

[72] Inventors **John J. McDonald**
Park Ridge, N.J.;
Ralph L. Fusco, Commack, N.Y.
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 [73] Assignee **R. Hoe & Co., Inc.**
New York, N.Y.

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Primary Examiner—William B. Penn
 Assistant Examiner—E. M. Coven
 Attorney—Sawyer and Kennedy

[54] **DRIVE MEANS FOR THE INKING MECHANISM OF A PRINTING MACHINE**
13 Claims, 5 Drawing Figs.

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 [51] Int. Cl. **B41f 31/28**
 [50] Field of Search **101/365,**
348, 349, 352, 366, 205-210, 350, 351; 318/85,
78

[56] **References Cited**
UNITED STATES PATENTS
 1,922,885 8/1933 De Vries **318/78**

ABSTRACT: A mechanism for driving multiunit pumps of an inking mechanism in a printing machine using a signal-sending device to transmit electrical pulse signals, in response to rotation of the press drive shaft, to a motor control circuit, which in turn operates stepping motors to drive an ink pump including remote control means for selectively operating any such unit. An entire pumping unit can be electrically turned on or off to meet various pumping requirements as called for by different operating conditions.

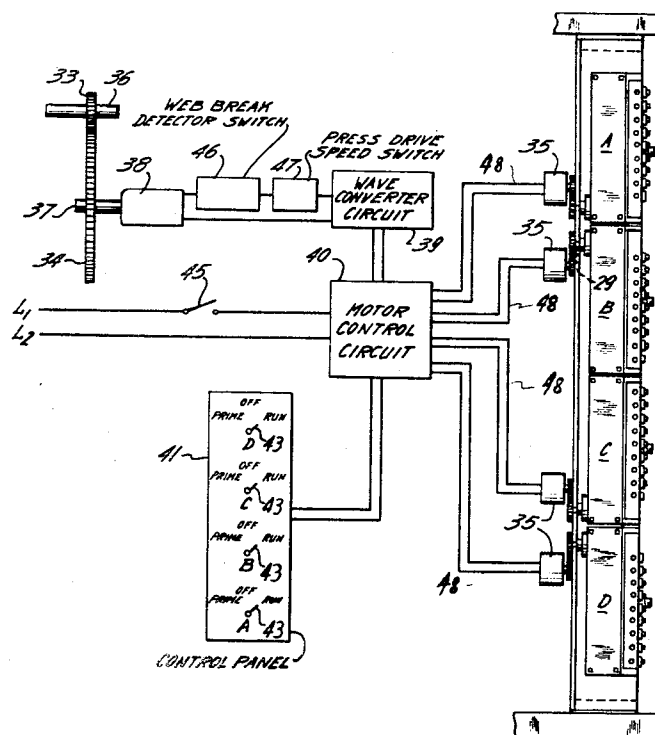
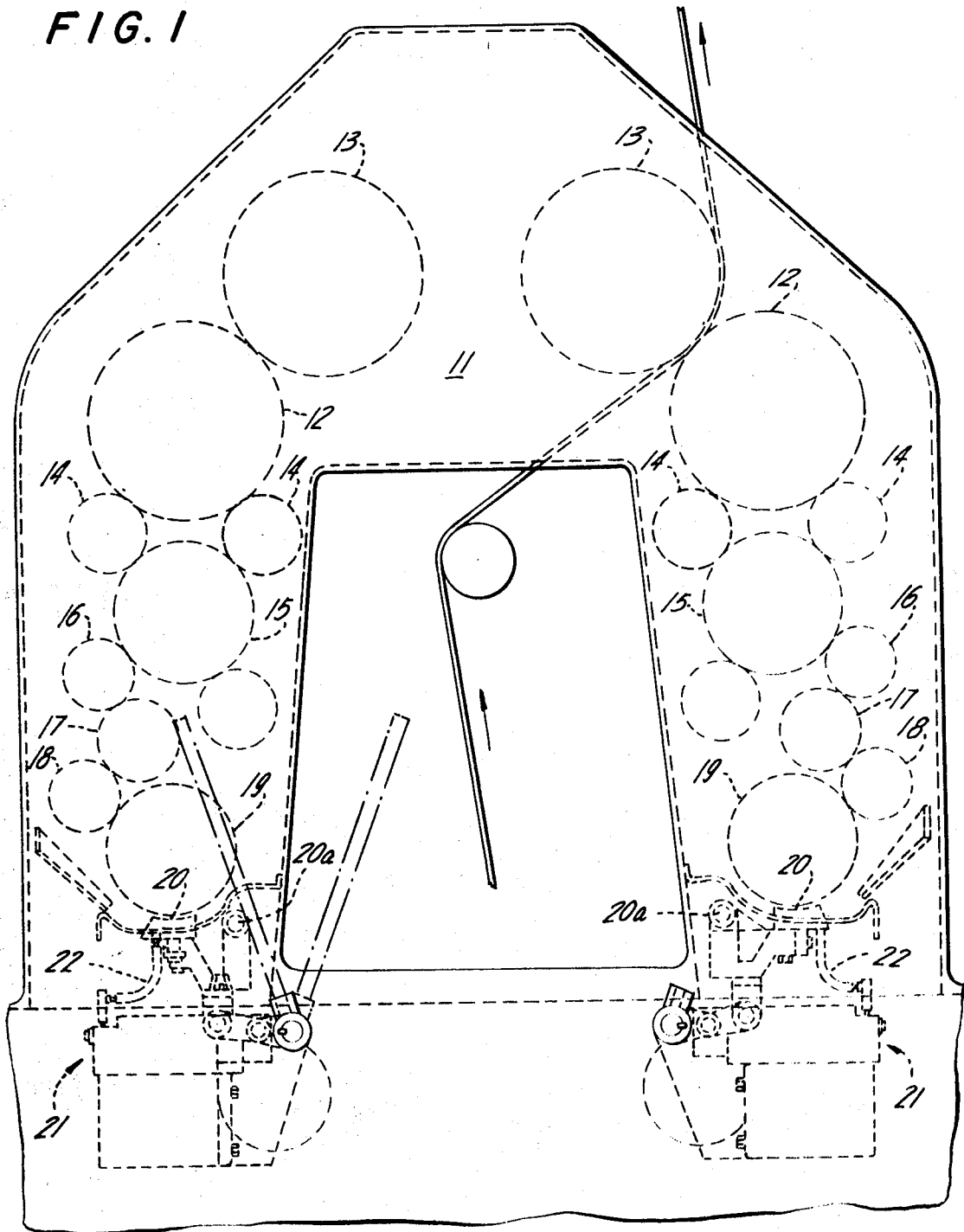


FIG. 1



INVENTORS

JOHN J. McDONALD
RALPH L. FUSCO

FIG. 3

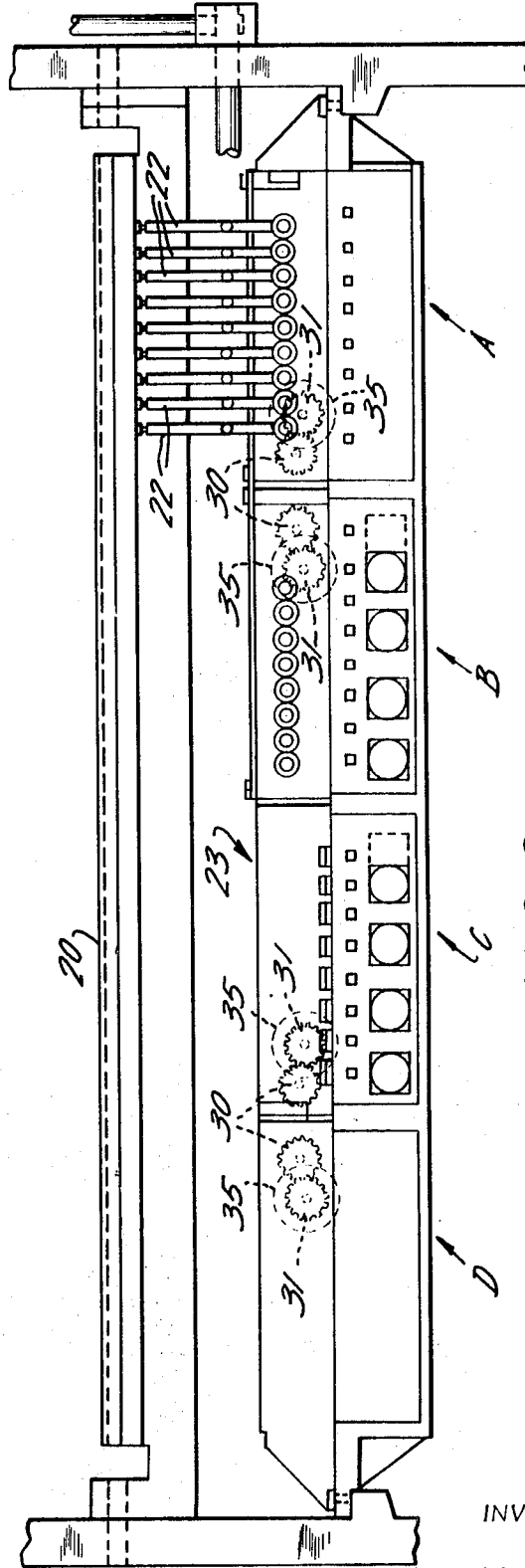
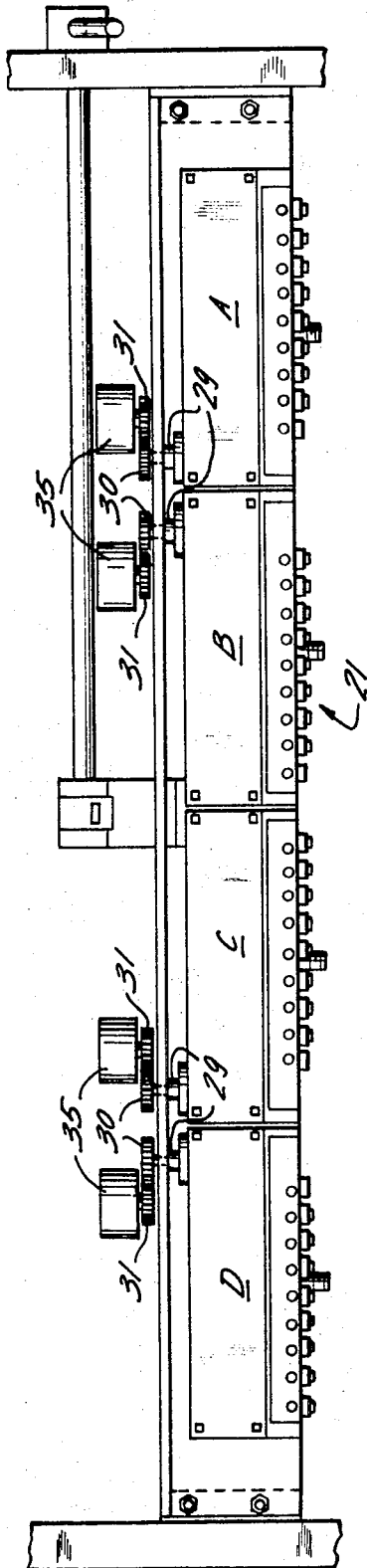
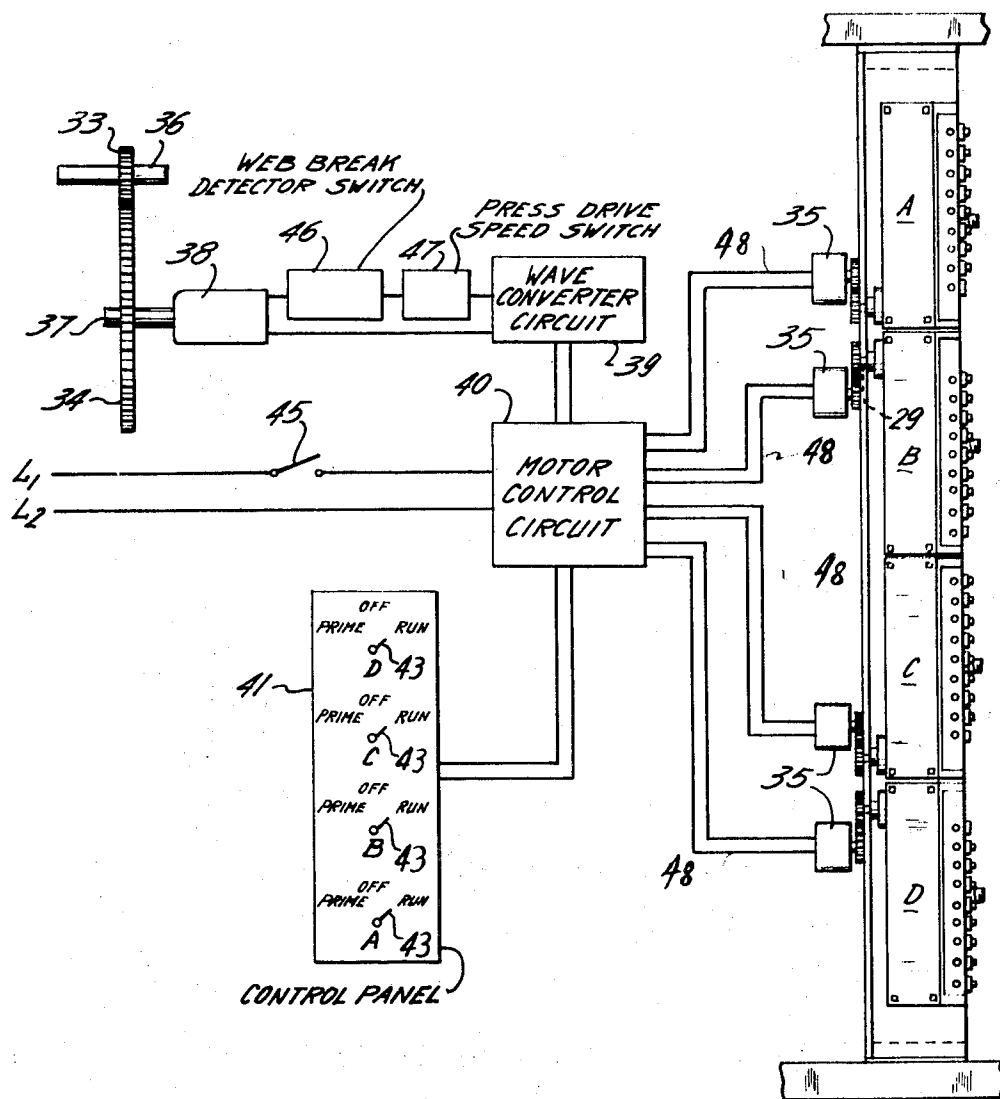


FIG. 2

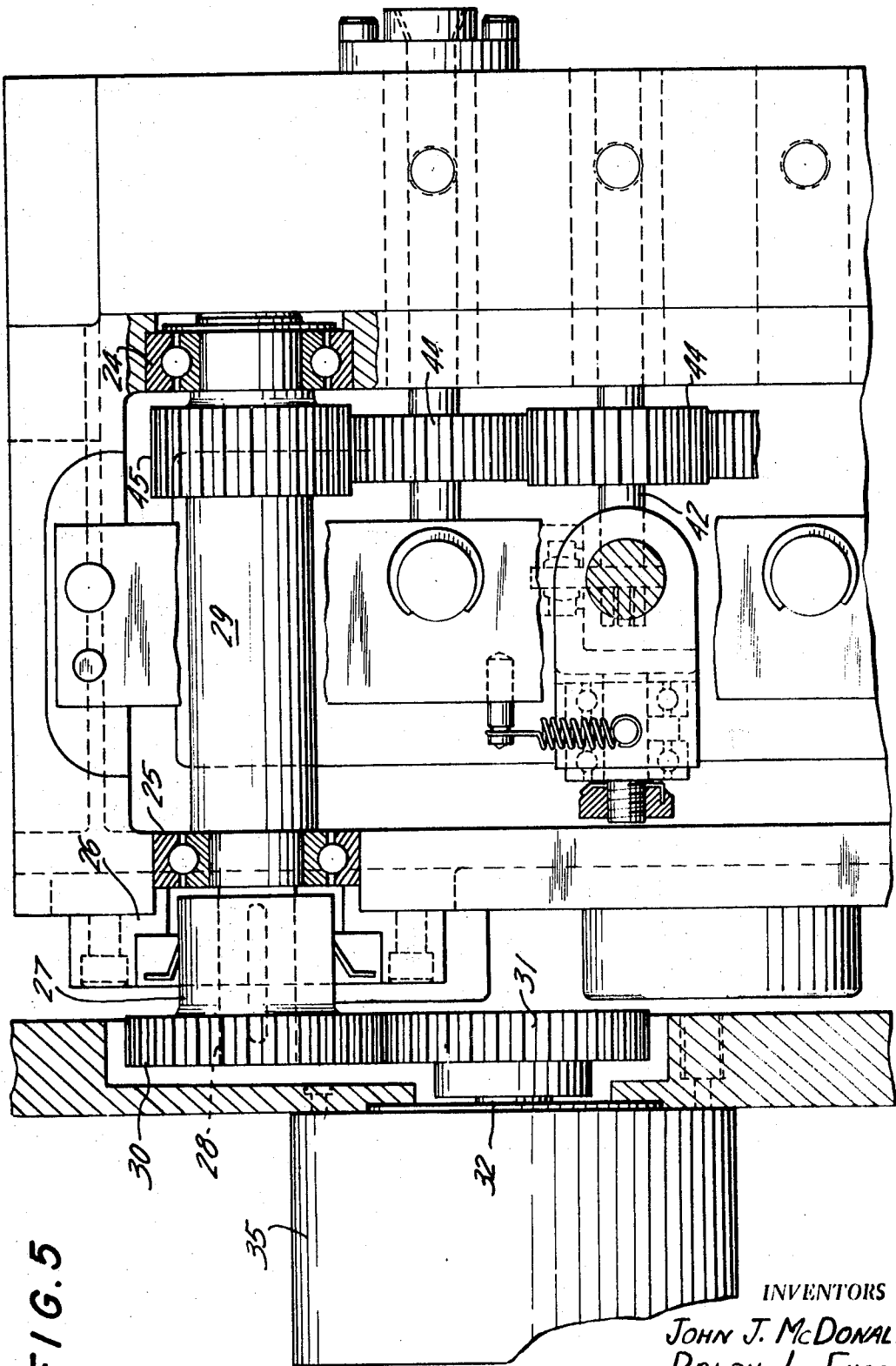
INVENTORS

JOHN J. McDONALD
RALPH L. FUSCO

FIG. 4



INVENTORS
 JOHN J. McDONALD
 RALPH L. FUSCO



DRIVE MEANS FOR THE INKING MECHANISM OF A PRINTING MACHINE

BACKGROUND OF THE INVENTION

This invention relates generally to rotary printing presses and more particularly to the inking system of such a press.

One such type of inking system is shown in Fusco U.S. Pat. No. 3,366,051, the present invention being an improvement thereon, and comprises a pump for feeding ink from a reservoir through an ink rail to a first drum of an ink motion and a drive mechanism mechanically linked to the press drive for driving the pump in synchronization with the press. While the pump, as disclosed in the above-mentioned Fusco patent, signifies an advance over the art of ink pumps for printing machines, major problems continue to exist due to the shortcomings of the drive mechanism for such a pump.

In a typical linking mechanism of modern design, as for example the Fusco inking mechanism, there are a number of units, one such unit for each page width of printing machine. Each unit contains a number of measuring pump elements, there being typically, one such element for each column width of the printing mechanism, and each pumping element communicates through a flexible tubing to the ink rail, for supplying ink to one of the nozzles thereof. The rate of pumping of each pumping element can be individually varied or totally silenced by limiting the stroke of the pump plunger to zero, through remote control means. The plunger of each pump element is driven by means of a train of meshing spur gears which is secured to the plunger, which in turn is driven through gear boxes and transverse shafts from a drive shaft. The drive shaft is driven by gearing directly from the main press drive.

During the period of webbing up the press the printing machine will be operating at slow or threading speeds while the web of paper is being threaded through the machine. The pumps will still be operating and continually pumping ink onto the lower rollers of the ink motion during the webbing process. As a result there is a heavy buildup of ink on the lower rollers which will either be slung off these rollers when the press speed is increased, resulting in contamination of surrounding equipment, or it will find its way up the ink motion flooding the printing plates and eventually causing smears on the travelling web thereby producing waste. In a multiunit press, the webbing up procedure may take considerable time depending on the number of units, i.e. the number of webs which have to be threaded through the machine. During this time ink is continuously being pumped onto the ink motions even in those units where webs have not yet been threaded. The resulting accumulation of ink on the rollers can become quite excessive resulting in dirty presses. The mechanism for operating these pumps as heretofore used, and as described above, has been generally incapable of preventing this costly and messy ink buildup. One means of turning off the pumps during the webbing-up operation would be to silence each pump element by limiting its plunger stroke to zero; however, this is neither practical nor desirable as it would require difficult and time consuming readjustment of the amount of stroke of each plunger to its previous setting.

A similar problem occurs when a web from one printing unit of a multiunit press breaks. With no web travelling between the printing cylinder and the impression cylinder there is no means for carrying away the ink which is being pumped up the ink motion to the printing cylinder. As a result, ink continues to build up on the rollers, printing cylinder, etc., until the press comes to a stop, there being no means to quickly and conveniently turn off the pumps.

Another situation which causes similar problems is when a unit is running with less than all the printing plates mounted on the printing cylinder, as for example when the press is running with a half-width roll of paper. The pumping units which supply ink to that half of the cylinder with no plates must be turned off since there is no paper to carry the ink away. With the present equipment it is quite difficult and inconvenient to turn off an entire unit.

It is accordingly an object of the present invention to provide a novel means for driving the pumping units of a modern ink pump, such as disclosed in the above-mentioned Fusco patent, wherein the problems of the prior drive mechanisms are overcome.

It is an object of this invention to provide an ink pump drive mechanism which permits the rapid and convenient selection of pumping units by remote control facilitating the turning on or off of any unit, i.e. all pumping elements of the unit, without requiring stroke adjustments of the individual pumps and without having to mechanically detach any such unit.

A further object of the present invention is to provide a means for automatically turning on the pumping units only when the press is ready to print and for rapidly and automatically turning off the pumping units when the press is no longer capable of printing (the occurrence of a web break) thereby preventing costly waste and ink buildup on the rollers during webbing up the press.

Still another object of the present invention is to provide a new drive mechanism for the ink pumping system of a printing machine which helps eliminate some of the problems of maintaining clean equipment by preventing the supply of ink to the inking rollers and cylinders during nonprinting operations of the printing machine.

A further object of the present invention is to provide a unique means for driving the inking mechanism of a printing machine which has few mechanical parts and connections and which is virtually maintenance free.

Other objects, advantages and features of the present invention will become more apparent from the following detailed description in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic side elevational end view of one unit of a printing machine provided with an ink-pumping mechanism as driven by the present invention;

FIG. 2 is an elevational view of the ink-pumping mechanism of the unit of FIG. 1;

FIG. 3 is a plan view of the mechanism of FIG. 2;

FIG. 4 is a block and schematic diagram of the drive system as provided for by the present invention; and

FIG. 5 is an enlarged plan view partly broken away of the mechanism shown in FIG. 2.

DESCRIPTION OF THE INVENTION

The inking mechanism as driven by the present invention may be applied to printing mechanisms having any of various arrangements of ink motion elements. For definiteness of illustration, it is shown herein, by way of example, as applied to a printing unit of the general type shown in Fusco U.S. Pat. No. 3,366,051. The unit is of the familiar arch type, in which the frame 11 accommodates two printing arrangements which may be identical apart from being, respectively, right and left hand. The printing or plate cylinder 12 for one mechanism cooperates with an impression cylinder 13 and is inked by the ink motion comprising drum and roller elements 14 to 19, inclusive. The plate cylinder is supplied with ink form rollers 14 from an ink drum 15 which is, in turn inked by a train of transfer rollers 16-17-18 from the initial ink drum 19 which is supplied with ink by an ink rail 20. The ink rail 20 is mounted for pivotal movement about a pivot 20-a, so that it may be moved up and down for adjusting its inking position with relation to the first drum 19 of the ink motion or for moving it into and out of operative position. The drums 15 and 19 may have an axial reciprocating motion for distributing the ink, as is usual. The ink-pumping mechanism indicated generally at 21 in FIG. 1, is supported by a girder element 23 from the frames 11 and runs parallel to and comparatively close to the ink rail 20.

The inking mechanism (FIG. 2) is preferably divided into number of units A,B,C,D, there being one such unit for each

page width of the printing mechanism. Each unit contains a number of measuring pump elements, there being, typically, one such element for each column width of the printing mechanism, and each pumping element communicates through a flexible tubing 22 to the ink rail, for supplying ink to one of the nozzles thereof.

The construction and operation of the measuring pump elements form no part of the present invention and should be taken as shown and described in detail in the above-mentioned Fusco patent. As shown in FIG. 5 the individual pumping elements of each pumping unit are driven by a train of meshing gears 44 each being secured to the plunger 42 of the individual pumping element. The gears 44 of adjacent plungers mesh with each other, and the gear at one end of the line is driven by a spur gear 45, carried on a drive shaft element 29. Shaft 29 is supported between bearings 24 and 25. The drive shaft extends beyond bearing 25, which is retained by ball bearing retainer 26, and is fitted into one of coupling 27. Fitted to the other end of coupling 27 is a shaft segment 28 on which is carried a spur gear 30. Gear 30 meshes with gear 31 which is mounted on the output shaft 32 of a stepping motor 35. As motor 35 is caused to operate, as will be described hereinafter, gear 31 will drive gear 30 which in turn, will drive the shaft 29 over coupling 27 thereby resulting in the transmission of rotation from gear 45 through gear train 44 to the plungers 42 resulting in the pumping operation of the individual pumping elements.

The embodiment shown herein provides that units A and C are right hand while units B and D are left hand. This arrangement is for illustrative purposes only and need not be followed in practice. The drive mechanism as heretofore used on such ink pumps have required that this arrangement be used so as to simplify the drive connections. Accordingly, whenever the drive means, as provided by the present invention is used to replace existing drive mechanisms the right-hand, left-hand alternate arrangement would not be altered. New installations, however, would not necessitate such arrangement and all the units of an inking mechanism may for example be right handed, i.e. the drive shaft element 29 of each unit would be located on the same side.

Stepping motor 35 is to be operated in synchronization with the speed of the press so that the rate of pumping will follow the need of ink to be supplied to the press as determined by the speed of the press. Each of the DC per units A,B,C, and D is provided with a stepping motor 35 mounted on the housing of the unit as by bolting thereto as shown in FIG. 5. The stepping motor 35, sometimes referred to as an indexing motor or a synchronous inductor motor of the type shown for example in U.S. Pat. No. 2,931,929 and in U.S. Pat. No. RE. 25,445, is of the commercially known available type utilizing a permanent magnetic rotor and a stator formed with magnetizable poles having first and second windings for moving in a uniform increment upon each actuation and permitting stalling or overpowering. In such a motor torque is developed as a result of the interaction of magnetic fields produced by the stationary multiphase winding and a unidirectional flux produced by the permanent magnetic rotor. The torque requirements for driving the pump elements through shaft 29 is in the range of 300 to 400 inch-ounces. The motor which is used is selected in accordance with this requirement. If it be desired that a particular pumping unit be deactivated, which would be the case if the page being supplied with ink from the particular unit is not to be printed from, its stepping motor can be electrically disconnected from its power source and all the pumping elements of the unit will cease to operate as its drive shaft 29 will no longer be driven. This is accomplished without having to silence each pumping element by limiting the stroke of the plunger to zero, which would thereafter require resetting of the stroke to its normal amount when the unit is reactivated.

In order to synchronously drive the stepping motors 35, and hence the pumps, the press main drive shaft 36 shown in FIG. 4, of each printing mechanism is provided with a spur gear 33

which meshes with gear 34 mounted on shaft 37 of a signal sending device or pulse generator 38. The ratio between gears 33 and 34 is 1:4 so that shaft 37 rotates at one-fourth the rotational speed of press drive shaft 36. The pulse generator may also be an indexing motor of the commercially available type having a comparatively low torque output, in the area of 4 inch-ounces at 80 volts DC winding and 0.07 amps per winding. The device is driven by the transmission from shaft 36 and hence operates as a generator to produce an output signal or pulse having the general configuration of a sinusoidal wave. The pulse generator 38 is mounted on the frame of the machine and its pulse is electrically transmitted to a wave converter circuit 39 which operates to produce a square wave signal from the low intensity sinusoidal wave. The square wave signal or pulse is then fed into a motor control circuit 40 which acts to translate the input pulses into impulse signals for causing rotational movement of stepping motors 35 through leads 48 (actually five leads to each motor). This is accomplished by circuitry substantially as shown in Madsen U.S. Pat. No. 3,280,395. Power is supplied to the system through leads L₁, L₂ which supply normal 110 v., AC. In line L₁ there is located a unit selector switch 45. Each printing mechanism comprises one of the two printing couples accommodated in the arch type unit, and each such printing mechanism is supplied with a separate and complete drive system for its pumping units as shown in FIG. 4. If a particular printing mechanism or unit is not to be used during a particular run, switch 45 will remain open and no power will be available for operation of the stepping motors 35 resulting in nonoperation of the pumping units of the nonselected printing unit. Hooked into the motor control circuit 40 is a control panel 41 of selectively operating any or all of the pumping units A,B,C, or D by turning on or off any of the stepping motors 35 by use of the switches 43. This is accomplished by turning switch 43 to either the "OFF" or the "RUN" position. A third position marked "PRIME" permits operation of motors 35 at maximum press speed for individual page pump priming, as necessary for example during color changes. In this manner the pressman is able to quickly, easily, accurately and completely cut off the entire supply of ink to any page width portion of the printing cylinder, thereby preventing the flooding of ink on that portion of the printing cylinder on which no printing plate is placed, without disturbing the normal settings of the pump elements and without having to mechanically detach the unit from the drive mechanism by means of a mechanical clutch as heretofore was necessary.

Motor control circuit 40 can also be made capable of varying the rotational speed of motor 35 by providing suitable means for causing such speed adjustments. It is thus possible to obtain a finer control of the pumping rate of the individual pumping elements than was heretofore possible by adjusting both the stroke of the plungers and the speed of the pump until the proper combination to obtain the desired result is achieved.

The use of the synchronous inductor motor for driving the pumps adds a further flexibility and capability to the inking mechanism of the printing machine. The use of this motor and its control circuit makes it possible to synchronize the phase relation between the ink drum of the ink motion and the pump so that a more controlled amount of ink can be supplied to the ink drum. By insuring that the displacement of the pump is in proper phase relation with the rotation of the ink drum the drum will receive a more uniform layer of ink.

Located in series between the pulse generator 38 and the wave converter circuit 39 are the contacts of a web break detector switch 46 and a press drive speed switch 47. The press drive speed switch is mounted on the press drive and when the press is operating at speeds below 100 ft. per minute the switch contacts will be open and consequently no pulse from the signal-sending device 38 will be received by the wave converter circuit 39 and therefore no pulses will be delivered to any of the stepping motors 35. With motor 35 silenced, drive shaft 29 will not rotate and all the pumping units of the print-

ing mechanism will not be operating and no ink will be delivered to any portion of the ink motion of that printing unit. This means that during the webbing up of the press, an operation which is conducted at speeds well below 100 ft. per minute, no ink will be pumped onto the ink motion resulting in the elimination of smearing the paper web at the beginning of the run and in the elimination of ink-laden rollers and associated parts of the printing machine, which heretofore was a major contributing factor in undesirable ink sling and ink misting. With the press drive speed switch 47 open, motors 35 being silenced because no pulse is being received, the pumps will not be operating, the rollers and cylinders will be clean (ink free) during the webbing operation and there will be no ink sling and very little if any of ink misting when the press is brought up to speed. As a result any ink mist suppression system which may be attached to the unit will be able to operate more efficiently with less frequent cleaning of its parts because the amount of contamination buildup on its operating surfaces, and which directly affect its operating efficiency, will be greatly reduced.

When the press is brought up to operating speeds, switch 47 will close and the circuit will be closed so that wave converter circuit 39 receives the pulses from pulse generator 38 and the stepping motors 35 will operate to drive the pumping units.

Web break detector switch 46 is in the closed position when the web is properly threaded through the printing unit, each unit being supplied with such a switch. When a web break occurs in any unit its switch 46 will open, again opening the circuit between generator 38 and wave converter circuit 39, resulting in instantaneous shutoff of the pumping units. Stepping motors 35 are capable of coming to a complete stop within approximately 5° of rotation from the time pulses are no longer transmitted to them, thereby insuring almost instantaneous stoppage of ink supply and eliminating any possibility of coasting which would tend to continue supply of ink. If the pumps were not shut off, as heretofore was the case, the pumps, operating at the high synchronous speed of the press, would continue to pump ink onto the ink motion, but the ink which is ultimately delivered to the printing cylinder 12 would not be carried away by a web travelling in the printing couple between printing cylinder 12 and impression cylinder 13, resulting in a flooding condition and all the disadvantages appurtenant thereto. However, with the present invention it is possible to avoid this situation by electrically and instantaneously silencing the drive mechanism for the pumping units of the printing mechanism in which the web has broken, by disconnecting the source of the input pulses required to drive motors 35 due to the opening of switch 46.

As can be understood from the foregoing, the present invention provides a new means for driving the ink mechanism of a printing machine in which each pumping unit of the inking mechanism can be selectively turned on or off easily and conveniently by remote control means and in which the entire inking mechanism is automatically rendered inoperative during nonprinting operations of the printing machine.

While the invention has been described and illustrated with respect to a certain preferred embodiment which gives satisfactory results it will be understood by those skilled in the art after understanding the purpose of the invention that various other changes and modifications may be made without departing from the spirit and scope of the invention and it is therefore intended to cover all such changes and modifications in the appended claims.

What is claimed is:

1. An inking mechanism for a web printing machine comprising an ink pump supported from the frame of said machine having a plurality of page width pump units for supplying ink to the ink rail of an ink motion of said printing machine, each unit being drive by a shaft element, a stepping motor mounted on each of said units for driving said shaft element for operating said pump, a signal-sending device geared to the main drive shaft of the machine for producing electrical pulses in response to the rotational movement of said main drive shaft,

means connected to said signal sending device for converting said signals into impulses and transmitting said impulses to said stepping motors so that said stepping motors operate to drive said ink pump units in synchronous relationship to the speed of the press, means connected to said signal converting and transmitting means for selectively operating said stepping motors so that said pump units can be turned on or off by remote control, an electrical power source for operating said motors, and electrical switch means connected between said signal sending device and said stepping motors for automatically interrupting the transmission of impulses to said stepping motors upon the occurrence of a web break and when the machine is running at threading speeds, whereby said stepping motors are instantaneously and automatically silenced so that no ink is pumped by said ink pumps onto the ink motion of said printing machine when no web is threaded through said machine and when said machine is running at threading speeds.

2. An inking mechanism for a rotary web printing machine comprising an ink pump having a plurality of page width pump units in side-by-side relation for supplying ink to the ink rail of an ink motion of said machine, each said unit including a housing containing individual column width pumping elements, said elements being driven by a train of meshing gears, said train of gears being driven from a drive shaft element, said ink pump being supported from the frame of the printing machine running parallel to said ink rail, a stepping motor mounted on the housing of each of said units for driving said drive shaft element of each unit so as to operate said pumping elements, means geared to the main drive shaft of the printing machine for producing electrical motor control signals synchronized with the speed of said printing machine, means connected between said signal-producing device and said stepping motors for converting said signals into electrical impulses and for transmitting said impulses to said stepping motors for operating said stepping motors so as to drive said pump units.

3. The inking mechanism according to claim 2, further comprising means connected between said signal producing means and signal converting and transmitting means for automatically and instantaneously preventing the transmission of said impulses to said motors during nonprinting operations of said printing machine so as to prevent the pumping of ink onto said ink rail during said operations.

4. The inking mechanism according to claim 3, wherein said means for automatically preventing transmission of said impulses to said stepping motors during nonprinting operations comprises a web break detector switch mounted on the printing machine having its contacts closed when said web is threaded through said printing machine and is unbroken, whereby said web break detector switch is opened upon the occurrence of a web break so that no signal will be communicated to said signal converting means thereby preventing the operation of said stepping motors so that no ink is being pumped by said pumps.

5. The inking mechanism according to claim 4, wherein said means for automatically preventing transmission of said impulses to said stepping motors during nonprinting operations comprises a press drive speed switch mounted on the main drive of said printing machine having its contacts closed only at running speeds of said machine so that no signal will be communicated to said signal converting and transmitting means at speeds below running speeds thereby preventing operation of said stepping motors so that no ink is being pumped by said pumps.

6. The inking mechanism according to claim 5, wherein said speeds below running speeds are all speeds up to 100 feet per minute.

7. The inking mechanism according to claim 2, wherein said signal-producing means comprises a pulse generator.

8. The inking mechanism according to claim 2, wherein said signal-producing means produces pulses having a general configuration of a sinusoidal wave.

9. The inking mechanism according to claim 8, wherein said signal converting means comprises a wave converter circuit for converting said sinusoidal waves into square wave impulses and a motor control circuit connected between said wave converter and said stepping motors for transmitting said impulses to said stepping motors so as to operate said stepping motors.

10. The inking mechanism according to claim 9, wherein said gear ratio between said signal sending means and said main drive shaft is 4:1 so that said signal-sending means operates at one-quarter the rotational speed of said main drive shaft.

11. The inking mechanism according to claim 9, further comprising remote control means hooked into said motor con-

trol circuit, said means comprising a control switch for each said stepping motor so as to selectively operate each said motor.

12. The inking mechanism according to claim 11, wherein said control switch has a position for operating said motors at priming speeds.

13. The inking mechanism according to claim 12, further comprising a selector switch connected between said electrical power source and said motor control circuit whereby the source of electric power for operating said stepping motors can be disconnected so that the entire ink pump of said printing machine can be remotely turned off.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,608,486 Dated December 27, 1971

Inventor(s) John J. McDonald and Ralph L. Fusco

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title Page, Item 73, Assignee: Change "R. Hoe & Co., Inc., New York, New York" to --Wood Industries, Inc., Plainfield, New Jersey--.

Signed and sealed this 2nd day of May 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents