Jan. 9, 1934. L. W. CLAYBOURN 1,942,593

MEANS FOR REDUCING CURVED PRINTING PLATES TO UNIFORM THICKNESS

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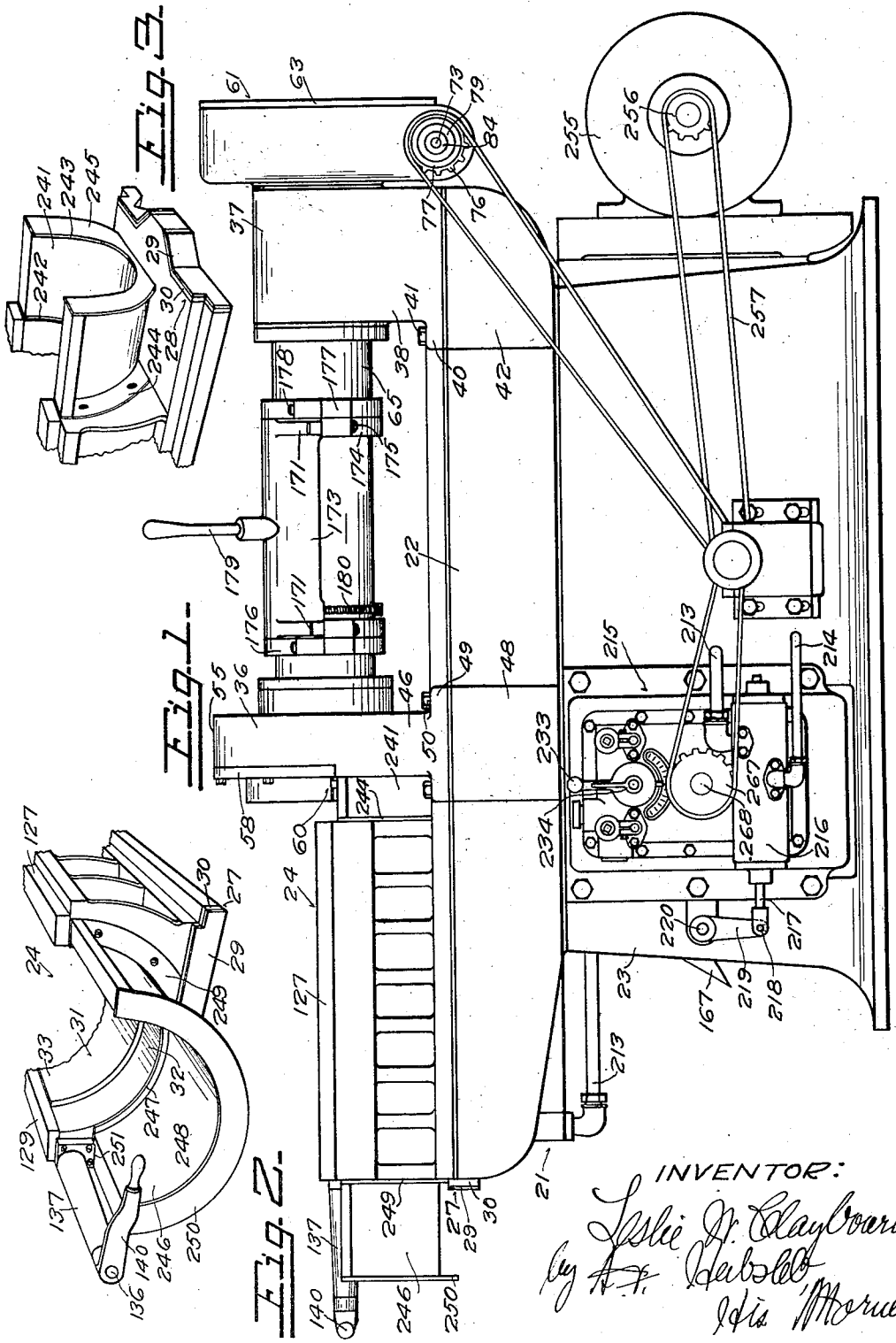


Fig. 3.

Fig. 1.

Fig. 2.

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MEANS FOR REDUCING CURVED PRINTING PLATES TO UNIFORM THICKNESS

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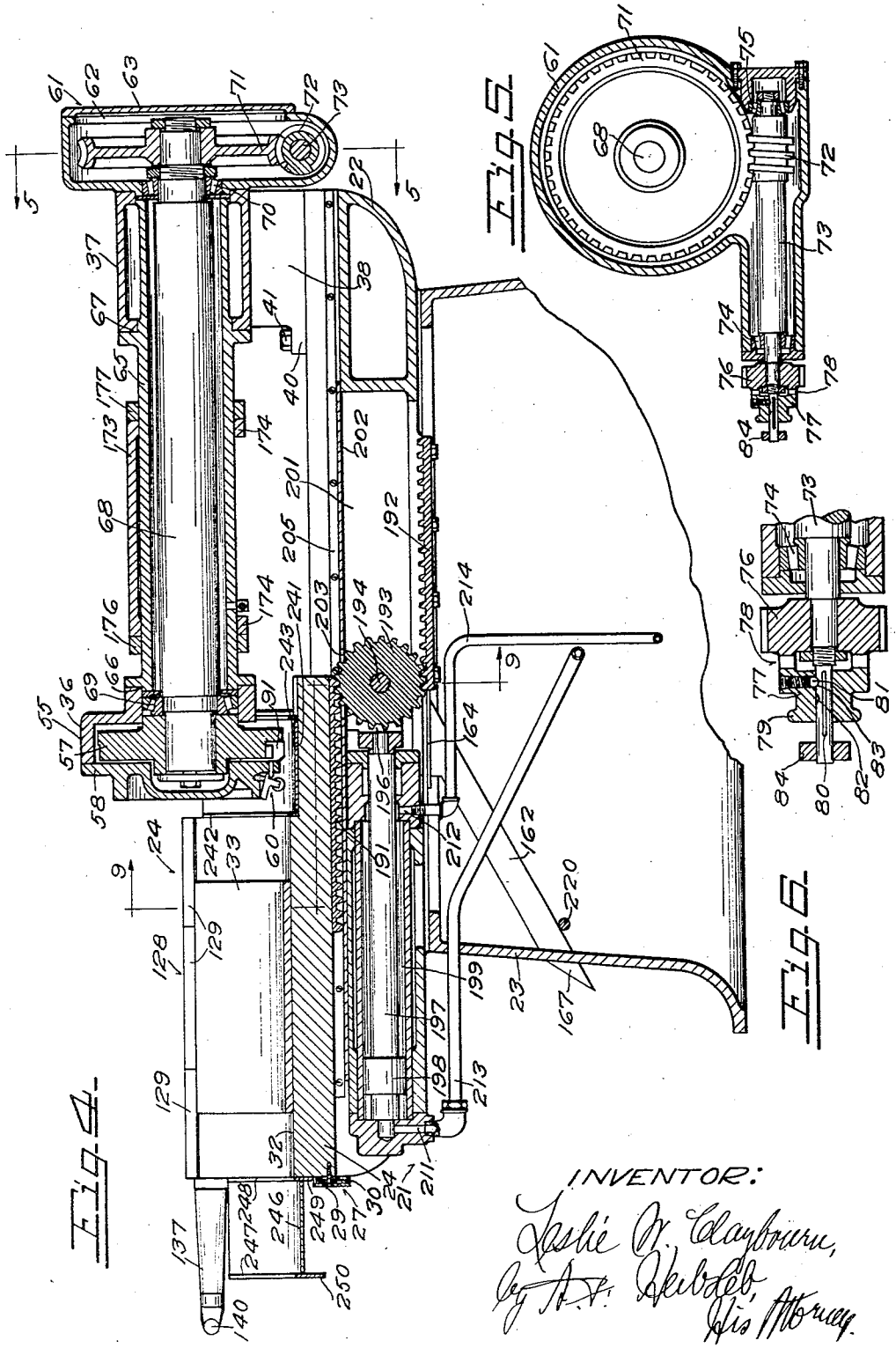


FIG. 4.

FIG. 5.

FIG. 6.

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MEANS FOR REDUCING CURVED PRINTING PLATES TO UNIFORM THICKNESS

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Fig. 7.

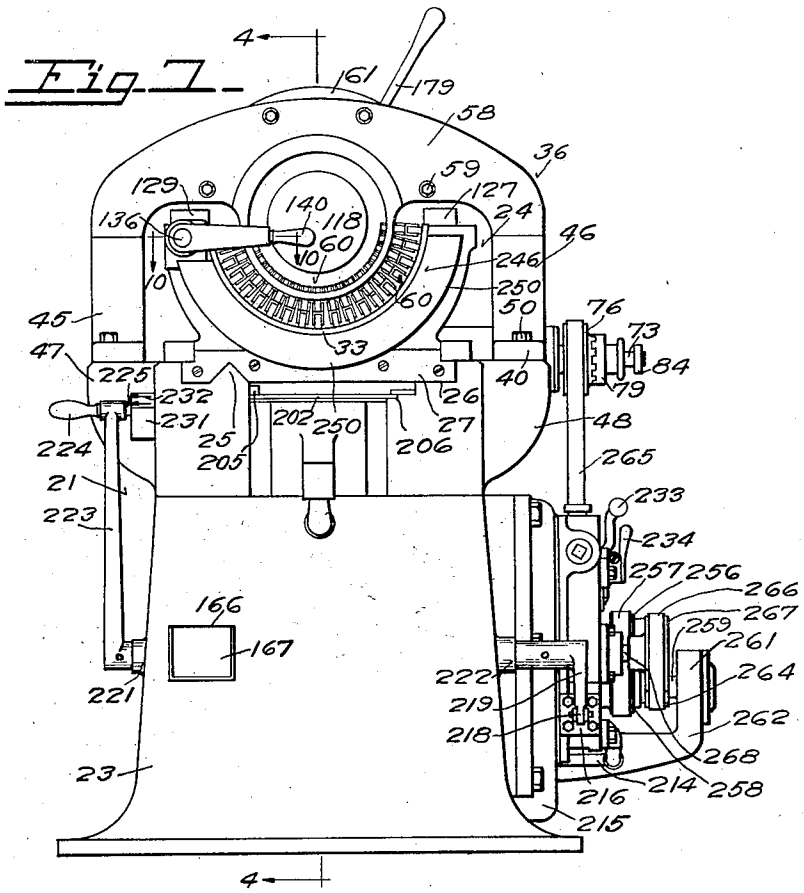
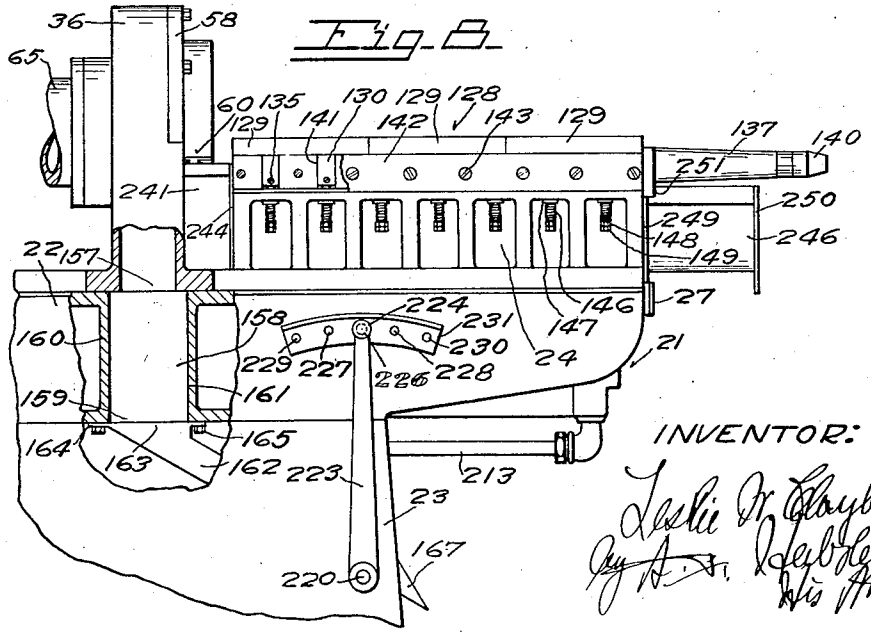


Fig. 8.



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Fig. 9.

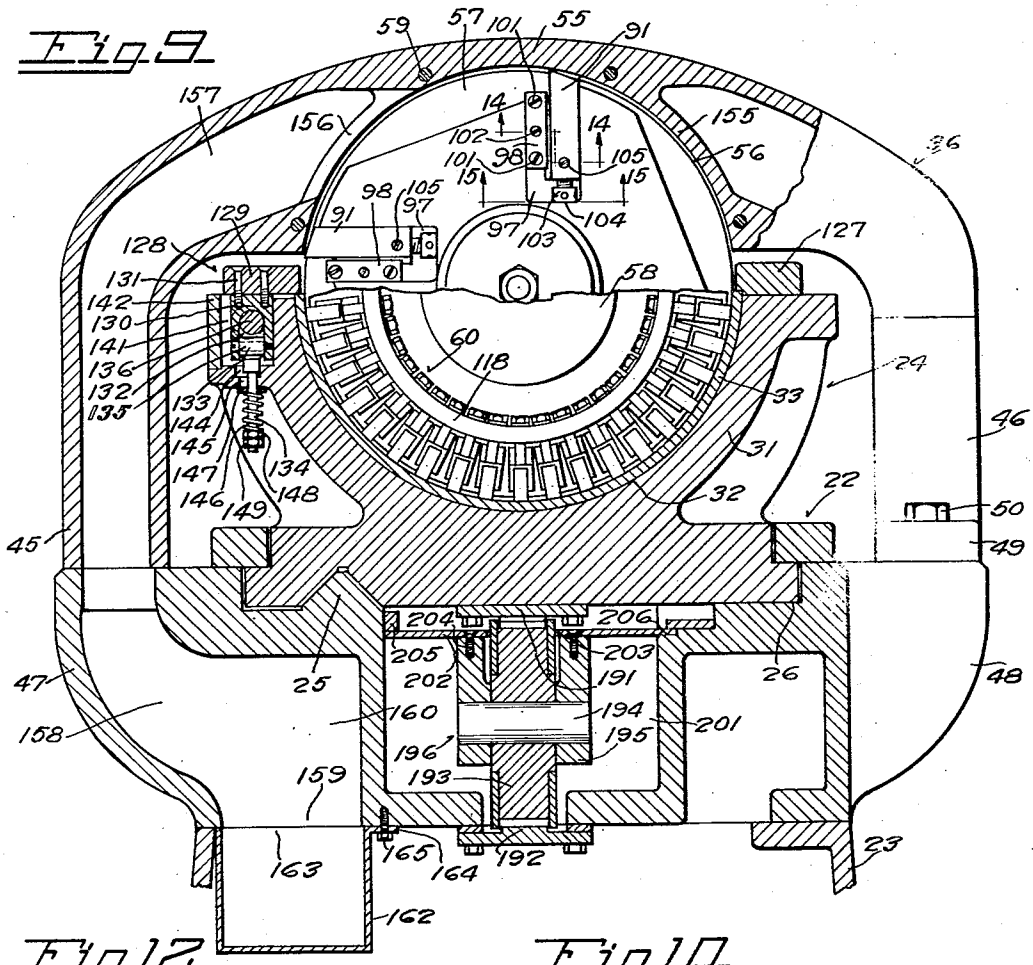


Fig. 12.

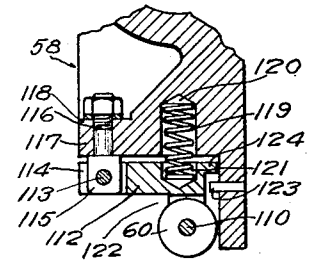
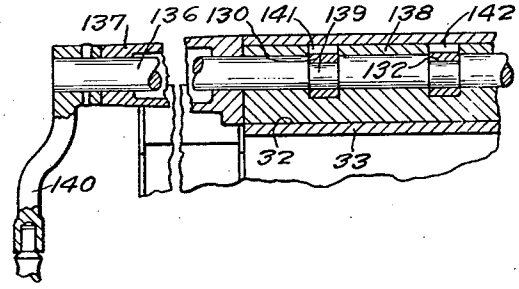


Fig. 10.



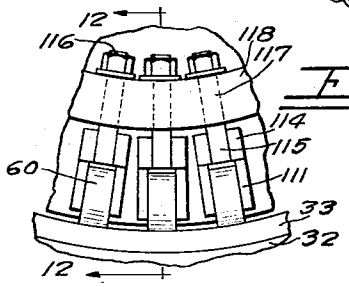


Fig. 11.

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MEANS FOR REDUCING CURVED PRINTING PLATES TO UNIFORM THICKNESS

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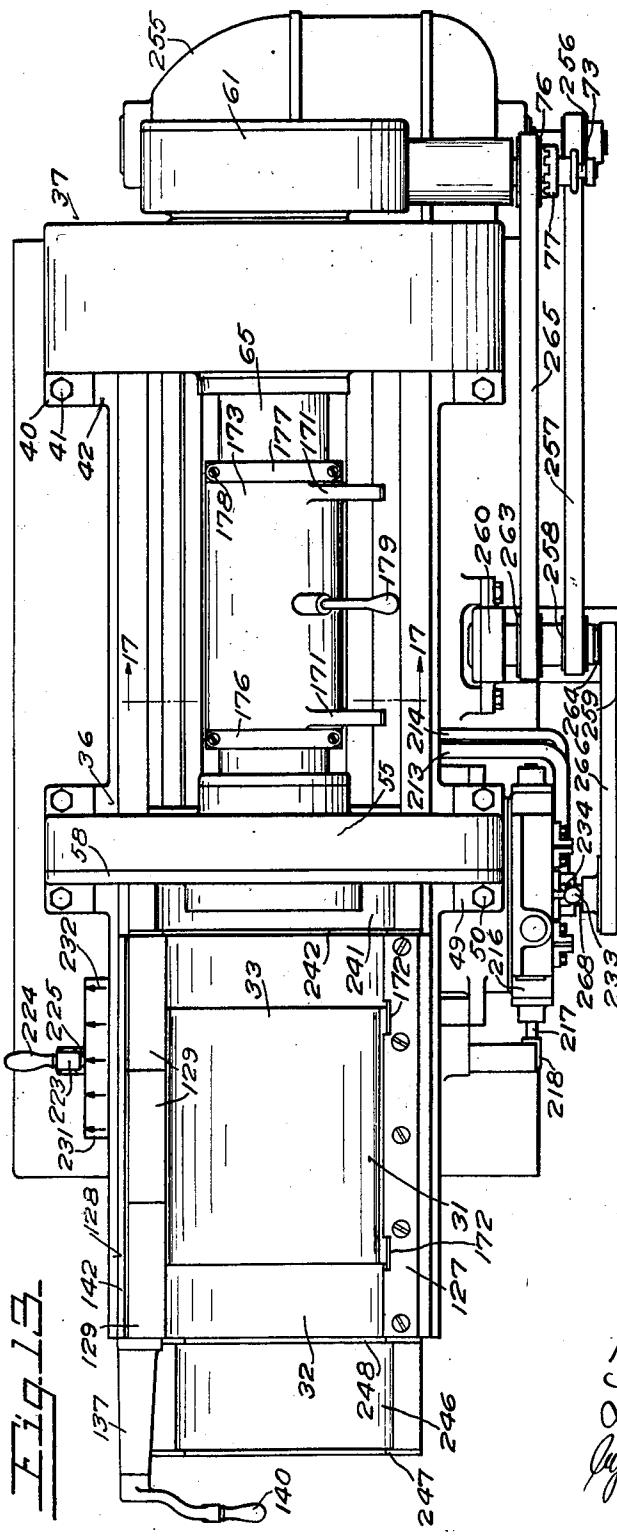


Fig. 13

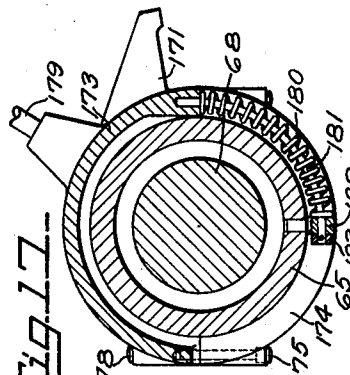


Fig. 17

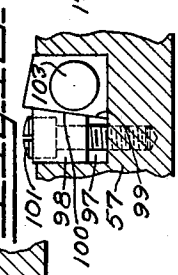


Fig. 15

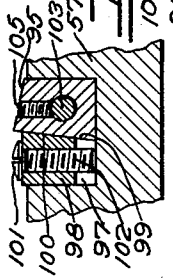


Fig. 14

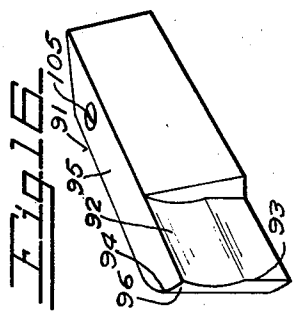


Fig. 16

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UNITED STATES PATENT OFFICE

1,942,593

MEANS FOR REDUCING CURVED PRINTING PLATES TO UNIFORM THICKNESS

Leslie W. Claybourn, Milwaukee, Wis.

Application April 18, 1932. Serial No. 605,976

24 Claims. (Cl. 29—21)

My invention relates to means for reducing curved printing plates to uniform thickness in the nature of a boring operation and comprising a rotary cutter which acts progressively on the inner face of a curved printing plate, progressive movement in axial direction being caused between the rotary cutter and the curved printing plate during the cutting operation.

It is the object of my invention to provide novel means for accomplishing this; further, to provide novel means for pressing a curved printing plate toward a hollow supporting block or pillow in close adjacency to the path of the cutter; and, further, to provide novel means for pressing a curved printing plate throughout its width in radial directions outwardly toward an arcuate supporting face in proximity to the path of a rotary cutter whose axis of rotation is lengthwise of said arcuate supporting face, for ironing out the curved printing plate proximate to the path of the cutter, and pressing all portions of the printing surface of the printing plate upon said arcuate supporting face and causing the cutting to take place throughout the inner surface of the curved printing plate at uniform distances from the printing surface in order to reduce the curved printing plate to uniform thickness throughout its printing portions.

It is the object of my invention further to provide novel cutting means in a machine of this character; further, to provide novel pressing means in a machine of this character; further, to provide novel relation of rotary cutting means and sectional presser means acting in proximity to each other on the inner face of the curved printing plate; further, to provide novel means causing travel between the rotary cutter and presser means and the curved printing plate; further, to provide novel driving means for the movable member through which axial movement is obtained between the rotary cutter and presser means and the curved printing plate; further, to provide novel means for protecting said driving means from the chips cut from the curved printing plate; further, to provide novel control means for the driving means; further, to provide novel guiding means for the curved printing plate; further, to provide novel clamping means for the curved printing plate; and, further, to provide novel ejecting means for the curved printing plate.

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

Fig. 1 is a side elevation of my improved device looking from the rear of the machine.

Figs. 2 and 3 are perspective views of the respective ends of the carriage showing the guards, partly broken away.

Fig. 4 is a central longitudinal section of my improved device, taken on the line 4—4 of Fig. 7, partly broken away.

Fig. 5 is a cross-section, taken in the plane of the line 5—5 of Fig. 4, showing a portion of the driving means for the rotary cutter head.

Fig. 6 is a sectional detail view of the clutch for the same, taken on the same section line.

Fig. 7 is an end elevation of my improved device.

Fig. 8 is a side elevational view of the same, partly broken away.

Fig. 9 is a cross-section of my improved device, taken on the irregular line 9—9 of Fig. 4, and partly broken away.

Fig. 10 is an axial sectional detail view of the clamping means for the plate, taken in the plane of the line 10—10 of Fig. 7, and partly broken away.

Fig. 11 is an enlarged detail view of the sectional presser means, partly broken away.

Fig. 12 is an axial section of the same, taken in the plane of the line 12—12 of Fig. 11.

Fig. 13 is a plan view of my improved device.

Fig. 14 is a cross-section, taken on the irregular line 14—14 of Fig. 9, and showing the clamping means for the cutter blade, and partly broken away.

Fig. 15 is a cross-section of the same, taken on the line 15—15 of Fig. 9, and partly broken away.

Fig. 16 is a perspective view of the cutter blade; and,

Fig. 17 is a cross-section of the plate ejecting means, taken on the line 17—17 of Fig. 13.

The frame 21 of the machine comprises a bed 22 and a pedestal 23. A carriage 24 is slidable lengthwise of the bed on guideways 25, 26, (Fig. 9). The end of the carriage has wipers 27, 28, thereon, (Figs. 1, 2, 3 and 4), which respectively comprise an outer stiff plate 29 and a felt pad 30 between the latter and the end of the carriage, suitably secured to the carriage. These wipers act on the guides at the respective ends of the carriage and wipe the chips and dirt which may lodge on the guides away from the carriage so as to maintain the contact faces of the guides under the carriage clean.

The carriage comprises a pillow 31 which has a supporting surface 32 for the curved printing

plate, represented at 33. (Figs. 4, 9 and 13.) This supporting surface is preferably of a curvature corresponding to the desired curvature of the printing face of the curved printing plate. It is provided with a hollow or trough in which the printing plate is received for being cut.

Bridges 36, 37, extend above the path of travel of the carriage. The bridge 37 has legs 38 provided with flanges 40 which are fixed to the bed by bolts 41, being fixed to side extensions 42 of the bed. (Figs. 1, 4 and 13.)

The bridge 36 has legs 45, 46, which are secured to laterally extending bulges 47, 48, of the bed, the said legs being provided with flanges 49 fixed to the bed by bolts 50. (Figs. 1, 7, 9 and 13.)

The bridge 36 is provided with a hood 55 which extends in axial direction and is provided with a hollow 56 to form a housing for the rotary cutter head 57. (Figs. 4, 7 and 9.) A plate 58 is provided for said hood, being bolted thereto by bolts 59, and forms a head on which presser devices 60 are mounted.

A housing 61 is on the bridge 37, being suitably fixed thereto. It has an end opening 62 which is normally closed by a plate 63, releasably secured to said housing. (Figs. 4 and 5.) A sleeve 65 is received in bearings 66, 67, in the respective bridges and is supported thereby.

A cutter shaft 68 rotates in said sleeve, and is journaled in bearings 69, 70, in the respective bridges. (Fig. 4.) It has the cutter head 57 fixed thereon. The cutter head is shown at one end of the shaft, the other end of the shaft has a worm wheel 71 fixed thereto, which is meshed by a worm 72 on a shaft 73, journaled in bearings 74, 75, of the housing 61. The latter shaft is suitably driven. It is shown as having a gear 76 held endwise thereon.

A clutch collar 77 is slidable on this shaft, there being a clutch 78 between the clutch collar and the gear, shown as a tooth clutch, the teeth of the same being on the respective proximate ends of the clutch collar and the gear. (Figs. 5 and 6.) The clutch collar is movable endwise on the shaft, as by being provided with a knob 79, by means of which the clutch collar may be manually shifted. The clutch collar has spline groove and key connection 80 with the shaft, the gear 76 being normally loose on said shaft.

The clutch collar is provided with positioning means shown as a spring pressed ball 81 arranged to be received in notches 82, 83, on said shaft in the respective engaged position and disengaged position of the clutch. A collar 84 fixed on the shaft maintains the clutch collar on the shaft.

The cutter head 57 is provided with cutter blades 91. These cutter blades are adjustable on the head. (Figs. 9, 14, 15 and 16.) Each of the cutter blades is provided with a cutting end which has a hollow 92 at its advancing face, forming a cutting edge 93 of non-linear outline, all portions of which, however, are equal radial distances from the axis of rotation of the cutter head so that the cutting edge will remove the shavings from the inner face of the curved printing plate with a shearing cut for providing ease and speed of cutting.

The cutting end of the cutter blade is also provided with an outer end receding face 94, providing end clearance for the cutter blade, and with a slanting receding side wall 95 for providing clearance at the side of the cutter blade, and forming an advanced cutting corner 96 for the cutter blade which enters the rear face of the curved printing plate and shears the chips off of said rear face.

The cutter head is provided with recesses 97 in which the respective cutter blades are received. (Figs. 4, 9, 14, 15 and 16.) These recesses are shown open at the outer side of the cutter head. The side walls of the recesses are preferably parallel with each other, one of the side faces of the cutter blade resting against one of said walls and the other of said walls coacting with one face of a wedge block 98. The shank of the cutter blade and the wedge block have wedge faces 99, 100, between them.

Means are provided for clamping the shank of the cutter blade and the wedge block in the recess, accomplished by means of clamp screws 101 received through holes in the wedge block and threaded into the rear wall of the recess, for drawing the wedge block inwardly. Inward motion of the wedge block is limited by a set screw 102 threaded in the wedge block and having its inner end bear against said rear wall.

Outward endwise adjustment of the cutter blade is obtained by a set bolt 103 threaded in the inner end of the cutter blade, the head of the bolt being positioned by the inner end wall 104 of the recess. Turning the set screw in one direction moves the cutter blade outwardly, and turning the set screw in the other direction permits the cutter blade to be moved inwardly. The clamping of the cutter blade is done preferably after outward adjustment of the cutter blade has been accomplished. When the set bolt has been adjusted, it is clamped in adjusted position by a set screw 105 threaded in a transverse threaded hole in the shank of the cutter blade and clamping the set bolt to the cutter blade.

These adjustments accurately determine the distance of the cutting edge of the cutter from the axis of rotation of the cutter and the diameter of the cut curved inner surface of the curved printing plate, for accurate resting of the same on the plate cylinder of the printing press.

The cutter is preferably provided with a number of the cutter blades, exemplified as four. These cutter blades act successively on the inner face of the curved printing plate as the curved printing plate is being fed past the cutter head, the cutting being accomplished in spiral paths, the widths of which are determined by the speeds of rotation of the cutter and the axial feeding movement of the plate.

Presser means are provided for the curved printing plate in close adjacency to the cutter head. They are shown in advance of the cutter head and are instanced as the hold-down head 58 provided with sectional presser parts 60, exemplified as rollers. (Figs. 9, 11 and 12.)

Each of the rollers is mounted on a journal pin 110 located in the bearings of a fork 111 on a lever 112 pivoted on a pin 113, received through a fork 114 of said lever and a pivot head 115 of a bolt 116, clamped in a bearing 117 on a ledge 118 of the plate 58. A spring 119 has its respective ends received in recesses 120, 121, respectively in the head and the lever, for urging the presser roller toward the printing plate. The levers are mounted in an arcuately arranged recess 122 of the plate. One wall of this recess is provided with pins 123 for the respective levers, the levers being provided with lugs 124 which engage the pins and limit their outward movement. The presser ends of the levers extend toward the cutter head.

The rollers are mounted side by side throughout the contact area of the inner face of the

curved printing plate, and are arranged in radial planes on the presser head, and press outwardly in radial directions upon the inner face of the curved printing plate, for urging all printing portions of the printing face of the printing plate upon the resistant supporting surface for the printing plate, so as to iron out the printing plate and compel all portions of the printing surface of the printing plate to be located in a true cylindrical plane, the cutter blades acting on the various portions of the curved printing plate thus pressed radially outward, in close adjacency to the presser devices, so that the inner backing face of the curved printing plate is cut concentric with the cylindrical plane of the printing surface of the printing plate, and all portions of the printing plate are cut successively to uniform thickness throughout its printing portions, for providing a printing plate which throughout has printing portions of uniform thickness, so as to minimize the necessity of make-ready of the finished printing plate. This action upon the curved printing plate progresses lengthwise of the curved printing plate throughout all portions thereof.

The printing plate is preferably inserted in its pillow or trough and clamped therein in advance of the action thereon by the presser devices and the cutters. One side of the trough is provided with a stationary stop 127, which extends throughout the length of the trough and is shown as a bar having an inwardly projecting ledge, the bar being screwed to one of the upper edges of the trough. (Figs. 7, 9 and 13.) This inwardly projecting ledge forms a stop for one edge of the curved printing plate.

At the other edge of the trough there is a clamp 128, exemplified as comprising a series of clamp plates 129, arranged in substantial line with each other lengthwise of the trough. (Figs. 4, 7, 8, 9 and 13.) These clamp plates are provided with depending bearings 130 secured to the respective clamp plates by screws 131. Each of the clamp plates is provided with a plurality of these bearings. These bearings are respectively provided with a downwardly opening slot 132, forming the tines of a fork between which the head 133 of a tension shank 134 is pivoted on a screw 135 received through the head and secured in the tines of the fork. The head is preferably round in cross-section for aiding in universality of its movement.

A crank shaft 136 is journaled in a bearing bracket 137 extending rearwardly beyond the trough at one end of the crank shaft and in bearings 138 in the wall of the trough, the shaft being provided with eccentric portions 139 about which the walls of the slots 132 are received. (Figs. 8, 9 and 10.) A handle 140 is fixed to the outer end of the shaft for rocking the same.

The eccentric blocks or bearings 130 are movable in cross-slots 141 in the side wall of the trough. The outer lateral ends of said slots are closed by a closing plate 142 secured to the side wall of the trough by screws 143.

The tension shanks 134 are received through laterally extending slots 144, 145, in the bottom walls of the cross-slots 141. The lower end of the head of the tension shank and the upper end of the shank have lateral movement in the slots 144, 145, upon rocking of the eccentric shaft.

Downward movement of the eccentric blocks or bearings 130 for the eccentrics is urged by springs 146 received about the tension shanks, and located between washers 147 at their inner ends and adjusting nuts 148 and jam nuts 149 on the outer threaded ends of the same. Each of the eccentric bearings is provided with a spring of this character. The springs urge the clamp plates into contact with the edge of the curved printing plate for clamping the curved printing plate in the trough, upon rocking of the eccentric shaft for clamping positions of the clamps.

If it is desired to unclamp the printing plate the eccentric shaft is rocked in the opposite direction for moving the eccentrics upwardly and outwardly, causing the eccentric bearings and the clamp plates to follow this movement, for moving the clamping edges of the clamping plates out of contact and out of range with the curved printing plate for releasing clamping action upon the printing plate and permitting movement of the curved printing plate past the inner edges of the clamping plates.

The rotary cutter head rotates in the hollow of the cutter housing and within the inner surface of the curved printing plate for performing its cutting operation. (Figs. 8 and 9.) As it does so it creates chips taken off the inner surface of the curved printing plate, the chips being carried with the outer periphery of the cutter head and the air currents created thereby and the centrifugal action of the cutter head, around the outer portion of said hollow and within the arcuate wall 155 of the upper portion of said hollow.

The chips are projected laterally at the upper descending portion of the path of the rotary cutter head, through a port 156 in the side wall of said housing, and into a chip passage 157 in the leg 45 of the bridge 36, the lower end of which passage communicates with a passage 158 in the bed, which is a continuation of the passage in the bridge, and which has a lower discharge opening 159. The end walls of said passage in the bed are formed by cross-ribs 160, 161 (Fig. 8), in the hollow side wall of the bed.

A chip discharge chute 162 has a receiving mouth 163 at its upper end which is placed across the lower end of the discharge mouth of the chip passage in the bed, (Figs. 1, 4, 7, 8 and 9), the chute being provided with a flange 164 which is secured to the lower face of the bed by bolts 165. The discharge chute slants downwardly and is positioned in the pedestal, the discharge end thereof projecting through an opening 166 in the end wall of said pedestal, forming a projecting end or spout 167 which is arranged to discharge into a suitable pan placed therebelow for receiving the chips.

The cutting performed in the present device is intended to be a roughing cutting, and the device is such that this roughing cutting may be accomplished with great accuracy and great speed. It is the intention to follow this roughing cutting by a finishing cutting by means of a suitable shaving machine.

Novel means are provided for removing the curved printing plate after the same has been operated on. (Figs. 1, 4, 13 and 17.) This is shown accomplished by means of a rotary plate shifter, rotatable about the sleeve 65, and provided with fingers 171 arranged to contact the edge of the curved printing plate which has been stationarily positioned by the stationary stop 127. This stationary stop is provided with slots 172 which recede from the inner edge of the curved printing plate, and through which the fingers move into contact with said edge, for sliding the curved printing plate laterally upon the inner

face of the trough past the clamping jaws, after the latter have been released, until the previously clamped or advancing edge of the curved printing plate has been moved upwardly beyond the trough and said clamping plates, so that the same may be grasped by hand and its removal manually completed.

The fingers are on an arced plate 173 received part-way about the sleeve 65 and forming a bearing therewith in conjunction with arcuate straps 175, which are received about the balance of the circumference of said sleeve, and are secured at their respective ends to the arcuate plate by bolts 175, thereby forming a bearing for the plate shifter or knock-out device about said sleeve. Endwise movement of the plate shifter about the sleeve is limited by collars 176, 177, respectively formed in sectors and clamped about said sleeve by bolts 178.

The plate shifter is provided with a handle 179 for manipulating the same. It is normally urged into retracted position so that its fingers are normally out of range of the carriage and its supported parts during movements of the carriage. This is accomplished by a spring 180 about an arcuate rod 181, fixed in one edge of the arcuate plate 173, the other end of the rod sliding in a bearing 182 fixed in the sleeve, the spring being located between said bearing and the arcuate plate for normally raising the fingers. Retractive movement of the plate is limited by a collar 183 fixed to the end of said arcuate rod.

The driving means for the carriage are shown as comprising a rack 191 in the bottom of the carriage and a rack 192 fixed in the base, the racks having a gear 193 therebetween and meshing therewith. (Figs. 4 and 9.) The gear is on a journal pin 194, the ends of which are in bearings 195 of a fork 196 at the end of a piston rod 197, which has a piston 198 in a cylinder 199. The piston and cylinder form two members which have relative movement between them for moving the carriage. The piston is shown as the movable member and has connection with the gear.

The arrangement of the racks and the driving connection of the gear are such that a given axial movement of the piston causes twice that amount of movement of the carriage, because the gear is anchored on the stationary rack and acts as a lever about its journal pin for imparting a multiplied extent of movement to the actuated rack during the axial movement of the piston.

The rack and pinion and piston operate in the hollow 201 of the bed. In order to protect the parts in said hollow from the chips and other foreign substances, the upper end of the hollow is covered by a plate 202 which has an opening 203 therein just sufficiently large to permit the upper portion of the gear 193 to project therethrough into engagement with the rack 191. The plate is secured to the fork 196 by means of bolts 204 projecting through holes in the plate and threaded into the fork. One of the edges of the plate bears against a bar 205 secured to the side face of one of the side walls of the hollow of the bed, the other edge of the plate sliding in a guide 206 at the other of the side walls of said opening. The plate is sufficiently long to cover the opening throughout the lengthwise movements of the gear and piston.

Fluid under pressure is admitted into the cylinder at the respective sides of the piston through ports 211, 212, pipes 213, 214, connecting with said respective ports. (Figs. 1, 4, 7 and 13.) This pressure fluid may be instanced as oil. The fluid pressure may be created and controlled by suitable means, instanced as a casing 215, secured to the frame and containing a suitable pump or pumps for pumping the oil from a reservoir in the lower portion of the casing into the cylinder 199 through the respective pipes 213, 214. A suitable valve 216 controls the direction and volume of flow from the pumping means to the cylinder for moving the carriage in either direction at various speeds for either a slower feeding movement or a faster quick traverse movement. Suitable relief valves are provided for avoiding excess pressure.

A valve stem 217 of the valve 216 is connected with the movable member of the valve and is extended as an operating rod which has pivotal connection 218 with an arm 219 fixed to a rocker rod 220, journaled in bearings 221, 222, in the pedestal and provided with an operating arm 223 fixed thereto. (Figs. 1, 7, 8 and 13.) The operating arm is provided with an operating handle 224 having connection with a spring pressed pull-pin 225 arranged to engage a series of holes 226, 227, 228, 229, 230, in a control plate 231 provided with markings of a gage 232 indicating the effect of placement of the operating handle in its various positions.

When the pull-pin is in the hole 226 the valve ports of the valve are in closed position for neutral or stop relation of the carriage. When the pull-pin is in the hole 227, the valve is set for feeding movement of the carriage in cutting direction. The speed of this feeding movement is controlled by the adjustment of a feed control lever 233, which controls means for permitting greater or less flow into the cylinder. A clamp nut 234 clamps the lever in adjusted position. If the pull pin is in the hole 228, the valve is set for slow retractive movement of the carriage. If the pull-pin is in either of the end holes 229, 230, the valve is set for quick traverse movements of the carriage in its respective directions.

The arrangements of the ports and coacting valve member are such that when flow of fluid into either end of the cylinder takes place, a return flow to the reservoir of the fluid in the other end of the cylinder also takes place. The movement of the carriage ceases upon arrival of the piston at substantially either end of the cylinder, relief of pressure in the cylinder being provided through suitable relief valves, or other usual means for relief of excess pressure may be provided, and suitable by-pass valves may be arranged to be automatically opened upon limit of travel of the carriage in either direction being reached, for by-passing the fluid under pressure back to the reservoir. This prevents breakage of parts and permits cessation of movement of the carriage if the carriage should meet excess resistance.

The respective ends of the carriage are preferably provided with protective guards and gutters for the chips. (Figs. 1, 2, 3, 4, 7 and 13.) The guarded inner end of the carriage comprises an arcuate plate 241 having a flange 242 extending inwardly therefrom adjacent to the end of the pillow and having an inner edge which conforms to the inner supporting face of the trough. It also has an inwardly extending flange 243 whose inner edge is also arcuate to conform to the inner form of the trough. A cross gutter is thus formed in which chips and other foreign substances may be received when the pillow is cleaned endwise. The guard is provided with a

radially outwardly extending flange 244 by means of which it is secured to the inner end face of the pillow and an outwardly extending flange 245 at its free end for strengthening the same. The lower portions of these last-named flanges are removed to accommodate the inwardly extending portion of the carriage. The guard is arranged to readily pass under the presser devices and cutters in close adjacency thereto to guard against the fingers of the operator coming in contact with the same.

The outer end of the pillow is provided with a similar guard for similar purposes. This outer guard comprises an arcuate plate 246 having end arcuate flanges 247, 248, extending inwardly for forming the gutter, at the outer end of and outside the curved supporting face of the pillow. An outwardly extending inner flange 249 of the gutter is secured to the outer end of the pillow in suitable manner, and an outwardly extending outer flange 250 of the gutter strengthens the outer overhanging end of the gutter. This gutter is provided with a recess 251 for accommodating the bearing bracket 137.

The apparatus is suitably driven, as by an electric motor 255, the rotor of which has a pulley 256 thereon. A flexible band 257, as a silent chain, is received over said pulley and a pulley 258 on a shaft 259 journaled in bearings 260, 261, of a bracket 262 extending from the pedestal. Pulleys 263, 264, are also secured to said shaft. A silent chain 265 is received about the pulley 263 and the pulley 76 on the cross shaft 73. A silent chain 266 is received about the pulley 264 and a pulley 267 on a drive shaft 268 of the pump mechanism.

In operation, the curved printing plate is inserted into the hollow of the pillow 31 during retracted relation of the clamps 128, with its printing face toward the curved supporting face of said pillow and while said pillow is located in advance of the pressing and cutting means, as exemplified in Figs. 1, 4 and 13. One edge of the curved printing plate is moved against the fixed stop 127, the clamp 128 being then clamped upon the other edge of the curved printing plate by operation of the handle 140. It is understood that the cutter blades have been previously adjusted for rotating in a cutting path of the desired radius.

The operating handle 224 is then moved to coact with the hole 227 for causing the entrance of fluid under pressure through the port 211 of the cylinder 199, thereby causing movement of the piston and piston rod to the right, as viewed in Fig. 4. This causes feeding movement of the gear 193 along the rack 192 and moves the rack 191 with it at twice its own speed of movement and for twice the distance of its own travel.

This feeding movement brings the curved printing plate into contact with the presser devices which press the curved printing plate outwardly in radial directions, so that its printing portions are pressed against its arcuate supporting surface for ironing out the printing plate and moving all portions of the printing surface thereof into a uniform and correct cylindrical plane. The cutter head is rotating proximate to these presser devices and acts to cut the inside face of the printing plate while all portions thereof being cut are so pressed outwardly by the sectional presser devices, for reducing the printing plate to uniform thickness throughout its printing portions.

The cutter head acts in a spiral path along the inner face of the curved printing plate, preferably cutting with a shearing cut, and operating to cut the inner face of the curved printing plate with extreme accuracy and rapidity.

When the curved printing plate has been moved beyond the cutter head to a point opposite the plate removing device 171, the travel of the carriage ceases, and the operator places the operating handle 224 into neutral position for causing cessation of feed of pressure fluid. The device is, however, provided with suitable safety means for relieving pressure if such operation of the handle should not take place.

The handle 140 is then turned for rocking the shaft 136 for release relation of the clamp 128, placing the clamping plates beyond the range of movement of the printing plate. The handle 179 is then moved for rotating the plate removing device about its sleeve 65, whereby the fingers 171 thereon move past the slots 172 in the fixed stop plate 127 and against the edge of the curved printing plate. Further movement of the handle moves the curved printing plate about its arcuate support for moving the advance edge of the printing plate past the clamping plates, and moving a portion of the printing plate laterally out of the trough, whereupon the projecting portions of the printing plate may be grasped by the hand and the same moved manually from its pillow. The fingers and plate ejecting means are automatically returned to normal positions by the spring 180.

Rotation of the cutter head may take place independent of the axial movement of the pillow by permitting the handle 224 to remain in neutral position and engaging the clutch 78. If desired, endwise movement of the pillow and carriage may be effected during absence of rotation of the cutter head by disengaging said clutch and shifting the operating handle 224.

The chips created by the rotary cutter head are automatically removed by rotation of the rotary cutter head conveying the chips along the inner face of the outer wall of the housing of the rotary cutter head, and ejecting the same laterally through the chip opening 156, the chip passages 157, 158, and into the chip chute 162.

The levers on which the presser devices are mounted extend toward the cutter head so as to be proximate to the cutter head in performing their pressing operations. The cutter blades on the cutter head are also radially and accurately adjustable for insuring proper cutting of all of the cutter blades with accuracy and speed.

The gutters at the respective ends of the pillow receive chips and foreign substances which may be in the pillow and protect the operator from injury.

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 pillow having a curved printing plate receiving trough, a rotary cutter head whose axis of rotation is in line with the axis of the curvature of said trough, sectional presser means in close adjacency to said rotary cutter head, said trough having a curved printing plate supporting face, means urging said sectional presser means toward various portions of said supporting face about its curvature for pressing all printing portions of said printing plate into a sector of a cylindrical plane coincident with the curvature of said supporting face, and means for causing endwise movement sub-

stantially parallel with the axis of rotation of said rotary cutter head between said pillow and said rotary cutter head and presser means.

2. In a machine of the character described, the combination of a pillow provided with a curved supporting face for a curved printing plate, a rotary cutter head having an axis of rotation in line with said trough, a series of sectional presser devices respectively located substantially in radial planes of said curved supporting face and comprising levers having pivots arranged within said curved supporting face and projecting toward said rotary cutter head, presser parts on said levers in close adjacency to said rotary cutter head, said rotary cutter head and the curvature of said curved supporting face having substantially coincident axes which are also substantially the center line from which project said radial planes, and means causing endwise movement between said pillow and said rotary cutter head and presser devices substantially parallel with said axes.

3. In a device of the character described, the combination of a curved support for a curved printing plate, said curved support forming the sector of a cylinder, a presser head comprising sectional presser devices acting on the inner face of a curved printing plate in said support for pressing all portions of said printing plate outwardly toward said support, a rotary cutter head in adjacency to said presser devices, said rotary cutter head having an axis of rotation coincident with the axis of the curvature of said support and arranged for cutting the inner face of said curved printing plate, and means causing lengthwise movement between said support and said head during cutting coaction between said rotary cutter head and said inner curved face of said curved printing plate.

4. In a device of the character described, the combination of a frame, a pillow forming a trough having a curved supporting face for a curved printing plate, a support on said frame above said pillow, said support comprising a housing, a rotary cutter head in said housing, a presser head forming a wall of said housing and comprising a series of radially acting presser parts in close adjacency to said rotary cutter head arranged for pressing the curved printing plate throughout its radial portions toward said curved supporting face, and means causing feeding movement between said pillow and said rotary cutter head parallel with the axis of rotation of said rotary cutter head and with the center line from which the curvature of said curved supporting face is described, whereby to cause cutting along helical sectors between said rotary cutter head and the inner face of said curved printing plate.

5. In a device of the character described, the combination of a bed, a carriage comprising a pillow having a curved supporting face forming a trough for a curved printing plate, a rotary cutter head in line with said trough, said carriage movable lengthwise of said bed, a stationary rack, a rack on said carriage, a gear between said racks meshing with said racks and means for moving said gear along said stationary rack for moving said carriage lengthwise of said bed.

6. In a device of the character described, the combination of a bed provided with a hollow having an upward opening, a carriage movable lengthwise of said bed above said hollow, said carriage comprising a pillow having a trough with a curved printing plate supporting face, a rotary cutter head in line with said trough, means for moving said carriage lengthwise comprising a stationary rack at the bottom of said hollow, a rack on said carriage, a gear between said racks meshing with said racks, a cylinder and piston for a pressure fluid, one of which has connection with said gear for moving the same along said stationary rack, a cover plate for said opening, said cover plate provided with a slot through which the upper part of said gear extends for meshing with said rack on said carriage, and connecting means between said plate and the moving means for said gear, and said plate being longer than said opening and movable lengthwise at the top of said hollow and arranged for maintaining said opening substantially closed throughout the movements of said carriage.

7. In a device of the character described, the combination of a bed, a carriage movable lengthwise thereon and comprising a pillow having a trough with a curved supporting face for a curved printing plate, a rotary cutter head for cutting the inner face of said curved printing plate, means for moving said carriage lengthwise of said bed substantially parallel with the axis of rotation of said rotary cutter head whereby to cause cutting along helical sectors between said rotary cutter head and the inner face of said curved printing plate, said means for moving said carriage comprising a cylinder and a piston therein, constituting a pair of members, one of which is movable and has operative connection with said carriage for moving said carriage lengthwise of said bed, pressure chambers in said cylinder at the respective sides of said piston, fluid pressure means having connections with said respective chambers, and control means therefor for selectively moving said carriage in opposite directions lengthwise of said axis.

8. In a device of the character described, the combination of a bed, a carriage, a pillow thereon having a trough provided with a curved printing plate supporting face, a rotary cutter in line with said trough for cutting the inner face of the curved printing plate in said trough, a stationary rack, a rack on said carriage, a gear between said racks meshing with said racks, means for moving said gear lengthwise of said racks for moving said carriage crosswise of the cutting path of said rotary cutter head comprising a cylinder and a piston, forming a pair of members, one of which has lengthwise movement and attachment with said gear, pressure chambers in said cylinder at the respective sides of said piston, fluid pressure means having communication with said respective chambers, and control means therefor for controlling the lengthwise movements of said carriage along said bed.

9. In a machine of the character described, the combination of a hollow support having an inner curved supporting face for a curved printing plate, a presser head comprising sectional presser devices, means for mounting and urging said sectional presser devices radially outward upon the inner face of the curved printing plate in said hollow support for pressing said curved printing plate toward said inner curved supporting face, a rotary cutter head in adjacency to said presser head, said rotary cutter head having an axis of rotation parallel with said supporting face, said hollow support and said heads forming members, one of which has endwise movement relatively to the other parallel with the axes of rotation of said head and of the curvature of said inner curved supporting face, and means causing said

endwise movement, said last-named means comprising a cylinder and a piston forming a pair of relatively movable elements, one of which has attachment with said endwise movable member, and fluid means causing traverse between said members.

10. In a device of the character described, the combination of a bed, a carriage movable lengthwise thereon, a bridge on said bed about said carriage, a rotary cutter head journaled in said bridge, said carriage comprising a pillow forming a trough having a curved supporting face for a curved printing plate, said cutter head provided with cutting edges for cutting the inner face of said curved printing plate, and an arcuate gutter at the end of said trough shieldingly received about said rotary cutter head.

11. In a device of the character described, the combination of a bed, a carriage movable lengthwise thereon and comprising a pillow having a trough with a curved supporting face for a curved printing plate, a bridge on said support spanning said carriage, a rotary cutter head journaled in said bridge and having cutting edges operating on the inner face of a curved printing plate in said trough, and transverse arcuate gutters at the respective ends of said trough shieldingly received about said rotary cutter head at the limits of endwise movements of said carriage.

12. In a device of the character described, the combination of a bed, a carriage reciprocable lengthwise thereon, said carriage comprising a pillow having a trough with a curved supporting face arranged for receiving a curved printing plate, a rotary cutter head having an axis of rotation in line with said trough, the axes of rotation of said rotary cutter head and of the curvature of said trough being substantially coincident, means for rotating said rotary cutter head comprising power interrupting means, and means for reciprocating said carriage substantially parallel with said axes comprising power interrupting means, said respective interrupting means arranged to be selectively placed in active and inactive positions for independently rotating said cutter head and reciprocating said carriage.

13. In a machine of the character described, the combination of a bed, a carriage movable lengthwise thereon and comprising a pillow having a trough with a curved supporting face for a curved printing plate, a rotary cutter head in line with said trough, a shaft for said rotary cutter head, a rotary driving means for the latter including a clutch forming control means for selectively rotating said cutter head and leaving said cutter head non-rotative, means for reciprocating said carriage comprising power operating means, control means for the latter, and means for placing said control means in neutral position or in operating position for stationary relation or reciprocating relation of said carriage, said control means being independent of each other.

14. In a machine of the character described, the combination of a pillow having a curved printing plate receiving trough, a rotary cutter head having an axis of rotation in line with said trough, means for causing reciprocation between said pillow and said rotary cutter head lengthwise of said trough, said trough arranged for receiving a curved printing plate at one side of said cutter head, and curved printing plate ejecting means at the other side of said cutter head provided with an ejecting part rotatable in said trough crosswise of said trough.

15. In a device of the character described, the combination of a rotary cutter head, a shaft therefor, means for rotating said shaft, a carriage comprising a pillow forming a trough with a curved supporting face for a curved printing plate, the axis of rotation of said rotary cutter head being in line with said trough, means for reciprocating said carriage for moving said trough past said cutter head and to either side of said cutter head, said trough arranged for receiving a curved printing plate at one side of said rotary cutter head, and plate ejecting means about said shaft at the other side of said rotary cutter head for removal of the cut curved printing plate from said trough.

16. In a device of the character described, the combination of a reciprocating carriage comprising a pillow forming a trough having a curved printing plate supporting face, a rotary cutter head having an axis of rotation in line with said trough, a shaft for said rotary cutter head, a sleeve about said shaft, and plate ejecting means rockable about said sleeve, said plate ejecting means comprising contact means for the curved printing plate for moving the curved printing plate along the curvature of said trough for lateral discharge of the curved printing plate.

17. In a device of the character described, the combination of a carriage comprising a pillow having a trough with a curved printing plate receiving face, a rotary cutter head having an axis of rotation in line with said trough, a shaft therefor, a bridge about said carriage in which one end of said shaft is journaled and through which said carriage and pillow are endwise movable for moving the curved printing plate in parallel relation with said shaft, and plate removal means journaled about said shaft and provided with contact means for one edge of the curved printing plate for moving the curved printing plate lateraly along said curved supporting face for lateral removal of the curved printing plate about said shaft.

18. In a device of the character described, the combination of a bed, a bridge supported thereby intermediate of the ends of said bed, an outer bearing, a sleeve between said bridge and said outer bearing, a shaft rotatable in said sleeve, a rotary cutter head at one end of said shaft, a carriage comprising a pillow forming a trough having a curved printing plate supporting face, means for moving said carriage lengthwise of said bed for moving the curved printing plate in said trough past said rotary cutter head through the space under said bridge into lateral position with relation to said shaft, and a plate ejector rockable about said sleeve and having plate engaging means thereon for one of the edges of said curved printing plate moving said curved printing plate laterally along the curvature of said curved supporting face for removal of the cut printing plate about said sleeve.

19. In a device of the character described, the combination of a bed, a bridge supported thereby intermediate of the ends of the bed, an outer bearing, a sleeve between said bridge and said outer bearing, a shaft rotatable in said sleeve, a rotary cutter head at one end of said shaft, a carriage comprising a pillow forming a trough having a curved printing plate supporting face, means for moving said carriage lengthwise of said bed for moving the curved printing plate in said trough past said rotary cutter head through

the space under said bridge into lateral position with relation to said shaft, a plate ejector rockable about said sleeve and having plate engaging means thereon for one of the edges of said curved printing plate moving said curved printing plate laterally along the curvature of said curved supporting face for removal of the cut printing plate about said sleeve, and means for automatically returning said plate ejector to normal position out of the paths of said carriage and pillow.

20. In a device of the character described, the combination of a frame, a carriage comprising a pillow forming a trough having a curved supporting face for a curved printing plate, a stationary stop on said pillow for one edge of said curved printing plate, a releasable clamp at the other side of said trough for the other edge of said printing plate, a bridge on said frame about said carriage, a shaft journaled in said bridge, a rotary cutter head on said shaft, said bridge forming a gap between said rotary cutter head and said frame in which said carriage, pillow stop and clamp reciprocate, and means for reciprocating said carriage.

21. In a device of the character described, the combination of a bed, a carriage movable lengthwise thereon and comprising a pillow forming a trough having a curved supporting face for a curved printing plate, a bridge on said bed about said carriage and pillow, a rotary cutter head journaled in said bridge, the axes of rotation of said rotary cutter head and of curvature of said curved supporting face being substantially coincident, means moving said carriage substantially parallel with said axes, and a presser head on said bridge comprising a series of radially acting presser parts in close adjacency to said rotary cutter head for pressing all printing portions of said printing plate toward said curved supporting face in close adjacency to the path of said cutter head for cutting said pressed portions while so pressed and reducing said curved printing plate to uniform thickness in its printing portions.

22. In a device of the character described, the combination of a bed, a carriage movable lengthwise thereon and comprising a pillow having a trough with a curved supporting face for a curved printing plate, a bridge on said bed about said carriage, a rotary cutter head journaled in said bridge, said bridge comprising a cutter housing in which said rotary cutter head rotates, said housing comprising a curved outer wall about the ascending upper portion of said cutter head and a laterally extending opening at the advance end of said wall for receiving chips from said rotary cutter head, and a chip directing passage communicating with said opening, said cutter head having an axis of rotation in line with said trough.

23. In a device of the character described, the combination of a bed, a carriage movable lengthwise of said bed and comprising a pillow having a trough with a curved printing plate supporting face arranged for receiving a curved printing plate, a bridge on said bed about said carriage, and a rotary cutter head journaled in said bridge, said bridge comprising a housing for said rotary cutter head having an arcuate wall about the upwardly moving upper portion of said rotary cutter head and a laterally extending opening at the end of said wall, and one of the legs of said bridge and said bed provided with chip passages communicating with each other and with said opening for receiving chips ejected from said housing through said opening.

24. In a device of the character described, the combination of a bed, a pedestal therefor, a carriage movable lengthwise of said bed and comprising a pillow having a trough with a curved printing plate supporting face arranged for receiving a curved printing plate, a bridge on said bed about said carriage, a rotary cutter head journaled in said bridge, said bridge comprising a housing for said rotary cutter head having an arcuate wall about the upwardly moving upper portion of said rotary cutter head and a laterally extending opening at the end of said wall, one of the legs of said bridge and said bed provided with chip passages communicating with each other and with said opening for receiving chips ejected from said housing through said opening, and a chip chute in said pedestal communicating with said passages and having a discharge spout outside said pedestal.

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