Nov. 6, 1945. R. J. HARRY 2,388,408

SOAKING-PIT CRANE

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Fig. 1.

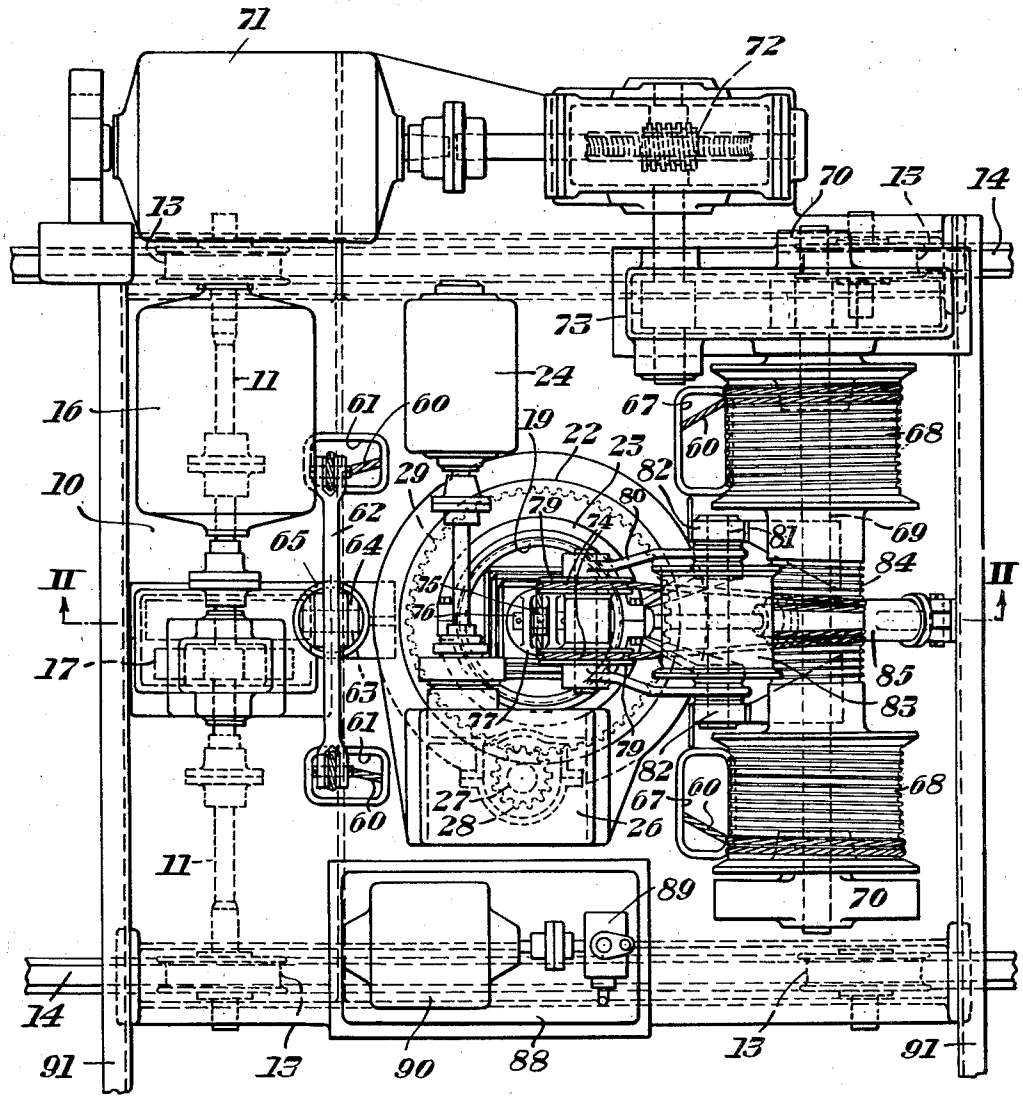

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Fig. 2.

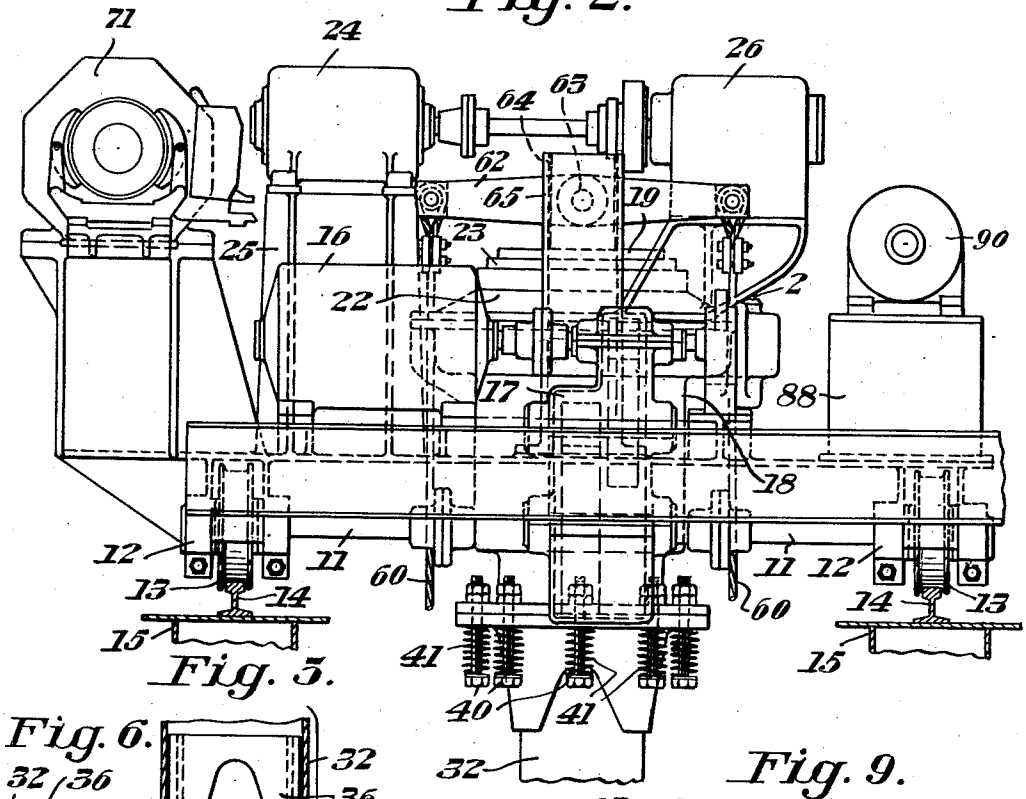


Fig. 5.

Fig. 6.

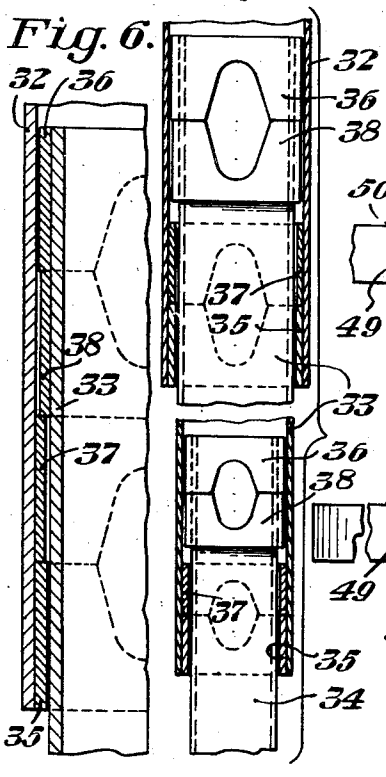


Fig. 9.

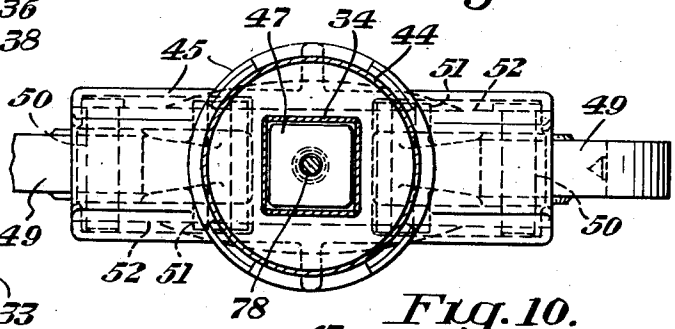
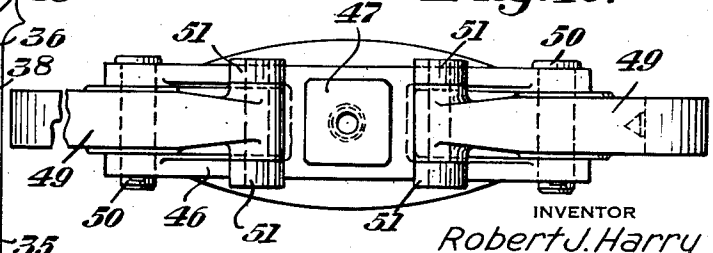


Fig. 10.



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SOAKING-PIT CRANE

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Fig. 3.

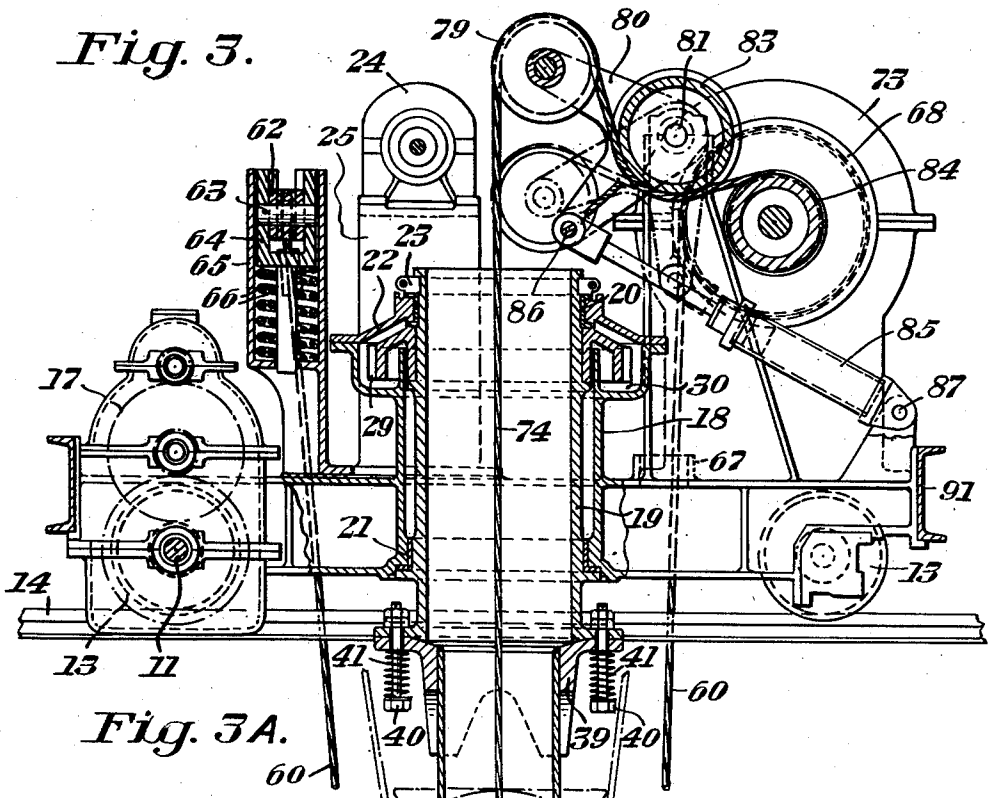
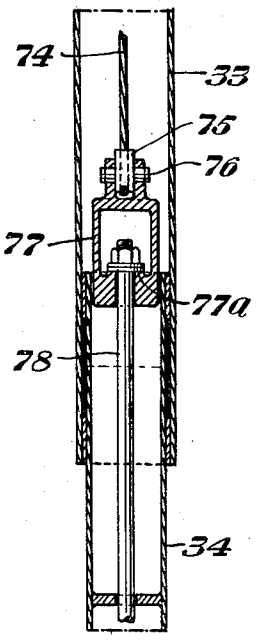


Fig. 3A.



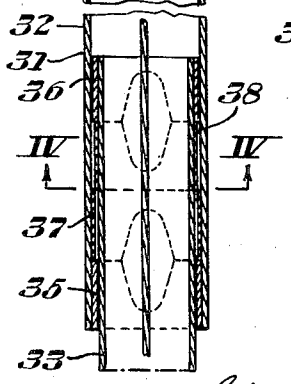


Fig. 4.

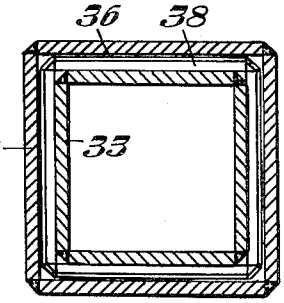


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Fig. 3B.

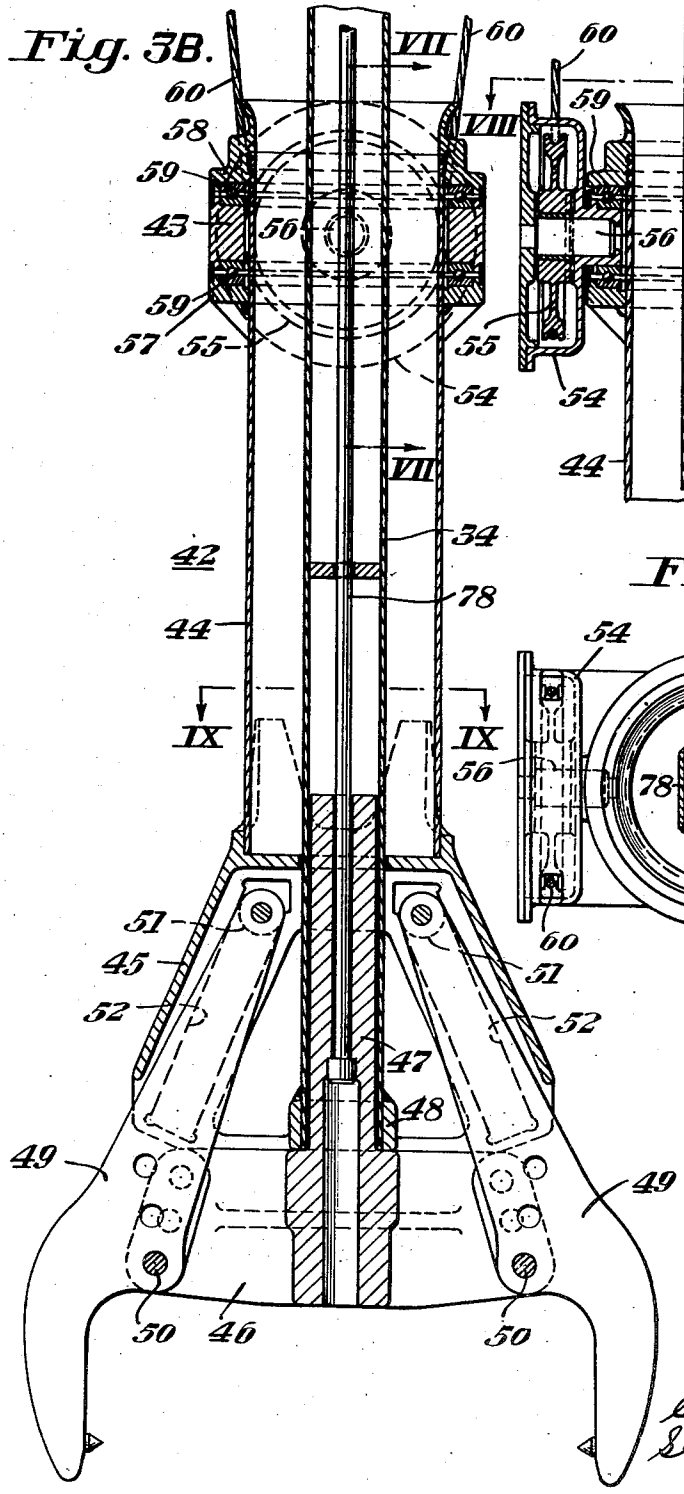


Fig. 7.

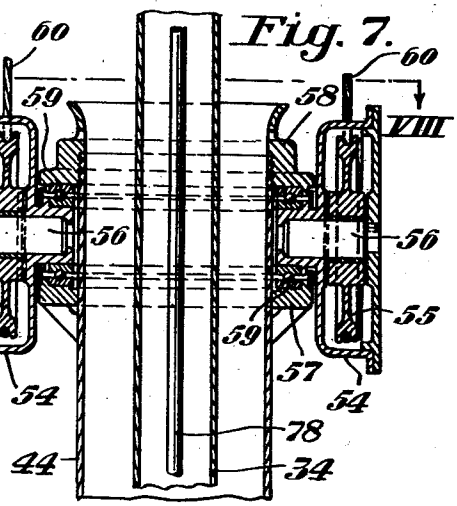
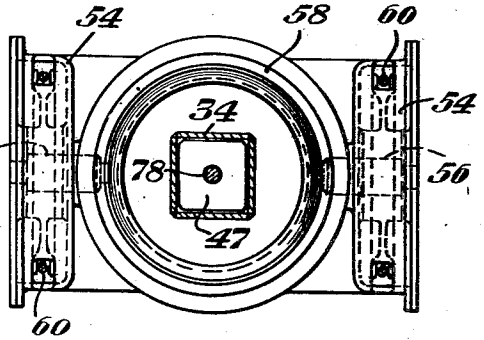


Fig. 8.



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Patented Nov. 6, 1945

2,388,408

UNITED STATES PATENT OFFICE

2,388,408

SOAKING-PIT CRANE

Robert J. Harry, Alliance, Ohio, assignor to The Alliance Machine Company, Alliance, Ohio, a corporation of Ohio

Application June 9, 1944, Serial No. 539,463

15 Claims. (Cl. 212—11)

This invention relates generally to article-handling apparatus and, in particular, to a crane adapted for placing ingots in a soaking pit and removing them therefrom.

Soaking-pit cranes, as usually made heretofore, have been characterized by a heavy and cumbersome construction including a fixed guide frame in which a column or "stiff leg" is vertically reciprocable for effecting movement of the tongs engaging the ingot. The guide frame also carries mechanism for rotating the tongs. In my Patent 2,306,055 I disclosed and claimed an improved form of crane which does not require the "stiff leg" previously employed. It is the object of my present invention to improve further upon the construction of my prior patent and, in particular, to provide a soaking-pit crane having a telescopic column depending from the trolley thereof for causing angular movement of the tongs, and a mechanism for operating the tongs-actuating cable which is of much simpler construction than anything proposed previously for this purpose.

In a preferred embodiment, my invention comprises a crane trolley having a telescopic column mounted thereon for rotation and depending therefrom. A tongs support has guided vertical movement on the lower end of the column and is suspended from the trolley by a cable hoist. I provide means for turning the column thereby causing rotation of the tongs about their vertical axis. The tongs support includes tongs-actuating means controlled by a cable depending from the trolley through the column. I provide means for deflecting a portion of this cable out of its normal path, thereby taking in the cable to operate the tongs-actuating means. The cable-deflecting means is conveniently a sheave mounted for movement by means of a cylinder and piston operated by fluid pressure.

Further details, novel features and advantages of the invention will become apparent from the following complete description which refers to the accompanying drawings illustrating the preferred embodiment. In the drawings,

Figure 1 is a plan view with parts omitted for the sake of clearness;

Figure 2 is a side elevation, such as would be seen by looking on Figure 1 from the left, with parts omitted;

Figures 3, 3A and 3B together constitute a sectional view taken along the plane of line II—II of Figure 1, with parts omitted;

Figure 4 is a cross section through the telescopic column taken along the plane of line IV—IV of Figure 3;

Figure 5 is a partial vertical section through the telescopic column;

Figure 6 is a similar view showing a portion of Figure 5 to enlarged scale;

Figure 7 is a partial section taken along the plane of line VII—VII of Figure 3B;

Figure 8 is a plan view of the tongs support with the suspending cables and telescopic column in section, the plane of which is indicated by line VIII—VIII of Figure 7;

Figure 9 is a plan view of the lower portion of the tongs support with parts in section along the plane of line IX—IX of Figure 3B; and,

Figure 10 is a plan view of a fulcrum bracket forming part of the tongs support.

Referring in detail to the drawings, my improved crane comprises a trolley 10 having shafts 11 journaled in bearings 12 thereon, the shafts being provided with wheels 13 adapted to travel along rails 14 carried by the girders 15 of the crane bridge. The girders 15 are connected in the usual manner to end frames (not shown) having wheels adapted to travel along tracks at opposite sides of the building or bay in which the crane is installed. The trolley may be of cast or fabricated construction. It provides a floor or deck on which is mounted the apparatus necessary for lifting and actuating the ingot gripping tongs. The trolley is driven along the rails 14 by a motor 16 through reduction gearing 17 including a gear keyed on the left-hand shaft 11.

The trolley 10 is provided with a vertical hub 18 substantially central thereof. A hollow cylindrical post 19 is rotatable in the hub 18 on bearings 20 and 21. The bearing 20 is carried on a collar 22 resting on the hub 18. A split bearing ring 23 is seated in a circumferential groove around the upper end of the post 19 and rests on the upper flange of the bearing 20 to transfer thereto the weight of the post 19 and connected parts to be described hereinafter.

A motor 24 is provided for rotating the post 19. The motor is carried on a base 25 and drives reduction gearing 26 including a vertical shaft 27 having a pinion 28 thereon. The pinion 28 meshes with a ring gear 29 keyed on the post 19. The toothed periphery of the gear 29 extends downwardly into an annular well 30 formed on the hub 18 which may be kept filled with oil.

A telescopic column indicated generally at 31 is carried on the hub 18 and depends below the trolley. The column includes a plurality of co-

axial hollow tubular sections 32, 33 and 34. These sections are non-circular in cross section. In the illustrated embodiment, they are square and may conveniently be fabricated by welding pairs of angles together at the edges of their flanges. Inside the lower end of each section except 34 are welded plates 35 forming bearing sleeves adapted to engage the exterior of the next smaller section. Adjacent the upper end of each section except 32 plates 36 are welded for a similar purpose. As best shown in Figure 6, the plates 35 and 36 have a slight clearance relative to the surface of the adjacent section to permit easy sliding movement therein. Plates 37 are welded in each section except 34 above the plates 35 and plates 38 are welded in each section except 32 below the plates 36. The plates 37 and 38 form abutting sleeves adapted to limit the movement of each section downwardly out of the next larger section. As shown in Figure 6, the plates 37 and 38, while not as thick as the plates 35 and 36, in order to provide ample clearance, overlap at their edges when brought into abutment, thus limiting the maximum extension of the telescopic column.

The upper end of the column section 32 is welded in a flanged collar 39. The column 31 is yieldably secured to the post 19 by bolts 40 extending through the flange on the collar 39 and a cooperating flange on the lower end of the post, having compression springs 41 thereon. These springs are designed to carry the weight of the column. Their function is to permit angular movement of the column relative to the post 19, in case the column or ingot carried by the tongs should strike a fixed object while the crane or trolley is in motion.

A tongs support indicated generally at 42 includes a hoisting yoke 43, a tubular sleeve 44 rotatably carried thereby, a tongs head 45 secured to the tube and a fulcrum bracket 46. The bracket 46 has a stud 47 reciprocable in the lower end of the column section 34. The head 45 has a socket 48 in which the lower end of said section is fixed. Tongs 49 are pivoted to the bracket 46 by pins 50 and have rollers 51 traveling in inclined tracks 52 formed in the head 45. A plurality of holes for the pins 50 are provided in the tongs to permit a variation in the range and gripping force thereof.

The yoke 43 includes a bearing ring and housings 54 on opposite sides thereof adapted to receive sheaves 55 journaled therein on stub shafts 56. The yoke 43 surrounds the upper end of the tube 44 being disposed between a collar 57 welded thereto and a flange ring 58 threaded onto the upper end thereof. Thrust bearings 59 between the yoke 43 and the ring 58 and between the yoke 43 and collar 57 permit the tongs support as a whole to turn about its vertical axis relative to the hoisting yoke. The tube 44 is welded in the upper end of the head 45. The sloping tracks 52 formed in the head cause the lower ends of the tongs to move inwardly when the bracket 46 is lowered relative to the head.

The tongs support and the actuating mechanism therefore are suspended on cables 60 trained around the sheaves 55. These cables extend upwardly through holes 61 in the trolley to an equalizer bar 62. The bar 62 is pivoted on a pin 63 to a block 64 slidably disposed in a socket 65 on cushion springs 66. The cables also extend upwardly through holes 67 in the trolley to spaced winding drums 68 mounted on the shaft 69. The shaft 69 is journaled in bearings 70 and is driven by a motor 71 through reduction gearing 72 and 73. By operating the motor 71, the tongs support and actuating mechanism may be raised or lowered as a whole.

Raising and lowering of the bracket 46 relative to the head 45 is effected by a cable 74 extending downwardly through the post 19 and column 31. The cable 74 passes around an equalizer block 75 pivoted on a pin 76 to a clevis 77. A pull rod 78 extends upwardly through a central bore in the stud 47 of the bracket 46. It is supported on a thrust bearing 77a in the clevis and has a head engaging a shoulder in the bore. The cable 74 extends upwardly around sheaves 79 journaled on bell cranks 80. The bell cranks are pivoted on a shaft 81 carried on standards 82 mounted on the trolley. The cable also passes around a guide drum 83 journaled on the shaft 81 and thence around a winding drum 84 on the shaft 69 intermediate the drums 68. The drum 84 has a diameter only one-half that of the drums 68. The bell cranks 80 are adapted to be swung through an angle of about 40°, as indicated in chain lines in Figure 3, by a cylinder and piston 85. The piston rod of the cylinder is pivoted to the bell cranks at 86 and to a fixed bearing 87 on the trolley.

The shifting of the bell cranks 80 and sheaves 79 between their extreme positions is accomplished by supplying fluid under pressure to one end of the cylinder 85 and relieving it from the other by a suitable control valve. The fluid-supply system includes a tank 88 on the trolley, a pump 89 mounted on the tank and a motor 90 also mounted on the tank for driving the pump. Suitable pipe connections and a valve (not shown) are employed to control the operation of the piston and cylinder. The valve is preferably mounted in the operator's cab suspended from one side of the trolley on cantilevers 91.

The bell cranks 80 are held in their solid-line positions when the hoisting yoke is being lowered to pick up an ingot. It will be apparent that the bracket 46 rises or descends at the same rate as the hoisting yoke as a whole because of the 2:1 ratio between the diameters of the drums 68 and that of drum 84, and the reeving of the cables 60 and 74. When the tongs have been positioned above an ingot, the winding drums are held stationary and the bell cranks 80 are swung from their solid-line positions to their chain-line positions, thereby permitting the bracket 46 to descend relative to the head 45. The tongs close on the ingot as they descend and when they have firmly gripped it, the hoisting yoke may be raised to lift the ingot by again operating the winding drums.

When the ingot has been placed at the desired point, the tongs are released by applying fluid pressure to cause the cylinder and piston 85 to swing the bell cranks 80 from their chain-line positions to their solid-line positions, thus deflecting the portions of the cable between the sheaves 79 and the drum 84 about the drum 83 out of their normal path and taking in the depending portions of the cable 74 to raise the bracket 46. This opens the tongs and releases the ingot.

It will be apparent from the foregoing that the invention provides a soaking-pit crane having important advantages over cranes known heretofore. In particular, the crane embodying my invention is materially lighter in weight and lower in cost than cranes known previously. In addition, the use of a telescopic column reduces the head-room required above the rails on which the trolley travels. It will be understood that my

crane is capable of all the operations performed by prior cranes, i. e., raising, lowering, gripping, releasing and rotation. The sections of the telescopic column 31, being non-circular in section, transmit positively to the tongs head 45 and fulcrum bracket 46 the angular movement imparted to the post 19 by the motor 24 and reduction gearing 26. The column, however, does not support any load except its own weight and need, therefore, be only heavy enough to transmit the required torque without material deflection. The fact that the column is unloaded makes feasible the flexible connection thereof to the post 19 by means of the springs 41.

Although I have illustrated and described but a preferred embodiment of the invention, it will be understood that changes in the details or arrangement of the various elements may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended below said trolley, a hollow telescopic column depending from said post and slidable through said support but non-rotatable therein, a tongs bracket engaging the lower end of the column but non-rotatable relative thereto, tongs pivoted on said bracket, means on said support serving to actuate the tongs on raising or lowering of the bracket relative thereto, a cable passing through the post and column and suspending the bracket, and means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket.

2. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended below said trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, and means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket.

3. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended below said trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column suspended on springs from said post and depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, and means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket.

4. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a bearing collar suspended below said trolley, a tongs support having a swivel mounting in said collar, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, and means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket.

5. The apparatus defined by claim 4 characterized by said collar having sheave blocks on opposite sides thereof adapted to receive suspending cables.

6. In a crane, a trolley adapted to travel back and forth, a hollow telescopic column rotatably carried on said trolley and depending therebelow, a hoisting yoke suspended below the trolley having guided vertical movement on said column, tongs carried by said yoke, actuating means for said tongs, a cable passing through the column to said means, and means on the trolley for deflecting a portion of the cable out of its normal path to move said actuating means.

7. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended on cables below said trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket, winding drums for the first-mentioned cables and a winding drum for the last-mentioned cable, all said drums being mounted on a common shaft.

8. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support including sheave blocks for receiving suspending cables depending from the trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, and means on the trolley for deflecting a portion of said cable out of its normal path to take in the depending portion of the cable and raise said bracket, winding drums on the trolley, to which one end of the first-mentioned cables extend and an equalizer lever pivoted on the trolley to which the other ends are secured.

9. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended below said trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, a winding drum on the trolley to which said cable extends, a movable sheave on the trolley engaging the cable, and means for actuating the sheave to deflect the cable out of its normal path and take in the depending portion of the cable.

10. In a crane, a trolley adapted to travel back and forth, a hollow post mounted vertically on the trolley for rotation about its own axis, a tongs support suspended below said trolley, means for moving the tongs vertically relative to said support, a hollow telescopic column depending through said support, said support and

means being non-rotatable relative to said column, a cable passing through the post and column and suspending said means, a winding drum on the trolley to which said cable extends, a bell crank pivoted on the trolley having a sheave thereon engaging said cable, and means for actuating said crank to cause the sheave to deflect the cable out of its normal path and take in the depending portion of the cable.

11. The apparatus defined by claim 10 characterized by said actuating means being a cylinder and piston.

12. The apparatus defined by claim 6 characterized by said column including coaxial sections of non-circular tube of progressively varying size, said sections having means adjacent their ends limiting the movement of one section downwardly out of the next section above.

13. The apparatus defined by claim 6 characterized by said column including coaxial sections of non-circular tube of progressively varying size, said sections having bearing sleeves adjacent their ends adapted to engage the interior of the next larger tube and the exterior of the next smaller tube.

14. The apparatus defined by claim 6 characterized by a tubular sleeve depending from said yoke and surrounding said column, a tongs head secured to said sleeve, and a bracket movable vertically relative to said head, said tongs being pivoted to said bracket and engaging said head for guided tilting movement when the bracket moves relative thereto.

15. In a crane, a trolley, a hoisting yoke suspended from said trolley, a tongs head carried on said yoke, a fulcrum bracket reciprocable in said head, opposed tongs pivoted on pins extending through holes in said bracket, there being a plurality of spaced holes in said bracket for each tong and a separate hole in each tong corresponding to the several holes therefor in the bracket whereby both the range of and the gripping force exerted by the tongs may be varied by inserting the pins in different pairs of matching holes in the bracket and tongs, respectively.

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