

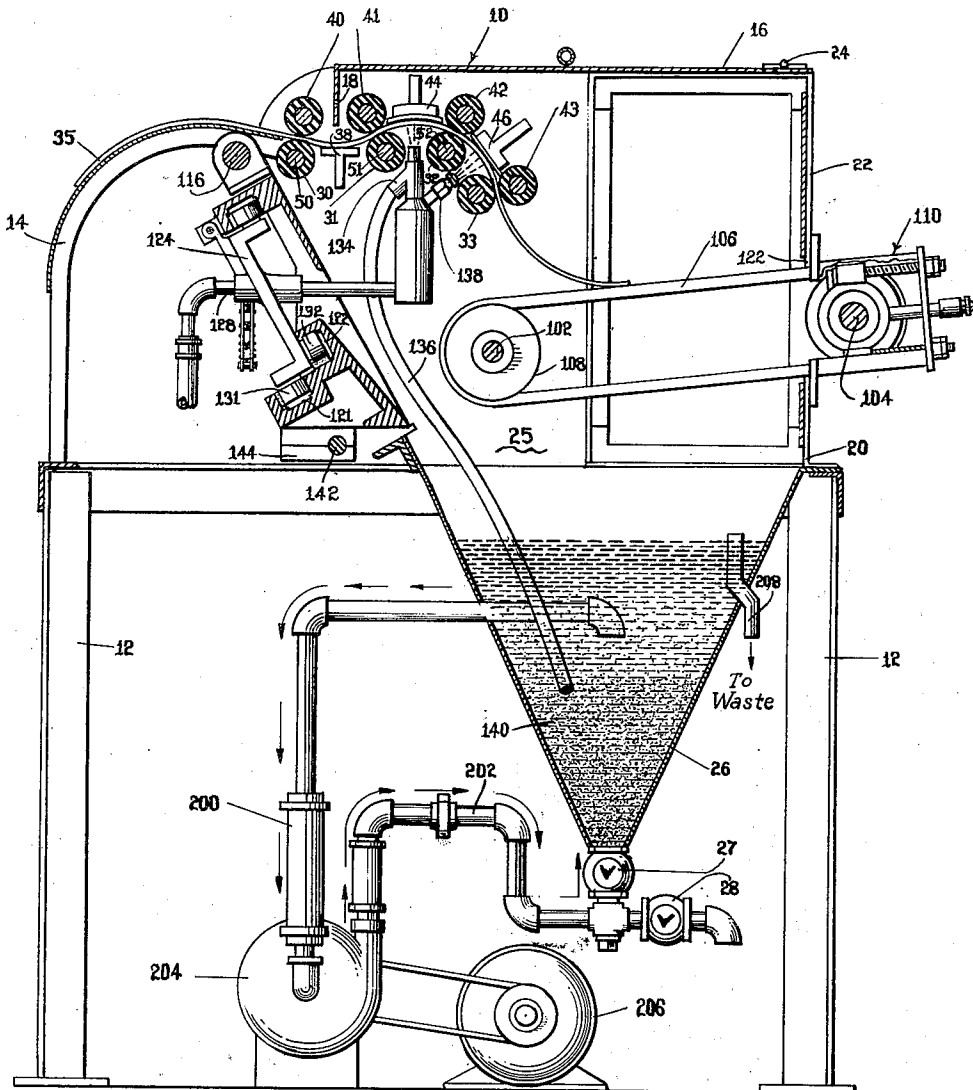
2,612,731

PLATE BLASTING MACHINE

Filed Oct. 9, 1950

4 Sheets-Sheet 1

Fig. 1



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Oct. 7, 1952

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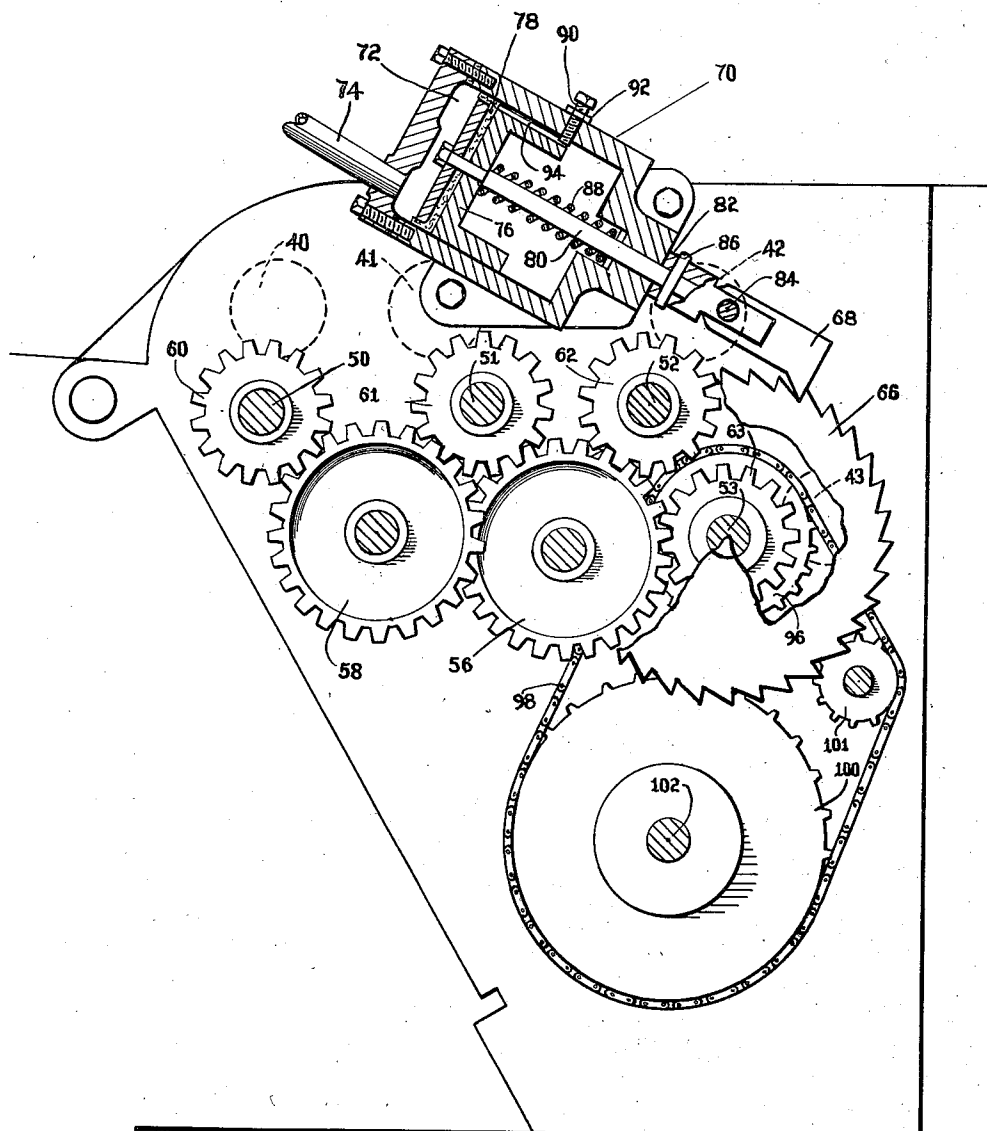
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Fig. 2



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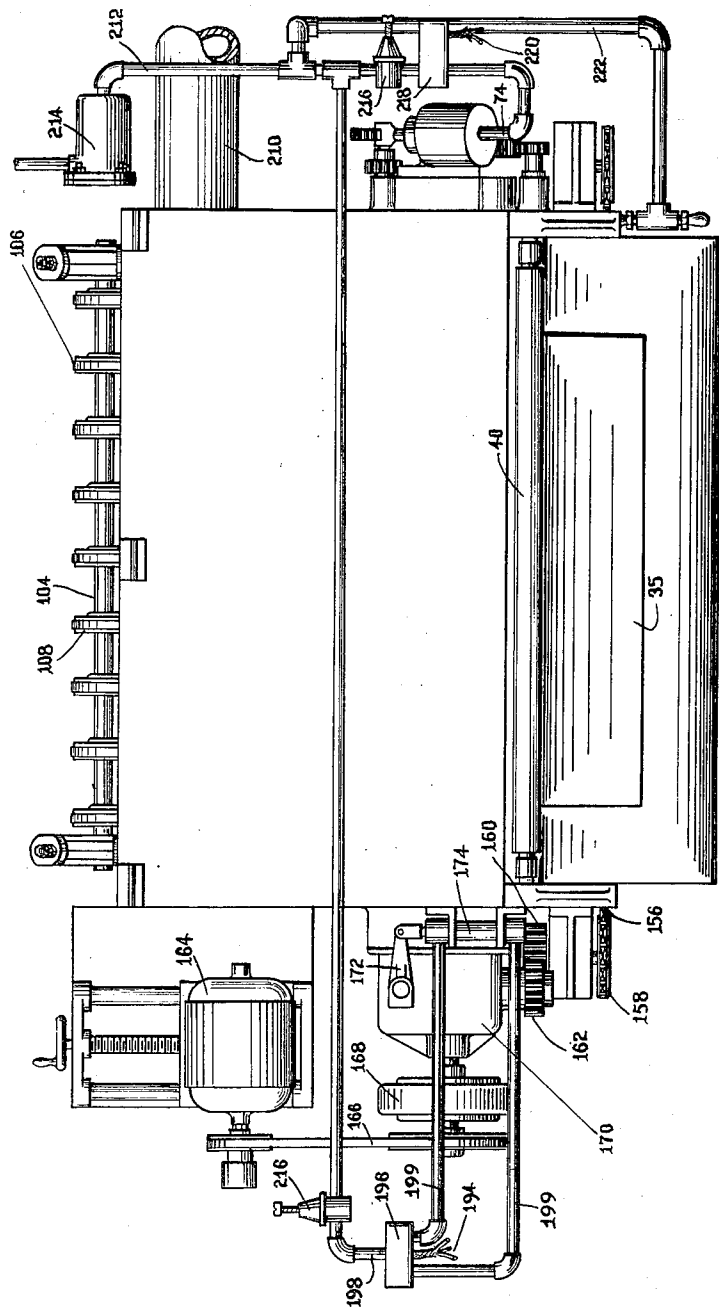


Fig. 3

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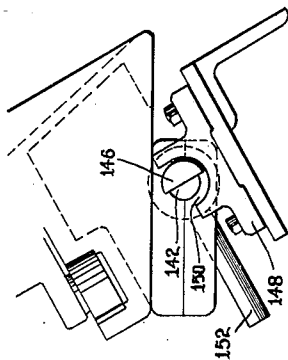


Fig. 4

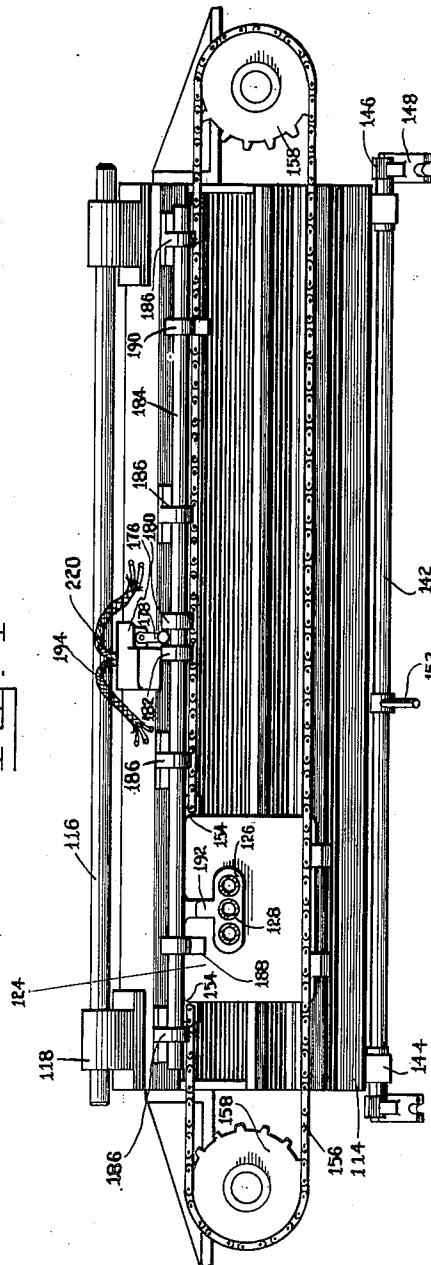


Fig. 5

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2,612,731

PLATE BLASTING MACHINE

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Application October 9, 1950, Serial No. 189,209

8 Claims. (Cl. 51-8)

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The present invention relates to machines and methods for abrasive blasting of metal plates, particularly for blasting new or used metal lithographic plates for the purpose of giving them a grained surface suitable for properly holding the usual image-defining coatings.

Among the objects of the present invention is the provision of a novel type of plate graining machine and method by means of which lithographic plates are given an improved grain that is more effective for lithographic purposes.

Further objects of the present invention include the provision of an automatic type of plate blasting machine in which the plates to be blasted do not have to be individually clamped in place and do not have to be unclamped, but can be fed through with a minimum of handling and labor.

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

Fig. 1 is a sectional side view of one form of automatic plate blasting machine exemplifying the invention;

Fig. 2 is a fragmentary side view of a portion of the plate driving mechanism of the machine of Fig. 1;

Fig. 3 is a plan view of the construction of Fig. 1;

Fig. 4 is a detail side view of a portion of the nozzle carriage locking mechanism of the construction of Fig. 1; and

Fig. 5 is a front view of the construction of Fig. 1.

According to the present invention a lithographic plate is arranged to be held in curved shape so as to present a concave surface, and an abrasive stream is directed against the concave surface to grain it. The plate may be automatically moved along a travel path including the blasting zone by a supporting structure which automatically engages the plate without requiring a clamping operation, and advances the plate in steps, an abradant stream being directed between steps along a swath transversely of the plate stepping movement so that swath by swath one entire plate surface becomes grained.

In the machine shown in Figs. 1 to 5 inclusive, a housing 10 supported on legs 12 includes a loading apron 14 a top cover 16 having a depending front flange 18 and a rear wall 20 the upper portion 22 of which is hinged as indicated at 24. Side walls 25 complete the upper portion of the housing enclosure. The lower portions of the

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housing taper down to a hopper-shaped bottom 26 terminating in an isolating valve 27 and a drain cock 28.

At the rear edge of apron 14 are rotatably mounted a set of spaced gripping rollers 30, 31, 32, 33, each cooperating with a closely engaging roller 40, 41, 42 and 43 respectively. These pairs of rollers are positioned so that their nips define a travel path through which the rollers move a metal sheet such as the lithographic plate 35. To assist in guiding the sheet through the path which is curved around a transverse axis, fixed guide strips 38, 44 and 46 may be mounted across the housing as shown. The first pair of rollers 30, 40 is mounted in exposed position between the end of apron 14 and the flange 18, so that a sheet can be readily moved into their nip by merely being placed on the apron and slid toward these rollers.

Rollers 30, 31, 32 and 33, are shown as having rubber surfaces held on shafts 50, 51, 52 and 53 respectively, and each of these shafts carries a gear 60, 61, 62 and 63 on one end. These gears are all intermeshed as by the idler gears 56, 58 so that all the rollers are actuated by shaft 53. This shaft 53 also carries a ratchet wheel 66 which cooperates with a ratchet dog 68 connected for to-and-fro movement by an air cylinder 70 to rotate the ratchet wheel one step with each to-and-fro cycle of the dog 68.

As shown the air cylinder 70 has an expansible chamber 72 connected to a source of air under pressure indicated by the line 74. One wall of this chamber 72 is formed by a piston 76 which may carry a sealing member such as a leather gasket 78 and is fixed to a guide shaft 80 which projects from the cylinder, and carries a pivot fitting 82 to which the dog 68 is pivoted as shown by the pivot 84. The fitting 82 may be secured to the shaft as by the tapered pin shown at 86. A spring 88 rests against the internal surface of cylinder 70 and urges the piston in the direction that compresses the chamber 72. To keep the dog 68 properly aligned, an aligning screw 90 is adjustably held as by a lock nut 92 so that its tip projects into the cylinder bore and engages in an elongated groove 94 provided in the side of the piston. It will accordingly be seen that a piston is normally held in the position shown in Fig. 2, but that the admission to the chamber of air under pressure will cause the piston to be pushed out so that dog 68 carries ratchet wheel 66 around one step in clockwise direction as seen in Fig. 2. When the compressed air is permitted to escape from chamber 72, the piston will be car-

ried back to the position shown by spring 88 and in this return movement the dog pivots around pin 84 and slides over the teeth of ratchet wheel 66 so that this wheel is not moved. If desired the conventional type of holding catches (not shown) may be fitted against the teeth of ratchet wheel 66, or of any of the other gears, to assure that there will be enough resistance against counterclockwise rotation of this wheel for the dog 68 to pivot and slide over the wheel without rotating it.

Shaft 53 is shown as also carrying a sprocket 96 around which a chain 98 is fitted for driving a belt sprocket 100 suitably mounted for rotation on a shaft 102. As more clearly shown in Figs. 1 and 3 shaft 102 extends within the housing and cooperates with a corresponding external shaft 104 by means of a set of flexible belts 106 suitably driven as by pulleys 108 fixed to the respective shafts. A tension adjusting mechanism 110 is shown as provided for assuring that the belts are suitably driven. Above the belts the rear wall 20 is slotted as indicated at 112 so that metal sheets deposited on the upper run of the belts is automatically conveyed out of the housing to a position where the advancing portions of the sheets can be withdrawn manually or automatically.

The forward face of housing 10 is provided with a blast projecting assembly for directing a blasting stream against a concave portion of sheet 35. As shown more clearly in Figs. 1 and 5, the blasting assembly includes a door 114 extending across the width of the housing 10 and pivoted at its upper portion on hinge pin 116, as by means of the hinge fittings 118 welded or otherwise secured to the door. Track ways 120, 121, 122 are provided in door 114, and in these track ways are fitted cooperating rollers 130, 131, 132 pivotally carried by a nozzle carriage 124 which is thereby transversely slidable with respect to the housing 10. Through a suitable boss 126 in the carriage, one or more blasting conduits 128 are fitted. Outside of the housing these conduits are connected to a source of fluid under pressure while internally of the housing the conduits lead to one or more blasting nozzles 134. In the form of the invention shown in the figures each blasting nozzle is the so-called suction type in which the discharge of a stream of compressed fluid causes an abrasive mixture to be sucked in through a secondary feed line 136 so that the abrasive particles are violently projected by the nozzle along with the fluid. One very effective construction for such a nozzle is described in U. S. Patent No. 2,369,576 granted February 13, 1945. The abrasive stream is preferably a mixture of finely divided grit particles such as sand, in a liquid such as water. In Fig. 1 the blasting nozzle assembly is shown as also including an auxiliary nozzle 138 which projects a stream of washing fluid not containing any abrasive. One of the conduits 128 may be used to separately supply this nozzle.

For releasably holding the complete door assembly 114 in place it is provided at its lower portions with a locking mechanism shown as including a transverse shaft 142 journaled in supports 144 fixed to the door and having on each end an outwardly extending semi-cylindrical locking cam 146. Secured at each side of the housing for cooperation with the cam 146, are lock fittings 148 which have upwardly facing semi-cylindrical grooves 150 in which the cam 146 can be received. A rotating handle 152 is fixed to rod 142 for rotating the rod about 90 degrees in the journal supports 144. As shown more clearly in

Fig. 4 the semi-cylindrical surfaces of members 146 and 150 are so related that when rod 142 is in the extreme clockwise position shown in this figure, it is impossible for the door-carrying cam 146 to pivot around hinge pin 116. However upon rotation of rod 142 in a counterclockwise direction, the semi-cylindrical cam 146 will be turned away from groove 150 so that the downward movement of the door with the cam around hinge pin 116 can take place. To bring the door into its closed position, it is only necessary to move handle 152 to its counterclockwise or lower limit, and then swing the door into the position shown in Fig. 1 after which handle 152 is returned to the locking position shown in Fig. 4.

Carriage 124 has at its upper edge laterally projecting ears 154 to which are secured the ends of a driving chain 156 held by laterally disposed sprockets (Fig. 5). One of these sprockets is shown as driven through gears 160, 162 actuated by means of a driving motor 164 connected as by adjustably held belt 166 with a speed reducer 168 which drives gear 162 through a reversing unit 170. Reversing is controlled by a lever 172 connected for to-and-fro tilting by means of a double air cylinder 174 of any suitable type.

For suitably timing the reversing operations, an interlock switch 176 is shown as mounted on door 114 and pivotally carries a control arm 178 the tip of which is fitted between collars 180, 182 fixed to a transversely slidable shaft 184 held by support rings 186 also fastened to the door. A pair of limit blocks 188, 190 adjustably held on the shaft 184 as by set screws, not shown, are arranged to project in the path of an operating nose 192, which is conveniently formed integral with the carriage boss 126. By adjusting blocks 188, 190 to positions along shaft 184 corresponding approximately to the span occupied by a sheet 35 to be grained, the nozzle travel can be correspondingly limited. Rotation of motor 164 will cause the carriage 124 to move in one direction until it engages one of the blocks 188, 190 and then carry the engaged block and shaft 184 along with it for a sufficient distance to move control arm 178 by the amount required to trip switch 176. A cable 194 connected from switch 176 to a dual solenoid 196 is thereby arranged to shift a supply of compressed air from line 198 through one of the lines 199 to the dual air cylinder 174 to effect movement of reversing arm 172 and thereby reverse the rotation of driven sprocket 158. The carriage is thereby caused to return in the opposite direction until nose 192 engages the opposite block of the set 188, 190 and then returns shaft 184 in the opposite direction to trip control arm 178 back to the original position. Continuous to-and-fro carriage movement is thereby automatically obtained.

In the lower portion of hopper 26 a slurry 140 of abrasive particles and liquid is kept to supply the abrasive mixture to nozzle suction line 136. The slurry is kept agitated during blasting by a circulation system shown as including a rotary pump 204 having an outlet line 202 connected to the bottom of the hopper and an inlet line 200 opening in the hopper at a level above the bottom and generally above that of which most of the abrasive particles settle. The pump 204 is shown as driven by electric motor 206 and keeps the slurry sufficiently agitated so that the abrasive particles do not pack down and are easily sucked up into the blasting nozzle. An overflow line 208 is shown as provided for fixing the upper level of the slurry in the hopper 26. Inasmuch as washing nozzle 138 introduces liquid which runs

down into the hopper, the overflow will automatically prevent the accumulation of too much liquid in the slurry. The agitation by pump 204 is preferably arranged so that the desired abrasive particles in the slurry will settle sufficiently far that they are not appreciably carried out through overflow 208, while finer particles such as fragmented abrasive and other debris removed from the plate 35 being blasted, will remain in appreciable proportion in the upper layers of slurry 140 and will tend to be washed out with overflowing liquid.

During the blasting large clouds of finely-divided particles of abrasive, debris, and liquid are formed in the housing 10. To keep these materials from coming out of the housing into the surrounding space and inconveniencing operators stationed nearby, the housing is provided with a suction conduit 210. This conduit is connected to the suction side of a blower which is energized whenever blasting is effected. The suction is sufficient to draw in air from around the housing through all the crevices and gaps in the housing walls, doors, sheet intake and outlet slots, etc. It will accordingly be unnecessary to seal any of these openings.

To simplify the operation of the above machine the compressed air used to operate cylinders 70 and 174 is also arranged to be the projecting fluid connected through conduits 128 to the blasting nozzle 134. As shown in Fig. 3 an air supply line 212 which may include a filter 214 is connected through regulating valve 216 to solenoid line 198 while another regulating valve 216 connects line 212 with the driving cylinder line 74. A solenoid valve 218 in the last line connection is linked as by cable 220 with the switch 176 so that the solenoid is momentarily actuated with each movement of control arm 178 to permit the compressed air to momentarily operate air cylinder 70. Another branch 222 of the air intake line 212 can be directly connected by means of some of the conduits 128 to one or more blasting nozzle 134. If desired, the blasting line may have an additional solenoid control valve connected for operation simultaneously with motor 164 so that whenever blasting is initiated the driving motor will start carriage traverse movement and prevent gouging of a plate by stationary blasting streams directed at only a portion of the plate.

A feature of the invention is the abrasive blasting of the plate surface while it is in concavely curved condition. It has been discovered that this greatly reduces the peening effect of the blasted particles against the surface, to not only improve the characteristics of the surface with respect to its ability to suitably hold the lithographic coatings normally used to define image areas, but in addition reduces the curvature that always results when blasting a flat or convex surface. This curvature is undesirable and is apparently due to the small amount of expansion which a peened surface undergoes. Such expansion causes the peened surface to be larger than the opposite surface of a treated sheet, and the sheet automatically assumes a somewhat cylindrical curvature with the larger surface on the outside of the cylinder. This is a stable configuration for such an article inasmuch as the curved external surface of the cylinder has a somewhat larger radius of curvature and can therefore accommodate the extra amount of surface present. In practice it is often found necessary to reduce this curvature by bending a sheet in the opposite direction so that the untreated surface is convex

and stretches somewhat. This is however, a violent treatment and shortens the life of the plate which normally can be used many times over by repeated regaining, for preparing separate lithographic printing members. A blasting concavity having a curvature radius not greater than one foot and preferably larger than four inches, is very effective.

An additional feature of the machine of the invention is the fact that it will handle and successfully blast plates of any size so long as these plates can be received within the transverse dimension of the housing. Furthermore no adjustments of any kind are needed when the size of the treated plates is changed. It may however be desirable to improve the blasting efficiency of the machine by restricting the to-and-fro travel of the nozzle carriage when plates of relatively narrow widths are being treated. This is conveniently done by merely adjusting the positions of blocks 188, 190 and the adjustment can be done at any time even after part of the narrow plate has been blasted.

In addition to the above no special manipulation is required to fix or clamp a plate in the machine or to unclamp the plate for removal from the machine. A plate to be treated is merely fed in until its leading edge is engaged in the nip between rollers 30, 40, after which the machine automatically feeds the entire plate through, grains it, washes it and delivers it in finished condition at the discharge end of belts 106. If desired, an additional conveyor can be provided for receiving the plates as they roll off belts 106 and deliver them to any suitable location.

The specific details of reversing unit 170 as well as of the speed reducer 168 form no part of the present invention and any suitable types of these well-known mechanisms can be used.

The rollers 40, 41, 42 and 43 may also have resilient rubber surfaces, as shown in the drawings, although only one resilient roll surface is all that is needed at any one nip. If desired, none of the roll surfaces need be resilient in which case it is desirable to have one of each pair of rollers resiliently mounted in its bearings, to assure that the individual plates are suitably gripped and fed through the machine.

In place of the geared interconnections between the driving rollers, a sprocket and chain combination can be used with a single chain driving all the driving rollers as well as the sprocket 100. The chain adjusting idler 101 shown in Fig. 2 can then be relocated and additional idlers supplied if necessary to securely hold the chain engaged with various driving sprockets. Friction type drives such as pulley and belt combination are not as desirable in view of the plate gouging that can take place should the drive slip.

The suction arrangement described above for reducing the escape of dust, is preferably equipped with a filter or fume arresting mechanism so that the withdrawn air can have its suspended contaminants removed after which the purified air can be discharged at any convenient location. Highly effective filter mechanisms are shown in the copending Gladfelter and Garver patent applications Serial No. 114,844, filed September 9, 1949, now Patent No. 2,576,008, granted November 20, 1951; and Serial No. 189,210, filed October 9, 1950.

As explained in connection with the first of these copending applications, the hopper isolating valve 27 is closed before the machine is shut down and before the slurry circulation is interrupted. This keeps the abrasive particles from

settling in any appreciable quantity in the small diameter circulation passageways where they could easily prevent the resumption of circulation. In addition the drain valve 28 can be opened after valve 27 is closed, permitting the rapidly clearing liquid at the pump intake in the hopper, to flush through the circulation line and wash out substantially all particles before the circulation pump is stopped. Should the slurry circulation passageways inadvertently become blocked, they are most readily cleared by operating the pump with isolating valve 27 closed and drain valve 28 open. After clearing, the valve 28 is closed and valve 27 opened and slurry agitation will invariably begin regardless of how much settling has taken place in the hopper.

With the above type of machine a blasting air pressure of about 80 pounds per square inch with finely divided sand of about 150 to 250 mesh is highly satisfactory for graining zinc, stainless steel, copper or aluminum plates. Other gases, such as carbon dioxide or steam, may however be used in place of air and other abrasives such as metal powder, "carborundum," emery, or glass powder, etc., may be used in place of sand.

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 the invention is not limited to the specific embodiments hereof, except as defined in the appended claims.

What is claimed is:

1. In an automatic lithographic plate graining apparatus for automatically receiving such plates, automatically graining them and automatically discharging the grained plates; supporting structure for receiving an incoming plate; advancing and guiding mechanism connected with the supporting structure for energization to carry a received plate in a predetermined work path along at least part of which the plate is curved; blasting elements connected with the advancing and guiding mechanism for jetting an abrasive stream toward said part of the work path in a direction that causes particles of the stream to strike and grain the concave portion of the curved plate; said advancing and guiding mechanism being connected for moving a received plate in small steps along the work path direction, the blasting elements are connected for graining only a portion of the plate's width transversely of the work path direction, the advancing and guiding mechanism is connected to the blasting elements for carrying these elements to and fro across the work path between advancing steps and also includes discharge elements connected for automatically carrying the plate out from said part of the work path.

2. The combination as defined by claim 1 in which the advancing and guiding mechanism includes a plurality of closely spaced pairs of grip feed rollers positioned with their nips defining said curved work path.

3. In an automatic lithographic plate graining machine a set of horizontally extending rollers for receiving the flat surface of a lithographic plate to be grained, said rollers being positioned for energization to grip the received plate and advance it in a work path that curves vertically to concavely bend one surface of the plate around an axis directed transversely of the work path;

nozzle structure connected to project a stream of abrasive particles and water against a portion of the concavely bent plate surface to grain that portion of the surface; energizing mechanism connected to carry the nozzle structure to and fro transversely across the work path to grain a transverse swath across the concavely bent plate section, said energizing mechanism being connected for actuating the rollers to advance the plate along the work path by approximately the longitudinal extent of the swath after each complete traverse of the nozzle structure, for uniformly graining the entire plate, and to discharge the plate after the graining is completed.

4. The combination as defined by claim 3 and further including a fixed support alongside the rollers at the beginning of the work path, said fixed support providing a surface for holding an incoming plate before it is completely entered into the work path.

5. The combination as defined by claim 3 in which the nozzle structure also includes a washing nozzle for automatically washing the grained plate surface.

6. The combination as defined by claim 3 in which fixed guide members are positioned alongside the work path to help guide the advancing plate along the work path curve and to support the plate against the deflecting force of the impinging abrasive stream.

7. In an automatic lithographic plate graining machine a set of horizontally extending rollers for receiving the flat surface of a lithographic plate to be grained, said rollers being positioned for energization to grip the received plate and advance it in a work path; nozzle structure connected to project a stream of sand and water against a portion of the plate surface to grain that portion of the surface; energizing mechanism connected to carry the nozzle structure to and fro transversely across the work path to grain a transverse swath across the plate section, said energizing mechanism being connected for actuating the rollers to advance the plate along the work path by approximately the longitudinal extent of the swath after each complete traverse of the nozzle structure, for uniformly graining the entire plate, and to discharge the plate after the graining is completed.

8. The combination as defined by claim 7 in which the energizing mechanism includes trip members connected to reverse the transverse nozzle structure movement and to also cause the grip rollers to go through a plate advancing step, and the trip members are adjustable transversely of the work path to limit the transverse nozzle movement to the transverse widths of plates that are being grained.

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