My invention relates to machines for reducing printing plates to uniform thickness. The term printing plate as herein employed includes so-called electrotypes, etchings, stereotypes, and the like, whether flat or curved, and whether less than type-high, or type-high or including bases.

My present invention is an improvement on the invention shown, described and claimed in my applications for Letters Patent of the United States on improvements in shaving machines, respectively filed September 21, 1926, as Serial No. 138,841, and September 23, 1926, as Serial No. 137,265.

It is the object of my invention to provide a novel arrangement of rotary cutter-heads acting in different paths upon the back of the printing plate for reducing the printing plate to proximate uniform thickness; further, to provide a novel arrangement of rotary cutter-heads respectively divided into cutter-sections which act successively on the back of the printing plate, and preferably in overlapping relation, for reducing the back of the printing plate to proximate uniform thickness; further, to provide a novel arrangement of rotary cutter-heads cutting in different paths and shaving means acting successively on the back of the printing plate; further, to provide a plurality of rotary cutting agencies acting successively in overlapping relation on the back of the printing plate and shaving means so arranged that the plurality of rotary cutting agencies reduce the printing plate to proximate thickness followed by the action of the shaving means to reduce the printing plate to finished uniform thickness during a single relative travel between the rotary cutting agencies and the shaving means on the one part and the printing plate on the other; further, to provide a rotary cutter-head having a plurality of cutter-sections including reversely slanting cutting edges in a machine of the character mentioned whereby to reduce the end shifting strain between the rotary cutter-head and the printing plate; further, to provide a plurality of such rotary cutter-heads arranged to act simultaneously on the printing plate, the cutting portions of which overlap each other, and, further, to provide shaving means in connection therewith whereby the rotary cutter-heads and shaving means act successively at one relative passage between the same and the printing plate.

It is the object of my invention further to provide a novel arrangement of cutter-heads, shaving means and presser means for the printing plate; further to provide a rotary cutter-head having sectional cutting portions and presser means for the printing plate arranged to act on the printing plate between such sectional cutting portions; further, to supplement such rotary cutter-head and presser means with shaving means at the side of the rotary cutter-head and presser means between the shaving means and the rotary cutter-head; further, to provide a plurality of rotary cutter-heads respectively provided with spaced-apart cutting portions and presser means for the printing plate located in the spaces between such cutting portions; and, further, to supplement such arrangement with shaving means, and presser means between the shaving means and the rotary cutter-heads.

It is the object of my invention further to provide novel means for mounting the cutter-heads; further, to provide novel means for mounting the presser means; further, to provide novel means for moving the presser means into and out of active relation; further, to provide novel means for exposing the rotary cutter-heads; and, further, to provide novel means for causing travel between the printing plate and the cutting agencies.

In the present exemplification of my invention the printing plate is caused to travel relative to the cutting agencies. It is obvious that in certain phases of my invention traveling movement may be imparted to the cutting agency while the printing plate is stationarily positioned, within the purport of my invention and the scope of the appended claims.

The invention will be further readily understood from the following description and claims, and from the drawings, in which latter:

Fig. 1 is a front elevation of my improved
device, and showing the carriage in assumed position in dotted lines.

Fig. 2 is an end elevation of the same.

Fig. 3 is a cross-sectional detail view, taken in the plane of the irregular line 3—3 of Fig. 4.

Fig. 4 is a plan view of my improved device, partly broken away.

Fig. 5 is a rear view of the same.

Fig. 6 is a vertical longitudinal section of the same, taken in the plane of the line 6—6 of Fig. 2.

Fig. 7 is a side elevation showing the adjusting means for the shaving knife, partly broken away.

Fig. 8 is a horizontal sectional bottom view detail of my improved device, taken in the plane of the line 8—8 of Fig. 6, partly broken away.

Fig. 9 is a vertical cross-sectional view of the same, taken in the plane of the irregular line 9—9 of Fig. 6, partly broken away, showing the presser means in lowered position.

Fig. 10 is a similar view of the same, showing the presser means in raised position, and one of the end supporting means for the rotary cutter-head released preparatory to removal of the rotary cutter-head.

Fig. 11 is a cross-sectional view, taken in the plane of the line 11—11 of Fig. 9, partly broken away.

Fig. 12 is an enlarged sectional detail view of one of the presser means, taken in the plane of the line 12—12 of Fig. 8.

Fig. 13 is a sectional detail view of the handle end of the operating arm, taken on the line 13—13 of Fig. 1.

Fig. 14 is a cross-section of my improved device, taken in the plane of the line 14—14 of Fig. 10, partly broken away, showing the presser devices in raised position.

Fig. 15 is a cross-sectional detail view of the means for the presser-roller, taken in the plane of the line 15—15 of Fig. 14.

Fig. 16 is a detail view of the presser devices and shaving deflectors, partly broken away and viewed in the direction of the line 16—16 of Fig. 14; and,

Fig. 17 is a bottom view of the printing plate showing the action of the cutting devices thereon.

In the present exemplification, the frame 21 of the machine comprises a base 22. A carriage 23 is arranged to reciprocate in the frame, the frame being provided with guide-ways 24 for guiding the carriage, the carriage having complementary guideways 25. (Figs. 1, 2, 6 and 9.)

Suitable means are provided for causing reciprocation of the carriage. I have shown such reciprocation caused by a fluid under pressure, for instance oil received under pressure into a cylinder 27 on the frame, (Fig. 6), for actuating a piston 28 in the cylinder, the piston being on a piston-rod 29. The carriage is provided with a bracket 30, to which the piston-rod is secured by a reduced threaded end 31 of the piston being received in a bearing 32 on the bracket and a nut 33 threaded over said threaded reduced end for clamping the bracket and consequently the carriage to the piston-rod.

Suitable fluid pressure creating and control means for the oil are provided. Thus a casing 34, (Figs. 2, 5 and 6), is fixed to the frame and contains a suitable oil reservoir and a suitable pump for placing the oil under pressure, the oil under pressure being conducted from the pump through pipes 35, 36, 37, communicating at their respective ends with the casing by means of ports 38, 39, and with the respective ends of the cylinder 27 through ports 40 and 41, these pipes being alternately employed as pressure pipes and as return pipes for return of the oil to the reservoir, depending on the direction in which it is intended to move the carriage.

The direction of flow of the oil is controlled by means of suitable valves in a valve-casing 42, (Figs. 1, 2 and 5), the valves having connection with a valve operating rod 43 arranged to reciprocate in the valve-casing and to be operated by an arm 44, having articulation therewith by means of a pin 45, the arm 44 being fixed to a shaft 46 journaled in bearings 47, 48, in the base, and having an operating arm 49 fixed thereto.

An adjusting lever 51, (Figs. 2 and 5), controls a valve in the casing for adjusting the rate of feed of the oil under pressure for controlling the speed of travel of the carriage. The adjusting lever is provided with a pointer 52 complementary to a gage-plate 53 provided with registry marks for indicating the rate of feed. The adjusting lever is arranged to be clamped in place by a clamp-nut 54.

The pump, for creating the pressure on the oil may be a usual gear-pump in the casing 35 driven by a shaft 58 journaled in the casing 35 and provided with a sprocket-pinion 59. (Figs. 2, 5 and 6.) The pump is actuated by an electric motor 60 supported in the base, the rotor of which has connection with a shaft 61 journaled in the base and having a sprocket-pinion 62 fixed thereto. A suitable drive chain 63, which may be a so-called silent chain, is received about the sprocket-pinions 59, 62, for driving the pump.

The operating lever 49 is provided with an operating handle 67 for controlling the movements of the carriage, (Figs. 1, 2 and 13), the operating lever being arranged to be held in adjusted positions, as by means of a pull-pin 68 coating with holes 69, 70, 71 and 72 in a control-plate 73 fixed to the base, the shelf 74 of which may be provided with suitable indications for indicating desired positions of the operating handle. The
pull-pin is on a stem 75 fixed to the hub 76 of the handle, this hub being movable endwise in a bearing 77 on the operating lever. The operating lever is provided with a socket 78 in which a flange 79 on the pull-pin is received. A spring 50 in the socket between said flange and the bottom of the socket normally urges the pull-pin into the holes.

In the present exemplification, when the operating lever is in vertical position and the pull-pin 68 is in the hole 72, the valves controlling the flow of fluid under pressure are in closed relation for rest position of the carriage. When the operating lever is shifted for locating the pull-pin in the hole 72 the carriage is caused to travel in cutting direction at the rate of speed determined by the adjustment of the feed control lever 51, this position of the operating lever controlling the feeding movement of the carriage in cutting direction. This feeding movement is a movement of the carriage from the position shown in Fig. 6 toward the left, to the dotted position of the carriage shown in Fig. 1. If a quick traversing movement of the carriage in the same direction is desired, the control-lever is shifted farther in the same direction for causing registry of the pull-pin 68 with the hole 69.

If movement of the carriage in the opposite direction is desired, the operating lever is shifted toward the right, as viewed in Fig. 1, a quick traversing movement of the carriage being caused when the pull-pin 68 registers with the hole 72. This traversing movement of the carriage is a return of the carriage to its normal position shown in Fig. 6, for reception of the printing plate prior to the reducing operation. This return of the carriage is usually accomplished with a quick traversing movement.

The rate of speed of movement of the carriage is determined by the extent of the shifting of the operating lever out of its normal position. The movement of the carriage in either direction will cease upon limit of movement of the piston 28 in the cylinder 27 being reached in either direction, the pump being provided with usual pressure relief means for relieving excess pressure in the cylinder, and suitable by-pass valves may be arranged to be opened upon the limit of travel of the carriage in either direction being reached, for by-passing the fluid under pressure back to the reservoir when the piston reaches either of its limits of movements.

The adjustment between the carriage and the cutters for determining thickness of the finished printing plate is shown accomplished by adjustment of the support for the printing plate. The printing plate, instance at 85, is supported on a bed 86, which is adjustable up and down toward and from the cutters, between end guides 87, 88; and side guides 89, 90, on the carriage. (Figs. 6 and 9.) The bottom of the bed is provided with ribs 91 having inclined guideways 92 at their lower edges, (Figs. 6, 9 and 11), the latter coacting with inclined guideways 93 on ribs 94 on a slide 95 guided in longitudinal guideways 96 in the carriage. This slide forms a wedge between the carriage and the bed. Longitudinal movement of the wedge raises or lowers the bed, according to the direction of longitudinal movement of the wedge.

This longitudinal movement of the wedge is shown accomplished by providing the wedge with a threaded bearing 97 in which a screw-rod 98 is threaded. The screw-rod is rotatable in a bearing 99 on the carriage, and is held endwise in said bearing, as by a gear 100 and a collar 101 respectively fixed to said screw-rod at the respective ends of said bearing. A pinion 102 meshes with the gear 100 and is operated by a handle 103 for rotating the screw-rod. (Figs. 2 and 4.) The handle while rotating the pinion also rotates suitable disks interengaged between the handle and pinion and provided with peripheral indications which successively appear at openings 104 in a casing 105, in which the interengaged disks are located, for indicating the resultant of the adjusting rotation of the handle.

The carriage may be provided with removable plates 111, 112. (Figs. 4 and 6.) A stop 113 is located on the carriage. An edge of the printing plate is arranged to be placed against this stop.

The cutting devices are exemplified as a rotary cutter-head 117, a rotary cutter-head 118 and a shaving knife 119. (Figs. 8 and 11.) The rotary cutter-heads are respectively exemplified as comprising spaced-apart rotary cutter-sections 121, 122, separated endwise respectively by spaces 123, 124. The cutter-sections of each cutter-head are coincident transversely of the machine with the spaces of the other cutter-head, and cutter-sections of the respective cutter-heads preferably overlap each other transversely of the machine, so that the combined rotary cutter-heads reduce the printing plate to proximate thickness throughout the area of the printing plate.

The cutting edges of the sections of the cutter-head are preferably oblique, (Figs. 4 and 8), the different cutter sections on the same rotary cutter-head being preferably slanted at opposite angles so that the end thrusts of the cutter-head upon the printing plate due to the obliqueness of the cutting edges is substantially equalized, part of the cutter-sections producing an end thrust in the one direction and part of the cutter-sections on the same cutter-head producing an end thrust in the opposite direction. The oblique or slanting cutting edges of the rotary cutter-heads produce shearing cutting movements upon the printing plate, preventing cutting blows upon the printing plate, and, in connection with dividing the cutter-heads into cut-
ting sections, provide for extreme rapidity and smoothness of cutting. The cutting edges of adjacent cutter-sections preferably slant in opposite directions.

The cutter-head 117 comprises a cuttershaft 127 and the cutter-head 118 comprises a cuttershaft 128. (Figs. 9 and 11.) Each of these cuttershafts comprises a shoulder 131 and has a key-groove 132 therein. The cutter-sections are received over the shaft and have complementary key-grooves, and are rotatively held to the shaft by keys 133 received in said key-grooves. The cutter-sections are separated by spacing collars 134. A collar 136 is located between the shoulder 131 and the cutter-section adjacent thereto. A collar 138 is located between the inner raceways 137 of roller bearings 138 and the cuttersection adjacent thereto. A nut 139 is received over the threaded end 140 of the shaft and clamps the cutter-sections and collars and said inner raceways between said shoulder 131 and said nut. Said roller bearing comprises a cage 141 having an adjustable end 142.

The opposite end of the cuttershaft is formed as a plug 145, shown of frusto-conical form, received in a complementally formed socket 146 of a journal-piece 147, held journa-lwise in bearings 148, 149, in the main frame and held against endwise movement therein. A bolt 150 has a threaded end received in a threaded socket 151 in the plug. A washer 152 is located between the outer end of the journal-piece and the head 153 of the bolt.

Rotation of the bolt in one direction draws the plug into the socket of the journal-piece for rigidly fixing the shaft and journal-piece together, with their axes of rotation coincident.

Sprocket-wheels 154, 155, are fixed to the respective journal-pieces. (Figs. 5 and 8.) A sprocket-chain 156, which may be a so-called silent chain, is received loopwise about said sprocket-wheels and about a sprocket-pinion 157 fixed to the shaft 61, at the inside of the sprocket-pinion 62, and rotated by the motor, for rotating the cuttersheads.

The cuttersheads are rotated at high speeds and are provided with a number of cutting edges arranged about their peripheries and said cutting edges are comparatively short, with the result that short chips are formed in the operation of the rotary cutter-heads, and means are provided for drawing these chips away from the cuttersheads and from the printing plate being operated on, as soon as formed, as will be hereinafter more fully explained.

The bearings at the driven ends of the rotary cutter-heads are shown mounted in a standard 161 at one side of the machine. (Figs. 2, 3, 4, 9 and 11.) A bracket 162 extends from said standard above the bed of the machine. This bracket is adjustable up and down away from and toward the rotary cutter-heads and is instanced as carrying presser devices arranged to press upon the printing plate being operated on, for forcing the various portions of the printing plate toward the supporting face of the bed, in order that all parts of the printing surface 163 of the printing plate 85, (Fig. 6), which is presented toward said supporting surface, are level with said supporting surface while the cutters are acting on the back or rear face of the printing plate at or closely adjacent to said pressed-down portions.

The printing surface 163 of the printing plate may be uneven in places and for instance contain hollows 164. (Fig. 6.) The presser devices are so arranged and iron out or press all portions of the printing surface into or parallel with the supporting surface of the printing plate, the cutting devices acting to produce a backing face for the printing plate which is parallel with said supporting surface, in order to produce a printing plate which is of even thickness throughout its printing portions.

The presser devices are instanced as including series 165, 166, 167 and 168, of presser devices, the rollers of said respective series being spaced apart. (Figs. 4, 6, 8, 9 and 11.) The respective rollers of the series 165 are coincident with the spaces 123 between the cutter-sections of the rotary cutter-head 117, and the rollers of the series of presser devices 167 are coincident with the spaces 124 between the cutter-sections of the cutter-head 118. The rollers of this latter series are offset with relation to the rollers of the series 165, 166.

The rollers of the series of presser devices 165, 166, (see Fig. 8) are shown located in the path of the cutter-sections of the cutter-head 118 and the rollers of the series of presser devices 167 are shown located in the path of the cutter-sections of the cutter-head 117. In other words, the rollers of the series 165, 166, are located in the plane perpendicular to the axes of the cutter-heads in which the cutter-sections of the cutter-head 118 are located, and the rollers of the series 167 are located in the plane perpendicular to the cutter-heads in which the cutter-sections of the cutter-head 117 are located. The rollers of the series of presser devices 168 are located in laterally spaced apart relations between the rotary cutter-heads and the shaving knife.

These rollers of the respective presser devices are located closely adjacent to the cutting edges of the cutter-sections (see Figs. 8 and 11) while cutting, and at the ends of said cutter-sections. They extend into the vertical planes parallel with the axes of the respective cutter-heads in which the sections of the respective cutter-heads are located.

The respective presser rollers are journaled in forks 171 (see Fig. 12). The fork is provided with a pin 172 for supporting the
roller, the roller rotating on the pin. The upper end of the fork is movable in a socket 173 in the bracket 162. The fork is provided with a shoulder-piece 174 from which a stem 175 extends. The outer end of the stem is reciprocable in an adjusting bolt 176, adjustable in the outer threaded portion of a bore 177 in the bracket. A spring 178 between the shoulder-piece 174 and the adjusting bolt, normally causes movement of the presser-roller toward the printing plate. The bolt 176 adjusts the tension of the spring 178.

The movement of the presser-roller toward the bed is limited by a lip 179 on the fork 171 arranged to coact with the lip 180 on a lip-piece 181 releasably secured to the bracket. (Figs. 11, 12 and 15.) The lip 180 has a flat face 182, which coacts with a correspondingly shaped wall 183 in the lip-piece for preventing turning of the fork, and compelling the presser roller to maintain its path parallel with the direction of travel of the printing plate.

Each of the rollers is provided with similar mounting, limiting and adjusting means. The lip-pieces for the forks of the rollers of the respective series 165, 166, 167 and 168 of presser-rollers are respectively shown at 185, 186, 187 and 188, all of these lip-pieces being functionally and structurally similar.

The bracket 162 is provided with openings 191 for the cutter sections of the cutter-head 117, and with openings 192 for the cutter sections of the cutter-head 118. (Figs. 4, 6, 8, 10 and 14.) These respective openings are separated by ribs 193, 194, in which respectively the presser devices of the respective series 163, 167, are located. The bracket and the ribs thereof are provided with recesses 195, 196, in which the spacing collars on the respective cutter-shafts are located when the bracket is lowered into working position, the portions of the ribs and brackets at the respective sides of said recesses being located at the respective sides of the cutter-shafts when the bracket is in lowered position.

These openings also provide passageways for the chips made by the rotary cutter-heads, the chips passing through said openings and through passages 197, 198, in a hood 199 received above the bracket, communicating with a passage 200 in the standard, when said bracket is in lowered position. The hood is fixed to the bracket by a bolt 201 so as to make an air-tight joint therewith. The passage 197 is complemental to the cutter-head 117, and the passage 198 is complemental to the cutter-head 118. The passage 200 is arranged to communicate with a suction-piece 203 suitably secured to the standard, and communicating with all of the openings in the bracket for drawing the chips through said openings, through the hood, through the passage 200 and the suction-piece 202. A suitable suction device and suction piping communicate with said suction-piece for forming the necessary suction for causing travel and removal of the chips as soon as said chips are formed.

The bracket is adjustable toward and from the cutter-heads for exposing the cutter-heads for attention and for withdrawing the cutter-heads from the machine. (Figs. 3 and 4.) The adjustment of the bracket is obtained by providing the standard 161 with guideways 205, guideways 206 on a slide-plate 207 coacting therewith. This slide-plate forms part of the bracket. A screw-rod 208 is journaled and held endwise in a bearing 209 on the bracket, and is threaded into a threaded bearing 210 on the standard. The screw-rod is provided with an operating end 211 for receiving a suitable wrench for readily turning the screw-rod for raising and lowering the bracket.

The position of the presser devices may be collectively adjusted with relation to the bed and with relation to the rotary cutter-heads and the shaving knife 119 by means of said adjustment. When the bracket has been adjusted or returned to desired extreme downward position, it is clamped by means of bolts 212 for clamping the gib 213 on the bracket to the guideways on the standard.

In order to aid in directing the shavings, from the rotary cutter-heads into the exhaust passages, the walls of said exhaust passages at that side thereof toward which the cutting edges of the cutter-sections move in performing the cutting stroke, are respectively provided with deflectors 217, 218, respectively backed by braces 219, 220. (Figs. 8, 14 and 15.) These deflectors and braces are suitably secured to the bracket. They are located at the infeeding sides of the respective rollers of the series 165, 167 of rollers, leaving the rollers however free to exert pressure and to yield to pressure. They are preferably wider than the rotary cutter sections with which they respectively coact.

The deflectors 217 are fixed in position by means of screws 221 received through bars 222 and bent portions of said deflectors and threaded into the bracket. The braces 219 are held in place by screws 223 received through holes in the braces and threaded into the bracket. Locating pins 224 prevent turning of said braces. The deflectors 218 are held in place by screws 225 received through holes in said deflectors and held to the bracket. Locating pins 226 prevent shifting of said deflectors. The braces 220 are held in place by screws 227 received through holes in said braces and threaded into the bracket. Locating pins 228 in said braces and bracket prevent shifting of the braces.

The lower portions of the peripheries of the presser rollers normally extend below the plane of the bottoms of the cylindrical paths in which the cutting edges of the rotary cutters move, so as to exert pressure upon the
printing plate while the printing plate is passing under the cutters, the presser rollers being also raised by said pressure, resisted by the springs 178, for raising the lips 179 (Fig. 12) away from the lips 180. The shaving knife 119 is provided with a shaving edge 229. (Fig. 11), which is operatively positioned slightly lower or nearer the supporting surface of the printing plate than said plane in which the lowest portions of said respective cylindrical paths are located, so as to remove a slight shaving off of the back of the printing plate and provide the back of the printing plate with a smooth surface while the printing plate has all portions of its printing surface pressed against the supporting face on the bed, so that the finished printing plate is of equal thickness throughout its printing portions between its printing face and its rear face.

The shaving knife is shown slantingly mounted on a supporting face 233 of a yoke 234. (Figs. 4, 5, 6, 7 and 11.) The respective ends of the yoke are fixed to the frame, one of the ends being located in a recess 235 in the standard 161 and the other end of said yoke being located on a standard 236 at the other side of the frame, the respective ends of the yoke being fixed to said standards respectively by bolts 237, 238.

The shaving knife is adjustable to elevation with relation to the bed. This is accomplished in the present instance by providing the shaving knife with slots 241, (Figs. 7 and 11), through which screws 242 pass and have threaded connection with the yoke for clamping the shaving knife in adjusted positions. A locating bar 243 is fixed to the yoke, being received in a groove 244 therein, and clamped to the yoke by screws 245. It extends across the yoke above and spaced from the knife. Adjusting bolts 247 are threaded in threaded bearings 248 in the bar and bear against the upper edge of the shaving knife for adjusting the shaving knife toward the bed. Adjusting bolts 249 are threaded in threaded bearings 250 in the shaving knife for adjusting the shaving knife away from the bed. Rotation of the bolts 247, 249, adjusts the shaving knife toward or from the plane of the bed, the knife being clamped in adjusted positions by the clamp-screws 242.

A bearing-block 255 is provided with a bearing 256 for the cage 141 at the end of each of the rotary cutter-shafts. (Figs. 1, 8, 9 and 10.) A cap 257 is fixed across the end of each of said bearings in said bearing-block. The bearing-block is, when in operative position, fixed to the standard 236 by means of bolts 258 passing through said bearing-block and threaded into said standard. A guide-rib 259, received in guide grooves in said bearing-block and said standard respectively, aids in positioning the bearing-block. When the bracket 162 is in lowered position, its free end is fixed to the bearing-block for rigidly holding the parts together, as by means of bolts 260 received through said bearing-blocks and threaded into threaded holes 261 in the end of said bracket.

Figs. 9 and 11 show the bracket and the parts mounted thereon in lowered position, and the parts in connected relation for operation of the machine.

Figs. 10 and 14 show the bracket and the pressure parts mounted thereon in raised relation, and Fig. 10 shows the bearing-block in outwardly shifted relation to illustrate ease with which the parts may be dissociated for attention to the cutters and removal of the rotary cutter-heads.

In operation, the printing plate is placed on the bed while the carriage is in retracted position. (See Fig. 6.) The carriage is moved in cutting direction so that the printing plate passes the cutters, the rotating cutter-heads reducing the printing plate to proximate thickness in separated narrow paths, the paths of the cutter-sections of the respective cutter-heads overlapping each other, the shaving knife thereupon acting upon those portions of the printing plate so reduced to proximate thickness, for removing a slight shaving and reducing the printing plate to accurate even thickness throughout its printing portions, the printing plate passing all of the cutting devices at one operation for being reduced to uniform thickness and provided with a smooth backing surface throughout, the carriage being brought to rest after the cutting operation. (See dotted lines in Fig. 1.) The printing plate is then removed from the bed, and the carriage is returned to normal position.

When the printing plate passes the cutter-head, the back of the printing plate is provided with separated cut paths 264, (see Fig. 17), produced by the spaced-apart cutter-sections of the cutter-head 117, these paths reducing the printing plate along said paths to proximate uniform thickness. The advancing movement of the printing plate next brings it into coaction with the cutter-head 118, the spaced-apart cutter-sections of which provide the back of the printing plate with additional separated cut paths 265, of equal depth with the separated cut paths, removing the uncut bands 266 between said last-named paths, and reducing the printing plate to substantial uniform thickness throughout. The feeding of the printing plate next brings it into coaction with the shaving knife 119, which removes a slight shaving from the back of the printing plate along the path 267 for reducing the printing plate to uniform exact thickness throughout its printing portions and providing the back of the printing
plate with an extremely even polished surface.

In my improved device the rough cutting is done by the rotary cutter-heads, and the final cutting is done by the shaving knife, at one feeding passage between the printing plate and the cutting between. The duty of the shaving knife being slight a printing plate of extreme accuracy in thickness is obtained.

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

1. In a machine of the character described, the combination of a plurality of rotary cutter-heads comprising spaced-apart cutter-sections, the cutter-sections of one cutter-head operating opposite the spaces between cutter-sections of another cutter-head, and presser means for each of said cutter-heads operating between cutter-sections of said cutter-head and opposite the cutter-sections of the other cutter-head.

2. In a machine of the character described, the combination of a plurality of rotary cutter-heads comprising spaced-apart cutter-sections, the cutter-sections of one cutter-head operating opposite the spaces between cutter-sections of another cutter-head, presser means for each of said cutter-heads operating between cutter-sections of said cutter-head and opposite the cutter-sections of the other cutter-head, and means for elevating said presser means above said rotary cutter-heads.

3. In a machine of the character described, the combination of a plurality of rotary cutter-heads comprising spaced-apart cutter-sections, the cutter-sections of one cutter-head operating opposite the spaces between cutter-sections of another cutter-head, shaving means, and presser means between said rotary cutter-heads and said shaving means.

4. In a machine of the character described, the combination of a bed, a plurality of rotary cutter-heads, a shaving knife, feeding means for causing relative feeding movement between said bed and said cutter-heads and shaving knife for causing successive action on the printing plate by said rotary cutter-heads and said shaving knife, presser means arranged to act on the back of the printing plate between said rotary cutter-heads and between said rotary cutter-heads and said shaving knife, and means for elevating said presser means above said rotary cutter-heads along separated paths, presser means acting between the cutter-sections of said respective cutter-heads, and means for elevating said presser means in the spaces between cutter-sections above said cutter-sections.

6. In a machine of the character described, the combination of a bed, a plurality of cutting agencies arranged to cut the back of the printing plate, presser means in advance of said respective cutting agencies, and means for elevating said presser means past said cutting agencies.

7. In a machine of the character described, the combination of a bed, a rotary cutter, presser means, means for elevating said presser means above said rotary cutter, and means for endwise release of said rotary cutter between said bed and said presser means.

8. In a machine of the character described, the combination of a bed, a plurality of rotary cutter-heads respectively comprising spaced-apart cutter-sections respectively arranged to cut the back of the printing plate along separated paths, presser means acting between the cutter-sections of said respective cutter-heads, means for elevating said presser means in the spaces between cutter-sections above said cutter-sections, and means for endwise release of said rotary cutter-heads between said bed and said presser means.

9. In a machine of the character described, the combination of a rotary cutter-head, a slide thereabove, said slide provided with a passage extending lengthwise of said cutter-head, chip directing means in said passage complemental to said cutter-head, and a standard for said slide, said standard provided with a passage for chips complemental to said first-named passage.

10. In a machine of the character described, the combination of a rotary cutter-head comprising spaced-apart cutter-sections, a slide thereabove, said slide provided with openings in which said cutter-sections are received, said slide provided with a passage extending lengthwise of said cutter-head and communicating with said openings, and chip-directing means on said slide complemental to said cutter-sections and said openings.

11. In a machine of the character described, the combination of a plurality of rotary cutter-heads respectively comprising spaced-apart cutter-sections, the cutter-sections of said respective cutter-heads being opposite the spaces between cutter-sections of the adjacent cutter-head, a slide, said slide provided with cross-ribs received in said spaces and with openings complemental to said cutter-sections, said side provided with cross-passages communicating with said openings, and chip-directing means on said slide complemental to said cutter-sections and said openings.

12. In a machine of the character de-
scribed, the combination of a plurality of rotary cutter-heads respectively comprising spaced-apart cutter-sections, the cutter-sections of said respective cutter-heads being opposite the spaces between cutter-sections of the adjacent cutter-head, a slide, presser-means on said slide between proximate cutter-sections, chip-directing means on said slide supplemental to said cutter-sections, means for elevating said slide whereby to elevate said presser means through said spaces and to elevate said chip-directing means, and means for endwise shifting of said cutter-heads under said slide.

13. In a machine of the character described, the combination of a frame, a bed, a rotary cutter-head comprising a plurality of spaced-apart cutter-sections, a slide provided with cross-ribs received in the spaces between said cutter-sections, a journal-member for said cutter-head journaled in said frame, means for releasably securing one end of said cutter-head to said journal-member, a bearing-block for the other end of said cutter-head, means for elevating said slide on said frame whereby to elevate said cross-ribs out of said spaces, and means for endwise movement of said bearing-block and of said shaft for removal of said shaft between said bed and said slide.

14. In a machine of the character described, the combination of a frame, a bed, a rotary cutter-head comprising a plurality of spaced-apart cutter-sections, a slide provided with openings in which said cutter-sections are received, a releasable hood on said slide, said hood provided with a passage communicating with said openings, means for elevating said slide on said frame, and means for endwise removal of said cutter-head between said bed and said slide.

15. In a machine of the character described, the combination of a frame, a support for a printing plate, cutting means complementary to said support, and means causing reciprocating movement between said support and said cutting means whereby to cause cutting of said printing plate, said last-named means comprising a carriage, a cylinder and a piston therein comprising a pair of actuating members, connecting means between one of said members and said carriage, and fluid means causing traverse between said members.

16. In a machine of the character described, the combination of a frame, a support for a printing plate, cutting means complementary to said support, and means causing reciprocating movement between said support and said cutting means whereby to cause cutting of said printing plate, said last-named means comprising a carriage, a cylinder and a piston therein comprising a pair of actuating members, connecting means between one of said members and said carriage, fluid means causing traverse between said members, and a single operating handle controlling the speed of traverse in both directions between said members.

In testimony whereof, I have hereunto signed my name.

LESLIE W. CLAYBOURN.