

Nov. 13, 1962

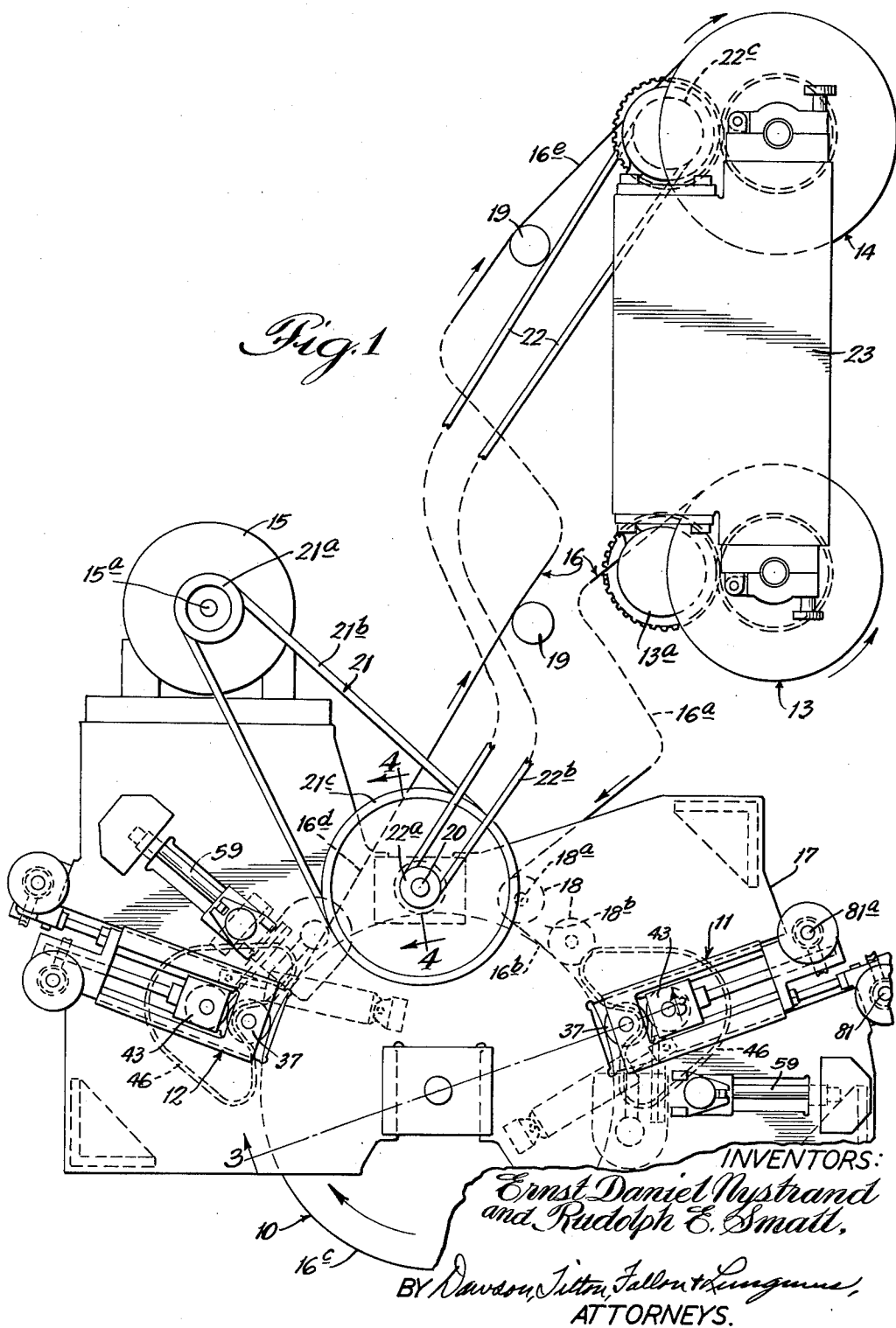
E. D. NYSTRAND ET AL

3,063,367

PRINTING PRESS

Filed May 14, 1959

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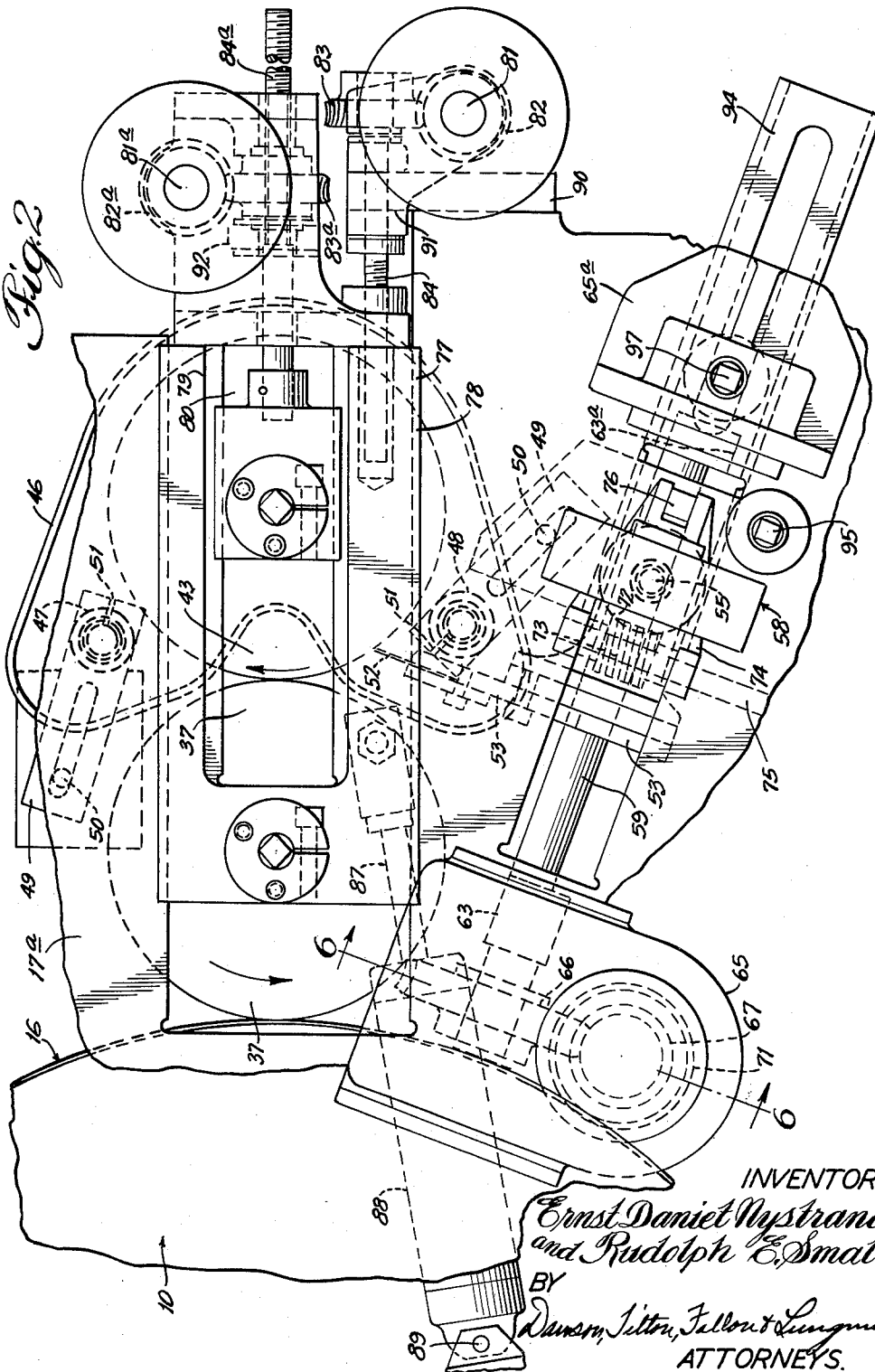
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6 Sheets-Sheet 2



INVENTORS:

*Ernst Daniel Nystrand
and Rudolph E. Small.*

BY

Danson, Sitter, Fellon & Lundquist,
ATTORNEYS.

Nov. 13, 1962

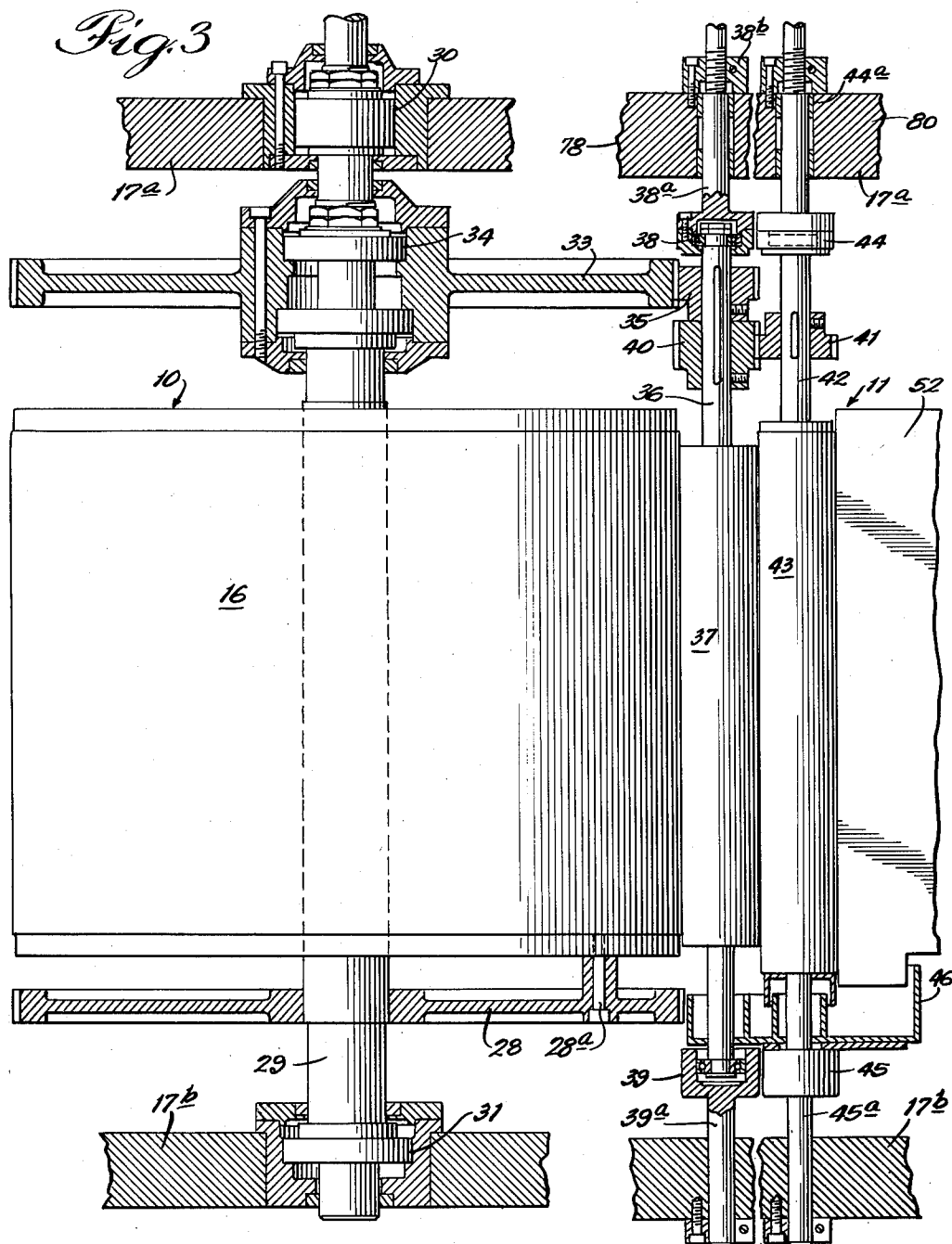
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INVENTORS:
Ernst Daniel Nystrand
and Rudolph E. Small,
BY Dawson, Titton, Feller & Longmire,
ATTORNEYS.

Nov. 13, 1962

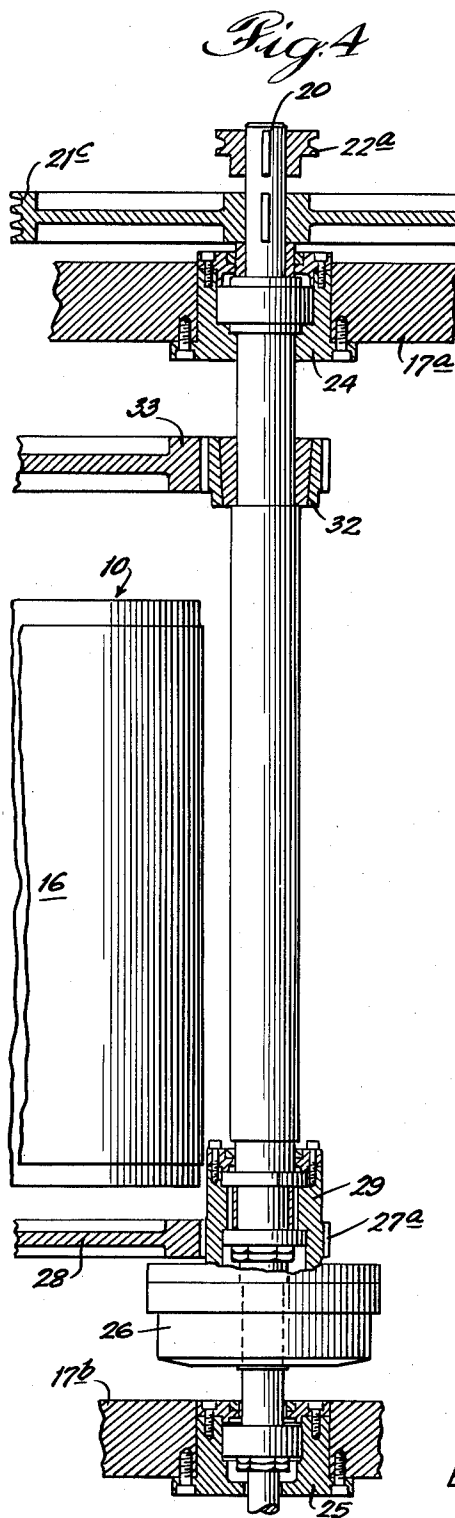
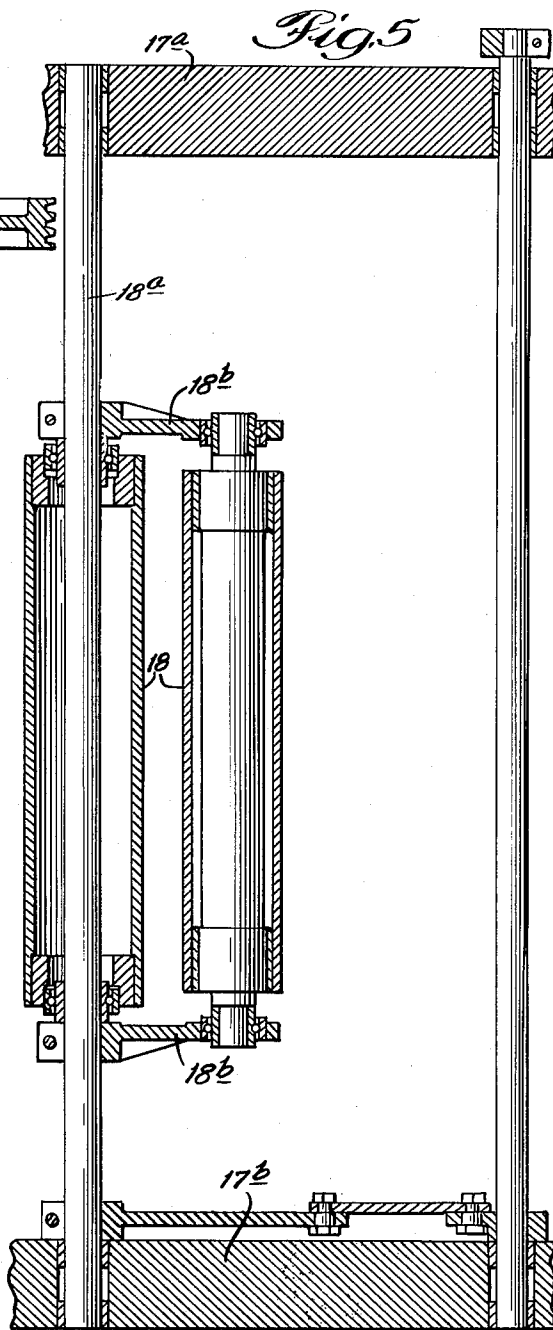
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6 Sheets-Sheet 4



INVENTORS:
*Ernst Daniel Nystrand
and Rudolph E. Small,*
BY *Dawson, Sifton, Fallon & Leungman,*
ATTORNEYS.

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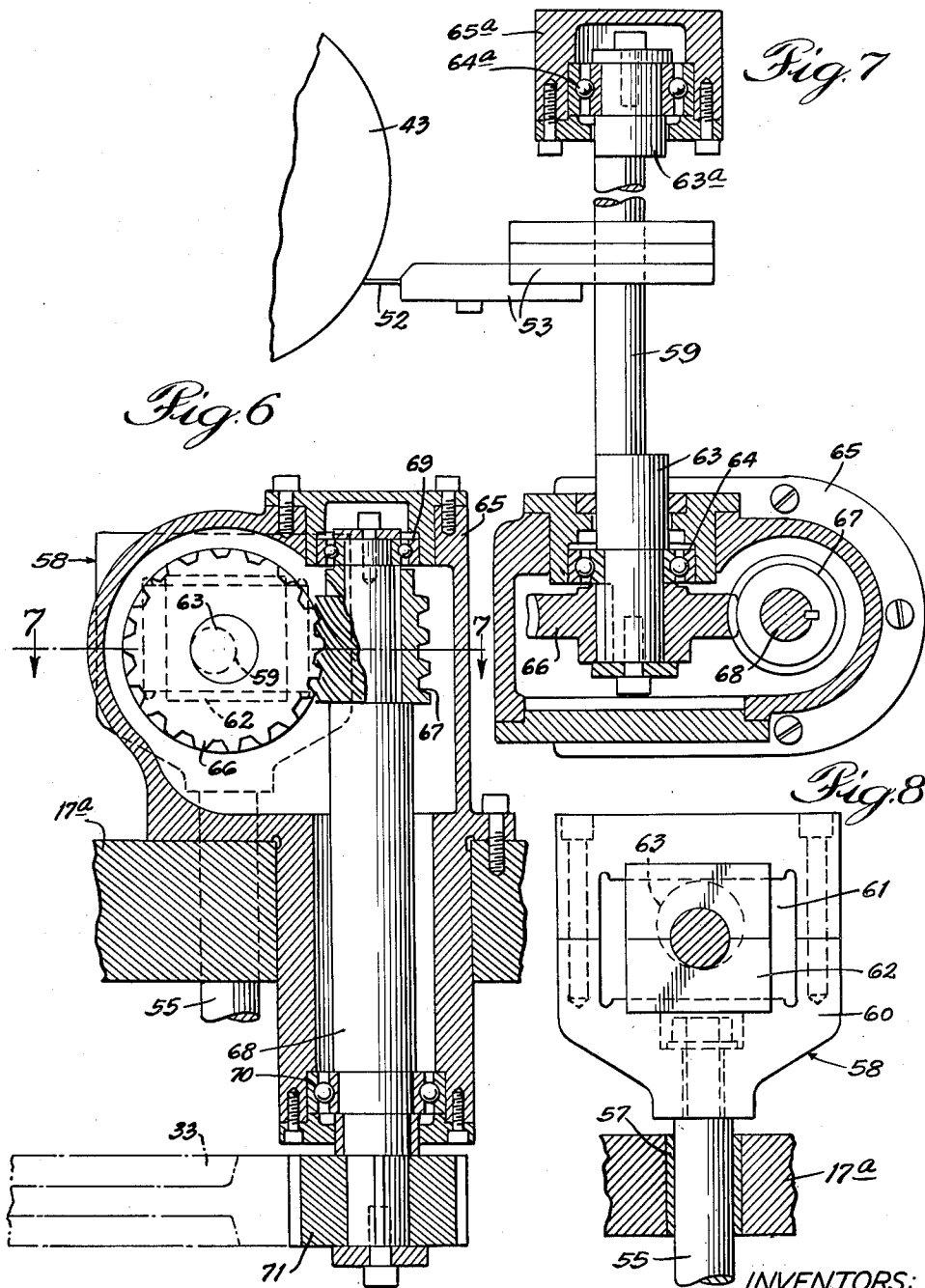
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6 Sheets-Sheet 5



INVENTORS:
*Ernst Daniel Nystrand
and Rudolph E. Small,*
BY *Dawson, Titton, Fallon & Longmire,*
ATTORNEYS.

Nov. 13, 1962

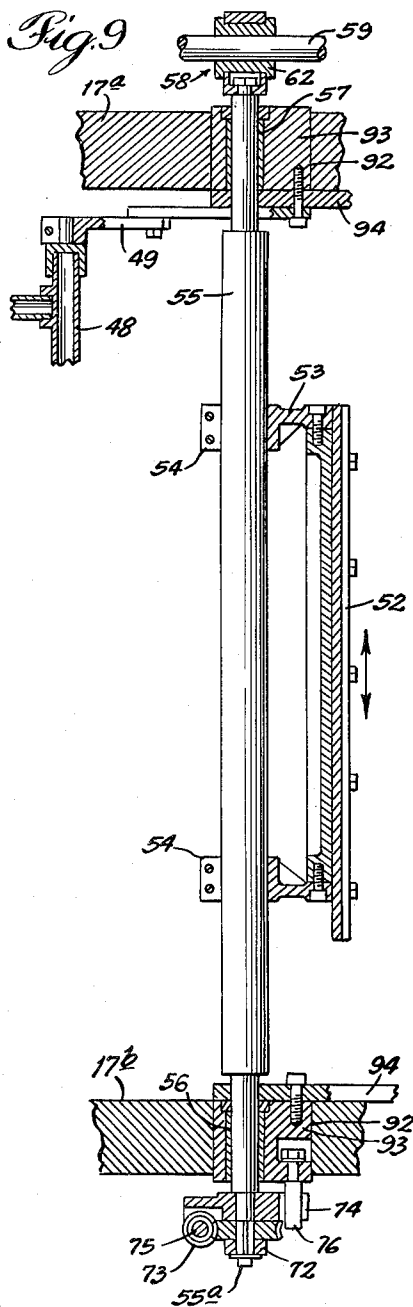
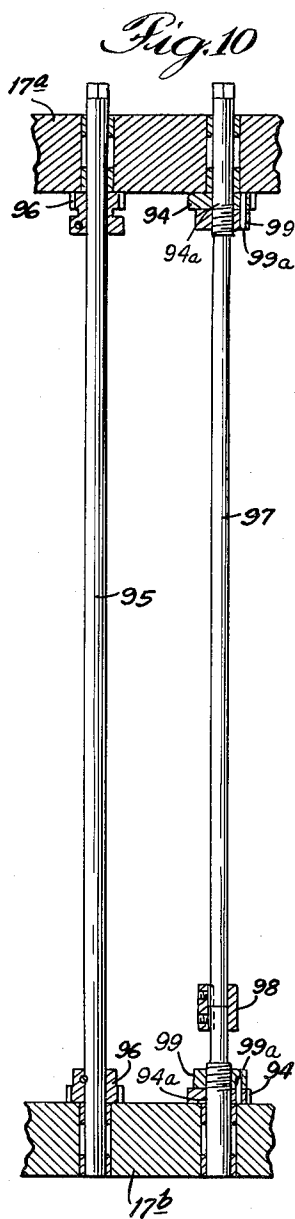
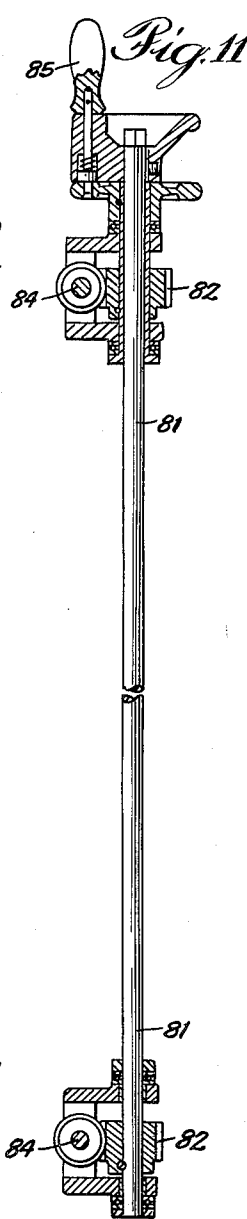
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6 Sheets-Sheet 6



INVENTORS:

*Ernst Daniel Nystrand
and Rudolph E. Small,*
BY *Dawson, Little, Fallon & Rungnes,*
ATTORNEYS.

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3,063,367

PRINTING PRESS

Ernst Daniel Nystrand and Rudolph E. Small, Green Bay, Wis., assignors to Paper Converting Machine Co., Inc., Green Bay, Wis., a corporation of Wisconsin
Filed May 14, 1959, Ser. No. 813,104
15 Claims. (Cl. 101—152)

This invention relates to a printing press, and, more particularly, to a press employing a single impression cylinder cooperating with a plurality of ink-applying units.

In a single impression cylinder, a web is partially wrapped around the cylinder and travels with the cylinder as the cylinder rotates. At spaced-apart points on the periphery of the cylinder, ink is applied to provide a composite printed web. A number of advantages accrue from this procedure, especially the ease with which registration can be achieved. Each ink-applying unit can be indexed carefully and matched for proper registration. However, the advantages of the single impression cylinder for printing have only been imperfectly realized in the past. Each ink-applying unit presents a different problem, since it is located at a different position on the periphery of the single impression cylinder. In the past, different ink formulations have had to be employed because of the different lengths of time elapsing between the application of ink to the printing roll and the time the ink is transferred therefrom to the web.

It is an object of this invention to provide a novel printing mechanism that overcomes these drawbacks and provides beneficial advantages for multicolored printing, and the like. Another object is to provide a printing press in which the advantages of a single impression cylinder are realized without any of the disadvantages characteristic of the ink-applying units of the past. Still another object is to provide a novel printing mechanism employing a single impression cylinder having its axis vertically disposed. Yet another object is to provide a printing mechanism in which a plurality of printing units are disposed about the periphery of an impression cylinder, each unit including a rotogravure or engraved roll and a transfer roll.

A further object of the invention is to provide a novel mechanism for offset gravure printing. A still further object is to provide a printing mechanism effective to provide offset gravure printing in which each of the printing units is characterized by the same geometry and wherein a single ink formulation can be employed. A yet further object is to provide a printing mechanism having a plurality of ink-applying stations disposed about a single impression cylinder in which the need for special drying expedients at each ink-applying station is eliminated.

Another object is to provide a printing mechanism in which a single impression cylinder is vertically disposed for rotation with a traveling web, the cylinder being equipped with a plurality of equally spaced-apart ink-applying roll units, each of the units being substantially identical. Yet another object is to provide, in a mechanism of the character described in the object immediately preceding, a novel mechanism for doctoring the ink-applying roll units. Still another object is to provide, in a printing mechanism of the character described hereinbefore, a novel drive transmission system which permits of the replacement of ink-applying rolls so as to achieve different register on the web. Other objects and advantages of this invention can be seen as this specification proceeds.

The invention will be described in conjunction with an illustrative embodiment in the accompanying drawing, in which—

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FIG. 1 is a top plan view, partially broken away, of a press embodying teachings of this invention;

FIG. 2 is an enlarged view of a fragment of the apparatus seen in FIG. 1, the view in FIG. 2 also being a top plan view and featuring the ink-applying means equipped with larger ink-applying rolls;

FIG. 3 is a fragmentary elevational view, partially in section, of the apparatus of FIG. 1 and specifically showing the ink-applying unit and the impression cylinder;

FIG. 4 is a fragmentary elevational view, partially in section, of drive means for the apparatus and corresponds essentially to a view taken along the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary elevational view, partially in section, showing web guide rolls;

FIG. 6 is a fragmentary elevational view, partially in section, of a portion of the ink-applying means and corresponds essentially to a view taken along the line 6—6 of FIG. 2;

FIG. 7 is a cross-sectional view, taken along the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary elevational view of a yoke structure employed in conjunction with the apparatus seen in FIGS. 6 and 7;

FIG. 9 is a fragmentary elevational view, partially in section, of doctoring means associated with the apparatus seen in FIGS. 6—8;

FIG. 10 is a fragmentary elevational view, partially in section, of a pair of cross shafts employed with the apparatus of FIGS. 6—9; and

FIG. 11 is a fragmentary elevational view, partially in section, of apparatus for positioning the ink-applying means.

In the illustration given, and with particular reference to FIG. 1, the numeral 10 designates generally an impression cylinder. Inasmuch as FIG. 1 is a top plan view, the axis of the cylinder 10 is seen to be disposed vertically. The numeral 11 designates generally a first ink-applying unit, while the numeral 12 designates a second ink-applying unit. The numeral 13 designates an unwinder for the apparatus, while 14 designates generally a rewinder for the apparatus. The numeral 15 designates a motor for driving the various rotative elements in the press which are employed to unwind, print, and rewind a web generally designated 16.

In FIG. 1, the numeral 16a designates the portion of the web leaving the unwinder 13. The numeral 16b designates that portion of the web on the impression cylinder 10 before it is engaged by the first ink-applying unit 11. The numeral 16c designates the web on the impression cylinder 10 during the first drying operation and after it has been pressed by the first ink-applying unit 11. 16d indicates that portion of the web leaving the second ink-applying unit 12 and during the second drying step. Finally, 16e designates that portion of the web as it is about to be rewound on rewinder 14.

Still referring to FIG. 1, the numeral 17 designates a frame which supports the elements 10—12 above described. If desired, the frame may be extended to support also the unwinder 13 and rewinder 14. The numeral 18 designates guide rolls in the path of travel of the web 16, the guide rolls being suitably supported for rotation on frame 17. The rolls are also seen in FIG. 5 with one roll being mounted on a shaft 18a supported in the frame portions 17a and 18a. The other roll is supported on arms 18b so as to be positioned to press web 16 against impression cylinder 10. The numeral 19 designates yet other guide rolls employed for directing the travel of web 16 and which are interposed between the frame 17 and the unwinder and rewinder 13 and 14, respectively.

The numeral 20 designates a shaft which is mounted for rotation about a vertical axis and suitably supported

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within frame 17. The shaft 20 is the main drive shaft and will be described in more detail hereinafter in connection with FIG. 4.

The numeral 21 (seen only in FIG. 1) designates generally transmission means for transmitting rotative power from motor 15 to shaft 20. The transmission means 21 includes a sheave 21a suitably locked on motor shaft 15a. The transmission means 21 also includes a belt 21b which is entrained over sheave 21a and also over sheave 21c, the last-mentioned sheave being locked on shaft 20.

Transmission means generally designated 22 are seen in FIG. 1 for transmitting a rotative power from the main drive shaft 20 to the rewinder 14. For this purpose, a sheave 22a is provided on shaft 20, which is coupled to a sheave 22c on rewinder 14 through a belt 22b. A similar transmission system may be provided for the unwinder 13. If desired, the rewinder 14 and unwinder 13 can be supported on the same frame such as is designated by the numeral 23.

Referring now to FIG. 4, the elements previously referred to and designated by the numerals 20, 21c, 22a, 10, 16, and 17 can be seen. The shaft 20, as seen in FIG. 4, has keyed to it the sheaves or pulleys 22a and 21c. The shaft 20 is journaled in the frame 17 by a roller bearing 24 in the upper frame 17a and by a ball bearing 25 in the lower frame 17b. The shaft 20 is equipped with a clutch 26 which engages a gear housing 27 equipped with gear teeth 27a. The gear teeth 27a engage a gear 28 provided as part of the impression cylinder 10, the large gear or bull gear 28 being seen in complete form in FIG. 3.

Referring now to FIG. 3, the upper and lower frames 17a and 17b are seen, which rotatably support the impression cylinder shaft 29. For this purpose, the upper frame portion 17a is equipped with a bearing 30, and the lower frame portion 17b is equipped with a bearing 31.

In the operation of the elements thus far described, rotative motion from motor 15 is transmitted through means 21 to shaft 20. Shaft 20, in rotating and with clutch 26 engaged with housing 27, causes a corresponding rotation of the bull gear 28. The bull gear 28, being locked on impression cylinder 10 as at 28a, causes a corresponding rotation of the impression cylinder 10, and, with it, the web 16.

As can be seen from FIG. 4, the shaft 20 also provides means for driving the ink-applying units. For this purpose, the shaft 20 is equipped with a pinion 32 which engages a second bull gear 33 associated with shaft 29 of impression cylinder 10. Referring now to FIG. 3, where the second bull gear 33 is seen in its entirety, it will be noted that a bearing 34 is interposed between the bull gear 33 and the shaft 29 so that the gear 33 is free to rotate relative to the shaft 29. Thus, the shaft 29 serves as a support for the gear 33 which is employed for transmitting rotative motion from the shaft 20 to the ink-applying units independently of any rotation of the impression cylinder 10.

As can be seen in FIG. 1, the ink-applying units 11 and 12 are disposed at other portions of the periphery of cylinder 10 than shaft 20, and the large gear 33 provides means for coupling the rolls of the ink-applying units 11 and 12 to the shaft 20. Here, it is to be appreciated that only two ink-applying units are shown for the sake of clarity of presentation, but a number of units may be conveniently installed about the periphery of cylinder 10.

Referring again to FIG. 3, the numeral 35 designates a pinion gear having spiral or helical teeth mounted on shaft 36. Shaft 36 carries a rubber-covered transfer roll 37 which is arranged for contact with web 16. The pinion gear 35 is engaged by the bull gear 33 also equipped with spiral or helical teeth so that as gear 33 rotates, so also will the roll 37. The shaft 36 is vertically disposed and is journaled in a bearing 38 supported by

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retractable shaft 38a in the upper frame portion 17a. The shaft 36, at its lower end, is journaled in bearing 39 supported by retractable shaft 39a in the lower frame portion 17b. The shaft 36 is equipped with a second gear 40 which mates with a gear 41 carried by a second shaft 42. The shaft 42 is on the axis of an engraved or gravure roll 43. The shaft 42 is supported from the upper frame portion 17a in a fashion similar to shaft 36, being journaled in bearing 44 supported by retractable shaft 44a, while the lower end of the shaft 42 is journaled in a bearing 45 carried by a shaft 45a retractably mounted in the lower frame portion 17b. Thus the rolls 37 and 43 may be removed from the frame 17.

In the apparatus just described for driving the ink-applying rolls 43 and 37, each rotation of shaft 20 provides a corresponding rotation in rolls 37 and 43 through the gear train made up of pinion 31, bull gear 33, and gears 35, 36 and 41. When clutch 26 is disengaged and the rolls 37 and 43 retracted horizontally away from impression cylinder 10 by a break-away mechanism to be described hereinafter, it is possible to rotate the roll 37 independently of the single impression cylinder 10. This prevents ink from drying on the rolls and maintains the rolls in proper register with each other. Change of register longitudinally of web 16 is achieved by turning shaft 38a, threadedly received in a stationary nut 38b. This results in raising or lowering shaft 36. The mating helical teeth on gears 33 and 35 free the roll 37 to revolve slightly around its axis. Change of registry transversely of web 16 is achieved by moving the engraved roll 43 vertically relative to the transfer of roll 37, and this is achieved by raising or lowering shaft 44a in a fashion similar to that described relative to shaft 36a. The gear 41 is a straight or spur gear and thus can be moved vertically relative to the spur gear 36 to change the transverse register on web 16. This results in vertical movement of roll 43.

For the purpose of describing one of the ink-applying units in greater detail, reference will be made to the showing in FIG. 2. In FIG. 2, the numerals 37 and 43 again designate a transfer roll and a gravure roll, respectively. These rolls in FIG. 2 represent about the maximum diameter rolls employable, while the showing in FIG. 1 has the rolls shown in the minimum diameter employable.

In FIG. 2, the numeral 46 designates a shroud extending about the bottom portion of gravure roll 43 for the purpose of collecting ink flowing down gravure roll 43. The shroud 46 can also be seen in top plan view in FIG. 1 and in sectional elevational view in FIG. 3. In FIG. 2, the means for supplying ink is seen in the form of two vertically-extending pipes 47 and 48. The ink pipe 47 is positioned so as to apply ink to the periphery of roll 43 just after impression has been made, i.e., transfer of ink to the rubber-covered roll 37. The pipe 48 is positioned to apply ink to the engraved roll 43 just prior to contact between roll 43 and the doctor blade 52. Each pipe is carried by pipe-supporting arms 49 which are movably secured to the frame 17a and are pivotally related therewith as at 50. The numeral 51 (seen only in FIG. 2) designates orifices in pipes 47 and 48 for supplying ink over the entire vertical surface of the gravure roll 43. Pump means (not shown) may be provided for recirculating ink from shroud 46 to pipes 47 and 48. Also seen in FIG. 2 and adjacent pipe 48 is a doctor blade 52 which is arranged for vertical reciprocation against the surface of gravure roll 43.

In the operation of the ink-applying unit 11, the rolls 37 and 43 are rotated by the gear coupling with shaft 20. As the roll 43 rotates, ink is applied thereto in a plurality of streams from pipes 47 and 48. This ink is received and trapped in the gravure depressions provided on the surface of roll 43, with excess ink being doctored therefrom by means of the doctor blade 52. The ink from the gravure depressions is transferred to the rubber-

covered transfer roll 37 and from the transfer roll 37 to the web 16 traveling on the periphery of the impression cylinder 10.

The means for providing the vertical reciprocation of the doctor blade 52 will now be explained in conjunction with FIGS. 2 and 6-10. Referring now to FIG. 9, the doctor blade 52 is seen in side elevation and is seen to be rigidly mounted on frame 53. The frame 53 is equipped with a pair of clamping brackets 54 which positionably mount the doctor blade 52 on a vertically-extending shaft 55. The shaft 55 is carried in the frame 17 by means of a bearing 56 in the lower frame portion 17b and in the upper frame portion 17a by a bearing 57. The extreme upper portion of the shaft 55 is connected to a Scotch yoke generally designated 58, which in turn is connected to an eccentrically-mounted shaft 59. The structure of the yoke 58 can be seen in detail in FIG. 8, where the numeral 60 designates the horizontally split body of the yoke. The yoke body 60 is equipped with a slot 61, in which is mounted a laterally-reciprocable block 62. The Scotch yoke 58 operates to resolve a circular motion provided by shaft 59 into two rectilinear components, the horizontal component being taken up by the block 62, while the vertical component is applied to shaft 55 to provide the vertical reciprocation of doctor blade 52.

To provide the circular motion of shaft 59, the eccentric construction seen in FIG. 7 may be employed. There, the shaft 59 is seen to be provided with integral portions 63 and 63a at the ends thereof. The axes of portions 63 and 63a are offset from the axis of the shaft 59 so that when the portions 63 and 63a rotate in bearing 64 and 64a, respectively, the shaft 59 develops an eccentric motion. Each bearing 64 and 64a is supported in a suitable housing 65 and 65a, respectively, with the housing 65 also providing a housing for the gearing transmitting power to the shaft 59. In the housing 65, a worm gear 66 is mounted on the end of shaft portion 63 so that as the worm gear 66 is turned, the shaft 59 follows its eccentric path. Operating to turn the worm gear 66 is a worm 67, best seen in FIG. 6. The worm 67 is locked to a shaft 68 which extends vertically upwardly from the upper frame portion 17a. Thus, the shaft 59, Scotch yoke 58, and worm gearing 66 and 67 are all positioned above the upper frame portion 17a. The shaft 68 is journaled at its upper end in a bearing 69 suitably mounted in the housing 65. At its lower end, the shaft 68 is supported in a bearing 70 secured to the upper frame portion 17a. At its extreme lower end, the shaft 68 is equipped with a spur gear 71 which engages the bull gear 33. Thus, the doctor blade is reciprocated whenever the gravure roll 37 is rotating and irrespective of whether the impression cylinder 10 is rotating.

Angular relocation of the doctor blade 52 may be accomplished by the turning structure seen at the extreme lower portion of FIG. 9 and which is also seen in plan view in FIG. 2. The extreme lower end of shaft 55 is equipped with a gear 72 which is engaged by a worm 73, the worm 73 being mounted for rotation within a bracket 74 slidably positioned on frame 17. The worm 73 is equipped with a horizontally-extending turning handle 75, only a fragment of which is seen in FIG. 2. Thus, under the turning of handle 75, the shaft 55 is turned through an angle, and with it, doctor blade 52. In this manner, a proper engagement between the doctor blade 52 and the roll 43 can be obtained. Also, when the doctor blade oscillating means is shifted, the blade can be positioned so as to bear against the proper point of the periphery of roll 43.

To immobilize the shaft 55 in any given angular position, the bracket 74 is equipped with a pin 76 which is effective to lock the bracket 74 relative to frame portion 17b, all of which can be seen in FIG. 9.

The upper and lower portions 17a and 17b of frame 17 are each provided with a slot 77 (see FIG. 2). Mounted

for lateral sliding movement within slots 77 of frame 17 are upper and lower carriages 78, only the upper carriage being seen in the drawing and this only in FIG. 2. The carriages 78 rotatably support roll 37 and are each equipped with an elongated slot 79. The slots 79 slidably receive a second set of carriages 80. Carriages 80 rotatably support the engraved roll 43. Mounted on frame 17 are a pair of cross shafts 81 and 81a (see FIG. 2 and also FIG. 11), which are equipped with gears 82 and 82a, respectively, engageable with gears 83 and 83a carried by shaft extensions 84 and 84a on each of the carriages 78 and 80. Thus, by the turning of the handles 85 and 85a (see FIG. 11) on shaft 81 and 81a, respectively, the carriages 78 and 80 can be made to travel inwardly and outwardly of the impression cylinder 10. In this fashion, larger or smaller rolls 37 and 43 can be installed and adjustments made for proper roll pressure.

The carriages 78 are each connected at their inner ends to piston rods 87 (see FIG. 2). The piston rods 87 are provided as part of cylinders 88, which at their closed ends are pivotally mounted as at 89 to a portion of frame 17.

The shafts 84 associated with carriages 78 are mounted in bearings 90 provided as part of frame 17. The shaft 84 have limited horizontal movement in bearings 90 under the urging of cylinders 88. The limited movement is designated by the space 91 (see FIG. 2). Thus, when the piston rods 87 are extended out of cylinders 88, carriages 78 are moved outwardly to separate roll 37 from the cylinder 10. Upon retraction of piston rod 87, roll 37 is brought into engagement with cylinder 10. It is to be appreciated that the separation effected is quite small, but sufficient to keep the otherwise contacting surfaces out of contact and prevent the unfavorable drying of ink thereon. If desired, a corresponding movement of the doctor blade may be provided when the rolls 37 and 43 are spaced from the impression cylinder.

The break-away mechanism for the roll 37 which has just been described can be found in greater detail in the copending application of Ernst Daniel Nystrand, Serial No. 813,204, filed May 14, 1959, and reference hereby is made to that application.

To reposition the doctor blade assembly, specifically shaft 55, in various locations relative to impression cylinder 10 so as to accommodate different sized rolls 37 and 43, the upper and lower frames 17a and 17b are equipped with elongated slots 92 in which blocks 93 are slidably received (see FIG. 9). Attached to each block is a rack plate 94. Extending through the frames 17a and 17b is a shaft 95 (see FIG. 10) equipped with upper and lower pinions 96 engageable with racks 94 for moving the blocks 93 in slots 92. The shaft 95 is suitably journaled in frames 17a and 17b for rotation. Locking of the racks in any given position relative to slots 92 is achieved by shaft 97 (see FIG. 10). Shaft 97 is journaled in frames 17a and 17b and is provided in two portions united by a coupling 98. Threadedly received on shaft 97 are nuts 99 which are oppositely threaded. Pins 99a are provided in nuts 99 and extend into the racks 94 to restrain nuts 99 against rotation. Thus, turning of shaft 97 causes nuts 99 to tightly clamp racks 94. The racks 94 are equipped with slots 94a to accommodate shaft 97 when the racks 94 are moved relative thereto.

By the printing apparatus described herein, it is now possible to combine the advantages of the single impression cylinder and yet employ gravure printing techniques. The single impression cylinder 10 can be constructed with a metal surface and thus have a wear-resistant surface, unlike the usual impression cylinders constructed with rubber surfaces and employed in gravure printing. The metal surface of the impression cylinder 10 resists rupturing stresses which might be induced either by the operation or changes in temperature which have made the use of rubber-covered single impression cylinders impractical in the past. By providing means for inserting larger or

smaller ink-applying rolls, as the case may be, the apparatus becomes versatile for any sized repeat. The further incorporation of means for separating the ink-applying rolls and the impression cylinder yields a beneficial operation, since there is no longer the possibility of fouling the rolls and web during web stoppage. Additionally, the angled orientation of the cylinder 88 provides an advantageous stabilization of the carriages 78 against vibration.

Through this invention, it is now possible to provide superior printing, i.e., gravure printing, on extensible webs and other stocks of uneven thickness. The invention substantially reduces the pressures necessary to transfer ink from the gravure cells to the web. This reduces the cost of cylinders and increases the web width possible in a given printing repeat.

While, in the foregoing specification, we have set forth a detailed description of an embodiment of the invention for the purpose of explanation thereof, many variations in those details will be perceived by those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. In a printing press, a metal-surfaced impression cylinder, a plurality of transfer rolls disposed about the periphery of said cylinder with the axes of said rolls being disposed parallel to the axis of said cylinder, said rolls being in releasable engagement with the surface of said cylinder for applying ink to a web traveling with said cylinder, said rolls having surfaces covered with resilient material, a gravure roll for each transfer roll mounted for ink-transferring engagement therewith, and means for applying ink to said gravure rolls, and doctor means for each gravure roll, said cylinder and rolls all having vertically disposed axes.

2. The structure of claim 1 in which said doctor means comprise a blade for each gravure roll mounted for reciprocation parallel to the axis thereof.

3. The structure of claim 1 in which said ink-applying means comprises vertically-disposed pipe means apertured to direct ink horizontally against each of said gravure rolls.

4. The structure of claim 3 in which said doctor means is positioned to contact an area of said gravure roll between the area of said gravure roll receiving ink from said ink-applying means and the area of said gravure roll contacting its associated transfer roll, and shroud means about said rolls for confining the ink therein.

5. In a printing press, a frame rotatably supporting an impression cylinder with its axis vertically, a plurality of ink-applying units disposed about the cylinder periphery and rotatably mounted on said frame, each of said units comprising roll means with the axis thereof disposed vertically, means for driving said rolls and said single impression cylinder, means for feeding a web for travel on said impression cylinder, and means for feeding ink to each of said units, said units being spaced apart circumferentially about said impression cylinder and with the roll means in each unit being positioned relative to said cylinder to define ink travel paths having about the same drying time.

6. The structure of claim 5 in which said driving means comprising shaft means vertically rotatably disposed in said frame, means for rotating said shaft means, and cooperating gear means on said shaft means, impression cylinder and roll means.

7. The structure of claim 6 in which means are provided for rotating the gear means on said roll means independent of the gear means for rotating said impression cylinder.

8. The structure of claim 7 in which the said roll means is movable vertically to alter the register of said roll means with a web on said impression cylinder.

9. The structure of claim 8 in which said roll means

comprises a pair of rolls, one of said rolls being a gravure roll and the other a transfer roll, gear means coupling said rolls together.

10. In printing apparatus, a frame supporting an impression cylinder for rotation therein with the axis thereof disposed vertically, a plurality of ink-applying roll means including units disposed about the periphery of said cylinder, said frame slidably supporting subframes for moving said ink-applying roll means-including units out of contacting relation with said cylinder, means for feeding a web for travel on said impression cylinder, and means for feeding ink to each of said units, said units being spaced apart circumferentially about said impression cylinder and with the roll means in each unit being positioned relative to said cylinder to define ink travel paths having about the same drying time.

11. In printing apparatus, a frame having an impression cylinder mounted therein for rotation about a vertical axis, a shaft for said cylinder on the axis thereof equipped with a pair of gears, one of said gears being arranged to drive said cylinder, a plurality of ink-applying units peripherally disposed about said cylinder and positionably mounted on said frame, each of said units comprising contacting transfer and gravure rolls with only the transfer roll of each unit adapted to contact a web travelling with said cylinder, a doctor blade reciprocally mounted on said frame for each gravure roll, gear means connected to each doctor blade and coupled to the other shaft gear, and eccentric means interconnected between said doctor blade and said gear means.

12. The structure of claim 11 in which said rolls are each equipped with gear means and said other gear engages said roll gear means for rotating said rolls.

13. The structure of claim 11 in which each of said units is equipped with an upstanding pipe apertured to provide an ink stream for coating said gravure roll adjacent said doctor blade and on the side thereof remote from said transfer roll and a second pipe is provided on the opposite side of said gravure roll.

14. In printing apparatus, a frame having upper and lower horizontal portions vertically spaced apart, a first vertically-disposed shaft journaled for rotation in said portions and supporting an impression cylinder, a second vertically-disposed shaft journaled for rotation in said portions and equipped with gear means, means for driving said second shaft, gear means on said first shaft cooperating with the gear means on said second shaft, a pair of vertically-disposed shafts mounted adjacent the cylinder periphery with a roll on each of said pair of vertically-disposed shafts, one of said rolls being in selective contacting relation with said cylinder to print a web travelling thereon and the other of said rolls being remote from said cylinder but in contact with said one of said rolls to apply an inked pattern thereto, gear means on the roll shafts cooperating with the gear means on said first shaft, doctor blade means for said other roll equipped with gear means for reciprocating said doctor blade means, said first shaft gear means being operative to rotate said cylinder and rolls and to reciprocate said doctor blade means.

15. In ink printing apparatus, a frame supporting an impression cylinder for rotation therein with the axis thereof disposed vertically, a plurality of ink-applying units disposed about the periphery of said cylinder, said frame slidably supporting subframes for moving said ink-applying units out of contacting relation with said cylinder, each of said units comprising a transfer roll and a gravure roll, said transfer roll being positioned intermediate said gravure roll and said cylinder for sequential transfer of ink from said gravure roll to a web traveling with said cylinder, a doctor blade for each gravure roll positioned adjacent to the area of contact between said transfer and gravure rolls, ink-supplying means for each gravure roll, and means on said frame for relocating each

doctor blade in said ink supply means when rolls of different diameters are substituted.

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