

PATENT SPECIFICATION

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(54) ELECTROPHOTOGRAPHIC COPYING APPARATUS

- (71) We, AGFA-GEVAERT AKTIENGES-
 SELLSCHAFT, a body corporate recognised
 under German Law, of Leverkusen, Ger-
 many do hereby declare the invention, for
 5 which we pray that a patent may be granted
 to us, and the method by which it is to
 be performed, to be particularly described
 in and by the following statement:
- 10 The present invention relates to an elec-
 trophotographic document copying appar-
 tus having an objective arrangement
 which is arranged to form stripwise a con-
 tinuous laterally correct image of an
 15 original.
- The invention provides an elec-
 trophotographic copying apparatus, which
 includes fixed support means for an
 original to be copied, a carriage for a copy
 20 support material, the carriage being
 movable past the fixed support means be-
 tween a first position and a second posi-
 tion and being formed with an image gate,
 means mounted on the carriage for sup-
 25 porting a reel of a flexible copy support
 material, means mounted on the carriage
 for continuously feeding a continuous web
 of flexible copy support material from a
 reel on the reel supporting means past the
 30 image gate, a corona discharge device
 movable with the carriage, and arranged to
 impart an electrical charge over the surface
 of the flexible copy support material before
 the copy support material reaches the
 35 image gate, an objective arrangement
 movable with the carriage and arranged to
 form stripwise on the copy support
 material at the image gate a continuous
 laterally correct image of an original sup-
 40 ported by the fixed support means during
 movement of the carriage from its first
 position to its second position, means,
 movable with the carriage, for inverting the
 copy support material after it has passed
 45 the image gate, a transport belt arranged
 [Price 25p]
- to receive the inverted copy support mate-
 rial and severing means arranged to sever
 the exposed portion of the copy support
 material from the remainder of the web
 immediately before the image gate when 50
 the carriage reaches the second position.
- In this way a correct sided copy is
 produced directly on the copy support
 without an additional step of transfer to a
 copy blank. In addition the cutting device 55
 controlled by the exposure movement in
 conjunction with the continuously moving
 transport belt permits an exposed copy
 support to be developed while another is
 being exposed so that a greater throughput 60
 is achieved.
- Advantageously, the feed means for the
 copy support material is arranged to feed
 the copy support material past the image
 gate with a velocity relative to the image 65
 gate which is equal to the velocity of the
 carriage relative to the fixed support for
 the original so that the copy support mate-
 rial comes to rest after having been in-
 verted. Thus the copy produced by the ap- 70
 paratus bears a 1:1 size relation to the
 original. The cutting device is, preferably,
 mounted on the carriage.
- Advantageously, the feed means for the
 copy support material is arranged to be 75
 driven by drive means for the carriage dur-
 ing movement of the carriage from its first
 position to its second position. Preferably,
 there is provided resilient means tending to
 urge the carriage into its first position and 80
 the drive means for the carriage is so
 coupled to drive means for the transport
 belt by releasable coupling means that
 when the carriage reaches its second posi-
 tion the coupling is released and the car- 85
 riage returned to its first position.
- Advantageously, the means for inverting
 the copy support material includes a
 transport roller arranged behind the image
 gate and held in engagement with the 90

transport belt under its own weight or by resilient means. Preferably, there is provided for inverting the copy support material a hood arranged partly to surround the transport roller.

One form of electrophotographic copying apparatus constructed in accordance with the invention will now be described by way of example, with reference to the accompanying drawing, which is a sectional elevation of the copying apparatus.

The accompanying drawing shows a book copying apparatus having an objective arrangement which may be as described and claimed in British Patent Application 56037/68 (Serial No. 1 254 450). A pivotable upper section 12 of the apparatus housing is linked to a lower section 11 by means of a hinge 13. The upper section 12 has an opening 12a in which is inserted a transparent supporting plate 12b for an original, for example a hook 33, which is to be copied. Also provided in the upper section 12 is a guide path 14 for a carriage 17 which is guided on rollers 15 and 16 and has a socket 18 for an objective arrangement composed of grid-like lenses 1. The socket 18 is at the same time constructed as a reflector for accommodating two fluorescent tubes 19 and 20 which illuminate the original to be copied. The fluorescent tubes 19 and 20 are arranged in a particularly space-saving manner parallel to the objective arrangement 1.

The carriage 17 includes a mounting 17a for a spindle 21 of a zinc oxide paper supply reel 22 and transport rollers 23 and 24 for advancing paper from the reel. The transport roller 23 is coupled to the roller 16 by a flexible belt 25 and a free-wheel (not shown), so that when the carriage 17 is advanced in the direction of the arrow C the paper is drawn in the direction of the arrow D from the reel 22, the spindle of which can be provided in the usual manner with a friction brake. The zinc oxide paper is thus conveyed past a corona discharge device 26 to a picture gate formed by a support 27 and a transparent pressure plate 28. From here it passes a pair of transport rollers 29 and 30 and by means of a hood 31a arranged on a pivot lever 31 is deflected round the transport roller 30 which acts as a return sheave. Since with projection on a scale of 1:1 the speed of movement of the zinc oxide paper relative to the carriage in the direction of the arrow D corresponds in magnitude and direction to the speed of movement of the carriage 17 in the direction of the arrow C, the speeds of the carriage 17 and zinc oxide paper therefore cancel each other out after the paper has been deflected through 180° by means of the roller 30 and the hood 31a. The end of the zinc oxide paper

after leaving the roller 30 is, therefore, at rest.

The spindles 29a and 30a of the transport rollers 29 and 30 are each supported in an elongated hole 17b and 17c of the carriage 17 so that under their own weight, or under the action of a spring (not shown), they rest against one another and upon a conveyor belt 32 arranged beneath the transport roller 30. The conveyor belt 32 is formed by several adjacent cords which are tensioned over two rollers 34 and 35 provided with grooves to accommodate the pulley cords. The roller 35 is driven in the direction of the arrow E by a drive motor 37 by way of a flexible belt 36. The conveyor belt 32 thereby tends to pull the end of the zinc oxide paper held between the rollers 29 and 30 and the conveyor belt 32 away in the direction of the arrow E. However, when the carriage is moved past the original 33 during the exposure process, since the paper is at rest once it has been deflected round the roller 30 it only rests against the surface of the conveyor belt 32.

Attached to the lever 31, which is pivotable about a pin 38 arranged in the carriage 17, is a knife 39 which co-operates with a cutting edge 27a of the support 27. The lever 31 is held in its rest position by a lug 31b which by means of a tension spring 40 is urged against a stop 41 of the carriage 17. At the end of the advancing movement of the carriage 17 a lug 31c of the lever 31 meets a bolt 42 fixed to the apparatus, which at the same time serves as a bearing spindle for a return sheave 43. The lever 31 is thereby pivoted into the position shown in broken lines and the knife 39 severs the exposed portion of the zinc oxide paper from the still unexposed portion. At the same time, the hood 31a is pivoted away from the transport roller 30 so that the exposed paper can be removed by the conveyor belt 32 without hindrance into a developing apparatus 44. It is there so deflected by means of guide ribs 44a that it is submerged in developing fluid 44b in the developing tank and finally passes between the discharge rollers 45, 46 and 47. The roller 47 is connected by means of flexible belts 48 to a roller 49 which is driven from the motor 37 by way of a flexible belt 50. The belts 48 together form a conveyor belt which conveys the developed copy support to a discharge point 51 from whence it can be removed through an aperture 11a in the apparatus housing. An infra-red radiation source 52 is also provided over the conveyor belt 48 to dry the copy support.

The carriage 17 is advanced by means of a cord 54 wound on a drum 53 which is connected to the drive motor 37 in a

known manner by means of a releasable coupling. The drive cord 54 runs over return pulleys 43 and 55 and is anchored to a pin 56 of the carriage 17. A further cord 58 guided over a return pulley 57 and anchored on a pin 59 of the carriage 17 is connected to a spring 61 attached to the upper section 12 of the housing.

The method of operation of the apparatus is as follows: In the initial position of the apparatus the end of the copy support is situated exactly below the right hand end of the original support member 12b as viewed in the drawing. The illumination arrangement 19 and 20 and the corona discharge device 26 are now switched on. After the releasable coupling between the winding drum 53 and the drive motor 37 has engaged, the carriage 17 starts to move in the direction of the arrow C, whereupon the charged end of the copy support moves into the exposure gate 27, 28. It is recommended that the drive means should be set in operation after a certain time lag from the switching on of the illumination arrangement, so that the first section of the copy support entering the exposure arrangement receives the full exposure. During the movement of the carriage 17 in the direction of the arrow C the copy support is unrolled on the surface of the transport belt 32 in the manner previously described, but cannot be pulled away from the latter until cut off by the knife 39, since the pressure of the rollers 23 and 24 is greater than that between the rollers 30 and the conveyor belt 32.

After the paper has been cut off at the end of the exposure process, the coupling between the drive motor 37 and the winding drum 53 is released, either manually or by means of a contact switch, so that the carriage 17 can return to its initial position under the influence of the return spring 61. Owing to the free-wheel between the carriage drive and the transport rollers 23, 24, the severed end of the zinc oxide paper remains stationary beneath the corona discharge device. The cut edge thus lies exactly beneath the beginning of the original again so that there is no paper wastage.

The next exposure process can now be commenced, provided that the previously exposed paper section is still moving into the developing apparatus 44. It is only necessary to ensure that the belt 32 consists of a material which together with the paper have a greater coefficient of friction than two zinc oxide papers sliding one above the other. The previously exposed paper is then drawn from under the paper section deposited on the conveyor belt 32 later, although the latter section is at rest in relation to the apparatus. During several consecutive copying processes, therefore,

the exposure and developing times may overlap to a considerable extent.

WHAT WE CLAIM IS:—

1. An electrophotographic copying apparatus, which includes fixed support means for an original to be copied, a carriage for a copy support material, the carriage being movable past the fixed support means between a first position and a second position and being formed with an image gate, means mounted on the carriage for supporting a reel of a flexible copy support material, means mounted on the carriage for continuously feeding a continuous web of flexible copy support material from a reel on the reel supporting means past the image gate, a corona discharge device movable with the carriage and arranged to impart an electrical charge over the surface of the flexible copy support material before the copy support material reaches the image gate, an objective arrangement movable with the carriage and arranged to form stripwise on the copy support material at the image gate a continuous laterally correct image of an original supported by the fixed support means during movement of the carriage from its first position to its second position, means, movable with the carriage, for inverting the copy support material after it has passed the image gate, a transport belt arranged to receive the inverted copy support material and severing means arranged to sever the exposed portion of the copy support material from the remainder of the web immediately before the image gate when the carriage reaches the second position.

2. An apparatus as claimed in claim 1, wherein the feed means for the copy support material is arranged to feed the copy support material past the image gate with a velocity relative to the image gate which is equal to the velocity of the carriage relative to the fixed support for the original so that the copy support material comes to rest after having been inverted.

3. An apparatus as claimed in claim 1 or claim 2, wherein the severing means is mounted on the carriage.

4. An apparatus as claimed in any one of claims 1 to 3, wherein the feed means for the copy support material is arranged to be driven by drive means for the carriage during movement of the carriage from its first position to its second position.

5. An apparatus as claimed in claim 4, wherein there is provided resilient means tending to urge the carriage into its first position and the drive means for the carriage is so coupled to drive means for the transport belt by releasable coupling means



known manner by means of a releasable coupling. The drive cord 54 runs over return pulleys 43 and 55 and is anchored to a pin 56 of the carriage 17. A further cord 58 guided over a return pulley 57 and anchored on a pin 59 of the carriage 17 is connected to a spring 61 attached to the upper section 12 of the housing.

The method of operation of the apparatus is as follows: In the initial position of the apparatus the end of the copy support is situated exactly below the right hand end of the original support member 12b as viewed in the drawing. The illumination arrangement 19 and 20 and the corona discharge device 26 are now switched on. After the releasable coupling between the winding drum 53 and the drive motor 37 has engaged, the carriage 17 starts to move in the direction of the arrow C, whereupon the charged end of the copy support moves into the exposure gate 27, 28. It is recommended that the drive means should be set in operation after a certain time lag from the switching on of the illumination arrangement, so that the first section of the copy support entering the exposure arrangement receives the full exposure. During the movement of the carriage 17 in the direction of the arrow C the copy support is unrolled on the surface of the transport belt 32 in the manner previously described, but cannot be pulled away from the latter until cut off by the knife 39, since the pressure of the rollers 23 and 24 is greater than that between the rollers 30 and the conveyor belt 32.

After the paper has been cut off at the end of the exposure process, the coupling between the drive motor 37 and the winding drum 53 is released, either manually or by means of a contact switch, so that the carriage 17 can return to its initial position under the influence of the return spring 61. Owing to the free-wheel between the carriage drive and the transport rollers 23, 24, the severed end of the zinc oxide paper remains stationary beneath the corona discharge device. The cut edge thus lies exactly beneath the beginning of the original again so that there is no paper wastage.

The next exposure process can now be commenced, provided that the previously exposed paper section is still moving into the developing apparatus 44. It is only necessary to ensure that the belt 32 consists of a material which together with the paper have a greater coefficient of friction than two zinc oxide papers sliding one above the other. The previously exposed paper is then drawn from under the paper section deposited on the conveyor belt 32 later, although the latter section is at rest in relation to the apparatus. During several consecutive copying processes, therefore,

the exposure and developing times may overlap to a considerable extent.

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WHAT WE CLAIM IS:—

1. An electrophotographic copying apparatus, which includes fixed support means for an original to be copied, a carriage for a copy support material, the carriage being movable past the fixed support means between a first position and a second position and being formed with an image gate, means mounted on the carriage for supporting a reel of a flexible copy support material, means mounted on the carriage for continuously feeding a continuous web of flexible copy support material from a reel on the reel supporting means past the image gate, a corona discharge device movable with the carriage and arranged to impart an electrical charge over the surface of the flexible copy support material before the copy support material reaches the image gate, an objective arrangement movable with the carriage and arranged to form stripwise on the copy support material at the image gate a continuous laterally correct image of an original supported by the fixed support means during movement of the carriage from its first position to its second position, means, movable with the carriage, for inverting the copy support material after it has passed the image gate, a transport belt arranged to receive the inverted copy support material and severing means arranged to sever the exposed portion of the copy support material from the remainder of the web immediately before the image gate when the carriage reaches the second position.

2. An apparatus as claimed in claim 1, wherein the feed means for the copy support material is arranged to feed the copy support material past the image gate with a velocity relative to the image gate which is equal to the velocity of the carriage relative to the fixed support for the original so that the copy support material comes to rest after having been inverted.

3. An apparatus as claimed in claim 1 or claim 2, wherein the severing means is mounted on the carriage.

4. An apparatus as claimed in any one of claims 1 to 3, wherein the feed means for the copy support material is arranged to be driven by drive means for the carriage during movement of the carriage from its first position to its second position.

5. An apparatus as claimed in claim 4, wherein there is provided resilient means tending to urge the carriage into its first position and the drive means for the carriage is so coupled to drive means for the transport belt by releasable coupling means



that when the carriage reaches its second position the coupling is released and the carriage returned to its first position.

6. An apparatus as claimed in any one of claims 1 to 5, wherein the means for inverting the copy support material includes a transport roller arranged behind the image gate and held in engagement with the transport belt under its own weight or by resilient means.

7. An apparatus as claimed in claim 6, wherein there is provided, for inverting the copy support material a hood arranged partly to surround the transport roller.

8. An electrophotographic copying apparatus in accordance with claim 1 substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

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