July 22, 1952 C. S. CRAFTS ET AL 2,604,017

STEREOTYPE FINISHING MACHINE

Filed Nov. 16, 1945 11 Sheets-Sheet 1

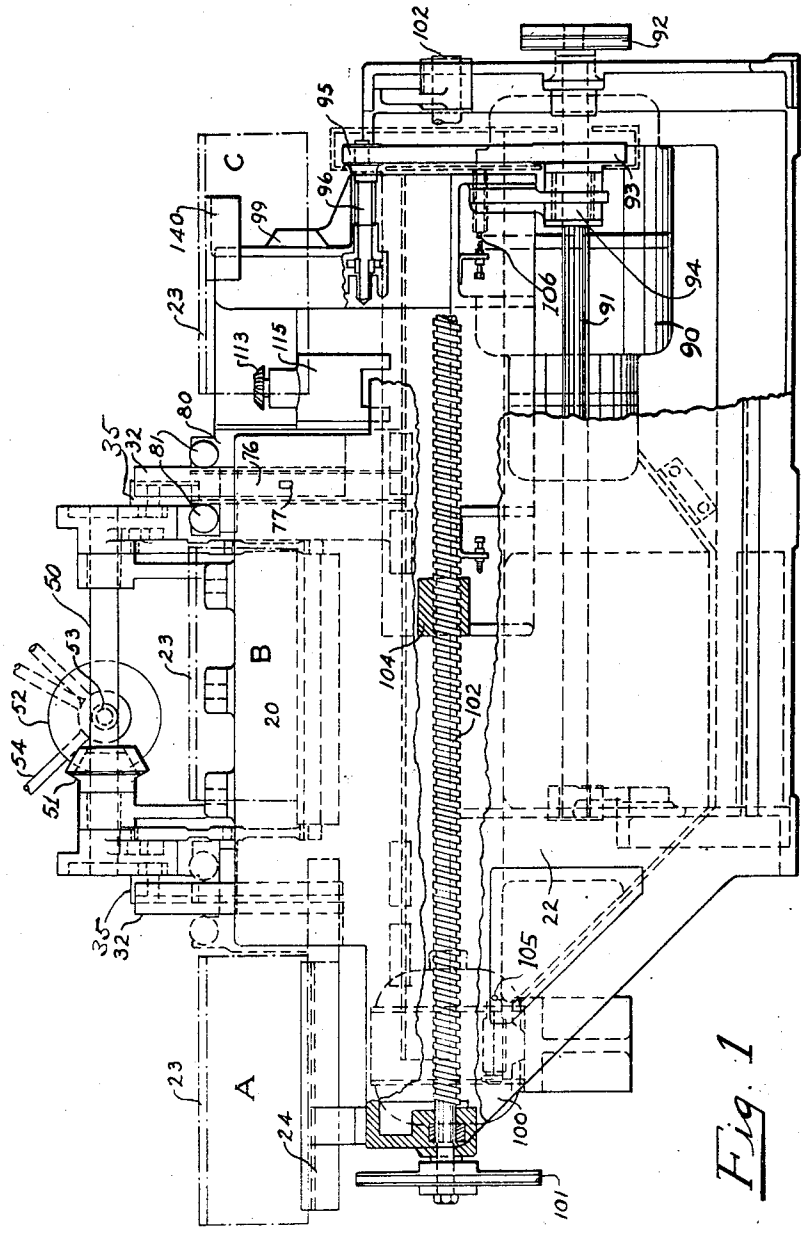


Fig. 1

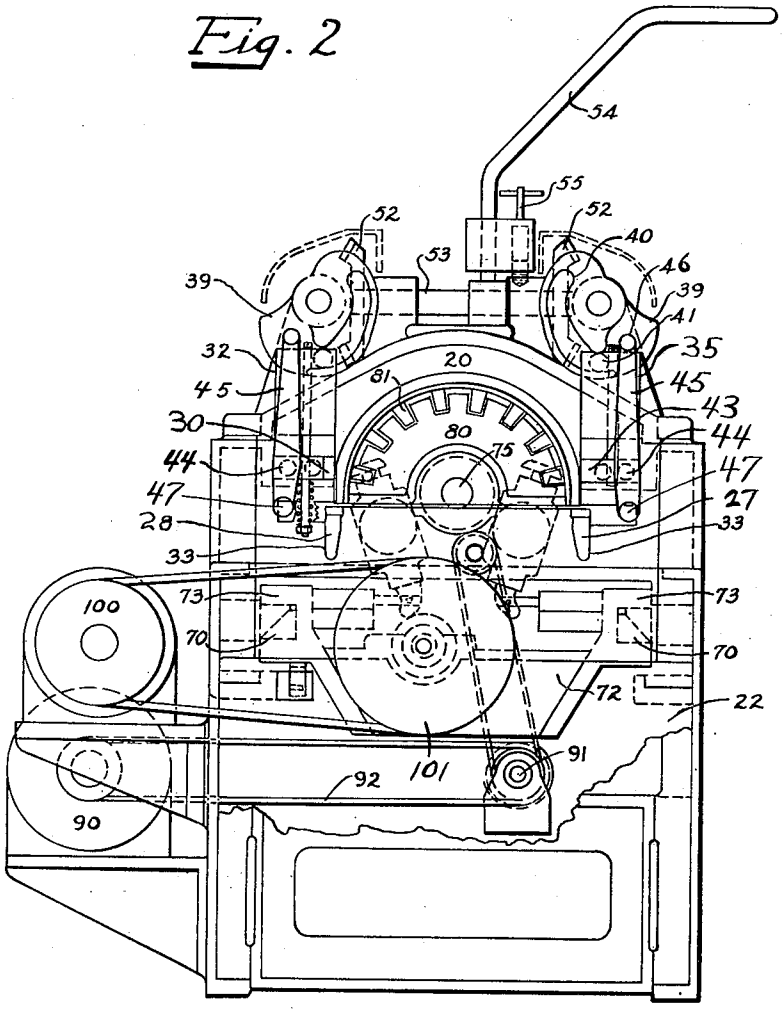
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July 22, 1952 C. S. CRAFTS ET AL 2,604,017

STEREOTYPE FINISHING MACHINE

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Fig. 2



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STEREOTYPE FINISHING MACHINE

Filed Nov. 16, 1945 11 Sheets-Sheet 3

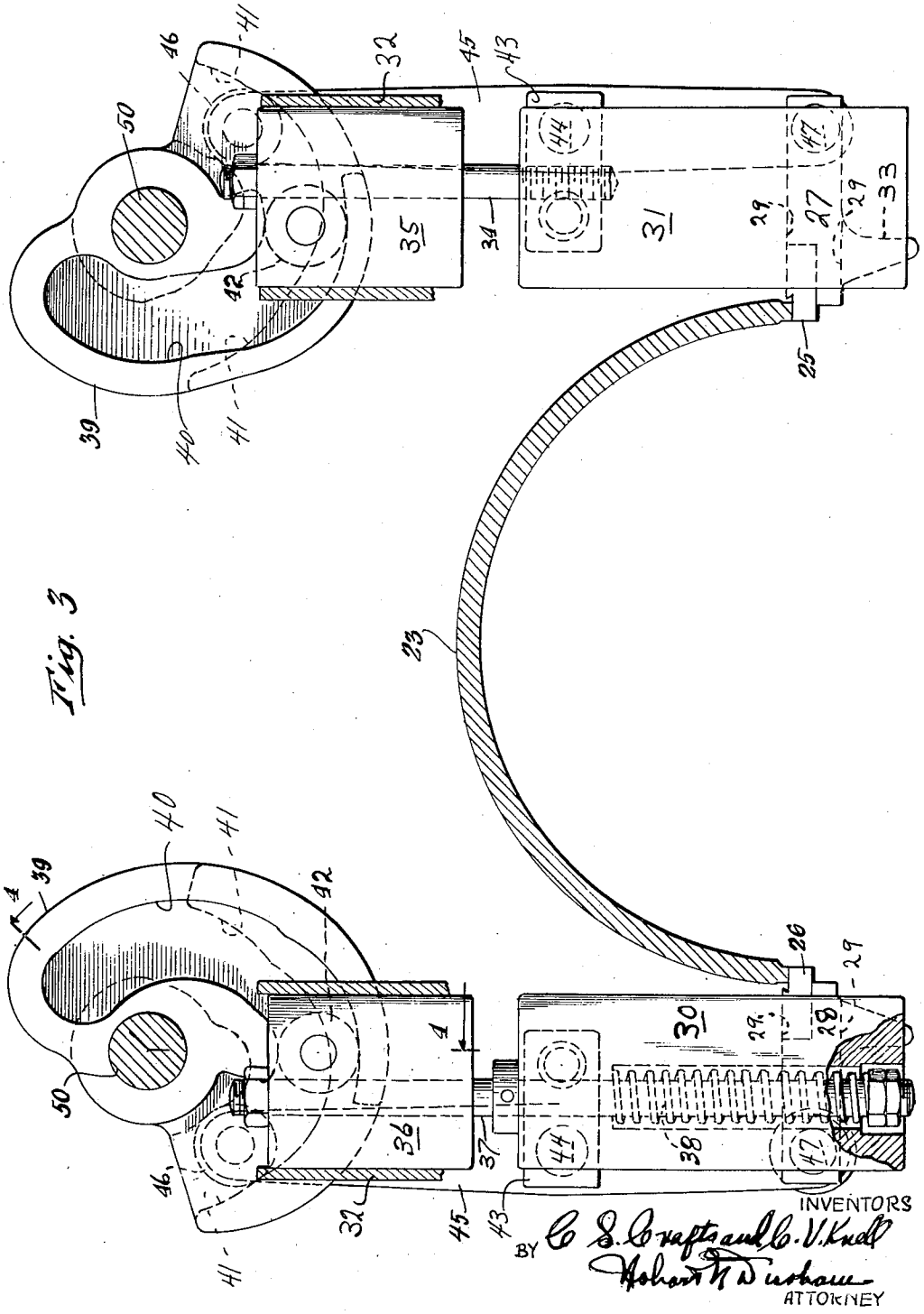


Fig. 3

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STEREOTYPE FINISHING MACHINE

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Fig. 5

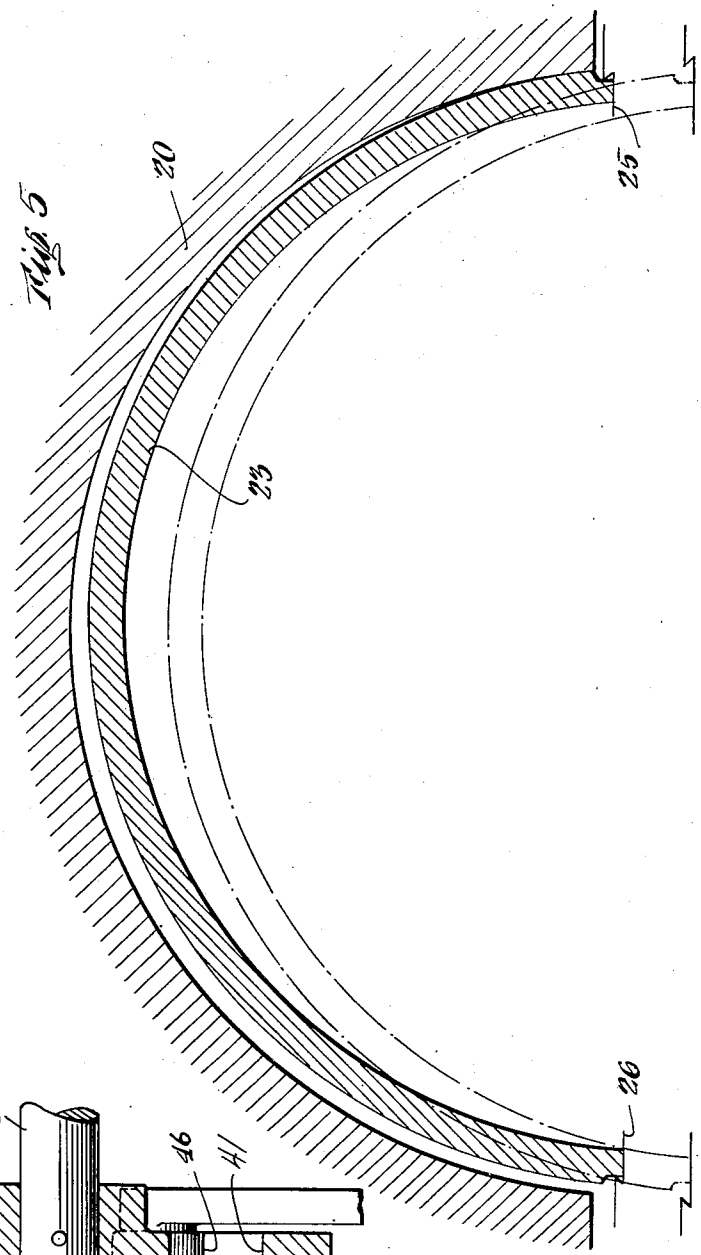
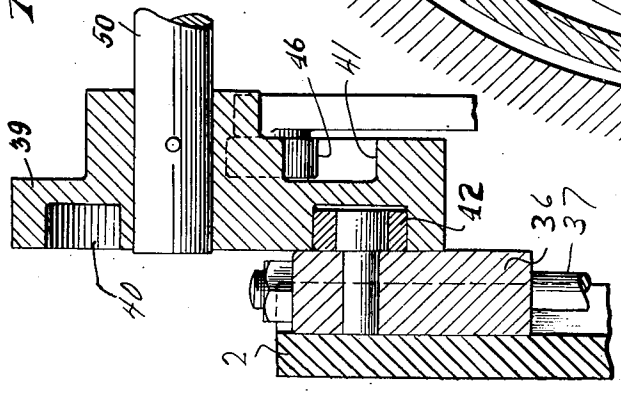


Fig. 4



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STEREOTYPE FINISHING MACHINE

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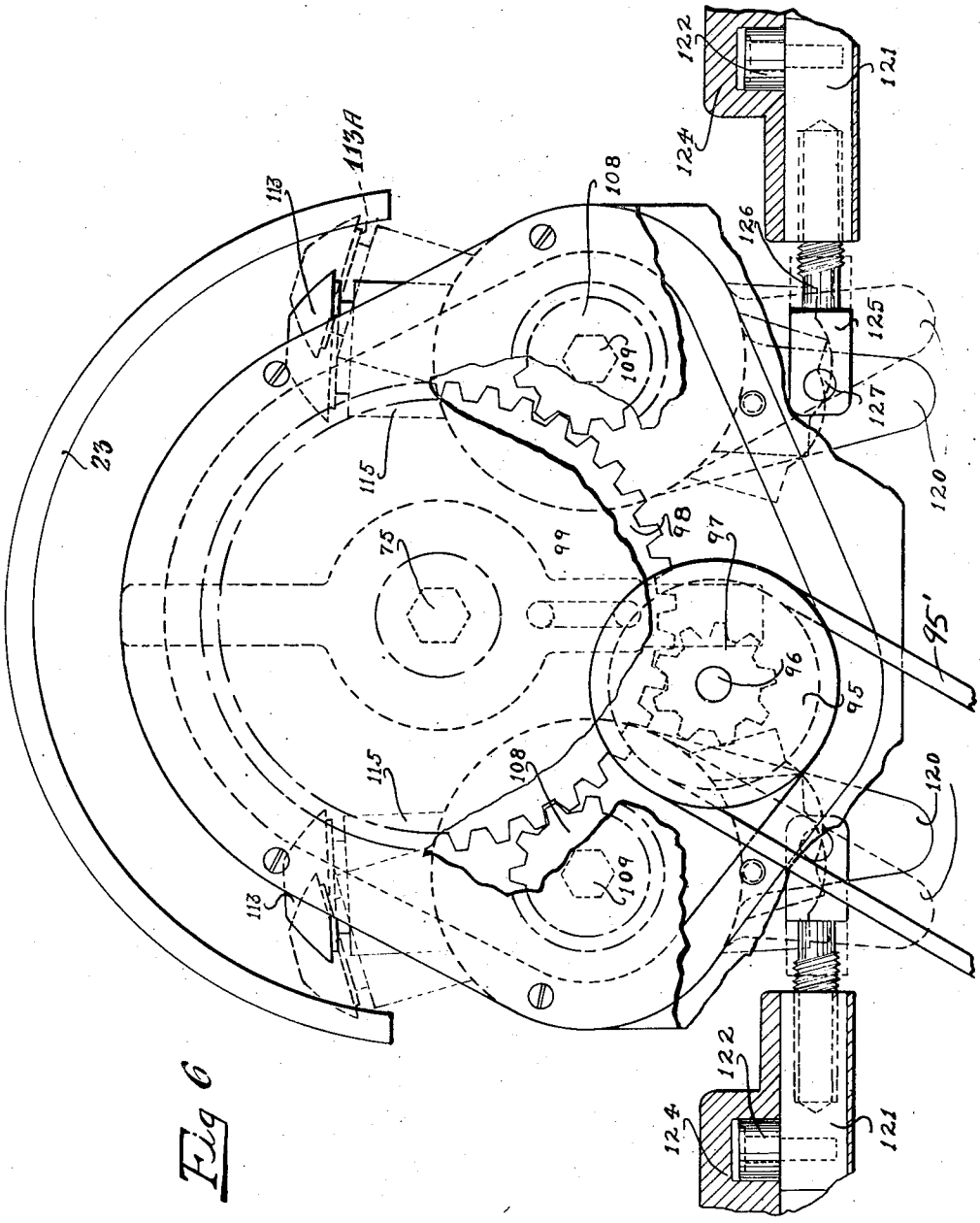


Fig 6

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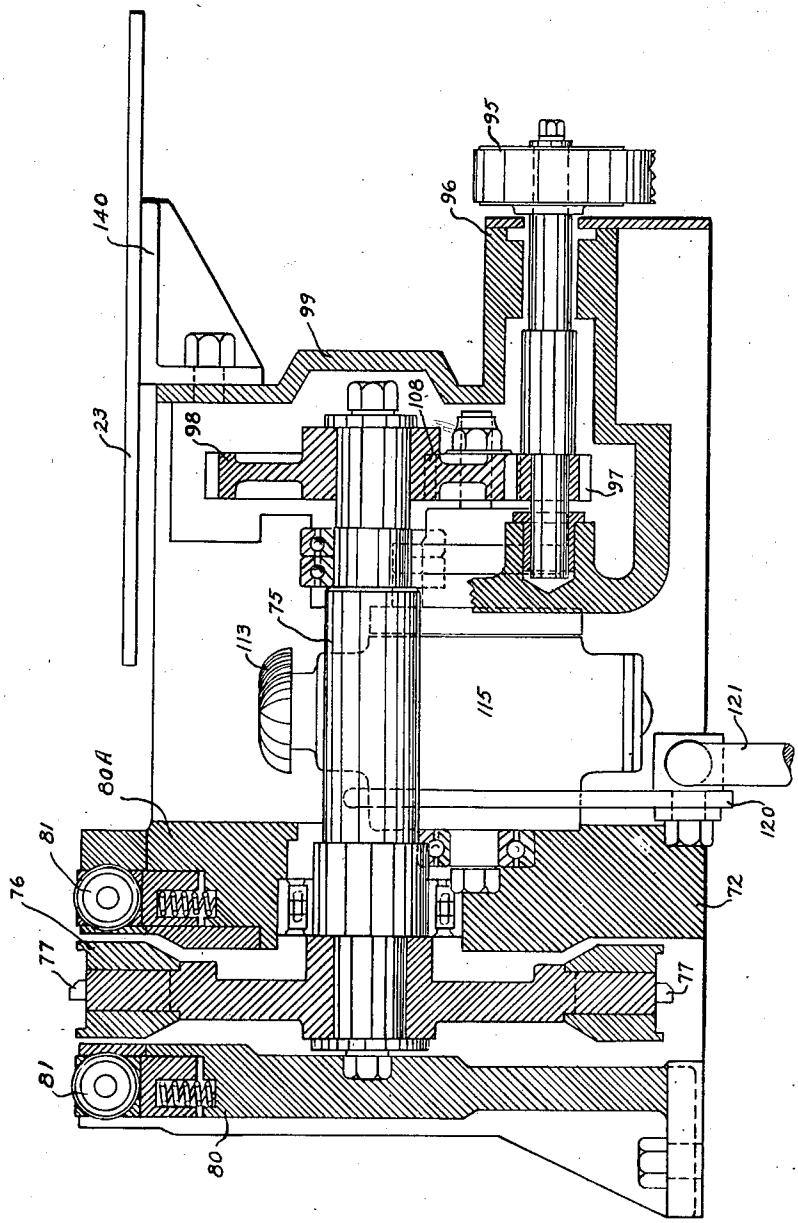
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July 22, 1952 C. S. CRAFTS ET AL 2,604,017

STEREOTYPE FINISHING MACHINE

Filed Nov. 16, 1945 11 Sheets-Sheet 6

Fig. 7



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STEREOTYPE FINISHING MACHINE

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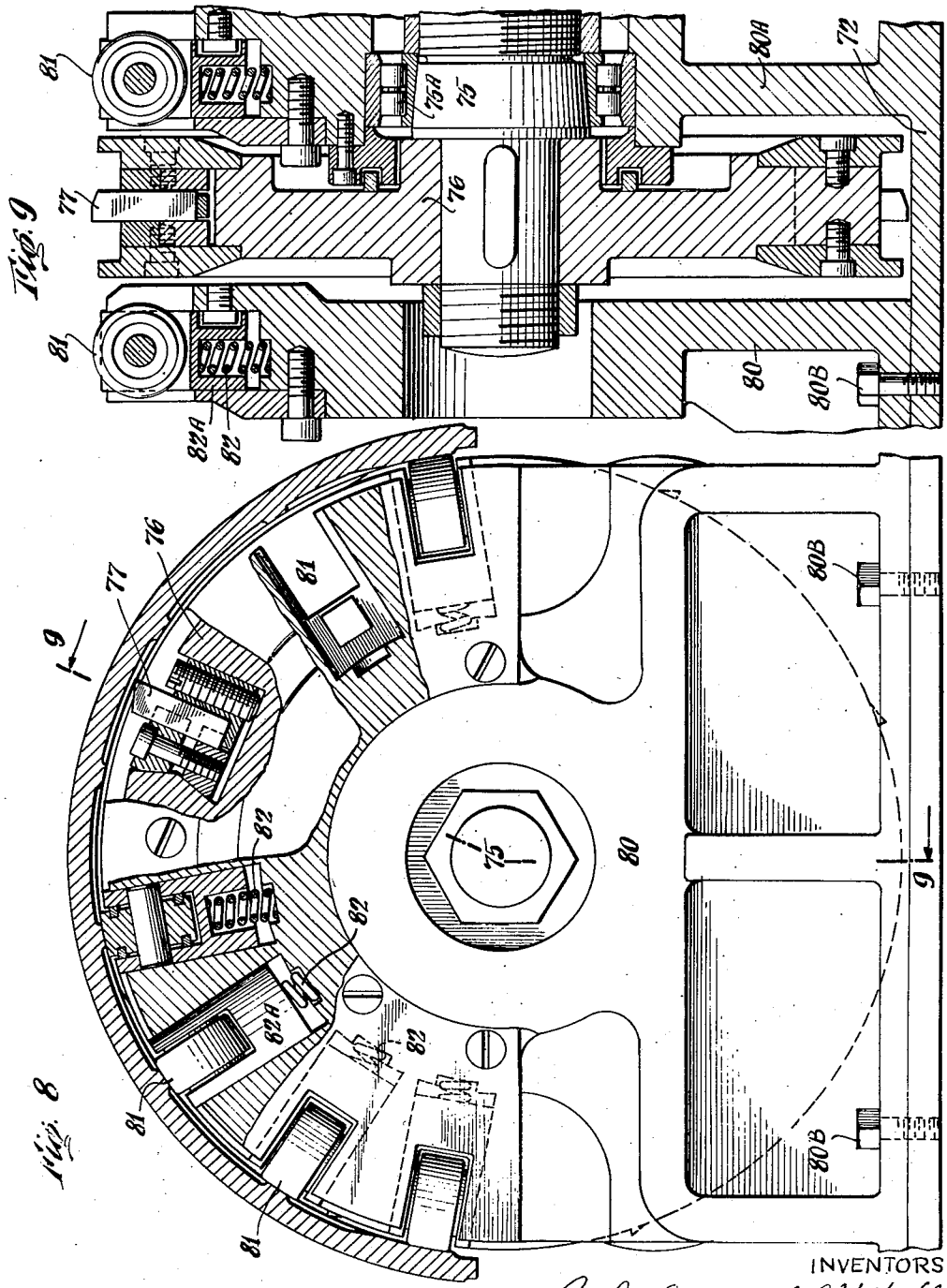


Fig. 9

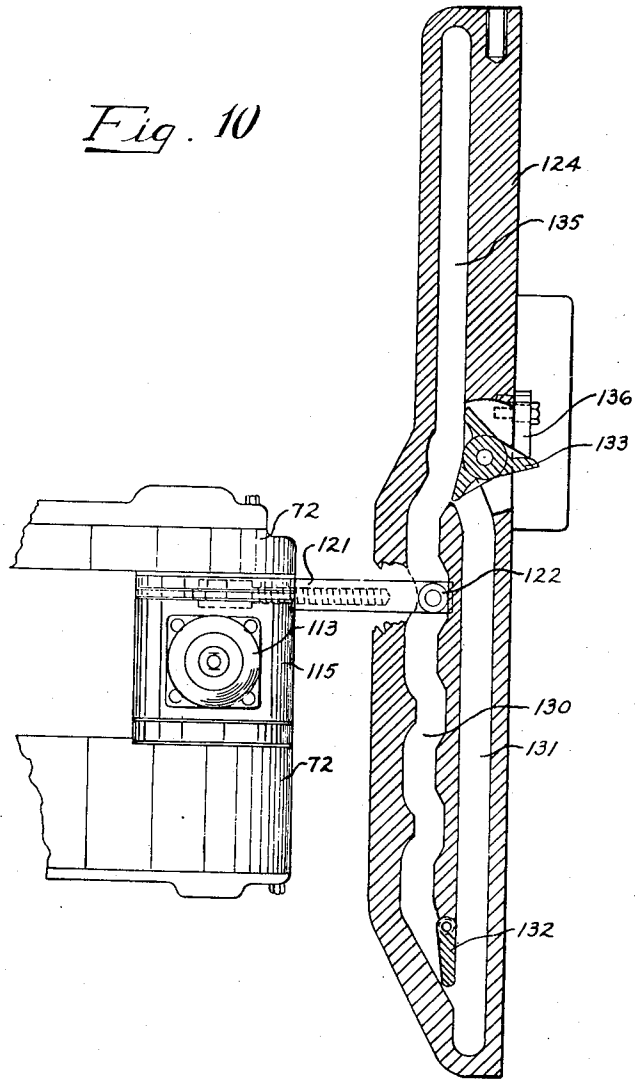
Fig. 8

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STEREOTYPE FINISHING MACHINE

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Fig. 10



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STEREOTYPE FINISHING MACHINE

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Fig. 13

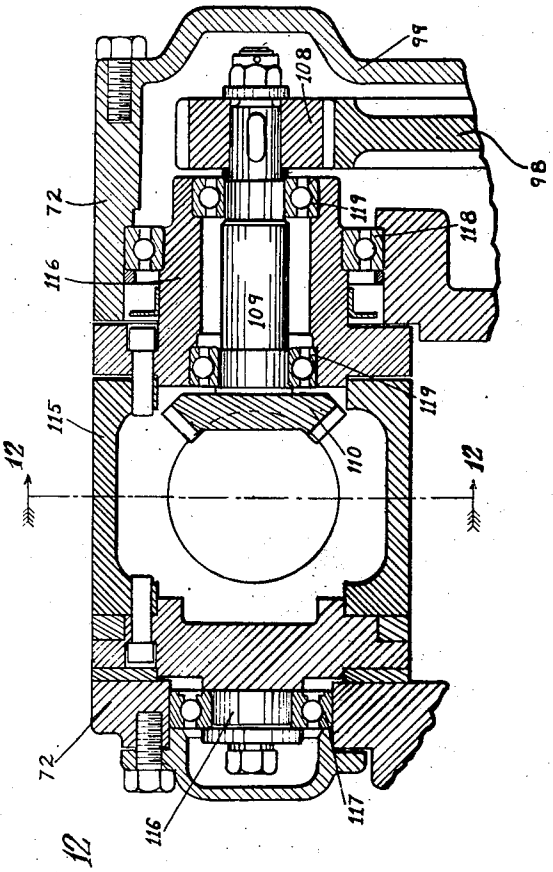


Fig. 11

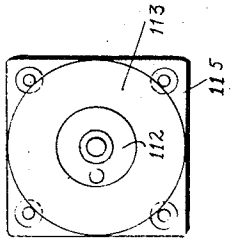
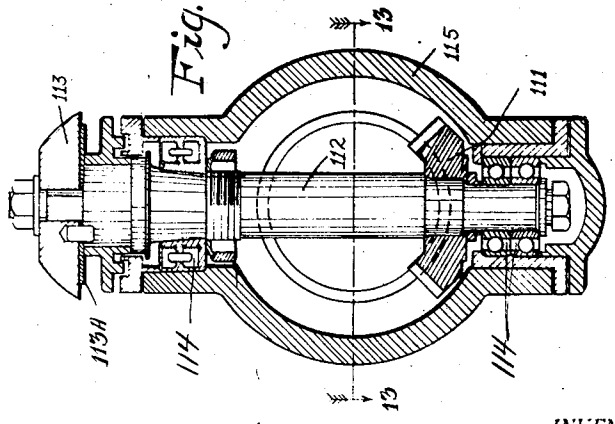


Fig. 12



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STEREOTYPE FINISHING MACHINE

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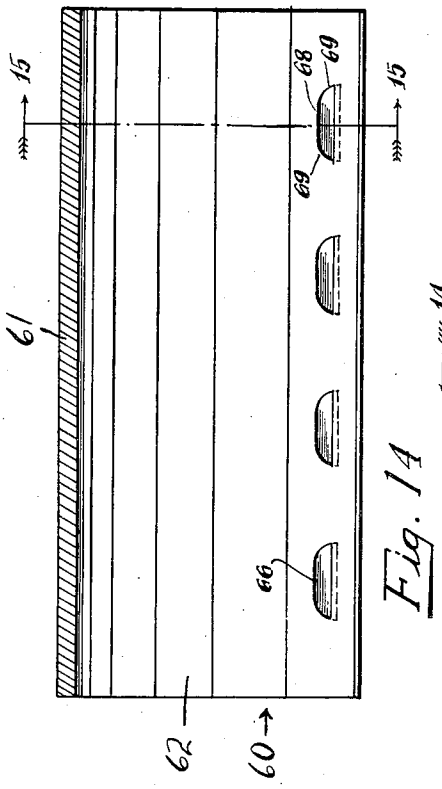


Fig. 14

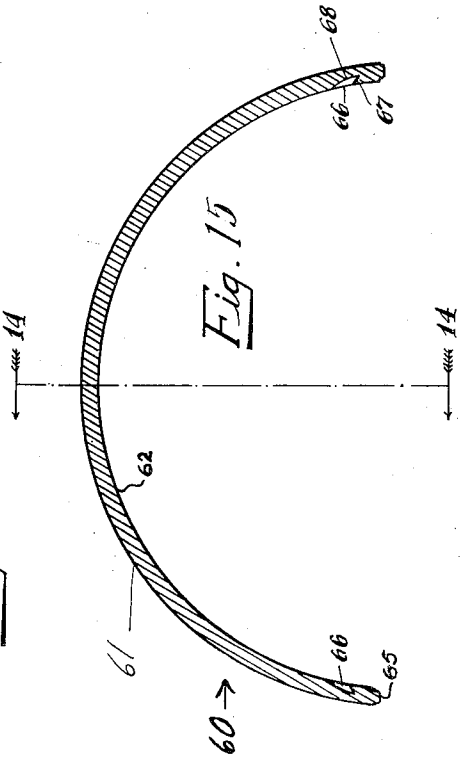


Fig. 15

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STEREOTYPE FINISHING MACHINE

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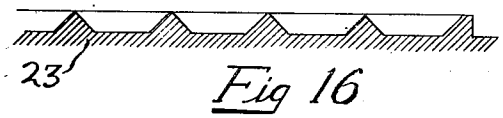


Fig 16

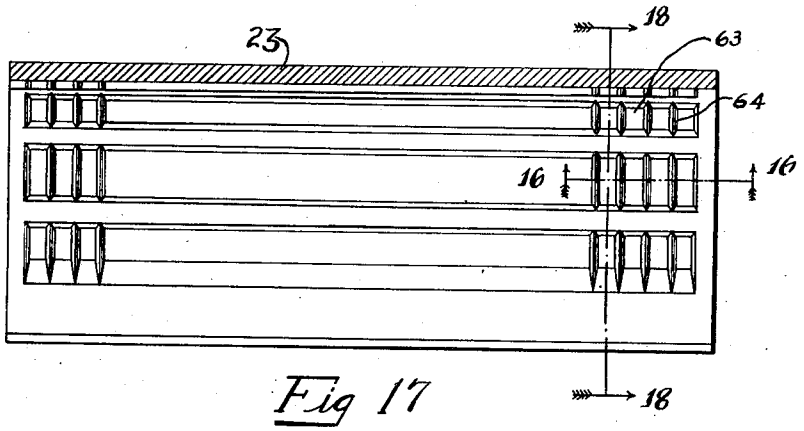


Fig 17

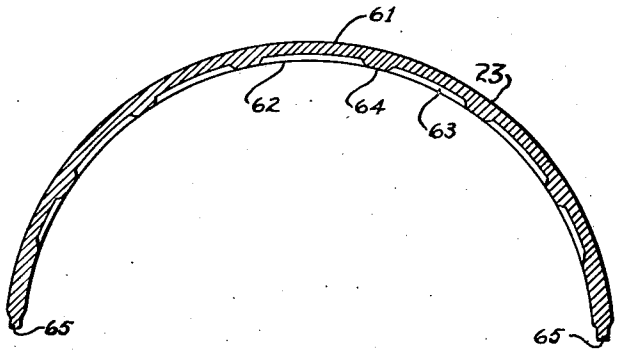


Fig 18

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Patented July 22, 1952 2,604,017

UNITED STATES PATENT OFFICE

2,604,017

STEREOTYPE FINISHING MACHINE

Curtis S. Crafts, Oak Park, and Christopher Verne Knell, Glenn Ellyn, Ill., assignors to The Goss Printing Press Company, Chicago, Ill., a corporation of Illinois

Application November 16, 1945, Serial No. 629,123

13 Claims. (Cl. 90—15)

1

The present invention relates to a novel and improved plate finishing machine and more particularly to an improved machine for accurately finishing the interior of semi-cylindrical stereotypes such as are conventionally used for newspaper presses.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Figure 1 is a side elevation, with certain parts broken away and other parts shown in section, of a typical and illustrative embodiment of the present invention;

Figure 2 is an end elevation of the plate finishing machine shown in Figure 1;

Figure 3 is a detail view of the upper portion of Figure 2 with certain parts omitted;

Figure 4 is a section along the broken line 4—4 of Figure 3;

Figure 5 is a view showing two positions of the plate as it is moved into the supporting arch for finishing;

Figure 6 is an end view of the rotary boring and slot milling means forming a part of the preferred form of the present invention;

Figure 7 is a side elevation, with certain parts being shown in section and a rotary boring means and slot milling means forming part of the preferred embodiment of the present invention;

Figure 8 is an end elevation of the tool head shown in Figure 7;

Figure 9 is a section along the line 9—9 of Figure 8;

Figure 10 is a detailed view, partly in section and with other parts broken away of the means for controlling the slot milling means of Figure 6;

Figure 11 is a top elevation of the milling cutter;

Figure 12 is a vertical section of the milling cutter housing and drive;

Figure 13 is a sectional view taken on the line 13—13 of Figure 12;

Figure 14 is a sectional view taken on the line 14—14 of Figure 15;

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Figure 15 is a sectional view of a finished stereotype as produced by the finishing machine of the present invention; taken on the line 15—15 of Figure 14;

Figure 16 is a fragmentary sectional view showing the section 16—16 of Figure 17;

Figure 17 is a developed view of the interior surface of the plate prior to the plate being worked on by the finishing machine; and

Figure 18 is a sectional view taken on the line 18—18 of Figure 17 and showing the stereotype plate as it is received by the plate finishing machine.

The present invention has for its object the provision of a novel and improved boring head for finishing the interior surface of a stereotype plate so that it may be accurately positioned on a printing cylinder. Certain additional features of the plate finishing machine of which the present invention forms a part are described herein and claimed in the co-pending application, Serial No. 629,122, filed Nov. 16, 1945, of C. Verne Knell and in the copending application Serial No. 68,326, filed December 30, 1948, of Curtis S. Crafts and Christopher Verne Knell, the latter application being a division of the present application.

In accordance with the present invention, the stereotype plate finishing machine includes an arch or hollow, generally semi-cylindrical form, of a diameter and length corresponding to the external dimensions of the stereotype after it has been mounted on the plate cylinder for printing, and means are provided below the arch or form for supporting the plate by engagement with its straight edges, with the axis of the stereotype parallel to the axis of the arch, and for moving one or both of the plate edge supporting means upwardly while moving one or both of them towards and then away from the other, thereby compressing the plate diametrally as it is raised into contact with the arch to seat it firmly therein, the movement of the supporting means away from each other being accomplished at the end of the seating operation whereby scarring of the plate on the arch is avoided and the plate supporting members are removed from the path of the finishing tool which will accurately surface the interior of the plate. A further feature of the seating movement is that one side edge is seated first and contact of the plate with the arch flows up from this side edge and down to the other edge. The arch preferably has open ends whereby the plate may be positioned therein and removed therefrom by axial movement.

The plate seating means preferably comprises a lever means operated by rotatable cams which have a common actuating means, the lever means

being provided at each side of the arch and including vertically slidable blocks on which the levers are pivotally mounted so that the levers may be horizontally swung as they and the blocks are vertically moved. One of the levers is preferably resiliently connected to its plate supporting means whereby the final seating of the plate is accomplished by a yielding action to accommodate minor dimensional variations in the plate.

Means are provided for finishing the interior of the plate and preferably comprise an axially movable cutter head or boring tool which is moved through the arch by means of a power driven screw, cam controlled milling cutters also being provided for cutting the plate hook recesses in the interior of the plate adjacent to its straight edges, as the interior of the plate is surfaced. These recesses are preferably spaced apart axially of the plate and are accurately located with respect to the plate hooks on the plate cylinder. Mounted on the boring head carriage and to either side axially of the cutter bits thereof is a substantially semi-cylindrical plate carrying parti-spherical rollers radially and resiliently actuated into rolling engagement with longitudinal ribs formed on the interior surface of the stereo, in order that the parti-cylindrical surfaces generated on said ribs by the cutters shall be as perfect as possible.

The finished plate is preferably removed from the arch or form in the same direction as it was inserted and a support or saddle is provided just behind the axially movable cutter head so that, on release of the plate from the arch, the plate is lowered onto the support and is moved out of the arch as the cutter head is screw returned to its original position.

Referring now in detail to the accompanying drawings which illustrate a typical, illustrative and preferred embodiment of the present invention, there is provided an arch **20** or supporting member having a semi-cylindrical interior face of a diameter and length corresponding to the desired printing surface of the stereotype plate, and of sufficient strength so that it does not yield appreciably as the plate is firmly pressed into it and interiorly surfaced. Arch **20** comprises a heavily ribbed member which is bolted to the upper portions of the main frame **22**, and is preferably located substantially midway between the longitudinal ends of the main frame, thereby providing a plate receiving portion at one end of the frame, and a plate delivering portion at the other end of the frame onto which the finished plate is delivered. In actual practice, said arch generally has a diameter of from sixteen to twenty inches and an axial length of from fifteen to twenty inches, the interior surface of the arch corresponding accurately to the printing surface of the stereotypes to be finished therein.

At the receiving end A of the plate finishing machine, at the left as shown in Figure 1 are provided a pair of spaced plate edge receiving surfaces **24** which may receive and support the two straight, diametrally opposed edges of the stereotype **23** to be interiorly finished, axially alined with the longitudinal axis of the machine.

Means are provided at the plate finishing portion B of the machine, intermediate its longitudinal ends for supporting the plate, which supports **25, 26** are normally alined axially and laterally with the surfaces **24** and the plate may be slid from one to the other while the supports **25, 26** are in their normal or lowest position. Plate receiving surfaces **24** are fixed to the frame of the machine while surfaces **25, 26** are mounted for compound vertical and horizontal movement thereon independently of each other as more fully hereinafter described.

Plate supporting surfaces **24, 25** and **26** are preferably all in a single horizontal plane parallel to the diametral edges of the semi-cylindrical interior surface of the arch **20**, so that the arch is uniformly spaced from the upper surface of the plate **23** at both sides thereof. The arch therefore constitutes the reference surface for the operations to be performed on the plate.

The supports **25, 26** are carried on plate rails **27, 28** slidable in lateral channels **29** formed in blocks **30, 31** which are slidable in vertical guideways **32** mounted on the main frame **22**. Plate rails **27, 28** have depending portions with finished surfaces **33** engaging flats formed on the main frame **22**. A threaded tie rod **34** ties block **31** to block **35** similarly slidable in guideway **32**, whereby the distance between blocks **31** and **35** may be varied to accommodate stereoplates **23** of varying diameters. Block **30** is resiliently and adjustably connected to block **36** slidable in guideway **32** by means of threaded plunger **37** extending through both blocks and surrounded by coil spring **38** located in a stepped bore in block **30** and bearing upward against the latter and downward against nuts threaded on plunger **37**.

Four cams **39** each comprise two cam tracks **40, 41**. The tracks **40**, seen in front elevation in Figure 3, act through rollers **42** journalled in blocks **35, 36**, to raise the blocks upon revolution of the cams **39** from the illustrated position. Links **43** journalled in blocks **30, 31** carry fulcrum journals **44** of levers **45**. Cam rollers **46** in tracks **41** shown in broken lines in Figure 3, upon the above-mentioned revolution of cams **39**, oscillate with a horizontal directional component, the oscillation being transmitted over levers **45** to plate rails **27, 28** to which the levers are pivotally connected at **47**, causing lateral travel of rails **27, 28** in channels **29**.

For simultaneously and equally operating the cams **39**, a pair usually being provided at each end of the plate **23**, the cams are mounted on shafts **50** which are parallel and suitably journalled above the arch **20** and intergeared. As embodied, each shaft **50** has a gear **51** meshing with a mitre gear **52** on transverse shaft **53** journalled in the frame and provided with an operating lever **54** releasably coupled to the shaft **53** by means of set screw **55**, so that a manual movement of the lever **54** can move cams **39** from their lowermost position to their uppermost position.

The two cams **39** connected to blocks **31** and **35** are designed to raise these blocks slightly ahead of blocks **30, 36**, so that as the blocks **31, 35**, carrying support **25** with them, reach the upper limit of their travel, blocks **30, 36** and support **26** have not yet reached their upper limit, all as clearly shown in Figures 3 and 5. These figures also show that the supports **25, 26**, actuated by the above-described mechanism, have a compound motion which is upward and inward without tipping, which is effective to compress plate **23** diametrally as it seats in arch **20** and thereby prevent any wiping action between plate and arch which would damage the printing surface of the plate. Subsequent to the full line position illustrated in Figure 5, support **25** is retracted laterally outward somewhat, which is effective to increase and equalize the diametrally outward seating pressure of the right edge of the plate in the arch

Contemporaneously with the lateral retraction of support 25, support 26 completes its upward travel and is laterally retracted. Completion of the upward travel of support 26 causes leftwardly successive peripheral portions of plate 23 to seat in the arch, the contact progressing upward from the right side of Figure 5 to the top of the arch and thence downward to the left edge which rests on support 26. It is notable that support 25 is positively actuated in its movement, while support 26 is resiliently actuated in its movement by mechanism which is similar to the actuating mechanism of support 25 except for the addition of spring 38, which is effective through support 26 to press plate 23 upward and cause the latter to exert circumferentially transmitted pressure against the positively actuated support 25. The right edge of plate 23 may be finished in register with its printing surface for color work or the like, and the above seating and clamping mechanism permits the entire plate to be seated in register with the registered right edge, so that the finishing of the interior and the forming therein of plate hook recesses for tension lockup of the plate on the printing cylinder may be done with unprecedented exactness of register. Consequently the right-hand edge of the plate may be referred to as the registering edge and the left-hand side as the tensioning edge.

While the plate is firmly secured in its position seated in the arch 20 it may be interiorly finished to conform accurately to the cylindrical surface of the plate cylinder of the printing press on which it will eventually be secured and printed. For this purpose, means axially movable of the plate are provided for boring or otherwise finishing the interior cylindrical surface of the plate, and due to the firm support of the plate this finishing may be much more accurate than usual; thereby resulting in a printing plate which will produce impressions of higher quality than usual.

To carry out this interior finishing of the plates, means are preferably provided for accurately boring the interior of the plate, such means moving axially of the plate as the boring tool is rapidly revolved.

Figures 16 to 18 show various views of the plate as it is placed on the finishing machine, while Figures 14 and 15 show schematic views of the plate, as finished.

The finished plate shown in Figures 14 and 15 comprises a semi-cylindrical member 60 having a printing surface 61 and an interior surface 62 to be seated on and closely conform to the outer surface of a plate cylinder and when so seated to provide a printing member of a predetermined size and having an accurate cylindrical surface so that the impression thereof will be of high quality.

Plate 60 is provided with internal recesses 63 between ribs 64, to lighten the plate, these ribs and recesses being shown more in detail in the developed view, Figure 17. Plate 60 is also formed with straight edges 65 of less thickness than the main body of the plate. Recesses 63 are formed over the entire inner surface, except at the edges, although shown only over a portion of the surface in Figure 17.

Figures 14 and 15 show the plate as it is finished by the machine illustrated (except that the ribbing is omitted for clarity). The interior surface of the plate 60 has been surfaced so that all of the ribs lie in a uniform cylindrical surface and the inner surface is formed with two parallel series of slots 66 closely adjacent the straight edges 65 each slot having a flat side 67 inclined towards the straight edge, the other longitudinal side 68 of the slot being parti-cylindrical and terminating in rounded ends 69.

The means for interiorly finishing the stereotype comprise an axially movable rotary surfacing means, preferably a boring tool or cutter for surfacing the plate and axially movable controlled milling means for forming the longitudinal series of spaced slots, both means acting on the same axial movement of the finishing means. The finishing means also include means for radially pressing the plate against the arch immediately in advance and to the rear of the cutter means to insure accurate finishing of the plate. While many different forms of such means may be employed, we preferably provide the means illustrated and the frame 22 formed with slideways 70 parallel to each other and horizontally spaced running the greater part of the length of the machine on which the cutter means are mounted for movement axially of the plate 23. The cutter or boring means are carried by a slidable frame 72 having guides 73 which cooperate with the slideways 70.

Slidable frame 72 carries a heavy shaft 75 journalled therein and at one end is provided with a boring head 76 driven thereby and having a plurality of boring bits 77 extending radially therefrom and adjustable to bore the plate accurately to the proper diameter, the shaft 75 being accurately held in alinement with the axis of the arch 20. For accurately holding the plate during the finishing and to exert pressure in addition to that exerted by the supporting means 25, 26, axially in advance and just behind the boring tool, the frame 72 is formed with two substantially semi-cylindrical plates 80, 80A respectively, somewhat smaller than the interior of the plate 23, one at either side of the boring head 76, each plate carrying a plurality of parti-spherical rollers 81, spaced to contact with axially extending ribs 64 on the stereotype, each of said rollers being yieldably mounted by heavy springs 82 engaging pillow blocks 82A for radial movement relative to shaft 75 so that any irregularity in the surface of the plate 23 is smoothed out while the plate is finished. Plate 80A is formed integral with frame 72 and carries concentrically anti-friction bearing 75A of shaft 75, while plate 80 is removably mounted on frame 72 as by cap screws 80B.

The boring head is preferably driven at high speed so that a fine finish is obtained on the interior of the plate. For this purpose, motor 90 is mounted at one side of frame 22 and drives longitudinal shaft 91 by belt 92 and suitable pulleys. Means are provided for driving shaft 75 from shaft 91, regardless of the axial position of boring head 76. Shaft 91 is formed to receive and drive slidably keyed or splined pulley 93 which is slidable on shaft 91 and is moved axially by bracket 94 depending from frame 72 and movable therewith. Pulley 93 by belt 95' drives pulley 95 on shaft 96 which carries pinion 97, journalled in frame 72, and meshing with gear 98 fast to shaft 75 and enclosed in housing 99.

Frame 72 is axially movable and may be motor driven. Motor 100 mounted on frame 22 is belted to pulley 101 carried by screw shaft 102 journalled in the frame 22 and in cooperating threaded engagement with a threaded sleeve 104 on frame 72 so that rotation of shaft 102 axially moves the frame 72 and its boring head

76 and pressure rollers 81. Motor 100 is reversible and may drive the frame 72 in either axial direction.

Limit switches 105 and 106 are provided in the motor circuit to prevent excessive axial movement of the boring head.

The milling cutters for milling the plate hook receiving slots in the interior surface of the plate 23 may be driven from the same motor 90 as the boring tool. Gear 98 drives pinions 108 on parallel shafts 109 which are mounted for rotation in and axial movement with frame 72. At its other end each shaft has a bevel gear 110 meshing with a bevel gear 111 on the milling cutter shaft 112 which is driven thereby to drive the milling cutters 113, while shaft 112 may oscillate about shaft 109 as the milling cutters 113 and chamfer milling cutters 113A on the same shaft and just below them are moved into and out of cutting contact with the plate surface as the slots 66 are formed.

Shaft 112 is mounted by bearings 114 in a tool mount or housing 115 which has sleeve-like ends 116 concentric with shaft 109 and is mounted for oscillation by means of bearings 117, 118 seated in frame 72, while shaft 109 is rotatably mounted within one of the sleeves 116 by bearings 119. Thus milling cutters 113 may be rapidly rotated from motor 90 and may also be moved revolubly about shaft 109. In the full line position of Figure 6, the milling cutters 113 are rotating idly while in the dotted line position they are in cutting engagement with the plate 23 to form the slots 66 therein. It will be noted that the shafts 109 are arranged generally below the associated plate edge. More specifically, they are located below the plate edge but spaced inwardly toward the axis of the plate. As a result of such arrangement the pockets milled by the milling cutters may be caused to be undercut as shown, insuring more positive plate lockup.

To control the length of the slots 66 formed in the plate 23, means are provided for rocking each of the milling cutters 113 towards and from the plate as the cutters are moved axially of the plate. The cutters 113 are mounted for rocking motion by means of the sleeves 116 to provide a collar type of coupling between the housing and frame. The housing 115 is provided with a depending arm 120 pivotally connected to a slide 121 carrying a cam follower which is guided and controlled by stationary cam 124 fast to frame 22. Follower 122 is a roller mounted on a slide 121 which is connected to clevis 125 by screw rod 126, clevis 125 being pivoted to arm 120 by pivot pin 127.

Figure 10 shows the cam 124 having a slot forming track 130 and a return track 131 adapted to control follower roller 122 and thereby the rocking of the milling cutter 113. In its cutting the cutter frame 72 moves forward (downwards of the sheet in Fig. 10), follower 122 is moved laterally to form, for example, four slots 66 of the required depth and at the desired longitudinal points along the axial length of the plate 23. On reaching the end of the plate, follower 122 displaces switch 132 and enters the end of the cam track, switch 132 being then spring restored to the position shown. On reverse axial movement of the cutting and boring means, follower 122 travels in return track 131 until follower reaches star switch 133 which is rotated as the follower 122 enters the common cam track 135, switch 133 being held against retrograde movement by means of the detent spring 136, so that follower 122 always enters track 130 rather than the return track 131.

The pitch of lead screw 102 and the cut and speed of cutter bits 77 are so related that on one pass of the boring tool the interior of the plate is accurately finished, and simultaneously all of the plate hook recesses 66 are formed in the plate. Thereafter the boring tool and milling cutters may be idly withdrawn in the opposite axial direction.

When the interior of the plate has been fully finished, lever 54 may be returned to its original position dropping the plate to the lowermost position shown in Figure 5 so that it is free to be removed from the arch and the finishing machine. Means are preferably provided for automatically removing the plate from the arch on the return movement of the cutters, thereby making use of the otherwise idle axial movement thereof. To this end, frame 72 carries an arcuate saddle 140, preferably mounted on the gear housing 99 and shaped to fit the interior of the finished plate and at such a height that it, rather than the supporting ledges 25, 26 will support the plate as the cams 39 return the ledges to their normal inoperative position. The finished plate is thus deposited on the arcuate saddle 140 and when the axially movable frame 72 is returned to its original position the plate is carried with it to its unloading position C.

Suitable conventional switches are provided for:

Starting, stopping and reversing motor 100 driving the lead screw to cause the forward and reverse travel of the axially movable frame 72.

Starting and stopping the motor 90 for the boring and milling cutters.

Energizing signal devices such as signal lights for indicating that the plate is securely held for finishing, has been finished and that the finishing operation has been completed and the machine is ready to receive another plate.

By properly driving the various parts of the machine it is possible to finish stereotype plates at a rate well in excess of two plates per minute, depending on the skill of the operator.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What is claimed is:

1. In a machine for finishing tension lockup plates, the combination comprising a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for movement parallel to the axis of said support, a driven shaft revolubly mounted in said frame parallel to the axis of said support, a milling cutter and shaft mounted perpendicularly to said driven shaft and having a right angle driving connection therewith, a cam track mounted on said machine and having a portion thereof in fixed parallel relation to the axis of said support, and means for coupling said cutter shaft to said cam track for rocking of the cutter bodily about the driven shaft and into milling engage-

ment with the plate upon axial movement of said frame.

2. In a machine for finishing tension lockup plates, the combination comprising a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for movement parallel to the axis of said support, a driven shaft mounted for movement axially with said frame, a milling cutter and shaft mounted perpendicularly to said driven shaft and having a right angle driving connection therewith, and means including a cam track portion and cam follower portion engaging with the cam track portion for guiding said milling cutter, one of said portions being coupled to said milling cutter shaft and the other of said portions being coupled to said support, part of said cam track portion being oriented parallel to the axis of said support and part at an angle thereto so that the cutter is rocked into engagement with the interior surface of the plate and then moved parallel to the edge thereof upon axial movement of said frame.

3. In a machine for finishing tension lockup plates, the combination comprising a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for movement parallel to the axis of said support, a housing mounted for bodily movement with said frame and pivoted thereto about an axis parallel to the direction of movement of the frame, a milling cutter and shaft journaled in said housing for bodily rocking with the housing, driving means including a shaft extending within said housing for driving the milling cutter shaft in all the positions of rocking thereof, and means having interengaging cam track and cam follower components for guiding said milling cutter, one of said components being coupled to said milling cutter shaft and the other of said components being coupled to said support, part of said cam track components being oriented parallel to the axis of said support and part at an angle thereto so that the cutter is rocked into engagement with the interior surface of the plate and then moved parallel to the edge thereof upon axial movement of said frame.

4. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for axial movement with respect to said support, a housing bodily movable with said frame and pivoted thereto for rocking movement about an axis which is parallel to the direction of movement of said frame, a milling cutter and shaft journaled in said housing and perpendicular to the rocking axis for rocking movement of the cutter into and out of engagement with the interior surface of said plate, means for driving said milling cutter shaft, a cam track mounted on said machine and having a portion thereof in fixed parallel relation to said support, and a cam follower attached to said housing for engaging said cam track so that the cutter is rocked bodily into milling engagement with the plate upon axial movement of said frame.

5. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for axial movement with respect to said support, a tool mount having a milling cutter and shaft journaled therein, means for mounting said tool mount on said frame for bodily movement therewith in an axial direction while permitting said mount to be advanced transversely to such direction and toward the interior surface of said plate for pocket-cutting engagement between said cutter and said plate, and means including a cam track and cam follower interposed between said tool mount and said support for guiding said tool mount, the cam track being so oriented relative to said support that the cam movement which results upon axial movement of said frame causes the cutter to be advanced toward the inner surface of said plate and then parallel to the edge thereof.

6. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame mounted for axial movement with respect to said support, a housing having a milling cutter and shaft journaled therein, a collar-type coupling for coupling the housing to said frame for axial movement of the two together while permitting said milling cutter to rock bodily in said housing into and out of engagement with the interior surface of said plate, a driven shaft extending through said coupling into said housing and having a right angle driving connection with said cutter shaft, a cam track mounted on said machine and having a portion thereof in fixed parallel relation to said support as well as a portion at an angle thereto, and a cam follower coupled to said housing for engaging said cam track so that the cutter is rocked into milling engagement with the plate and then moves parallel to the edge thereof upon axial movement of said frame.

7. In a machine for finishing plates for tension lockup and having a registering edge and a tensioning edge, the combination comprising an arch-shaped supporting surface for engaging the printing surface of said plate, clamping means for urging said plate against said arched surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the registering and tensioning edges thereof, said milling means comprising a frame movable axially of said support, driven shafts revolubly mounted in said frame for movement therewith, said shafts being arranged parallel to and spaced generally opposite the registering and tensioning edges of said plate, means for driving said shafts in unison, a milling cutter and shaft mounted substantially perpendicular to each of said driven

shafts and extending into the region enclosed by said plate and having right angle driving connections with their respective driven shafts, means for rocking said milling cutters and associated shafts bodily about their driven shafts for pocket milling engagement with the interior surface of said plate at the ends thereof, said rocking means including a cam track and cam follower, a portion of the cam track being parallel to the axis of said support and a portion at an angle thereto for rocking said milling cutters into milling engagement with said plate and then parallel thereto upon axial movement of said frame, said plate clamping means including stop means for positively positioning the registering edge of said plate with respect to the paths of rocking movement of said cutters to facilitate exact register of said plate for color work or the like.

8. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate precisely positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame having a mount for a milling cutter thereon, a milling cutter and shaft journaled in said mount, said mount being mounted in said frame for rocking movement of the cutter about an axis which is generally parallel to the axis of the plate, feeding means providing relative movement between said frame and said support in the direction of the plate axis, and camming means having a movable portion coupled to said tool mount and a fixed portion mounted on the machine, said fixed and movable portions coacting to rock the cutter mount for bringing the milling cutter into pocket-milling engagement with said plate.

9. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support providing a reference surface together with means for clamping said plate with a surface of the plate positioned with respect to said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame, means providing relative movement between said frame and said support in the direction of the plate axis, a housing connected to said frame and pivoted thereto for rocking movement about an axis which is parallel to the direction of said relative axial movement, a driven shaft projecting into said housing and coaxial with the rocking axis thereof, a milling cutter and shaft journaled in said housing and having a right angle driving connection with said driven shaft, and guiding means having a movable portion coupled to said cutter housing at a point spaced from the rocking axis thereof and having a portion mounted on said machine in fixed relation to said support, said fixed and movable portions being so arranged as to produce movement of said movable portion and consequent rocking movement of the cutter into milling position at the interior surface of said plate upon relative axial movement between said frame and said support.

10. In a machine for finishing tension lockup plates comprising, in combination, a support for a plate, said support including a reference surface together with means for clamping said plate into contact with said reference surface, means for milling axially spaced pockets in the interior surface of said plate adjacent the straight edges thereof, said milling means including a frame, means providing relative axial movement between said frame and said support, a tool mount having a milling cutter and shaft journaled therein, means for mounting said tool mount on said frame for relative movement with respect to said support in an axial direction while permitting said mount to be rocked about an axis toward the interior surface adjacent one of the edges of said plate, and means including a cam track and cam follower interposed between said tool mount and said support for guiding said tool mount in the rocking movement thereof, at least a portion of said cam track being oriented so as to move the cutter toward said plate and then parallel to the edge thereof upon relative axial movement between said frame and said support, the rocking axis of said tool mount being spaced below the associated plate edge and spaced inwardly toward the axis of the plate to permit the pockets to be peripherally undercut during the milling thereof for hooking in tension.

11. In a machine for finishing a cylindrically curved tension lockup printing plate having generally arcuate edges and generally linear edges extending substantially parallel to the cylindrical axis of the plate, the combination comprising a support for holding a plate in a predetermined position, milling means for milling pockets in the concave surface of the plate spaced axially thereof adjacent the generally linear edges thereof, said milling means including a frame, means for effecting relative movement between said frame and said plate support in the direction of the plate axis, a tool mount pivoted to the frame on the concave side of the plate for rocking movement about an axis which is generally parallel to the plate axis, a rotatable milling spindle journaled in said mount and extending generally transverse to the pivotal axis of the mount, means for driving said spindle, and drive means including a movable portion coupled to the tool mount and a fixed portion mounted on the machine cooperating to rock the tool mount into milling position adjacent the concave surface of the plate in coordinated relationship with the relative axial movement between said frame and said plate support.

12. In a machine for finishing cylindrically curved tension lockup printing plates having generally arcuate edges and generally straight edges, the combination comprising a support for a plate, means for clamping the plate on the support, means for milling axially spaced pockets in the concave surface of the plate adjacent the straight edges thereof, said milling means including a frame, means for effecting relative movement of said support and said frame in the direction of the plate axis, a tool mount having a milling cutter and shaft journaled therein, means for driving the cutter, means mounting said tool mount on said frame for bodily movement therewith relative to the support in an axial direction while providing for transverse movement of the cutter toward the interior surface of said plate for pocket cutting engagement between the cutter and said plate, and a drive including elements interconnected respectively with said tool mount and said support for advancing the cutter toward the inner surface of said plate.

13. In a machine for finishing a cylindrically curved tension lockup printing plate having generally arcuate edges and generally linear edges extending substantially parallel to the cylindrical

axis of the plate, the combination comprising a support for holding a plate in a predetermined position, milling means for milling pockets in the concave surface of the plate spaced axially thereof adjacent the generally linear edges thereof, said milling means including a frame, means for effecting relative movement between said frame and said plate support in the direction of the plate axis, a tool mount pivoted to the frame on the concave side of the plate for rocking movement about an axis which is generally parallel to the plate axis, a rotatable milling spindle journaled in said mount and extending generally transverse to the pivotal axis of the mount, means for driving said spindle, and a drive including elements interconnected respectively with said tool mount and said support for advancing

said milling spindle toward the inner surface of said plate.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
679,278	Crocker	July 23, 1901
1,324,562	MacConnell	Dec. 9, 1919
2,085,908	Huck	July 6, 1937
2,168,548	Wood	Aug. 8, 1939
2,341,194	Schwartz	Feb. 8, 1944
2,424,524	Weimer	July 22, 1947