April 29, 1952 R. F. ABERLE 2,594,705

CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 1

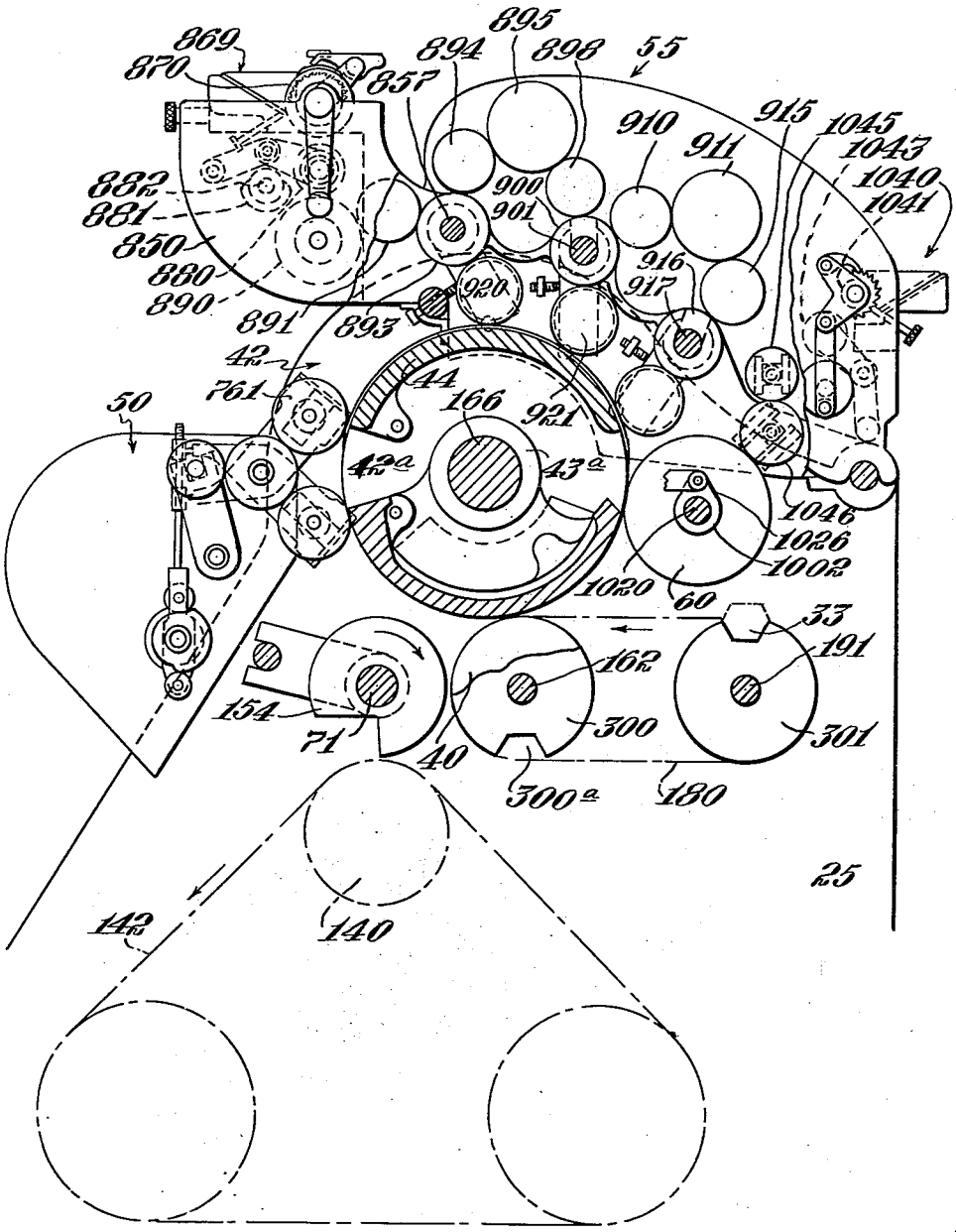


Fig. 1

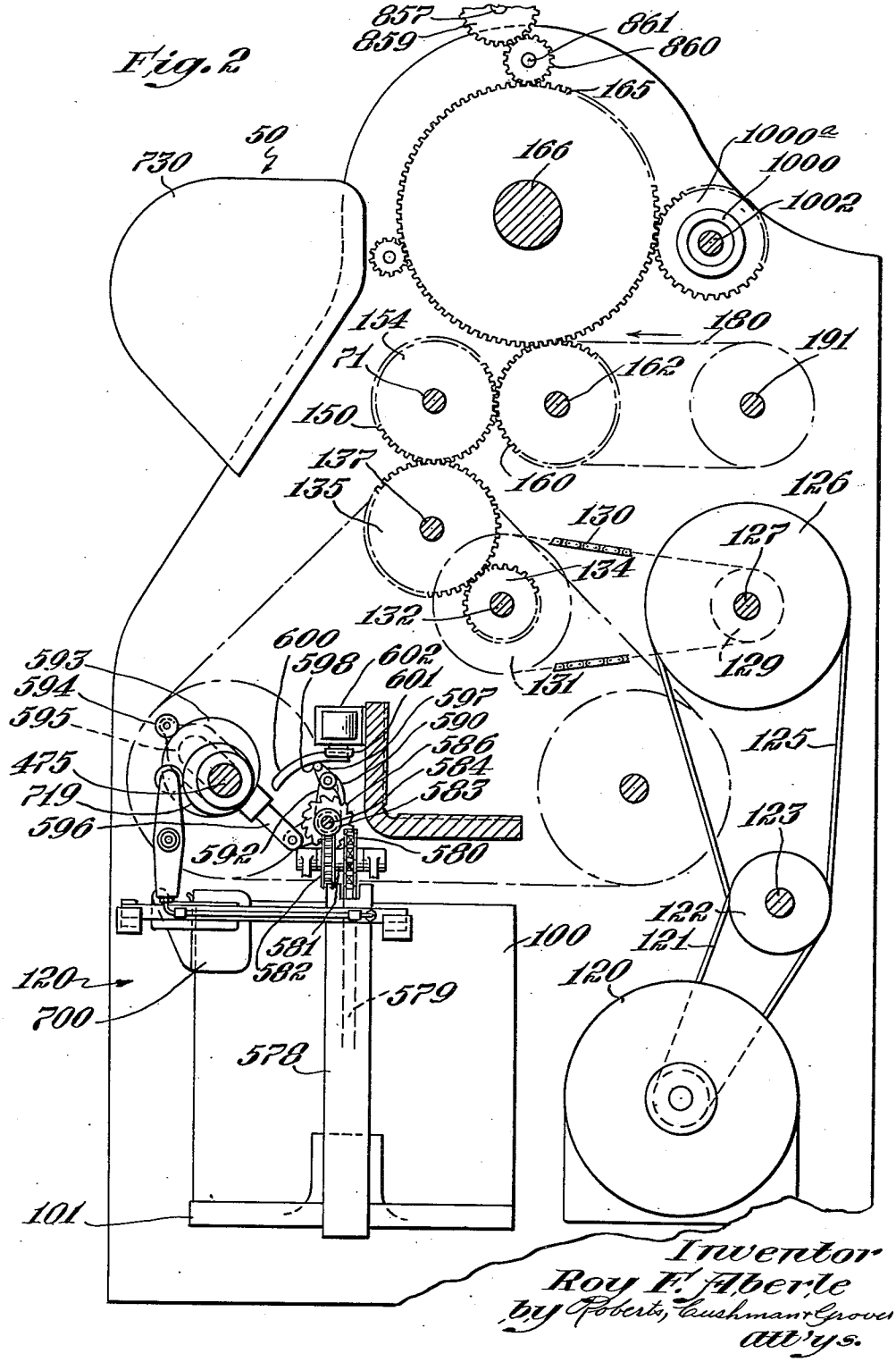
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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

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Fig. 2



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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 3

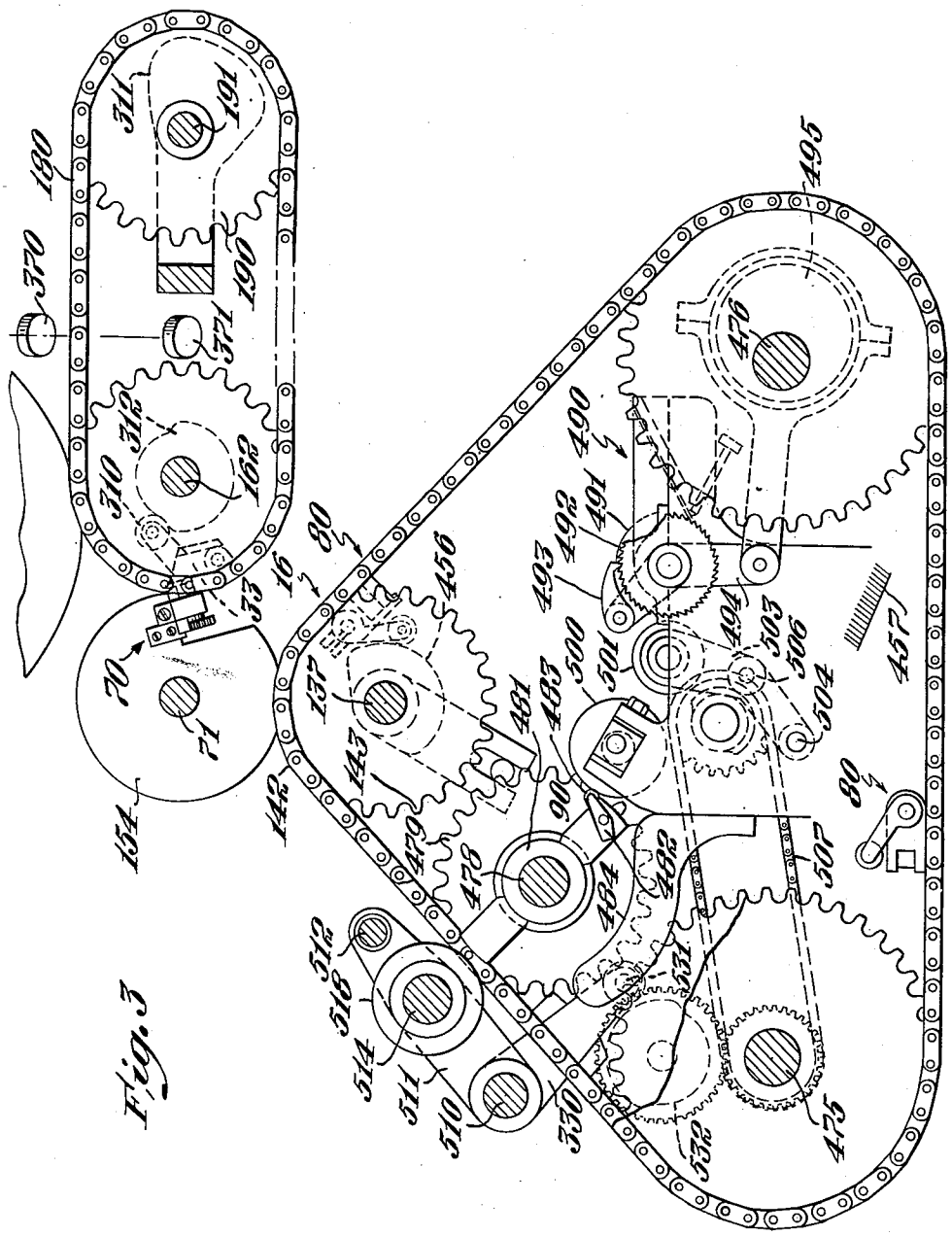


Fig. 3

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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 4

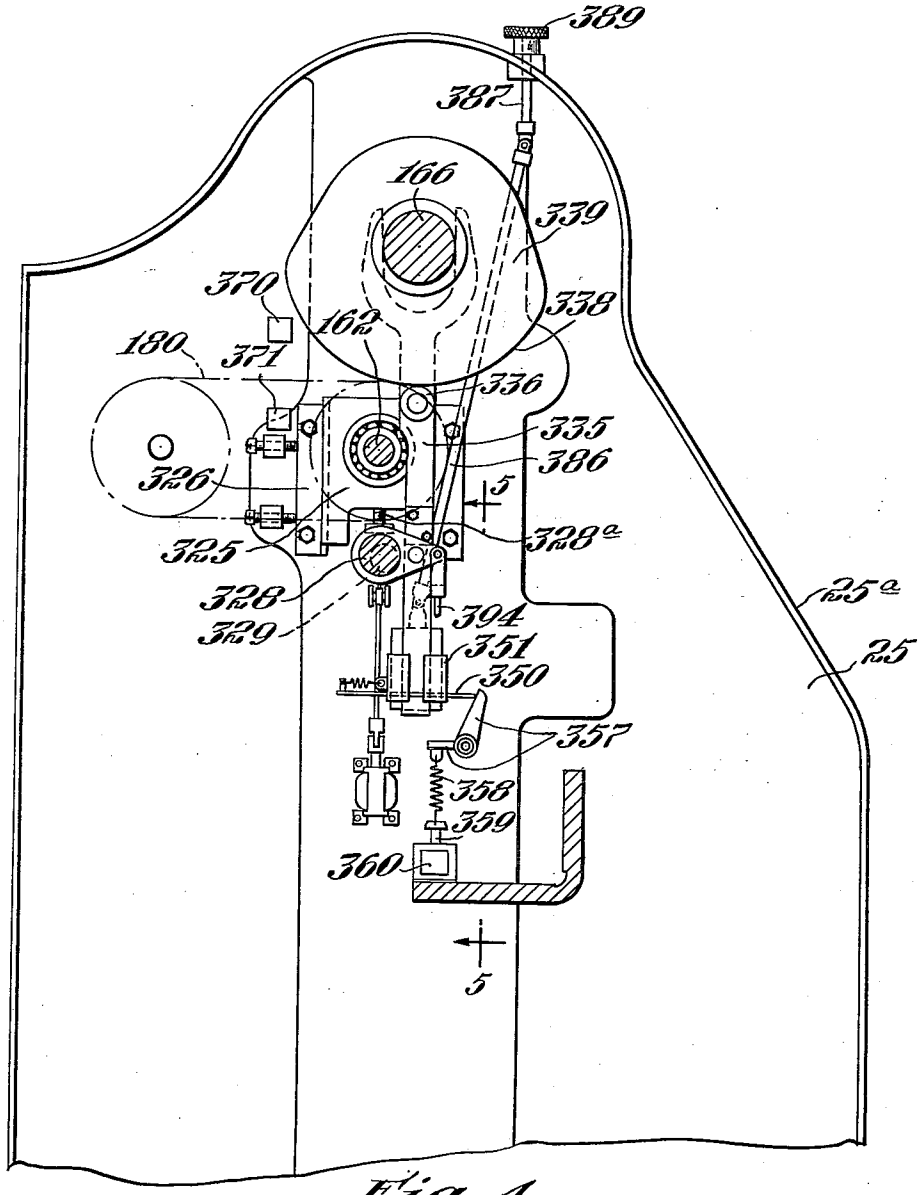


Fig. 4

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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 5

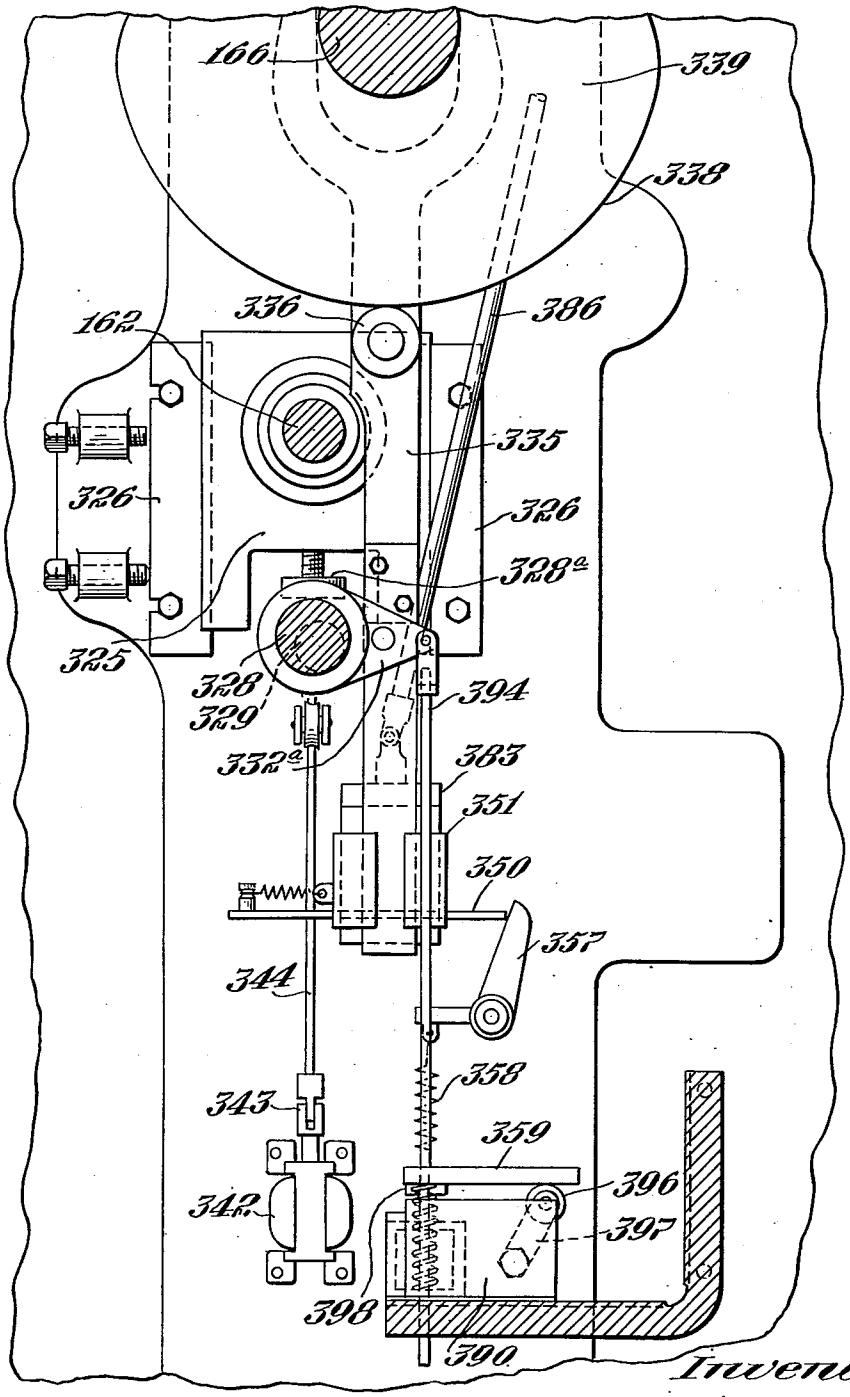


Fig. 5

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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 6

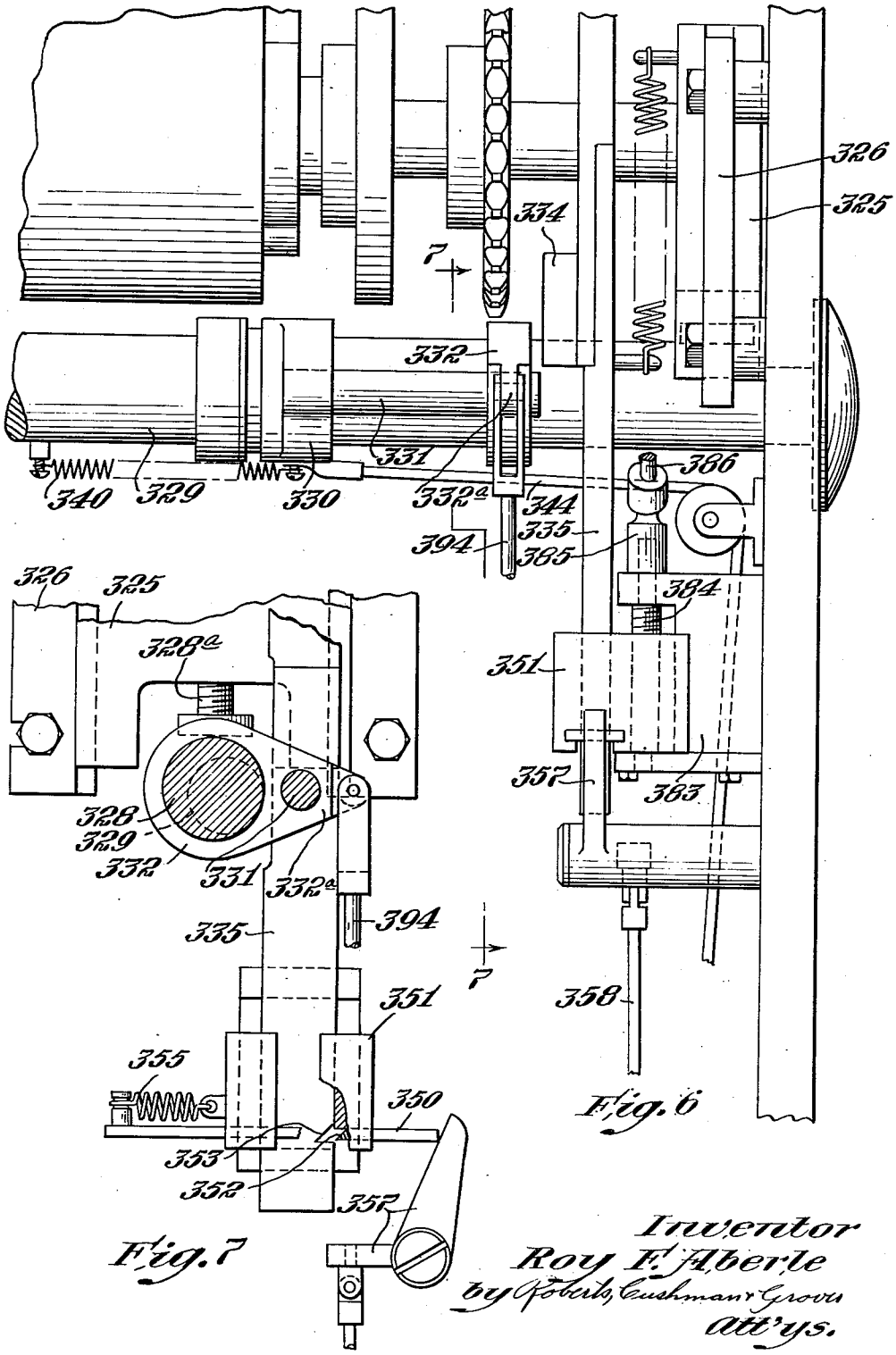


Fig. 6

Fig. 7

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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept 20, 1946 8 Sheets-Sheet 7

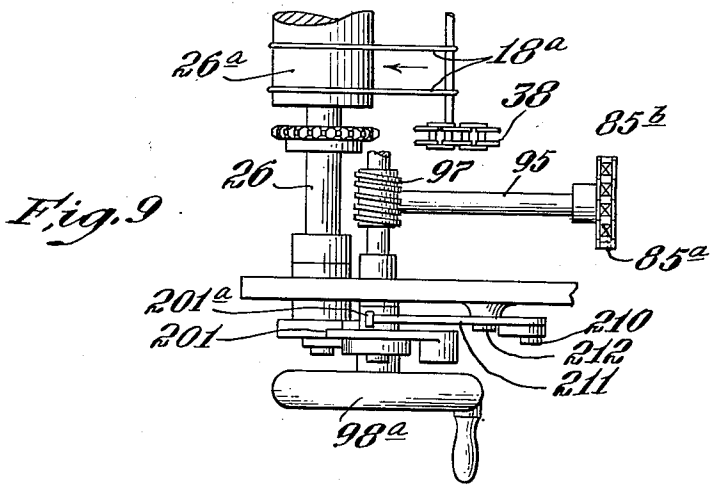


Fig. 9

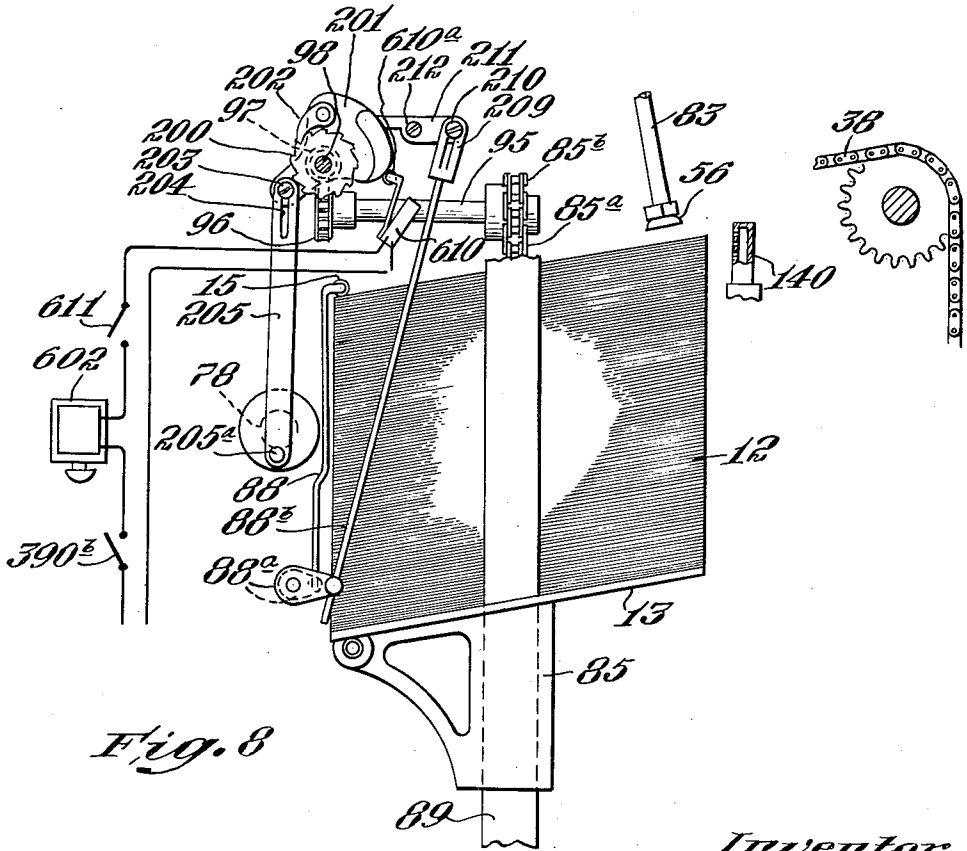


Fig. 8

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CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Original Filed Sept. 20, 1946 8 Sheets-Sheet 8

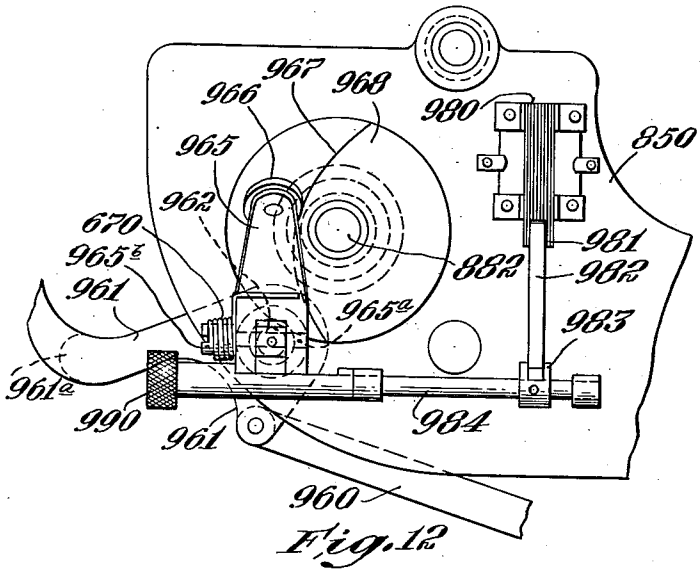


Fig. 12

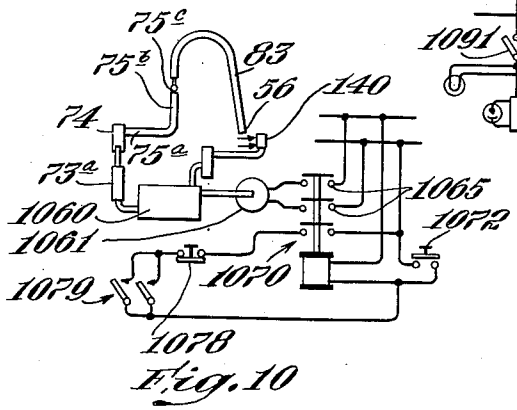


Fig. 10

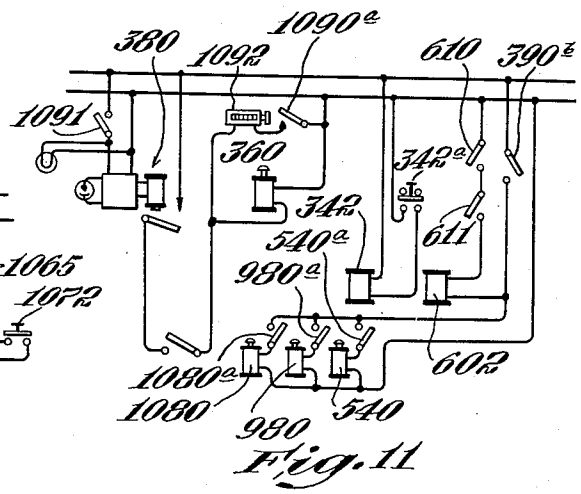


Fig. 11

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Patented Apr. 29, 1952

2,594,705

UNITED STATES PATENT OFFICE

2,594,705

CONTROL FOR STACK SUPPLY AND STACK DELIVERY FOR PRINTING PRESSES

Roy F. Aberle, Portland, Maine, assignor to Southworth Machine Company, Portland, Maine, a corporation of Maine

Original application September 20, 1946, Serial No. 698,252, now Patent No. 2,542,073, dated February 20, 1951. Divided and this application April 9, 1948, Serial No. 20,083. In Canada September 18, 1947

4 Claims. (Cl. 271—3)

1

This invention relates to printing presses and is most particularly applicable to sheet-fed lithographic offset presses. Among the objects of the invention are to improve the general organization of a press and its driving gearing; to provide improved supply stack and delivery stack supports and improved control over the raising and lowering of the stack supports in accordance with the action of the sheet-feeder mechanism.

In the drawings:

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

Fig. 2 is a diagram, looking in the same direction as Fig. 1, showing certain of the driving connections and showing the pile delivery;

Fig. 3 is a vertical sectional view, looking in the same direction as in Figs. 1 and 2, showing sheet-conveying mechanism and mechanism for printing upon (more specifically, numbering) the previously-printed sheets that are carried by the sheet-conveying mechanism;

Fig. 4 is a vertical sectional view of the press taken from the opposite point of view from Figs. 1, 2 and 3 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. 5 is a view similar to Fig. 4 on a larger scale, showing also an electric switch responsive to separation of the main and offset cylinders;

Fig. 6 is a fragmentary vertical sectional view taken on the line 6—6 of Fig. 4 on a larger scale;

Fig. 7 is a fragmentary vertical sectional view on the line 7—7 of Fig. 6;

Fig. 8 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. 9 is a diagram in the nature of a plan view of a fragment of the feeding apparatus of Fig. 8;

Fig. 10 is a diagram of control circuits for many of the elements of the press;

Fig. 11 is a diagram showing the control of the feeder pump motor;

Fig. 12 is an elevation, partly broken away and partly diagrammatic, showing the form rolls for the main cylinder and mechanism for controlling the operation of these form rolls;

Outline of general organization of machine

The illustrated machine contains many of the features of the machines of my prior Patents Nos. 2,140,256 and 2,257,490 and is especially adapted to be used in combination with the sheet-feeding mechanism shown in my copending application Serial No. 590,225, filed April 25, 1945, now Patent No. 2,497,849, dated February 21, 1950, a continuation-in-part of application Serial No. 490,556, filed June 12, 1943, now abandoned; and is a division of copending application Ser. No. 698,252, filed September 20, 1946, now Patent No. 2,542,073, dated February 20, 1951.

2

The main frame of the press includes opposite interconnected side plate sections 25 which are preferably flanged at their lateral margins, 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 Figs. 1, 2 and 3 are momentary stopped are laterally aligned and are then gripped by gripper fingers on a gripper bar 33 carried by chains 180. The course of chains 180 is indicated in Figs. 1, 2 and 3.

The sheet is carried by the traveling gripper bar 33 to and partly around a rubber covered offset cylinder 40, 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. Main cylinder 42 comprises opposite end portions 42a 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 42a. 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, paper stop fingers, side jogger mechanism and gripper bar 33 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 main cylinder 42 is provided with plate-dampening mechanism indicated generally at 50 and plate-inking mechanism indicated generally at 55 so as first to dampen the water-receptive blank portions of the lithographic plate and then to ink the ink-receptive image-carrying portions during the time that the impression surface 44 is cooperating with the offset cylinder 40. Further rotation of the main cylinder then brings

the dampened and inked lithographic plate on segment 43 into position to offset its inked image onto the rubber surface of the offset cylinder 40.

A supplemental roll 60, for instance carrying a rubber plate having raised letters, is arranged to offset onto the otherwise blank surface of the impression segment 44 of the main cylinder. The image thus transferred to the impression surface 44 is then printed onto the upper surface of the sheet simultaneously with the printing onto the lower surface of the sheet by offset cylinder 40.

Leaving the nip between the offset cylinder 40 and the impression segment 44, the printed sheet is released by the grippers of bar 33 and simultaneously gripped by a circularly moving second set of grippers 70 (Fig. 3), which move around axis 71 (Fig. 1), and at the end of an approximately 90° circular travel release the sheet and transfer it to third grippers 80 (Fig. 3), which are carried by chains 142 in a generally triangular path, as shown in Figs. 1 and 3.

On the first or downwardly inclined portion of this triangular path away from the offset cylinder, the sheet may be subjected to a further printing operation. Mechanism for such further printing preferably comprises, as shown in Fig. 3, one or more rotating serial numbering units 90 and cooperating platen rolls 91 between which the sheet is carried (Fig. 3) so that the sheet is numbered on its lower surface upon which it had previously received an impression from the offset cylinder.

The chain-carried third grippers 80 then carry the sheet onto the lower horizontal run of their triangular path, in which the grippers are caused to open and drop the sheet, with its offset printed and numbered surface uppermost, onto an automatically lowered stack 100 (Fig. 2) on a platform 101 on which the newly arrived sheet is aligned both longitudinally and transversely by corner-jogging mechanism indicated generally at 120.

Pressure mechanism and control of pressure mechanism in accordance with sheet feed

As shown in Figs. 4 and 5 the shaft 162 of the offset cylinder is mounted in sliding blocks 325 which are vertically movable in guideways 326. A pressure control or cam shaft 328 is eccentrically mounted at 329 at its ends and acts as a cam, through adjustable tappets 328a, to support the sliding blocks 325. Rotation of the cam shaft 328 in a counterclockwise direction as viewed in Figs. 4 and 5 permits the offset cylinder to move away from the main cylinder, and rotation of the cam shaft 328 in a clockwise direction lifts the offset cylinder and forces it under pressure against the main cylinder.

A sliding collar 330 (Fig. 6) on shaft 328 carries a horizontal connecting pin 331 which is guided through a slot in an arm 332a which extends from a fixed collar 332 on shaft 328. Connecting pin 331 is adapted to be projected to the right in Fig. 6 to a position in which it underlies a shoulder 334 on a vertically reciprocable pressure fork or plunger 335.

A cam follower roller 336 (Figs. 4 and 5) on the pressure fork 335 is adapted to be contacted by cam surface 338 of a cam 329 mounted on the shaft 166 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. 6 by a spring 340 which acts on the slidable collar 330, 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 343 connected by a flexible cable 344 to the slidable collar 330. Energization of the solenoid 342 by means of a push-button switch 342a (Fig. 10) thus pulls the pin 331 to the right in Fig. 6, 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 328 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 339 on the main cylinder shaft is such that the high part of the cam surface 339 bears against cam follower roller 336 only during the presentation of the plate segment 43 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. 7, is slidably mounted in a block 351 and includes a bevelled portion 352 adapted to slide into a wedge shaped recess 353 in the pressure fork 325. Latch 350 is normally urged to the right or unlatched position in Fig. 7 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 359 of a solenoid 360 as shown in Fig. 4.

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. 4 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. 10, 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 325 is held in its depressed position of Fig. 7 by the high surface 338 of the cam 339. The notch 353 is accordingly in position to receive the latch 350.

The block 351 which carries the latch 350 is vertically slidably mounted in a stationary guide bracket 383 (Fig. 6) and a screw 384 which is rotatable in the bracket 383 is threaded into the block 351. A rod consisting of jointed portions 385, 386 and 387 (Figs. 6 and 4), fastened to the

screw **384** and to a knob **389**, enables the screw **384** 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 at such level 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 deenergized.

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. The 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 connecting pin **331**, breaking the normal frictional contact between these parts, whereupon the spring **340**, Fig. 6, will pull the pin **331** out from under the shoulder **334**. Succeeding strokes of the pressure fork will thereupon 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 **342a**.

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.

Location of the light beam

Interruption of the light beam B from the lamp **370** to the photoelectric cell **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 best be accompanied by locating the lamp **370** and cell **371** as indicated diagrammatically in Fig. 3, 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 manner 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:

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 latch **350** 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 **353** in the pressure fork is located so as to permit free movement of the latch **350** into or out of latching position.

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 sheets to reach the line of printing contact and be gripped between the main and offset cylinders before the light beam is re-established after passage of the sheet and the latch solenoid **360** accordingly de-energized.

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 4'' from the line of printing contact between the main and offset cylinders at the point where the beam is interrupted by the paper.

Limit switches responsive to application of pressure to offset cylinder

Numerous operations of the machine are controlled by a limit switch indicated at **390** in Fig. 6 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. 10 and 11. 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 332a constituting a projection from collar 332, and rod 394 and has fastened thereto near its bottom end a bracket 395 adapted to depress a cam follower roller 396 on 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 398 may be provided to assist the upward return of rod 394 and bracket 395 upon release of the latch 350.

Prevention of latching of pressure fork while pressure fork is disconnected from offset cylinder

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. 10 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 342a, 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 339 sufficiently high so that it is possible to project the pin 331 into the path of this shoulder 334 for reconnection of the pressure fork and offset cylinder.

Pile delivery

As the sheets are discharged from the gripper bars 146 of the delivery conveyor the sheets drop printed side up upon a stack 100 supported on a table indicated diagrammatically at 101, Fig. 2, and slidable vertically on slides 578.

A suitable mechanism for lowering the table 100 as the paper accumulates thereon may comprise chains 579 shown in Fig. 2 adapted to be raised or lowered by corresponding sprockets 580. Each sprocket 580 is fast on a shaft 581 which also carries a worm gear 582 meshing with a worm 583 on a shaft 584. A ratchet wheel 586 on shaft 584 is adapted to be engaged by a ratchet pawl 590 pivotally mounted on a bell crank 592, and bell crank 592 is continuously oscillated by an eccentric 593 on shaft 475, a cam follower 594, yoke 595 and a connecting link 596.

The ratchet pawl 590 includes a tail portion 597 carrying a cam follower roller 598. A curved cam plate 600 is mounted on the vertically movable armature 601 of a solenoid 602 above the path of cam follower roller 598. When the solenoid 602 is not energized the curved cam plate 600 depresses the cam follower roller 598 and tail 597 of the pawl 590, so as to retain the pawl out of engagement with the ratchet wheel 586, thus allowing the pawl to swing idly. On the other hand when solenoid 602 is energized as described hereinafter cam plate 600 is lifted sufficiently to allow the pawl 590 to drop into engagement with the teeth of the ratchet wheel 586 as shown in Fig. 2. When in this position the pawl and ratchet wheel cooperate to turn the worm 584 and parts driven thereby, to lower the stack table 101. De-energization of the solenoid 602 immediately stops the lowering of the stack table.

Control of pile delivery; detection of stack elevation in feeder

Figs. 8 and 9 are fragmentary views of the feeding apparatus of the press, which preferably is constructed as described in my copending application Serial No. 590,225, filed April 25, 1945, which may be referred to for a more detailed description. Fig. 9 shows a fragment of the continuously rotating axle 26, roller 26a and one of the sprocket-driven conveyor chains 38 carrying sets of cords 18a which convey the sheets from the stack 12 of Fig. 8 into the press. Fig. 8 shows a stack 12, of sheets to be printed, carried by a table 13 supported by bracket 85 which is slideably mounted on guide bars 89.

Sheets are lifted singly and in succession from top of stack 12 by reciprocating suction picker nozzles 56 which move downwardly and upwardly through gaps between successive sets of the cords 18a, 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 18a, and holding it there until such set of cords 18a complete the separation of the sheet from the stack. The suction in the nozzles 56 is then broken and the traveling cords 18a 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. 8 by air blast nozzles 140, 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.

Suction is supplied to the nozzles 56 through flexible tubes 83 (Figs. 8 and 11), a suction header conduit 75c, conduits 75b and 75a, and a mechanically controlled valve 74 which breaks the suction at the proper times, a conduit 73, and a flexible coupling 73a which leads to the suction side of a motor-driven air pump indicated diagrammatically at 1060. Air is supplied under pressure to the nozzles 140 from the pressure side of the pump 1060 (Fig. 11) under the control of a mechanically actuated piston valve 161.

Table 13 is adapted to be elevated by a chain 85a driven by sprocket 85b on a shaft 95 which is rotated by a worm gear 96. A worm 97, adapted to drive the worm gear 96, is carried on a shaft 98 which also carries a ratchet wheel 200. An eccentrically weighted plate 201 is freely rotatable on shaft 98 and carries a pivotally mounted pawl 202 adapted to fall by gravity into engagement with the teeth of ratchet wheel 200. The center of gravity of the plate 201 is toward the right of the shaft 98 as seen in Fig. 8, which causes the plate 201 to tend to rotate about the shaft 98 in a clockwise direction, tending to keep a pin 203, carried by plate 201, in engagement with the upper end of a slot 204 in a pitman 205. The lower end of this pitman is pivotally connected to an eccentric pin 205a on a continuously driven shaft 78.

A paper stack height feeler roller 15 is carried by the upper end of a member 88 and bears upon the topmost sheet of the stack. Member 88 is pivotally connected to the inner arm of a double crank 88a of which the outer arm is pivotally connected to the lower end of a connecting rod 88b. Rod 88b carries a slotted head 209 which slidably engages a pin 210 at the right end of a lever 211 which is pivotally mounted on a stud 212 projecting from a side frame plate of the feeder. The end of the lever 211 opposite to the

pin 210 is adapted to detain a shoulder 201a (Fig. 9) which is integral with the hub of the plate 201 and which projects radially therefrom, see Fig. 29, thus preventing the plate from rotating clockwise, as viewed in Figure 8. As the height of the top of the stack 12 decreases, the control feeler roller 15 and member 88 descend, the crank 88a rotates, the connecting rod 88b descends and the detent lever 211 disengages the shoulder 201a and allows the plate 201 to rotate clockwise, as viewed in Figure 8, bringing the pawl 202 into position to engage a new tooth or teeth on the ratchet-wheel 200. Operation of the pitman 205 then results in actuating the pawl 202 to turn the ratchet-wheel 200, shaft 98, and shaft 95 and move the chain 85a to lift the table 13 and thereby raise the top of the stack to the appropriate level for feeding from the top of the stack. A handwheel 98a may be provided on shaft 98 for adjusting the paper stack table and also for lowering it to receive a further supply of sheets.

A limit switch 610, not provided in the said copending application, is located on the feeder so that its operating arm 610a is adapted to be cammed to the right in Fig. 8 by rotation of the plate 201 in a clockwise direction, and the limit switch 610 is so arranged that such movement of its arm closes the switch, closing a circuit through the solenoid 602 of the pile delivery control mechanism.

Thus each time the table 13 of the feeder is elevated by the mechanism of Figs. 29 and 30, the table 101 (Fig. 2) at the delivery end of the press is correspondingly lowered.

It is often convenient, especially in starting the press, to run the press idly without feeding paper through it and in this operation the feeder paper stack table 13 may either be empty or the top of the stack 12 may be sufficiently low so that it does not engage the feeler 15, and consequently during such running the table 13 may be caused to rise. In such idle running of the press, the limit switch 310b will be open because of the absence of pressure at the offset cylinder, and because this limit switch 390a is interposed in the circuit of pile delivery control solenoid 602 (Fig. 10) the latter will not be energized. Accordingly, when the press is run idly, the pile delivery table 101 will not automatically lower even though the feeder paper stack table 13 rises.

A manually operated switch 611 is also interposed in the circuit of the pile delivery control solenoid 602 and by opening this switch, automatic lowering of the pile delivery table can be suspended both during idle running and during printing.

Control of sheet feed

The press is preferably 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. 11, the 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. 11, the air pump 1060, which provides suction for the picker nozzles 56 and air pressure for the air blast nozzles 140, is driven by an electric motor 1061 receiving its current through contacts 1065, 1065 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 1065 and 1066. Closing of the motor switch contacts 1065 and 1066 is also accompanied by closing of holding circuit contacts 1075 and 1076 adapted to establish a holding circuit through the magnetic coil of switch 1070 and through a push button stop switch 1078, 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 1078.

The limit switch 390c which opens, as previously explained, when pressure is not applied to the offset roll, is interposed (Fig. 11) 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 390c.

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 390c 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 342a, Fig. 10, will energize the solenoid 342 to effect connection between the pressure fork 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 390c will close. Thereupon the operator can open manual switch 1079, Fig. 11, and further operation of the feeder pump motor will depend upon limit switch 390c remaining closed. At any time thereafter at which a sheet fails to be properly fed, and the offset and combined cylinders separate, limit switch 390c 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 application Serial No. 590,225.

Review of control circuit wiring diagram

Many of the elements of the control circuit and their functions have been described above. Referring to Fig. 10, 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 diagrammatically at 1090, under the control of the manually operated switch 1091.

The photoelectric amplification network 1090 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 1090 may for example together constitute the device known as the General Electric Company "Photoelectric Relay C R 7505 K 100 G 2," only those parts of that device that are necessary for an understanding of this invention being shown herein.

As previously described, and as will be ap-

parent from the diagram of Fig. 10, the latch solenoid 360, the numbering unit solenoid 540, the supplemental offsetting cylinder solenoid 1060, and the counter 1092 are connected in parallel so that each is adapted to receive an impulse when the photoelectric relay 380 operates to close the circuit between contacts D and F in the event that limit switch 390a is closed.

Manually controlled switches 540a, 1080a, and 1092a, connected in series with the solenoids 540, 1080 and counter 1092 respectively, are adapted to be opened so as to prevent operation of any of these elements as desired. Thus, the press may be run without its numbering unit functioning, or without its supplemental offsetting cylinder functioning, or without its counter functioning, or without any or all of these functioning, as desired.

As explained above, the push button switch 342 is depressed to energize solenoid 342 to pull the pin 331 to the right in Fig. 6, 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 353 of the pressure fork.

The operator can release the push button switch 342a 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 390a, 390b and 390c to open.

The open condition of limit switch 390a (Fig. 10) prevents energization of solenoid 360 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, and also prevents energization and operation of the counter 1092.

The open condition of limit switch 390b prevents energization of solenoid 540 and prevents operation of the numbering mechanism, prevents energization of solenoid 1080 and prevents offsetting from the supplemental offsetting cylinder.

The open condition of limit switch 390b (Fig. 10) also prevents energization of solenoid 602 and prevents automatic lowering of the pile delivery table. The open condition of limit switch 390b also prevents energization of solenoid 980 and so prevents operative contact of the form rolls with the plate segment of the main cylinder excepting in the event that the knob 990 (Fig. 12) is turned and held by hand to permit such operative engagement.

The open condition of limit switch 390c (Fig. 11) breaks the holding circuit of the feeder pump motor switch (unless the manual switch 1079 is closed), and so stops the feed of sheets. Feed of sheets may, however, be carried on in the open condition of limit switch 390c by having the switch 1079 closed.

I claim:

1. In a sheet-fed printing press, relatively movable main and offset cylinders, means for holding the cylinders engaged under pressure while a sheet is present therebetween, said means being responsive to the absence of a sheet to separate the cylinders, stack supports for supplying sheets to said cylinders and for receiving printed sheets discharged therefrom, said stack supports being vertically movable, means operable to effect raising the supply stack support and lowering the delivery stack support, a stack feeler normally rendering the means for raising the supply stack support ineffective, said feeler being operable by removal of sheets from the top of the stack to render the stack elevating means effective to raise the stack support, means rendering the means for lowering the delivery stack support ineffective while said supply stack support is at rest, an electric circuit including a switch and solenoid, the switch being located in a position to be closed by response of the stack feeler to initiate elevation of the supply stack support to energize the circuit, said solenoid being located in a position to render the lowering means for the discharge stack support effective, and a second switch in the circuit connected to the means for holding the cylinders engaged and operable by separation of the cylinders to open the circuit and hence to render the stack lowering mechanism ineffective without interfering with continued operation of the supply stack support elevating means.

2. In a sheet-fed printing press, relatively movable main and offset cylinders, means for holding the cylinders engaged under pressure while a sheet is present therebetween, said means being responsive to the absence of a sheet to separate the cylinders, stack supports for supplying sheets to said cylinders and for receiving printed sheets discharged therefrom, said stack supports being vertically movable, ratchet means operable to effect raising the supply stack support and lowering the delivery stack support, each ratchet means comprising a ratchet wheel and pawl, a stack feeler normally holding the pawl of the supply stack operating mechanism ineffective, said feeler being operable by removal of sheets from the top of the stack to render the pawl effectively operable, a cam holding the pawl of the delivery stack operating mechanism ineffective, an electric circuit including a switch and solenoid, the switch being located in a position to be closed by operable engagement of the pawl and ratchet of the supply stack operating mechanism to energize the circuit, said solenoid being located in a position such that upon actuation it will render the pawl of the delivery stack support operating mechanism operably effective, and a second switch in the circuit connected to the means for holding the cylinders engaged and operable by separation of the cylinders to open the circuit and hence render the pawl of the stack lowering mechanism ineffective.

3. In a sheet-fed printing press in accordance with claim 2, wherein there is eccentric operated means for constantly oscillating the pawls idly while the latter are held ineffective.

4. In a sheet-fed printing press in accordance with claim 2, wherein there is means for manually closing the second switch to restore operation of the stack support lowering means.

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