

June 17, 1952

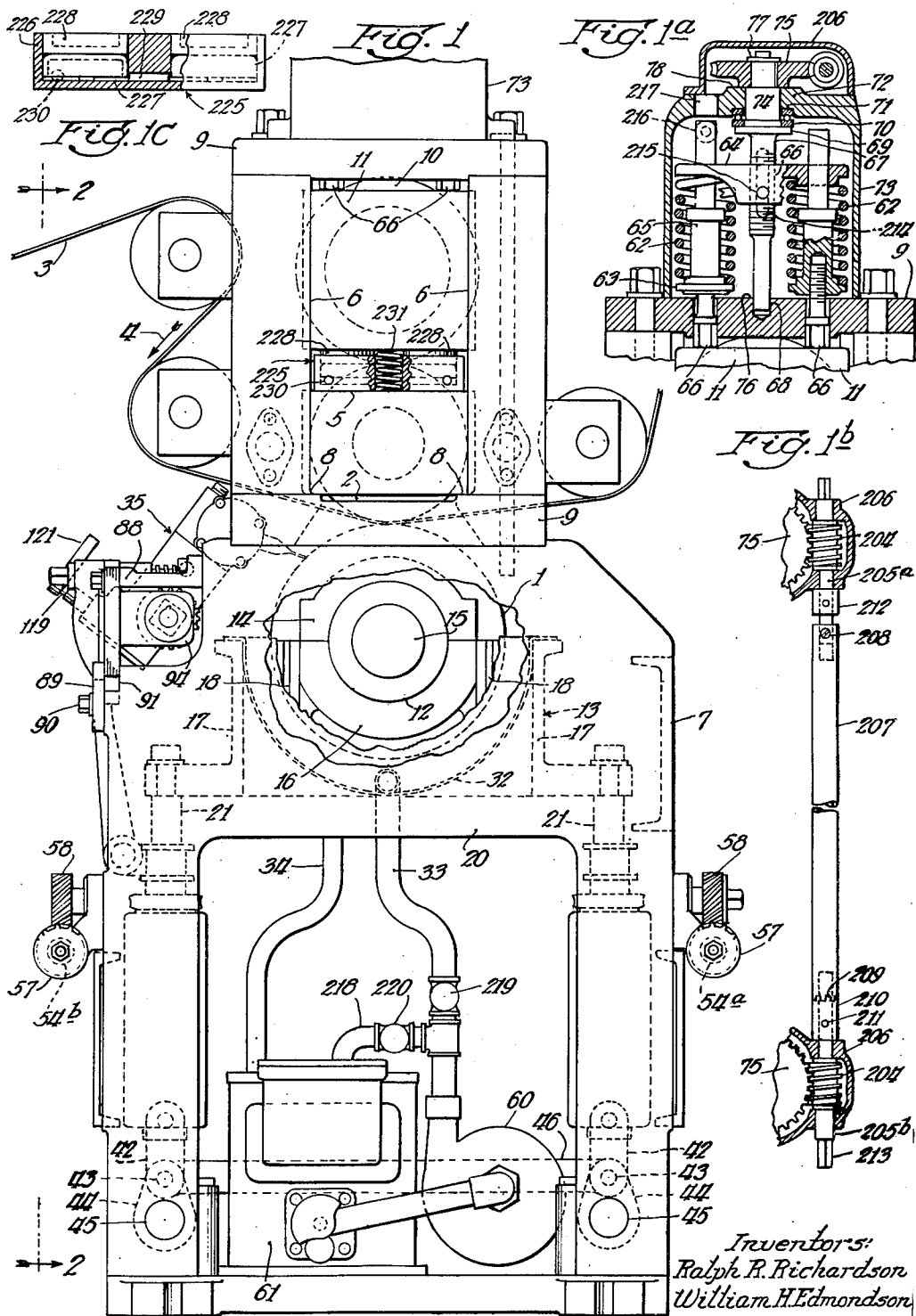
R. R. RICHARDSON ET AL

2,601,220

CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

Filed Aug. 20, 1945

10 Sheets-Sheet 1



Inventors:
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June 17, 1952

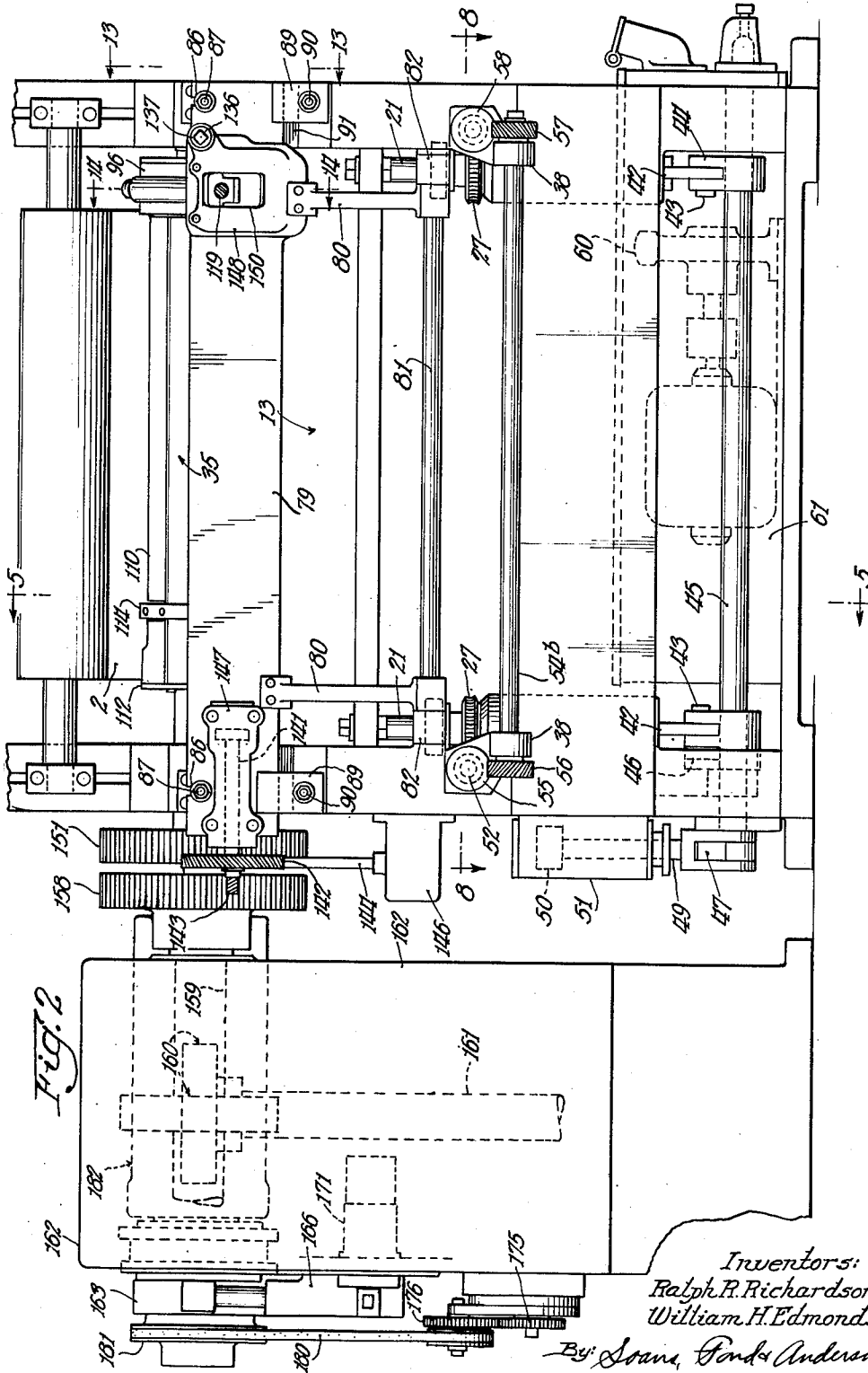
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2,601,220

CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

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10 Sheets-Sheet 2



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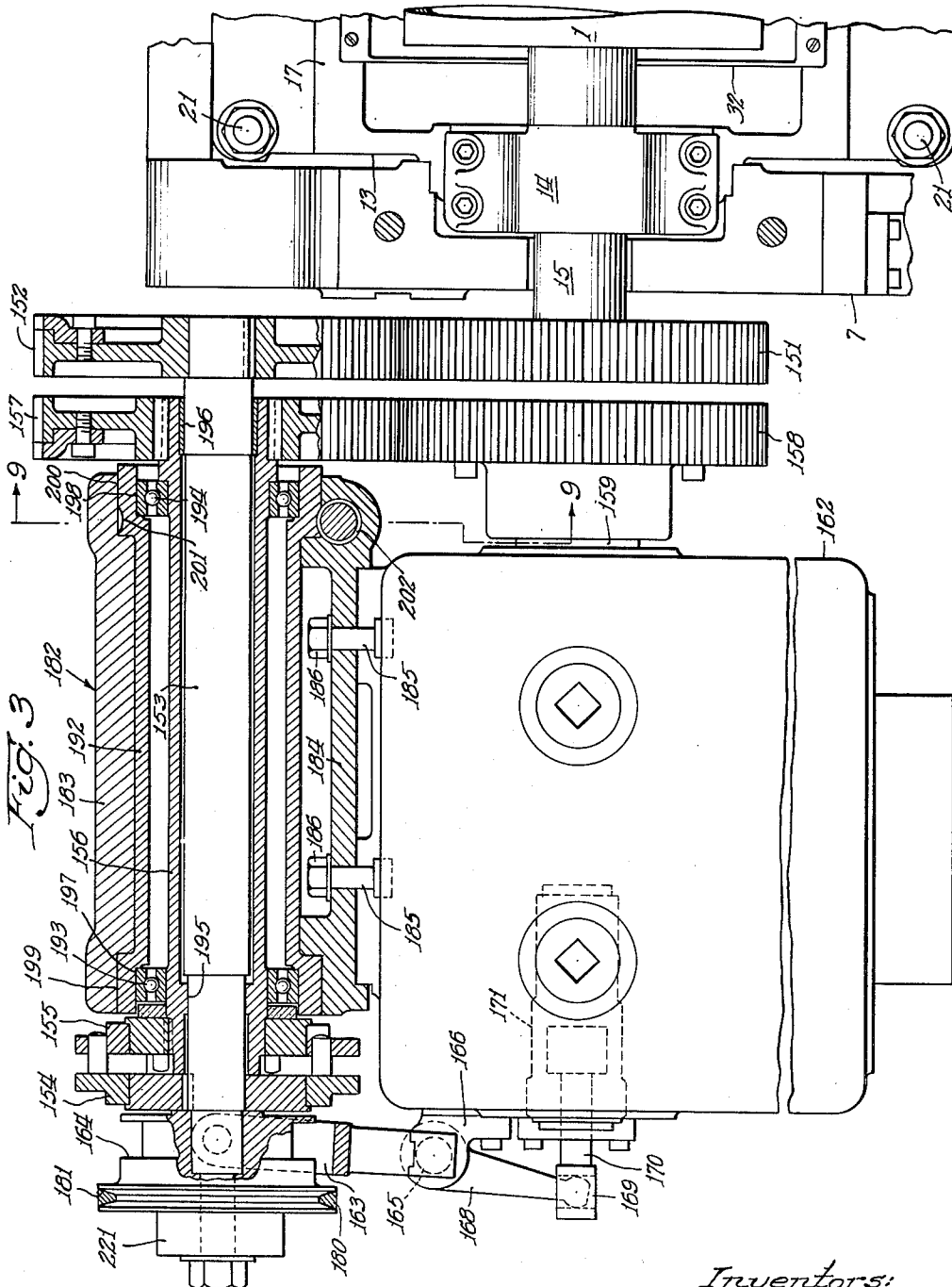
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

Filed Aug. 20, 1945

10 Sheets-Sheet 3



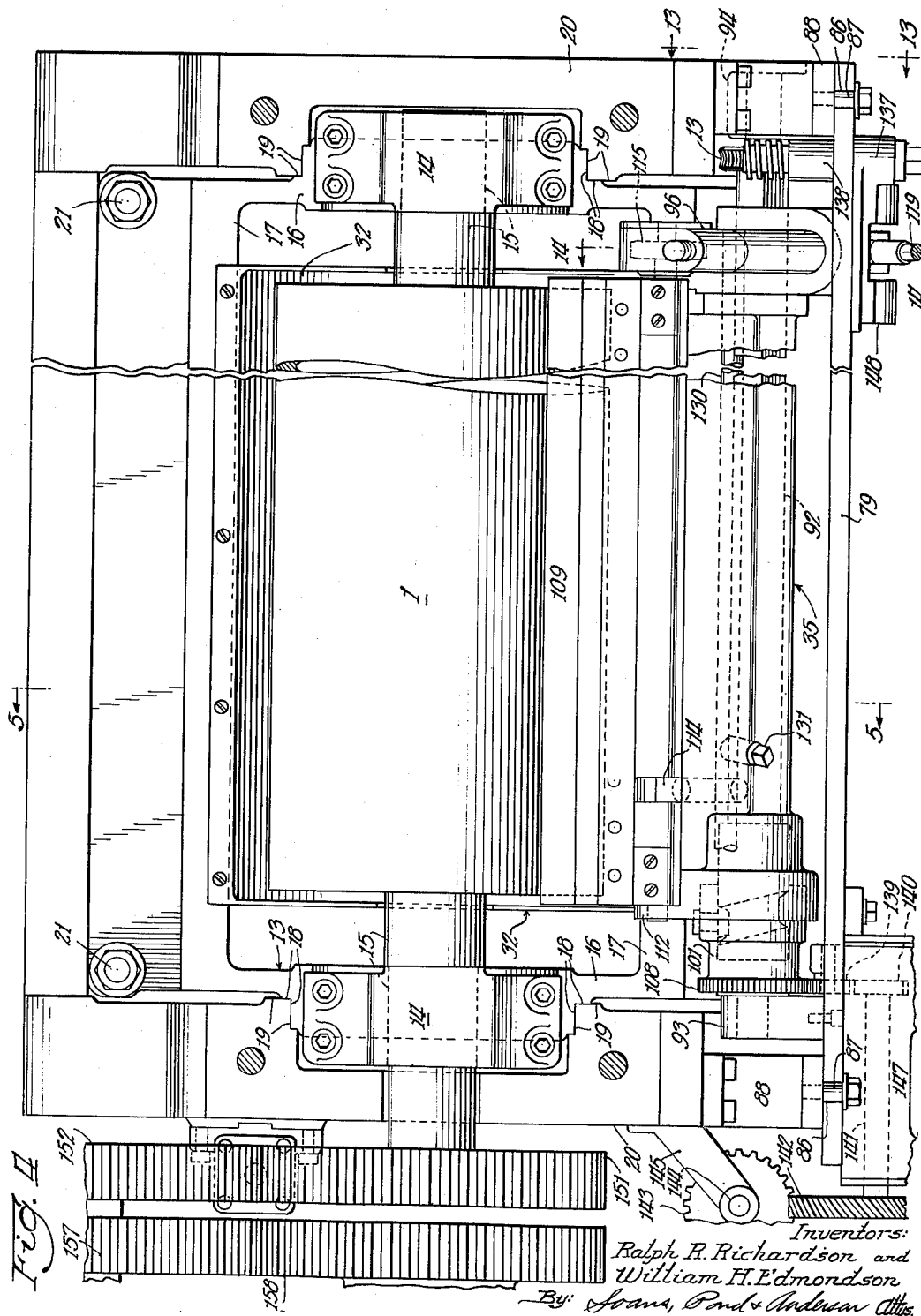
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

10 Sheets-Sheet 4



June 17, 1952

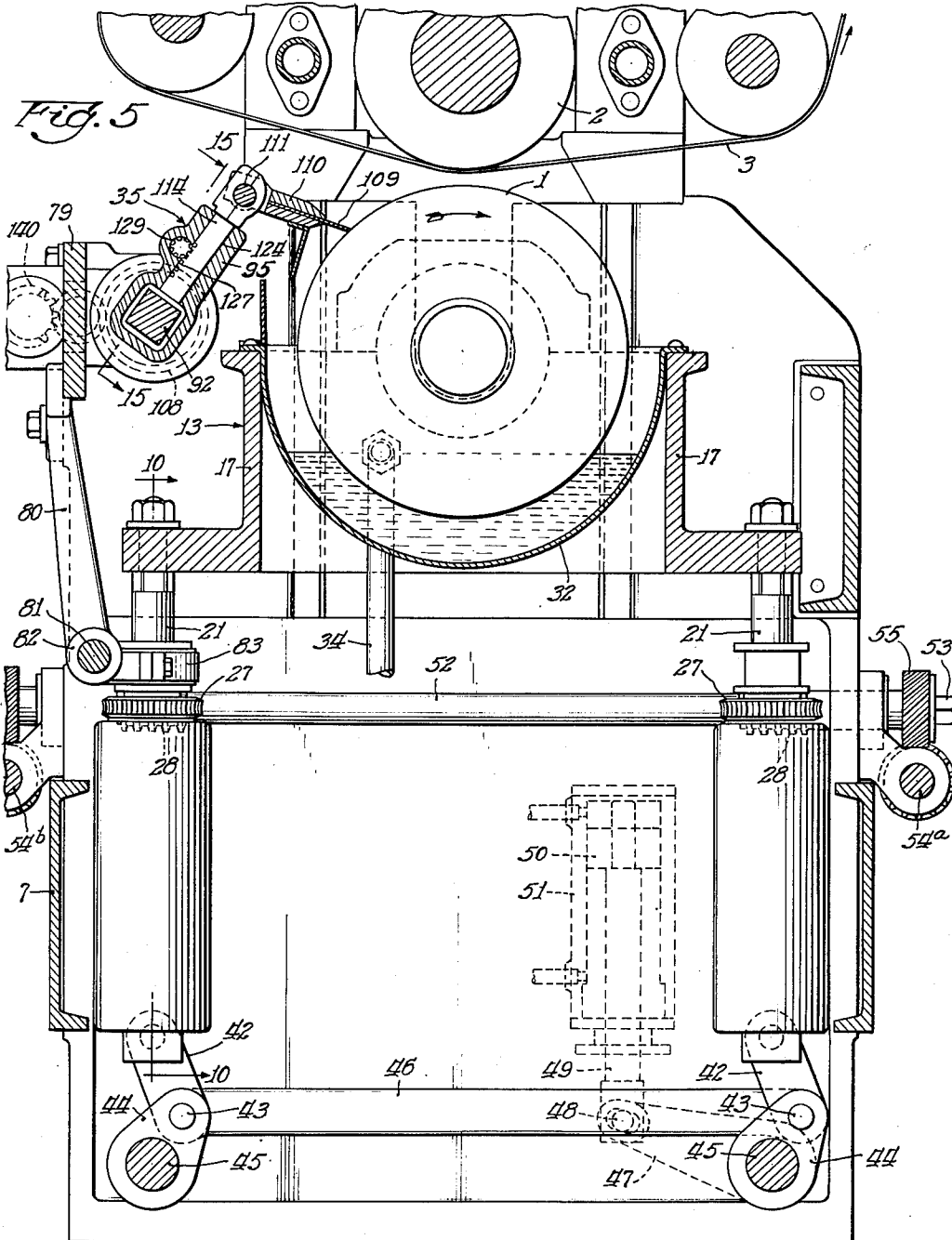
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

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10 Sheets-Sheet 5



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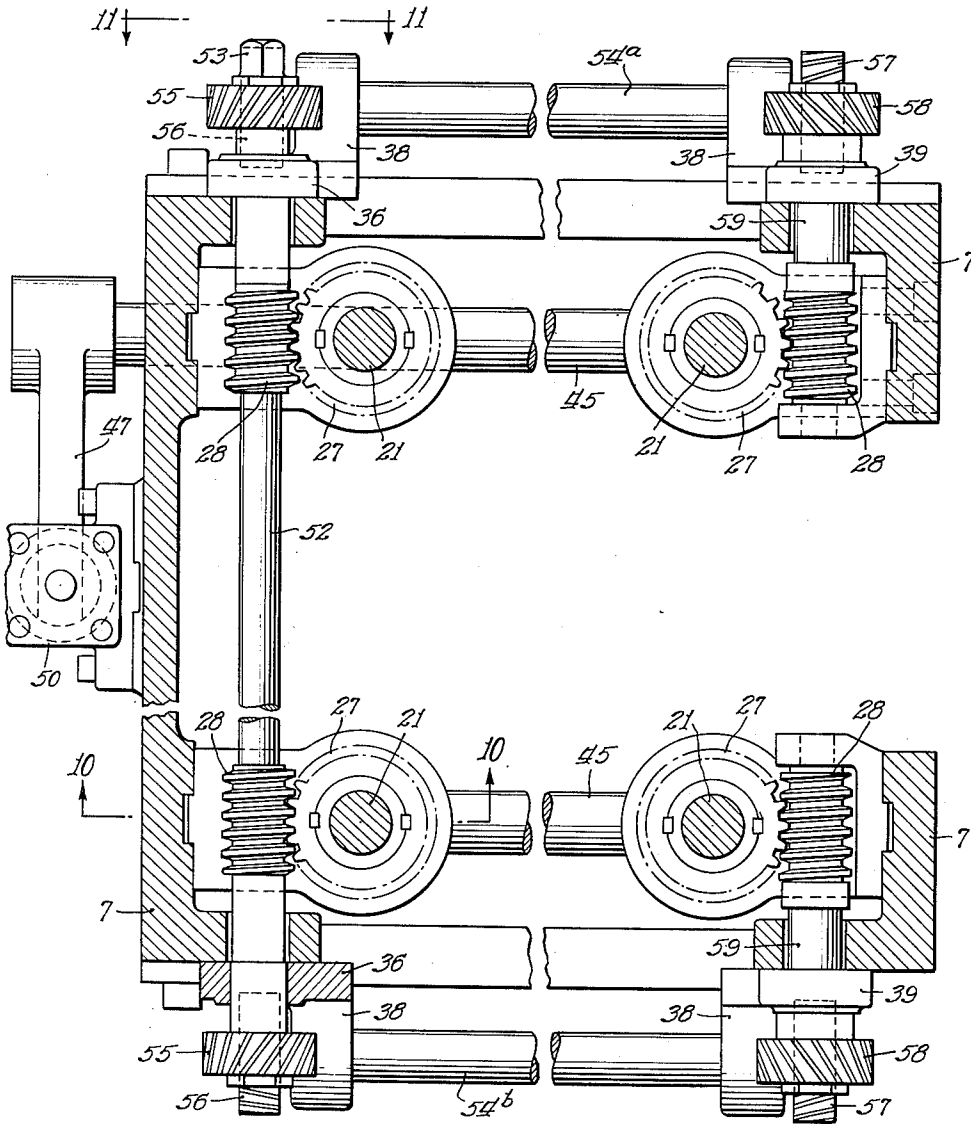
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

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10 Sheets-Sheet 7

Fig. 8



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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

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10 Sheets-Sheet 8

Fig. 9

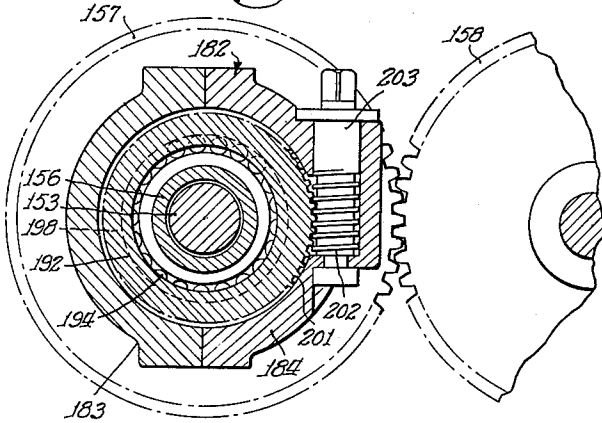


Fig. 10

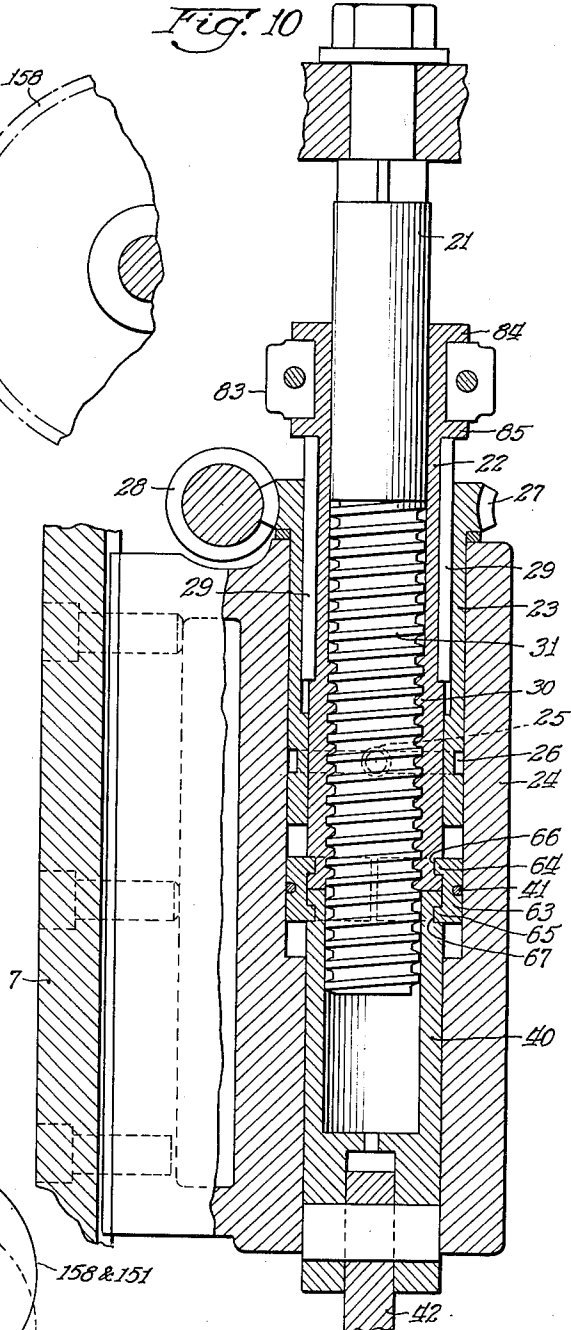


Fig. 11

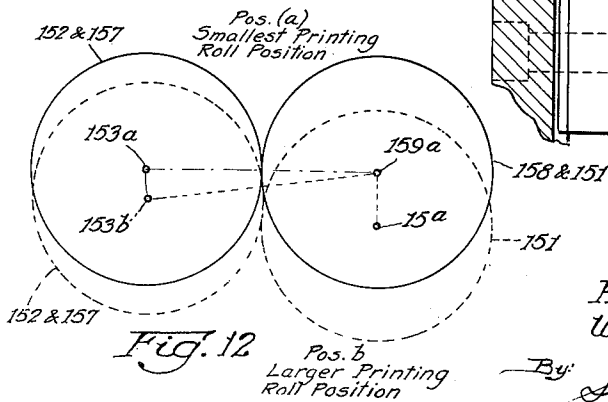
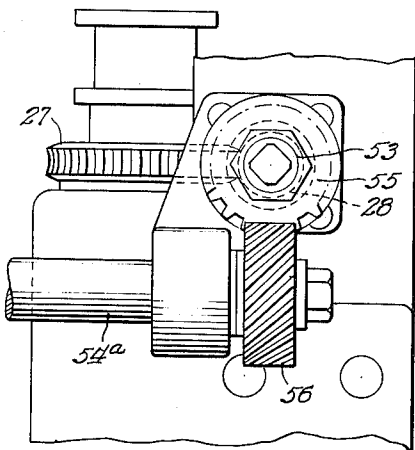


Fig. 12

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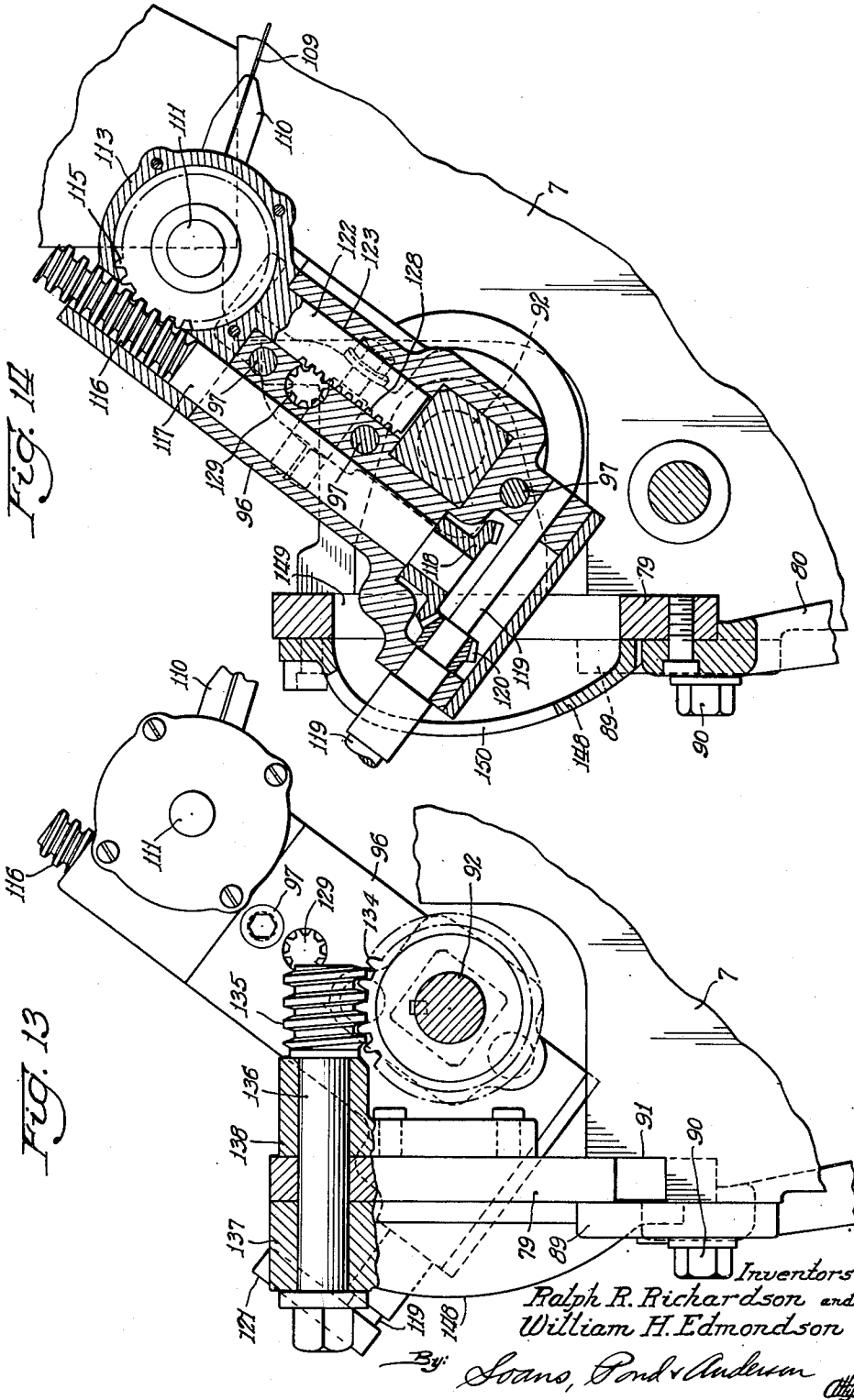
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

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June 17, 1952

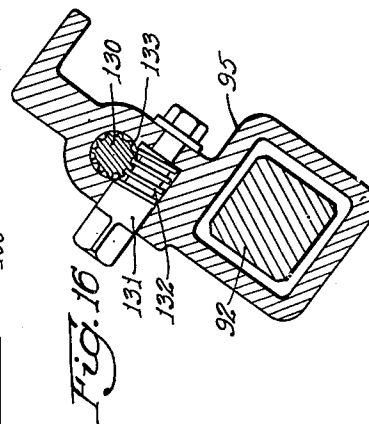
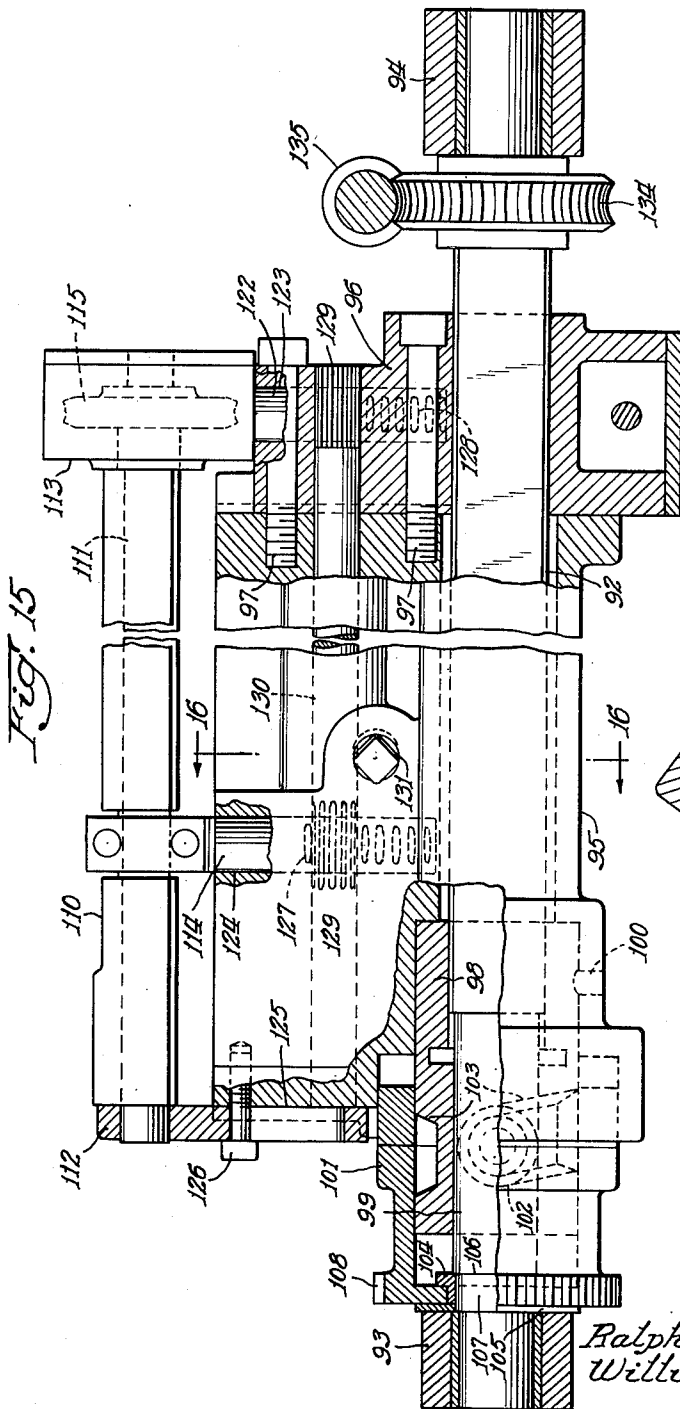
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CYLINDER ADJUSTING MECHANISM FOR ROTARY PRINTING PRESSES

Filed Aug. 20, 1945

10 Sheets-Sheet 10



Inventors:
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UNITED STATES PATENT OFFICE

2,601,220

CYLINDER ADJUSTING MECHANISM FOR
ROTARY PRINTING PRESSES

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Application August 20, 1945, Serial No. 611,533

16 Claims. (Cl. 101—157)

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This invention relates to printing presses, and it is concerned particularly with a printing press wherein the printing cylinder is movable into and out of contact with the sheet or web being printed on and its supporting impression cylinder as distinguished from the more conventional press arrangement in which the printing cylinder is rotatable on a fixed axis, and the impression cylinder together with the sheet or web are movable to and from the printing cylinder. This invention is also more particularly concerned with a printing press in which the printing cylinder is movable as aforesaid, and in which the printing cylinder is of the so-called gravure or intaglio type.

In the operation of an intaglio printing press, fast drying ink is now generally used and special arrangements are provided for preventing drying of the ink on the intaglio printing cylinder, especially when the press is temporarily shut down for any purpose. One means for preventing the drying of ink on the printing cylinder during a shut down period is to keep the printing cylinder in rotation during such shut down period but out of contact with the web being printed. The roll being in continuous rotation constantly rotates through the bath of ink supplied to it and is thus kept wet at all times. The speed of rotation of the printing roll may be cut down from its normal printing speed or it may be increased but this is relatively unimportant. It is however important, especially in a multi-color press, that the printing cylinder be accurately re-registered with the printing cylinders of other printing units when printing on a continuous web.

The main objects of the present invention are to provide simple but effective means for automatically adjusting the printing cylinder towards and from the impression cylinder under which the web or sheet travels for engagement by the printing cylinder; to provide means whereby the operative relationship of the printing cylinder and impression roll may be accurately adjusted and maintained independently of the means for moving the printing cylinder to and from such operative relationship; to provide means which, when the press unit is shut down and the printing cylinder adjusted to inoperative position, will automatically effect independent rotation of the printing cylinder so as to prevent the drying of ink thereon; to provide an intaglio printing press in which the relationship between the printing cylinder, the ink applying means and the ink doctoring means may remain constant in

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all positions of the printing cylinder; and to provide a printing press of the character indicated wherein printing cylinders of various diameters may be used with relatively simple adjustments of the parts of the press which are affected by the change in printing roll diameter.

Other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawings (ten sheets) wherein there is illustrated an improved intaglio printing press embodying a selected form of the invention.

In the drawings:

Fig. 1 is a side elevation, certain parts being broken away to more clearly illustrate other parts;

Fig. 1a is a side elevation of the upper portion which is broken away in Fig. 1;

Fig. 1b is a plan of a part of the mechanism;

Fig. 1c is a section showing certain details of a portion of the mechanism shown in Fig. 1;

Fig. 2 is an end elevation looking at the left-hand end of the press as shown in Fig. 1;

Figs. 3 and 4, when taken together, constitute a plan view of substantially the entire press structure, Fig. 3 being partially in section and illustrating mechanism for driving the printing cylinder, and Fig. 4 showing the printing roll in the main body of the press from which there has been removed for purposes of illustration certain parts which normally overlie the printing roll;

Fig. 5 is a section approximately on the lines 5—5 of Figs. 2 and 4;

Fig. 6 is a side elevation of mechanism appearing at the left-hand end of Fig. 2;

Fig. 7 is an end view, partially in section, of the mechanism shown in Fig. 6, the mechanism being located on the far side of the left-hand end portion of Fig. 2;

Fig. 8 is a plan section on the line 8—8 of Fig. 2;

Fig. 9 is a section on the line 9—9 of Fig. 3;

Fig. 10 is a cross section on the line 10—10 of Figs. 5 and 8;

Fig. 11 is a fragmentary side elevation as indicated by the line 11—11 of Fig. 8;

Fig. 12 is a diagrammatic illustration;

Figs. 13 and 14 are elevational and sectional views respectively on the lines 13—13 and 14—14 of Figs. 2 and 4, certain portions being broken away and shown in section in Fig. 13;

Fig. 15 is a section on the line 15—15 of Fig. 5; and

Fig. 16 is a section on the line 16—16 of Fig. 15. The printing press illustrated in the drawings

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embodies a printing roll 1 and an impression cylinder 2, the paper or flat web 3 on which printing is to be effected being passed between said printing roll and impression cylinder in the direction indicated by the arrow 4. The impression roll 2 is preferably a rubber covered roll and it is vertically slidably mounted through the agency of bearing blocks 5 at its opposite ends in vertically extending guide members 6—6 which are supported by the stationary main frame 7. Downward movement of the impression roll 2 may be limited by engagement of the lower edges of its bearing blocks 5 with shoulders 8—8 formed on a frame member 9 and the impression cylinder is normally urged downwardly by means of an overlying roll 10. The roll 10 is vertically slidably mounted in the ways 6—6 through the agency of its end bearing members 11 and suitable spring means is provided for urging the bearing blocks 11 and the roll 10 downwardly to thereby urge the roll 2 downwardly.

The bearing blocks 11 at opposite sides of the frame are normally urged downwardly by pairs of springs 62—62 which are normally under compression between collars 63 and the overlying ends of a cross-head member 64. The collars 63 are formed integrally with spring guides 65 which threadedly receive extension bolts 66 which extend through the frame member 9 and bear on the upper edge of the pressure roll bearing block 11. The cross-head 64 has a screw threaded central opening 66 which threadedly receives a screw post 67, the lower end of which is journaled as indicated at 68 in the frame member 9. The upper end of said screw post is provided with a suitable flange 69 for engaging a thrust bearing 70 which is seated on an annular bearing surface 71 provided in the top wall 72 of the housing 73 which encloses the spring pressure mechanism. The upper end portion of the screw post 67 is provided with a cylindrical bearing area 74 which is journaled in a suitable bearing opening in the top portion 72 of the housing, and above said bearing portion 74 the post is extended to receive a gear or worm wheel 75 which is suitably keyed to the post.

The washer 77 is secured by a screw to the end of the post so as to overlie a portion of the gear 75 to prevent its endwise removal from the post. The gear 75 has a hub portion which engages the upper surface 78 of said top wall member 72 to prevent downward movement of the post.

It will be seen that by rotation of the worm wheel 75 the screw post 67 will be rotated to thereby effect vertical adjustment of the cross-head 64 and corresponding adjustment of the compression of the springs 62. The pressure of the springs 62 is, of course, transmitted downwardly to the extensions 66 and the bearing block 11 so that the pressure roll 10 acts to yieldingly move the impression cylinder 2 to its lower limit of movement as determined by engagement of the lower edges of the bearing blocks 5 with the shoulders 8 on the frame member 9.

When the printing roll 1 is in its operative elevated position, as shown in Fig. 1, the impression cylinder 2 should be moved upwardly very slightly so that a very slight space exists between the shoulders 8 and the lower edge of the bearing blocks 5 to thereby insure pressure contact between the impression cylinder 2 and printing roll 1 (or between the web or sheet and the printing roll) across the entire length of the printing roll. The upward spacing of the lower

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edges of the bearing blocks 5 from the shoulders 8 need be only slight, merely sufficient to make sure that the shoulders 8 do not prevent the springs 62 from pressing the impression cylinder into engagement with the printing roll when the latter is in its elevated operative position.

When the press is initially assembled, the springs at both sides are, of course, properly adjusted to provide the required spring effected contact between the impression cylinder and the printing roll.

In setting up the press, the cross-head 64 is adjusted to compress the springs to a predetermined degree after which the extensions 66 are adjusted in such a manner that when the bearing blocks 5 are in engagement with the shoulders 8, the lower ends of the guide posts 65 will at least slightly clear the top surface 76 of the frame member 9. This will insure the application of spring force to the impression cylinder at all times.

Once the press is set up it should not often be necessary to vary the adjustment of the spring pressure at one side without also adjusting the pressure at the other side. Accordingly means are provided for simultaneously acting on the worm wheel 75 at each side of the press to correspondingly rotate the screw post 67.

The adjustment mechanism last referred to comprises, at each side of the machine, worm-gears 204 which are respectively carried by shafts 205a and 205b which are suitably journaled in housing cap members 206. The shafts 205a and 205b are extended toward each other to enter suitably bored out ends of a tubular shaft 207. One end of the tubular shaft 207 is secured by set screw or other suitable means as indicated at 208 to the shaft 205a and at its other end it is provided with clutch teeth 209 which are adapted to mesh with corresponding clutch teeth on a collar 210 which is secured by set screw 211 or other suitable means to the shaft 205b. A collar 212 is secured to the shaft 205a to engage the outer surface of the cap 206 to prevent shifting of the shaft 205a and gear 204 inwardly, the gear itself being provided with an endwise extending flange portion similarly engaging an inside surface of the cap 206 to prevent endwise shifting in the other direction. The shaft 205b is extended outwardly from the cap 206 and provided with a squared or other suitably formed portion 213 which may be engaged by suitable wrench or operating handle for turning the shaft 205b, and through the members 210 and 207, the shaft 205a. Thus the spring mechanisms at both sides of the machine may be simultaneously adjusted in the same direction. In the event that it should be found necessary to adjust one side and not the other, the set screw 208 at one end of the tubular shaft 207 may be loosened to permit the tubular shaft 207 to be moved endwise sufficiently to disengage the inter-meshing clutch teeth 209. When the clutch teeth are so disengaged, either side may be adjusted independently of the other and for this purpose the shaft 205a may also be extended outwardly as is the shaft 205b to facilitate adjustment at that side of the press.

For the purpose of providing a visual indication of the extent of compression of the springs 62, each housing 73 is provided with a vertically extending elongated slot 214 to permit a pin 215 projecting laterally from the cross-head 66 to extend into a visible relation to a suitably graduated scale or other indicating means provided

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on the side wall of the housing adjacent the slot 214.

To prevent the cross-head 64 from rotating with the screw post 67 when effecting adjustment of the springs 62 there may be provided a pair of set screws, one of which is indicated at 216, respectively disposed on opposite sides of one of the spring guide posts 65 which is preferably made slightly longer than the other such post. The screws 216 are threaded through the respective side walls of the housing 73 so that the inner ends of the screws will embrace the upper end of the elongated spring guide post 65. The purpose of elongating the post which cooperates with such set screws is to avoid any interference between the set screws and the cross-head 64 when the latter is adjusted to its highest elevation on the screw post 67.

When the printing roll 1 is adjusted to its operative position, the impression cylinder 2 and the intermediate pressure roll 10 are moved upwardly slightly as already indicated. Such movement is, of course, transmitted to the spring guide posts 65, the upper ends of which terminate sufficiently short of the overlying top wall 72 of the housing to permit such upward movement of the posts. However, in respect of the spring post 65 which is made somewhat longer to cooperate with the positioning screws 216, there is provided in the top wall 72 of the housing an opening 217 into which the upper end of the posts 65 may extend in the event that an excessive amount of upward movement is transmitted to said spring posts.

The printing cylinder 1 is mounted for vertical adjustment toward and from the impression cylinder 2, and there are provided two means for effecting such movement of the printing cylinder. One means for moving the printing cylinder toward and from the impression cylinder surface to produce a predetermined limited amount of separation of the printing cylinder from the impression cylinder is to temporarily interrupt the printing operation of the press. The other means for adjusting the printing cylinder is designed to afford a greater range of adjustment and serves mainly to permit the mounting of printing cylinders of a substantial range of diameters in the press for cooperation with the same impression cylinder. The details of the printing roll mounting and the said adjusting means will presently be described.

When the printing operation is temporarily interrupted by lowering the printing cylinder from the impression cylinder, it is desirable to also relieve the pressure of the pressure roll 10 on the impression cylinder which, being rubber covered, might tend to be deformed by the continued application of the pressure roll pressure on a fixed portion of the impression cylinder, it being understood that the paper web and the impression cylinder would normally be stopped when the printing operation is interrupted.

For the purpose of relieving the impression cylinder 2 of pressure from the pressure roll 10 when the printing operation is stopped, there is provided a unit indicated at 225 intermediate the bearing blocks 5 and 11 of the printing and pressure rolls respectively. Said unit 225 (see Fig. 1c) consists of a suitable housing 226 provided with a pair of pneumatic cylinders 227 respectively containing pistons 228 which are movable vertically. The cylinders 227 are interconnected by a port 229 and a conveniently located port 230 is

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provided for admitting and releasing compressed air from the cylinders.

When the printing cylinder is lowered, a suitable air valve will be either manually or automatically actuated to admit compressed air into the cylinders below the pistons 228 whereupon the latter will be moved upwardly, their upper ends coming into engagement with the lower side of the pressure roll bearing block 11. The air pressure may be sufficient to move the pistons upwardly against the pressure of the springs 62 an extent sufficient to just slightly separate the pressure roll 10 from the impression cylinder 2 or at least sufficient to relieve the pressure of the roll 10 on the cylinder 2.

When the press is to be shut down for an extended time period and when air pressure may be shut off, the pressure of the springs 62 may be manually reduced by turning of the shaft 207 (Fig. 1b) as already explained, so as to permit a pair of springs 231 to effect upward movement of the pressure roll from the impression cylinder. The springs 231 are also housed in said housing 225 intermediate the pneumatic cylinders. The unit 225 is seated on the printing cylinder bearing block 5 and the openings in the housing 226 for the springs 231 may extend completely through said housing so that the opposite ends of the springs will seat on the upper and lower edges respectively of the bearing blocks 5 and 11. The springs 231 are, of course, of such strength that they will be effective to raise the pressure roll after release of the springs 62 has been effected to a suitable extent.

The printing cylinder 1 is preferably of the intaglio type and it is journaled in bearings such as indicated at 12 (Fig. 1) formed in a vertically movable and adjustable auxiliary frame member or cradle 13. Suitable bearing caps 14 are provided for cooperating with the bearings 12 to hold the end shafts 15 of the printing roll in place in the bearings 12.

The auxiliary frame member or cradle 13 comprises opposite side portions 16—16, which are rigidly interconnected by transversely extending frame elements such as indicated at 17. The side members 16—16 are provided with vertically extended bearing surfaces such as indicated at 18 cooperating with bearing surfaces 19 provided on the opposite side portions 20—20 of the main frame 7 (see Figs. 1, 4 and 5).

The auxiliary frame structure 13 is vertically adjustably supported in the main frame 7 by means of posts 21—21, there being two such posts at each side of the auxiliary frame. The posts 21 have the auxiliary frame 13 seated on their upper ends and secured thereto as indicated in Fig. 1 and each of said posts 21 extends downwardly into a sleeve 22 (see Fig. 10) which is vertically slidably but non-rotatably mounted within another sleeve 23. The outer sleeve 23 is in turn rotatably mounted in a suitably bored out bracket or casting 24 which is fixedly mounted on an adjacent portion of the main frame 7.

The outer sleeve 23 is held against vertical movement in the casting 24 by means of a pin 25 which is seated in the casting 24 and has its inner end projecting into a groove 26 provided in said outer sleeve. The upper end of the outer sleeve 23 is provided with a helical gear or worm wheel 27 through which the outer sleeve may be rotated by means of a cooperating helical gear or worm 28.

The inner sleeve 22 is keyed to the outer sleeve by means of keys indicated at 29—29 so that the

inner sleeve is rotatable in unison with the outer sleeve but is also vertically slidable relative to the outer sleeve. Said inner sleeve is provided with internal screw threading indicated at 30 cooperating with screw threading 31 provided on the lower portion of the post 21 so that when the sleeves 23 and 22 are rotated, the post 21 will be adjusted up or down. By rotating the sleeves 23 and 22, the vertical position of the post 21 and of the auxiliary frame 13 may be adjusted. This adjustment is made sufficient to permit the use of printing rolls of whatever range of sizes is desired; for example, from 6-inch diameter rolls to 12-inch diameter rolls. The extent of adjustment required for that range of printing rolls is, of course, 3 inches plus whatever additional allowance may be desired.

The printing roll 1 may receive ink from any suitable means, such as an ink trough or pan shown at 32 which is removably mounted in the cradle 13. The trough 32 may be removed with the cradle after ink inlet and outlet conduits 33 and 34 respectively (Figs. 1 and 5), are disconnected from the trough or pan. A doctor mechanism shown at 35 is arranged as will hereinafter be explained so that it may easily and quickly be moved to an out-of-the-way position to permit the cradle 13 and printing roll 1 to be moved vertically into and out of place in the press.

For the purpose of adjusting the frame 13 up and down to accommodate different sized rolls, it is of course desirable that the four posts 21 be simultaneously adjusted. This is effected by simultaneously rotating the sleeves 22 around the respective posts. For that purpose there is provided a shaft 52 suitably journaled in bearings 36 carried by the main frame 7, the said shaft being equipped with worm-gears, such as the worm-gears 28 previously mentioned for meshing with the worm wheels 27 of the respectively adjacent post structures. By turning the shaft 52, the two adjacent post structures will be simultaneously adjusted up or down in accordance with the direction in which the shaft 52 is rotated. To facilitate rotation of the shaft, one end thereof is provided with a squared projection 53 for receiving a suitable crank or hand wheel.

Extending parallel with the opposite ends of the apparatus there are provided shafts 54a and 54b, each of which are suitably journaled in the bearings 38 carried by the main frame 7. The shafts 54a and 54b are geared to the shaft 52 so as to be rotated when the shaft 52 is rotated, suitable helical gearing comprising gears 55 on the shaft 52 and gears 56 on the shafts 54a and 54b being provided.

At the other ends of the shafts 54a and 54b there are provided helical gears 57 which mesh with helical gears 58 provided on short shafts 59, which are suitably rotatably supported in bearings 39 carried by the main frame 7. Said shafts 59 carry worm-gears 28 in mesh with the worm wheels 27 of the respectively adjacent post structures 21. Rotation of the shaft 52 is thus imparted to the shafts 54a and 54b and to the two short shafts 59 so that all four of the post units 21 will be simultaneously adjusted in the same direction. The various connecting gears are, of course, properly selected to effect rotation of all of the gears 27 simultaneously in the same direction.

In conventional intaglio printing presses provision is usually made for elevating the impression cylinder, such as the impression roll 2 together with the sheet or web 3 for the purpose

of interrupting the printing operation. That procedure results in a slackening of the web 3 and creates difficulties in effecting registering of the printing effected by the printing roll associated with the elevated impression cylinder with any previously or subsequently applied printing or with previously determined printing positions on the web.

For the purpose of facilitating temporary separation of the printing roll and the impression cylinder, provision is made in the improved structure for easily and quickly lowering and raising the printing roll to a limited extent, for example, about 1/2-inch (or whatever distance may be desired). In this instance, the raising and lowering of the printing roll is effected by raising and lowering the auxiliary frame 13 on which the printing roll is supported. This is done by moving the inner sleeve 22 (Fig. 10) and the post 21 at each corner, vertically. Such movement is accomplished through the agency of a sleeve extension member 40 which is vertically slidable in the casting 24 and interconnected with the sleeve 22 by means of a split collar 63 having internal flanges 64 and 65 which enter annular grooves 66 and 67 respectively in the inner sleeve 22 and the member 40. The parts of the split sleeve 63 are held in assembled relation and in operative relation to the inner sleeve 22 and the member 40 by means of a spring ring 41.

The lower end of the member 40 projects from the lower end of the casting 24 and has pivoted to it a link 42 which extends downwardly and has its lower end pivoted as shown at 43 (see Figs. 1 and 5) to an arm 44 carried by a shaft 45. There are two shafts such as the shaft 45, one at each end of the main frame, and there are of course two arms 44 on each of the shafts for cooperating respectively with the post elevating mechanism at each corner. The shafts 45 are journaled in suitable bearings provided in the main frame 7. At one side of the apparatus the arms 44 are interconnected by a link 46 so that both shafts 45 will rock in unison (see Figs. 1, 2 and 5).

One of the shafts 45 (see Figs. 2 and 5) is provided at one end with an arm 47 which extends at an angle to the adjacent arm 44 and has its free end connected by suitable pin and slot connection shown at 48 to the outer end of a piston rod 49. The piston rod 49 carries a piston head 50 within an hydraulic cylinder 51 into which fluid under pressure may be delivered for moving the piston 50 in the required direction for rocking the arm 47 and the shafts 45. As shown in Fig. 5, the printing roll 1 is in a lowered position and out of contact with the web 3. When pressure fluid is admitted to the upper end of the cylinder 51, it will of course force the piston 50 downwardly therein to thereby rock the shafts 45 counterclockwise (Fig. 5) so that the arms 44 and links 42 will be adjusted to a position of substantially vertical alignment as shown in Fig. 1, thereby moving the posts 21, the auxiliary frame 13 and the printing roll 1 upwardly into printing relationship to the sheet or web 3 and the impression cylinder 2. The delivery of pressure fluid to the cylinder 50 may be controlled by any suitable manual or automatic means, and it will of course be understood that appropriate piping is provided for delivering pressure fluid selectively to either end of the cylinder while releasing pressure fluid from the opposite end thereof.

Ink may be supplied to the ink trough or pan 32 in any suitable manner. In this instance, there is shown a motor driven pump 60 (see Figs. 1 and

2) which draws ink from a suitable well or tank 61 and discharges it into the conduit 33 which discharges into the pan 32 (Fig. 1).

The ink is delivered to the lower portion of the pan 32 and the ink level may be determined by means of the position of the outlet opening through which the drain pipe 34 communicates with the ink pan.

By reference to Fig. 5 it will be seen that the ink supplied to the roll 1 is carried by the roll rearwardly and then upwardly to the printing line. Before the ink coated surface of the roll reaches the printing line, surplus ink is removed by the doctoring mechanism 35 previously referred to. Said doctoring mechanism 35 is of the general type shown in Edmondson Patent 2,323,983, July 13, 1943, but modified and improved in some respects as will presently be described.

Surplus ink may flow downwardly on the surface of the roll 1 and into the pan 32 or any other suitable means may be provided for taking care of the ink which is doctored from the roll.

The doctoring mechanism 35 is carried by a plate 79 which is, in turn, supported by a pair of arms 80—89. The upper ends of the arms 80 are screwed or otherwise securely attached to the lower edge portions of the plate 79 and the lower ends of the arms are rotatably mounted on a shaft 81. The shaft 81 is supported by suitably bored out brackets 82—82 which have collar-like portions 83 secured to the upper ends of the inner sleeves 22 of the adjacent vertically adjustable post structures (see Figs. 5 and 10). The collar portions 83 may be split form and suitably bolted together so as to permit assembly thereof around the upper end of said sleeve 22 between upper and lower flanges 84 and 85 respectively formed integrally with the sleeve 22.

It will be seen that when the sleeve 22 is moved up or down by means of the toggle like elements consisting of the links 42 and the rock arms 44, the arms 80, the plate 79 and the doctor blade mechanism will also be moved vertically in unison with the post structures and in unison with the printing roll. Hence, vertical adjustment of the printing roll by means of the hydraulically actuated toggle structure will occasion no change in the relationship of the doctor blade to the printing roll. It should be observed that the collar 83 is of such size that it fits snugly on the flanged upper end portion of the inner sleeve 22 so as to firmly support the arms 80 and the doctor blade structure while at the same time permitting the inner sleeve 22 to be rotated through the agency of the outer sleeve 23 for adjustment purposes already explained.

For cooperating with the arms 83 to support the plate 79 and the doctor blade structure, opposite end portions of the plate 79 are vertically slidably mounted on the adjacent portion of the main frame structure 7. For that purpose each upper edge portion of the plate 79 near each end is provided with a slot 86 fitting slidably around and under a bolt 87, which is threaded into the adjacent main frame portion or into suitable brackets, such as indicated at 88, which are in turn secured to the main frame proper. The bolts 87 are preferably of a shoulder type as best shown in Fig. 4, which will provide the required space between the head of the bolt and the adjacent surface of the supporting bracket or frame part to permit sliding of the plate as already indicated. The lower marginal portion of the plate at each end is also slidably secured to the main frame or

to the brackets 88, this being accomplished in this instance by means of clip plates 89, which are bolted as shown at 90 to the adjacent main frame portion (see Figs. 1, 2 and 13). The frame part 7 is suitably recessed as indicated at 91 to cooperate with the face of each clip 89 to vertically slidably receive the lower marginal end portions of the said plate 79.

The doctor blade structure proper comprises a normally stationary shaft 92 which may be of square cross section for most of its length but which is provided with rounded end portions suitably journaled in bearings 93 and 94 which are carried by the plate 79 (see Figs. 4 and 15). A body casting 95 for the doctor blade is horizontally slidably mounted on the shaft 92, such mounting being effected at one end through the agency of an arm 96 which is bolted to the end of the casting 95, as indicated at 97—97. The arm 96 has a square opening broached out to properly fit on the square portion of the shaft 92. At the other end of the body casting 95 (Fig. 15) the casting is slidably mounted on the shaft through the agency of a sleeve 98, a portion of which has a square socket fitting over an end portion of the square shaft 92, and another portion suitably bored out to slidably and rotatably fit on a round or cylindrical portion 99 of said shaft 92. The sleeve 98 fits inside a suitably formed portion of the casting 95 and the sleeve is rigidly connected to the casting by suitable means, such as one or more set screws such as indicated at 100. Thus the sleeve 98 and casting 95 are movable horizontally as a single unit on the shaft 92.

To effect horizontal reciprocation of the body casting 95, there is provided a tubular member 101 which has a portion fitting telescopically over an outer end portion of the sleeve 98. The tubular member 101 is provided with a suitable roller 102 projecting inwardly from its inner surface and projecting into a cam groove 103 provided in the sleeve 98. The cam groove 103 is so formed that rotation of the tubular member 101 in a fixed plane will effect reciprocation of the sleeve 98 and body casting 95. Additional details of the cam groove and roller structure are shown in the aforementioned Edmondson Patent 2,323,983. The tubular member 101 is held against horizontal shifting movement by means of a suitably flanged bushing 104, which is in turn locked in place between the inner end of the bearing 93 or a washer 105 and a shoulder 106 formed on the shaft 92 by the provision of a suitably reduced diameter portion 107 of the shaft. The tubular member 101 is further provided with spur gear teeth 108 by which the member may be rotated.

The doctor blade 109 is clamped between the portions of a split head 110, the said head 110 being secured to a shaft 111. The shaft 111 is journaled at its ends in end members 112 and 113 (see Fig. 15) and near one end in a post member 114. The post 114 has a suitably formed head as best shown in Fig. 5 including a bolted on cap portion for rotatably supporting the shaft 111.

The shaft 111, together with the doctor blade 109 and its carrying head 110 may be rocked to adjust the angular relationship of the doctor blade to the printing roll. The means for effecting such rocking of the shaft 111 is best shown in Figs. 14 and 15. As there shown, the shaft 111 is provided with a worm wheel 115 which is keyed or otherwise secured to the shaft. Said worm wheel 115 meshes with a worm gear 116 provided on a shaft 117, which is rotatably mounted in the arm-like end member 96 and

provided at its lower end with a bevel gear 118 which is keyed or otherwise secured to the shaft. The shaft 117 may be rotated by means of a manually rotatable shaft 119 suitably journaled in the lower end portion of the arm 96 and provided with a bevel gear 120 which meshes with the gear 118. The outer end of the shaft 119 may be provided with a hand lever or arm 121 to facilitate turning of said shaft 119 (see Fig. 1).

The end member 113 in which the shaft 111 is journaled includes a shaft or post portion 122 which is slidable inwardly and outwardly in a socket 123 provided in said end arm 96. The post portion 122 of the end member 113 (see Figs. 14 and 15) corresponds to the post portion 114 of the intermediate bearing support for the shaft 111 which is also slidable inwardly and outwardly in a suitable socket 124 provided in said body casting 95 (see also Fig. 5). The end member 112 (Fig. 15) is similarly slidable in a guide way 125 provided in the end of the body casting 95 and it is adapted to be locked in selected position by means of a clamping screw 126. Each of the posts 114 and 122 are provided with gear teeth or racks 127 and 128 respectively which mesh with pinions, such as shown at 129 formed in a shaft 130, which is rotatably mounted in the body casting 95 and end arm 96. By rotating the shaft 130, the supporting members 114 and 122 for the shaft 111 may be moved inwardly and outwardly, provided of course that the clamping screw 126 is so adjusted as to permit the end member 112 to follow the movement of the shaft 111. For rotating the shaft 130 there is provided an adjusting member 131 (see Fig. 16) which is suitably rotatably mounted in the body casting 95, secured against endwise movement and provided with worm gear teeth or equivalent screw threading, such as shown at 132 in mesh with suitable teeth 133 provided on a portion of the shaft 130. Because of the small pitch diameter of the gear 133 the adjusting member 131 is disposed at a slight angle, as is clearly shown in Fig. 4 to properly dispose its teeth 132 in operative relationship to the teeth 133 which are advantageously formed parallel with the axis of the shaft 130. The outer end of the adjusting member 131 is preferably squared as indicated to receive an adjusting wrench or lever to facilitate manual turning thereof.

When the shaft 111 is adjusted up or down relative to the upper edge of the body casting 96, the gear 115 on the shaft 111 will roll over the teeth of the worm gear 116 which is extended to maintain meshing relationship with the gear 115 as best shown in Fig. 14. Hence, if the shaft 111 is adjusted upwardly from the lowermost position shown in Fig. 14, the angle of the doctor blade 109 would be changed. The angle may be restored to the initial angle by turning the shaft 119 as already explained.

The doctor blade structure is also rockable about the axis of the shaft 92 to thereby adjust the doctor blade 109 toward and from the surface of the printing roll. Such adjustment is particularly desirable to facilitate the use of different sized printing rolls in the press.

For rocking the doctor blade structure about the axis of the shaft 92, said shaft is provided at one end with a worm wheel 134 which is keyed or otherwise secured to the shaft. Said worm wheel is in mesh with a worm gear 135 carried by a shaft 136 which is suitably rotatably mounted in brackets 137 and 138 which are mounted on the plate 79. One end of the shaft 136 pro-

jects forwardly from the front bracket 137 and is suitably squared as shown in Fig. 13 to facilitate turning thereof by means of a wrench or the like. Turning of the shaft 136 and its worm gear 135 will, of course, effect turning of the shaft 92 and the entire doctor blade structure. Rotation of the shaft 92 is imparted to the doctor blade structure by reason of the fact that the end arm 96 is mounted on a square portion of the shaft 92 as shown in Figs. 14 and 15.

The bearing 137 may be formed as a part of a housing 148 which is mounted on the plate 79 to cover a portion of the end arm 96 which projects outwardly through an opening 149 (Fig. 14) in the plate 79. Said housing 148 is suitably slotted as shown at 150 to permit the adjusting shaft 119 to project into readily accessible position.

The doctor blade structure may, in its entirety, be swung outwardly from the printing roll about the axis of the shaft 81 on which the structure is pivotally supported by means of the arms or brackets 80—80.

The means for driving the gear 108 and thereby effecting reciprocation of the doctor blade is such that said swinging movement of the doctor structure may be readily effected without first removing or disconnecting any of the driving connections. As shown in Figs. 2 and 4, the gear 108 is driven by means of a pinion 139 and a gear 140 which are suitably mounted for rotation on the plate 79 or in suitable bearing brackets secured thereto. The gear 140 is carried by a shaft 141 which is provided at its other end with a helical gear 142 which meshes with another helical gear 143. The gear 143 is carried by the upper end of a shaft 144 which is journaled in a bracket 145 carried by the side frame element 20. The lower end of said shaft 144 may be connected directly to an electric motor 146 mounted on the side frame of the machine. A suitable speed reducing gearing may be incorporated in the casing of the motor, if desired. The shaft 141 which carries the gears 140 and 142 is journaled in a suitable housing 147 which is secured to the plate 79.

When the doctor blade structure is to be swung outwardly on the shaft 81, the upper locking bolts 87—87 and the clips 89—89 are removed whereupon the doctor blade structure may be swung in its entirety to an inoperative, out-of-the-way position. Such outward swinging movement of the doctor blade structure effects disengagement of the gear 142 from the gear 143 and when the structure is returned to operative position the gears 142 and 143 may be readily brought into mesh without difficulty so that the driving connection between the motor 146 and the doctor blade structure is restored.

The printing roll 1 is driven through a gear 151 suitably mounted on the shaft 15 of the printing roll. Said gear 151 meshes with a gear 152 (see Fig. 3) which is of split construction to permit adjustment of the effective widths of the teeth of the gear. Said gear 152 is keyed to one end of a shaft 153, the other end of which carries a clutch member 154 which cooperates with another clutch member 155. The clutch member 155 is keyed to a tubular shaft or sleeve 156 which has keyed to its other end another split gear 157 which meshes with a driving gear 158 carried by a drive shaft 159. The drive shaft 159 is in turn driven by any suitable connections to a power source which in this instance may be considered as a main driving shaft which is drivingly con-

connected to each of a plurality of printing press units employed for multi-color printing. As shown in Fig. 2, the shaft 159 is driven by suitable gear connections indicated at 160 to a vertically disposed shaft 161 which extends downwardly into driving connection with a main drive shaft common to all of the driven units of apparatus. The shaft 159 is, of course, suitably journaled in the supporting housing 162.

The clutch comprising the clutch parts 154 and 155 is preferably of the type shown in Edmondson application Serial No. 399,104, filed June 21, 1941, now Patent Number 2,384,418, September 4, 1945. Said clutch mechanism is of a type which can be repeatedly engaged in only a single driving position so that the printing cylinder 1 would always occupy the same operative relationship to the driving means which is common to other printing units. Thus restoration of register between all of the printing units of the press is readily attained.

The clutch is controlled by means of a forked member 163 which carries suitable pins or rollers operating in a groove 164 provided in a part which is rigid with the clutch member 154. Said forked member 163 is secured to the upper end of a vertically disposed shaft 165 which is journaled in a bearing bracket 166 secured to one side of the housing 162. Said bearing bracket 166 is suitably slotted as indicated at 167 (Fig. 6) to permit an arm 168 to be mounted on said shaft 165. The arm 168 is keyed to the shaft 165 so as to permit the shaft to slide vertically through the arm 168 while at the same time insuring the transmission of rocking movement from the arm 168 to the shaft 165 and clutch controlling member 163 whenever the arm is rocked. The outer or free end of the arm 168 is suitably connected as indicated at 169 (Figs. 3 and 6) to the free end of a piston rod 170 of a pneumatic cylinder 171 which is mounted in the casing 162.

The pneumatic cylinder 171 is suitably connected to a source of pressure air and control means (not shown) so that when the cylinder 51 is actuated to lower the printing roll 1 and parts associated therewith to an inoperative position, the clutch member 154 will be disengaged from the clutch member 155 to thereby interrupt the normal drive of the printing cylinder 1.

For the purpose of maintaining the printing cylinder in rotation when its normal drive is disengaged, there is provided an auxiliary driving electric motor 172 suitably mounted on the housing 162 and connected through a suitable speed reducing unit 173 to a shaft 174 which extends from the speed reducing unit 173. Said shaft 174 has secured to it a gear 175 which meshes with a gear 176 which is rotatable on a short shaft 177 carried by a suitable bracket element 178 of the speed reducing unit 173. A pulley 179 is secured to the gear 176 and a belt 180 is employed for transmitting rotation from the pulley 179 to a pulley 181 which is secured to or formed integrally with the clutch part 154.

When the electric motor 172 is energized it is operative to drive the pulley 181 and the clutch member 154 and hence the shaft 153 through which the printing cylinder shaft 15 is driven by means of gears 152 and 151.

When the auxiliary driving motor 172 is not in operation and the press is being operated through the main drive, driving of the auxiliary motor through the belt connection 89 is prevented by providing a suitable, known form of overrunning

clutch mounting for the pulley 181 and clutch member 154 on the shaft 153. Such a clutch mounting is embodied in a hub part 221 formed on one side of the pulley 181 and so arranged that rotation of the pulley 181 at a relatively low speed and in one direction will be transmitted to the shaft 153. However, when the press is being driven through the main drive, the shaft 153 will be driven at a higher rate of speed and the shaft will then rotate freely within the clutch containing hub 221 of the pulley 181. Thus the auxiliary driving motor 172 is protected from reverse driving forces.

The motor 172 may be automatically controlled by suitable switch mechanism (not shown) interlocked with the control means for the hydraulic cylinder 51 and the pneumatic cylinder 171 so that the electric motor will be started and stopped in properly timed relation to the lowering and raising of the printing roll. The timing should be so arranged that the motor 172 will be started after the clutch members 154 and 155 are disengaged and the motor should be stopped just prior to reengagement of said clutch members. The respective driving forces for the printing roll are thus prevented from simultaneously driving the roll. The required timing mechanism is well known in the art and is, therefore, not herein illustrated.

When the printing cylinder is in its inoperative lowered position, it is driven at a reduced speed by means of the auxiliary driving motor 172. In this manner the printing cylinder is maintained in motion so as to prevent ink from drying on any portion of the cylinder even though the printing unit is otherwise temporarily stopped for any purpose.

The auxiliary drive mechanism just described is made adjustable to permit it to operate in the manner described in connection with printing rolls of various diameters which result in different positions of elevation of the shaft 15 and the driving gear 151. As best shown in Figs. 3, 6 and 7, the shaft 153, the tubular shaft 156 and the parts associated therewith are supported for rotation in a tubular housing 182 which is preferably formed integrally with a bracket 184. The housing portion 182 may be made in two sections separable along a plane parallel with and extending through the axis of the shaft 153 so as to permit assembly of the structure illustrated. A cap-like section 183 of the housing may be bolted to the remainder of the housing by suitable bolts, such as indicated at 183a (Fig. 7). The bracket plate 184 is vertically adjustably mounted on the adjacent side wall of the housing 162 by means of bolts 185 which are secured against rotation and against lateral movement in the housing 162 and passed through suitable upper and lower slots, such as indicated at 186 and 187 respectively in the bracket plate 184. By loosening the clamping nuts 186 on the bolts 185 the bracket plate 184 may be freed sufficiently to permit its being moved up or down as may be required. Such movement of the plate may advantageously be effected through means such as one or more suitably positioned bolts, such as indicated at 188 which are threaded through brackets 189 mounted on the housing 162. The upper ends of the bolts 188 are provided with heads 189 anchored in slots provided in the bracket plate 184 so that up or down movement of the bolt 188 will be transmitted to said bracket plate 184. The bolts 188 may also be provided with nut-like collars 191 to facilitate

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turning of the bolt by means of a wrench or the like, such collars being located in properly spaced relation to the bolt heads 190 for embracing between them a portion of the bracket plate 184, as shown in Fig. 7.

The axis of the driven gear 151, at its highest elevation, i. e., when the smallest printing roll is in use, will be concentric with the axis of the axially fixed drive gear 152. When a larger diameter printing roll is used, the axis of the gear 151 will, of course, be lowered. Lowering of the axis of the printing roll shaft 15 and its driving gear 151 will, of course, require appropriate adjustment of the position of the axis of the gear 152 to maintain it in proper mesh with the gear 151. It may be observed that it is not feasible to lower the axis of the gear 152 to the same extent that the axis of the gear 151 is lowered since that would also involve lowering of the gear 157 to an improper, if not inoperative, relationship to the main driving gear 152. Accordingly provision is made for adjusting the gears 152 and 157 both downwardly and towards the gears 151 and 158 respectively whereby the gears 152 and 157 may be maintained in proper meshing relationship to their respective cooperating gears 151 and 158.

In the diagram, Fig. 12, there is represented the relationship of the gears 151, 152, 157 and 158 when there is in use a printing roll having a diameter which is greater than the diameter of the smallest printing roll which the press is designed to use. The axis 15a of the larger printing roll shaft 15 and the driven gear 151 is spaced from the axis 159a of the drive shaft 159 and gear 152. (Fig. 3 may be advantageously considered together with Fig. 12 in connection with this explanation.) In Fig. 12, the coaxial gears 152 and 157 are represented (a) in full lines in an elevated position for driving engagement respectively with the gears 151 and 158 when they are coaxial as when the smallest diameter printing roll is in use, and (b) in broken lines in a lowered position for driving engagement respectively with the gears 151 and 158 when they are not in coaxial relationship as when a larger diameter printing roll is in use. The common axis of the gears 152 and 157 is indicated at 153a and 153b in two positions respectively corresponding to the two illustrated positions of the gears 152 and 157.

In order to maintain the gears 152 and 157 in proper mesh with the gears 151 and 158 respectively when they are out of coaxial alignment, as when a printing roll of larger than minimum size is to be used, the common axis of the gears 152 and 157 is adjusted downwardly from 153a to 153b in an arc having its center coincident with the fixed axis 159a of the drive shaft 159 and gear 152. Such arcuate adjustment of the axis 153a serves, of course, to maintain the gear 157 in proper relationship to the gear 158 and it will be apparent from the diagram that such adjustment also serves to place the gear 152 in proper operative relationship to the gear 151, the axis of which is downwardly offset relative to the axis of the gear 158. The downward movement of the said common axis of the gears 152 and 157 is one-half of the distance that the axis 15a is lowered for the selected larger size printing roll from the location of the axis 15a for the minimum sized printing roll. It will also be apparent that this condition will prevail throughout the range of printing roll diameters which may be employed.

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For effecting the indicated adjustment of the gears 152 and 157 the bracket plate 184 is vertically movably mounted on the housing 162 as already explained. The vertical component of movement of the gears 152 and 157 may be effected by appropriate turning of the adjusting screws 188.

The horizontal component of the arcuate adjusting movement of the gears 152 and 157 is obtained by means of an eccentric mounting of the tubular shaft 156 and the shaft 153 in the housing 182. This is effected by means of a sleeve-like member 192 rotatably mounted within the housing 182 and equipped with ball bearings 193 and 194 at its opposite ends for rotatably supporting the tubular shaft 156. The shaft 153 is, of course, suitably journaled in opposite end portions of the tubular shaft 156 as shown at 195 and 196 where suitable anti-friction bearings may be provided if desired. The sleeve 192 is somewhat enlarged at its ends for receiving the ball bearings 193 and 194 and the seats or bearing surfaces 197 and 198 for the respective anti-friction bearings 193 and 194 are concentrically disposed relative to the common axis of the shaft 153 and tubular shaft 156. The bearing seat or surfaces 199 and 200 on which the sleeve member 192 is rotatable, are eccentrically disposed relative to the said bearing surfaces 197 and 198 respectively so that rotation of said sleeve 192 will effect the lateral or horizontal component of adjustment of the common axis of the shafts 153 and 156.

For rotating the sleeve 192, a portion of the bearing surface 200 at one end of the sleeve is provided with gear teeth, indicated at 201 (see Figs. 3 and 9), which mesh with the teeth 202 of a screw or worm gear 203 which is suitably rotatably mounted in a portion of the housing 182. One end of the screw 203 is squared or otherwise formed to accommodate a wrench or wheel for facilitating manual rotation of the screw and thereby turning of the adjusting sleeve 192 to effect the required lateral adjustment of the gears 152 and 157.

Suitable controls (not shown) are, of course, provided for effecting properly timed admission and exhaustion of pressure fluid from the hydraulic and pneumatic cylinders 51 and 171 respectively, and for the energization of the auxiliary driving motor 172.

In Figs. 6 and 7, the parts are illustrated in positions occupied for actuating the smallest printing roll which the press is designed to handle. When a larger printing roll is employed and the driving shaft 153 and tubular shaft 156 (see Fig. 3) are lowered and moved inwardly about the axis of the drive shaft 159 and gear 152, adjustment is required to maintain the auxiliary driving belt 180 (see also Figs. 2 and 6) tight enough to effectively transmit power to the pulley 181. Such adjustment is effected by loosening one or more set screws, such as indicated at 222, in the annular member 223 in which bracket 178 is mounted for rotation (see Figs. 6 and 7). The bracket member 178 may then be rotatably adjusted to lower the position of the pulley 179 to the extent required for maintaining the driving belt 180 tight.

Lowering of the driving shaft 153 and parts associated therewith also necessitates lowering of the clutch controlling member 163. This is permitted to follow the downward movement of the shaft 153 automatically as an incident to the vertically slidable mounting of the shaft 165 in the hub of the arm 168.

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It will be seen that in the described printing press structure, vertical lowering of the printing roll, as readily effected by the hydraulic means described, permits the press unit to be made temporarily inoperative without disturbing the position of the paper being printed on. Waste of paper is thus avoided and difficulties of effecting reregistration of the printing unit relative to other printing or other units operating on the same paper are overcome.

The described structure further includes an arrangement whereby when the printing roll is lowered to temporary inoperative position it is automatically kept in rotation but usually at a lower speed; this prevents drying of ink on the roll and eliminates time-consuming printing roll cleaning operations each time that the press unit is made temporarily inoperative. Also, it will be observed that accurate adjustment of the printing roll to proper operative relation to the impression cylinder may be easily effected without disturbing, or without hindrance from, the mechanism which permits the roll to be temporarily lowered to an inoperative position. The doctor blade mechanism is so arranged that it follows the printing roll up and down into its inoperative and operative positions respectively, and said doctor blade mechanism is further readily movable in its entirety to an inoperative, out-of-the-way position facilitating removal of the printing cylinder and replacement thereof. The mounting of the doctor blade mechanism which permits the latter to be swung to an out-of-the-way position is such that its other adjustments are not necessarily changed so that it may be readily restored to its normal relationship to the printing roll without readjusting the setting of the various parts. In general, the structure is such that extensive time losses experienced with conventional presses incident to temporary stoppages are effectively eliminated together with certain advantages in respect to the facility with which various sizes of printing rolls may be mounted in the press without making extensive other changes in the mechanism.

Various changes in the structure may be made while retaining the principles of the invention as referred to in the following claims.

We claim:

1. In a printing press, a rotatable printing roll, a normally fixed main frame, an auxiliary frame extending around said printing roll and vertically slidably mounted on said main frame, said printing roll being journaled in said auxiliary frame, means for vertically adjustably supporting said auxiliary frame and printing roll comprising four posts located respectively adjacent the corners of said auxiliary frame, means for effecting simultaneous predetermined vertical adjustment of said posts to thereby correspondingly adjust said printing roll to and from printing position, mechanism adjustable independently of said means for effecting adjustment of said posts variable, selected distances vertically to thereby adapt the auxiliary frame to support printing rolls of various diameters with their uppermost surface portions at a predetermined elevation in printing position, and means for simultaneously effecting like adjustment of said posts to the selected variable extent.

2. In a printing press, a rotatable printing roll, a normally fixed frame, an auxiliary frame element vertically slidably mounted on said fixed frame for vertically adjustably supporting said printing roll, and means for effecting vertical

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adjustment of said auxiliary frame comprising a post anchored to said auxiliary frame and having a screw threaded portion, a normally fixed bracket having an opening into which said screw threaded post portion projects, an inner sleeve provided with internal screw threading engaging the screw threading on said post within said bracket, an outer sleeve surrounding said inner sleeve, means for interlocking said sleeves for unitary rotary movement while permitting relative vertical movement therebetween, means for locking said outer sleeve to said bracket against vertical movement while permitting rotation thereof, means for rotating said outer sleeve to thereby also rotate said inner sleeve for effecting vertical movement of said post, and means for effecting independent vertical movement of said post and inner sleeve within said outer sleeve.

3. In a printing press, a rotatable printing roll, a normally fixed frame, an auxiliary frame element vertically slidably mounted on said fixed frame for vertically adjustably supporting said printing roll, and means for effecting vertical adjustment of said auxiliary frame comprising a post anchored to said auxiliary frame and having a screw threaded portion, a normally fixed bracket having an opening into which said screw threaded post portion projects, an inner sleeve provided with internal screw threading engaging the screw threading on said post within said bracket, an outer sleeve surrounding said inner sleeve, means for interlocking said sleeves for unitary rotary movement while permitting relative vertical movement therebetween, means for locking said outer sleeve to said bracket against vertical movement while permitting rotation thereof, means for rotating said outer sleeve to thereby also rotate said inner sleeve for effecting vertical movement of said post, an inner sleeve extension member vertically slidably mounted in said bracket and connected to said inner sleeve so as to permit relative rotation between said inner sleeve and said extension while uniting said sleeve and extension for unitary vertical movement within said bracket, and means connected to said sleeve extension for effecting vertical movement of said extension, said inner sleeve and said post.

4. A printing press according to claim 3 wherein there is also provided a doctor blade structure for removing surplus ink from said printing roll, said doctor blade structure being also vertically adjustably mounted on said normally fixed frame, and means interconnecting said doctor blade structure and said vertically movable post for effecting vertical adjustment of said doctor blade structure simultaneously with vertical adjustment of said printing roll.

5. In a printing press, a rotatable printing roll, a main frame, an auxiliary frame vertically slidably mounted in said main frame, said printing roll being journaled on said auxiliary frame so as to be thereby vertically adjustably supported, a doctor blade structure for acting on said printing roll, means vertically adjustably mounting said doctor blade structure on said main frame, and means interconnecting said doctor blade structure and said auxiliary frame for effecting unitary vertical adjustment of said auxiliary frame and doctor blade structure to thereby maintain the operative relationship between the doctor blade and printing roll, said interconnecting means comprising a shaft se-

cured to said auxiliary frame in relatively fixed relation thereto, and a pair of arms pivotally mounted on said shaft and secured to said doctor blade structure for transmitting vertical movement of said auxiliary frame and shaft to said doctor blade structure, said doctor blade structure being also pivotally movable about the axis of said shaft from operative relation to said printing roll to an inoperative out-of-the-way position to provide access to said printing roll.

6. In a printing press, a main frame, an auxiliary frame element vertically slidably mounted in said main frame and provided with means for rotatably supporting a printing roll, said auxiliary frame member being adapted to be supported in various positions of vertical adjustment relative to said main frame member to thereby selectively support printing rolls of various diameters with their upper surface portions at a predetermined elevation common to all of the printing rolls, there being a shaft portion adapted to be journaled in said auxiliary frame element for mounting the respective rolls therein, a gear train comprising a main drive gear, a driven gear mounted on said printing roll shaft, a pair of intermediate gears, one of which meshes with said drive gear and the other of which meshes with said driven gear, clutch means for disengageably connecting said pair of intermediate gears, whereby said printing roll is drivable by said drive gear through said train of gears and whereby said drive gear is adapted to be disconnected from said driven gear by disengagement of said clutch means, means operative through one of said intermediate gears when said clutch is disengaged, to drive said printing roll, and means for mounting said pair of intermediate gears for movement relative to the peripheries of said drive and driven gears to permit driving engagement to be maintained between the respective intermediate gears and said drive and driven gears in various positions of adjustment of said driven gear incident to the employment of printing rolls of various diameters.

7. In a printing press adapted to employ various sized printing rolls with the axes thereof at various positions to locate portions of the printing surfaces of the respective rolls in a common predetermined position, an axially fixed drive gear, a driven gear which is coaxial with the selected size printing roll, means for transmitting rotation from said drive gear to said driven gear comprising a pair of coaxial, interconnected, intermediate gears respectively meshing with said drive and driven gears, means for mounting said intermediate gears for arcuate movement about the axis of said axially fixed drive gear, said mounting means comprising a vertically adjustably mounted supporting member, a sleeve rotatably mounted in said member, means carrying said intermediate gears and rotatably mounted in said sleeve, said sleeve having relatively eccentrically disposed external and internal bearing surfaces for respectively rotatably supporting the sleeve in said member and rotatably supporting said gear carrying means, said eccentrically disposed bearing surfaces serving to effect lateral shifting of the axial position of said intermediate gears as an incident to turning of said sleeve.

8. In a printing press embodying a substantially fixed position impression cylinder and means adjustable radially of said cylinder for supporting various sized printing rolls in operative relation to said impression cylinder, an axial-

ly fixed drive gear, a driven gear coaxial with the selected size printing roll, said driven gear being of the same size for all of the various sized printing rolls which may be employed as desired, means for transmitting rotation from said fixed drive gear to said driven gear in each of its various positions incident to the various sizes of printing rolls employed from time to time, comprising a pair of intermediate gears interconnected for the unitary rotation and respectively meshing with said drive and driven gears, means for mounting said pair of gears for arcuate movement about the axis of said drive gear, said mounting means comprising a vertically adjustably mounted supporting member, a sleeve rotatably mounted in said member, means carrying said intermediate gears and rotatably mounted in said sleeve, said sleeve having relatively eccentrically disposed external and internal bearing surfaces for respectively rotatably supporting the sleeve in said member and rotatably supporting said gear carrying means, said eccentrically disposed bearing surfaces serving to effect lateral shifting of the axial position of said intermediate gears as an incident to turning of said sleeve, and means carried by said supporting member for turning said sleeve.

9. A printing press comprising an impression roll, a printing roll mounted for movement from cooperative relationship with said impression roll to such spaced relationship thereto as to permit the sheet material normally to be printed on to pass between said rolls without contacting said printing roll, and means for driving said printing roll embodying a normally fixed drive member, a driven member fixedly connected to said printing roll, and transmission means operatively connected to said drive member and to said driven member, said transmission means comprising a pair of coaxial members respectively operatively connected to said driving means and said driven member, a disengageable clutch interconnecting said pair of members, and an auxiliary drive means connected to the one of said pair of members which is connected to said driven member for driving the latter when said clutch is disengaged.

10. A printing press comprising an impression roll, a printing roll mounted for movement from cooperative relationship with said impression roll to such spaced relationship thereto as to permit the sheet material normally to be printed on to pass between said rolls without contacting said printing roll, and means for driving said printing roll, said driving means embodying a normally fixed drive member, a driven member fixedly connected to said printing roll, and transmission means operatively connected to said drive member and to said driven member, said transmission means being adjustable to permit the same to deliver its power output to said driven member in various locations thereof incident to the employment of various sizes of printing rolls, and said transmission means comprising a pair of members respectively operatively connected to said driving means and said driven member, a disengageable clutch interconnecting said pair of members, and an auxiliary drive means connected to the one of said pair of members which is connected to said driven member, said auxiliary drive means being operative to drive said driven member when said clutch is disengaged.

11. A printing press comprising an impression roll, a printing roll mounted for movement from cooperative relationship with said impression roll

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to such spaced relationship thereto as to permit the sheet material normally to be printed on to pass between said rolls without contacting said printing roll, a pressure roll normally engaging said impression roll and urging the same in a direction toward said printing roll, said pressure, impression and printing rolls being journaled in bearing blocks mounted for sliding movement, means for effecting movement of said printing roll to said spaced relationship to said impression roll, and means for effecting movement of said pressure roll from said impression roll, to relieve the pressure of said pressure roll on said impression roll, comprising a housing interposed between adjacent edges of the bearing blocks of said pressure and impression rolls, said housing being provided with a cylinder having a piston movable therein in the direction of movement of said pressure roll relative to said impression roll, and a connection to a source of fluid pressure for operating said piston.

12. A printing press comprising an impression cylinder, a printing cylinder supported for movement from a predetermined printing position relative to said cylinder to an inoperative position spaced from said cylinder, repeatedly operable means for moving said printing cylinder a predetermined distance from said printing position to said inoperative position and back to said printing position, means holding said impression cylinder yieldingly in operative relation to said printing cylinder when the latter is in printing position and urging said impression cylinder to follow said printing cylinder when the latter is moved to said inoperative position, and means for limiting to such a small distance, the distance which said impression cylinder may follow said printing cylinder when the latter is moved from printing position that incidental changes in the position and tautness of a printing web guided by said impression cylinder will be negligible.

13. A printing press comprising an impression roll, a printing roll mounted for movement from cooperative relationship with said impression roll to such spaced relationship thereto as to permit the sheet material normally to be printed on to pass between said rolls without contacting said printing roll, a pressure roll normally engaging said impression cylinder and urging the same in a direction toward said printing roll, means for effecting movement of said printing roll to said spaced relationship to said impression roll, bearing blocks rotatably supporting said pressure, impression and printing rolls, said bearing blocks being slidably mounted for movement toward and from each other, adjustable pressure spring means for urging said pressure roll toward said impression roll, means for effecting movement of said pressure roll from said impression roll so as to relieve the pressure of the pressure roll on said impression roll when the printing roll is moved from said impression roll, said means comprising at each end of the said roll, a housing interposed between the adjacent edges of the bearing blocks for said pressure and impression rolls, said housing having a cylinder and a piston movable in said cylinder in the direction of sliding movement of the pressure roll bearing blocks, a connection to a source of fluid pressure for operating said piston, and spring means positioned in said housing so as to be operative to overbalance said adjustable pressure means upon reduction of the pressure of the latter.

14. In a printing press adapted to employ various sized printing rolls with the axes thereof at

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various positions to locate portions of the printing surfaces of the respective rolls in a common predetermined position, an axially fixed drive gear, a driven gear which is coaxial with the selected size printing roll, intermediate gear means meshing with said drive and driven gears for transmitting rotation from said drive gear to said driven gear, means for mounting said intermediate gear means for arcuate movement about the axis of said axially fixed drive gear, said mounting means comprising a vertically adjustably mounted supporting member, a sleeve rotatably mounted in said member, means carrying said intermediate gears and rotatably mounted in said sleeve, said sleeve having relatively eccentrically disposed external and internal bearing surfaces for respectively rotatably supporting the sleeve in said member and rotatably supporting said gear carrying means, said eccentrically disposed bearing surfaces serving to effect lateral shifting of the axial position of said intermediate gears as an incident to turning of said sleeve.

15. In a printing press adapted to employ various sized printing rolls with the axes thereof at various positions to locate portions of the printing surfaces of the respective rolls in a common predetermined position, an axially fixed drive gear, a driven gear which is coaxial with the selected size printing roll, means for transmitting rotation from said drive gear to said driven gear comprising a pair of coaxial, interconnected, intermediate gears respectively meshing with said drive and driven gears, clutch means for disengageably connecting said intermediate gears, auxiliary driving means connected to the one of said intermediate gears which meshes with said driven gear to drive the same when said clutch means is disengaged, means for mounting said intermediate gears for arcuate movement about the axis of said axially fixed drive gear, said mounting means comprising a vertically adjustably mounted supporting member, a sleeve rotatably mounted in said member, means carrying said intermediate gears and rotatably mounted in said sleeve, said sleeve having relatively eccentrically disposed external and internal bearing surfaces for respectively rotatably supporting the sleeve in said member and rotatably supporting said gear carrying means, said eccentrically disposed bearing surfaces serving to effect lateral shifting of the axial position of said intermediate gears as an incident to turning of said sleeve.

16. In a printing press, a normally fixed main frame, an auxiliary frame, means supporting said auxiliary frame for vertical adjustment relative to said main frame comprising a plurality of posts, means for effecting simultaneous predetermined vertical adjustment of said posts to thereby correspondingly adjust said auxiliary frame, whereby a printing roll carried by said auxiliary frame is adapted to be adjusted to and from printing position relative to a cooperating printing roll carried by said main frame, and means for effecting variable selected adjustments of the lengths of said posts to thereby adapt the auxiliary frame to support printing rolls of any diameter within a predetermined range of diameters in printing position relative to a printing roll carried by said main frame as aforesaid.

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