ROTARY DRUM PRINTER AND INKING APPARATUS THEREFOR

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This invention pertains to printing and marking machines of the type having a rotating printing drum, and more particularly, to the inking arrangement for such machines.

It may be explained that industrial marking machines, such as those used in rolling mills for marking metal strips and sheets and as used in diverse other industrial plants for applying identifying marks on traveling webs of material, or on cartons, are purely incidental to the production of the plant. Therefore, unlike printing machines in print shops, they are unattended much of the time and are expected to run, day after day, with only occasional attention. Frequently, such machines are located in a heated environment, as for example over traveling strip metal in a steel mill, or in a dust-laden atmosphere, or where particles of lint may be prevalent. Such conditions may give rise to evaporation of solvent from the ink or change in viscosity that results in the ink flowing too freely or not freely enough. An excess of ink is likely to produce blurred printing and give rise to an accumulation of gummed ink and foreign particles around the edges of the type that produces further blurring, and insufficient ink, of course, makes the imprint too light. Increase in speed, as when printing on rapidly moving strips, increases the difficulty of proper inking of the type. Control of ink is also difficult because in many machines the printing drum is of large diameter with type on only part of its periphery, while the transfer roll, continuously receiving ink, is of smaller diameter, so that ink is only intermittently transferred from its surface to the type of the printing drums.

An ink fountain with a dip roll revolving therein which in turn applies ink to a transfer roll has been most widely used since it is simple to take care of. Continuous circulatory ink systems have been devised, but as the ink is recirculated its viscosity increases and automatic viscosity control devices are expensive and are subject to unfavorable conditions of use.

The present invention provides an inking apparatus for industrial marking machines in which the ink is fed from a source of supply to a nozzle or nozzles and discharged therefrom at the exact rate at which it is consumed. The ink is directed from a nozzle and spread over a transfer roll which in turn supplies it to the inking roll. Thus an excess of ink may not accumulate on the transfer roll, and if transferred to the type of the printing roll, nor will the ink be too meagerly applied. The ink itself has no contact with the atmosphere until it leaves the nozzle and just an instant before it is used, so that it does not become more viscous by loss of solvent or become contaminated by dust. Moreover, the apparatus is simple and relatively inexpensive.

A primary object of the invention is to provide an industrial printing machine and attachment therefor that will supply ink to the type of the printing roll of the machine at just the required rate needed and without exposing the ink to the atmosphere until the moment of its use.

A further object of the invention is to provide an inking applying mechanism that will automatically adapt itself to changes in the speed at which the machine is run.

A further object is to provide an inking arrangement which will operate for sustained periods of time in mill and factory environments with little attention.

A complete understanding of the instant invention may be had from the following detailed description of a specific embodiment thereof when read in conjunction with the appended drawings, wherein:

FIG. 1 is an elevational view of the rotary drum printer and inking apparatus with the inking and squeegee rolls somewhat schematically shown;

FIG. 2 shows in elevation an embodiment of the inking apparatus for the machine;

FIG. 3 is a sectional view taken along line III—III of FIG. 2;

FIG. 4 illustrates another embodiment of the inking apparatus of the printer;

FIG. 5 shows in elevation another arrangement for spraying ink onto a roll;

FIG. 6 illustrates inking apparatus arranged for spraying ink onto a vertical aligned squeegee roll;

FIG. 7 shows in sectional view a further embodiment of an inking apparatus utilizing a wick for ink supply to a roll;

FIG. 8 is a side elevation showing in detail the mounting frame for the transfer and squeegee rolls, the view being a side elevation, but with the meshing gears only schematically indicated; and

FIG. 9 is a top plan view of one side of the support as shown in FIG. 8.

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a rotary drum printer, generally designated numeral 11. The printer includes a printing drum 12, a transfer roll 13, and a squeegee roll 14, all of which are arranged and secured to a printer frame 15 in the manner hereinafter more fully described. The frame supports a fixed bearing block 16 with bearings 17, and the latter support a drum shaft 18 on which the printing drum 12 is carried. The transfer roll 13 applies ink onto the faces of type indicated at 19 on the periphery of the printing drum. In the example illustrated, the type 19 is located on one portion of the periphery of the printing drum 12 so that it makes an imprint at widely spaced intervals on strip material being marked, although the type may extend more or less completely about the circumference of the drum.

The squeegee roll 14 is of less length than the transfer roll so that it contacts only the area of the transfer roll between its ends and does not engage the end portions of the transfer roll. Its function is to spread ink that is applied to either the surface of the squeegee roll or the transfer roll by its pressure contact with the transfer roll over the surface of the latter roll to be applied by that roll to type 19. For applying ink to one roll, as here shown, onto the surface of the squeegee roll 14 there is provided an ink reservoir 21 which is connected by a feed tube 22 to a spray nozzle 23, which functions similar to a paint spray nozzle, and which is fixed to a first extension plate 24 of the printer frame 15 by a support bracket 25 in such a manner that the nozzle is over the squeegee roll. Air under pressure is supplied through a second tube 26 leading from a compressor or source of pressure, not shown. The nozzle 23 has a usual adjusting screw 27 which is turned to regulate the ink flow from the nozzle. This can be adjusted according to the requirements of printing from less than a single drop at each operation to a copious spray. The nozzle 23 is oriented with respect to that roll onto which it applies ink, as here, to the squeegee roll 14, such that ink sprayed from the nozzle will impinge on the roll periphery in advance of the right between it and the transfer roll, but close enough so that ink that may
be thrown centrifugally will substantially entirely be directed against the surface of the other roll which is approaching the flight between the two rolls. This would be a quadrant of the roll and the squeegee light. An electromagnetically-operated valve 28 is provided in the air line 26 near the nozzle 23 and between the latter and the source of air. This valve is opened and closed to control the flow of air to the nozzle. Only when air is supplied to the nozzle will ink be discharged therefrom. This valve is operated intermittently to apply ink on one of the rolls in amounts regulated by the adjustment of the nozzle screw 27, and regulated to supply the requirements of the type. The intermittent application of controlled amounts of ink onto the squeegee roll avoids an oversupply of ink. The valve 28 is governed by an electrical circuit designed generally as 29, and which includes a source of electrical energy, not shown, connected to a normally-open switch 31 which is operated by a cam follower and switch operator which is movable upwardly from the extended position shown in FIG. 1 to a switch-closing or depressed position, and which is biased to normally remain in the open position. When the operator 32 is depressed, the switch 31 is closed to complete the circuit from the energy source through lines 33 to the electromagnetically-operated valve 28.

When current flows to the valve 28, the valve opens to the passage of air from the air source to the nozzles, whereby the latter discharges the required amount of ink.

The valve operator 32 of the switch 31 projects into the path of rotation of a cam 34 which is supported on a stub shaft 35 which is rotated by a gear 36. The gear is controlled by rotation of a spur gear 37 mounted on a shaft 38. Carried by the shaft 38 is another spur gear 39 which is mounted on the shaft 18 of the printing drum. The gear train comprised by these gears is thus driven by rotation of the printer drum 12, so that the cam 34 is rotated at a rate of speed proportional to the speed of rotation of the drum 12. Accordingly, the switch operator is depressed by the cam 34 once for each revolution of the cam, and at a rate proportional to the drum rotation as determined by the ratio of the gears 36, 37, 39 and 41, which as here shown is a speed reducing gear so that the cam rotates at a speed substantially lower than the speed of the drum.

The rotating cam 34 thus depresses switch operator 32 to close the normally-open switch 31 and energize the valve 28 for actuation of the nozzle 23 whereby ink is sprayed upon the squeegee roll. The rotating cam 34 is peripherally elongated wide strip of ink is deposited on the squeegee roll. As this roll presses against the transfer roll, the strip is squeegeed or spread laterally over the transfer roll to the full width required to ink the type 19, but since the squeegee roll does not bear against the ends of the transfer roll, these areas of the transfer roll are not inked, and the ink is confined to the area of the transfer roll where it is needed. If the ink on the squeegee roll is not transferred to the transfer roll in one rotation, nor is all of the available ink on the transfer roll accepted by the type on one rotation, so that there may be a plurality of rotations of the squeegee roll between each spraying operation.

Referring now to FIGS. 2 and 3, the squeegee roll is omitted and there is shown a nozzle 43 which is supported for the ejection of ink into a doctoring slipper 44 mounted over the periphery of the transfer roll 45. The slipper 43 is essentially an inverted trough-like enclosure in the form of a rectangular housing with sidewalls 46 and 46a, endwalls 47, top 48, and an open side confronting the periphery of the transfer roll. The lower edge of the sidewall 46, which is the trailing edge relative to the rotation of the transfer roll, is beveled to conform to the contour of the transfer roll while the lower edge of sidewall 46a is beveled to provide decreasing clearance between said edge and the periphery of the roll in the direction of rotation of the roll. The sidewall 46 comprises a doctor or spreader to spread the ink and clears the periphery of the roll a distance prescribed by such factors as ink viscosity, chemistry and spreading qualities. The other sidewall serves to induce the re-entry of ink on the roll surface into the space under the slipper, while the slipper or enclosure confines the spray, the spray nozzle and any centrifugal discharge of ink at the moment of its contact with the roll 45.

The nozzle 43 of FIGS. 2 and 3, which is similar to the nozzle in FIG. 1 and is similarly operated intermittently, is operated in a manner as described with regard to the operation of the nozzle 23 of FIG. 1, and is supported by a bracket 51 to a printer frame. The spray wall 46 of the slipper. The ink supplied on the roll 45 of the transfer roll 45, and the spray wall 46 of the slipper. The ink supplied on the roll 45 is transferred in the customary manner to the type on the printing roll 52. In the modification of the invention shown in FIGS. 2 and 3, a doctoring slipper is utilized to spread ink on a transfer roll, whereas in the modifications of FIGS. 1, 5 and 7 ink is applied onto a squeegee roll which spreads the applied ink onto the transfer roll by the bight or contact of the squeegee roll with the transfer roll.

In FIG. 4 there is shown a drop feeder 53 of a conventional form supported on a slipper 54 of a type similar to that explained with reference to FIGS. 2 and 3. The feeder 53 is a standard gravity type having an adjusting screw 55 which is rotated to regulate the delivery of drops of ink at regular intervals. A sight glass 56 is normally provided by which the drops leaving the feeder can be observed. The drops of ink fall from the end of the feeder 53 disposed within the enclosure or slipper 54 similar to that described in FIG. 3 and are spread onto the surface of a transfer roll 57 by the sidewall of the slipper as above explained. Although the drop feeder 53 is shown supported by the slipper 54 in FIG. 4, it is within the contemplation of the invention that the feeder over a squeegee roll with the drops applied thereon being spread onto a transfer roll by the rolling contact therewith. The use of a drop feeder is most satisfactory where the printing drum rotates at a constant moderate speed because with variable speed the dropper must be adjusted at each speed to drop the ink more or less frequently.

It may be desirable to arrange more than one spray
nozzle over a squeegee roll, or along a slipper where the slipper is used, and when the squeegee or transfer roll is of substantial length. This is shown in FIG. 5 where plural aligned nozzles 58 are shown on a bracket 59 over a squeegee roll 61, the remainder of the machine in this case being the same as in FIG. 1. An enclosure or guard might be used with this arrangement similar to that shown in FIG. 3 or otherwise particularly at the ends of the squeegee roll where the pattern being printed requires heavy application of ink near the ends of the squeegee roll.

The arrangement generally shown in FIGS. 1, 2 and 5 may also be used in a printer having vertical rolls. This is indicated in FIG. 6 where there is a squeegee roll 62, a transfer roll 63, and a printing drum 12. An ink spray nozzle 64 inserted in slipper 65 is operated as described in FIG. 1.

Another arrangement for the supply of ink onto a squeegee roll is depicted in FIG. 7 wherein a wick-type dropper 77 is located over a squeegee roll 66. The dropper 77 has a reservoir 67 provided with a cover 68. A hollow, rectangularly-walled tube 69 extends downwardly from the lowermost point of the reservoir, and a wick 71 of material such as felt or the like is placed within the tube. The wick 71 may extend the full length of the tube, or it may extend for only a portion of the length of the tube so long as it passes through a hinged wall portion 72 of the tube at its lower end. The hinged wall portion 72 includes a hinge 73 connecting a stationary tube wall with a swinging wall section 74 which opens or closes the passage of the tube 69 to press the wick 71 for regulating the flow of ink from the reservoir to the lower end of the tube from which it drops. A stop screw 75 is carried on an arm 76 and contacts the wall section 74 to urge it inwardly toward the opposing fixed wall of the tube 69 and to release it for swinging movement away from the opposing wall. The adjustment of the stop screw of the stop screw 75 thus controls the rate at which drops are applied to the squeegee roll 66. The drops supplied on the periphery of the squeegee roll are next spread onto the transfer roll of a printer by a typical squeegee action which such rolls contact. The dropper 77 may be employed with a slipper, as in FIG. 4, in which event the drops of ink fall into the slipper and upon a transfer roll to be spread by the slipper and applied onto the type of a printing drum.

The rate at which ink is supplied to the transfer roll, either by a spray or by a doctoring slipper, will be affected by physical properties of the ink, such as its viscosity, spreading characteristics, etc., and these factors are also affected by the pressure of the transfer roll against the printing drum and the pressure of the squeegee roll against the transfer roll, where a squeegee roll is used. In FIGS. 1 and 2 the mounting of the transfer roll and squeegee roll is only schematically shown. In FIGS. 8 and 9 one actual arrangement is shown.

In FIGS. 8 and 9 it will be seen that the side plates 24 are formed separately from the frame 15 and are secured thereto by a plurality of bolts 80 engaged in slotted openings 24e in the plates 24 that are elongated in a direction generally parallel to a line of centers between the printing drum and the shaft 13c of the transfer roll. This shaft is carried in bearings 81 fixed on the outer faces of the side plates 24.

The outer ends of the plates 24 are bifurcated, providing spaced upper and lower extensions 24a and 24d respectively. A bearing block 82 is slidably fitted between the extensions of each plate, and each has a bearing 83 bolted thereto. These are bearings for the shaft 14c of the squeegee roll 14. The outer ends of the plates 24 are connected by an end plate 84. A wedge 85 is confined between the back plate and the confronting inclined edge 82a of block 82. Each wedge has the lower end of a screw-threaded rod 86 screwed into it, and each such rod has a handle 87 at its top bearing on the top edge of arm 24a so that when the screw is turned to move the wedge up, it will accept pressure against the bearing block with which it cooperates to increase the pressure of the squeegee roll against the transfer roll. To relieve this pressure, the wedge is backed down.

With this arrangement, the pressure of the transfer roll against the printing drum can be adjusted by loosening the bolts 80 and moving the arms toward or away from the printing roll and then tightening the bolts when the adjustment has been made. Making this adjustment does not change the relation between the transfer roll and the squeegee roll. This relation may be changed, however, by adjusting the wedge nuts or elements 85 up or down as above explained, and this adjustment does not change the relation between the transfer roll and the printing drum.

As here shown, roll shafts 13a and 14c are provided with spur gears 13b and 14b respectively, through which they rotate together without slippage, and the gears permit the slight adjustment required for the squeegee roll relative to the transfer roll. However these rolls may be driven by frictional contact instead of with spur gears if desired.

Ordinarily the squeegee roll and transfer roll are non-absorbent and in the case of a squeegee roll it is desirable resilient.

It is important that the ink be delivered to the squeegee roll at a point close to where the roll is approaching the point of contact with the transfer roll so that ink thrown tangentially by centrifugal force impinges against a surface of the transfer roll which is also approaching such point of contact instead of being thrown into space, as might otherwise be the case at high speed.

With the instant invention a printer is provided having an inking apparatus which supplies ink intermittently at a rate commensurate with the rate at which it is used and in the preferred form at a rate automatically correlated to the speed of rotation of the printing drum, as well as the size of the areas to be printed upon and the density of the marking, whether light or heavy, thereby avoiding oversupply of ink when the speed is varied. Ink is discharged only as it is needed so that circulating systems open to the air are eliminated.

1. For use on a printing machine having a rotatable printing drum with printing type thereon supported in a frame, an inking unit comprising a support including supporting plates adapted to be secured to said frame, a rotatable transfer roll mounted in said support, a rotatable squeegee roll driven by the transfer roll mounted in said support, one of said rolls having a bearing the other for adjustable toward and away from the other for varying the pressure of the squeegee roll against the transfer roll, said rolls constituting the only rolls in the unit means for adjustably securing the support to the said frame for adjustment in a direction to move the transfer roll toward or away from the printing drum in said frame, and means for intermittently applying ink to one of said two rolls in controlled amounts and at a location in advance of the bight between the two rolls but on a quadrant which is approaching the bight.

2. A printing unit for printing machines as defined in claim 1 in which the ink is supplied to the periphery of the squeegee roll and subsequently spread on the surface of the transfer roll.

3. A printing machine of the class described having a frame, a rotatable printing drum with work-imprinting type thereon, a rotatable transfer roll bearing against the printing drum for applying ink to the type on said drum, a rotatable squeegee roll bearing against the transfer roll, the transfer roll being driven by contact with the printing drum, the squeegee roll being driven by the transfer roll, adjustable valve-controlled means for intermittently applying ink at intervals to the squeegee roll and shutting off the supply of ink between said intervals, and means
controlled by rotation of the printing drum for effecting
the intermittent opening and closing of the valve-con-
trolled means while the printing drum is rotating, whereby
ink is supplied to the transfer roll according to the speed
of the printing drum.
4. A printing machine as defined in claim 3 wherein
the valve-controlled means is a spray nozzle utilizing air
pressure to effect the discharge of ink and the valve-con-
trolled means controls the air flow to the nozzle, and
wherein the nozzle is adjustable for regulating the amount
of ink discharged at each operation of the valve.
5. A printing machine as defined in claim 3 wherein
the transfer roll is of smaller diameter than the printing roll
and the squeegee roll is of smaller diameter than the trans-
fer roll, and said rolls constitute all of the rolls in the
printing machine.
6. A printing machine as defined in claim 5 wherein
the squeegee roll is of less length than the transfer roll and
terminates inwardly from each end of the transfer roll,
the printing roll having tires at each end thereof against
which the transfer roll is frictionally engaged for rotating
the transfer roll, the squeegee roll being of a length to
avoid contact with the tire-engaging portions of the trans-
fer roll and being driven by its frictional engagement with
the transfer roll.
7. A printing machine having a rotatable printing drum
with type therein, a rotatable transfer roll for applying
ink to the type of the printing drum, inking means ar-
 ranged to intermittently supply ink to an area of the trans-
eroll of less width in the direction of the axis of the trans-
eroll than the area required to be inked during the
operation of the printing drum at spaced intervals and at a
rate substantially equal to the rate at which ink is re-
 moved therefrom by the type on the printing drum, and
means at the surface of the transfer roll at a position an-
gularly spaced about the periphery of the transfer roll
from the inking means and from the area of contact of
the transfer roll with the printing roll type for spreading
the ink so supplied both along the transfer roll and around
the periphery of the transfer roll over the required area,
but less than the full width of the transfer roll.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,308,754
March 14, 1967

John E. Munn

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 42 to 44, strike out "The spray wall 46 of slipper. The ink supplied on the roll 45 of the transfer roll and insert instead -- The spray of ink into the slipper 44 is directed against the periphery of the transfer roll 45, --.

Signed and sealed this 2nd day of January 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents