

- [54] **PRINT MACHINE FOR USE WITH HIGH SOLVENT INKS**
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[57] **ABSTRACT**

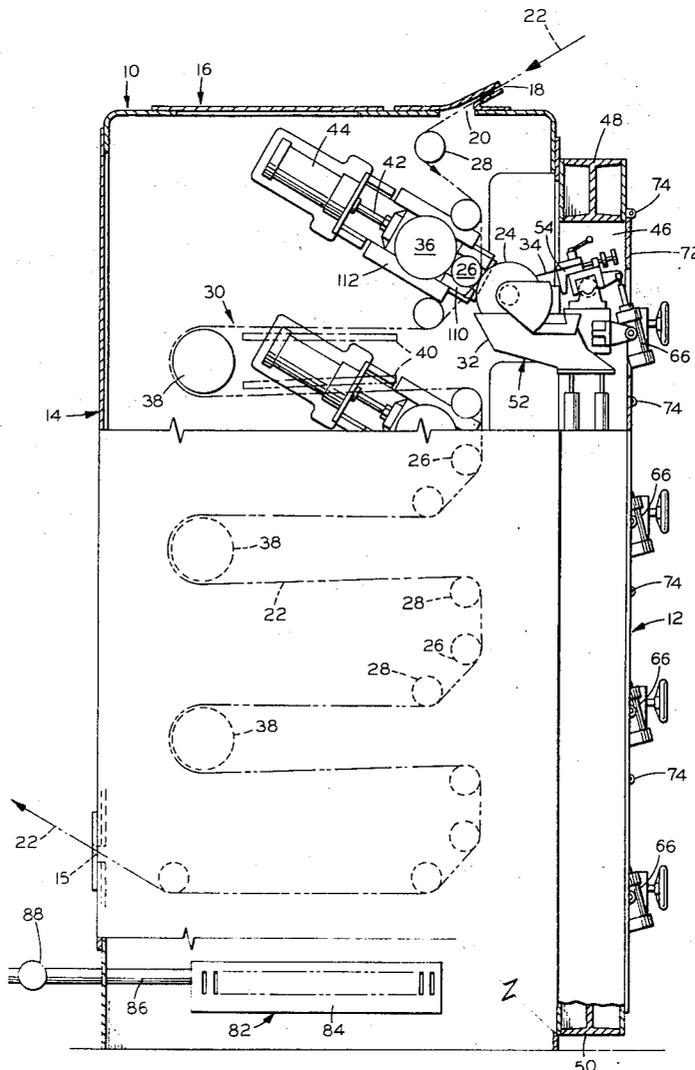
A print machine for multicolor operation with high solvent, rapid drying inks utilizes a multiplicity of pairs of print rolls and press rolls rotatably supported on the machine frame and a vertical gate member pivotally mounted on one face of the frame and supporting a multiplicity of inking units for supplying ink to the surface of the print rolls. The print rolls have their axes lying in a common vertical plane and the press rolls have their axes lying in a common vertical plane.

The gate member includes closure members between inking units substantially closing the space therebetween, and closure means is provided on the opposite face of the frame so as to provide a substantially closed housing. Vent means is provided to evacuate solvent fume from the interior of the housing.

Cover members are also pivotally disposed about the segment of the outward circumferential surface of each print roll between the ink trough of the inking units and the doctor blades thereof to prevent premature drying of the ink on the circumferential surface of the print roll.

- [56] **References Cited**
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12 Claims, 2 Drawing Figures



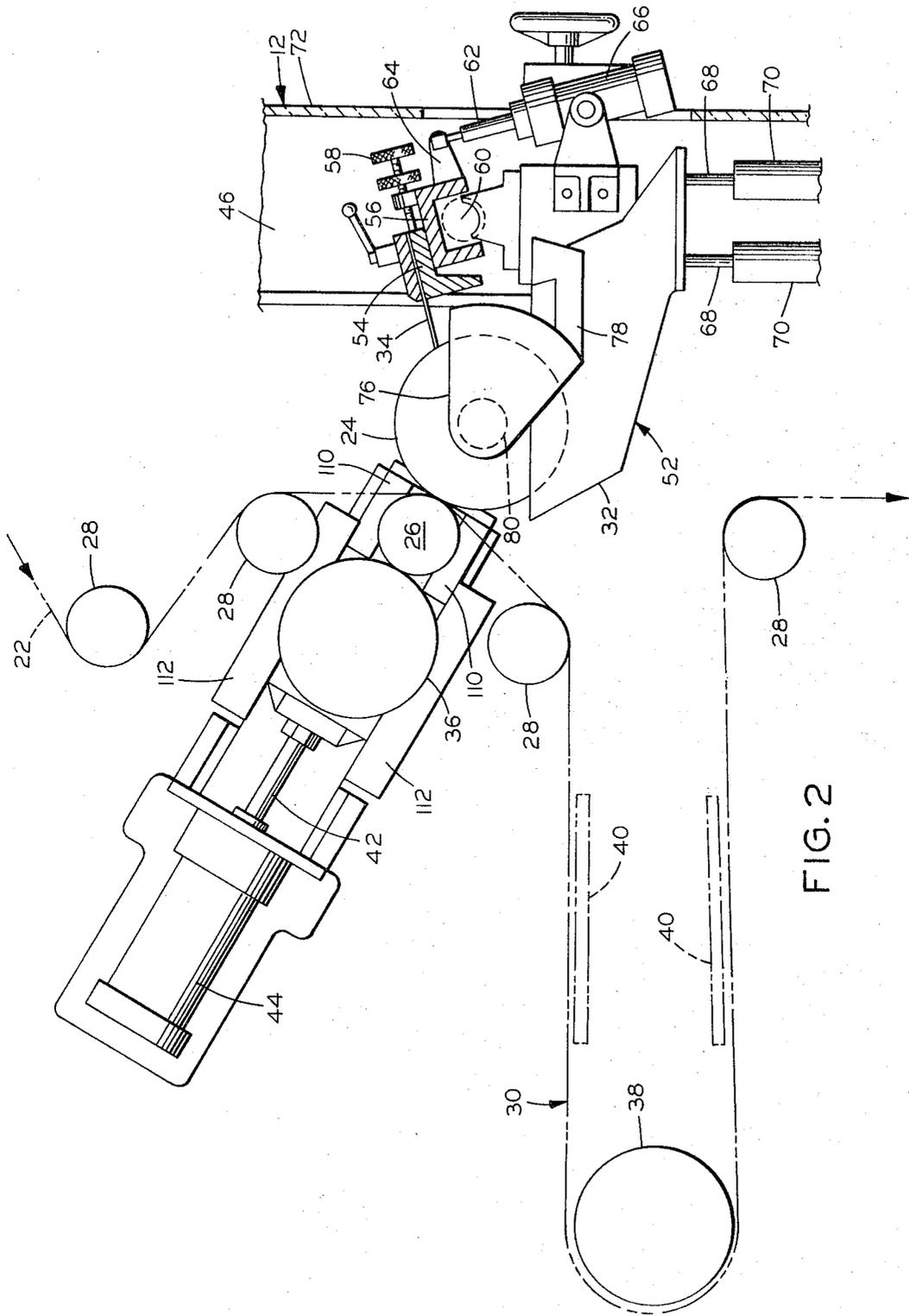


FIG. 2

PRINT MACHINE FOR USE WITH HIGH SOLVENT INKS

BACKGROUND OF THE INVENTION

Generally, there are numerous different types of print machines for use in printing various types of webs including textiles, paper, plastic and metal. Some machines utilize a large cylindrical drum or backing cylinder about the circumference of which are disposed the engraved rolls. Still other machines have been proposed in which the engraved and press rolls are arranged vertically or horizontally depending upon the desired path of the web therethrough. Such machines have use for intaglio printing and for relief printing; when the former technique is employed, it is common to have a doctor blade for removing excess color from the surface of the engraved print roll.

Various techniques are utilized for feeding the color to the surface of the print roll, and most commonly, an ink roll rotates in a trough to pick up the color or ink and carries the color on its surface into contact with the print roll. In some machines, it has been proposed to rotate the engraved print roll directly in the ink trough with attendant problems from the standpoint of effecting desirable color distribution and rapid reassembly of the apparatus.

Among the problems encountered in printing of various webs is the necessity or desirability of effecting drying of the coating applied by one print station before the web passes into the nip of the next print station in order to avoid bleeding or smudging of colors. This problem is particularly significant in printing upon plastics and metal which do not possess the inherent porosity of woven or nonwoven fabric or even of paper.

An obvious solution to this problem is the use of rapidly drying inks which then increases the fire and explosion hazard resulting from the accumulation within the print machine environs of highly volatile solvents escaping from the inks and colors. A further problem in the use of high solvent inks is the difficulty in limiting or controlling of solvent escape from the ink applied to the surface of the print roll prior to its contact with the web to effect transfer thereto.

It is an object of the present invention to provide a novel and high speed print machine in which the danger of fire and explosion resulting from the accumulation of volatile fumes from high solvent inks is minimized.

It is also an object to provide such a machine in which the drying of high solvent inks and colors on the print roll surface is retarded to preclude premature drying.

Another object is to provide such a machine in which the web and inks are substantially confined to an enclosure during their operative treatment and usage and in which there is provided convenient means for viewing the operation of the internal components of the machine.

SUMMARY OF THE INVENTION

It has now been found that the foregoing and related objects can be readily obtained in a print machine for the substantially continuous printing of a web traveling therethrough which includes a machine frame and a vertical gate member pivotally mounted on one face of the frame and moveable between an open position ex-

posing that face and a closed position substantially closing that face. Rotatably supported on the frame in vertically spaced alignment are a multiplicity of pairs of cooperating print and press rolls with the print roll of each pair being disposed outwardly adjacent the gate member. A multiplicity of inking units are supported on the gate member in vertically spaced alignment and each cooperates with one of the print rolls for applying a coating of ink to the circumferential surface of the associated print roll as it rotates during operation of the machine. Each inking unit includes an ink trough and means for moving the ink trough on the gate.

Closure means are provided about other surfaces of the machine frame to substantially close the space defined by the frame. The gate member is provided with closure members and at least one of these is disposed between adjacent inking units and movable between a first position substantially closing at least a portion of the vertical space therebetween and a second position exposing the vertical space therebetween. The gate with its closure members cooperates in the closed position thereof with the machine frame and the closure means to provide a substantially closed housing for the print and press rolls and the ink trough. Gas vent means is provided on the machine and communicates with the interior thereof for withdrawing vapors therefrom.

The gas vent means includes suction means to create a negative pressure in the gas vent means for withdrawing vapors, and preferably the vent means communicates with the housing adjacent the lower end thereof. In this embodiment, the print rolls and press rolls are supported in the machine frame for passage of the web being printed downwardly through the machine.

The gate member is desirably provided with a multiplicity of the closure members each substantially closing at least a portion of the space between adjacent inking units, and the closure members are transparent and pivoted on the gate for movement between open and closed positions. For convenience, the pivotal mounting is at the top of the closure members so that they may be pivoted upwardly to expose the space between inking units.

The closure means on the opposite face of the machine frame is conveniently a door substantially closing that face in its closed position and mounted on the frame for movement to an open position exposing that face.

To minimize solvent loss, the print rolls and ink troughs are mounted in their respective supports so that the print rolls rotate in the ink troughs in the operative position thereof. Elongated print roll cover members are pivotally supported on the machine and are dimensioned and configured to cover substantially the entire axial length of the print rolls over a portion of their circumferential surface adjacent the ink troughs to minimize loss of solvent from the ink coating thereon as they rotate through the ink bath in the troughs towards the nip between the print and press rolls. The inking units desirably include doctor blades pivotally mounted in the gate above the ink troughs, and the cover members extend substantially over the arcuate segment of the print rolls between the ink troughs and doctor blades. The cover members are comprised of an elongated sidewall of non-permeable material having a concave configuration extending closely adjacent the convex configuration of the print roll periphery and of

end walls which provide the support for pivotal movement about the axis of the print roll.

In order to minimize hazards still further, pneumatic motor means are utilized for driving the print and press rolls.

BRIEF DESCRIPTION OF ILLUSTRATED EMBODIMENTS

FIG. 1 is a partially schematic elevational view of a print machine embodying the present invention with portions removed and broken away to reveal details of internal construction; and

FIG. 2 is a fragmentary side elevational view to an enlarged scale of one of the printing stations of the machine of FIG. 1.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Turning now in detail to FIG. 1 of the attached drawings, therein partially diagrammatically illustrated is a print machine embodying the present invention and utilizing a frame generally designated by the numeral 10. One face of the frame 10 has pivotally mounted thereon a gate generally designated by the numeral 12 which is movable between an open position exposing that face of the machine for access to the interior thereof and a closed position substantially sealing that face. The opposite face of the machine has pivotally mounted thereon a door generally designated by the numeral 14 which is movable between a closed position substantially sealing that face and an open position exposing the interior of the machine. The door 14 is provided with an exit port 15 through which the web 22 is discharged from the machine. The top of the frame 10 is provided with a removable cover generally designated by the numeral 16 having a feed port 18 formed therein registering with an aperture 20 in the top of the machine frame. As will be appreciated, the frame 10, gate 12, door 14 and cover 16 thus provide a substantially closed chamber in which the operating components of the machine for printing the web 22 are disposed.

The general structure and operation of the print and press rolls is described in great detail in the copending applications of Johann Heinrich Saueressig Ser. No. 210,064, filed Dec. 20, 1971 and Ser. No. 345,873, filed Mar. 29, 1973. As pointed out therein, the web 22 is driven through the machine by its engagement in the nip between the print rolls 24 and press rolls 26. As is pointed out in the latter of the above-mentioned applications, the web 22 is deflected from a straight line path about idler rolls 28 through an evaporation mechanism generally designated by the numeral 30. Ink is supplied directly to the surface of the print rolls 24 by their rotation in the ink trough 32 and they are driven so as to rotate therethrough by conventional drive apparatus (not shown).

Turning now in detail to FIG. 2 of the drawings, the press roll 26 is disposed with its axis spaced above that of the print roll 24 so that it is in tangential contact therewith adjacent the upper portion of the circumference at a point closely spaced relative to the doctor blade 34. The backing roll 36 may be seen to be substantially larger in diameter than the press roll 26, and it is disposed with its axis in the common plane defined by line drawn through the axes of print roll 24 and press roll 26. The press roll 26 and backing roll 36 are jour-

naled in slides 110 and 112, respectively, the slides 110 also being slidable in the channels of slide 112 as a result of movement of the piston 42 effected by operation of the cylinder 44.

Referring now to both FIGS. 1 and 2, it can be seen that the web 22 is deflected from a straight line path downwardly through the cooperating pairs of print and press rolls 24, 26 about the idler rolls 28 and through the deflection and evaporation mechanism 30. As can be seen, the evaporation mechanism 30 includes a porous deflection tube 38 which has its axis parallel to the axes of the rolls 24, 26 and it is generally spaced below the level of the nip between the rolls 24, 26 and desirably below the axis of the print roll 24. The deflection tube 38 is at least in part constructed of a sintered metallic material so as to provide a porous structure along its length and air or other gaseous medium under pressure is introduced into the center thereof and escapes through the porous wall portion so as to maintain a spacing between it and the web 22 passing thereabout. The gaseous medium coming into contact with the web 22 not only serves to provide the cushion avoiding frictional contact with the deflection tube 38 but it also serves to effect evaporation of solvent from the printed coating upon the surface of the web 22. To facilitate the removal of solvent and drying of the coating applied at each of the print stations, elongated drying units 40 are provided along both the upper and lower horizontal legs of the path of travel of the web 22 towards and away from the porous deflection tube 38. The details of construction and operation of the deflection tube 38 and drying units 40 are fully described in the aforementioned copending application of Johann Heinrich Saueressig, Ser. No. 345,873.

The general structure of the pivotally mounted gate member 12 is described in considerable detail in each of the aforementioned copending applications of Johann Heinrich Saueressig. The gate 12 is generally comprised of vertical side posts 46, a top cross member 48 and a bottom cross member 50. Mounted on the gate member are a series of inking units generally designated by the numeral 52 and including the ink trough 32 and the doctor blade 34, with one of the inking units 52 cooperating with each of the print stations defined by the print rolls 24. The doctor blade 34 extends from the clamp 54 which in turn is slidably mounted upon the channel member 56 so that it may be moved secantally relative to the print roll 24 by means of the adjusting screw assembly 58. The channel member 56 in turn is pivotally mounted upon the supports 60 so that the entire doctor blade assembly may be pivoted about the axis of the supports 60 moving the blade into or from secant contact with the surface of the print roll 24. This pivotal movement is effected by the piston 62 which is connected to an extension 64 on the channel member 56 and which reciprocates within the cylinder 66 which in turn is supported upon the frame of the gate 12. As will be appreciated, this allows the doctor blade 34 to be rapidly pivoted away from the surface of the print rolls 24 when opening of the gate 12 is desired. The ink trough 32 is movable vertically on the gate 12 by reason of its slidable support thereon and action of the pistons 68 which operate in response to pneumatic pressure in the cylinders 70. As a result, the ink trough 32 may be rapidly moved downwardly to a level below the bottom of the print rolls 24 when it is desired to open the gate 12 or when it is desired to dis-

continue supply of a particular color to a print station.

To provide a substantially closed face for the gate 12, a multiplicity of closure members 72 are pivotally mounted thereon in pivot brackets 74 for movement between a closed position substantially closing the face of the gate 12 and open position wherein the print station normally covered thereby is exposed for repair or adjustments. The closure members 72 are desirably dimensioned and configured so as to substantially encompass the spacing between the sides of the gate 12 and the spacing between adjacent print stations with cutouts or notches in their edges permitting the extension therethrough in the closed position of the operating elements projecting beyond the outer face of the gate 12 such as the cylinders 66. For convenience and ease of operation, the closure members 72 are desirably fabricated from transparent, solvent-resistant plastic sheet material or from tempered glass.

To retard drying of the ink applied to the surface of the print roll 24 as it rotates outwardly from the ink trough 32, cover members 76 are provided and each comprises side wall portions and an axially elongated wall portion extending closely adjacent to and along the length of the print rolls 24 above the ink trough 32 and to a point closely adjacent the doctor blade 34. As can be seen, the axially elongated wall portion is of arcuate configuration so as to closely conform to the circumferential surface of the print roll 24. The ink trough 32 is provided with a flange 78 which will support the cover member 76 in the desired position thereof when the ink trough 32 is elevated into operative position. The cover member 76 is pivotally mounted on the shaft elements 80 for rotation about the axis of the print roll 24 and it may be removed from the shaft elements 80 to facilitate cleaning or removal of the print roll 24. As will be appreciated, this arrangement provides a confined space through which the highly solvent loaded ink coating on the print roll 24 passes prior to its contact with the doctor blade 34. The volatilization of the solvent from the coating is thus minimized during at least this portion of the path of travel of the print roll 24 to the printing nip.

To evacuate solvent and other fumes from the interior of the print machine, there is provided an exhaust system generally designated by the numeral 82 and comprised of an intake vent 84 disposed adjacent the bottom of the print machine and a duct 86 extending therefrom and outwardly of the print machine. The fumes are exhausted by operation of an exhaust fan 88 with which the duct 86 communicates, and the fumes are desirably passed through suitable solvent removal and treating apparatus to avoid air pollution.

By providing a closed housing for the print machine, it will be appreciated that the present invention permits the utilization of highly volatile ink formulations without substantial concern for explosion and the like as the fumes are being rapidly evacuated and treated. It will be appreciated that the machine desirably employs pneumatic motors for operating the various components thereof, including the print roll and press roll, as well as utilizes pneumatic cylinders to effect pivoting and other movement of accessory elements. Depending upon the capacity of the fan or other evacuating means, and depending upon whether the web is being deflected about the porous walls, the interior of the housing may

be maintained at a partial vacuum so as to facilitate the rapid removal of fumes therefrom.

The present invention not only minimizes fire hazard but also tends to protect the interior of the housing from undue solvent attack and deterioration thereof. By rapidly evacuating the solvent fumes, drying of the printed coating upon the web is facilitated. The use of the cover members to substantially enclose the path of travel between the ink trough and the doctor blade minimizes the premature evaporation of the high solvent inks which are so beneficial in the printing of synthetic plastic sheet material, foil, paper and the like. When no doctor blade is employed, the cover members may extend substantially the entire circumferential surface of the print roll between the ink trough and the press roll. Also, if it is desired to employ an ink roll to coat the surface of the print roll, the cover members may be modified in configuration accordingly to provide the desired enclosure for not only the exposed surface of the print roll but also the ink roll. The cover members may be carried by the shaft for the print roll or by separate support shafts as illustrated, and these shafts may be mounted on the machine frame or the machine gate.

The closure members on the gate may be varied in form or in manner of mounting so long as they are removable to facilitate access to the interior of the gate. They can be plates which are normally fixed in position by screws or other fasteners and which may have transparent window portions therein to permit observation of the operation at the print stations, or they can be pivoted members with properly located notches as illustrated. Depending upon the number and location of elements projecting beyond the front surface of the gate, the closure members may be a single piece extending across the full width of the gate or they may each be comprised of a plurality of separate elements secured to the gate member, some of which are pivotally mounted as illustrated and some of which are secured by other suitable means.

From the illustrations of the preferred form of the apparatus, it will be appreciated that the apparatus may be utilized for printing fabric, synthetic plastics, film, paper, metal and other continuous webs. The web redirection assembly with its drying action is particularly advantageous in the printing of non-porous materials since passage of the web into the next printing station while the previously deposited print coating is still wet would tend to produce smearing or running of colors and pattern. The machine may be used for intaglio printing as illustrated, in which case a doctor blade (or a pair of doctor blades) is employed or it may be used for relief printing. Where high solvent inks are employed, it is preferred that the print roll rotate directly in the ink trough so as to minimize premature drying on the print roll; however, it is possible to utilize the apparatus quite effectively with a separate ink roll to facilitate coating of the print roll.

Although the web is shown as passing through the web redirection apparatus, it should be appreciated that the web may be passed vertically downwardly in substantially a straight line through the several print stations where adequate drying may be effected between print stations. Similarly, although the web is shown as passing downwardly through the several print stations and entering at the top and exiting at the bot-

tom of the machine, a reverse direction may also be employed.

As will be readily appreciated, the overall assembly is one which lends itself to rapid interchangeability, disengagement of individual units and variation in printing technique, while at the same time providing a high degree of safety and permitting utilization of high solvent inks. The apparatus permits the evacuation of solvent fumes from the interior of the machine to avoid contamination of the atmosphere and to minimize any danger of fire or explosion while at the same time permitting minimization of premature drying on the print rolls.

Having thus described the invention, we claim:

- 1. A print machine for the continuous printing of a continuous web traveling therethrough comprising:
 - a. a machine frame;
 - b. a vertical gate member pivotally mounted on one face of said frame and movable between an open position exposing said one face and a closed position substantially closing said one face;
 - c. a multiplicity of pairs of cooperating print and press rolls rotatably supported on said frame in vertically spaced alignment, the print roll of each pair being disposed outwardly adjacent said gate member;
 - d. a multiplicity of inking units supported on said gate member in vertically spaced alignment and each cooperating with one of said print rolls for applying a coating of ink to the circumferential surface of an associated print roll as it rotates during operation of the machine, each inking unit including an ink trough and means for moving said ink trough on said gate;
 - e. closure means about other surfaces of said machine frame substantially closing said space defined by said frame;
 - f. closure members on said gate member, at least one of which is disposed between adjacent inking units and is movable between a first position substantially closing at least a portion of the vertical space therebetween and a second position exposing the vertical space therebetween, said gate with its closure members cooperating in the closed position thereof with said machine frame and closure means to provide a substantially closed housing for said print and press rolls and said ink troughs; and
 - g. gas vent means on said machine communicating with the interior thereof for withdrawing vapors from the interior thereof.
- 2. The print machine of claim 1 wherein said gas vent means includes suction means for withdrawing fumes

from said housing.

3. The print machine of claim 1 wherein said vent means communicates with said housing adjacent the lower end thereof and wherein said print rolls and press rolls are supported in said machine for passage of the web being printed downwardly therethrough.

4. The print machine of claim 1 wherein said gate has mounted thereon a multiplicity of said closure members each substantially closing at least a portion of space between adjacent inking units.

5. The print machine of claim 4 wherein said closure members are transparent and are pivoted on said gate for movement between said positions thereof.

6. The print machine of claim 4 wherein said closure members are pivotally mounted to said gate at the top thereof so that they may be pivoted upwardly into said second position thereof.

7. The print machine of claim 1 wherein said closure means on said opposite face of said machine frame is a door substantially closing said opposite face in a first position and mounted thereon for movement to a second position exposing said opposite face.

8. The print machine of claim 1 wherein said print rolls are disposed for rotation in said ink troughs in the operative position thereof.

9. The print machine of claim 8 wherein said machine includes elongated print roller cover members pivotally supported on said machine and dimensioned and configured to cover substantially the axial length of said print rolls over a portion of the circumferential surface thereof adjacent said ink troughs to minimize loss of solvent from the ink coating thereon as they rotate through the ink bath in said troughs towards the nip between said print and press rolls.

10. The print machine of claim 9 wherein said inking units include doctor blades pivotally mounted in said gate above said ink troughs and said cover members extend substantially over the arcuate segment of the print rolls between said ink troughs and said doctor blades.

11. The print machine of claim 9 wherein said cover members are comprised of an axially elongated side wall of non-permeable material and of concave configuration extending closely adjacent the convex surface of the associated print roll and end walls pivotally supporting said cover members for pivotal movement about the axis of the associated print roll.

12. The print machine of claim 1 wherein there is included pneumatic motor means for driving said print and press rolls.

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