

March 31, 1942.

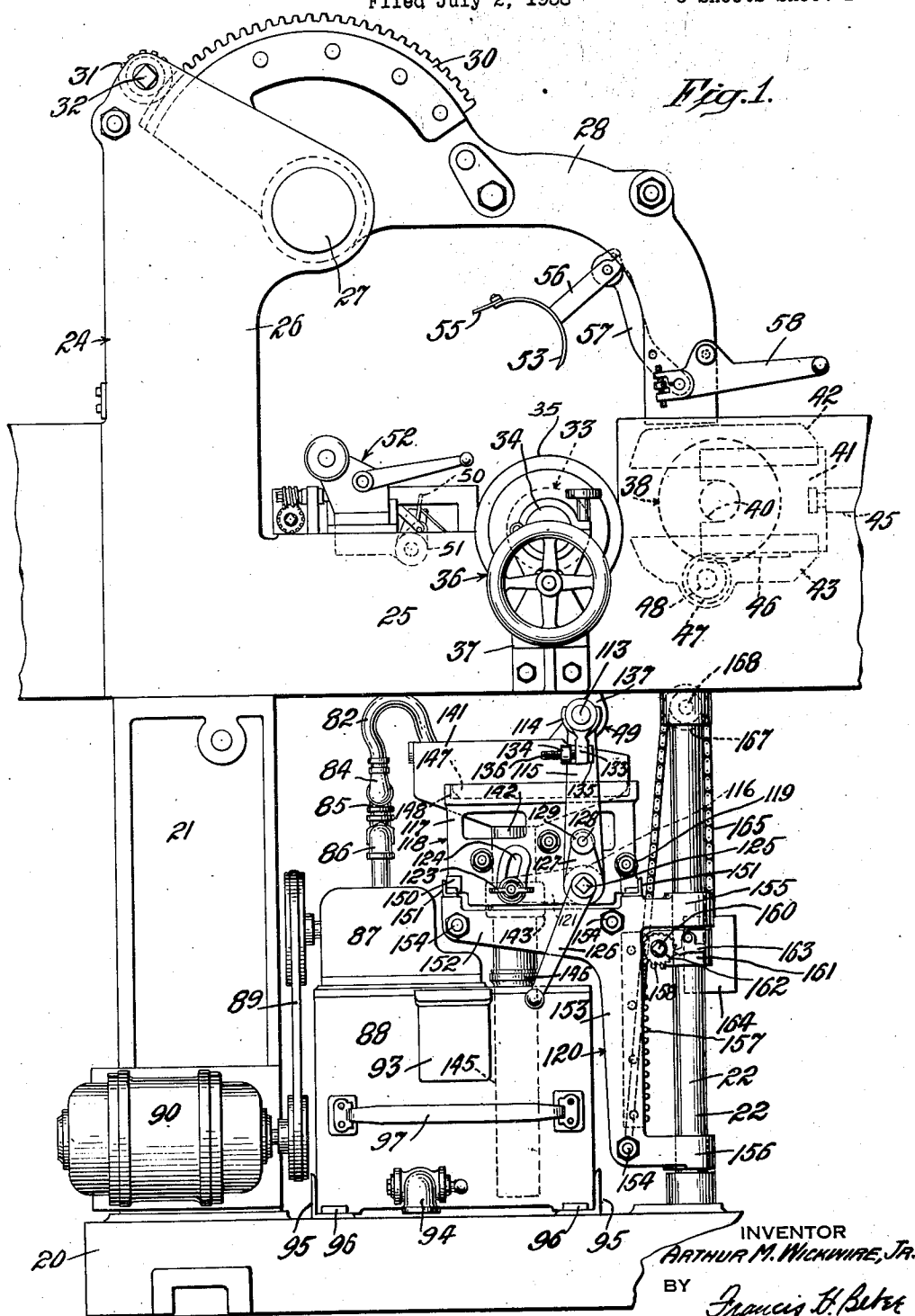
A. M. WICKWIRE, JR

2,278,387

METHOD AND APPARATUS FOR INKING PRINTING CYLINDERS

Filed July 2, 1938

5 Sheets-Sheet 1



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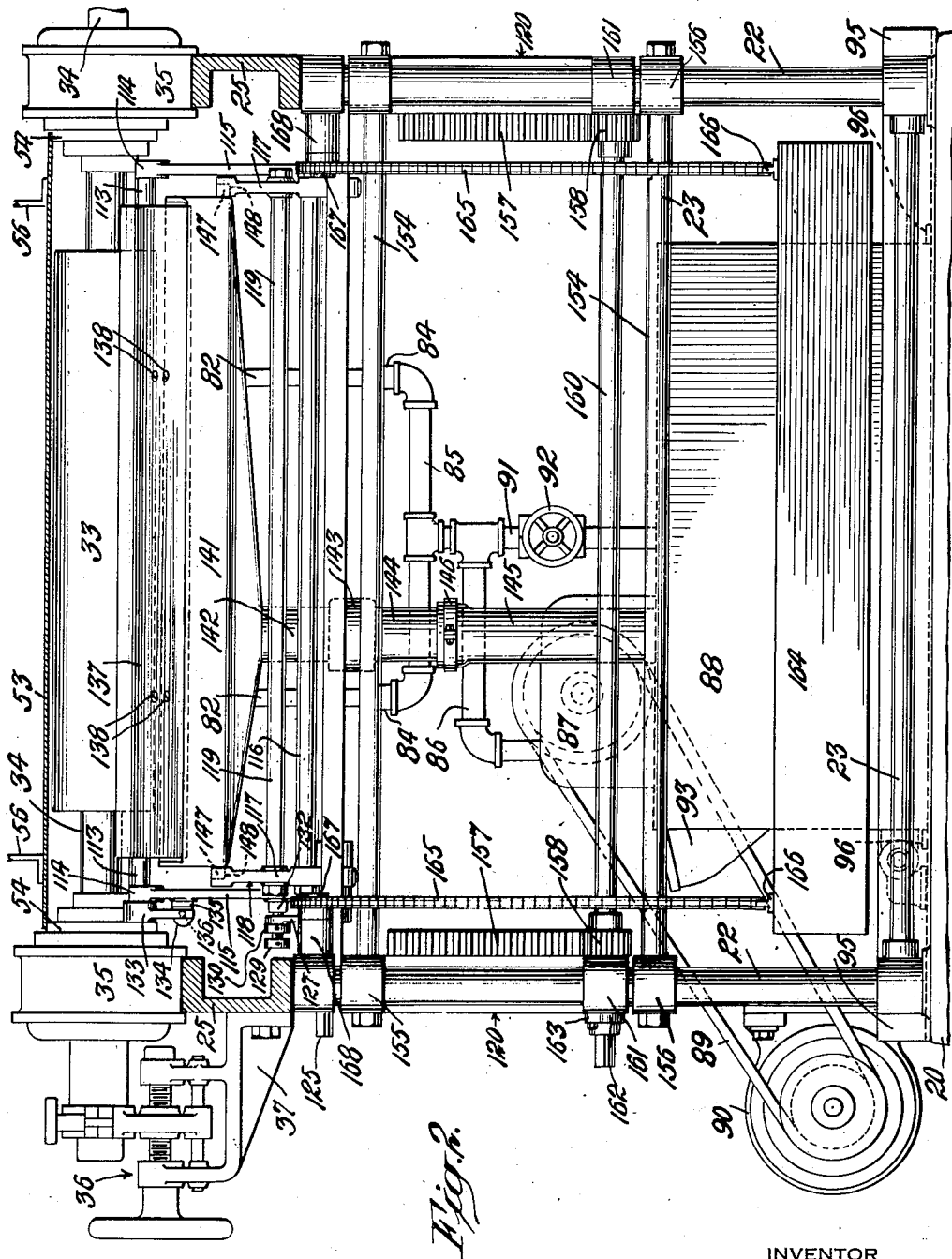
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METHOD AND APPARATUS FOR INKING PRINTING CYLINDERS

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5 Sheets-Sheet 2



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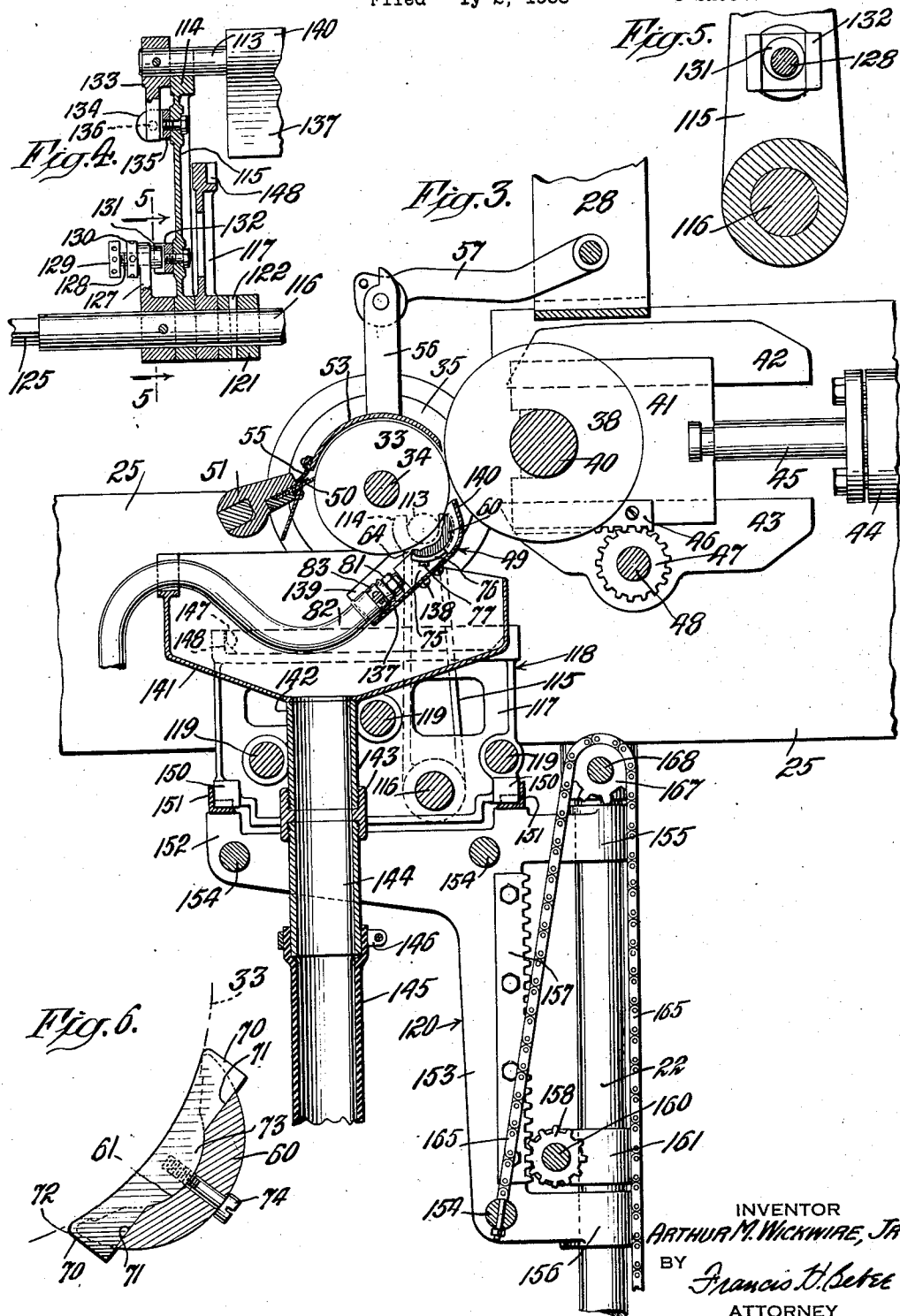
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METHOD AND APPARATUS FOR MAKING PRINTING CYLINDERS

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5 Sheets-Sheet 4

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2,278,387

METHOD AND APPARATUS FOR INKING PRINTING CYLINDERS.

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5 Sheets-Sheet 5

Fig. 10.

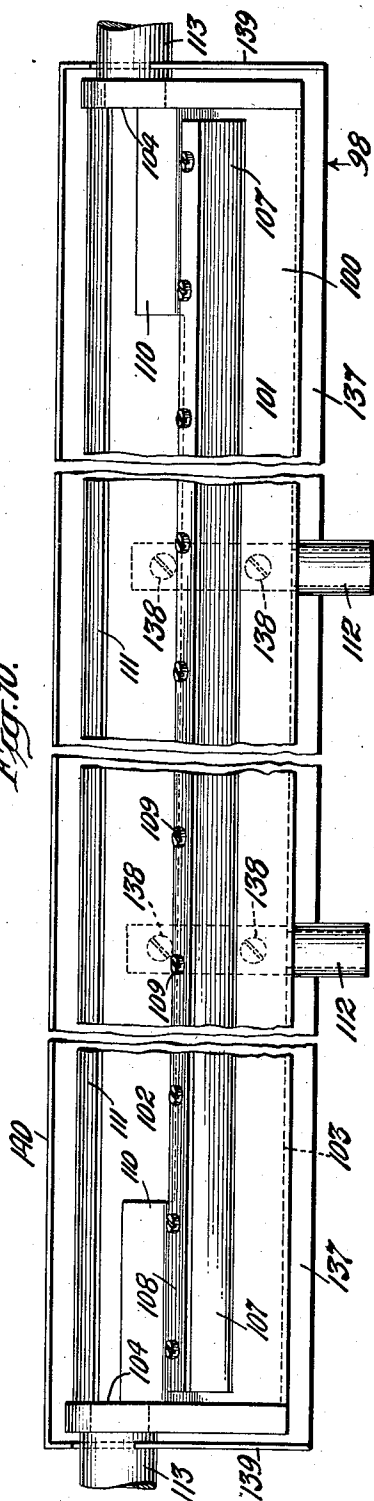


Fig. 11.

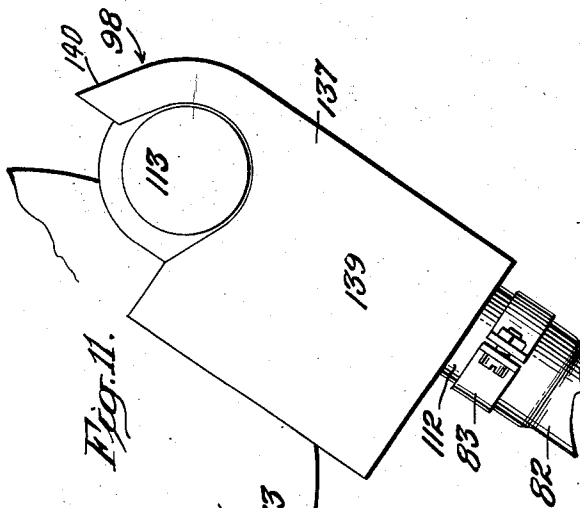
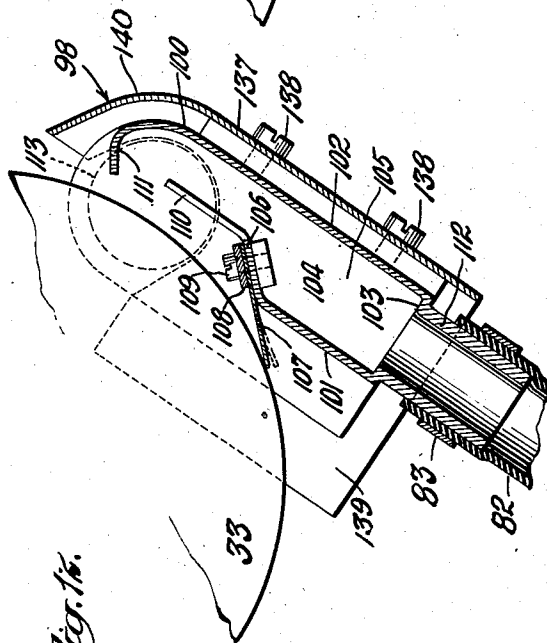


Fig. 16.



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UNITED STATES PATENT OFFICE

2,278,387

METHOD AND APPARATUS FOR INKING
PRINTING CYLINDERS

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assignor, by mesne assignments, to Interchemical Corporation, New York, N. Y., a corporation
of Ohio

Application July 2, 1938, Serial No. 217,139

17 Claims. (Cl. 101—157)

This invention relates to high speed intaglio or gravure printing and aims to provide an improved method and apparatus for applying ink or other marking material to the surface of an intaglio printing cylinder.

In printing, and particularly intaglio or gravure printing, if a plurality of colors are to be applied to the paper, each color must be dried before the succeeding color is applied. If a continuous web is being printing, it becomes necessary to provide a considerable length of web between each unit in order that each color may be thoroughly dry before a subsequent color is applied. Furthermore, attempts are constantly being made to increase the speed of the printing operation. To attain both a shorter web length and increased speed and still realize the full possibilities of rotogravure printing as to quality, very volatile inks must be used, and such inks must be brought to the printing line without undue loss of solvents.

Many factors must be considered in connection with this problem. The rate of evaporation of solvents is directly proportional to the area exposed to the air. Likewise, it is dependent upon the condition of the air, that is, whether the air is receptive to solvents or not. The effect of evaporation on the surface of a quantity of ink in terms of percentage of solvent loss may be said to depend upon the relation of the area exposed and the total volume of ink affected by the evaporation. Thus, a bath of ink of substantial quantity in relation to the surface area exposed to the air would not be greatly affected by evaporation from the surface because the percentage of solvent loss would be small. When, however, the ink is spread in a thin film over the surface of a printing member, such as an engraved printing cylinder, and the excess ink has been removed by a doctor blade, there is a very high ratio of exposed surface due to the extreme shallowness of the cells of the engraving.

Even a minute evaporation from these cells will render the ink unsuited for transfer to the paper. The reasons for this are that evaporation of solvent actually diminishes the volume of ink in the cell and makes it more difficult for the paper to pick it up. Moreover, since evaporation takes place at the surface where it comes in contact with the paper, the viscosity and other properties of the ink are altered. In addition to this, the paper usually does not remove all the ink from the cells, and if evaporation occurs after the printing operation and before the engraving is again flooded with ink, the ink will eventually

dry in the bottom of the cells and tend to make them smaller. This, of course, has a detrimental effect on the quality of the imprint.

In order to overcome these difficulties, it has been suggested that the entire ink fountain be enclosed. This has been accomplished by providing a substantially airtight housing in which the major portion of the printing cylinder is mounted, and only a portion of the cylindrical surface in the region of the impression line is exposed. While this arrangement has permitted the use of volatile inks, it has not been entirely satisfactory in all respects. Such constructions are usually cumbersome and expensive; and it is difficult to remove the printing cylinder when it is desired to change engravings. Moreover, if different colored ink is to be used in a subsequent run, the entire housing must be thoroughly cleaned before operations can again be started.

I have discovered that the above mentioned and other difficulties may be obviated, and very volatile inks or other marking materials may be used and printing of excellent quality obtained, without enclosing the major portion of the printing cylinder and the ink fountain in a substantially airtight housing.

In accordance with my invention, ink is applied to the surface of the printing cylinder in the form of a thin and regulated film or layer so as to provide a uniform protective coating over the surface of the cylinder and the cells of the engraving, which coating is of sufficient thickness that the consistency of the ink is not appreciably altered by normal loss of solvent therefrom, but which is also so controlled in amount that said ink will not fall or be otherwise removed from the surface of the cylinder by the normal rotation thereof. Preferably, this layer of ink is applied to the surface of the printing cylinder closely following the printing line. Such a method of applying ink to a printing cylinder may be effectively and advantageously combined with the methods of preventing evaporation disclosed in Irving Gurwick United States Patent No. 2,272,406, dated February 10, 1942.

One form of apparatus embodying my invention may comprise a substantially trough shaped ink applying member which is substantially co-extensive with the length of the printing cylinder, and is provided with a lower lip or regulating device which is adapted to perform the dual function of forcing the ink into the cells of the engraving and regulating the thickness of the film or layer of ink applied. This applicator is preferably pivotally mounted on a pair of arms,

which in turn are pivoted to a movable frame or carriage so that the applicator may be adjusted and properly positioned for printing cylinders of different sizes. The carriage also supports suitable pans and shields for receiving excess ink removed from the printing cylinder and returning it to a removable reservoir which is conveniently located beneath the press. A pump associated with this reservoir supplies the ink or other marking material to the applicator in the desired amounts.

These and other features and objects of my invention will become apparent upon consideration of the following description of specific embodiments thereof and by reference to the accompanying drawings, in which:

Fig. 1 is a side elevational view of one unit of a multi-color printing press in which the ink applicator and its associated mechanism have been included and are shown in inoperative position;

Fig. 2 is a fragmentary front elevational view, partly in section, of the apparatus, and showing the ink applicator and its associated mechanism in operative position;

Fig. 3 is a fragmentary vertical sectional view of the apparatus showing the arrangement of the ink applicator with respect to the printing and impression cylinders;

Fig. 4 is a detail view, partly in section, of a portion of the supporting structure;

Fig. 5 is a vertical sectional view taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is a sectional detail view of the applicator, and showing the end seal arrangement;

Fig. 7 is a sectional detail view of the applicator operatively positioned with respect to the printing cylinder;

Fig. 8 is an elevational view of the face of the applicator, showing the position of the end seals and the supply conduits;

Fig. 9 is a fragmentary plan view, partly in section, showing the details of the supporting structure;

Fig. 10 is an elevational view, similar to Fig. 8 of a modified form of ink applicator embodying my invention;

Fig. 11 is a fragmentary side elevational view of the applicator shown in Fig. 10; and

Fig. 12 is a vertical sectional view, similar to Fig. 7, of the modified form of applicator.

I have shown my invention applied to an intaglio printing machine of the general type disclosed in the above referred to patent of Irving Gurwick. It will be understood however that, in its broader aspects, the invention is not restricted in its use to such a machine, but may be used in printing machines generally, and particularly rotary intaglio printing machines.

As shown in Figs. 1 and 2, the printing press to which my invention has been applied comprises a base 20 upon which are mounted a pair of heavy side frame members 21 and a pair of tubular side frame members or posts 22 which are spaced apart by a plurality of transverse supporting members 23. The side frame members form a support for upper frame pieces 24 which include horizontal frame portions 25 and upright extensions 26. Pivoted at 27 to the upright extensions 26 is a movable top frame structure 28 which extends outwardly and downwardly toward the horizontal portion 25 of the upper frame, and forms a support for any parts, such as breaker rolls and the like, which are mounted above the said horizontal portion. A toothed

segment 30 is mounted on each side of the top structure adjacent the pivots 27 and cooperates with pinions 31 provided on a shaft 32 having a squared or keyed end so that it may be rotated to move the top structure to an upper or open position away from the horizontal portion 25, all as is disclosed in my copending application, Serial No. 343,914, filed July 5, 1940.

An engraved roller or printing cylinder 33, having a shaft 34, is journaled in suitable bearings 35 mounted in the horizontal portions 25 of the upper frame. At the left hand side of the press (Fig. 2) the shaft may extend through its associated bearing 35 into engagement with an adjusting mechanism 36 for effecting lateral register of the printing cylinder, which mechanism is supported on a bracket 37 secured to the horizontal frame. Cooperating with the printing cylinder 33 is a resilient impression cylinder 38 which, as shown in Figs. 1 and 3, is positioned at the right hand side of the printing cylinder and has its shaft 40 journaled in suitable bearing blocks 41. These bearing blocks are slidably mounted between upper and lower guideways 42 and 43, respectively, and adapted to be moved toward the printing cylinder and held in operative engagement therewith by means of hydraulic cylinders 44 having their piston rods 45 operatively connected with the bearing blocks. In order that the bearing blocks at each side of the press may move evenly in the guideways without causing skewing of the shaft 40, the lower side of each block is provided with a toothed rack 46 which engages with a pinion 47 mounted on a shaft 48 supported in the side frames. This entire construction and manner of mounting the impression cylinders is disclosed in and forms the subject matter of my Patent No. 2,263,323.

With the particular printing press arrangement thus far described, a web of paper or other material to be marked, may be fed substantially vertically downwardly between the printing cylinder 33 and impression cylinder 38 to receive markings on one side thereof, and in such manner as to provide a maximum amount of "live" web before passing to a subsequent printing or treating unit, as disclosed in the above mentioned application of Irving Gurwick. Ink or other marking material is supplied to the printing cylinder in the lower portion thereof in quantities greater than are needed for printing. I have shown ink being applied by means of my improved ink applicator 49 which is adapted to be positioned close to the printing line and will be described in detail hereinafter. Excess ink is removed and the printing cylinder conditioned for printing by means of a laminated doctor blade 50 mounted in a holder 51 which is supported for reciprocation in any suitable manner on the horizontal side frames 25. The doctor blade may be provided with any suitable mechanism 52 (Fig. 1) for moving it into and out of operative position and for adjusting its position when printing cylinders of different size are employed.

It will be noted that the doctor blade is positioned at the side of the printing cylinder opposite the printing line. For preventing evaporation of volatile ink solvents between the doctor blade and the printing line, the top portion of the printing cylinder is covered with a thin blanket of static air saturated with the volatile solvents. This is accomplished by means of a curved shield or cover 53 as disclosed in the copending application of Irving Gurwick. The shield 53 is positioned the desired distance from

the surface of the printing cylinder by means of collars 54 (Fig. 2) provided on the shaft 34 or associated with the bearings 35, and said shield extends from the doctor blade to a point closely adjacent the printing line. Movement of the blanket of air is prevented by means of a resilient sealing strip 55. The shield may also be supported by means of arms 56 pivotally connected to lever arms 57 which in turn may be pivoted to the top frame structure 28 and arranged to be moved into and out of operative position by means of an operating lever 58.

Heretofore, ink has been supplied to the printing cylinder by means of a fountain in which the cylinder rotates or by other types of applicators which are adapted to direct a stream of ink upon the printing surface. When volatile inks have been used, it was thought necessary to enclose the fountain so as to prevent evaporation. I have found, however, that if the ink is applied to the surface of the printing cylinder in a substantially uniform film of controlled thickness, and preferably along a line in close proximity to the line of printing, improved quality of printing may be effected without any detrimental evaporation from the cells of the engraved or printing cylinder. I shall now describe one form of my improved ink applicator.

As best shown in Figs. 3, 7 and 8, the ink applicator 49 comprises an elongated trough member 60 having an inside curved ink distributing section or portion 61 and upper and lower sloping walls or edges 62 and 63, respectively. When the applicator is in operative position with respect to the printing cylinder, the lower edge 63 thereof is adapted to be spaced from the surface of the cylinder to provide a thin uniform groove 64 through which the ink will be fed in the desired thin uniform film, while the upper edge 62 is provided with a lip 65 which practically touches, or is in close proximity to, the surface of the printing cylinder so as to reduce the tendency of ink to flow therethrough. Due to the curved shape of the ink distributing section 61 and the sloping lower edge 63, the ink contacting the surface of the cylinder beneath the trough 60 will be forced inwardly toward the center of the cylinder so that all of the cells of the engraving will be completely filled. The construction also provides a rather wide area over which the ink is in contact with the surface of the printing cylinder. The manner of mounting the applicator so that it may be properly positioned and adjusted with respect to the printing cylinder will be described hereinafter.

Ink is supplied to the trough 60 through any suitable number of inlet orifices 66 opening into the curved distributing section 61 of the trough. I have shown two inlet orifices 66, each of which has an angular deflector or baffle plate 67 mounted thereover and secured to the edge 63 by means of screws 68, as shown in Figs. 7 and 8. These deflectors are provided with apertures 69 spaced on either side of the orifice 66 and the entire construction is such that the ink which is fed through the orifices will be uniformly distributed throughout the length of the applicator. To prevent the ink from passing out the ends of the trough, retainer members 70 are mounted in grooves 71 provided in the trough 60 adjacent each end of the printing cylinder 33. These retainers are arranged close to the ends of the cylinder, shaped to conform substantially to the surface of the cylinder as indicated at 72 in Figs. 6 and 7; and are provided with curved portions

73 which correspond to the shape of the curved distributing section 61 and into which screws 74 are threaded for holding the end seals in the grooves 71.

Fittings 75 having flanges 76 are connected by screws 77 to the trough 60 over each orifice 66, and each fitting is provided with a passage 78 which is adapted to register with the associated orifice 66. The lower end of each fitting is provided with a threaded socket 80 for the reception of a hose nipple 81 to which a suitable resilient supply hose 82 is connected by means of a clamping collar 83.

Referring now to Figs. 1 and 2, it will be seen that the two supply hoses 82 are connected to suitable nipples 84 provided in the ends of a substantially U-shaped distributing conduit 85. A conduit 86 leads from the distributing conduit 85 to a pump 87 which may be mounted in any convenient location adjacent a removable ink reservoir 88 and driven, through a belt 89 and suitable gears and shafts, by a motor 90 mounted on the frame of the press. A conduit 91 having a hand operated valve 92 therein may be provided to connect the distributing conduit 85 and/or the conduit 86 with the reservoir so that when the press is shut down, all ink may be easily drained from the applicator back into the reservoir; this conduit 91 also serves as a by-pass to regulate the flow of ink to the applicator. The ink reservoir 88 comprises a large box-like tank having a suitable covered inlet 93 and a drain cock 94; and it is removably positioned on angle bars 95 provided on the base 20, and maintained in position thereon by means of stop members 96. The angle bars form tracks for the reservoir so that it may be easily removed from operative position without colliding with other parts of the press, a handle 97 being provided on the end of the reservoir for this purpose. In this manner, the reservoir may be easily and quickly changed when it is desired to use ink of another color, and periods of shut down are greatly reduced.

In Figs. 10, 11 and 12, I have shown a modified form of ink applicator 98 which embodies the same principles of operation as the applicator 49, but includes certain additional features. As shown, the applicator 98 comprises a trough 100 substantially as long as the printing cylinder 33 and having a front wall 101, a rear wall 102, a bottom wall 103, and suitable end walls 104, which together form an elongated ink distributing chamber 105. Front wall 101 is bent inwardly near the upper end thereof to form a support 106 for a thin resilient ink metering and applying blade 107 which extends into close proximity to the surface of the cylinder 33 and is removably secured to the support 106 by means of a clamping plate 108 and suitable screws 109. Beyond the ends of the cylinder 33 the front wall 101 has upwardly extending deflecting portions 110; and rear wall 102, at the upper end thereof, is curved inwardly toward the cylinder to provide a deflecting portion 111. Ink is fed into the chamber 105 through inlet nipples 112 provided in the bottom wall 103 and connected with the supply hoses 82. As the ink enters the chamber 105 it will gradually fill said chamber until it overflows over the blade 107. The entire space between the blade and the surface of the printing cylinder fills with ink, and as the cylinder rotates and more ink is supplied, the blade 107 will be deflected downwardly, as indicated in dotted lines in Fig. 12, to cause the desired thin film of ink to be applied to the surface of the cylinder. The particular advantage of

this applicator over the applicator 49 described above is that the entire chamber 105 is filled with ink before any is applied to the printing cylinder; and by maintaining the applicator substantially horizontal, the flow of ink into the space between the blade 107 and the surface of the cylinder will be uniform throughout the length of the printing cylinder. The applicator 98 also differs from the applicator 49 in that no particular means is provided to prevent the ink from flowing out over the end portions or the top thereof.

Each of the ink applicators 49 and/or 98, whichever may be used, is maintained in proper position with respect to the surface of the cylinder during operation of the press, and is so supported and mounted that it may readily be adjusted to accommodate printing cylinders of different size, and may be moved from operative to inoperative position. I shall now describe the supporting and adjusting mechanism for the ink applicator.

As best shown in Figs. 2 and 4, the ink applicators are provided at the ends thereof with trunnions 113 which are secured to the ends of the trough 60 or 100, in any suitable manner, and adapted to be pivotally supported in yokes 114 provided on the upper ends of a pair of supporting arms 115. The supporting arms are mounted on a shaft 116 which is journaled in side frames 117 of a supporting structure which is designated as a whole (Figs. 1 and 3) by the reference numeral 118. This structure 118 includes a plurality of transverse members or spacing rods 119 and forms the support for the ink applying and ink draining devices; it is removably mounted upon a carriage 120 which is adapted to be moved up and down with respect to the printing cylinder 33, as will be more fully described below.

For effecting angular adjustments of the supporting arms 115, an arm 121 is secured inside one of the side frames 117 to the shaft 116 by means of a pin 122 (Fig. 4) and provided at the end thereof with a suitable locking device, such as a thumb-screw 123 (Figs. 1 and 9). This thumb-screw is adapted to ride in a reinforced slot 124 provided in the associated side plate 117, so that the arm may be locked in any adjusted position. The shaft 116 may be provided with a keyed or squared end 125 which is adapted to receive a suitable hand crank 126 for turning the arms 115 to any adjusted position when the thumb-screw 123 is loosened.

Should it be necessary or desirable to set or adjust one of the arms 115 individually with respect to the other arm 115, this may be accomplished by means of an adjusting arm 127 fixed to the shaft 116 adjacent one of the arms 115. In Figs. 4, 5 and 9, it will be observed that the upper end of this arm 127 has a threaded opening for receiving a screw 128 which is provided with a suitable head 129 and lock nut 130 on the outer end thereof and an eccentrically mounted disk or cam 131 on the inner end. The cam 131 is adapted to engage the side walls of a suitable grooved or channelled member 132, fastened to the associated arm 115, in any convenient manner. By loosening the lock nut 130 and turning the head 129, cam 131 engaging the walls of the channelled member will cause the associated arm 115 to be moved through a very small arc for adjustments with respect to the other arm 115.

Provision is also made for adjusting the angular position of the applicator in the yokes 114. As shown in Figs. 4 and 8, a downwardly ex-

tending arm 133 is fixed upon one of the trunnions 113 and positioned adjacent a wall or lug 134 provided on member 135 which is secured to the associated arm 115 in any suitable manner. A screw 136 is threaded through this wall 134 and extends into a threaded opening provided in the arm 133, so that by turning said screw the applicator may be rotated in the yokes 114.

Any ink which may escape from either applicator 49 or 98 is caught by a shield 137 which is secured to the associated trough by means of screws 138 and suitably spaced therefrom in any convenient manner. The shield may be of any shape, but preferably has end walls 139 and an upwardly curved portion 140 which extends into close proximity to the surface of the cylinder and the web. A large drain pan 141 of any suitable shape and construction is arranged beneath the printing cylinder 33 and, as shown in Fig. 3, is at least wide enough to receive any ink which drops from the shield 138 and also all excess ink removed by the doctor blade 50. The drain pan has downwardly sloping bottom walls which lead the ink to a suitable outlet conduit 142 which is connected by a coupling 143, and extension 144 to a large hose 145. The hose 145 is removably secured to the extension 144 by means of a collar 146 and passes through an opening provided in the top of the reservoir 88 so as to return all ink thereto.

The drain pan 141 may be supported in any convenient manner beneath the printing cylinder 33 and shield 137. I have found it desirable, however, to provide flanges 147 on the sides of the pan, which flanges are adapted to fit into and engage with suitable angular shoulders 148 provided on the upper edges of the side walls 117 of the supporting structure 118. Thus, the entire drain pan may be easily removed from the supporting structure, if desired.

Referring now to Figs. 1 and 3, it will be noted that each of the side walls 117 of the supporting structure is provided with feet 150 which rest on angle bars 151 secured to substantially horizontally disposed arms 152 forming part of the carriage 120. These arms are provided at the top of and formed integrally with, a pair of vertical side members 153 which are spaced apart and maintained substantially rigid by means of transverse supporting rods 154. At its upper end, each side member 153 is provided with a collar 155 and at its lower end with a collar 156, and these collars are slidably mounted on their associated tubular supports 22 of the main frame of the press so that the carriage 120 may be moved up and down thereon, i. e. toward and away from the printing cylinder.

For effecting such movement of the carriage 120, a toothed rack 157 may be provided on the edge of each side member 153 and between the upper and lower collars 155 and 156 thereof. These racks are arranged to engage with pinions 158 mounted on the ends of a shaft 160 which is journaled in suitable bearings provided in collars 161 secured to the tubular members 22. Shaft 160 may be constructed to receive a suitable crank so that it may be easily turned for moving the carriage which will be held in any position to which it is moved by means of a ratchet gear 162 (Fig. 1) mounted on the shaft 160 and cooperating with a suitable pawl 163 pivoted on the collar 161. Fig. 1 shows the carriage 120 in its lower inoperative position, while Figs. 2 and 3

show said carriage in its upper operative position.

It will be appreciated that the carriage 120 and the apparatus supported thereby are rather heavy and would be difficult to move by the shaft 160 alone. To facilitate moving the carriage, a counterbalance weight 164 may be provided, if desired. This weight is supported at each end thereof by means of a chain 165, one end of which is secured to a lug 166, provided on the weight. Each chain then extends upwardly and over a sprocket 167 and has its other end suitably secured to the transverse rod 154 extending between the lower ends of the side frames 153. The sprockets may be mounted for rotation on stub shafts 168 which are attached to the side frames of the press adjacent the horizontal frame members 25 in any convenient manner.

From the drawings and the foregoing description, it will be apparent that by rotating the shaft 160, the carriage 120 may be easily moved from its lower position as shown in Fig. 1, to its upper operative position, as shown in Figs. 2 and 3. When in the upper position, the various adjustments described above may be made for setting the ink applicator properly with respect to the printing cylinder. As the carriage is moved back to its lower position, the conduit 145 recedes into the reservoir; and when in the lower Fig. 1 position, the entire supporting structure 118 and the apparatus carried thereby may be removed from the carriage simply by releasing the coupling 143 on the drain pipe, said coupling being positioned about opposite the line between the bottom of the side frames 117 and the top of the horizontal arms 152. Likewise, the ink applicator 41 or 98 may be readily removed from the yokes 114, and the drain pan 141 lifted from the supporting structure. In this manner, changes of parts for printing cylinders of different size, for cleaning, for repairs and the like, may be quickly effected and inoperative periods cut to a minimum.

While I have described preferred embodiments of the apparatus and method features of my invention, it will be understood that various changes may be made and certain features or steps employed without others, without departing from my invention or sacrificing any of its advantages.

What I claim is:

1. A method of inking an engraved printing cylinder with an ink containing volatile ink solvents which comprises applying a thin and substantially uniform film of ink to the surface of the cylinder, wiping all excess ink from said cylinder so as to condition said cylinder for printing, and protecting the thus conditioned surface from evaporation by means of a thin film of air saturated with volatile ink solvents.

2. In an intaglio printing press, the combination of an engraved printing cylinder; an ink applying member positioned adjacent the surface of the printing cylinder and including a chamber for holding a body of ink in contact with the surface of the printing cylinder and a regulating portion which is adapted to force the ink against the surface of the printing cylinder and regulate the thickness of the film of ink applied thereto; means for supplying ink to said applying member; and carriage means arranged beneath said printing cylinder for supporting said ink applying member and moving it vertically toward and away from said printing cylinder.

3. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder cooperating therewith and providing

a printing line between said two cylinders; means for applying a thin and uniform film of ink to the surface of said printing cylinder; means for conditioning the surface of said cylinder for printing; and means arranged between the conditioning means and the printing line, in the direction of rotation of said printing cylinder, for preventing evaporation of ink from the conditioned surface.

4. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder arranged substantially horizontally beside said printing cylinder and providing a printing line between said two cylinders; and means for applying a thin and uniform film of ink to the surface of said printing cylinder in the first quadrant thereof beyond the printing line.

5. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder positioned substantially horizontally beside said printing cylinder so as to provide an impression line between said cylinders; and means positioned directly below such printing line for applying a thin and uniform film of ink to the surface of said printing cylinder.

6. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder positioned beside said printing cylinder so as to provide an impression line between said cylinders; and means positioned below such printing line for applying a thin and uniform film of ink to the surface of said printing cylinder, said ink applying means comprising an elongated trough-shaped member having a chamber portion which is adapted to hold a body of ink in contact with the surface of said printing cylinder and a lip portion angularly disposed adjacent the surface of the printing cylinder so as to create an inwardly directed component of force which is adapted to force ink inwardly against the surface of the cylinder.

7. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder positioned beside said printing cylinder so as to provide an impression line between said cylinders; and means positioned below such printing line for applying a thin and uniform film of ink to the surface of said printing cylinder, said ink applying means comprising an elongated trough-shaped member disposed adjacent the surface of the printing cylinder and having a lower lip portion which is positioned at a predetermined distance from said surface so as to regulate the thickness of the film of ink applied to said surface, and which is angularly disposed with reference to the surface of the printing cylinder so as to create an inwardly directed component of force which causes the ink to be pressed against the surface of the cylinder.

8. In an intaglio printing press, the combination of a substantially horizontally disposed printing couple including an engraved printing cylinder; a frame member; a carriage slidably mounted on said frame member for vertical movement beneath said printing cylinder; and means carried by said carriage for applying ink to the surface of said printing cylinder.

9. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder positioned substantially horizontally beside said printing cylinder so as to provide a printing line between said cylinders; and means positioned below said printing line for applying a thin and uniform film of ink to the surface of said printing cylinder, said ink

applying means being supported on a carriage which is adapted to be moved vertically toward and away from said printing cylinder so that the ink applying means may be positioned properly with respect to the surface of said printing cylinder regardless of the size of the latter.

10. In an intaglio printing press, the combination of a substantially horizontally disposed printing couple including an engraved printing cylinder; a frame member; a carriage slidably mounted on said frame member for vertical movement beneath said printing couple; means carried by said carriage for applying ink to the surface of said printing cylinder; and means for moving said carriage toward and away from said printing cylinder.

11. In an intaglio printing press, the combination of an intaglio printing cylinder; wiping mechanism for said cylinder; a carriage mounted beneath said printing cylinder for vertical movement toward and away from said printing cylinder; means mounted on said carriage for applying ink to the surface of said printing cylinder; and means disposed beneath said printing cylinder and carried by said carriage for receiving the excess ink removed from the printing cylinder by said wiping mechanism.

12. In an intaglio printing press, the combination of a substantially horizontally disposed printing couple including an intaglio printing cylinder; a carriage beneath said printing couple and movable vertically toward and away from said printing cylinder; a pair of supporting arms pivotally connected to said carriage; an ink applying member mounted on said supporting arms; and means for adjusting said supporting arms to various angular positions with reference to said carriage.

13. In an intaglio printing press, the combination of a substantially horizontally disposed printing couple including an engraved printing cylinder; a pair of supporting arms arranged beneath said printing couple; an ink applying member rotatably supported in said arms; means for moving said arms to various angular positions with reference to said printing cylinder; and means for adjusting the angular position of said ink applying member with respect to said supporting arms.

14. A unitary intaglio printing press, comprising a base; side frame members mounted on said base; an engraved printing cylinder rotatably journaled in said side frame members; a carriage mounted beneath said printing cylinder for vertical movement toward and away from said printing cylinder; an ink applying member mounted on said carriage; an ink reservoir removably mounted on said base beneath said carriage; and means for conveying ink from said reservoir to said ink applying member.

15. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder arranged substantially horizontally beside said printing cylinder and providing a printing line between said two cylinders; means for applying a thin and uniform film of ink to the surface of said printing cylinder in the first quadrant thereof beyond the printing line; means for conditioning the surface of said cylinder for printing; and means arranged between the conditioning means and the printing line, in the direction of rotation of said printing cylinder, for preventing evaporation of ink from the conditioned surface.

16. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder cooperatively arranged at the side of said printing cylinder and providing a printing line between said two cylinders; and means for applying a thin and substantially uniform film of ink to the surface of said printing cylinder in the first quadrant thereof beyond the printing line.

17. In an intaglio printing press, the combination of an engraved printing cylinder; an impression cylinder arranged at the side of said printing cylinder and providing a printing line which is positioned at the side of said printing cylinder; means for applying a thin and substantially uniform film of ink to the surface of said printing cylinder; means for conditioning the surface of said cylinder for printing; and means arranged between the conditioning means and the printing line, in the direction of rotation of said printing cylinder, for preventing evaporation of ink from the conditioned surface.

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