

Nov. 28, 1950

O. E. ZAHN
GRAINING OR ABRADING LITHOGRAPHIC PLATES OR THE
LIKE BY CENTRIFUGAL BLAST OF WET SLURRY

2,532,136

Filed March 17, 1949

5 Sheets-Sheet 1

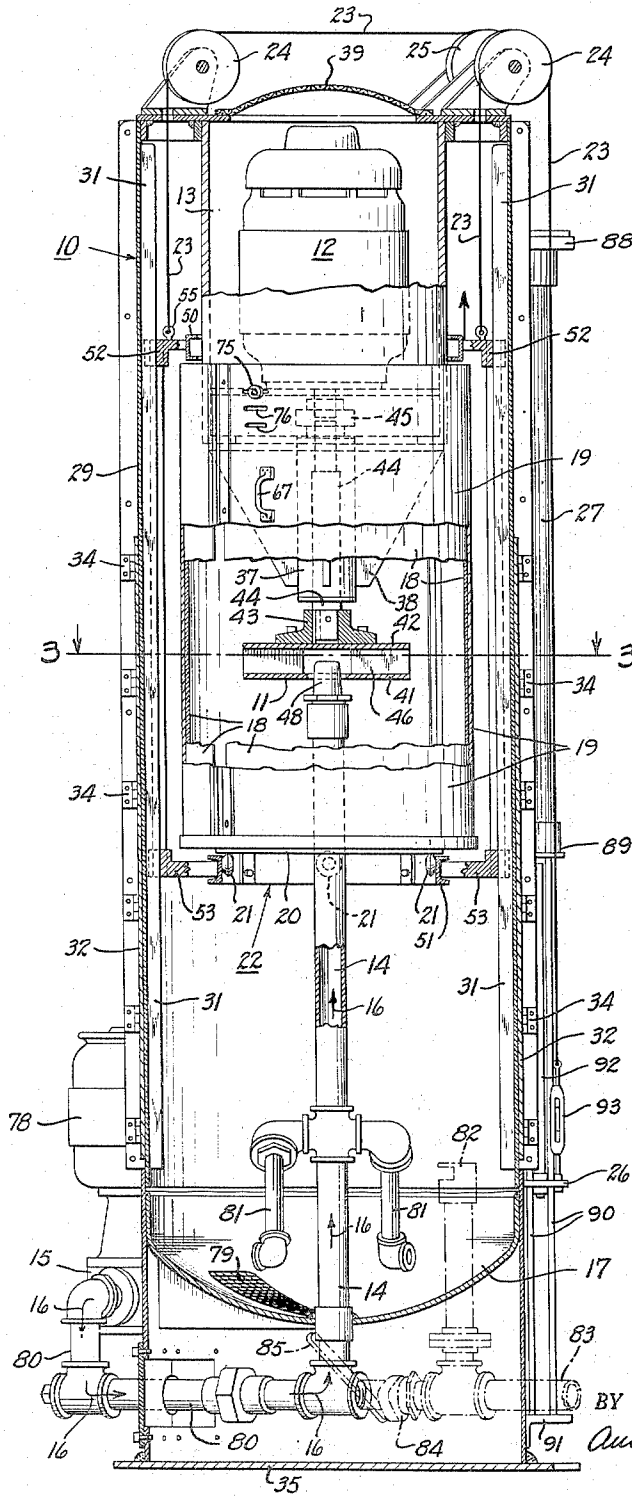


Fig. 1

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5 Sheets-Sheet 2

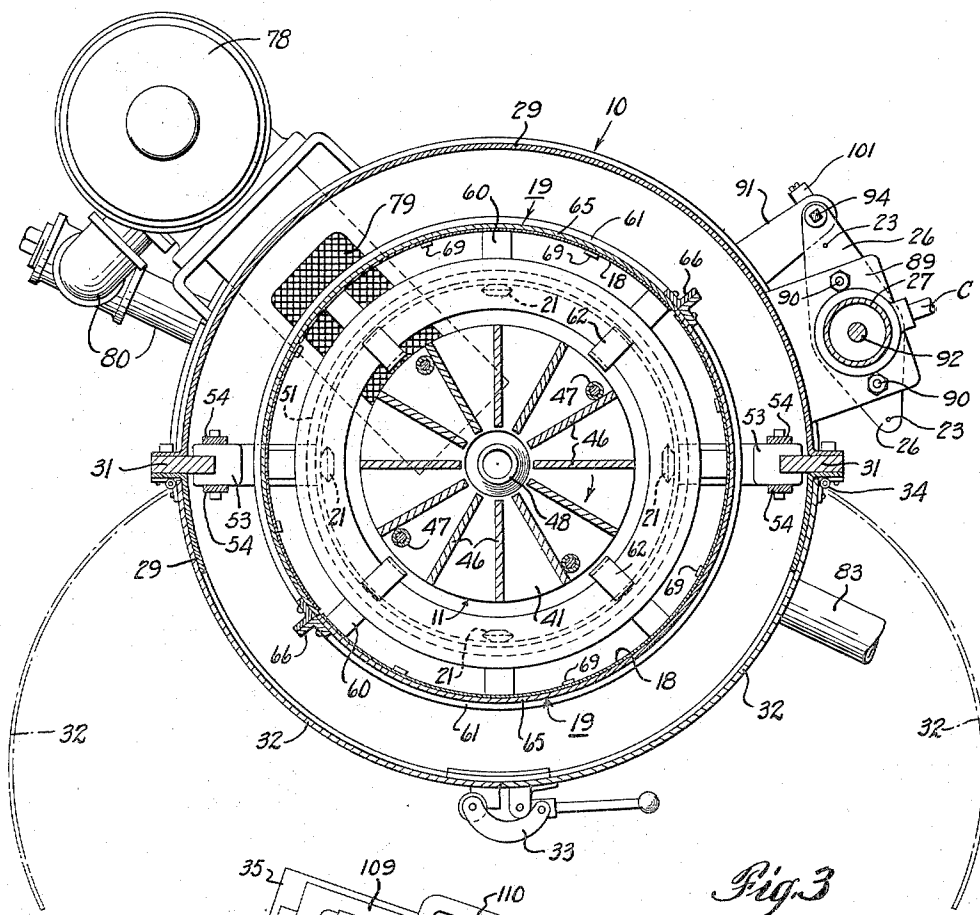


Fig. 3

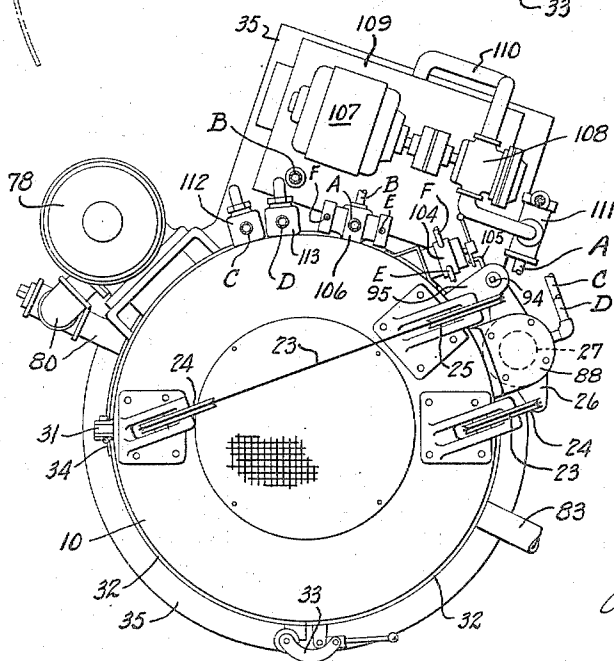


Fig. 2

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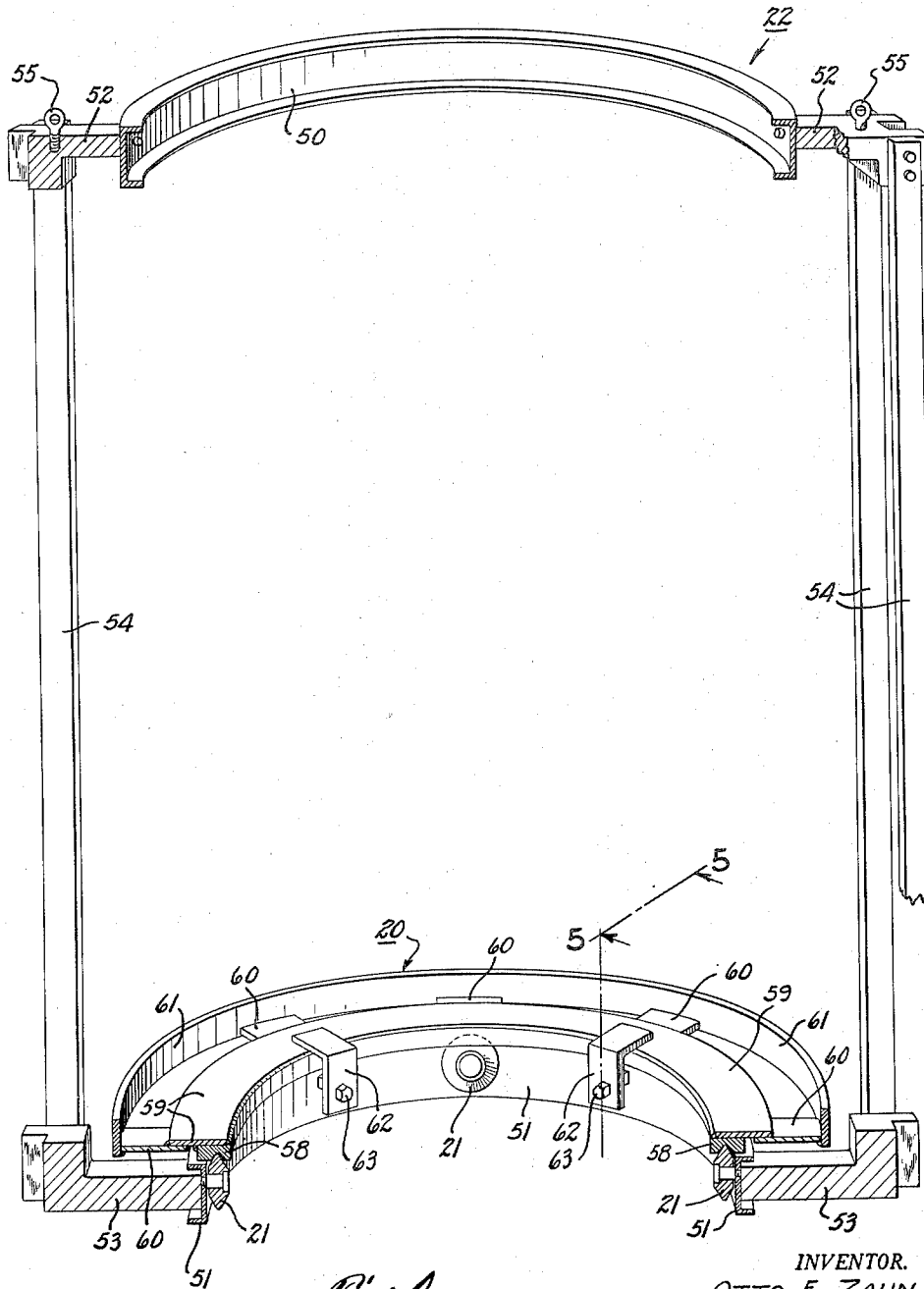
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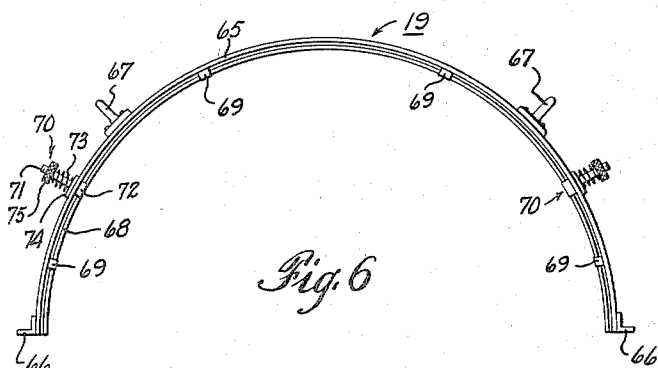


Fig. 6

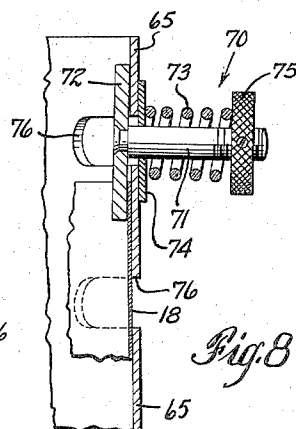


Fig. 8

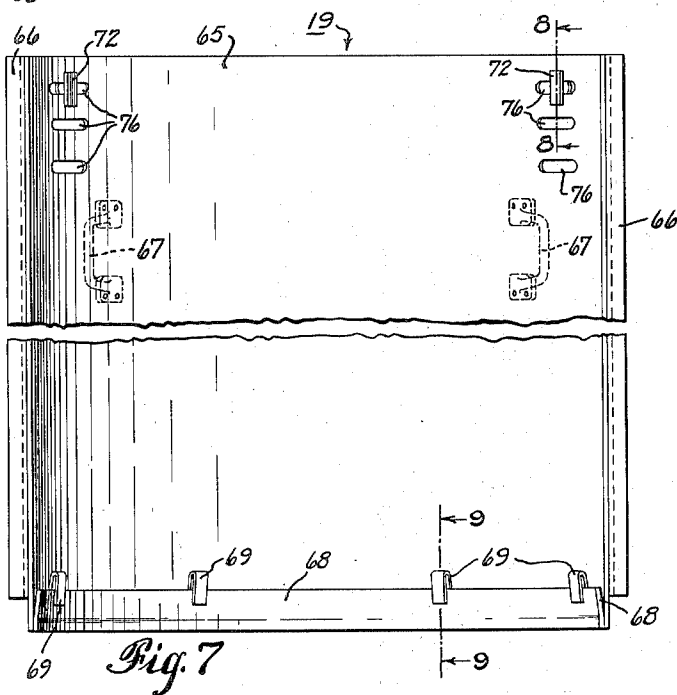


Fig. 7

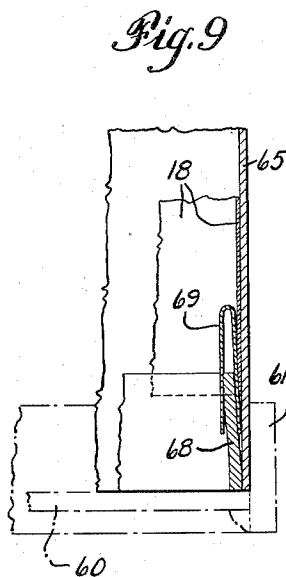


Fig. 9

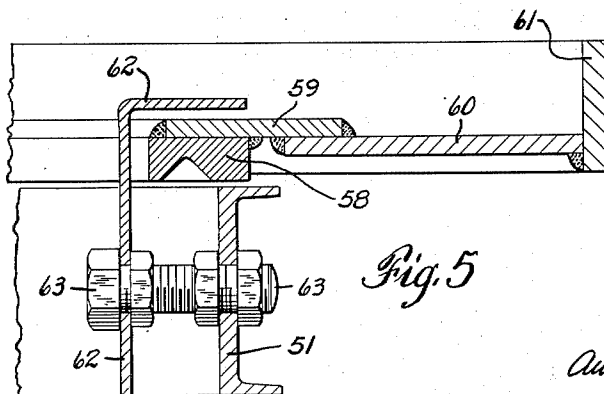


Fig. 5

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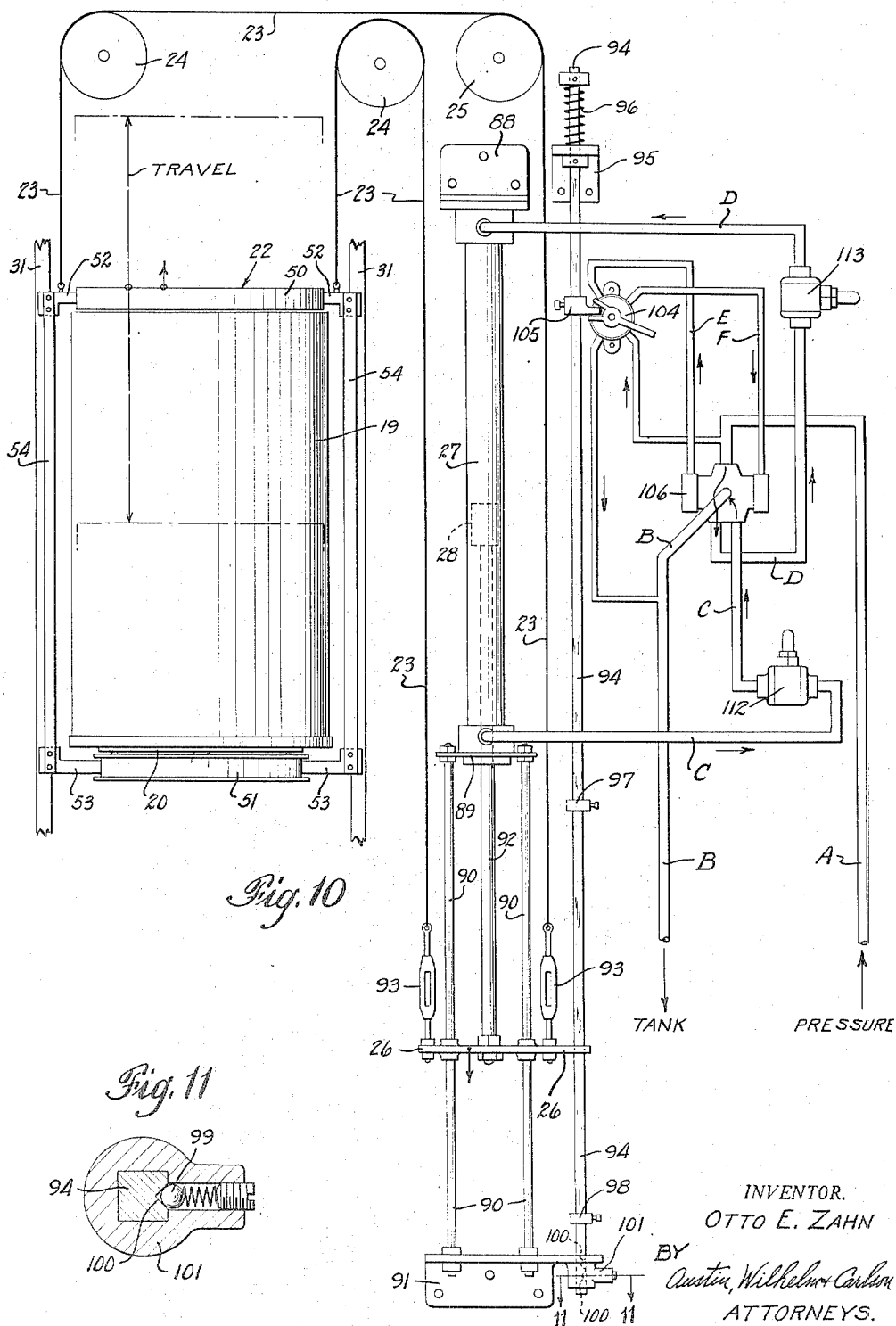
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UNITED STATES PATENT OFFICE

2,532,136

GRAINING OR ABRADING LITHOGRAPHIC
PLATES OR THE LIKE BY CENTRIFUGAL
BLAST OF WET SLURRY

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Application March 17, 1949, Serial No. 81,896

11 Claims. (Cl. 51—9)

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The invention relates to the abrading or grain-
ing of surfaces and, more particularly, to the art
of graining lithographic sheets.

It is common practice to "grain" or roughen
the surfaces of metallic sheets or plates for
lithographic purposes, to make the liquid recep-
tive areas accept and hold moisture more easily
and uniformly.

An object of the invention is to produce a
method, and machine, for graining such plates
more quickly and less expensively than is possible
with present commercial practices.

According to a preferred manner of practicing
the invention, the sheet is abraded by the use
of a slurry comprising a suitable vehicle, such as
water, in which is suspended a suitable graining
or abrading agent, such as fine iron grit. The
slurry is fed into a blast wheel which discharges
the material at high velocity against the surface
of the sheet.

According to a preferred form, the machine for
practicing the invention comprises, essentially, a
vertical cabinet in which an elevator is reciproc-
ated up and down. On the elevator is mounted
a rotary turntable. On the turntable is mounted
a plurality of cylindrical plate holders or shells.
Each plate holder has devices for supporting
cylindrical plates to be grained. Mounted in the
cabinet, and concentrically of the elevator, is a
horizontally disposed, non-directional blast
wheel. The blast wheel is adapted to discharge
a slurry horizontally, and uniformly about its
entire periphery, against the cylindrical plates,
as they are moved back and forth in the path of
the blast. Suitable means for driving the elevator
are provided, including a hydraulic servomotor
arrangement. Suitable means is also provided
for feeding and circulating the slurry and for
keeping it stirred up. Such circulatory system
comprises an upstanding feed pipe feeding into
the open center of the blast wheel. The spent
slurry drops to the bottom of the cabinet where
it is caught in a sump. The spent slurry is drawn
off by a circulatory pump which feeds the up-
standing feed pipe. Suitable stirring pipes are
branched off from the feed pipe to bypass part
of the slurry back into the sump, the discharge
being in such direction as to keep the slurry
stirred up.

The invention also consists in certain new and
original features and combinations hereinafter
set forth and claimed.

Although the novel features which are believed
to be characteristic of this invention will be par-
ticularly pointed out in the claims appended

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hereto, the invention itself, as to its objects and
advantages, and the manner in which it may be
carried out, may be better understood by referring
to the following description taken in connection
with the accompanying drawings forming a part
hereof, in which:

Fig. 1 is a vertical central section, partly in
elevation, of the complete machine;

Fig. 2 is a top plan view of the complete ma-
chine, with certain of the piping omitted;

Fig. 3 is a plan section along line 3—3 of Fig. 1,
taken through the blast wheel;

Fig. 4 is an enlarged half section, in perspec-
tive, of the reciprocating elevator;

Fig. 5 is a fragmentary detail section, taken
along line 5—5 of Fig. 4, showing the construc-
tion of the rotatable carriage or turntable, in
relation to the lower supporting ring of the ele-
vator;

Fig. 6 is a plan view of one of the plate holders;

Fig. 7 is an elevation of a plate holder, viewing
it from the inside;

Fig. 8 is a fragmentary section taken along line
8—8 of Fig. 7, showing a releasable holding mem-
ber for the top edge of the plate to be processed;

Fig. 9 is a fragmentary section taken on the
line 9—9 of Fig. 7, showing spring clips along
bottom ring of the plate holder which hold the
work plate in place;

Fig. 10 is a schematic view illustrating the hy-
draulic system utilized for reciprocating the ele-
vator; and

Fig. 11 is a detail plan section taken along line
11—11 of Fig. 10, showing the ball detent for
yieldably maintaining upper and lower position
of pilot valve actuator rod.

In the following description and in the claims,
various details will be identified by specific
names for convenience, but they are intended to
be as generic in their application as the art will
permit.

Like reference characters denote like parts in
the several figures of the drawings.

In the drawings accompanying and forming
part of this specification, certain specific disclo-
sure of the invention is made for purposes of ex-
planation, but it will be understood that the de-
tails may be modified in various respects with-
out departure from the broad aspect of the in-
vention.

The machine will first be described generally.

The machine comprises, in general, a vertical
cylindrical tank or cabinet 10 in which is mount-
ed the centrifugal blast wheel 11; the blast wheel
is driven by the electric motor 12 secured in mo-

tor housing 13. Slurry is fed upwardly to the center of the blast wheel 11 by a feed pipe 14; pipe 14 receives discharge from a centrifugal slurry pump 15, arrows 16 indicating direction of slurry flow. Spent slurry is caught in the bottom of the sump 17 whence it flows back into slurry pump 15.

Two lithograph plates 18 are mounted in two, half-cylindrical, plate holders 19 (see also Figs. 6, 7 and 9) which are supported on a rotary turntable 20. The turntable 20 is mounted on four rollers 21 which in turn are mounted at the bottom of an elevator cage 22.

The elevator cage 22 is supported by two lines or cables 23 running over pulleys 24, 25 mounted at the top of the cabinet; these lines extend to a power-driven, vertically-movable yoke 26 (see Fig. 10) for reciprocating the cage vertically. The yoke 26 is driven by a hydraulic engine comprising a cylinder 27 having a piston 28. Hydraulic pressure is supplied alternately to the ends of the cylinder by a suitable hydraulic servomotor mechanism.

Thus, by driving the blast wheel to discharge slurry, and by vertically reciprocating the elevator cage, all parts of the lithographic plates may be subjected to the action of the slurry and suitably grained.

The machine will now be described more in detail.

As shown particularly in Figs. 1, 2 and 3, the cabinet 10 has an upright cylindrical configuration; it comprises a generally cylindrical wall 29 suitably supported by structural frame members on a base 35. The structure includes the vertical elevator rails 31. Near the bottom is a dished wall 17 forming a sump to hold the spent slurry. The interior of the cabinet is accessible through a large front opening closed by two swinging doors 32. The doors are hinged to the cabinet near the elevator rails 31 by a series of hinges 34. The doors are held closed by a series of door clamps 33. The height of the opening is made slightly smaller than the height of the doors 32. The doors are opened to insert and remove the lithographic plates and are closed to confine the slurry to the inside of the cabinet.

The cylindrical motor housing 13 depends from the top of the cabinet, forming an annular space with the side walls of the cabinet to permit telescopic movement of the elevator, as discussed below. The bottom of the motor housing 13 is closed and from it depends a bearing tube 37. The bearing tube 37 is strengthened by a series of triangular gussets 38 secured to the bearing tube and to the bottom of the motor housing 13.

The electric motor 12 is suitably supported in the housing 13. A direct coupling 45 connects the motor shaft and extension shaft 44. Shaft 44 is journaled in the bearing tube 37. A screen 39 provides a ventilating opening for the motor. The rest of the motor housing is enclosed to protect it from the slurry.

Supported on the lower end of the extension shaft 44 is the horizontal blast wheel 11. This wheel may be of any suitable construction adapted to deliver a horizontal blast for the entire 360° of its circumference.

In its present form, the blast wheel 11 is made up of a lower plate 41 and an upper plate 42 to which the hub 43 is secured. The hub is suitably keyed on shaft 44. Between plates 41 and 42 are a series of radial blades 46 (Fig. 3) extending from a point spaced from the center to the periphery of the plates. These blades are suitably

clamped between the plates 41, 42 by suitable clamping devices indicated by 47. A discharge fitting 48, supported at the top of slurry feed pipe 14, passes through a concentric hole in the bottom of lower plate 41 into the open hub of the wheel.

It will be understood that, as slurry is fed under pressure upwardly through feed tube 14 and as the blast wheel is rotated at centrifugal discharging speed, the slurry will be fed equally to the inner ends of the several blades 46. The blades 46 pick up the slurry and discharge it at high speed continuously, throughout the entire circumference of the wheel, against the lithographic plates, as explained more fully below.

Referring now more particularly to Figs. 4 to 9, the elevator cage 22 comprises an upper ring 50 and a lower ring 51 suitably connected by pairs of vertical tie strips 54. The upper and lower rings are suitably made by bending channel stock as shown.

The upper ring 50 connects with guide shoes 52 having slots embracing the elevator rails 31. Similarly, the lower ring 51 has lower shoes 53. As shown, these shoes connect the upper and lower rings with the vertical tie strips 54. The upper shoes 52 have eye bolts 55 for connection to the supporting cables 23.

The lower ring 51 has four rollers 21 for supporting the turntable 20. Turntable 20 is made up of a track member 58 having an annular groove in which the rollers 21 ride. Secured to track 58 is a flat ring 59; ring 59 is secured to an upstanding collar 61 by a series of radial spacing strips 60. Track member 58, flat ring 59, spacing strips 60 and collar 61 are suitably welded together. Four retaining angles 62 are supported by adjusting bolt assemblies 63 secured to lower ring 51. These angles are spaced slightly from the turntable and are for the purpose of preventing the turntable 20 from being tipped or lifted off the rollers 21.

Removably resting on the turntable 20 are the two semi-cylindrical plate holders 19 (see particularly Fig. 9). As shown in Figs. 6 and 7, each plate holder 19 comprises a curved steel sheet 65 having its vertical margins suitably reinforced by angle strips 66. Handles 67 are provided for lifting the plate holders off the turntable 20.

For removably supporting the lithographic strips to be grained, the plate holder 19 is provided with a lower holding ring 68; the upper edge of ring 68 is suitably offset from the cylindrical plate 65 to provide a space in which the lithographic plate is inserted. A series of U-shaped spring clips 69 engage in this annular space to facilitate insertion of the lithographic plates in position on the holder plates and the removal therefrom.

The upper edge of the lithographic plate is held in position by a plurality of T-clamps 70 (see also Fig. 8). Each of these clamps comprises a shank 71 and a cross piece 72 suitably secured thereto, and a knurled nut 75 threaded on the shank 71. A spring 73 acts between a washer 74 and nut 75. The plate holder 19 has a series of slots 76 at different levels through which the T-clamps are inserted, depending upon the height of the lithographic plates. It will be understood that the cross piece 72 is inserted through the particular slot 76 and the T-clamp turned to engage over the upper edge of litho plate 18, as indicated especially in Fig. 8.

The slurry circulatory system is as follows. Mounted at the side of the cabinet, and down near

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the bottom, is a centrifugal slurry pump 15; pump 15 is direct coupled with an electric drive motor 78. The pump 15 discharges through piping 80 in the direction of arrows 16 to the riser pipe 14.

Intersecting the riser pipe 14 are a series of bypass pipes 81. These pipes project downwardly at an angle to the riser pipe 14 and terminate in open elbows, as shown particularly in Fig. 1. It is preferred to use three equally spaced stirring pipes 81; only two pipes are shown for simplicity of illustration. Any suitable number may be used, the object being to bypass some of the slurry back into the slurry tank or sump 17 to keep the slurry stirred up, to prevent solid particles from settling out from the liquid vehicle.

The discharge pipe 80 connects with a drain pipe 83 through a normally closed gate valve 84; valve 84 is suitably controlled by a lever 85. An overflow pipe 82 connects with drain pipe 83 to limit the height of the slurry in the bottom of the cabinet.

The bottom of sump 17 is provided with an outlet communicating with the inlet of slurry pump 15; the outlet is covered by a screen 79.

The slurry circulates as follows. The pump 15 draws slurry from the sump 17 through screen 79, discharges it through pipe 80 into riser pipe 14. The pipe 14 feeds the wheel 11. The rotating wheel discharges the slurry against the work, whence the spent slurry drops to the bottom of the cabinet where it is re-circulated. Part of the slurry is bypassed through the stirring pipes 81 whose outlets are directed at such a tangential angle with respect to the circular sump as to keep the slurry stirred.

While the blast wheel 11 is discharging slurry, the elevator cage is being reciprocated up and down to expose all parts equally of the litho plate to the graining action of the slurry. The elevator is shown in the figures on its way up.

The elevator cage 22 is reciprocated automatically in any convenient manner. In the form shown, a standard hydraulic servomotor mechanism is used which is especially adapted for this particular purpose. The servomotor mechanism comprises a cylinder 27 suitably mounted at the side of the tank by upper and lower brackets 88 and 89. See also Fig. 10 where the parts are shown somewhat diagrammatically to facilitate description and understanding of the invention.

Stationary slide rods 90 connect bracket 89 and a lower bracket 91 also secured to the tank. A yoke 26 slides vertically on rods 90; the yoke is connected to piston rod 92 secured to piston 28 slidable in cylinder 27. Turnbuckles 93 connect the lines or cables 23 to the yoke 26. These cables pass over the pulleys 24 and 25 journaled at the top of the tank and down into the tank, as indicated particularly in Figs. 1 and 2. In Fig. 10 the parts are shown with the hydraulic fluid forcing piston 28 downwardly, which in turn pulls cage 22 upwardly.

The control mechanism includes a control rod 94 slidable in bracket 91 and in an upper bracket 95 also secured to the side of the tank. A balance spring 96 balances the weight of the rod 94. Rod 94 carries adjustable collars 97 and 98 which are engaged by yoke 26 to limit the stroke of the servomotor 27, 28. Collars 97 and 98 are adjustable on actuating rod 94 to limit the stroke from substantially maximum position, as shown in the drawings, to a smaller stroke which can be obtained by moving the adjustable collars 97 and 98 toward each other.

A detent arrangement yieldably holds the con-

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trol rod 94 in upper or lower position. (See also Fig. 11.) The detent includes a spring pressed ball 99 slidably mounted in a fitting 101 secured to bracket 91. The ball 99 yieldably engages a pair of notches 100 in actuating rod 94. Thus, when yoke 26 engages lower collar 98, it will push rod 94 downwardly to cause the ball 99 to engage in the upper notch 100 to yieldably hold the actuating rod 94 in lower position. Similarly, when yoke 26 engages upper collar 97, it pushes rod 94 upwardly to engage ball 99 in the lower notch 100 to hold the rod 94 in the upper position shown in Fig. 10.

Liquid to the hydraulic motor 27, 28 is admitted through pipes C and D. These pipes alternately apply pressure to the ends of the cylinder 27 simultaneously exhausting the other end of the cylinder.

Liquid flow is controlled by a four-way pilot valve 104 which is operated by a lug 105 secured to the actuating rod 94. Pilot valve 104 is thus operated between two positions to operate a standard four-way main valve 106 which controls the flow through pipes C and D, as explained below.

As part of the hydraulic control system, a hydraulic pump 108 is mounted on a hydraulic tank 109 alongside the cabinet (see Fig. 2). The hydraulic pump 108 is driven by an electric motor 107. The pump draws liquid from tank 109 through suction pipe 110 and discharges through a pressure relief valve 111 to pipe A. Pipe A feeds main valve 106 and pilot valve 104, as shown by the direction of the arrows in Fig. 10. Pipe B is an exhaust pipe taking liquid from main valve 106 and pilot valve 105 back to tank 109.

Pipe C connects the lower end of cylinder 27 and main valve 106 through a throttle valve 112; pipe D connects the upper end of cylinder 27 and main valve 106 through a second throttle valve 113. These throttle valves are of standard construction. They may be adjusted to variably throttle the hydraulic fluid being fed to the cylinder 27 and in this way the speed of movement of the servomotor 27, 28 may be controlled. Regardless of throttle adjustment, the valves 111 and 112 always pass freely exhaust fluid. Thus, by adjusting throttle valves 112 and 113, the speed of movement of the servomotor 27, 28 may be adjusted.

The several valves, viz.: pilot valve 104, main valve 106 and throttle valves 112, 113 are of standard construction. It is thought that their operation will be obvious from the following description.

The arrows on the several pipes A, B, C and D indicate flow of liquid to move the piston 28 downwardly, as shown in Fig. 10. The pilot valve 104 has previously been operated to the position shown to place main valve 106 in the position shown. Liquid thus flows through pipe A in the direction of the arrows, through main valve 106 to pipe D to the upper end of the cylinder 27. Exhaust fluid passes from the lower end of cylinder 27 through pipe C, main valve 106 to return pipe B.

When yoke 26 reaches collar 98, it pushes control rod 94 down to engage the upper notch 100 with detent ball 99. This pulls collar 105 down to operate pilot valve 104. This reverses the flow through pipes E and F to reverse the position of main valve 106. This causes liquid pressure to be applied to pipe C to force piston 28 upwardly and, permits the upper end of the cylinder 27 to exhaust through pipe D.

Operation of machine

One method of operating the graining machine is as follows. The slurry motor 78, the hydraulic motor 107 and the blast wheel motor 12 may be all separately controlled.

Assuming that all of the motors are stopped and that it is desired to insert new plates to be grained, the cabinet doors 32 are opened and the plate holders 19 are removed from the cabinet; the turntable 20 facilitates removal. The two lithograph plates 18 to be grained are set and secured in their plate holders 19 and the plate holders, in turn, are set on the turntable 20 to form a complete cylinder. The first plate holder is inserted first; the turntable is turned 180° and the second plate holder is then placed in position. It is only necessary to close the cabinet doors and the machine is ready for operation.

The machine may be started in the following order. The blast wheel motor 12 may be first started, then the hydraulic motor 107 and the servomotor 27, 28, then the slurry pump motor 78. The lithograph plates may be subjected to the blast of slurry for any desired length of time. The amount of graining is determined by the plate grainer or operator of the machine. Tests have shown that some plates may be grained in as little as three minutes while others take longer.

The machine may be stopped, after a plate is grained, by first stopping the elevator, then the blast wheel and last the slurry pump using the slurry to brake the wheel.

The control of the elevator speed is set by adjusting the throttle valves 112 and 113. When the valves are opened, the elevator travels faster, and vice versa. The depth of the grain may be controlled in various ways: by slow or fast travel of the elevator, by change from short to longer blades in the blast wheel, or by the number of passes or reciprocations of the elevator.

Thus the invention provides a small, compact machine using a wet process. It grains plates more uniformly, faster, and more cheaply. Tests have shown that desired grain can be obtained from about three or four minutes to about twelve minutes of operation, depending upon whether plate to be grained is a new plate, an albumin plate or a deep etch plate.

The present machine can produce a grain on zinc, aluminum, copper or stainless steel plates. Any desired grain size can be obtained by changing the size of the abrasive. There is no vibration. All of the fast moving parts rotate and are balanced, and the only reciprocating parts move at slow speed. There is no dust. All of the wet abrasive slurry is contained within the cabinet of the machine.

The type of slurry may be varied according to conditions. Excellent results have been obtained using a very fine iron grit suspended in water with caustic to remove albumin, a rust inhibitor and a wetting agent. However, many of the slurries, that are now used with conventional horizontal, vibrating tray-type litho-plate graining machines, may also be used to practice the invention.

The present machine produces a much more uniform grain than conventional machines; and because of the great uniformity of grain, it has been found that less water is necessary in the printing process which is very desirable because sharper images are produced.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that

various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a graining machine, an upright, substantially cylindrical cabinet, a non-directional blast wheel whose plane is substantially horizontal, means for rotating said wheel, said wheel comprising a plurality of substantially radial blades and having an open center, a feed conduit feeding material to said open center, means for feeding a slurry of liquid and solid particles to said conduit, an elevator cage having means for supporting the plate to be grained, and means for reciprocating said cage up and down in a path surrounding said wheel to subject substantially all parts of the work plate to said slurry blast.

2. In a blasting machine, a cabinet, a cage, means for reciprocating said cage axially, a turntable rotatably mounted on said cage, a set of plate holders resting on said turntable, said plate holders each having means for supporting a plate to be blasted, and means inside said cage for blasting said plates.

3. In a graining machine, an upright cabinet, an elevator cage having shoes, said cabinet having guide rails on which said shoes ride, sheaves journaled on the top of said cabinet, lines passing over said sheaves connecting said elevator cage, means connected to said lines for reciprocating said cage up and down, said cage including a lower supporting ring, rollers rotatably mounted on said ring, a turntable having a track member provided with an annular groove riding on said rollers, a set of plate holders resting on said turntable, said plate holders each having means for supporting a plate to be grained, and means for blasting said plates.

4. In a blasting machine, a cabinet, a motor housing supported from the end of said cabinet, said housing having an open end but otherwise being substantially closed, an electric motor in said housing having a shaft passing through the wall thereof, a blasting device on said shaft, a cage, means for supporting the plate to be blasted on said cage, means for reciprocating said cage into the annular space between said motor housing and cabinet wall to expose all parts of the plate to the action of said blast device.

5. In a lithographic plate graining machine, an upright cabinet, a motor housing suspended from the top of said cabinet, said housing having an open top but otherwise being substantially closed, an electric motor in said housing having a depending shaft passing through the bottom thereof, a blast device on said shaft, an elevator cage having shoes, guide rails inside said cabinet on which said shoes ride, means for supporting the plate to be grained on said cage, means for reciprocating said cage into the annular space between said motor housing and cabinet wall to expose all parts of the plate to the graining action of said blast device.

6. In a blasting machine, a plate holder for holding a lithographic plate or the like, said plate holder comprising a cylindrical sheet, a lower holding ring secured to the lower edge of said sheet, the upper edge of the ring being offset from the cylindrical sheet to provide an annular holding space, the upper end of said sheet having a series of slots at different levels, a series of clamps each comprising a shank and a head, each said shank having an abutment and a

spring surrounding the shank engaging said abutment, whereby the lower edge of the lithographic plate may be inserted in said annular holding space and the heads of said clamps may be inserted in appropriate slots and engaged over the upper margin of said lithographic plate.

7. In a graining machine, a plate holder for holding a lithographic plate or the like, said plate holder comprising a cylindrical sheet having reinforced straight margins, a holding ring secured to the lower margin of said sheet, the upper edge of the ring being offset from the cylindrical sheet to provide an annular holding space, a series of U-shaped clips engaged in said annular space, the upper end of said cylindrical sheet having a series of slots at different levels, a series of T-clamps each comprising a shank and a cross piece, each said shank having an abutment and a spring surrounding the shank engaging said abutment, whereby the lower edge of the lithographic plate may be inserted in said annular holding space and the cross piece of said T-clamps may be inserted in appropriate slots and engaged over the upper margin of said lithographic plate.

8. In a lithographic plate graining machine, an upright cabinet having a sump, a blast wheel journaled in said cabinet, said wheel comprising a series of blades and having an open center, a feed pipe having its end communicating with said open center, a slurry pump having an intake conduit communicating with said sump and a discharge conduit communicating with said feed pipe, an elevator cage surrounding said wheel, said cage having means for supporting a plate to be grained, and means for reciprocating said cage axially of the wheel.

9. In a lithographic plate graining machine, an upright cabinet having a sump, a blast wheel journaled in said cabinet, said wheel comprising a series of blades and having an open center, an upstanding feed pipe projecting up from the sump and having its end communicating with said open center, a slurry pump having an intake conduit communicating with said sump and a discharge conduit communicating with said feed pipe, said feed pipe having a series of stirring pipes having outlets directing streams into said sump to stir the slurry therein, an elevator cage surrounding said wheel, said cage having means for supporting a plate to be grained, and means for reciprocating said cage axially of the wheel.

10. In a blasting machine, an upright, generally cylindrical cabinet having a bottom constituting a sump, a motor housing suspended from the top of the cabinet, an electric motor in said housing having a shaft passing through the bottom thereof, a blast wheel on said shaft, said wheel comprising a series of blades and having

an open center, an upstanding feed pipe having its end communicating with said open center, a slurry pump having an intake conduit communicating with said sump and a discharge conduit communicating with said feed pipe, an elevator cage having shoes, guide rails projecting from the inside wall of said cabinet on which said shoes ride, means for reciprocating said cage up into the annular space between said motor housing and cabinet wall and down below said sump, a turntable rotatably mounted on said cage, a set of plate holders mounted on said turntable, said plate holders each having means for supporting a plate to be blasted.

11. In a lithographic plate graining machine, an upright, generally cylindrical cabinet having a bottom constituting a sump, a motor housing suspended from the top of the cabinet, said housing having an open top but otherwise being substantially closed, an electric motor in said housing having a depending shaft passing through the bottom thereof, a blast wheel on said shaft, said wheel comprising a series of radial blades and having an open center, an upstanding feed pipe having its end communicating with said open center, a slurry pump having an intake conduit communicating with said sump and a discharge conduit communicating with said feed pipe, said feed pipe having a series of tangentially discharging stirring pipes immersed in the pool of slurry in said sump, an elevator cage having shoes, guide rails projecting from the inside wall of said cabinet on which said shoes ride, sheaves journaled on the top of said cabinet, lines passing over said sheaves connecting said elevator cage, means connected to said lines for reciprocating said cage up into the annular space between said motor housing and cabinet wall and down to said sump, said cage including a lower supporting ring, rollers rotatably mounted on said ring, a turntable having a track member provided with an annular groove riding on said rollers, a pair of semi-cylindrical plate holders resting on said turntable, said plate holders each having means for supporting a semi-cylindrical plate to be grained.

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REFERENCES CITED

The following references are of record in the file of this patent:

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