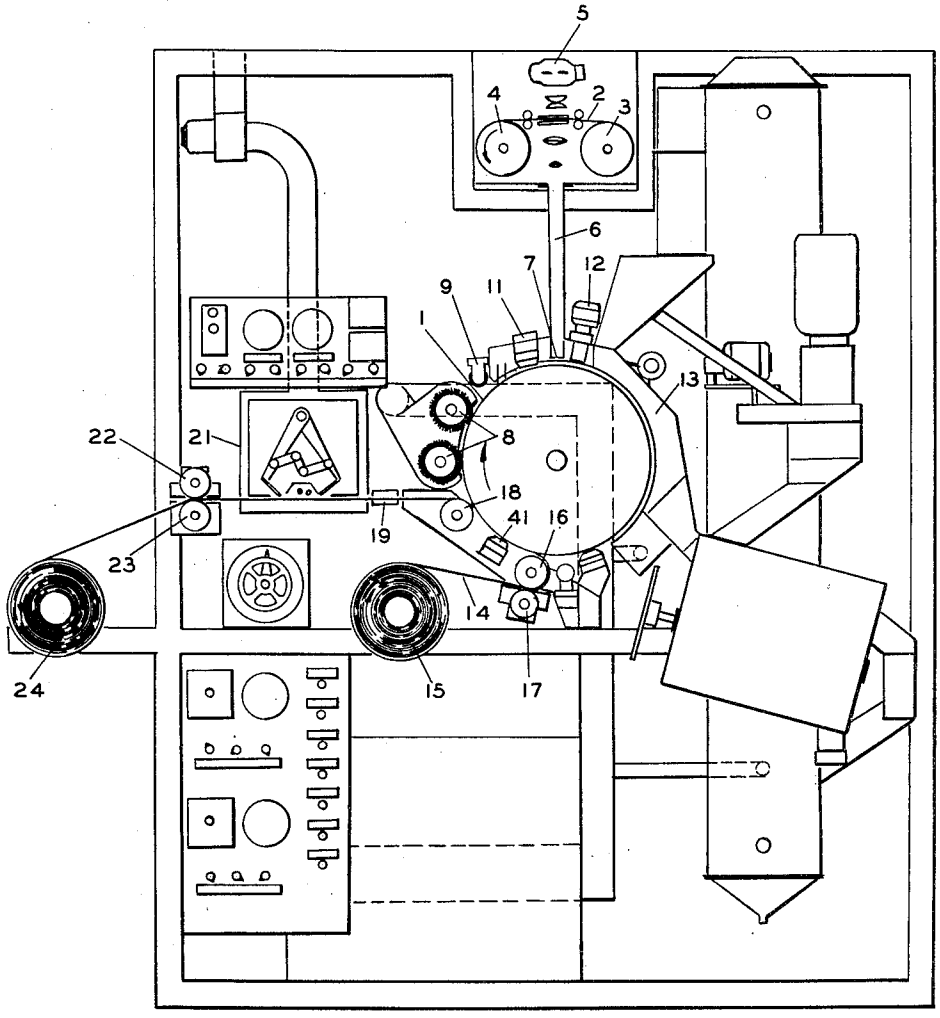
Feb. 19, 1957 H. E. CRUMRINE ET AL 2,781,705

PAPER HANDLING MECHANISM FOR XEROGRAPHIC COPYING MACHINE

Filed Oct. 29, 1953 4 Sheets-Sheet 1

FIG. 1



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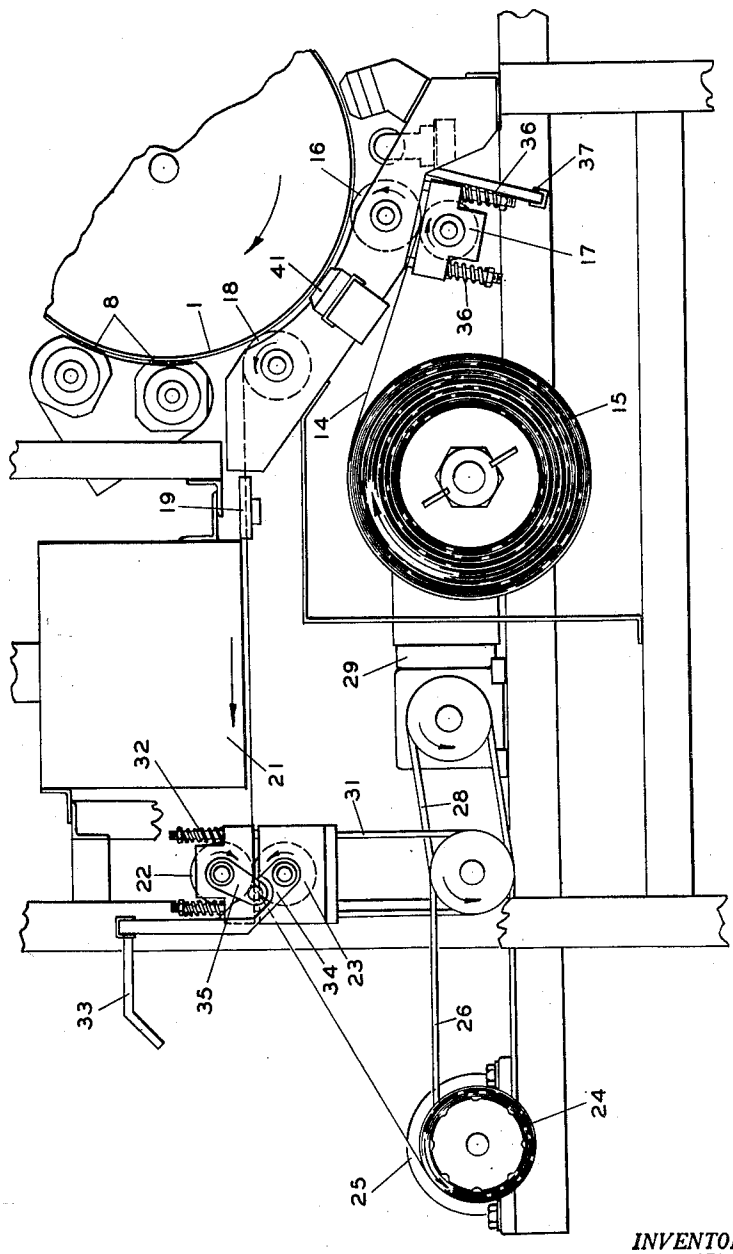
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PAPER HANDLING MECHANISM FOR XEROGRAPHIC COPYING MACHINE

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FIG. 2



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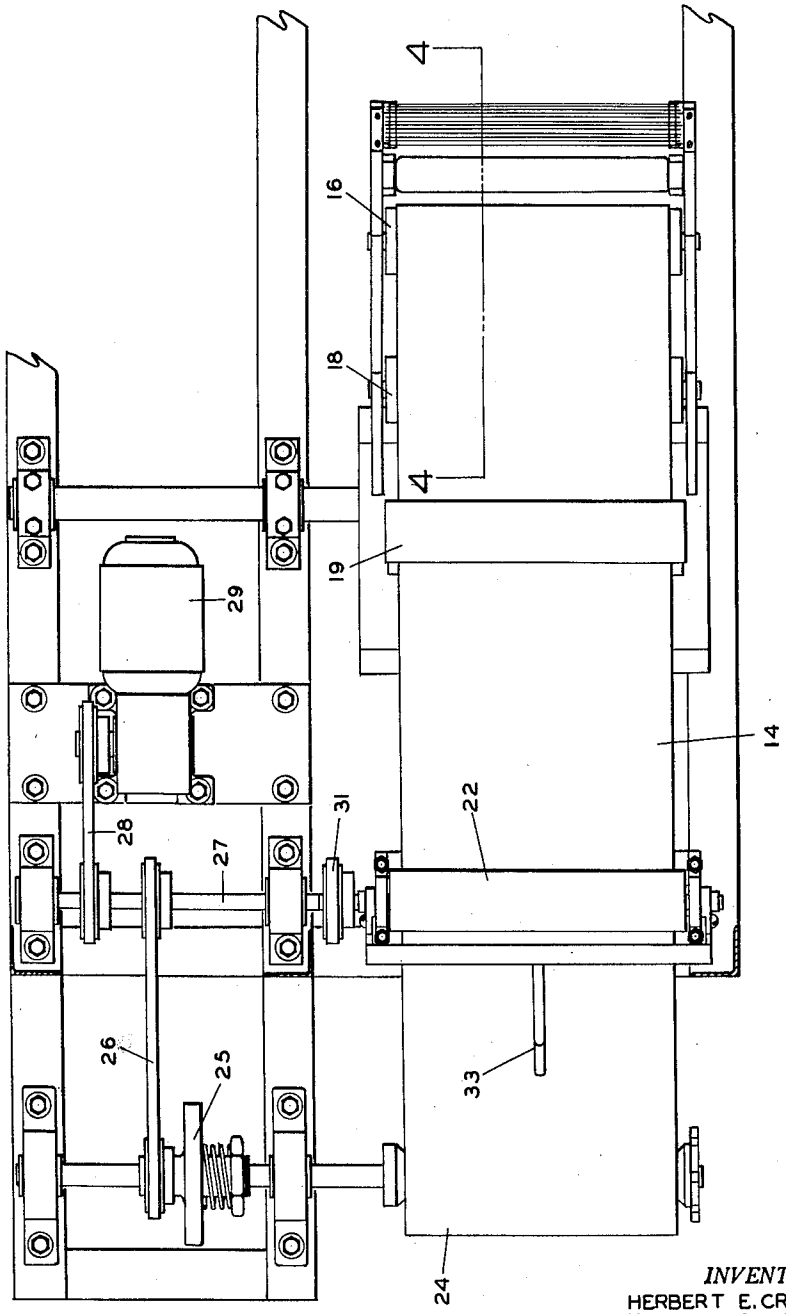
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PAPER HANDLING MECHANISM FOR XEROGRAPHIC COPYING MACHINE

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FIG. 3



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PAPER HANDLING MECHANISM FOR XEROGRAPHIC COPYING MACHINE

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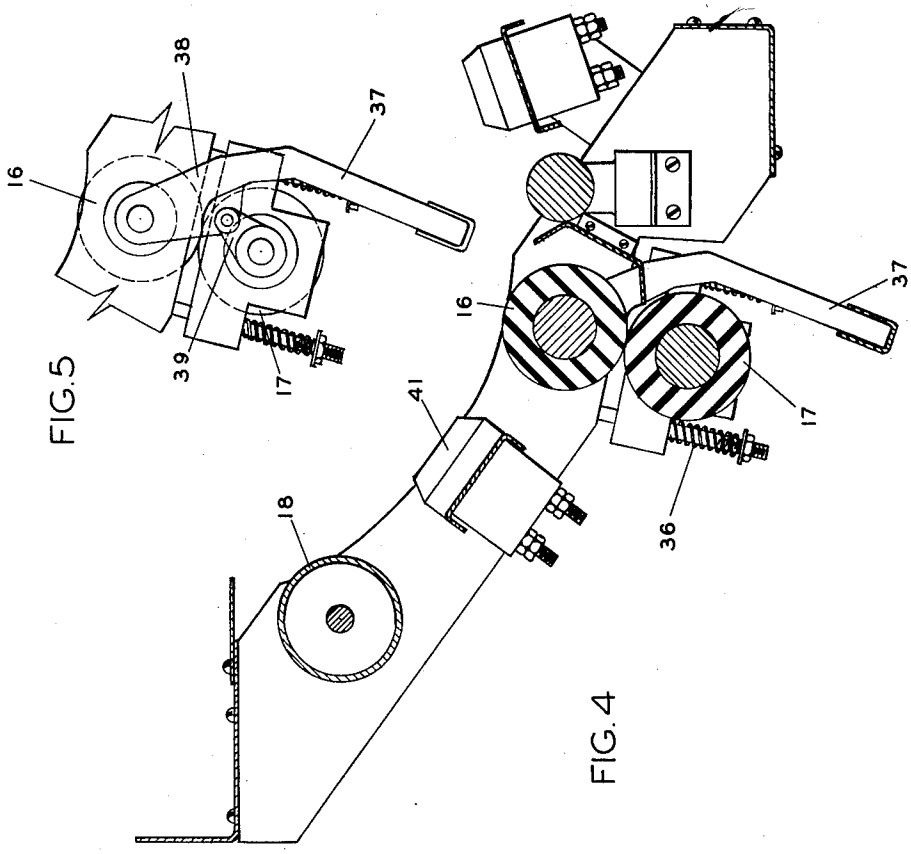


FIG. 4

FIG. 5

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2,781,705

PAPER HANDLING MECHANISM FOR XEROGRAPHIC COPYING MACHINE

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Application October 29, 1953, Serial No. 389,098

8 Claims. (Cl. 95—1.7)

This invention relates to paper handling mechanism for xerographic copying machines of the general type used for reproduction of microfilm in which an image is projected onto an electrostatically charged photo-conductive insulating surface of a rotating drum, such charged surface being exposed and the exposed surface subjected to the cascading action thereover of developer material to produce a powder image on the drum which is subsequently transferred to a paper or other transfer web or sheet, and it has for its purpose to provide efficient, practical, and fast means for moving paper into contact with the drum and transferring powder images from the drum to the paper.

A further purpose is to afford mechanism for satisfactorily holding the paper against the drum during image transfer and effective means for drawing the paper through the machine, while fusing images onto the paper and protecting the machine and paper from fire that might result from the fuser mechanism.

In a more particular aspect, the invention has to do with paper feeding mechanism including drag rolls that engage the paper under tension, a guide roll, a receiving roll, and drive rolls located and operating in such tension relationship to the drag rolls and receiving roll as to draw the paper uniformly and evenly, without buckling, at a proper speed in relation to the drum from which the powder image is transferred onto the paper.

Another object of the invention is to afford an efficient arrangement of drag rolls and guide roll for properly holding the paper against the drum while charging the paper to transfer images from the drum onto the paper, and drive rolls for moving the paper from the guide roll through a fire-snuffing chamber and past a fuser mechanism while maintaining certain tensions on the paper by the drag rolls, drive rolls, and receiving roll.

To these and other ends, the invention consists in the construction and arrangement of parts that will appear clearly from the following description when read in conjunction with the accompanying drawings, the novel features being pointed out in the claims following the specification.

In the drawings:

Fig. 1 is a generally diagrammatic side elevation illustrating a preferred embodiment of the invention as applied to a xerographic microfilm copying machine;

Fig. 2 is an enlarged side elevation with parts broken away;

Fig. 3 is a plan view;

Fig. 4 is an enlarged detail sectional view taken through the drag rolls and guide roll assembly approximately on line 4—4 of Fig. 3, and

Fig. 5 is an enlarged detail end view of the means for separating the drag rolls.

The invention is illustrated in connection with a xerographic machine such as employed for continuously copying images from microfilm, although applicable to other xerographic copying machines in which a sheet of paper or other transfer material is moved in contact with a portion of a rotating drum to permit transferring a powder image from the drum to the paper, and in the structure shown, 1 designates the drum provided with the usual insulating photo-conductive surface, the drum being rotated by suitable drive mechanism, while 2 designates the microfilm to be copied and which is moved from a supply roll 3 onto a receiving roll 4 by suitable mechanism. 5 designates a lamp housing for projecting images from the microfilm 2 through a lens system, light barrel 6 and slit 7 onto the drum. The surface of the xerographic drum 1 as it rotates is successively operated on by brushes 8 which remove any powder adhering from a previous operation, then subjected to the action of a discharge lamp 9 which dissipates any electrostatic charges remaining on the drum or created by the cleaning brushes 8, after which a charging grid 11 operates to charge electrostatically the photo-conductive insulating surface of the drum immediately before it passes under the slit 7 through which the image is projected, resulting in the formation of a corresponding electrostatic image on the drum. Following this, the exposed surface of the drum passes under an electrometer 12 to give an indication of the amount of charge on the drum and thence through a developer chamber 13 in which a developer mixture of carrier and toner particles is cascaded over the charged surface of the drum, the toner particles adhering to the electrostatic image to form a powder image. After leaving the developer chamber, the charged and image-bearing area of the drum preferably passes over a regenerating grid and lamp, following which the drum moves into contact with a continuously traveling web of paper or other transfer material, the controlling mechanism for which constitutes the subject matter of the present invention and will now be described in detail.

The paper or other transfer material, indicated at 14, is fed from a supply roll 15 and travels initially from the supply roll in between an upper drag roll 16 located in proximity to the bottom of the drum and a lower drag roll 17 located beneath the upper drag roll as shown, the drag rolls being separable and held in contact with the paper on opposite sides thereof and one of said drag rolls being yieldable away from the paper to permit varying the pressure on the paper.

The paper moves upwardly around upper drag roll 16 into contact with the image-carrying surface of the drum 1 and is held thereagainst by the upper drag roll 16 and guide roll 18 over which the paper travels after leaving the drag rolls and drum 1. The paper web after leaving guide roll 18 travels preferably in a horizontal plane through a fire-snuffing chamber 19 and under a fuser mechanism 21 of any suitable construction to a point between upper and lower drive rolls 22 and 23 which grip the paper with sufficient tension to draw it through the machine from drag rolls 16 and 17 around the image-carrying portion of the drum and over the guide roll 18.

After leaving drive rolls 22 and 23, the paper web travels to a receiving roll 24 onto which it is wound and from which the completed roll of paper may be removed after the powder images have been permanently affixed by the fuser mechanism 21. The receiving roll 24 is operated through a friction clutch 25 and belt 26 from a drive shaft 27 which in turn is driven through belt 28 from motor 29 through a reduction gear, the drive rolls 22 and 23 being operated from drive shaft 27 through belt 31. The drive rolls 22 and 23 operate at a slightly faster peripheral speed than the drum 1 in order to maintain the transfer paper under tension. Proper relation of the paper to the rotating drum is maintained by holding the paper against the drum by static charge.

Drive rolls 22 and 23 are held against the paper under pressure such as to maintain the paper under approximately 12 to 15 pounds tension, the drag rolls 16

and 17 are held under such pressure as to maintain the paper under approximately 2 to 4 pounds tension, and receiving roll 24 is driven at a constant torque by the friction clutch set to maintain the paper under approximately 10 pounds tension at the minimum roll size.

32 designates springs which hold the supporting frame and drive roll 22 against drive roll 23, and the drive rolls are separable, when necessary for threading paper through, by a lever 33 connected to an arm 34 journalled on the lower drive roll 23 and pivotally connected to arm 35 journalled on the upper drive roll, so that by moving lever 33 clockwise, referring to Fig. 2, the rolls can be moved apart against the tension of springs 32 to inert or straighten the paper web. Springs 36 similarly control the drag rolls 16 and 17, while 37 designates a lever, see Fig. 5, extending from arm 38 journalled on drag roll 16 and pivotally connected to arm 39 journalled on drag roll 17, so that by moving lever 37 clockwise, referring to Fig. 5, the drag rolls can be separated against the tension of springs 36.

The drag rolls 16 and 17 are rubber-faced as shown while drive rolls 22 and 23 are metal-faced, and the pressures on the drive rolls, drag rolls, and receiving roll are adjusted through the springs 32, 36, and friction clutch 25 respectively, so that the drive rolls will pull the paper from the drum against the tension of drag rolls 16 and 17 and draw it through the machine without wrinkling the paper so as to produce a tight even roll of paper of gradually increasing diameter on the receiving roll, and the tension on the paper exerted by the receiving roll is always somewhat less than the tension exerted by the drive rolls and the receiving roll can never draw the paper faster than the drive rolls, while the paper travels at the same speed as the drum while in engagement therewith.

41 designates a charging grid located in slightly spaced relation to the path of the paper where the paper contacts the drum 1 preferably intermediate the drag roll 16 and guide roll 18, and operating to impose an electrostatic charge on the paper and thereby effecting transfer of the powder images from the surface of the drum to the paper at a point directly opposite the portion of the paper web which is in closest contact with or tangential to the adjacent surface of the drum.

After the paper travels from guide roll 18 through the fire-snuffing chamber 19 comprising a narrow enclosing chamber through which the paper can move in spaced relation to the surrounding walls, the powder image is affixed on the paper by the fuser mechanism indicated at 21 which may be of suitable form and operates to secure the powder image permanently to the paper by heating and softening the powder forming the image. In the event of the fuser mechanism continuing to function when the paper stops feeding, or if for any reason the paper should become ignited at the point of the fuser mechanism, the fire-snuffing chamber 19 operates as a barrier and stops the flame, preventing the blaze from moving toward the drum or affecting the main body of paper.

Where the term "paper" is used throughout the specification and claims, it is to be understood as including a web or tape of any suitable transfer material, and while the invention is described in relation to a particular embodiment, it is not restricted to the details disclosed, and this application is intended to cover such modifications or departures as may come within the purposes of the improvements or the scope of the following claims.

We claim:

1. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said means including drum charging means, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the bottom of the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a paper guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the upper drag roll and said guide roll, and upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls and at a peripheral speed greater than that of the drum.

2. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said treating means including charging means, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a paper guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the upper drag roll and said guide roll, and upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls and at a peripheral speed greater than that of the drum, the drive rolls having a peripheral speed silghtly greater than the drum and exerting a tension on the paper of approximately 12 to 15 pounds while the drag rolls exert a tension on the paper of approximately 2 to 4 pounds.

3. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said treating means including means for charging the drum surface, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the bottom of the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a paper guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the

upper drag roll and said gide roll, upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls and at a peripheral speed greater than that of the drum, fuser mechanism located adjacent to the path of travel of the paper between said guide roll and said drive rolls, and a paper-receiving roll located beyond the drive rolls.

4. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said treating means including means for charging the drum surface, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a paper guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the upper drag roll and said guide roll, upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls and at a peripheral speed greater than that of the drum, fuser mechanism located adjacent to the path of travel of the paper between said guide roll and said drive rolls, and a fire-snuffing chamber located between said guide roll and said fuser mechanism and through which the paper travels before reaching the fuser mechanism, said drive rolls acting to draw the paper past the drum and fuser mechanism, and a paper-receiving roll located beyond the paper drive rolls.

5. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said treating means including means for charging the drum surface, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and large transfer means, said image transfer means comprising a paper supply roll, a paper drag roll located in proximity to the drum, a second paper drag roll located adjacent to and in pressure engagement with the first mentioned drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the first mentioned drag roll and against the drum, a paper guide roll located in proximity to the drum and acting with the first mentioned drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the first mentioned drag roll and said guide roll, paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls and at a peripheral speed greater than that of the drum, and a paper-receiving roll located beyond the drive rolls.

6. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said treating means including means for charging the drum surface, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the bottom of the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper in contact with the drum as the paper travels past the drum, the paper traveling thence over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the upper drag roll and said guide roll, upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of said drag rolls, and a paper-receiving roll located beyond the drive rolls, the paper drive rolls being driven at a peripheral speed slightly greater than that of the drum.

7. A xerographic continuous copying machine for reproducing images from microfilm including microfilm continuous feeding mechanism, a rotary drum having an insulating photoconductive surface, and treating means past which said drum is successively movable, said means including means for charging the drum surface, light exposure means operating to project an image from the microfilm onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, an upper paper drag roll located in proximity to the bottom of the drum, a lower paper drag roll located beneath and in pressure engagement with the upper drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the upper drag roll and against the drum, a guide roll located in proximity to the drum above the upper drag roll and acting with the upper drag roll to hold the paper in contact with the drum as the paper travels past the drum, the paper traveling thence over the guide roll in a horizontal plane, a charging grid located in proximity to the path of the paper intermediate the upper drag roll and said guide roll, upper and lower paper drive rolls in pressure engagement with opposite surfaces of the paper while in said horizontal plane at a point beyond said guide roll and acting to draw the paper through the machine against the tension of the drag rolls, a paper-receiving roll located beyond the drive rolls, means for driving the paper drive rolls at a peripheral speed slightly greater than that of the drum, and independently adjustable pressure applying means for said drive rolls and said drag rolls whereby said drive rolls are maintained against the paper at a pressure substantially greater than are the drag rolls.

8. A xerographic copying machine for reproducing images from copy including a copy feeding mechanism, a rotary drum having an insulating photo-conductive surface, and treating means past which said drum is successively movable, said treating means including means for charging the drum surface, light exposure means operating to project an image from the copy onto the photoconductive surface of the drum, image developing means, and image transfer means, said image transfer means comprising a paper supply roll, a paper drag roll located in proximity to the drum, a second paper drag roll located adjacent

to the first mentioned drag roll and acting to hold a paper web thereagainst as the paper travels between the drag rolls and thence around the first mentioned drag roll and against the drum, a paper guide roll located in proximity to the drum and acting with the first mentioned drag roll to hold the paper web in contact with the drum as it travels past the drum, the paper traveling thence away from the drum and over the guide roll, a charging grid located in proximity to the path of the paper intermediate the first mentioned drag roll and said guide roll, and paper drive rolls in pressure engagement with opposite surfaces of the paper at a point beyond said guide roll and acting to draw the paper through the machine.

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