

PATENT SPECIFICATION

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COPYING

(54) IMPROVEMENTS IN AND RELATING TO OPTICAL COUPLING APPARATUS *Correction 6*

(71) We, AGFA-GEVAERT AKTIENGES-
 ELLSCHAFT, a body corporate recognised
 under the laws of the Federal Republic of
 Germany, of Leverkusen, Federal Republic
 of Germany, do hereby declare the inven-
 tion, for which we pray that a patent may
 be granted to us, and the method by which
 it is to be performed, to be particularly de-
 scribed in and by the following statement:—

The invention relates to optical copying
 apparatus.

It is already a known procedure to ex-
 pose a stationary original strip-by-strip by
 means of a moving objective onto a moving
 record support. Owing to the strip-by-strip
 method of exposure, however, only a rela-
 tively limited copying speed can be achieved.

An increase in the copying speed can be
 obtained by the use of a flash exposure
 device with a stationary objective and mov-
 ing record support. However, a lack of
 sharpness in the image, caused by the dura-
 tion of the flash, adversely affects any fur-
 ther increase in the copying speed in pre-
 viously proposed arrangements.

The invention provides optical copying
 apparatus which comprises means for sup-
 porting an original, means for supporting a
 record support providing a flat image sur-
 face, the supporting means for the original
 and for the record support being arranged
 for relative movement between the original
 and the record support during an exposure,
 a flash exposure device, an objective for
 producing an image of the original on the
 image surface of a record support on its
 support means, and means for moving the
 objective relative to the original support
 means for the duration of the exposure in
 the same direction as, and parallel to, the
 movement of the image surface of the record
 support relative to the original during that
 exposure.

Advantageously, the means for moving
 the objective is arranged to move the objec-
 tive for the duration of the exposure at a
 speed relative to the original dependent
 upon the speed at which the image sur-

face of the record support is arranged to
 move relative to the original and dependent
 on the projection scale in a similar manner
 to that which is known for strip-by-strip
 scanning operations.

In this way an unblurred copy can be ob-
 tained for practically any record support
 speed. In comparison with known strip-by-
 strip scanning techniques, the objective need
 travel only over a short distance, thus mak-
 ing possible relatively small apparatus di-
 mensions and a short movement of the ob-
 jective. The relatively short movement of
 the objective can be achieved with a mov-
 ing device of the simplest type. Further-
 more, a flash of relatively long duration
 may be used, which can be produced by
 means of a relatively low voltage. The cost
 of the electrical voltage supply and the safety
 measures necessary with high voltages can
 thus be reduced.

Advantageously, switching means is pro-
 vided for the flash exposure device which is
 arranged to actuate the exposure device in
 response to the movement of the objective
 relative to the original. Preferably, there is
 provided a member arranged to rotate as the
 objective moves relative to the original, and
 the said member is arranged to actuate the
 switching means when a predetermined point
 on the member reaches a predetermined
 position in its path of rotation. With such
 an arrangement, the flash exposure opera-
 tion can be synchronised with the relative
 movement of the objective in a simple man-
 ner.

The means for moving the objective may
 comprise a rotatable crank disc and a con-
 necting rod arranged to transmit drive from
 the crank disc to the objective to impart
 reciprocal movement to it. With this ar-
 rangement an approximate balance of move-
 ment can be created in a simple manner.

A complete balance of movement can be
 achieved if the means for moving the objec-
 tive comprises an endless belt or chain on
 supporting means arranged to impart reci-
 procal movement to the objective. In such

an arrangement, the means for moving the objective may include a pin and slot coupling between the endless belt or chain and the objective. The pin is preferably attached to the endless belt or chain and the slot is preferably in the form of a groove in a carriage on which the objective is located.

Alternatively, the means for moving the objective may comprise a rotatable eccentric cam arranged to impart the desired reciprocal movement to the objective, on rotation. In such an arrangement, a cam follower, preferably, a runner, is advantageously provided on a carriage on which the objective is located to bear against the cam surface under the action of resilient means. By means of this arrangement, practically any motion characteristic can be provided in a simple and reliable manner.

Optical copying apparatus constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a semi-diagrammatic section through the apparatus;

Figure 2 shows a modification of a part of the apparatus shown in Figure 1;

Figure 2a shows a further modification of a part of the apparatus shown in Figure 1; and

Figure 3 shows a further modification of a part of the apparatus shown in Figure 1.

Referring to the accompanying drawings, in Figure 1, a transparent support plate 2 for an original 3 which is to be copied is arranged on an apparatus housing 1. For the illumination of the original 3, two flashlamps 6 and 7 are fitted, each of which is surrounded by a reflector 4 and 5, respectively, and which briefly produce a high intensity illumination. The original 3 is exposed by means of a movable objective 8 onto a flat image surface 9 of a record support 10. This record support 10 is in the form of an endless electrophotographic strip which moves in the direction of the arrow A. It is electrostatically charged in a known manner by a corona discharge device 11. Adjoining the image surface 9 in a manner which is known and is not shown, there are developing and fixing devices. The record support 10 is tensioned over a cylindrical roller 13 mounted on a spindle 12 supported in the apparatus housing 1. The spindle 12 is connected by means of drive means 29 to a main drive motor 14 of the apparatus.

The objective 8 is fitted on a carriage 15 which is capable of reciprocal movement in the direction of the arrows B and C, and slides on guide bars 16. A crank disc 19 and a push-rod 20 linked between a stud 17 on the carriage 15 and a crank-pin 18 of the crank disc transmit reciprocal move-

ment to the objective carriage 15, drive for the rotation of the crank disc 19 also being derived from the main drive motor 14 via drive means 30. The crank disc 19 carries an electrical contact member 21 which co-operates with a contact spring 22. The contact spring 22 is connected by means of a control lead 23 to switching means 24 for the flashlamps 6 and 7. By way of chassis connections 25 and 26 the control current circuit is closed when the contact member 21 meets the contact spring 22. The switching means 24 is connected to mains leads 27 and to the flashlamps 6 and 7 by means of leads 28.

The method of operation of the apparatus according to the invention is as follows.

In the operating phase shown in Figure 1, the crank-pin 18 is situated approximately in the centre between dead-centre points E and F. On rotation of the crank disc 19 in the direction of the arrow D, the objective carriage 15 accordingly moves almost uniformly in the direction of the arrow B. At the dead-centre point F of the crank disc 19, it alters the direction of its movement to the direction of the arrow C. Its direction of movement remains the same as far as the dead-centre point E, and then changes again to the direction of the arrow B. Starting from the dead-centre point E the copying operation commences, so that when the flash is released the objective carriage 15 is at the uniform speed. The release of the flash then always occurs when the crank-pin 18 is in the immediate vicinity of the point G. After the exposure, the crank-pin 18 returns to the point E, and the copying operation can begin afresh.

The common drive is effected by means of the main drive motor 14 by way of the drive means 29 for the spindle 12 of the roller 13 and by way of the drive means 30 for the spindle 31 of the crank disc 19. The drive means 29 and 30 consist of drive chains, the transmissions of which produce the result that exactly at the point G the speed of the objective carriage 15 is half the speed of the record support, 10. In this way, blurring of the original 3 is prevented. By means of this apparatus the flash operation and the moving operation are synchronised.

Figure 2 shows a modification of the objective carriage 15 and the means for transmitting reciprocal movement to it. The objective carriage 15 is formed with a groove 32 in which a slide-block 33 is guided. In the slide-block 33 there is a pin 34 which is connected to an endless chain 35. The chain 35 is guided round two gearwheels 36 and 37. In the portion of its path of movement in which the pin 34 moves in a straight line, a uniform movement of the objective carriage 15 along the guide bars 16 in the

direction of the arrows B and C takes place. At the regions of curvature of the chain 35, however, a sinusoidal retardation or acceleration of the pin 34 and thus of the objective 8 occurs. The gearwheel 36 is connected by way of the drive means 30 to the main drive motor 14 which is not shown in this Figure. In order to actuate the flashlamps 6 and 7 in the modification of Figure 2, a spring contact 22¹ may be provided as shown in Figure 2a. The contact 22¹ is connected to the switching means 24 in the same manner as the contact 22 of Figure 1 and is arranged to co-operate with the pin 34 to release the flash. Alternatively, the drive means 30 of the arrangement shown in Figure 2 may be arranged to rotate a disc similar to the disc 19 with its contact 21 as shown in Figure 1 at such a transmission ratio that for each complete cycle of the pin 34 the disc makes precisely one revolution.

Figure 3 shows a further modification of the objective carriage and the means for imparting reciprocal movement to it, in which, under the action of a spring 38 which engages with the stud 39 of the objective carriage 15, a runner 40 fitted on the objective carriage 15 rests against the periphery 41 of a cam disc 42. The periphery 41 of the cam disc 42 is given a cam characteristic such that uniform movement of the objective carriage 15 in the direction of the arrow B is adjoined by optimum braking and acceleration sections. The drive of the cam disc 42 is effected by way of the drive means 30, indicated by a dash-dotted line, from the main drive motor 14 (shown in Figure 1). The means for imparting reciprocal movement shown in Figure 3, in spite of its simple and robust construction, can achieve a complete balance of movement. In this arrangement, the flash lamps 6 and 7 may also be actuated by means of a disc similar to the disc 19 with its contact 21, the disc being driven by the drive means 30 at the same speed as the cam disc 41.

WHAT WE CLAIM IS:—

1. Optical copying apparatus which comprises means for supporting an original, means for supporting a record support providing a flat image surface, the supporting means for the original and for the record support being arranged for relative movement between the original and the record support during an exposure, a flash exposure device, an objective for producing an image of the original on the image surface of a record support on its support means, and means for moving the objective relative to the original support means for the duration of the exposure in the same direction as, and parallel to, the movement of the

image surface of the record support relative to the original during that exposure.

2. Optical copying apparatus as claimed in claim 1, wherein the means for moving the objective is arranged to move the objective for the duration of the exposure at a speed relative to the original dependent upon the speed at which the image surface of the record support is arranged to move relative to the original and dependent on the projection scale in the same manner as in strip-by-strip scanning apparatus.

3. Optical copying apparatus as claimed in claim 1, or claim 2, wherein switching means is provided for the flash exposure device which is arranged to actuate the exposure device in response to the movement of the objective relative to the original.

4. Optical copying apparatus as claimed in claim 3, wherein there is provided a member arranged to rotate as the objective moves relative to the original, and the said member is arranged to actuate the switching means when a predetermined point on the member reaches a predetermined position in its path of rotation.

5. Optical copying apparatus as claimed in claim 4, wherein the switching means comprises a contact member on the rotatable member and a contact member fixed with respect to the original and the arrangement is such that when the two contacts meet they close an electric circuit which actuates the flash exposure device.

6. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises a rotatable crank disc and a connecting rod arranged to transmit drive from the crank disc to the objective to impart reciprocal movement to it.

7. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises an endless belt or chain on supporting means arranged to impart reciprocal movement to the objective.

8. Optical copying apparatus as claimed in claim 7, wherein the means for moving the objective includes a pin and slot coupling between the endless belt or chain and the objective.

9. Optical copying apparatus as claimed in claim 8, wherein the pin is attached to the endless belt or chain and the slot is in the form of a groove in a carriage on which the objective is located.

10. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises a rotatable eccentric cam arranged to impart reciprocal movement to the objective, on rotation.

11. Optical copying apparatus as claimed

direction of the arrows B and C takes place. At the regions of curvature of the chain 35, however, a sinusoidal retardation or acceleration of the pin 34 and thus of the objective 8 occurs. The gearwheel 36 is connected by way of the drive means 30 to the main drive motor 14 which is not shown in this Figure. In order to actuate the flashlamps 6 and 7 in the modification of Figure 2, a spring contact 22¹ may be provided as shown in Figure 2a. The contact 22¹ is connected to the switching means 24 in the same manner as the contact 22 of Figure 1 and is arranged to co-operate with the pin 34 to release the flash. Alternatively, the drive means 30 of the arrangement shown in Figure 2 may be arranged to rotate a disc similar to the disc 19 with its contact 21 as shown in Figure 1 at such a transmission ratio that for each complete cycle of the pin 34 the disc makes precisely one revolution.

Figure 3 shows a further modification of the objective carriage and the means for imparting reciprocal movement to it, in which, under the action of a spring 38 which engages with the stud 39 of the objective carriage 15, a runner 40 fitted on the objective carriage 15 rests against the periphery 41 of a cam disc 42. The periphery 41 of the cam disc 42 is given a cam characteristic such that uniform movement of the objective carriage 15 in the direction of the arrow B is adjoined by optimum braking and acceleration sections. The drive of the cam disc 42 is effected by way of the drive means 30, indicated by a dash-dotted line, from the main drive motor 14 (shown in Figure 1). The means for imparting reciprocal movement shown in Figure 3, in spite of its simple and robust construction, can achieve a complete balance of movement. In this arrangement, the flash lamps 6 and 7 may also be actuated by means of a disc similar to the disc 19 with its contact 21, the disc being driven by the drive means 30 at the same speed as the cam disc 41.

WHAT WE CLAIM IS:—

1. Optical copying apparatus which comprises means for supporting an original, means for supporting a record support providing a flat image surface, the supporting means for the original and for the record support being arranged for relative movement between the original and the record support during an exposure, a flash exposure device, an objective for producing an image of the original on the image surface of a record support on its support means, and means for moving the objective relative to the original support means for the duration of the exposure in the same direction as, and parallel to, the movement of the

image surface of the record support relative to the original during that exposure.

2. Optical copying apparatus as claimed in claim 1, wherein the means for moving the objective is arranged to move the objective for the duration of the exposure at a speed relative to the original dependent upon the speed at which the image surface of the record support is arranged to move relative to the original and dependent on the projection scale in the same manner as in strip-by-strip scanning apparatus.

3. Optical copying apparatus as claimed in claim 1, or claim 2, wherein switching means is provided for the flash exposure device which is arranged to actuate the exposure device in response to the movement of the objective relative to the original.

4. Optical copying apparatus as claimed in claim 3, wherein there is provided a member arranged to rotate as the objective moves relative to the original, and the said member is arranged to actuate the switching means when a predetermined point on the member reaches a predetermined position in its path of rotation.

5. Optical copying apparatus as claimed in claim 4, wherein the switching means comprises a contact member on the rotatable member and a contact member fixed with respect to the original and the arrangement is such that when the two contacts meet they close an electric circuit which actuates the flash exposure device.

6. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises a rotatable crank disc and a connecting rod arranged to transmit drive from the crank disc to the objective to impart reciprocal movement to it.

7. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises an endless belt or chain on supporting means arranged to impart reciprocal movement to the objective.

8. Optical copying apparatus as claimed in claim 7, wherein the means for moving the objective includes a pin and slot coupling between the endless belt or chain and the objective.

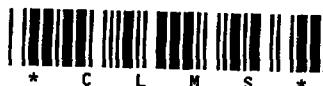
9. Optical copying apparatus as claimed in claim 8, wherein the pin is attached to the endless belt or chain and the slot is in the form of a groove in a carriage on which the objective is located.

10. Optical copying apparatus as claimed in any one of claims 1 to 5, wherein the means for moving the objective comprises a rotatable eccentric cam arranged to impart reciprocal movement to the objective, on rotation.

11. Optical copying apparatus as claimed



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in claim 10, wherein a cam follower provided on a carriage on which the objective is located is arranged to bear against the cam surface under the action of resilient means.

12. Optical copying apparatus substantially as hereinbefore described with reference to, and as shown in, Figure 1 or modified as shown in Figure 2 or Figure 2a or Figure 3 of the accompanying drawings.

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