March 21, 1967 A. TEPLITZ 3,309,740

STOPPER ROD RIGGING FOR LADLES

Filed April 21, 1964 6 Sheets-Sheet 1

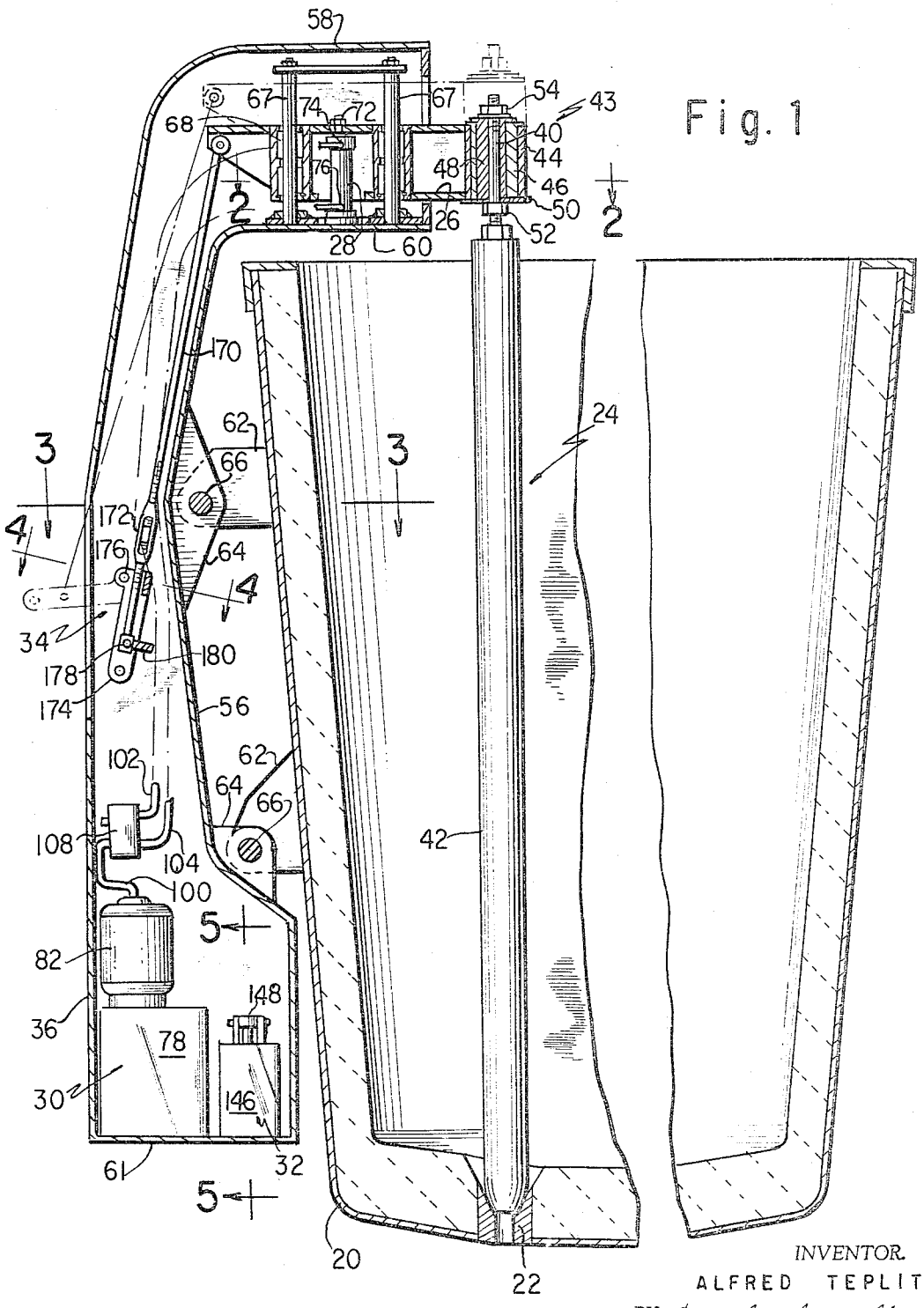


Fig. 1

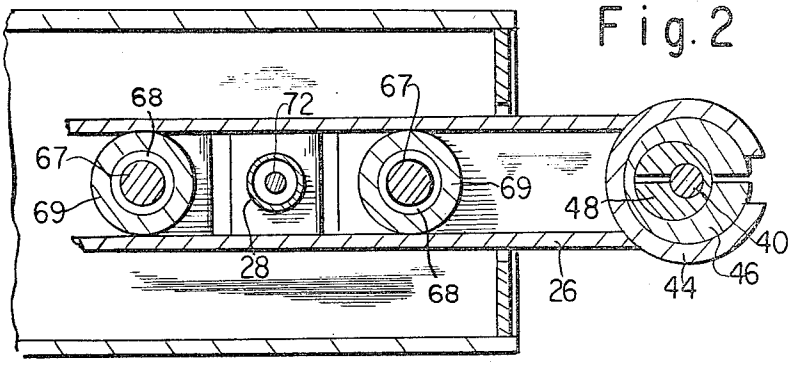
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STOPPER ROD RIGGING FOR LADLES

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Fig. 2



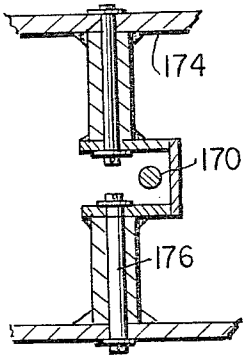


Fig. 4

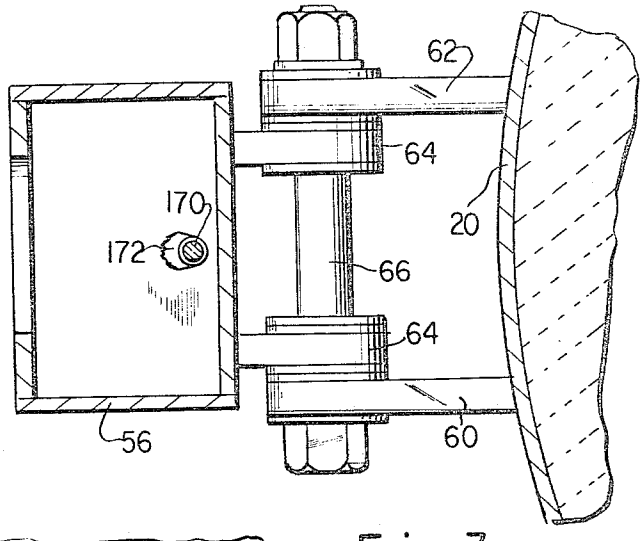


Fig. 3

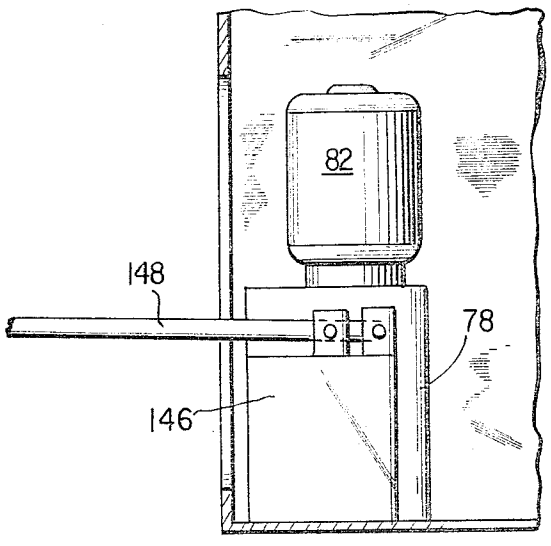


Fig. 5

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STOPPER ROD RIGGING FOR LADLES

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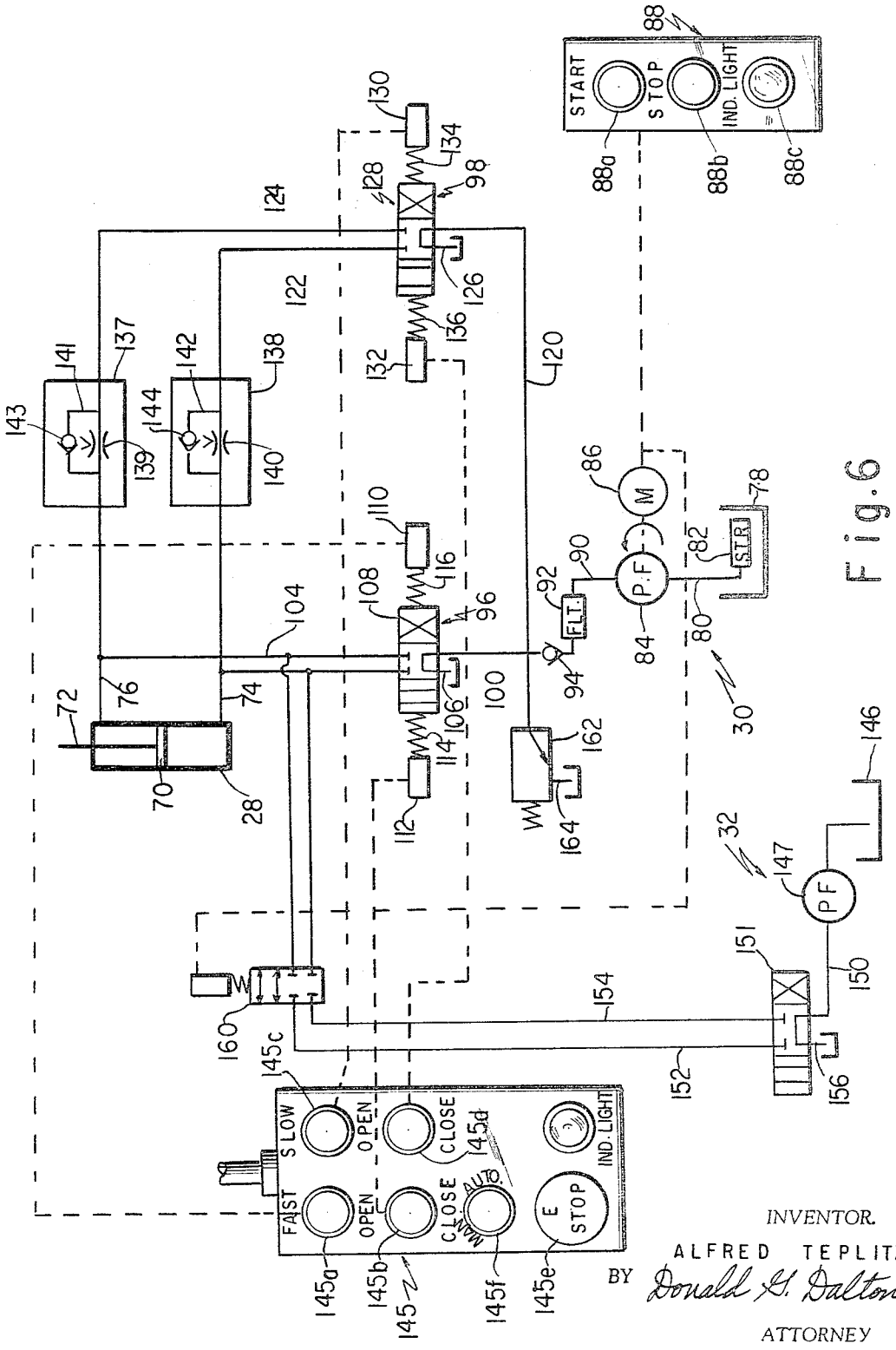


Fig. 6

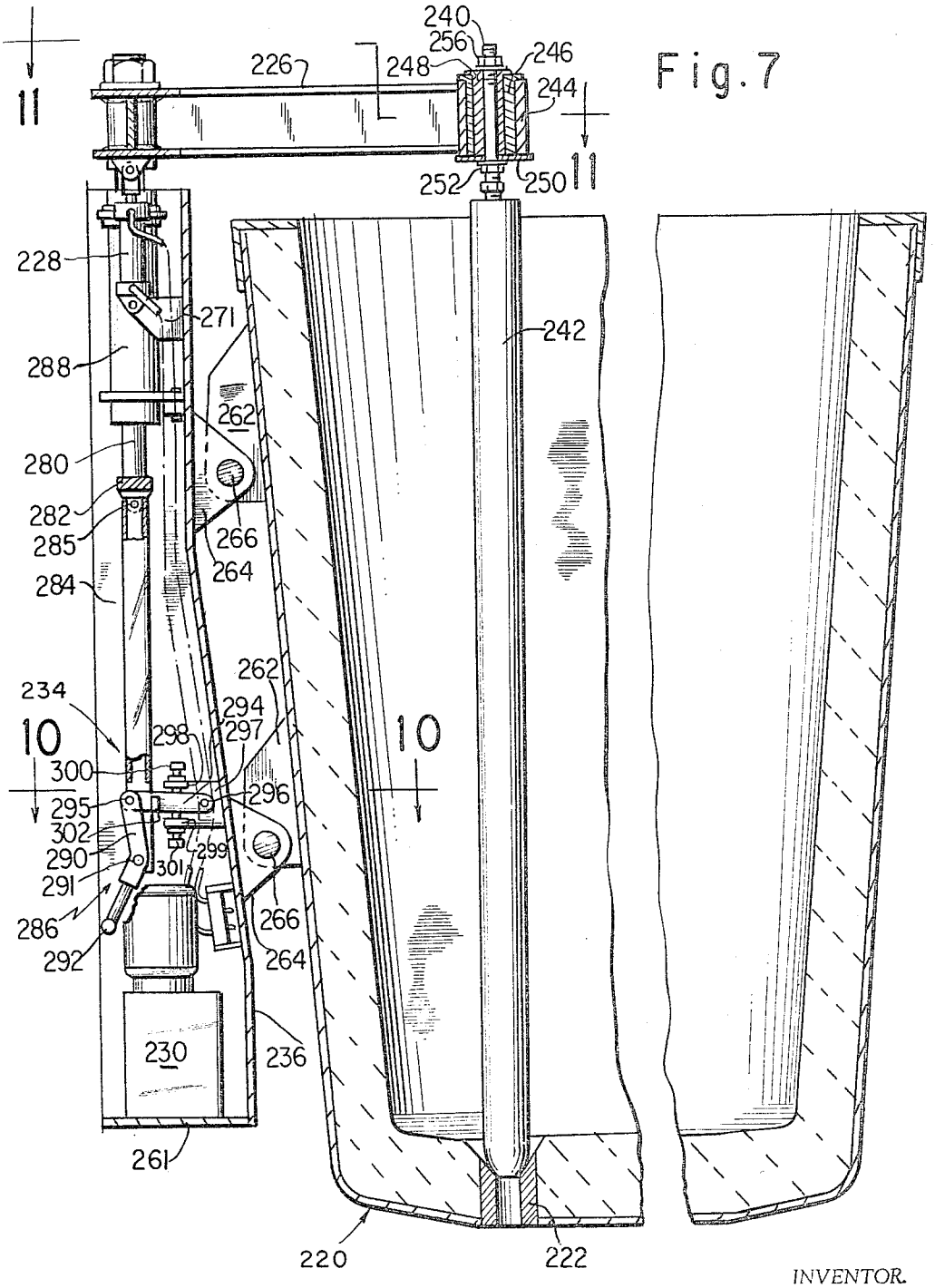
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STOPPER ROD RIGGING FOR LADLES

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Fig. 7



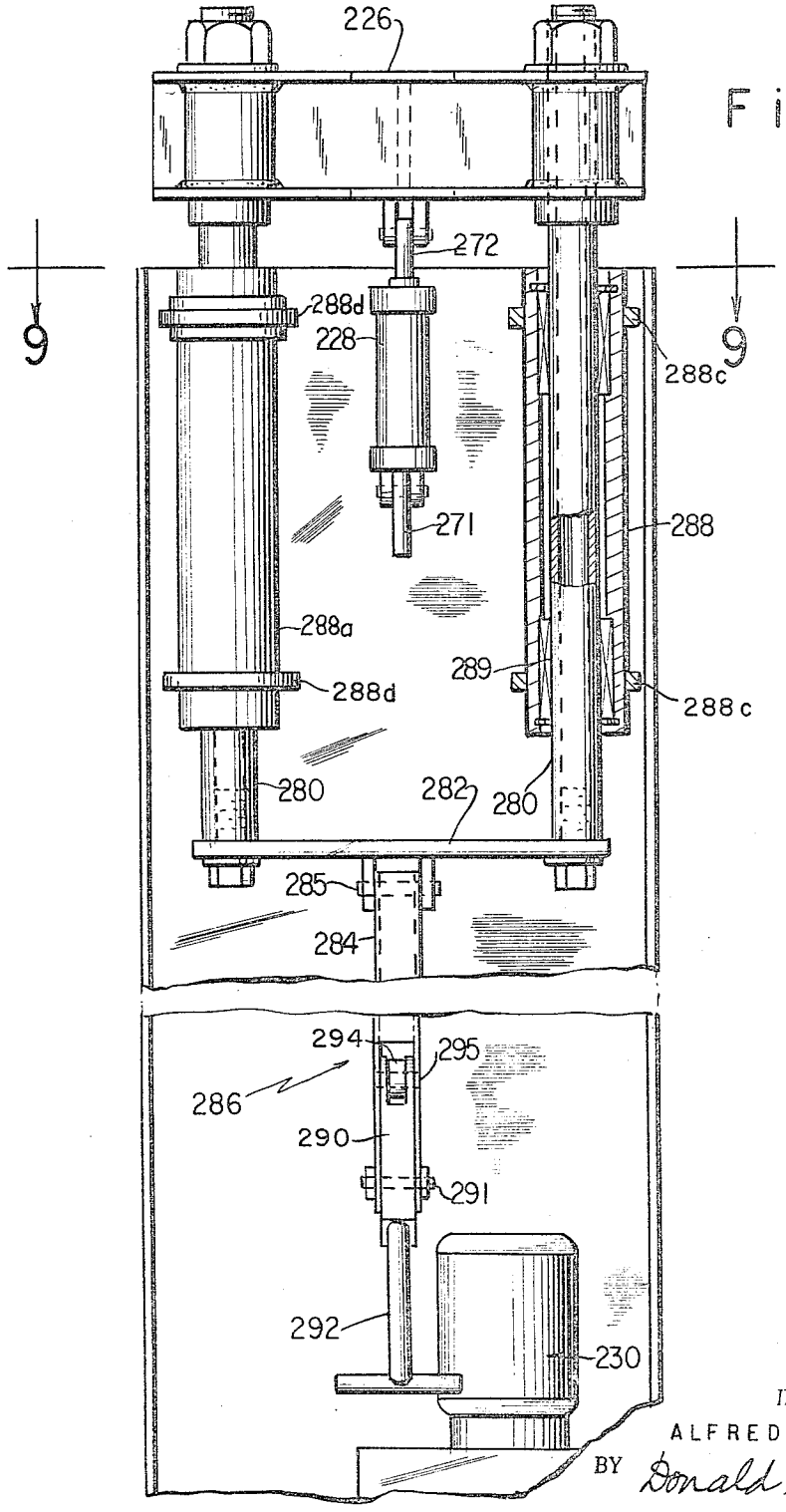
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STOPPER ROD RIGGING FOR LADLES

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Fig. 8



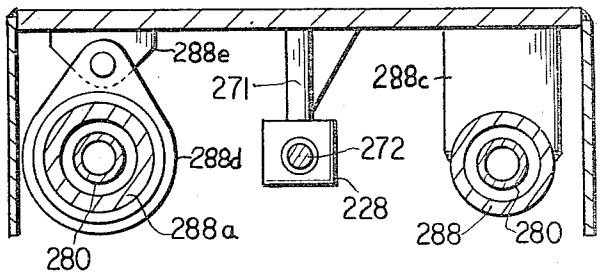
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STOPPER ROD RIGGING FOR LADLES

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Fig.9



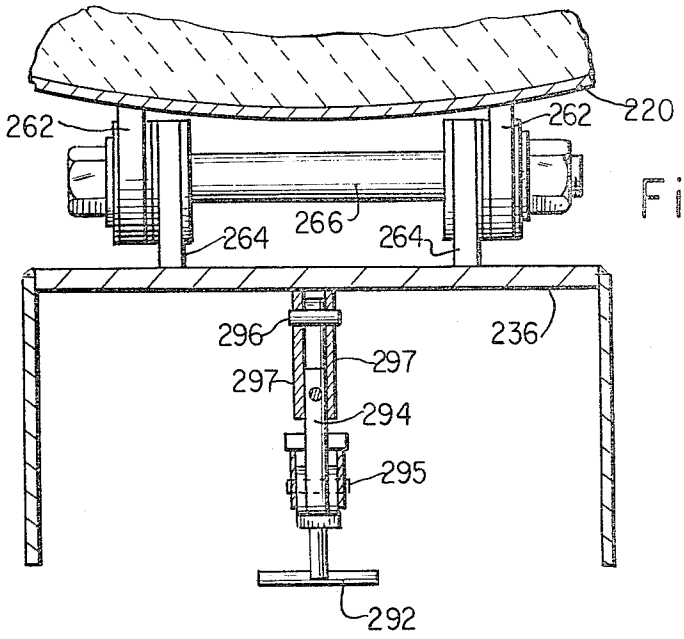


Fig.10

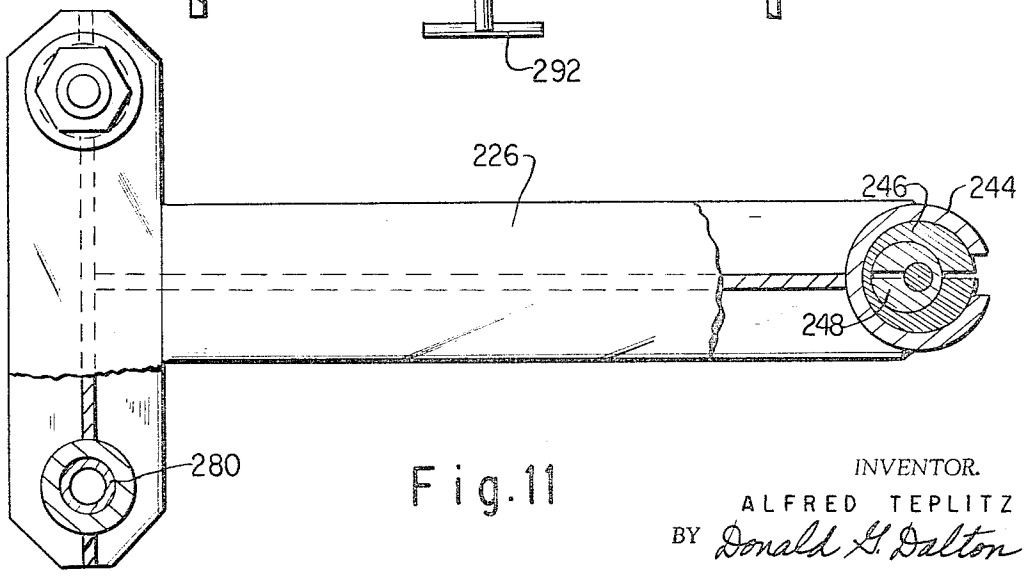


Fig.11

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United States Patent Office 3,309,740 Patented Mar. 21, 1967

3,309,740

STOPPER ROD RIGGING FOR LADLES

Alfred Teplitz, Pittsburgh, Pa., assignor to United States Steel Corporation, a corporation of Delaware

Filed Apr. 21, 1964, Ser. No. 361,391
7 Claims. (Cl. 22—85)

This invention relates to bottom pour ladles for the pouring of molten steel and the like, and particularly to a bottom pour ladle having a novel stopper rod rigging which is especially adapted for use in the continuous casting of steel.

The conventional bottom pour ladle comprises a steel refractory lined vessel having a nozzle in the bottom and a stopper rod for opening and closing the nozzle. The stopper rod may be controlled either manually or by an electrically actuated hydraulic cylinder such as that described in Carleton Patent No. 2,832,110.

Bottom pour ladles have been used heretofore primarily in pouring molten steel into conventional ingot molds. The stopper rod was required primarily for on-off operation, and precise control of its position was not necessary. Continuous casting of steel, on the other hand, requires precise control of the rate of flow of molten metal from the ladle so as to maintain the desired molten metal level in the mold.

Presently known ladle stopper rod mechanisms do not make sufficiently precise control possible. Manually operated stopper rods cannot be controlled precisely because of the great physical effort necessary to move them. Both manually and hydraulically operated stopper rod riggings heretofore known have relatively slender mechanisms which tend to deflect under load. The rigging is generally so constructed as to permit lost motion between the parts. Stopper rod riggings heretofore known have been constructed so that the reciprocable elements of the rigging are prone to stick in the framework in which they move, causing irregular operation. A still further disadvantage of presently known apparatus is that a substantial portion of the hydraulic actuating mechanism is located on a fixed platform and connected to the hydraulic cylinder on the ladle by flexible hose connections of substantial length. Hydraulic systems having such hose connections tend to be spongy and slow, and therefore not precise, in their operation.

It is an object of this invention to provide a bottom pour ladle having a self-contained hydraulic system which includes a cylinder for control of the stopper rod, a power source, and a fluid reservoir for the hydraulic system both mounted on the ladle itself.

A further object of this invention is to provide a stopper rod rigging for a bottom pour ladle which is rugged, rigid, simple and reliable and which precisely controls the motions of the stopper rod.

These and other objects will be apparent from the specification which follows.

In the drawings:

FIG. 1 is a vertical sectional view of a ladle having the novel stopper rod rigging and actuation system therefor according to this invention.

FIG. 2 is a horizontal sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a horizontal sectional view taken along line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 1.

FIG. 5 is a vertical sectional view taken along line 5—5 of FIG. 1.

FIG. 6 is a diagrammatic view of the hydraulic control system and electrical system for controlling the movements of the stopper rod of the ladle in FIG. 1.

FIG. 7 is a vertical sectional view of a ladle and stopper rod rigging according to a modified form of the invention.

FIG. 8 is a side elevational view of the apparatus shown in FIG. 7.

FIG. 9 is a horizontal sectional view taken along line 9—9 of FIG. 8.

FIG. 10 is a horizontal sectional view taken along line 10—10 of FIG. 7.

FIG. 11 is a top elevational view, shown partly in section along line 11—11 of FIG. 7.

Referring now to FIG. 1, 20 indicates a refractory lined bottom pour ladle having a nozzle 22 in the bottom and a stopper rod rigging including a vertically reciprocable stopper rod 24 and cross bar 26 for controlling the flow of molten metal through the nozzle. Movements of the stopper rod are controlled in normal operation by hydraulic motor 28, which is operated by an electrically powered hydraulic pump and control system indicated generally at 30. An auxiliary manually operated hydraulic pump and control system 32 is provided for use in emergency, particularly in case of power failure. A manually operated locking mechanism indicated generally at 34 is used to lock the stopper rod in the shut position while the ladle is being filled with molten metal and transported to the location where the metal is to be poured. The hydraulic motor 28, pump and control system 30, auxiliary pump and control system 32, and locking mechanism 34 are all supported on a generally vertically extending supporting structure 36 which is rigidly secured to the exterior of the ladle.

Ladle 20 may be of conventional construction including a steel shell having a refractory inner lining. The stopper rod 24 preferably comprises a metal rod 40 surrounded by a refractory sleeve 42 which may conveniently be made in sections. A suitable stopper rod is shown and described in United States Patent No. 2,832,110. The upper end of metal rod 40 is screw threaded.

Cross bar 26 and stopper rod 24 are joined together by a joint indicated generally at 43, which permits precise positioning of stopper rod 24 over nozzle 22 and at the same time prevents angular movement of stopper rod 24 relative to cross bar 26. This joint also permits easy replacement of stopper rod 24. Joint 43 includes a cylindrical sleeve 44, split bushings 46 and 48, and the upper end of metal rod 40. Sleeve 44 is integrally attached to cross bar 26. Bushing 46, which fits inside sleeve 44, is flanged at its upper end, and has an eccentric bore for receiving split bushing 48, which also is flanged at its upper end and has an eccentric bore for receiving the upper end of metal rod 40. A washer 50 is placed beneath sleeve 44 and bushings 46 and 48, and nuts 52 and 54 on metal rod 40 engage washer 50 and the flange on bushing 48 respectively to provide a tight assembly joining cross bar 26 and stopper rod 24. Bushings 46 and 48 are split to facilitate their removal and replacement.

It is normally necessary to replace the stopper rod 24 after each use. To replace the stopper rod, cross bar 26 is first raised to its uppermost position, which can be done manually as will be hereinafter described. Nut 54, bushing 48 and bushing 46 are removed in that order. Metal rod 40 is then moved laterally through the slot in sleeve 44, and the old stopper rod 42 is lifted out of place. The reverse procedure is followed in installing the new stopper rod. Nut 52 and washer 50 are placed on the new rod. Metal rod 40 at the upper end of the new stopper rod is then passed through the slot in sleeve 44. Bushings 40 and 48 in that order are put in place, and are then rotated so as to position the stopper rod 42 precisely over nozzle 22. Last of all, nut 54 is put in place and tightened.

The generally vertically extending supporting structure

36 includes a generally vertically extending box-like frame 56 terminating at its upper end in a horizontally extending section 58 which includes a horizontal platform 60 and terminating at its lower end in a horizontal platform 61. A portion of the outer side wall of frame 56 is cut away to permit access to the manually operated locking mechanism 34. Supporting structure 36 is rigidly secured to ladle 20 by means of a pair of brackets 62 mounted on the ladle, brackets 64 mounted on the vertically extending frame 56 of the supporting structure 36, and a pair of pins 66 securing the brackets 62 and 64 together.

A pair of guide rods 67 projecting upwardly from platform 60 guide the movements of cross bar 26, permitting free vertical movement while preventing lateral shifting. These guide rods 67 slide in bearings 68, which are held in place by cylindrical bearing housings 69.

Hydraulic motor 28 is located between the fixed supporting structure 36 and cross bar 26, and has a pair of relatively movable parts interconnecting these two. In the illustrated embodiment, hydraulic motor 28 is a conventional double acting cylinder having a piston 70 shown diagrammatically in FIG. 6 and a piston rod 72 extending externally in one direction. The hydraulic cylinder 28 includes a pair of fluid ports 74 and 76 at the bottom and the top respectively for admitting fluid under pressure to either end of the cylinder on opposite sides of piston 70. Admission of fluid under pressure to cylinder 28 via fluid port 74 raises cross bar 26 and stopper rod 24. Conversely, admission of fluid under pressure via port 76 lowers cross bar 26 and stopper rod 24. Cylinder 28 is supported on platform 60 and the piston rod 72 is attached to cross bar 26.

The hydraulic pump and control system 30 is supported on platform 61 of the fixed supporting structure 36. This hydraulic pump and control system, which is shown diagrammatically in FIG. 6, includes a fluid reservoir 78, a conduit 80 having strainer 82 therein and leading from reservoir 78 to a fixed volume displacement pump 84 which is driven by electric motor 86. Electric motor 86 is remotely controlled from a push button control panel 88 which includes start and stop buttons 88*a* and 88*b* respectively and an indicator light 88*c* to indicate when the motor is functioning. The start button 88*a* is pressed to start up hydraulic control system 30 when pouring of metal is about to begin. When pouring is completed, the stop button 88*b* is pushed to shut off hydraulic control system 30. Fluid flows under pressure from the outlet side of fixed volume displacement pump 84 through conduit 90 which has a filter 92 and a check valve 94 therein.

High pressure fluid from conduit 90 may be supplied either to high speed actuating system 96 or low speed actuating system 98. High speed system 96 is used for raising and lowering the stopper rod 24 at high speeds and generally through relatively large distances, while the low speed operating system 98 is used for lower speed operation and hence more precise control of the stopper rod.

The high speed actuation system 96 includes a high pressure fluid conduit 100, a pair of conduits 102 and 104 leading to the inlet ports 74 and 76 respectively of hydraulic cylinder 28, a return conduit 106 which leads back to reservoir 78, and a four-way three-position solenoid operated valve 108 for selectively controlling the admission of high pressure fluid from conduit 100 to conduits 102, 104 and 106. Valve 108 is a reciprocating valve which includes a pair of solenoids 110 and 112 for causing reciprocation of the valve, and a pair of compression springs 114 and 116 for returning the valve to a neutral position when neither solenoid is energized. Energization of solenoid 110 moves valve 108 to the left so as to place high pressure conduit 100 in communication with conduit 102 and thereby raise piston 70 and move the stopper rod 24 upwardly. Conversely, energization of solenoid 112 moves valve 108 to the left, placing high pressure conduit 100 in communication with conduit 104, moving piston 70 and stopper rod 24 downwardly toward the closed position. When neither solenoid is energized, compression springs 114 and 116 return valve 108 to its neutral position which is shown in FIG. 6, in which position high pressure fluid in conduit 100 is returned via conduit 106 to reservoir 78 and the pressures on either side of piston 70 in cylinder 28 are equal. When the hydraulic cylinder is in such a state the stopper rod 24 remains in its previously set position.

Low speed actuating system 98 includes high pressure conduit 120 which may supply fluid under pressure selectively to conduit 122 leading to the lower inlet port 74 of hydraulic cylinder 28, conduit 124 leading to the upper inlet 76 of cylinder 28, and return conduit 126 which leads back to reservoir 78. This system also includes a four-way three-position valve 128 which is identical to valve 108. This valve 128 includes a pair of solenoids 130 and 132 and a pair of compression springs 134 and 136. Energization of solenoid 130 moves valve 128 to the left to admit fluid under pressure to conduit 122 and thereby raise piston 70 and stopper rod 24. Conversely, energization of solenoid 132 moves valve 128 to the right to admit high pressure fluid from conduit 120 to conduit 124 and thereby raise piston 70 and stopper rod 24. When neither solenoid is energized, springs 134 and 136 return valve 128 to its central position as shown in FIG. 6, in which position high pressure fluid from conduit 120 is returned via conduit 126 to reservoir 78, establishing equal pressure on either side of piston 70 and retaining the stopper rod 24 in its previously set position.

Conduits 122 and 124 have temperature and pressure compensated variable orifice flow control valves 137 and 138 respectively therein. These valves reduce the rate of hydraulic fluid flow into cylinder 28 and thus permit close control of the piston speed. Valves of this type are disclosed in Vickers Hydraulic No. 5001C, page *c*–1, published by Vickers, Inc., Detroit, Mich. Valves 137 and 138 have variable orifices 139 and 140 respectively which have uniform flow rates over wide ranges of pressure temperature and fluid viscosity. Valves 137 and 138 have return lines 141 and 142 respectively which have check valves 143 and 144 respectively therein, permitting flow of fluid from the cylinder 28 toward four-way valve 128 and preventing flow in the opposite direction.

Valves 108 and 128 are electrically operated from a control panel 145 at a remote location. Control panel 145 comprises four push buttons 145*a*, 145*b*, 145*c* and 145*d*, connected to one of the solenoids 110, 112, 130 and 132 respectively so as to permit raising or lowering of the stopper rod at either high or low speed as desired. Control panel 145 may also be provided with an emergency stop button 145*e* for interrupting current to the entire system.

Instead of operating the hydraulic control system 30 manually as described above, the system may be operated automatically in response to the molten metal level in the mold to control the movements of stopper rod 24. A suitable automatic control system is described in the copending patent of John R. Tiskus et al. No. 3,300,820, entitled, "System for Controlling the Liquid Level in a Continuous Casting Mold or the Like." The automatic control system described in the Tiskus et al. application may be used to control the movements of either solenoid operated valve 108 or solenoid operated valve 128. A switch 145*f* on control panel 145 permits switching from manual to automatic operation.

An auxiliary control system indicated generally at 32 is provided for use in the event of power failure and for positioning a newly installed stopper rod. This auxiliary system comprises a fluid reservor 146, a manually operated fixed volume displacement pump 147 (shown in FIG. 6) having handle 148 for pumping of hydraulic fluid, a pump outlet conduit 150, and a hand operated four-way three-position valve 151 which places high pressure fluid

on conduit 150 on the outlet side of pump 146 selectively in communication with conduit 152 leading to the top inlet port 74 of hydraulic cylinder 28, conduit 154 which leads to the inlet port 76 at the lower end of cylinder 28, and return conduit 156 which leads back to reservoir 144. The auxiliary control system 32 also includes a normally open solenoid operated valve 160 which blocks communication between conduits 152 and 154 and the hydraulic cylinder 28 as long as the solenoid is energized, and which closes to permit such communication in the event of power failure. An electrical connection between control panel 88 and valve 160 is provided so that starting of electric motor 86 energizes solenoid valve 160 so as to block communication between auxiliary control system 32 and cylinder 28.

A relief valve 162 having an outlet line 164 which leads back to reservoir 78 prevents an excessive pressure build-up in the system.

Locking mechanism 34, which is used to hold the stopper rod 24 in position closing nozzle 22 while molten metal is poured into ladle 20 and while the ladle is being transported from the furnace to the position of use, includes a rod 170 having a turnbuckle 172 for adjustment of its length, and a manually operated handle 174 for moving the rod 170. Manually operated handle 174 is pivotally mounted on pivot pin 176 which is journaled in supporting structure 36, and is pivotally connected to rod 170 by shaft 178. Limit stop 180 limits the counterclockwise movement of handle 174. Upward movement of the handle 174 to the dotted line position of FIG. 1 unlocks the locking mechanism 34 to permit movement of stopper rod 24 by hydraulic cylinder 28. The mechanism as shown in FIG. 1 is in the locked position.

The locking mechanism 34 can also be used for manual operation of stopper rod 24 in the event of power failure or other emergency. However, it is desirable to substitute a structurally strong member such as an I-beam or channel section for rod 170 if the locking mechanism 34 is to be so used. Manually operated control system 32 and solenoid operated valve 160 associated therewith can be eliminated if locking system 34 is to be used for emergency operation of the stopper rod.

Referring now to FIGS. 7 to 10 and especially to FIG. 7, 220 indicates a refractory lined bottom pour ladle having a nozzle 222 in the bottom and a stopper rod rigging including a vertically reciprocable stopper rod 224 and a cross bar 226 for controlling the flow of molten metal through the nozzle. Movements of the stopper rod are controlled in normal operation by hydraulic motor 228, which is operated by an electrically powered hydraulic pump and control system indicated generally at 230. A manually operated locking mechanism indicated generally at 234 is used to lock the stopper rod in the shut position while the ladle is being filled with molten metal and transported to the location where the metal is to be poured. Locking mechanism 234 also serves as a manual system for controlling the movements of stopper rod 224 and cross bar 226 in case of emergency, and particularly in the event of power failure. The hydraulic cylinder 228, pump and control system 230, and locking mechanism 234 are all supported on a generally vertically extending supporting structure 236 which is rigidly secured to the exterior of the ladle.

Ladle 220 may be of conventional construction including a steel shell having a refractory inner lining. Stopper rod 220 comprises a metal rod 240 surrounded by refractory sleeve 242 which may conveniently be made in sections. Stopper rod 224 is joined to cross bar 226 by means of a joint 243 which includes cylindrical sleeve 244 integral with arm 226, a flanged split bushing 246 inside sleeve 244 and having an eccentric bore for a second flanged split bushing 248, which has an eccentric bore for receiving the upper end of metal rod 240, and washer 250 which underlies sleeve 244 and bushings 246 and 248. The joint is held in place by nuts 252 and 254.

It will be noted that the aforesaid joint 243 between stopper rod 224 and cross bar 226, as well as ladle 220 and stopper rod 224, are herein illustrated as identical to their counterparts in the embodiment of FIG. 1.

The generally vertically extending supporting structure 236 comprises a vertically extending three-sided frame which terminates at its lower end in a horizontally extending platform 261. This frame is open along the side remote from ladle 220 to permit ready access to the manually operated mechanism 234. Supporting structure 236 is rigidly secured to ladle 220 by means of a pair of brackets 262 mounted on the ladle, brackets 264 mounted on supporting structure 236, and a pair of pins 266 securing the brackets 262 and 264 together.

Referring now to FIG. 8, the mechanism for controlling the movements of cross bar 226 and stopper rod 224 will be shown in detail. Hydraulic cylinder 228, which is a conventional double acting cylinder, is secured to supporting structure 236 by bracket 271 and has a vertically reciprocable piston having piston rod 272 extending exteriorly in one direction and secured to cross bar 226. The cylinder may be attached to cross bar 226 and the piston rod 272 to supporting structure 236 is desired.

The movements of hydraulic cylinder 228 during formal operation are controlled by a hydraulic pump and control system 230, which is identical to the hydraulic pump and control system 30 illustrated in FIG. 6 except for the omission of the auxiliary manually operated system 32 and solenoid operated valve 160. These parts may be included, however, in which case locking mechanism 234 is used only to lock stopper rod 224 shut and is not used to operate the stopper rod manually in case of emergency.

Locking mechanism 234 includes a pair of hollow rods 280 and 280*a*, a cross bar 282 connecting rods 280 and 280*a*, a vertically depending rod 284 pivotally connected to cross bar 282 by pivot pin 285, and a lever 286 for manual operation of the locking mechanism. Rods 280 and 280*a* are guided in their reciprocatory movement by guide sleeves 288 and 288*a* respectively. Sleeve 288 is fixedly mounted on supporting structure 236 by brackets 288*c*. Sleeve 288*a* is pivotally mounted on supporting structure 236 by a pair of rings 288*d* which are connected by pins to lugs 288*e* welded to support 236. This arrangement allows for unequal thermal expansion of the several parts of the assembly and thus prevents binding of guide rods 280 and 280*a* in sleeves 288 and 288*a*. At the same time the mounting of locking mechanism 234 is essentially rigid. Sleeves 288 and 288*a* have anti-friction bearings 289. Lever 286 includes a bent lever arm 290 pivotally connected to rod 284 by pivot pin 291 and terminating at its lower end in handle 292. The upper end of lever arm 290 is pivotally connected to link 294 by pin 295. Link 294 is held in fixed position except during installation of a new stopper rod, as will be hereinafter described. Thus pin 295 serves as a fulcrum for lever arm 290. Link 294 is secured at its opposite end by pin 296 to a pair of parallel plates 297 which are on either side of link 293. Parallel plates 297 are welded to supporting structure 236. A pair of short bars 298 and 299 are welded to plates 297. These bars support set screws 300 and 301 respectively, which bear against opposite sides of link 294. Set screws 300 and 301 are used to position link 294 and with it the entire stopper rod rigging when a new stopper rod is installed. In this manner stopper rod is caused to seat precisely on nozzle 222 when manual operating mechanism 234 is in the closed position shown in FIG. 7. Once the stopper rod has been positioned, set screws 300 and 301 hold link 294 in a fixed position. Thus pivot pin 295 acts as a fulcrum about which lever arm 290 pivots. A limit stop 302 on link 294, against which rod 284 abuts when stopper rod 224 is locked in shut position, limits counterclockwise movement of rod 284

and lever arm **290**. To insure locking of locking mechanism **234**, limit stop **302** is positioned so that the center axis of rod **284** is slightly to the right of pivot pin **295** when the locking mechanism **234** is in its locked position.

Operation of a ladle according to this invention will now be described with particular reference to FIGS. 1 to 6. A new stopper rod is secured to cross bar **26** while the cross bar is in the raised position. This is generally done before each heat of molten metal introduced into the ladle. The stopper rod **24** is then lowered by auxiliary hydraulic system **32** until the stopper rod touches nozzle **22**. The stopper rod is then positioned laterally by rotation of eccentric bushings **46** and **48** until it is precisely over nozzle **22**. Turnbuckle **172** is then backed off until handle **174** can be brought against limit stop **180** with little or no force. Turnbuckle **172** is then tightened until stopper rod **24** seats firmly on nozzle **22**. The ladle is now ready for use. After the molten metal has been introduced, the ladle **20** is transported to the place where the molten metal is to be poured, i.e., in position over a tundish or mold. Electrical connections are then made between motor **86** and valves **108** and **128**, which are on the ladle, and the appropriate control panels **88** and **145**, which are located at convenient fixed locations away from the ladle. Handle **174** is then lifted. This unlocks the stopper rod **24** and places it under control of hydraulic cylinder **28**. Motor **86** is started up from control panel **88**, and movements of the stopper rod are controlled from control panel **145**. After pouring of molten metal has been initiated, switch **145***b* can be moved to automatic position if desired, in which case the movements of stopper rod **24** are thereafter controlled automatically in response to the level of molten metal in the mold.

Operation of the ladle of FIGS. 7 to 10 is generally similar to operation of the ladle of FIGS. 1 to 6. After stopper rod **224** has been secured to cross bar **226**, handle **292** is lowered to lower the stopper rod against nozzle **222**. The height of the stopper rod is adjusted so that it seats firmly against the nozzle **222** by adjustment of set screws **300** and **301**. This raises or lowers link **294** and with it the entire stopper rod assembly. The ladle **220** is then ready for use. Handle **292** is down as shown in FIG. 7, so as to lock stopper rod **224** in closed position against nozzle **222**, while molten metal is being introduced into the ladle and while the ladle is being transported to the point of use. When the ladle is in position over a tundish or mold, handle **292** is raised and the stopper rod is thereafter under control of hydraulic cylinder **228**. Further operations are as in the ladle of FIGS. 1 to 6.

The entire structure according to either embodiment of this invention, with the exception of control panels **88** and **145** and the wires leading from these panels to the members which they control, are mounted on the ladle. This does away with the long flexible hose lines of previously known hydraulic systems, which result in spongy operation. However, the hydraulic systems may be mounted externally if it is desirable, in special situations, to do so. Furthermore, the stopper rod rigging according to this invention is rugged and rigid, so that the stopper rod seats precisely on the nozzle and does not become misaligned due to deflection of the rigging under load or play within the rigging.

While I have illustrated this invention with respect to specific embodiments thereof, it is to be understood that these are merely by way of illustration and that variations can be made by those skilled in the art.

What is claimed is:

1. Apparatus for precision pouring of molten steel into a continuous casting mold, said apparatus comprising:

(a) a bottom pour ladle having a bottom discharge opening,

(b) a stopper rod rigging including a stopper rod for controlling th edischarge of molten steel through said opening and a cross bar connected to said stopper rod,

(c) a framework rigidly mounted on the side of the ladle,

(d) guide means comprising a plurality of guide members each secured directly to both said cross bar and said framework for guiding the vertical movements of said stopper rod rigging while preventing horizontal movement thereof, and

(e) an actuation system for said stopper rod rigging including a hydraulic motor directly connected to said framework and said cross bar and a hydraulic pump and control system mounted on said framework for controlling the movements of said hydraulic motor.

2. Apparatus according to claim **1** in which said framework includes a horizontal platform at substantially the upper end thereof and extending over a portion of the ladle, said hydraulic motor and at least one of said coacting guide members being supported on said platform.

3. Apparatus according to claim **1** in which said framework includes a generally vertically extending portion adjacent to the exterior of said ladle, said hydraulic pump and control system being mounted on said vertically extending portion of said framework.

4. Apparatus according to claim **1** in which said hydraulic motor is a hydraulic cylinder fixedly mounted on said platform and having an exteriorly extending piston rod connected to said cross bar.

5. Apparatus according to claim **1** in which said actuation system includes a pump for hydraulic fluid and a valve for selectively supplying hydraulic fluid under pressure to one end of said hydraulic cylinder to thereby control the movements of said stopper rod rigging.

6. Apparatus according to claim **3** in which said vertically extending portion of said framework terminates at its lower end in a horizontal platform, said actuation system including a hydraulic reservoir supported on said platform.

7. Apparatus according to claim **1**, including means for manually locking said stopper rod rigging in the shut position.

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