

P. H. DOUGLAS & I. D. THOMAS.
CHARGING APPARATUS.
APPLICATION FILED OCT. 3, 1908.

937,144.

Patented Oct. 19, 1909.

3 SHEETS—SHEET 1.

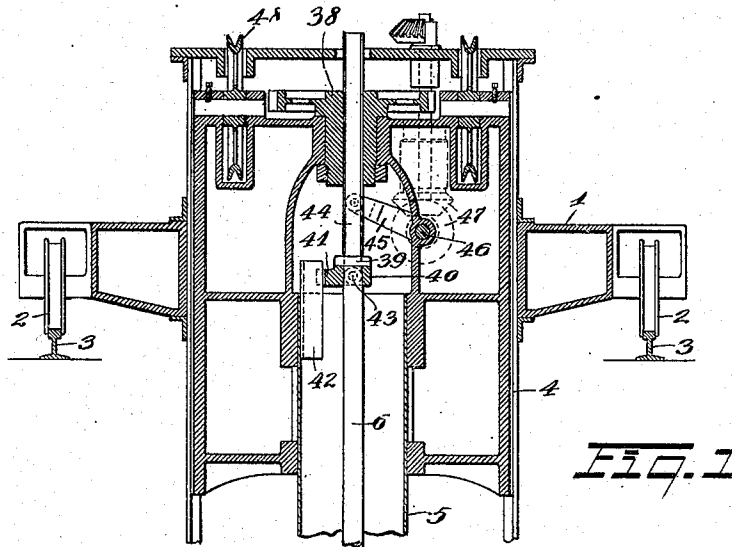
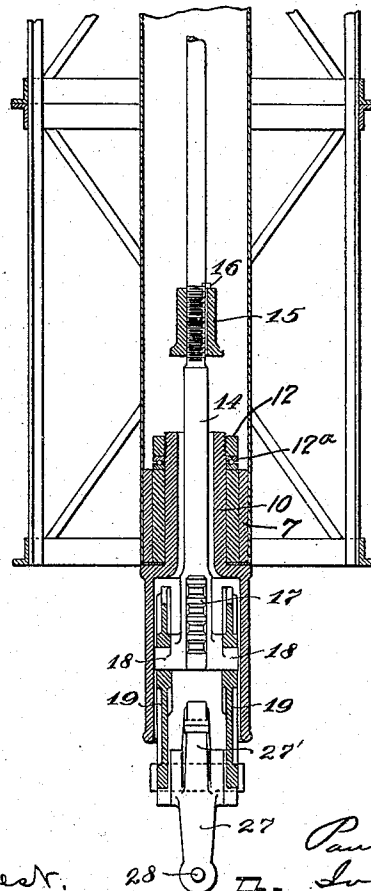


FIG. 1



Witnesses:

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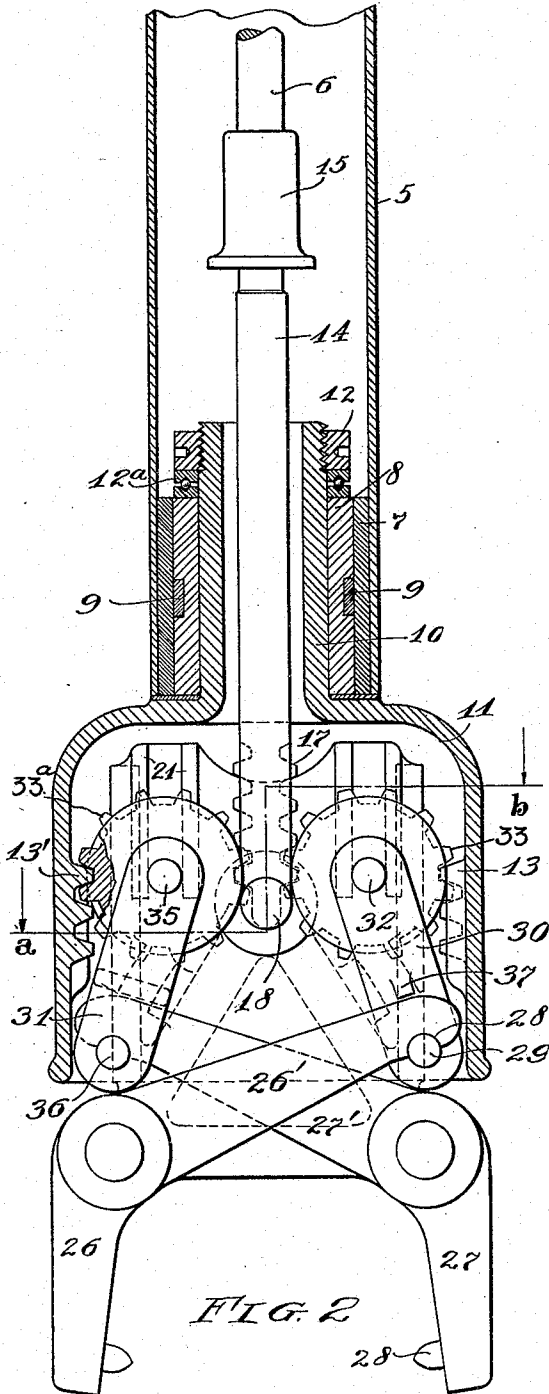


FIG. 2

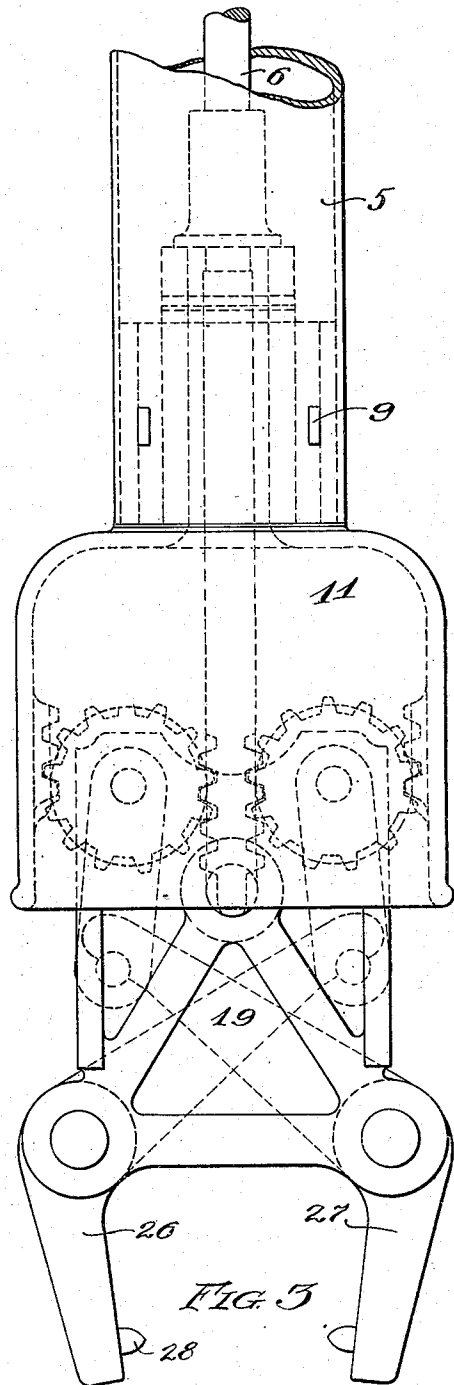


FIG. 3

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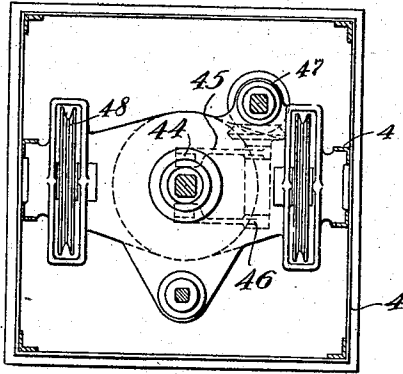


FIG. 4

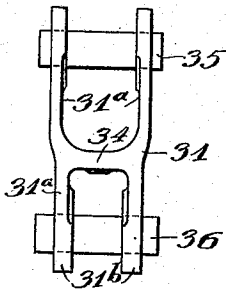


FIG. 6

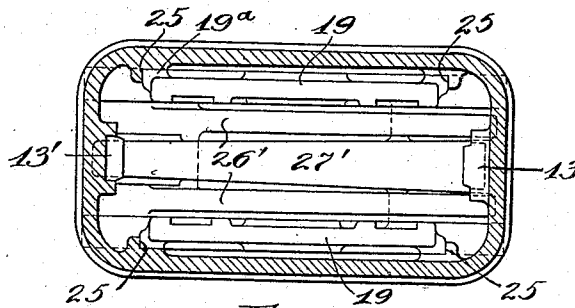


FIG. 5

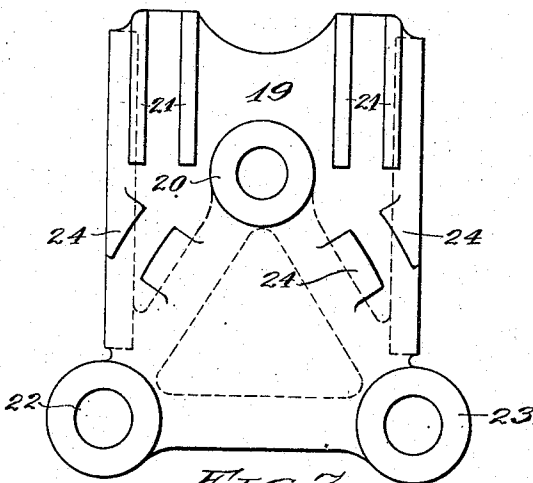


FIG. 7

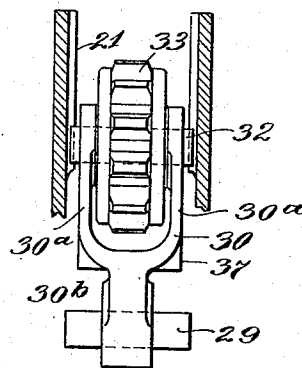


FIG. 8

WITNESSES:

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UNITED STATES PATENT OFFICE.

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CHARGING APPARATUS.

937,144.

Specification of Letters Patent.

Patented Oct. 19, 1909.

Application filed October 3, 1908. Serial No. 456,003.

To all whom it may concern:

Be it known that we, PAUL H. DOUGLAS and IVOR D. THOMAS, citizens of the United States, residing at East Cleveland and Cleveland, respectively, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Charging Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

Our invention relates to charging mechanism and more particularly to that class of mechanism used for charging and drawing ingots from a heating furnace or soaking pit.

The mechanism herein described is designed for use in connection with overhead traveling cranes and has for its object to produce a highly efficient and powerful construction for operating the gripping jaws of the ingot-engaging tongs; to simplify and improve the mechanism for handling the ingots; and to provide a construction of mechanism that is readily accessible for repairs, replacements, etc.

Generally speaking, the invention comprises the elements and combinations thereof set forth in the accompanying claims and illustrated in the accompanying drawings, forming part hereof, wherein—

Figure 1 is a sectional elevation of a vertical charging crane having our invention applied thereto; Fig. 2 is a sectional side elevation of the tongs and the operating mechanism associated therewith, the tongs being shown in open position; Fig. 3 is a side elevation of the tongs in closed position, part of the operating mechanism being shown in dotted lines; Fig. 4 is a top plan view showing a portion of the charging crane with our invention applied thereto; Fig. 5 is a longitudinal sectional view upon the line *a—b* of Fig. 2, certain portions of the mechanism being removed; and Figs. 6, 7 and 8 are details of the tongs-operating and carrying mechanism, which will be later described.

Generally speaking, the form of crane used to carry the mechanism herein described is immaterial. The trolley of an ordinary

type of crane is represented generally at 1, having its opposite outer ends provided with wheels 2 adapted to run upon parallel rails 3.

Upon the transverse girders of the trolley 1 is mounted a frame 4 which, as shown in Fig. 4, is rectangular in cross section although the cross sectional shape of this frame may assume other forms if desired. The frame is composed of structural iron members and is indicated in the drawings as formed from angle irons. Within the frame and located substantially in the central portion thereof and carried thereby is a hollow mast 5 within which is housed a shaft 6. The tongs are suspended from the lower portion or extension of the shaft 6, and at the upper part of the frame 4 is mounted the mechanism for operating the shaft 6 and the mast 5.

Within the mast 5, at the lower end thereof, is an internal collar 7 which is securely fastened to the inner walls of the said mast. Within this collar is a second collar 8 which is secured to the collar 7 by means of keys 9. Within the collar 8 and journaled therein is the neck 10 of the tongs-operating member 11. The upper end of the neck 10 is screw-threaded and is engaged by a screw-threaded collar 12. Between the collar 12 and the top of the member 8 is an anti-friction thrust bearing represented generally at 12^a, which will permit the rotation of the neck of the member 11 within the collar 8. The outside diameter of the collar 12 and of the thrust bearing 12^a is a trifle less than the inside diameter of the collar 7, so that upon removal of the keys 9, the collar 8 and the attached collar 12 of member 11 and thrust bearing 12^a may be removed through the collar 7.

As will be seen from the drawing, the tongs-operating member 11 is constructed as a casing the lower part of which flares outwardly and assumes in cross section the form of a parallelogram with the corners rounded, as shown more particularly in Fig. 5. Upon the inner walls, at opposite ends of the member 11, are racks 13 and 13', whose function will be explained later.

The shaft 6 is continued by means of an

extension 14, the shaft 6 and extension 14 being secured together by means of a sleeve 15 which is provided with an internal screw-thread, the ends of the members 6 and 14 being also screw-threaded so as to engage with the screw-threads upon the interior of the sleeve. The sleeve 15 forms a stop with the neck 10 to limit the travel of the shaft 6 in a downward direction and thereby limits the amount of opening of the tongs. This stop is adjustable and therefore provides a limited adjustment of the opening between the jaws of the tongs. A key 16 occupies a key-way formed in the members 6 and 14 and sleeve 15 to lock these parts together so that they will move as a unit.

The lower portion of the member or extension 14 is formed with a double rack 17 and at the extreme lower end of the member 14 are projections 18 which extend at right angles to the member 14 from opposite sides thereof.

Upon the projections 18 are mounted the tongs-carrying frames 19, which are mounted within the casing 11, are nearly of the full length of said casing and assume the form shown in Fig. 7. The frames or members 19 are formed with journals 20 which are engaged by the projections 18 upon the member 14. At the upper ends of these frames 19 are formed pairs of inwardly projecting ribs or flanges 21. At the lower ends of the frames 19 are additional journal bearings 22 and 23. Pairs of parallel lugs 24 are also formed upon each of the members 19 near the sides thereof and below the journal 20. The outer side of each member 19 is provided with ribs 19^a adapted to engage rabbets 25 which are formed upon the inner walls of the member 11, these rabbets being so formed as to permit vertical movement between the members 19 and the member 11. From an inspection of Figs. 1 and 7 it will appear that two such members or frames 19 are employed, located respectively on opposite sides of the shaft extension 14.

In the journals 22 and 23 of each of the members 19 are pivotally secured the tongs 26 and 27. These tongs are formed as bell crank levers, the lower portions or jaws of which are each provided with a projection 28 adapted to engage an ingot. The upper part or operating arm of the tong 26 is bifurcated, as indicated at 26' in Fig. 5, while the operating arm of the tong 27 is formed as a single arm, as indicated at 27' in Fig. 5, the arm 27' being adapted to pass between the forks of the bifurcated arm 26', as clearly shown in said figure. The outer ends of the arms 26' and 27' are formed with half bearings, as indicated at 28, and engage with pins 29 and 36 which are carried by the lower portions of links 30 and 31 respectively. The construction of one of these links, 30, is

shown in Fig. 8, the upper part of the said link being formed with parallel arms 30^a which are spaced apart, and the lower portion being formed as a single arm 30^b. Through the upper ends of the arms 30^a extends a pin 32, which pin projects beyond the sides of the said arms. The lower arm 30^b also supports the pin 29 which projects beyond the sides of the said arm and forms a support for the forks or arms 26' of the tong 26. Each arm 30^a is provided above the single arm 30^b with a lug 37, forming, with the pin 29, a retainer for one of the branches of the bifurcated arm 26'.

Upon the pin 32 is mounted a toothed member or gear 33 which is adapted to rotate upon the pin 32. This toothed member is of sufficient diameter to mesh with the rack 13 and with one side of the double toothed rack 17 formed upon the lower end of the member 14.

The construction of the link 31 is shown in Fig. 6, it being formed with parallel arms 31^a connected at points preferably below their center by a bridge 34. The arms 31^a are provided at their opposite ends with aligned openings through which project pins 35 and 36. The pin 36 is engaged by the arm 27' of the tong 27. Upon the pin 35 is mounted a toothed member or gear 33^a which is in all respects similar to the other toothed member 33 shown in Fig. 8. The toothed member 33^a engages with the rack 17, upon the side opposite to that engaged by the member 33 and also with the rack 13' formed upon the inner side of the casing 11.

The projecting ends of the pins 32 and 35 extend between and engage the ribs 21 which are formed upon the members 19, as heretofore explained and as shown in Fig. 8. By this construction the toothed members or gears 33, 33^a are always held in operative relation to the racks 17, 13 and 13', but are compelled to move in a vertical direction.

The lugs 24 which are formed upon the members 19 are curved, as shown in Fig. 7, being curved on arcs described from the center of journals 22, 23, the space between each pair of lugs being sufficient to receive therebetween the end of a pin 29 or 36 and the radii of the arcs being equal respectively to the distance from the center of one of the tongs journals to each side of the half-bearing formed in its outer portion. In assembling, the links are elevated until the pins 32 and 35 enter between the appropriate pair of lugs 24 and the outer ends of the tongs arms are inserted, by a rotary movement, between a pin (29 or 36) and the lugs 37 or bridge 34, the outer end of each tongs arm being rounded to facilitate this insertion. The tongs shaft or pin is then inserted into the journal 22 or 23. In disassembling, the

links are elevated in like manner and are prevented from swinging around their upper pivots as a center during the removal of the tongs.

5 At the upper end of the frame 4 is the operating mechanism for the mast 5 and shaft 6. The shaft 6 at its upper end is formed square in cross section and engages a square bore in the hub of the gear 38, which
10 is operated from suitable motor mechanism to rotate the shaft 6. The upper end of the mast 5 is sleeved on the hub of gear 38. Surrounding the shaft 6 is a collar 39 which is fast thereon. Below this collar is a second
15 collar or stop 40 surrounding the shaft and permitting the said shaft to move freely within the collar. At one end this collar is provided with a projecting bifurcated arm 41 which engages with a guide 42 projecting
20 inwardly from the mast 5 and preventing the rotation of the collar 40. Projecting from opposite sides of the collar 40 are trunnions 43 to which are connected the lower ends of links 44, as will be seen in dotted
25 lines in Figs. 1 and 4. At their upper ends these links are pivotally secured to arms 45, which in turn are secured upon the rock shaft 46 so that they will be raised or lowered as the shaft 46 is rotated. Shaft 46 is
30 caused to rotate through gear connections 47 with suitable motor mechanism (not shown). The shaft 6 is made in a single piece from the upper end thereof to sleeve 15, which permits its easy removal from the other
35 parts, so that in case of breakage it will only be necessary to remove the collar 15 and the collar 39 in order to remove the entire shaft. By virtue of the squared portion at its upper end, the shaft 6 may be readily turned by
40 means of the gear 38, and may also be raised and lowered through the hub of the gear 38 by means of the collar 39 and associated lifting mechanism without breaking its connection with said gear, enabling the tongs to be
45 shifted as occasion may require to grip an ingot.

The parts 14 and 19 constitute what may be termed a tongs-carrying device while the part 11 constitutes what may be termed a
50 tong-operating frame or member.

The frame 4 is provided with the usual sheaves 48 for hoisting ropes whereby the frame and the attached mast and ingot-handling mechanism may be raised and lowered.
55

The operation of the mechanism is as follows:—The entire crane is moved to a position so as to be vertically above the ingot it is desired to operate upon. The shaft 6 and
60 extension 14 are raised so that the members 19 occupy their highest position with relation to the inclosing casing 11, as is shown in Fig. 2. The entire mechanism comprising the frame or casing 4, shaft 6 and mast 5 are

then lowered until the members 19 rest upon 65 the top of the ingot. The mast 5 is then raised, carrying with it the member 11 which will cause the toothed members or gears 33, 33^a to rotate upon the spindles 32 and 35 through the motion imparted to said gears 70 by the racks 13, 13' upon the member 11. The gears or members 33, 33^a will also travel upon the double rack 17 formed upon the extension 14 in a direction toward the top of the rack and in so doing will carry with 75 them the links 30 and 31. This takes place while the extension 14 and rack 17 are stationary, being supported through the members 19 upon the top of the ingot. The raising of the said links 30 and 31 will cause the 80 lever arms 26' and 27' to be raised so as to swing about their bearings 22 and 23. This will cause the lower ends of the tongs 26 and 27 to approach each other and grip the sides of the ingot to which they are opposed. The 85 continued movement of the mast 5 will raise the entire mechanism and the ingot held between the tongs.

When it is desired to release the ingot, the entire mechanism is lowered until the ingot 90 rests upon the platform or other place where it is desired to deposit the same. Continued lowering of the mast 5 will cause the gears or toothed members 33, 33^a to rotate and to travel along the rack 17 in a downward direction, thereby lowering the links 30 and 31 95 which in turn will lower the arms 26' and 27' and cause the tong jaws 26 and 27 to move about their pivots in a direction to open the jaws, spreading them apart and 100 thus releasing the ingot, leaving the parts in the position shown in Fig. 2.

It will be noticed that the tendency of the tongs to grip the ingot is proportional to the weight of the ingot itself, for as the mast 5 105 is raised the tendency is always to raise the ends of the arms 26' and 27' of the tongs, which can have no other effect than to cause the jaws 26 and 27 to exert a greater gripping force upon the ingot and, the greater 110 the weight of the ingot, the greater will be this force, for the greater will be the tendency of the mast 5 when raised to elevate the levers 26' and 27' to a higher position.

It will be seen further that a single shaft 115 carries the tongs and rotates the same about a central axis. This point is of great importance, both as to simplicity of construction and efficiency of operation.

Having thus described our invention, we 120 claim:

1. The combination of a tongs-operating member or frame, a tongs-carrying shaft, a collar on said shaft, links pivoted to said collar, a rock shaft, and arms projecting 125 from said rock shaft and pivotally connected with said links.

2. In a charging apparatus, the combina-

- tion of a hollow mast having a tongs-operating member, a tongs-carrying shaft mounted in said mast, a rock shaft having one or more arms rigid therewith, a link carried by each of said arms and projecting within said mast, means for rotating said shaft within said mast, and a connection between said link or links and said shaft arranged to permit the rotation of said shaft.
3. In a charging apparatus, the combination of a tongs-operating member, a tongs-carrying shaft, a gear mounted on said shaft and reciprocable with respect thereto, a collar sleeved on said shaft, a stop for said collar, means engaging said collar to prevent the rotation thereof, and means connected with said collar for raising and lowering the shaft.
4. In a charging apparatus, the combination of a hollow mast having at its lower end a tongs-operating member, a tongs-carrying shaft within said mast, a collar sleeved on said shaft, a stop on said shaft engaging said collar, means engaging the collar to prevent the rotation thereof, means connected with said collar for raising and lowering the shaft, and means for rotating said shaft.
5. In a charging apparatus, the combination of a hollow mast, a tongs-operating member carried thereby, and a tongs-carrying shaft within said mast, said shaft comprising an upper and a lower section, and a sleeve connecting said sections.
6. In a charging apparatus, the combination of a hollow mast, a tongs-operating member carried thereby, and a tongs-carrying shaft mounted within said mast and reciprocable therewithin, said shaft comprising an upper and a lower section having their adjacent ends threaded, a sleeve having an internal thread mounted on the threaded ends of the shaft sections, said sections and said sleeve having keyways, and a key mounted in said keyways.
7. In a charging apparatus, the combination of a tongs-operating member provided with an upwardly extending neck, a tongs-carrying shaft projecting through said neck, said shaft comprising an upper and a lower section, a member adjustably connecting said sections and adapted to engage said collar when the shaft is lowered, and means for raising and lowering said shaft.
8. In a charging apparatus, the combination of a tongs-operating member provided with an upwardly extending neck, a tongs-carrying shaft projecting through said neck, said shaft comprising an upper and a lower section, a member connecting said sections and adapted to engage said collar when the shaft is lowered, and means for raising and lowering said shaft.
9. In a charging apparatus, the combination of a tongs-operating member, said member having a pair of racks therewithin, a tongs-carrying member within the former member and having its opposite sides provided with racks, tongs pivoted to the latter member and each provided with an operating arm, a link connected to each of said arms, and a gear connected with each of said links, each of said gears being interposed between a rack on the former member and the opposed rack on the latter member.
10. In a charging apparatus, the combination of a tongs-operating member having a pair of racks therewithin, a centrally arranged tongs-carrying member provided on opposite sides thereof with racks opposed to the former racks, a gear interposed between each rack on the former member and the opposed rack on the latter member, a link depending from each of said gears, and a pair of tongs pivoted to the latter member and each having an operating arm connected to a link.
11. In a charging apparatus, the combination of a tongs-operating member having a rack, a tongs-carrying member provided with a rack opposed to the former rack, a gear interposed between said racks, a link connected to said gear, and a tong pivoted to the latter member and having an operating arm connected to said link.
12. In a charging apparatus, the combination of a tongs-operating member provided on its opposite ends with racks, a tongs-carrying device comprising a centrally arranged member provided on its opposite sides with racks opposed to the racks on the tongs-operating member and a pair of frames, each frame being provided with a pair of guide ways, the guide ways of one frame being opposed to those of the other, gears having each a pin mounted in the opposed guide ways of said frames and each meshing with a rack on the tongs-operating member and a rack on the centrally located member, a link depending from the pin of each gear, and a pair of tongs journaled between said frames and each having an operating arm connected to a link.
13. In a charging apparatus, the combination of a tongs-operating member provided with a rack, a tongs-carrying device comprising a member provided with a rack opposed to the rack on the tongs-operating member and a pair of frames, each frame being provided with a guide way, the guide way of one frame being opposed to that of the other, a gear having a pin mounted in the opposed guide ways of said frames and meshing with said racks, a link depending from the pin of said gear, and a tong journaled between said frames and having an operating arm connected to said link.
14. In a charging apparatus, the combination of a tongs-operating member, a tongs-

operating device mounted within said member and comprising a pair of opposed frames and a member connected thereto for raising and lowering the same, a pair of tongs pivoted to said frames and having operating arms projecting into the space between the same, devices connected with the tongs arms and arranged to be operated by relative movement between said members, and means for moving one of said members relatively to the other.

15. The combination of a tongs-operating member having a rack, a tongs-carrying member having a rack, a pair of frames carried by the latter member having opposed guides, a gear meshing with said racks and having a pin mounted in said guides, a link pivoted to said pin, and a tong having an arm connected to said link.

16. In a charging apparatus, the combination of a tongs-operating member and a tongs-carrying member mounted within the former member, the latter member comprising a shaft and a tongs-carrying extension, said extension and said shaft being detachably connected.

17. In a charging apparatus, the combination of a hollow mast, a collar removably secured therewithin, a tongs-operating member comprising a frame having a neck projecting within and above said collar, an anti-friction bearing on said neck engaging said collar, and a tongs-carrying member extending through said neck.

18. In a charging apparatus, the combination of a hollow mast, a collar within and rigid with the lower end of said mast, a second collar removably secured within the former collar, a tongs-operating member comprising a frame having a neck projecting through and above the second collar, an anti-friction bearing secured to said neck and resting on the second collar, said bearing and said second collar being of less diameter than the internal diameter of the first collar, and a tongs-carrying member projecting upwardly through said neck.

19. In a charging apparatus, the combination of a tongs-operating member comprising a frame and an upwardly projecting neck, a shaft, a tongs-carrying extension of said shaft projecting through said neck, and a sleeve connecting said shaft and said extension and adapted to be engaged by the upper end of said neck.

20. In a charging apparatus, the combination of a tongs-operating member, a tongs-carrying member within the former member, a pair of tongs pivotally connected to the latter member and each having an arm provided with a rounded end and having in its lower face a half bearing, a pair of links within the tongs-operating member each having a pin adapted to engage the half bearing on a tong arm and each having arm-retain-

ing means spaced from said pin, members connected with said links and adapted to be reciprocated within the tongs-operating member by relative movement between said member and the tongs-carrying member, and means for causing such relative movement between said members.

21. In a charging apparatus, the combination of a tongs-operating member, a tongs-carrying member within the former member, a tong pivotally connected to the latter member and having an arm provided with a rounded end and having in its lower face a half bearing, a link within the tongs-operating member having a pin adapted to engage the half bearing on the tong arm and having a lug spaced from said pin, a member connected with said link and adapted to be reciprocated within the tongs-operating member by relative movement between said member and the tongs-carrying member, and means for causing such relative movement between said members.

22. In a charging apparatus, the combination of a tongs-operating member, a pair of tongs-carrying frames within the said member and each having vertical guides, toothed members having pins extending between the opposed guides of said frames, links depending from said pins, a pair of tongs pivoted between the frames and each having an operating arm, a pin carried by each link and adapted to engage a tongs-operating arm, curved spaced lugs projecting from the latter frames and adapted to receive said pins, racks carried respectively by the tongs-operating member and the tongs-carrying member for rotating said toothed members, and means for causing relative movement between said members.

23. In a charging apparatus, the combination of a pair of tongs, a shaft connected therewith, means for rotating said shaft, a rock shaft, an arm connected with said rock shaft, and a connection between said arm and the first mentioned shaft for raising and lowering the same, said first mentioned shaft being rotatable with respect to said connection.

24. In a charging apparatus, the combination of a hollow mast, a tongs-operating member carried thereby, a shaft within said mast, tongs operatively supported by said shaft, a projection on said shaft, and a projection carried by said mast and adapted to engage the former projection to limit the movement of said shaft.

25. In a charging apparatus, the combination of a tongs-carrying member and a tongs-operating member each provided with a rack, a gear meshing with said racks, a tong connected with said gear, and means for moving one of said members relatively to the other.

26. In a charging apparatus, the combina-

tion of a tongs carrying member and a tongs
operating member, each provided with a
rack, a gear meshing with said racks, a link
carried by and movable with said gear, a
5 tong connected with said link, and means for
moving one of said members relatively to the
other.

In testimony whereof, we hereunto affix

our signatures in the presence of two wit-
nesses.

PAUL H. DOUGLAS.
IVOR D. THOMAS.

Witnesses:

J. B. HULL,
A. J. HUDSON.