United States Patent

Musgrave

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[54] DOCTOR BLADE OSCILLATABLE BETWEEN PLATE CYLINDER AND INK TRANSFER ROLL

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[52] **U.S. Cl.** **101/157,** 101/349

[51] **Int. Cl.** **B41f 9/10,** B41f 9/16

[58] **Field of Search** 101/157, 169, 152, 153, 154, 101/170

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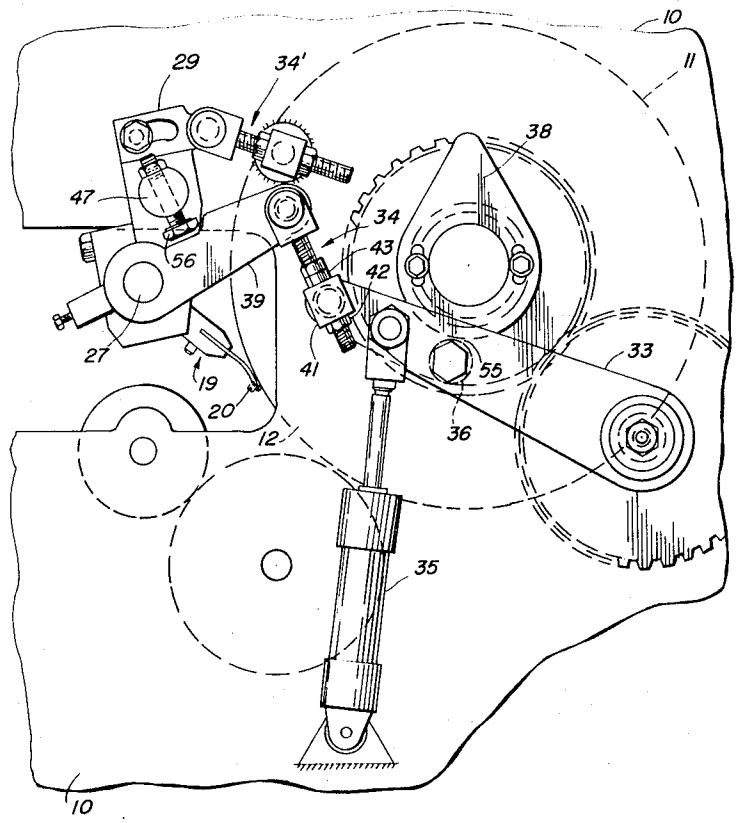
Primary Examiner—J. Reed Fisher

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[57] **ABSTRACT**

An oscillating doctor blade used in a rotary intaglio printing press having a transfer roller, a form roller and a printing plate cylinder adjacent the transfer roller, for conserving ink by scraping the excess ink off the etched or engraved surface of the printing plate and then swinging the ink-gathering face of the doctor blade so as to carry the excess ink into direct contact with the adjacent transfer roller for immediately feeding back the ink into the press inking train for use in the next inking and printing operation.

9 Claims, 8 Drawing Figures



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SHEET 1 OF 4

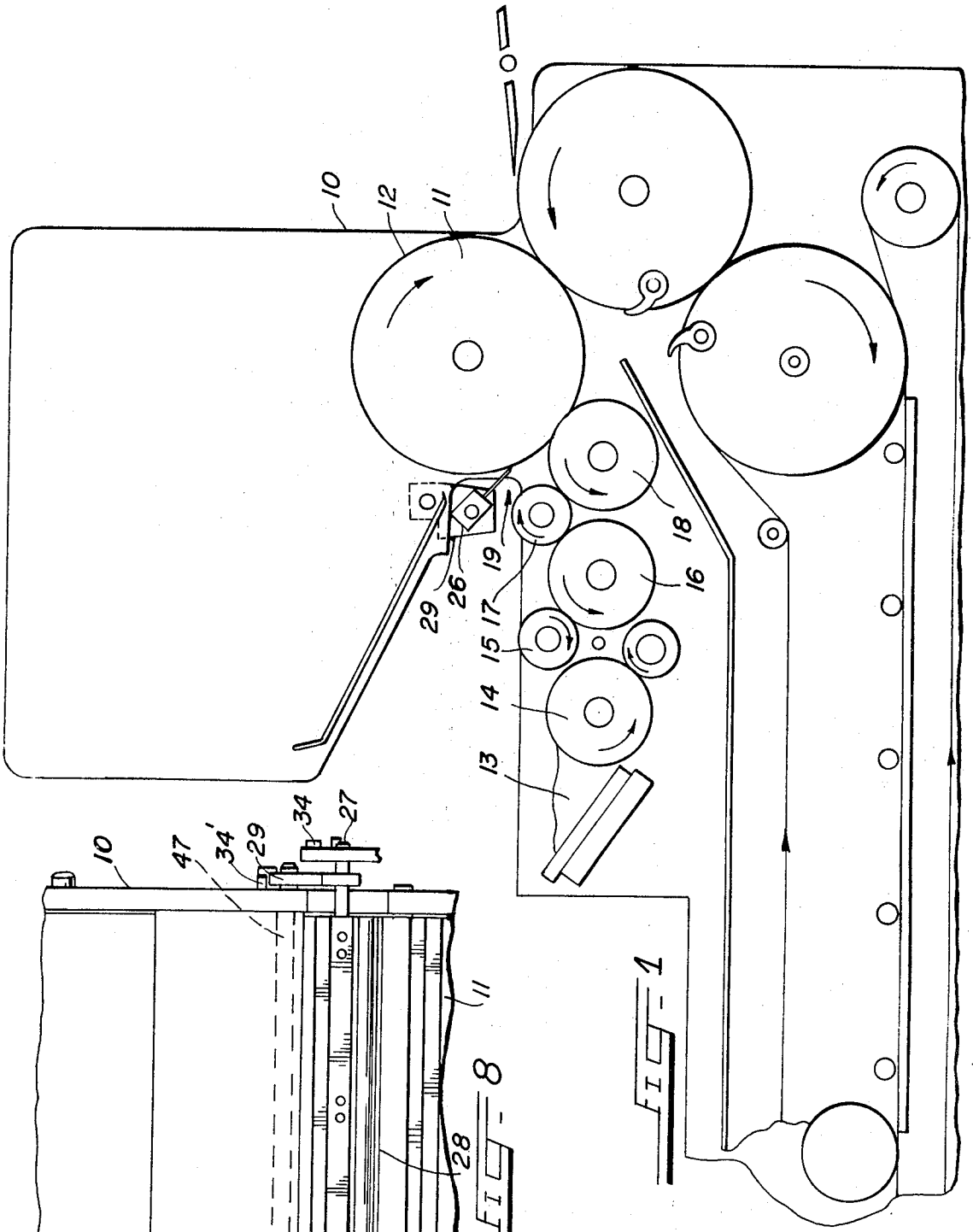


FIG - 1

FIG - 8

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FIG. 4

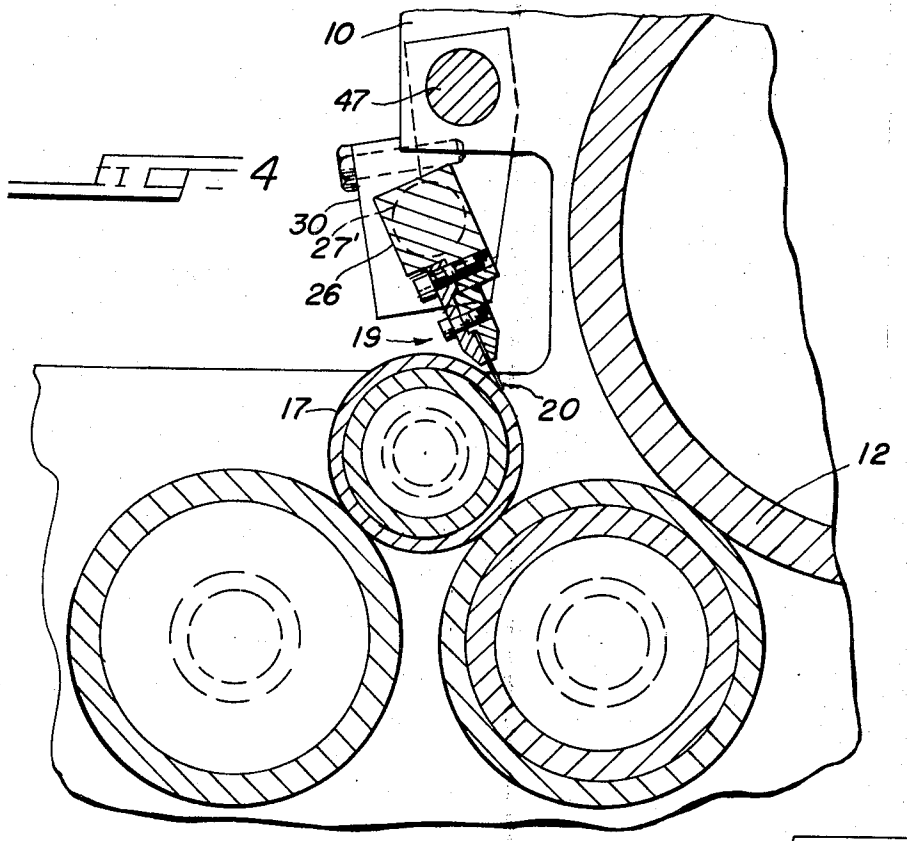


FIG. 2

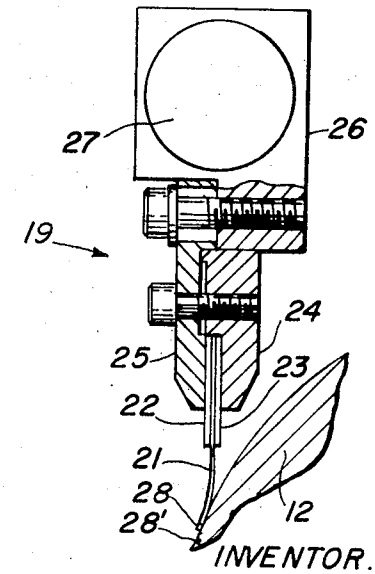
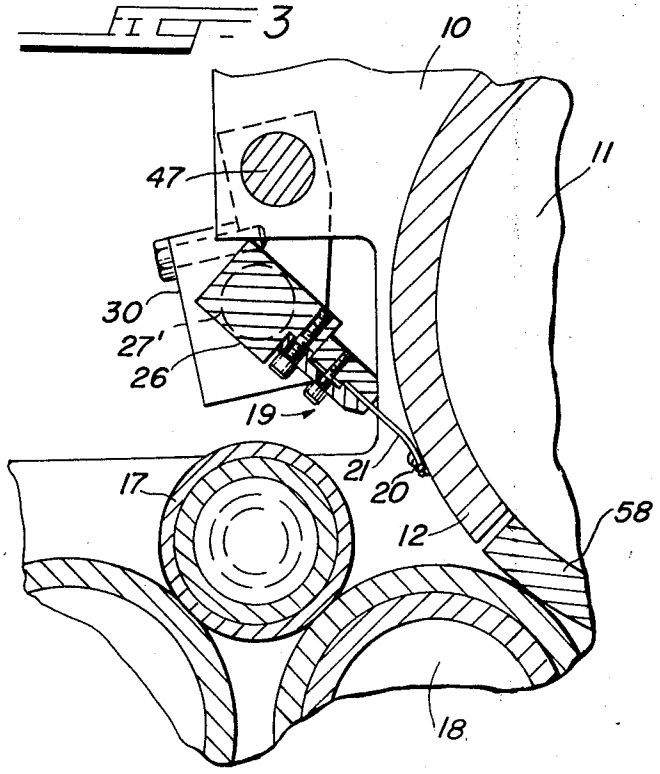


FIG. 3



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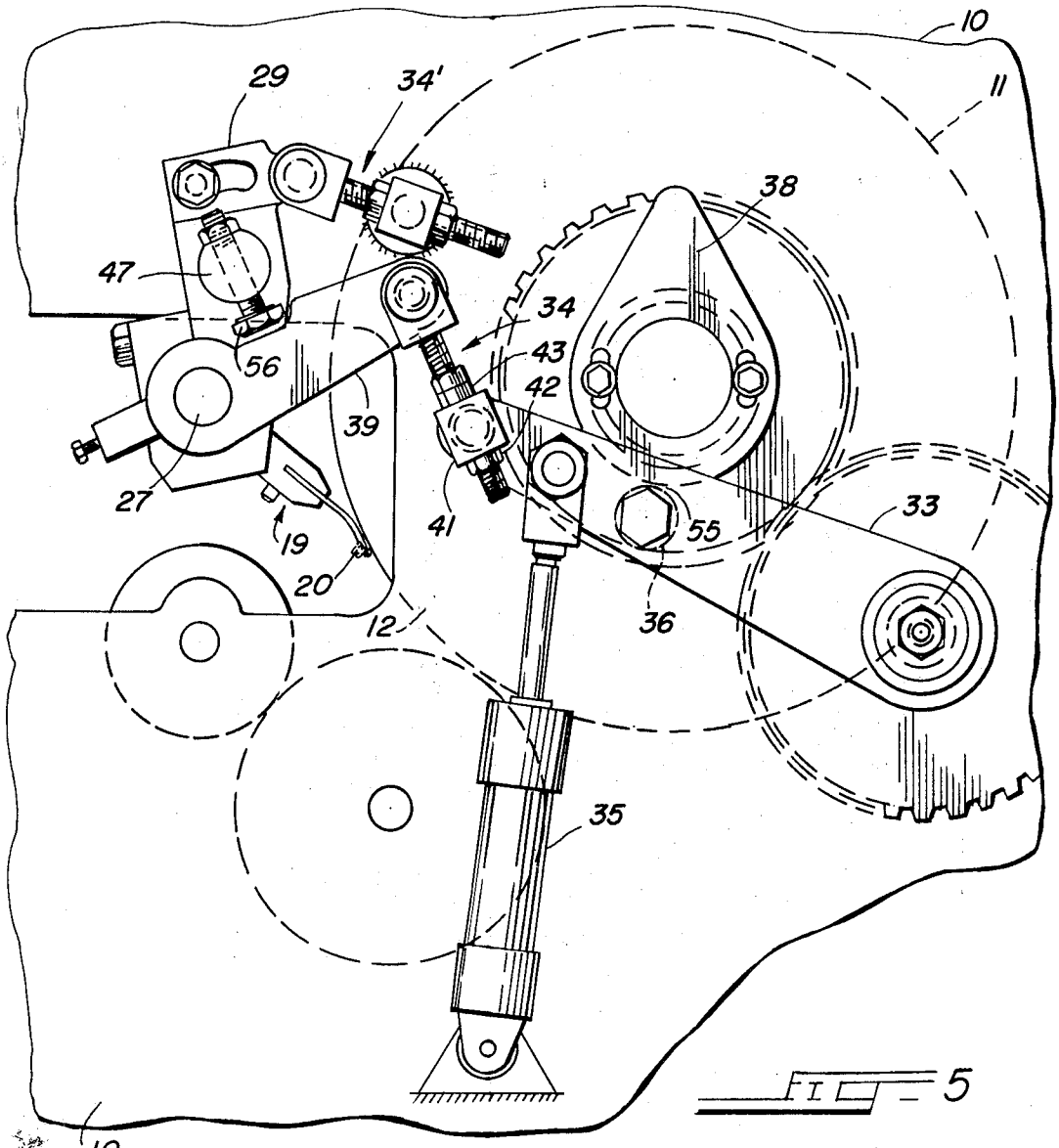


FIG 5

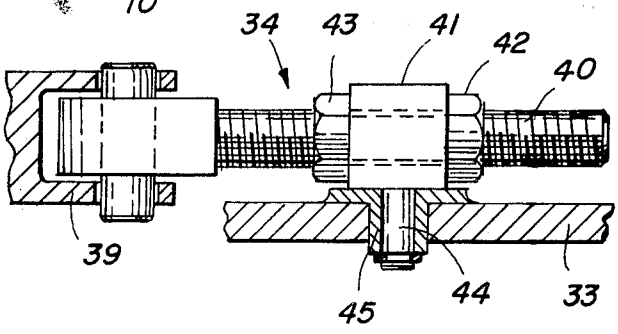


FIG 7

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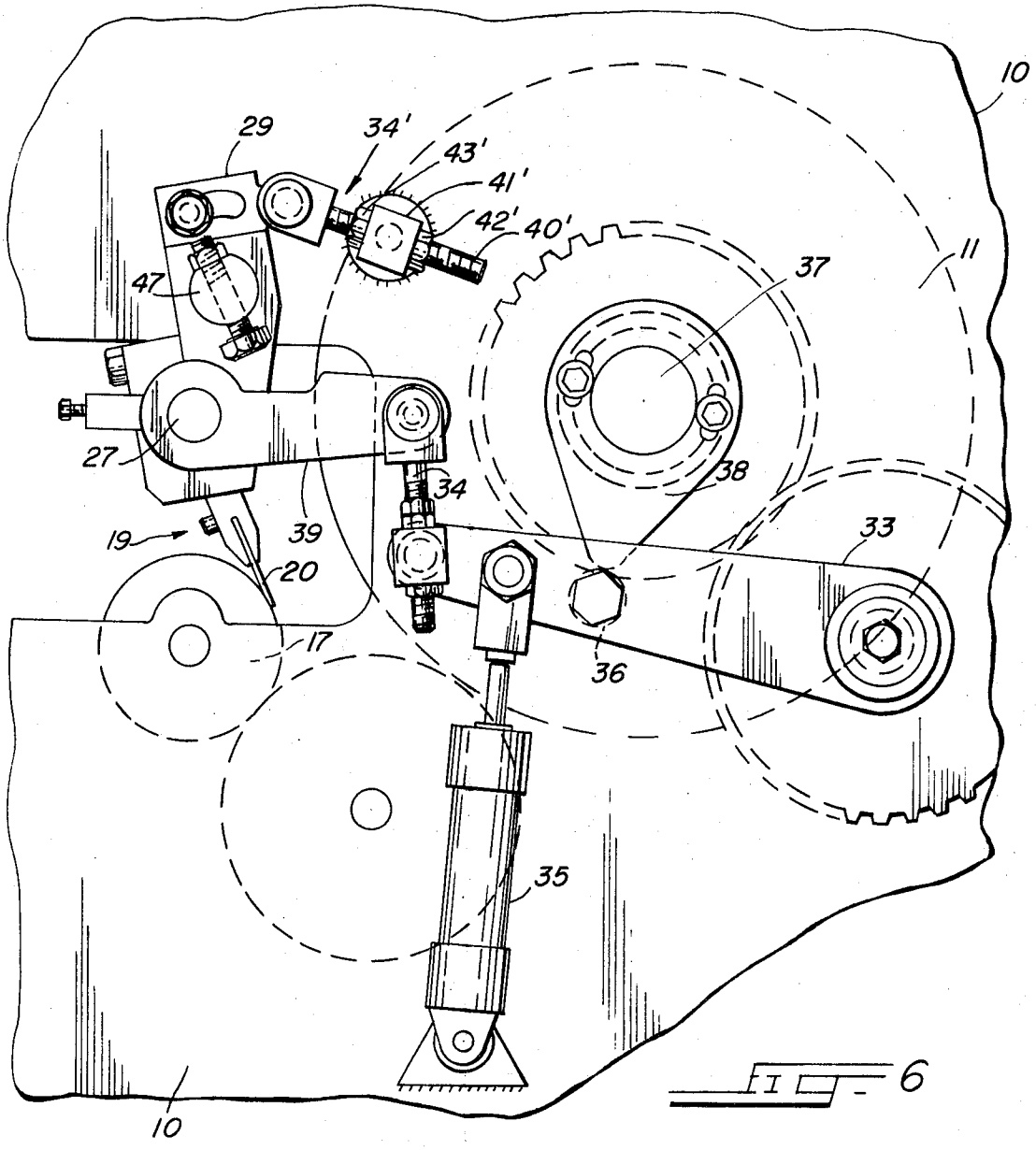


FIG. 6

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DOCTOR BLADE OSCILLATABLE BETWEEN PLATE CYLINDER AND INK TRANSFER ROLL

BACKGROUND OF THE INVENTION

The invention relates to a method of and an apparatus for conserving ink used in rotary intaglio presses. In presses of this kind, a cylinder having a printing plate mounted thereon is rotated and receives ink from a form roller disposed to engage the printing plate. The form roller receives ink from a transfer or vibrator roller which in turn is supplied by a receiver roller. The receiver roller receives ink from a ductor roller which is supplied by a fountain roller which is normally in contact with a source of ink called a fountain. This structure forms the inking train of the press. The purpose of an inking train is to insure the uniform development of an ink film on the form roller for transfer to the printing plate in preparation of the printing operation.

Following application of the ink to the plate, it is necessary to remove the excess ink therefrom. A doctor blade is held against the rotating peripheral surface of the plate to scrape off excess ink, leaving ink only in the etched or engraved portions of the plate to constitute the printing image.

In the past, the doctor blade has been fixed to the frame of the press so as to scrape the excess ink off the engraved surface of the printing plate directly into a trough or pan disposed beneath the scraping edge of the doctor blade. Ink gravitationally fell into this pan. In such case, the ink caught by the pan very quickly dries out and must be discarded or remilled to the proper consistency if it is to be reused. It is not returned directly to the fountain by the operator. This adds to the cost of operating such presses because intaglio inks are expensive and normally approximately 25 percent of the ink supplied to the inking train actually gets to print. The rest is thrown away.

Plate cylinders in rotary intaglio presses are designed with interchangeable printing plates having a gap in their circumference for accommodating the plate securing means. It is common practice to apply a cover plate to these recesses for the purpose of preventing printing ink form reaching and collecting in such gap. Along the edges of such plate, where it contacts the printing surface on the cylinder, the transverse recess so-formed can catch and jamb the ink-gathering edge of the doctor blade unless provision is made to limit the engagement of the doctor blade with the plate cylinder.

In the operation of rotary intaglio printing presses according to the prior art, it is important that the doctor blade angle and doctor blade pressure on the printing plate be independently adjustable within certain limits. It has been found, for example, that, depending on the consistency and the inks used, it is essential to correspondingly vary said angular relation and/or the blade pressure in order to attain the best results both as to quality of printing, as well as to quantity of production.

SUMMARY OF THE INVENTION

More specifically, and as disclosed hereinafter by way of example, the invention relates to a method of conserving ink used in rotary intaglio printing. In essence, the gist of this invention lies in a method of feeding-back, directly into the inking train, excess ink scraped off the printing plate.

The invention also relates to an apparatus for conserving ink used in rotary intaglio printing presses. Here the gist of the invention lies in a cam actuated link and lever mechanism mounted on the press which swings the ink-gathering face of the doctor blade between a scraping engagement position, wherein the blade presses against the printing plate on the plate cylinder to remove excess ink therefrom, and an ink discharge position, wherein the excess ink on the ink-gathering face of the blade is discharged to the transfer roller. In the mechanism of this invention, the doctor blade is automatically oscillated about a swing axis at least once during each revolution of the plate cylinder putting it in momentary contact with the surface of the adjacent transfer roller and feeding-back the excess ink to the transfer roller immediately and in a regular, continuous manner. This ink is then immediately applied to the form roller in readiness for the next inking and printing operation.

In addition to the prior art requirement of adjustability of doctor blade scraping angle and doctor blade pressure against the printing plate, the operation of rotary intaglio printing presses according to this invention requires that doctor blade contact pressure against the transfer roller in the ink feedback circuit must also be adjustable if optimization of quality printing and quantity production is to be maintained.

It is thus an object of this invention to provide an improved method of conserving ink used in rotary intaglio printing presses and a means for immediately feeding-back excess ink scraped from the printing plate to the inking train so that it can be continuously reused and not be discarded.

DESCRIPTION OF THE DRAWINGS

A specific embodiment of this invention is shown in the accompanying drawings, in which:

FIG. **1** is a diagrammatic illustration of a rotary intaglio printing press incorporating the improvement of this invention;

FIG. **2** is a partially sectioned end view showing the doctor blade and its supporting clamp;

FIG. **3** is a fragmentary sectional view showing the doctor blade in scraping engagement with the printing plate and its relation with the transfer and form rollers;

FIG. **4** is a similar view showing the doctor blade in ink discharge position against the transfer roller;

FIG. **5** is a fragmentary side view of a rotary press showing the cam-lever and link mechanism for operating the doctor blade and showing the doctor blade in its scraping position against the printing plate on the plate cylinder;

FIG. **6** is a similar view showing the cam-lever and link mechanism with the doctor blade in ink discharge position against the transfer roller;

FIG. **7** is a partially sectioned view showing the adjustable change-of-length link; and

FIG. **8** is a fragmentary end view of a rotary press showing how the doctor blade swing bar is suspended in the throw brackets mounted on the bracket support shaft which in turn is journaled in the side plates of the press frame.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, it will be seen that the plate cylinder **11** carrying the printing plate **12** is journaled in the side plates **10** of the press frame. An ink fountain **13** is mounted on frame **10** and supplies ink to a fountain roller **14** which is also journaled in the frame plates **10**. Ductor rollers **15** are journaled to oscillate in frame **10** and are disposed for intermittent rolling contact with the fountain roller **14** which carries ink from the fountain **13** to the receiver roller **16**. The receiver roller **16** is also journaled in frame **10** and mounted for rolling contact with the transfer roller **17**, the receiver roller transferring ink to transfer roller **17** which in turn further transfers the ink to the form roller **18**. The transfer roller **17** is likewise journaled in the press frame plates **10** and is positioned for continuous rolling contact with the form roller **18**, which is also journaled in frame **10** for rolling contact with the printing plate **12**, the form roller **18** receiving ink from the transfer roller **17** and applying the ink directly to the printing plate **12** in preparation for the printing operation. Doctor blade **19** is mounted on a swing bar **26** journaled to oscillate in doctor blade throw brackets **29–30** mounted on press frame **10** for limited rotary movement about a horizontal axis as will be hereafter described. Doctor blade **19** depends between the plate cylinder **11** and the transfer roller **17** for oscillatory movement therebetween from scraping engagement with the plate cylinder **11** to an ink discharge position against the transfer roller **17**.

The detail of the doctor blade is shown in FIG. **2** and it will be seen that the blade **21** comprises an element of a doctor blade assembly **19** which includes two stiffening plates **22** and

23 between which the blade 21 is held for mounting in the doctor blade assembly by means of assembly clamping plates 24 and 25. The clamp plate 25 is slidably mounted on the swing bar 26 to allow for adjustment of the contact edge 28 of the blade 21 to a bias position relative to the horizontal element of the printing plate 12. This bias position of the doctor blade prevents jambing of the blade 21 in the transverse groove 28' between the printing plate 12 and the conventional cover plate during rotation of the plate cylinder 11. The ends 27–27' of the swing bar 26 are of cylindrical form and as shown in FIG. 8, fix the swing axis about which the doctor blade assembly 19 oscillates during operation of the press. FIG. 3 shows a cross section of the swing bar 26 as it depends from the throw brackets 29–30 with the doctor blade 21 in scraping engagement with the printing plate 12 and showing the build-up of excess ink on the ink-gathering face 20 of the blade. The mounting of the swing bar 26 between the throw brackets 29 and 30 is shown in FIG. 8, the cylindrical ends 27–27' of the swing bar being journaled in the throw brackets which in turn are mounted for limited rotation on the shaft 47 journaled in the press frame plates 10.

FIG. 4 shows the doctor blade 21 with the ink-gathering face thereof in contact with the transfer roller 17 for discharging excess ink thereto, the blade assembly having been oscillated about the swing bar axis from the scraping engagement with the printing plate 12 to the ink discharge position.

FIG. 5 shows cam lever arm 33 in low lift position effecting engagement of doctor blade 19 with printing plate 12 scraping excess ink therefrom. Cam lever arm 33 is pivotally mounted at one end on frame 10 and pivotally carries adjustment end of change-of-length link 34 at its far end having cam follower 36 rotatably mounted thereon intermediate its ends. Cam 38 is coaxially mounted on and constrained to rotate with plate cylinder 11. Cam 38 cooperates with cam follower 36 to move cam lever arm 33 in timed relation with the rotation of printing plate 12 on plate cylinder 11. A pneumatic cylinder 35 is pivotally mounted at one end on frame 10 and pivotally connected by its other end to cam lever arm 33. This cylinder is energized to induce cam follower 36 into cooperation with cam 38. A doctor blade lever arm 39, mounted at one end on and constrained to rotate with cylindrical end 27 of swing bar 26, as shown in FIG. 2, pivotally carries the pin end of change-of-length link 34 at its far end so that doctor blade 19 is in scraping engagement with the plate cylinder 11 when cam follower 36 on cam lever arm 33 dwells at low lift on cam 38, as shown in FIG. 5, and in ink discharge position against the transfer roller 17 when cam follower 36 on lever arm 33 dwells at high lift on cam 38, as shown in FIG. 6. Throw brackets 29 and 30 mounted on bracket support shaft 47 are adjustable for limited rotation in frame side plates 10 for fixing the contact pressure of blade 21 against transfer roller 17 in a manner hereinafter to be disclosed in detail.

The detail in RIG. 5 shows doctor blade 19 engaged in scraping printing plate 12 with cam follower 36 not in contact with cam 38 by a small distance 55. The determination of small distance 55 is by adjustment in length of change-of-length link 34 with doctor blade 19 engaged against printing plate 12. With small distance 55 air pressure in pneumatic cylinder 35 uniquely determines blade 21 pressure against printing plate 12.

Adjustable stop 56 mounted on bracket support shaft 47 affixed to frame 10 limits the oscillation of doctor blade lever arm 39 and doctor blade 19 in the plate cylinder direction and thus limits the override of contact edge 27 of blade 21 into jambing engagement with the recesses between the printing plate 12 and the cover plate 58, as shown in FIG. 3.

In the oscillation of the doctor blade, cam follower 36 on cam lever arm 33 lifts said lever arm as cam 38 rotating with plate cylinder 11 cooperates with the same. Link 34 pivotally connected at one end to the far end of lever arm 33 and pivotally carried at its other end by the outside end of doctor blade lever arm 39 lifts said lever arm 33 carrying with it link 34 and rotating connecting doctor blade lever arm 39 about the axis of swing bar 26 effecting an oscillation of the doctor blade from ink scraping engagement against the printing plate to ink discharge position against the transfer roller.

FIG. 6 shows cam lever arm 33 in high lift position effecting engagement of doctor blade 19 with transfer roller 17 discharging excess ink thereon. Doctor blade throw brackets 29–30 mounted on support shaft 47 are adjustably fixed in relation to press side frames 10 so that the described oscillation of doctor blade 19 is uniquely a function of the lift of cam 38 fixing thereby the extent of doctor blade oscillation and the contact pressure of blade 21 against transfer roller 17.

Adjustment of the blade 21 contact pressure against transfer roller 17 is effected by changing the position of cylindrical ends 27–27' on swing bar 26 depending between transfer roller 17 and plate cylinder 11. As throw brackets 29–30 are adjusted in limited rotation about support bar 47 to move swing bar 26 closer to transfer roller 17, the contact pressure of blade 21 is increased. As throw brackets 29–30 are adjusted to move swing bar 26 closer to plate cylinder 11, this contact pressure is decreased. A detail of the means for making this limited rotary adjustment of brackets 29–30 follows hereinafter.

Adjustment of the pressure of blade 21 against the printing plate 12 during scraping is attained by setting the air pressure in pneumatic cylinder 35 with blade 21 in engagement with plate 12 and adjusting change-in-length link 34 to give a desired small distance 55.

A detail of the means for effecting adjustment of the doctor blade 19 scraping angle relative to printing plate 12 is shown in FIG. 7, wherein change-of-length link 34 has threaded bar 40 pivotally mounted to the outside end of doctor blade lever arm 39 slidably extending through a hole in block 41 and engaged thereon by jamb nuts 42 and 43 acting on opposite faces of said block 41. Block 41 has stub shaft 44 extending at right angles to the axis of said hole in block 41 rotatably mounted in bushing 45 on the far end of cam lever arm 33 so that change-of-length link 34 is in effect pivotally connected to the far end of cam lever arm 33 and to the outside end of doctor blade lever arm 39 respectively. Referring again to FIG. 5, a change in length of link 34 by repositioning jamb nuts 42 and 43 on threaded bar 40 relative to block 41 adjusts the angle of the doctor blade 19 relative to the printing plate 12 on plate cylinder 11 during scraping. An increase in length of link 34 increases doctor blade 19 angle with respect to the printing plate 12.

A detail of the means for effecting adjustment of the doctor blade 21 contact pressure against transfer roller 17 is shown by FIG. 6, wherein change-of-length link 34', which is functionally similar to link 34, is pivotally mounted to the outside end of doctor blade throw bracket 29. A change in length of link 34' by repositioning jamb nuts 42' and 43' on the threaded bar 40' relative to block 41' adjusts the angular position of doctor blade throw bracket 29 on bracket support shaft 47 relative to press frame 10. Similar adjustment of the angular position of doctor blade throw bracket 30 relative to press frame 10 is made by the adjustment of a change-of-length link 34'', which is functionally similar to link 34', pivotally mounted to the outside end of doctor blade throw bracket 30. Coordinated adjustment of both throw brackets 29 and 30 on opposite ends of bracket support shaft 47 angularly positions cylindrical ends 27 and 28 of swing bar 26 about the center of bracket support shaft 47. This displaces doctor blade ink-gathering face 20 on blade 21 in relation to transfer roller 17 adjusting the contact pressure of doctor blade 19 against transfer roller 17 thereon.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that the details of construction shown may be altered or omitted without departing from the spirit of the invention as defined by the appended claims.

We claim:

1. In a rotary intaglio printing press for immediately feeding back the excess ink scraped from the printing plate to the ink-

ing train having a frame, a plate cylinder journaled for rotation of the frame, a printing plate mounted on the plate cylinder, a form roller journaled on the frame in rolling contact with the plate cylinder, and a transfer roller journaled on the frame adjacent the plate cylinder in rolling contact with the form roller, the improvement comprising: a doctor blade, means for mounting said doctor blade for oscillation about an axis parallel with the axis of the plate cylinder between an angular scraping engagement with the printing plate and a discharge position wherein the ink gathering face of the blade contacts the transfer roller, and means for oscillating the doctor blade in timed relation with the rotation of the plate cylinder therebetween.

2. A rotary intaglio printing press according to claim 1 wherein means is provided for adjusting the angular engagement of the doctor blade with respect to the printing plate.

3. In the rotary intaglio printing press of claim 2 wherein the doctor blade angle adjusting means comprises: a bushing mounted in the cam lever arm, a block having opposite faces with a hole having an axis perpendicular to and through opposite faces therein, a stub shaft depending from one face on the block at right angles to the axis of the hole journaled in the bushing, a threaded bar slidably mounted in the hole in the block engaging jamb nuts against the opposite faces of the block, said threaded bar pivotally connected to the doctor blade lever arm at its other end.

4. A rotary intaglio printing press according to claim 1 wherein means is provided to limit the engagement of the doctor blade with the printing plate.

5. A rotary intaglio printing press according to claim 1 wherein means is provided for adjusting the pressure of the doctor blade against the printing plate.

6. In the rotary intaglio printing press of claim 5 wherein the doctor blade pressure adjusting means comprises: a bushing mounted in the cam lever arm, a block having opposite faces with a hole having an axis perpendicular to and through opposite faces therein, a stub shaft depending from one face on the block at right angles to the axis of the hole journaled in the bushing, a threaded bar slidably mounted in the hole in the block engaging jamb nuts against the opposite faces of the block, said threaded bar pivotally connected to the doctor blade lever arm at its other end.

7. A rotary intaglio printing press according to claim 1 wherein means is provided to adjust the contact pressure of the doctor blade against the transfer roller in the ink discharge position.

8. In the rotary intaglio printing press of claim 7 wherein the means for adjusting the contact pressure of the doctor blade against the transfer roller comprises: a bracket support shaft, a plurality of doctor blade throw brackets supporting swing bar mounted for adjustable angular position on the bracket support shaft, a block with a hole pivotally mounted to the frame, a threaded bar slidably mounted in the hole in the block engaging jamb nuts against the opposite sides thereof, said threaded bar pivotally connected to the doctor blade throw bracket at its other end.

9. In the rotary intaglio printing press of claim 1 wherein the means for oscillating the doctor blade comprises: a swing bar parallel to the axis of the blade cylinder journaled to oscillate in a bracket means mounted on the frame, a doctor blade lever arm mounted on the cylindrical end of the swing bar having an outside end, a cam lever arm pivotally mounted on the frame having a far end, a change-in-length link adjusting means pivotally connecting the outside end of the doctor blade lever arm and the far end of the cam lever arm, a cam coaxially mounted on and constrained to rotate with the plate cylinder in cooperation with the cam follower to move the cam lever in timed relation with respect to the rotation of the printing plate on the plate cylinder, a pneumatic cylinder pivotally mounted at one end on the frame and pivotally connected to the cam lever arm at the other end energized to induce the cam follower to cooperate with the cam.

* * * * *