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Bendall

[11] **3,860,339**

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[54] **COPYING MACHINE**

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[73] Assignee: **Xerox Corporation,** Stamford, Conn.

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[52] **U.S. Cl.** **355/14,** 271/64
[51] **Int. Cl.** **G03g 15/00**
[58] **Field of Search** 355/14, 97, 99, 100, 102, 355/106, 109; 271/64

[56] **References Cited**

UNITED STATES PATENTS

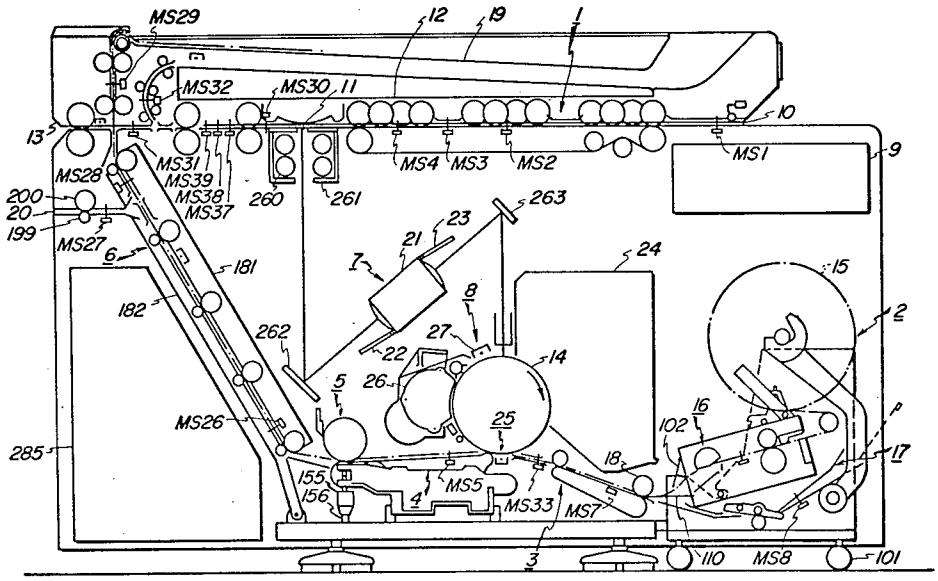
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Primary Examiner—Richard M. Sheer

[57] **ABSTRACT**

An improved electrostatic copying machine in which documents to be reproduced are transported along alternate paths to exit at the front or the rear of the machine and in which copies produced are transported along alternate paths to exit at the front or rear of the machine. One of the copy paths intersects with the document path. An electrical control enables different combinations of the document and copy paths to be effected at the option of a machine operator while preventing a combination with the path of intersection between document and copy.

5 Claims, 2 Drawing Figures



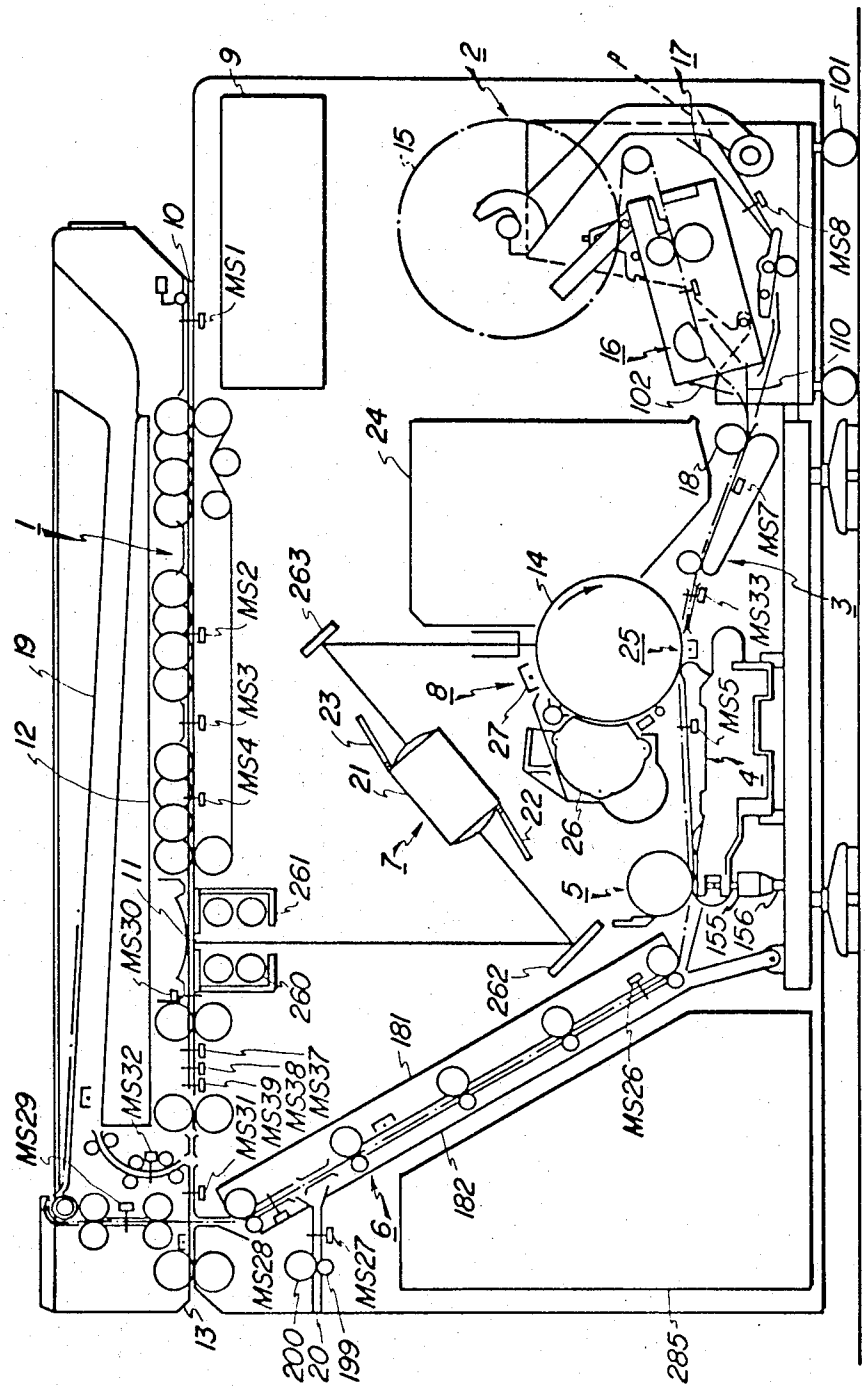

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FIG. 1

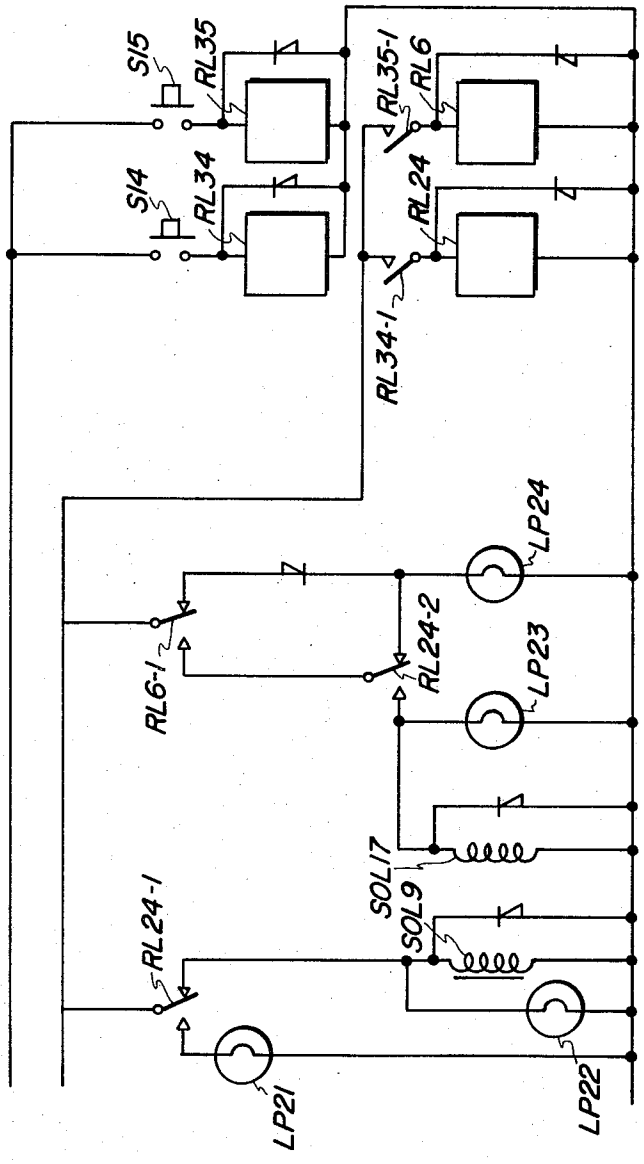

S15
RL35
RL35-1
RL6
S14
RL34
RL24
RL34-1
LP24
RL6-1
RL24-2
LP23
SOL17
SOL9
RL24-1
LP21
LP22

FIG. 2

COPYING MACHINE

This invention relates to a copying machine, that is to say, to a machine into which a document to be copied is fed, and from which the document is retrieved together with one or more copies of the document. The invention has application to any copying machine in which the document and copy respectively follow predetermined paths through the machine, but will be particularly described with reference to an electrostatographic reproducing machine.

Copying machines are known in which the document and copy follow predetermined paths through the machine. Many such machines, however, suffer from the disadvantage that only one path is usually available for each of the copy and document. There is accordingly no choice of delivery positions, nor any choice as to the kind of documents which may be copied. One known kind of copying machine in which this disadvantage is partially overcome is described in our U.K. Patent Specification No. 1,094,188. The machine described in this earlier specification enables documents that are fed into the front of the machine to be either returned along a curved path to the front of the machine, or else delivered to the rear of the machine after following a plane path through the machine. This latter path enables stiff documents to be copied. Flexible documents, on the other hand, are more conveniently delivered to the front of the machine, thereby saving the operator from having to walk around the machine to retrieve the document. In this known machine, however, the copy paper follows a path located wholly to one side of the path followed by the document, with the consequent disadvantage that it gives rise to a relatively large machine.

It is an object of the present invention to provide a copying machine in which some of the disadvantages of known copying machines are overcome.

According to the present invention, there is provided a copying machine including means for conveying a document into the machine for copying, means for feeding the document out of the machine along either one of two document paths, means for feeding the copy out of the machine along either one of two copy paths, one of said document paths and one of said copy paths intersecting one another, and means for permitting the document and copy to follow any selected combination of said paths other than said intersecting paths.

Preferably, one of the document paths is a substantially plane path, thereby permitting stiff documents to be copied.

Preferably, one document path and one copy path are such as to deliver the document and copy respectively to the front of the machine, and the other document path and the other copy path are such as to deliver the document and copy respectively to the rear of the machine, the rear document path and the front copy path intersecting one another. In these circumstances, the machine permits of a very compact arrangement, while allowing the feeding of flexible or stiff documents. In the case where flexible documents are fed in, the document may be delivered to the front of the machine, whilst the copy may be delivered either to the front or to the rear of the machine. Optionally, a flexible document may be fed to the rear of the machine, along the plane path, which is obviously the path which must be selected for stiff documents. In this case, the copy is fed to the rear. The copy is prevented from being fed to the front of the machine to prevent the occurrence of a collision at the intersection of the document and copy paths.

A copying machine in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic cross-sectional representation of an electrostatographic reproducing machine; and

FIG. 2 is a circuit diagram showing the portions of the control circuitry of the machine of FIG. 1 which are relevant to the invention.

Referring to FIG. 1, a brief outline of the machine and its mode of operation will be given with reference to the major sub-units of the machine, followed by a more detailed description of the sub-units relevant to the invention.

The document to be copied is fed into a document handler **1** by way of a feed-in slot **10** at the front of the machine. The document is carried by the document handler **1** past an exposure slit **11**, and is then conveyed either towards the front of the machine, to be delivered into a document tray **12**, or to the rear of the machine, as required (or as necessitated by the stiffness of the document) through a rear exit slot **13**. As the document is fed into the document handler **1**, copy paper, from the copy paper feeder **2**, is fed over a registration transport assembly **3** into contact with the photoconductive drum **14** of the machine. Copy paper may be supplied either from a copy paper roll **15** which is then cut to the desired length by a rotary knife **16**, or may be fed in cut lengths through a manual feed chute **17**. The registration transport assembly **3** ensures that the leading edge of the copy paper sheet arrives at the drum **14** in registration with the leading edge of the developed image which is brought by rotation of the drum **14** into transferring contact with the copy paper sheet. The copy paper sheet, carrying the transferred image, is carried along a horizontal transport assembly **4** to a fuser assembly **5**, where the image is heat-fixed onto the copy paper sheet. The copy paper sheet, carrying the fixed image, is then fed into the lower end of a vertical transport assembly **6**, to be fed out as required, either into a copy tray **19** mounted above the document tray **12**, or through a rear exit mouth **20**.

As the document passes over the exposure slit **11**, an image of the document is projected by an optical system **7** onto the photoconductive drum **14** of a xerographic system **8**. For a detailed description of this machine, reference may be made to our co-pending patent application Ser. No. 371,455 entitled ELECTOSTATOGRAPHIC COPYING MACHINE filed on June 19, 1973, in the names of Dennis M. Bendall, William R. Harris, Peter (NMI) Summers, Raymond S. Pyart, Jeffrey (NMI) Ken, Michael C. D. Sherborne, Alistair J. Caldwell, Peter M. Thorp and John A. Jones.

Considering now the document handler in more detail, an original document, which may be opaque or transparent, and which may be of flexible or rigid material, is fed into the document handler at feed-in slot **10**. Feed-in slot **10** is formed between the underside of the document tray **12**, and a feed-in platform **30** mounted on the top front portion of the machine frame. Assuming that the machine is in a "print" condition, a set of conveyor belts **31** drive the document forwardly into the machine. The conveyor belts **31** extend around rol-

lers **32** and **33**, of which the rearmost roller **33** is a drive roller.

Above and in contact with the conveyor belts **31** are a series of rollers consisting of foam polyurethane discs **36**, which rest under the weight of their supporting shafts, (not shown) on the belts **31**. The discs **36** thus hold a document (if present) down onto the belts **31**. At the rearmost end of the belts **31**, the document is fed between the exposure slit **11** and a platen **39** which is spring loaded into engagement with the document, and is supported on the underside of the document tray **12**. Having passed between the exposure slit **11** and platen **39**, the leading edge of the document is gripped between a rubber-coated drive roller **40** and a pinch roller **41** which rests under its own weight on top of the document, and maintains it in engagement with the drive roller **40**. The document is further advanced by a pair of rollers **42, 43**, exactly similar to the rollers **40** and **41** respectively.

After passing the rollers **42** and **43**, the leading edge of the document arrives at a deflector baffle **44**, mounted on the machine frame and operated by a solenoid SOL **9**, which determines whether the document is fed forwardly and upwardly for delivery to the document tray **12**, or rearwardly out of exit slot **13**. In the case where the document is to be fed forwardly, it is fed around a curved guide **45**, mounted on the machine frame, by three pairs of rollers **46, 47**, and **48**. The rollers of each pair on the outside of the curve are drive rollers.

If the rear exit mode is selected for the document, the deflector baffle **44** feeds the document between a drive roller **49** and a set of polyurethane foam discs **50** which rest under the weight of their support shaft (not shown) on the roller **49**.

Turning now to consider the copy paper path, the finished copy is driven upwardly by the vertical transport assembly **6**. A set of drive rollers are provided on a driving assembly **181**, and a set of back up rollers are provided on a pinch pan assembly **182**. After being fed by the first four sets of rollers and back up rollers the paper encounters a deflector baffle **196**, which dictates whether the paper will be delivered forwardly to the copy tray, **19**, on top of the machine, or through the exit mouth **20** at the rear of the machine. The deflector baffle **196** is operated by a solenoid SOL **17**, and if the paper is to be fed to the front of the machine, guides the paper directly upwards past an exit mouth **197** in the pinch pan. If, on the other hand, the paper is to be fed to the rear of the machine, the deflector baffle **196** is moved by the solenoid SOL **17** so that the paper is deflected to pass through the exit mouth **197** of the pinch pan and out of the exit mouth **20** at the rear of the machine.

If the copy paper is to be fed forwardly to the copy tray **19**, after deflection by the deflector baffle **196** the paper is driven by a fifth set of drive rollers on the driving assembly **181**, and upwards towards an upper vertical transport assembly **204**. On emerging from the top of the lower vertical transport assembly **6**, the leading edge of the copy paper is guided by baffles across the path followed by documents being fed to the rear of the machine. Obviously, a collision of document and copy would occur at this point if the document were fed to the rear of the machine, and the copy to the front. The machine logic circuitry accordingly allows the delivery of document to the front and copy to the front, document to the rear and copy to the rear, and also document to the front and copy to the rear. The circuitry is arranged, however, such that it is not possible for the document to be fed to the rear and the copy to the front.

Once the copy paper has passed the rear-exit document path, it is fed further upwards by the upper vertical transport assembly **204**. On emerging from between the uppermost roller **209** and back up roller **210** of the upper vertical transport assembly, the paper is guided from motion in a vertical direction to motion in a horizontal direction by a substantially quarter-cylindrical guide plate **212**. As it is guided around the guide plate **212**, the paper passes over a perforated tube **213** which blows air under the copy paper as it is fed into the copy tray **19**. The copy accordingly slides down towards the front of the copy tray **19** assisted by the cushion of air formed under the sheet by the perforated bar **213**.

Referring to FIG. **2**, document deflector baffle **44** is operated by solenoid SOL **19**, and copy paper baffle **196** is operated by solenoid SOL **17**. These solenoids have been arranged so that, when de-energised, the documents are fed to the front exit position, and copies are fed to the rear exit position, thus ensuring a "fail safe" element in the operation of the machine. Solenoids SOL **17** and SOL **19** are actuated by means of electro-mechanical latching relays (divide by two) so that the system retains a memory of its last command even if power is removed.

Considering first the selection of the copy exit mode, the operation of "copy to front or rear" switch S **15** by the operator, causes RL **35** to change state. This will either de-energise or energise the slave relay RL **6** dependent on the previous condition of RL **35**. RL **6** has one change over contact, RL **6-1**, supplying power in its first, normally closed, state to the "copy rear exit" indicator lamp LP **24**. When relay RL **6** is called the normally open part of the change-over contact RL **6-1** then supplies power to the copy exit solenoid SOL **17** via the normally open contact RL **24-2** of the document exit selection slave relay RL **24**. Thus if RL **24** is called when RL **6** is called, the copy exit solenoid SOL **17** will be acutated, and the copy returned to the front of the machine.

Considering now the selection of document exit mode, pressing operator switch S **14** ("document to front or rear") causes relay RL **34** to change state. This will either energise or de-energise its slave relay RL **24**, depending upon its previous condition. RL **24** has two sets of change-over contacts. RL **24-2** changes over to switch the "copy front exit" demand from RL **6-1** either to the copy exit solenoid SOL **17** and copy-front-exit lamp LP **23** (the normally open contact) or to the copy-rear-exit lamp LP **24** (the normally closed contact). RL **24-1** switches power to either the "document front exit" indicator lamp LP **21** (the normally open contact) or to the "document rear exit" solenoid SOL **19** and its indicating lamp LP **22**.

This switching of the copy-front-exit signal through RL **24** inhibits the condition in which documents and copies would collide (documents to the rear and copies to the front).

What we claim is:

1. An improved electrostatic copying machine for handling documents to be reproduced and copies produced along alternate transport paths comprising:

means for transporting documents along first or second paths,

means for transporting copies along third or fourth paths wherein a one of said copy paths intersects with a one of said document paths, and

control means for selectively transporting the documents and copies along a desired predetermined path at the option of a machine operator while preventing a combination which would result in the aforementioned intersecting paths.

2. The machine of claim **1** wherein one of the document paths is a substantially plane path.

3. The machine of claim **1** wherein one of said document paths and one of said copy paths are such as to deliver the document and copy respectively to the front of the machine, and the other document path and the other copy path are such as to deliver document and copy respectively to the rear of the machine, the rear document path and the front copy path intersecting one another.

4. The machine of claim **3** wherein said control means for transporting the document and copy to follow the selected paths comprises a document exit selection switch and a copy exit selection switch, the document exit switch actuating a document direction selecting device, and the copy exit selection switch actuating a copy direction selecting device, the copy exit selection switch being operable to direct the copy to the front only if the document exit selection switch has been operated to select the front exit.

5. The machine of claim **4** wherein the document direction selecting device is a solenoid operated baffle and the copy direction selecting device is a solenoid operated baffle.

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