Feb. 24, 1953 W. I. GLADFELTER ET AL 2,629,207

PLATE BLASTING MACHINE

Filed Oct. 9, 1950 4 Sheets-Sheet 1

Fig. 1

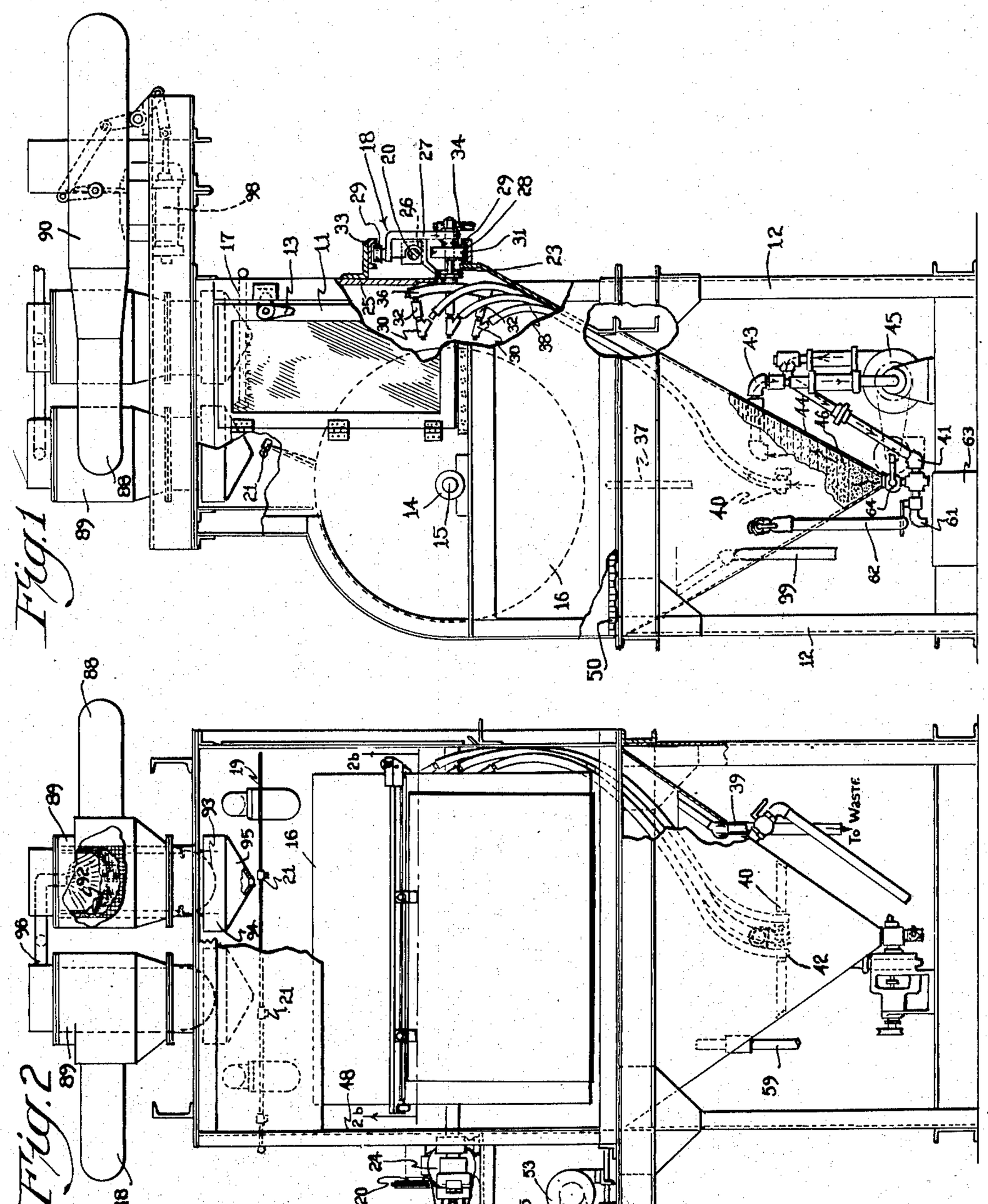


Fig. 2




INVENTORS.
W. I. GLADFELTER &
R. R. GARVER
BY Arthur S. Kennedy
THEIR ATTORNEY.

Feb. 24, 1953 W. I. GLADFELTER ET AL 2,629,207

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Filed Oct. 9, 1950

4 Sheets-Sheet 2

Fig. 3.

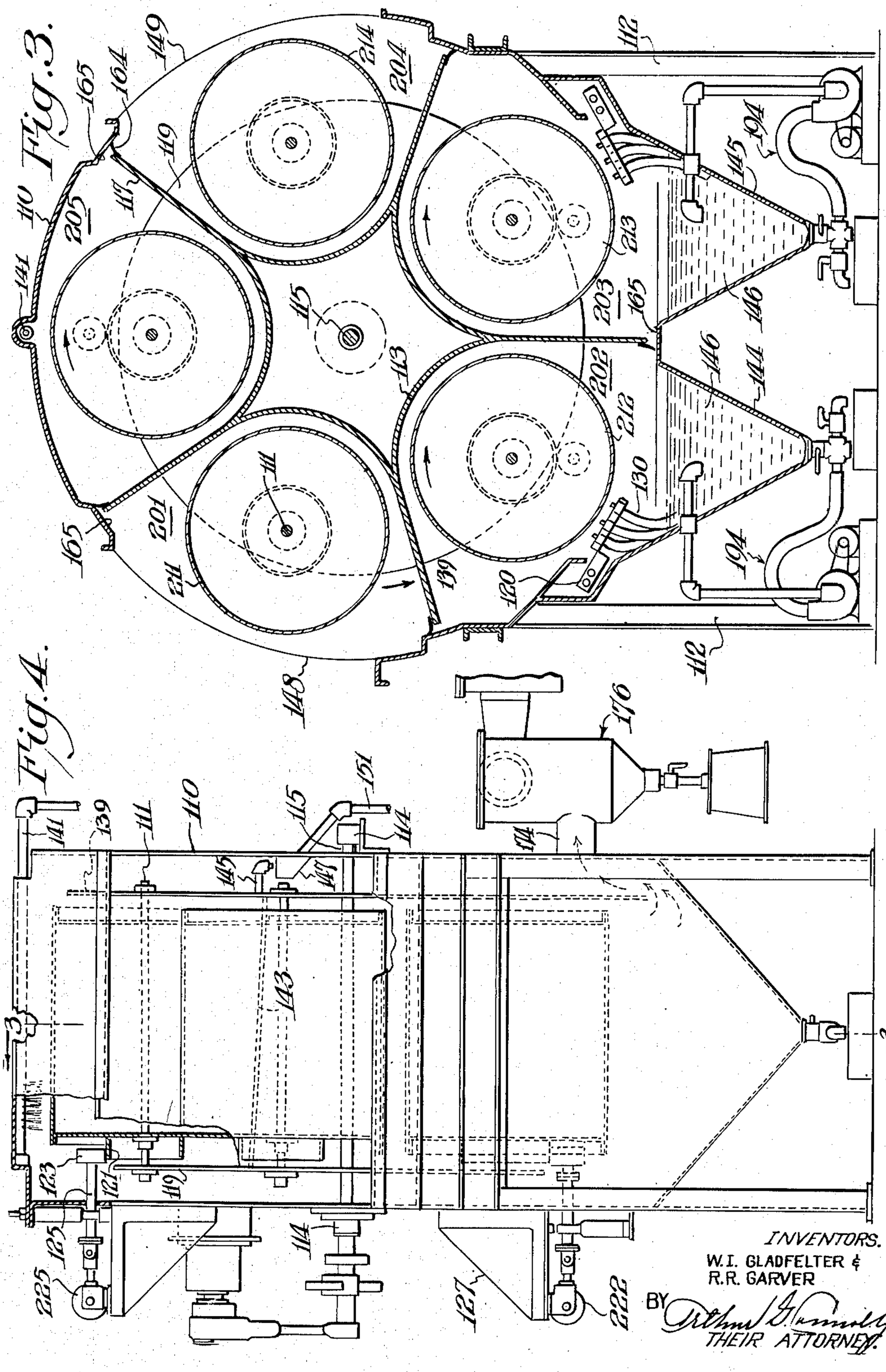



Fig. 4.

INVENTORS.
W. I. GLADFELTER &
R. R. GARVER
BY Arthur J. Kennedy
THEIR ATTORNEY.

Feb. 24, 1953 W. I. GLADFELTER ET AL 2,629,207

PLATE BLASTING MACHINE

Filed Oct. 9, 1950 4 Sheets-Sheet 3

Fig. 2a

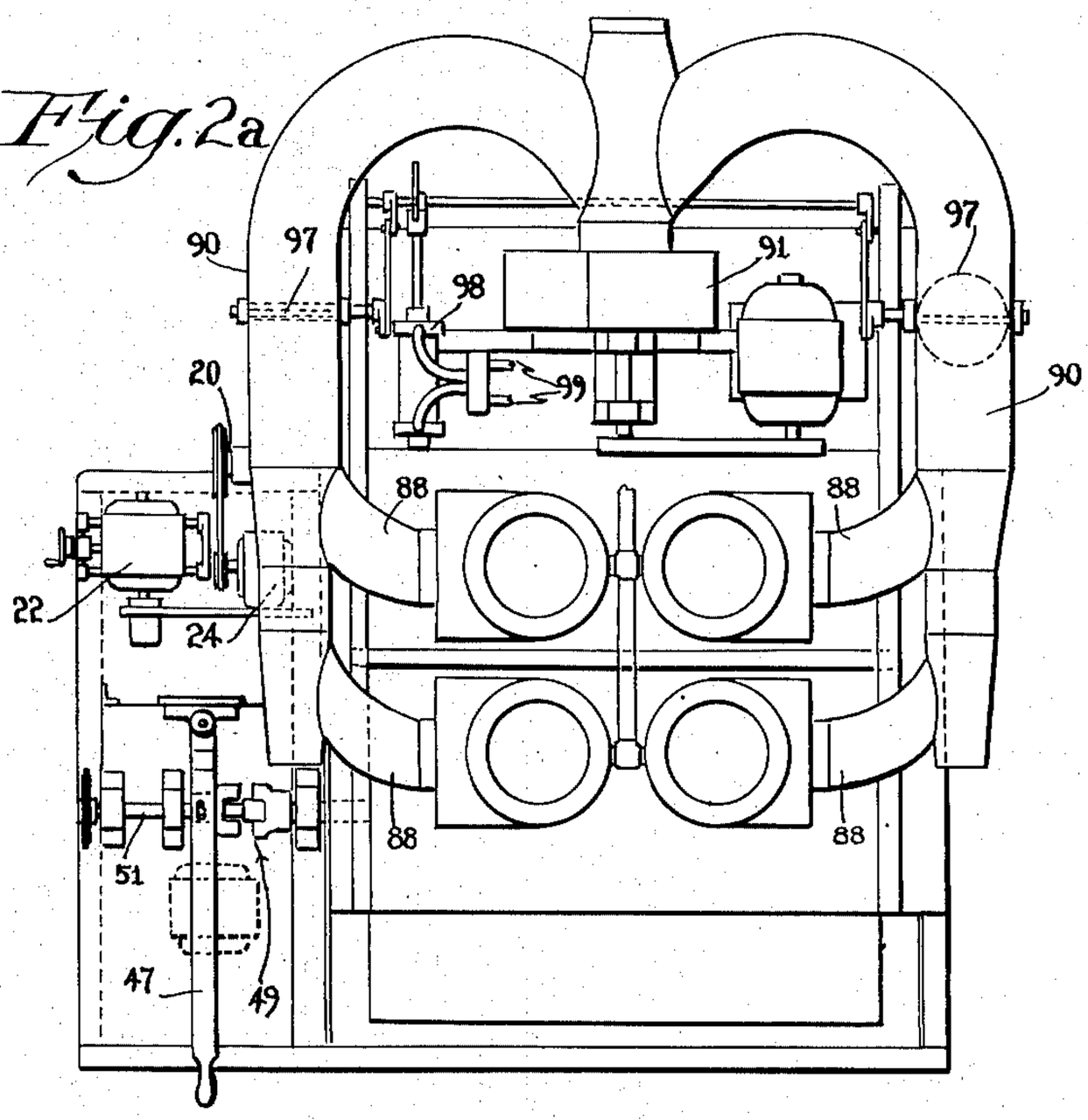



Fig. 2b

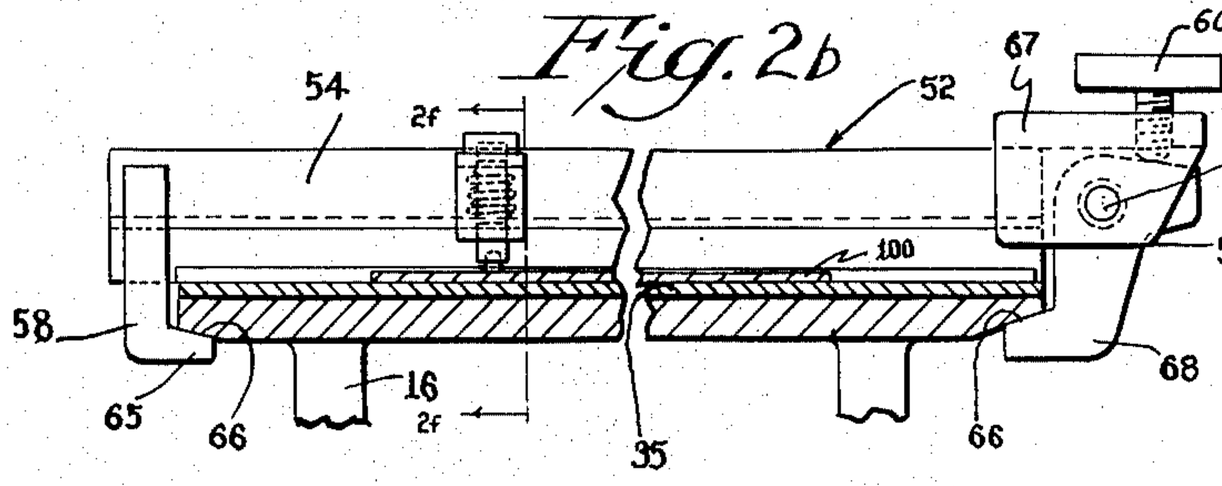



Fig. 2c

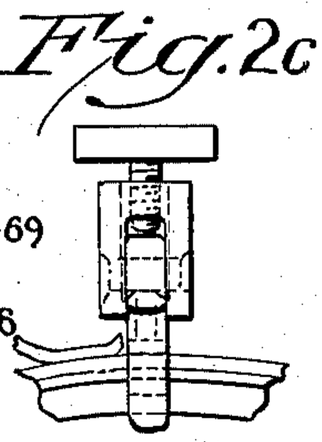


Fig. 2d

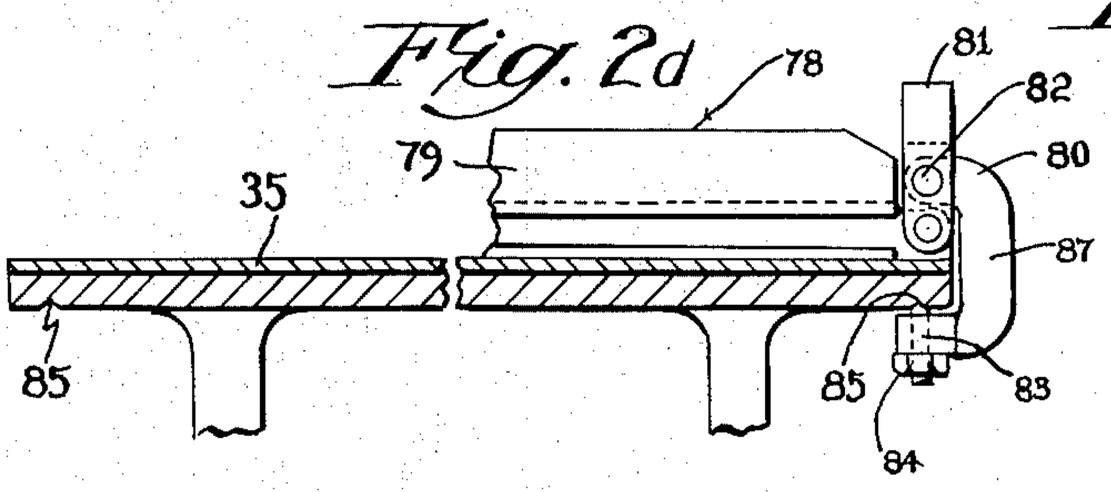



Fig. 2e

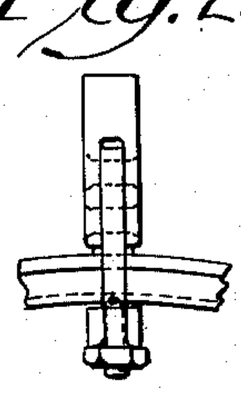
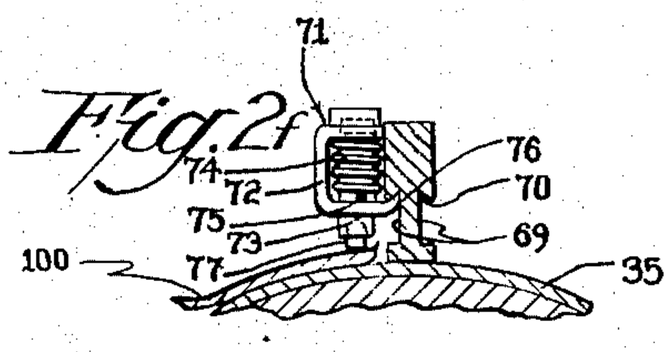



Fig. 2f




INVENTORS.
W.I. GLADFELTER &
R.R. GARVER
BY Richard D. Kennedy
THEIR ATTORNEY.

Feb. 24, 1953 W. I. GLADFELTER ET AL 2,629,207

PLATE BLASTING MACHINE

Filed Oct. 9, 1950 4 Sheets-Sheet 4

Fig. 5.

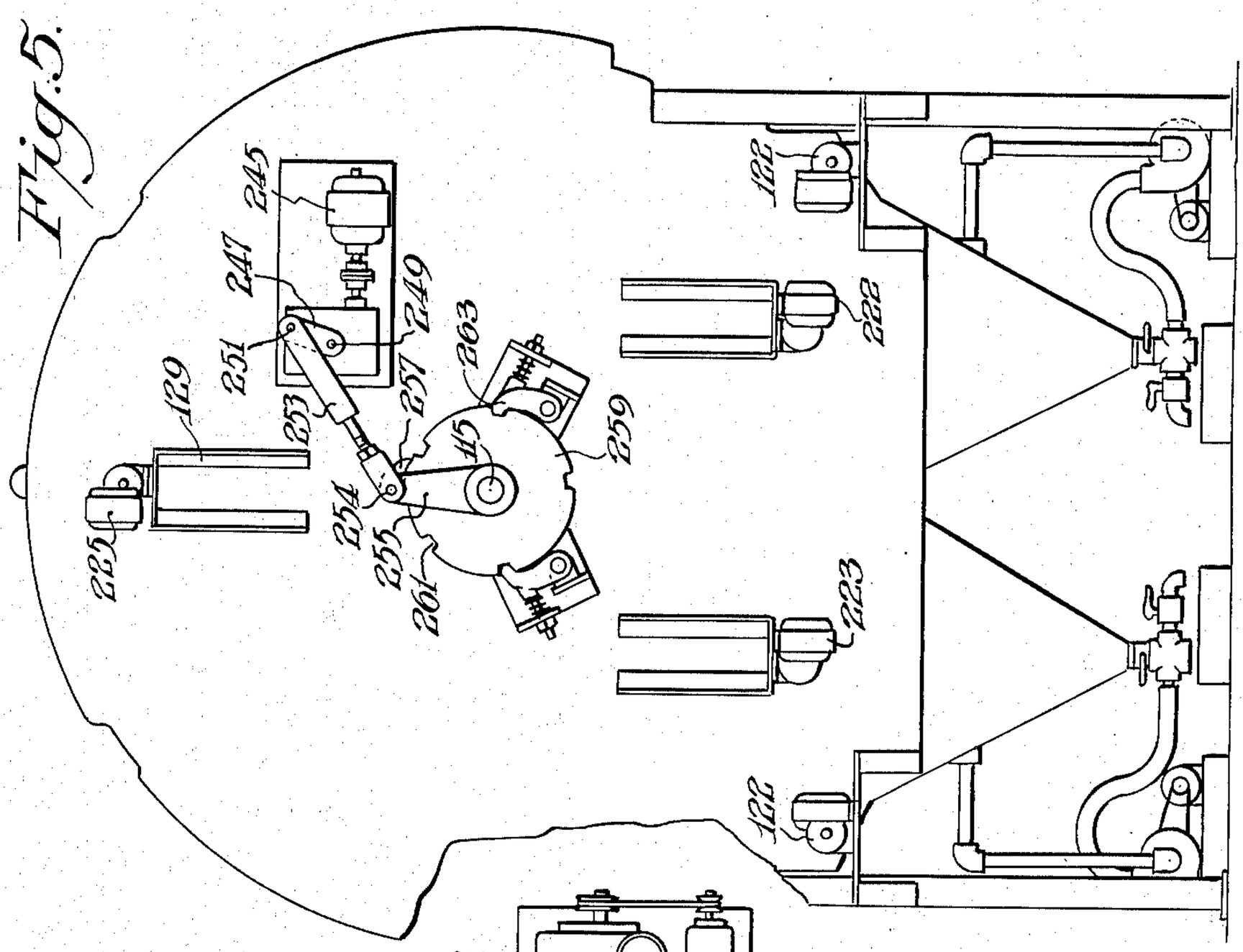
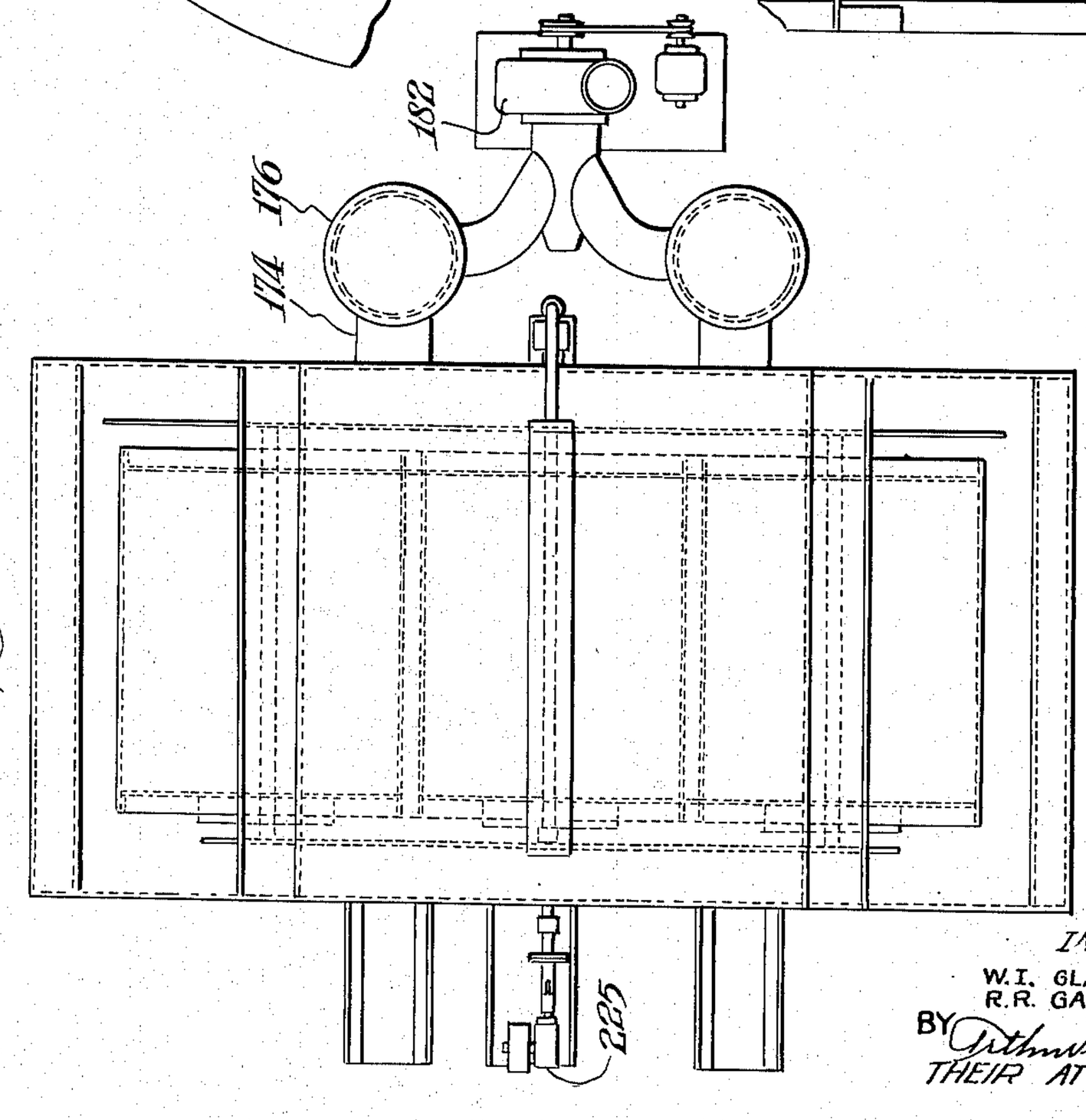



Fig. 6.



INVENTORS.
W. I. GLADFELTER
R. R. GARVER
BY Arthur G. Connolly
THEIR ATTORNEY

Patented Feb. 24, 1953 2,629,207

# UNITED STATES PATENT OFFICE

2,629,207

## PLATE BLASTING MACHINE

Wiltie I. Gladfelter and Ralph R. Garver, Hagerstown, Md., assignors to Pangborn Corporation, Hagerstown, Md., a corporation of Maryland

Application October 9, 1950, Serial No. 189,210

15 Claims. (Cl. 51—15)

1

This invention relates to abrading machines, more particularly to machines for blasting with abrasive particles the surface of metal plates such as the lithographic plates used in the printing industry.

Abrasive blasting machines are characterized by the development of clouds of finely divided particles of abrasive and abraded materials which easily pass through small openings and thereby escape from the machines into their surroundings. For any effective commercial use of such machines, it is essential that such discharge be substantially completely prevented, to keep the environment from becoming uncomfortable to the machine operator or attendant and to prevent irritation and possible infection of the respiratory tract of these individuals by the escaping particles. It has accordingly been an established practice to provide completely closed, dustproof housings for such machines and to station the operator outside of the enclosure.

The blasting of metal plates, which may be as large as 2 by 4 feet in area, does not readily lend itself to the use of completely enclosed housings inasmuch as the provision of suitable loading and unloading mechanism makes the construction and operation of the machine quite awkward. This is particularly serious when the blasting is intended to effect a very uniform abrading of the metal sheet surface, as in the case of lithographic plates. For such treatment, it is desirable to have the individual metal sheets carefully mounted on a movable holder to have their surfaces uniformly moved through an abrading blast.

The fastening of the metal sheets to the movable holder has also been a problem in the art. Most blasting machines must be designed to blast sheets that can be varied in size in accordance with other requirements. Lithographic plates used in a single small lithographing establishment, for example, can vary both in length and in width from about 10 inches to about 50 or more inches. A single blasting machine for graining these lithographic plates, should be capable of securely receiving and holding plates having any of these dimensions, and carrying them through the abradant stream. An extremely practical type of plate holding and moving device includes a rotatable drum on the surface of which longitudinally extending bars are adjustably clamped to hold the plate ends. However, such adjustable clamping of the prior art, as shown in Fritsche Patent No. 2,005,654 for example, is not conveniently effected, and requires excessive manipulative operations.

2

Among the objects of the present invention is the provision of plate blasting machines which avoid the above and related difficulties.

Further objects of the invention include blasting machines for uniformly blasting metal plates in which machines the plates are readily loaded and from which they are readily unloaded.

Still further objects of the present invention include the provision of plate clamping mechanism that is simple to use and requires very little manipulative treatment to clamp or release a plate.

The above, as well as other objects of the present invention, will be more readily understood from the following description of several of its exemplifications, reference being made to the accompanying drawings wherein:

Fig. 1 is a side view of a plate blasting machine embodying the present invention, with parts broken away to better show some of the details;

Fig. 2 is a front elevational view of the machine shown in Fig. 1;

Fig. 2*a* is a top view of the apparatus of Figs. 1 and 2;

Fig. 2*b* is a detail sectional view taken along line 2*b*—2*b* in Fig. 2, and showing the plate clamping mechanism of the apparatus of Figs. 1, 2 and 2*a*;

Fig. 2*c* is a side view of the construction of Fig. 2*b*;

Figs. 2*d* and 2*e* are views, similar to Figs. 2*b* and 2*c*, of a modified form of clamping mechanism;

Fig. 2*f* is a sectional view taken along the line 2*f*—2*f*, of the apparatus of Fig. 2*b*;

Fig. 3 is a sectional view of a different embodiment of a plate blasting machine exemplifying the invention, this view being taken along line 3—3 of Fig. 4;

Fig. 4 is a front elevational view, with parts broken away, of the machine shown in Fig. 3;

Fig. 5 is a side view of the machine shown in Figs. 3 and 4; and

Fig. 6 is a top view of the machine shown in Figs. 3, 4 and 5.

According to the present invention a work piece blasting machine is provided in the form of a housing, blasting structure mounted within the housing and connected for projecting a stream of blasting particles towards exchangeable work pieces and an uncovered work-piece-loading and unloading opening in the housing. To keep the blastant particles from emerging through the uncovered opening, the housing is arranged to closely fit against the movable plate-holding structure and a stream of air is arranged to be sucked into

the machine through this spacing during blasting. In addition, sealing elements can be extended between the housing and the plate-holding structure at some or all of the margins of the opening. Work-piece-holding clamps can be provided to hold these pieces in the path of the abrasive stream. The clamps preferably include quickly adjustable spring catches and are arranged to hold one or more individual plates along any portion of a holder such as the periphery of a rotatable drum thereby simplifying the replacements of the work pieces.

Referring to the construction shown in Figs. 1, 2 and 2*a*, it will be seen that the machine includes a housing **10** supported on legs **12** and carrying bearings **14** in which is journaled a drum **16** on shaft **15**. In the rear of the housing is secured a traversing mechanism indicated generally at **18** and shown as including a threaded enclosed shaft **20** journaled at both ends and coupled to an electric motor **22** through a reduction gear box **24**. Threadedly engaged by the shaft **20** is a slidable block or nut **26** held by a carriage **27** which is equipped with rollers **28, 29** guided along fixed tracks **31, 33**. On the carriage is mounted a set of blasting nozzles **30** directed toward a portion of the drum periphery. In the form shown, each nozzle is connected by a hose **32** to a compressed air line **34** through an air manifold **36**. Also connected to the individual nozzles are abrasive mixture supply lines **38**, which extend down to the lower portion of the housing where they are held in place as by clamps **40** so that the lines open at **42** into a dependent portion of the housing in the general shape of a hopper **44**. The hoses are of flexible construction so that they remain connected at their respective ends and, at the same time, permit the nozzles to be carried by the traversing mechanism to and fro longitudinally across the drum. In this type of construction the nozzles are of a so-called suction type so that the passage of compressed air through them causes the blasting mixture to be sucked up from the hopper where it is indicated at **46**, and forcefully expelled against the drum surface with the compressed air. Such nozzles are well known, one very effective construction being described in U. S. Patent No. 2,369,576 granted February 13, 1945. The abrasive mixture is preferably a suspension of finely divided grit particles such as sand, in a liquid such as water.

The hopper **44** is equipped with an agitating device shown as a slurry circulating arrangement including a centrifugal pump **45** having an outlet line **41** connected to the bottom of the hopper, and an inlet line **43** opening at a point in the hopper above the level at which the abrasive particles generally settle. An overflow conduit **39** is arranged to fix the maximum liquid level above the slurry **46** by automatically permitting higher strata of liquid to discharge to waste. An additional overflow line **59** adjusted to a suitably higher level may be provided as for indicating obstruction of line **39**. A slurry drain **61**, liquid drain **62**, drain receptacle **63** and hopper isolating valve **64** are also included to simplify the cleaning of the hopper and the initiation of slurry circulation.

The housing **10** has an uncovered opening **48** on the side of the drum opposite the nozzle assembly. As shown, the housing walls about the opening may be somewhat curved to more closely follow the cylindrical wall surface of the drum. Through the opening **48** plates to be blasted may be conveniently loaded onto the drum **16** and unloaded from it when the treatment is completed. A grating **50** may be provided between the lower portion of the opening and the drum to serve as a support or rest as, for example, to hold a tool or a sheet while it is being mounted or dismounted.



For rotatably driving the drum **16** around its longitudinal axis, the shaft **15** is coupled by means of clutch **49** to a clutch shaft **51** which is impelled by electric motor **53** via belt driven reducer **55** and chain-and-sprocket drive **57**. A clutch operating handle **47** is shown as projecting out beside the housing opening **48** for convenient manipulation to engage and disengage the clutch and thereby start and stop the drum rotation as desired. Adjustable positioning mounts are shown for motors **22** and **53** to compensate for variations in drive belt tension.

The drum **16** carries on its periphery clamping devices one of which is indicated at **52**. The clamps are shown as including a rod **54**, to the ends of which are fastened as by welding clamping jaws **56, 58**. Jaw **58** is shown as fixed in position with an inwardly directed tooth **65** engaged against the tapered undersurface **66** of the drum end which is flanged as more clearly shown in Fig. 2*b*. The other jaw **56** has a fixed boss **67** which pivotally carries a tooth **68**, as by the pivot pin **69**. A manually operable clamping screw **60** is threadedly received in boss **67** and the end of this screw engages the pivoted tooth **68** and holds it in engagement with a corresponding tapered under-surface **66**, at the opposite end of drum **16**.

The rod **54** is also longitudinally grooved on opposite faces, as shown more clearly at **69** in Fig. 2*f*. At the furthest portion from the drum surface, these grooves are undercut into the rod to provide a seat **70** for a readily attachable and detachable spring holder **71**. The holder **71** has a generally U-shaped body **72** and through both arms of the U are aligned openings in which are slidably received a plunger **73**. A biasing force urges the plunger to slide in one direction, and in the form shown is provided by a coil spring **74** compressed between one arm of the body and a pin **75** carried by the plunger. The other arm of the body is extended to form a claw **76** shaped to fit in the seat **70**. A friction grip **77** of rubber or similar material is held in a socket at the plunger end towards which it is spring biased to firmly hold a portion of a work sheet such as lithographic plate **100** in place against the drum. At the other end of the plunger the body **72** is open to permit retraction of the plunger so that the finger can be conveniently depressed against the action of spring **74** for mounting and dismounting purposes. The tapered drum flange surface **66** can be extended entirely around the drum to enable mounting of the clamp **52** in any radial position. Similarly, the groove **69** may be arranged to extend along the entire length of rod **54** to accommodate one or more fingers **71** in any distribution.

Figs. 2*d* and 2*e* show a somewhat different form of clamp **78** in which a rod **79** is grooved in a manner generally similar to rod **54**, but clamping jaws **80** at each end of rod **79** are arranged for quick anchoring or release by a single manipulative movement. The clamp jaws **80** at each end of rod **79** can be of identical construction including a C-member **80** pivoted at one end by a pin **82** to a handle **81**, the handle in turn being pinned for rotation about the end of rod **79**. The other end of C-member **81** carries a positioning element shown as a set-screw **83** threadedly received in member **87** and equipped

with a locking nut 84. The tip of screw 83 is shown as pointed and as received in a correspondingly shaped groove 85 in the inner surface of the drum flange.

By merely rotating handle 81 outwardly around the end of bar 79, the C-member can be disengaged from the drum flange. This simple operation at both ends of clamp 78 completely frees the clamp so that it can then be removed. For attachment of the clamp, the procedure is reversed. To improve the ease of clamp manipulation, the pin 82 can be arranged to be tightly received in handle 81, and easily rotatable in C-member 87.

To keep particles of the blasting mixture and/or abraded material from escaping from the machine, it is equipped with an air flow actuating device arranged to suck air in through all openings in the machine housing. As shown in Figs. 1, 2 and 2*a*, a set of air conduits 88 are connected to filter chambers 89 that open into the top of housing 10. These conduits 88 are led through symmetrical manifolds 90 to the intake of a motor-driven blower 91, the discharge outlet of which is open to the surrounding atmosphere or is led away to venting means not shown.

It has been discovered that a one horsepower suction device will give the desired absence of leakage when used with an apparatus in which openings in the housing total not more than about 10 square feet. This simple expedient makes it unnecessary to carefully seal openings or provide air-tight closures. Where advisable, the housing openings can be effectively reduced in size as by bringing the housing walls relatively close to the drum 16. Thus the shaping of the front of the housing so that it follows the contour of the drum as shown more clearly in Fig. 1, serves to restrict the effective cross section of the air passageway there provided. Another effective technique for restricting the air intake is by the addition of a baffle or vane 37 which extends across the housing so that its lower end dips below the hopper overflow level and its upper edge is relatively closely adjacent to the drum periphery. In the chamber 89 there may be mounted dust obstructing air filters such as the cylindrical fabric tubes 92. Screens 93 are advantageously used to support the fabric tubes and to cover the intake to each chamber 89 so as to trap the coarser particles such as those of the abrasive. Baffle rings 94 and perforated baffle cups 95 can be provided to spread out the air sucking action and permit more of the coarser suspended particles to settle in the housing without being sucked against the screens.

The chambers 89 also carry a water supply line 96 through which washing water may be delivered for spraying the filter elements and removing the particles which are filtered out by them. This rejuvenates the filters so that they can be directly reused after the washing step without any handling.

For best operation it is desirable that the filtering action be continuous as long as the machine is in operation. Accordingly, the manifolds 90 are shown as equipped with dampers 97 which are connected for out-of-phase simultaneous operation, as by the hydraulically driven air cylinder 98. Air pressure lines 99 are connected in the conventional manner to the cylinder and solenoid-operated valves (not shown) in these lines can be actuated by time-controlled circuits to close one damper, while the other is opened, and at the same time suplying wash liquid to the lines 96 in the chambers connected to the manifold having the closed damper. At regular or irregular intervals the cylinder 98 is reversed to shift the dampers so that the previously inactive manifold circuit is put into operation while the other is subjected to the washing step in preparation for the next shift. Any convenient motor such as that for blower 91 or traversing carriage 26 can be used as the air-cylinder timing motor.



The filter washings drain through the baffles 95 and housing into the slurry in hopper 44. Finely divided particles or lithographic coating materials float or do not settle rapidly in the slurry and are preferentially removed by the automatic overflow arrangement, so that the slurry can be arranged to keep contamination quite low.

The operation of the machine may be controlled by a solenoid valve in the compressed air line 34 and this valve may be electrically or mechanically connected with nozzle traversing motor 22 and the motor for blower 91 so that air filtering and movement of the nozzles begin when the blasting is starting and continue so long as blasting is being maintained. It is usually advisable to energize the circulating pump 45 somewhat in advance of the blasting so as to stir up the blasting mixture as indicated by the arrows in Fig. 1 and put this mixture in such condition that it will be effective to produce the desired blasting characteristics as soon as the blasting has begun. If desired, the drum rotation can also be interlinked with the nozzle traverse so that the blasting is uniformly distributed at all times. However, it is desirable to be able to rotate drum 16 independently of the blasting as, for example, when mounting or replacing the plates to be abraded. It is accordingly advisable to have the clutch 49 or other mechanism for such independent drum rotation either manually by the machine attendant or by suitable actuation of the drum rotating motor.

Figs. 3 to 6 inclusive show a different embodiment of the present invention. Here an external casing 110, supported on legs 112, rotatably carries an internal wheel 113 journaled as by shaft 115 in bearings 114. The wheel 113 includes outwardly projecting vanes 117 which extend outwardly and in an axial direction to form partitioned compartments indicated respectively at 201, 202, 203, 204, and 205. On each side the vanes 117 are secured to differently sized side plates 119, 139. Journaled between these side plates on shafts 111 in each compartment is a drum as indicated at 211, 212, 213, 214, and 215. These drums may be identical with drum 16 shown in Fig. 1. Most of the drum details are accordingly omitted in the interest of clarity. One end of each drum carries an outwardly projecting cylindrical flange 121 by which it can be rotatably driven.

Into compartments 202, 203, and 205 there is fitted, beyond the smaller side plate 119, a drum driving mechanism shown in the form of a friction roller 123 held on a spur shaft 125 suitably arranged for rotating by an electric motor. Motors for compartments in positions 202, 203, 205 are shown respectively (Fig. 5) at 222, 223 and 225 as mounted externally of the housing on conveniently positioned brackets 127. The drum driving mechanisms are fixed with respect to the housing so that the compartment positions referred to above indicate the portion of the housing in which these compartments are located or may be moved to. In other words, as the wheel

113 is rotated in the direction shown by the arrow 139 in Fig. 3 the compartment at position 201 will move to the position of compartment 202, then successively to the positions 203, 204, 205 and from there on to position 201. During such wheel movement the drums will be engaged by and rotatably driven when in positions 202, 203, 205 by reason of frictional contact with the rollers 123. At positions 201 and 204 the drums will be disengaged from the drum rotating mechanism.

The lower portion of the housing 110 is shown as shaped to provide hoppers 144 and 145 below the compartments 202 and 203 respectively. These compartments also contain nozzle blasting equipment 130 which may be generally similar to that shown in the construction of Fig. 1 and also provided with a threaded shaft 120 connected for rotation by an external electric motor 122 (Fig. 5). Hoppers 144, 145 contain blast mixture 146 and are fitted with agitating mechanism 194 as in the construction of Fig. 1.

At one end, each compartment 202, 203 communicates by means of duct 174 (Fig. 6) with an individual separator 176 both of which may be identical with the separator 89 shown in Fig. 1 but may be operated with a common exhaust blower 182.

Compartment 205 carries at its top a spray washing line 141 connected to a suitable source of washing liquids such as water. The floors of each of the compartments 201 to 205 inclusive taper towards shaft 115 adjacent the side plate 139, as shown more clearly in Fig. 4 at 143. Side plate 139 carries a drain connection 145 adjacent the floors 143, and the housing 110 has an internal trough 147 positioned just below compartment 205 and connecting with a discharge line 151. This construction enables a drum to be washed at position 205 and directs the washing into trough 147 and out of the machine so that the wash material is kept from mixing with the abrasive mixture 146 in hoppers 144, 145.

Housing 110 is provided with uncovered openings 148, 149 by which the compartments 201, 204 are exposed so that the cylindrical surface of their drums in the position shown are readily accessible. The remainder of the housing may be completely enclosed and sealed against leakage of suspended particles. Vanes 117 are shown as carrying sealing strips 164 which cooperate with arcuate depressions 165 in the housing to seal the compartments from each other and reduce the possibility of suspended particles finding their way from the blasting zones to the openings 148, 149. The sides of the compartments can be sealed from each other by side sealing strips as shown in Fig. 1 or by using addition sealing flaps held so as to project from the side edge of the vane and engaging the inside surface of adjacent portions of the housing. To simplify the side sealing, the mating portions of the housing walls may be carried inwardly adjacent the side sealing portions of the respective vanes particularly at the side of the housing which faces the cylindrical flanges 121, inasmuch as at these positions the side sealing flaps must clear the inwardly projecting drive rollers 123.

To further simplify the sealing problem the drum carrying wheel 113 is arranged to rotate only in distinct and spaced steps rather than in a continual manner. By this technique, the blasting can be arranged to take place only between the steps while the wheel is in such position that the compartments are substantially sealed from each other. Suitable wheel stepping mechanism is shown in Figs. 4 and 5. An electric motor 245 is connected to rotate a crank pin 247. Journaled in an outer portion of the crank pin, as indicated at 251, is an adjustable advancing arm 253 which in turn pivotally connects at 254 to a ratchet arm 255 rotatably held by shaft 115. A ratchet dog 257 is carried by ratchet arm 255 and is urged by a spring, not shown, in clockwise direction as seen in Fig. 5 around pin 254. Fixed to shaft 115 is a ratchet wheel 259 the periphery of which has a plurality of spaced dog engaging grooves 261. One or more holding lugs 263 may be provided as shown to releasably engage in the ratchet wheel grooves and assure that the ratchet wheel does not rotate between steps.



Rotation of pin 247 causes advancing arm 253 to move through cycles of to and fro oscillation, carrying ratchet arm 255 and ratchet dog 257 through to and fro oscillating movement round shaft 115. The groove engaging end of dog 257 has its sides so shaped that a counterclockwise movement of dog 257 causes the dog to be lifted out of the groove 261 while the ratchet wheel is held in place by the lugs 263. The counterclockwise dog travel is arranged to be of sufficient extent to bring the driven end of the dog into the next groove 261. The engaging end of the dog is so shaped that clockwise movement of the dog from this position will cause the dog to overcome the holding forces of lugs 263 and rotate the ratchet wheel 259 one step. At the end of this step the lugs 263 again seat themselves into grooves while the ratchet dog 257 is returned in counterclockwise direction for the next advancing step.

In the machine shown in Figs. 3 to 6 inclusive, plates to be abraded may be loaded on a drum in compartment 201. From this position the first step of the wheel 113 will carry the plates to the compartment at position 202. Here they will be rotated by the drum 212 under the driving influence of roller 123, while blasting is effected by the nozzle assembly 130. The blasting nozzles are arranged to traverse longitudinally of the drum 212 during the drum rotation in the manner explained in connection with Fig. 1. After the desired blasting treatment at position 202, the wheel 113 is stepped bringing the plates now to position 203 where another blasting treatment is effected in a similar manner. At the end of the second blasting treatment, the plates are stepped to position 204 where they can be unloaded. The subsequent advancing step of wheel 113 carries the unloaded drum to position 205 where it is washed. The final step in the drum rotation carries the washed drum to position 201 where it is ready to receive the next set of plates.

A feature of this form of the invention is that the plates on one or more drums are continually being blasted and abraded while the plates on other drums are being unloaded or replaced. In addition, the loading can be entirely distinct from the unloading and, as shown, may even be on opposite sides of the machine so that one does not interfere with the other. This avoids the possibility of confusion between the supply of plates to be blasted and the withdrawal of the treated plates. One operator may be assigned the duty of loading while an entirely different operator does the unloading.

The blasting at positions 202 and 203 may be of identical or of different characteristics. If desired, the hopper 144 may be supplied with abrasive of different size and/or hardness so that the dual abrasion can be of varied nature. Al-

ternatively, only one of the compartments 202—203 may be used for abrasion at a time with the other held in reserve.

The present invention also encompasses modifications of the above machine. Thus, for example, a washing position may be inserted between the two successive blasting operations or after all blasting is completed and before articles blasted are unloaded.

The nozzle traverse of either of the above machines can be arranged so that with each turn of the drum shaft, the blast moves longitudinally a relatively small amount to give the desired overlap between successive turns of the spiral blasting trace. In this way one entire traverse of the nozzles will complete the abrading treatment. If desired, however, the plate to be treated may be given one or more repeat operations. The traverse mechanism may have a manual or automatic reversing arrangement, One suitable form for automatic traverse reversal is the reversible motor type of construction shown, for example, in Patent No. 2,495,269, granted January 24, 1950. Another convenient reversing mechanism is provided by having the thread on shaft 20 arranged in endless form so that it extends uniformly from one end to the other and then bends back and runs uniformly back to the first end where it again bends back and joins the beginning. In this construction the block 26 may be provided with a rotatable thread claw which is arranged to fit into the thread of shaft 20 and be carried by it from one end to the other and be rotated by the reversal of the thread to then follow the thread return path back along the shaft. This is the well known reversing mechanism commonly used in level winding mechanisms and needs no further description.

In the place of the threaded traversing shafts the machines may have a reciprocating belt drive for the nozzles, as shown in copending Huyett application Serial No. 103,710, filed July 8, 1949 which issued as Patent No. 2,590,819 on March 25, 1952.

By way of additional modification, the drums having the construction of Figs. 1 and 3 may be arranged for rotation in small steps with a complete traverse of the blasting nozzle assembly between steps to trace across the drum a set of parallel blasting lines having the desired overlap. This will also provide a uniformly abraded finish. If desired steam may be used as a blasting gas instead of all or part of the air. Alternatively, water under pressure will also do a good job of projecting the blasting mixture. The use of water as an impellant will dilute the mixture and make it advisable to withdraw the mixture collecting in the housing, separate out most of the water and supply the separated portions for reuse so that the grid is not subject to excessive dilution. For this purpose the blasting mixture is conveniently kept external of the housing and fed directly to the nozzles.

Either or both types of machines described above may have a viewing window which, as shown at 11 in Fig. 1, may be hinged in place and provided with a suitable locking device 13. This enables the window to be opened for simplifying maintenance such as replacement of the nozzles. To improve observation through the window, a window washing line 17 can be supplied to continually or periodically supply a washing fluid such as water over the transparent sections.



Figs. 1 and 2 also show a sheet washing line 19 equipped with nozzles 21 through which a washing liquid can be sprayed over the surface of the drum and any plate mounted through. As indicated above in connection with the construction of Figs. 3 to 6 inclusive, this simplifies clamping and unclamping of the work sheets and reduces the amount of abrasive clinging to the unlocked sheet after graining is completed.

In abrasive blasting machines such as those described above, it is highly desirable to protect mechanical drive elements such as the traverse shaft 20 and engaged block 26, against the abrading action. These elements are accordingly mounted externally of the housing in which the blasting is effected. This type of construction however calls for a communication passageway of some sort through which the external drive elements are connected to the internal nozzles. The construction of Fig. 1 has such a slot shown at 23. Although the use of a suction device as indicated above will keep back all air-suspended particles from escaping out through this slot, the presence of liquid in the blastant stream as well as the drum and filter washings will cause liquid to be thrown about the housing and to drain from the walls such as the rear housing wall 25. The draining liquid tends to escape through a conventional slot as by reason of surface tension effects and to carry along abrasive particles which work their way into closely fitting parts such as the threaded drive, and rapidly erode the threads.

A feature of the present invention is the offsetting of the slot in wall 25 so that the wall portion defining the lower edge of the slot extends further out from the center of the housing than the wall portion defining the upper edge of the slot. This serves to catch and trap all materials dripping down on wall 25 and prevents these materials from reaching the carriage traverse mechanism in any appreciable quantity.

To provide an abrasion-resistant and uniform work surface against which the plates are clamped and abraded, the drums such as drum 16 may have a suitably hard outer periphery of stainless steel for example. This is shown more clearing in Figs. 2*b* to 2*f* inclusive where an external coating sheet 35 of stainless steel is illustrated as fixed to the drum periphery, as by welding the stainless steel sheet around a suitably prepared drum surface.

An additional feature of the present invention is the ease with which work sheets of substantially any different size can be mounted in place on the drum by the mounting clamps. The clamping bar itself can, as pointed out above, be readily shifted to any portion of the drum periphery, while the individual fingers are easily and rapidly fixed anywhere along these rods. In other words, all that is needed is that a pair of clamping bars be applied to the drum and adjusted in position so that the length of the work sheet will be received between them. As many fingers are then applied to these bars as considered necessary to hold the longitudinal margins of the sheet in a suitable number of places. The clamping is readily accomplished in a few seconds and the unclamping is even more rapidly effected.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope hereof, it is to be understood that it is not limited to the

specific embodiments hereof, except as defined in the appended claims.

What is claimed is:

1. A lithographic plate graining machine for holding a plurality of lithographic plates and graining at least one plate while another is exchanged, said machine comprising a housing; a wheel rotatably mounted on a horizontal axis within the housing, said wheel presenting a plurality of axially-extending compartments disposed around the wheel periphery, and having vanes partitioning the compartments from each other; a plurality of drums, each positioned in a different compartment with its axis horizontal and each journaled for rotation about its axis, said drums having clamping elements for holding lithographic plates against their cylindrical external surface; blasting elements mounted within the housing for projecting a graining mixture toward portions of at least one drum when it is held by the wheel in a first part of the housing; driving mechanism connected for rotating the wheel, rotating the individual drums when they are in said part of the housing, and also traversing the blasting elements across the rotating drum to bring substantially all parts of a plate held on said drum in the path of the blast; and an uncovered opening in a second part of the housing opposite a portion of the wheel periphery, said opening being large enough to admit a lithographic plate for replacing a plate held on a drum when the drum is brought by the wheel to said second part of the housing.

2. The machine as defined by claim 1 and further including a second uncovered opening in a part of the housing approximately opposite the first opening, said second opening being also large enough to admit a lithographic plate, the driving mechanism being connected for rotating the wheel in steps, for rotating the individual drums when they reach the blasting position, and for automatic disengagement from the drums when they are stepped to positions adjacent the housing openings.

3. The machine as defined by claim 1 and further including a washing mechanism mounted within a portion of the housing for washing the drums when they are brought by the wheel to a position at an opening.

4. The machine as defined by claim 3 in which the blasting elements are positioned adjacent the low portion of the wheel, the housing includes a hopper at its lower portion to catch and collect blasting mixture dropping from the compartment having the drum being blasted, and all the compartments having sloping floors for guiding the washed-off mixture to a wash collector and preventing dilution of the collected blast mixture by the washing.

5. The machine as defined by claim 1 in which the compartment partitions carry sealing elements cooperating with the housing to reduce the leakage of blasting mixture from the blasting compartment to the plate-replacing compartment.

6. In an adjustable clamping device for rapidly clamping sheets of varying sizes to a surface of extended area with marginal flanges on opposite edges of the area, an elongated rod long enough to extend from one of said flanges to the other, clamping jaws secured to each end of the rod for selectively clamping the rod to the surface at any portion of the flanges, said rod having an elongated longitudinally extending seat, and a spring finger having a seat-engaging anchoring claw portion, a sheet-holding grip portion and a resilient structure connected to urge the claw portion into anchoring engagement with the seat and the grip portion in gripping engagement with a sheet held on said surface to fix the finger in place against any longitudinal portion of the seat and clamp in place correspondingly positioned portion of the sheet, and exposed manipulating structure connected to the resilient structure for manipulation to release the finger from anchoring engagement with the seat and enable rapid positioning and adjustment of the finger.

7. In an adjustable clamping device for rapidly clamping lithographic sheets of varying sizes to an elongated abrasive blasting machine drum having a flange on each end, an elongated rod long enough to extend from one of said flanges to the other, clamping jaws secured to each end of the rod for selectively clamping the rod to the surface at any portion of the flanges, at least one of the jaws being pivotally held on the rod for rapid engagement with and disengagement from a drum flange, said rod having an elongated longitudinally extending seat in the form of a pocket having its blind end facing the drum when the rod is clamped in place, and a spring finger having a seat-engaging anchoring claw portion, a sheet-holding grip portion and a resilient structure connected between the claw portion and the grip portion to urge the claw portion into anchoring engagement with the seat and the grip portion in gripping engagement with a sheet held on said drum to fix the finger in place against any longitudinal portion of the seat and clamp in place correspondingly positioned portion of the sheet, a portion of the grip structure being exposed for manipulation to release the finger from anchoring engagement with the seat and enable rapid positioning and adjustment of the finger.

8. In an abrasive blasting machine for graining lithographic plates of all sizes within a range of dimension limits, a cylindrical drum having an outer surface large enough to receive the largest plate, said drum being mounted for rotation about its cylindrical axis and having at each end axially directed flanges extending entirely around its periphery, the internal face of each flange having a tapering clamp guiding portion, a blasting structure for projecting a stream of abradant toward a portion of the cylindrical periphery of the drum, impelling mechanism connected to axially rotate the drum with respect to the blasting structure for presenting substantially the entire cylindrical periphery to the abradant stream, at least one adjustable clamp mounted on the drum to hold both ends of a lithographic plate in place, said clamp including an elongated rod extending from one of said flanges to the other, clamping jaws secured to each end of the rod and holding the rod against the drum by engagement against the tapering portion of the internal flange surface, said rod having an elongated longitudinally extending seat in the form of a pocket having its blind end facing the drum when the rod is clamped in place, and a spring finger having a seat-engaging anchoring claw portion, a sheet-holding grip portion and a resilient structure connected between the claw portion and the grip portion to urge the claw portion into anchoring engagement with the seat and the grip portion in gripping engagement with a sheet held on said drum to fix the finger in place against any longitudinal portion of the seat and clamp in place a correspondingly positioned portion of the sheet, a por-

tion of the grip structure being exposed for manipulation to release the finger from anchoring engagement with the seat and enable rapid positioning and adjustment of the finger.

9. In a wet blasting machine having automatically traversing nozzle mechanism extending through a traverse slot in the upwardly extending wall of a housing and externally driven for projecting a fluid stream of slurried abrasive particles against a wide surface contained in the housing to automatically sweep the stream over the surface, the improvement for reducing the passage of projected material from the housing through the slot to the nozzle driving mechanism outside of the slot, which improvement comprises the offsetting of the upwardly extending housing wall so that the portion defining the lower edge of the slot extends further out from the center of the housing than the wall portion defining the upper edge of the slot to catch all materials dripping down this wall.

10. The combination as defined by claim 9 in which the machine includes a suction device connected to suck air out of the housing and thereby draw air into the housing through the slot, and the slot provides a restricted air passageway which, together with all other openings in the housing walls, totals not more than about 10 square feet of passageway cross section per horsepower of the suction device.

11. In a wet abrasive-particle blasting apparatus, an enclosed housing, a wall surface in said housing, an uncovered loading port formed in said wall surface, a work carrier positioned within said housing adjacent said port but spaced therefrom at all points to form a continuous uncovered gap between said carrier and said wall all around the periphery of said port, blasting means including abrasive particles and liquid supply elements positioned within said housing on the side of the carrier opposite to the side facing said port, for projecting a slurry of abrasive particles at said carrier, and suction means connected to the interior of said housing for producing an air current stream from outside the housing through said port and said gap to the interior of the housing, said air current opposing and preventing egress of debris and abrasive particles from said housing through said uncovered port.

12. The combination set forth in claim 11 in which said work carrier is a drum and has clamping structure positioned on the periphery thereof for removably securing work articles thereto.

13. The combination set forth in claim 12 in which said port is about as large as said drum and the gap is large enough to pass the clamping structure.

14. In an abrasive-particle blasting apparatus, an enclosed housing, a wall surface in said housing, an uncovered loading port formed in said wall surface, a cylindrical work carrier positioned within said housing adjacent said port but spaced therefrom at all points to form a continuous uncovered gap between said carrier and said wall all around the periphery of said port, blasting means positioned within said housing on the side of the carrier opposite to the side facing said port for projecting a slurry of abrasive particles at said carrier, and suction means connected to the interior of said housing for producing an air current stream from outside the housing through said port and said gap to the interior of the housing, said air current opposing and preventing egress of debris and abrasive particles from said housing through said uncovered port, and an additional egress-blocking structure within the housing in the form of a vane fixed in place with an edge positioned adjacent the work carrier to provide an additional baffle restricting the path for the escape of particles from the blasting zone.

15. In a wet abrasive particle blasting apparatus, an enclosed housing, a wall surface in said housing, an uncovered loading port formed in said wall surface, a cylindrical work carrier positioned within said housing with part of its cylindrical face adjacent said port but spaced therefrom at all points to form a continuous uncovered gap between said carrier and said wall all around the periphery of said port, blasting means including abrasive particle and liquid supply elements positioned within said housing on the side of the carrier opposite to the side facing said port for projecting a slurry of abrasive particles at said carrier, and suction means connected to the interior of said housing for producing an air current stream from outside the housing through said port and said gap to the interior of the housing, said air current opposing and preventing egress of debris and abrasive particles from said housing through said uncovered port, a portion of the housing adjacent the port being curved to follow the cylindrical contour of the carrier and also limit the width of the gap.

WILTIE I. GLADFELTER.
RALPH R. GARVER.

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