United States Patent

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[73] Assignee **The Singer Company**

[54] **COPYING APPARATUS**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **355/8,** 355/16
[51] **Int. Cl.** **G03g 15/00**
[50] **Field of Search** 355/8, 3, 12, 16, 11

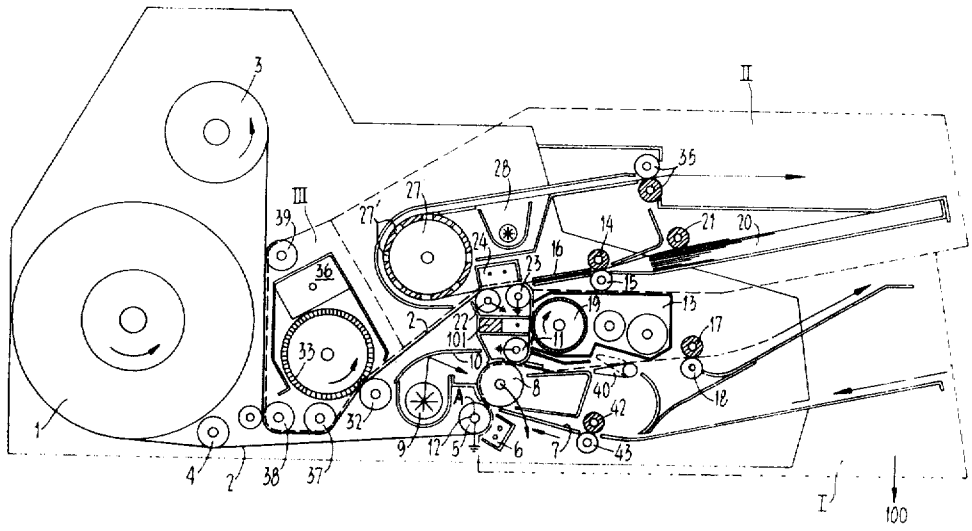
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ABSTRACT: An electrostatic copying machine in which a charge carrier in the form of a web or tape having a photoconductive surface is conducted from a supply reel through the apparatus by means of guide rollers past a plurality of component elements for the production of an electrostatic intermediate image for transfer, when developed, onto ordinary paper for the final copy, thence onto a takeup reel. Such component elements include a charging station, an exposure station for forming a latent image on the web, a developing station, an image transfer station where the developed image is transferred onto ordinary paper and a fusing station wherein the transferred image is fixed on the copy paper. In such a machine certain functional units of the device are removable to enable the initial threading of the photoconductive web through the various stations.



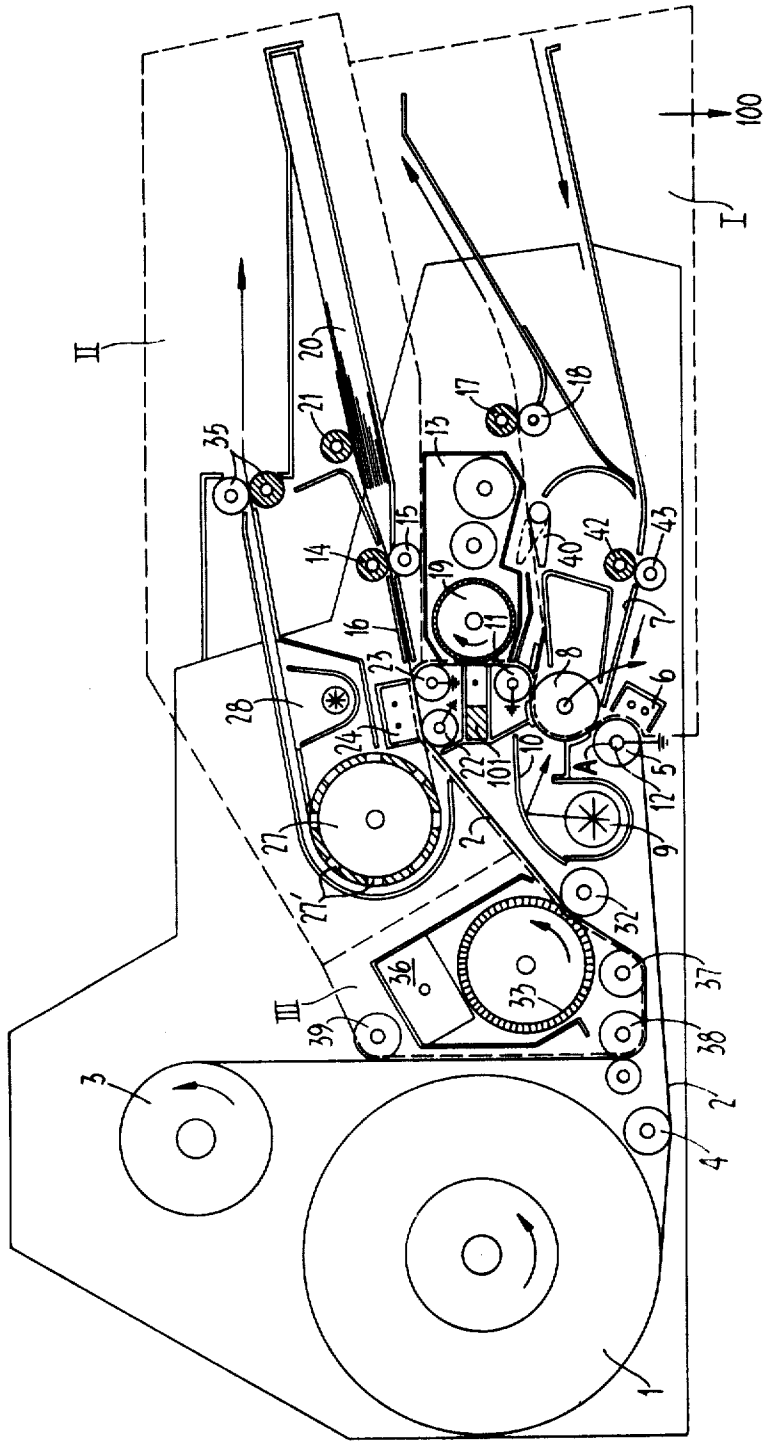

100
I
II
III
A
1
2
2'
3
4
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12
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14
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16
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19
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101

Fig. 1

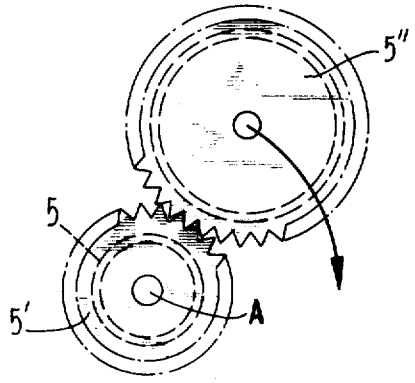


Fig_2

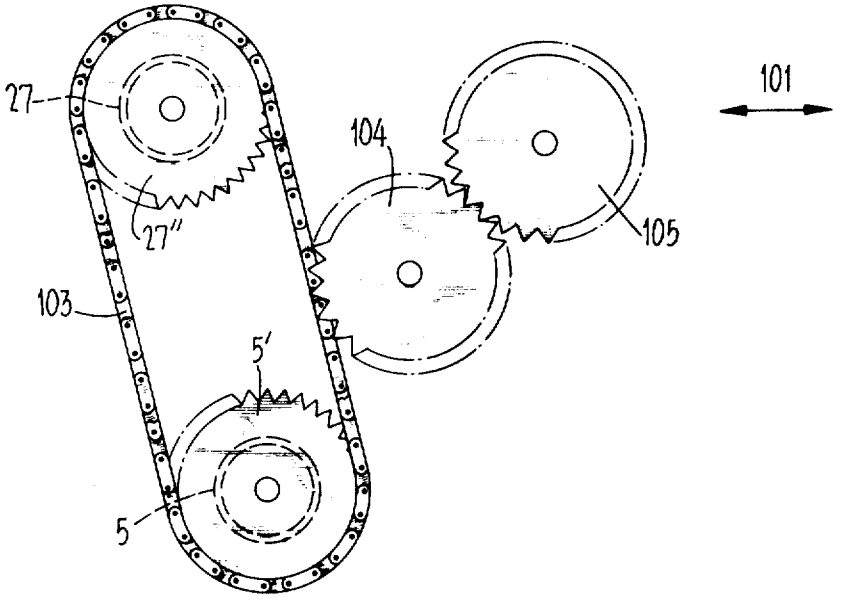


Fig_3

COPYING APPARATUS

BACKGROUND OF THE INVENTION

In known devices, wherein a photoconductive web or tape is used as the charge carrier, the initial introduction of the tape into the apparatus is very difficult. For this purpose, special transport rollers and gripping rollers, together with special guides for the tape, are incorporated into the construction of the apparatus to automatically direct the tape initially through the various stations. The necessity for these special rollers and the provision of guide systems increase the cost of manufacture of the apparatus.

SUMMARY OF THE INVENTION

In accordance with the present invention, rollers and structural elements necessary for the operation of the apparatus are assembled into groups or subassemblies at least one of which is adjustable within the machine to expose the path of travel of the tape. Such a group of rollers and structural elements is rockable within the main framework of the machine.

In the use of three such groups or subassemblies, each of two of the subassemblies may be easily and simply removed from the main framework of the machine while the third is rockable about a pivotal support, thereby exposing the path of travel of the tape to enable the threading of a new tape through the various function stations and onto the takeup reel.

In a modified development of the invention, an auxiliary length of tape, or leader, is secured at its one end to the takeup reel and at its other end is releasably or detachably secured by an adhesive foil to the leading end of the tape. After the takeup reel is filled, the tape is rewound onto the supply reel, the rewinding operation is terminated as the adhesively joined end of the tape or leader moves into an exposed area in the path of travel of the tape. The used reel of tape is then removed from the machine and the leading end of a new tape is joined to the auxiliary strip, or leader, for rethreading of the tape onto the takeup reel.

Accordingly, it is an object of the invention to provide an electrostatic copying device with improved means for the easy and simple threading of a tape through the various functional stations thereof.

Another object of the invention is to provide an electrostatic copying machine with displaceable unitized structural elements for exposing the path of travel of a photoconductive tape for the easy threading of a tape through the various stations of the machine.

Other objects and advantages will be apparent from the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings, in which:

FIG. 1 is a diagrammatic sectional elevational view of the machine,

FIG. 2 is a detailed view of a driving and driven gear, one adjustable rotatably to the other, and

FIG. 3 is a view of a drive mechanism showing a train of driven gears which are engageable or disengageable with a chain drive.

Referring to FIG. 1, a photoconductive tape or web 2, which serves as the charge carrier, travels through the apparatus and is wound on a takeup reel 3. From the supply reel 1, the tape or web 2 is conducted around guide rollers 4 and 5, roller 5 being secured on a shaft 12 journaled at its ends in the main framework of the machine and axially disposed parallel to a corona discharge element 6. At this point in its path of travel, the photoconductive surface of the tape 2 receives a charge from the corona 6 and the tape and its charged surface travel around an exposure roller 8. Immediately following the charging of the tape 2, an original 7 is moved by a pair of coacting feed rollers 42 and 43 into engagement with the tape, between the tape and the exposure roller 8, where the reflex imaging of the original onto the charged surface of the tape is effected by means of a light source 9 and a mirror 10. The exposure roller 8 forms a substantially U-shaped path of movement for the original sheet 7. Thus, an electrostatic latent image is formed on the tape which then moves over roller 11 and roller 23.

As the tape 2 moves in its path over the roller 11, the original sheet 7 is separated therefrom and by means of coacting feed rollers 17 and 18 is ejected from the machine. If more than one, or multiple, reproductions of the original 7 is desired, a diverter gate 40 is selectively adjusted from a substantially horizontal position to the angular position shown in FIG. 1 to redirect the discharged original 7 against the arcuate guide plate 41 into frictional contact between feed rollers 42 and 43 for reengagement between a newly charged surface of the tape 2 and the exposure roller 8.

As the tape 2 moves into the area between rollers 11 and 23, the latent image formed thereon is dusted with developer powder by a brush 19 rotating in a reservoir 13 of such powder. In order to repel the powder from the nonimage area of the tape, thereby preventing a gray background in the reproduction, a bias, or counter, corona 101 is provided, disposed in the main framework of the machine and in opposition to the rotating developer brush 19, with the tape passing therebetween.

In passing over the roller 23, the tape is directed in its path over a roller 22 beneath and slightly spaced from a corona 24. At this time, i.e., as the developed latent image passes over roller 23, a sheet of ordinary copy paper 16 is separated from a stack 20 of copy paper by means of a separator roller 21 and is moved into frictional contact between coacting feed rollers 14 and 15. Upon its engagement between the rollers 14 and 15, the copy sheet 16 is moved in a plane coincident with the plane of movement of the tape 2 over rollers 22 and 23 and beneath the corona 24 which serves to effect the transfer of the developed latent image on the tape to the sheet of copy paper 16.

As a transfer of the developed latent image to each sheet of copy paper is completed, the copy sheet 16 is separated from the tape or web 2 by means of a plurality of openings 27' arranged axially and circumferentially in the wall of a rotating cylinder 27 with only those openings 27' in substantially 180° of the cylinder surface being open to a subatmospheric pressure within the cylinder 27. Thereafter, the copy sheet bearing the transferred image is moved by the cylinder 27 past an infrared fusing lamp 28, at which time the transferred image is bonded to the copy sheet 16. As the copy sheet 16 is moved past the fusing lamp 28, the leading edge thereof engages between ejector rollers 35, prior to the release of the copy sheet by the cylinder 27, to enable the discharge of the copy sheet or reproduction onto a receiving tray.

Following the separation of the copy sheet 16 from the tape 2, the tape is directed downwardly between a roller 32 and a brush 33 rotating counter to the direction of movement of the tape. At this point, in the path of travel of the tape 2, the residual developer powder on the tape is removed by the rotating brush 33 and is exhausted by means of a suction device 36. Following the cleaning of the tape, it is directed in its path over rollers 37, 38 and 39 onto takeup reel 3.

When it becomes desirable to replace the used tape with a new tape, the threading of a new tape in known devices is done with very great difficulty. In order to simplify the threading of a new tape in a machine of the present invention, the various rollers and structural elements have been unitized, i.e., separate groups of such rollers and structural elements are constructed in the form of subassemblies, or units, as indicated at I, II, III in FIG. 1. These units are then secured in the main framework of the machine which carries the supply reel 1, the takeup reel 3, guide rollers 4, 5, 11, 22 and 23, the exposure light source 9 and its mirror 10, together with the bias corona 101. Group, or unit, I indicated by dashed line in the drawing comprises the corona 6, the exposure roller 8, the developer powder reservoir 13 and the developer brush 19, feed rollers 42, 43, ejector rollers 17, 18, and the selectively operable diverter gate 40, as well as the arcuate guide plate 41. As a group, these elements of unit I are supported within

an auxiliary framework which is rockably supported on the respective ends of shaft 12 which provides a rotary axis for roller 5.

The second structural element group, or unit, II indicated in dashed line in FIG. 1, comprises the copy paper supporting tray, separator roller 21, feed rollers 14, 15, transfer corona 24, the apertured separator cylinder 27, the infrared fusing device 28 and the ejector rollers 35 for the copy paper 16. The cleaning device 33 and 36 together with rollers 37, 38 and 39, are incorporated in the subassembly, or unit, III. Each of the units, I, II, and III are rockably and removably secured in a cooperating relationship in a suitable manner within the main framework of the machine.

When it becomes desirable to install a new tape in the machine, unit I is rocked in the direction of arrow 100 about its pivotal support 12 to expose the path of travel of the tape 2 over rollers 5, 11 and 23. The removal of units II and III from the main framework of the machine is effected so that the new tape 2 has but to be placed in position over rollers 5, 11, 23, 22 and 32, with its leading end secured on takeup reel 3. With the provision of sufficient slack in the tape, the units III and II are replaced in that order in the main framework of the machine and unit I is rocked upwardly to the position shown in FIG. 1 and secured in place.

Referring to FIG. 2, a gear 5' is secured on the shaft 12 and serves to drive roller 5. Enmeshed with the gear 5' is a gear 5'' which drives the exposure roller 8 so that as the unit I is rocked downwardly in the direction of the arrow 100 in FIG. 1, the gear 5'' rolls on the gear 5'.

In a modification of the invention, the unit I is slidable horizontally in the main machine frame, e.g., in the direction of the arrows 101 in FIG. 3. In this modification, a driving chain 103 is connected between a suitable sprocket wheel 5' secured on shaft 12 and a suitable sprocket wheel 27'' for driving apertured cylinder 27. A sprocket wheel 104 (FIG. 3) together with a gear secured thereon for driving gear 105, all of which are suitably supported in the auxiliary frame of the unit I serve through suitable gearing to drive exposure roller 8. As the unit I is moved to the right as viewed in FIG. 1, the sprocket 104 is moved out of its normal engagement with the driving chain 103 and the tape path is exposed.

In a modified arrangement an auxiliary piece of tape, or leader, is secured at its one end to the takeup reel 3 and is secured at its other end by any suitable means, such as an adhesive foil, to the leading end of the tape 2. The length of the auxiliary piece of tape is of a dimension such that, upon rewinding of the tape 2 onto the supply reel 1, the auxiliary piece of tape is drawn out through the apparatus to a point to the left of the roller 4 in FIG. 1. The auxiliary piece of tape is then released from the used tape 2, the supply reel 1 is exchanged by a reel with a new photoconductive tape and the leading end of this tape is again attached to the piece of auxiliary tape. Upon rotation of the takeup reel 3, the auxiliary piece of tape, as well as the new tape 2, is threaded through the device and the machine is again ready for operation.

What I claim is:

1. An electrophotographic printer comprising:

a first framework,

an auxiliary framework rockably supported on said first framework,

a supply reel and a takeup reel supported in said first framework,

a web having a photosensitive surface and adapted to move in a path from said supply reel to said takeup reel,

guide means supported in said first framework operable to define the path of travel of said web,

a corona charging element supported in said auxiliary framework normally positioned adjacent the path of travel of said web for applying a charge to said photosensitive surface of said web,

an exposure means mounted in said first framework for reflex imaging the message side of an original sheet to form a latent electrostatic image on said web subsequent to the operation of said corona charging element,

a first paper feed means mounted in said auxiliary framework normally operable to direct said original sheet into contact with the photosensitive surface of said web for movement with said web in substantially a U-shaped path past said exposure means,

means for removing said original sheet from contact with said photosensitive surface of said web subsequent to the formation of the latent image on said web,

an ejector means for discharging said original sheet upon operation of said removing means,

a diverter means selectively adjustable to supersede the operation of said ejector means and redirect said original sheet for repeat control by said first paper feed means and said removing means,

a developer means supported in said auxiliary framework normally positioned adjacent the path of travel of said web for applying developer powder to the electrostatic latent image formed on said web,

a second paper feed means for moving a copy sheet into engagement with the developed image bearing surface of said web, the movement of the copy sheet being in a plane coincident with the defined path of movement of said web,

an image transfer means for effecting the transfer of the developed latent image from said web to said copy sheet upon engagement of said copy sheet with the image bearing surface of said web,

means for separating the copy sheet from said web following the operation of said image transfer means, and

a fusing means for fixing the transferred image on the copy sheet subsequent to the operation of said separating means,

said auxiliary framework being rockable on said first framework to remove said corona charging element, said first paper feed means and said developer means from their respective positions adjacent the defined path of travel of said web thereby exposing a portion of the path of travel of said web to enable threading of said web from said supply reel to said takeup reel.

2. In the apparatus of claim 1 wherein said first paper feed means comprises a reflector roller for maintaining contac said original with said web for movement therewith, and

a pair of coacting rollers for directing the original into engagement with said reflector roller and said web.

3. In the apparatus of claim 1 wherein said developer means comprises a developer power reservoir, and

a brush rotatable in the power within said reservoir operable to apply powder to the latent image bearing surface of said web.