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[31] **P 15 72 291.5**

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[54] **COPYING APPARATUS AND CONTROL THEREFOR**
13 Claims, 8 Drawing Figs.

[52] U.S. Cl..... 355/14
[51] Int. Cl..... G03g 15/00
[50] Field of Search..... 355/106, 107, 14

ABSTRACT: An improved copying apparatus has control means for transporting sheets of copying material from a stack and has an exposure device along which an original can be guided. By actuation of a switch, when an original is inserted, a copy paper is moved, by rollers associated with the stack of copy paper, from a ready position in order to transport the copy paper, synchronously with the original, through the exposure device and through processing devices upstream and downstream of the exposure device. The ready position of the copy paper is determined by a switch in the path of the copy paper, and this switch is actuated by the arrival of the copy paper and stops the withdrawal means. The switch is released after the passage of the copy paper so that one copy paper follows another in succession into the ready position.

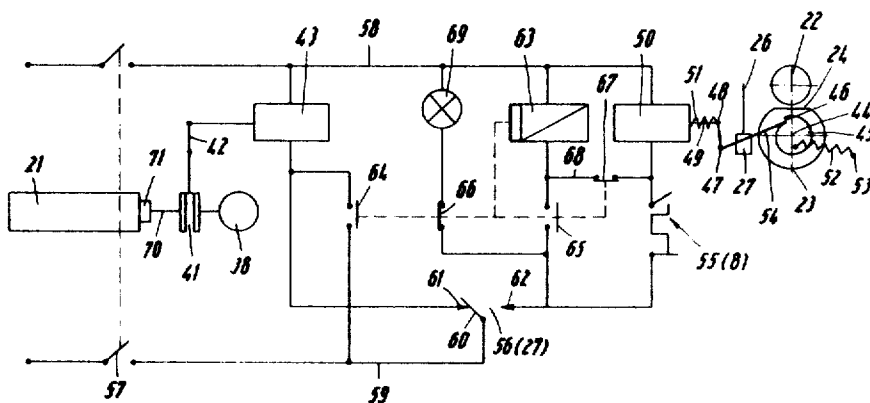
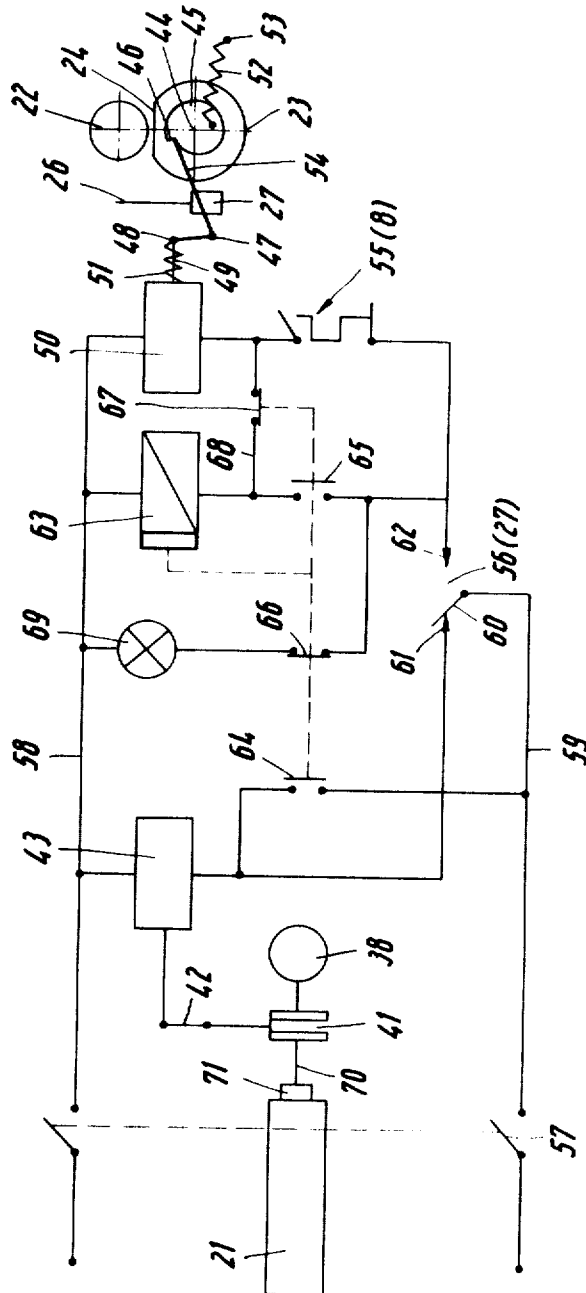


Fig. 1



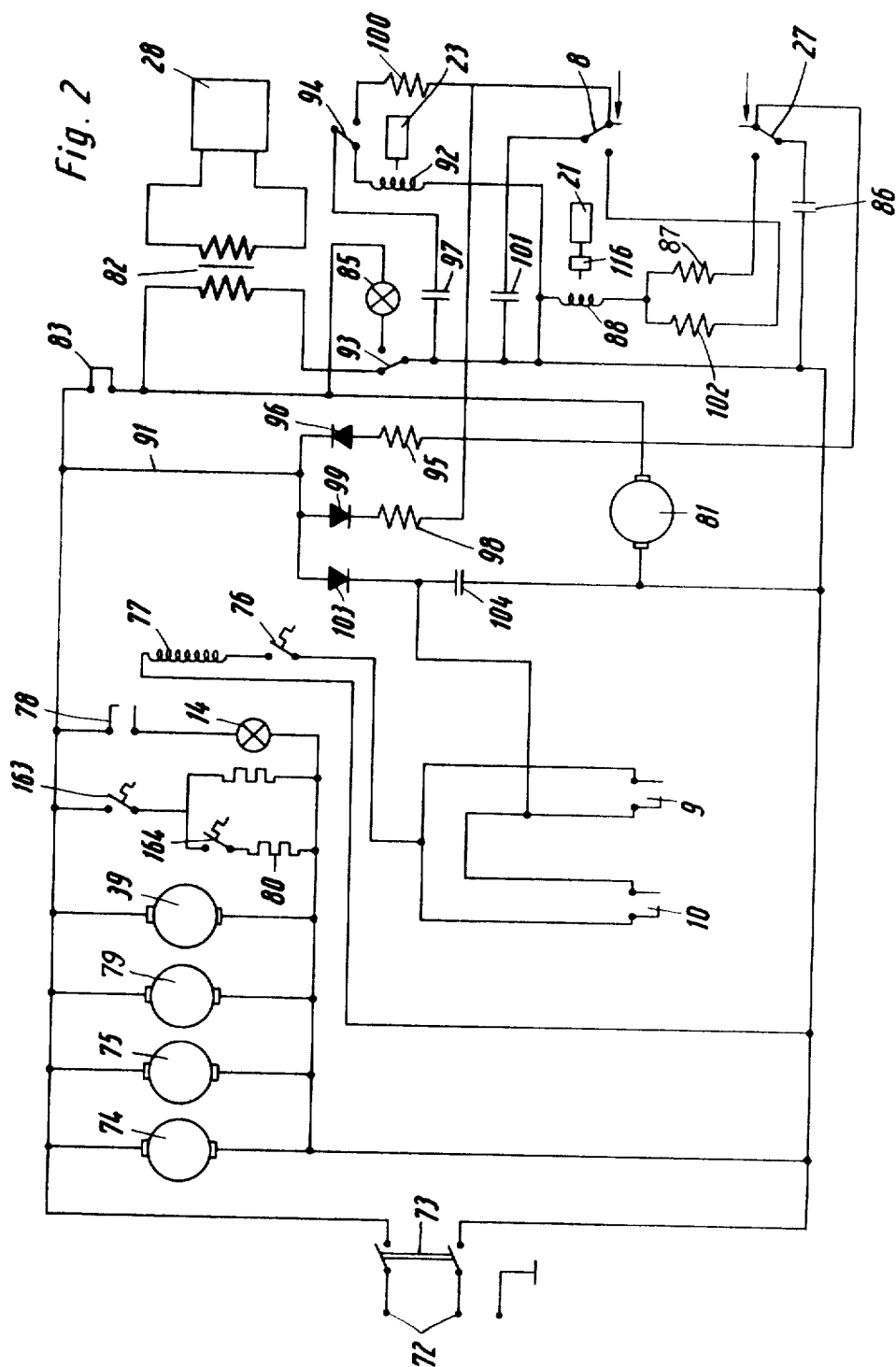


Fig. 3

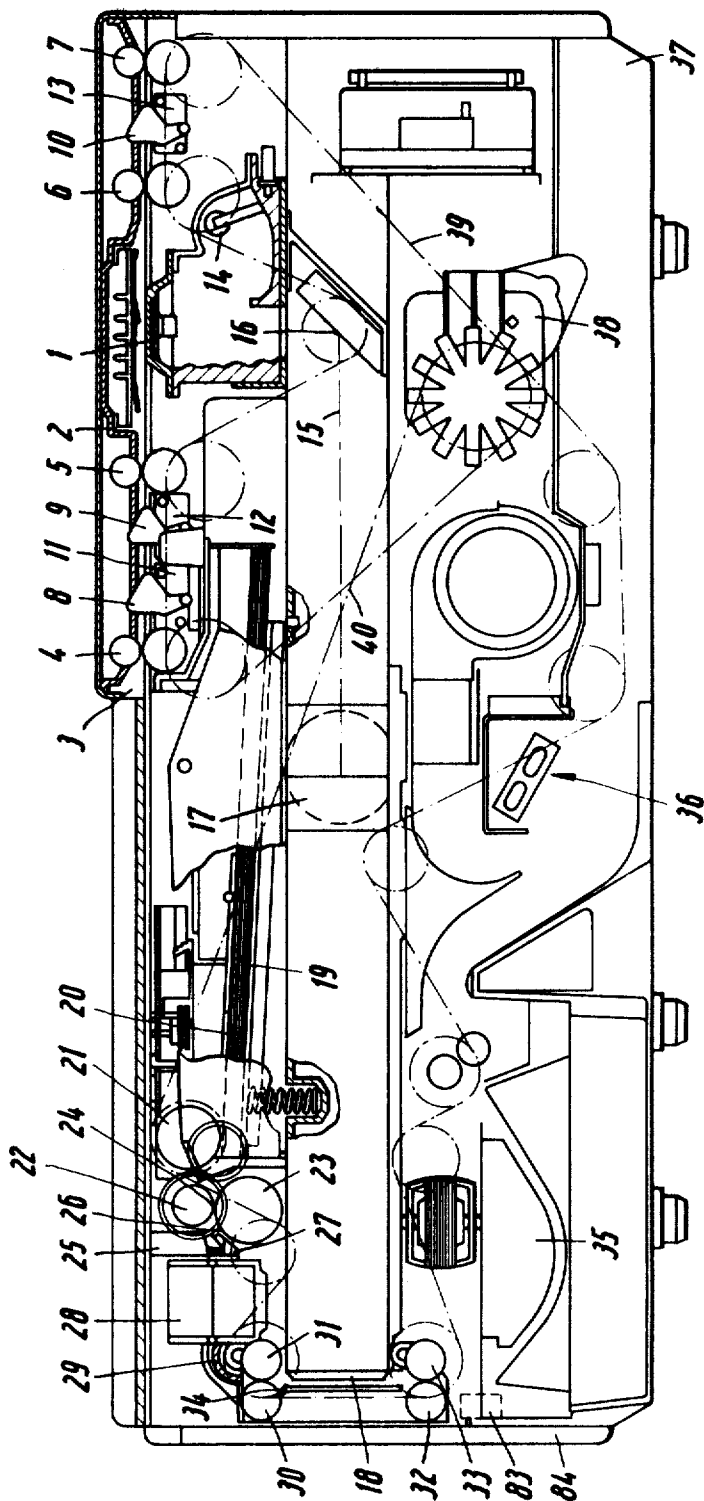


Fig. 4

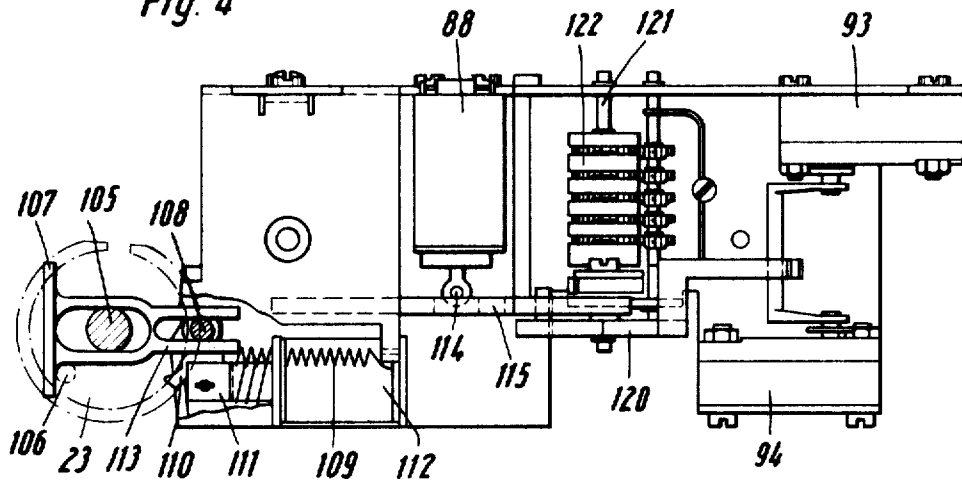
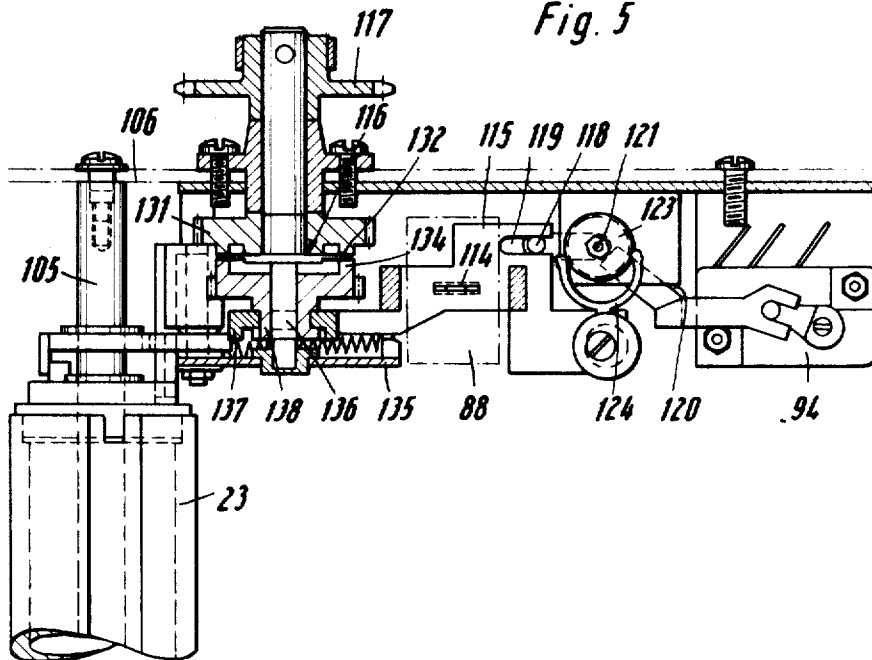


Fig. 5



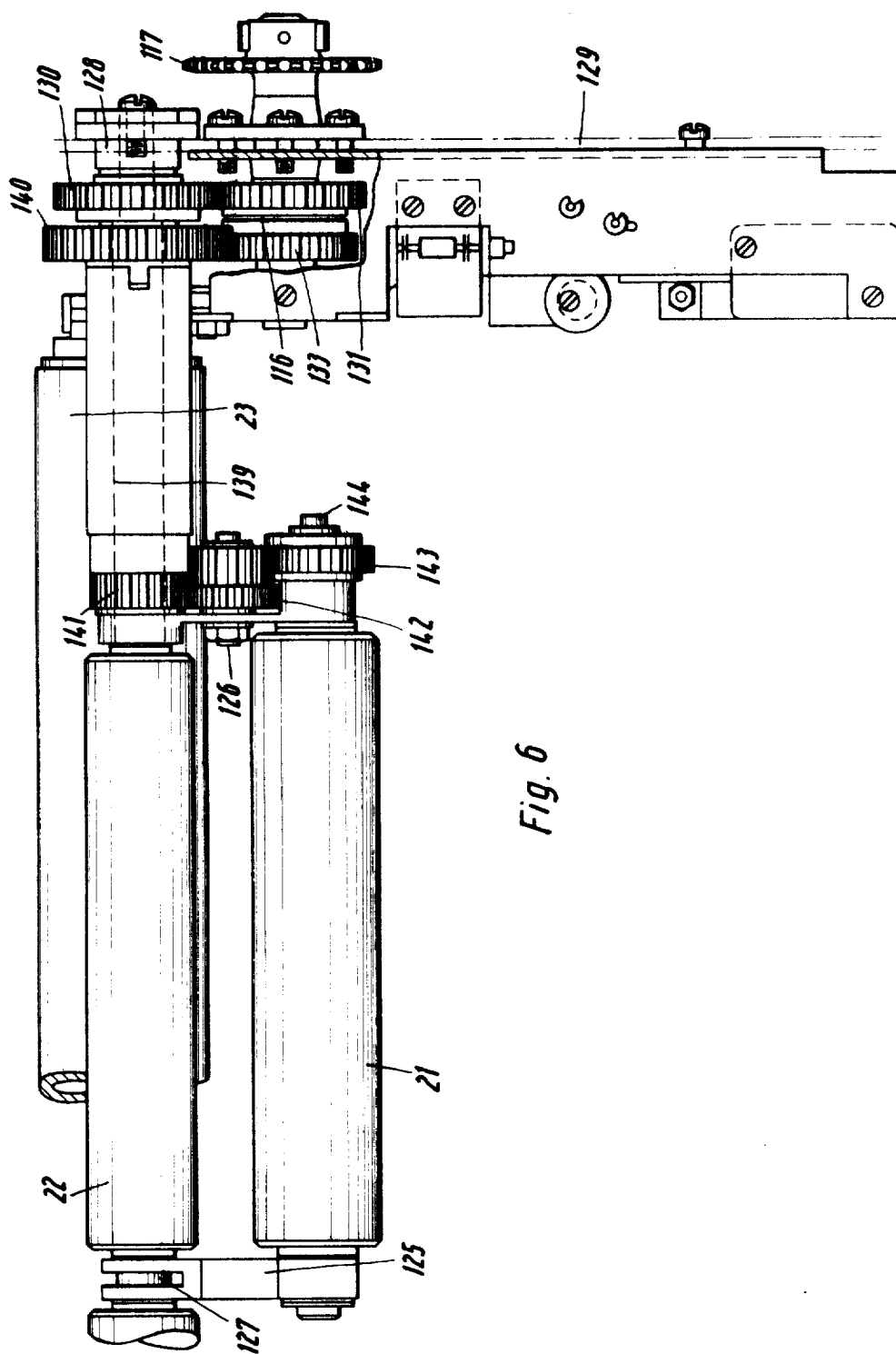


Fig. 6

Fig. 7

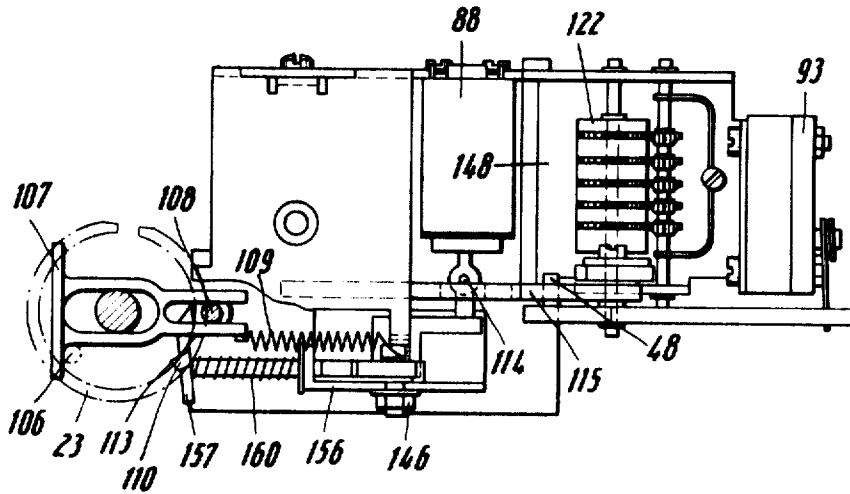
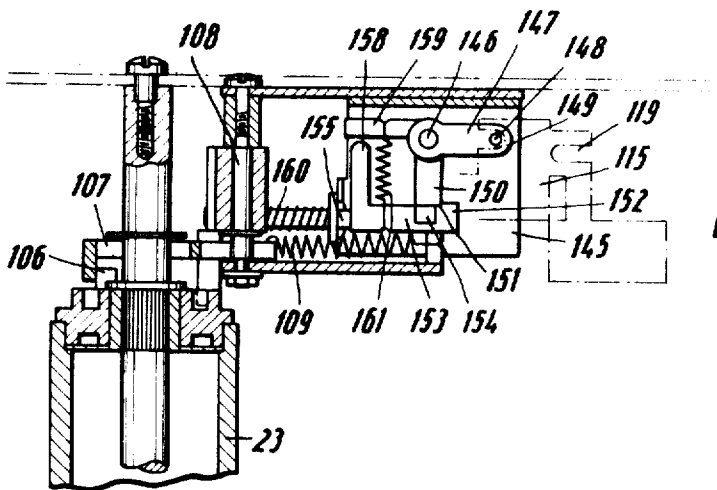


Fig. 8



COPYING APPARATUS AND CONTROL THEREFOR

The invention relates, as indicated, to copying apparatus.

In a known construction, the withdrawing means for the copy paper consists of a unit, comprising a withdrawing roller resting on the top sheet of a copy paper stack, and a pair of ready position rollers downstream thereof are held resiliently in contact with each other. Behind this pair of rollers, there is arranged a switch determining the ready position. Following, in spaced relationship, is transport devices required in the apparatus, such as pairs of rollers. These rollers are in contact with each other and receive the copy paper after it leaves the ready position. This unit is controlled by a common drive, such as a common clutch for all rollers.

This known construction has several drawbacks. A paper in the "ready" position is under the pressure of two contacting rollers, in which the contact pressure must be strong enough to produce a definite transport engagement. This could damage the sensitized coating of the copy paper, if it is held in the ready position for a longer period. In addition, during the entry of the leading edge of the copy paper not yet defined by the withdrawing roller, difficulties may arise because this roller may operate with a certain amount of slip.

The copy paper feed is started when the leading edge of the original activates, via a contact switch, a drive arrangement for the withdrawing and "ready" position rollers. The copy paper continues to move into a position where it can be gripped by the other rollers of the copy paper transport.

In the known apparatus, the copy paper feed unit is stopped only after the trailing edge of the copy paper has past by the "ready" position contact switch. During this period, both the feed and transport rollers are in driving engagement with the copy paper. With small differences present in the driving speed of the two sets of rollers, the resulting friction between the rollers and the copy paper may produce undesired effects.

The previous solution to this problem was to have the original activate the ready position and with driving rollers for a short direction and reduce the spacing between the pairs of ready position and transport rollers. Upon deactivation, the ready position rollers were allowed to "free wheel" as the copy paper engaged the transport rollers. Such a solution, however, is incomplete since the rollers are still in contact with the paper. An added drawback in the known device is the function of the "ready" position switch. The switch will allow a second sheet of copy paper to be fed only after the trailing edge of the first sheet has past by the switch. This produces a considerable gap between the two sheets which results in loss of copy time.

Furthermore, the known arrangement has the drawback of an expensive control, because the unit comprising the withdrawing roller is not only stopped by the copying paper actuated switch, but also started thereby, and the same process is also carried out in the reverse order by the stop switch actuated by the original.

It is the object of the invention to solve these drawbacks by means permitting a simpler control and handling of the copying paper in a more careful manner, while the withdrawing means is switched off only by the arrival of the copying paper in the ready position.

It is another object of the invention to provide a device of the kind above described in which the stop or limit switch for the original switches the drive for the copying paper by a temporarily effective advancing or feed element (advancing and contact pressure roller), as well as the separate drive of the withdrawing roller on the stack, which roller is equipped with a freewheeling device. The feed member forms, in the inoperative position with a continuously revolving synchronous member, a gap adapted to receive the copying paper, while being in working engagement in the operating position until the copying paper has been gripped by other transport mechanisms, with the copying paper being released in the reforming gap. The drive for the withdrawing roller has a lower speed than that of the feeding element, and the

freewheeling device is attached to the withdrawing roller in such a way as to allow the copy paper to be taken up at the speed of the feed elements. The transport of the next sheet is begun as soon as the freewheeling device engages the drive, thus minimizing the gap between copy paper sheets and reducing time delay between introduction of originals.

Since the withdrawing means comprise only one roller and the other elements of this unit are missing, the frictional forces acting during the withdrawing of the copying paper are substantially smaller, especially in view of the fact that the freewheeling device is mounted directly between the shell of the withdrawing roller and its associated shaft. The careful treatment of the paper is further improved by the copying paper resting in the ready position in a free space between the ready position rollers the paper has been transported to the transport mechanism.

Such an arrangement has already been proposed in German Pat. application No. L 56277 VIIIb/15e.

In conjunction with the freewheeling device, this construction has the advantage that, after transportation by means of rotating the counterpressure roller equipped with the flat, the copying paper is withdrawn through the reformed gap without making frictional contact, as a result the continuously driven roller need not entrain gears or other rollers. Moreover, the feed and counterpressure roller equipped with the flat, and forming the releasable feed element, transports the sheet of paper through a substantial, but accurately defined, travel, at the end of which there is a pair of transport rollers of the transport mechanism. When, in this construction, the trailing edge of a copying sheet, which may be gripped by a pair of transport rollers of a downstream transport mechanism, leaves the withdrawing roller, the drive affecting the latter becomes immediately effective for carrying the next copying sheet into the ready position.

In addition, upon reformation of the gap between the ready position rollers, the counterpressure and feed roller is brought to a stop by a locking device.

The construction of the withdrawing means, particularly of the withdrawing roller, has already been proposed and comprises a control assuring that one sheet of copying paper follows another in tight sequence, so that the time lag between successive introductions of originals is substantially smaller. The present invention represents a further improvement of this proposed arrangement.

The electrical control means comprises a relay circuit with a relay, adapted to be energized when a copying paper is in the ready position and an original has been inserted. The relay controls the activation of the withdrawing and ready position rollers as will be more fully described. The relay may be a delay type relay and may operate a warning lamp by means of a normally closed contact.

According to a further feature of the invention, the switching means comprises a relay circuit with a relay, adapted to be energized by the switch in the operating position when a copying paper is in the ready position, and which moves a contact bridging the rest contact of the switch, in order to actuate the roller. The exact timing of the relay circuit at the moment of actuation of the withdrawing roller is of lesser importance, because the withdrawing roller is defined and stopped by the switch in the ready position. Conveniently, the relay may respond with a delay. In a preferred embodiment, one relay may also operate a warning lamp, e.g., by means of a rest contact.

In another embodiment of the electrical control means, a charging and discharging circuit for a capacitor is associated with the contact switch actuated by the original. The discharge circuit includes a clutch-control magnet for actuating the withdrawing roller. The counter pressure and feed roller may be actuated by an impulse from the discharge circuit by way of an operating magnet or may be actuated through a mechanical linkage operably connected to the clutch-control magnet.

In the arrangement with capacitors, conveniently both the switch in the ready position and the contact switch for the original have respective connections with a capacitor and connect this connection to the discharge circuit via the small clutch-control magnet which is adapted to be energized alternatively by the contact switch, for switching on the drive of the withdrawing roller, and by the switch for switching this drive off, while the release of the switches closes a charging circuit for the capacitors.

According to another feature of the invention, the circuit of the small clutch-control magnet is connected to the winding of an actuating magnet for the feed and counterpressure roller, causing the same to be energized briefly, upon energization of the clutch-control magnet, for switching on the drive of the withdrawing roller by the contact switch, but remains unenergized by the actuation of the switch. To this end, the energizing circuit for the winding must incorporate a circuit breaker.

According to another preferred feature of the invention, connecting means are provided between the small clutch-control magnet and two reversing switches, of which one, on actuation of the small clutch-control magnet by the contact switch, causes a high-voltage transformer for the charging device to be switched on and a warning lamp indicating the ready state to be switched off, while the other is arranged in the energizing coil of an actuating magnet for the feed and counterpressure roller and energizes this circuit on energization of the clutch-control magnet by the contact switch and opens it by the switch in the ready position. Conveniently, a lever on the small clutch-control magnet has arranged thereon an actuating lever for a switching bridge for the reversing switches, which actuating lever is also connected to a counter which is advanced by half a step for every actuation of the small magnet. The magnet lever also control a clutch between the apparatus drive and the withdrawing roller.

According to yet another embodiment of the invention, the magnet lever of the clutch-control magnet is connected to a pivotable release lever, having a click-stop device cooperating with a pawl for the feed and counterpressure roller. This device comprises a stop arrangement, preferably with a spring, between one arm of the release lever and the pawl (or pin), which releases the ratchet lock when the release lever has been pivoted through a certain angle, in order to prepare the stopping of the counterpressure roller after one revolution. Preferably, the pawl is pivotable on the ratchet lever, and a spring is mounted between the pawl and a support and biases the pawl and the lever, after the release of the ratchet engagement, in the locking direction.

A further essential feature of the invention comprises a circuit for a driving motor for the developing device, with a warning lamp indicating the ready state, and wherein the high-voltage transformer is connected by means of a contact breaker which opens when the apparatus, and particularly the developing section, is opened.

The invention will be further described, by way of example, with reference to the accompanying drawings, illustrating the same in a nonlimiting manner, and in which:

FIG. 1 is a schematic wiring diagram of a control arrangement for the copying apparatus according to the invention;

FIG. 2 is a schematic wiring diagram explanatory of another embodiment of the invention;

FIG. 3 shows diagrammatically a side elevation view of an apparatus, with the front cover dismantled and in partly broken away representation, and is explanatory of the arrangement of the elements of FIG. 2 in the apparatus;

FIG. 4 is a side elevation view, in greater detail, of a unit omitted in FIG. 3;

FIG. 5 is a diagrammatical top view of the unit of FIG. 4 in partial cross section;

FIG. 6 is a partial view of the sheet dispenser drive, seen from the top and in partial cross section;

FIG. 7 shows another embodiment of the unit of FIG. 4; and

FIG. 8 is a top view of FIG. 7 in cross section along the line VIII—VIII, with certain parts omitted.

For the sake of clarity, the arrangement of the individual parts will first be described with reference to FIG. 3. The copier shown there comprises an exposure window or surface 1, above which is a guide 2 for the original. Driven pairs of transport rollers 4, 5, 6, 7 are provided for transporting the original, which is inserted through an opening 3. These rollers have a part of their circumference extending into the guide, and grip the original. Actuating arms 8, 9 and 10 of switches 11, 12 and 13, respectively, project into the guide and are operated by the passage of the original therethrough.

The exposure window is illuminated by a light source 14. The light beam 15, which is deflected by a mirror 16 and passes through an objective lens 17, impinges on a transparent reproduction window 18, and the copying sheet passes along this window. The light beam propagates along a channel defined by the housing walls.

Above the channel is a stack holder 19 for copying sheets 20. A withdrawing roller 21 runs on the top of the stack, and is mounted articulately about the axis of a transport roller 22 which is continuously driven and arranged downstream in the direction of movement of the paper, as described further below. Roller 22 is so associated with a feed and counterpressure roller 23, with a flattened portion 24 that the part of the periphery outside the flat 24 can make driving contact with the transport roller 22, while, when the rollers 22, 23 are in the position of FIG. 3, a gap is formed between them. Behind the gap, there is a ready state switching bridge 25 with a passage, into which projects an arm 26 of a switch 27, which determines the readiness of the sheet of copying paper.

Following the switch 27, in the direction of movement of the copying sheet, there is a charging device 28 and the curved guide elements 29. A copying sheet passing through charging device 28 and along guide elements 29 is engaged by a pair of synchronously driven transport rollers 30 and 31, forming part of the transport mechanism of the apparatus, to transport the copying sheet in front of the reproduction window. As the copying sheet passes the reproduction window, it is engaged by a further driven pair of transport rollers 32 and 33. Between the two pairs of rollers, the sheet of copying paper is held against the reproduction window by plate-shaped contact pressure means 34. After leaving the exposure station, which is constituted by the reproduction window 18, the copying sheet travels into the developing section 35 and thereafter through a drier and a heater, shown generally at 36. Downstream of the drier and heater, there is a delivery chute with a delivery slot 37.

The drive motor is indicated generally at 38 and drives a chain 39 which, in turn, drives the transport element for moving the original through the guide 2. Motor 38 also drives another chain 40 which drives the transport means for the sheet of copying paper.

FIG. 1 is a simplified circuit diagram, for explaining merely the control for withdrawing the copying sheet from the stack and introducing it into the transport mechanism of the apparatus, i.e., the first pair of rollers 30, 31. The withdrawing roller 21 is also shown. This figure also includes the transport roller 22 and the counterpressure and feed roller 23 with the flat 24, and, behind the same, the switch 27 with the switch arm 26. For the sake of clarity, the representation is somewhat exploded.

FIG. 1 also indicates diagrammatically that the drive, for example, the motor 38, is connected to the withdrawing roller 21 by a clutch 41, adapted to be engaged by a linkage 42 via an operating magnet 43. A spring arranged on the magnet effects the resetting and opening of the clutch 41 in the deenergized state.

This embodiment of the counterpressure and feed roller 23 has a switching cam 45 fixedly mounted on its shaft 44. The cam has a step 46 into which engages one end of a crank lever 54, mounted pivotably at 47, and the other end of which is hinged to an armature rod 49 of an actuating magnet 50. The switch rod may be surrounded by a return spring 51, or this spring may be arranged within the magnet, as described in conjunction with magnet 43.

The cam is biased by a tension spring 52 mounted at 53 on the frame of the apparatus. When the lever 54 is withdrawn from the step 46 by the energization of the magnet, the spring 52 pulls the feed roller into frictional engagement with the transport roller 22, causing it to be carried along until the flat is again opposite the transport roller and the lever 54 engages again into the step 46.

The switch 8 in FIG. 3 is shown at 55(8) in FIG. 1. It is actuated by the original, and consists of a unit with two contacts of which, during the passage of the original, first one is closed and then the other is opened, in order to give a switching impulse.

The switch 27 is shown with its contacts at 56(27), in this case in the noncopying position.

Supply conductors 58 and 59 are connected to a source of DC current through a main switch 57. Conductor 59 is connected to the movable arm 60 of switch 56, this arm being engageable with either of a pair of fixed contacts 61 and 62. In the nonoperated state, arm 60 is engaged with contact 61. Actuating magnet 43 is connected between contact 61 and conductor 58. The switch assembly 55 and actuating member 50 are connected in series between contact 62 and conductor 58.

In addition, a relay 63, which is preferably a delayed action relay, is connected between contact 62 and a conductor 58. Relay 63 has normally open contacts 64 and 65 and normally closed contacts 66 and 67. Normally open contacts 65 are in the supply circuit of relay 63, and normally open contacts 64 are in parallel with the circuit including contact 61 connecting conductor 59 to magnet 43.

Normally closed contacts 67 are interposed in a lead 68 connected, on the one hand, between relay 63 and contacts 65 and, on the other hand, between magnet 50 and switch assembly 55. Normally closed contacts 66 are interposed in a lead connected between contact 62 and conductor 58, and including a lamp 69.

After the apparatus has been switched on, magnet 43 is energized through engagement of contact arm 60 with contact 61. Withdrawing roller 21 transports a copying sheet which runs between rollers 22 and 23 to switch arm 26, which disengages switch arm 60 from contact 61 and engages arm 60 with contact 62. This effects opening of clutch 41 and stops rotation of the withdrawing roller with the copying paper in the ready position.

If an impulse is triggered off by an original via the switching unit 55, the magnet 50 will be energized. This lifts crank lever 54 to disengage step 46 to release feed and counterpressure roller 23 which is accelerated the spring 52. Roller 23 contact with the transport roller 22 and advances the copying paper between these rollers, namely, in the representation of FIG. 3, through the charging device 28, until the paper reaches the pair of rollers 30, 31. Then the flat of the feed roller 23 is again facing the transport roller 22, so that lever 54 engages step 46 and the roller arrangement 22, 23 remains in the locked position. So long as the paper continues to advance, the switch arm 60 makes contact with the contact 62.

The relay 63 has been energized by the switching impulse of the switching unit 55 via the circuit 68. Either immediately or after a brief delay, contacts 64 and 65 close. Contacts 65 complete a holding circuit for relay 63, so that relay 63 remains energized until contact arm 26 returns into the illustrated position, after passage of the copying sheet. The working roller contains a freewheeling device 71 between the shaft 70 and the roller surface, permitting the free rotation of the roller under the action of the withdrawn sheet of paper. When the trailing edge of the sheet has left the roller 21 and hence also the stack 20, the transporting action of the roller 21 becomes effective, owing to the unidirectional action of the freewheeling device.

The rest contact 67 opens when relay 63 is deenergized in order to prevent a second energization of the magnet 50 during this operating cycle. Preferably, the working contact 65 trails behind the rest contact 67. The rest contact 66 extinguishes the lamp 69 after the insertion of the original, indicating that no original should be inserted.

When the trailing edge of the copying sheet of paper has left the switch arm 26, the contact arm 60 return into the position shown in the drawing. The relay 63 is deenergized and its contacts also return into the positions shown. The switch contact 61 takes over the further energization of the magnet 43 so that the next copying sheet advances into the ready position, in which the switching arm 26 and the contact arm 61 are again reversed, causing the withdrawing roller to stop.

The lamp 69 lights up, giving the signal for the introduction of a new original.

It may thus be seen that the switch 27 triggers a control action only when actuated by the leading edge of the copying sheet, because the original effects, by means of the switching unit, both the switching on of the feed and counterpressure roller 23 and the switching on of the withdrawing roller 21. Roller 21 remains in operation until a new sheet of copying paper actuates with its leading edge, the switching arm 26, which has meanwhile returned.

FIGS. 2 and 4 to 8 show two other solutions, based on the same control principle. One solution comprises a more decentralized electrical control, although cooperating with mechanical transmission members (FIGS. 2 and 4 to 6). The other solution is based mainly on mechanical linkages. These figures and particularly those concerned with the second solution, show only differing parts. During the description of this solution with reference to FIGS. 7 and 8, those parts which can be omitted in the circuit of FIG. 2 will be indicated.

In FIG. 2, the supply circuit is indicated at 72 as connected to a main switch 73. Upon closure of switch 73, various motors, such as fan motors 74 and 75, a main motor 38, a further fan motor 79 and a heater 80 are energized. Heater 80 is energized through thermal switches such as 163 and 164 in such a manner that one thermal switch controls two heating elements while the other thermal switch controls a further heating element, for the purpose of maintaining a predetermined temperature.

The circuit further comprises several light sources 14, controlled by a switching contact 78. The operating winding of this contact is shown at 77 and is connected in series with a temperature relay 76, with a unit comprising two parallel switches 9 and 10. It has been shown in FIG. 3 that the switch 9 is in the path of the original in front of the light source and the switch 10 behind the same. Thus, when the switch 9, closed, by the leading edge, is released by the passage of the trailing edge, the switch 10 has meanwhile been closed so that the excitation for the actuating winding 77 is maintained for a sufficiently long period. Current is supplied to the switch circuit through a rectifier 103, associated with a capacitor 104. With an AC supply, these two parts also may provide a DC supply for the light source 14.

The drive motor 81 for the developer pump, and a primary winding of the high-voltage transformer 82, whose secondary is connected to the charging device 28, are connected with a mains lead via a circuit breaker 83 which is opened when a housing wall or flap (for example, 84 in FIG. 3, affording access to the developing insert) is opened, so that the pump motor 81 and the transformer 82 are switched off. This is an advantageous construction, particularly for changing or topping up developing substance, on the one hand, because the flap 84 gives access to the developing insert 35 and returns automatically to the inoperative position, in which the liquid developer flows back into a storage tank, and, on the other hand, because the switching off of the high voltage prevents any danger for a person operating the apparatus.

The circuit controlled by the circuit breaker 83 contains also a warning lamp 85 indicating whether an original can be inserted after the apparatus has been switched on, i.e., whether a sheet of copying paper is in the ready position. Even if this is the case, the extinction of the lamp indicates, during the opening of the flap 84, that no copy can be made.

It should be noted that parts shown in FIG. 3 are indicated in FIG. 2 by the same reference numerals.

FIG. 2 shows, in addition to the On-Off switches 9 and 10, already mentioned, and operating the light source 14, also a reversing switch 8 moved from the position shown into the other position by the advance of the original. The switch 27 is the switch controlling the ready position of the copying sheet.

FIG. 2 shows further a small clutch-controlling magnet 88 and a switching magnet 92. The small magnet operates with permanent magnet end positions and switches a switching tongue, which is retained selectively and positively in one of two end positions. The mechanical connections of this tongue will be explained further below. It is sufficient to state here that the small clutch-control magnet 88 operates the control of a clutch for connecting the withdrawing roller 21 (FIG. 3), while the switching magnet 92 effects the release of the feed and counterpressure roller 23 (FIG. 3), apart from other functions relating to the control of the counter, whose step-by-step advance (two steps for every cycle of one copy) reacts on reversing switches in the circuit. Such switches are indicated, by way of example, at 93 and 94.

In the following description, the functional cycle will be described, together with other circuit elements required for this purpose and whose arrangement follows from FIG. 2.

In principle, it should be mentioned that the circuit described operates by means of switching impulses, which is of advantage from the viewpoint of the accuracy of the control timing.

The switches are located in the position shown in the drawing. After the closing of the main switch 73, the directly connected parts are operated.

In this position, the clutch-control magnet 88, is in a position such that the clutch for the withdrawing roller 21 is engaged and copying paper is withdrawn from the stack. Let it be assumed that this withdrawing roller has a freewheeling device as described in conjunction with FIG. 1.

Before the copying paper has reached the ready position, the capacitor 86 is charged via the switch 27. The charging is effected via a damping resistor 95 and a rectifier 96 connected to the upper supply conductor by lead 91.

When the copying paper reverses the switch 27, the capacitor 86 is discharged via the damping resistor 87 and the winding of clutch-control magnet 88, which issues a switching impulse. This impulse uncouples the clutch for the withdrawing roller 21.

In addition, clutch-control magnet 88 also moves, by means to be described later, a ratchet wheel of a first counting roller of a counter (FIGS. 4 and 5) through one-twentieth of a revolution. This causes the switches 93 and 94 to be reversed by means of the mechanism shown in FIGS. 4 and 5.

The switch 93 causes the warning lamp 85 to light up, indicating that a copy can now be made. Through the switch 94 in its reversed position, the capacitor 97 is charged via the damping resistor 98 and a rectifier 99, as well as a protecting resistor 100.

During the operations so far described, the high-voltage transformer has been connected across the supply conductors by the switch 93. In the no-copy state, this takes place only during the first switching on of the apparatus. This HV transformer 82 is now switched off by the movement of the switch 93.

The apparatus is now prepared to make copies.

The inserted original operates the switches 8, 9, 10. The switching of the light sources by switches 8, 9, 10 has already been explained.

Before the original reaches the switch 8, the capacitor 101 has been charged via this reversing switch, the damping resistor 98, the rectifier 99 and the lead 91. When the switch 8 is reversed by the original, the capacitor 101 is discharged through the damping resistor 102 and the coil of magnet 88. The latter is reversed to its original position, causing the clutch for the withdrawing roller 21 to reengage, and the roller to revolve. In addition, the ratchet wheel of the first counter is rotated through a further one-twentieth of a revolution so that it has now advanced through one-tenth, i.e. by one unit.

Simultaneously the switches 93, 94 are actuated. Reversal of the switch 93 to its illustrated position causes the lamp 85 to go out and energizes through the HV transformer 82 the charging station 28. Reversing of the switch 94 to its illustrated position discharges the capacitor 97 through the winding 92 of the switching magnet, in order to release the feed and counterpressure roller. The engagement between the feed and drive rollers 22, 23 causes the copying sheet to be transported out of the ready position, as described with reference to FIG. 1. This transport continues until the sheet passes through the charging device 28 and reaches the pair of transport rollers 30, 31.

Since the switching magnet 92 for the feed and counterpressure roller 23 has been excited for only for a short duration, the ratchet of this roller 23 engages again after one revolution. Meanwhile, the original switches the light source 14 by means of the switches 9 and 10, as described above.

When the trailing edge of the original leaves the switch 8, this switch returns into its position shown in FIG. 2. In consequence, the capacitor 101 is again charged through this switch, the damping resistor 98 and the rectifier 99.

The switching magnet with the exciter coil 92, for the feed and counterpressure roller 23, operates in the manner described parallel to the clutch-controlling magnet 88. The magnet 92 can therefore be omitted and may be replaced by a special mechanical link on the working member of magnet 88, for effecting the short duration release of the feed and counterpressure roller 23, so that this roller is again stopped after one revolution.

FIGS. 4, 5 and 6 show the construction of the switching magnet. In these figures, equivalent parts are designated by the same reference numerals as in the other figures.

FIGS. 4 and 5 show the feed and counterpressure roller 23 with its shaft 105, mounted in a frame member 106. This shaft has on its end face or on a part mounted thereon a stop lug 106. A ratchet lever 107 is mounted on the shaft and surrounds it after the manner of a clip and is horizontally movable with its free end on the ratchet axle 108. The tension spring 109 acts on the ratchet lever 107, corresponding to the spring 52 in FIG. 1.

A switching drum pawl 110 is mounted in the frame rotatably about the pawl axis 108. This pawl is connected to an armature rod 111 of the operating magnet 112, the winding of which is shown at 92 in FIG. 2. When the winding 92 is energized, the pawl 110, engaging into a step 113 on the feed and counterpressure roller 23, is lifted and the spring 109 pulls this roller 23 into engagement with the transport roller 22.

The clutch-controlling magnet 88 (FIGS. 4 and 5) moves its switching tongue 114 in the direction perpendicular to the plane of FIG. 4. During this movement, the magnet lever 115 is carried along and engages the coupling for the withdrawing roller 21, shown generally at 116, and connecting the chain sprocket 117 (in a manner to be described in detail with reference to FIG. 6). In addition, the magnet lever 115 entrains, by means of a pin 118 engaging into a slot 119, the switch lever 120. This lever 120 is mounted rotatably on the axis 121 of a counter 122. The counter 122 has a ratchet wheel 123, entrained by a clip 124 through one-twentieth of one revolution, when the clip 124, mounted on the magnet lever 115, is moved. The ratchet wheel 123 is connected with the first number or digit disc of the counter 122 so that the twofold actuation of the magnet lever, during the switching of the clutch-controlling magnet 88, causes the advance through one digit, while the switches 93 and 94 are simultaneously operated twice.

FIG. 6 shows the feed and counterpressure roller 23, and, above the same, the transport roller 22 and the withdrawing roller 21. The shaft 127 of the transport roller 22 carries two pivotable arms 125, 126 which support the shaft of the withdrawing roller 21. Near its mounting 128 in the frame 129, the shaft 127 carries a fixed gear 130, meshing with a gear 131 which is fixedly connected with the sprocket 117. This sprocket is driven by the chain 40 (see FIG. 3).

The meshing gear 131 forms simultaneously the driving member of a clutch, formed, for example, by a spur toothing 132 (FIG. 5). The driven part of this clutch, shown generally at 116, carries, on the outside, the gear ring 133 and, on the inside, a spur toothing 134, adapted to be brought into engagement with the toothing 132. The driven part 116 with the gear ring 133 is axially movable on a pin 136 mounted in a frame portion 135. The magnet lever 115 is connected to this driven part of the clutch such as by a part 137 engaged in a peripheral hub recess 138 of gear 133. It may be seen from FIG. 5 that the reciprocating movement of the driven part engages and disengages the clutch, and this engagement may be augmented by a spring, not shown in detail.

A bush 139 is mounted rotatably on the shaft 127 (FIG. 6) and is connected firmly with a gear 140 which meshes with the gear 133. On the left end of the bush, as viewed in FIG. 6, there is a driving gear 141, meshing via a transmission 142 with a drive pinion 143 on the shaft 144 of the withdrawing roller 21. Preferably, in the hub of the pinion 143, i.e., between the gear ring and the shaft 144 of the withdrawing roller, there is a freewheeling device such that the withdrawing roller can be rotated faster in its driving direction. The reduction gear 142 has a ratio such that the withdrawing roller 21 revolves at a slightly smaller peripheral speed than the transport roller 22. Thus, when the copying paper is gripped by the transport roller 22 and the feed roller 23, it can be pulled out from under the actuated withdrawing roller 21, as already described.

In FIGS. 7 and 8, corresponding and equivalent parts are again designated by the same reference numerals as in FIGS. 4 and 5. It may be seen that this construction comprises only the switch 93, while the switch 94 has been omitted. Also the actuating magnet 112 with its winding 92, shown in FIG. 4, has been omitted.

The magnet lever 115 is again moved by the tongue 114 of the clutch-controlling magnet 88. The counter is carried along by the slot 119, as already described. A release lever 147 is mounted rotatably about a pin 146 in the main frame plate 145 and engages, by means of a pin 148, onto the actuating slot 149 of the magnet lever. The release lever 147 is therefore rotated, by the movement of the magnet lever, about the mounting pin 146. The release lever 147 is a cranked lever and has, on its other leg 150 an actuating lug 151, engaging into a ratchetlike part 152 of a ratchet lever 153. Lever 153 is movable, on the one hand, between a forked end 154 of the leg 150, and may be lifted off the lug. The ratchet lever 153 has also mounted thereon a rod 155, passing through an over-size hole in a fixed bearing plate 156, and connected at its end, with clearance, to the arm 157 of the ratchet pawl 110, pivotable about the ratchet axis 108, as already described. The ratchet lever 153 has also a pin 158, directed towards an arm 159 of the release lever 147, but terminating at a distance therefrom in the starting position.

Between the bearing plate 156 and the arm 157, there is a compression spring 160.

When the release lever 147 is rotated, the lug 151 entrains the ratchet lever towards the right. It is here assumed that the magnet lever 115 moves first in the direction of the arrow. By way of the entrainment of the ratchet lever 153 which is held by the spring 161 in engagement, the ratchet lever 110 is withdrawn from the notch 113. The clearance prevents tilting during the circular movement.

The unlocking releases the feed and counterpressure roller 23 as it carries out one revolution.

During movement of release lever 147, arm 159 is rotated counterclockwise, as viewed in FIG. 8. After passing through the gap between it and pin 158, arm 159 engages pin 158 to operate this pin to disengage ratchet lever 153 from its locking engagement with lug 151. This enables the ratchet lever to be moved to the left by the spring 160 so that the ratchet pawl 110 rests on the feed and counterpressure roller 23 and drops into the step after one rotation. Simultaneously, the ratchet lever 153 is withdrawn.

During switching off, when lever 115 moves in the opposite direction, arm 150 again engages its lug 151 behind the ratchetlike abutment.

This mechanical construction saves electrical circuitry and components.

We claim:

1. In copying apparatus of the type including an exposure device, guide means operable to guide an original past the exposure device, switch operator means along the guide means actuated by an original, when the original is within the zone of the exposure device, to operate a switch contact arm, a stack holder for copying sheets, withdrawing means associated with the stack holder and operable to withdraw a top sheet from the latter, a reproduction device, copy sheet processing means, transport mechanism operable to transport copy sheets along a transport path past the reproduction device and through the processing means, an intermittently operable copy sheet feed and contact pressure roller in the transport path downstream of the stack holder, and a continuously operable transport roller cooperable with the feed and contact pressure roller; the improvement comprising, in combination, copy sheet position detecting switch means in the path of the copy sheet immediately downstream of said feed and contact pressure roller and said transport roller cooperably therewith; drive means driving said transport mechanism and said transport roller in synchronism with each other; clutch means operable to connect said drive means to said withdrawing means for driving the latter in a copy sheet withdrawing direction; a freewheeling device included in said clutch means and providing for free movement of said withdrawing means in the copy sheet withdrawing direction; said position detecting switch means determining a ready position of a copy sheet in said transport path; electrically energized clutch operating means effective, when energized, to engage said clutch means; a first energizing circuit for said clutch operating means normally closed by said position detecting switch means and opened, to disengage said clutch means, upon operation of said position detecting switch means by a copy sheet in said ready position; means operable by said switch contact arm, responsive to actuation of said switch operator means by an original, to effect actuation of said feed and contact pressure roller from a rest position into a working position wherein it is driven in synchronism with said transport mechanism to feed a copy sheet, in said ready position, into engagement with said transport mechanism; a second energizing circuit for said operating means closed by said switch contact arm, responsive to such actuation by said switch operator means by an original, to reengage said clutch means to drive said withdrawing means; said feed and contact pressure roller having a configuration such that, in conjunction with said transport roller, it defines, in its rest position, a gap to receive the leading edge of a copy sheet in said ready position, and such that, when in its working position, it grips a copy sheet between itself and said transport roller to feed the copy sheet into engagement with said transport mechanism; said feed and contact pressure roller reattaining its rest position, to re-form said gap, immediately upon engagement of the copy sheet by said transport mechanism, to release the trailing edge of the copy sheet in said gap; and transmission means, between said drive means and said withdrawing means, having a reduction ratio such that, upon engagement of said clutch means, said withdrawing means is driven at a copy sheet feed rate less than that of said feed and contact pressure roller, with the feed rate difference being compensated by said freewheeling device; whereby, simultaneously with actuation of said feed and contact pressure roller into its working position, said withdrawing means is driven to transport the next copying sheet to said ready position.

2. In copying apparatus, the improvement claimed in claim 1, wherein said withdrawing means comprises rollers; said feed and contact pressure roller having a flattened portion which, when aligned with said transport roller, defines said gap and, when such alignment is interrupted, said feed and

contact pressure roller moves into driving engagement with said transport roller; release means operatively associated with said feed and contact pressure roller to effect movement of said contact pressure roller from said rest position into said working position; an actuating magnet for said release means; and circuit means connecting said actuating magnet with said switch contact arm and with said position detecting switch means.

3. In copying apparatus, the improvement claimed in claim 1, including switching means operatively connected with said clutch operating means; a relay included in said switching means; a relay circuit including said relay, said contact switch means and said position detecting switch means; said relay circuit being closed by said switch contact arm when said position detecting switch means has been actuated by a copy sheet in said ready position; said first energizing circuit for said clutch-operating means including a rest contact of said position detecting switch means; and a rest contact of said relay in parallel with said rest contact of said position detecting switch means and included in said second energizing circuit.

4. In copying apparatus, the improvement claimed in claim 2, including a capacitor connected to said switch contact arm; a charging circuit and a discharging circuit for said capacitor controlled by said switch contact arm; and a clutch-controlling magnet in said discharge circuit controlling said clutch means; said capacitor providing a discharge pulse, of short duration, controlling said release means.

5. In copying apparatus, the improvement claimed in claim 3, including a signal lamp which, when energized, indicates readiness to copy with a copy sheet in said ready position; and an energizing circuit for said signal lamp including a rest contact of said relay.

6. In copying apparatus, the improvement claimed in claim 4, including a second capacitor connected to said position detecting switch means; each capacitor being connected to said discharge circuit through said clutch-controlling magnet; said clutch-controlling magnet being actuated alternately by said switch contact arm, for engaging said clutch means, and by said position detecting switch means, for disengaging said clutch means; each of said contact and position detecting switch means, in its rest position, closing a charging circuit for its respective capacitor.

7. In copying apparatus, the improvement claimed in claim 4, in which the winding of said actuating magnet is connected to said clutch-controlling magnet and is energized, together with said clutch-controlling magnet, for a brief period, for engaging said clutch means, by operation of said switch contact arm, and is deenergized by operation of said position detecting switch means.

8. In copying apparatus, the improvement claimed in claim 7, in which said actuating magnet is provided with a pawl operable on said release means; said release means including a spring biased cam and cam follower arrangement; said cam follower being actuated by said pawl.

9. In copying apparatus, the improvement claimed in claim

4, including a magnet lever operable by energization of said clutch-controlling magnet; a detent member and a ratchet lever operable to control said release means; a pivotable release lever interconnecting said magnet lever and said detent member; said release lever having a first arm; a connection, including a spring, provided, with clearance, between said first arm and said ratchet lever and operable to effect release of said detent member responsive to a predetermined rotation of said release lever in order to prepare for stopping of said feed and contact pressure roller after one revolution of the latter; a pawl pivoted on said ratchet lever; and a spring connected between this pawl and a fixed point and biasing said pawl and said ratchet lever, after release of the click-stop engagement, to reestablish such engagement.

10. In copying apparatus, the improvement claimed in claim 6, including a lever operable by said clutch-controlling magnet; a switching bridge operable to operate said reversing switches; a pivotable actuating lever articulately interconnecting said switching bridge and said magnet lever; and a counter having an actuating lever connected to said magnet lever and advanced, by half a unit step, responsive to each actuation of said clutch-controlling magnet.

11. In copying apparatus, the improvement claimed in claim 6, wherein said copying apparatus includes a developing device comprising part of said processing means and a housing including an openable flap adjacent said developing device; said drive means including a drive motor; an energizing circuit for said drive motor, said developing device, said warning lamp and said high-voltage transformer; and a circuit breaker in said energizing circuit retained closed when said housing is closed and opening when said flap is opened.

12. In copying apparatus, the improvement claimed in claim 6, in which said copying apparatus includes a charging device for the copy sheets; a high-voltage transformer connected to said charging device to energize the latter; a pair of reversing switches; a warning lamp indicating the readiness to produce a copy; a first circuit including said lamp and said actuating magnet, and controlled by one reversing switch; said one reversing switch, responsive to energization of said clutch-controlling magnet, connecting said transformer to a source of potential and deenergizing said warning lamp and, responsive to deenergization of said clutch-controlling magnet disconnecting said transformer from said source of potential and energizing said warning lamp; the other reversing switch being included in a second circuit including the exciting winding of said actuating magnet, and closing said second circuit responsive to energization of said clutch-controlling magnet by said switch contact arm, and opening said second circuit responsive to deenergization of said clutch-controlling magnet by said position detecting switch means.

13. In copying apparatus, the improvement claimed in claim 10, in which said magnet lever is connected with said clutch means to operate the latter; and reduction gearing between said clutch means and said withdrawing roller and including said freewheeling device.