June 18, 1940. H. F. HAGEMEYER 2,205,093

CRUCIBLE HANDLING MECHANISM

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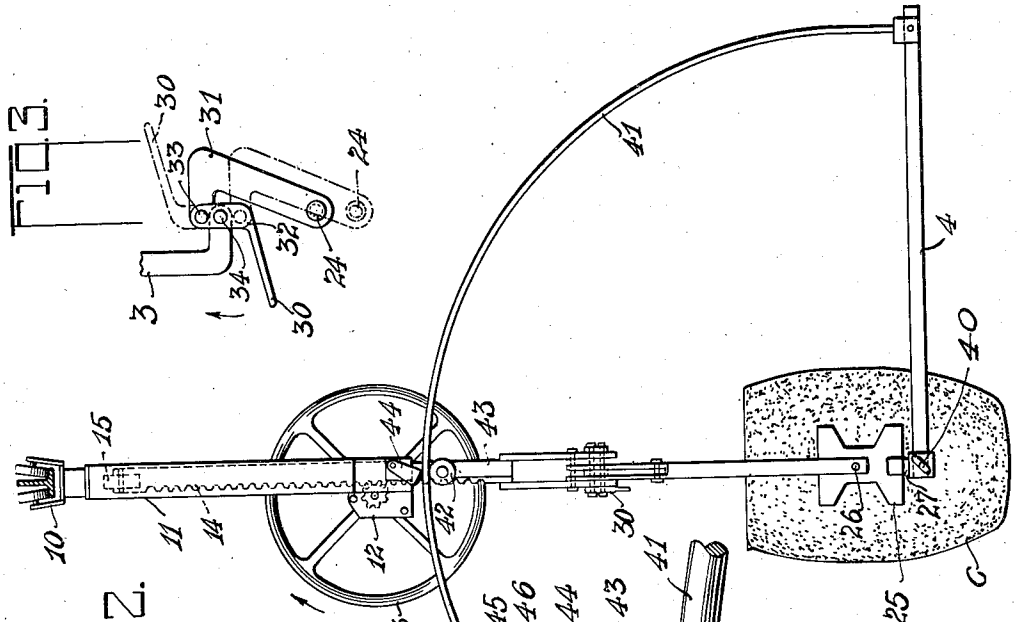


FIG. 2.

FIG. 3.

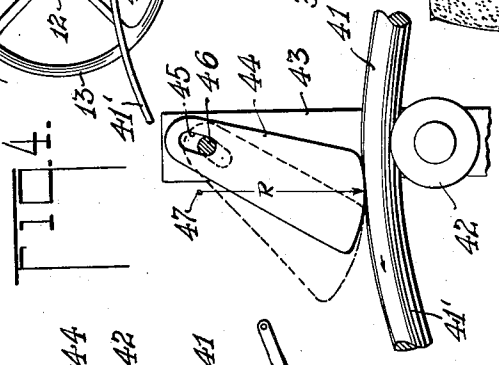


FIG. 4.

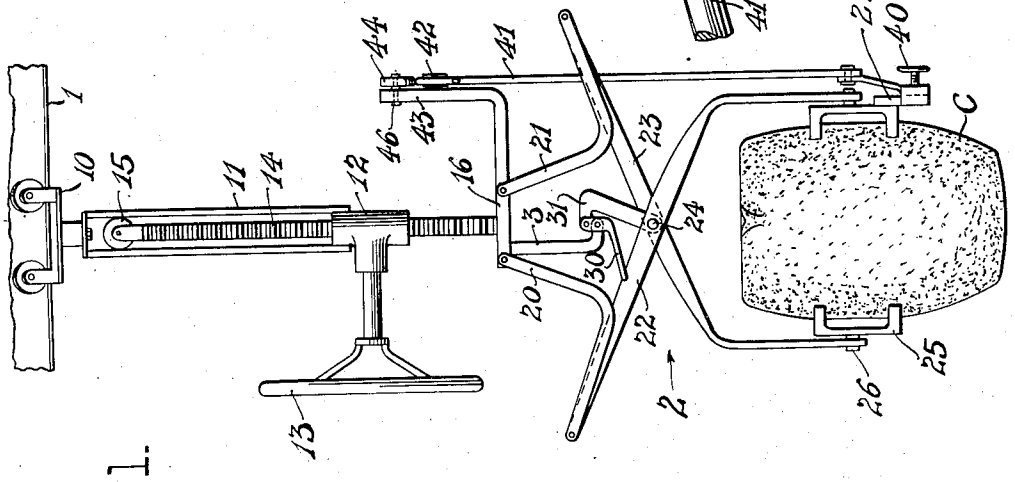


FIG. 1.

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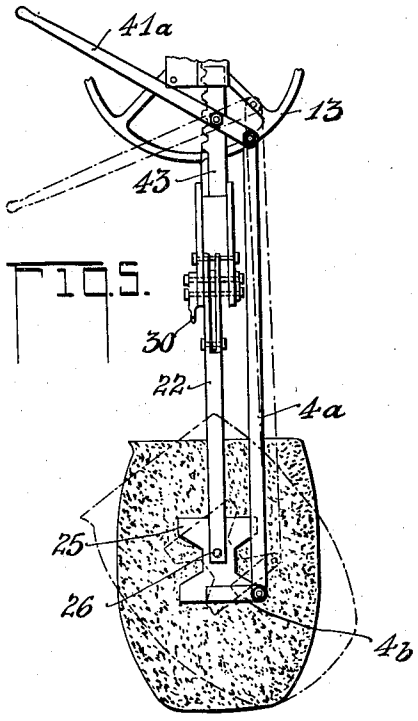


FIG. 5.

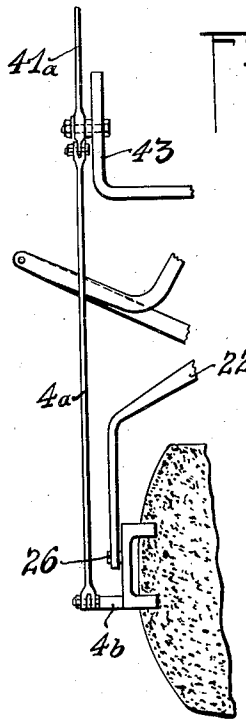


FIG. 6.

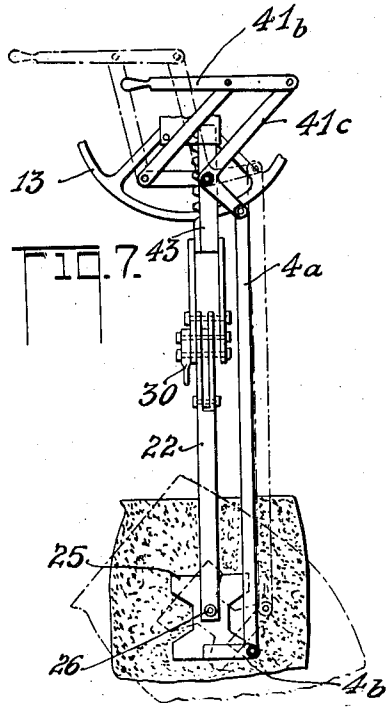


FIG. 7.

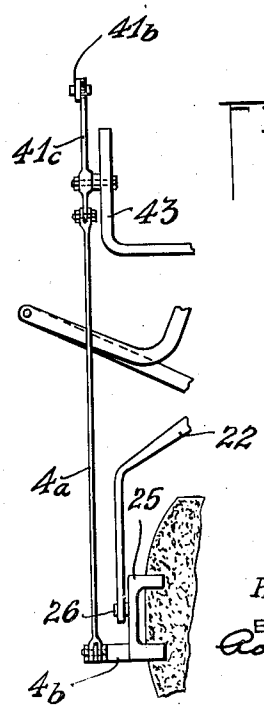


FIG. 8.

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CRUCIBLE HANDLING MECHANISM

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Application August 2, 1938, Serial No. 222,600

10 Claims. (Cl. 22—82)

My invention relates to crucible handling mechanism and particularly to such mechanism for lifting a crucible from a metal melting furnace, transporting it to molds which are to be poured, and pouring from the crucible into the molds while the crucible is being held by my device.

Heretofore it has usually been the practice, especially in the smaller foundries, to lift the crucible from a metal melting furnace and set it on the floor during the skimming operation, and thereafter to carry the crucible in a cradle having oppositely projecting handles, each of which is carried by a man. These men then pour into the mold either while manually supporting the crucible, or while its weight is partially supported either by suspension or by resting the bottom of the crucible on some sort of stand.

Another type of apparatus conventionally used consists of a stationary cradled crucible from which the molten metal is poured into small hand crucibles, each carried by one man. To operate such apparatus at least two men are required, one to carry a hand crucible and the other to pour into the hand crucible from the melting crucible.

With my apparatus the metal is poured directly from the crucible in which it is melted so that no chilling takes place by pouring from one crucible into another. A single man may perform all the operations to control the apparatus for lifting the crucible from the melting furnace, transporting it to the molds and pouring from the crucible into the molds. Moreover, he need not support the weight of the crucible and its contents but may merely control its movements, and he can perform the pouring operation more quickly and surely than two men or more could heretofore.

Briefly my apparatus includes mechanism such as a pair of tongs to grip the crucible, which tongs are supported by mechanism for lifting and sustaining the weight of the crucible, and which mechanism is mounted for movement from the furnace over to the molds to be poured. The crucible is preferably supported between swingable plates provided on the tongs arms. A tilting lever which may be connected to one of the crucible engaging plates may be moved by the operator to tilt the crucible for pouring metal therefrom into the molds. Preferably a stop is provided which will hold the crucible in any desired tilted position while it is being moved from one mold to the next, but in such position that molten metal will not drip therefrom during such movement.

The principal object of my invention therefore is to provide a single supporting mechanism for a crucible which will serve to remove it from the melting furnace, to support it during transference therefrom to the molds to be poured, and to enable it to be tilted for pouring into the several molds.

A further object is to provide such apparatus which may be operated conveniently by one workman only, who need not support the weight of the crucible or its contents.

Still another object is to provide such mechanism which will be readily controllable with the minimum effort, and which will assume a position of equilibrium if the workman should remove his hands entirely from the apparatus, without danger of spilling molten metal.

An additional object is to provide an automatic arrangement for maintaining the crucible in a tilted position just insufficient for metal to be poured therefrom as it is moved from one poured mold to the next to be poured.

All these objects I obtain by mechanism which has relatively few parts and is of simple construction, but which is sufficiently sturdy to withstand long and severe usage.

In the drawings I have illustrated a device which has proved to be satisfactory in actual operation. Modifications in certain of its details may be desirable, however, to adapt its operative principles to suit particular foundry installations, equipment and technique. Other objects inherent in the construction of the mechanism in the form which I now prefer, will be understood from the following detailed description, the inventive features of my device being defined in the claims.

Fig. 1 is a front elevation view of my apparatus in registry with a crucible, but not gripping it.

Fig. 2 is a side elevation view of the device in the same attitude as shown in Fig. 1.

Fig. 3 is a fragmentary front elevation view illustrating the operation of the mechanism for moving the tongs between the crucible gripping and releasing position.

Fig. 4 is a fragmentary side elevation view showing in detail the tilting handle locking device.

Fig. 5 is a side elevation view and

Fig. 6 is a rear elevation view of a modified form of my apparatus.

Fig. 7 is a side elevation view and

Fig. 8 is a rear elevation view of a still further form of my apparatus.

The proportions of the levers illustrated in Figs. 5 to 8, inclusive, are not critical, and may be any found to be suitable for a specific installation.

The size of the crucible C should be chosen according to the capacity required for a single pour and the size of the furnace employed. Thus the crucible will be set into the furnace and gradually filled with metal to be melted. When the metal has been heated to the proper temperature the crucible will be withdrawn from the furnace, skimmed, transported to the molds, and all or nearly all of the metal poured therefrom before it is returned to the furnace for a fresh heat.

The device illustrated in the drawings is readily operable to hold the crucible during this complete cycle of operations, and may be managed throughout such operating cycle by a single workman. A track 1 extends from a position over the melting furnace to a location alongside the molds to be poured, which may be set with their sprues in line. Along this track moves a carriage 10 from which are suspended vertical ways 11 having a pinion and brake mechanism 12 supported on their lower end, which mechanism is controlled by hand wheel 13. The particular construction of mechanism 12 is not part of my invention. The pinion of this mechanism meshes with a rack 14 which is guided for reciprocation between the ways 11 by a guide wheel or the like 15. The rack 14 acts as a support for a cross-bar 16 upon the opposite ends of which are pivoted links 20 and 21 of lazy-tongs mechanism generally indicated as 2. On the lower ends of the links 20 and 21 are pivoted, respectively, tongs arms 22 and 23, forming the tongs proper, which are mutually pivoted at 24. The lower ends of arms 22 and 23 carry crucible engaging plates or shoes 25 pivoted at 26 upon the tongs arms at points slightly above the center of gravity of such plates. This location of the pivot causes plates 25 to assume vertical positions at all times unless positively deflected therefrom. To enable the pivot pins 26 to withstand the high heat to which they are subjected without binding, they should be made of steel having a nitrided shell.

The tongs may be opened and closed by mechanism shown in detail in Fig. 3, which may consist of a link 3 secured to cross-bar 16, and having its lower end bent into a substantially horizontal position. A second link 31, hooked at its upper end, has its lower end connected to the tongs pivot 24, its upper end being disposed adjacent to the lower bent end of link 3. A connecting link 32 is pivoted both to the lower end of link 3 and to the upper end of link 31, and is provided with a handle 30 operable to swing the upper end of link 31 with respect to the lower end of the link 3 between the solid and broken positions of Fig. 3. In the solid line position of handle 30 and link 31 this link is in its uppermost position, which maintains the pivot 24 in its raised position to hold the lower ends of the tongs arms 22 and 23 farthest apart. When the handle 30 is swung into the broken line position, pivot 33 is swung about pivot 34 as an axis into its broken line position, wherein the pivot 24 of the tongs arms is lowered to allow the crucible engaging plates 25 to move toward each other for gripping a crucible therebetween.

Fig. 1 shows the tongs mechanism lowered over a crucible C, but link 31 is retained in its upper position, thus holding gripping plates 25 apart. These plates or shoes are substantially cylindrically concave to conform to the sides of the crucible, and preferably are roughened on their inwardly facing surfaces to afford a more secure grip upon the sides of the crucible. As link 31 is lowered by means of handle 30, plates 25 are also lowered somewhat so that they will engage the crucible at or below its central bulge. The center of gravity of the crucible, however, whether empty or full should be below the line of pivots 26 so that unless held in a tilted position the crucible will always assume a normal upright position without attention on the part of the operator, and can never swing upside down.

The crucible engaging shoes 25, it will be understood, are both freely pivoted to the arms 22 and 23. It is merely necessary in pouring from the crucible, therefore, to tilt the plates 25 in order to tilt the crucible C, the arms 22 and 23 and the rest of the mechanism remaining undisturbed. Since both planes 25 with the crucible clamped therebetween must move in unison, it is only necessary to actuate one plate in order to swing them both as the crucible is tilted. A satisfactory tilting arrangement may consist of a tang 27 projecting downward from one of the plates 25, to which a tilting lever 4 is secured by a set screw 40. To the swinging end of the lever 4 may be connected an arcuate tilting rod 41, which joint may or may not be of the pivoted type, although less binding will occur if this is a pin joint. Preferably the center of the rod's curve coincides with the axis of pivots 26. This rod 41 preferably extends upwardly adjacent to the supporting rack 14 and may be guided in a grooved roller 42, pivoted upon an extension 43 of cross-bar 16. The free end of the rod projecting past the roller constitutes the tilting handle 41'. Various other lever arrangements could be employed to accomplish this tilting action, the one illustrated being merely that which I now prefer. A vertical link 4a attached to a horizontal tang 4b, for example, might replace lever 4, which link could be vertically reciprocated either by a pivoted lever 41a, or by a horizontally reciprocating bar 41b connected to the upright arm of a bell crank 41c, the upper end of such vertical link 4a being connected to the horizontal bell crank arm.

Extension 43 also carries a stop block 44, pivoted thereon, the details of which are shown in Fig. 4. The upper end of the stop block 44 has a slot 45 extending lengthwise thereof which fits over a pivot pin 46 fixed on the extension 43 of cross-bar 16. When in the stopping position shown in solid lines in Fig. 4, the center of the arcuate lower end is at an eccentric point such as 47, its radius of curvature being indicated by the line R. As the handle 41 is pulled in the direction indicated by the arrow to tilt the crucible, the lower end of the stop block, by its frictional engagement with the rod, is moved into the broken line position, wherein the upper end of slot 45 has moved downward to seat on pivot pin 46. When the tilting rod moves back in the opposite direction its frictional engagement with the block 44 first raises this block until the lower end of its slot is in contact with the pivot pin 46, effecting a lost motion action. Further rearward movement of rod 41 is prevented by the binding action caused by the eccentric lower end of the stop block being wedged into tight engagement with the rod.

Because of the lateral projection of tilting lever

4, it is necessary to remove the tilting mechanism illustrated while the crucible is being lifted from the melting furnace. To do this it is merely necessary to loosen the set screw 40 and slide lever 4 off the tang 27, and then to remove rod 41 from between the roller and the stop block 44 by swinging the stop block forward.

With the tilting mechanism laid aside the carriage 10 is rolled along the track 1 until the lower ends of the tongs arms 22 and 23 are directly over the crucible. The control wheel 13 is then turned in the direction of the arrow shown in Fig. 2 to rotate the pinion of mechanism 12 in the direction to lower rack bar 14. When crucible engaging plates 25 have reached their proper position with respect to the crucible as shown in Figs. 1 and 2, the lowering operation is stopped, the braking action of mechanism 12 serving to hold the tongs at this height. The handle 30 is then swung to the broken line position of Fig. 3 to allow the crucible engaging shoes 25 to move toward each other, as previously explained, so that the crucible will be gripped. Counter rotation of wheel 13 will lift the crucible from the melting furnace and, when clear thereof, the carriage 10 will be rolled along the track 1 to the place where the metal is to be skimmed.

Prior to the skimming operation the tilting lever 4 may again be attached to the tang 27 by means of the set screw 40, and the rod 41 placed in operative position between roller 42 and stop block 44. During the skimming operation, therefore, the crucible C may be tilted to any extent desired merely by drawing forward the handle 41', and it will be held in such tilted position by the stop block. When the skimming operation has been completed, the lower end of the stop block will be drawn forward manually into released position to allow rod 41 to move rearwardly until the crucible is in upright position, which position it has been pointed out, it assumes automatically because of the location of the axis of pivots 26 above its center of gravity.

The carriage 10 is next moved on along the track to the pouring station at which location the molds to be poured will be between the crucible and the operator. He may now, by reaching over the line of molds, raise or lower the crucible with the hand wheel 13 until it is at the proper height for pouring. He then grasps with his other hand the tilting handle 41' and draws it forward to tilt the pot into pouring position while at the same time, with his hands thus holding the wheel 13 and the handle 41', he locates the crucible in its proper lateral position with respect to the sprue into which the metal is to be poured. When the first mold has been filled, the operator need merely release the tilting handle, whereupon the stop block will be automatically moved into gripping position as the weight of the metal and the crucible slides rod 41 backward. Such backward movement prior to firm engagement of stop block 44, allowed by slot 45, is just enough for the crucible to tip back slightly so that the metal will not spill out during shifting of the carriage 10. The carriage will then be moved along the track to a position opposite the next mold, whereupon the tilting handle 41' will be drawn forward again to pour metal into the second mold. This procedure is repeated until all the molds have been filled. Because of the decreasing quantity of metal in the crucible, it will be necessary to raise it by means of hand wheel 13 into a new position after each mold is poured, in which position it will be held by the braking action of mechanism 12. Holding the crucible from swinging clear back to its upright position between pours greatly expedites the complete pouring operation. Also the usual sloshing of the metal back and forth between the pouring of each mold, which greatly increases the oxidation of the metal to form dross, is practically eliminated. When all the molds have been poured, the rod 41 and arm 4 will be removed and the rest of the device run back along the track 1 to a position over the melting furnace into which the crucible may be lowered, while still held by the tongs, ready to receive a new charge of metal.

As my invention I claim:

1. Crucible handling mechanism, comprising a suspension member, lazy-tongs including two bars each pivoted by one end to said suspension member, two crossed tongs arms having their upper ends pivoted respectively to the free ends of said bars, and a pivot interconnecting the overlapping parts of said arms, two crucible engaging shoes mounted one on the free end of each arm of said lazy-tongs, and tension toggle linkage interconnecting said suspension member and said tongs arms pivot, and variable in effective length to open and close said lazy-tongs, thus to move said shoes between crucible gripping and crucible releasing positions.

2. Crucible handling mechanism, comprising a suspension member, lazy-tongs including two bars each pivoted by one end to said suspension member, two crossed tongs arms having their upper ends pivoted respectively to the free ends of said bars, and a pivot interconnecting the overlapping parts of said arms, two crucible engaging shoes mounted one on the free end of each arm of said lazy-tongs, two links, one rigid with and depending from said suspension member and the other pivoted to and extending upwardly from said tongs arms pivot, and a third link pivotally connected to the adjacent ends of said two links and swingable to lengthen or shorten the composite length of the three links to close or open, respectively, said lazy-tongs, thus to move said shoes between crucible gripping and crucible releasing positions, and said third link being swingable to dispose its pivot connection with the tongs pivot link directly above its pivot connection with the suspension member link, thereby to hold said lazy-tongs in full open position.

3. Crucible handling mechanism, comprising supporting means, two spaced crucible gripping arms carried thereby, two opposite crucible engaging shoes pivoted one on the end of each of said arms to swing about a common axis generally perpendicular to said shoes, a tilting lever rigid with one of said shoes and disposed in a plane generally perpendicular to its pivot axis, a tension member connected to and extending upward from the swinging end of said tilting lever to a location adjacent to said supporting means and reciprocable to swing such lever for tilting the crucible into pouring position, and gripping means mounted on said supporting means, engageable with said tension member and operable automatically to maintain said tension member and tilting lever stationary substantially in that position into which they are moved in tilting the crucible.

4. Crucible handling mechanism, comprising tongs including two mutually pivoted arms, two opposite crucible engaging shoes pivoted one on the end of each of said arms to turn about a common axis generally perpendicular to said shoes, a tilting lever rigid with one of said shoes

and disposed in a plane generally perpendicular to its pivot axis, an upright rod having its lower end connected to the swinging end of said tilting lever, and a handle for said upright rod movable to reciprocate it generally lengthwise to swing said lever for turning the shoe rigid therewith, thus to tilt a crucible engaged by such shoe.

5. Tilting mechanism, for crucible supporting tongs depending from a support and carrying two opposite crucible clamping shoes each pivoted to turn about an axis perpendicular thereto for tilting of a crucible clamped thereby into pouring position, comprising an arcuate crucible tilting rod curved substantially concentric with the pivot axis of a crucible clamping shoe and having its handle end supported thereabove by the tongs' support, means connecting the other end of said crucible tilting rod to such crucible engaging shoe for converting lengthwise movement of such rod into turning of such shoe, and means carried by the tongs' support guiding said crucible tilting rod for lengthwise arcuate movement to tilt a crucible clamped between the shoes into pouring position.

6. Crucible handling mechanism, comprising a mounting, swingable crucible supporting means carried thereby, a crucible tilting rod operatively connected to said means for swinging such means by movement of said rod lengthwise in one direction to tilt a crucible supported by said means, a crucible tilting handle rigid with said rod, and rod gripping means supported by said mounting incorporating lost motion means and operable to grip said rod automatically upon slight lengthwise movement thereof in the direction opposite to the tilting direction, to restrain further movement in such direction, thus maintaining such crucible tilted.

7. Crucible handling mechanism, comprising a mounting, swingable crucible supporting means carried thereby, a crucible tilting rod operatively connected to said means for swinging such means by movement of said rod lengthwise in one direction to tilt a crucible supported by said means, a guide pulley engaging said rod and mounted on said crucible supporting means, a block having a generally arcuate edge engaging the side of said rod opposite said guide pulley, and pivot means interconnecting said block and said mounting, disposed eccentrically of the center of curvature of said block's arcuate edge, and supporting said block for swinging its arcuate edge lengthwise of said rod into and out of clamping engagement therewith.

8. Control mechanism for a crucible hoist carrying two opposite crucible clamping shoes, each pivoted to turn about an axis perpendicular to such shoe for tilting of the crucible into pouring position, comprising a hoist control operatively connected to the crucible hoist for effecting raising and lowering movement thereof, and including a handle mounted substantially directly above one crucible clamping shoe, a crucible tilting rod having its handle end supported by the hoist substantially directly above the opposite crucible clamping shoe at substantially the same height above such shoes as said hoist control handle, said handles thus being positioned for ready grasping simultaneously by a single operator standing in a position, laterally, midway between such shoes one with each hand, and means connecting said crucible tilting rod to a crucible clamping shoe to convert movement of such rod into turning of such shoe, for tilting the crucible engaged thereby into pouring position by movement of said tilting rod handle.

9. Control mechanism for a crucible hoist carrying two crucible clamping arms, and two crucible engaging shoes pivoted one to each of such arms to swing about a common horizontal axis, for tilting a crucible held therebetween into pouring position, comprising a hoist control, operatively connected to the hoist to effect raising or lowering movement thereof, mounted on one side of a vertical plane perpendicular to such crucible tilting axis and passing medially through a crucible held by the crucible supporting means, for ready grasping with one hand by an operator in a position to be bisected by such plane, a pouring control, operatively connected to a crucible engaging shoe to effect swinging thereof for tilting a crucible engaged thereby about such horizontal axis, mounted on the side of such vertical plane opposite said hoist control and approximately equidistant from such plane, for ready grasping by the operator in such position with his other hand, and a crucible gripping control, operatively connected to the crucible clamping arms for effecting relative movement thereof between crucible clamping and released positions, mounted, laterally, substantially midway between said hoist control and said pouring control, said hoist control and said pouring control thus being operable simultaneously by a single operator in such position, one with each hand, and said crucible gripping control being operable by the operator with either hand.

10. Crucible handling mechanism, comprising a suspension member, a cross-bar carried by said suspension member, lazy-tongs including two bars connected to said cross-bar at spaced points, two crossed tongs arms having their upper ends pivoted respectively to the free end of said bars, and a pivot interconnecting the overlapping parts of said arms, two opposite crucible engaging shoes, pivoted one on the free end of each arm of said lazy-tongs to turn about a common axis, means operable to close or open said lazy-tongs for gripping or releasing, respectively, a crucible, and means operable to swing a crucible engaging shoe on its pivot to tilt a crucible gripped by said lazy-tongs into pouring position.

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