United States Patent

Gonzalez

[15] **3,685,898**

[45] **Aug. 22, 1972**

[54] **PAPER FLIP CONTROL APPARATUS**

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[21] Appl. No.: **206,228**

[52] U.S. Cl. .....**355/3**, 219/216, 226/94, 263/6 E, 271/18, 271/DIG. 2

[51] **Int. Cl.**.....**G03g 15/00**, B65h 17/28

[58] **Field of Search** .....355/3, 8, 14; 219/216; 263/6 E; 226/94; 271/18, DIG. 2, DIG. 3

[56] **References Cited**

UNITED STATES PATENTS

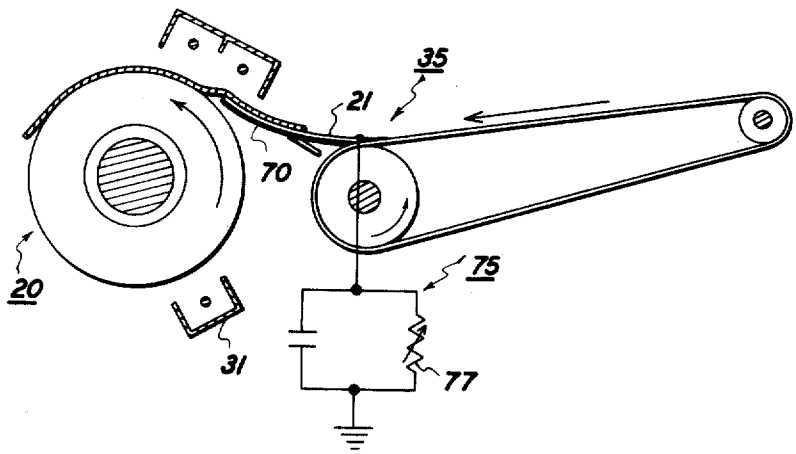
3,508,824	4/1970	Leinbach et al.	271/18 R
3,519,253	7/1970	Aser et al.	263/6 E

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[57] **ABSTRACT**

An improvement for apparatus for heat fixing a heat fusible image to a cut sheet of support material on which a xerographic powder image has been electrostatically transferred and wherein a charging device tacks the support material into thermal communication with a moving preheat roll for a predetermined period, and wherein another charging device of opposite polarity produces a pretacking condition of the moving preheat roll, a control circuit coupled to a guide baffle feeding the support sheet towards the preheat roll which control circuit includes a variable resistance for controlling a flow of charges to ground from the guide in order to minimize trail edge flip of the support material. The underside of the guide is coated with an electrically insulated material while the top side is electrically coupled to control circuit. The flow of electrical charges from the guide varies with the particular type of stock for the support material.

4 Claims, 5 Drawing Figures



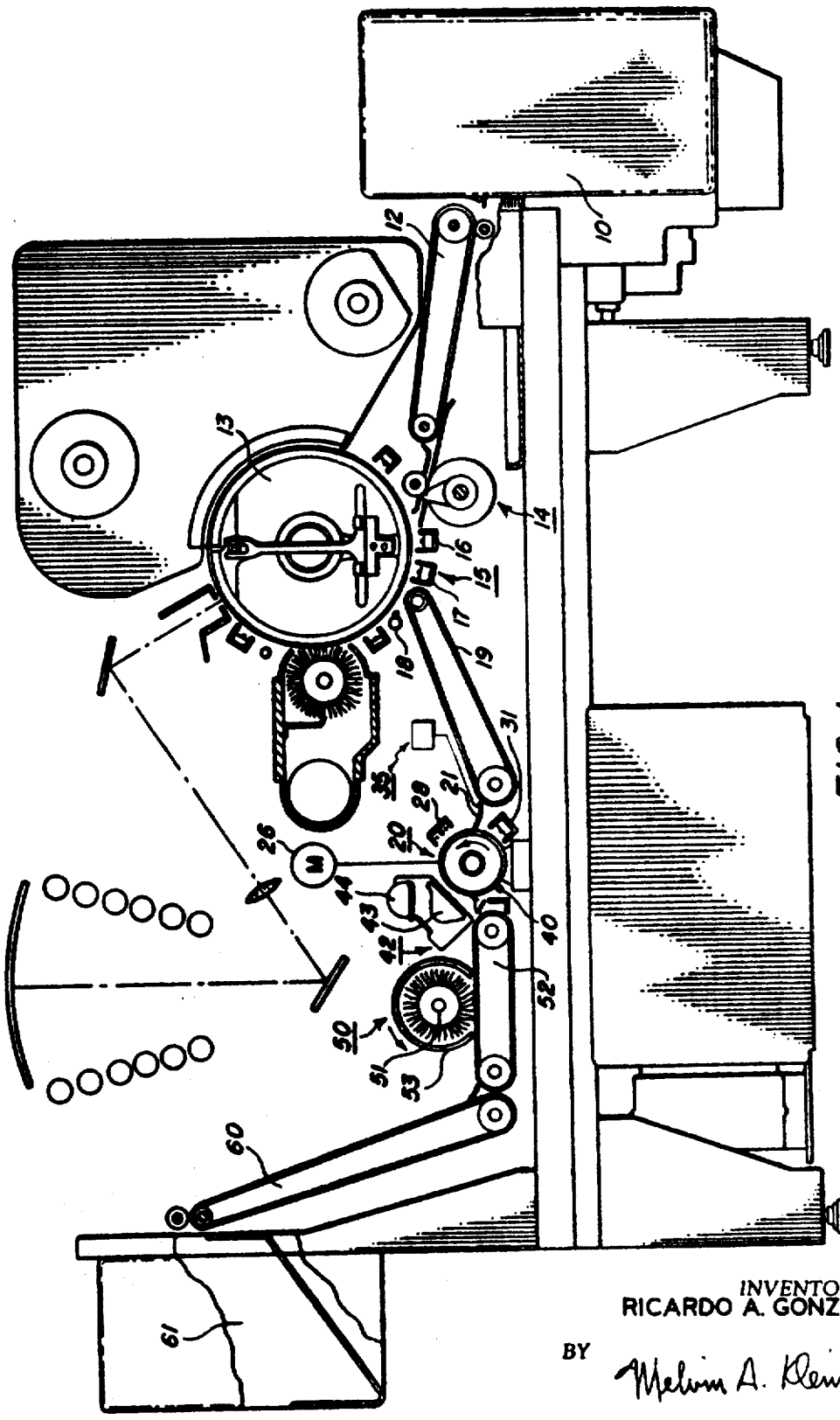


FIG. 1

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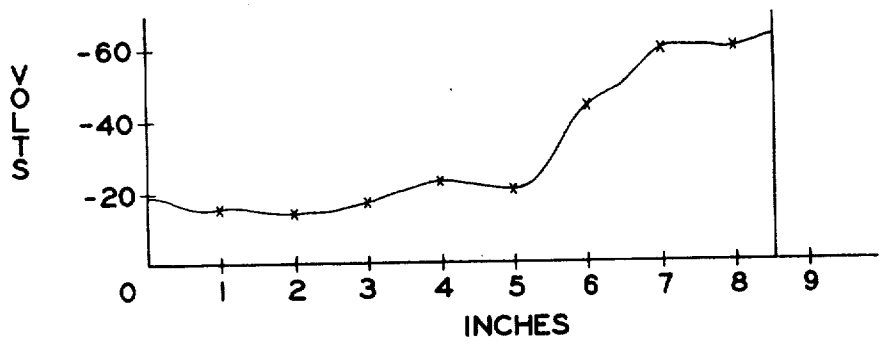

VOLTS
-60
-40
-20
0
1
2
3
4
5
6
7
8
9
INCHES

FIG. 2

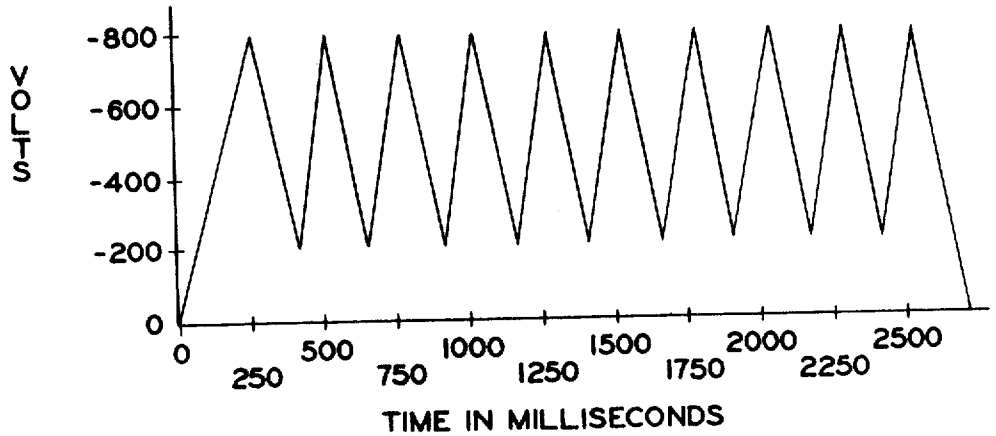

VOLTS
-800
-600
-400
-200
0
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
TIME IN MILLISECONDS

FIG. 3

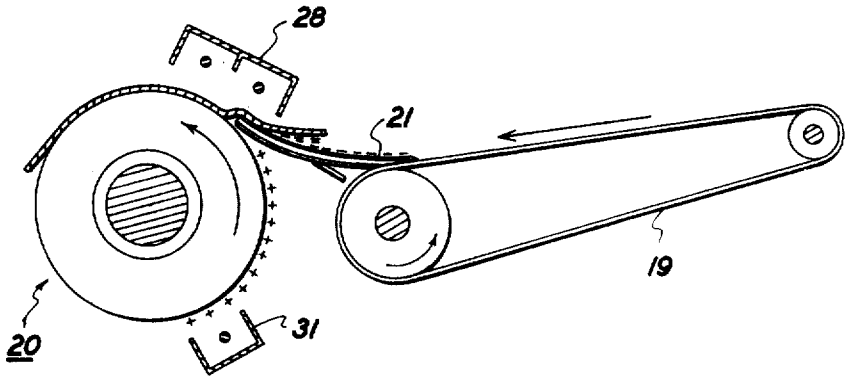


FIG. 4

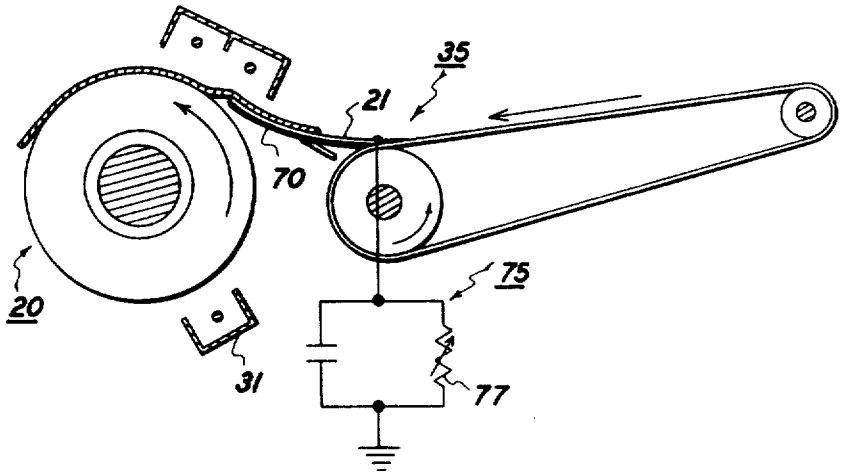


FIG. 5

PAPER FLIP CONTROL APPARATUS

This invention relates to xerography and in particular to an improvement in handling image bearing support material which is electrostatically tacked onto a movable heated surface for selectively heat fusing toner images.

The use of a high temperature infrared source as a means to rapidly fuse xerographic powder images by first preconditioning a paper support material is already known as described in U. S. Pat. No. 3,519,253. With this particular type of fusing apparatus image bearing support material is electrostatically tacked, image side up, on a movable heated surface and the surface and the image bearing support material are moved into thermal communication with a radiant energy source emitting energy concentrated about a wave length at which the toner is highly absorptive and at which the support material is relatively non-absorptive.

While this particular type of fusing system is satisfactory, it has been found that in using different paper stock that in the tacking of the support sheet material to the preheat roll there is a "trail edge flip" resulting in improperly fused images. The instant invention minimizes the trail edge flip problem and is specifically intended as an improvement over the fusing system described in U. S. Pat. No. 3,519,253. However it is intended that the invention have use in any appropriate paper handling system.

It is therefore an object of this invention to improve handling of paper support material.

It is a further object of the invention to facilitate the handling of sheet material bearing powder toner images through controlled heat fusing systems.

It is still a further object of the present invention to minimize trail edge flip of sheet material advanced from a xerographic transfer station to a movable fusing surface.

It is still a further object of the present invention to improve the handling of paper from the transfer station at which the powder image is transferred to the paper to a fusing station at which the powder image is permanently fused to the paper by tacking to a roll surface advanced past a radiant heat source.

These and other objects of the invention are obtained by accurately controlling the flow of charges acting on sheets in the sheet transport path as they are transported into contact with the surface of the heated roll at the fusing station.

For a better understanding of the present invention as well as other objects and features thereof, reference is had to the following detailed description of the invention to be read in connection with the accompanying drawings wherein:

FIG. 1 illustrates schematically an automatic xerographic reproducing apparatus incorporating paper flip control apparatus of the present invention;

FIG. 2 is a plot illustrating a typical charge distribution found on the underside of a sheet of paper leaving the xerographic transfer station and entering the fusing zone;

FIG. 3 is a plot showing the electrical behavior of the prior art lead-in baffle to the preheat roll of the fusing zone under the influence of a tacking corotron;

FIG. 4 is a side view illustrating trail edge flip of a sheet of paper tacked to the preheat roll of the fusing station; and

FIG. 5 is a side view similar to FIG. 4 illustrating the improved paper path handling apparatus according to the present invention.

Referring now to FIG. 1, there is shown a high-speed xerographic machine in schematic form utilizing a selective heat fusing system including the features of the present invention. Cut sheets of bond paper are deposited in a tray **10** prior to delivery into the machine. The paper tray not only supplies the machine with supply support paper but also serves to aid in preconditioning the paper prior to infrared heat fusing. On demand, cut paper is transported by means of a vacuum transport system **12** to the xerographic transfer station **15**. The paper is aligned by registry device **14** and then moved into contact with xerographic drum **13**. Drum **13**, which is moving at the same peripheral speed as transport **12**, has placed upon it a latent image which has been developed by means of xerographic developing powder. The powder image is transferred electrostatically to the paper support by exposing the back of the paper, or the side not in contact with the toner image, to an ion discharge from transfer corotron **16** which is of sufficient strength to attract the image from the drum to the paper. After transfer, the image-bearing support sheet is removed from the drum by charging from an A.C. detacking corotron **17** and an air stream from air puffer **18** and placed image side up upon vacuum belt transport system **19**.

The cut paper support material, having a toner image loosely adherred thereto, is moved into contact with a heated roll **20** by means of belt transport **19**. Belt transport **19** is placed at a relatively steep angle in reference to the horizontal plane and acts in conjunction with curvilinear guide member or baffle **21** so as to crimp or arcuate the paper being transported thereon. Placing the paper in a bowed configuration prestresses the paper so that it possesses sufficient rigidity to be forced into intimate contact with the heated roll **20** under the driving action of transport **19**.

Conductive heating of the paper is accomplished by electrostatically tacking the paper into contact with heated roll **20**. Effectively tacking the paper to the heated roll for the entire paper surface eliminates any boundary layer of air or gas which might form between the heated surface and the paper. The roll which is being maintained at a constant temperature supplies heat directly to the paper at a constant controllable rate. The arcuated paper support material is driven into intimate contact with the surface of roll **20**, which is coated with Teflon, with image side up. The paper is then electrostatically tacked to the Teflon surface by exposing the paper to a spray of charged ions emitted from tacking corotron **28**. A preconditioning corotron **31** positioned forward to the point at which paper contacts roll **20** prepares the insulated surface to receive the paper. The preconditioning corotron generates a corona discharge of opposite polarity to that generated by the tacking corotron and places this charge upon the insulating surface of the roll. In the past, the charged paper leaving the drum surface has experienced trail edge flip in the vicinity of the baffle **21** which is substantially eliminated by paper flip control apparatus **35** with the teaching of the present invention as will be explained more fully hereinafter.

A source of infrared radiation **42** comprising a high temperature quartz lamp is mounted in a reflector as-

sembly **43** about which is placed a manifold system **44**. As heated roll **20** rotates in the direction indicated, preconditioned paper which is tacked to the heated roll image side up is drawn into thermal contact with the infrared radiation being emitted from the high temperature quartz lamp. The energy propagated by the lamp is at an intensity level capable of rapidly and efficiently heating xerographic toner of varying densities.

The cut sheet of paper tightly adherring to the roll **20** is removed from the roll by means of pick-off arm **65**. As the paper is stripped from the roll, it is driven forward into contact with vacuum transport **52**. The fused toner image on the paper is vacuum transported beneath brush assembly **50** where residual or unfused toner is removed from the paper. Brush **51** is mounted in respect to transport **51** so that some interference exists between the paper and the brush fibers. Rotating the brush at a relatively high speed in a direction opposite to that of the paper removes unfused residual toner often referred to as "background." Residual toner so removed is exhausted by means of a vacuum system maintaining a negative pressure under hood **53**. The fused and brushed paper copy is then vacuum transported to receiving bin **61** by means of transport system **60**.

It is believed that the above description is sufficient for purposes of understanding the operation of the xerographic machine and fusing system. Further details of the machine and system may be found in U. S. Pat. No. 3,519,253 entitled "Selective Xerographic Fuser."

Referring now to FIG. **2**, there is shown a typical charge distribution found on the underside of a sheet of paper leaving the xerographic drum. It will be noted that as the paper leaves the drum and approaches the fusing area the paper is approximately neutral due to the action of the AC detacking corotron **17**. However, there is still a very small charge left on the paper which tends to always concentrate toward the trail edge of the paper.

It has been found that the baffle **21** which has an insulating coating and is located in front of the preheat roll, behaves as a capacitor when it is influenced by the electrostatic field of the tacking corotron **28**. The baffle charges up negatively and discharges at a constant rate as shown in FIG. **3**. As a result of this, the paper moving in over the baffle which is constantly charging and discharging the two surfaces tend to slightly repel each other thus letting the paper slide freely over the baffle. However, since the baffle's charge is constantly varying, the forces repelling the two surfaces are also varying. In some instances a higher negative charge toward the trail edge of the underside of the paper coincides with the high negative charge point on the baffle. This increases the repelling forces between the two surfaces and consequently induces a flip-up which is shown most clearly in FIG. **4**.

In accordance with the present invention, this trail edge flip-up is eliminated enabling the paper bearing powder images to be tacked to the heated roll **20** and properly fused. It will be appreciated that paper's charge as it passes over the baffle depends on its ability to polarize in the presence of the corotron's field. Naturally, different paper brands have different polarizing abilities and, therefore, behave differently crossing this guide or lead-in baffle. Those papers having better polarizing abilities would have a higher charge over the baffle than others. This would mean that some papers would then be repelled more than others. The present invention produces selective charges on an improved baffle arrangement as shown in FIG. **5** which can be varied to a desired level for various brands and types of paper. In this manner the forces repelling the paper are also controlled and flip-up is substantially eliminated.

Referring now to FIG. **5**, there is shown flip-up control apparatus **35** according to the present invention, flip-up control apparatus **35** includes a lead-in baffle **21** which is made of stainless steel or other suitable conductive material coated only on its underside with an electrically insulating coating **70** and having an adjustable resistance RC circuit **75** in parallel connected from the uncoated baffle top to ground. By increasing a variable resistance **77** the flow of charges from the baffle to ground is restricted. This restriction of flow gives rise to a buildup of negative charges on the baffle and therefore the forces repelling the paper are increased. When this occurs, less tacking of the paper to the baffle is observed. On the other hand, by decreasing the resistance the flow of charges from the baffle to the ground is increased. By increasing this flow of charges, the number of charges on the baffle is decreased and, therefore, the baffle will suddenly become less negatively charged. When this occurs, the forces repelling the paper are decreased and increased tacking of the paper to the baffle takes place.

The variation in voltage between the baffle and ground has been observed to be 400 volts D.C. It has been found that for this voltage variation a capacitor of .**01** microfarad in parallel with a variable resistor ranging from about 15,000 ohms to about 10×10^8 ohms has produced the desired results.

By this simple yet unique control circuit the amount of negative charge on the baffle is suitably controlled. By controlling the charges on the baffle, the forces acting on the paper as it passes over the baffle are also controlled producing an ideal combination of forces for adequate tacking to be achieved for various types of paper.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth; and this application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

What is claimed is:

1. In an apparatus for heat fixing a heat fusible image to a cut sheet of support material on which a xerographic powder image has been electrostatically transferred and wherein charging means tack the support material into thermal communication with a moving preheat means for a predetermined period of time and further, wherein other charging means of opposite polarity produce a pretacking condition on the moving preheat means the improvement comprising guide means made out of a conductive material for guiding the sheet material into contact with the preheat means and circuit means coupled to the guide means and ground and including an RC network for causing a flow of charges from the guide means to ground to control the electrical forces acting on the support material as it passes over the guide means into contact with the preheat means.

2. Apparatus according to claim 1 wherein the RC network includes a variable resistance.

3. Apparatus according to claim 2 wherein the side of the guide means not in contact with the support material has an electrically insulating coating.

4. Improved apparatus for transporting paper sheet material comprising

first transport means for conveying paper sheet material along a predetermined path,

baffle means interposed in the sheet path for changing the direction of the paper sheet material, said baffle means having a conductive surface for contacting the paper sheet material and an electrically insulating surface,

tacking corotron means positioned adjacent the baffle means for producing charges on the baffle means and paper sheet material for tacking the paper sheet material to the baffle means, and circuit means coupled to the baffle means and ground and including an RC network having a variable resistance for selectively controlling the flow of charges from the baffle means to ground.

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