Nov. 7, 1950 J. E. MEYER 2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Filed April 21, 1945 5 Sheets-Sheet 1

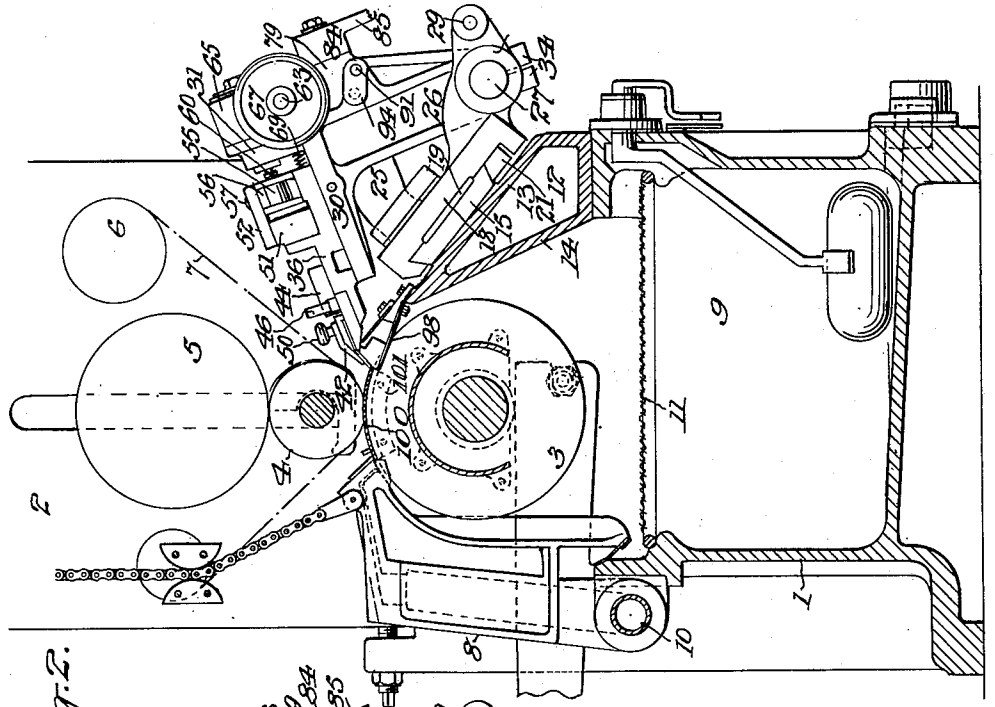


Fig. 2.

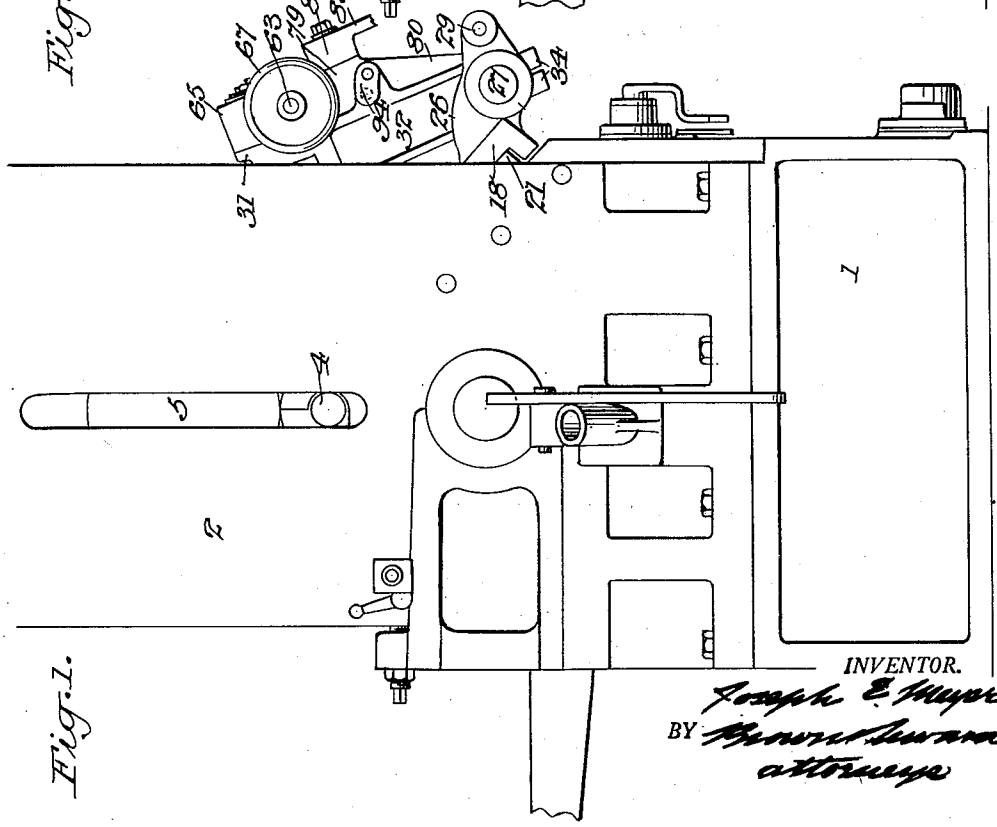


Fig. 1.

INVENTOR.
Joseph E. Meyer
BY Howard Howard
attorneys

Nov. 7, 1950 J. E. MEYER 2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Filed April 21, 1945 5 Sheets-Sheet 2

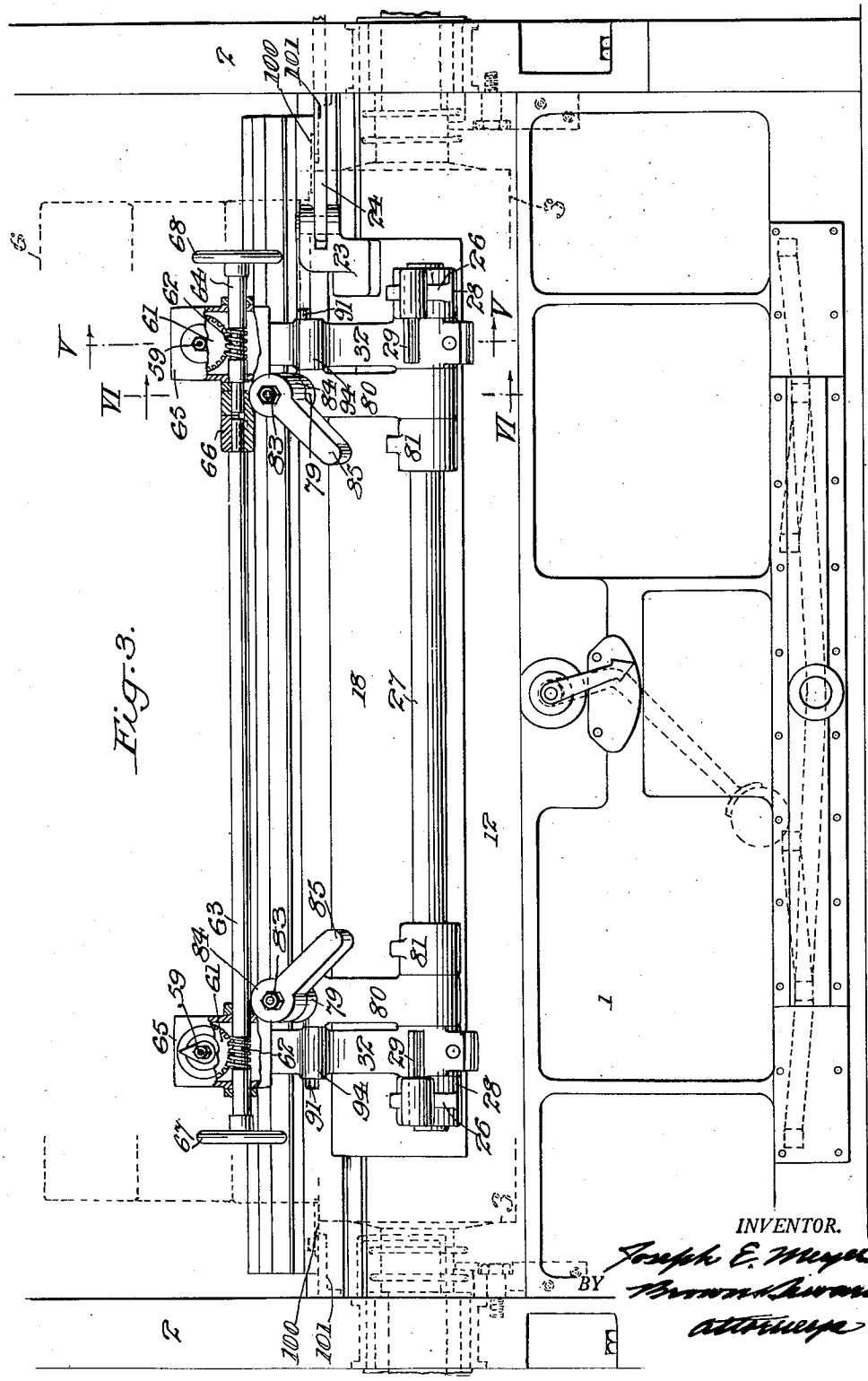


Fig. 3.

INVENTOR.
Joseph E. Meyer
BY Brown & Brown
attorneys

Nov. 7, 1950 J. E. MEYER 2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Filed April 21, 1945 5 Sheets-Sheet 3

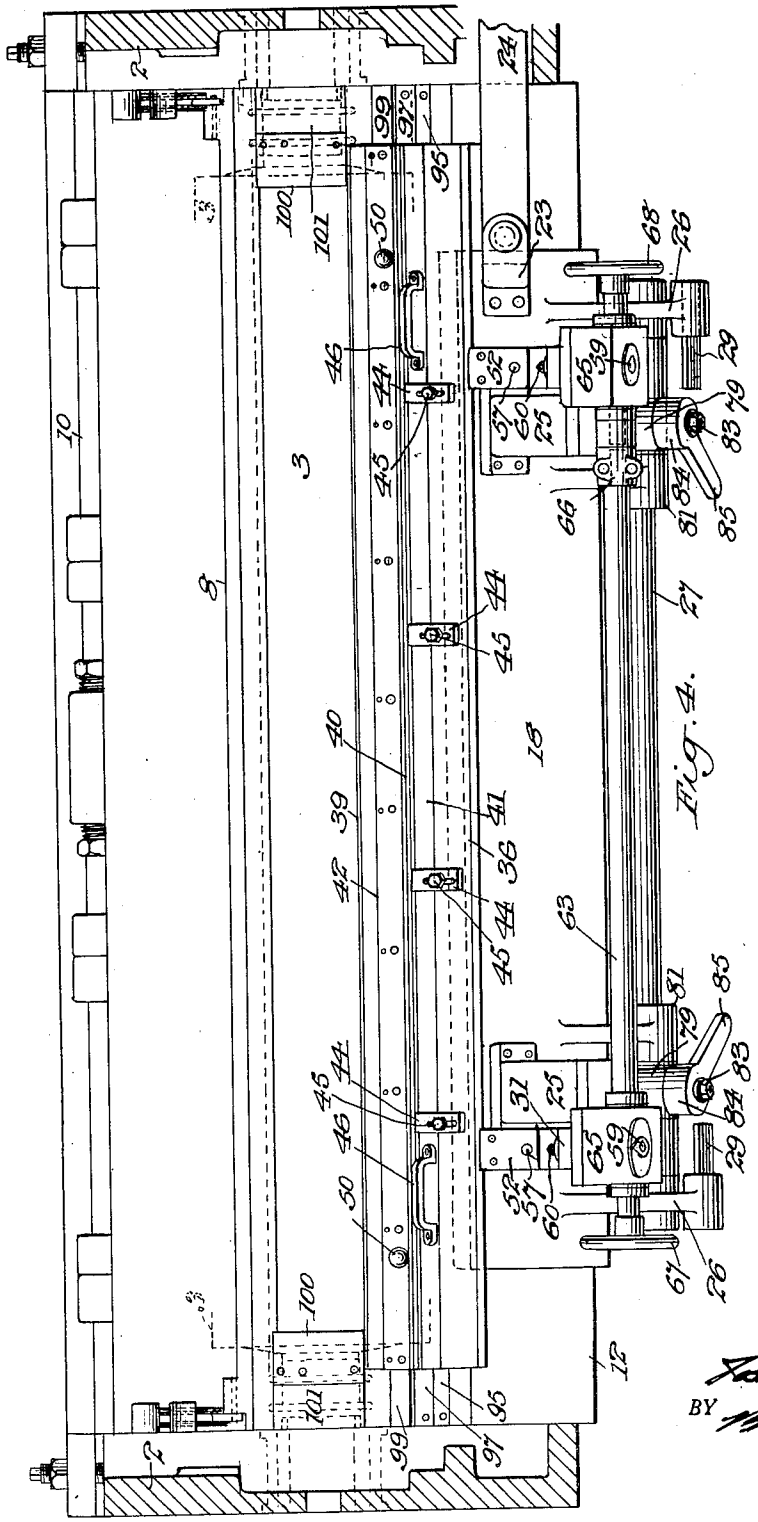


Fig. 4.

INVENTOR.
Joseph E. Meyer
BY Bowman Howard
attorneys

Nov. 7, 1950 J. E. MEYER 2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Filed April 21, 1945 5 Sheets-Sheet 4

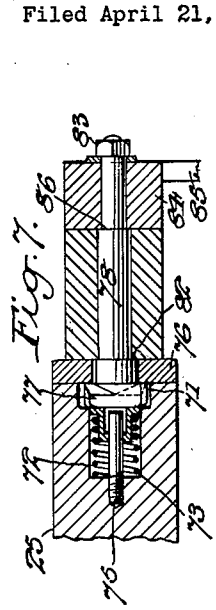


Fig. 7.

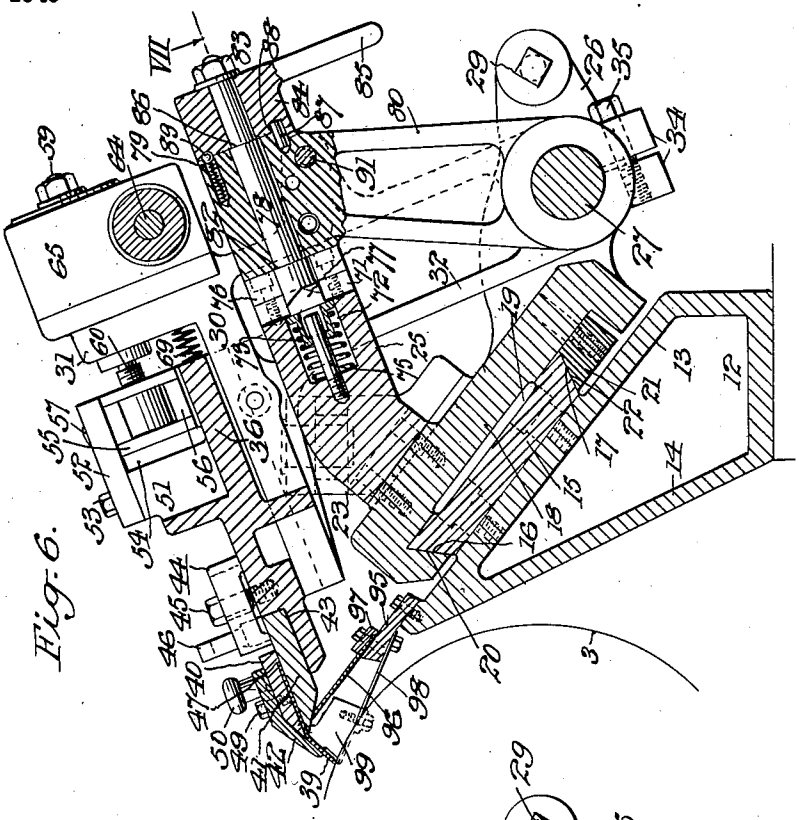


Fig. 6.

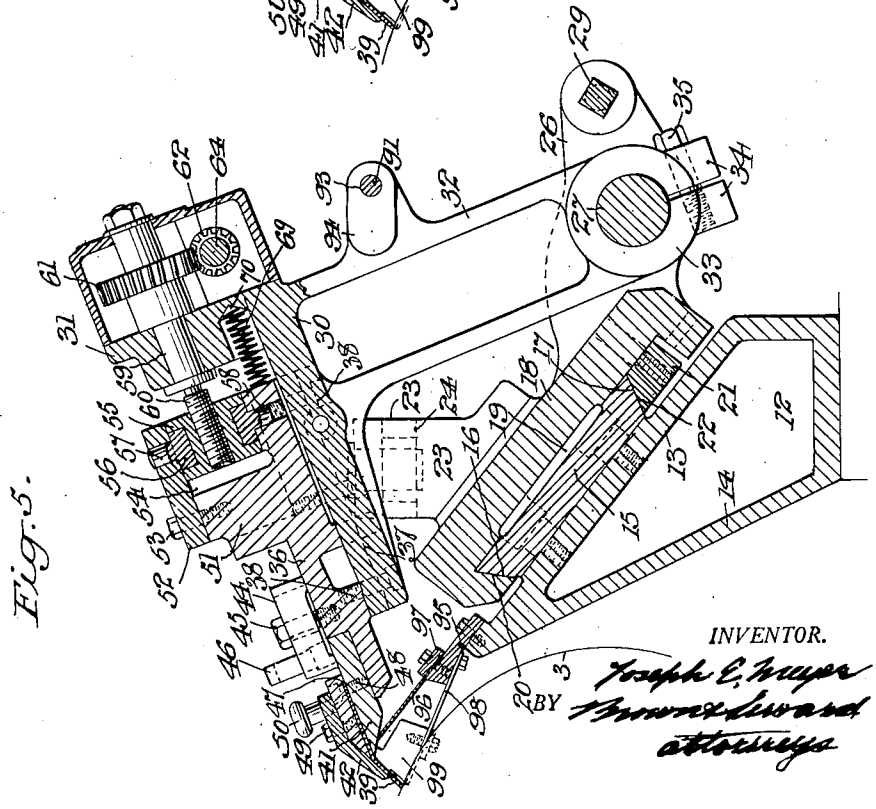


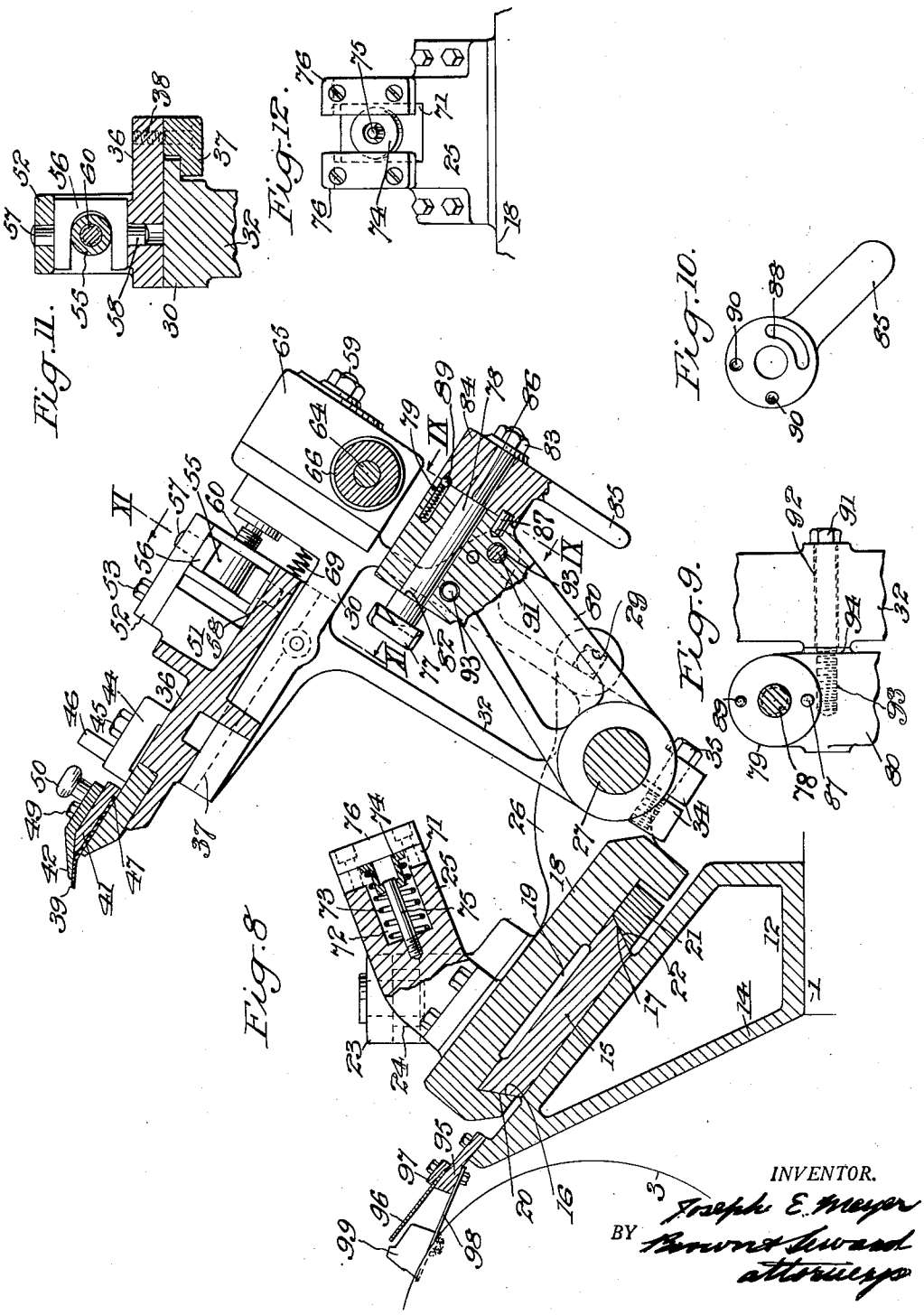
Fig. 5.

INVENTOR.
Joseph E. Meyer
BY Brown & Edwards
attorneys

Nov. 7, 1950 J. E. MEYER 2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Filed April 21, 1945 5 Sheets-Sheet 5



INVENTOR.
Joseph E. Meyer
BY Brown & Howard
attorneys

Patented Nov. 7, 1950

2,528,965

UNITED STATES PATENT OFFICE

2,528,965

DOCTOR MECHANISM FOR ROTARY INTAGLIO PRINTING PRESSES

Joseph E. Meyer, Westerly, R. I., assignor to C. B. Cottrell & Sons Company, Westerly, R. I., a corporation of Delaware

Application April 21, 1945, Serial No. 589,598

10 Claims. (Cl. 101—157)

1

My invention is directed to certain improvements in the construction, form and arrangement of the several elements of an enclosed ink fountain for rotary intaglio printing presses whereby the structure of the ink fountain is materially simplified and the operation of its movable elements facilitated.

My invention includes a novel and simplified wiping mechanism for the design cylinder; the inking mechanism shown, but not claimed herein, forming the subject matter of my copending application filed February 1, 1945, its Serial No. being 575,679, now Patent No. 2,460,184. The sealing mechanism shown and described, but not claimed herein, forms the subject matter of my copending application filed March 20, 1947, its Serial No. being 736,095, now Patent No. 2,495,-017.

My invention also includes, generally, novel means for mounting and swinging the doctor frame and for adjusting the contact pressure of the doctor blade on the printing cylinder, and novel means for limiting the inward swinging movement of the doctor frame and for locking it in its adjusted position at the limit of its inward swinging movement.

My invention also includes, more specifically, a reciprocating carriage, a doctor frame and its lock levers pivoted to swing on and reciprocate with the carriage; devices being provided for securing the doctor frame to the lock levers and additional devices being provided for releasably securing the lock levers to the carriage with the doctor frame in its wiping position.

My invention also comprises novel sealing means for the fountain at the upper portions of the printing cylinder at its ends combined with means for preventing the escape of the ink from the cylinder through the space between the back frame and doctor blade.

One object of my invention is to provide a rigid doctor blade platform which can be slid toward and away from the printing cylinder by micrometer screw adjustments to bring the doctor blade into parallelism with the printing cylinder without any distortion or twisting of the platform.

Another object is to provide means whereby the blade and holder may be readily removed for replacement, by pivoting the whole assembly on a shaft on the carriage, thereby permitting the doctor blade and holder to be swung back away from the printing cylinder.

A practical embodiment of my invention is represented in the accompanying drawings in which

Fig. 1 represents a detail side elevation of the

2

ink fountain with my improvements incorporated therein;

Fig. 2 represents a detail vertical section taken within the near side frame with the doctor frame locked to the carriage with the doctor frame in its wiping position;

Fig. 3 represents a detail rear elevation partly in section of the ink fountain;

Fig. 4 represents a detail top plan view partly in section of the ink fountain;

Fig. 5 represents on an enlarged scale a detail section taken in the plane of the line V—V of Fig. 3, looking in the direction of the arrows;

Fig. 6 represents on the same scale a detail section taken in the plane of the line VI—VI of Fig. 3, looking in the direction of the arrows;

Fig. 7 represents a section taken in the plane of the line VII of Fig. 6;

Fig. 8 represents a detail section similar to Fig. 6 with the doctor frame unlocked from the carriage and swung to the limit of its open position;

Fig. 9 represents a detail section taken in the plane of the line IX—IX of Fig. 8, looking in the direction of the arrows;

Fig. 10 represents an inside face view of one of the locking handles;

Fig. 11 represents a detail section taken in the plane of the line XI of Fig. 8, looking in the direction of the arrow; and

Fig. 12 represents a detail end view of one of the upper arms of the reciprocating carriage.

The printing press frame includes, generally, a hollow base 1 and two side frames 2. The printing cylinder is denoted by 3, its impression cylinder by 4 and the pressure cylinder by 5. The web guide rollers 6 are arranged to lead the traveling web 7 to and from the impression cylinder. These cylinders and guide rollers may be suitably mounted for rotation between the side frames 2.

Ink under pressure may be supplied to the inker head and thereby onto the printing cylinder, from any suitable source, not shown herein, through the horizontally disposed pipe 10 which, in the present instance, is shown as being supported by the base 1. This inker head forms the front wall of the upper portion of the fountain bowl 9. This inker head may be swung on its ink supply pipe 10 into and out of its inking position.

Means which will not be specifically described herein may be provided for the removal and replacement of the printing cylinder 3 through the front of the upper portion of the ink fountain when the inker head is swung to its lowered or non-inking position. A screen 11 separates the fountain bowl 9 into upper and lower portions.

A back frame 12 is fixedly mounted on the hollow base 1 on the opposite side of the printing cylinder 3 from the inker head 8, which back frame includes outer and inner walls 13 and 14 inclined upwardly and inwardly until they meet near the top of the printing cylinder adjacent the impression cylinder 4. The inner wall 14 of this back frame forms the back wall of the upper portion of the fountain bowl 9. The ends of the back frame snugly contact the inner walls of the side frames 2 for sealing the ink fountain at these points.

The wiping mechanism for the printing cylinder is constructed and arranged as follows. A slide bar 15 is fixedly secured to the inclined outer wall 13 of the back frame 12. This slide bar is provided with undercut upper and lower edges 16 and 17.

A doctor reciprocating carriage 18 is mounted to slide on the fixed slide bar 15, said carriage being provided with a groove 19 for receiving the slide bar. The upper undercut side 20 of the groove 19 contacts the corresponding upper undercut edge 16 of the slide bar 15. A cross bar 21 which is removably secured to the carriage 18 within the groove 19 is provided with an undercut edge 22 which contacts the lower undercut edge 17 of the crossbar 15. The carriage 18 may be reciprocated by providing the carriage at one end thereof with an uprising lug 23 attached to one end of a connecting rod 24 operated from a suitable power means, not shown herein.

The carriage 18 is also provided at each end with upper and lower arms 25 and 26. A shaft 27 is mounted to rock in bosses 28 on said lower arms 26. A stop 29 is carried by each of the lower arms 26 for limiting the outward swinging movement of the doctor frame away from its wiping position, which frame is shown as including two swinging brackets 30 having uprising portions 31 and depending arms 32. These arms 32 terminate in split bosses 33 having lugs 34 fitted to receive clamp screws 35 for securing the brackets to the rock shaft 27. These split bosses 33 are located adjacent the bosses 28 on the lower arms 26 of the carriage to cause the rock shaft 27 to reciprocate endwise with the said carriage 18.

Micrometer screw adjustments are provided for sliding the doctor blade platform 36 on the horizontal portions of the two brackets 30 toward and away from the printing cylinder 3 between guides 37 secured along the outer ends of the platform by screws 38 and overlapping the outer sides of the brackets 30. Sufficient clearance is provided between the guides 37 and the brackets 30 to prevent binding of the doctor blade platform when being adjusted to bring the doctor blade into parallelism with the printing cylinder.

The usual doctor blade assembly comprises the doctor blade 39, the upper and lower blade clamping bars 40 and 41 and the blade deflecting bar 42. The lower clamping bar 41 is seated in a recess 43 extending across the inner edge of the platform 36 with its beveled edge portion projecting beyond the platform toward the printing cylinder. This lower clamping bar 41 is removably secured to the platform 36 by the bridge clamps 44 and their screws 45. This lower clamping bar 41 is shown as provided with two handles 46 for use in swinging the wiping mechanism into and out of its wiping position. The rear portion of the doctor blade 39 is shown as seated in a shallow recess 47 located along the bottom of the upper clamping bar 40, screws 48 being provided for clamping the upper and lower clamping bars together with the doctor blade therebetween. The doctor blade deflecting bar 42 is shown as secured by screws 49 to the upper jaw bar 40. The blade deflecting bar 42 may be provided with knobs 50 for facilitating the handling of the doctor blade.

The micrometer means for individually adjusting either end of the doctor blade or for simultaneously adjusting both ends of the doctor blade toward and away from the printing cylinder to bring it into parallelism with the printing cylinder, is constructed and arranged as follows.

The doctor blade platform 36 of the swinging doctor frame is provided with two uprising portions 51 located over the swinging brackets 30. Projecting arms 52 are removably secured by screws 53 to the tops of the said uprising portions 51, recesses 54 being formed between the said arms 52 and the platform 36 for receiving nuts 55, said nuts being swiveled on axes perpendicular to the platform by providing the nuts with annular grooves for receiving the arms of yokes 56 provided with upper and lower trunnions 57 and 58 pivoted in said arms 52 and platform 36 respectively. Sufficient clearance should be provided between the cylindrical parts of the yokes 56 and the nuts 55 to permit the adjustment of the doctor blade platform 36 without its binding.

Doctor blade adjusting screws 59 are rotatably mounted in the uprising portions 31 of the swinging brackets 30, said screws having their inner portions 60 threaded into the said swiveled nuts 55. The outer non-threaded portions of these adjusting screws 59 are provided, exterior to the uprising portions 31, with gears 61 which mesh with worms 62 fast on the alined coupled sections 63 and 64 of a divided hand shaft, which shaft sections are rotatably mounted in their respective casings 65 carried by the brackets 30, which casings house the worms 62 and worm gears 61. The coupling 66 serves to releasably secure the inner adjacent ends of the alined shaft sections together. The outer ends of these shaft sections are provided with hand wheels 67 or 68. When the coupling 66 is tightened to clamp the two shaft sections together either one of the hand wheels 67 and 68 may be used to adjust the platform 36 and thereby the doctor blade bodily toward and away from the printing cylinder. When the coupling 66 is loosened the adjusting screws 59 may be individually adjusted for bringing the doctor blade into parallelism with the printing cylinder by turning one or the other of the said hand wheels 67 or 68, the swiveling of the nuts 55 permitting this individual adjustment of the ends of the platform 36.

Coil springs 69 are interposed between the outer end of the platform 36 and the adjacent faces of the uprising portions 31 of the brackets 30 for keeping a constant inward pressure on the platform 36 to eliminate any lost motion between the platform and the swinging brackets 30. The outer portions of these springs 69 may be housed in recesses 70 in the uprising portions 31 to keep the springs in place.

The means for releasably locking the swinging doctor frame to the reciprocating carriage and for limiting the inward movement of the doctor blade when it reaches its wiping position, is constructed and arranged as follows.

Vertical slots 71 extend across the free ends of the upper arms 25 of the doctor reciprocating carriage 18 and circular recesses 72 lead inwardly

from the bottoms of these vertical slots. Coil springs 73 are located between the bottoms of the circular recesses 72 and washers 74 which are slidable on central pins 75 screwed into the bottoms of said circular recesses.

Two parallel lock plates 76 are secured to the end of each of the upper arms 25 of the carriage in position to overlap the vertical slot 71. These lock plates 76 are spaced apart sufficiently to permit the insertion and removal of the double cam surfaced cross head 77 of each of the lock pins 78 when the pins are turned to their unlocked position to bring the cross heads 77 to their vertical positions. These lock pins 78 which are rotatably mounted in the heads 79 of lock levers having depending arms 80 loosely mounted on the rock shaft 27 between the split bosses 33 on the depending arms 32 of the doctor frame brackets 30 and the arms 81 projecting from the carriage 18 in line with the lower arms 26 thereof.

These lock pins 78 are provided with annular shoulders 82 near their double cam cross heads 77 to prevent outward endwise movement of the pins through lock lever heads 79.

Nuts 83 threaded on the outer ends of the lock pins 78 serve to crowd the hubs 84 of the handles 85 against the annular shoulders 86 on the lock pins to fix the handles thereon. To limit the throw of the handles 85 to their locked and unlocked positions studs 87 project from the outer faces of the heads 79 into curved slots 88 in the inner faces of the hubs 84 of the handles 85 concentric with the axes of their lock pins 78. These handles 85 are yieldingly held at the limits of their locked and unlocked positions by spring pressed balls 89 carried by the heads 79, which balls enter spaced shallow recesses 90 in the inner faces of the hubs 84 of the handles 85. It will be seen that when the double cam cross heads 77 of the lock pins 78 are turned from their vertical unlocked position to their horizontal locked position the double cam surfaces on the cross heads will be forced under their respective lock plates 76 against the pressure of the spring pressed washers 74. When the lock pins are turned to their unlocked position the spring pressed washers 74 serve to force the lock pins outwardly and thereby hold the doctor blade away from contact with the printing cylinder when the doctor frame is swung inwardly, until the lock pins are turned to their locked position. This locking movement will cause the double cam heads of the pins to force the washers 74 inwardly by the cam action of the heads with their lock plates 76. This arrangement prevents the doctor blade digging into the printing cylinder when the frame is swung toward the cylinder into position to be locked to the carriage by the turning of the lock pins to their locked position.

For the initial setting of the doctor frame in the correct wiping position for a printing cylinder of a large size (as illustrated in Fig. 8) the two lock levers are swung on the rock shaft 27 to bring a selected one of two screw threaded holes 93 in each of the depending arms 80 into alinement with the hole 92 in its adjacent depending arm 32 of the doctor frame. Screw bolts 91 are then inserted through the holes 92 into threaded engagement with the alined holes 93, to removably lock the doctor frame and the lock levers together. When the doctor frame is to be set in the correct position for a small sized printing cylinder the screw bolts 91 are removed and the rock levers are swung on the shaft 21

until the other screw threaded hole 93 in each depending arm 80 is brought into alinement with the hole 92 in each depending arm 32. The screw bolts 91 are then inserted through the holes 92 into threaded engagement with the second screw threaded holes 93 in the said depending arms 80 of the lock levers.

The means for sealing the ink fountain at the wiping mechanism is as follows.

A holder bar 95 is secured along the upper edge of the fixed back frame 12. A sealing plate 96 which extends across the fountain is secured to the upper surface of the holder bar 95 by the strip 97. The upper edge of this sealing plate 96 presses against the beveled inner edge of the lower clamp bar 41 when the doctor blade is in its wiping position and forms an ink seal between the lower clamp bar and the top of the back frame.

Narrow spring strips 98 are secured at their lower ends to the under surfaces of the holder bar 95 at the ends of the printing cylinder 3. Sealing blocks 99 are secured to the upper portions of the said strips 98 in position to press against the under surfaces of the doctor blade and the lower jaw bar 41 beyond the upper edge of the sealing plate 96. These sealing blocks also slightly overlap the ends of the cylinders.

The seals which are located at the ends of the printing cylinder between the inking and wiping mechanism are shown herein as comprising curved members 100 overlapping the cylinders and having depending flanges 101 which are secured to the side frames 2.

In operation: presuming the lock levers have been locked to the doctor frame by the screw bolts 91 and the doctor frame with the lock levers has been swung together to its open position against the stops 29. The doctor frame may then be swung inwardly until the double cam heads 77 of the locking pins 78 are engaged by the spring pressed washers 74 in the upper arms 25 of the carriage 18. As has been heretofore explained, these spring pressed washers, by their engagement with the double cam heads 77 prevent the doctor blade 39 touching the printing cylinder 3. The turning of the pins 78 to their locking positions will cause the cams on the heads 77 to engage the inner walls of the lock plates 76 and force the spring pressed washers back and move the doctor blade inwardly to its wiping position. An accurate setting of the doctor blade 39 may then be accomplished by adjusting the ends of the platform 36 either simultaneously or individually by the manipulation of the micrometer adjusting screws 59 through the divided shaft 63, 64 and its hand wheels 67, 68; it being understood that either hand wheel may be used when the shaft sections 63, 64 are clamped together by the coupling 66 to adjust both ends of the doctor blade 39 at the same time. When the shaft sections 63, 64 are released from each other by loosening the coupling 66 either end of the platform 36 of the swinging doctor frame and thereby the doctor blade 39 may be adjusted to bring the doctor blade into parallelism by the manipulation of the proper hand wheel. When it is desired to unlock the doctor frame and swing it together with the lock levers to their open position against the stops 29 on the lower arms 26 of the carriage 18 the lock levers are released from the carriage by turning the lock pins 78 into position to release their cross heads 77 from their engagement with the lock plates 76 on the upper arms 25 of the carriage. It will be

observed that the doctor frame may be swung to its open position and returned to its wiping position without disturbing the previous accurate setting of the doctor blade.

It is evident that various changes may be resorted to in the construction, form and arrangement of the several parts without departing from the spirit and scope of my invention, and hence I do not intend to be limited to the particular embodiment herein shown and described, but what I claim is:

1. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder and a wiping mechanism therefor comprising a reciprocating carriage, a doctor frame including brackets pivoted to swing on the carriage, a platform slidable on the brackets, a doctor blade mounted on the platform, and coacting means for adjusting the ends of the doctor blade individually or simultaneously toward and away from the printing cylinder comprising swiveled nuts on the platform and manually operated adjusting screws mounted on the brackets and threaded into said nuts.

2. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder and a wiping mechanism therefor comprising a reciprocating carriage, a doctor frame including brackets pivoted to swing on the carriage, a platform slidable on the brackets, a doctor blade mounted on the platform, and coacting means for adjusting the ends of the doctor blade individually or simultaneously toward and away from the printing cylinder comprising swiveled nuts on the platform and manually operated adjusting screws mounted on the brackets and threaded into said nuts, a divided hand shaft having worm and gear connections between the shaft sections and their respective adjusting screws and a releasable coupling for securing the shaft sections together.

3. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder of a predetermined size and a wiping mechanism therefor adjustable for cylinders of different sizes comprising a carriage reciprocable on said back frame, a shaft mounted to rock on said carriage and to reciprocate therewith, a doctor frame including brackets fixed to rock and reciprocate with said shaft, lock levers reciprocating with and loosely mounted on said shaft, removable means for securing the lock levers to the doctor frame in different angular positions with respect thereto, and manually operated lock pins pivoted in the lock levers and arranged to be locked to and released from the carriage.

4. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder of a predetermined size and a wiping mechanism therefor comprising a reciprocating carriage, a shaft mounted to rock thereon and to reciprocate therewith, a doctor frame including brackets fixed to rock and reciprocate with said shaft, lock levers reciprocating with and loosely mounted on said shaft, manually operated lock pins pivoted in the lock levers and arranged to be locked to and released from the carriage, and spring means for yieldingly engaging the lock pins to prevent the doctor frame from swinging to its locked position.

5. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder of a predetermined size and a wiping mechanism therefor adjustable for cylinders of different sizes and comprising a carriage reciprocable on said back frame, a shaft mounted to rock on said carriage and reciprocate therewith, a doctor frame including brackets fixed to said shaft to rock and to reciprocate therewith, lock levers reciprocating with and loosely mounted on said shaft, and manually operated lock pins pivoted in the lock levers and provided with cross heads arranged to be locked to and released from the carriage.

6. In an enclosed ink fountain, a base, a fixed back frame having an upwardly and inwardly inclined outer wall, a printing cylinder of a predetermined size and a wiping mechanism therefor adjustable for cylinders of different sizes and comprising a carriage reciprocable on said inclined outer wall, upper and lower arms projecting from the carriage, a shaft mounted to rock in said lower arms and reciprocate with the carriage, a doctor frame including brackets fixed to said shaft to rock and reciprocate therewith, lock levers reciprocating with and loosely mounted on said shaft, means for removably securing the lock levers to their brackets in different angular positions with respect thereto, and means for releasably securing the lock levers to their respective upper carriage arms comprising manually operated lock pins pivoted in the lock levers and arranged to be locked to and released from the upper carriage arms.

7. In an enclosed ink fountain, a base, a fixed back frame having an upwardly and inwardly inclined outer wall, a printing cylinder of a predetermined size and a wiping mechanism therefor comprising a carriage reciprocable on said inclined outer wall, upper and lower arms projecting from the carriage, a shaft mounted to rock in said lower arms and reciprocate with the carriage, a doctor frame including brackets fixed to said shaft to rock and reciprocate therewith, lock levers reciprocating with and loosely mounted on said shaft, means for removably securing the lock levers to their brackets in different angular positions with respect thereto, and means for releasably securing the lock levers to their respective upper carriage arms comprising manually operated lock pins pivoted in the lock levers and provided with cross heads arranged to be locked and released from the upper carriage arms.

8. In an enclosed ink fountain, a base, a fixed back frame having an upwardly and inwardly inclined outer wall, a printing cylinder of a predetermined size and a wiping mechanism therefor comprising a carriage reciprocable on said inclined outer wall, upper and lower arms projecting from the carriage, a shaft mounted to rock in said lower arms and reciprocate with the carriage, a doctor frame including brackets fixed to said shaft to rock and reciprocate therewith, lock levers reciprocating with and loosely mounted to rock on said shaft, means for removably securing the lock levers to their brackets in different angular positions with respect thereto, and means for releasably locking the lock levers to their respective upper carriage arms comprising manually operated lock pins pivoted in the lock levers and provided with cross heads having cams arranged to engage the upper carriage arms for forcing the doctor frame into its wiping position.

9. In an enclosed ink fountain, a base, a fixed back frame having an upwardly and inwardly inclined outer wall, a printing cylinder of a predetermined size and a wiping mechanism therefor comprising a carriage reciprocable on said inclined outer wall, upper and lower arms project-

ing from the carriage, a shaft mounted to rock in said lower arms and reciprocate with the carriage, a doctor frame including brackets fixed to said shaft to rock and reciprocate therewith, lock levers reciprocating with and loosely mounted to rock on said shaft, means for removably securing the lock levers to their brackets in different angular positions with respect thereto, and means for releasably locking the lock levers to their respective upper carriage arms comprising manually operated lock pins pivoted in the lock levers and provided with cross heads having double cams arranged to engage the upper carriage arms for forcing the doctor frame into its wiping position.

10. In an enclosed ink fountain, a base, a fixed back frame, a printing cylinder of a predetermined size and a wiping mechanism therefor comprising a reciprocating carriage, upper and lower arms projecting from the carriage, a shaft mounted to rock in said lower arms and reciprocate with the carriage, a doctor frame including brackets fixed to rock and reciprocate with said shaft, lock levers reciprocating with and loosely mounted on said shaft, means for initially securing the lock levers to their brackets, and means for releasably locking the lock levers to their respective upper carriage arms comprising manually operated lock pins pivoted in the lock levers and provided with cross heads having double cams arranged to engage the upper carriage arms for forcing the doctor frame into its wiping position, and spring pressed washers in said carriage arms arranged to engage said cross head for yieldingly preventing the doctor blade to be swung to the limit of its inward movement when unlocked.

JOSEPH E. MEYER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
Re. 21,212	Weiss	Sept. 18, 1938
1,562,470	Owen	Nov. 24, 1925
2,097,791	Heller	Nov. 2, 1937
2,110,289	Crafts	Mar. 8, 1938
2,124,420	Kaddeland	July 19, 1938
2,178,069	Crafts	Oct. 31, 1939
2,183,045	Presby	Dec. 12, 1939
2,278,138	Paardecamp	Mar. 31, 1942
2,292,344	Heller et al.	Aug. 11, 1942
2,352,337	Meyer	June 27, 1944
2,405,795	Luehrs	Aug. 13, 1946