

Nov. 27, 1962

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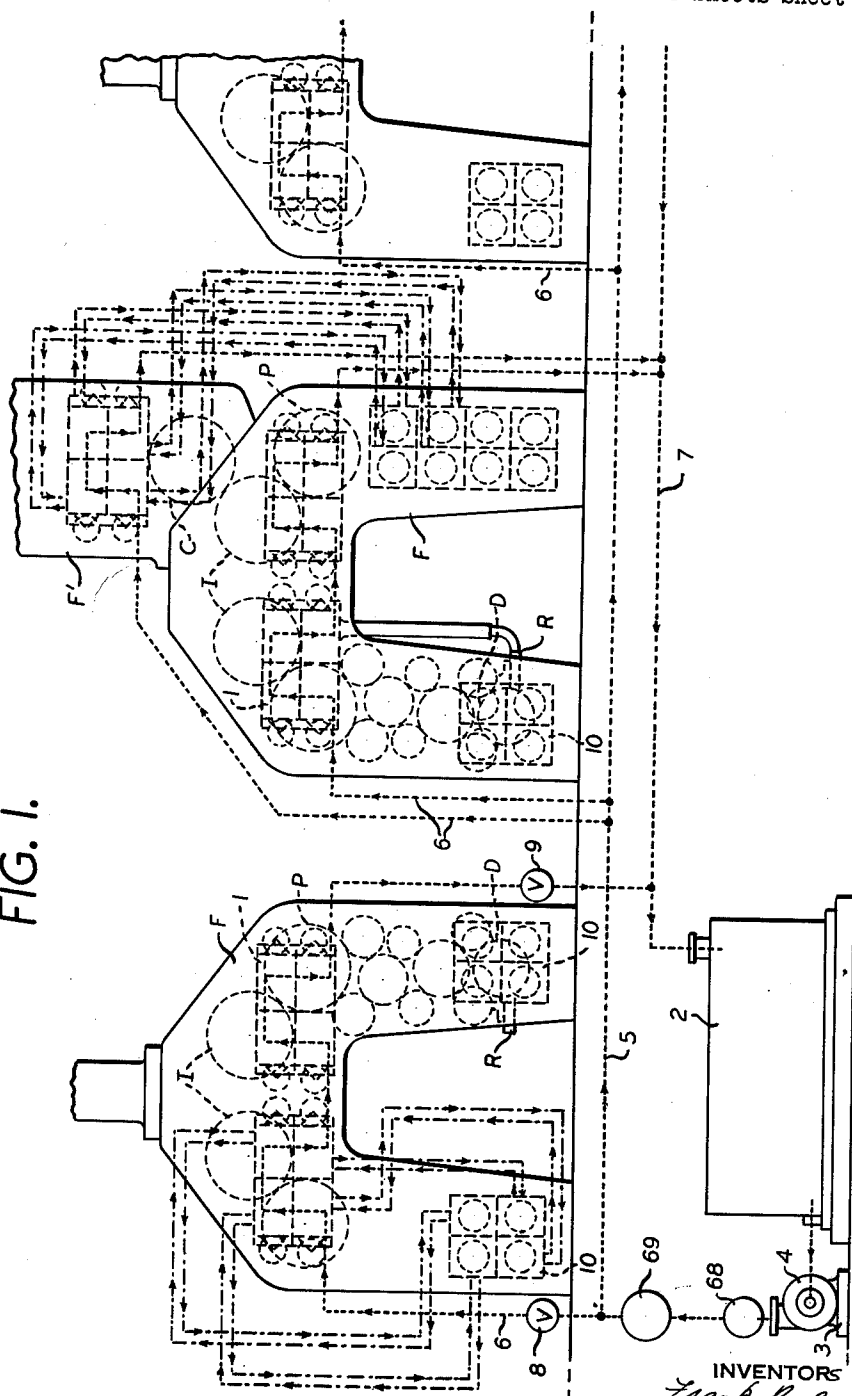
3,065,693

PRINTING MACHINE INK PUMPING SYSTEM

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3 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

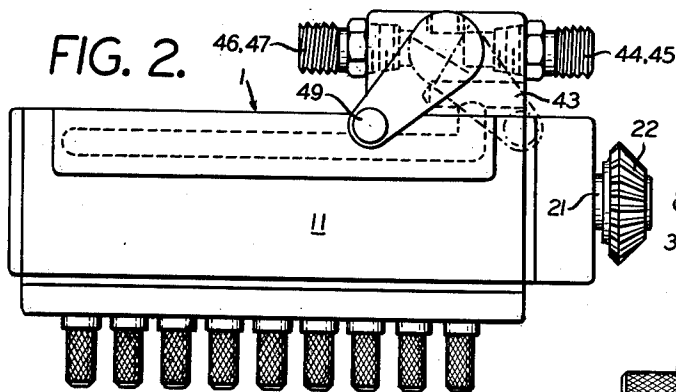


FIG. 3.

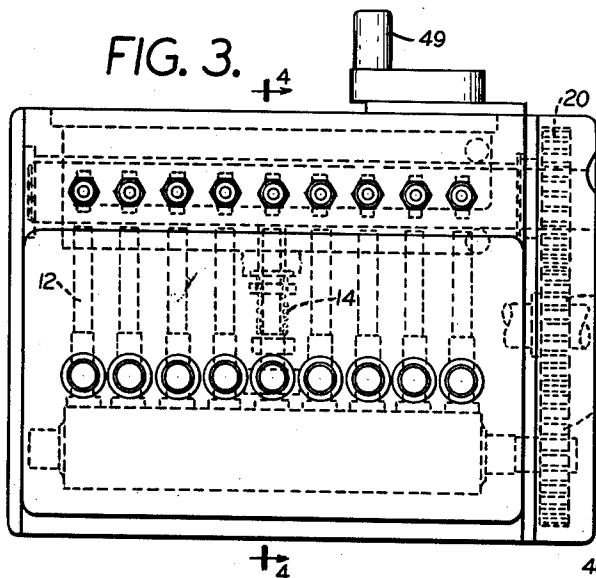


FIG. 4.

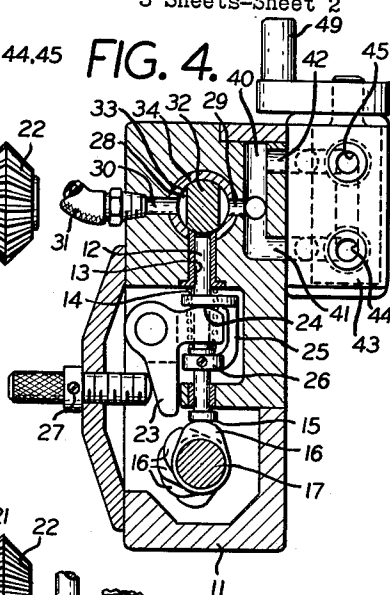


FIG. 5.

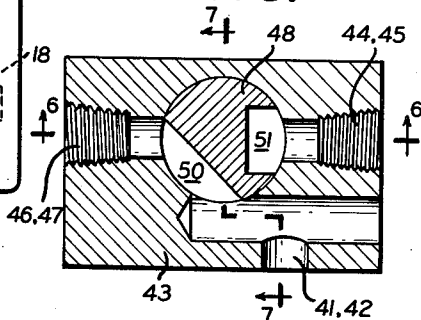


FIG. 6.

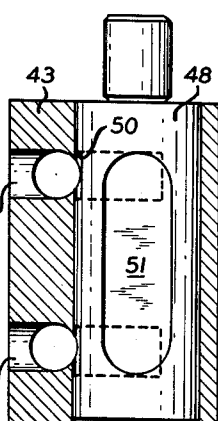
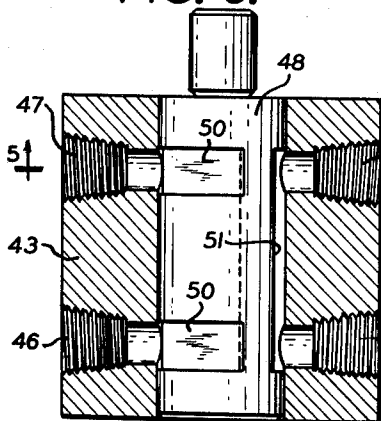


FIG. 7.

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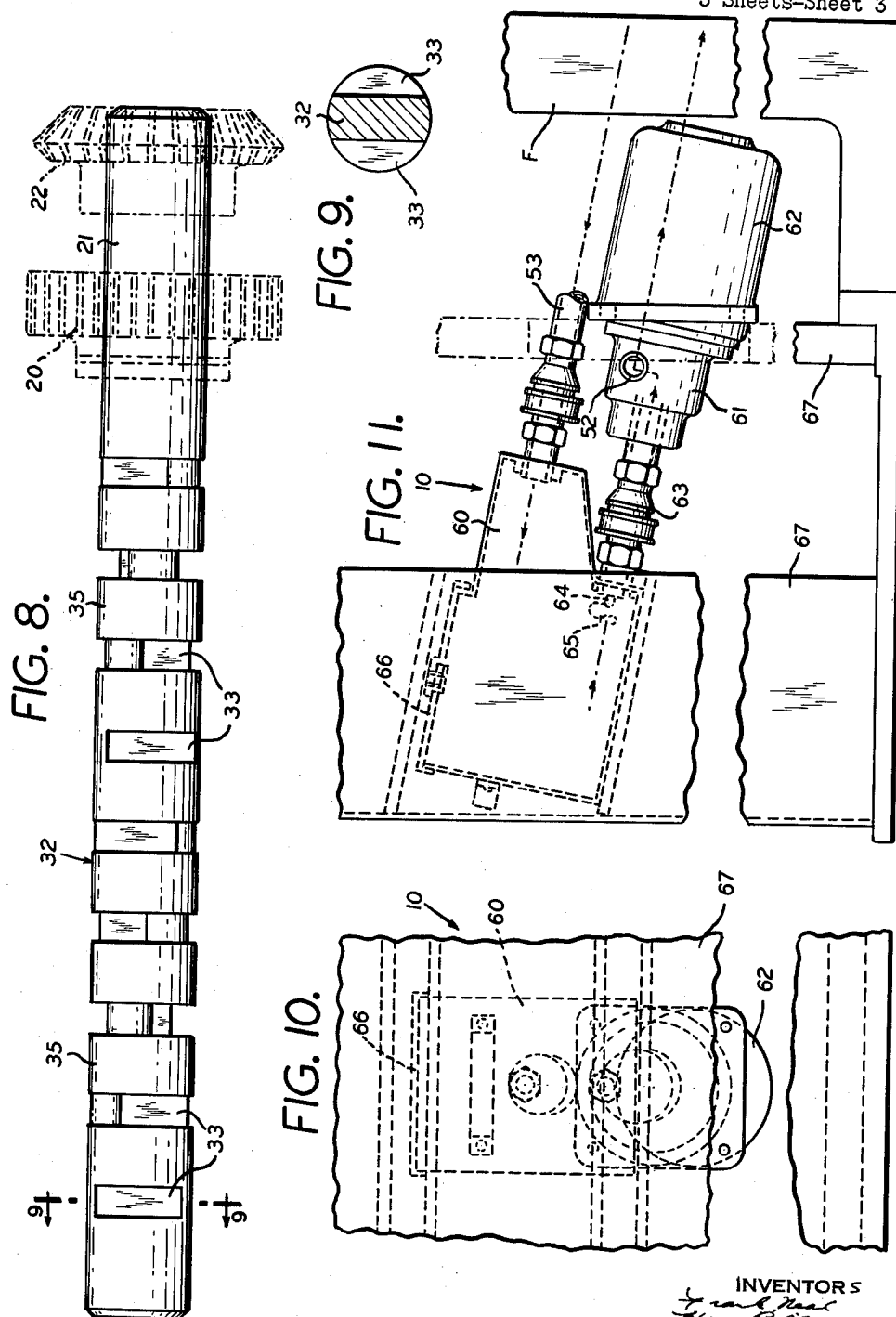
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PRINTING MACHINE INK PUMPING SYSTEM

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PRINTING MACHINE INK PUMPING SYSTEM
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 16 Claims. (Cl. 101-366)

This invention relates to ink pumping systems for printing machines.

More particularly, the invention is concerned with inking mechanisms such as used typically in relief and offset printing machines and in which the ink is supplied at a measured rate corresponding to the rate of consumption of ink by the printing machine or at a variety of such measured rates for the respective axial divisions or portions of the printing cylinder where there is a difference in ink consumption as between such sections or portions. Typically in such machines, the ink is supplied at a measured and regulable rate to each column width along the cylinder, the number of columns per page width and the number of pages across the cylinder varying from machine to machine, but involving ordinarily four or five pages, each having eight or nine columns. In such machines, it is known practice to pump the ink which is of a somewhat viscous character by means of a pump or number of pumps each having a separate positive displacement (and generally reciprocating) piston and cylinder for each column with a valving mechanism controlling the operation of a number of these piston and cylinder devices. The inks used being viscous and tending to settle, difficulty is experienced in maintaining the desired regulated rates of flow and also in cleaning the mechanisms and in changing from one color ink to another. This difficulty becomes aggravated in offset and magazine presses using high viscosity inks.

It is an object of the invention to provide an improved ink pumping mechanism, in which the ink is supplied from a preconditioned circulating body of ink maintained under pressure, insuring the filling of the individual ink pumps at each suction stroke.

Another object of the invention is to provide an inking mechanism and method which preconditions or pre-masticates the ink, thus achieving a more even distribution of ink and, in some cases, reducing the number of cuts or ink drums otherwise required on the ink motion by which the ink is transferred from the ink pump to the printing cylinder.

Another object of the invention is to provide an improved rotary valve mechanism for ink pumping mechanisms, permitting a smoothing out and regularization of the valving and pumping action.

Another object of the invention is to provide a simplified ink pumping mechanism by means of which torque variation in the ink pump drive may be reduced to a minimum.

Further objects are to minimize sedimentation or settling of the ink and provide for a ready change from one color ink to another with a minimum of time lost and cleaning required.

The system and method of the invention provide for the circulation of a large body of ink through a number of ink pumping mechanisms and under conditions insuring thorough mixture and preliminary working of the ink, as well as pressurizing of the suction or intake ports of the individual ink pumps supplying the different plate cylinders and pages and columns or other axial divisions of these cylinders. At the same time, the invention provides for by-passing given pumping mechanisms from the main circulation and substituting a circulation from a system supplying ink of a different color, thus providing an extremely ready change of color, whenever desired.

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A system embodying the invention in a preferred form will now be described with reference to the accompanying drawings, and the features forming the invention will then be pointed out in the appended claims.

In the drawing:

FIG. 1 is a schematic side elevation of a number of printing units together with ink pumps and ink circulating arrangements;

FIG. 2 is a plan view of an individual ink measuring pump;

FIG. 3 is a front elevation of the pump of FIG. 2;

FIG. 4 is a section on the line 4-4 of FIG. 3;

FIGS. 5, 6 and 7 are enlarged sectional views of a valve element forming part of the pumping mechanism of FIG. 2, and are taken on the indicated sections lines 5-5, 6-6 and 7-7 of FIGS. 6 and 5;

FIG. 8 is a side elevation view of a valve body member shown in FIG. 4;

FIG. 9 is a section on the line 9-9 of FIG. 8; and

FIGS. 10 and 11 are, respectively, front and side elevation views of an ink supply and circulating arrangement used for colored ink.

Referring now to FIG. 1, there is indicated in that figure by way of example, two units of a line of printing units which may comprise any desired number of such units for operating from the same or different webs in various combinations. These units are of the so-called arch type, each including two printing couples, composed of a plate cylinder P and impression cylinder I carried in a unit frame F. Some of these units may have so-called added color provision, as is shown in the case of the second unit from the left, where an added color cylinder C cooperates with the impression cylinder in one of the couples and is carried in an auxiliary frame structure F'. The arrangement of units, frame structures and added color mechanism forms, in itself, no part of the present invention and will not be described in detail herein. For details of a press such as selected for illustrating the present invention, reference may be made to prior patents.

Each couple has associated with it an ink motion, this being indicated for one of the couples shown in FIG. 1 although it will be understood that each such couple and each added color cylinder will have such a mechanism, as is usual. The initial ink drum D of the ink motion is supplied with ink from an ink rail R by means of an ink measuring pump or pumps, there being typically for each such ink rail, four measuring pumps 1, each of which supplies ink for a page width and each of which, in turn, contains a number of individual piston pumps for supplying a column width, as later described. In the system of the present invention, the monotone or black printing ink for a number of printing couples is contained in a reservoir or sump 2. The ink for a line of units may be supplied by one or more of these reservoirs or ink for more than one line of units or units in different lines of units may be supplied from a common reservoir in any arrangement found convenient.

Each measuring pump unit 1 contains an intake channel (as later described) through which ink is continuously circulated from the reservoir 2 by means of a pump 3 driven by motor 4, which typically is a constant speed electric motor, but may also be a variable speed motor. The pumping mechanisms 1 may be connected in the circulating line in various series, parallel and series-parallel arrangements, but the arrangement indicated schematically in FIG. 1 will ordinarily be found suitable. According to this arrangement, the ink is supplied from a line 5 through branch lines 6, which go through all pumping mechanisms 1 of a given unit in series and then return to a discharge line or manifold 7, as indicated. The sys-

tem thus comprises a supply manifold and discharge manifold, each branch of which takes care of the eight pumps of a given unit or two couples. The supply to and discharge from each unit may be regulated by ink supply valve and pressure gauge units 8 and ink discharge valve and pressure gauge elements 9, insuring that proper pressure is maintained in all the lines 6 and that a suitably rapid circulation of ink takes place through all these lines. Ordinarily, the rate of ink circulation through each unit may be about the same as that through the other units, and is not critical.

A number of colored ink supply pumping mechanisms 10 are indicated in FIG. 1, but shown in more detail in FIGS. 10 and 11. Description of these elements will, however, be deferred until after the monotone ink supply and pumping arrangement have been described.

A typical ink measuring pump 1 is shown in FIGS. 2, 3 and 4. It comprises a housing or casing 11 containing a number of ink pumping plungers 12 which are reciprocable in cylinder bores 13. Each piston plunger 12 is urged downwardly by a spring 14 and its lower end 15 engages a cam 16 carried by a cam shaft 17. This shaft is rotated in synchronism with the press through gears 18, 19, 20 (FIG. 3) within the pumping unit, the shaft 21 carrying gear 20 being connected through bevel gearing 22 to the press drive, as usual. A separate cam 16 is preferably provided for each plunger 12 and these cams are offset angularly or spirally arranged. In the case shown where there are nine plungers in each pumping unit 1, there are nine such cams and they are spaced apart by 40°. The stroke of any plunger 12 may be regulated by means of the bell crank 23, one arm of which engages an abutment 24 carried on a yoke 25 and fastened to the plunger as by the collar and set screw arrangement indicated at 26. The bell crank 23 will not interfere with the upward stroke of the plunger 12 under the action of cam 16, but may limit its downward stroke. By adjusting screw 27, one of which is provided for each bell crank, the stroke of the corresponding plunger 12 may accordingly be regulated as desired. The cylinder 13 communicates with a bore 28 having intake ports 29 and discharge ports 30, the latter of which are connected through tubing 31 to the unit ink rail in the usual manner, there being one such connection for each column width. A valve body 32 is rotatably carried in the bore 28 and comprises grooves 33 for permitting ink flow separated by cylindrical sections 34 which form a seal to the wall of the bore 28. Between plungers the valve body 32 has continuous cylindrical portions 35 sealing to the wall of the bore 28 and separating each pump and cylinder together with its suction and discharge port from adjacent similar elements. The grooves 33 for the various pumps are displaced angularly or set in spiral fashion, this arrangement corresponding to the arrangement of cams 16, so that the valving action is properly related to the movement of the plunger pistons 12. The valve body 32 may be formed integral with and by machining the shaft 21, previously referred to. As will be apparent in starting in the position of FIG. 4, as the cam shaft 17 rotates, piston 12 will perform its suction stroke. At the same time, valve body 32 rotates so that a passage 33 connects the pump cylinder 13 to the intake 29, thus permitting the cylinder 13 to be filled. This action requires about 90° of rotation of the cam shaft 17 and of the valve body 32. During the next 180° of rotation of the cam 17, the follower 15 is on a dwell and the valve body also rotates 180°, assuming a position at right angles to that shown in FIG. 4. Thereafter, during the next 90° of rotation of the cam shaft 17, the piston plunger makes its upward or discharge stroke and during this time a passage 33 connects the cylinder 13 with the outlet port 30. Upon completion of this movement, the parts are restored to the position of FIG. 4 in readiness for another pumping operation.

The intake ports 29 which are short communicate with a distributing channel 40 to which ink is supplied through a connection 41 and from which ink is discharged through a connection 42, both of which lead to a valve box or chest 43 fastened to the housing 1 as shown. This valve chest contains connections 44, 45 for applying ink at one end of the chest and similar connections 46, 47 for colored ink at the other end of the chest and a bore containing a valve body 48 which is rotatable between the two positions indicated in FIG. 2 by means of a handle 49. The valve body 48 has two ink passages or grooves 50 aligned with the connections 44, 45 and also with connections 46, 47 and an axial groove 51, as indicated. With the valve body 48 in the position of FIG. 5, the passage 51 is lined up with monotone ink connections 44, 45, thus by-passing the main ink circulation around the pumping unit in question. At the same time, passages 50 connect the colored ink connections 46, 47 to the valve chest inlet and discharge 41, 42. Rotating the valve body 48 through 90° establishes connection between the black or monotone ink connections 44, 45 and the passages 41, 42 and cuts off circulation from the colored ink connections 46, 47.

Each pumping unit 41 may be connected to a colored ink supply unit 10, if desired, through supply piping 52 and discharge piping 53, as indicated in FIG. 1, the supply pipe leading to a connection 46 and the discharge pipe leading to a connection 47 for the relevant pumping unit 1.

The structure of the added color ink supply units 10 is shown in FIGS. 10 and 11. It comprises a reservoir 60 to which the return line 53 is connected and from which the ink is discharged into the supply line 52 by means of a pump 61 driven by an individual motor 62 and having its intake connected to the reservoir 60 through piping 63, the pump shaft may be extended through the connection 63 as indicated at 64 to carry a small agitator 65. A removable cover 66 provides for filling the reservoir 60 as needed. Any desired number of these added color ink supply units may be supported in brackets or shelf arrangements 67 adjacent the press frame F. As will be apparent, these units may be omitted where no color printing is contemplated by a given printing unit or couple and may be added, replaced or shifted around as desired to meet particular conditions.

The monotone ink for a large number of couples may, as indicated above, be supplied from a single reservoir 2 and at a rate very much in excess of the total ink consumption of all units supplied. For example, in a typical case, ink circulation into and out of the reservoir 2 may be maintained at a rate of about 35 gallons a minute where the consumption of ink in all the units supplied may be less than one gallon per minute. In consequence, a thorough mastication or pre-working and pre-conditioning of the ink takes place and is maintained. By reason of the separate drive motor for the ink pump 3, which is operable independently of the press in general, the circulation may be started at any time in advance of press operation, permitting pre-conditioning of the ink and may be maintained during intervals of non-operation of the press, to maintain the ink in condition.

The pressures required and pipe sizes found necessary are not excessive, $\frac{5}{8}$ to $\frac{3}{4}$ inch pipe being satisfactory for the pipe line 6 and two inch pipe or thereabouts being suitable for the pipe lines 5 and 7. Under these conditions, an inlet pressure at point 8 of about 40 p.s.i. and a return pressure at point 9 of about 30 p.s.i. are conveniently maintained and are not substantially affected by the quantity of ink consumed by the measuring pump units 1 being supplied or by whether one or more of these units may be by-passed. In fact, the quantity of monotone ink circulated through the valve chest of each measuring pump unit 1 will ordinarily exceed the maximum ink consumed by the measuring

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pump unit in a ratio of several hundred to one, so that the withdrawal of ink by the measuring pump units does not materially affect the action of the ink circulating system. The main ink circulation may have an ink filter and heat conditioner 68 and 69 for maintaining the ink in clean condition and for heating, cooling or maintaining it at constant temperature wherever desired.

What is claimed is:

1. Inking mechanism for printing machines comprising an ink measuring pump for supplying ink to a printing machine and having a cooperating piston and cylinder and an intake adjacent the cylinder, and an ink circulating system comprising an ink reservoir, ink circulating conduits including a passage in communication with the said measuring pump intake and means for circulating ink from said reservoir through said passage and back to the said reservoir.

2. Inking mechanism for printing machines comprising an ink measuring pump for supplying ink to a printing machine and having a plurality of cooperating pistons and cylinders and an intake adjacent the cylinders, and an ink circulating system comprising an ink reservoir, ink circulating conduits including a passage in communication with the said measuring pump intake, and means for circulating ink from said reservoir through said passage and back to the said reservoir.

3. Inking mechanism for printing machines comprising an ink measuring pump for supplying ink to a printing machine and having a plurality of cooperating pistons and cylinders and an intake adjacent the cylinders, and an ink circulating system comprising an ink reservoir, ink circulating conduits including a passage in communication with the said measuring pump intake, the volume of the space between the said passage and the said cylinders being a fraction of the displacement of the said pistons, and means for circulating ink from said reservoirs through said passage and back to the said reservoir.

4. Inking mechanism for printing machines comprising an ink measuring pump for supplying ink to a printing machine and having a cooperating piston and cylinder and an intake adjacent the cylinder, and an ink circulating system comprising an ink reservoir, ink circulating conduits including a passage in communication with the said measuring pump intake, ink flow restricting means in the said conduits for maintaining substantially constant pressure in the said passage and means for circulating ink from said reservoir through said passage and back to the said reservoir.

5. In a printing machine having a plurality of printing couples, inking mechanism comprising, for each couple, an ink measuring pump for supplying ink thereto and having a plurality of cooperating pistons and cylinders and an intake adjacent the cylinders, and an ink circulating system comprising an ink reservoir, and ink circulating conduits including a plurality of passages in series with each other and respectively in communication with the said measuring pump intakes of a corresponding plurality of couples, and means for circulating ink from said reservoir through the said plurality of passages and back to the said reservoir.

6. An inking system comprising a plurality of mechanisms according to claim 5, connected in parallel and having a common ink reservoir and ink circulating means.

7. Inking mechanism according to claim 6, comprising also for each such inking mechanism, conduit restrictions for balancing flow through the said linking mechanisms.

8. Inking mechanism according to claim 5, comprising means for driving the measuring pumps from and in synchronism with the printing couples and separate means for driving the ink circulating means independently thereof.

9. Inking mechanism according to claim 8, in which the said separate means comprises a constant speed electric motor.

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10. An ink measuring pump for printing machines comprising an aligned plurality of ink pumping pistons and cylinders, means for reciprocating the said pistons in their cylinders for pumping ink, valve means comprising a bore communicating with the said cylinders, a rotatable valve body fitting the said bore and having passages, an ink intake and a connection therefrom to said bore for supplying ink to each said cylinder through a said passage in a predetermined angular position of the valve body, and ink discharge conduits, each communicating with the said bore in a position for receiving ink through a said passage from a said cylinder when the valve body is in a different predetermined angular position.

11. An inking mechanism for printing machines comprising an ink measuring pump according to claim 10 and means for circulating ink to and from said ink intake and maintaining ink therein at a substantially fixed pressure.

12. An ink measuring pump for printing machines comprising an aligned plurality of ink pumping pistons and cylinders, means for reciprocating the said pistons in their cylinders for pumping ink, valves means comprising a bore communicating with the said cylinders, a rotatable valve body fitting the said bore and having passages registered with the said cylinders and arranged at angles with respect to each other, an ink intake and a connection therefrom to said bore for supplying ink to each said cylinder through a said passage in a predetermined angular position of the valve body, ink discharge conduits, each communicating with the said bore in a position for receiving ink through a said passage from a said cylinder when the valve body is in a different predetermined angular position, and cam means for reciprocating the said pistons, the phases of the said pistons differing from each other and corresponding to the said different angles of the said passages, whereby the power consumption of the said reciprocating means is substantially steady.

13. An ink measuring pump for printing machines comprising a cylinder block having an aligned plurality of cylinder bores and pistons therein, means for reciprocating the said pistons in their cylinder bores for pumping ink, the block having a cross bore communicating with the said cylinders and discharge and intake ports communicating with the said cross bore, a rotatable valve body fitting the said bore and having passages for selectively connecting the cylinder bores with the discharge ports and with the intake ports, and means for rotatively moving the said valve body and reciprocating the said pistons in timed relation thereto for pumping ink from the said intake ports to the said discharge ports.

14. In a printing machine having a plurality of printing couples, inking mechanism comprising, for each couple, an ink measuring pump for supplying ink thereto and having a plurality of cooperating pistons and cylinders, an intake adjacent the cylinders, an ink passage communicating with said intake, a by-pass passage, ink connections and a control valve for selectively connecting the said ink connections to the ink passage and to the by-pass passage, and an ink circulating system comprising an ink reservoir, pump and ink circulating conduits connecting a plurality of ink measuring pumps in series by means of their ink connections, whereby ink is supplied continuously to the said pumping mechanisms for the various printing couples and the ink supply for a selected couple may be cut off while maintaining flow for supplying other couples through the said by-pass passage.

15. Inking mechanism according to claim 14, comprising for a said couple, color printing ink supply means including colored ink connections connectable by the said control valve to the said ink passage when the control valve is in position for by-passing the ink circulation, and a separate colored ink reservoir, pump and conduits connected to the said colored ink connections for supplying colored ink.

16. Inking mechanism according to claim 8, in which

the said separate means comprises a variable speed electric motor.

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