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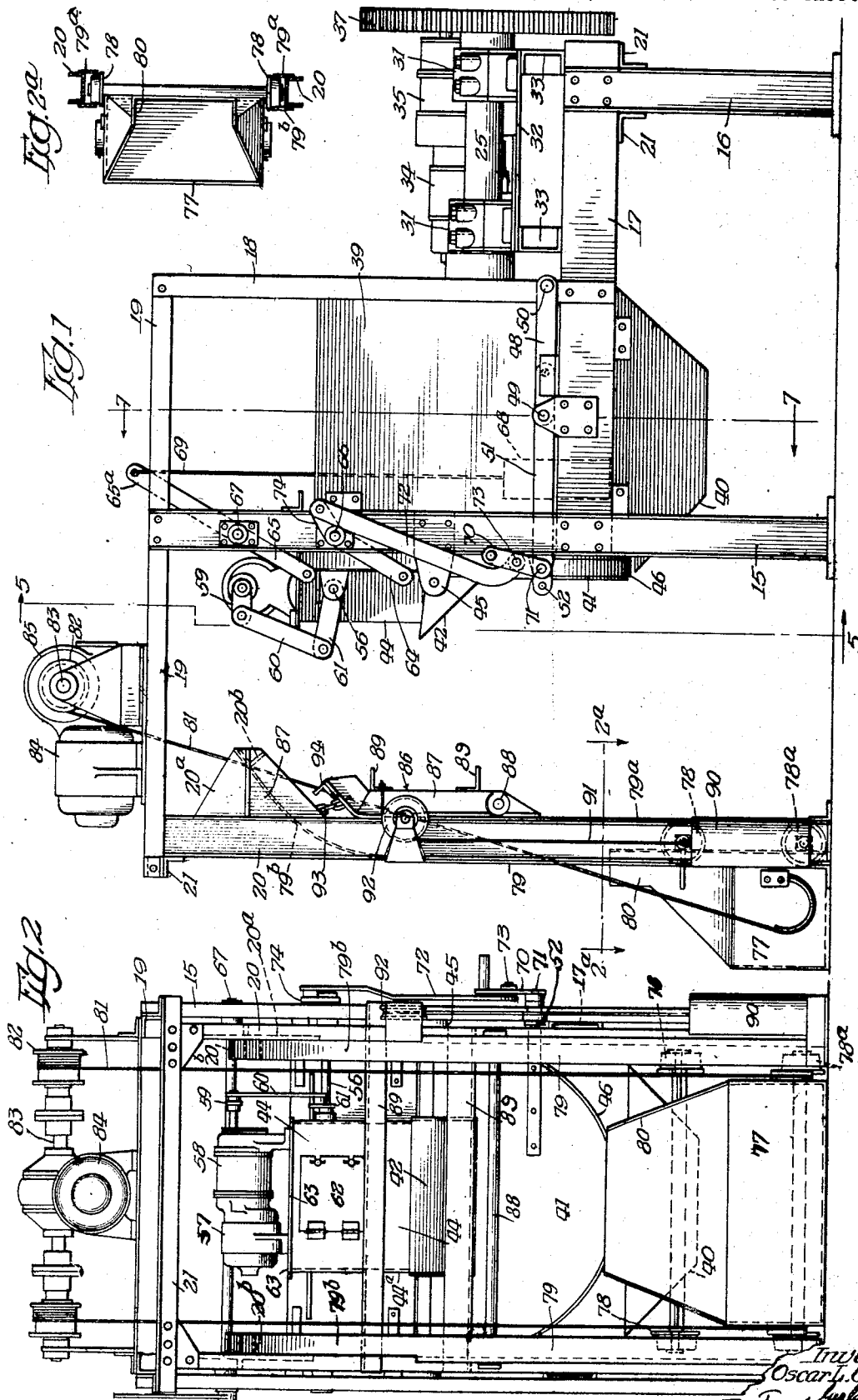
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2,211,099

APPARATUS FOR CLEANING METAL PARTS

Filed Dec. 19, 1939

3 Sheets-Sheet 1



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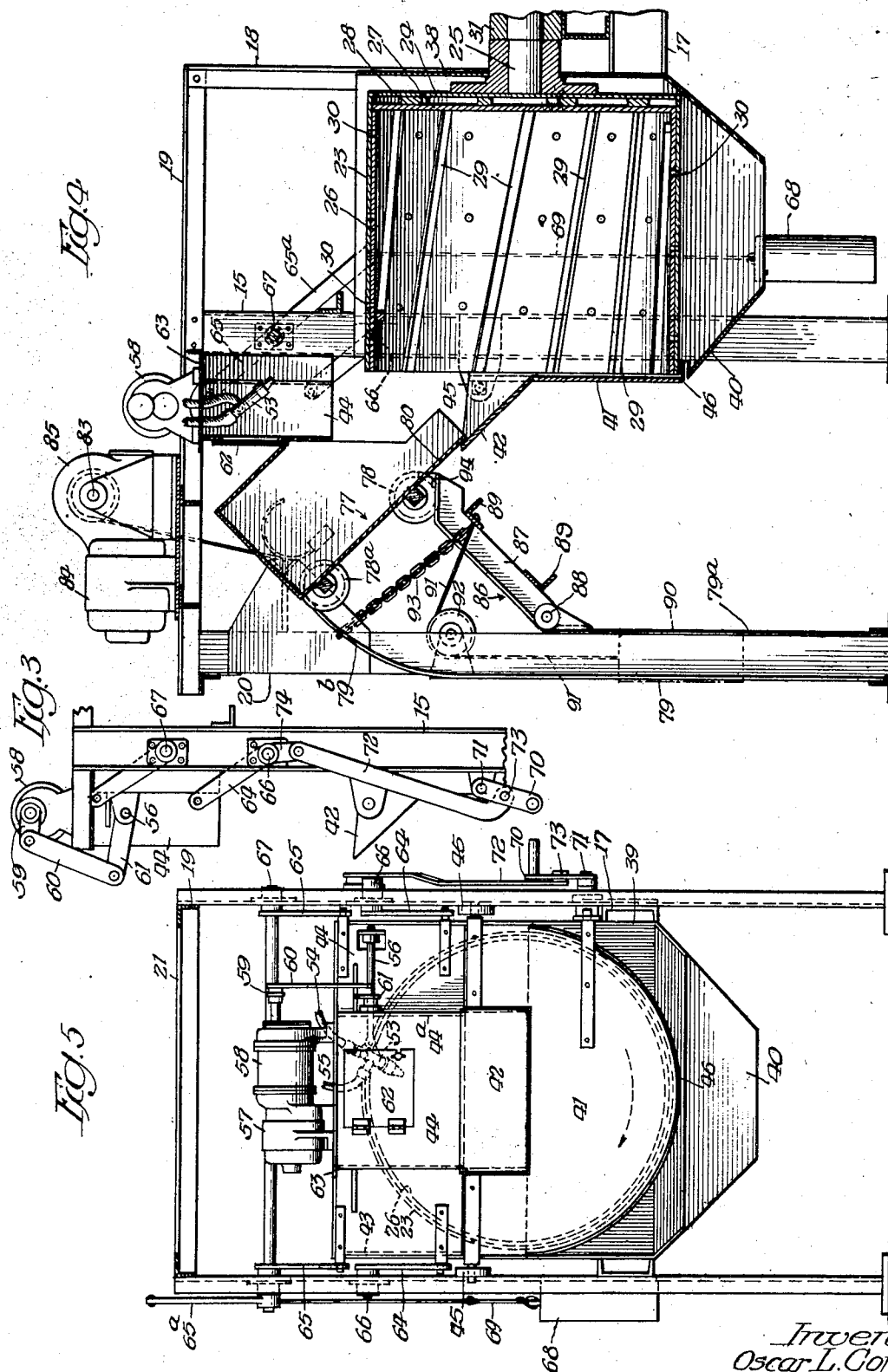
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APPARATUS FOR CLEANING METAL PARTS

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

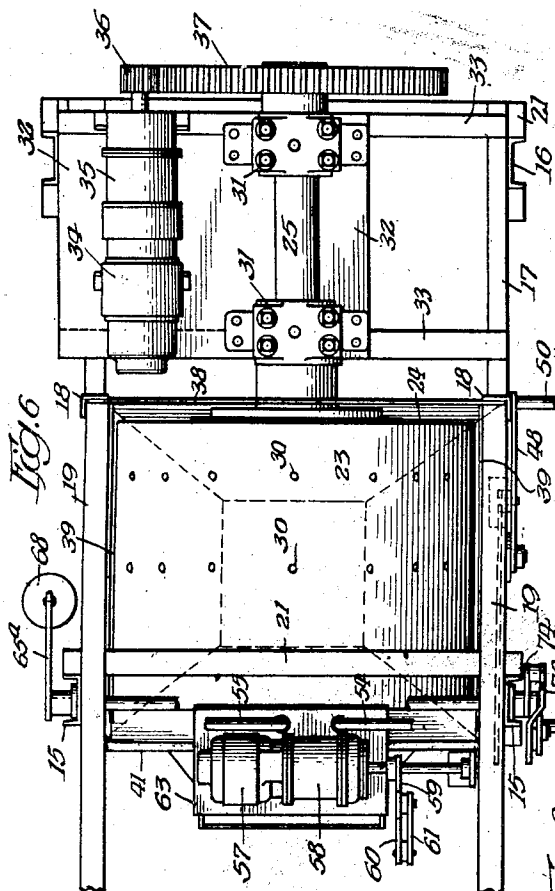


Fig. 6

Fig. 10

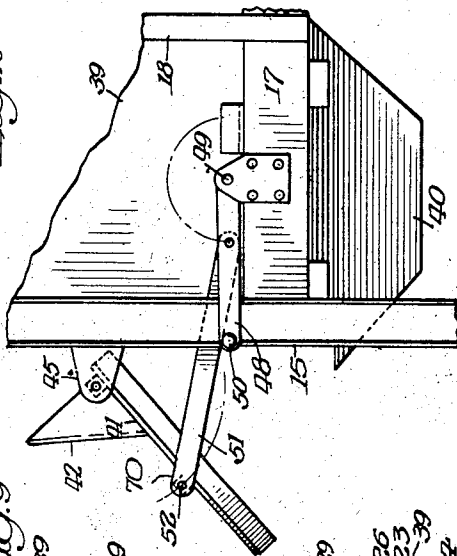


Fig. 9

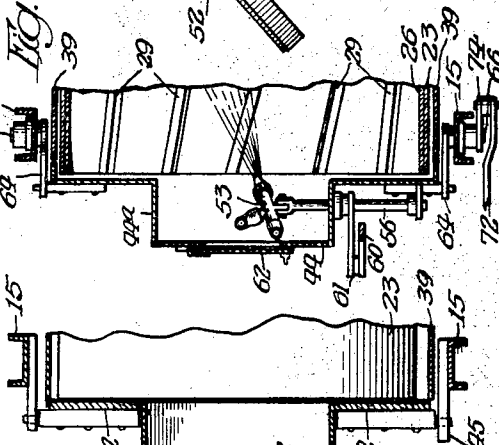
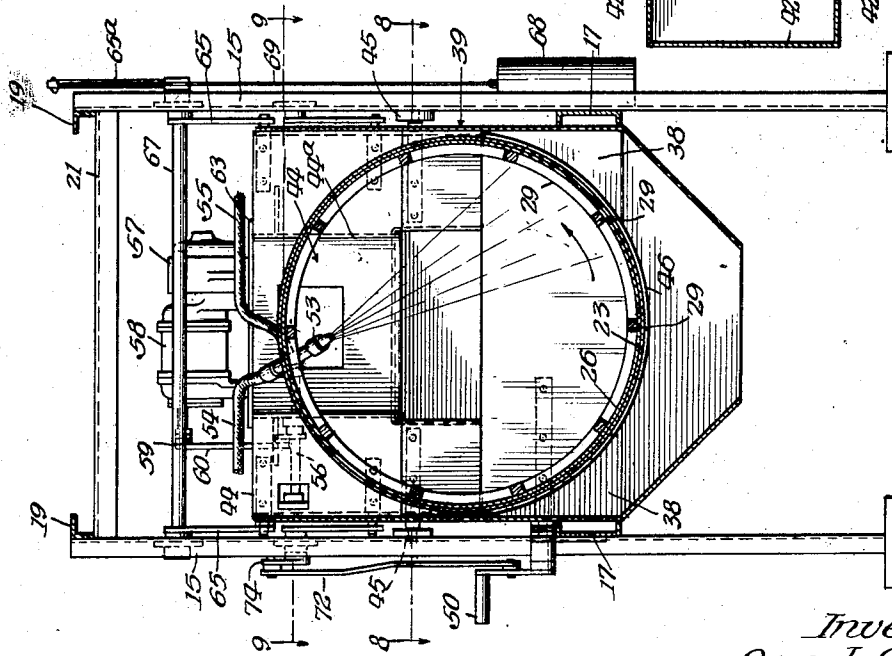


Fig. 8

Fig. 7



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UNITED STATES PATENT OFFICE

2,211,099

APPARATUS FOR CLEANING METAL PARTS

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13 Claims. (Cl. 51—13)

The invention relates to casting-cleaning apparatus.

One object of the invention is to provide an improved casting-cleaning apparatus of the rotary tumbler type in which an abrasive is hydraulically projected against the casting, which is simple in construction and efficient in operation.

Another object is to provide apparatus comprising an open ended drum and a hydraulic nozzle, for delivering the abrasive through the open end of, and onto, the castings in the drum and driven mechanism for shifting the jet to direct a stream of water and abrasive throughout the length of the drum to more effectively clean all of the castings in the drum.

Another object is to provide a casting-cleaning apparatus of this type which includes a drum which is substantially closed at one end and open at the other and which can be quickly charged with castings and from which the castings can be expeditiously discharged to expedite the cleaning operations.

Another object is to provide apparatus of this type in which the hydraulic nozzle delivers the stream through the open end of the drum and which is movably mounted so it can be shifted to clear said open end when the drum is to be charged with castings.

Another object is to provide apparatus of this type in which the charge is delivered into, and is discharged through, the open end of the drum, and mechanism for driving the drum in one direction for cleaning, and in the reverse direction for discharging the castings.

Another object of the invention is to provide improved apparatus of this type in which separately operable doors or closures, which are supported independently of the drum, are used for the open end of the drum for charging the drum with, and discharging the castings therefrom, respectively.

Another object of the invention is to provide improved apparatus of this type, which comprises improved charging mechanism for delivering the castings into the open end of the drum.

Other objects of the invention will appear from the detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings: Fig. 1 is a side elevation of apparatus embodying the invention. Fig. 2 is an

end view. Fig. 2^a is a section on line 2^a—2^a of Fig. 1. Fig. 3 is a detail illustrating the charging door and its shifting mechanism when the door is raised. Fig. 4 is a vertical longitudinal section illustrating the charging apparatus delivering a charge of castings into the drum. Fig. 5 is a section on line 5—5 of Fig. 1. Fig. 6 is a plan. Fig. 7 is a section on line 7—7 of Fig. 1. Fig. 8 is a section taken on line 8—8 of Fig. 7. Fig. 9 is a section taken on line 9—9 of Fig. 7. Fig. 10 is a detail showing the device for shifting the discharge-door in its open position.

The invention is exemplified in apparatus carried by a supporting frame or structure which comprises standards 15, 16 and 20 adapted to be supported on the floor, horizontal side-beams 17 between standards 15, 16, upright-beams 18 having their lower ends fixed to beams 17, longitudinal top-beams 19, connecting standards 15, 16 and 20, and angle-iron cross-beams 21, all rigidly secured together to form a rigid supporting frame for the cleaning and charging apparatus.

A drum for tumbling the castings comprises a cylindrical wall or shell 23 and an end wall 24 which closes one end of the drum and is fixedly secured to, and supported by, a shaft 25 which drives the drum. The opposite end of the drum is open to receive and discharge the castings and so that water and an abrasive can be directed onto the castings in the drum. A liner 26 of suitable wear-metal extends around the inner periphery of the drum and a liner 27 of similar metal extends across the end 24 of the drum, being spaced therefrom by ribs 28. The inner face of liner 26 is provided with helical ribs 29 for tumbling the castings and moving them endwise thereof in the drum. Openings 30 are provided in the liners 26 and 27 for the escape of water and abrasive from the drum. Shaft 25 which drives and supports the drum is journaled in bearings 31 which are mounted on a bed-plate 32 which is supported by cross-beams 33 which are fixed to the side-beams 17 of the supporting frame. The mechanism for driving the shaft 25 to rotate the drum in one direction for cleaning, and in the opposite direction for discharging the castings, comprises a reversible electric motor 34 mounted on plate 32, speed-reducing gearing 35, a pinion 36 driven by said gearing, and a gear 37 fixed to shaft 25. A housing, around the closed end and the sides of the drum, comprises an end-wall 38, side-walls 39 and a discharge hopper 40 below the drum. This housing is adapted to catch the water and abra-

sive discharged through holes 30 and from the open end of the drum, for delivery into a suitable receptacle for re-use or for discharge. The housing is fixedly secured to the supporting-frame in any suitable manner.

The castings are prevented from falling out of the open end of the drum during the cleaning operation by a pivoted discharge door 41 which is supported independently of the drum and extends across the lower portion of the open end of the drum. The central upper portion of door 41 is provided with a hopper 42. Discharge door 41 is pivoted, at its upper end, in brackets 45 and is provided with a rim 46 which laps the adjacent end of the drum. When door 41 is swung outwardly, as indicated in Fig. 10, the clean castings can be discharged from the lower portion of the drum. The mechanism for opening and closing door 41 comprises a lever 48 which is provided in a fixed bracket 49 and provided with a handle 50 at its free end and a link 51 which is eccentrically pivoted to lever 48 and, as at 52, to the door 41. When the door is closed, link 51 and lever 48 are in dead-center relation so that the door will be locked. In opening the door, lever 48 is shifted through an arc of 180° so that the link 51 will be applied to lever 48 so that the door will be held in its open position.

The castings in the drum are subjected to a hydraulic stream mixed with an abrasive, such as water and sand, during the rotation of the drum in one direction, delivered from a suitable mixing nozzle 53. Water under high pressure is delivered to the nozzle through a flexible pipe 54 and sand is delivered to the nozzle through a flexible pipe 55. The water sucks the sand into the nozzle so the mixed sand and water will be forcibly projected against the castings to clean them. The nozzle may be of any suitable water and abrasive mixing type, as well known in the art. During the cleaning operation, the drum is rotated at a slow speed, for example 2 R. P. M., to tumble the castings therein. The stream from nozzle 53 is directed through the open end of the drum and into and toward the bottom portion of the drum to strike the castings where they are tumbled. To project the hydraulic stream longitudinally along the drum and against all of the castings therein, the jet is pivotally mounted and operated to swing in an arc so that the stream will be directed back and forth longitudinally of the drum. The casing of nozzle 53 is fixed to a shaft 56 which is journaled in the charging door 44. The mechanism for operating or swinging the nozzle 53 comprises an electric motor 57, speed-reducing gearing 58 driven by said motor, a crank 59 driven by said gearing, a link 60 operated by crank 59, and an arm 61 fixed to shaft 56 and pivoted to and operated by link 60. Rotation of the crank 59 causes the link 60 to swing arm 61 and rock shaft 56 to oscillate the nozzle 53. Said nozzle 53 and its operating mechanism are mounted on the vertically movable charging door 44 so that, during cleaning operations the nozzle will be disposed to direct the stream through the upper portion of the open end of the drum, and during the charging of the drum, the nozzle will be raised to clear the upper portion of the open end of the drum to receive the charge. A small door 62 is hinged to the charging door 44 adjacent the nozzle 53 to provide convenient access to the nozzle for replacing the tips thereof which are subjected to great wear in practice. The central portion of

door 44 is outwardly offset, as at 44^a, and its ends are extended to the sides 39 of the housing around the drum to prevent splashing from the upper portion of the open end of the drum. Motor 57 and reducing gearing 58 are mounted on a bed-plate 63 fixedly secured to the top of door 44. Door 44 is supported for vertical movement by a pair of parallel arms or levers 64, 65, the outer ends of which are pivoted to the door. Arm 64 is pivoted at 66 and arm 65 is pivoted, as at 67, to the supporting-frame. The device for raising and lowering door 44 comprises a hand-lever 70 which is pivoted at 71 to the supporting-frame, a link 72 pivoted at 73 to lever 70, and an arm 74 fixed to swing with arm 64. When door 44 is in its lowered position the device for operating it will be locked, as illustrated in Fig. 1 on account of the dead-center relation of lever 70 and link 72. To lift said door the operator swings lever 70 outwardly and downwardly to operate link 72 downwardly so it will swing arm 64 upwardly. Arms 64 and 65 will cause door 44 to move vertically. When lever 70 is swung downwardly it will hold link 72 so that the door 44 will be held in its raised position. A counterweight 68 is connected by a cable 69 to an extension of arm 65^a to facilitate the lifting of the charging door and the mechanism carried thereby. When door 44 is raised the nozzle and its shifting mechanism will be lifted to clear the portion of the open end of the drum above door 41 for the delivery of castings into the drum. When door 44 is lowered, the hydraulic nozzle will be lowered into its operative position and door 44 will prevent splashing of water and abrasive through the upper portion of the open end of the drum.

The apparatus for delivering a charge of castings into the drum comprises a bucket 77, the upper end of which is provided with a discharge spout 80. The bucket is provided at each side with a pair of wheels 78, 78^a which are adapted to travel between guide-plates 79, 79^a which are fixed to the front end and rear faces of standards 20. The upper ends of guide-plates 79^a terminate adjacent a pivoted switch-frame 86. The upper end of guide-plate 79 is curved, as at 79^b. Plates 20^a confine the bucket against transverse movement while it is in dumping position. Switch-frame 86 comprises a pair of arms 87 fixed to a cross-shaft 88 which is pivotally supported on standards 20 and angle-beams 89 which rigidly cross-connect the arms. Frame 86, when the bucket is lowered, is normally held in vertical position (Fig. 1) by a weight 90 which is connected to one of the cross-bars 89 by a cable 91 which passes around a guide-sheave 92. Chains 93 are provided to limit the downward pivotal movement of the switch-frame toward the discharge chute 42. The hoisting mechanism for the bucket 77 comprises a pair of cables 81 and windlasses 82 for winding the cables. Said windlasses are fixed to a shaft 83 which is driven from an electric motor 84 through reducing gearing 85. When cables 81 are wound on the windlasses 82, the bucket will be lifted and guided between guide-plates 79, 79^a, until the wheels 78 reach the lower end of arms 87 of switch-frame 86. As the hoisting of the bucket continues the wheels 78 will swing the switch-frame 86 outwardly into position illustrated in Fig. 4. The wheels 78 will ride on arms 87 and be directed toward the drum and onto the angular outer end of arms 87 until they engage a stop bar 94 fixed to said arms. The chains 93 limit the swinging

movement of the switch-frame and hold it while the bucket is discharging. The continuing hoisting of the bucket will cause it to fulcrum on the axis of wheels 78 and the wheels 78^a will be deflected by the curved portion 79^b of plates 79 until the bucket is inverted with the end of its spout 80 discharging into the hopper 42, as illustrated in Fig. 4. The bucket will then discharge its load of castings through hopper 42 and the upper portion of the open end of, and into, the drum. The load is discharged after the door 44, which carries the hydraulic nozzle and its charging mechanism, has been lifted above the drum. After the load has been discharged, motor 84 is operated in reverse direction to lower the bucket. During the lowering movement the bucket will first fulcrum on the axis of wheels 78 until the bucket has been inverted sufficiently so that wheels 78^a will descend and pass between guide-plates 79, 79^a. Wheels 78 will ride downwardly and outwardly along arm 87 of switch frame 86 until the wheels 78 pass between plates 79, 79^a so that during the continuing lowering movement they will run downwardly into normal or charge-receiving position shown in Fig. 1.

The operation of the apparatus will be as follows: to charge the drum, the door 44, which carries the hydraulic nozzle and its operating mechanism, will be raised by means of lever 70, link 72, arm 74 and arms 64, 65 so that they will be positioned as illustrated in Fig. 3, to clear the upper portion of the open end of the drum above door 41. Next, the bucket 77, containing a load of castings which are to be cleaned, will be hoisted to dump the castings into the drum. The bucket will then be lowered and door 44 will be closed, which will bring the nozzle 53 into its operative position. Motor 34 will then be operated to rotate the drum with the castings therein in one direction while the discharge door 41 is closed. The ribs 29 in the drum will cause the castings to be lifted, tumbled or turned over in the drum and tend to move them in the direction of the rotation of the drum and toward the closed end of the drum. During the rotation of the drum the motor 58 will be operated to oscillate the nozzle 53 so that its stream will be directed on the castings along the entire bottom portion and lengthwise of the drum. This oscillation of the nozzle distributes the hydraulic stream so it will reach substantially all portions of the castings being tumbled in the drum cleaned. The water under high pressure draws sand from pipe 55 into the nozzle so that the castings are subjected to a hydraulic blast in which an abrasive is suspended and by which the abrasive is projected against the castings. The operation of the drum and hydraulic jet is continued for a sufficient period to thoroughly clean the castings. During the cleaning operation, the water and sand will flow out of the drum through the perforations 30 and between the door 41 and the open end of the drum so that they will be discharged through hopper 40. When the castings have been cleaned, lever 48 is operated to open the discharge door 41 and the motor 34 is reversed to reverse the direction of rotation of the drum. The ribs 29 in the drum will then be rotated so as to move the castings away from the closed end of the drum and discharge them through the lower portion of the open end thereof. After the drum has been emptied of castings, door 41 will be closed and the charging operation repeated, as before.

The invention is not to be understood as re-

stricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

While the apparatus has been particularly described in connection with the cleaning of metal castings, it will be understood that it can be used for cleaning other metal parts, such as forgings and stampings.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In cleaning apparatus for metal parts, the combination of a drum for retaining the metal parts, having one of its ends open and its other end substantially closed, means connected to the closed end of the drum for rotating the drum, a hydraulic nozzle for directing a stream of water and an abrasive through the open end of, and onto, the parts in the drum, apparatus for elevating and dumping a charge of parts into, and through, the open end of the drum, and a discharge door supported independently of the drum for covering the lower portion of the open end of the drum, a vertically movable charging door supported independently of, and for covering the upper portion of the open end of the drum.

2. In cleaning apparatus for metal parts, the combination of a drum for retaining the metal parts, having one of its ends open and its other end substantially closed, means connected to the closed end of the drum for rotating the drum, a hydraulic nozzle for directing a stream of water and an abrasive through the open end of, and onto the metal parts in, the drum, a hopper supported independently of the drum, apparatus for elevating and dumping a charge of parts into the hopper, a discharge door, supported independently of the drum and below the hopper, a vertically movable door, supported independently of, and for covering the upper portion of the open end of the drum.

3. In cleaning apparatus for metal parts, the combination of a drum for retaining the metal parts, having one of its ends open and its other end substantially closed, means connected to the closed end of the drum for rotating the drum, a hydraulic nozzle for directing a stream of water and an abrasive through the open end of, and onto the metal parts in, the drum, apparatus for elevating and dumping a charge of parts through the open end of the drum, a discharge door, supported independently of the drum for covering the lower portion of the open end of the drum, a vertically movable door on which the nozzle is mounted, supported independently of, and for covering the upper portion of the open end of the hopper, and means for shifting the vertically movable door into and out of operative position.

4. In cleaning apparatus for metal parts, the combination of a supporting frame, a drum rotatably supported on the frame, having one of its ends open and its other end substantially closed, mechanism mounted on said frame for driving the drum, charging and discharging doors supported on the frame, independently of the drum, for covering the open end of the drum, hoisting mechanism mounted on the frame comprising a bucket for elevating and dumping a charge of said parts through the open end of and into the drum, a hydraulic nozzle disposed adjacent the open end of the drum for delivering a stream of water and abrasive onto the metal parts in the drum, and means for separately

shifting the doors for charging the drum with, and discharging therefrom, metal parts.

5. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means on the inner periphery of the drum for directing the parts horizontally away from the open end and for directing the parts horizontally toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, means for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, a vertically movable support on which the nozzle and its shifting means are mounted, and means, including a lever, for shifting the support to move the nozzle and its shifting means so the nozzle will clear the open end of the drum.

6. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for directing the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, a motor, means operated by the motor for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, a vertically movable support on which the motor, the nozzle, and its shifting means are mounted, and means for shifting the support to move the motor, nozzle, and its shifting means so the nozzle will clear the open end of the drum.

7. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for directing the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, a motor, means operated by the motor for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, a vertically movable support on which the motor, the nozzle, and its shifting means are mounted, and means, including a lever, for shifting the support to move the motor, nozzle, and its shifting means so the nozzle will clear the open end of the drum.

8. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for directing the parts horizontally away from its open end and toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, means for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, a support slidable vertically and in a plane transverse to the axis of the

drum for the nozzle and its shifting means, and means, including a lever, for shifting the support to move the nozzle and its shifting means so the nozzle will be raised vertically to clear the open end of the drum.

9. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for tumbling the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, means for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, means disconnected from the drum for covering its open end comprising a charging door mounted to slide vertically in a plane transverse to the axis of the drum, the nozzle and its shifting means being mounted on and movable with the charging door, and means for shifting the door to clear the open end of the drum for charging.

10. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for tumbling the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, a motor, means operated by the motor for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, means disconnected from the drum for covering its open end comprising a charging door, the motor, nozzle and its shifting means being mounted on the charging door, and means for shifting the door to clear the open end of the drum for charging.

11. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for tumbling the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, a motor, means operated by the motor for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, means disconnected from the drum for covering its open end comprising a vertically slidable charging door, the motor, nozzle and its shifting means being mounted on and movable vertically with the charging door, and means including a lever for shifting the door to clear the open end of the drum for charging.

12. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed, and rotatable solely on a substantially horizontal axis, power-operated means for rotating the drum, means in the drum for tumbling the parts toward its closed end, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, power-means for continuously shifting the nozzle to direct the stream onto the metal parts sub-

stantially throughout the length of the drum, means disconnected from the drum for covering its open end comprising a vertically slidable charging door, the nozzle and its shifting means being mounted on the charging door, means, including a lever, for shifting the door to clear the open end of the drum for charging, and a counterbalance for the door and parts carried thereby.

13. In cleaning apparatus for metal parts, the combination of a rotatable drum for retaining the metal parts, having one of its ends open and its other end substantially closed and mounted to rotate on a fixed substantially horizontal axis, means in the drum for directing the parts towards its closed end when the drum is rotated in one direction and for directing the parts towards its

open end when the drum is rotated in the opposite direction, means comprising independently operable discharging and charging doors, mounted independently of and for closing the open end of the drum, a nozzle disposed adjacent the open end of the drum for delivering water and an abrasive under high pressure into the drum, means for continuously shifting the nozzle to direct the stream onto the metal parts substantially throughout the length of the drum, and power-operated means for rotating the drum in one direction to tumble the parts toward its closed end and in its opposite direction to discharge the parts through the discharging door when the latter is open.

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