taken on the vertical plane of line 3—3 of Fig. 2, looking in the direction of the arrows.

Referring now more specifically to Fig. 1 of the drawing, reference numeral **10** designates, for example, a crucible for molten metal which is connected with one end of a compound conduit **12**. The other end of the conduit **12** is connected with one end of an elbow connector **14** having its other end in open communication with one end of a discharge conduit **16** from which metal is passed into an ingot mold **18**. A valve designated, in general, by reference numeral **20** is interposed in the conduit **12**, the valve **20** being constructed in accordance with the teachings of this invention.

At this point it is deemed expedient to point out that while the valve **20** illustrated in Fig. 1 is disposed between one crucible and an ingot mold, the valve **20** may also be positioned intermediate two crucibles of a multi-crucible metal treating system without departing from the spirit or scope of this invention.

The tubular conduit **12** is seen to comprise an elongated length of substantially hollow cylindrical steel pipe **22** having radially outwardly projecting flanges **24**, **26** at each end thereof, respectively. Bolts **28** secure the flange **24** to the outer casing **30** of the crucible **10**, and a gasket **32** formed of neoprene impregnated asbestos is disposed intermediate the casing **30** and the flange **24**. In a similar manner, bolts **34** secure the flange **26** to a radially and outwardly extending flange **38** formed at the inlet side of the elbow connector **14**. Between the flanges **26** and **38** is interposed a neoprene impregnated gasket **40**.

The compound conduit **12** includes the pipe **22** and a plurality of circular liners **42**, **44**, **46**, **48**, **50**, **52** and **54**, all formed of a refractory material. The pipe **22** is seen to surround the refractory liner or shell **42** which is preferably formed of Transite. The shell **42**, on the inner side thereof is provided with a helicoidal groove **56** in which is partially imbedded a length of hollow copper coil **58**. The refractory liner **42** embraces the refractory **44** formed of norblack and which is provided with an exterior helicoidal groove **60** complementing the groove **56** and receiving therein the remainder of the pipe **58**.

The liner **44** surrounds the refractory liner **46** which may be formed of any one of the following compositions:

(1) 80% thorium dioxide, 10% yttrium trioxide, 10% zirconium dioxide;

(2) 90% thorium dioxide, 10% yttrium trioxide;

(3) 85% thorium dioxide, 10% hafnium dioxide, 5% yttrium trioxide;

(4) Carbon graphite which has been impregnated with 90% thorium, 10% hafnium which is then fired to a minimum temperature of 3000° F.

The refractory or liner **46** encases the refractory liner **48** which is formed of molybdenum oxide, its dioxide or trioxide. The refractory liner **48** surrounds the refractory liner **50** which may be formed of the compounds referred to above in connection with the liner **46**.

The refractory liner or shell **52** is surrounded by refractory liner **50** and the shell **52** is formed of molybdenum

trioxide compressed under a pressure of from 18,000 to 32,000 p. s. i. Since the method for obtaining this liner is not of vital importance to the present invention, the same will not be described herein.

The refractory liner **52** surrounds the innermost refractory liner **54**, the latter being formed of molybdenum oxide, its dioxide or trioxide.

As is seen in Figs. 2 and 3 of the drawings, the compound conduit **12** is arranged and disposed in such a manner that the refractories forming the component elements thereof are coaxially aligned and that the refractory liner **54** is provided with a longitudinally or axially extending passage **62**, which is also disposed in coaxial alignment with respect to the named refractories.

As has been discussed in my above-referred to copending patent application, the copper pipe 58A has one of its ends connected with the source of liquid coolant and the other one of its ends 58B is connected with a convenient source of liquid discharge. The pipe **58** is also connected by wires 58C and 58D to a source of high-frequency alternating current to provide for induction heating of the liquid metal in the passage **62**.

The valve **20** to which this invention pertains, is seen to traverse the compound conduit **12** and to project on opposite sides thereof. To this end, the outer steel pipe **22**, the refractories **42**, **44**, **46**, **48**, **50**, **52** and **54** are coaxially bored at **64**, **66**, **68**, **70**, **72**, **74**, **76** and **78**, respectively.

A substantially hollow cylindrical steel sleeve **80** has the lower end thereof fixedly secured to the steel pipe **22** as by welding **82**, and is disposed in coaxial alignment with the above-referred to bores. The upper end of the sleeve **80** is provided with a radially outwardly extending flange **84** forming a seat **86**, the function of which will be described below.

A vertical or substantially upright cylindrical flange **88** extends from the marginal edge of the flange **84** and terminates in a radial and outwardly extending flange **90**.

A substantially cylindrical valve guide member designated, in general, by the reference numeral **92** is seen to comprise a substantially hollow elongated tubular member **94** formed of a refractory material such as molybdenum oxide, its dioxide or trioxide. The upper end of the valve guide member **94** is provided with a radially and outwardly extending flange **96** having a marginal peripheral groove **98** formed in the upper face thereof. Intermediate its ends the valve guide member **94** is provided with a pair of substantially annular, outwardly projecting bosses **100**, **102** which are integrally formed therewith and through which extend a pair of diametrically opposed liquid inlet and outlet ports **104**, **106**, respectively. The refractory member **94** is encased within a refractory **108** which is formed of molybdenum trioxide compressed under a pressure of 18,000 to 32,000 p. s. i. As is seen in Fig. 2 of the drawings, the refractory **108** also surrounds the flange **96** and terminates in an inwardly extending radial flange **110** which is disposed within the recess **98**. The refractory **108** is also seen to surround but does not extend across the bosses **100**, **102** and projects across the lower end of the valve guide **94**.

The valve cap or closure member designated in general by the reference numeral **112**, is seen to comprise a vertically elongated hollow steel cylindrical member **114** having a substantially closed bottom end portion **116** from which projects a radial outwardly extending flange **118**. The flange **118** is substantially the same diameter as the flange **90** and the two flanges are secured together by means of bolts **120** and nuts **122**. As is seen in Fig. 2 a neoprene impregnated asbestos gasket **124** is interposed between the two flanges **90** and **118**.

One end of a boss **126** is integrally formed with the bottom wall **116** and projects vertically therefrom in spaced relation relative to the cylindrical member **114**. The boss **126** is provided with a bore **128** coaxially aligned with the cylindrical member **114** and is adapted to slidably receive therein the upper end of a valve stem **130**. The bore **128** is provided with a keyway **132** to receive a key **134** disposed within the keyway **136** formed in the valve stem **130**, whereby the stem is secured against rotation relative to the bore **128**. A gasket **138** is mounted over the upper end of the valve stem **130**, the gasket again being formed of neoprene impregnated asbestos. As is seen in Fig. 2, the upper end of the cylindrical member **114** terminates in an outwardly turned radial flange **140** which is adapted to receive thereon gasket **142** formed of neoprene impregnated asbestos. The gasket **142** is apertured at **144** to serve a purpose to be described.

A closure member **146** comprising a substantially circular steel disk is superposed over the gasket **142** and is secured to the flange **140** by means of stud bolts **148**. The closure member **146** is provided with an inner hub portion **150** which projects downwardly through the aperture **144** formed in the gasket **142**, and the lower end thereof seats against the gasket **138**. The hub **150** is provided with a central, internally threaded bore **152** which communicates at its upper end with an internally threaded opening **154** formed in an external vertically projecting hub portion **151** of the cap **146**. As is seen in Fig. 2, the upper end of the valve stem **130** is threaded at **158** and is threaded through the hub **150** and extends beyond the hub **156**. A fitting **160** is externally threaded for mounting within the internally threaded hub **156** and the fitting is provided with a smooth bore **162** which receives the upper end of the valve stem **130** therethrough. The threaded upper end of the valve stem **130** is threaded within a bore **164** formed in a boss **166** of a manually operated hand-wheel **168**.

The lower end of the valve stem **130** is fixedly secured by conventional means to a substantially cylindrical valve designated, in general, by the reference numeral **170**. The valve **170** is telescopically mounted within the valve guide **92** for reciprocation therein. The valve **170** is preferably formed of a refractory material identical to that from which the valve guide is constructed, namely, molybdenum oxide, its trioxide or dioxide.

The lower end of the valve member **170** is provided with a transversely extending circular bore **172** which communicates at its inner end with an enlarged substantially circular passage **174** having a downwardly and inwardly inclined periphery designated at **176**. It is manifest from the drawing that the passage **174** has a greater transverse cross-sectional area than the transverse cross-sectional area of the bore **172**.

As is seen in Fig. 2, a steel pipe **180** extends through the sleeve **80** and adjacent portions of the refractory **108** and the valve guide **92** so that the inner end of the pipe **180** is positioned in open communication with the space between the closure member **112** and the upper end of the valve **170**. The other or outer end of the pipe **180** is connected with a source (not shown) of inert gas under pressure such as, for example, helium, argon, kripton, and other similar gasses. A control valve **182** is interposed in the pipe **180**.

A steel discharge pipe **184** extends through the sleeve **80** and adjacent portions of the refractory **108** and the valve guide **92**, the pipe **184** also having its inner end in open communication with the space between the closure member **112** and the upper end of the valve **92**. A control valve **186** is interposed in the discharge pipe **184**, and the outer or external end of the discharge pipe **184** is connected with a conventional gas recovery and recirculation system (not shown) for reuse.

A substantially rectangular housing is designated by reference numeral **188**. The housing **188** includes a pair of oppositely disposed side walls **190**, **192**, a pair of oppositely disposed end walls **194**, **196**, a pair of oppositely

disposed top and bottom walls **198**, **200**, and a partition wall **202**. The upper ends of the side and end walls terminate in an outwardly turned continuous flange **204** which is welded at **206** to the under side of the conduit **12**.

The end wall **194** is partially cut away to form an access opening **208** into the housing **188**, and the access opening is provided with a closure member **210** which is removably secured thereacross by means of bolts **212** which enter threaded openings formed in the wall **194** and in a flange **214** which depends from the bottom wall **200**.

An elongated cylindrical boss **216** projects laterally from the end wall **194** and is provided with an axially extending bore **218**. The outer end of the boss **216** terminates in a radial flange **220**. A cap **222** having a central bore **224** is releasably secured to the flange **220** by means of stud bolts **226**, a centrally apertured gasket **228** formed of neoprene impregnated asbestos being interposed between the flange and the cap.

A shaft **230** is mounted for reciprocation within the bores **218** and **224**, the shaft terminating at its inner end within the housing **188**. A disk **232** is fixedly secured at the terminus of the inner end of the shaft. The other, or outer, end of the shaft **230** has a handle member **234** secured thereto.

The partition wall **202** is provided with an opening **236** across which extends a closure member **238** hingedly connected at **240** to the top wall **198**. It will be noted that the disk **232** confronts and normally engages against the closure member **238** to maintain the same in its normally closed position. If desired the closure member **238** may be provided with a neoprene impregnated asbestos gasket **242**.

An elongated substantially cylindrical boss **244** projects laterally from the end wall **196** and is provided with an axially extending bore **246**. The outer end of the boss **244** terminates in a radial flange **248** to which is secured, by bolts **250**, a cap **252**. As is seen in Fig. 2, a neoprene impregnated asbestos gasket **254** is interposed between the flange **248** and cap **252**.

A plunger rod **256** is mounted for reciprocation within the bore **246**. To effect reciprocation of the rod **256**, one end of a shaft **258** is fixedly secured thereto while its other end projects through the cap **252** and terminates in a handle **260**.

In Figs. 2 and 3, it is seen that the lower extended end of the valve guide **92** and the adjacent portions of the refractory **108** are received in the housing **188** between the end wall **196** and the partition wall **202**. The refractory **108** and valve guide **92** are provided with aligned apertures **262**, **264**, respectively, which are also aligned with the bore **246** of the boss **244** to receive the plunger rod **256** therethrough. Diametrically opposite thereof, the valve guide **92** and the refractory **108** are apertured at **266** and **268**, respectively, the latter apertures being substantially equal to or slightly larger than the passage **174** formed in the valve **170**.

The lower end of the valve guide **92**, the refractory **108**, and the bottom wall **200** of the housing **188** are formed with coaxially aligned apertures to provide a continuous passage **270**, respectively, the apertures being coaxially aligned. A fitting **276** is threaded into the passage **270** and receives one end of a pipe **278**. A valve **280** is connected in the pipe **278** and its other end is connected with a source of inert gas under pressure selected from those mentioned above.

A gas discharge passage **282** extends through the valve guide **92**, and adjacent portions of the refractory **108** and the end wall **196**. As is seen in Fig. 2, the passage **282** at its inner end communicates with the space below the valve **170**, and a fitting **284** connects a discharge pipe **286** with the outer end of the passage **282**. A valve **288** is interposed in the pipe **286**, and the latter, at its outer end is connected with a reclaiming system (not shown) for recirculation and reuse.

If desired, the boss **126** and the valve stem **130** may be provided with cooling means which, as shown in Fig. 2, includes a helicoidal conduit **300** which surrounds the boss **126**. The upper end of the conduit **300** terminates in a passage **302** formed in the cylindrical member **114** and into which is threaded one end of a conduit **304** having a valve **306** interposed therein. The other end of the conduit **304** is connected with a source of liquid coolant (not shown). The lower end of the helicoidal conduit terminates in a passage **308** formed in the lower end of the cylindrical member **114**, the passage **308** also being connected with one end of a discharge pipe **310** having a valve **312** interposed therein.

Having described this invention in detail, the operation thereof will be set forth immediately below.

As has been stated above, Fig. 1 illustrates the valve **20** as being interposed in the compound conduit **12** between a crucible **10** and the discharge elbow **14**, the elbow **14** being connected through pipe or conduit **16** with the ingot mold **18**. It will be recognized, of course, that the discharge side of the conduit **20** may be connected with another crucible of a multi-crucible metal treating system instead of with the ingot mold **18**.

During the time that the metal in the crucible **10** is being treated and heated the valve **170** is normally lowered to its normally closed position as indicated by its dotted line position shown in Fig. 2. This cuts off the flow of molten metal through the bore **104** and prevents transfer of the metal from the crucible **10** to the mold **18**. Let it now be assumed that the treating time for the metal in the crucible **10** has substantially reached its termination. In this case the operator will then rotate the wheel **168** to effect a lifting of the valve **170** to a point where at the inlet side of the passage **174** it is raised to communicate with the boss **100** while the outlet side of the passage **174** remains sealed against an adjacent portion of the valve guide **94**. With the valve in this position, the molten metal passes through the inlet side of the passage **174** and fills the cavity defined by the passages **172**, **174** and that portion of the valve guide **94** against which the outlet side of the passage **172** is sealed.

During the taking of the metal sample, the valves **182**, **186**, **280** and **288** are moved to their open position to permit any one of the above-referred to inert gasses to enter and circulate in the space above and below the valve **170** at controlled substantially equal pressures.

When the cavity **172**, **174** has been substantially filled, the operator will rotate the wheel **168** in a counterclockwise direction, thereby permitting the valve **170** to move downwardly until the inlet side of the passage **174** is lowered below the boss **100**. It is thus seen that the sample of the molten metal in the crucible **10** is retained within the passage **172**, **174**, and this sample is held in the above-referred to position until the same cools to its solidified form, and reaches a temperature of approximately 2,700° F.

It is important to note that during the time that the sample is taken and while the same is being converted from its liquid to its solid form, contamination from external gaseous sources is prevented and that the sample, if exposed at all to a gaseous element, is only contacted by the inert gas which effects no chemical reaction with the sample.

Upon reaching its solidified form, valve **170** is lowered still further until the passage **172** is brought into alignment with the bore **246** of the boss **244**. At this point, and should it be so desired, the metal sample may be permitted to cool still further, for example, to approximately 800° F.

When the sample has reached its minimum cooling temperature, the operator will grasp the handle **260** and force the same toward the valve **20**. The plunger rod **256** is consequently moved to the left as viewed in Fig. 2. Prior to the movement of the plunger rod **256**, the operator withdraws the shaft **230** to the left again as viewed

in Fig. 2 to effect a release of the disk 232 from the closure member 238. It is now seen that as the plunger rod 256 is moved to the left, as described above, the solidified metallic sample filling the passages 172, 174 is ejected into the compartment formed in the housing 188 and which is defined by the end wall 194, the closure member 210, the partition wall 202 and the top and bottom walls, 198, 200, respectively, and those portions of the side walls 190, 192 which extend between the partition wall 202 and the end wall 194.

Thereafter the bolts 212 are unloosened to free the closure member 210 from the end wall 194 and the sample is removed through the aperture 208.

The sample is then subjected to metallurgical and other tests to determine if the same possesses the proper alloy composition, if it has homogeneous uniformity and if it has the proper grain refinement. Assuming that the tests reveal that the metal in the crucible 10 meets all of the required conditions, the valve 170 is raised by turning the hand wheel 168 in a clockwise direction until the passages 172, 174 are aligned with the bosses 104, 106 and the molten metal will now pass freely through the bore 104 into the ingot mold 18.

Assuming on the other hand, that the tested sample disclosed that the metal within the crucible 10 did not fulfill the required specifications, the molten metal in the crucible 10 may be further treated by known metallurgical techniques to bring it into conformity with the requirements of the specification prior to the time that the valve is moved to its open position.

From the foregoing remarks it should now become clear that the compound valve and sample-taking device provides means whereby the metallurgist is assured that the metal passing from one crucible to the next or from the final crucible in a multi-crucible treating system to an ingot mold is an exact process which may be repeated time after time and that the physical and chemical characteristics of the treated metal batches will not deviate from a predetermined specification.

The helicoidal conduit 58 is disposed in heat transfer relation with respect to the molten metal flowing through the passage or bore 62 in a manner more specifically set forth in my copending application referred to supra, and as has been set forth above and in the copending application, the conduit 58 is also connected with a source of alternating current to heat the molten metal in the bore 62 by induction. This type of heating effects turbulence in the molten metal by virtue of eddy currents, and it has been found that the introduction of the refractory 52 formed of molybdenum trioxide greatly increases the eddy current effect.

Having described and illustrated in detail one embodiment of this invention, it will be understood that the same is offered merely by way of example and that the invention is to be limited only by the scope of the following claims.

I claim:

1. In combination, a valve guide and a valve mounted for reciprocation therein and being entirely contained therein, said guide comprising an elongated substantially hollow body member having a pair of opposed open and closed ends, an inlet port and an outlet port disposed intermediate said ends, and a closure member for said open end; said valve having a continuous passage formed therein and extending transversely therethrough and having an inlet side and an outlet side, said inlet side having a greater transverse area than said outlet side; means connected with said valve and extending through said closure member for actuation to effect reciprocation of said valve to its closed position or its open position wherein said inlet port, said inlet side, said outlet port and said outlet side are in open communication with each other; and said means being operable to move said valve relative to said guide to effect sealing of said outlet side of said valve against an adjacent portion of said guide while leaving a portion of said inlet side in open communication with said inlet port thereby forming a cavity to receive and retain material flowing through said inlet port and partially open said inlet side.

2. In the combination defined in claim 1 wherein said valve guide is provided with a pair of opposed transversely extending openings; and said means being adapted to move said inlet side of said valve into open communication with one of said last-named openings and to move said outlet side of said valve into communication with the other of said last-named openings; said other of said last-named openings being adapted to receive a tool therethrough to ram said material in said cavity through said one of said last-named openings.

3. In the combination defined in claim 2 wherein said guide is provided with means for introducing a fluid under pressure between said closed end of said guide member and the adjacent end of said valve; and said guide is provided with means for introducing a fluid under pressure between said closure member and the adjacent end of said valve.

4. In the combination as defined in claim 2, wherein means are provided for connecting the space between said closed end of said valve guide and the adjacent end of said valve with a source of vacuum, and wherein means are provided for connecting the space between said closure member and the adjacent end of said valve with a source of vacuum.

5. Fluid control means for controlling the flow of fluid through a conduit, having a continuous passage extending longitudinally therethrough, said control means comprising a valve guide member extending transversely through said conduit and having portions projecting laterally from opposed sides of said conduit, said valve guide member comprising an elongated substantially hollow body having a pair of opposed open and closed ends, said valve guide member having opposed and confronting fluid inlet and outlet ports aligned with said passage, and said valve guide means having a material discharge opening and a tool receiving opening formed therein adjacent said closed end thereof, said material discharge opening and said tool receiving being disposed in opposed confronting relation, and said material discharge opening having a greater transverse cross-sectional area than said tool receiving opening; a closure member for said open end of said valve guide member; a valve mounted for reciprocation within and entirely contained within, said valve guide member, said valve having a continuous passage formed therein and extending transversely therethrough, said valve passage having an inlet side and an outlet side of which said inlet side has the greatest transverse cross-sectional area; and valve actuating means connected with said valve and extending through said closure member for selectively moving said valve to its closed position, to its open position with said valve passage in open communication with said passage formed in said conduit, to a material sampling position wherein said valve outlet side is sealed against an adjacent portion of said valve guide while said valve inlet side remains in communication with said valve guide inlet to form a material sampling cavity and to a final position wherein said valve actuating means moves said valve to align said material discharge opening, said valve inlet side, said valve outlet side and said tool receiving opening, whereby a tool inserted through said opening engages against the material sample in said cavity to eject said sample through said material discharge opening.

6. Fluid control means as defined in claim 5 wherein said conduit, said valve guide member and said valve are formed of a refractory material, means for introducing an inert gas in the space between said closed end of said valve guide member and the adjacent end of said valve, and means for introducing an inert gas in the space between said closure member and the adjacent end of said valve.

7. Fluid control means as defined in claim 5 wherein said conduit, said valve guide member, and said valve are formed of a refractory material, means for connecting the space between said closed end of said valve guide member and the adjacent end of said valve with a vacuum source, and means for connecting the space between said closure member and the adjacent end of said valve with a vacuum source.

8. Fluid control means for controlling the flow of a liquid through a compound conduit, said liquid possessing the physical characteristic of solidification upon cooling, said compound conduit comprising an outer elongated substantially hollow metallic casing and a liner therefor formed of a refractory material, said casing being disposed in embracing relation relative to said liner and said liner having a continuous passage extending longitudinally therethrough, a valve guide member comprising an elongated substantially hollow body formed of a refractory material and having a pair of opposed open and closed ends, said valve guide member extending transversely through and projecting beyond opposite sides of said compound conduit intermediate the ends thereof, said valve guide member having a pair of oppositely disposed spaced and confronting fluid inlet and outlet ports formed therein and aligned with said passage formed in said liner, said valve guide member having a material discharge opening formed therein adjacent said closed end and a tool receiving opening disposed in spaced confronting relation relative thereto, a valve formed of a refractory material and mounted for reciprocation in said valve guide member and being entirely contained therein, said valve having a continuous passage formed therein and having a liquid inlet side and a liquid outlet side, said fluid inlet side having a transverse cross-sectional area greater than the transverse cross-sectional area of said liquid outlet side, and means connected with said valve and extending through said closure member to effect reciprocation thereof within said valve guide member, said means being operable to move said valve to its closed position, to its open position with said valve passage disposed in communicating relation with respect to said valve guide inlet and outlet ports, to its liquid sampling position wherein said valve outlet side is sealed against an adjacent portion of said valve guide member while said valve inlet side is in partial communication with said valve guide inlet port thus forming a liquid sample taking cavity, said means being further operable to subsequently seal said inlet side of said valve against an adjacent portion of said valve guide member to permit said material in said cavity to cool and solidify, and said means being further operable to move said valve to a position wherein said inlet side of said valve and said outlet side of said valve are aligned, respectively with said discharge opening and said tool receiving opening, whereby a tool thrust through said tool receiving opening engages against the solid sample and to eject said solid sample through said discharge opening.

9. Fluid control means as defined in claim 8 wherein means are provided for introducing an inert gas in the space between said closed end of said valve guide member and the adjacent end of said valve, and means for introducing an inert gas in the space between said closure member and the adjacent end of said valve.

10. Fluid control means as defined in claim 8 wherein means are provided for connecting the space between said closed end portion of said valve guide member and the adjacent end of said valve with a vacuum source, and means for connecting the space between said closure member and the adjacent end of said valve with a vacuum source.

11. Fluid control means as defined in claim 9 wherein said conduit casing has a substantially hollow housing secured thereto, said housing surrounding said closed end of said valve guide member, its said discharge and tool receiving openings, an elongated boss secured to said housing and having a passage formed therein aligned with said tool receiving opening, and said tool comprising a plunger rod mounted for reciprocation within said last named housing and operable to eject said sample into said housing.

12. Fluid control means as defined in claim 11 wherein said housing is provided with a partition wall disposed in confronting relation with respect to said discharge opening, said partition wall having an opening formed therein aligned with said discharge opening, a closure member hingedly connected with said opening formed in said partition wall, and means releasably securing said closure member in its normally closed position.

13. Fluid control means as defined in claim 12 wherein said closure member is provided with means disposed in heat transfer relation relative to said valve actuating means.

14. Fluid control means as defined in claim 13 wherein said housing has an access opening formed therein to remove said sample therefrom, and a closure member removably secured to said housing and extending across said access opening.

15. Fluid control means for controlling the flow of a liquid through a compound conduit, said compound conduit comprising an outer steel pipe having a plurality of liners formed of a refractory material disposed therein in surrounding relation relative to each other, at least one of said liners being formed of molybdenum trioxide compressed under a pressure of 18,000 to 30,000 p. s. i. and the innermost one of said liners having a continuous passage formed therein, a metallic conduit disposed between a pair of said liners and having one of its ends connected with a source of fluid under pressure, means connecting said conduit with a source of alternating current to provide induction heating means for liquid flowing through said passage, a valve guide extending transversely through said compound conduit and having a pair of oppositely disposed ends projecting laterally through and beyond opposite sides of said compound conduit, said valve guide being formed of a refractory material including a casing formed of molybdenum trioxide compressed under a pressure of 18,000 to 30,000 p. s. i., said valve guide member having a pair of oppositely disposed spaced and confronting inlet and outlet ports with said casing being discontinuous thereover, said inlet and outlet ports being aligned with said passage formed in said one liner, said valve guide member having a discharge opening and a tool receiving opening formed therein in spaced confronting relation, and said casing being discontinuous over said discharge and tool receiving openings, a housing secured to said pipe and receiving therein said closed end of said valve and said discharge and tool receiving openings, a boss projecting laterally from said housing and having a passage extending therethrough in alignment with said tool receiving opening, a plunger rod mounted for reciprocation within said last-named passage, a closure member for said open end of said valve guide member, a valve formed of a refractory material and disposed for reciprocation in said valve guide member, said valve having a continuous passage formed therein including an inlet side and an outlet side, said inlet side of said passage having a greater transverse cross-sectional area than the transverse cross-sectional area of said outlet side, means connected with said valve to effect reciprocation thereof to its closed position, to its open position with its said passage communicating with said passage formed in said liner, to a liquid sampling position wherein said outlet side of said valve is sealed against an adjacent portion of said valve guide member while a portion of said inlet side of said valve is in communication with said inlet port to define a liquid receiving cavity, to its position wherein said inlet and outlet sides are sealed against adjacent portions of said

valve guide to permit said sample to solidify, and finally to its position wherein said discharge opening of said valve guide, said inlet side of said valve, said outlet side of said valve, said outlet port of said valve and said passage formed in said boss are disposed in confronting relation whereby actuation of said plunger rod effects an ejection of said sample into said housing.

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