May 12, 1953 E. F. SCHULZE 2,637,883

LADLE TIPPING MECHANISM

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FIG. 1

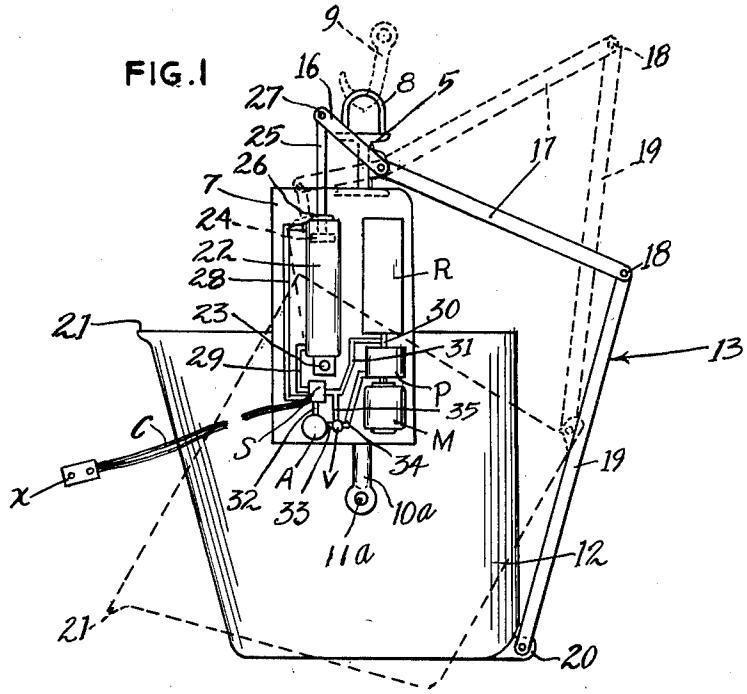
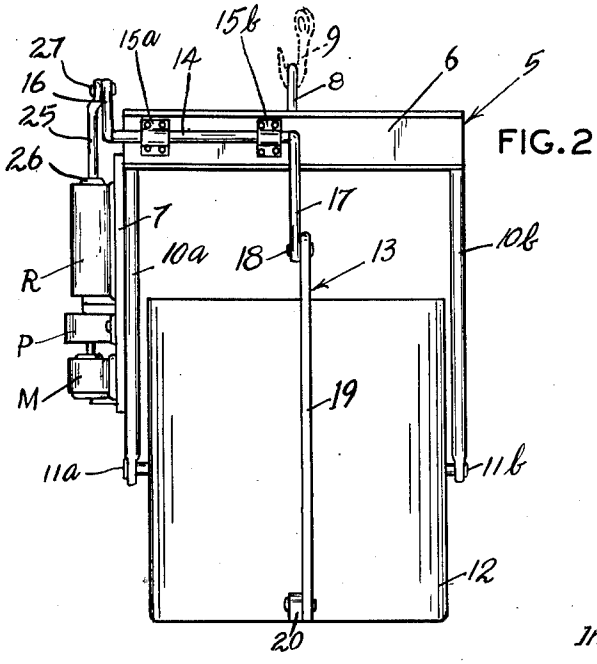


FIG. 2



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LADLE TIPPING MECHANISM

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1 Claim. (Cl. 22—82)

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This invention relates to mechanism for controllably tilting ladles used in foundry furnaces and the like where molten metal is poured into molds.

This invention is an improvement over my previous invention disclosed and patented in Patent #2,463,811 issued to me on March 8, 1949 and entitled Ladle Tipping Mechanism. The mechanism disclosed in my prior application which culminated in the above patent was designed for controllably tilting a ladle in a manner intended to eliminate jerkiness and lack of uniformity and the consequent flaws in the castings made thereby. While this structure has proved very successful and is a big improvement over ladle tilting mechanisms previously known, I have found through steady experimenting that the structure has certain deficiencies in that the platform provided for therein and disposed above the ladle obstructs the view from above while the ladle is being filled, while flux is being added to its contents, and while the pouring operation is being commenced. Furthermore, the intense heat of the contents of the ladle affects the movable parts of the hydraulic system adversely since these parts are disposed above the ladle. In addition, I have found that it is possible to design a structure to accomplish the desired purpose which is even more compact than that disclosed in my previous patent.

It is an object of my invention to provide a simplified, highly efficient ladle tipping mechanism which is steady and positive in its operation and which will not have its operation adversely affected by the heat of the contents of the ladle.

Another object is to provide such a ladle tipping mechanism capable of remote control to produce slow, uniform tilting of the ladle and constructed to permit ready access to and clear view from above of the contents of the ladle.

A further object is to provide a ladle tilting mechanism of the type described which combines compact hydraulic system, a ladle support, and connecting operating mechanism, all compactly embodied in an integral unit disposed laterally of the ladle for more efficient operation and utilization of space.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to similar parts throughout the several views and, in which:

Fig. 1 is a side elevational view of one embodiment of my invention showing the ladle in upright position in solid lines and in tilted position in broken lines;

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Fig. 2 is a rear elevational view of the same with the ladle in upright position.

My improved mechanism includes, as shown in Figs. 1 and 2, an overhead structure indicated generally as 5 and comprised of a cross-sectionally I shaped elongated bar 6 and a platform or plate 7 depending from one end of the bar 6. As shown, the bar 6 is provided along its upper surface and centrally thereof with a heavy ring 8 adapted to receive a hook 9 for suspension of the mounting structure 5 and the mechanism attached thereto which will be hereinafter described. Secured to each end portion of the bar 6 are the bail arms 10*a* and 10*b* which are adapted at their lower end for co-operation with the trunnions 11*a* and 11*b* to suspend the ladle 12 and to pivot the same.

My tilting mechanism indicated generally as 13 includes a rockshaft 14 which is pivotally mounted by a pair of fulcrum plates 15*a* and 15*b* secured to one end portion of the bar 6. The inner end of this rockshaft 14 terminates at substantially the mid-section of the bar 6 and the outer end extends laterally beyond one end of the bar, as shown best in Fig. 2. Rigidly connected to the outer end of the rockshaft 14 is a relatively short power-receiving arm 16. Connected to the inner end of the rockshaft 14 at a slight angle to the power-receiving arm 16 is a ladle-connection lever arm 17. As shown, this lever arm 17 extends downwardly and rearwardly relative to the ladle 12. The rear end of the lever arm 17 is pivotally connected by a pivot pin 18 to a link 19 which extends downwardly therefrom toward the rear and bottom of the ladle 12. At its lower end this link 19 is pivotally connected to a pouring lug 20 rigidly affixed to the central portion of the lower rear edge of the ladle 12. This pouring lug 20 is fixed directly opposite from the pouring spout 21 of the ladle. The axis of the pivot pin 18 and the pivotal connection to the pouring lug 20 are substantially parallel to the horizontal rockshaft 14 and to the axis of the trunnions 11*a* and 11*b*. I have sometimes hereinafter referred to the lever arm 17 and the link 19 together with the pivot pin 18 and the pivotal connection at 20 as linking mechanism.

While it is possible to use any of a varied number of hydraulic power systems in conjunction with the tilting mechanism described above, I prefer to employ in the system utilized a substantially vertically arranged hydraulic cylinder

22 pivotally mounted at its lower end upon a pivot rod 23 which in turn is rigidly mounted on the plate 7. As shown, the plate 7 is rigidly connected to the bail arm 10*a* as well as to the bar 5. This provides added rigidity both to the bail arm and to the hydraulic power system. Slidably mounted within the cylinder 22 is a suitable piston 24 fixed to the end of an elongated piston rod 25 which extends through a suitable packing gland 26 on the upper end of the cylinder 22. This piston rod 25 is pivotally connected by a pivot pin 27 to the free end of the power receiving arm 16 to drive the same. The axis of the pivot rod 23 is disposed substantially parallel to the rockshaft 14 and, as shown, is slightly forward of the same. The cylinder 22, of course, is capable of pivotal movement on the pivot rod 23 to either an upward or backward position.

My hydraulic system is arranged so that fluid may be forced through cylinder supply conduits 28 and 29 against either the upper or lower end of the piston 24. The direction of the fluid can be controlled remotely by an operator through a system to be described hereinafter. As shown, my hydraulic system includes a hydraulic pump P driven by a motor M rigidly affixed to the plate 7. The pump P has its intake connected by a conduit 30 with a fluid reservoir R and also has a branch connection with a return conduit 31 which is connected to a selector valve mechanism S mounted on plate 5 adjacent the cylinder 22. The discharge of the pump P is connected by a conduit 34 with a relief valve V which in turn is connected by a conduit 33 to an accumulator tank A. The tank A is connected by a conduit 32 to the selector valve mechanism S. The valve V is also connected to the conduit 31 by a relief conduit 35.

The selector valve mechanism S includes a valve system (not shown) of conventional type wherein passage of fluid under pressure through conduit 29 to the upper end of cylinder 22 with return of fluid through conduit 28 may be accomplished or wherein reverse flow of fluid for retracting the piston 24 may be accomplished or wherein fluid may be locked in both of the communicating conduits 28 and 29. This valve system is subject to immediate and sensitive control by any suitable conventional means such as a solenoid or electro-magnetic coil (not shown) or, if desired, manually controlled handles may be supplied. In the form of the invention illustrated an electro-magnetic control is shown wherein the wires or conductors for operating the hydraulic system in opposite directions are housed in a service cable C extending to a push button switch X which may be finger controlled from a distance from the position of the ladle.

Operation

From the drawings and the foregoing description it can be readily seen that I have provided a compact unit adapted to be readily connected with conventional foundry ladles for controllably tilting the same in a slow and uniform manner. Such tilting movement is an important requisite in the formation of excellent castings. It should be noted that my present invention requires a minimum of space yet operates with a maximum of efficiency.

In operation, my invention which supports the ladle 12 is properly positioned above a mold into which the molten metal is to be poured and adjusted to the proper height. The mechanism when adjusted to position is disposed as shown in Fig. 1 with the ladle 12 in horizontal or normal untilted relation. The entire structure, of course, is maintained aloft through the hook 9 which is normally secured to a cable or the like for movement.

To tilt the ladle, the operator standing at a point of vantage some distance away from the ladle controls the mechanism by finger pressure actuating the proper button or other element to cause hydraulic fluid to flow through the cylinder supply conduit 28 against the outer end of piston 24. Piston rod 25 is protracted steadily, slowly and uniformly, applying its power to the pivoted end of the power-receiving arm 16. The leverage thereby exerted on the power-receiving arm is transmitted to the rockshaft 14 which, of course, pivots therewith within the fulcrum plates 15*a* and 15*b*. Instant release of the control element locks the hydraulic mechanism and the tilting mechanism immediately. No jerkiness is encountered since the connection of the piston rod 25 through the medium of the tilting mechanism 13 is positive and free from lost motion. The nature of the hydraulic system with balancing of fluid on both sides of the piston eliminates any unsteadiness or jerkiness in the hydraulic system itself.

The pivoting of the rockshaft 14 will, of course, cause the lever arm 17 to raise toward the position shown in broken lines in Fig. 1 and thereby carry with it upwardly the link 19, which in turn draws the pouring lug 20 upwardly causing the ladle 12 to slowly and steadily tilt toward the position shown in broken lines in Fig. 1. The ladle is further tilted or returned to normal pouring position by manipulation of the proper element of the valve control which may be instantly and sensitively controlled by the operator. This control is so sensitive as to permit minute variations in the position of the ladle without causing the contents of the ladle to move unsteadily.

It should be noted that because of the rigid linkage between the ladle and piston rod 25, the ladle is at all times maintained rigidly in the desired position and is not freely tiltable. Whenever the piston rod is stopped, the ladle is locked in rigid and non-swingable position.

The tilting or swinging of the ladle with my mechanism is always uniform and may be regulated as to speed to suit the particular need, according, of course, to the pressure upon the hydraulic fluid and the proportions of the working parts of the hydraulic system.

In the foregoing it will be seen that I have provided a tilting mechanism wherein the power mechanism for driving the same is positioned laterally relative to the ladle. This is extremely important inasmuch as it is important for the operator of the pouring operation to have a clear view of the contents of the ladle to properly regulate the pouring of the same and for the adding of flux. It is even more important that the power mechanism be disposed so as to be entirely unaffected by the heat radiated from the contents of the ladle. By positioning the power mechanism outwardly of the plate 7 and laterally with respect to the open portion of the ladle I have substantially eliminated any adverse effects of the intense heat normally cast off by the contents of the ladle.

It should also be noted that by arranging the power mechanism substantially as shown in Figs. 1 and 2 I have provided a ladle tipping mechanism which makes maximum utilization of space.

It can be readily seen when comparing my present invention with previous ladle tipping mechanisms that I have provided a means for uniformly tilting a ladle which requires for all practical purposes no space over and above that normally required for the ladle to which it is attached.

Wherever herein the term hydraulic is used in the specification and claims that term contemplates not only systems and parts thereof where hydraulic liquid is utilized but systems wherein any fluid (gaseous or liquid) under pressure is employed. Also, wherever the term linkage mechanism is used it is intended to include the lever arm 17 and the link 19 with their means for connection to their respective members and between each other.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

A ladle, a bail having a cross bar spaced upwardly from the ladle and arms extending downwardly from the cross bar and pivoted to the ladle at opposite sides thereof, a plate mounted vertically along the bail arm at one side of the ladle, a rocker shaft extending longitudinally of said cross bar with one end projecting outwardly therefrom over said plate and carrying a forwardly extending lever arm, the inner end of said rocker shaft terminating intermediate the length of the cross bar and at its inner end carrying an arm extending rearwardly over the

ladle midway the width thereof, a vertical link back of said ladle pivoted at its upper end to the rear end of the inner arm and at its lower end to the ladle at the rear thereof and serving to tilt the ladle forwardly to a pouring position when the rocker shaft is turned in a direction to exert upward pull upon the link, a cylinder extending vertically outwardly of the plate and pivoted at the lower end to the plate, a piston in said cylinder having a rod extending upwardly through the top of the cylinder and at its upper end pivoted to the outer arm and causing rotation of the rocker shaft when the piston is moved longitudinally of the cylinder, a pump carried by said plate, and valve-controlled conduits connecting said pump with opposite ends of said cylinder for controlling directional movement of the piston in the cylinder.

EDMUND F. SCHULZE.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,008,406	Davis	Nov. 14, 1911
1,560,241	Jones	Nov. 3, 1925
1,601,436	Goldberg	Sept. 28, 1926
1,620,829	Moore et al.	Mar. 15, 1927
1,783,128	Morgan	Nov. 25, 1930
1,911,111	During	May 23, 1933
2,025,069	Newton	Dec. 24, 1935
2,088,547	Camerota	July 27, 1937
2,145,956	Stern	Feb. 7, 1939
2,463,811	Schulze	Mar. 8, 1949