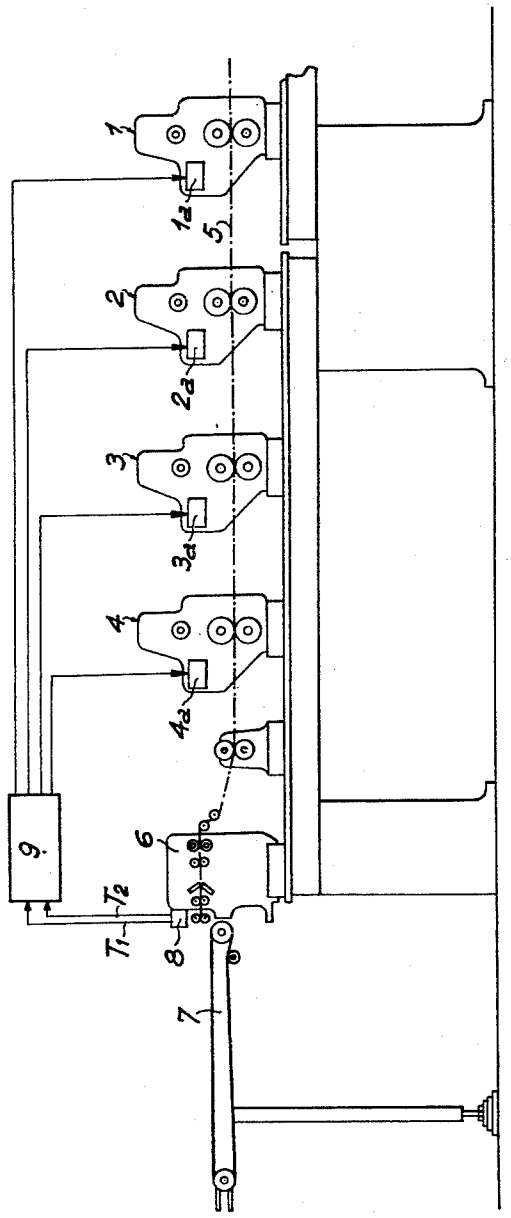
June 30, 1964 L. J. CHAMBON 3,139,025

COUNTER CONTROLLED ROTARY PRINTER

Filed Feb. 26, 1962 9 Sheets-Sheet 1

Fig.1.



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COUNTER CONTROLLED ROTARY PRINTER

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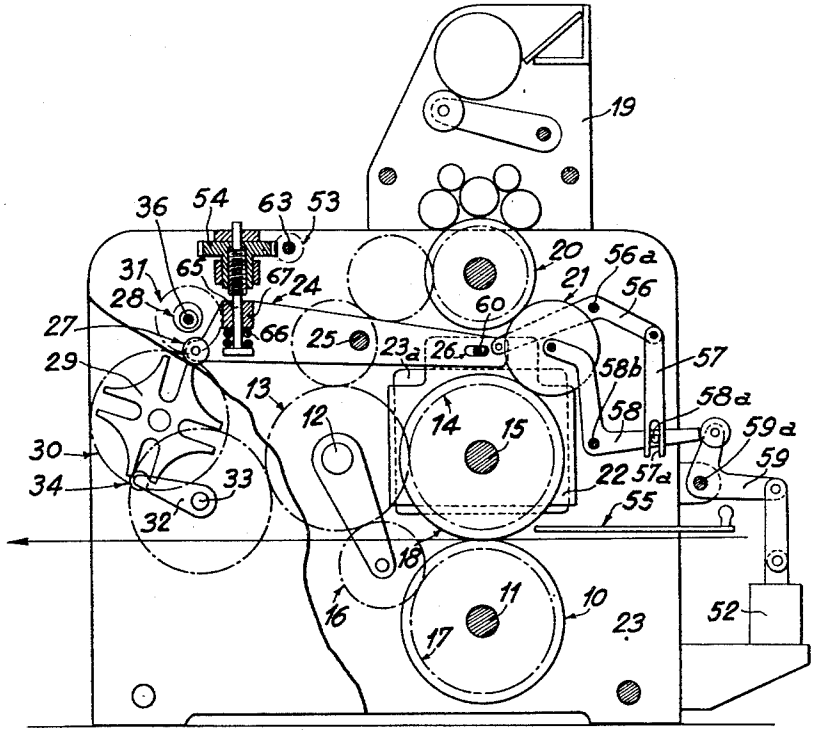
Fig.2.



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COUNTER CONTROLLED ROTARY PRINTER

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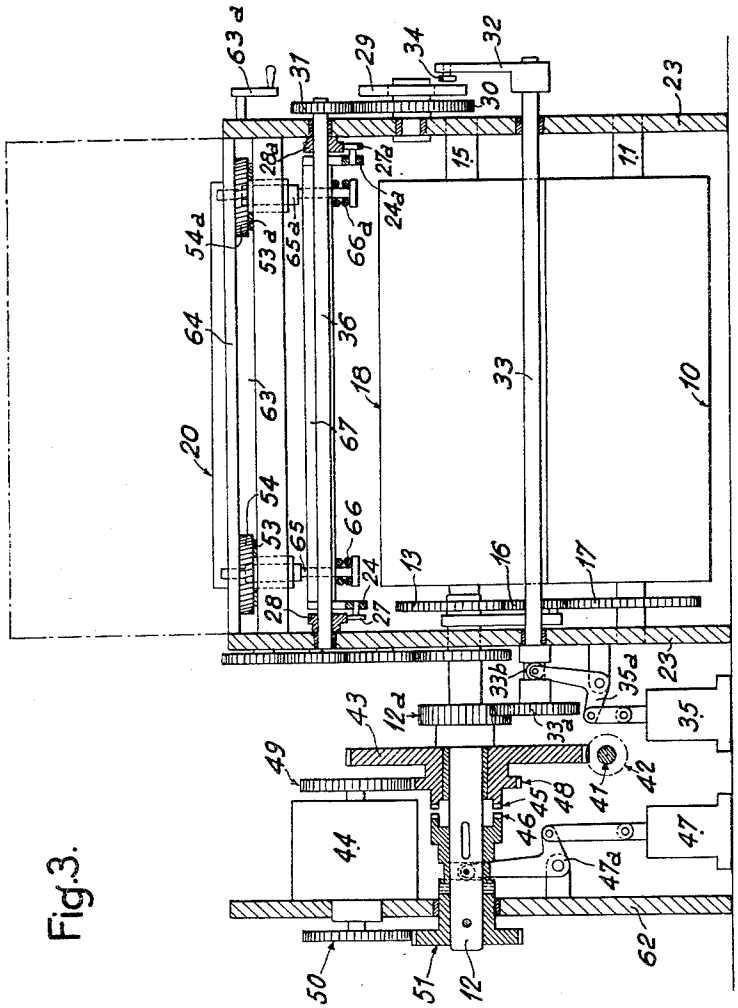

Fig.3.

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COUNTER CONTROLLED ROTARY PRINTER

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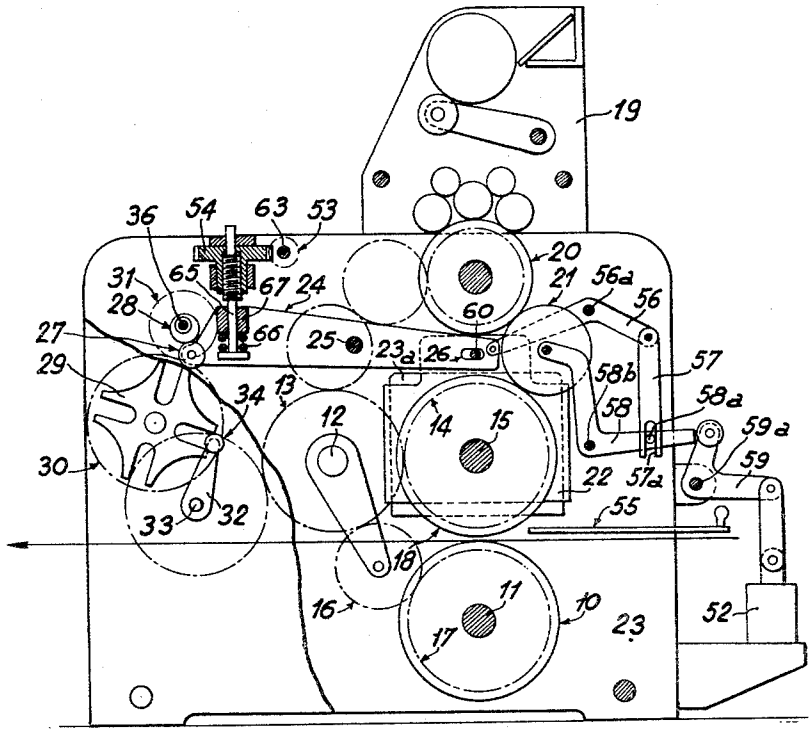
Fig.4.



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COUNTER CONTROLLED ROTARY PRINTER

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Fig.5.

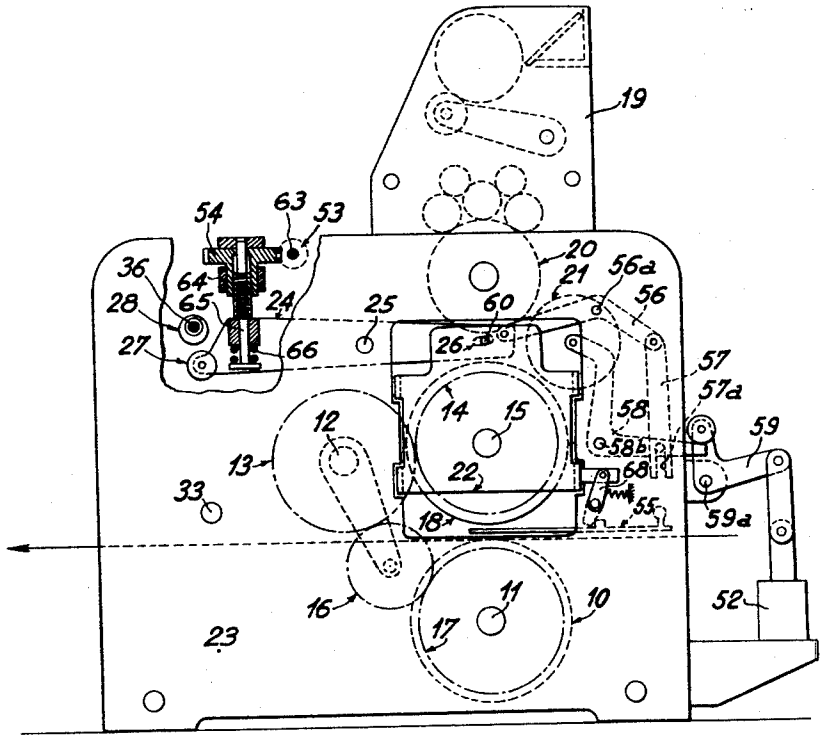

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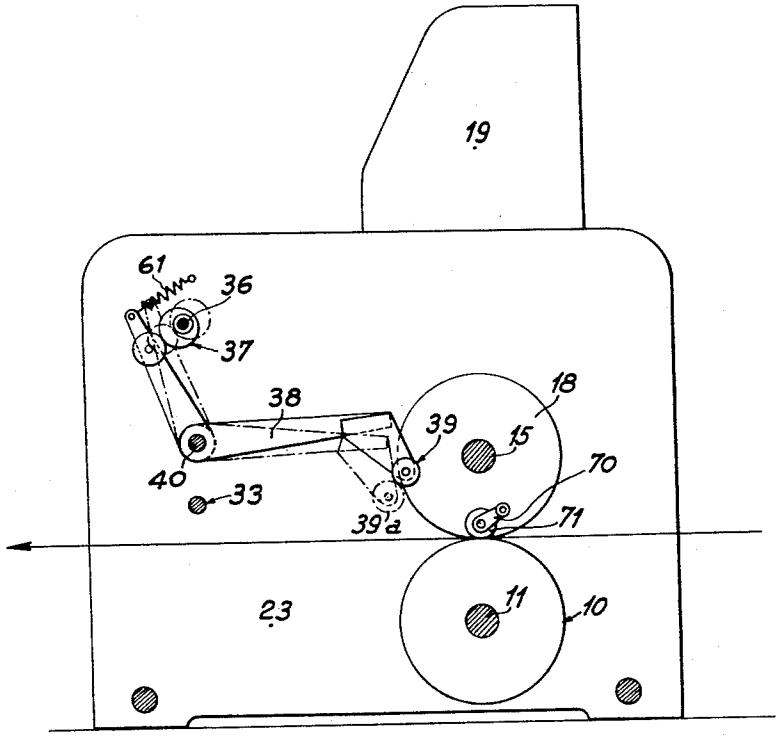
Fig.6.



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COUNTER CONTROLLED ROTARY PRINTER

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Fig. 7A.

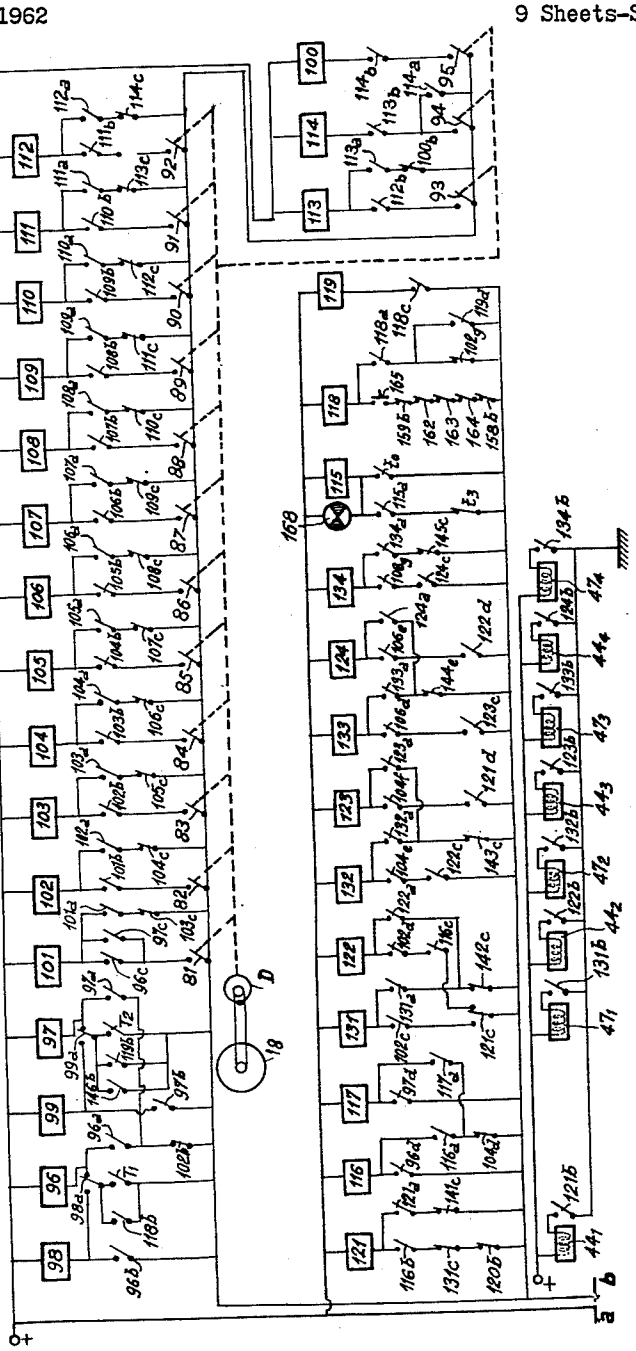

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Fig. 7 B.

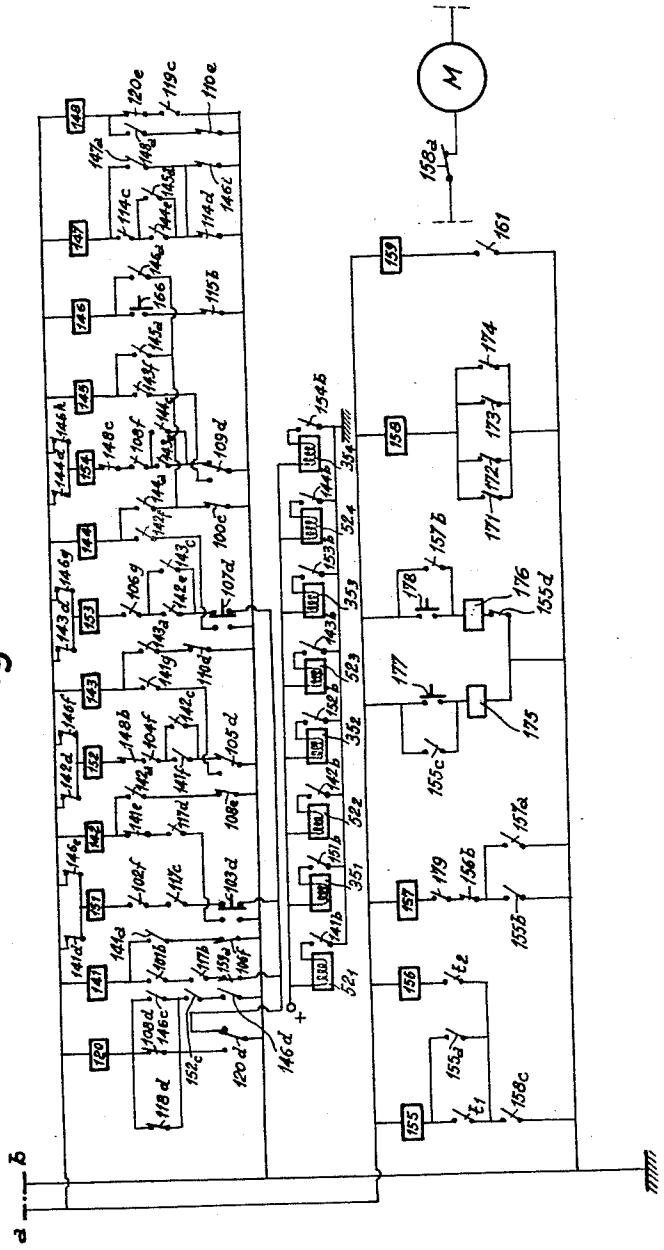

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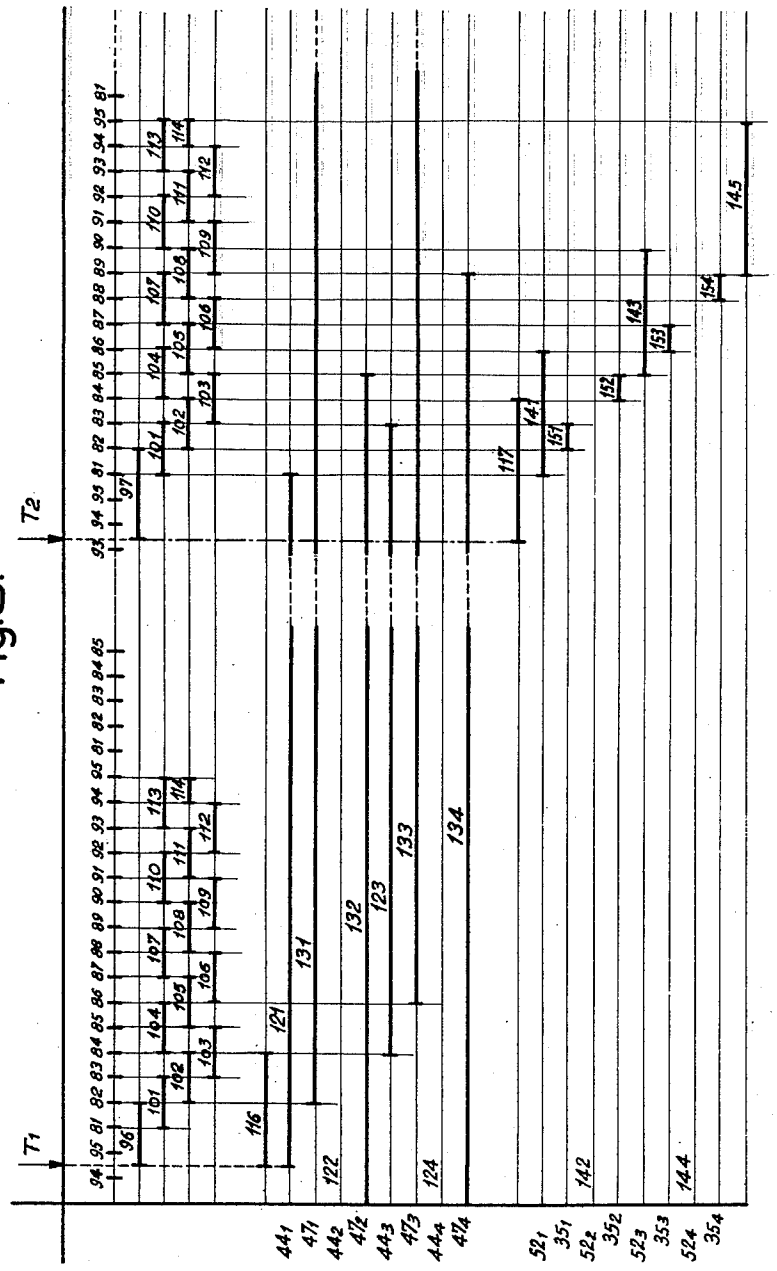
Fig.8.



United States Patent Office 3,139,025 Patented June 30, 1964

3,139,025

COUNTER CONTROLLED ROTARY PRINTER

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Filed Feb. 26, 1962, Ser. No. 175,726
Claims priority, application France Mar. 20, 1961
18 Claims. (Cl. 101—92)

The present invention relates to rotary printing machines adapted to print forms such as checks or sheets, wherein changes of wordings and/or of serial numbers are performed in comparatively small successive series.

An object of the invention is to provide a rotary printing machine enabling to proceed to the printing and numbering of the successive series without stopping the machine, nor interrupting the printing of the sheets.

According to the invention, the rotary printer for continuously printing series of checks and sheets, the wordings of which vary from one series to the other, comprises: two printing sets of one or several printing apparatus with variable wordings, each set being adapted to be alternatively operated; a counting device present for counting the number of sheets to be printed in each series; and a device, controlled by said counter, and operative, as soon as the number of sheets to be printed in a series is reached, to automatically shut off the apparatus for printing said series and put into service those apparatus which were preset for printing the succeeding series, the arrangement being such that no loss of paper will occur between two successive series.

According to one specific application of the present invention to the printing of numbered checks or sheets, the machine may comprise four printing apparatus, arranged successively in the path of the printed sheets. Two such printing apparatus, the first and the third, for instance, are used at the same time, one for printing the variable text of the wording, and the other the serial numbers of the series considered. While both apparatus are in a printing position, the two others, viz. the second and the fourth, are at rest, i.e. no pressure is being applied thereon and the cylinders of these apparatus are stopped, so as to enable the operator to manually position the text of the wordings and the adjustment of the numbering device, which will then be ready to serve for the printing of the next series. During these operations, the paper web continues to pass in the second and in the fourth apparatus at rest.

The invention will be best understood from the following description and appended drawings, of a preferred embodiment of the invention, given by way of non-limitative example; in the drawings:

FIGURE 1 is an elevational, partly sectional view of a printing machine according to the invention;

FIGURE 2 is an elevational, partly cross-sectional view of the printing apparatus in its operating position, i.e. with the cylinder in pressure relation with its counter cylinder;

FIGURE 3 is a cross-sectional, diagrammatic view of a printing apparatus in the operating position;

FIGURE 4 is a diagrammatic elevational, partly sectional view of a printing apparatus in an elementary disengagement position i.e. wherein the printing cylinder is upwardly shifted at a very small distance apart from the paper web;

FIGURE 5 is a diagrammatic elevational view, partly in cross-section, of the printing apparatus in its totally disengaged position;

FIGURE 6 is a diagrammatic cross-sectional view of a number printing apparatus, showing the control device of the weels of the number printers;

FIGURES 7A and 7B, connected along the line *a–b*, illustrate the electrical wiring diagram of the machine;

FIGURE 8 is a graphical illustration of the method of operation of the machine.

Referring to FIG. 1, the machine according to the invention comprises essentially, located after a stationary printing set (not illustrated), two variable entry printing apparatus **1** and **2** and two number printing apparatus **3** and **4**, through which successively passes a web of paper **5** from which is formed the desired checks and sheets.

Once printed and numbered, the paper web **5** traverses a rotary cutting device **6**, the cut-off sheets entering a receiver device **7**, after passing in front of a counter **8**. This counter, which may be of the electric or electronic type records the number of the checks or sheets printed with the serial numbers in each series. The counter **8** is preset for a given number of sheets to be produced in each one of the series.

As will be seen in more detail later in this description, with reference to the method of operation, the counter **8** causes signals to be transmitted on lines **T1** and **T2**, these lines being connected to an electrical control device generally designated by numeral reference **9**. The device **9**, in turn, actuates servo systems diagrammatically illustrated at **1***a*, **2***a*, **3***a*, **4***a*, associated with the printing apparatus **1**, **2**, **3**, **4**, respectively, causing therein the various successive operations to occur, enabling the units of the operating apparatus to be reversed.

A printing apparatus will now be described with reference to FIGS. 2 and 3. This apparatus is driven from a driving shaft **12**, which, in turn, is driven by a device to be ulteriorily described. The driving shaft **12** is interlocked with pinion **13** which drives a pinion **14** fixedly secured on a shaft **15** which supports, in shifting relation, the printing cylinder **18**. Pinion **13** also controls, through an intermediate pinion **16**, pinion **17** secured on shaft **11** of the counter cylinder **10** of the printing cylinder **18**. Since pinions **13**, **14** and **17** are identical to one another, the shafts **12**, **15** and **11** rotate at the same angular velocity and, consequently, the counter cylinder **10** is driven at the same peripheral speed as the printting cylinder **18**.

The printing apparatus is provided, at its upper portion, with a conventional printer's inking device, generally designated by numeral reference **19**. The ink is spread over an inking table **20** driven by driving shaft **12** and distributed over the printing cylinder **18** by the inking roller on inker **21**.

Shaft **15** of printing cylinder **18** is supported by two bearings located at the front and at the back of the apparatus, respectively, said bearings being adapted to move vertically in slots **23***a* provided in the supporting brackets **23**.

The vertical motion of bearings **22** and consequently of printing cylinder **18** is controlled by bearing levers **24**, **24***a* pivoted on axis **25** carried by brackets **23** and connected by a cross-bar **67**. Each bearing lever **24**, **24***a* has at one end an oblong slot **26** into which bears a pin **60** integral with bearing **22** with which it cooperates. At their other end, bearing levers **24**, **24***a* carry rollers **27**, **27***a* respectively, driven by eccentrics **28**, **28***a* secured on the same transversal shaft **36**. A pinion **31**, secured on said shaft **36**, is engaged with pinion **30** fixedly secured to a four-branch Maltese cross **29**.

The Maltese cross **29** may be rotated by a lever **32** blocked on shaft **33**, the other end of which carries a pinion **33***a* in engagement with an identical pinion **12***a* interlocked with driving shaft **12**, so that shaft **33**, and consequently lever **32**, may perform a complete revolution for each rotation movement of shaft **12**, i.e. for each revolution of the printing cylinder **18**.

Shaft 33 may be transversally slidable, so that a roller 34 secured on the end of lever 32 may or may not come within the range of the Maltese cross 29. This is achieved by a pressure-control electromagnet 35 actuating a bell-crank lever 35*a* pivotally mounted on bracket 23, one end of said lever 35*a* carrying a roller acommodated in a groove 33*b* formed in shaft 33.

This pressure-control electromagnet 35 is adapted to effect the engagement and disengagement of the printing cylinder 18 from its corresponding counter cylinder 10 and, when energized, causes shaft 33 to move towards the left in FIG. 3, thus bringing the roller 34 within range of the Maltese cross 29. At this moment, upon shaft 12 being driven as will be shown later in this description, one turn of lever 32 will bring the Maltese cross 29 to rotate through a quarter-turn, so that shaft 36, and consequently eccentrics 28, 28*a* will rotate through half a turn, the gear ratio of pinions 30 and 31 being equal to two. The eccentrics 28, 28*a* will then occupy the position shown in FIG. 4; their eccentricity is set in such a manner as to pivot the bearing levers 24, 24*a* through a predetermined angle and consequently to produce an elementary vertical movement of the printing cylinder 18 above the paper web, thus discontinuing the pressure the latter applies thereon, as is clearly shown in FIG. 4.

When the pressure-control electromagnet 35 is de-energized, shaft 33 is moved back to the right (FIG. 3) under the action of a retracting spring (not illustrated). Under these conditions, roller 34 of lever 32 moves clear of the Maltese cross and does not actuate it any more.

The energization of the pressure control electromagnet 35 is effected at a predetermined instant of the cycle, as will be seen later, at the time the pressure-applying engagement or disengagement of the printing cylinder 18 has to take place.

The extent of the elementary vertical movement corresponding to the engaging and disengaging of the cylinder has been selected very small on purpose, so as to avoid inertial and strain efforts on the machine rotating at a comparatively high speed.

The pressure setting of the printing cylinder 18 on its opposite counter-cylinder 10, is indicated in each apparatus by an electric pressure-check contact. These pressure-check contacts are shown at 161, 162, 163 and 164 in the electric wiring diagram (FIGS. 7A–7B).

In the number printing apparatus 3 and 4, shaft 36 which controls the engaging and disengaging of the printing cylinder 18, also carries an auxiliary eccentric 37 (FIG. 6) actuating a mechanism adapted to engage the control lever 70 of the wheels 71 of the numbering device carried by the cylinder 18. As will be seen in FIG. 6, the eccentric 37 normally pushes back into the operating position, as indicated in solid lines, a numbering control lever 38 pivoted on axis 40 against the action of a return spring 61. Lever 38 carries, at one end thereof, a roller 39 which, in the position marked in solid lines, causes control lever 70 to be pivoted and consequently a partial rotation of the wheels 71 of the numbering device.

It will be appreciated that when shaft 36 rotates through half a revolution, on release of printing cylinder 18, to take up the position shown in broken lines, the numbering control lever 38 will pivot about axis 40 in a clockwise direction, under the action of spring 61, and the roller 39 will occupy the position 39*a* wherein no action is exercised on control lever 70 actuating the wheels 71 of the numbering device, so that the latter will stop counting.

The control mechanism for putting into service a printing apparatus will now be described, with reference to FIG. 3. A main rotating shaft 41, which is rotated by a motor (not illustrated) controls via a helical pinion 42 a helical gear 43 which is mounted idly on driving shaft 12 of the printing apparatus. The helical gear 43 is integral with a claw 45 which rotates constantly therewith, while a counter claw 46 rotates integrally with shaft 12 and may slide on the latter. The connection and disconnection between the claw 45 and the counter-claw 46 are controlled by a coupling electromagnet 47 which causes the counter-claw to be slidable on the driving shaft 12 through bell crank 47*a* pivoted on bracket 62.

When the coupling electromagnet 47 is energized, it causes the counter-claw 46 to move to the right in FIG. 3 and the coupling with claw 45, while the de-energization of the electromagnet 47 causes said counter-claw 46, urged by a return spring, not illustrated, to slide to the left and, consequently, the de-coupling thereof.

The helical pinion 43, which is continuously rotated, is interlocked with a pinion 48 which, in turn, meshes with another pinion 49 which drives one of the discs of an electromagnetic friction coupling 44. The terminal pinion 50 of said friction coupling 44, which is integral with the other disc thereof, is in engagement with pinion 51 secured on shaft 12.

When the electromagnet of the friction coupling 44 is not energized, pinion 50 is not driven and the driving shaft 12 remains stationary.

On the contrary, when the electromagnet 44 is energized, the output pinion 50, and consequently the driving shaft 12, will both be gradually rotated.

The starting-up speed of the apparatus through the friction coupling 44 has been selected so as to be close to that of the machine (about 93%); thus, the coupling takes place with a minimum impact when the electromagnet 47 causes the counter-claw 46 to move to the right.

The relative speed between the claw 45 and its corresponding counter-claw 46 being, at the instant of the coupling operation equal to 0.07 N r.p.s., this coupling operation will require, under the most defavorable conditions, a time interval equal to $\frac{1}{0.07}$ N second. The coupling electromagnet 47 remains energized during the whole of the time of operation of the printing apparatus, whereas the friction coupling 44 is de-energized a certain time after the engagement of the pawls has taken place.

The printing apparatus comprises, on the other hand, a device adapted to bring about an additional vertical movement of the printing cylinder 18. This device comprises two worm wheels 53, 53*a* integral with the same shaft 63 manually driven by means of a wheel 63*a* or through a small, independent motor. In the case of a motor drive, the motor may be either manually actuated by the operator, or automatically during the transfer cycle.

To the levers 24, 24*a* are associated worm wheels 54, 54*a*, respectively, in engagement with the corresponding wheels 53, 53*a* said worm wheels being rotatively mounted on a cross-bar 64. Inside the wheels 54, 54*a* are screwed threaded spindles 65, 65*a* supported by springs 66, 66*a* on cross bar 67 connecting the levers 24, 24*a*. It is thus seen that the rotation of shaft 63 causes a corresponding rotation of the worm wheels 54 and, for a convenient direction of rotation, a downward translational movement of the threaded spindles 65 and consequently the pivoting, in a counter-clockwise direction in FIG. 5, of the levers 24, 24*a*. As clearly indicated in FIG. 5, the resulting amount of upward additional movement of the bearings 22 is sufficient to release the front bearing from its guides for readily disassembling the same.

The printing apparatus comprises, on the other hand, a safety table 55 adapted to be introduced by the operator in an operating position illustrated in FIG. 5 between the cylinder 18 and the corresponding counter-cylinder 10. Upon positioning said safety table 55 in its operating position, the latter, on actuating a stop 68, will release the same and enable the front bearing to be dismounted, this dismounting operation being impossible unless the safety table 55 has been first placed in the operating position.

On the other hand, the positioning of the safety table in the operating position 55 causes, in each apparatus, a

safety contact to be actuated, these contacts being indicated by the reference numerals 171, 172, 173 and 174 in the wiring diagram in FIG. 7B. This safety contact prevents subsequently the resetting into operation of the printing apparatus if the operations, by manual change, required for printing the next series, are not finished at the desired moment and if, in particular, the table has not been set in the non-operating position occupied thereby in FIGS. 2 and 4.

The raising of the bearings in the position indicated in FIG. 5 also causes the spacing apart of the inker 21 from the printing cylinder 18. In effect, on the mobile end of lever 24 is pivotally mounted a bell-crank lever arm 56 about an axis 56*a* carried by bracket 23. Pivotally mounted on lever 56 is a link 57 provided at its end with an oblong recess 57*a* the bottom of which bears, at a given instant, on a pin 58*a* integral with inker lever 58 pivotally mounted on axis 58*b* carried by bracket 23. Inker levers 58 support the inker 21.

Under these conditions, and upon a further pivotal movement of levers 24, 24*a* (FIG. 5), the rotation of bell-crank lever 56 will cause lever 57 to be pressed down and, consequently, inker lever 58 to pivot in a clockwise direction and inker 21 to be spaced apart from cylinder 18. Said inker 21 is maintained in spaced relation from the printing cylinder 18 by means of a holding lever 59 pivotally mounted in 59*a* on bracket 23 and urged by a spring (not shown). Said lever 59 is controlled by means of an inker control electromagnet 52. The holding lever 59 prevents inker 21 to re-engage the cylinder 18 when pressing the latter again into contact with its counter cylinder 10. This arrangement enables the starting up of the printing apparatus through the friction coupling 44, without bringing the inking operation in action.

Just before effecting the pressing into contact of these cylinders for the final operation, the inker control electromagnet 52 is energized, as will be seen later in this description, and releases the holding lever 59, so that inker 21 is positioned in the operating state, i.e. in engagement with the inking table 20 and the printing cylinder 18.

The operation of the machine according to the invention will now be described, with reference to the electric wiring diagram illustrated in FIGS. 7A and 7B and to the graphic of FIG. 8.

It will be assumed that the machine is initially set to continuously print a series of 6000 check forms for instance, by means of the printing apparatus 2 and 4. The printing apparatus 2 prints the variable wording, whereas the printing apparatus 4 prints the serial numbers on the checks, in the order required. The printed paper band is then cut off in the rotary cutting device 6 and the checks obtained are counted by counter 8. This counter, which may be of the electric or electronic type, is pre-set for the number of the checks to be prepared in a given series, i.e. in the example illustrated, for the number 6000. A little before the end of the series printing, i.e. after the counter has recorded, for instance, the passage of 5850 checks (which corresponds, for a total time of preparing the given series equal to 12 minutes, to about 20 seconds before the end of the operation), the counter will transmit a first signal which is transmited through line T1 (FIG. 1) to the electric control device 9, in order to initiate the first operations of the transfer cycle. Then, and as soon as the counter 8 has recorded the passage of the total amount of 6000 checks, the counter 8 will transmit through the line T2 a second signal which is also applied to said electric control device 9, in order to terminate the operations for the transfer cycle.

The control device 9 comprises essentially (FIG. 7A) an electric distribution chain which produces pulses in synchronism with the paper feed and which is controlled by a cyclic rotary distributing device D, which performs one complete revolution for each rotation of the printing cylinder 18. In the example illustrated, the rotary distributor controls the closing of timing contacts 81 through 95, in the order illustrated at the upper portion of the graph represented in FIG. 8.

The succeeding timing contacts of the distributor D should be adjusted in such a manner that, if the closing of timing contact 82 corresponds to the passage of a paper sheet in the printing apparatus 1, that of timing contact 84 will correspond to the passage of this sheet in the apparatus 2, that of timing contact 86 to the passage in apparatus 3, that of timing conact 88 to the passage in apparatus 4, and finally, that of timing contact 94 to the passage in the counter 8.

To the timing contacts 81, 82 . . . 94 of the rotary distributor D are associated timing relays 101, 102 . . . 114, respectively. These timing relays constitute a chain and their contacts play various parts during the transfer cycle, during which one of the printing sets is brought out of service while the other set is put into operation.

The starting of a transfer cycle is initiated by energizing one of starting relays 96 and 97. Relay 96 is energized by closing of one of the operating contacts T1 and 118*b*. The closing of contact T1 corresponds to the transmission of the first electric signal T1 by counter 8.

Similarly, the second starting relay 97 may be energized in consequence of the closing of one of the operating contacts T2, 119*b* and 148*b*, connected in parallel. Contacts 118*b*, 146*b*, 119*b*, as well as the other contacts which will be described further below, are part of the corresponding relays 118, 146, 119, etc., the various functions of which will be explained later in this description.

The starting relays 96 and 97 are maintained in energized condition through their respective normally open contacts 96*a* and 97*a*, connected in series with the normally closed contact 102*b* of relay 102. Consequently, relays 96 and 97 when energized remain in this state until the energization of the second relay 102 of the relay chain controlled by the rotary distributor is effected. Relays 98 and 99 connected in series with the normally open contacts 96*b* and 97*b*, respectively, are adapted to isolate relays 96 and 97 against any long-term action of starting contacts such as 118*b*, T1, 146*b*, 119*b* and T2. To this end, relays 98 and 99 control the normally closed contacts 98*a* and 99*a*, respectively, located in the excitation circuits of the relays 96 and 97.

If it is now assumed that the counter 8 has recorded the passage of a sufficient number of printed checks (i.e. 5850 in the example illustrated), it will transmit the first signal T1 resulting in the closing of contact T1. This brings about the excitation of starting relay 96 and, consequently, the closing of the normally open contact 96*c* which is connected in series with the timing contact 81 in the energizing circuit of the first timing relay 101 of the distribution chain. Upon the rotary distributor closing contact 81 (FIG. 8), timing relay 101 is therefore energized and maintained in this state by means of its normally open contact 101*a* and the normally closed contact 103*c*.

Similarly, when starting relay 97 is energized by closing contact T2, it will control the closing of the normally open contact 97*c* and thus prepare the excitation of the timing relay 101 when contact 81 closes.

The first timing relay 101 is maintined energized until the third stage of the distribution wherein the energizing of the third timing relay 103 takes place, upon closing contact 83, which thus causes the opening of the normally closed contact 103*c*.

The energizing of the first timing relay 101 causes the closing of the normally open contact 101b connected in the excitation circuit of the second timing relay 102, in series with the contact 82 of the rotary distributor. Consequently, when the latter closes timing contact 82 in the second stage of the distribution, the second timing relay 102 is energized and maintained in this state by its normally open contact 102*a* and the normally closed contact 104*c*. The second timing relay 102 is thus maintained

excited until the fourth timing relay **104** is energized, in the fourth stage.

The same process is repeated and the successive timing relays **101**, **102** . . . **114** are energized one after the other upon the closing of the corresponding timing contacts **81**, **82** . . . **94** and are maintained energized during two steps or stages of the electric distribution, this step or stage being defined by the interval of time separating the excitation of two successive timing relays of the chain.

At the end of a cycle, the closing of the last timing contact **95** of the distributor D causes the energizing of the last timing relay **100**, since the normally open contact **114b** is closed (relay **114** energized). The opening of the normally closed contact **100***b* causes then the de-energization of the timing relay **113** and, consequently, the opening of the normally open contact **113***b* and the de-energization of the timing relay **114**. All the timing relays of the distribution chain will thus have returned in the OFF position and the distributor is now ready for another cycle.

The starting up of the printing apparatus takes place under the control of the starting up relays **121**, **122**, **123**, **124** associated with the apparatus **1**, **2**, **3** and **4**, respectively, whereas the coupling of the same apparatus is effected under the control of coupling relays **131**, **132**, **133** and **134**, also associated, in the same order, to the apparatus **1**, **2**, **3**, **4**.

The starting relays **96** and **97** are followed up by relays **116** and **117**, in the energizing circuits of which are connected the normally open contacts **96***d* and **97***d*. The relays **116** and **117** are maintained energized by their normally open contacts **116***a* and **117***a* connected in series with the normally closed contact **104***d* of the fourth timing relay **104**. The relays **116** and **117** remain thus energized until the fourth timing relay **104** is energized, i.e. in the fourth stage of the distribution (FIG. 8).

The first signal T1 transmitted by counter **8**, which physically corresponds to the closing of contact T1, takes place a sufficient time before the counting finishes, in order that the various starting-up and coupling operations may be carried out before the automatic change of the apparatus. It has been assumed that, initially, the printing apparatus **2** and **4** were in operation, while the printing apparatus **1** and **3** were at rest. This results in the fact, as will be seen later, that the coupling relays **132** and **134** associated to the coupling electromagnets 47_2 and 47_4 of the apparatus **2** and **4** are energized, whereas the coupling relays **131** and **133**, associated to coupling electromagnets 47_1 and 47_3 of the apparatus **1** and **3** are not energized.

The starting up relay **121** which controls the starting up of the printing apparatus **1** is connected in series with the normally open contact **116***b*, the normally closed contact **131***c* and the normally closed contact **120***b*. Consequently, the exictation of relay **116** causes the closing of normally open contact **116***b* and the excitation of starting up relay **121**. The relay **121** is maintained energized by its normally open contact **121***a* and the normally closed contact **141***c*. Thus, the relay **121** will be maintained in the energized state until the inker control relay **141** is getting energized, as it will be seen later. Relay **121** controls a normally open contact **121***b* connected in the energizing circuit of the friction coupling electromagnet 44_1 of apparatus **1**, so that, upon the relay **121** being energized, this friction coupling will get started and the driving shaft **12** of the printing apparatus **1** is getting gradually rotated by the main rotating shaft **42** (FIG. 3).

Consequently, on the occurrence of the first signal T1 transmitted by counter **8**, the printing apparatus **1** is started up.

On the other hand, the excitation of relay **121** causes the transfer of contact **121***c* which is connected at rest in the energization circuit of starting up relay **122** to the operating position, said contact being thus connected in series in the excitation circuit of coupling relay **131** with the normally open contact **102***c* of the timing relay **102**. Consequently, at the second step of distribution, the closing of contact **102***c* causes coupling relay **131** to be energized and remain energized through its normally open contact **131***a* and the normally closed contact **142***c* of the inker control relay **142**. The coupling relay **131** controls the closing of a normally open contact **131***b* connected in the energization circuit of the coupling electromagnet 47_1 of the printing apparatus **1**, so that, at the second step, the coupling between the claw **45** and the counter-claw **46** will take place (FIG. 3).

On account of the starting up relay **121** being energized, the starting up relay **122** cannot be energized at the closing of contact **102***d* in the second step, since contact **121***c* is transferred in the operating position. Similarly, the coupling relay **132** cannot either be energized at the closing of contact **104***e* since contact **122***c* is opened. On the other hand, upon excitation of timing relay **104**, i.e. in the fourth step, the closing of the normally open contact **104***f* causes, since the normally open contact **121***d* is closed, the excitation of the starting up relay **123** associated with the printing apparatus **3**. The starting up relay **123** is maintained energized by its normally open contact **123***a* and the normally closed contact **143***c*. At the fourth step of the cycle, the closing of contact **104***f* will thus cause, on account of the closing of contact **123***b*, the energization of the friction coupling electromagnet 44_3 and consequently the starting up of the printing apparatus **3**.

The energization of relay **123** causes the closing of normally open contact **123***c*, which is connected in series with the normally open contact **106***d* and the coupling relay **133**. Consequently, at the sixth step of the cycle, the closing of contact **106***d* causes the energization of coupling relay **133** and, consequently, through the closing of the normally open contact **133***b*, the energization of the coupling electromagnet 47_3 of the printing apparatus **3**. It is therefore apparent that the printing apparatus **3** is started up and coupled four steps after the printing apparatus **1**.

Since the starting up relay **122** is not energized, the normally open contact **122***d* is open and the starting up relay **124** will not be energized at the sixth step, on closing of contact **106***e*.

A reverse process takes place when the printing apparatus **1** and **3** are in operation and must be put out of service, to be replaced by the printing apparatus **2** and **4**. In this case, the starting up relay **121** is not energized on closing contact **116***b*, since the normally closed contact **131***c* is then open (the coupling relay **131** being energized). On the other hand, the starting up relay **122** is energized in the second step (the contacts **102***d*, **116***c* being closed and contact **121***c* in the resting position) and then the starting up relay **124** in the sixth step of the cycle (contacts **122***d* and **106***e* being closed). It follows that, the printing apparatus **2** being started at the second step upon closing of contact **122***b* and coupled by closing of contact **132***b* in the fourth step, whereas the printing apparatus **4** is started in the sixth step (closing of contact **124***b*) and coupled in the eighth step (closing of contact **134***b*).

The method for bringing the printing cylinder **18** in and out of engagement with the various printing apparatus will now be described, these engagement and disengagement operations being controlled by pressure control relays **151**, **152**, **153** and **154** (FIG. 7B) associated with the apparatus **1** through **4**, as well as the release method of the inkers **21** which are controlled, in these apparatus, by inker control relays **141**, **142**, **143** and **144** respectively.

The engaging and disengaging operation of the printing cylinders **18** is started by the second signal T_2 transmitted by counter **8**. This second signal, which occurs as soon as the counter has recorded the passage of a number of checks equal to that of the series (6000 in the

example illustrated) causes the energization of the starting relay 97 on account of the closing of contact T2, the relay 97 being maintained energized by its normally open contact 97*a* and the normally closed contact 102*b*. The relay 97 being energized induces the closing of contact 97*d* which is connected in series with the relay 117. The latter is being energized and is maintained so by its contact normally open 117*a* and the normally closed contact 104*d*. It is assumed, as previously mentioned, that the printing apparatus 2 and 4 are in operation while the apparatus 1 and 3 are in the rest position, with no pressure applied thereon. Said apparatus, however, have been previously started-up and coupled when the signal T1 was transmitted.

Apparatus 1 being at rest, i.e. with no pressure applied, its pressure check contact 161 controlled by the position of the printing cylinder 18 is open. It follows that relay 159 is not energized when the apparatus 1 is not engaged and the normally closed contact 159*a* is consequently closed. Since contact 117*b* is closed up to the third step inclusively, the closing of contact 101*b* in the first step causes the inker control relay 141 to be excited. This relay 141 is maintained excited by its normally open contact 141*a* and the normally closed contact 106*f*. The resulting closing of the normally open contact 141*b* causes the energization of the inker-control electromagnet 52_1 which controls the release of inker 21 (FIG. 2) of the printing apparatus 1. Consequently, the inker 21 will now begin the inking operation in the first printing apparatus 1.

The pressure control relay 151 which controls the engagement and disengagement of the printing apparatus 1 for the application and removal of the pressure, is energized in the second step upon closing of the normally open contact 102*f*, since the normally open contact 117*c* is closed and contact 103*d* is in the rest position. The excitation of relay 151 lasts only the time corresponding to the second step since, in the third step, the switching of contact 103*d* to the operating position causes this excitation to be turned off. The energization of relay 151 causes the closing of its normally open contact 151*b* and consequently the energization of the pressure control electromagnet 35_1 which controls (FIG. 3) the sliding towards the left of shaft 33 and lever 32, and, consequently, the rotation through 90° of the Maltese cross 29. The duration of the energization of relay 151 which is equal to one step of a cycle is sufficient to assure the operation of the Maltese cross servo-mechanism. The rotation of the eccentrics 28, 28*a* causes then, as mentioned hereinabove, the pressure applying engagement of the printing cylinder 18 with its corresponding counter cylinder 10 in the printing apparatus 1.

Relay 141 being now energized up to the fifth step, included, the normally closed contact 141*e* is opened during this time interval and therefore the inker control relay 142 is not energized during the switching of the contact 103*d* at the third step. On the contrary, in the fourth step, the pressure control relay 152 is energized upon closing of the normally open contact 104*f* since the normally open contact 141*f* is closed and contact 105*d* is in the rest position. The energization of relay 152 then causes the closing of the normally open contact 152*b* and the energizing of the pressure control electromagnet 35_2 of the printing apparatus 2, resulting in pivoting the Maltese cross through a quarter-turn. This causes the printing cylinder 18 to be disengaged from its counter cylinder 10 in the printing apparatus 2 since these two cylinders were previously in engaged relationship.

In the fifth step of the cycle, the normally open contact 141*g* being closed, the switching of the contact 105*d* to its operating position will cause the energization of the inker control relay 143 which is maintained so by its normally open contact 143*a* and the normally closed contact 110*d*. The excitation of relay 143 causes the closing of the normally open contact 143*b* and thus the excitation of the inker control electromagnet 52_3 which controls the release of the inker 21 in the printing apparatus 3.

The same process as above is repeated, viz. at the sixth step the pressure control relay 153 is energized on account of the closing of the normally open contacts 106*g* and 143*c* and causes the energization of the pressure control electromagnet 35_3 associated with the printing apparatus 3, this resulting in a quarter-turn pivotal movement of the Maltese cross 29 of this apparatus and, consequently, in the pressure applying engagement of the printing cylinder 18.

In the eighth step of the cycle, the closing of the normally open contact 108*f* causes the energization of the pressure control relay 154 (contact normally open 143*e* closed) and consequently the closing of the normally open contact 154*b*, the subsequent excitation of the pressure control electromagnet 35_4 thus enabling the disengagement from pressure of the printing apparatus 4.

It is thus apparent from the above description that the following operations are proceeding: release and inking of inker 21 of the printing apparatus 1 (steps 1 to 5 inclusive), engagement of the printing cylinder 18 of the printing apparatus 1 (step 2), disengagement of the printing cylinder 18 of the printing apparatus 2 (step 4), release and inking of inker 21 of the printing apparatus 3 (steps 5 to 9), pressure applying engagement of printing cylinder 18 of printing apparatus 3 (step 6), disengagement from pressure of printing cylinder 18 of printing apparatus 4 (step 8).

The printing apparatus 1 and 3 are thus successively inked and pressure engaged, while the printing apparatus 2 and 4 are disengaged. It is obvious that if the printing apparatus 1 and 3 were initially in operation, the process would be reversed, the printing apparatus 2 and 4 being successively inked and pressure engaged and the printing apparatus 1 and 3 being released.

It is to be noted that the energization of relays 141 and 143, in the first and the fifth steps respectively, causes by opening contacts 141*c* and 143*c* the switching off of the excitation of relays 121 and 123 controlling the friction coupling electromagnets 44_1 and 44_3 previously energized when the printing apparatus 1 and 3 were started.

The method of disengaging the printing apparatus which were previously in operation, i.e. the apparatus 2 and 4 in the example illustrated, will now be described. These apparatus must be disengaged at the end of each printing operation of a series of checks, in order to enable the replacement of the engraving and the resetting of the numbering devices.

Since the printing apparatus 2 and 4 are assumed to be initially engaged, the coupling relays 132 and 134 thereof are energized during the total continuous printing of the checks of the previous series. Relay 132 is maintained energized by its normally open contact 132*a* and the normally closed contact 143*c*, whereas relay 134 is maintained energized by its normally open contact 134*a* and normally closed contact 145*a*. It was previously mentioned that, in relation with the transfer cycle, the disengagement of the printing apparatus 2 takes place in the fourth step, so that this disengagement is ended when the sixth step starts when relay 143, which releases inker 21 of the printing apparatus 3, is energized. Consequently, in the sixth step, the energization of relay 143 causes the opening of contact 143*c* and consequently the switching off of the excitation of relay 132. Contact 132*b* will then open and the coupling electromagnet 47_2 ceases to be energized, causing the disengagement of the printing apparatus 2.

Similarly, the disengagement of the printing apparatus 4 takes place in the eighth step so that this disengaging action is finished when relay 145 is energized from the ninth step. The energization of relay 145 causes the opening of contact 145*c*, the switching off of the excitation of relay 134 and that, subsequently, of the coupling electromag-

net 47_4, resulting in the disengagement of the printing apparatus 4.

The starting up operation of the machine according to the invention will now be described in more detail. Referring to FIG. 7B, it is seen that the supply of motor M, which drives all the printing apparatus of the machine through the main rotating shaft 42, is controlled by the contact 158*a* of relay 158. The relay 158 is a safety relay in the excitation circuit of which are connected in parallel the contacts 171, 172, 173 and 174. These contacts are controlled by the various safety tables 55 (FIG. 2) of the printing apparatus, in such a manner that, as long as such a safety table 55 is engaged between the printing cylinder 18 and its counter cylinder 10, the corresponding contact is closed, causing the relay 158 to be energized and contact 158*a* to be opened. It is therefore impossible to start the machine so long as one of the contacts 171–174 is closed, i.e. so long as a safety table 55 is in an operating position.

It has been seen, from the above description, that the engaging and disengaging mechanisms of the printing cylinders 18 of the various apparatus control various pressure check contacts 161, 162, 163 and 164. Contact 161 associated with the printing apparatus 1 is open when the pressure is shifted from this apparatus. It is connected in the excitation circuit of relay 159, the normally closed contact 159*b* of which is connected in the excitation circuit of relay 118.

The pressure check contacts 162, 163 and 164 associated with the printing apparatus 2, 3 and 4, respectively, are normally closed when the pressure is released from the corresponding apparatus.

It is assumed that, at the instant of starting of the machine, the various printing apparatus are in operating order, i.e. the pressure is relieved from these apparatus and consequently contacts 159*b*, 162, 163 and 164 are closed. On the other hand, the contact 158*b* of the safety relay is assumed to be equally closed. Consequently, if the starting button is actuated at 165, relay 118 is energized and maintained so by its normally open contact 118*a* and normally closed contact 102*g* and normally open contact 119*d*, connected in parallel.

Relay 118 starts up the electric distribution chain by its contact 118*b* connected in the excitation circuit of the starting relay 96, shunted over contact T1. Relay 118 thus plays the part of counter 8 which is then stopped, and replaces the first signal T1 transmitted during the operation by the latter.

The energization of relay 118 causes moreover the closing of operating contact 118*c* and consequently the energization of relay 119 which is a time-lag relay, the switching on delay of which is set in such a manner that it equals the time which normally separates two signals T_1 and T_2 transmitted by counter 8. Consequently, the energization of relay 119, after a certain delay, corresponds to the transmission of the signal T_2 for the starting up of the electric chain distribution.

Since at the starting of the machine the relay 131 is necessarily in the rest position (printing apparatus 1 being disengaged), the actuation of starting button 165 will cause the excitation of relay 121 through relays 118, 96 and 116. The set of relays at the lower side of FIG. 7A will then operate, as previously described, so that the printing apparatus 1 and 3 are successively started and coupled up whereas the printing apparatus 2 and 4 are at rest.

When time-lag relay 119 is energized, after an interval of time corresponding to the interval between the signals T_1 and T_2 of the counter, it will cause—through closing of contact 119*b*—the energization of relay 97 as well as that of relay 117. The set of relays controlling the release of the inkers and the pressure applying engagement and disengagement illustrated in the upper portion of FIG. 7B will then start operating. The operation is as previously shown except that relays 152 and 154 are not energized on account of the opening of contacts 149*b* and 148*c* due to the excitation of relay 148 (closing of contact 119*c*); relay 148 is indeed maintained energized by its operating contact 148*a*, up to the tenth step, when contact 110*e* will then open.

The printing apparatus 1 and 3 are therefore inked and engaged for pressure application whereas the printing apparatus 2 and 4 remain at rest.

At the fourteenth step, the energization of relay 114 causes the closing of contact 114*c*, the latter being connected in the energizing circuit of relay 147. This relay is then energized and maintained so by its normally open contact 147*a* and the normally closed contact 146*i*. Relay 147 controls the closing of the circuit of counter 8 and causes also the starting up of the mechanical counting at the receiver side. The normally closed contacts 114*d* and 146*i* being connected in parallel in the retaining circuit of relay 147, it is necessary that the relays 114 and 146 be simultaneously energized in order for the relay 147 to switch into rest position, in which position it will cancel the counting.

A specific application of the machine will now be described in relation with the production of blank checks, i.e. without numbers, nor printing of a variable entry.

This operation may be initiated at any desired moment outside the automatic changes of apparatus. To this end, the stop button 166 is depressed, thus causing relay 146 to be energized. Relay 146 will initiate the starting up of the electric distribution chain, substituting the transmission of signal T2 of the counter. In effect, it controls the closing of contact 146*b* which is shunted over contact T2 connected in the excitation circuit of relay 97.

In order that the operation of producing blank checks should take place correctly, the following requirements must be satisfied:

(1) Disengaging of the operating apparatus and their de-coupling.

(2) The apparatus must not be re-engaged in the meantime.

(3) Recording on a storage device those of the apparatus which are operating, in order that the running series is continued to be produced on the same apparatus after the manufacture of the blank checks.

(4) Stopping of the counting.

The pressure release on the operating apparatus is effected in the following way: relay 146 which is energized by depressing the button 166 will remain energized on account of its normally open contact 146*a* and normally closed contact 100*c* until relay 100 is energized, i.e. until the end of the operation of the electric distribution chain. As in the previous cases, it is assumed that the machine operates with the printing apparatus 2 and 4, the apparatus 1 and 3 remaining at rest and, consequently, the contact 159*a* closed.

The excitation of relay 146 causes the excitation of relays 97 and 117, so that the relays 141, 143 and 145 are successively energized. On the other hand, as the relays 141 and 146 are simultaneously energized, that is contacts 141*d* and 146*c* are opened, relay 151 cannot be energized and neither can, for that matter, the relay 153 (contacts 143*d* and 146*g* open). The printing apparatus 1 and 3 are therefore not pressure engaged and remain thus at rest. As to the relays 152 and 154, they function normally and cause the disengagement of the printing apparatus 2 and 4. The excitation of relays 143 and 145 cuts off the supply of the friction coupling electromagnets 47_2 and 47_4 after the disengaging of the printing apparatus 2 and 4.

The recording of the apparatus which were functioning is effected as follows: relay 146 being energized, the normally open contacts 146*c* and 146*d* are closed so that when relay 152 which controls the engagement and disengagement of the printing apparatus 2 is energized, the closing of contact 152*c* causes the storage relay 120 to be energized.

On the other hand, if the initially pressure engaged apparatus were the printing apparatus **1** and **3**, relay **152** would not have been energized (contacts **142***f* and **146***f* open) and consequently the storage relay **120** would not be energized. It is thus apparent that according as the apparatus **2** and **4**, or **1** and **3**, are in operation, the storage relay **120** will be or will not be energized.

In the case of the printing apparatus **2** and **4** being in operation, the relay **120** is maintained energized by its contact **120***d* switched into its operating position, and the two normally closed contacts connected in parallel **118***d* and **108***d*. The excitation of relay **120** is thus maintained up to the eighth step which follows the excitation of relay **118**, i.e. after starting up again the automatic operation, after the manufacture of the blank checks.

This re-starting up for the automatic operation of the normal printing of the checks is effected as follows: if relay **120** is energized, the engagement of the apparatus **1** and **3** must be prevented, while the pressure engagement of the printing apparatus **2** and **4** is initiated. To this end, the normally closed contact **120***b* of relay **120** connected in the excitation circuit of relay **121** prevents this latter relay to be energized, thus avoiding the starting up of the printing apparatus **1**. Consequently, it will prevent the subsequent energization of relays **141**, **151** and **153** which control the inker **21** and the pressure applying engagement of the apparatus **1** and **3** respectively.

Since, on the other hand, it is necessary to permit the pressure applying engagement of the apparatus **2** and **4**, relay **120** will break off, through its contact **120***e*, the excitation circuit of relay **148** so that relays **152** and **154** may henceforth be energized while contacts **148***b* and **148***c* are closed.

In the event relay **120** is not energized, the operation goes on as in a normal starting up.

The counting stopping is effected when the control of the blank check production is initiated, at the instant of energizing the relay **114** of the electric distribution chain, provided the relay **146** is energized. Indeed, since in this case contact **146***i* is open, the opening at the fourteenth step of contact **114***d* will cause the excitation of the counter relay **147** to be cut off.

The production of blank checks is in no case to be effected during the automatic change of the apparatus.

It is possible to provide a safety device for preventing the starting of a production cycle of blank checks during said period. This device may be as indicated in FIG. 7A and comprise a relay **115** which may be energized by a signal t_0 transmitted by the counter. Relay **115** once energized is maintained so by its contact **115***a* and a normally closed contact t_3 controlled by a second signal from the counter. A signal lamp **168** will then indicate to the operator, when lighted, that it is useless to depress the button **166** corresponding to the production of blank checks. On the other hand, the normally closed contact **115***b* connected in the excitation circuit of relay **146** will prevent any excitation of the latter to occur, so that it will be impossible to stop the machine.

The machine according to the invention also comprises a safety device which steps in when there is some delay in preparing the apparatus. The principle of this device is as follows: two minutes, approximately, before the termination of the counting, the counter **8** will deliver a signal t_1. If at this moment the operator has not yet finished with the preparation of the waiting apparatus, the machine will slow down up to its minimum speed, resulting in multiplying the two minutes left by the ratio existing between the maximum and minimum speeds. Two minutes before the end of the counting at the minimum speed, the counter **8** will deliver a second signal t_2. If at this moment the operator has still not finished with the preparation work, the machine will stop.

On the other hand, if the operator is able to finish before the occurrence of the second signal, the machine will automatically resume its maximum speed. Otherwise, the operator must start and accelerate himself the machine. In both cases, the counting goes on and it will then be necessary to replace the wasted paper during the slowing down or the starting up.

It is assumed that the transmission of the first and the second signals by counter **8** results in the closing of the contacts t_1 and t_2 connected in the excitation circuits of relays **155** and **156**, respectively (FIG. 7B). If the operator has not finished with the preparation of one of the waiting apparatus, one of the contacts **171–174** is closed and, consequently, relay **158** is energized. Contact **158***c* is then closed and the closing of the contact t_1 which corresponds to the transmission of the first signal by counter **8** causes the relay **155** to be energized, this relay being maintained so by its contact **155***a* until—safety being assured—the relay **158** is de-energized and the contact **158***c* opens.

The excitation of relay **155** causes the opening of contact **155***d* which is connected in the excitation circuit of relay **176** corresponding to the switching on of the maximum speed of motor M. On the other hand, the closing of contact **155***c* connected in parallel with contact **177** which controls the switching on of the minimum speed of the motor, causes the minimum speed relay **175** to be energized. Consequently, the machine will slow down automatically.

On the other hand, since the operating contact **155***b* is closed, as soon as contact **179** closes, which occurs during the end of the slowing down stroke, the relay **157** is energized. This relay **157** is maintained energized by its operating contact **157***a* and controls the closing of the normally open contact **157***b* shunted on the contact **178** which controls the switching on of the maximum speed. In consequence thereof, as soon as the relay is de-energized, i.e. as soon as the safety relay **158** is reset in its rest position, the relay **176** is again energized on account of the closing of the contacts **157***b* and **155***d* and, consequently, the motor will be accelerated until reaching its maximum speed.

If the safety relay **156** is still energized at the transmission of the second signal t_2 from the counter **8**, the relay **156** is energized through the closed contact **158***c*; the excitation of relay **156** will then cause the breaking of a contactor of motor M.

On the other hand, the excitation of relay **158** causes—on account of the opening of contact **158***a*—the switching off of the continuous and step-by-step operating circuit, thus preventing the starting of the machine as long as the desired safety requirements are not satisfied.

What I claim is:

1. A rotary printer, adapted to continuously print on the same web of paper or like material series of checks and sheets, the wording of which varies from one series to another, comprising a first and a second printing sets, successively located on the path of the web each printing set including at least one variable wording printing apparatus, said first and second printing sets being adapted to be alternatively operated for respectively printing first and second predetermined series of sheets, a counter device preset for the number of sheets to be printed in each series, and means controlled by said counter for automatically causing the first printing set which is active for printing said first series to be put out of operation as soon as the number of sheets to be printed is reached in the first predetermined series, and the second printing set which has been previously adjusted for printing the second series to be put in operation with no loss of paper between said first and second successive series.

2. A printer according to claim 1, in which each printing apparatus comprises a framework, bearing levers pivotally mounted on said framework, vertically movable bearings carried by said bearing levers, a shiftable printing cylinder and a corresponding counter cylinder, the printing cylinder being carried by said movable bear-

ings and being movable relating to said counter cylinder, and means for causing said bearing levers to pivot along a predetermined angle corresponding to an elementary movement of the printing cylinder enough for determining a pressure applying engagement or disengagement thereof.

3. A printer according to claim 2, comprising a pressure check contact associated with each printing cylinder and which indicates the position of the printing cylinder of the apparatus with which it is associated.

4. A printer according to claim 2 in which said means for causing said bearing levers to pivot comprises a first shaft, eccentrics carried by said first shaft and actuating said bearing levers, a pressure control electromagnet, means for energizing said pressure control electromagnet, and means for driving, when said pressure control electromagnet is energized, through half a turn said first shaft so as to move said bearing levers in one direction or the other and to provide either the pressure applying engagement or the disengagement of the printing cylinder.

5. A printer according to claim 4, comprising a second shaft slidably mounted on said framework and controlled by said pressure control electromagnet, a driving shaft rotatably driving said second shaft, a first lever secured on said second shaft, a roller on said first lever, a Maltese cross device, a transmission device between said Maltese cross device and first shaft, said transmission device having a gear ratio of two, said roller carried by said first lever moving past said Maltese cross device so that, when the pressure control electromagnet is energized, the roller of said first lever moves within the range of the Maltese cross and causes the latter to rotate a quarter-turn, the first shaft performing consequently a half-turn due to the gear ratio of the said transmission device.

6. A printer according to claim 4, comprising, in a number printing apparatus, a numbering device having at least one printing wheel and a control lever for causing a partial rotation of said wheel, said numbering device being carried by said printing cylinder, means for actuating said control lever at each revolution of said printing cylinder, and means controlled by said first shaft in order to put said control lever of said numbering device into or out of operation through said last-named means.

7. A printer according to claim 6, comprising an auxiliary eccentric carried by said first shaft, a numbering control lever pivotally mounted on said framework and actuated by said auxiliary eccentric, and a roller carried by said numbering control lever, said roller being selectively located in the path of the control lever of the wheel of the numbering device according to the position of the auxiliary eccentric so that the numbering is or not effected.

8. Printer according to claim 2, comprising a main rotating shaft, a driving shaft for rotatably driving said printing cylinder and its counter cylinder, electromagnetic coupling means between said main rotating shaft and said driving shaft for progressively starting up said printing cylinder and its counter cylinder, and electromagnetically controlled claw-coupling means between said main rotating shaft and said driving shaft.

9. A printer according to claim 2, comprising a third transverse rotatable shaft, a spindle adapted to pivot one of the bearing levers and means for converting the motion of said third shaft to a linear displacement of said spindle in order to cause said bearings to effect an additional vertical movement enabling the printing cylinder to be released.

10. A printer according to claim 9, comprising an inking table, an inker adapted to be engaged, on one hand, with said inking table and, on the other hand, with the printing cylinder, inker levers pivotally mounted on said framework and carrying said inker, means for connecting said bearing levers to said inker levers, said last-named means being adapted to move the inker from or towards the inking table and the printing cylinder, upon said printing cylinder bearings effecting the additional vertical movement.

11. A printer according to claim 9, comprising a bell-crank lever pivotally secured on one of the bearing levers, said bell crank being pivotally mounted on said framework, and a link connected between said bell crank lever and one of the inker levers.

12. A printer according to claim 9, comprising a holding lever for maintaining said inker levers in a position in which said inker is spaced apart from said printing cylinder and said inking table, and an inker control electromagnet actuating said holding lever in order to release said inker.

13. A printer according to claim 2, means for causing said bearings carrying the printing cylinder to effect an additional vertical movement to enable the printing cylinder to be released and be readily disassembled in view of changing the engraving and the numbering and further comprising a safety table adapted to be introduced in an operating position between the printing cylinder and its counter cylinder, when the printing cylinder has effected its additional upwards movement.

14. A printer according to claim 13, comprising a stop for prohibiting the printing cylinder to be released, said safety table when being positioned in the operating position between the printing cylinder and its counter cylinder, causing said stop to retreat for enabling the printing cylinder to be disassembled.

15. A printer according to claim 13, comprising a safety contact actuated by said safety table, said safety contact prohibiting the starting of the printing apparatus as long as the various preparation operations are not finished and said safety table is still in the operating position.

16. A printer according to claim 1, in which each printing apparatus comprises a main rotating shaft, a printing cylinder and its counter cylinder, a driving shaft for rotatably driving said printing cylinder and said counter cylinder, electromagnetic friction coupling means between said main rotating shaft and said driving shaft and including a friction coupling electromagnet, electromagnetically controlled coupling means between said main rotating shaft and said driving shaft and including a coupling electromagnet, means for vertically moving said printing cylinder relating to said counter-cylinder, a pressure control electromagnet for controlling said means for vertically moving said printing cylinder, an inker for inking said printing cylinder, means for moving said inker from and towards said printing cylinder, an inker control electromagnet for controlling said means for moving said inker, said counter device of printed sheets being adapted to produce a first signal, a short time before the end of the printing of a series of sheets, and, at the end of printing of the sheets of the series, a second signal, and electrical circuit means energized through said first and second signals, said electrical circuit means controlling, upon receipt of the first signal, the starting up and coupling of the printing cylinder and its counter-cylinder in the printing apparatus of the second printing set which was previously out of operation, and, upon receipt of the second signal, the pressure-applying engagement between the printing cylinder and its counter-cylinder of the second printing set which was previously out of operation and the pressure releasing disengagement between the printing cylinder and its counter cylinder in the printing apparatus of the first printing set which was previously in operation for printing the first series of sheets.

17. A printer according to claim 16, in which said electrical circuit means comprise a first and a second starting relays which are respectively energized by said first and second signals, an electric distribution chain for producing pulses in synchronism with the paper feed, said electric distribution chain including a cyclic rotary distributing device synchronously driven with said printing cylinder,

timing contacts which are actuated by said cyclic rotary distributing device, and a chain of timing relays respectively controlled by said timing contacts, said timing relays being successively energized at different steps of said electric distribution chain, when a starting relay is energized, and controlling the various successive operations of the transfer cycle.

18. A printer according to claim 17, in which said electrical circuit means comprise, for each printing apparatus, a starting-up relay, a coupling relay, a pressure control relay and an inker control relay, a normally open contact of said starting-up relay serially connected with the friction coupling electromagnet, a normally open contact of said coupling relay serially connected with the coupling electromagnet, a normally open contact of said pressure control relay serially connected with said pressure control electromagnet, a normally open contact of said inker control relay serially connected with said inker control electromagnet, said starting-up relays, coupling relays, pressure control relays and inker control relays being energized under the control of the timing relays, and contact means actuated by said starting-up relays, coupling relays, pressure control relays, inker control relays and timing relays, said contact means being so disposed that, at the instant of the excitation of the first starting relay, if the first set of printing apparatus is operating, while the second set of printing apparatus is at rest, the energization of said first starting relay causes the successive energization, at different steps of the electric distribution, of the starting up relays associated with the second printing set, the starting up relays associated with the first printing set not being energized, that after a starting up relay has been energized at a predetermined step of the distribution, the corresponding coupling relay is energized at a subsequent step, and that, when the second starting relay is energized, the energization of said second starting relay causes the successive energization, at different steps of the electric distribution, of said inker control relays and pressure control relays, so that the inker of the apparatus of said second printing set commences to ink the corresponding printing cylinder, thereby causing the pressure applying engagement of said printing cylinder and the pressure releasing disengagement in each printing apparatus of said first printing set.

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