

- [54] **AUTOMATIC OFFSET PRINTING PRESS**
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[52] **U.S. Cl.**..... **101/144, 101/425**
[51] **Int. Cl.**..... **B41f 7/06, B41f 35/06**
[58] **Field of Search**..... **101/137, 140, 141-145, 101/425**

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[57] **ABSTRACT**
In an automatic offset printing press, a preprinting operating, comprising the steps of applying ink to a master plate, transferring an ink image of the master plate to the blanket cylinder and feeding copy sheets between the blanket cylinder and the impression cylinder, is controlled by a first mechanical timer, an intermediate operation, comprising the steps of counting the number of printed copy sheets, terminating the application of ink to the master plate and terminating the feed of copy sheets, is controlled by a printed copy sheet counter, and a post-printing operation, comprising the steps of initiating and terminating cleaning of the blanket cylinder and shutting off the printing press, is controlled by a second mechanical timer forming a pair with the first mechanical timer.

14 Claims, 24 Drawing Figures

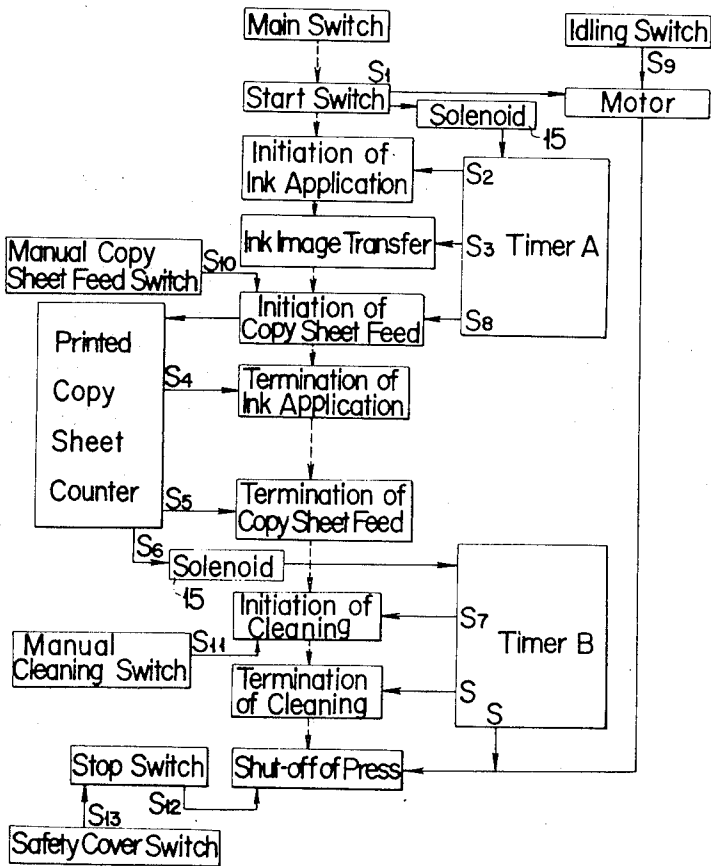


FIG. 3

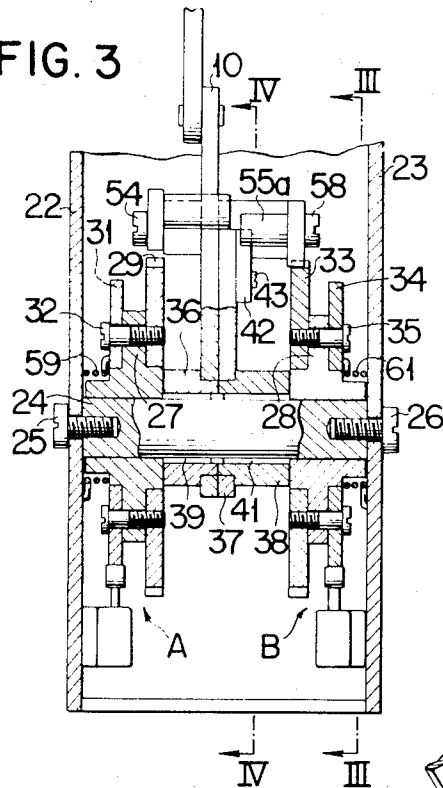


FIG. 6

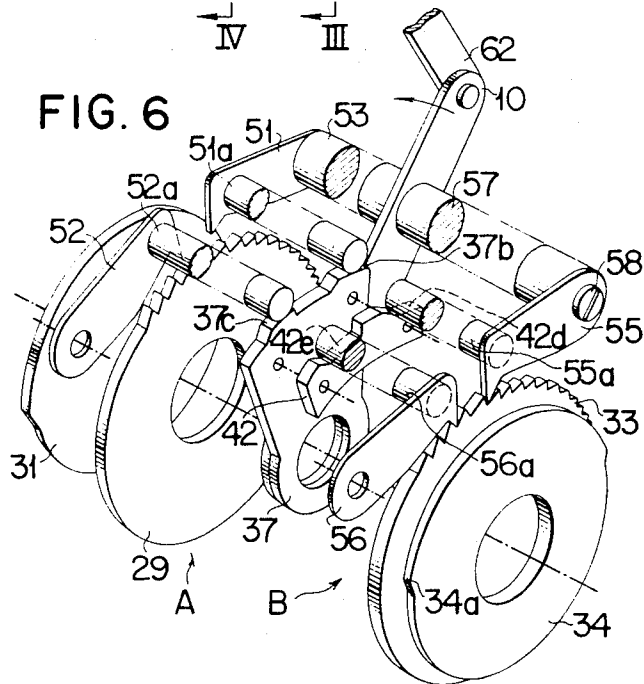


FIG. 7

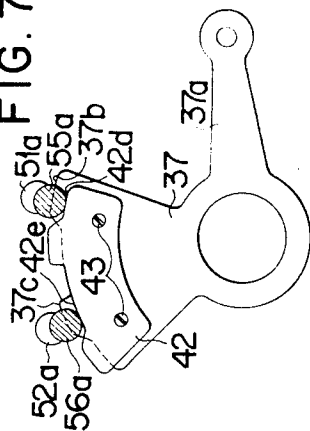


FIG. 8

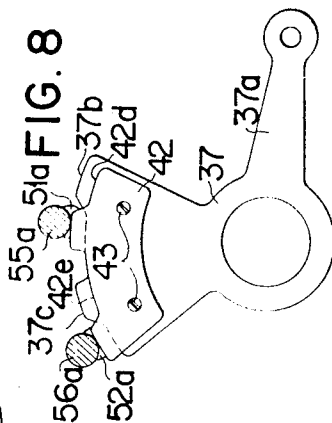


FIG. 9

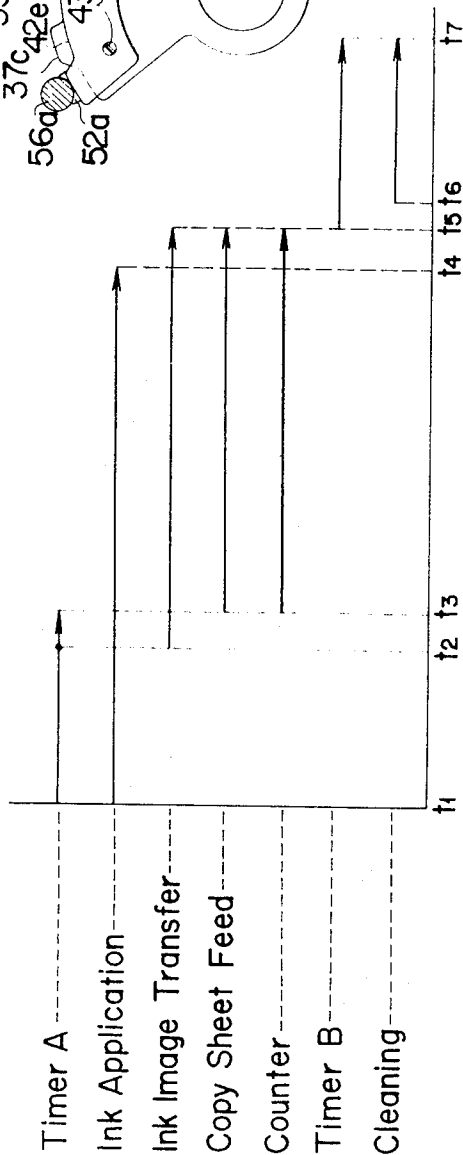


FIG. 10

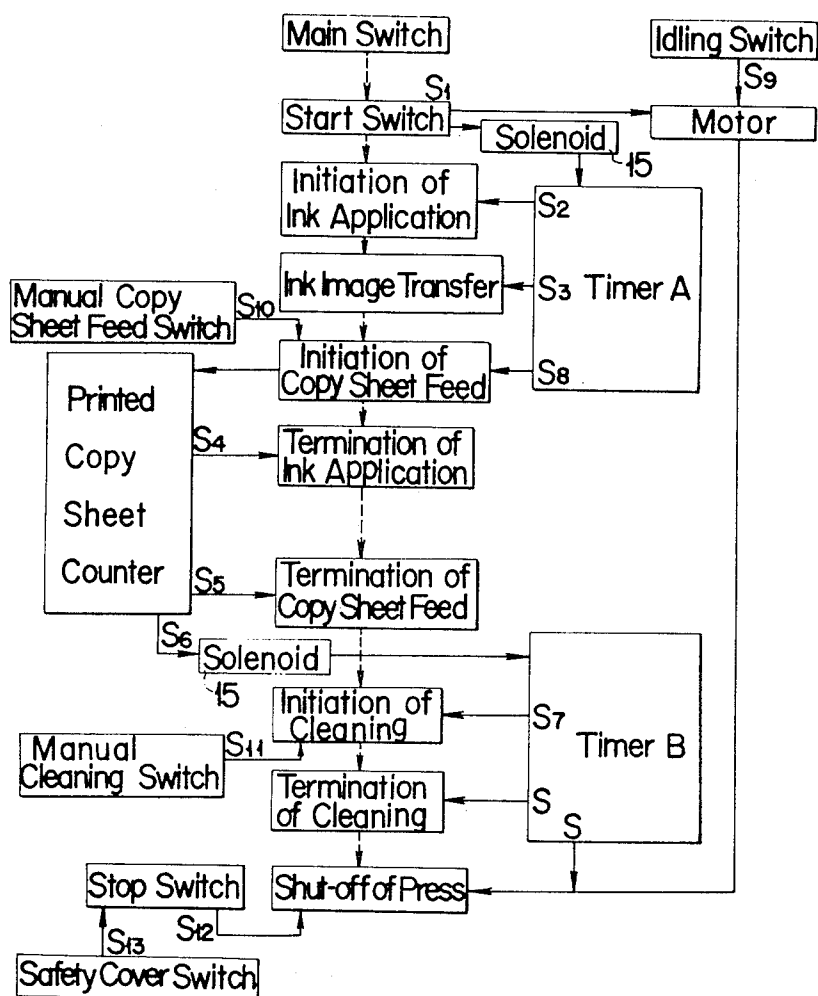


FIG. 11

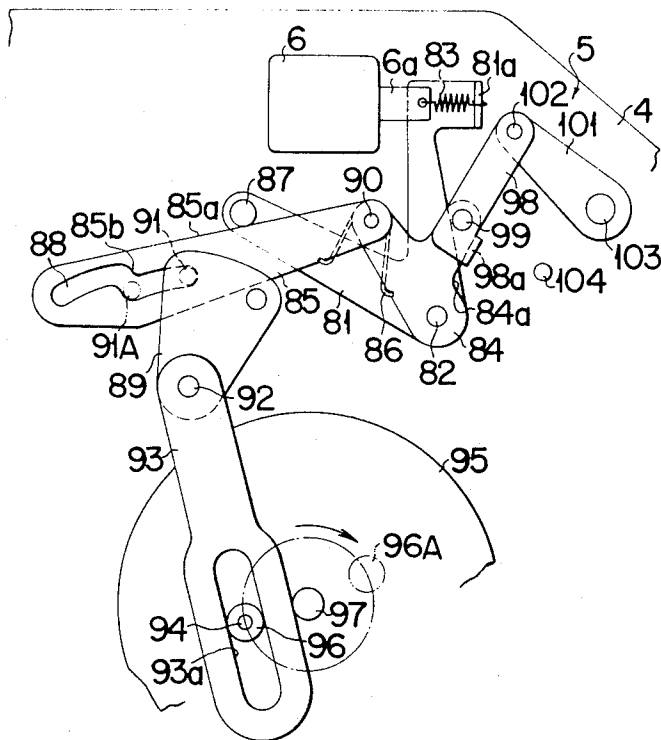


FIG. 12

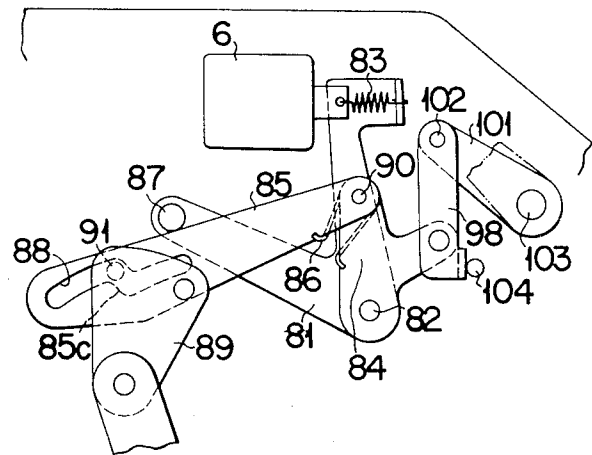


FIG. 15

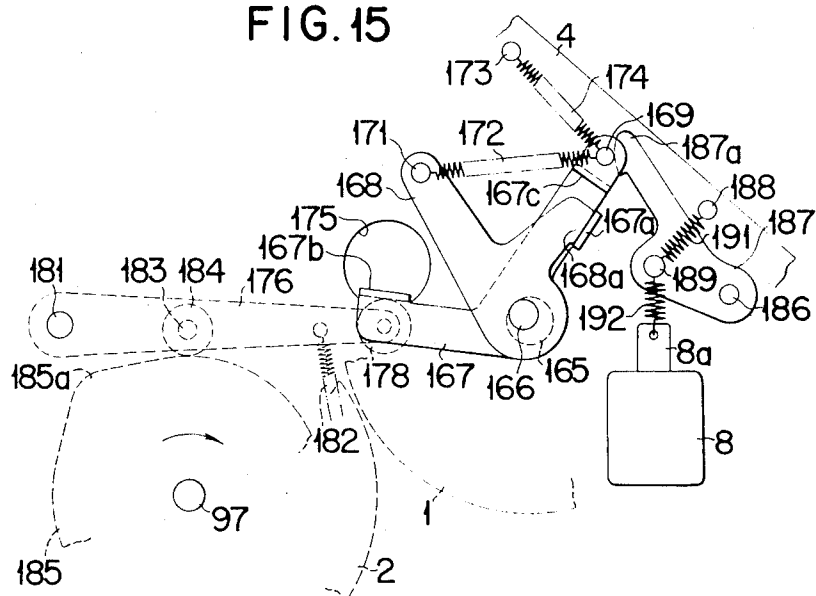


FIG. 16

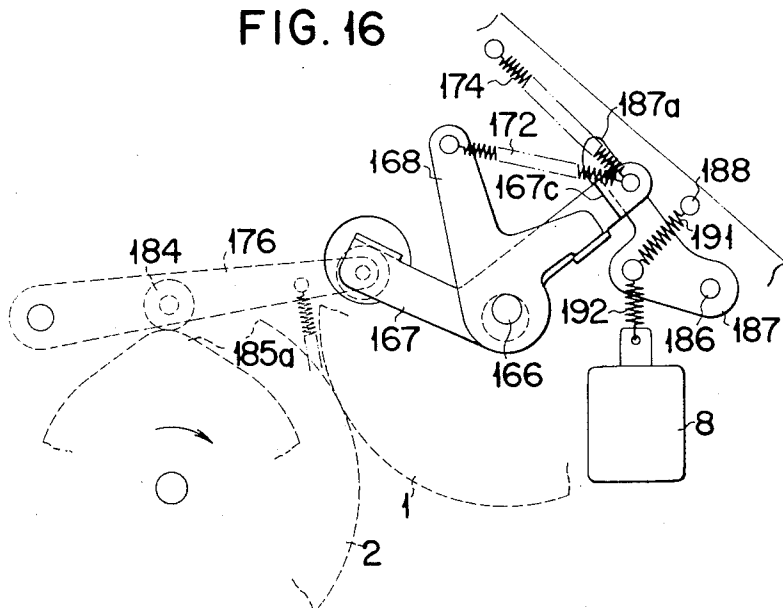


FIG. 19

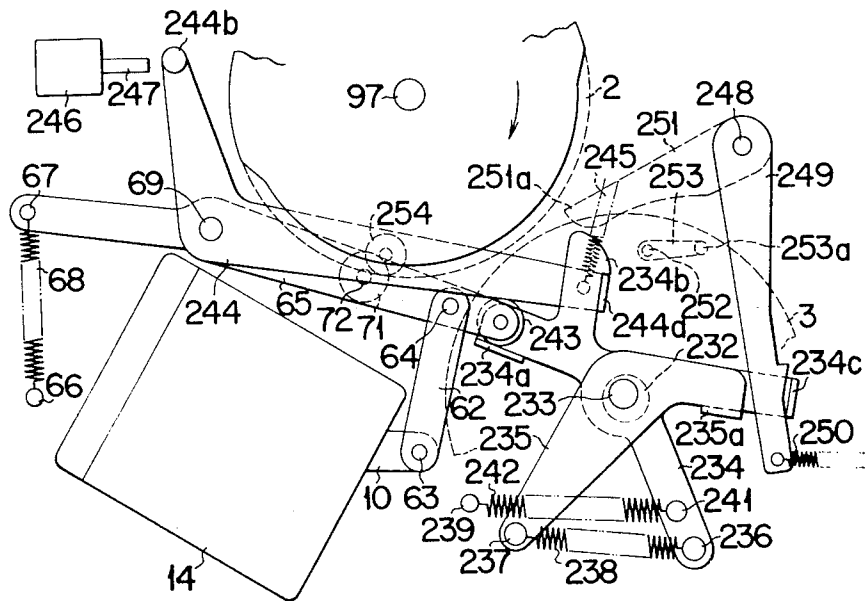


FIG. 20

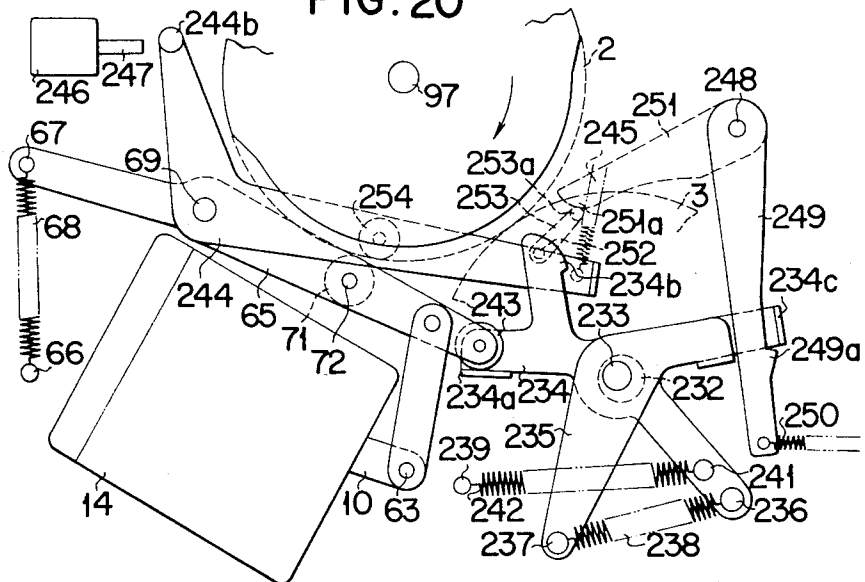


FIG. 21

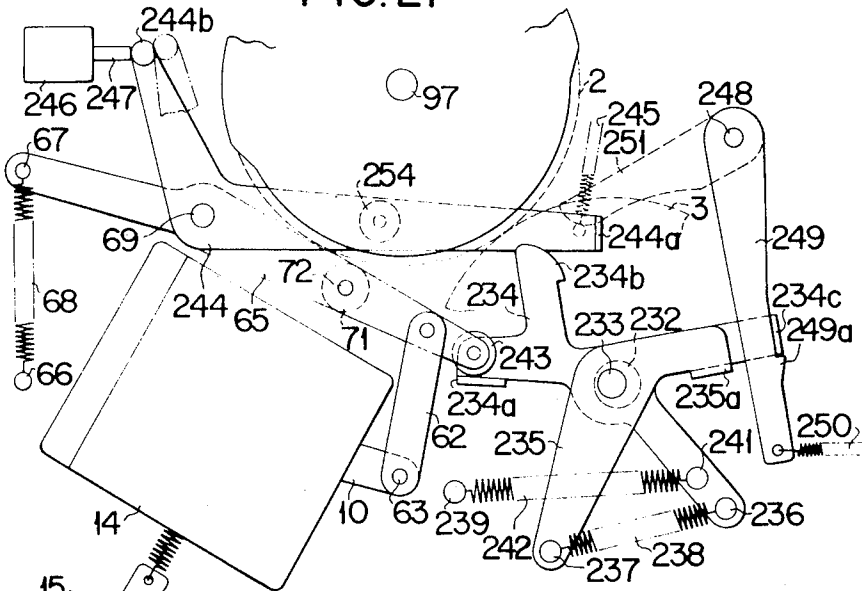


FIG. 22

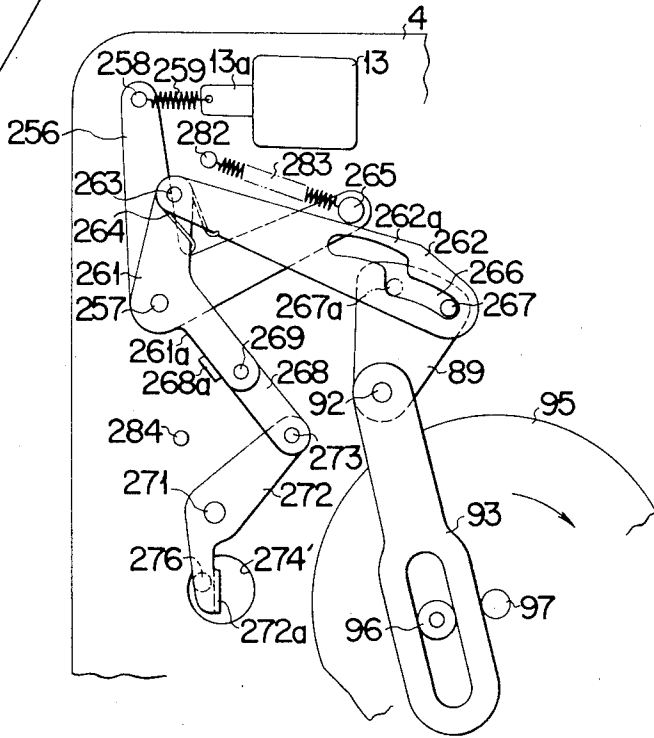


FIG. 23

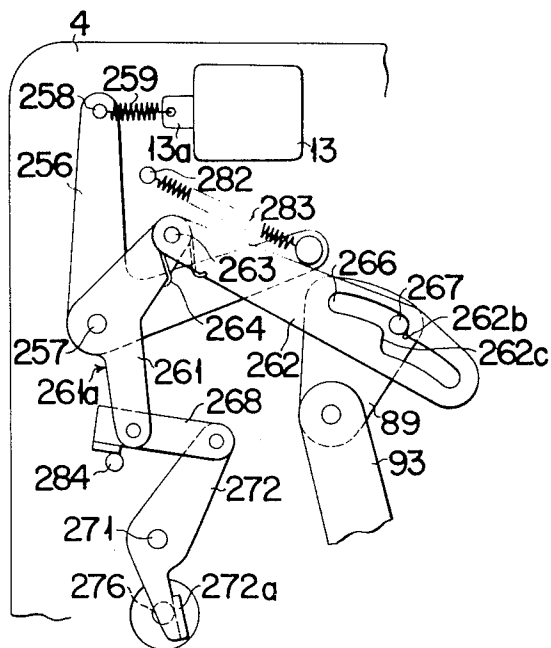
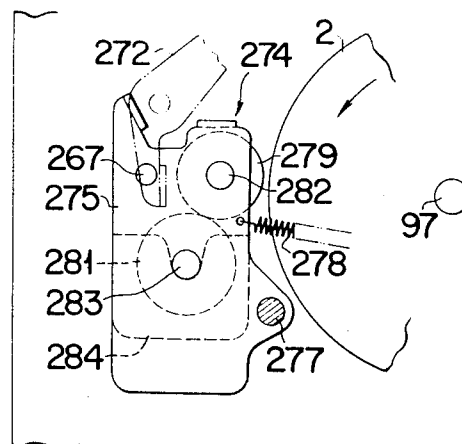


FIG. 24



AUTOMATIC OFFSET PRINTING PRESS

BACKGROUND OF THE INVENTION

A rotary offset printing press comprises, as its main components, a master cylinder, on which a master plate is wound, a blanket cylinder, for transferring an ink image on the master plate to copy sheets, and an impression cylinder for pressing each copy into contact with the blanket cylinder. In a printing operation utilizing such a rotary offset printing press, the following operations must be performed:

1. An ink forming operation for forming ink supplied from an ink well.
2. A plate feed operation for mounting an offset master plate on the master cylinder.
3. An etching operation for supplying an ink repellent solution to the master plate on the master cylinder.
4. An inking operation in which ink is applied to the master plate to which the etching solution has been previously applied.
5. A copy sheet feed and printing operation for feeding copy sheets between the blanket cylinder and the impression cylinder for printing of the sheets.
6. A cleaning operation for cleaning the peripheral surface of the blanket cylinder after a predetermined number of copy sheets has been printed.

In an offset printing press of a simple type, the master plate feed and etching solution applying operations are not carried out automatically, but instead an ink repellent etching solution is applied to a master plate and the master plate is then mounted manually on the master cylinder by the press operator.

In a semi-automatic offset printing press, switching from one of these operations to another is generally effected by successive operations of an operating lever. That is, the press operator must manually actuate an operating handle for each successive step.

Printing presses of this type have disadvantages. The period of time during which etching, inking and cleaning operations are performed is determined empirically by the press operators, so that the results achieved may vary from one press operator to another. In addition, the press operator must give full attention to the printing press at all times, for setting up the number of copy sheets to be printed and for changing the positions of the operating lever.

In order to obviate these disadvantages, a fully automatic offset printing press has been developed, in which all of the mentioned operations can be performed responsive to depression of a starting button by the press operator after setting the respective time intervals for the etching, inking and cleaning operations. More specifically, feeding of a master plate and application of an ink-repellent etching solution are effected automatically responsive to the depression of the operating button and, at the same time, a mark imprinted on the surface of a non-image region of the master plate, by the press operator, for indicating a predetermined number of copies to be printed, is automatically read out by a read-out device and stored in a memory. After a predetermined time interval set for etching and inking has elapsed, feeding of copy sheets is initiated automatically and printing is carried out. Upon completion of printing of a predetermined number of copy sheets, feeding of copy sheets is terminated by a command from a control mechanism including the memory. Following this, cleaning of the blanket cylinder is

effected during a previously preset time interval, thereby finishing the process of duplicating one master plate by the printing press. Upon completion of duplication of one master plate, a next following master plate is automatically mounted on the master cylinder following the removal of the preceding master plate, so that duplication of a plurality of master plates can be effected automatically.

In a printing press of this fully automatic type, manual attention of the press operator is not necessary during the printing process, except that the operator has to imprint, on the surface of a non-image portion of each master plate, a mark indicating a predetermined number of copy sheets to be printed and before the various operations are initiated. Such a printing press requires, as attachments, a device for automatically switching from one operation to another, safety devices, and an automatic read-out device, as well as a control mechanism for effecting sequential control of these devices. This complicates the construction of the printing press and increases its manufacturing costs, which is a substantial disadvantage of fully automatic offset printing presses making such presses unacceptable to general users who are not printers by trade.

On the other hand, it is known that the time required for applying ink to a master plate, or the time elapsing after initiation of ink application and before initiation of transfer of an ink image to the blanket cylinder, the time required for transferring the ink image to the blanket cylinder, or the time elapsing after initiation of the transfer of the ink image to the blanket cylinder before initiation of feeding of copy sheets, and the time required for effecting cleaning of the blanket cylinder, can be set based on experience obtained with conventional printing presses.

SUMMARY OF THE INVENTION

This invention relates to offset printing presses and, more particularly, to an automatic offset printing press in which automatic control of all the operations involved in printing is effected by means of two mechanical timers and a printed copy sheet counter.

The objective of the invention is to provide an automatic offset printing press which is simple in construction and low in cost, which does not require various devices and control mechanism of complex structure and high costs, generally used with conventional automatic offset printing presses, by utilizing two mechanical timers in which are stored time intervals required for carrying out various operations involved in printing, and which time intervals are known empirically. The timers issue commands for initiating and terminating the various operations in order to control the operation of the printing press, in cooperation with a printed copy sheet counter. The mechanical timers are particularly effective in controlling the time intervals required for ink application and cleaning, without relying on the experiences of the press operator.

In accordance with the invention, there is provided an automatic offset printing press in which the steps of applying ink to a master plate, transferring the ink image of the master plate to a blanket cylinder, and feeding copy sheets between the blanket cylinder and the impression cylinder can be initiated by commands from a first timer, with termination of ink application, termination of copy sheet feeding, and switching from the first timer to a second timer being effected by com-

mands from the printed copy sheet counter. Initiation and termination of cleaning are effected by commands from the second timer, so that the printing press can be operated automatically by activating and deactivating various devices without requiring an automatic switching device, safety devices and an automatic read-out device, and without requiring an expensive and complicated control mechanism for controlling the operations, such as hitherto has been used with conventional automatic offset printing presses.

An object of the invention is to provide an improved automatic offset printing press.

Another object of the invention is to provide such an automatic offset printing press which is simple in construction and low in cost.

A further object of the invention is to provide such an automatic offset printing press in which control of the sequence of operations is effected by two mechanical timers and a copy sheet counter.

Another object of the invention is to provide such an automatic offset printing press in which the time intervals for the various operations can be preset before hand and do not require reliance upon the experience of a press operator.

A further object of the invention is to provide such an automatic offset printing press which does not require automatic switching devices, safety devices, or read-out devices, and which does not require a complicated control mechanism for controlling these devices.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a left side elevation view of one embodiment of offset printing press in accordance with the invention;

FIG. 2 is a fragmentary side elevational view, to an enlarged scale, of the press shown in FIG. 1;

FIG. 3 is a sectional view illustrating one form of mechanical timing means used in the offset printing press embodying the invention;

FIG. 4 is a sectional view taken on the line III—III of FIG. 3;

FIG. 5 is a sectional view taken on the line IV—IV of FIG. 3;

FIG. 6 is a perspective view of the timing means;

FIGS. 7 and 8 are partial elevation views illustrating the manner of operation of change-over cams used with the timing means;

FIG. 9 is a time chart showing various operating steps of the offset printing press embodying the invention, and the manner of operation of the timing means and counter;

FIG. 10 is a block diagram, in the form of a flow chart, illustrating the various operating steps of the offset printing press in accordance with the invention, and the controls effected by the timing means and the counter;

FIG. 11 is a front elevation view of the inking device actuating mechanism;

FIG. 12 is a view similar to FIG. 11 but illustrating the parts in a different position;

FIG. 13 is a side elevation view of the inking device or unit;

FIG. 14 is an elevation view illustrating one form of ink volume adjusting means included in the inking unit;

FIG. 15 is a front elevation view of the ink image transfer mechanism;

FIG. 16 is a view, similar to FIG. 15, illustrating the manner of operation of the ink image transfer mechanism;

FIG. 17 is a front elevation view of the copy sheet feed mechanism;

FIG. 18 is a view, similar to FIG. 16, illustrating the manner of operation of the copy sheet feed mechanism;

FIG. 19 is a front elevation view of the mechanism for bringing the impression cylinder into operative engagement with the blanket cylinder, and of the printed copy sheet counter;

FIGS. 20 and 21 are views, similar to FIG. 19, illustrating the manner of operation of the mechanism of FIG. 19 and of the printed copy sheet counter;

FIG. 22 is a front elevation view of the cleaning mechanism;

FIG. 23 is a view, similar to FIG. 22, illustrating the manner of operation of the cleaning mechanism; and

FIG. 24 is a side elevation view of the cleaning mechanism.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, an offset printing press embodying the invention comprises a master cylinder 1, a blanket cylinder 2 and an impression cylinder 3, which cylinders are coupled to each other so as to rotate in the direction of the respective arrows shown in FIG. 2. The cylinders are mounted between two side plates 4 disposed parallel to each other. An ink applying mechanism 5, for causing an inking device or unit to perform an inking operation, and an ink application solenoid 6, are mounted at an upper portion of left side wall 4, and an ink image transfer mechanism 7 and an ink image transfer solenoid 8 are mounted downwardly and to the right on side wall 4 from mechanism 5 and solenoid 6.

A copy sheet feed command mechanism 9 and a copy sheet feed solenoid 11 are mounted toward the right end of left side plate 4 as viewed in FIG. 2, and a cleaning mechanism 12, for causing a cleaning device to effect a cleaning operation, and a cleaning solenoid 13 are mounted adjacent an upper left hand corner of left side plate 4.

Mechanical timing means 14, operable by a pivoted lever 10 adapted to be oscillated each time blanket cylinder 2 makes one revolution, as subsequently to be described, is mounted in the lower left portion of left side plate 4. As described hereinafter, timing means 14 comprises a first timer A, a second timer B, and a solenoid 15 for switching between the two timers.

A start button 16, for initiating operation of the printing press, and a stop button 17, for temporarily interrupting operation of the printing press, are also mounted on left side plate 4. To the right of buttons 16 and 17, there are a printed copy sheet counter 18 and indication tube means 21, which latter indicates the number of copy sheets set and stored in counter 18 as a reset button 19 is operated. The number of copy sheets indicated by tube means 21, which comprises indicating tubes 21a, 21b and 21c, is reduced each time one copy sheet is fed, as described hereinafter, until the indicated number becomes zero upon termination of the copy sheet feed operation.

In order to effect successive operation of the mentioned devices in chronological sequence, it is necessary to give a command to start operation and a command to terminate operation, in a predetermined order and at opportune times, to the solenoid of each mechanism for activating the associated device. The commands are issued successively by mechanism timing means 14, the construction of which will be explained first after which the mechanisms which are successively activated and deactivated by the commands issued by the timing means to control the various devices will be explained.

Of all the mentioned operation steps of an offset printing press, as mentioned above, the steps of feeding and discharging, or mounting and removing, master plates, and of applying an ink-repellent etching solution, are performed manually. All the operations ranging from the inking operation to the cleaning operation are divided broadly into pre-printing, intermediate and post-printing operations.

In the present invention, the pre-printing operation comprises the steps of inking a master plate, transferring an ink image of the master plate to the blanket cylinder and feeding copy sheets between the blanket cylinder and the impression cylinder. Initiation of these steps is controlled by the first timer *A* which becomes inoperative as soon as the feeding of copy sheets is initiated.

The intermediate operation comprises the steps of counting the number of printed copy sheets, terminating inking of the master plate immediately before termination of printing, and terminating feeding of the copy sheets when the printing is finished. Initiation of these steps is controlled by the printed copy sheet counter.

The post-printing operation includes the steps of initiating and terminating cleaning of the blanket cylinder, and that of shutting off the press. Initiation of these steps is controlled by the second timer *B*.

Timing means 14, as shown in FIGS. 3 through 8, comprises first timer *A*, for controlling the pre-printing operation, and second timer *B*, for controlling the post-printing operation. The opposite ends of a shaft 24 are firmly secured by screws 25 and 26 to respective covers 22 and 23 which are parallel to each other. A flange 27, constituting first timer *A*, and a flange 28, constituting second timer *B*, are rotatably fitted on shaft 24.

A ratchet 29 and a cam 31 are positioned on opposite sides of flange 27 and secured to each other by screws 32, and a ratchet 33 and a cam 34 are positioned on opposite sides of flange 28 and secured to each other by screws 35. A hub 36 fixed to or integral with pivoted lever 10, and a hub 38, fixed to or integral with a change-over cam 37 for a first timer *A*, are rotatably supported on shaft 24 by respective needle bearings 39 and 41.

A change-over cam 42 for second timer *B* is firmly secured to one side of change-over cam 37 for first timer *A*. As best seen in FIGS. 4 and 7, an arm 37a extends from the base of change-over cam 37 and its free end is pivotally connected to an end of a link or lever 44 by a pivot 45. The other end of lever 44 is formed with a slot 44a loosely receiving a pin 46 secured to one side plate of the press and supporting lever 44. A spring 47 is connected between a pin 44b on lever 44 and a pin 49 secured to a side plate of the press, and a spring 48 is connected between pin 44b

and the armature 15a of solenoid 15 which is mounted on a side plate of the press.

When solenoid 15, which is provided to switch between timers *A* and *B*, is energized to swing lever 44 downwardly about pin 46, cam 37 rotates clockwise about shaft 24, as viewed in FIG. 4, to move from the position shown in FIG. 7 to the position shown in FIG. 8. As best seen in FIGS. 6 and 7, a pin 51a on a ratchet operating pawl 51, and a pin 52a, on a stop pawl 52, are engaged with major diameter portions 37b and 37c, respectively, of change-over cam 37 for timer *A*. Stop pawl 52 is pivoted on an immovable part (not shown), and ratchet operating pawl 51 has its base connected to a shaft 53 by a screw 54, as best seen in FIG. 5, which shaft 53 is fixedly secured to pivoted lever 10.

Correspondingly, a pin 55a secured to a ratchet operating pawl 55, and a pin 56a, secured to a stop pawl 56, are engaged with respective minor diameter portions 42d and 42e of change-over cam 42 for timer *B*. Stop pawl 56 has its base pivoted to an immovable part (not shown), and ratchet operating pawl 55 is connected by a screw 58 to a shaft 57 firmly secured to pivoted lever 10.

When pins 55a and 56a on pawls 55 and 56, respectively, for second timer *B* are engaged with respective minor diameter portions 42d and 42e of cam 42, as shown in FIGS. 6 and 7, and pawls 55 and 56 are maintained engaged with the teeth of ratchet 33, pins 51a and 52a of pawls 51 and 52, respectively, for timer *A* are maintained in engagement with respective major diameter portions 37b and 37c of cam 37 of timer *A*, and pawls 51 and 52 are maintained out of engagement with the teeth of ratchet 29.

If change-over cams 37 and 42 are shifted from their position shown in FIG. 7 to their position shown in FIG. 8 as solenoid 15 is energized, pins 55a and 56a of the respective pawls 55 and 56 are engaged with major diameter portions 42b and 42c, respectively, of cam 42, and pawls 55 and 56 are released from engagement with the teeth of ratchet 33. At the same time, pins 51a and 52a of the respective pawls 51 and 52 are engaged with the respective minor diameter portions 37d and 37e of change-over cam 37, so that pawls 51 and 52 are engaged with the teeth of ratchet 29. It will thus be appreciated that pawls 51 and 52 for timer *A*, and pawls 55 and 56 for timer *B*, are never engaged with teeth of the respective ratchets 29 and 33 at the same time, only the pawls for one timer engaging the associated ratchet at any given time.

Return springs 59 and 61 are loosely fitted over the hubs of the respective flanges 27 and 28 between the respective cams 31 and 34 and the adjacent covers 22 and 23, respectively. These springs bias ratchets 29 and 33 to rotate back to their initial position in which they engage respective stops (not shown), upon release of the pawls from the ratchets.

An inking initiation switch S2, an ink image transfer initiation switch S3 and a copy sheet feed initiation switch S8 are disposed in angularly spaced relation around the periphery of cam 31 of timer *A*, as shown in FIG. 5. Similarly, the cleaning initiation switch S7 and a cleaning termination and press shut-off switch S are disposed in angularly spaced relation around the periphery of cam 34 for timer *B*, as shown in FIG. 4. These switches are actuated as their operators are brought into engagement with major diameter portions 31a and 34a of the respective cams 31 and 34 when

these cams rotate counterclockwise about shaft 24. The positions of switches S3 and S8, shown in FIG. 5, and those of switch S, shown in FIG. 4, relative to the major diameter portions 31a and 34a, respectively, can be adjusted from outside the timer so that it is possible to set suitable time intervals for inking, ink image transfer and cleaning.

If, after closure of the main switch shown in the flow chart of FIG. 10, start switch S1 of FIG. 10, which is the switch 16 of FIG. 2, is operated, the motor is energized to rotate master cylinder 1, blanket cylinder 2 and impression cylinder 3 in the directions of the respective arrows shown in FIG. 2. Solenoid 15, shown in FIG. 4, is energized upon closure of switch S1 to move lever 44 downwardly against the bias of spring 47. This shifts change-over cam 37 from the position of FIG. 7 to the position of FIG. 8, so that pins 55a and 56a of pawls 55 and 56, respectively, for timer B are brought into engagement with the major diameter portions 42b and 42c, respectively, of cam 42, and pawls 55 and 56 are released from engagement with the teeth of ratchet 33. Correspondingly, pins 51a and 52a of pawls 51 and 52, respectively, for timer A, are brought into engagement with the respective minor diameter portions 37d and 37e of change-over cam 37, and pawls 51 and 52 are engaged with the teeth of ratchet 29.

As blanket cylinder 2 rotates, it oscillates follower lever 65 once during each revolution. Lever 65 is articulatedly connected to pivoted lever 10, so that pivot lever 10 is also oscillated once during each revolution of blanket cylinder 2 in the direction of the arrow of FIG. 2. Such oscillation of lever 10 causes pawl 51 to step ratchet 29 angularly counterclockwise about shaft 24, and cam 31, which is integral with or fixed to ratchet 29 is also stepped angularly counterclockwise to depress the operator of switch S2. Actuation of switch S2 supplies a command to solenoid 6 of inking device actuating mechanism 5 of an inking device 73, shown in FIG. 13 and described hereinafter.

Summarizing, actuation of start switch S1 energizes the motor to rotate master cylinder 1, blanket cylinder 2 and impression cylinder 3 and, at the same time, solenoid 15 is energized and lever 10 is uncoupled from timer B and coupled to timer A. Timer A actuates switch S2 to give a "commence inking" command to inking device 73, whereby the application of ink to the master plate on cylinder 1 is initiated.

It will be appreciated that ratchet 29 is advanced by the distance of one tooth during each revolution of blanket cylinder 2 so that, after ink application is initiated by actuation of switch S2, the major diameter portion 31a of cam 31 successively actuates switches S3 and S8. Actuation of switch S3 provides a command for transfer of the ink image of the master plate to blanket cylinder 2, and actuation of switch S8 provides a command to initiate feeding of copy sheets to blanket cylinder 2 and impression cylinder 3.

In a conventional printing press, the time intervals for ink application, ink image transfer and cleaning are set independently without other conditions being taken into consideration. As a result, the amount of ink applied to the master plate, the amount of an ink image transferred to the blanket cylinder, and the extent of the cleaning operation of the blanket cylinder, after completion of printing a predetermined number of copy sheets, become greater for given intervals of time when the rpm of the motor driving the cylinders is in-

creased. Conversely, these time intervals are decreased when the rpm of the motor is decreased. This disadvantage is obviated by the present invention because control of the preprinting operation, or control of the initiation of ink application, ink image transfer and copy sheet feed, by means of first timer A is not effected in terms of time intervals. On the contrary, control is effected based on the number of revolutions of blanket cylinder 2, so that ink application, ink image transfer, and cleaning can be effected, as planned, without being at all affected by the speed or rotation of the blanket cylinder.

For example, the printing press can be so set that switch S3 is actuated to initiate ink image transfer when blanket cylinder 2 has made from two to twenty revolutions after ink application has been initiated by actuation of switch S2. Generally, the press is set such that ink image transfer is initiated when cylinder 2 has made about ten revolutions. Switch S8 is actuated, to initiate copy sheet feeding, when a sufficient amount of ink image has been transferred to blanket cylinder 2 after switch S3 has been actuated, and blanket cylinder 2 has made from one to five additional revolutions. The time intervals assigned to ink application and to ink image transfer are indicated by $t_1 - t_2$ and $t_2 - t_3$, respectively, in FIG. 9, and these time intervals can be varied or adjusted by shifting the positions of switches S2 and S3 angularly relative to the periphery of cam 31.

Ratchet 29 is shown in FIG. 5 as having a toothless portion 29a on its periphery, and pawl 51 is adopted to engage this portion 29a when the major diameter portion 31a of cam 31 actuates copy sheet feed initiation switch S8. Consequently, timer A is rendered inoperative simultaneously with initiation of copy sheet feeding at the time t_3 of FIG. 9, so that pawl 51 is merely reciprocated along toothless portion 29a.

As shown in FIG. 10, the printed copy sheet counter is actuated as soon as copy sheet feeding is initiated, so as to count the number of printed copy sheets. A predetermined number of copy sheets is set and stored beforehand in the counter, and the number of copy sheets to be printed is reduced, from this predetermined number, each time one copy sheet is printed until the number stored in the counter becomes zero. When there are no more copy sheets to be printed, copy sheet feeding is terminated by a command S5 from the printed copy sheet counter.

After termination of ink application to the master plate, it is impossible to print several copy sheets with the ink remaining on the master plate and the ink image on the blanket cylinder. By printing copy sheets without applying additional ink to the master plate, the ink image on the blanket cylinder can be made lighter in color, thereby facilitating cleaning of the blanket cylinder after completion of printing. For this purpose, the printed copy sheet counter issues a command S4, as shown in FIG. 10, immediately before completion of printing or when only about five copy sheets remain to be printed, so as to terminate application of ink to the master plate by inking device 73.

When printing is completed, the counter issues, in addition to the copy sheet feed terminating command signal S5, a printing termination signal S6 to the solenoid 15, as shown in FIG. 5, at a point t_5 in time, thus terminating the intermediate operation. Deenergization of solenoid 15 by signal S6 permits lever 44 to be restored, from its position in FIG. 5 to its position in

FIG. 4, by the bias of spring 47, thereby shifting change-over cams 37 and 42 from their positions shown in FIG. 8 to their position shown in FIG. 7. As a result, pawls 51 and 52 are released from engagement with ratchet 29 of timer A, and pawls 55 and 56 of timer B are brought into engagement with the teeth of ratchet 33, as shown in FIGS. 4 and 6. Ratchet 29 of timer A, thus released from engagement with stop pawl 52, is rotated clockwise about shaft 24 by spring 59, shown in FIG. 3, and stopped by a suitable stop secured to a stationary part of the press so as to be held in the original position shown in FIG. 5.

Pivoted lever 10 is now coupled to timer B, so that ratchet 33 is stepped counterclockwise about shaft 24 by pawl 55, once during each revolution of blanket cylinder 2. The starting time of timer B is indicated at *t5* in FIG. 9, and switch S7 is actuated by the major diameter portion 34a of cam 34 at time *t6* to issue a cleaning initiation command S7 (FIG. 10) to solenoid 13 (FIG. 2) of the cleaning device. Ratchet 33 continues to be stepped angularly counterclockwise about shaft 24 once during each revolution of blanket cylinder 2, and cam portion 34a actuates switch S after a predetermined interval so as to terminate cleaning.

The duration of the cleaning time can be set, as desired, by adjusting the position of switch S angularly, and can be adjusted to provide a time interval during which blanket cylinder 2 makes from two to twenty revolutions. Generally, cleaning is carried out while cylinder 2 makes from three to fifteen revolutions. The time at which switch S is actuated is indicated at *t7* in FIG. 9, and actuation of this switch effects not only termination of the cleaning operation but also deenergization of the motor, as shown in FIG. 10, so that operation of the printing press is terminated.

The toothless portion 33a on the periphery of ratchet 33 for timer B, as shown in FIG. 4, is engaged by pawl 55 when cam 34 has actuated switch S, so that timer B is rendered inoperative as soon as switch S is actuated. As shown in FIG. 10, an idling switch S9 is provided for the motor, so that actuation of switch S9 will energize the motor to rotate the master cylinder, blanket cylinder and impression cylinder idly while all the other devices or units of the printing press remain inoperative.

The copy sheet feed device and the cleaning device can be actuated manually, from outside the press, by actuating a manual copy sheet feed switch S10 and a manual cleaning switch S11, respectively. Actuation of these two switches enables effecting trial printing and cleaning of blanket cylinder 2 at any time as desired. In addition, there are provided a safety cover switch S13 and a stop switch S12, for actuation when a safety cover (not shown) for the printing press is removed and, by actuating these switches, it is possible to terminate temporarily operation of the printing press.

It will be understood that timing means 14 comprising timer A and timer B, respectively controlling the pre-printing operation and the intermediate operation, in accordance with the present invention, is not limited to the specific form shown in the drawings and described above, and that any mechanism which can detect the number of revolutions of blanket cylinder 2 and issue commands to various devices based on the detected number of revolutions may be used as the timing means. As explained above, the commands to initiate and terminate inking, ink image transfer, copy sheet feeding and cleaning are issued by mechanism timers A

and B. The operation of the various devices thus actuated by these commands will now be explained.

Referring to FIG. 11, an inking device actuating mechanism includes a two-arm first operation member 81 pivoted, intermediate its ends, on a pivot 82 secured to side plate 4, member 81 having a bent portion 81a at the end of one arm. A spring 83 is connected between this bent portion and an actuator 6a of inking solenoid 6. Pivot 82 further oscillatably supports a second operation member 84 having a drive member 85 pivotally connected to one end thereof by a pivot 90. Drive member 85 is biased clockwise about pivot 90 by a torsion spring 86 having one end engaged with member 84 and the other end engaged with member 85. Pivoting of drive member 85 relative to member 84 is limited by engagement of the upper edge of drive member 85 with a pin 87 secured on the end of the other arm of first operation member 81.

A stepped slot 88 is formed in drive member 85 and loosely receives a pin 91 secured to a pivotal member 89 which is fixed to a pivot 92 mounted on side plate 4. A follower 93 is fixed to pivot 92 and, in effect, is integral with member 89. Follower 93 is formed with a slot 93a which loosely receives a roller 96 rotatable on a shaft 94 connected to a cam 95 rotatable in the direction of the arrow about the axis of a shaft 97 which is fixed to rotate with blanket cylinder 2. As cam 95 rotates, follower 93 and pivotal member 89 are oscillated about the axis of shaft 92.

A connecting link 98 is pivotally connected at one end to member 84 through a pivot 99, and at the other end to the free end of an arm 101 through a pivot 102. Arm 101 has its opposite end fixed to a shaft 103 mounted on side plate 4, and is biased to pivot counterclockwise about the axis of shaft 103 by a relatively strong spring of the inking device described hereinafter. A stop 104, secured to side plate 4, restricts the range of movement of connecting link 98.

Pivot 99 is disposed slightly to the left of the dead center line interconnecting pivots 82 and 102, so that connecting link 98 is urged to pivot clockwise responsive to counterclockwise movement of arm 101, or in a direction in which pivot 99 moves away from stop 104. Such clockwise pivoting of link 98 is prevented by engagement of a bent portion 98a thereof with a side edge 84a of member 84. Stated differently, counterclockwise pivoting of arm 101 is precluded by precluding movement of pivot 99 away from stop 104 by bent portion 98a of link 98. When arm 101 pivots counterclockwise, application of ink to a master plate on master cylinder 1 is initiated.

In FIG. 13, an inking unit or device 73 is mounted on two side plates 105 which are arranged in spaced relation. These side plates are formed with cutouts 105a in their lower left portions, and the cutouts fit over a stay 106 secured at its opposite ends to side plates 4 of the printing press. The lower rightward portions of the side plates 105 are formed with offsets 105b which ride on a tubular shaft 107 secured at its opposite ends to the side plates of the printing press.

An inking forming roller 109 is mounted on a shaft 108 connected to side plates 105, and above inking forming roller 109 there is an ink fountain roller 112 which is supported by a shaft 113 and immersed in an ink fountain 111. To the left of ink forming roller 109, there is a water roller 115 supported by a shaft 116 and having its lower peripheral portion immersed in liquid

in a water tank 114. A support lever 117 is pivotal in shaft 116 and is formed with a slot 117a receiving a shaft 119 supporting a water ductor roller 118 which is biased against water roller 118 by a spring 121 mounted between a bent portion 117b of lever 117 and shaft 119.

Lever 117 is biased clockwise about shaft 116 by spring 124 connected between a pin 122 on lever 117 and a pin 123 on side plates 105. Water ductor roller 118 is thus biased to press against ink forming roller 109 by spring 124. A support lever 125 connected to shaft 108 of roller 109 is formed with a slot 125a which receives a segmental cutout of a shaft 127 supporting an inking roller 126 which is biased to press against forming roller 109 by spring 128 positioned between a bent portion 125b of lever 125 and shaft 127. Support lever 125 is biased clockwise about shaft 108 by a spring 132 having a relatively high resilient force, and which is connected between a pin 129, on one end of lever 125, and a pin 131 secured to side plates 105. Pivoting of lever 125 is precluded by shaft 127 pressing against the upper edge of an arm 123 fixed at its base to shaft or pivot 103.

The arm 101, whose pivotal movement is restricted as described with reference to FIG. 11, is fixedly secured to shaft 103, so that pivotal movement of arm 133 is substantially integral with arm 101, so that its pivoting is also precluded, with inking roller 126 being spaced slightly from the periphery of master cylinder 1, as shown in FIG. 13.

A pivotal lever 136, having a shaft 132 at its free end supporting an ink transfer roller 134, is mounted, at its base end, on a shaft 137 connected to side walls 105. Ink transfer roller 134 is biased to press against fountain roller 112 by spring 138 connected between shaft 135 and pin 131, and a short arm 141 having its base secured to shaft 137 has its lower side edge positioned against a pin 139 secured to lever 136. A follower lever 142, carrying a roller 142a on its lower portion, has its base secured to shaft 137, so that arm 141 and lever 142 are substantially integral with each other.

Gears 143 and 144 are mounted on respective shafts 145 and 146 supported in the lower portions of side walls 105, and are adapted to be rotated counterclockwise and clockwise, respectively, by a gear 147 fixed to rotate with blanket cylinder 2. Clockwise rotation of gear 144 is transmitted to gears (not shown) firmly secured to shaft 116 for water roller 115 and shaft 108 for ink forming roller 109, respectively, so as to rotate water roller 115 and forming roller 109 counterclockwise. Shaft 146 supporting gear 144 projects outwardly through one side plate 105 and supports a pinion 146', shown in FIG. 14, which meshes with a drive gear 148 rotatably mounted on shaft 108 supporting ink forming roller 109. A ratchet 149 is illustrated in FIG. 14 as mounted on shaft 113 of fountain roller 112, and is adapted to be engaged by a pawl 151 pivoted on a shaft 152 on one arm 153a of a two-arm follower 153 oscillatable on shaft 113. Pawl 151 is biased, by a spring 154 connected between arm 153a and pawl 151, to move in a direction toward engagement with the teeth of ratchet 149. Follower 153 is biased clockwise about shaft 113 by spring 157 connected between a pin 155 on side plates 105 and a pin 156 on follower 153. The other arm 153b of follower 153 has its side edge pressing against a roller 159 mounted on a shaft 158 connected to drive gear 148, as shown in FIG. 14.

An adjusting plate 161, for adjusting the quantity of ink supplied, is mounted on shaft 113, and a relief plate 162 is secured to one side surface of plate 161. By varying the position of relief plate 162, it is possible to adjust the amount of feed of ratchet 149. That is, if roller 159 of drive gear 148 rotates clockwise and arm 153b pivots clockwise in slaved relationship, then pawl 151 moves clockwise about shaft 113. At this time, a pin 151a at the free end of pawl 151 rides on relief plate 162, so that the forward end of pawl 151 is released from engagement with ratchet 149. When arm 153b is pushed outwardly by roller 159 so that follower 153 pivots counterclockwise about shaft 113, pin 151a on pawl 151 is released from engagement with relief plate 162 and the forward end of pawl 151 is brought into engagement with a tooth of ratchet 149, so as to step ratchet 149 counterclockwise. The degree of angular rotation of ratchet 149 can be adjusted by adjusting the time at which pin 151a of ratchet 151 is released from engagement with relief plate 162, or by setting the position of plate 162. As ratchet 149 rotates, fountain roller 112, shown in FIG. 13, and substantially integral with ratchet 149, rotates in the same direction so as to supply ink from fountain 111.

In conventional offset printing presses, the device for adjusting the quantity of ink supplied is secured directly to the side plates of the printing press, making it necessary to provide means for connecting the adjusting device with the inking device in the interior of the press. The provision of ink supply adjusting means, as shown in FIG. 14, in the inking unit or device, eliminates the connection means hitherto required with conventional printing presses and facilitates inspection and maintenance of the inking unit. Besides, ample space can be provided for various devices concentrated on left side plate 4 of the press.

Referring again to FIG. 14, a roller 164 is supported by a shaft 163 on the side of drive gear 148 opposite to that carrying shaft 158 supporting roller 159. When roller 164 is rotated counterclockwise, it engages and moves to the right roller 142a attached to follower lever 142 as shown in FIG. 13, so that short arm 141, which is substantially integral with lever 142 is pivoted counterclockwise. The pivotal movement of arm 141 causes lever 136 to pivot in the same direction, thereby bringing transfer roller 134 into pressing engagement with ink forming roller 109, so that the ink obtained from fountain roller 112 is transferred to ink forming roller 109. The ink transfer and ink supply are performed by transfer roller 134 and fountain roller 112, respectively, each time drive gear 148 makes one revolution.

The inking device actuation mechanism shown in FIG. 11 is in a position in which no command to apply ink has been issued, and in this position, pin 91, of member 89, merely reciprocates along the right half portion of slot 88 each time cam 95 makes one revolution. If start button 16 is actuated to activate timing means 14, then an inking command, produced by timing means 14 through actuation of switch S2 of FIG. 5, is supplied to solenoid 6 shown in FIG. 11. Energization of solenoid 6 pivots member 81 counterclockwise from its position in FIG. 11. When roller 96 of cam 95 moves to position 96A, shown in phantom, and pin 91 of member 89 moves to position 91A in the curved portion of stepped slot 88, drive member 85 is pivoted slightly counterclockwise by the bias of spring 83, so

that pin 91 engages an offset portion 85b of the drive member. When member 89 pivots clockwise, drive member 89 moves to the right, thereby causing member 84 to pivot clockwise, as shown in FIG. 12.

Connecting link 98 pivots counterclockwise until bent portion 98a abuts stop 104, and arm 101 pivots clockwise a small amount together with shaft 103. As a result, the arm 133 of FIG. 13, which is fixed with respect to arm 101 and shaft 103, pivots counterclockwise, so that inking roller 126 is pressed against the master plate (not shown) mounted on master cylinder 1 to apply ink thereto. During the time of ink application, pin 91 of member 89 merely reciprocates along the left half portion of slot 88.

When a command is issued to deenergize solenoid 6, and member 81 is restored to its original position shown in FIG. 11, drive member 85 is pivoted slightly clockwise by the bias of spring 86 when pin 91 on member 89 is brought to a position shown in FIG. 12 to engage another offset portion 85c of drive member 85. When member 89 pivots counterclockwise, drive member 85 is restored to its original position, shown in FIG. 11, so that operation member 84 and connecting link 98 are also restored to their original positions, with arm 101 pivoting slightly in a clockwise direction. As a result, arm 133 of FIG. 13 engages and moves upwardly inking roller 126, thus terminating ink application to the master plate on cylinder 1.

Referring to FIG. 15, which shows the ink image transfer mechanism, an eccentric shaft 166 is formed substantially integrally with shaft 165 supporting master cylinder 1, which is mounted in the printing press by engagement of eccentric shaft 166 in the opposite side plates of the printing press. A drive member 167 is mounted to pivot about eccentric shaft 166, and a follower 168 is fixed to shaft 166. Follower 168 has a short arm with a free end 168a biased to engage a bent portion 167a of drive member 167 by spring 172 connected between a pin 169 on drive member 167 and a pin 171 on follower 168. Drive member 167 is biased to pivot counterclockwise by a spring 174 connected between a pin 173 on side plate 4 and a pin 169 on drive member 167. The left portion of drive member 167 is formed with a bent portion 167b pressing against the edge of an opening 175 in side plate 4.

A roller 178 at the free end of a follower lever 176 engages bent portion 167b of member 167 which extends inwardly of side plate 4 through opening 175, and lever 176 has its base pivoted on a pivot 181 secured to the inner surface of side plate 4. Follower lever 176 is biased clockwise by a spring 182 connected between lever 176 and side plate 4. A roller 184 on a shaft 103 on lever 176 is biased by spring 182 to press against the periphery of a cam 185 fixed to rotate with blanket cylinder 2.

A lock member 187 oscillatable on a pivot 186 connected to side plate 4 is maintained, in the position shown in FIG. 15, by spring 191 connected between a pin 188 on side plate 4 and a pin 189 on lock member 187. A spring 192 connects pin 189 to the armature of ink image transfer solenoid 8 mounted on side plate 4.

When cam 105 rotates in the direction of the arrow together with blanket cylinder 2, roller 184 is moved upwardly by a protrusion 185a on the periphery of cam 185, so that follower 176 pivots counterclockwise. This causes drive member 167 to pivot clockwise against the bias of spring 174, thereby rotating shaft 165, mounting

master cylinder 1, clockwise about eccentric shaft 166 and bringing cylinder 1 into pressing engagement with blanket cylinder 2, as shown in FIG. 16.

Master cylinder 1 is pressed against blanket cylinder 2 only when roller 184 is riding on protrusion 185a of cam 185. When the two cylinders are pressed against each other, cutout portions thereof approach each other and the peripheral surfaces of the cylinders do not actually come into engagement with each other. In other words, drive member 167 and follower 176 pivot each time blanket cylinder 2 makes one revolution, and the cutout portions of cylinder 1 and cylinder 2 approach each other in the absence of an ink image transfer command.

If switch S3 is actuated by timer 4, shown in FIG. 5, then an ink image transfer command is issued to image transfer solenoid 8 shown in FIG. 15. Upon energization of solenoid 8, lock member 187 is pivoted counterclockwise into an operative position. If drive member 167 is pivoted clockwise by the action of cam 185 while lock member 167 is maintained in its operative position to which it has been moved, the upper edge of bent portion 167c of drive member 167 is caught by a hook 187a on lock member 187, as shown in FIG. 16. As a result, the periphery of master cylinder 1 is maintained pressed against the periphery of blanket cylinder 2, so that the operation of transferring the ink image of the master plate to the periphery of blanket cylinder 2 is initiated.

The printed copy sheet counter issues a command to terminate an ink image transfer operation to solenoid 6 at the same time as a copy sheet feed operation is terminated (at t5 in FIG. 9). Bent portion 167c of member 167 is maintained pressed with hook 187a of lock member 187 by the strong bias of spring 174 after deenergization of solenoid 8, so that lock member 187 in drive member 167 are maintained engaged with each other as shown in FIG. 16. If the bias of spring 174 maintaining bent portion 167c of drive member 167 in engagement with lock member 187 is reduced, as roller 184 of follower 176 rides on protrusion 185a of cam 185, then lock 187 is restored to its original position, shown in FIG. 15, by the bias of spring 191, thereby releasing drive member 167. This terminates the ink image transfer operation.

Referring to FIG. 17, which shows the copy sheet feed mechanism, a fork 195a at the free end of an operation member 195 loosely receives a pin 193 on the armature 11a of copy sheet feed solenoid 11. Member 195 is pivoted at its base on a pivot 194 connected to side plate 4. Also mounted on pivot 194 is a first lock member 196 formed with a bent portion 196a. Member 195 is formed with a bent portion 195b, and a compression spring 197 is connected between these two bent portions.

First lock member 196 has an arm extending obliquely downwardly and formed with a forward end 196b engaged with a bent portion 198a at one free end of a follower lever 198 oscillatable on a pivot 199 connected to side plate 4. A spring 201, connected between side plate 4 and lever 198, biases lever 198 to pivot counterclockwise. A roller 202 is mounted at the other free end of lever 198, and positioned against a cam fixedly secured to the shaft 97 of blanket cylinder 2. A bar 203 is oscillatable on pivot 199, and one free end thereof is formed with a serration 203a forming a segmental gear meshing with a pinion 205 mounted on

a shaft 204 connected to side plate 4. A roller 206 at the other end of bar 203 is positioned against the cam secured to shaft 97 of blanket cylinder 2.

Bar 203 is biased to pivot counterclockwise about shaft 190 by spring 207 connected between side plate 4 and bar 203. A stop 208 on the lower end portion of bar 203 engages a lock 211a of a second lock member 211 oscillatable on a pivot 209 connected to side plate 4. Second lock member 211 is formed, at its upper end, with a bent portion 211b, and first lock member 196 is formed with a bent portion 196c, a spring 112 interconnecting these two bent portions. Spring 212 biases lock member 211 in a direction to press its side edge 211c against bent portion 196c of first lock member 196.

A sector gear 213 and a support plate 214 are oscillatably supported by shaft 209 mounting lock member 211, and one end of a connecting link 215 is pivoted at 216 to sector gear 213 with the other end of link 215 being pivotally connected by pivot 217 to bar 203. A gear 219 is mounted on a shaft 218 connected to support plate 214 and is in meshing engagement with sector gear 213 and a gear 231 which is mounted, through a one-way rotation clutch 223, on a shaft 222 connected to support plate 214. A copy sheet feed roller 224 is fixedly secured to shaft 222, and is disposed in spaced relation above a stack of copy sheets 225 piled on a copy sheet feed tray (not shown). A roller 226 is mounted on the left end portion of support plate 214 and cause to press against bent portion 198a of lever 198 by the weight of copy sheet feed roller 224 and support plate 214.

A one-way rotation clutch 227 is provided between pinion 205 and shaft 204 so that shaft 204 can rotate only when pinion 205 rotates counterclockwise. Shaft 204 supports a lower roller 228 of a pair of feed rollers, the upper roller of which pair is not shown. The one-way rotation clutch 223 on copy sheet feed roller shaft 222 permits shaft 222 to rotate only when gear 221 rotates clockwise.

If timer 4 actuates switch S8 of FIG. 5 to issue a copy sheet feed command, solenoid 11 in FIG. 17 is energized and pivots member 195 counterclockwise to render first lock member 196 operative. If follower lever 198 is pivoted slightly in a clockwise direction by a cam rotating as a unit with blanket cylinder 2, first lock member 196 is pivoted counterclockwise by spring 197 to release follower lever 198 and at the same time charge spring 212. Lever 198, released from first lock member 196, is pivoted counterclockwise by a cam and support plate 214 moves in slaved relation therewith to bring copy sheet feed roller 224 into pressing engagement with the topmost copy sheet of the stack of sheets 225, as shown in FIG. 18.

Correspondingly, bar 203 is pivoted clockwise by a cam so as to slightly release lock 211a of second lock member 211 from engagement with stop 208. At this time, second lock member 211 is pivoted slightly clockwise by spring 212, releasing bar 203. If bar 203 pivots counterclockwise under the effect of a cam, then it causes, through connecting link 215, sector gear 213 to pivot clockwise, as shown in FIG. 18, so that gear 221 rotates clockwise. Thus, copy sheet feed roller 224 is rotated clockwise to feed the uppermost copy sheet from the stack to the pair of feed rollers 228. If bar 203 pivots clockwise under the control of a cam, then pinion 205 rotates counterclockwise to rotate feed rollers 228 in the same direction and feed the copy sheet to

impression cylinder 3. One-way clutches 227 and 223 operate in a manner such that, when bar 203 pivots counterclockwise, only copy sheet feed roller 224 rotates and, when bar 203 pivots clockwise, only feed rollers 228 rotate. The copy sheets are successively fed one by one to impression cylinder 3 by the action of bar 203 which oscillates each time blanket cylinder 2 makes one revolution.

A spring 231 is connected between bent portion 196a of first lock member 196 and a pin 229 on side plate 4. Lock member 196 and second lock member 211 are returned, from their position shown in FIG. 18, to their position shown in FIG. 17, by the spring 231 when solenoid 11 is deenergized by a command issued from the printed copy sheet counter. As a result, follower lever 198 and bar 203 are again locked, as shown in FIG. 17, thereby terminating feeding of the copy sheets.

Referring to FIG. 19, an eccentric shaft 233 is provided in a shaft 232 mounting impression cylinder 3, and is connected to the opposite side plates of the printing press so as to mount cylinder 3 on the press. A drive member 234 is pivotal with respect to eccentric shaft 233, and a follower 235 is fixed to this shaft. A spring 238 is connected between a pin 236 and drive member 234 and a pin 237 on follower 235, and biases bent portion 235a of follower 235 to engage one side edge of drive member 234. Member 234 is biased to pivot clockwise by spring 242 connected between a pin 239 on side plate 4 and a pin 241 on drive member 234. Pivotal movement of member 234 is precluded by a bent portion 234a formed at its left end and maintain pressing against a roller 243 mounted on the right end of follower lever 65. Roller 71 of lever 65 is biased by a spring 68 to press against a cam, as explained with reference to FIG. 1. Follower lever 65 pivots in slaved relation to the cam as the latter rotates clockwise.

A counter lever 244 is oscillatably mounted on pivot 69 of follower lever 65, and is biased to pivot counterclockwise by a spring 245 anchored to lever 244 and to side plate 4. Lever 244 has a bent portion 244a which is brought into engagement with a hook 234b on the upper portion of drive member 234 under the bias of spring 245. A pin 244b is mounted on the upper free end of counter lever 244 and positioned adjacent the free end of an actuator 247 for a counter 246 secured to side plate 4.

A lock member 249 has its base secured to a shaft 248 connected to the side plate, and is biased to pivot counterclockwise by a spring 250 connected between side plate 4 and the free end of member 249, so that a side edge 249a of member 249 is pressed against a bent portion 243c on the rightward portion of drive member 234. An inner arm 251, on the opposite surface of side plate 4, has its base firmly secured to shaft 248 so that it moves integrally with lock member 249. A detector lever 253 is supported by a shaft 252 connected to the opposite end of impression cylinder 3, for detecting whether or not a copy sheet is engaged with the impression cylinder. The inner arm 251 has a free end 251a which is disposed in the path of movement of a free end 253a of detector lever 253 when no copy sheet is fed to impression cylinder 3.

A roller 254 is mounted on counter lever 244 and, when roller 254 rides on the major diameter portion of a cam with the pressure of bent portion 244a of counter lever 244 against hook 234b of drive member 234 being slightly loosened, follower lever 65 is pivoted

clockwise by a cam, as shown in FIG. 20. This pivoting of lever 65 causes drive member 234 and follower 235 to pivot counterclockwise, thereby bringing bent portion 234c of drive member 234 to a position in which it is possible to engage a lock portion 249a of lock member 249.

However, if no copy sheet is fed to impression cylinder 3, free end 251c of inner arm 251 is kicked by the free end 253a of detector lever 253, as shown in FIG. 20, thereby preventing engagement of lock member 249 with bent portion 234c of drive member 234 to lock the latter. As a result, follower 65 is restored to its original position as shown in FIG. 19, and hence drive member 234 is also restored to its original position so that the bent portion 244a of counter lever 244 is caught by hook 234b of drive member 234. Counter lever 244 is maintained in its position shown in FIG. 20 by the action of the cam during the time drive member 234 pivots as mentioned.

If a copy sheet is fed to impression cylinder 3 and wound thereon, by operation of the copy sheet feed mechanism explained with reference to FIGS. 17 and 18, detector lever 253, of FIGS. 19 and 20, pivot slightly clockwise so that inner arm 251 is brought out of the path of movement of the free end 253a of detector lever 253 so that, as drive member 234 is pivoted counterclockwise by the action of follower lever 65, bent portion 243c of drive member 234 is caught by lock 249a of lock member 249 as shown in FIG. 21. As follower 235 pivots counterclockwise together drive member 234, shaft 232, mounting impression roller 3, is caused to rotate in the same direction about eccentric shaft 233, so that the surface of impression cylinder 3 is brought into contact with the surface of blanket cylinder 2 and the ink image on the blanket cylinder is transferred to the copy sheet on the impression cylinder. Impression cylinder 3 is maintained in pressing contact with the blanket cylinder continuously until the copy sheet feed operation is terminated.

On the other hand, counter lever 244, released by hook 234b of drive member 234b of drive member 234, pivots counterclockwise under the control of the cam, so that pin 244b depresses actuator 247 of counter 246. Counter lever 244 is adopted to make only one oscillation each time one of the stack of copy sheets 225 is supplied to impression cylinder 3, so as to count the number of copy sheets supplied. Follower lever 65 is adopted to make one oscillation each time blanket cylinder 2 makes one revolution, irrespective of whether a copy sheet is fed to the impression cylinder or not, so as to keep timing means 14 operative as explained previously.

If a predetermined number of copy sheets is set in counter 18, shown in FIG. 2, and reset button 19 is operated, the preset number will be indicated by indication means 21. Each time counter 246, shown in FIG. 21, for counting the number of copy sheets supplied to impression cylinder 3, is actuated after the initiation of copy sheet feeding, the number indicated by indication means 21 is counted down. When the value indicated shows that there are several copy sheets yet to be printed, a command is issued by counter 18, including indication means 21, to the inking device actuation mechanism shown in FIG. 11 so that the inking operation is terminated. Likewise, a command to terminate copy sheet feeding is supplied by counter 18 to the mechanism shown in FIG. 18 when a predetermined

number of copy sheets have been fed to impression cylinder 3, so that the copy sheet feed operation is terminated.

Counter 18 supplies, to solenoid 15 shown in FIG. 21, a command to switch between the timers simultaneously with the command to terminate copy sheet feeding. Energization of solenoid 15 results in timer B being rendered operative in place of timer A, which was idling during the sheet feed operation, so that timer B issues a cleaning command as explained with reference to FIG. 4. Referring to FIG. 22, a first operation member 256, having two arms, is oscillatable on a pivot 257 connected to side wall 4, and a spring 259 is connected between the pin 258 on the end portion of one arm of member 256 and armature 13a of cleaning initiation solenoid 13.

Pivot 257 oscillatably supports a second operation member 261 having a drive member 261 pivotally connected thereto, at one end, through a pivot 263, and biased to pivot counterclockwise by a torsion spring 264 on shaft 263 having one end engaged with member 261 and its other end engaged with member 262. The pivotal movement of drive member 262 under the bias of spring 264 is precluded by engagement of an upper side edge 262a of member 262 against a pin 265 attached to the end portion of the other arm of first operation member 256. A spring 283 is connected between pin 265 and a pin 282 on side plate 4, so as to bias first operation member 256 to pivot counterclockwise. Drive member 262 is formed with a stepped slot 266 in which there is loosely engaged a pin 267 on member 89. As member 89 is pivoted under the action of cam 95, pin 267 reciprocates in the right half portion of slot 266.

A connecting link 268 is pivoted at one end to member 261 by a pivot 269 and at its other end to the upper free end portion of a lever 272 through a pivot 273. Lever 272 is pivotally supported by a pivot 271 on side plate 4. Lever 272 has a lower bent portion 272a which extends through an opening 274' formed in side plate 4, and a pin 276, attached to a side plate 275 of a cleaning device or unit 274, shown in FIG. 24, presses against bent portion 272a, also as shown in FIG. 24.

Cleaning unit 274 is supported by a shaft 277 having its opposite end secured to the side plates of the printing press, and is urged to pivot clockwise by a spring 278 connected at one end to side plates 4 and at the other end to side plates 275 of unit 274. Cleaning unit 274 comprises a cleaning roller 279 and a cleaning liquid roller 281 supported on respective shafts 282 and 283, with cleaning roller 279 being biased to press against cleaning liquid roller 281 by a spring which has not been illustrated. Cleaning liquid roller 281 is partially immersed in cleaning liquid (not shown) contained in a cleaning liquid tank 284 secured to side plates 275 of the cleaning unit.

In FIG. 22, pin 269 interconnecting second operation member 261 and connecting link 268, is disposed slightly to the right of the dead center line connecting the axes of shafts 257 and 273, so that connecting link 268 is urged to pivot clockwise, or in a direction in which pin 269 is moved away from a stop 284 attached to the side plate, by the tendency of lever 272 to be pivoted counterclockwise by spring 278, shown in FIG. 24. This pivotal movement of connecting link 268 is precluded by a bent portion 268 thereof engaging a side edge 261a of second operation member 261. In other words, pivotal movement of lever 272 counter-

clockwise is precluded by precluding the movement of pin 269 away from stop 284, by bent portion 268a of connecting link 268. If lever 272 pivots counterclockwise, then a cleaning operation is performed.

When a predetermined number of copy sheets have been printed and switch S7, shown in FIG. 4, is actuated to supply, to solenoid 13 of FIG. 22, a command to commence cleaning, spring 259 is charged as solenoid 13 is energized, so that first operation member 256 and drive member 262 are urged to pivot clockwise. As rotation of cam 96 in the direction of the arrow brings pin 267 of members 89 to the position shown by a phantom line 267a, drive member 268 pivots slightly clockwise and pin 267 moves into the left half portion of slot 266.

As member 89 pivots and pin 267 is returned from its phantom line position 267a to a solid line position, pin 267 engages an offset portion 262b, shown in FIG. 23, in the edge of slot 266 and moves drive member 262 from its position shown in FIG. 22 to its position shown in FIG. 23. Consequently, second operation member 261 and connecting link 268 pivot clockwise and counterclockwise, respectively, so that bent portion 268a of connecting link 268 abuts against stopper 284.

Upon counterclockwise pivoting of connecting link 268, lever 272 pivots slightly counterclockwise and pin 276, and pressing against bent portion 272a, is moved to the right in slaved relation to lever 272. Consequently, cleaning unit 274 pivots clockwise about shaft 277, thereby bringing cleaning roller 279 into pressing engagement with the surface of blanket cylinder 3 to perform a cleaning operation.

During the time the cleaning operation is being performed, pin 267 of member 89 reciprocates in the left half portion of slot 266. As switch S of timer B shown in FIG. 4 is actuated to supply, to solenoid 13, a command to terminate cleaning, solenoid 13 is deenergized and first operation member 256 is returned to its position shown in FIG. 22 by spring 283. This permits drive member 262 to pivot counterclockwise under the bias of torsion spring 264, so that, when pin 267 of member 89 moves to its position shown in FIG. 23, drive member 262 pivots slightly counterclockwise and pin 267 engages another offset portion 262c.

If member 89 pivots counterclockwise about shaft 92 at this time, then drive member 262 returns from its position shown in FIG. 23 to its position shown in FIG. 22. As a result, second operation member 261, connecting link 268 and lever 72 are restored to the position shown in FIG. 22, thus releasing cleaning roller 279 from engagement with the surface of blanket cylinder 2, to terminate the cleaning operation.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An automatic offset printing press comprising, in combination, a master cylinder for supporting a master plate; an inking means for the master plate; a blanket cylinder to receive an ink image transferred from a plate on said master cylinder; a cleaning means for said blanket cylinder; an impression cylinder operable to press copy sheets against said blanket cylinder; means operable to rotate said cylinders in respective directions; a timer operator operable by rotation of one of

said cylinders at the end of each revolution thereof; a first mechanical timer operable by said operator to initiate, in a timed sequence corresponding to revolutions of said one cylinder, inking of the master plate, transfer of the ink image to said blanket cylinder, and feeding of the copy sheets between said blanket cylinder and said impression cylinder for printing of the copy sheets; a sheet counter activated by said first timer substantially simultaneously with initiation of copy sheet feeding, and operable to count the printed copy sheets and, as a function of the sheets counted, to terminate inking of the master plate, transfer of the ink image to the blanket cylinder, and feeding of the copy sheets; a second mechanical timer operable when actuated by said operator, to initiate cleaning of said blanket cylinder and, after a presettable time interval, to terminate such cleaning; respective first and second timer actuators, for said first and second mechanical timers, coupled to said timer operator for conjoint operation thereby; coupling means operatively associated with both said first and second timer actuator and operable, when activated, to displace said second timer actuator out of operative relation with said second timer and to displace said first timer actuator into operative relation with said first timer; said coupling means, when deactivated, displacing said first timer actuator out of operative relation with said first timer and engaging said second timer actuator with said second timer; a selectively operable start control operable to activate said coupling means to couple said first timer to said timer operator through said first timer actuator; and means controlled by said counter and operable simultaneously with termination of feeding of the copy sheets, to deactivate said coupling means to couple said second mechanical timer to said timer operator through said second timer actuator.

2. An automatic offset printing press, as claimed in claim 1, in which said coupling means couples said timer to said timer operator through the respective timer actuators only alternately in such a manner that only one timer is coupled to said timer operator at any one time.

3. An automatic offset printing press, as claimed in claim 1, including transfer means operable to transfer the ink image from a master plate on said master cylinder to said blanket cylinder; and copy sheet feeding means operable to feed copy sheets singly and successively to said impression cylinder; each of said first and second timers including a cam rotatable in accordance with rotation of said blanket cylinder; and respective switch means sequentially operated by each cam; the cam of said first timer operating switch means controlling initiation of activation of said inking means, initiation of activation of said transfer means and initiation of activation of said copy sheet feeding means; the cam of said second timer controlling switch means initiating activation of said cleaning means and termination of activation of said cleaning means.

4. An automatic offset printing press, as claimed in claim 1, including a frame mounting the components of said printing press; said inking means comprising an inking unit insertable into said frame as a unit and releasably resting on cross members of said frame.

5. An automatic offset printing press, as claimed in claim 1, including respective manual means, operable independently of said timers, to initiate copy sheet

feeding and cleaning of said blanket cylinder, respectively.

6. An automatic offset printing press, as claimed in claim 1, in which timer operator is operable by said blanket cylinder once during each revolution of said blanket cylinder.

7. An automatic offset printing press, as claimed in claim 6, including a cam rotatable with said blanket cylinder; said timer operator comprising a cam follower engaged with said cam and oscillated once during each revolution of said blanket cylinder; said coupling means being electrically operable said coupling means, when deenergized, coupling said timer operator to said second timer; said start control comprising a switch selectively operable to energize said coupling means to uncouple said timer operator from said second timer and to couple said timer operator to said first timer; said counter, upon termination of said copy sheet feeding, deenergizing said coupling means.

8. An automatic offset printing press, as claimed in claim 1, including transfer means operable, when activated, to transfer the ink image of a master plate to said blanket cylinder; and copy sheet feeding means operable, when activated, to feed copy sheets singly and successively to said impression cylinder; said first timer controlling initiation of operation of said inking means, said transfer means and said copy sheet feeding means; said counter controlling deactivation of said inking means, deactivation of said transfer means, and deactivation of said feeding means; said second timer controlling activation of said cleaning means and deactivation thereof.

9. An automatic offset printing press, as claimed in claim 8, including respective solenoids controlling activation and deactivation of said means controlled by said first and second timers and said counter; and respective switches operatively associated with said solenoids and operable by said first and second timers and said counter.

10. An automatic offset printing press, as claimed in claim 8, in which said counter is operable to store the number of copy sheets to be printed; said counter decreasing the stored number by one responsive to each feeding of a copy sheet to said impression cylinder, and terminating operation of said sheet feeding means when the stored count reaches zero.

11. An automatic offset printing press, as claimed in claim 10, in which said counter deactivates said transfer means when the number of copy sheets to be printed has been reduced to a preselected relatively small number.

12. An automatic offset printing press comprising, in combination, a master cylinder for supporting a master plate; an inking means for the master plate; a blanket cylinder to receive an ink image transferred from a plate on said master cylinder; a cleaning means for said blanket cylinder; an impression cylinder operable to press copy sheets against said blanket cylinder; means operable to rotate said cylinders in respective directions; a timer operator operable by rotation of one of said cylinders; a first mechanical timer operable to initiate, in a timed sequence, inking of the master plate, transfer of the ink image to said blanket cylinder, and feeding of the copy sheets between said blanket cylinder

and said impression cylinder for printing of the copy sheets; a start control selectively operable to couple said first timer to said timer operator; a counter activated by said first timer substantially simultaneously with initiation of copy sheet feeding, and operable to count the printed copy sheets and, as a function of the sheets counted, to terminate inking of the master plate, transfer of the ink image to the blanket cylinder, and feeding of the copy sheets; a second mechanical timer coupled to said timer operator by said counter substantially simultaneously with termination of feeding of the copy sheets, said second mechanical timer, when activated, being operable to initiate cleaning of said blanket cylinder and, after a presettable time interval, to terminate such cleaning; transfer means operable to transfer the ink image from a master plate on said master cylinder to said blanket cylinder; copy sheet feeding means operable to feed copy sheets singly and successively to said impression cylinder; each of said first and second timers including a cam rotatable in accordance with rotation of said blanket cylinder; and respective switch means sequentially operated by each cam; the cam of said first timer operating switch means controlling initiation of activation of said inking means, initiation of activation of said transfer means and initiation of activation of said copy sheet feeding means; the cam of said second timer controlling switch means initiating activation of said cleaning means and termination of activation of said cleaning means; said first timer includes a first ratchet fixed to rotate with the associated cam; said second timer including a second ratchet fixed to rotate with the associated cam; first pawl means operable to engage and step said first ratchet; second pawl means operable to engage and step said second ratchet; said timer operator including an oscillatable follower lever oscillated by said blanket cylinder once during each revolution of said blanket cylinder, and further including a pawl means actuating lever connected to said follower lever and oscillated thereby once during each revolution of said blanket cylinder; and change-over cam means operatively associated with said first and second pawl means and operable to render only one of said pawl means effective at any one time while rendering the other pawl means simultaneously ineffective.

13. An automatic offset printing press, as claimed in claim 12, in which each of said first and second pawl means includes a respective ratchet advancing pawl engageable with teeth on the associated ratchet; each of said first and second ratchets having a toothless peripheral portion engaged by the associated ratchet advancing pawl when the respective timer has completed its switch means operating functions for idling motion of the respective ratchet advancing pawls.

14. An automatic offset printing press, as claimed in claim 13, in which each of said first and second pawl means includes a respective locking pawl preventing reverse rotation of the associated ratchet; and respective spring means operatively associated with each of said first and second ratchets and biasing the associated ratchet to return to a start position; each said spring being operative upon disengagement of the associated pawl means from the associated ratchet.

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