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COPYING MACHINE

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FIG. 1.

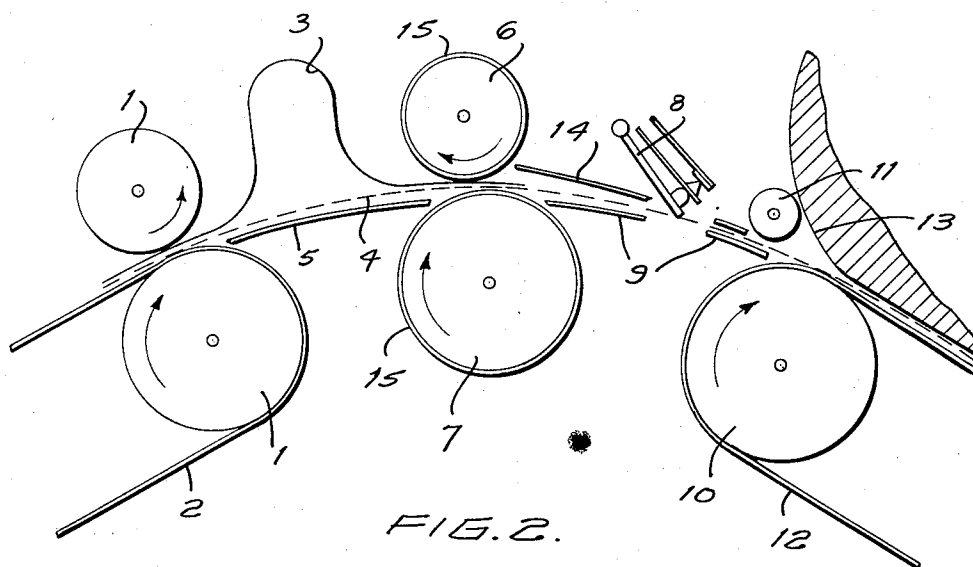
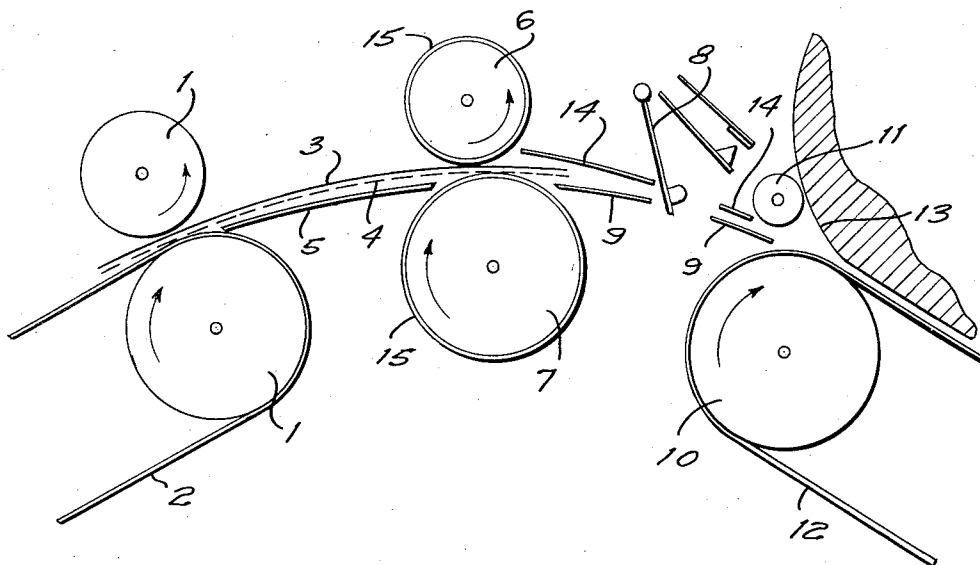


FIG. 2.

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COPYING MACHINE

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The present invention relates to a copying machine. More particularly, the present invention relates to a copying machine of the type used for making blueprints and the like, for example, wherein a copy sheet and an original sheet are placed in a part of the machine where the copy sheet is exposed so as to be impressed with a copy of the original, and thereafter the thus exposed copy sheet is developed in a different part of the machine so as to produce a copy of the original.

Inasmuch as the development of the exposed copy sheet requires treatment of the same with such materials as ammonia vapors, it is necessary that the sheets be separated from each other after exposure of the copy sheet and before development thereof.

One of the objects of the present invention is to provide a machine which is capable of reliably separating the original and copy sheet from each other before the copy sheet is developed.

Another object of the present invention is to provide a machine which separates the two sheets from each other in a fully automatic manner.

An additional object of the present invention is to provide an apparatus and a process capable of automatically and reliably separating an exposed copy sheet from an original in a fully automatic manner before the copy sheet reaches a developing part of the machine and after the sheets leave an exposure part of the machine and all of these operations taking place continuously while the original nevertheless stops its movement from the exposure part of the machine to the developing part of the machine.

An additional object of the present invention is to provide a structure capable of accomplishing all of the above objects and at the same time being composed of simple and ruggedly constructed elements which are very reliable in operation and which will require a minimum amount of maintenance over long periods of time.

With the above objects in view the present invention mainly consists of a copying machine which includes a pair of transporting rollers located closely adjacent to each other and being parallel to each other for transporting therebetween an original sheet and a copy sheet in a given direction when the rollers rotate in opposite directions. A feeler means is located in the path of movement of the sheets to be engaged and moved thereby for actuating a device which reverses the direction of rotation of one of the transporting rollers. The reversal of the direction of rotation of this one transporting roller causes the sheet engaged thereby to reverse its direction of movement so as to become separated from the other sheet.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific

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embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic illustration of one possible embodiment of a structure according to the present invention; and

Fig. 2 shows the structure of Fig. 1 in a different position thereof.

Referring now to the drawings, it will be seen that a first pair of transporting rollers 1 are provided, these transporting rollers 1 being parallel to each other and being rotatable in opposite directions for transporting a copy sheet 4 and an original sheet 3 which overlies and engage each other between the rollers 1 to the right, as viewed in Figs. 1 and 2. A band 2 may extend about the lower roller 1 of the drawings to be moved thereby, and this band 2 is located adjacent an unillustrated copy cylinder of the exposure part of the copying machine where the copy sheet 4 is exposed so as to be impressed with a copy of the original sheet 3, the copy sheet 4 being made of a suitable light-sensitive material. As the sheets 3 and 4 move to the right, as viewed in Figs. 1 and 2, they are supported by a guide member 5 which may be in the form of a sheet metal member supported in any suitable way, and thus the sheets 3 and 4 move to the right to a second pair of transport rollers 6 and 7 which are located at the right end of the guide member 5, as viewed in the drawings.

The transport rollers 6 and 7 are parallel to and located closely adjacent to each other and they are provided with outer surfaces having a high coefficient of friction so that they reliably engage the sheets 3 and 4 and continue the transportation thereof to the right, as viewed in the drawings. For example, the rollers 6 and 7 may have roughened outer surfaces, or they may be provided with coatings 15 of rubber, as indicated in the drawings, so that these rubber coatings provide a surface of a high coefficient of friction to reliably engage the sheets 3 and 4 so as to continue the transportation thereof to the right, as viewed in the drawings. In the illustrated example, the upper roller 6 which engages the original sheet 3 is reversible for a purpose described below.

A feeler means 8 is located in the path of movement of the sheets 3 and 4 to be engaged and moved thereby for actuating a device which reverses the direction of rotation of the roller 6, so that when the feeler means 8 is moved by the sheets 3 and 4 from the position of Fig. 1 to that of Fig. 2, the roller 6 is turned in the same direction of rotation as the roller 7, and thus the direction of movement of the original sheet 3 is reversed while the copy sheet 4 continues to move in the original direction to the right, as viewed in the drawings. As a result of this reversal of the direction of rotation of the roller 6, the sheet 3 which is still engaged by the rollers 1 and which is in direct engagement with the upper roller 1 of the drawings forms a loop, as indicated in Fig. 2, and when this sheet 3 which is thus looped finally moves with its right end, as viewed in Fig. 2, to the left of the roller 6, the sheet 3 is moved away from the sheet 4 by the upper roller 1, and suitable guide members may be provided for guiding the sheet 3 away to any desired location in a different direction from the movement of the sheet 4.

This sheet 4 continues to move to the right and after passing the feeler means 8, the sheet 4 is engaged by a third pair of transporting rollers 10 and 11, the roller 10 having a transporting band 12 passing thereabout, for example. The third pair of transporting rollers 10 and 11 continue the transportation of the copy sheet 4 to the right, as viewed in the drawings, and move the copy sheet 4 into a developing part 13 of the copying machine where the copy sheet 4 is developed and then removed from

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the machine in a manner not forming part of the present invention.

Thus, it is apparent that with the structure of the invention the original sheet 3 and the copy sheet 4 are reliably separated from each other in a fully automatic manner, before the sheet 4 enters into the developing part of the machine, so that in this way the original sheet 3 never reaches the developing part of the machine and moves away from the sheet 4 in a fully automatic manner.

The sheet 4 is guided from the roller 7 to the roller 10 by a sheet metal plate 9 which extends between the rollers 7 and 10 and which is supported in any suitable manner. Another sheet metal guide member 14 is located over the sheet 9, and these sheet metal plates 9 and 14 are formed with aligned openings through which the feeler means 8 extends in its rest position shown in Fig. 1. The guide plates 9 and 14 are located closely adjacent to each other and they approach each other as they recede from the rollers 6 and 7 and approach the feeler means 8, so that in this way the plates 9 and 14 cooperate with each other to guide the sheets to the feeler means 8 and to guarantee that the latter is moved by the sheets so as to actuate the device which reverses the direction of rotation of the roller 6. The feeler means 8 may be in the form of a lever which is pivotally mounted at its top end, as viewed in Figs. 1 and 2, and which simply hangs through the openings of the plates 9 and 14 in the position of the parts shown in Fig. 1. When this feeler means 8 is raised by the sheet to the position illustrated in Fig. 2, a projection located adjacent the bottom end of the feeler means engages a movable switch contact member to move the latter to a position where it engages a stationary switch contact member so as to close a circuit which causes the direction of rotation of the roller 6 to be reversed. For example, the closing of the electrical circuit in this manner may energize a magnet which shifts a clutch operatively connected to the roller 6 for reversing the direction of rotation thereof.

In the event that it is desired to handle sheets of different widths, then a plurality of feeler members 8 may be located beside each other and may be distributed across the path along which the sheets are transported. Such a plurality of feeler members 8 may operate with a plurality of switch contact members, or all of these feeler members may be mechanically interconnected for movement together so that only one switch contact member need be provided to be closed upon movement of the feeler members.

The feeler member 8 will be located in its operating position which causes the roller 6 to rotate in the same direction as the roller 7 as long as the feeler member 8 is engaged by the copy sheet 4. If this copy sheet is in the form of an endless band, then the roller 6 continuously turns in the same direction as the roller 7 and when a new original sheet engages the roller 6 it is immediately moved thereby in a direction opposite to the direction of movement of the sheet 4.

Of course, instead of reversing the direction of movement of the original sheet 3, the structure may be arranged so as to reverse the direction of movement of the copy sheet and suitable guides may be provided to lead the copy sheet whose direction of movement is reversed to the developing part of the machine.

The rollers 6 and 7 are preferably arranged with respect to each other in such a way that the space therebetween is less than the total thickness of the sheets 3 and 4 so that these sheets are reliably gripped by the rollers 6 and 7 to be transported thereby. However, it is preferred that the rollers 6 and 7 do not engage each other when there are no sheet therebetween. If the distance between the rollers 6 and 7 is smaller than the thickness of either of the sheets 3 and 4 then it may happen that when a single one of these sheets is engaged by the rollers 6 and 7 and the direction of rotation of the roller 6 is reversed so that it rotates in the same direction as the

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roller 7, the rollers 6 and 7 will engage opposite faces of the same sheet and will produce oppositely directed forces on these opposite faces which might cause the rollers 6 and 7 to simply remain stationary. In order to avoid such a stopping of the operation of the machine, it is preferred in accordance with the present invention to make the distance between the rollers 6 and 7 and the feeler means 8 greater than the distance between the feeler means 8 and the rollers 10 and 11. With the parts arranged in this way, as shown in Figs. 1 and 2, the sheet 4, for example, will be engaged by the rollers 10 and 11 before the sheet 4 can be engaged only the rollers 6 and 7, so that the additional pull on the sheet 4 exerted by the rollers 10 and 11 will guarantee that the sheet 4 continues to move in the desired direction even if only the sheet 4 is engaged by the rollers 6 and 7. In other words, as the sheets 3 and 4 move together through the rollers 6 and 7 and the feeler means 8 has not yet been engaged by the sheets, then the rollers 6 and 7 respectively engage the sheets 3 and 4. Upon engagement of the feeler means by the sheets, the sheet 3 starts to move in the reverse direction while the sheet 4 continues to move in the same direction. By arranging the rollers 10 and 11 closer to the feeler means 8 than the rollers 6 and 7, the sheet 4 will necessarily engage the rollers 10 and 11 before the sheet 3 has been moved to the left beyond the roller 6 whose direction of rotation has been reversed, and thus there is no danger of stopping the transportation of the sheet 4 even after the sheet 3 has moved to the left, as viewed in Fig. 1, beyond the roller 6 so that only the sheet 4 may possibly be engaged by the rollers 6 and 7 where these rollers are spaced from each other by a distance less than the thickness of the sheet 4.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of copying machines differing from the types described above.

While the invention has been illustrated and described as embodied in sheet separating means for copying machines, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a copying machine, in combination, a pair of transporting rollers parallel to each other and located closely adjacent to each other for engaging an original and an exposed copy sheet and transporting the same while said rollers turn in opposite directions, one of said rollers being reversible; a device for reversing the direction of rotation of said one roller; and feeler means located in the path along which the sheets are moved by said rollers to be engaged and moved by said sheets for actuating said device for reversing the direction of rotation of said one roller so that the sheet engaged by the latter changes its direction of movement while the other sheet continues to move in the same direction, whereby the original sheet and the copy sheet are separated from each other.

2. A process for operating a copying machine comprising the steps of rotating a pair of transporting rollers in opposite directions feeding an original sheet and a copy sheet superimposed upon each other between said rollers so as to transport them in a first direction partly beyond said rollers; and then moving said sheets into engagement with a feeler which reverses the direction of

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rotation of one of said rollers as long as said feeler is engaged by either one of said sheets so that during such engagement said rollers turn in the same direction, whereby the sheet engaged by said one roller is moved in a second direction opposite to said first direction in order to separate the sheets from each other.

3. In a copying machine, in combination, a first pair of transporting rollers arranged parallel to each other and rotating in opposite directions for engaging an original sheet and a copy sheet therebetween and transporting the same in a first direction; a second pair of transporting rollers located after said first pair of rollers in the direction of movement of the sheets and being arranged parallel to each other and rotating in opposite directions for engaging the sheets and transporting the same also in said first direction, one of said second rollers and one of said first rollers engaging one of said sheets simultaneously; and feeler means located after said second pair of rollers in the direction of movement of said sheets to be moved by the latter for actuating a device which reverses the direction of rotation of said one second roller so that said one sheet is moved in a second direction opposite from said first direction while the other of said sheets continues to move in said first direction, whereby said sheets are separated from each other and whereby said one sheet simultaneously engaged by said one second roller and said one first roller forms a loop between said one second roller and said one first roller.

4. In a copying machine, in combination, a first pair of parallel transporting rollers located closely adjacent to each other and rotating in opposite directions for transporting therebetween an original sheet and a copy sheet in a first direction; feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing one of said rollers so that the sheet engaged by said one roller moves in a reverse direction while the other sheet continues to move in said first direction; and a second pair of transporting rollers located after said feeler means in the direction of movement of the sheets and located closer to said feeler means than said first pair of rollers.

5. In a copying machine, in combination, a pair of parallel transporting rollers located closely adjacent to each other and being rotatable in opposite directions for transporting therebetween an original sheet and a copy sheet engaged by said rollers in a given direction; feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing one of said rollers so that the sheet engaged by said one roller reverses its direction of movement while the other sheet continues to move in said given direction, whereby the sheets are separated from each other; and a pair of guide members located closely adjacent to each other and extending between said rollers and feeler means for guiding said sheets from said rollers to said feeler means.

6. In a copying machine, in combination, a pair of parallel transporting rollers located closely adjacent to each other and being rotatable in opposite directions for transporting therebetween an original sheet and a copy sheet engaged by said rollers in a given direction; feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing one of said rollers so that the sheet engaged by said one roller reverse its direction of movement while the other sheet continues to move in said given direction, whereby the sheets are separated from each other; and a pair of guide members located closely adjacent to each other and extending between said rollers and feeler means for guiding said sheets from said rollers to said feeler means, said guide members being in the form of a pair of sheet metal plates extending from said rollers beyond said feeler means and formed with cutouts into which said feeler means extends to be engaged and moved by the sheets which move between said sheet metal plates.

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7. In a copying machine, in combination, a pair of transporting rollers parallel to each other and located closely adjacent to each other for rotation in opposite directions to transport therebetween an original sheet and a copy sheet in a given direction; feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing the direction of rotation of one of said rollers so as to reverse the direction of movement of the sheet engaged by said one roller while the other sheet continues to move in the given direction; and a second pair of transport rollers located directly behind said feeler means in the direction of movement of the sheets to engage said other sheet and continue the movement thereof in the given direction.

8. In a copying machine, in combination, a pair of transporting rollers parallel to each other and located closely adjacent to each other for rotation in opposite directions to transport an original sheet and a copy sheet in a given direction, said rollers having outer surfaces of a high coefficient of friction to reliably engage and move said sheets; and feeler means located in the path of movement of the sheets to be engaged and moved thereby for reversing the direction of rotation of one of said rollers to cause the sheet engaged thereby to reverse its direction of movement and to become separated from the other sheet.

9. In a copying machine, in combination, a pair of parallel transporting rollers located closely adjacent to each other and being rotatable in opposite directions for transporting an original sheet and a copy sheet between said rollers in a given direction, said rollers having outer layers of rubber for frictionally engaging said sheets to transport the same reliably; and feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing the direction of rotation of one of said rollers so as to reverse the direction of movement of the sheet engaged by said one roller to separate the sheets from each other.

10. In a copying machine, in combination, a first pair of transporting rollers for transporting an original sheet and a copy sheet from a part of the machine where the copy sheet has been exposed; a second pair of transporting rollers located in the path of movement of the sheets and being located closely adjacent to and parallel to each other for engaging and continuing the transportation of the sheets when said second pair of rollers turn in opposite directions, the one of said second pair of rollers which engages the original sheet being reversible in its direction of rotation; feeler means located after said second pair of rollers in the direction of movement of the sheets to be engaged and moved thereby for actuating a device for reversing the direction of rotation of said one of said second pair of rollers to reverse the direction of movement of said original sheet while the copy sheet continues to move in the original direction; and a third pair of transporting rollers located after said feeler means in the direction of movement of the sheets for engaging the copy sheet after it passes said feeler means and transporting said copy sheet to a developing part of the copying machine.

11. In a copying machine, in combination, a pair of transporting rollers parallel to and located closely adjacent to each other for transporting therebetween an original sheet and a copy sheet when said rollers rotate in opposite directions; feeler means located in the path of movement of said sheets to be engaged and moved thereby for actuating a device for reversing the direction of rotation of one of said rollers so that the sheet engaged by said one roller reverses its direction of movement; and a pair of sheet metal glide members respectively located on opposite sides of said sheets and respectively extending between said rollers and feeler means for guiding said sheets to said feeler means, said guide plates being located closely adjacent to each other and gradually approaching each other as they approach said feeler means.

12. A process for operating a copying machine comprising the steps of rotating a pair of transporting rollers in opposite directions; feeding an original sheet and a copy sheet superimposed upon each other between said rollers for movement in one direction; reversing the direction of rotation of one of said rollers so as to move the sheet engaged by said one roller in a second direction

opposite to said first direction in order to separate the sheets from each other.

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