Nov. 28, 1950 O. C. ROESEN ET AL 2,531,647

STEREOTYPE PLATE FORMING AND FINISHING MACHINE

Filed Sept. 10, 1946 12 Sheets-Sheet 1

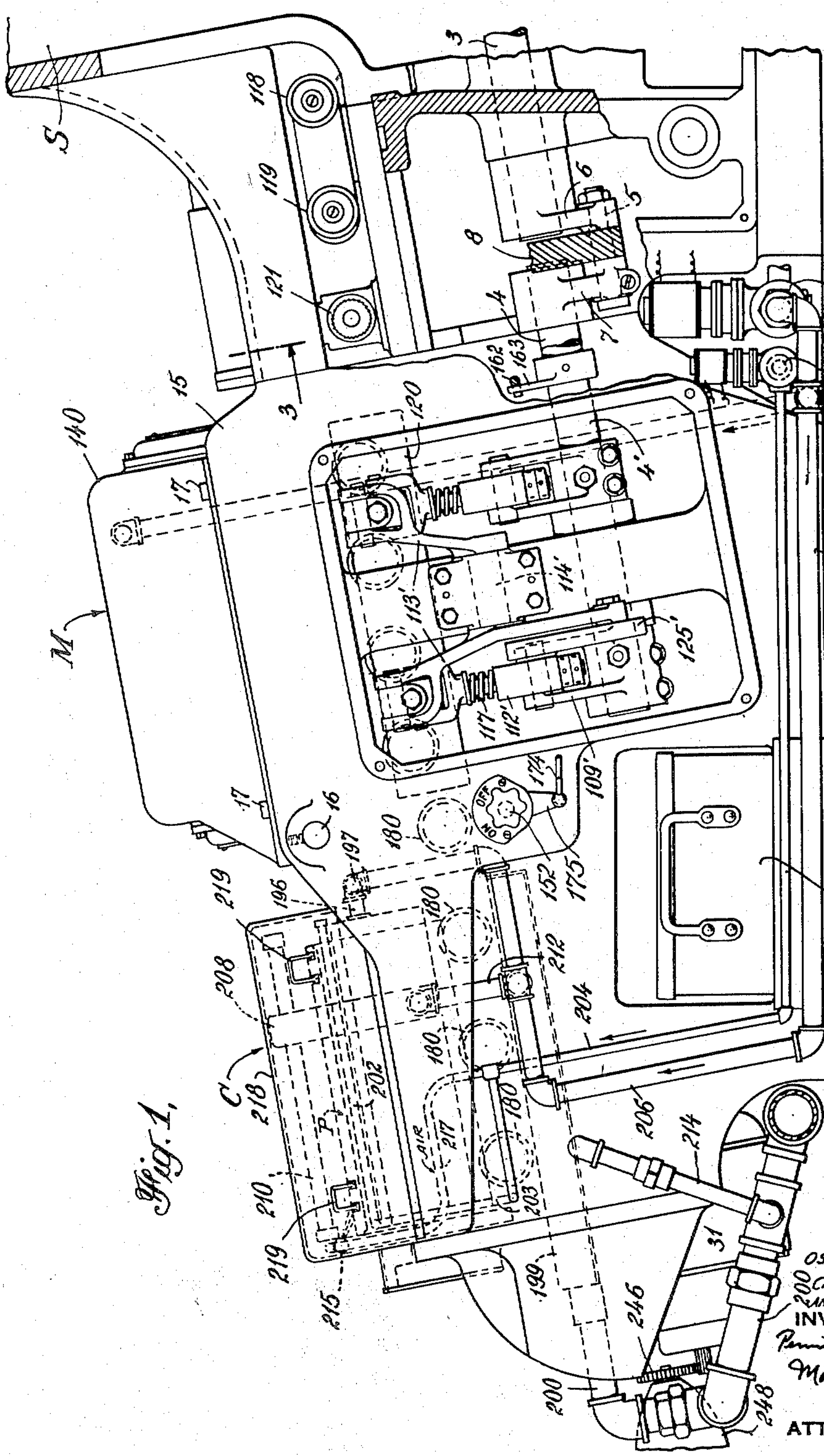

Fig. 1.

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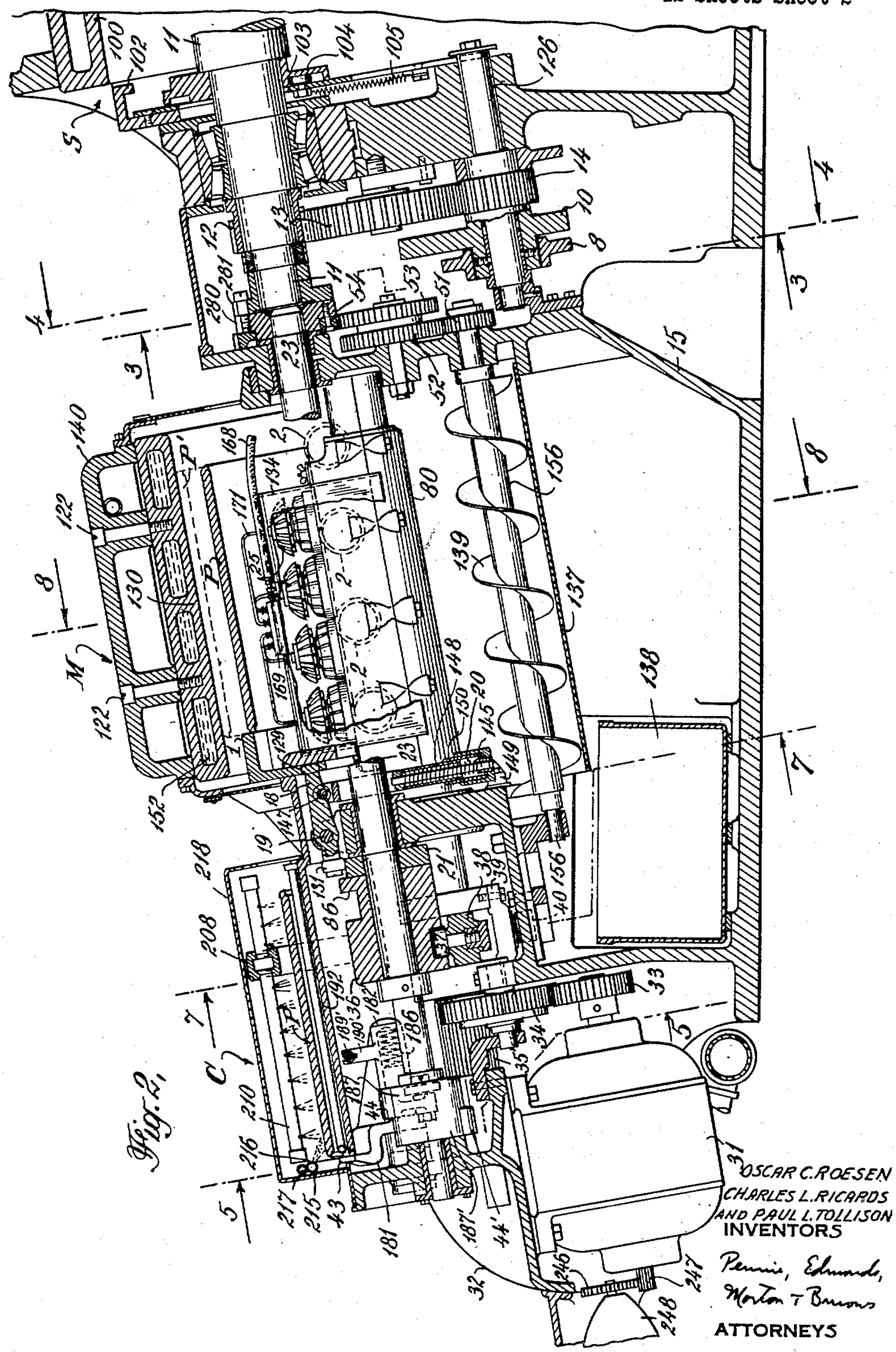
STEREOTYPE PLATE FORMING AND FINISHING MACHINE

Filed Sept. 10, 1946 12 Sheets-Sheet 2



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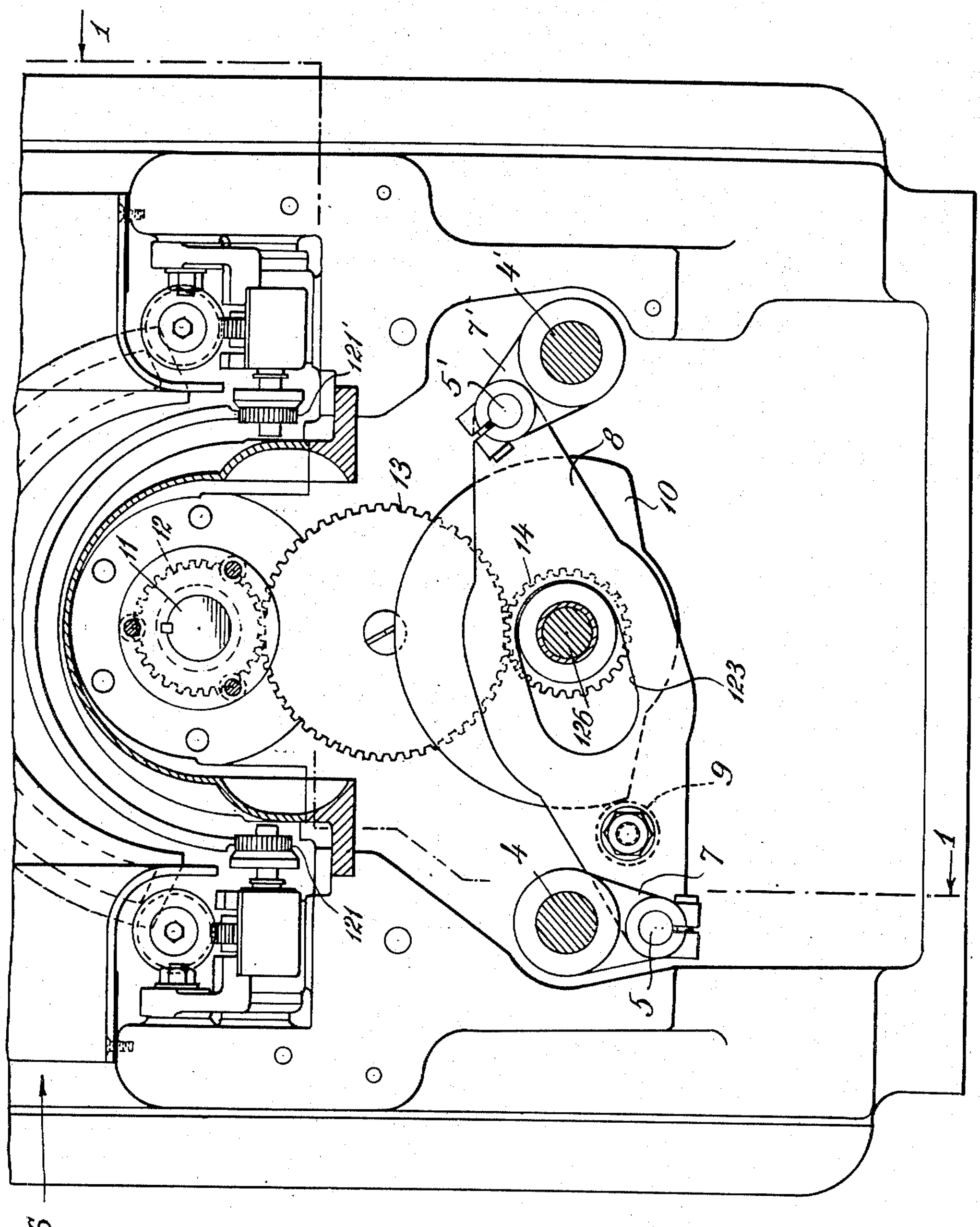

Fig. 3.

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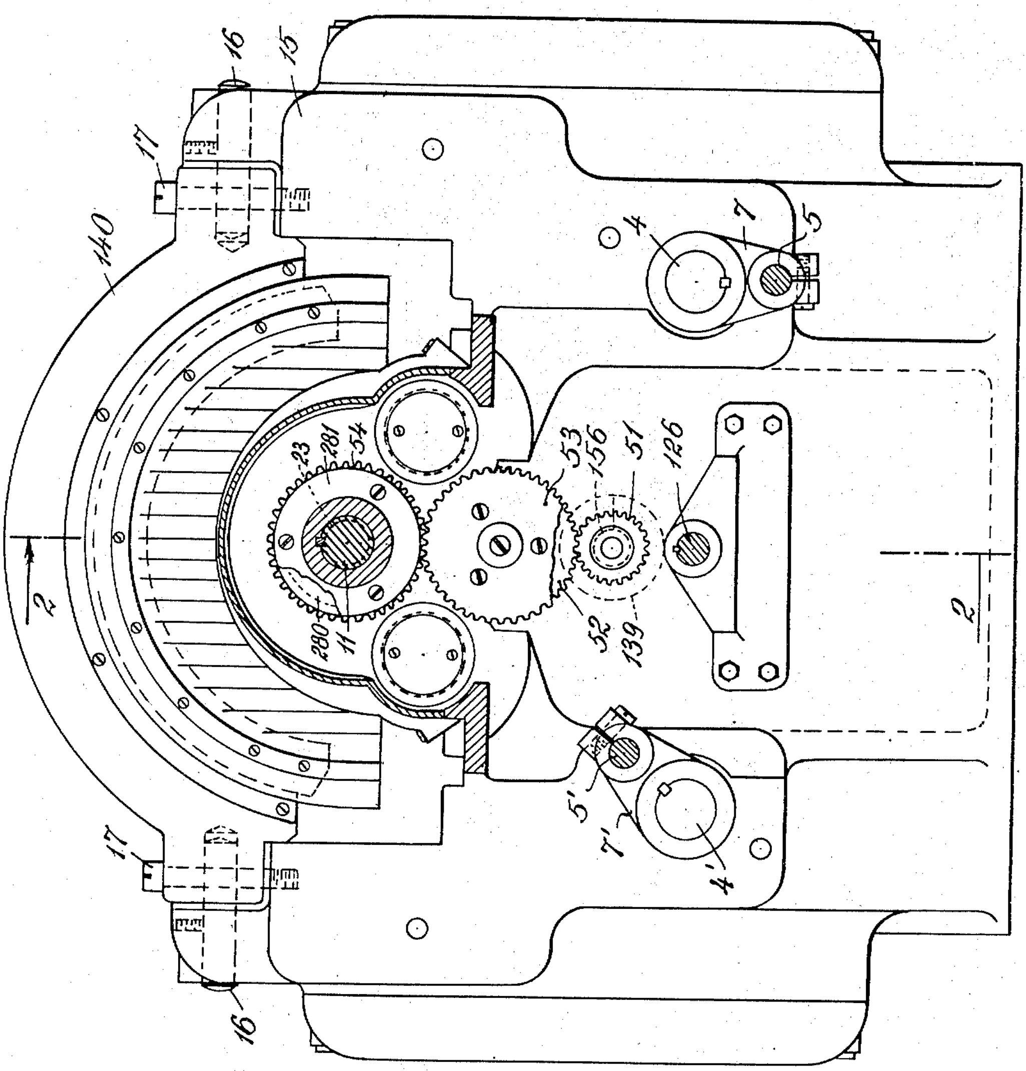

Fig. 4.

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Fig. 5,

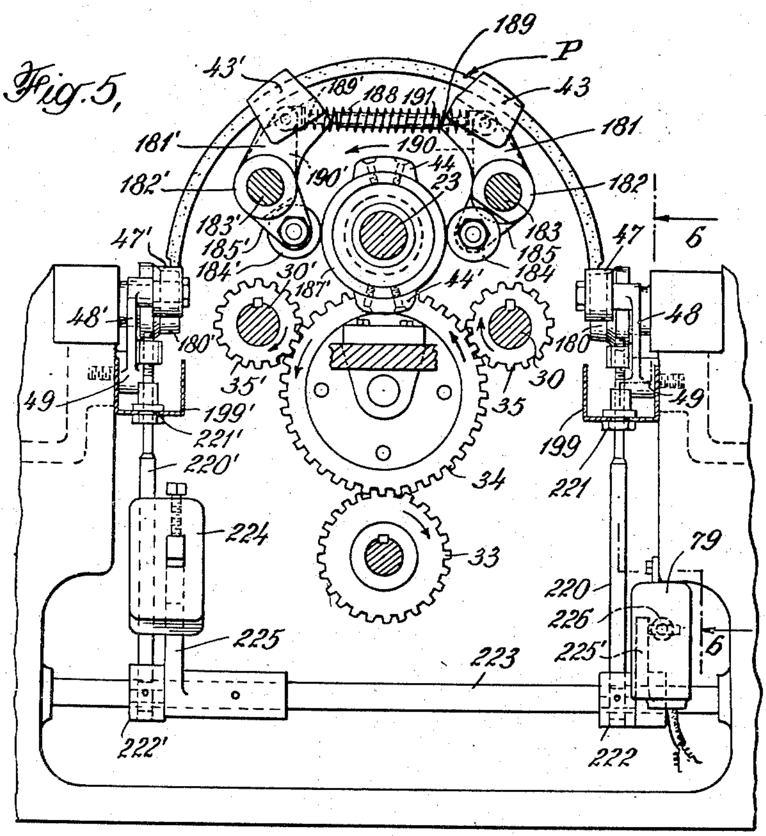
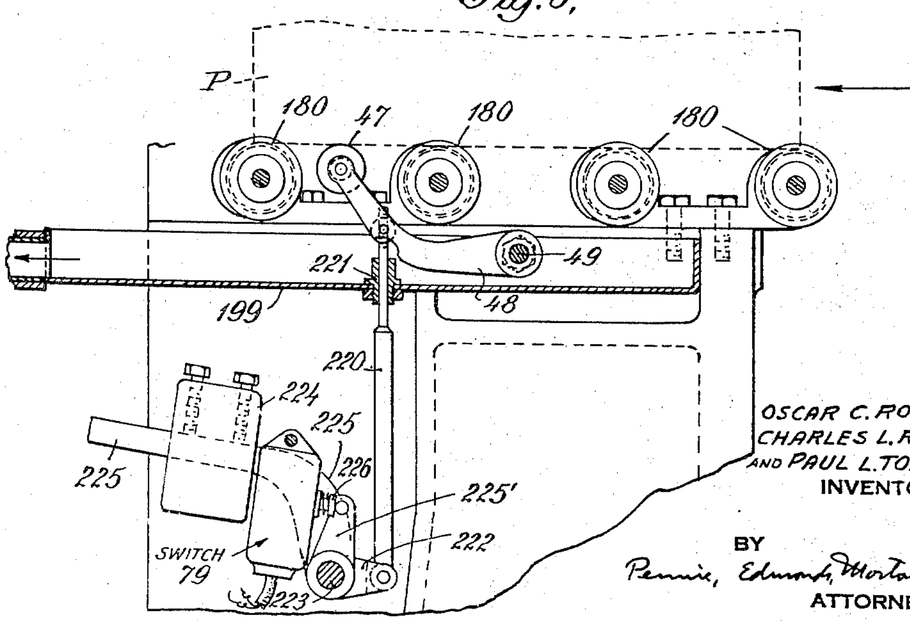


Fig. 6,



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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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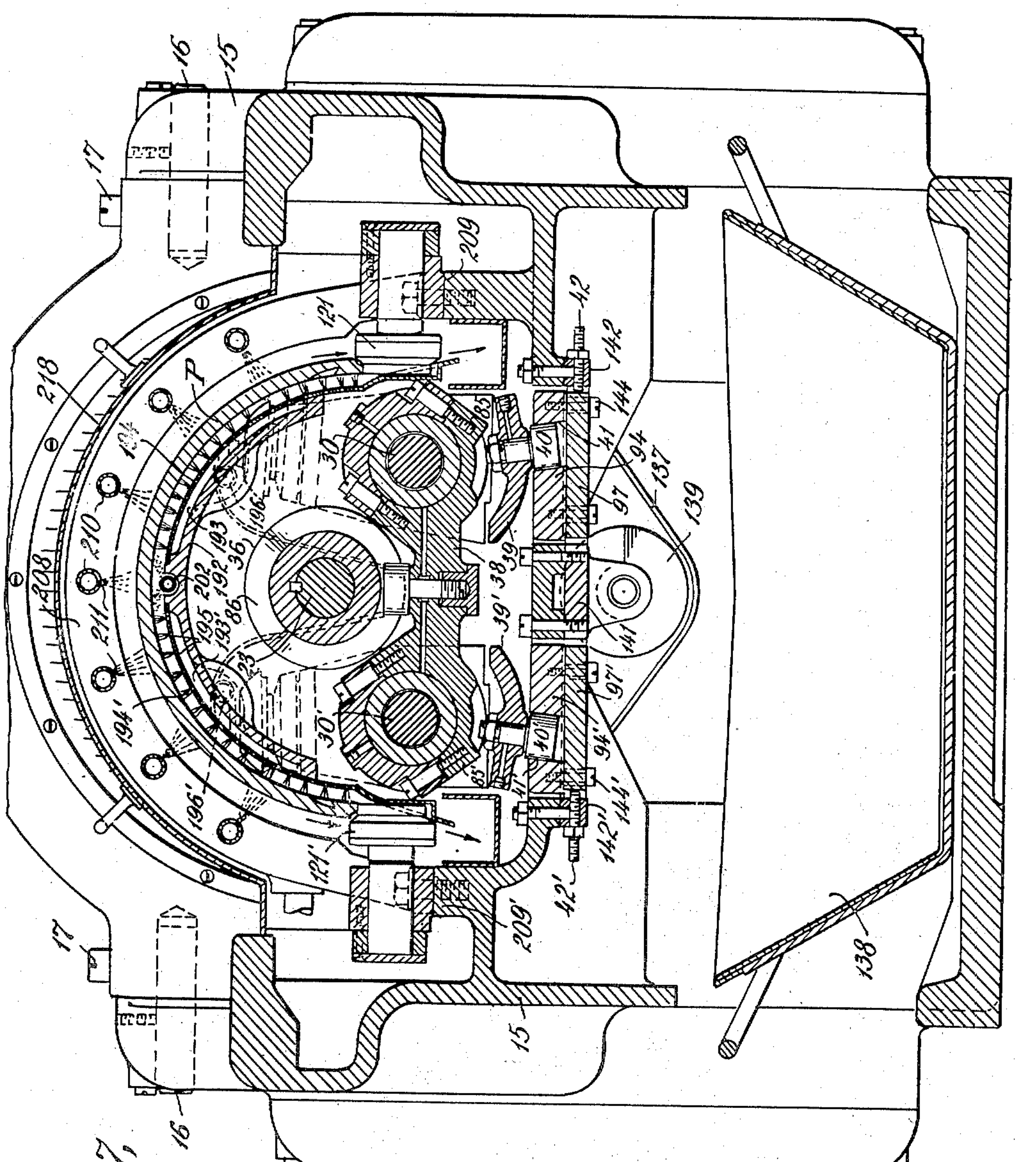

Fig. 7.

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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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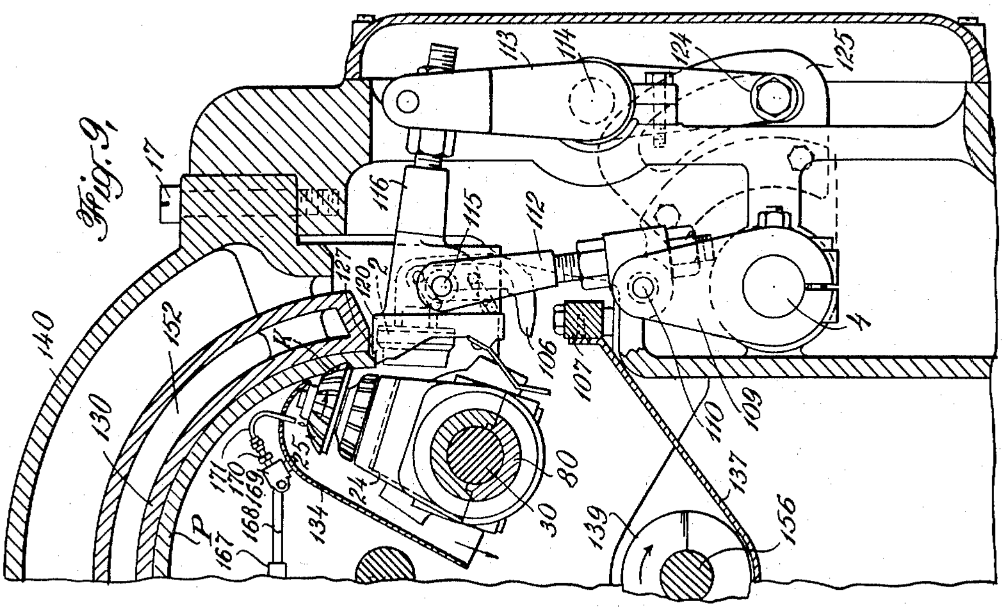

Fig. 9.

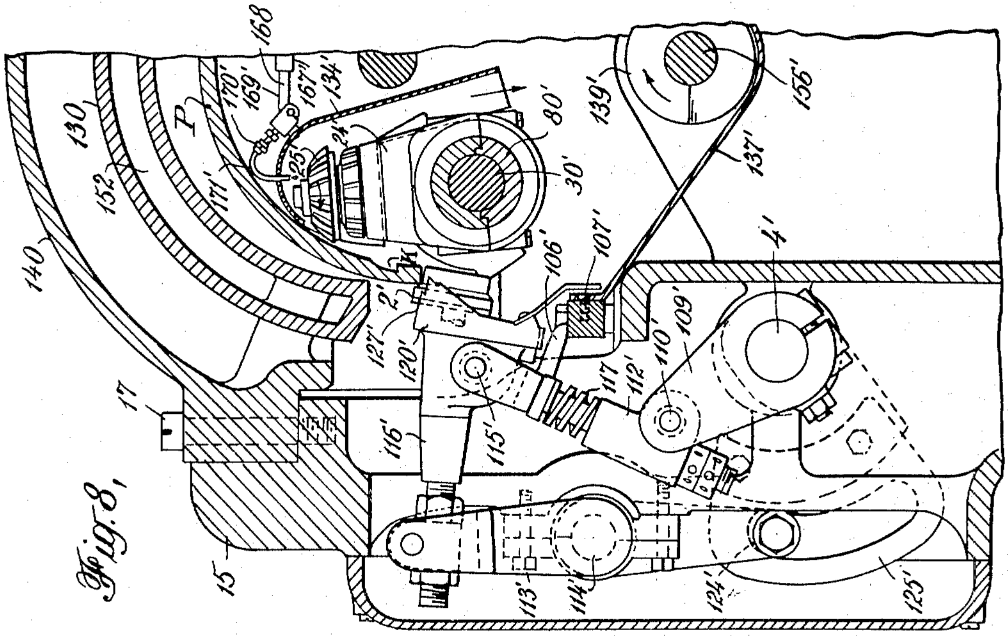

Fig. 8.

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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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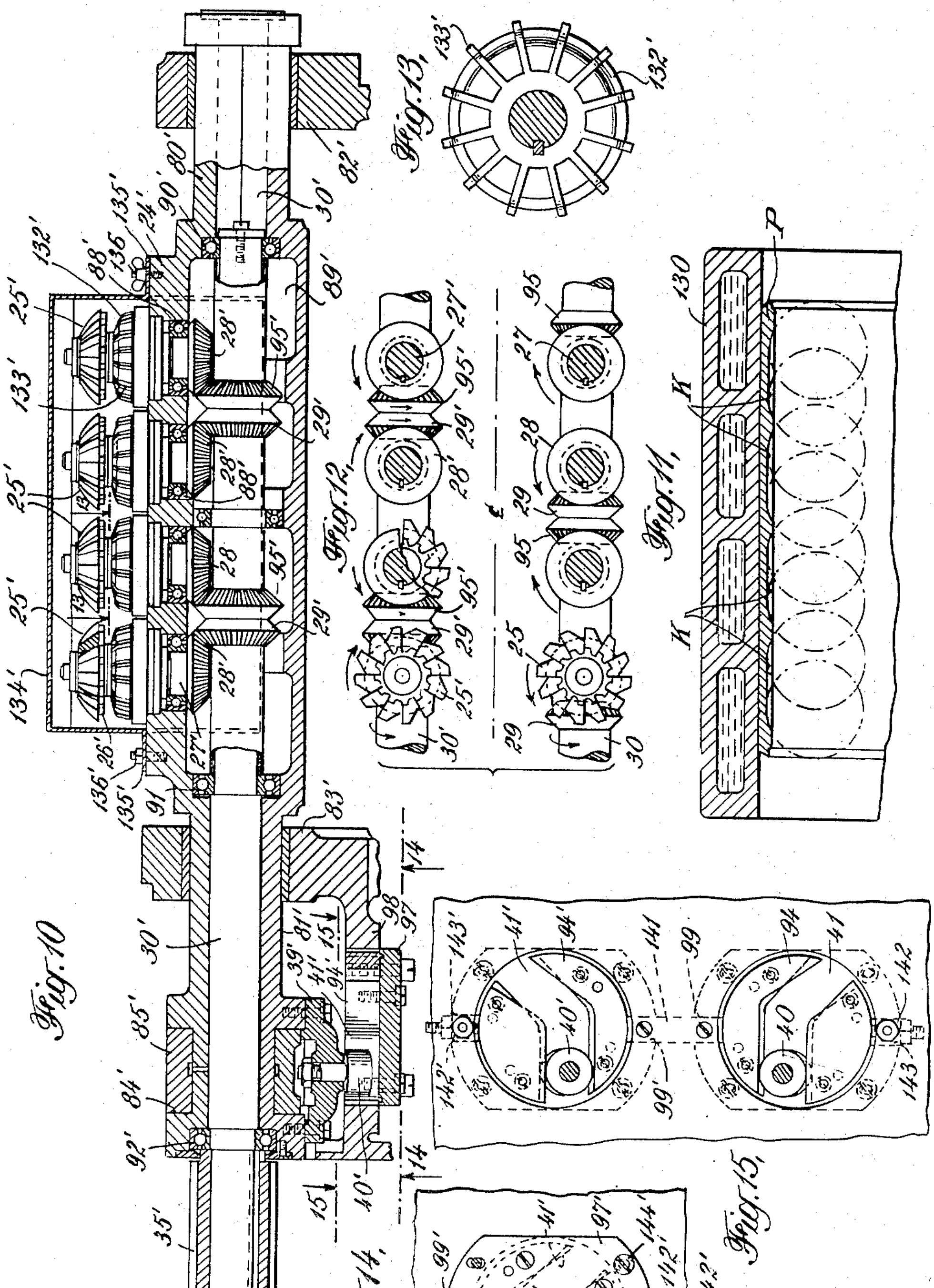

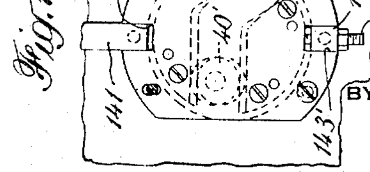

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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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Fig. 16.

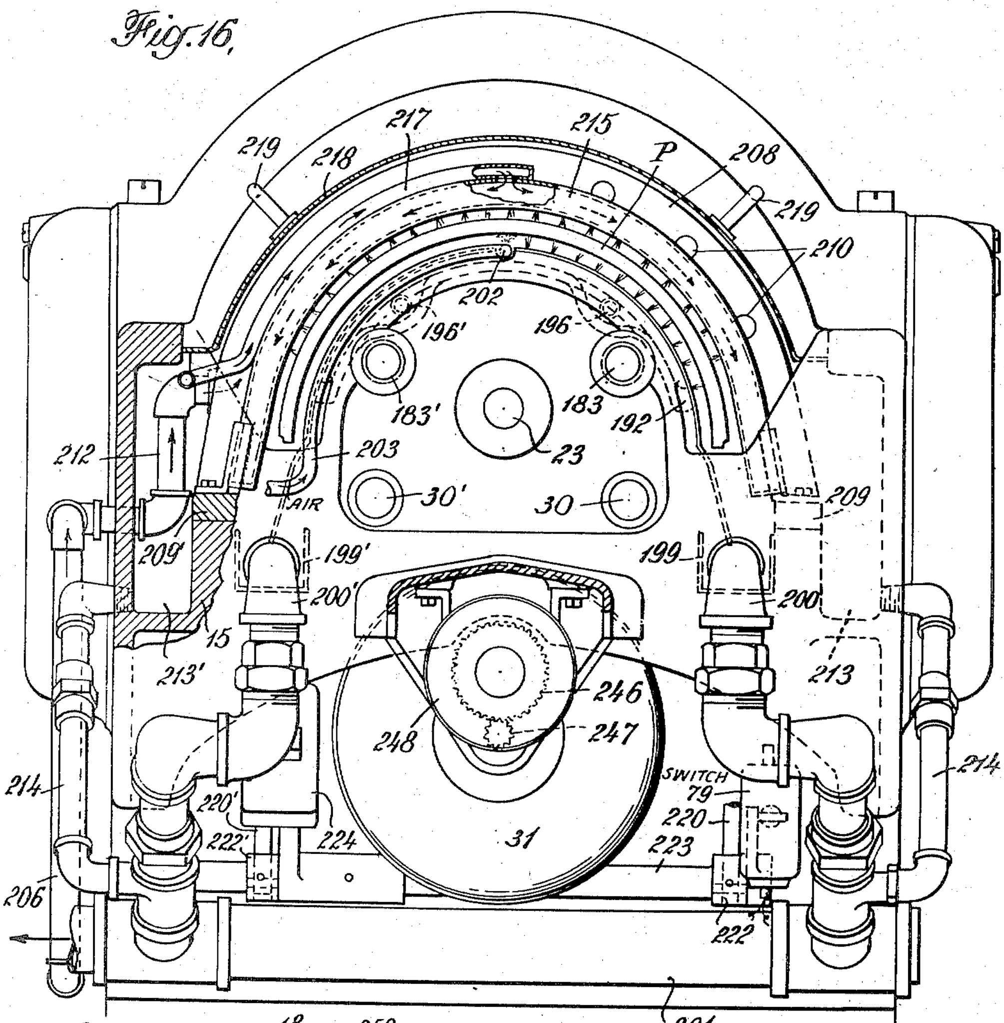


Fig. 18.

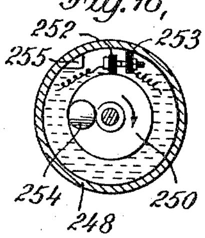
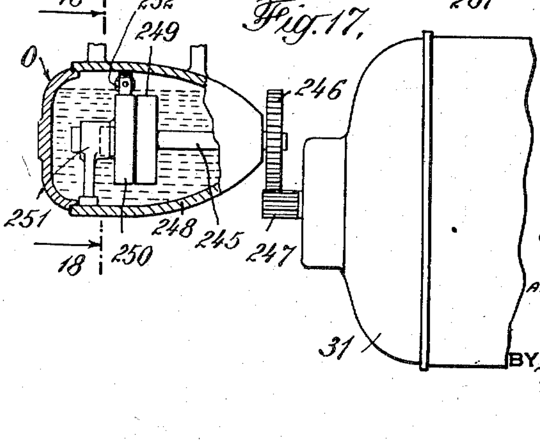


Fig. 17.



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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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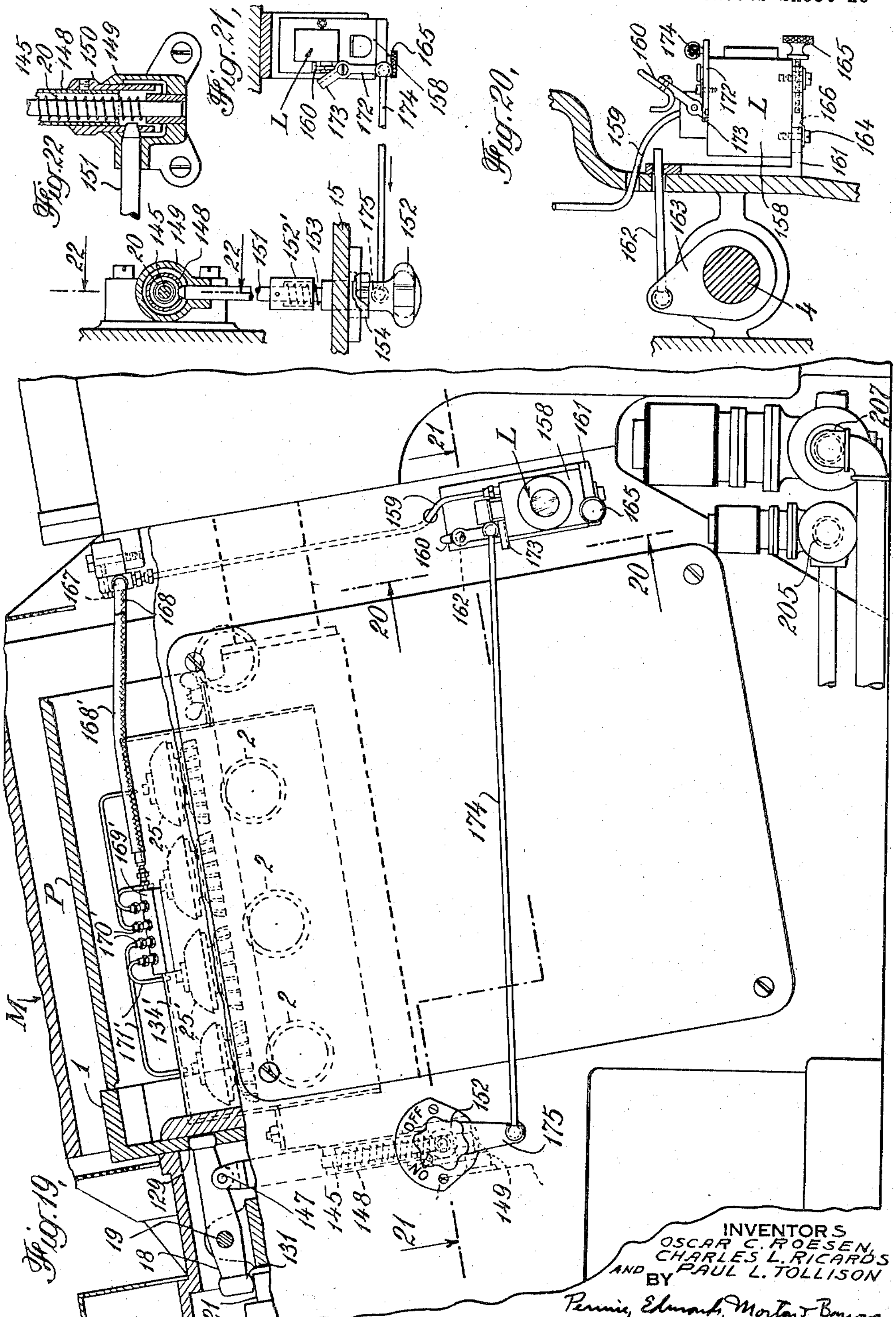

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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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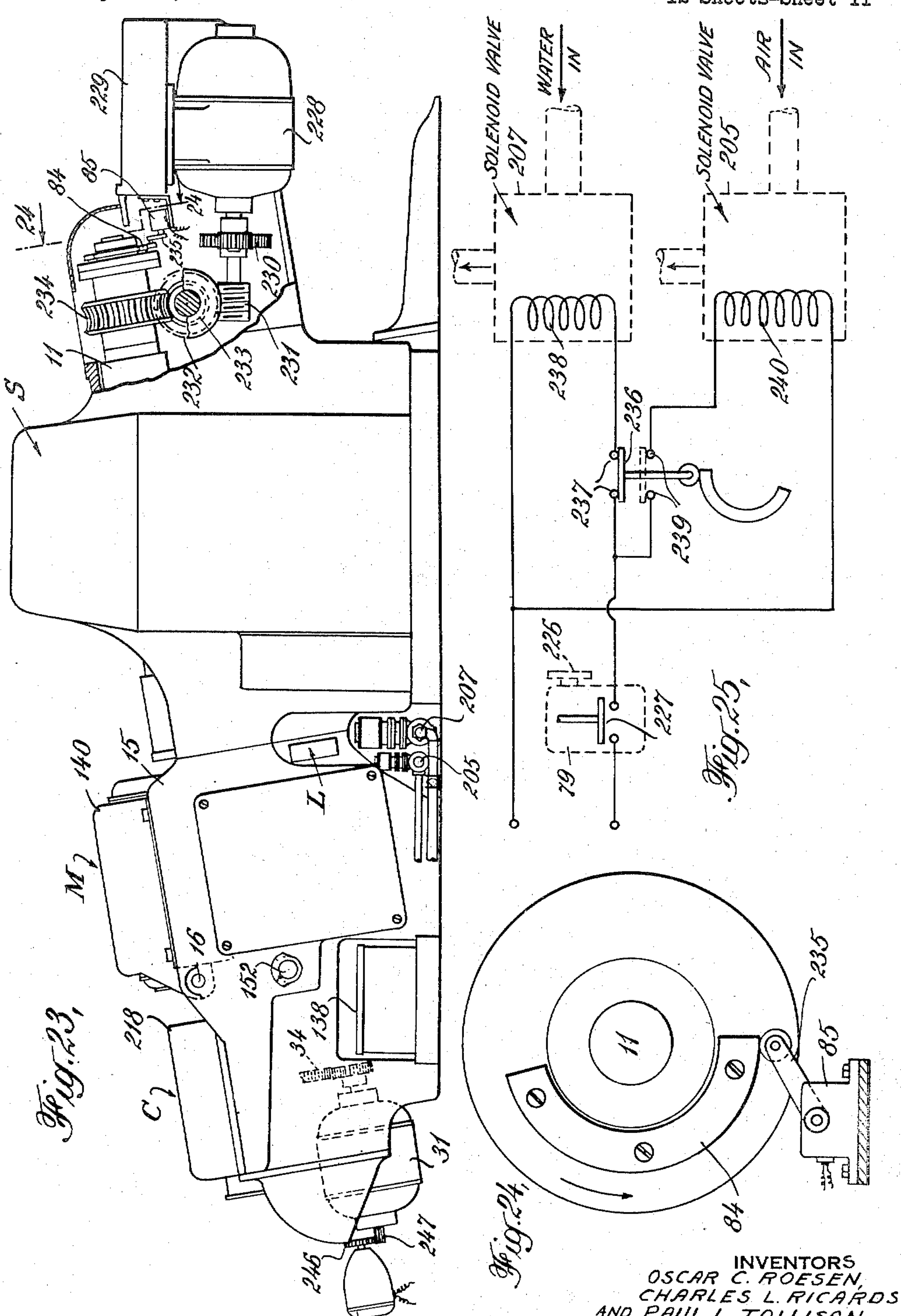

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STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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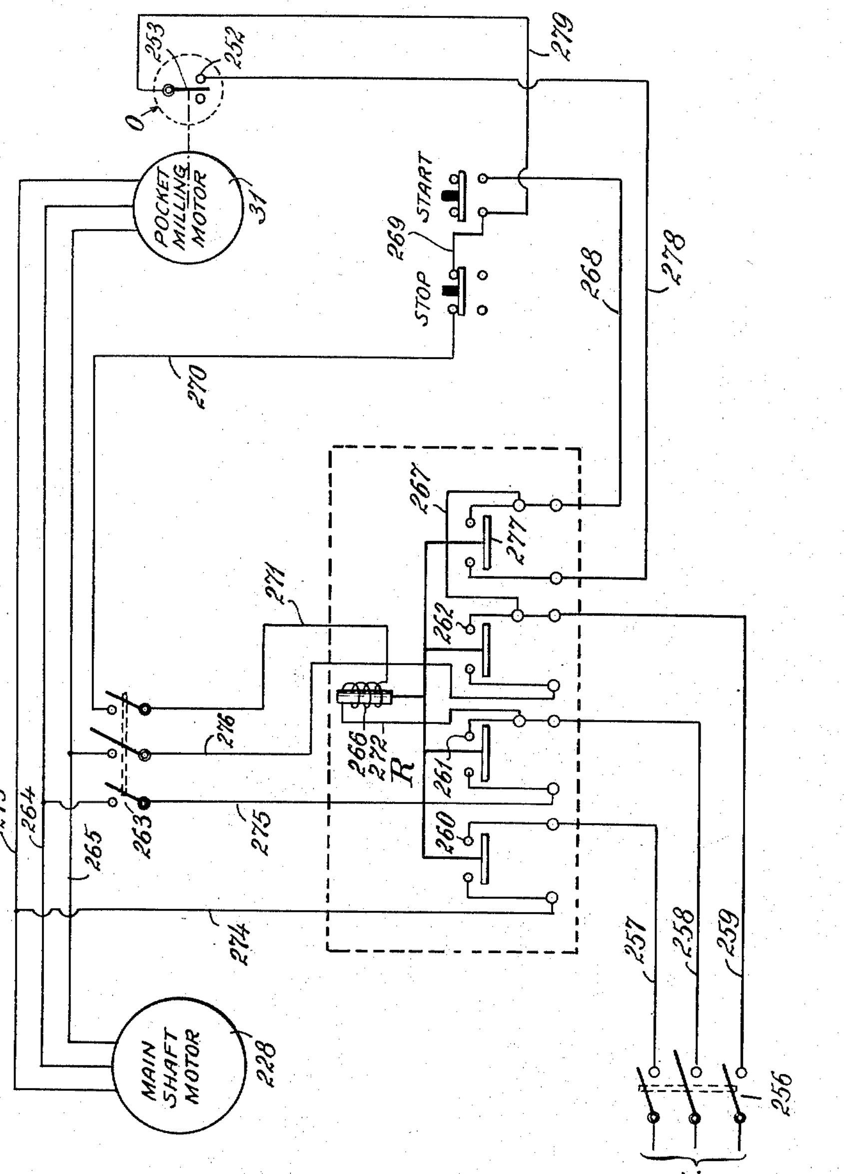
Fig. 26.



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Patented Nov. 28, 1950

2,531,647

UNITED STATES PATENT OFFICE

2,531,647

STEREOTYPE PLATE FORMING AND FINISHING MACHINE

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Application September 10, 1946, Serial No. 695,964

17 Claims. (Cl. 90—15)

1

This invention relates to a stereotype plate finishing machine and more particularly to an improved machine of this nature incorporating means by which pockets may be formed in the inner surfaces of such plates for use in clamping the plates to the cylinder of a printing press.

The machine of the invention is useful in finishing semi-cylindrical stereotype plates that are secured to the press cylinders by clamping elements that hold the plates under circumferential tension. For this purpose, the plates are provided with a series of recesses or pockets in their inner surfaces adjacent their straight edges for the reception of clamping means on the press cylinders. The machine of the present invention forms such pockets by milling them in the precast plate. The improved machine preferably incorporates a stereotype plate finishing section which shaves or finishes the inner surfaces of the cast plates, and a machine including this mechanism is disclosed in United States Patent No. 2,364,032. The improved machine further includes an improved plate cooling and drying section.

It is an object of the present invention to provide a machine of the type described which accurately and rapidly forms a plurality of pockets in the inner surfaces of stereotype plates and performs this operation on a succession of such plates automatically. Other objects include the provision of an improved machine of this type which is capable of forming pockets in a succession of plates with a high degree of accuracy and uniformity. A particular feature of the invention resides in the provision of a plurality of milling cutters in gang arrangement and mounting and operating means therefor whereby a plurality of pockets may be simultaneously formed in fixed and predetermined relation to each other and to the edges of the plate. Features of the machine include improved means for coordinating the control of the drive that moves the milling cutters into engagement with the plates and the cutter rotating drive so as to prevent injury to the machine or to the plates if the milling cutters are not rotated, improved control means for permitting the plates to move through the pocket milling section of the machine without having pockets milled therein, and improved means for mounting and lubricating the milling cutters and for disposing of the chips from the milling operation. Another feature of the machine comprises an improved combined plate cooling and drying mechanism and means for controlling the operation thereof. Other objects, advantages and

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characteristic features of the invention will become apparent from the following description of certain embodiments of our improved machine.

In describing the invention in detail, reference will be made to the accompanying drawings in which certain embodiments of our invention have been illustrated. In the drawings;

Fig. 1 is an elevation of a machine embodying our invention with certain parts cut away along the line 1—1 of Fig. 3;

Fig. 2 is a sectional elevation taken along the line 2—2 of Fig. 4 and viewed in the direction of the arrows;

Fig. 3 is a transverse section on an enlarged scale taken along the line 3—3 of Figs. 1 and 2 and viewed in the direction of the arrows;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 2 and viewed in the direction of the arrows;

Fig. 5 is a transverse section taken along the line 5—5 of Fig. 2 and viewed in the direction of the arrows;

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 5;

Fig. 7 is a transverse section taken along the line 7—7 of Fig. 2 and viewed in the direction of the arrows;

Fig. 8 is a partial transverse section taken on the line 8—8 of Fig. 2 and showing the parts in the positions occupied when a plate is received into or delivered from the pocket milling section of the machine;

Fig. 9 is a partial transverse section similar to Fig. 8, showing the parts in the positions occupied when pockets are being milled in the plate;

Fig. 10 is a sectional elevation of a gang of pocket milling cutters employed in the disclosed embodiment;

Fig. 11 is a sectional view illustrating the action of the cutters in milling pockets in a plate;

Fig. 12 is a plan view of the two gangs of cutters and their drive shafts illustrating the relative direction of rotation of the cutters;

Fig. 13 is an enlarged sectional view taken along the line 13—13 of Fig. 10 showing the construction of a cutter skirt;

Fig. 14 is a bottom plan view of a cutter rocking cam, taken along the line 14—14 of Fig. 10;

Fig. 15 is a plan view of the top of the cutter rocking cam mechanism taken along the line 15—15 of Fig. 10;

Fig. 16 is a discharge end view of the cooling and drying section of the machine with certain of the parts removed or broken away to show the interior construction;

Fig. 17 is a fragmentary elevation, partly in section, of the cutter driving motor and the control device driven thereby;

Fig. 18 is a sectional view of the control device taken along the line 18—18 of Fig. 17;

Fig. 19 is a side elevation of the pocket milling section of the machine showing the plate stop lockout and the cutter lubricator mechanism and control;

Fig. 20 is a sectional view taken along the line 20—20 of Fig. 19, showing the lubricator operating mechanism;

Fig. 21 is a sectional view taken along the line 21—21 of Fig. 19;

Fig. 22 is a sectional view taken along the line 22—22 of Fig. 21;

Fig. 23 is a side elevation of the complete machine showing the driving means for the main central shaft thereof;

Fig. 24 is an enlarged elevation of the control cam on the main central shaft, taken along the line 24—24 of Fig. 23;

Fig. 25 is a wiring diagram of the apparatus for controlling the supply of water and air to the cooling and drying section of the machine; and

Fig. 26 is a wiring diagram of the control system for the machine driving motors.

The mechanism illustrated in Figs. 1 and 2 constitutes generally the pocket milling section M and the cooling and drying section C of a plate finishing machine. The machine also includes a plate shaving section S, the discharge end of which is illustrated at the right of Figs. 1 and 2. The entire machine is illustrated in Fig. 23. The plate shaving section S is disclosed in United States Patent No. 2,364,032, and it will not be described in detail herein. It should be understood that the shaving section includes a shaving arch 100 with a central main shaft 11 therein which is continuously rotated by a drive motor 228. This main shaft and a continuation thereof constitutes a means for governing the cyclic operation of the several plate finishing and cooling sections of the machine as well as the progress of successive plates through the machine sections.

A vertically reciprocable stop or gate 102 is provided at the discharge end of the arch 100 and is operated by cam 103 on the shaft 11. A cam follower 104 engages the cam 103 and is connected to the stop 102. A spring 105 is employed to bias the stop upward and so to maintain the follower 104 in contact with the cam surface. The arrangement is such that the stop 102 is lowered to permit the discharge of a plate from the shaving section at the end of each cycle of the machine operation which is timed by one revolution of the main shaft 11.

When the stop 102 is lowered, a stereotype plate moves by gravity along the inclined path defined by the rollers 118, 119 and 121 and corresponding rollers on the rearward side of the machine. The plate then moves along the plate lifting rollers 2, 2′ in the milling section M until it comes to rest with its lower curved edge engaging the plate stop 1 at the lower end of the pocket milling section, as shown at P in Fig. 2. This pocket milling section includes an arch liner 130 secured to an arch 140 by bolts 122. The arch 140 in turn is attached to the main frame 15 by hinge pins 16 at the lower end of the section (Fig. 1) so as to permit lifting of the arch and liner to expose the mechanism in the pocket milling section. Bolts 17 are provided to hold the arch 140 in its lowered position.

The pocket milling section M, like the shaving section S preceding it, is provided with mechanism for lifting the individual plates from the lower positions in which they move into and from the section to fixed raised positions in contact with the arch liner 130 which may be provided with cooling water passages 157 (Fig. 2). The lifting mechanism of the pocket milling section is operated by the lifting shafts 4, 4′ which the torsionally connected to the corresponding shafts 3 of the shaving section by studs 5 and 5′ connected between levers 7 and 7′ on the shafts 4 and 4′ and corresponding levers on the shaving section lifting shafts, one of which is shown at 6 in Fig. 1. The shafts 4 and 4′ are rocked simultaneously with the corresponding shafts 3 of the shaving section by a link 8 connected to the studs 5 and 5′ at its opposite ends (Fig. 3). A cam follower 9 secured to the link 8 engages a cam 10 on a shaft 126, whereby the link 8 is reciprocated in timed relation to the rotation of the shaft 11. The link 8 is provided with a central elongated opening 123 which embraces the shaft 126. Gears 12, 13 and 14 transmit driving power from the main shaft 11 to drive the shaft 126 at the same speed as the shaft 11.

The plate lifting mechanism of the pocket milling section is of the same construction as that illustrated and described in detail in Patent No. 2,364,032 above referred to, and a detailed description thereof will not be given herein. The lifting mechanism as best shown in Figs. 8 and 9 comprises corresponding lifting parts adjacent opposite sides of the machine operated respectively by the shafts 4 and 4′. The coresponding oppositely disposed parts are designated by like reference characters bearing distinctive exponents. The rollers 2 and 2′ are connected to lifting bars 120 and 120′ by brackets having toes 106 and 106′ that engage fixed stops 107 and 107′ when the bars 120 and 120′ are in their lowest positions. Engagement of the toes with these stops lifts the rollers 2, 2′ above the upper edges of the lifting bars 120, 120′, as shown in Fig. 8. Thus when the lifting bars are lowered, the straight edges of the stereotype plate P thereon rest on the rollers 2, 2′ and are free to move into or out of the pocket milling section, subject to the control of the stop 1, and when the bars are lifted, the rollers drop below the upper surfaces of the bars so that the bars directly engage the lower edges of the plate, as shown in Fig. 9.

The lifting bars 120 and 120′ have ledges 127, 127′ which engage the outside surfaces of the plates adjacent their edges. The motion of the lifting bars is such that the plate is pinched slightly as it is raised so that its edges pass upward without striking the arch liner 130. This motion is provided by a series of levers operated from the shafts 4, 4′. A lever 109 is fixed to the shaft 4 and connected to the lifting bar 120 by a link 112 through pivots 110 and 115. A pinching fork lever 113 is carried by a fixed pivot 114 and carries on its lower arm a roller 124 engaging a cam groove in a cam 125, fixed to the shaft 4. The upper end of the lever 113 is pivotally connected to a stud 116 that is fixed to the lifting bar 120. With this arrangement, movement of the shaft 4 to the position shown in Fig. 9 lifts the bar 120, moving it inward toward the center of the arch as it is lifted so as to slightly pinch the plate, the pinching being relieved as the plate reaches its uppermost position in the arch liner 130. The link 112′ on the left side of the machine is provided with a spring 117 arranged to make the link resiliently compressible, so that the mechanism firmly clamps the plate in the arch liner when the plate is raised.

Due to the inclined position of the plate P in the pocket milling section M, it has a tendency to move outward by gravity from this section in all operating positions except when it is clamped against the arch liner 130 by the lifting bars 120 and 125. Such movement of the plate out of the milling section is prevented by the stop 1, and mechanism is provided to normally move this stop up and down in synchronism with the cyclic operation of the machine in performing the pocket milling operation. A lever 18, fulcrumed on a fixed stud 19 pivotally engages the stop 1 at 129 (Figs. 2 and 19). A cam follower roller 131 is carried by the opposite end of the lever 18 and engages a cam 21 fixed to the central shaft 23. A compressed spring 20 surrounds a rod 145 fixed to a sleeve 148 that is pivotally connected to the lever 18 at 147. The lower end of the spring 20 engages a fixed bracket 149 and the spring normally holds the roller 131 in contact with the cam 21 and lifts the plate stop 1 when the roller 131 engages the depressed part of the cam 21. The shaft 23 is connected to the main shaft 11 by interconnected flanges 280 and 281, and so forms a continuation of the shaft 11 and turns through one revolution for each operating cycle of the machine. The cam 21 is so shaped as to lift the stop 1 in synchronism with the action of the above described plate lifting mechanism. Thus the stop 1 is extended to hold the plate against movement out of the pocket milling section when the plate moves into this section and thereafter while the plate is lifted to and lowered from its clamped position, and the stop is retracted to move below the plate and so release it for movement out of the milling section after the plate has been lowered following a pocket milling operation. After the release of the plate by the stop 1, the cam 21 again extends the stop to a position to arrest the movement of the next successive plate fed into the pocket milling section.

It is sometimes desirable to pass plates through the machine without milling pockets therein, as where conventional compression locked plates, which do not require pockets, are to be produced. In accordance with the present invention, this may be accomplished by locking the plate stop 1 in its lower position, whereby plates thereafter feed from the shaving section into the pocket milling section, pass directly through the milling section to the cooling section C beyond it without being lifted into the milling arch or milled.

The mechanism for locking out plate stop 1 is best shown in Figs. 19, 21 and 22. A collar 150 is fixed to the lower end of the sleeve 148, and both the collar 150 and the rod 145 slidably engage a bracket 149 that is fixed to the frame of the machine. A lateral opening is formed in the collar 150 and a control rod 151 is slidably carried by the bracket 149 and has a tapered inner end that may be moved into the lateral opening in the collar 150 to retain the sleeve 148 in its lowered position in which the plate stop 1 is retracted to permit plates to pass through the milling section M without being lifted or milled. The rod 151 passes out through the side of the machine frame and carries an operating knob 152 at its outer end. A spring 153 compressed between the inner surface of the machine frame and a collar 152′ on the rod 151 biases the rod toward its inner plate stop lockout position. A cam 154 fixed to the outside of the machine frame around the rod 151 withdraws the rod from the sleeve collar opening when the knob 152 is turned to rotate the rod 151 in a counterclockwise direction to the position designated "On" in Fig. 19. The cam 154 permits the rod 151 to move inward under the action of the spring 153 and so to enter the lateral opening in the collar 150 when the knob 152 and rod 151 are turned clockwise to the position marked "Off." After the rod 151 is so moved inward by the spring 153, the next time that the cam 21 lifts the roller 131 and so retracts the plate stop 1, the inner tapered end of the rod snaps into a lateral opening in the collar 150 and locks the sleeve 148 and the plate stop 1 in the retracted plate releasing position. So long as the plate stop is thus locked down, rotation of the cam 21 does not move the stop operating lever 18.

In accordance with the invention, a series of spaced pockets are simultaneously milled in the inner surface of each plate adjacent each edge thereof by two sets or gangs of spaced milling cutters, the cutters of each set being mounted in a common supoprt and manipulated in unison. The cutter mounting element for each gang of cutters comprises an elongated cutter bar 24, 24′, one of which, namely, the rearward cutter bar 24′, is shown in section in Fig. 10. The cutter bars have elongated cylindrical end members, shown at 80′ and 81′ in Fig. 10, which form journals carried in bearings 82′ and 83′ that are integral with the main frame 15 of the machine. A cylindrical recess 84′ is provided beyond the end journal 81′, and the journal 85′ of a transverse yoke 38 is seated in this recess. The yoke 38 connects the two cutter bars 24 and 24′ to cause them to reciprocate in unison longitudinally along their axes in their end bearings (Fig. 7). A cam roller 37 is rotatably secured to the center of the yoke 38 and engages a cam groove 86 in a cam 36 fixed to the main central shaft 23 (Figs. 2 and 7).

The cam 36 is shaped to reciprocate the two cutter bars 24 and 24′ from the position shown in Figs. 2 and 10 toward the upper or entrance end of the pocket milling section M and back again during each operating cycle of the machine, this reciprocation taking place while the plate P is held in its raised position as shown in Fig. 9.

Each cutter bar carries a gang of pocket milling cutters 25, 25′. In the disclosed embodiment, four such cutters are provided on each cutter bar. As shown in Figs. 8, 9 and 11, the cutters are shaped to cut pockets K. K′ of generally hook shaped section in the inner surfaces of the stereotype plates near their straight side edges. The number of cutters employed on each cutter bar is the same as the number of pockets cut in each side of the plate. The cutters 25′ are fixed to the outer ends of parallel spindles 27′ journaled in anti-friction bearings 88′ in the cutter bar 24′. The spindles extend upward radially from the axis about which the cutter bar turns and along which it reciprocates in the bearings 82′ and 83′. An auxiliary cutter 26′ is provided below each cutter 25′ to remove any burr or protuberance that may be formed by the cutter 25′ along the lower edge of the pocket. A skirt or slinger 132′ is fixed to each of the spindles 27′ below the cutter 25′ thereon, and is provided with radially extending fins or ridges 133′ which serve to fan away the chips formed by the cutters.

Each cutter spindle 27′ has fixed thereto a bevel gear 28′ within a gear case 89′ in the cutter bar 24′. A central cutter drive shaft 30′ is journaled in the cutter bar coaxially with its end portions 80′ and 81′ in bearings 90′, 91′ and 92′. An elongated drive pinion 35′ is fixed to the end of the drive shaft 30′ beyond the lower end of the cutter bar as shown in Fig. 10. The lower end of the shaft 30′ is slidably journaled in the frame of the machine at 93′. A motor 31 mounted from the machine frame on a bracket 32 drives the pinions of the two cutter drive shafts through the gears 33 and 34 (Fig. 2).

A plurality of bevel gears 29′ and 95′ are fixed to the drive shaft 30′ within the gear case 89′ of the cutter bar 24′. The bevel gears 29′ engage cooperating bevel gears 28′ fixed to the spindles 27′ of alternate cutters, and the oppositely disposed bevel gears 95′ engage the bevel gears 28′ on the spindles of the intervening cutters, whereby the adjacent cutters are rotated in opposite directions. This arrangement insures that the teeth of adjacent pairs of cutters move in the same direction toward or away from the plate being milled, so that chips carried by the cutter teeth moving out of the plate are thrown toward the center of the machine and are not thrown into cutter teeth that are moving toward the plate. The lodging of a substantial amount of chips in or between cutter teeth that are entering the plate metal may cause inaccuracies in the cutting operation. The rotational arrangement of the cutters of the two sets 25 and 25′ is such that the cutters of each set throw chips toward the center of the machine from between each adjacent pair of cutters of each set, and the oppositely disposed cutters 25 and 25′ rotate in opposite directions. This rotational relation and the arrangement of the bevel gears 29 and 29′, 95 and 95′ for producing it are clearly illustrated in Fig. 12.

In order to prevent the chips from one set of cutters 25 from being thrown into the opposite set of cutters 25′, and generally to confine the chips to a desired discharge path, guards or hoods 134 and 134′ are respectively provided on the two cutter bars 24 and 24′. As shown in Figs. 8, 9 and 10, these hoods extend substantially vertically along the inner sides of the cutter bars and the cutters thereon, and curve outwardly over the upper ends of the cutters. The hoods are fixed to the cutter bars by means of nuts 136′ which pass through flanges 135′ on the hoods and engage bolts in the upper surfaces of the cutter bar 24′. The chips from the cutters 25, 25′ are thrown inward as explained and are deflected downward by the hoods as indicated by the arrows in Figs. 8 and 9. The chips fall into a chute 137 that extends beneath the pocket milling section, and are carried out through the end of this chute by a screw conveyor 139 and dropped into a pan 138. The conveyor 139 is carried by a shaft 156 journaled in the main frame and driven from the main central shaft 23 through the gears 51, 52, 53 and 54 (Figs. 2 and 4).

Fixed cam plates 94 and 94′ having cam grooves 41 and 41′ therein are provided for rocking the cutter bars 24 and 24′ about their axes as they are axially reciprocated, whereby the sets of cutters 25 and 25′ are moved outwardly to cut the pockets in the plates. Brackets 39 and 39′ carrying downwardly extending rollers 40 and 40′ are attached to the cutter bars 24 and 24′ as shown in Figs. 7 and 10. The rollers 40 and 40′ ride in the cam grooves 41 and 41′ of the cam plates 94 and 94′. The cam grooves are shaped as shown in Figs. 14 and 15 to move the rollers 40 and 40′ inwardly as the cutter bars are reciprocated axially toward the entrance end of the milling section M, thereby swingng the two sets of cutters 25 and 25′ outward and into pocket milling engagement with the inner surfaces of the plate P. The cam plates 94 and 94′ are formed integral with or fixed to plates 97 and 97′ which are adjustably clamped to the lower face of a frame member 98 in positions to fix the cam plates 94 and 94′ in openings in this frame member, as shown in Figs. 10, 14 and 15. The plates 97 and 97′ have lateral inner slots 99 and 99′ therein for the reception of a central key 141 fixed to the frame member 98. Keys 142 and 142′ similarly fixed to the frame member 98 engage oppositely disposed slots 143 and 143′ in the outer edges of the plates 97 and 97′, and adjusting bolts 42 and 42′ extend through the respective keys 142 and 142′ and engage the plates 97 and 97′ and serve to adjust these plates and the cam plates 94 and 94′ laterally of the machine to thereby adjust the lateral stroke of the cutters, as will be seen from Fig. 7. The plates 97 and 97′ are clamped to the frame member 98 by bolts 144 and 144′ which pass through laterally extending slots in the plates as shown in Figs. 14 and 15.

The motion imparted to the pocket milling cutters by the cam grooves 41 and 41′ is illustrated in Fig. 11. As there shown, the cutters are rocked outwardly as the cutter bar moves them longitudinally of the machine so that they penetrate the inside surface of the plate and cut the several pockets K′ simultaneously as they move longitudinally of the machine, being retracted from the plate at the end of the return stroke.

As the cutters 25, 25′ mill pockets in the plates, chips or lumps of plate metal frequently stick or cling to the cutters and impair the accuracy of the pocket milling operation. To avoid this, it is preferred in accordance with the present invention to provide apparatus for supplying a lubricant or cutting liquid to the cutters prior to or during each cutting operation thereon. In the disclosed embodiment, a lubricator L is employed to supply lubricant for this purpose. The lubricator L is of known construction in which a plunger type mechanism pumps lubricant from a reservoir 158 out through a tube 159 when a spring returned lever 160 is reciprocated, the amount of lubricant delivered on each reciprocation of the lever being determined by the length of its stroke. The lubricator L is carried by a bracket 161 secured to the outside of the machine frame as shown in Figs. 19 and 20, and a rod 162 reciprocated by an arm 163 fixed to the plate lifter operating shaft 4 extends through an opening in the main frame to engage and reciprocate the lever 160. The lubricator L is adjustable laterally of the machine to vary the length of the stroke of the lever 160, and for this purpose the screws 164 that secure the lubricator to the bracket 161 pass through elongated bracket openings 166. An adjusting screw 165 extends laterally in the bracket 161 and has a flange engaging the front of the lubricator for the purpose of obtaining a fine adjustment of the inward movement of the lubricator when it is desired to increase the stroke of the lever 160.

The lubricant supply tube 159 passes inside the machine frame through an opening and is connected to a fixed centrally disposed T 167 at the entrance end of the pocket milling section M (Fig. 19). Two flexible ducts 168 and 168' lead from the T 167 to the respective headers 169 and 169' carried respectively on top of the hoods 134 and 134' of the two cutter bars 24 and 24' (Figs. 8, 9 and 19). Each of these headers is provided with four outlets in the form of variable orifice metering units 170 and 170' from which tubes 171 and 171' extend through the tops of the hoods 134 and 134' at points directly over the respective milling cutters 25 and 25'. The metering units 170 and 170' insure that equal amounts of lubricant are delivered to the several cutters of each gang unit.

When the plate stop 1 is locked in its retracted position so that successive plates pass directly through the milling section M without being lifted into the arch liner 130, the cutters 25 and 25' swing outwardly during that part of the machine cycle when no plate is present in this section, and hence under these conditions, no lubrication of the cutters is required. In accordance with the invention, means are provided for preventing the supply of lubricant by the lubricator L when the plate stop 1 is locked out in its retracted position. A lever 172 is pivotally secured to the top of the lubricator reservoir 158 and has a wedge-shaped inner end 173 which moves under the lower end of the lubricator operating lever 160 and so moves this lever to and locks it in its outer position, out of range of the stroke of the operating rod 162, when the outer end of the lever 172 is moved to the left as shown in Fig. 21. A rod 174 is connected by ball and socket joints between the outer end of the lever 172 and a depending crank arm 175 fixed to the rod 151. When the rod 151 and knob 152 are in the "On" position as shown in Figs. 19 and 20, the lever 160 is free to move inward under its spring bias within range of the stroke of the operating rod 162, whereby the lever is oscillated and lubricant is supplied to the cutters. When the knob 152 and rod 151 are turned clockwise to the "Off" position to lock out the plate stop 1, the outer end of the lever 172 is swung to the left as shown in Figs. 19 and 21 and the lubricator operating lever 160 is moved to and locked in its inoperative position. Thereafter, as long as plates pass through the milling section M without being milled, no lubricant is supplied to the cutters.

After leaving the milling section M, the successive plates P pass into the cooling and drying section C of the machine along the rollers 180 and 180' adjacent the opposite sides of this section, and the successive plates are held in this section by the stops 43 and 43' adjacent the lower or outlet end of the section (Figs. 1, 2, 5 and 6). The stops 43 and 43' are respectively carried on upwardly extending arms 181, 181' of hollow sleeves 182, 182' which are slidably and rotatably carried on fixed stub shafts 183, 183'. Coiled compression springs, one of which is shown at 186' of Fig. 2, are interposed between the upper ends of the shafts 183, 183' and sleeves 182, 182' to permit resilient yielding movement of the stops carried by the sleeves toward the outlet end of the machine and thereby cushion the shock or impact caused by a plate striking the stops 43, 43'. Cam rollers 184, 184' are carried by depending arms 185, 185' on the sleeves 182, 182'. These rollers respectively engage cams 187, 187' fixed to the central main shaft 23 at longitudinally spaced points thereon, and oppositely disposed cam extentions 44 and 44' are provided on these cams. The stops 43 and 43' are biased toward their outward plate stopping positions, and the rollers 184 and 184' are held in contact with their respective cams 187 and 187' by a compressed spring 188 surrounding rods 189, 189' pivotally connected respectively to arms 190, 190' on the stop sleeves 182, 182' (Figs. 2 and 5). The rods 189 and 189' are slidably retained in alignment by a sleeve 191 within the spring 188. With this arrangement, the stops 43 and 43' are retracted to release a plate P from the cooling and drying section C at the end of each cooling and drying cycle, and are returned to stopping position immediately after the plate has moved out of the cooling section.

The cooling section contains a lower arch shaped spray casting 192 having water conducting depressions 193 and 193' in its outer surface. Spray plates 194 and 194' having openings 195 therein respectively cover the water conducting depressions 193 and 193' of the casting 192. The openings 195 serve as nozzles to spray water from the depressions 193 and 193' outwardly onto the under surface of the plate P (Figs. 7 and 16). Water is conducted into the depressions 193 and 193' of the casting 192 by pipes 196 and 196' connected to a pipe 197 which in turn is connected through a pipe 206 to a solenoid operated water supply valve 207 (Figs. 1, 7 and 16). The spray plates 194 and 194' have imperforate side extensions forming skirts 198 and 198' that extend below the casting 192 and terminate in the side troughs 199 and 199' (Figs. 1, 5, 7 and 16). Drain pipes 200 and 200' are connected to the lower ends of these troughs and led to a common transverse drain 201 (Figs. 1 and 16).

An under air pipe 202 extends along the top of the casting 192 in a groove therein and is provided with openings which direct jets of air upwardly and outwardly on the under surface of the plate, as shown in Figs. 7 and 16. An extension 203 of this pipe 202 is connected through the pipe 204 to a solenoid operated air supply valve 205 (Fig. 1).

An arch shaped outer water manifold 208 is suitably supported on extensions 209, 209' of the main frame intermediate the ends of the cooling and drying section, and extends close to and above the path of a plate in this section. Upper spray pipes 210 are connected to and extend in opposite direction from the manifold 208 along the length of the cooling and drying section and are provided with downwardly directed openings 211 through which water may be sprayed on the outer surface of the plate P (Figs. 1, 2 and 7). A pipe 212 conducts water from the pipe 206 to the manifold 208 (Figs. 1 and 16). As shown in Figs. 7 and 16, the frame 15 forms troughs 213 and 213' below and outside of the frame extensions 209, 209' in which some of the cooling water may collect, and drain pipes 214, 214' connect these respective troughs with the drain pipes 200 and 200', as shown in Figs. 1 and 16.

An outer arcuate air pipe 215 extends above the plate path just below the lower ends of the water spray pipes 210 at the outlet end of the cooling and drying section and is supported by suitable securement of its opposite ends to the frame extensions 209, 209' (Figs. 1, 2 and 16). A plurality of holes 216 extend through this pipe 215 in a direction radially inward and longitudinally rearward of a plate P so that the air jets passing through these holes strip water from the plate and force the water back toward the interior of the cooling and drying section as the plate moves out of this section. In order to insure that the air jets from these holes 216 are directed downward on both sides of the arcuate outer plate surface, the air inlet pipe 217 is connected to the arcuate air pipe 215 at its uppermost central point. The pipe 217 is connected to the air supply pipe 204 (Fig. 1). An arch shaped removable cover 218 is provided for the cooling and drying section C, and handles 219 thereon facilitate its removal.

In accordance with the invention, the supply of both cooling water and drying air to each plate in the combined cooling and drying section C is primarily governed by the movement of a plate into this section, the successive supply of first water and then air being controlled by the cyclic timing rotation of the main shaft of the machine. With this arrangement, the supply of water and air is initiated only if a plate is present in the cooling and drying section.

The plate movement responsive means for providing this control is shown in Figs. 5 and 6 and includes a pair of rollers 47 and 47' disposed at opposite sides of the machine in the path of the opposite side edges of the plates and adjacent the lowermost of the plate carrying rollers 180, 180'. The rollers 47 and 47' are respectively carried by arms 48 and 48' pivotally connected to the frame at 49, 49'. Operating rods 220 and 220' are respectively pivotally connected to the roller arms 48 and 48' and pass through stuffing glands 221, 221' in the troughs 199, 199'. The lower ends of the rods 220, 220' are respectively pivotally connected to crank arms 222, 222' fixed to a transverse shaft 223 journaled at its end in the machine frame. A counterweight 224 adjustably supported on a crank arm 225 fixed to the shaft 223 normally biases the connected mechanism so as to move a switch operating arm 225', which is fixed to the shaft 223 to a position to depress the plunger 226 of a switch 79 and so open the contacts 227 of this switch (Figs. 6 and 25). In this position, the rollers 47 and 47' are lifted slightly above the path of the lower side edges of a plate P supported by the conveying rollers 180, 180' of the cooling and drying section, as shown in Fig. 6. When a plate moves down into the cooling and drying section and its leading end approaches the stops 43 and 43', its side edges strike and depress the rollers 47 and 47' and so turn the shaft 223 clockwise as viewed in Fig. 6, permitting the plunger 226 of the switch 79 to move outward and close the contacts 227 of the switch. This switch closure supplies current to successively energize the solenoids which open the water and air valves 207 and 205 through control mechanism described below.

Referring to Fig. 23, the main central shaft 11 of the machine is driven by a motor 228 carried by a bracket 229 at the upper end of the machine above the shaving section S. The motor 228 drives the shaft 11 through the gear train 230, the worm 231, worm wheel 232, worm 233 and the worm wheel 234 fixed to the shaft 11.

The upper end of the shaft 11 carries a cam 84 which extends around substantially one-half the circumference of the shaft and cooperates with the operating lever 235 of a switch 85. The arrangement is such that when the operating arm 235 is depressed by the cam 84, the movable contact 236 of the switch engages the stationary contacts 237 thereof and completes an energizing circuit for the solenoid winding 238 of the water valve 205, provided the switch 79 operated by a plate in the cooling and drying section C has been closed as described above. The energizing circuit for the water valve solenoid 238 is readily apparent from the wiring diagram (Fig. 25). The cam 84 closes the switch 85 just after the point in the cycle of operation at which the plate stop 1 at the exit end of the milling section M has been retracted to permit a plate to pass into the cooling and drying section. Thus water is supplied simultaneously to the upper and lower surfaces of the plate in the cooling and drying section for substantially one-half of the cycle of machine operation, whereupon the cam 84 releases the switch arm 235 and the movable contact 236 of the switch 85 connects the stationary contacts 239. This results in a de-energization of the water valve solenoid 238 closing the water valve 207, and the energization of the solenoid 240 which opens the air valve 205. Thereafter for the remaining half of the cycle, compressed air is delivered from the air valve to the above described outlets in the cooling and drying section with the result that the cooling water is blown off of the inner and outer surfaces of the plate. The energizing circuit for the air valve solenoid 240 is clearly shown in Fig. 25. While the air valve 205 is still open, and shortly before the end of the cooling and drying cycle, the stops 43 and 43' are retracted by the cam mechanism on the shaft 23 which has been described above, and the plate moves out of the cooling and drying section. Air jets from the arcuate outer air pipe 215 play on the outer surface of the plate as it moves, stripping water from the plate surface and forcing the water back into the interior of the cooling and drying section. Just before the plate leaves the cooling and drying section, the trailing ends of its side edges leave the rollers 47 and 47', and the switch 79 is thereby opened de-energizing the solenoid 240 of the air valve 205 and thus cutting off the supply of air. This completes the cooling and drying cycle which is again initiated during the next revolution of the main shaft after a short interval to permit another plate to move into the cooling and drying section C.

As has been explained above, power from the main central shaft 11 driven by the motor 228 is employed to rock the gangs of cutters 25, 25' outward into milling engagement with the plates P, whereas the cutters are rotated by power from the motor 31. To avoid such damage to the machine parts and the plates as would result if the cutters were moved against the plate surfaces when not rotating, the machine of the invention incorporates control means acting to de-energize the main shaft drive motor 228 if and when rotation of the milling cutters is discontinued for any reason. For this purpose, means responsive to the rotation of the milling cutter drive motor 31 is employed to maintain the energizing circuit for the main shaft motor 228 closed.

As shown in Figs. 17, 18 and 23, a control device 0 is suitably supported adjacent and driven by the motor 31. The device 0 has a central shaft 245 carrying a gear 246 driven by a pinion 247 on the outer end of the shaft of the motor 31. The shaft 245 extends inside a closed housing 248 filled with oil or other suitable liquid, and has a disc 249 fixed to its inner end. A similar disc 250 is rotatably supported from a bearing 251 in axial alignment with and closely adjacent the disc 248. The free disc 250 carries a movable contact 252 cooperating with a fixed contact 253 carried by the housing 248. A weight 254 biases the free disc 250 to turn in a direction to separate the contacts 252 and 253 when the motor 31 is not operating, a stop 255 being provided to limit contact separating rotation of the disc. When the motor 31 is operating, driving torque is transmitted through the thin layer of oil between the discs 248 and 250, and the free disc 250 is turned in a direction to close the contacts 252 and 253 and hold them closed so long as the motor 31 continues to operate.

Referring to Fig. 26, the power for operating the motors 228 and 31 is obtained from any suitable source represented by the wires AC and is connected through a main switch 256 and the wires 257, 258 and 259 to the fixed contacts 260, 261 and 262 of a magnetically operated contactor R. A manually operable safety switch 263 located at the machine is connected between the contactor R and two of the leads 264 and 265 connected in parallel to the two motors 228 and 31. The remainder of the control circuits will be apparent from the following description of the operation.

When the button designated "Start" is depressed, the closing solenoid 266 of the contactor R is energized through a circuit including the line wire 259, wires 267 and 268, movable contact of the "Start" button, wire 269, movable contact of the "Stop" button, wire 270, safety switch 263, wire 271, solenoid 266 and wire 272 to line wire 258. Energization of the solenoid 266 closes the movable contacts of the contactor R, supplying energy from the line 257 to the motor lead 273 through the wire 274, from the line 258 to the motor lead 264 through the wire 275 and from the line 259 to the lead 265 through the wire 276. This energizes both of the motors 228 and 31. Energization of the cutter drive motor 31 causes its rotation and so closes the contacts 252 and 253 of the control device 0. Thereafter, when the operator releases the "Start" button, the energizing circuit for the contactor solenoid 266 is maintained through the contacts 252 and 253 of the device 0, the wire 267, the movable contact 277 of the contactor R and the wires 278 and 279. If for any reason, the cutter driving motor stops rotating, the contact 252 of the device 0 is moved away from the contact 253 thereof, the described holding circuit for the contactor solenoid 266 is broken and the contactor R opens, de-energizing the main shaft drive motor 228. Both of the motors 31 and 228 may be stopped by depressing the "Stop" button and so breaking the described contactor solenoid energizing circuit. In an emergency, the two motors may be de-energized by opening the manual safety switch 263.

The main central shaft made up of the interconnected aligned shafts 11 and 23 governs the cyclic operation of all of the machine sections. A cycle of operations is performed on a plate in each of the several machine sections during each revolution of the shaft. Thus while one plate is being shaved in the shaving section S, another plate has pockets milled therein in a pocket milling section M and a third plate is cooled and dried in the cooling and drying section C. The interval during which each plate remains in a given section is controlled by the stops 102, 1 and 43, 43' at the outlet ends of the sections, and as explained above, these stops are retracted to release one plate during each revolution of the central shaft. The stop 1 may be locked in retracted position to permit plates to pass directly through the pocket milling section and into the cooling and drying section C from the shaving section S. By virtue of the described control mechanism, the rotation of the main central shaft governs the supply of water to cool the plates for substantially half the cycle during which they remain in the section C, and to cut off the water supply and direct jets of air to strip the water from the plate during the remaining half of the operating cycle. Air supply is continued during the movement of the plate out of the cooling and drying section C so that air from the upper arched air pipe 215 strips water from the upper surface of the plate as it moves out of the cooling and drying section.

We claim:

1. In a machine for milling pockets in stereotype plates, the combination of a support for a semi-cylindrical plate, a cutter bar, means for mounting said cutter bar to rock about and slide along an axis parallel to the axis of a plate in said support, a plurality of parallel cutter spindles journaled in said cutter bar and extending radially of said bar axis, a cutter fixed to each of said spindles, means for simultaneously rotating said spindles, and means for moving said cutter bar longitudinally along its axis and for rocking said cutter bar about said axis during its longitudinal movement, whereby all of said cutters are moved in unison into contact with and along the interior surface of a plate on said support.

2. In a machine for milling pockets in the interior surfaces of semi-cylindrical stereotype plates, the combination with a plate supporting arch of a plurality of rotary pocket milling cutters disposed at points spaced longitudinally of the inner surface of said arch adjacent one edge thereof, means for simultaneously reciprocating said cutters in unison longitudinally of said arch and moving said cutters transversely of said arch, and means for rotating the adjacent cutters in opposite directions.

3. In a machine for milling pockets in stereotype plates, the combination with a support for a semi-cylindrical plate, a pair of spaced parallel elongated cutter bars extending parallel to the axis of a plate on said support adjacent opposite sides thereof, journals supporting said respective cutter bars for rocking movement about and longitudinal movement along their longitudinal axes, a plurality of rotary cutters carried on parallel spindles journaled in and extending radially of the axis of each of said cutter bars, means for reciprocating said cutter bars in unison along their axes, cams adjacent said respective cutter bars for rocking said bars about their axes as they reciprocate, whereby the cutters of said respective bars are moved laterally into engagement with the inner surfaces of a plate on said support, and means for simultaneously rotating the spindles of both of said cutter bars.

4. In a machine for milling pockets in stereotype plates, in combination with an arch and means for lifting a semi-cylindrical plate against said arch, a drive shaft connected to operate said plate lifting means, a pair of spaced elongated parallel cutter bars extending parallel to the axis of said arch adjacent opposite sides thereof, journals supporting said respective cutter bars for rocking movement about and longitudinal movement along their longitudinal axes, a plurality of rotary cutters carried on parallel spindles jour-

naled in and extending radially of the axis of each of said cutter bars, a cam driven by said drive shaft for reciprocating said cutter bars in unison in timed relation to the operation of said plate lifting means, cams adjacent said respective cutter bars for rocking said bars about their axes as they reciprocate, whereby the cutters of said respective bars are moved in unison into engagement with opposite inner surfaces of a plate on said arch while the cutter bars are reciprocated, and means for simultaneously rotating all of the cutters of both of said cutter bars.

5. In a machine of the character described, in combination, an arch for supporting a semi-cylindrical stereotype plate, a pair of spaced parallel elongated cutter bars disposed adjacent opposite sides of said arch parallel to its inner surface and adjacent its opposite side edges, a gang of milling cutters supported on each of said cutter bars, each gang comprising a plurality of rotary cutters carried on parallel aligned spindles extending upward from the cutter bar substantially radially of its longitudinal axis, means for simultaneously rotating all of said cutters, means for reciprocating said cutter bars along and rocking them about their longitudinal axes whereby said gangs of cutters are moved in unison into and longitudinally of the inner surfaces of a plate in said arch, and a hood secured to each of said cutter bars and extending upwardly therefrom between the cutters thereon and the cutters of the opposite cutter bar.

6. In a machine of the character described, in combination, an arch for supporting a semi-cylindrical stereotype plate, a pair of spaced parallel elongated cutter bars disposed adjacent opposite sides of said arch parallel to its inner surface and adjacent its opposite side edges, a gang of milling cutters supported on each of said cutter bars, each gang comprising a plurality of rotary cutters carried on parallel aligned spindles extending upward from the cutter bar substantially radially of its longitudinal axis, means for simultaneously rotating the adjacent cutters of each of said gangs in opposite directions, means for reciprocating said cutter bars along and rocking them about their longitudinal axes whereby said gangs of cutters are moved into and longitudinally of the inner surfaces of a plate in said arch, and a hood secured to each of said cutter bars and extending upwardly therefrom between the cutters thereon and the cutters of the opposite cutter bar.

7. In a machine of the character described, in combination, an arch for supporting a semi-cylindrical stereotype plate, a pair of spaced parallel elongated cutter bars disposed adjacent opposite sides of said arch parallel to its inner surface and adjacent its opposite side edges, a gang of milling cutters supported on each of said cutter bars, each gang comprising a plurality of rotary cutters carried on parallel aligned spindles extending upward from the cutter bar substantially radially of its longitudinal axis, means for simultaneously rotating all of said cutters, means for reciprocating said cutter bars along and rocking them about their axes whereby said gangs of cutters are moved into and longitudinally of the inner surface of a plate in said arch, a hood secured to each of said cutter bars and extending upwardly therefrom inside the cutters thereon and over the tops of the cutters, a lubricant supply device, means carried by each of said hoods over said cutters for dropping lubricant on said cutters, and flexible ducts connected between said hood carried means and said lubricant supply device.

8. In a machine of the character described, in combination with an arch for supporting a semi-cylindrical stereotype plate, means for lifting a plate into said arch, drive means for intermittently operating said plate lifting means, at least one elongated cutter bar disposed inside and adjacent one side edge of said arch, at least one rotary milling cutter supported on said cutter bar on a spindle extending upward from said cutter bar, means for rotating said cutter, means for rocking said cutter bar to move said cutter into the inner surface of a plate in said arch, a lubricant supply device, means for conducting lubricant from said device to and dropping it on said cutter, and means operated by said plate lifting device for intermittently operating said lubricant supply device.

9. In a machine of the character described, in combination with an inclined arch for supporting a semi-cylindrical stereotype plate, plate supporting means adjacent opposite sides of said arch for permitting a plate to move by gravity longitudinally beneath said arch, a plate stop adjacent the lower end of said arch and movable between an extended position for arresting movement of a plate beneath said arch and a retracted position for permitting a plate to move out from under said arch, plate lifting means for lifting a plate into said arch, intermittently operated drive means for successively moving said plate stop to its extended position and then operating said plate lifting means, and means for preventing movement of said plate stop to its extended position by said drive means whereby a plate may move through and out of said arch without being lifted by said plate lifting means.

10. In a machine of the character described, in combination with an inclined arch for supporting a semi-cylindrical stereotype plate, plate supporting means adjacent opposite sides of said arch for permitting a plate to move by gravity longitudinally beneath said arch, a plate stop adjacent the lower end of said arch and movable between an extended position for arresting movement of a plate beneath said arch and a retracted position for permitting a plate to move out from under said arch, at least one rotary pocket milling cutter within said arch movable laterally thereof into milling engagement with a plate in said arch, drive means for successively moving said plate stop to its extended position and then moving said cutter into contact with a stopped plate, and means for preventing movement of said plate stop to its extended position by said drive means whereby a plate may move through and out of said arch before said cutter is moved into engagement with said plate.

11. In a machine of the character described, in combination with an inclined arch for supporting a semi-cylindrical stereotype plate, plate supporting means adjacent opposite sides of said arch for permitting a plate to move by gravity longitudinally beneath said arch, a plate stop adjacent the lower end of said arch and movable between an extended position for arresting movement of a plate beneath said arch and a retracted position for permitting a plate to move out from under said arch, at least one rotary pocket milling cutter within said arch movable laterally thereof into milling engagement with a plate therein, drive means for successively moving said plate stop to its extended position, then moving said cutter into and out of milling engagement

with a stopped plate and then moving said plate stop to its retracted position, and means for holding said plate stop in its retracted position whereby a plate may move through and out of said arch before said cutter is moved into engagement with said plate.

12. In a machine of the character described, in combination with an inclined arch for supporting a semi-cylindrical stereotype plate, plate supporting means adjacent opposite sides of said arch for permitting a plate to move by gravity longitudinally beneath said arch, a plate stop adjacent the lower end of said arch and movable between an extended position for arresting movement of a plate beneath said arch and a retracted position for permitting a plate to move out from under said arch, at least one rotary pocket milling cutter within said arch movable laterally thereof into milling engagement with a plate therein, drive means for successively moving said plate stop to its extended position, then moving said cutter into and out of milling engagement with a stopped plate and then moving said plate stop to its retracted position, a lubricant supply device acting when operated to supply lubricant to said cutter, means for operating said lubricant supply device, and means for simultaneously holding said plate stop in its retracted position and stopping the operation of said lubricant supply device whereby a plate may be permitted to move through and out of said arch without engagement by said cutter.

13. In a machine of the character described, in combination with an inclined arch for supporting a semi-cylindrical stereotype plate, plate supporting means adjacent opposite sides of said arch for permitting a plate to move by gravity longitudinally beneath said arch, a plate stop adjacent the lower end of said arch and movable between an extended position for arresting movement of a plate beneath said arch and a retracted position for permitting a plate to move out from under said arch, at least one rotary pocket milling cutter within said arch movable laterally thereof into milling engagement with a plate therein, drive means for successively moving said plate stop to its extended position, then moving said cutter into and out of milling engagement with a stopped plate and then moving said plate stop to its retracted position, a lubricant supply device acting when operated to supply a lubricant to said cutter, means for operating said supply device, means for holding said plate stop in its retracted position against movement by said drive means, means for stopping the operation of said lubricant supply device and manually operable means for simultaneously actuating said plate stop holding means and said lubricant supply device stopping means.

14. In a machine of the character described, in combination, a cutter bar, a plurality of parallel spindles journaled in and extending from said cutter bar, driving means for rotating said spindles, rotary milling cutters fixed to said spindles, and skirts on said spindles between said cutters and said cutter bar having radially extending ribs thereon for propelling chips from said cutters outward from said cutter bar.

15. In a machine of the character described, the combination of a support for a semi-cylindrical stereotype plate, of a gang of rotary pocket milling cutters disposed along the inner surface of a plate on said support adjacent one side edge thereof, means for rotating adjacent pairs of cutters of said gang in opposite directions and a skirt having radially extending ribs thereon disposed beneath and connected to rotate with each of said cutters for propelling chips from said cutters outwardly from the plate.

16. In a machine of the character described, the combination with an arch for supporting a semi-cylindrical stereotype plate, of a pair of gangs of pocket milling cutters disposed respectively along opposite sides of said arch adjacent opposite edges thereof for engagement with the inner surfaces of a plate in said arch, a skirt having radially extending ribs thereon disposed beneath and connected to rotate with each of said cutters for propelling chips from said cutters, and a hood extending over each of said gangs of cutters and along the inner sides of said cutters for directing chips from said cutters and said skirts downwardly away from said arch.

17. In a machine of the character described, the combination with an arch for supporting a semi-cylindrical stereotype plate, of a pair of gangs of pocket milling cutters disposed respectively along opposite sides of said arch adjacent opposite edges thereof for engagement with the inner surfaces of a plate in said arch, a skirt having radially extending ribs thereon disposed beneath and connected to rotate with each of said cutters for propelling chips from said cutters, a hood extending over each of said gangs of cutters and along the inner sides of said cutters for directing chips from said cutters and said skirts downwardly away from said arch, and means for rotating the adjacent cutters of each of said gangs in opposite directions.

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Number	Name	Date
1,313,775	Winkler	Aug. 19, 1919
1,397,006	Jolls	Nov. 15, 1921
1,418,490	Sproul	June 6, 1922
1,616,256	Ericson	Feb. 1, 1927
1,843,471	Wood	Feb. 2, 1932
2,060,358	Wood	Nov. 10, 1936
2,273,963	Jereczek	Feb. 24, 1942
2,381,921	Nord	Aug. 14, 1945