Jan. 30, 1968 C. J. HERMACH ET AL 3,366,047

SKEWING ARRANGEMENT FOR PLATE CYLINDER AND FORM ROLLERS IN PRINTING PRESS

Filed Feb. 23, 1967 3 Sheets-Sheet 1

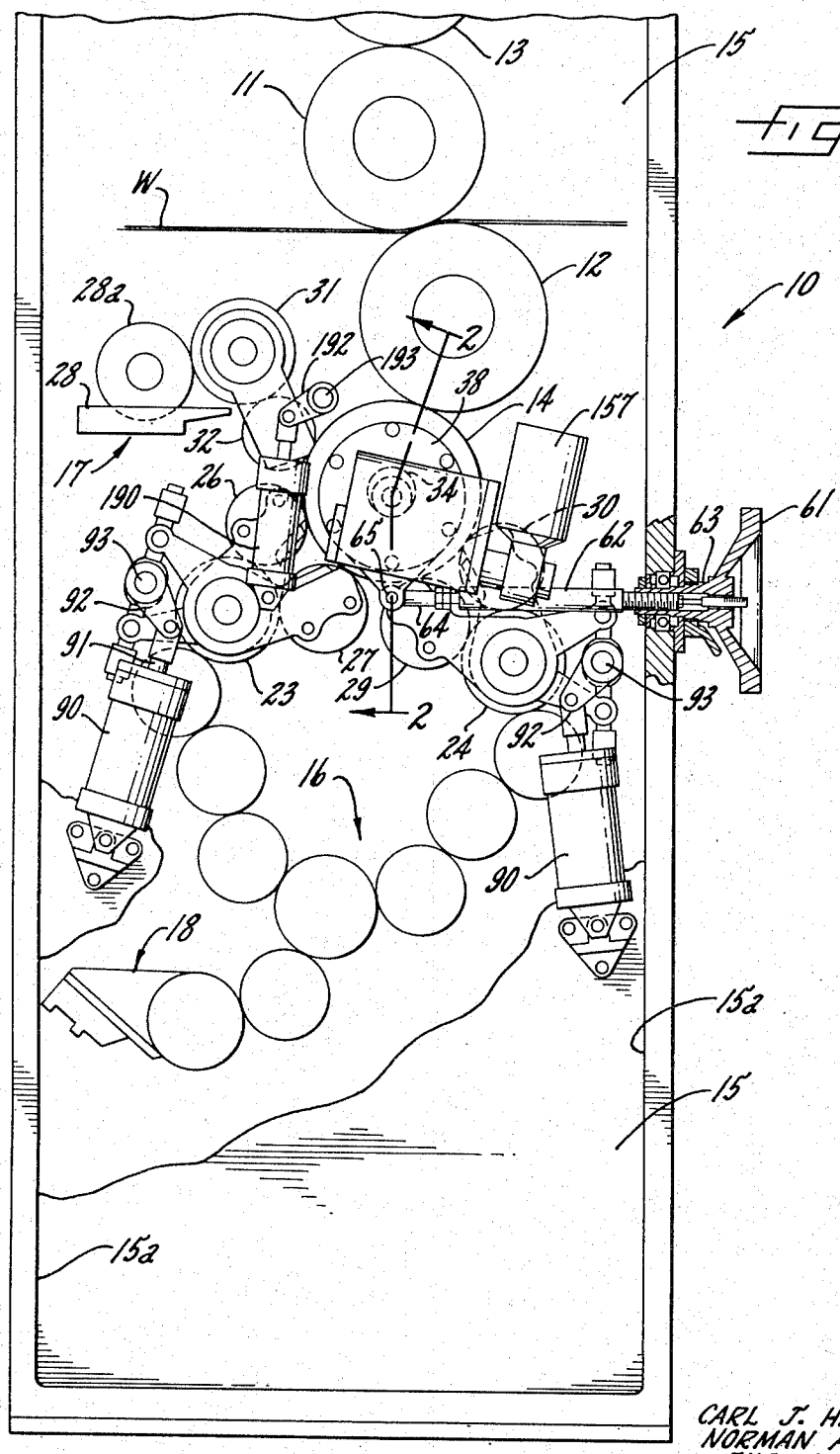


Fig. 1.

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Filed Feb. 23, 1967 3 Sheets-Sheet 2

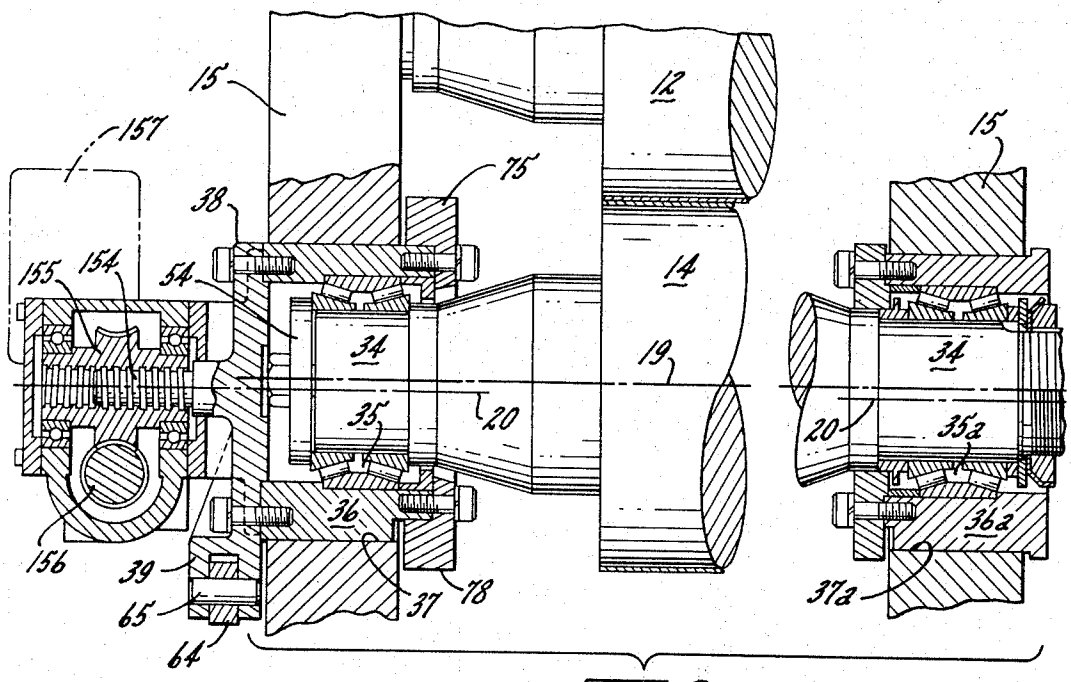


Fig. 2.

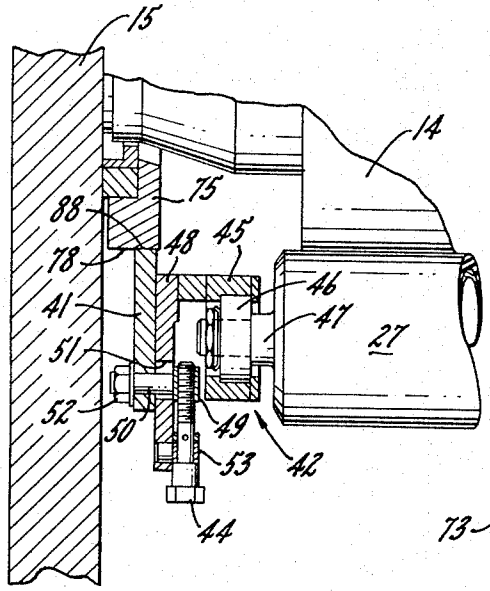


Fig. 4.

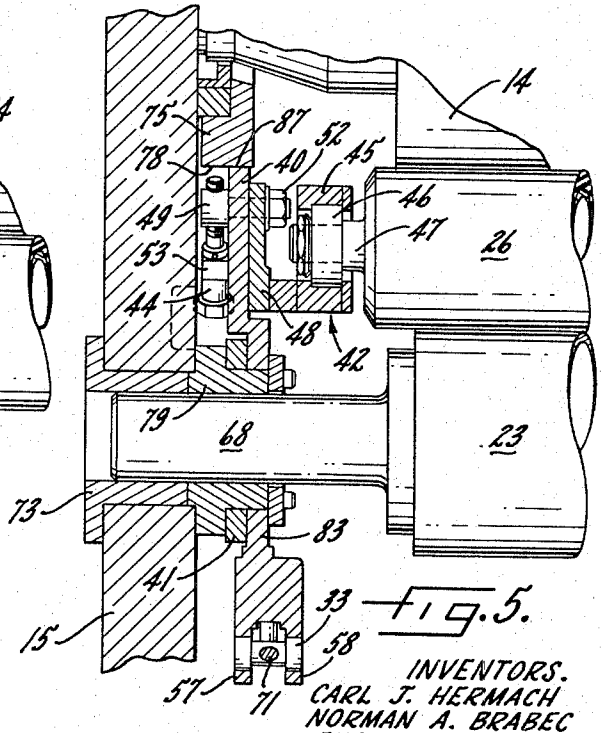


Fig. 5.

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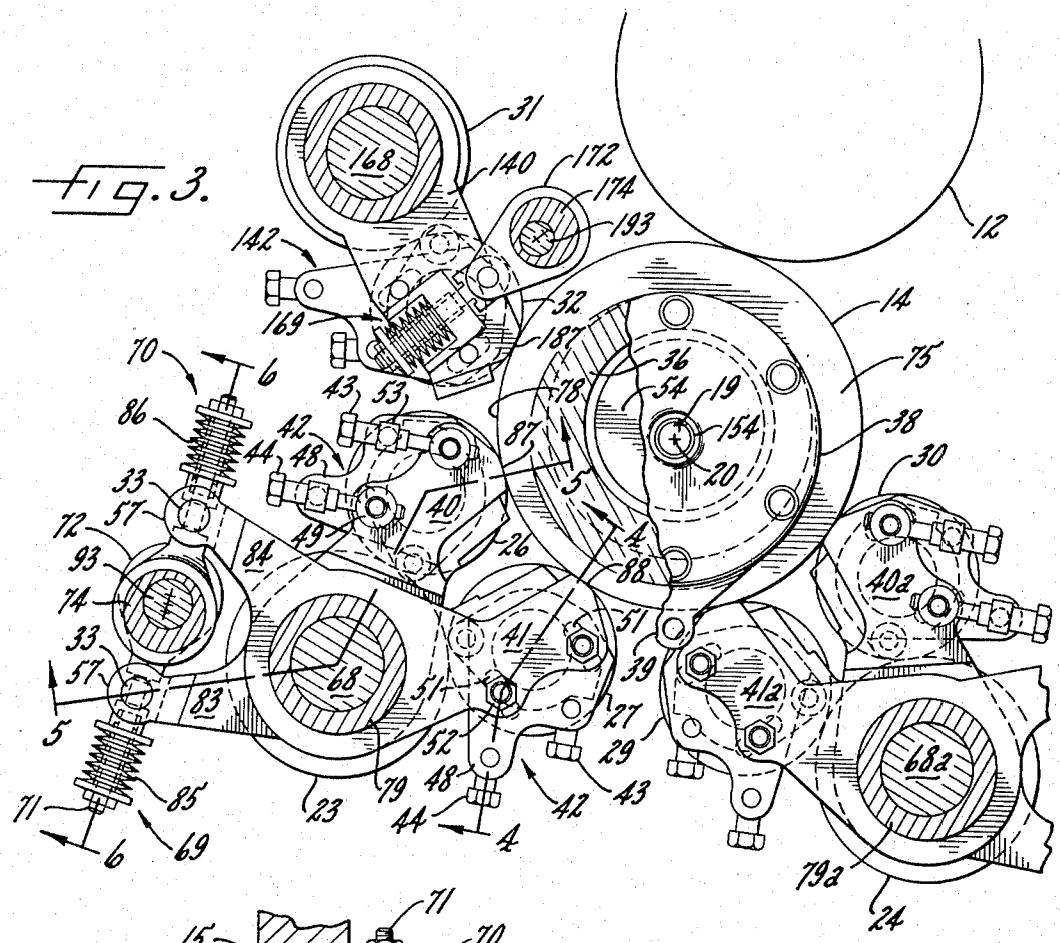
Fig. 3.



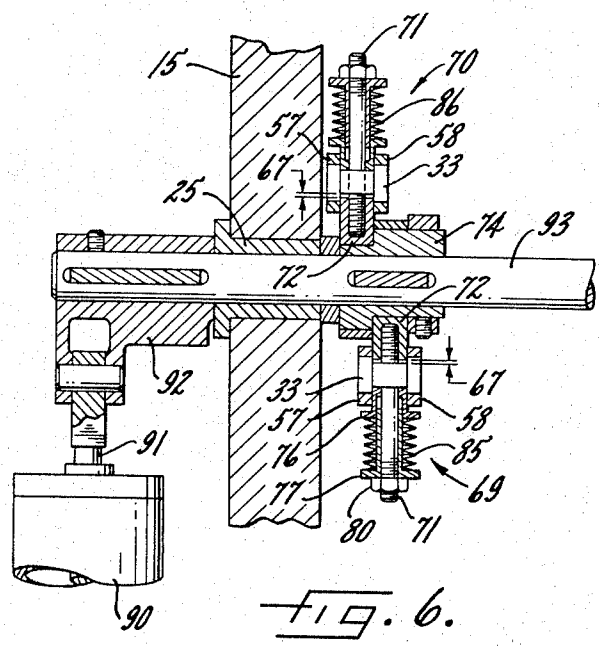




Fig. 6.

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3,366,047

# SKEWING ARRANGEMENT FOR PLATE CYLINDER AND FORM ROLLERS IN PRINTING PRESS

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9 Claims. (Cl. 101—216)

## ABSTRACT OF THE DISCLOSURE

A printing press having a plate cylinder which is mounted for slight skewing movement relative to the web to obtain register between successive printed impressions and which has provisions for automatically maintaining the associated form rollers in proper rolling engagement with the plates and ink drum over the range of skew adjustment.

For precise register of an impression relative to other impressions already on the web or to impressions to be subsequently impressed on the web, provision is often made for cocking or skewing the axis of the plate cylinder relative to the web while the press is in operation. To assure the even distribution of ink and water to the plate cylinder in its shifted position, the ink and water form rollers engaging the plate cylinder must be correspondingly skewed to maintain their alinement and contact pressure with the plate cylinder.

Typically, the ink and water form rollers in such a press are subjected to "throw-off" whereby the form rollers are moved to a position spaced from the periphery of the plate cylinder. It is desirable that these form rollers subsequently return to the same precise relationship with the plate cylinder regardless of its condition of skew in order to provide uniform and even distribution of water and ink. While complex linkages may be employed between the form rollers and the plate cylinder to aline the same after skewing the plate cylinder, it will be appreciated that such complex linkages and other mechanisms having delicate adjustments may in time develop a looseness or a play due to wear and vibration and thereby may not achieve the desired contact between the form rollers and the plate cylinder.

Accordingly, a general object of the present invention is to provide a mounting arrangement for a plate cylinder and associated form rollers in a printing press which is economical in construction and which assures more accurate and reproducible positioning of a form roller than has been afforded by prior mounting arrangements.

Another object of the invention is to provide a mounting arrangement of the above type which is capable of accurate and consistent operation over a long period of time and which avoids complicated linkages that may, as a result of useage, develop looseness or play.

A more specific object of the invention is to mount the form rollers on mounting plates biased against a reference ring coupled to the plate cylinder so that the form rollers follow the skewing movement of the plate cylinder and maintain an even and parallel relationship with the printing cylinder in all of its possible positions of adjustment.

A further object of the invention is to provide a mechanism in such a press capable of automatic return of a form roller to an unaltered relationship with a skewed plate cylinder following throw-off.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:



FIGURE 1 is a fragmentary elevational view, somewhat diagrammatic, of a printing press for carrying out the invention;

FIG. 2 is an enlarged, fragmentary setcional view taken along the line 2—2 of FIG. 1 in the direction of the arrows and showing the mounting of the opposite end of the plate cylinder in the frame of the press;

FIG. 3 is a fragmentary sectional view of a side elevation of the printing press, with the side frame removed and with portions broken away to show the relationship of the various form rollers with the printing plate cylinder;

FIG. 4 is a partial sectional view taken along the line 4—4 of FIG. 3 showing the mounting of an ink form roller as related to a ring carried by the plate cylinder;

FIG. 5 is a partial sectional view taken along the line 5—5 of FIG. 3 and showing the relationship of the form roller to an ink drum and its mounting plate;

FIG. 6 is a partial sectional view taken along the line 6—6 of FIG. 3 and showing the connection of a throw-off cylinder and the mounting plate for the ink form rollers.

While the invention is susceptible to various modifications and alternative constructions, the preferred embodiment of the invention is shown in the drawings and described in detail hereinafter. It is to be understood, however, that the present invention is not limited to such a disclosure, but aims to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The invention will be shown and described as used on units of offset printing presses of the perfecting type. The paper web runs between two co-acting blanket cylinders, and the ink impression or image carried on either cylinder is imprinted simultaneously on both sides of the web. Presses for printing a high quality product of several colors, may consist of several units in a line with the web running consecutively through each unit which applies a specific color thereon. It is necessary for the imprint of each color to be placed on the web precisely in register with the imprints of other colors, so that the final product will be a sharp and true reproduction of the original copy. It sometimes happens that errors are made in preparing or mounting the printing plate or that the cylinders of successive press units are not precisely parallel. When a cylinder is adjusted to compensate it affects the relationship of the associated members which must be correspondingly adjusted to maintain the proper cooperative relationship between them.

FIG. 1 of the drawings illustrates diagrammatically the structure used in practicing the invention as embodied in the lower half of a unit of a press **10** in which both sides of a web are printed simultaneously. The web W passes between blanket cylinders **11** and **12** which apply the ink images to the web. The blanket cylinders run in contact with the plate cylinders **13**, **14** and receive the inked images from plates held on the plate cylinders by suitable grippers. The plates are moistened and then a film of ink of desired color is applied to the receptive areas in accordance with the usual practice followed in offset printing. A pair of side frames **15**, provides support for the various elements in proper relation to carry out the printing operation or to perform other functions which will be described in the following paragraphs. Flange members **15***a* formed at right angles to the side frames provide structural reinforcement.

Ink is supplied by an ink fountain, designated generally as **18**, from which it is dispensed in regulated amount to a series of rollers designated generally at **16**, which transfer the ink to ink drums **23**, **24**. Form rollers **26**, **27**, **29**, **30** are interposed between drums **23**, **24** and plate cylinders **14**, and are adjusted to uniform longitudinal contact and desired pressure for application of ink to the printing plate. A special mounting is pro-

vided for the ink form rollers and it is this mounting which comprises part of the invention for maintaining alinement of these rollers with the plate cylinder.

To dampen the surface of the plate before the ink is applied to it a moistening arrangement, shown generally at **17** is used, including a shallow pan or mountain **28** and a fountain roller **28***a*. The roller transfers moisture to drum **31** which in turn contacts form roller **32** which rolls on the the surface of the plate. It is important that the liquid be applied uniformly over the entire surface of the printing plate and consequently form roller **32** is adjustably mounted so that it can be set against the plate with uniform longitudinal contact at desired pressure. The mounting which will be described includes means for maintaining alinement of the axis of the form roller with the axis of the plate cylinder.

It is customary practice in a design of offset printing units of the type disclosed herein, to mount both ends of the plate cylinder and blanket cylinder in the side frames in eccentric bushings. The purpose is to provide the adjustability needed to accurately aline the axes of these cylinders with other members of the press and further to provide "throw-off" so that printing plates or blankets can be changed. Such type of mounting, well known in the art, permits adjustment of the plate cylinder when the printed image is out of register by a small fraction of an inch. Such adjustment may be adequate to produce necessary registration without the burdensome task of correcting the position of the plate on the cylinder and may be done during operation of the press so that results can be immediately observed by inspection of the image printed on the web.

When necessary, adjustment for such registration is obtained by a slight rotation of the eccentric mounting at one end of the plate cylinder so that its axis, shown at **19** in FIG. 2, is slightly cocked or skewed. The supporting shaft or journal **34** for plate cylinder **14** is rotatably supported by a bearing **35**, which is mounted in a sleeve or bushing **36** received in a bore **37** in side frame **15** for limited rocking movement. As shown in FIG. 2, the bore of bushing **36** is eccentric to its outer surface so that axis **19** of plate cylinder **14** is slightly offset from the center **20** of bore **37**. Thus the axis **19** is positionable in an arc about center **20** when sleeve **36** is rotated. Circular plate **54** bolted to the end of shaft **34** serves as a retainer for bearing **35**.

The mounting for the journal on the opposite end of cylinder **14** is also shown in FIG. 2, corresponding parts being indicated by the same numerals with subscript "*a*." This mounting is similarly rockable and is locked in position after all members of the press have been properly alined.

For the purpose of rockably positioning eccentric bushing **36**, a cover plate **38** is securely fastened to the end of the bushing. At the edge of the cover plate is an integral arm **39** coupled to a connector **64** by a pin **65**. The connector is secured to the end of a thrust rod **62**. The outer end of the rod is also threaded for reception in a captive nut **63** which is rotatably mounted in the flange **15***a* of the side frame and which is coupled to a handwheel **61**. Rotation of the handwheel resulting in axial movement of the rod **62** rotates the eccentric bushing **36** to a desired angular position, shifting the end of axis **19** of plate cylinder **14** to a slightly skewed position. The handwheel may be turned in either direction and in practice a correction of up to 0.015 inch can be made in the position of certain areas of the image printed on the web. The small skewing movement is within the tolerance of the bearing **35**, so it is not necessary to provide any realinement of this bearing.

It is important to have the ink and the water uniformly distributed over the entire plate so that all areas of the plate operate under the same conditions for uniform color density. It has been found that skewing a plate cylinder as little as 0.015 inch produces misalinement of the plate cylinder and form rollers affecting the uniformity of inking. By mounting the form rollers in the manner shown in the drawings and described hereafter, the axes of the form rollers are maintained at all times precisely parallel with the axis of the plate cylinder.

The present invention contemplates a novel and simplified arrangement for causing the form rollers, such as the ink form rollers **26** and **27**, to closely follow the skewing movement of plate cylinder **14** and thus to maintain parallelism and uniform contact with the plate cylinder. Referring to FIGS. 2 and 3, it will be noted that a reference ring **75**, having an outside diameter the same as that of the plates on the plate cylinder **14**, is attached to bushing **36** so that its axis coincides with the axis **19** of the plate cylinder and so that its outer surface **78** is always in alinement with the surface of the plates. The outer surface of the ring, moving whenever the bushing is turned, thus becomes a reference for the surface of the plates for all positions of the plate cylinder.

For the purpose of coupling one end of each of the form rollers **26**, **27** to the reference surface of the ring to maintain proper running relation with the plate cylinder, the sockets of the respective form rollers are supported in mounting plates which are pivotally mounted about the shaft **68** of ink drum **23**. As shown in FIG. 5, the socket **42** which supports the form roller **26** is attached to a plate **40** on one side of the drum axis. A plate extension or arm **83** on the other side of the drum axis is engaged by suitable biasing means for holding the end of the plate **87** in contact with surface **78** of ring **75**, permitting the mounting plate to rock about the shaft of the drum and carry the end of the form roller with it, when it is necessary to skew the axis of the plate cylinder to obtain registration of the printed image on the web. Adjustable mounting for the form rollers also provided at the opposite ends except that at the opposite ends the mounting plates engage fixed stops and thus remain relatively stationary as the plate cylinder is skewed; consequently it is not necessary that the opposite ends of the rollers be shown or described in detail.

The other form rollers are mounted similarly to roller **26**. As shown in FIG. 3 form roller **27** is supported on a plate **41** which is pivotally mounted on the shaft **68** of ink drum **23**, while rollers **29**, **30** are supported on plates **40***a*, **41***a* which are pivotally mounted on the shaft **68***a* of ink drum **24**. Bushings indicated at **79**, and **79***a*, may be interposed between the mounting plates and the drum shafts on which they are mounted. Such shafts are in turn rotatably supported in the frame by bushings **73** (see FIG. 5). The mounting plates are biased into engagement with ring **75** at **87**, **88** and contact is maintained by means of suitable springs **85**, **86**, which bear against arms **83**, **84** of the mounting plates. Arms **83**, **84** are bifurcated and drilled to receive a pin **33** which extends between the two parts **57**, **58** to form a connection with the biasing mechanism. FIG. 6 shows a shaft **93** supported by bushing **25** in frame **15**. The shaft extends to the frame on the opposite side where it is similarly mounted and provides a fixed base for creating the biasing force to maintain contact between plates and ring **75**. This shaft **93** also supports a double throw eccentric or cam **74** by means of which the form rollers can be bodily separated from the plate cylinder **14** when required during operation of the press.

Mechanism for biasing the plates into engagement with ring **75** appears in FIGS. 3 and 6, details of the mechanism being shown at **69** and **70** in FIG. 6. As described above the arm **83** on the mounting plate **40** is bifurcated and fitted with a special pin **33**. This pin has flat sides at the center but is cylindrical at the ends so it can turn between the two parts **57**, **58** with respect to the arm **83**. A hole is drilled at right angles through the flat of this pin. A stud **71** passes through this hole and is threaded into the elongated portion of a strap fitting **72** that is ro-

tatably fitted to the eccentric 74 on shaft 93. A bushing 76 surrounding the stud is pressed by the spring 85 and engages one of the flat sides of pin 33 as shown in FIG. 6. Telescoped within the bushing 76 is a second bushing 77 which engages the opposite end of the spring. Spring member 85 is thus contained between the flanges of bushings 76 and 77. To complete the assembly, a nut 80 is threaded onto the outer end of stud 71 and serves as a means for adjusting the position of bushing 77 and hence the force exerted by the spring. In short, the biasing force of spring 85 urges bushing 76 into engagement with the flat on pin 33 which in turn is secured in arm 83 of mounting plate 40, tending to rotate the plate 40 in a clockwise direction as shown in FIG. 3, holding it resiliently in contact with ring 75 at the region 87. Springs 85, 86 are separately adjustable.

When it is necessary to skew the plate cylinder in a direction causing plate 40 to rotate in a counter clockwise direction, arm 83 moves in a direction away from fixed shaft 93 so that the spring 85 is further compressed, maintaining contact between the plate and ring 75. Upon movement of the cylinder in the reverse direction, the spring expands to rotate mounting plate 40 clockwise to hold it in engagement with the ring. A small clearance, shown at 67 in FIG. 6, is built into the arrangement during assembly. This clearance permits adequate clockwise rotation of the mounting plate 40 to insure that the mounting plate will at all times remain in contact with ring 75. It should be noted that the mechanism 70 acts upon the arm 84 of the mounting plate 41 in a similar manner to maintain contact with ring 75 at the region 88. The plate edges at 87, 88 are preferably in a cylindrical locus to provide well defined line contact with the ring.

Means are provided to permit adjustment of the roller sockets with respect to their mounting plates thereby to permit adjustment of the "set" of the roller with respect to the plate cylinder 14 and ink drum 23. Once a form roller has been adjusted into a position which provides the desired "set," the socket is locked in this position on the plate. During the subsequent movement of the mounting plate, carrying the end of the form roller with it, the "set" is maintained, thereby insuring a uniform film of ink across the width of the plate.

FIGS. 4 and 5 show the construction of the sockets 42 at the ends of the form rollers. Here it will be noted that the bearings 46 on the shafts 47 at the end of form rollers 26 and 27 are secured in housings 45 which in turn are attached to adjustable brackets 48 which are adjustably positioned on mounting plates 40, 41. Bracket 48 is held against the mounting plate by a nut 52 on a stud 50 which extends through a clearance opening 51 in the bracket terminating in a head member 49. When nut 52 is loosened to relieve the clamping force, bracket 48 may be shifted as required to make necessary adjustments of the form roller. As shown in FIG. 4, adjustment is obtained by turning an adjusting screw 44 which is captively held in a sleeve 53 fixed to the bracket 48 and which threadedly engages the head member 49 on stud 50. By turning screw 44, the bracket 48 is moved on its mounting plate. Two such screws are provided, spaced from one another, the second being indicated at 43. By playing the screws against one another, the form roller can be properly "set" against both of the adjacent members. The socket assemblies 42 shown in FIGS. 4 and 5 are substantially identical except that the adjusting screw 44 is between the mounting plate and the side frame of the press as shown in FIG. 5 and on the other side of the mounting plate in FIG. 4.

During operation of offset printing presses of the type described, it is necessary to bodily separate the ink and water form rollers from the surface of the plate cylinder. The mechanism shown includes means for producing this separation and also for moving the form rollers back into contact with the plate cylinder, without affecting the setting or alinement of the rollers. Independent controls are provided so that ink form rollers may be separated at one time and the water form roller separated at a different time. The throw-off operation may be performed when the plate cylinder is in alinement or when it is in a skewed position. In prior structures it has been difficult to regain accurate alinement between form rollers and a plate cylinder following a throw-off operation, when the form rollers were returned into contact with the plate cylinder. The disclosed arrangement eliminates this difficulty, because the mounting plates will always return to engagement with the surface 78 of ring 75, which is equivalent to the plate cylinder surface, thus assuring automatic realinement of form rollers and plate cylinders. Throw-off of the ink form rollers is here accomplished by a power cylinder 90, which is connected to a lever 92 on a throw-off shaft 93. Plunger 91 of cylinder 90 is actuated by movement of a piston within the cylinder and may be moved in or out as desired by applying pressure fluid to the appropriate end of the cylinder. This arrangement is shown in FIG. 1 while details of the mechanism will be found in FIGS. 3 and 6. A double-throw cam 74, with the throws positioned approximately 180 degrees apart, is keyed to shaft 93. The strap fittings 72 for connecting the plates with the means for biasing the plates against the ring 75 are fitted on to the cams so that assembly 69 is opposite to assembly 70. When cylinder 90 is actuated, cam action results in separating the arms 83, 84 on plates 40, 41 or drawing them closer together. When the mounting plates are in the positions shown in FIG. 3, a movement of cam shaft 93 will result in clockwise rotation of plate 41 and counterclockwise rotation of plate 40, breaking contact at 87, 88. It should be understood that cam shaft 93 extends entirely across the press and actuates mechanism on the opposite side of the press which is similar to that shown, so that throw-off occurs equally at both ends of the form rollers. When the press operator desires to bring form rollers again into contact with the plate cylinders and ink drums, the actuating cylinder 90 is actuated to rotate the cam shaft 93 back to its starting position re-establishing contact with the surface of ring 75 at 87 and 88, thus restoring the original alinement or "set."

Although ink is applied to the printing plate by pairs of form rollers each in contact with a drum, moisture is applied to the surface of the printing plate by the single water form roller 32 as shown in FIGS. 1 and 3. Maintenance of alinement of this form roller with the plate cylinder while in slightly skewed position is similar to the arrangement 42 described above, and is obtained by adjustably mounting the form roller 32 in a socket 142 attached to plate 140 which is pivotally supported on the shaft 168 of drum 31. An arrangement 169, similar to 69 which applies a biasing force to plate 41, is attached to strap fitting 172, biasing plate 140 against the ring 75 at point 187. Throw-off of the form roller 32 may be actuated by power means 190 (FIG. 1), which is connected to a lever 192 on the shaft 193 causing cam 174 and strap fitting 172 to rotate resulting in clockwise rotation of plate 140 as seen in FIG. 3. This lifts roller 32 off of the surface of the printing plate on plate cylinder 14. By means of a similar mechanism (not shown) at the opposite side of the press, the roller is lifted or separated for its full length. Reverse rotation of the shaft 193 restores uniform contact between the form roller 32 and the plate cylinder and alinement is maintained because plate 140 again contacts ring 75 at 187.

For the purpose of moving the cylinder 14 axially, means are provided for transmitting axial motion to the sleeve 36. Thus, referring to FIG. 2, the cover plate 38, which is secured to the eccentric sleeve 36, has an integral stub shaft 154 which extends axially outward and which is threaded, preferably with a thrust-transmitting thread of acme configuration. The stub shaft is engaged by an internally threaded worm wheel 155 driven by a worm 156 which, in turn, rotated by an adjusting drive

motor 157. Rotating the motor in one direction or the other causes the eccentric sleeve 36 in which the shaft of the cylinder is captive, to be moved in opposite directions. Thus it is seen that the same eccentric sleeve assembly is capable of bringing about two distinct types of adjustment, namely, the skewed shifting of the printing cylinder and the associated form rollers via the ring 75 and the endwise shifting of the printing cylinder by means of the threaded stub shaft 154.

It will be apparent in view of the foregoing that the objects, set forth at the outset, have been achieved effectively and at low cost. Not only may a high degree of registration accuracy be achieved by the skewing of the printing cylinder, but the automatic accompanying skewing of the form rollers which occurs insures that the uniformity of application of the water and ink films will remain unaffected. Thus the press may be quickly and easily adjusted under practical press room conditions.

When the form rollers are returned to contact after being separated or thrown-off, the condition of alinement of the form rollers with a skewed plate, and the adjustment or "set" of the form rollers with both the printing cylinder and ink drums is automatically re-established.

While the term "mounting plates" has been applied to the mounting members for the form rollers, such as that shown at 40, the members may take any desired physical shape consistent with their pivoted supporting function.

We claim as our invention:

1. In a printing press, the combination comprising a pair of spaced side frames, a cylinder for holding printing plates, means for journalling the cylinder in said frames, said journalling means including means at one end for laterally shifting the cylinder axis for skewing adjustment, an ink drum journalled in said frames and radially spaced from the plate cylinder, a form roller disposed for rolling engagement with said cylinder and said drum, a mounting plate supporting one end of the form roller and pivoted for swinging movement substantially about the drum axis, a reference ring at said one end of the cylinder coaxial with the cylinder and coupled to the cylinder to maintain the coaxial relationship in all positions of skew, and means for maintaining the form roller mounting plate in engagement with the ring so that the form roller follows the cylinder over its range of skewing adjustment.

2. The combination defined in claim 1 in which the reference ring is secured to the shifting means.

3. The combination defined in claim 1 in which the shifting means includes an eccentric sleeve interposed between the end of the cylinder and the side frame and in which the reference ring is secured to the sleeve.

4. The combination defined in claim 1 in which the outer diameter of the reference ring is substantially equal to the diameter of the surface of the plates on the plate cylinder.

5. The combination defined in claim 1 including throw-off means for rotating the mounting plate in a first direction to separate the plate from said reference ring and said form roller from said cylinder and for rotating said plate in a reverse direction to re-engage said plate with said ring and said form roller with said cylinder.

6. The combination defined in claim 4 in which the mounting plate is formed to provide line contact with the reference ring and in which an actuator is provided for separating the mounting plate from the ring while overcoming the biasing force.

7. In a printing press the combination comprising a pair of spaced side frames, a cylinder for holding printing plates, means for journalling the cylinder in said side frames, said journalling means including means at one end of the cylinder for laterally shifting the cylinder axis for skewing adjustment, a plurality of ink drums journalled in said frames and radially spaced from the plate cylinder, form rollers interposed between the ink drums and the plate cylinder, each form roller having a mounting plate supporting one end thereof and pivoted for swinging movement substantially about the axis of the associated ink drum, a reference ring at one end of the cylinder coaxial with the cylinder and coupled to the cylinder for maintaining the coaxial relationship in all positions of skew, means for biasing the mounting plates against the reference ring to establish axial alinement of form rollers and cylinder so that the form rollers follow the skewing movement of the cylinder and maintain uniform contact with the plates thereon over the range of skew adjustment, and means for simultaneously swinging the roller mounting plates in a direction away from the ring to achieve throw-off between the form rollers and the cylinder.

8. The combination defined in claim 7 in which the biasing force for maintaining each roller mounting plate in engagement with the ring is individually adjustable.

9. In a printing press the combination comprising a pair of spaced side frames, a cylinder for holding printing plates, means for journalling the cylinder in said side frames, said journalling means including means for shifting one end of the cylinder axis for skewing adjustment, drums journalled in said frames and radially spaced from the plate cylinder, form rollers rollingly interposed between the drums and the plate cylinder, each form roller having a mounting plate supporting each end thereof and pivoted for swinging movement about the axis of the associated drum, a reference ring at one end of the cylinder coaxial with the cylinder and coupled to the cylinder for maintaining the coaxial relationship in all positions of skew, each mounting plate having a ring-engaging surface, means for biasing the ring-engaging surfaces of the mounting plates against the reference ring so that the form rollers follow the cylinder and maintain contact with the plates thereon over the range of skew adjustment, means on the mounting plates between the rollers and the ring-engaging surfaces for individual adjustment of roller pressure, and means for simultaneously swinging the roller mounting plates in a direction away from the ring to achieve temporary throw-off between the form rollers and the cylinder.

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