

Nov. 15, 1966

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3,285,603

TRACING SEPARATOR

Filed July 15, 1964

4 Sheets-Sheet 1

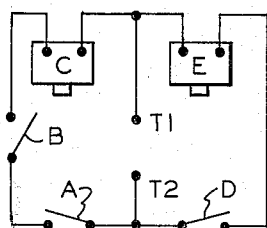
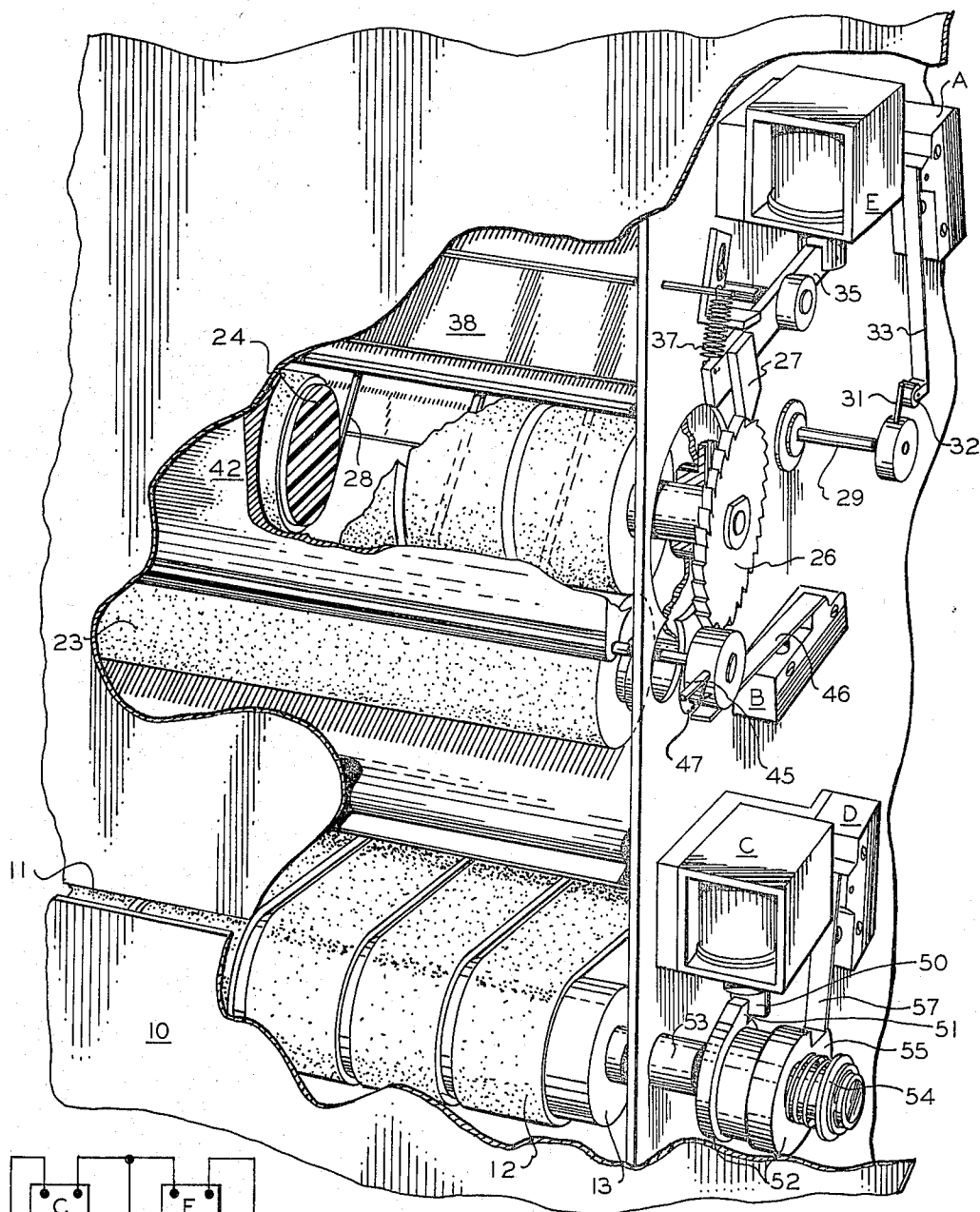


FIG. 1

FIG. 7

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4 Sheets-Sheet 2

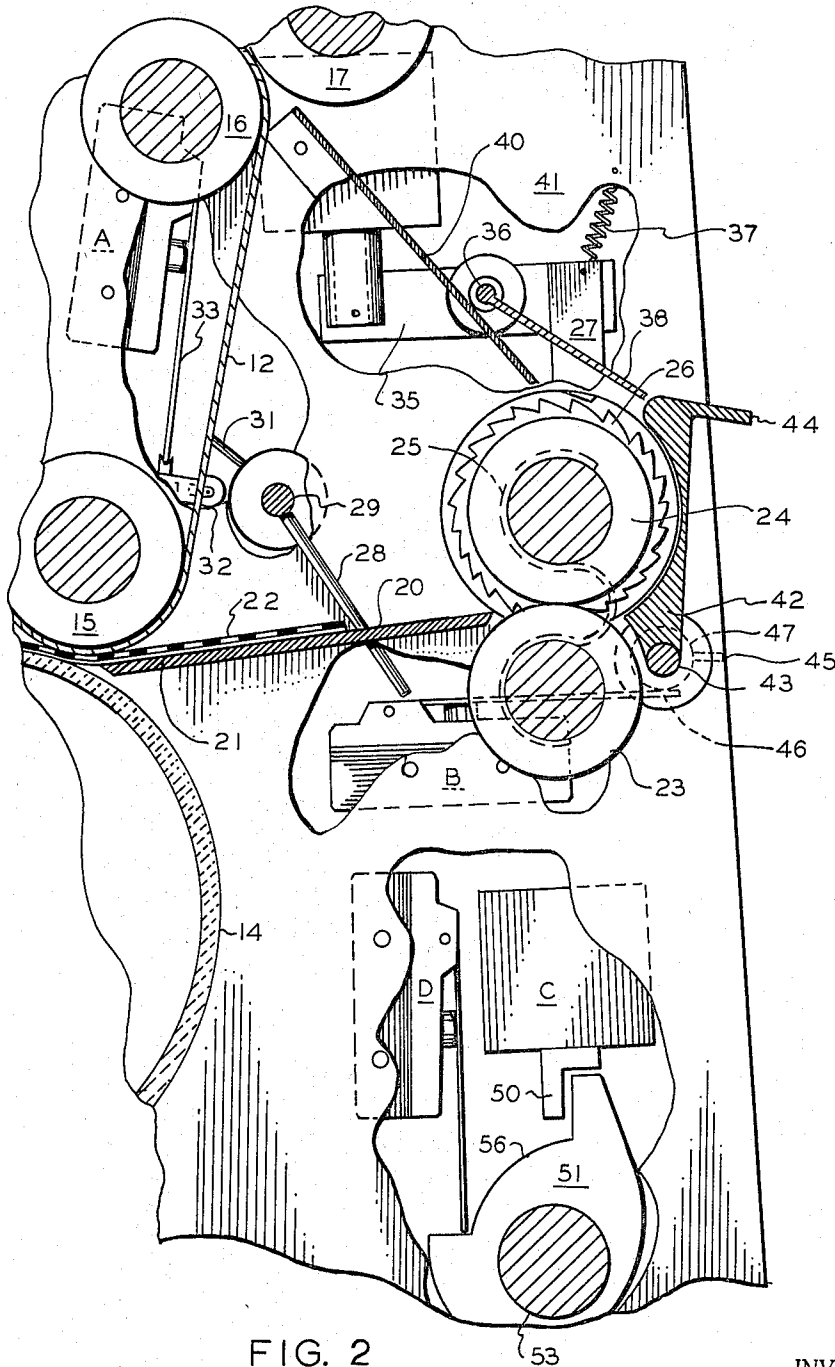


FIG. 2

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4 Sheets-Sheet 3

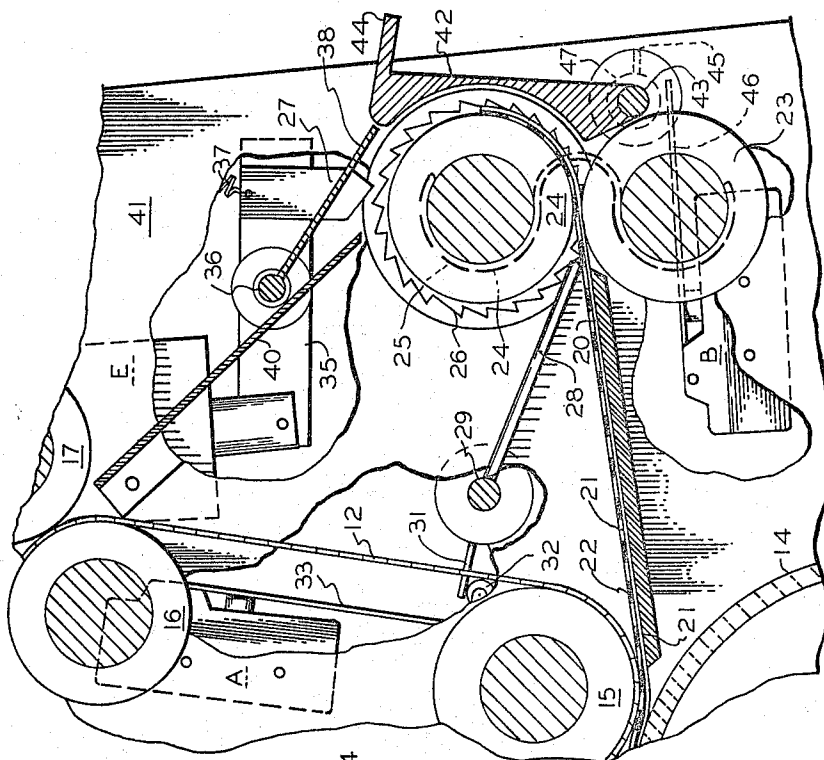


FIG. 4

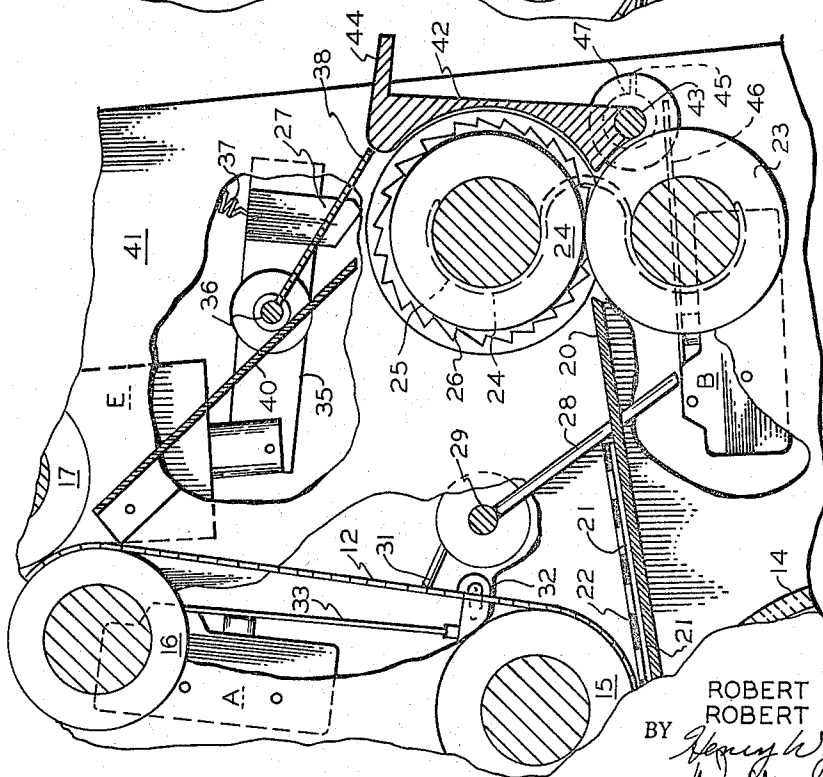


FIG. 3

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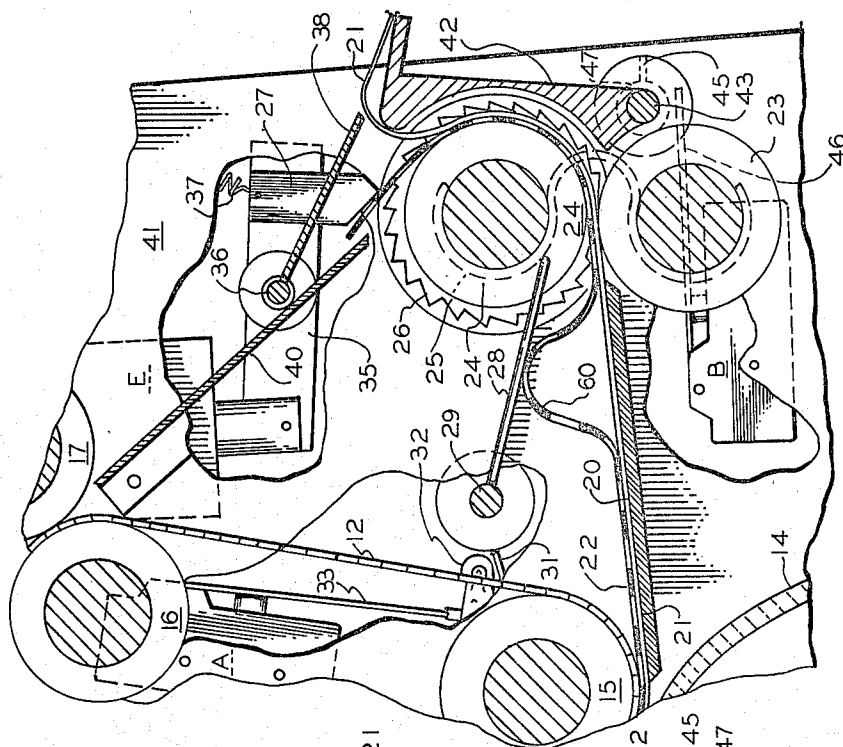


FIG. 5

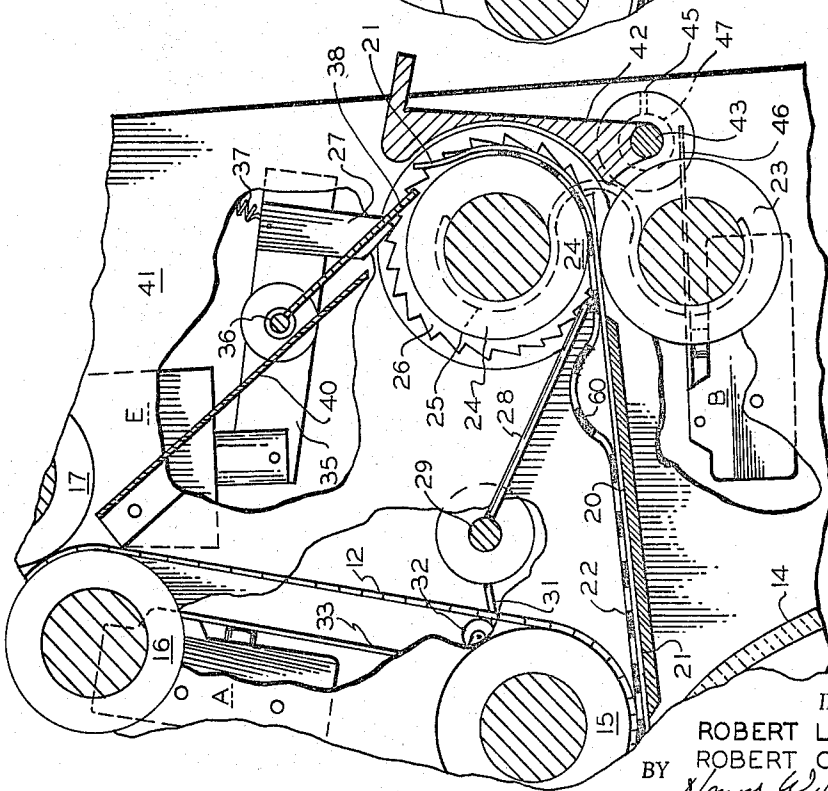


FIG. 6

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6 Claims. (Cl. 271-36)

This invention relates to photocopying or duplicating machines and, more particularly, to the component portion thereof which performs separation of the original from the copying material.

In the copying art, various processes are employed for making a duplicate copy of an original. Photocopying employs light-sensitive materials which are exposed in contact with an original in order to obtain a print thereof. In thermoprinting, use is made of heat-sensitive materials which, in contact with an original, are subjected to radiation rich in infrared to obtain a print of the original.

In the reproduction of transparent originals, the diazo-type machines are particularly advantageous. These generally employ a rotating glass cylinder containing an ultraviolet light source. The sensitized sheet, in contact with the original, is passed over the cylinder for exposure, after which the original is returned from the machine and the exposed sensitized sheet is conveyed further for gaseous, thermal, or moist development.

The separation of the sensitized sheet material from the original after it has passed the exposure stage, namely, after it is picked off from the surface of the rotating glass cylinder, has posed a problem since the very inception of the design of such machines. The sheets are strongly adherent and have no marginal differences for mechanical gripping.

Various attempts have been made to provide fingers, suction devices, etc. to effect separation and guiding of the separated sheets into different channels. The original must be returned from the machine so as to be used again for copying; whereas the exposed sensitized sheet must be further conveyed for necessary development. The latter is effected in a gaseous medium over the perforated walls of a developing tank in which ammonia vapors are generated for the so-called dry developing process or, in the case of the moist process, the sheets are fed into a tank containing the developing liquid for immersion.

The separating devices heretofore used leave much to be desired in the efficiency of their operation. In addition, they are costly, requiring the use of vacuum chambers and exhaust installations.

In a diazotype duplicating system, the original is often in the form of a tracing sheet or generally thin transparent paper which is in strong pressure contact with the sensitized material over the exposure cylinder. The frictional contact over the glass cylinder considerably enhances the adherence of the two sheets so that they are difficult to separate.

It is the primary object of this invention to provide in a diazotype apparatus effective separation of the original from the sensitized sheet by simple mechanical means, requiring no negative pressure nor elaborate endless belt conveyors.

It is a further object of the invention to provide a coactive mechanical assembly which effects the separation of the original in rapid succession automatically, thereby increasing the speed of the machine.

A particular feature of the invention resides in the operation of the separator which is based on frictional displacement between the superimposed sheet materials.

Other objects and features will be apparent from the following description of the invention, pointed out in

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particularity in the appended claims, and taken in connection with the accompanying drawings in which:

FIG. 1 is a front elevational view, in perspective, of a portion of a diazotype duplicating apparatus with the housing cut away showing the working elements of the separator mechanism;

FIG. 2 is a fragmentary, side elevational, schematic view illustrating the separator mechanism and associated coactive components;

FIG. 3 is a schematic view illustrating the function of the separator in the first stage of operation;

FIG. 4 is a view similar to FIG. 3 illustrating the actuation of the material sensing element in the second stage of operation;

FIG. 5 is a view similar to FIG. 4 showing the formation of the loop of sensitized material and the relative positions of the separator elements in the third stage of operation;

FIG. 6 is a similar view as the preceding figure, depicting the final stage of the separating operation; and

FIG. 7 is a schematic circuit diagram of the connections for the switches and solenoids which control the function of the separator mechanism.

Referring to the figures, in the view shown in FIG. 1 only such portions of the duplicating apparatus are shown which have a coactive function with respect to the separation of the original and copy material since the invention is concerned only with this phase of the machine operation. However, brief mention will be made of the overall machine operation in order to facilitate understanding of the problems which the invention has set out to solve.

For the purpose of duplicating by means of a diazotype apparatus, such as, for example, the machines widely known by the trade name "Ozolid" and produced by General Aniline & Film Corporation, it is necessary to place the original over a diazo sensitized sheet material for exposure over a rotating glass cylinder which contains a light source rich in ultraviolet radiation. Since the exposing rays must pass through the original, the latter is generally thin transparent paper material or tracing which exhibits a strong adherence to the sensitized material, particularly after the superposed sheets leave the exposing cylinder. This is also due to the electrostatic forces generated by the passing of the material over the glass cylinder.

Once the exposure has been effected, the original must be separated from the exposed sensitized material so that the latter may be passed through the developing portion of the machine. The separators heretofore used worked on the principle of exerting a pulling force, generally by suction means acting transverse to the plane of the sandwiched paper material which required comparatively large separator assemblies. As will be seen, the present invention works on the principle of exerting a force in the direction parallel to the plane of the material and slideably displace one from the other to a sufficient extent to provide a lead surface for conveyance by frictional engagement.

As seen in FIGS. 1 and 2, the housing 10 has an infeed opening 11 which faces the endless conveyor belts 12 which pass over the power-driven feed roller 13 and enter the machine to be wrapped around the exposing cylinder 14 and continue over various strategically placed idler rollers of which 15 and 16 are shown in FIG. 2. This is the conventional material feed system employed in diazotype apparatus and is not shown here in full detail since it has no bearing, per se, on the invention. Suffice it to say, that the infeed to the developing section is located between roller 16 and another adjacent roller 17.

The separator mechanism located toward the front of

the machine assembly comprises the following structural elements; a material pickoff plate 20 which engages the cylinder 14 and has the required edge configuration to guide the materials, namely, the original 21 and the superposed sensitized material 22 toward and between the bite of separator rollers 23 and 24.

Both these rollers have resilient surfaces of rubber or suitable plastic material and are held compressed for peripheral engagement by the compression spring 25, shown in dotted lines. The roller 23 is positively driven by a suitable connection to the power drive of the machine which also drives the infeed roller 13. For the sake of simplicity, the drive motor and interlinkages thereof are not shown here. It will be understood that when the machine is in operation, the roller 13 rotates and moves the infeed belts over the various rollers and over the exposure cylinder 14, driving the latter in clockwise direction. The roller 23 is also rotating when the machine is in operation. The roller 24 is friction-driven by the roller 23 and has a ratchet-faced flange 26 which is engaged by the pawl 27 when the latter is in its downward position. The function of this will be described later in connection with the operation of a separator mechanism.

Feeler bars 28 pivoted at 29 extend in slots of the pick-off plate 20 and move a lever arm 31. Upon sufficient pivotal movement of the bars 28, the arm 31 engages and rides past the roller 32 of the actuating lever 33 of the switch A. The latter is normally open and the displacement of the lever 33, as the arm 31 rides past roller 32, effects closure and subsequent opening of the switch contacts.

The pawl 27 is located at one end of the bar 35 which is pivoted at 36 and is actuated by the armature 34 of the solenoid E so that when the latter is energized, the bar 35 is lifted and the pawl 27 lowered into engagement with the ratchet 26. This, in fact, abruptly stops the rotation of the roller 24 which, as will be seen, is one of the salient operational features of the separator assembly. Upon de-energizing of the solenoid E, bar 35 is lifted by the spring 37 so as to disengage the pawl 27 from the ratchet 26.

At the pivot point 36, the bar 35 actuates also the deflector or flipper plate 38 which, upon lowering of the pawl 27 engages the face of the roller 24. This is more clearly shown in FIGS. 3, 4, 5 and 6 which illustrate the various stages of the separation cycle. A guide plate 40 is permanently attached to the frame 41 and placed at an angle directed between the bites of rollers 16 and 17 which form the inlet opening to the developing section of the apparatus. Consequently, material passing over the guide plate 40 will be constrained to enter between rollers 16 and 17. A front guide member 42 is pivoted at 43 which, in the upright position shown, serves to guide the original out of the copying apparatus over the lip 44. The guide member 42 may be manually moved into downward position and, in so moving, will rotate the collar 45 attached to the shaft 46. The collar 45 has a pin 48 which engages the actuator spring 46 of the switch B. The latter is normally closed but will be opened upon lowering of the guide member 42. The purpose of this, as will be seen, is to disable the operation of the separator when it is desired to have both the original and the exposed copy sheet delivered from the duplicating apparatus.

Although the roller 24 is suddenly stopped by the pawl 27, the roller 23, being power driven, will continue to rotate. Since the superposed sheet materials 21 and 22 are between these rollers, the one, namely, the original 21, being engaged by the surface of the rotating roller 23, will slip past the other. Thus, it is seen that the force exerted by the roller 23 is in the direction parallel to the plane of the sheet materials and effects separation by frictional displacement. The exposed sensitized material 21, held by the roller 24, will form a loop as it is being fed from the exposure cylinder 14. It would continue

to pile up over the pickoff plate 20 in the space between the cylinder 14 and the rollers 23 and 24. Obviously, after slippage between the sheets 21 and 22 has been effected to such an extent that the original 21 has the required lead for further separate conveyance, the roller 24 must be released for rotation so that it may convey the sensitized material 22.

The time duration for retarding the roller 24 is effected by the actuation of the solenoid C. As seen in FIGS. 1 and 2, the solenoid C is mounted on the frame 41 having its armature 50 in a vertical position which, when de-energized, engages the stop 51 which is part of the slip clutch assembly 52 mounted on the shaft 53. The clutch comprises the spring 54 and cam 55. The latter has a notch 56 receiving the actuator spring 57 of the switch D.

The switch D is normally open and is in the circuit controlling the energizing of the solenoid E. Consequently, when the armature 50 of the solenoid C is lifted, the cam 56 will be allowed to rotate, thereby closing the contacts of the switch D. During the time the clutch assembly 52 is free to rotate, the switch D remains closed until the notch 56 arrives in the position to accept the spring 57. Since the lifting of the armature 50, namely, the energizing of the solenoid C is only for a short duration, caused by the flipping of the lever 33 of the switch A by the lever arm 31 of the feeler bars 28, the solenoid C becomes de-energized before the clutch assembly 52 makes one revolution. Consequently, the stop 51 will be engaged when the notch 56 is in the position to release the switch actuator spring 57. From this it will be seen that the switch D is closed only for one revolution of the shaft 53. During this time, the solenoid E is energized holding the pawl 27 against the ratchet face 26 for the stopping of the roller 24. During this period, sufficient slippage takes place between the sheet materials 21 and 22 for the feeding of the original 21 over the front guide member 42 to ride past the flipper plate 38 which, in its downward position engages the surface of the roller 24. The location of the flipper plate 38 in relation to the tangency point of the rollers 23 and 24 is such that this distance allows sufficient time for the leading edge of the original to pass the point of tangency prior to the time that the roller 24 is released. After this point is reached, the original 21 will continue to be fed out over the lip 44 of the deflector member 42.

As soon as the clutch assembly 52 is stopped by the armature 50 of the solenoid C of the switch D is opened, releasing the holding of the roller 24 by de-energizing the solenoid E so that both rollers 24 and 23 will now rotate in unison. The flipper plate 38 will now be in its upper position, guiding the sensitized material over the guide plate 40 toward and between the bite of rollers 16 and 17, whereby it is fed into the exposure portion of the apparatus.

The sequential operation of the separator mechanism is illustrated in FIGS. 3, 4, 5 and 6. As seen in FIG. 3, both the original 21 and the sensitized material 22 are about to engage the feeler bars 28. Continuing the feeding of these materials which are in intimate contact causes pivotal displacement of the feeler bars 28. As seen in FIG. 4, upon sufficient displacement, when the materials reach the bite of the rollers 23 and 24, the bar 28 is lifted, actuating the switch A. At this instant, the solenoid C is energized, closing the switch D which, in turn, energizes the solenoid E, and the pawl 27 is now lowered and stops the roller 24. The sensitized material 22 is now held; whereas the original 21 continues to be fed around the periphery of the roller 24 and is prevented by the lowered flipper plate 38 to continue in any other direction than past the front deflector member 42 toward emerging from the duplicating apparatus.

When one revolution of the shaft 53 has been made, the switch D is opened and the solenoid E is de-energized and the pawl 27 lifted. The sensitized material 22, which during this time formed a loop 60, is now being fed to-

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gether with the original 21 and guided by the lifted flipper plate 38 over the fixed guide plate 40 toward the rollers 16 and 17. Separation of the original 21 and the copy material 22 has thus been effected within a time duration of only one revolution of the feed roller 13. FIG. 6 shows the release of the roller 24 and the separated sheets 21 and 22 being fed into divergent paths. After the feeding is completed, the returned original 21 may be used again for making another print. The operating cycle has been completed and the feeler bars 28 are lowered into position for the ensuing operation.

FIG. 7 shows the simple circuit for controlling the solenoids C and E. Terminals T₁ and T₂ represent the power source. The closing of switch A completes the circuit to the solenoid C through normally closed contacts of the switch B. Switch D is operated by the clutch mechanism 52 and closes the circuit to solenoid E which, as mentioned before, actuates the stopping mechanism for the roller 24. If it is desired to disable the separator mechanism, switch B is opened. This is effected by lowering the front deflector member 42. The switching action of the feeler bar 28 in closing the switch A will have no effect inasmuch as, when switch B is opened, no current can flow to solenoid C. With the front deflector member 42 in downward position, both the original and sensitized material will be delivered, unseparated, at the front of the duplicating apparatus.

What is claimed is:

1. In a diazotype copying apparatus utilizing a rotating exposure cylinder over which a sheet of original to be copied and a sheet of sensitized material in superposed relation and intimate contact therewith are passed for exposure, the improvement in separating the original from the sensitized sheet after exposure and conveying said sheet for development which comprises, a pair of rollers including a driven roller and a follower roller having co-engaging surfaces of resilient composition, a first guide means for passing said contacting sheets between the bite of said rollers, means for sensing the advance of said sheets, means actuated by said sensing means for stopping the rotation of said follower roller for a predetermined time whereby the tractive force of said driven roller constrains the sheet in contact therewith to advance and slide past the other sheet being held by the tractive force of said stopped roller, second guide means operable by said stopping means for engaging the leading edge of said advancing sheet, and means for restoring operation of

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said stopped roller whereby the tractive force thereof constrains said other sheet to travel over a distinct path separated from said first sheet by said second guide means.

2. Apparatus in accordance with claim 1 wherein said second guide means is placed in guide position by the operation of said stopping means.

3. Apparatus in accordance with claim 1 wherein said stopping means comprises a pawl engaging a ratchet-faced flange of said follower roller, said pawl being placed into engaging position by an electromagnet energized by a timing device.

4. Apparatus in accordance with claim 1 wherein said means actuated by said sensing means comprises a switch closing the circuit to a solenoid having an armature engaging a slip clutch attached to a rotary shaft, a cam carried by said clutch, said cam engaging the actuating arm of a switch closing the circuit to said electromagnet, whereby upon retraction of said armature said cam effects actuation of said switch for the duration of one revolution of said shaft.

5. Apparatus in accordance with claim 4 wherein said rotary shaft comprises the shaft of the infeed roller carrying a plurality of endless conveyor belts for the insertion of the original and sensitized sheet materials.

6. The method of separating the original tracing from the sensitized copy material after exposure which comprises, passing both said material toward co-engaging surfaces of a pair of rollers, applying a hold for stopping the rotation of one of said rollers upon engaging said materials while continuing rotation of the other of said rollers, thereby constraining said material in contact with said driven roller to slip by said material held by said stopped roller, releasing the hold on said stopped roller and causing passage of said separated material into divergent directions.

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