The present invention relates to rotary intaglio printing presses and more particularly to novel and improved impression mechanisms of such presses.

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

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

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

Of the drawings:

Figure 1 is a side elevation of an embodiment of the present invention, with certain parts broken away;

Figures 2 and 2A are a vertical sectional view, on an enlarged scale taken through the end frame of the structure shown in Figure 1;

Figure 3 is a vertical sectional view taken on the line 3--3 of Figure 1;

Figure 4 is a fragmentary horizontal sectional view taken on the line 4--4 of Figure 3;

Figures 5 is a fragmentary end elevation of the impression mechanism with the side frame removed.

Figure 6 is a similar view with the parts in position to permit removal or replacement of the impression roller;

Figure 7 is a vertical section taken on the line 7--7 of Figure 5;

Figure 8 is a fragmentary detailed side elevation of the limit switch operating means shown in Figure 1;

Figure 9 is a fragmentary detailed horizontal section taken on the line 9--9 of Figure 1;

Figure 10 is a fragmentary vertical section taken on the line 10--10 of Figure 3;

Figure 11 is a view similar to Fig. 2A of a modified embodiment of the invention;

Figure 12 is a diagrammatic view of this modification:

Figure 13 is a similar view of an impression arrangement of the prior art.

This application is in part a continuation of my prior copending application Ser. No. 165,281, filed Sept. 23, 1937.

The invention provides a novel and improved impression mechanism for rotary gravure printing presses of the type having a driven printing cylinder and impression roller and a rotatably mounted heavy back-up cylinder, one mounted above the other, so that the paper is pressed against the intaglio printing cylinder by the back-up cylinder exerting its pressure through the impression roller.

The invention has for its object the provision of improvements in the general arrangement and construction of parts in the impression mechanism for such a printing press. A further object of the invention is the provision of a novel and improved impression mechanism which will operate with fractional width rolls as well as with full width rolls. A further object is the provision of a rotary gravure press in which the impression cylinder is positively limited in its downward movement towards the printing cylinder and is resiliently held downwardly against these positive limits. Still another object is the provision of an improved rotary gravure press in which the parts are moved accurately by electric motors and may be moved away from and returned to any desired position.

In an illustrative embodiment of the invention, means are provided by the invention for raising and lowering the back-up cylinder at one or the other or both ends by automatic power means, such as a motor, and manual means as well, for raising and lowering the impression roller with the back-up cylinder, while permitting a limited relative movement between the impression roller and the back-up cylinder.

The back-up cylinder is preferably operated by means of a threaded shaft by which it is possible to raise and lower the back-up cylinder and the arrangement is such that the weight of the back-up roller to be exerted against the printing cylinder through the impression roller can act in certain positions of the back-up cylinder despite the means for raising and lowering said cylinder.

The cooperation of the fixed stops or limits against which the back-up cylinder normally rests and the means provided for resiliently holding the back-up cylinder against these stops or limits results in great advantage in the operation of the press, in that an accurate gauging of the printing pressure can be obtained and wrapping of a broken web about the impression roller will cause no damage as the maximum pressure is limited by the resilient means pressing on the back-up cylinder. Also when using fractional width impression rollers substantially uniform.
pressure may be exerted by both ends of the impression roller on the web to be printed, despite the tendency of the impression roller to give non-uniform pressure due to the length of shaft extending from one end of the fractional width roller.

With the printing press of the type defined, the web break, thus necessitating complete re-threading of the new web, or should it be necessary for any other reason to move back the back-up cylinder and the impression roller from the printing cylinder, the previous adjustments made for correct printing pressure for the particular intaglio cylinder used would have to be again obtained when the roller and cylinders are once more placed in operative position.

In accordance with the present embodiment, means are also provided to accurately indicate and measure the position of the center of the back-up cylinder with respect to the impression roller and the printing cylinder, so that once the correct pressure has been obtained for any work being done on the printing press, this same setting may be referred to after the back-up cylinder has been raised out of position whereby the correct printing pressure may be established before beginning the next operation again in operation.

Also, either one or the other end of the impression roller may be held to limit its relative movement with reference to the back-up cylinder, so that the weight of the overhanging impression roller shaft will be prevented from influencing the printing pressure when fractional width rollers are used.

If desired, limiting means for both the upward and downward movements of the back-up cylinder and impression roller may be provided, so that the actuating means, such as the motor means, will be automatically stopped when the roller and cylinder are in proper printing position or are in proper withdrawn position and it may further be provided to prevent downward movement of the back-up cylinder and impression roller by the motor, in case the pressure between the impression roller and the printing cylinder becomes excessive, such as might result from the use of too large an impression roller for the work, or from improper setting of parts of the press.

The back-up cylinder is preferably mounted in a supporting frame which is adapted to be vertically movable and the impression roller is mounted in pivoted arms attached to said frame, provided on the frame for limiting downward movement of the said arms with relation thereto, so as to prevent the impression roller being forced into too close contact with the surface of the printing cylinder, which would result in injury thereof.

In this embodiment of the invention the impression roller, back-up cylinder and printing cylinder have their axes in substantially the same vertical plane. The printing cylinder is driven and the impression roller and back-up cylinder are rotated by contact with each other and the web. The impression roller is mounted in pivoted arms, which in turn are mounted on vertically movable blocks sliding in guideways in the press frame, and these blocks carry stops which limit movement of the arms and thereby limit the downward movement of the impression roller and may also serve to hold either end of the impression roller at a fixed point. These vertically movable blocks carry the back-up cylinder by means of self-aligning bearings, and the back-up cylinder is preferably of relatively heavy construction. Extending upwardly from the blocks are threaded shafts threaded into a sleeve which is slidably splined to a worm that the sleeve may move upwardly beyond the gear. Pressing against the upper portion of each sleeve is a relatively heavy spring which applies its force to the back-up cylinder through the sleeve, the downward movement of the sleeve and cylinder being limited by the worm gear. Motor means and manual means are provided for rotating the worm gears to raise and lower the back-up cylinder and these motor means may be selectively coupled to either or both of the worm gears so that the ends of the back-up cylinder may be raised either an equal or an unequal amount.

A member extends from one block and contacts with a fixed indicator of the micrometer type so as to show the position of the back-up cylinder with reference to the printing cylinder, and thereby give an accurate micrometric indication of their relative position and the printing pressure produced thereby, as well as the degree of compression of the impression roller.

Limit switches are provided for controlling the motor action. One of these limit switches may prevent the backing cylinder being raised too far. Another limit switch prevents movement of the backing cylinder and impression roller too low a position, and this may include a micro-switch which will automatically stop the motor at the right point in the downward travel of the back-up cylinder and impression roller. Another limit switch is provided which is adapted to open the motor circuit when the impression springs are too highly compressed, thus guarding against the operator lowering the impression roller with a large roller in place at the time when the machine is adjusted for using a smaller roller.

The limited relative movement between the impression and back-up cylinder holds the roller out of contact with the printing cylinder as the back-up cylinder is raised, and also provides a space between the impression roller and back-up cylinder for paper in case a web break causes the web to wrap around the impression roller, at which time the back-up roller and back-up cylinder may move upwardly and away from their normal position against the compression of the heavy springs normally holding the back-up cylinder seated.

According to the present invention, the printing pressure is exerted solely by the weight of the back-up cylinder and impression roller through the compression of the resiliently covered impression roller, and the possible downward movement of the back-up cylinder will be limited by the sleeves and worm gears. Thus, when printing from fractional width rolls, the downward movement of the back-up cylinder will be limited and only a certain maximum pressure can be exerted although the back-up cylinder contacts with an impression roller only for a portion of its length, and the impression roller is positioned adjacent one end of the back-up cylinder. In such a case, one end of the impression roller shaft would be fixed and on the other end would be free to rise and fall with variations in pressure.

It will be understood that the foregoing general description and the following detailed description as well are exemplary and explanatory of the invention but are not restrictive thereof.

Referring now in detail to the illustrative em-
bodiment of the invention as shown in the accompanying drawings, there is provided the conventional rotatable driven intaglio or rotary photogravure printing cylinder 20, journaled in the side frames 21 and 22 and adapted to be driven in the conventional manner. Immediately above the cylinder 20 is mounted a resilient impression roller 24, and immediately above the impression roller is a rotatable thrust bearing 25, which is also mounted on a stub 10 projecting downwardly from the cap 77 which is bolted to the upper cross member 78 of the frame, closing the aperture 79 within which is the spring 70 and cylinder 25. The aperture seat 72 is supported on a shoulder 80 of the collar 81, which is slitt at 82 and may be tightened by screw 83 to securely clamp the lower end of the hollow cylinder 73. The collar 81 is internally threaded and is fitted to the threaded exterior of the bell 88. Bell 88 is enlarged toward its lower end and receives the ball thrust bearing 85 which is also supported on a cylinder 87 near the upper ends of the sleeve 82, and thereby the force of the spring 70, reacting against the cross member 78, is applied to the screw 58 through sleeve 52, ball bearing 56, collar 81 and collar 81. By rotating collar 81 with reference to the bell 85, the compression of spring 70 may be varied to vary the printing pressure, and means are provided for facilitating this relative movement comprising the sockets 90 to receive a turning bar, and key 91 which holds the bell 88 against rotation with respect to the cylindrical housing 93 bolted to the upper surface of the support 59. Suitable lubricating means 95 are provided for the engaging thread portions of the members 81 and 99.

The interior of the bell 85, the seat 72 and the spring 70 are preferably cylindrical, and slightly larger than the threaded end of the rod 50, so that the rod may telescope into the spring.

The interior of the support 99 within which is mounted the gear hub 54, the sleeve 52 and their associated parts, is preferably closed by means of the web 97, so that these parts may be run in oil, and suitable oil retainer rings 98 are provided to prevent leakage of oil down the rod 50. In order to further guard against the dripping of oil on the pressure cylinder 25, an accordion-pleated boot 100 surrounds the rod 50 and is attached to the member 58 by plate 101, and to the member 25 by plate 102.

As shown in Figure 3, the spring construction and means for vertically moving the bearing block 27 and the cylinder end is duplicated at each end of the press, and by this means the pressure on the two ends may be independently varied if desired.

Means are provided for raising, lowering and supporting the pressure cylinder 25, and as embodied, these means comprise motor-driven screw means mounted in an upper part of the side frames 21 and 22. A vertically extending rod 59 has its lower end securely fastened in a recess in the upper part of bearing block 27 by means of the blocks 51, and the upper end of this rod is threaded and passes through the correspondingly threaded sleeve 52. Sleeve 52 is provided with a shoulder 53 by which it, the rod 59, and cylinder 25 are supported on the upper face of hub 54, this hub being rotatably mounted by means of ball bearings 58 which are supported in members 57 and 60 bolted to the upper and lower faces, respectively, of supports 59. Supports 59 are positioned between the spaced-apart vertical members of the side frame, and rest upon shoulders 60 formed at the upper part of the guiding edges 40. Thus, the cylinder 25 is positively raised to the desired position through the turning of sleeve 52 which remains at its constant elevation. Sleeve 52 is provided with a vertical key 63 running in a keyway 64 on the inside of the hub 54, thereby permitting the sleeve 52 to move upwardly and away from the hub 54 when this is required by the operation of the press.

Means are provided for resiliently opposing movement of the cylinder 25 away from its printing position to prevent damage when a web break occurs, and for this purpose a relatively heavy, helically coiled spring 70 is compressed and exerts its force downwardly upon the upper portion of the screw rod 59. Spring 70 is seated on the aperture seat 72 upon the apertured seat 72, and is encased within the hollow cylinder 73 which slides over the seat 71. Seat 71 retains a ball thrust bearing 78 which is also mounted on a stub 10 projecting downwardly from the cap 77 which is bolted to the upper cross member 78 of the frame, closing the aperture 79 within which is the spring 70 and cylinder 25.
other clutch member comprises a sleeve 130 slidably splined on sleeve 122 and resiliently moved into clutch engaging position by means of the compression spring 131. This clutch may be disengaged by movement of the collar 133 to the right (Figure 4) so as to compress spring 131 and thereby move the clutch sleeve 130 out of mesh with the clutch member 125.

At the other end of the press, these means are duplicated for raising and lowering the screw rod 50, but the clutch at that end is disengaged by being moved to the left rather than the right.

Means are provided for selectively disengaging either of the two clutching members, and as embodied, a rod 135 extends from one side of the press to the other, being slidably mounted in suitable bearings formed in the cross bars 137, supported between the frame members. On this rod are clamped brackets 140 which support the collars 133, and a handle 142 pivoted at 143 and pivotally connected to the rod 135 by pivot pin 144 serves to move the rod towards one end or the other of the press. By moving the rod to the right (Figure 3), the left-hand clutch is disengaged and only the right-hand end of the cylinder will be raised or lowered, while by moving the rod to the left, only the left-hand end of the cylinder will be raised or lowered. In its normal position and as shown, both ends of the cylinder 20 will be raised or lowered simultaneously and at an equal amount.

Motor 114 is connected for driving shaft 110 at a reduced speed. Motor 114 is shown as suspended from one of the cross ribs 150 and has mounted on its shaft end a pinion 151 meshing with the gear 152 which is rotatably mounted by and keyed to shaft 110, a hanger 154 being suspended from cross-rib 155 for the support of the central portion of the shaft 110 and the rod 135.

The motor operation of the shaft 110 is similar to the manual operation previously described. As is customary in rotary photographe presses, the pressure cylinder 25 does not press the paper directly against the printing cylinder 20, but acts through the intermediate impression roller 24 which may be supported in vertical alignment with the cylinder 20 and 28. The roller 24 is preferably resilient and is generally formed as a rubber-covered roller, the rubber covering serving to prevent the paper between it and the cylinder 20 into the cellular interlaced portions on the surface of the cylinder 20. As embodied, the impression roller 24 is rotatably mounted in pivoted arms which are supported from the vertically movable bearing block 27, and thus the impression roller is free to move up and down to a limited extent, as it is squeezed between the cylinders 28 and 29.

Roller 24 is preferably water-cooled to improve the quality of printing, as well as the life of the roller. As embodied, the roller comprises a resilient covering 160 mounted on a tubular steel core 161 which is shrinked onto the inserted roller ends 162. The roller ends 162 have an outward portion of reduced diameter to receive the inner race of ball bearing 163 which fits against the shoulder 164, the bearing being concentric with the roller by means of the tapered and slotted sleeve 166 and the threaded sleeve 167. These sleeves being forced inwardly by means of the cap 168 which is held to the shaft end by means of screws 170 threaded into the roller end.

Cooling water is introduced into the interior of the core 161 through the shaft end 162 by means of a packed joint which comprises a tube fitted within a bore in the roller end 162 and rotatable with respect thereto. This joint is packed by means of the packing 173 which is compressed by means of the sleeve 174 forced inwardly by the screws 175 which are threaded into the shaft end 162. The outer end of the tube 172 is angled and connects with a flexible hose through which cooling water is supplied.

The construction of the other end of the roller may be a duplicate of that shown in Figure 7, but the flow of water is opposite at the two ends of the roller.

Means are provided for rotatably supporting the roller 24, and as embodied these means comprise a pair of arms 180, one at each end of the roller 24, pivoted by means of the pivot pins 181 which are supported in a bracket 182 depending from the bearing block 27. These arms extend from one side of the bearing block to a point directly beneath the cylinder 25, and are there shaped to receive and clamp the ball bearing 183.

This clamp comprises a semi-cylindrical socket 184 provided with a recess for receiving the outer race of the bearing, and another semi-cylindrical socket member 185 pivoted at 186 to the first socket member. A boss 187 projects from the member 186 and extends towards the pivot pin 181 and is recessed at 188 to receive the end of the clamping bolt 189 which is threadedly mounted in eye 191 formed as an extension of the pivot pin 181. The clamping bolt 189 exerts a pressure radially from pivot pin 181, and therefore clamps the socket member 185 to the member 186 to hold the bearing 183 in place, as shown in Figure 5.

Member 184 is provided with an inwardly offset portion 190 which is slotted to form guideways 191 between which the angled end of the water tube 172 may be positioned and held against rotation.

Means are also provided for limiting the relative movement in a vertical direction between the roller 24 and the cylinder 25, these means also serving to prevent the pivoted arms 180 and the socket members 184 to the member 1864 to hold the bearing 183 in place, as shown in Figure 5. Member 184 is provided with an inwardly offset portion 190 which is slotted to form guideways 191 between which the angled end of the water tube 172 may be positioned and held against rotation.
position, the rails 202 and 203 form a track for the grooved portion 219 of the roller end cap 200, so that the possibility of the roller running off the rails 202 and 203 is substantially eliminated.

Means are also provided for removing from the press any water which may leak through the packed joints at the ends of the roller, and for this purpose, the end cap 200 projects into a chamber 216 formed on one part of the members 184, and this chamber 216 slopes towards an aperture to which is connected the flexible drain hose 214.

Motor control means are provided for controlling the operation of the motor so as to automatically stop the movement of the cylinder raising and lowering means when it has reached a predetermined point in its upward or downward travel, thereby preventing injury to the mechanism and cylinders. As embodied, there is provided a limit switch 220, mounted on the side frame 22, and this switch is provided with a laterally projecting arm 206 which is adapted to be engaged and moved to switch-opening position by abutment 201 on edge of block 27 when the cylinder 20 and its supporting block 27 have been sufficiently raised.

A similar limit switch 220 provided with a laterally projecting arm 221 is mounted below the switch 220 and is adapted to be engaged by the vertically movable abutment on the block 27 to limit the downward movement of the cylinder and thereby prevent the block 27 and cylinder 25 from being lowered too low and into a position where the cylinder 20 might be damaged. Abutment 222 is vertically adjustable with reference to the block 27 to accommodate different sizes of cylinders.

In addition to the two foregoing limit switches which limit the movement of the bearing block 27 and cylinder 25 with reference to the machine frame, there is provided a further limit switch which limits the movement of the cylinder 25 with reference to the cylinder 20 and roller 24 and thereby prevents the building up of an excessive impression pressure, as well as permits the automatic return of the cylinder 25 and roller 24 to proper position after they have been raised. In other words, the downward movement of the cylinder 25 and its supported roller 24 is limited when the spring 72 has been compressed a predetermined amount corresponding to the predetermined proper printing pressure between the impression roller 24 and the rotary photogravure cylinder 20.

As embodied (Figs. 1, 2 and 8) it is provided a finger 230 to contact with the under face of collar 89 and it is pivotally mounted on a bracket 231 projecting laterally from the housing 23, and this finger is connected with an arm 234 which is connected with a bell crank 232 pivotally mounted on the fixed web 91 at bracket 235 by means of link 236 and is resiliently pressed upwardly by means of the tension spring 238.

The lower leg of bell crank 232 is formed as a pointer 237 which travels over a scale 239 to give the operator an indication of the spring compression which creates the printing pressure, and an arm 240 is mounted coaxially with the bell crank 202, and is connected thereto by the arcuate slot 241 and screw 242 so as to permit relative movement between the arm 240 and bell crank 232. Arm 240 is provided with a laterally projecting lug 244 which is adapted to contact with and move the plunger 246 of the micro-limit switch 247 mounted on one side of the scale 239, this switch also serving to interrupt the power circuit supplying motor 114.

Thus, the motor 114 causes the cylinder 25 and roller 24 to be lowered. In case the roller 24 is not in place, or the cylinder 20 has been removed, limit switch 220 will stop the downward movement in the position shown in Fig. 1, but if both the cylinder 20 and roller 24 are in place, the roller 24 is squeezed between the cylinders 20 and 25 by the weight of the cylinder 25 causing a corresponding movement of the finger 230 and pointer 237. If the pressure is in excess of the predetermined printing pressure, lug 244 moves the switch plunger 246 to circuit opening position causing the power to be discontinued to motor 114 and thereby preventing damage to the mechanism.

Means are also provided for visually indicating to the operator the exact control position of the pressure cylinder 25, and for this purpose a dial micrometer 249 (Figs. 1 and 9) of conventional construction is mounted on the side frame 21 by means of bracket 250. A slidable bracket 251, vertically positionable the block 27 and guided by a slot 252 is provided on the underside of the cylinder 25 which is held in desired position by means of the screw 254, is provided with a laterally projecting arm 256 and an outwardly projecting shaft 258. Arm 257 is rotatably journalled on shaft 258 and is urged in a counterclockwise direction by means of the helical spring 259. Its movement being limited by means of the knurled screw 260 which projects through and is threaded in an aperture at the end of arm 257 and contacts with a pad 261 formed at the end of arm 256, while arm 257 is also provided with a pad 263 to contact with the sensitive point 264 of the micrometer 249. When the correct printing position has once been determined, the screw 260 may be turned to produce a zero reading of the micrometer, and thereafter the operator can determine by inspection of the micrometer any deviation from this normal and correct position for the cylinder 25 and block 27.

The operation of the illustrative embodiment previously described will be apparent from the detailed description thereof, but may be summarized as follows:

With the entire mechanism off the impression, spring 70 is compressed to a point where its total load is slightly greater than the maximum impression pressure which will be used. When this occurs, the back-up cylinder and its supporting mechanism are moved downward and the downward load is carried by sleeve 52 resting on the upper shoulder of the worm gear at 53.

To set up a four-page wide roll on impression, the roller is positioned into its socket and is adjusted on both ends by means of adjusting nuts 198 until there is approximately ½ inch space between the rubber roller and the back-up cylinder. The entire mechanism is then lowered until the rubber roller contacts the printing cylinder by which it is supported, and the ½ inch clearance between the rubber roller and the back-up drum has just been taken up. The pointer on the dial 249 is then set to zero by means of adjusting screw 260 and 264. The backing roll is then lowered through its mechanism until the correct reading is obtained on the dial indicator. This being the proper impression, when setting the four-page wide roll, the lower limit switch 220 is then set to stop the mechanism in its downward motion at this point. Should the web break and wrap around the rubber roller, the impres-
sion roll can move upwards as soon as the combined pressure of the rubber and the paper becomes equal to and greater than the load on spring 76, since the sleeve 52 is free to slide vertically in worm gear 115 and since 3/4 inch space was originally allowed in the setting between the rubber roll and the back-up roll. During the printing process, however, spring load is taken on lip 53 and, consequently, the full weight of the back-up roller is never exerted on the rubber roll and printing cylinder. To set a one page wide rubber roll when the rubber is on the outside page: The backing roll and rubber roll are moved off impression. Then the rubber roll is set in its sockets and both ends are brought up by means of adjusting screws or nuts 196 until the rubber roll is tangent to the backing roll on both ends. Then the side on which the rubber roller lies is lowered about 1/8 inch. The entire device is then lowered until the rubber contacts the printing cylinder and the back-up drum just contacts the top of the rubber roll in which position the dial indicator is set to zero. The mechanism is then lowered until the proper reading is obtained on the dial indicator, and the lower limit switch then sets. In this way, the unbalanced weight of the paper stock is supported on the extreme end by the adjusting nuts 196 while that bearing on the stock nearest the rubber itself is free to swing a distance of 1/8 inch away from the back-up roller. Figures 11 and 12 illustrate a modified embodiment of the present invention and, as shown, the parts are generally similar to those of Figures 1 to 10. However, and as shown structurally in Figure 11 and diagrammatically in Figure 12, the back-up cylinder 25, the impression roller 24 and the intaglio printing cylinder 20 are not in the same vertical plane, but the axis of the impression roller 24 lies ahead of the plane connecting the axes of cylinders 20 and 25, that is, the point of impression, which is the point at which the paper is pressed against the intaglio cylinder 20, is beyond the plane passing through the axes of cylinders 20 and 25.

In the past, it has been customary to have the back-up cylinder, impression roller and printing cylinder vertically aligned, with all of their axes in a common plane, as shown in Figure 2A, or in those cases the impression roller has been placed as shown in Figure 13, with its axis lying in advance of the plane connecting the axes of cylinders 20 and 25. In either of these cases, however, the impression roller 24 tends to move back and forth in an amount determined by the play in the impression roller bearings, thereby resulting in poor quality printing. When the roller is placed as shown in Figure 13, the roller is constantly being driven from the cylinder 20, and is urged into the narrowing space between the cylinders 20 and 25, but due to its resilient covering, the roller moves back and forth and its compression between cylinders 20 and 25 under the driving torque transmitted to it by the cylinder 20 is balanced against the bearings for the roller. This balancing action causes the roller to vibrate in a horizontal plane and the pressure exerted on the naps is never constant. When the roller is positioned as shown in Figure 2A, it is compressed between the cylinders 20 and 25 where they are closest together, and it vibrates similarly tending to move to one side or the other, but always being restrained towards a central position by its support and bearings. However, by placing the roller axis as shown in Figures 11 and 12, the driving torque and roller compression act in a single direction and tend to press the roller against the bearings for the roller, thereby holding the roller in a constant position, and producing a constant 3/4 inch pressure between the roller and printing cylinder.

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

What I claim is:
1. In a rotary photogravure printing press an impression roller, a pressure cylinder, means for rotatably supporting said cylinder, pivotally mounted means radially movable with respect to said cylinder for rotatably supporting said roller whereby the roller may move toward and from said cylinder and angularly thereof, and an outwardly extending trackway to receive and support the roller while it is moved to and from its other support.

2. In a rotary photogravure printing press an impression roller, a rotatable pressure cylinder, means for positively limiting downward movement of the cylinder, means comprising a resiliently supporting upward movement of the cylinder, and motor operated means for selectively raising or lowering either or both ends of the cylinder. A rotary photogravure printing press comprises a pair of pressure frames having guideways, a bearing support vertically movable in each guideway, springs forcing the supports downwardly, a pressure cylinder rotatably mounted in said bearing support, an angularly movable impression roller mounted beneath said cylinder and normally held parallel therewith, means for angularly moving the impression roller relative to the cylinder and means for variably positioning said cylinder.

4. In a rotary photogravure printing press a pair of press frames having guideways, one frame at either side of the press, a slidable bearing block in each guideway, a bearing support mounted on said bearing block, and means controlled by the pressure indicator for operating the limit switch on too great pressure between the pressure and printing cylinders.

5. In a rotary photogravure printing press a pair of press frames having guideways, one frame at either side of the press, a slidable bearing block in each guideway, a bearing support mounted on said bearing block, a spring means for applying a resilient force to said cylinder and roller, a limit switch, a pressure indicator, and means controlled by the pressure indicator for operating the limit switch on too great pressure between the pressure and printing cylinders.

6. In a rotary photogravure printing press, the combination of a printing cylinder and
pressure cylinder, vertically movable bearing blocks in which the pressure cylinder is rotatably supported, means for positively limiting downward movement of the cylinder, means for independently raising and lowering the pressure cylinder towards the printing cylinder, and means for independently varying the limiting means and the pressing means at the ends of the cylinder.

In a rotary printing press, a pressure cylinder, means for raising and lowering the cylinder by its ends, a motor, clutches connecting the motor with the raising and lowering means, and manually operable means for selectively disengaging either clutch.

In a rotary printing press, a pressure cylinder, screw means for vertically moving the cylinder by its ends, a motor, clutches connecting the motor with the screw means, and a manual means common to the clutches for selectively disengaging either clutch.

In a rotary photogravure printing press, the combination of a pressure cylinder, means for rotatably supporting the cylinder by its ends, screw means attached to the supports, a threaded sleeve on each screw, a gear held against axial movement and slidably keyed to the sleeve, means for limiting movement in one direction between the sleeve and gear, and a compression spring resiliently pressing on each of said sleeves.

In a rotary photogravure printing press, the combination of a pressure cylinder, means for rotatably supporting the cylinder by its ends, screw means attached to the supports, a threaded sleeve on each screw, a gear held against axial movement and slidably keyed to the sleeve, means for limiting movement in one direction between the sleeve and gear, a compression spring resiliently pressing on each of said sleeves, and means for varying the compression of the springs independently of said screw means.

A rotary photogravure printing press including in combination a rotatably mounted photogravure printing cylinder, a rotatably mounted, vertically movable back-up cylinder, a rotatable impression roller compressed between the cylinders, stops limiting the downward movement of the back-up cylinder and springs for holding the back-up cylinder against its stops, said springs serving to allow upward movement of the roller and back-up cylinder in case a web wraps around the roller.

A rotary photogravure printing press including in combination a rotatably mounted photogravure printing cylinder, a rotatably mounted, vertically movable back-up cylinder, a rotatable impression roller compressed between the cylinders, means for independently raising and lowering the cylinder, variably positionable stops limiting the downward movement of the back-up cylinder and springs for holding the back-up cylinder against its stops, said springs being movable with the limiting means whereby movement of the limiting means does not vary the compression of the springs.

A rotary photogravure printing press including in combination a rotatably mounted photogravure printing cylinder, a rotatably mounted, vertically movable back-up cylinder, a fractional width rotatable impression roller compressed between the cylinders, means for supporting the roller adjacent to the back-up cylinder with one end of the roller in contact with the back-up cylinder, and means for limiting movement of the back-up cylinder towards the printing cylinder.

A rotary photogravure printing press including in combination a rotatably mounted photogravure printing cylinder, a rotatably mounted, vertically movable back-up cylinder, a fractional width rotatable impression roller compressed between the cylinders, means for supporting the roller adjacent to the back-up cylinder with one end of the roller in contact with the back-up cylinder, means for limiting movement of the back-up cylinder towards the printing cylinder, and spring means opposing movement of the back-up cylinder with reference to its limiting means.

A rotary photogravure printing press including in combination a rotatably mounted photogravure printing cylinder, a rotatably mounted, vertically movable back-up cylinder, a fractional width rotatable impression roller compressed between the cylinders, means for supporting the roller adjacent to the back-up cylinder with one end of the roller in contact with the back-up cylinder, means for variably limiting movement of the back-up cylinder towards the printing cylinder, said roller supporting means permitting the roller to be compressed towards the back-up cylinder.

CURTIS S. CRAFTS.