UNITED STATES PATENT OFFICE

2,564,591

SHEET FEED INTERRUPTER MEANS FOR PRINTING PRESSES

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Original application September 20, 1946, Serial No. 698,232. Divided and this application April 8, 1948, Serial No. 20,085. In Canada September 18, 1947

2 Claims. (Cl. 271—57)

This invention relates to printing presses and more particularly to sheet-fed, lithographic, offset presses of the kind illustrated in my co-pending application Serial No. 698,232, filed September 20, 1946 which has matured to Patent No. 2,542,073, granted February 20, 1951, of which this application is a division. The principal object of the invention is to provide improved control of the feeding means for delivering the topmost sheet from a stack of sheets to be printed to the printing couple of that press. Other objects are to provide means for automatically discontinuing operation of the feeding means in the absence of a sheet between the constituent rolls of the printing couple, and other means for controlling operation of the feeding means independently of the presence or absence of a sheet at the printing couple.

As herein illustrated, pneumatic means in the form of a nozzle is arranged to lift the topmost sheet from the stack for transfer to the printing couple. A sub-atmospheric pressure is maintained in the nozzle by an electric motor-driven pump connected thereto and operation of the motor and hence maintenance of the low pressure in the nozzle is effected in accordance with the presence or absence of sheets to be printed between the printing couple or independently thereof by a circuit connecting the motor to a source of electric power. The electric circuit includes a holding circuit for maintaining the motor in continuous operation once it has been initiated and sheets continue to be fed to the printing couple, a manually operable starting switch to initiate operation of the motor, a manually operable stopping switch to stop the motor if desired, regardless of the presence or absence of sheets in the printing couple, a switch automatically operable to stop the motor in the absence of sheets, operation of this latter switch being effected by separation of the printing couple, and a manually operable switch for maintaining the holding circuit intact independently of this last switch which is actuated by separation of the printing couple.

In the drawings:

Fig. 1 is a diagram showing the main rolls of the press;

Fig. 2 is a vertical sectional view of the press taken from the opposite point of view from Fig. 1 and looking outward toward one of the side frames, showing especially the mechanism for applying pressure to the offset cylinder, many of the mechanisms of the press being omitted;

Fig. 3 is a view similar to Fig. 2 on a larger scale, showing also an electric switch responsive to separation of the main and offset cylinders;

Fig. 4 is a fragmentary vertical sectional view taken on the line 4—4 of Fig. 2 on a larger scale;

Fig. 5 is a fragmentary vertical sectional view on the line 5—5 of Fig. 4;

Fig. 6 is a diagram in the nature of a side elevation of the paper stack and paper stack platform of the feeding apparatus for use with the press;

Fig. 7 is a diagram in the nature of a plan view of a fragment of the feeding apparatus of Fig. 6;

Fig. 8 is a diagram of control circuits for many of the elements of the press;

Fig. 9 is a diagram showing the control of the feeder pump motor.

The improved control for the sheet feeding means is especially adapted to be used in combination with the sheet feeding mechanism shown in my Patent Nos. 2,497,849 and 2,543,073.

Referring to Fig. 1, the main frame of the press includes opposite interconnected side plate sections 25 which are preferably flanged as at 26 at their lateral margins (Fig. 2), the flanges serving to cover and protect various gears, chains, bearings and control mechanisms that are located adjacent to the two side plates 25.

Sheets fed successively by feeding mechanism such as that of said applications enter the machine from the right as shown in Fig. 1, and are gripped by gripper fingers on a gripper bar 33 carried by chains 180 to a printing couple. The course of chains 180 is indicated in Fig. 1.

The sheet is carried by the traveling gripper bar 33 to and partly around a rubber covered offset cylinder 40 which constitutes one component of the printing couple, the offset cylinder having a recess adapted to receive the gripper bar.

As shown in Fig. 1 offset cylinder 40 cooperates with a main cylinder indicated generally at 42 which constitutes the other component of the printing couple. Main cylinder 42 comprises opposite end portions 43a mounted on a shaft 166, a lithographic plate holder segment 43 having hub portions 43a also mounted on the shaft 166, and an interchangeable impression segment 44 detachably secured to the opposite end portions 43a. Depending upon the character of the work being done, impression segments having surfaces of various materials may be used as more fully described hereinafter.

As explained in the above patents, a lithographic plate on segment 43 offsets an image onto the offset cylinder 40, the sheet is then carried in between the offset cylinder and the impression
segment 44 of the main cylinder, which results in the image being printed from the offset cylinder 40 onto the lower surface of the sheet.

The timing and arrangement of the main and offset cylinders and the feeding mechanism, is such that a sheet to be printed is presented to the nip between the offset and main cylinders at each revolution of the main cylinder, or in other words, at each second revolution of the offset cylinder.

The driving connections for the main printing couple and for the other parts of the machine are described in detail in the aforesaid Patent No. 2,542,075, to which reference may be had.

As shown in Figs. 2 and 3 the shaft 102 of the offset cylinder is mounted in sliding blocks 225 which are vertically moveable in guideways 226. A pressure control or cam shaft 226 is eccentrically mounted at 228 at its ends and acts as a cam, through adjustable tappets 228, to support the sliding blocks 225. Rotation of the control shaft 226 in a counterclockwise direction as viewed in Figs. 2 and 3 permits the offset cylinder to move away from the main cylinder, and rotation of the control shaft 226 in a clockwise direction lifts the offset cylinder and forces it under pressure against the main cylinder.

A sliding collar 330 (Fig. 4) on shaft 226 carries a horizontal connecting pin 331 which is guided through a slot in an arm 332 which extends from a fixed collar 333 on shaft 226. Connecting pin 331 is adapted to be projected to the right in Fig. 4 to a position in which it underlies a shoulder 334 on a vertically reciprocal pressure fork or plunger 335.

A cam follower roller 336 (Figs. 2 and 3) on the pressure fork 335 is adapted to be contacted by cam surface 338 of a cam 330 mounted on the shaft 102 of the main cylinder, to apply pressure to the pressure fork or plunger 335 at each rotation of the main cylinder.

The connecting pin 331 is urged to the left in Fig. 4 by a spring 340 which acts on the slidable collar 333, tending to disengage the pin 331 from the pressure fork shoulder 334, thus allowing the pressure fork or plunger 335 to move idly.

A solenoid 342 (Fig. 5) has its movable armature 344 connected by a flexible cable 244 to the slidable collar 333. Energization of the solenoid 342 by means of a push-button switch 342 (Fig. 5) thus pulls the pin 331 to the right in Fig. 4, carrying it into the path of the pressure fork shoulder 334.

During continued printing, the pressure of pressure fork shoulder 334 upon the pin 331 retains the pin under this shoulder against the action of the spring 340, thus keeping the pressure fork connected to the pressure control eccentric shaft 226 as long as the pressure fork is sufficiently low in position for the shoulder 334 to bear against the pin 331.

The shape of the cam 330 on the main cylinder shaft is such that the high part of the cam surface 338 bears against cam follower roller 336 only during the presentation of the plate segment to the offset cylinder.

In normal printing, pressure between the offset cylinder and the impression segment 44 is secured by latching the pressure fork in a pressure-applying position by detector-controlled latch mechanism.

A latch 350, Fig. 5, is slidable mounted in a block 351 and includes a beveled portion 352 adapted to slide into a wedge shaped recess 353 in the pressure fork 335. Latch 350 is normally urged to the right or unlocked position in Fig. 5 by a spring 355, but upon the detection of feed of a sheet to the press, latch 350 is urged to the left and into the recess 353 by a bell crank 357 which is connected by a flexible connection 358 to the movable armature 333 of a solenoid 360 as shown in Fig. 2.

Solenoid 360 is energized by the interruption of a light beam by a sheet as the sheet is carried toward the offset cylinder by the gripper fingers 32 and gripper bar 33.

In Fig. 2 a source of light such as an electric lamp is indicated at 370 and a photo-electric cell normally exposed to the light beam is indicated at 371, the beam of light from lamp 370 to cell 371 being adapted to be interrupted by a properly fed sheet carried by the gripper bar 33 passing along the upper run of chain 180.

Referring to the wiring diagram of Fig. 8, solenoid 360 is normally de-energized and is adapted to receive its operating current through a circuit which includes the terminals D and F of a relay 380 which is de-energized when the photo-electric cell 371 receives light from the light source 370. When the beam from the light source 370 to the cell 371 is interrupted, the relay 380 is energized, closing the circuit between terminals D and F and sending an impulse through the circuit which includes the solenoid 360.

This energization of relay 380, and consequently of the solenoid 360, takes place during the offsetting portion of the cycle, that is, while the image from the lithographic plate on segment 43 is being transferred to the offset cylinder, and hence while the pressure fork 335 is held in its depressed position of Fig. 5 by the high surface 338 of the cam 330. The notch 333 is accordingly in position to receive the latch 350.

The block 351 which carries the latch 350 is vertically slidable mounted in a stationary guide bracket 293 (Fig. 4) and a screw 346 which is rotatable in the bracket 293 is threaded into the block 351. A rod consisting of joined portions 335, 336 and 371 (Figs. 4 and 2), fastened to the screw 346 and to a knob 360, enables the spring 340 to be turned to adjust the level of the block 351 and hence the level at which the latch 350 will hold the pressure fork during proper presentation of a sheet between the offset cylinder and impression segment. Normally the latch-carrying block 351 will be adjusted so that the latch 350 will have at least a slight clearance from the bottom surface of notch 353 as the latch enters the notch during the offsetting portion of the cycle.

When a properly fed sheet passes and interrupts the light beam at a time near the end of the offsetting portion of the cycle, the solenoid 360 inserts the latch in the notch 353 and holds it there until the latch is caught and held by the bottom surface of the notch when the cam surface 338 ceases to apply downward pressure to the pressure fork. When the trailing end of the sheet subsequently passes the light beam, the solenoid 360 becomes de-energized.

If a sheet fails to be fed, the solenoid 360 will be energized as a result of interruption of the light beam by the passing empty gripper bar, but will become de-energized while the cam surface 338 is still applying downward pressure to hold the pressure fork in its lowest position. The latch then is removed from the notch by the spring 355 while the cam surface 338 is still active, and at the end of the offsetting portion of the cycle the pressure fork is not latched but is free to rise considerably higher than if it were latched.
resulting considerable rise of the pressure fork permits a considerable counterclockwise movement of the shaft 328 which allows the offset cylinder to drop out of position to press against the plate segment of the main cylinder, preventing the offsetting of a further image onto the offset cylinder.

Moreover, when the pressure fork fails to be latched by the latch 350, the shoulder 324 of the pressure fork will move higher than will the corresponding pin 331, breaking the normal frictional contact between these parts, and by means of the spring 340, Fig. 4, will pull the pin 331 out from under the shoulder 324. Succeeding strokes of the pressure fork will thereafter be idle and the offset cylinder will remain out of contact with the main cylinder until the solenoid 342 is re-energized by manual operation of the switch 342.

It will be observed that in the normal operation of the press, while sheets are being normally fed, the pressure fork or plunger 335 moves only through so much of its stroke as effects the relatively slight separation and approach of the axes of the offset cylinder and the main cylinder appropriate to the successive presentation of the plate segment and impression segment to the offset cylinder. Interruption of the light beam B from the lamp 370 to the photocell element 371 by the gripper bar 33 as the latter travels along the lower run of the chains 180 can be avoided by disposing the light beam so that it is not crossed by the gripper bar in this lower run of the chains. This may be accomplished by locating the lamp 370 and cell 371 as indicated in Patent No. 2,242,073 mentioned above, with both the lamp and cell outside of the courses of the chains 180, but with one of these elements, for instance the lamp, somewhat above the other of these elements in such a way that the beam B crosses the line of travel of the gripper bar only at the upper run of the chains 180.

The control of various parts of the press, and more especially the latch solenoid 360, by the interruption of the light beam B by the sheet being fed, involves certain further relations of the light beam to the press which may be summarized as follows:

1. The light beam is in a position such that the sheet being fed interrupts the beam while the lithographic plate segment 43 of the main cylinder is active, during the time the light 380 is neither held in latching position by the pressure fork 325 nor held out of latching position by the pressure fork 325. As indicated above, during the presentation of the plate segment to the offset cylinder the notch 335 in the pressure fork is located so as to permit free movement of the latch 350 into or out of latching position.

2. The point of interruption of the light beam by the paper is sufficiently near to the line of printing contact between the main and offset cylinders to permit relatively short sheet length to reach the line of printing contact and be gripped between the main and offset cylinders before the light beam is reestablished after passage of the sheet and the latch solenoid 360 accordingly de-energized.

3. The point of interruption of the light beam by the paper is however sufficiently spaced from the line of printing contact so that the interrupting effect of an empty gripper bar does not persist up to the time that the impression segment becomes active, but on the contrary the beam is re-established and the latch solenoid 360 is de-energized in time to let the latch 350 move out of the notch 353 before the impression segment is presented to the offset cylinder.

These conditions are best provided for in the press herein shown by locating the light beam B so that it is approximately 1" from the line of printing contact between the main and offset cylinders at the point where the beam is interrupted by the paper.

Numerous operations of the machine are controlled by a limit switch indicated at 390 in Fig. 4 which preferably constitutes a single throw gang switch comprising switches 390a, 390b and 390c, which control various circuits as shown by the wiring diagrams of Figs. 8 and 9. The limit switch 390, including its three component switches, is responsive to the application of pressure to the offset cylinder, normally tending to open, but being closed whenever the offset cylinder is held up in position to press against the main cylinder. Since, as indicated above, the pressure of the offset cylinder is released when failure of feed is detected, the various operations of the machine which are controlled by the switches 390a, 390b and 390c are also controlled by the detection of failure of feed. It should be explained here that the employment of three limit switches 390a, 390b and 390c rather than a smaller number of such switches, is described herein in the interest of simplicity. All three of these limit switches act simultaneously in response to the release and application of pressure at the offset cylinder. The skilled electrician will be able to cause a lesser number of limit switches to exercise the same controlling functions by utilizing more complicated, or apparently more complicated, control circuits.

A vertically movable rod 394 is pivotally connected to an arm 322 constituting a projection from collar 332, and rod 394 has fastened thereto near its bottom end a bracket 395 adapted to depress a cam follower roller 360 operating an operating arm 397 of the limit switch 390. The adjustment of the switch and rod 394 is such that in the pressure applying positions of the offset cylinder the limit switch 390 is closed. A spring 390 may be provided to assist the upward return of rod 394 and bracket 395 upon release of the limit switch 390.

As indicated above, the several switches which comprise the gang limit switch 390 control several of the operations of the press. Switch 390a, when open as indicated in Fig. 8 as in the event of disconnection of the pressure fork and offset cylinder, breaks the circuit through the latch solenoid 360. This renders the latch 350 incapable of moving to latching position until the offset cylinder has first been connected to the pressure fork by means of the pin 331 by manual operation of the push-button switch 342, and the offset cylinder brought again into pressure relation to the main cylinder.

Thus it is assured that the pressure fork, while disconnected from the offset cylinder, will be capable of rising during each revolution of cam 333 sufficiently high so that it is impossible to project the pin 331 into the path of this shoulder 334 for reconnection of the pressure fork and offset cylinder.

Delivery of sheets to the printing couple is effected as illustrated in Figs. 6 and 7 which are fragmentary views of the feeding and apparatus of the press. The foregoing mechanism is constructed as described in my Patent 2,497,849, which may be referred to for a more detailed description. Fig.
7 shows a fragment of the continuously rotating axle 16, roller 20° and one of the sprocket-driven conveyor chains 38 carrying sets of cords 10° which convey the sheets from the stack 12 of Fig. 6 into the press. Fig. 6 shows a stack 12, of sheets to be printed, carried by a table 13 supported by brackets 55 which is slideably mounted on guide bars 56, 58.

Sheets are lifted singly and in succession from top of stack 12 by reciprocating suction picket nozzles 56 which move downwardly and upwardly through gaps between successive sets of the cords 10°, picking up the trailing end portion of the top sheet, lifting this trailing end portion above the path of travel of the next set of cords 10°, and holding it there until such set of cords 10° complete the separation of the sheet from the stack. The suction in the nozzles 56 is then broken and the traveling cords 10° advance the sheet into the press.

Lifting of the sheets is facilitated by intermittent blasts of air directed against the upper right face of the stack of Fig. 6 by air blast nozzles 143, such blasts of air fanning out the top several sheets of the stack and accomplishing the first part of the elevation of the trailing edge portion of the top sheet.

Blast is also directed against the sheet at the proper time, a conduit 73, and a flexible coupling 73° which leads to the suction side of motor—driven air pump indicated diagramatically at 1060. Air is supplied under pressure to the nozzles 143 from the pressure side of the pump 1059 (Fig. 9), under the control of a mechanically actuated piston valve 161.

In accordance with this invention press is provided with means for automatically stopping feed of sheets when a sheet fails to be properly fed, and in the preferred form of such mechanism, indicated in the diagram of Fig. 8, a feed of sheets is automatically stopped as a result of separation of the combined plate and impression cylinder and the offset cylinder. Provision is also preferably made for permitting feed of the sheets notwithstanding the separation of the combined and offset cylinders.

As indicated in the diagram of Fig. 9, the air pump 1059, which provides suction for the picket nozzles 56 and air pressure for the air blast nozzles 143, is driven by an electric motor 1061 receiving its current through contacts 1055 and 1066, 1066 of a magnetically closed switch 1070. A push button starting switch 1072 is adapted to energize the magnetic coil of switch 1070 to cause the circuit of the feeder motor to become closed through contacts 1055 and 1056. Closing of the motor switch contacts 1055 and 1056 is also accompanied by closing of holding circuit contacts 1075 and 1075 adapted to establish a holding circuit through the magnetic coil of switch 1070 and through a push button stop switch 1072, thus to maintain the motor circuit closed after release of the starting switch 1072 and permit the motor to be stopped by pressing the stop switch 1072.

The limit switch 30° which opens, as previously explained, when pressure is not applied to the offset roll, is interposed (Fig. 9) in the holding circuit of the motor switch 1070. A manually operable switch 1079 is also interposed in this holding circuit, in parallel with the limit switch 30°.

With the manual switch 1079 closed, the holding circuit will be automatically established through the switch 1070 upon closing the push button starting switch 1072, notwithstanding the limit switch 30° may be open as a result of separation of the main and offset cylinders. With the press and the conveyor of the feeder running, and the feeder pump motor also working, sheets may be fed through the press in order to make certain that all parts of the press are properly adjusted to accommodate the sheets.

Closing the switch 342° Fig. 8, will energize the solenoid 342° to effect connection between the pressure force 325° and the offset cylinder, and thus bring the offset cylinder into pressure relation to the combined cylinder, whereupon printing will begin and the several limit switches including limit switch 390° will close. Thereupon the operator can open manual switch 1079, Fig. 9, and further operation of the feeder pump motor will depend upon limit switch 390° remaining closed. At any other time thereafter at which the sheet fails to be properly fed, and the offset and combined cylinders separate, limit switch 390° will open and automatically stop the feeder pump motor 1061 and feeder air pump 1060. This feed of further sheets is thus instantly stopped, although the pickers 56 and conveyors of the feeder continue to be driven in timed relation to the main cylinder and the various conveyors of the press by the driving connections described in said Patent No. 2,497,549.

Many of the elements of the control circuit and their functions have been described above. Referring to Fig. 8, a suitable alternating current line is shown as adapted to supply current to the electric lamp 370, the photoelectric cell 371, the photoelectric relay 380 and a photoelectric amplification network indicated diagramatically at 1080, under the control of the manually operated switch 1091.

The photoelectric amplification network 1080 is of such character as to transmit amplified current to the relay 380 such as to close the circuit between contacts D and F upon the interruption of the beam of light normally cast by lamp 370 upon the cell 371.

The cell 371, relay 380 and network 1080 may for example together constitute the device known as the General Electric Company "Photoelectric Relay C R 7505 E 100 G 2°" only those parts of that device that are necessary for an understanding of this invention being shown herein.

As explained above, the push button switch 342° is depressed to energize solenoid 342 to pull the pin 331 to the right in Fig. 4, carrying it into the path of the pressure fork shoulder 334, thus effecting an initial connection between the pressure fork and the offset cylinder, a connection which is maintained by pressure of the pressure fork shoulder 334 upon the pin 331 until failure of a sheet to be fed causes the latch 350 to fail to be engaged and held in the recess 352 of the pressure fork.

The operator can release the push button switch 342° as soon as a properly fed sheet has caused the latch 350 to hold the pressure fork.

Failure of feed of a sheet causes release of pressure upon the offset cylinder and causes limit switches 390°, 390° and 390° to open.

The open condition of limit switch 390° (Fig. 8) prevents energization of solenoid 380 and prevents latching of the pressure fork in its lower or pressure-applying position unless the offset cylinder has been moved into pressure relation to
the main cylinder by means of the connecting pin 331.

The open condition of limit switch 390° (Fig. 9) breaks the holding circuit of the feeder pump motor switch (unless the manual switch 1078 is closed), and so stops the feed of sheets. Feed of sheets may, however, be carried on in the open condition of limit switch 390° by having the switch 1078 closed.

I claim:

1. In a sheet-fed printing press, a pair of cylinders comprising a printing couple, means for feeding sheets to said couple, said feeding means including pneumatic sheet-elevating mechanism for lifting a portion of the top sheet from a stack of sheets to be printed, a pump adapted to energize said pneumatic sheet elevating mechanism, an electric motor for drivingsaid pump, a switch controlling the current supply to said motor, a magnetic holding circuit adapted to retain said switch closed, means for automatically separating said cylinders upon failure of feed, second and third switches interposed in said holding circuit and means for automatically opening said second switch to break said holding circuit upon separation of said cylinders, said third switch being manually operable to maintain the holding circuit intact independently of the position of said second switch.

2. In a sheet-fed printing press, a pair of cylinders comprising a printing couple, means for feeding sheets to said couple, said feeding means including pneumatic sheet-elevating mechanism for lifting a portion of the top sheet from a stack of sheets to be printed, a pump adapted to energize said pneumatic sheet elevating mechanism, an electric motor for driving said pump, a switch controlling the current supply to said motor, a magnetic holding circuit adapted to retain said switch closed including a manually operable push button starting switch to make the circuit, a manually operable push button stopping switch for breaking the circuit, a first switch manually operable for separation of the cylinders to break the circuit and a second switch associated with the first switch manually operable in conjunction with said first switch in one position to break the circuit and in another position to maintain the circuit independently of said first switch.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>772,705</td>
<td>Dexter</td>
<td>Oct. 19, 1904</td>
</tr>
<tr>
<td>1,207,331</td>
<td>Tauscher</td>
<td>Feb. 1, 1921</td>
</tr>
<tr>
<td>1,741,848</td>
<td>Kelly</td>
<td>Dec. 31, 1929</td>
</tr>
<tr>
<td>2,091,283</td>
<td>Johnson</td>
<td>Aug. 31, 1937</td>
</tr>
</tbody>
</table>