

PATENT SPECIFICATION

(11)

1 461 061

1 461 061

- (21) Application No. 11623/74 (22) Filed 15 March 1974
 (31) Convention Application No. 2 313 349 (32) Filed 17 March 1973 in
 (33) Germany (DT)
 (44) Complete Specification published 13 Jan. 1977
 (51) INT. CL.³ G03B 27/76
 (52) Index at acceptance
 G2A 404 411 473 474 483 488 494 574 615 616 663 702
 706 711 712 742 BH
 G2X B13

(19)



(54) METHOD AND APPARATUS FOR CONTROLLING EXPOSURE OF A PRINTING MATERIAL

- (71) We, AGFA-GEVAERT AKTIEN-GESELLSCHAFT, a body corporate organised according to the Laws of Germany, of Leverkusen, Germany, do hereby declare the invention 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 described in and by the following statement:—
- 10 The invention relates to a method and apparatus for controlling the exposure to two colours of printing light of a printing or copying material, in particular a two-layer material, the gradation of which is 5 different in each of the colours.
- German Patent Specification 1 572 236, describes a device of the type referred to above in which is provided a drum, onto which is spread a graph having a calibration 20 curve determined for the batch of copying material in question. This calibration curve is derived from the evaluation of prints of neutral density wedges, which are exposed with different colour ratios.
- 25 The calibration curve thus allows the determination of total exposure time and colour ratio on the basis of the maximum and minimum original densities by mechanical means. There is a certain difficulty in carrying out the process with the 30 known apparatus, in that the period of time for testing the apparatus and for adjusting the calibration curve is relatively long on account of the large number of exposures, developments and evaluations. 35 The result of this is that to observe an adequately accurate procedure, all the factors influencing exposure and development, such as composition and temperature of 40 the developing baths, brightness of the copying light source, and the like must be held constant very accurately until the determination of the next calibration curve. This presents considerable difficulties.
- 45 It is already known to expose simultaneously and adjacent to one another on an individual test film, several images of a grey wedge having different colour ratios, wherein the exposure is varied in a direction at right angles to the direction of the density alteration of the grey wedge, for example, by moving a cover plate over the film in one direction during one colour exposure and in the opposite direction during the second colour exposure. In a similar 50 manner, such a test exposure may be controlled in intensity using crossed neutral density wedges, one of the wedges being rotated through 180° relative to its position during the first colour exposure for the second colour exposure. To evaluate 55 such a film which may be considered as a test exposure table, it is already known to draw thereon isodensities corresponding to the desired copy density values and then to carry out the determination of exposure values for a original on the basis of the maximum and minimum densities with a slide-rule type instrument. Errors in operation are not to be excluded here. An object of the invention is to simplify the evaluation of such a test exposure table, to determine exposure values for a given original on the basis of its maximum and minimum densities, and to exclude errors 65 in operation.
- The invention provides an apparatus for controlling the exposure to two colours of printing light of a printing material the gradation of which is different for each colour, which apparatus comprises electronic 80 timer means, first means for adjusting the timer means to control a total exposure time and second means for adjusting the timer means to control the ratio of exposures in each of the two colours, first carrier means arranged to support a test exposure, second carrier means on which are adjustably mounted first and second photo electric means arranged in use to de- 85 90

termine the optical density of points on the test exposure when supported by the first carrier means, control means for comparing the output of each photo electric means with a different predetermined value corresponding respectively to the maximum and minimum densities required in the copy and arranged to control drive means for varying the relative position of the carrier means, the arrangement being such that when the first and second photo-electric means are set to predetermined positions on the second carrier means corresponding to the maximum and minimum densities of the original to be copied, the control means is arranged to halt the drive means when the output of each photo-electric means bears a fixed relationship to the respective predetermined value, the carrier means being so coupled to the adjuster means that the adjuster means are set in accordance with the relative positions of the carrier means.

Thus, an operator need only adjust the positions of the photo-electric means to positions corresponding to measured values for an original to be printed and set the apparatus into operation. This determines, by means of photoelectric scanning of the test exposure table, the correct total exposure time and the correct colour ratio, and sets these values at the timer. Also, exposure may be started by the apparatus automatically.

The invention also provides a method of controlling the exposure, to two colours of printing light, of a printing material the gradation of which is different for each colour, which comprises so making a test exposure of a piece of material from a batch to be printed that the total exposure of the material varies in a first direction and the ratios of the exposures in each colour vary in a second direction at right angles to the first direction, scanning the test exposure with two photo-electric devices, arranged to lie on a line lying at a fixed angle to the first direction and whose positions on that line are predetermined in accordance with the maximum and minimum density values in an original to be copied, determining when the positions of the photo-electric devices relative to the test exposure are such that the output of each photoelectric device bears a fixed relationship to a different predetermined value corresponding respectively to the maximum and minimum densities required in the copy to be made of the original, and controlling the total exposure and the ratio of exposures in each colour in accordance with the said relative positions.

Advantageously, the second carrier means comprises a scale on which are marked optical density values and the

photo-electric means are so mounted on the scale that their positions can be adjusted to positions corresponding to the maximum and minimum optical densities of an original to be printed. In this way, if the densities of the original are first determined by a densitometer, the apparatus can determine the exposure and colour ratios required to give a predetermined density range in a print made from any original.

The drive means, advantageously, includes means for driving the first carrier in a first direction and means for driving the second carrier in a second direction at right angles to the first direction. Preferably, the first carrier means comprises a drum mounted to rotate about its axis and the second carrier means comprises a scale lying parallel to the axis of the drum and movable parallel to the axis of the drum.

Advantageously, the control means is arranged to compare the output of a first one of the photoelectric devices with a first predetermined value and so to operate the drive means that the output of the first photo-electric device is caused to become, and then to remain at during further operation of the drive means, a value which bears a fixed relationship to the first predetermined value, the control means being arranged to halt the drive means when the output of the second photo-electric device bears a fixed relationship to a second predetermined value. Thus the control means operates as a servo-control system which maintains a constant value signal at the first photo-electric device until the signal at the second photo-electric device reaches a predetermined level. The control means, preferably, includes a first comparison amplifier one input of which is connected to the first photo-electric device and the other input of which is connected to a potentiometer the value, of which is arranged to be set to the first predetermined value, the output of the first comparison amplifier being connected to motor drive means for one of the carrier means. The control means may include a second comparison amplifier one input of which is connected to the second photoelectric device, the other input of which is connected to a second potentiometer the value of which is arranged to be set to the second predetermined value and the output of which is connected to motor drive means for the other carrier means.

Advantageously, each of the adjusting means comprises a variable resistor the sliding tapping of which is mechanically coupled to a different one of the carrier means and the control means includes switch means arranged to connect the variable resistors into the timer means when the drive means is halted. In this

way the timer is automatically set to the required values while the photoelectric devices scan the test exposure.

One form of method and apparatus for controlling the exposure of a printing material in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 shows diagrammatically a test exposure,

Fig. 2 shows diagrammatically, an apparatus for evaluating the test exposure shown in Fig. 1, and

Fig. 3 is a circuit diagram of a timing device for controlling exposure in accordance with the evaluation made by the apparatus of Fig. 2.

Referring now to the accompanying drawings, Fig. 1 shows a substantially square piece of film which is divided into six horizontal columns of equal width. This piece of film of a material, whose properties are the same as those of a film to be exposed, is exposed through a neutral density wedge the density of which decreases steadily from left to right (as shown in Fig. 1) from approximately 2.5 to 0. In the table, the proportion of blue exposure increases from bottom to top from 0 to 100%, and the proportion of yellow exposure decreases from 100 to 0%, so that at any one point on the test exposure 1 the two exposures add up to 100%. This variable yellow and blue exposure can be carried out both by time control and intensity control.

It is possible to determine precisely from the local coordinates of any point on the test exposure both the density of the wedge and the ratio of the colour exposures at that point on the test exposure. After exposure as described above, the piece of film is developed, for example, in a developing machine in which films whose exposure is to be controlled in accordance with the test exposure, are also to be processed. The effects of different treatment in the development of the test film and the production film are, therefore, excluded.

Fig. 2 shows an apparatus for evaluating the exposure 1 shown in Fig. 1. The exposure 1 is spread out in a definite position on a transparent drum 2, which contains a light source (not illustrated) for illuminating the exposure 1. The drum 2 can be rotated about an axis 3 by a motor 4. In the immediate vicinity of the casing of the drum 2 is a scale 5 so arranged as to move in a longitudinal direction parallel to the axis of the drum. The scale is engaged, for example, by way of a rack 6 with the pinion of a reversible motor 7. The scale 5 carries movably arranged on it, two photo-

cells 8 and 9 which lie in close proximity to the film 1, so that they can measure the density of a very small area of its surface very accurately by means of the light source arranged inside of the drum 2. The scale 5 carries a density scale having the same range as that of the grey wedge used for making the exposure 1 so that the photocells 8 and 9 may be adjusted without difficulty to positions on the density scale 5 which correspond respectively to the minimum and maximum density of an original to be exposed.

The photocell 8 is connected to an input of a first sum-and-difference amplifier 10, the second input of which is connected to the slip ring of an adjustable resistor 11 which acts as a potentiometer. The output of the amplifier 10 is connected to the reversible motor 7. The output of the photocell 9 is connected to the input of a second sum-and-difference amplifier 12, the second input of which is connected to the slip ring of a second adjustable resistor 13 which also acts as a potentiometer. The output of the sum-and-difference amplifier 12 controls the motor 4 for the rotation of the drum 2, and moreover activates switches 15 and 16 by means of a relay 14. Resistors 20 or 19 are adjusted by the motors 4 or 7, and form part of the circuit of an electronic timer as shown in Fig. 3, and described in detail in German Patent Specification No. 1572236. This circuit is, therefore, only described briefly below.

The resistor 19 lies between a positive voltage supply 17 and another resistor 18 which is connected to earth. The slip ring 19a of the resistor 19 is connected to the input of a further potentiometer 21, parallel to which lies a potentiometer 22. The slip rings 21a or 22a are connected alternately by a change-over switch 23, to one terminal of a correcting resistor 24, which is earthed at the other end. The switch 23 is connected by way of a resistor 25 to the input of an integration amplifier 26 which is connected as an operational amplifier with feedback through a capacitor 27. A transistor 28 the emitter-collector section of which is connected in parallel with the capacitor 27 serves to discharge the capacitor 27 if a corresponding impulse is supplied by a control device 29. The voltage at the output of the integration amplifier 26 is supplied via resistors 30 and 31 to the input of comparison amplifiers 32 and 33. A reference voltage which is supplied to the input of the amplifier 32, is determined by a resistor 34. A reference voltage supplied to the amplifier 33 is taken from the slip ring 20a of the resistor 20 and conveyed via a resistor 35 to the amplifier 33. The amplifiers 32 and 33 determine the exposure times, response of the

comparison amplifier 33 effecting change-over from the first colour exposure to the second colour exposure and the response of the second amplifier 32 terminating the overall exposure.

The method of operation of the device described above is as follows:—

From a batch of copying material having uniform properties, in particular sensitivity, which is new for processing, there is removed a test sheet, which is exposed with different original density values and different colour ratios as described above and shown in Fig. 1. This film is then developed in the developing machine provided for all the following sheets, so that the photographic density achieved in the film corresponds precisely to the photographic density of the copies obtainable under identical conditions of exposure. The test exposure film 1 is then spread out by known means on the drum 2, the positioning on the drum corresponding to the positioning in the test exposure apparatus, that is, with the variation in the density of the wedge through which the exposure was taken running parallel to the drum axis. The apparatus is thus after a period of approximately 15 minutes, adjusted to the batch of material in question. If an original is now presented for copying, first of all the densities at the lightest and darkest points on the original are determined by a known densitometer. Then, on the scale 5, the photocell 8 is adjusted to the lowest density value in the original, whilst the photocell 9 is adjusted to the highest density value in the original. Simultaneously, the desired limiting values for the densities of the copy are adjusted at the resistors 11 and 13, for example, for the reproduction originals for intaglio printing, a maximum density of 1.6 of the positive is set at the resistor 11 and a minimum density of 0.3 is set at the resistor 13.

On account of the type of exposure of the test film 1, the lines of equal density for any desired minimum and maximum copy density are convergent and approach one another on rotation of the drum 2 in direction of the arrow 36. The adjusting operation advantageously begins from a position on the test exposure film 1 in which the scale 5 lies in the region of the greatest separation between the lines of equal density, that is, at the bottom of the test exposure film, as seen in Figure 1. First of all the comparison amplifier 10 is switched on to evaluate the signal from the photocell 8, and compares the value of the signal received from the photocell 8 with the value preset at the resistor 11. If these values are not equal, then the resultant output from the amplifier 10 causes the

motor 7 to be energised, with current of the appropriate polarity, so that the scale 5 is driven until the photocell 8 is scanning that region of the film 1 which lies at the beginning of the desired equal density line. Since the value of the signal received at the amplifier 10 from the photocell 8 is now equal to the value preset at the resistor 11, the output from the amplifier 10 is zero and the motor 7 comes to a standstill. The second sum-and-difference amplifier 12 is now switched on. The photocell 9 will not, in general, be lying, at this stage, over a region of film 1 the density of which corresponds to the value set at the resistor 13. Therefore, the value of the signal received at the amplifier 12 from the photocell 9 will differ from the value set at the resistor 13 and the consequent output from the amplifier 12 causes the motor 4 to be energised, thereby effecting rotation of the drum 2 in the direction of the arrow 36.

The density value measured by the photocell 8 is meanwhile being compared continuously, by the amplifier 10, with the desired maximum copy density value set at the resistor 11. Since the lines of equal density on the film 1 are curves, the rotation of the drum 2 causes the photocell 8 to lie over and scan a region of the film which is not of the desired preset maximum density. The amplifier 10 thus registers a difference in its two input valves and its consequent output signal causes the motor 7 to become energised again so as to drive the scale 5 in the appropriate direction so that the photocell 8 again lies over a region of the desired density. In this way, the photocell 8 follows the line of equal density, corresponding to the value set at the resistor 11, as the drum 2 rotates, the motor 7 acting as a servo-system.

The drum 2 continues to rotate as long as the amplifier 12 detects a difference between the value of the signal from the photocell 9 and the value set at the resistor 13. Since the lines of equal density converge, as seen by the photocells 8 and 9, as the drum rotates in the direction of the arrow 36, the photocell 9 eventually approaches the line on which lie regions of density equal to the desired minimum copy density set at the resistor 13. As the photocell 9 approaches this equal density line, the difference in the two input values to the amplifier 12 becomes smaller, and the motor 4 drives the drum 2 more slowly. Rotation of the drum 2 stops completely when the input values to the amplifier 12 become equal, that is, when the photocell 9 lies over a region on the film 1 which is on the line of equal density corresponding to the desired minimum copy density set at the resistor 13. The switches 15 and 16 are now closed by the switching

device 14, so that the timer is ready to operate, as described with reference to Fig. 3.

To start the rotary movement of the drum 2, a switch 37 may be connected to the sum-and-difference amplifier 10, which switch switches on the amplifier 12 if there is balance. If the operation of the servo system 8, 10 and 7 is sufficiently quick, the two amplifiers can be switched on simultaneously.

The beginning of an exposure, for example, by the opening of a shutter, with simultaneous blocking of the transistor 28, can also be triggered by the switching device 14. Initially, for example, a blue filter may lie in the copying light beam so that the film sensitivity in blue may be allowed for by adjustment of the slip ring 22a. The adjustment of the slip ring 19a is effected by the motor 7 driving the scale 5, and alters the voltage supplied to the integrating amplifier 26 so that limiting values set at the comparison amplifiers 31 and 32 may be reached more or less quickly, that is to say, the resistor 19 determines the total exposure time. The voltage integrated by the amplifier 26 in the capacitor 27, is compared by both amplifiers 32 and 33 with the respective reference values. According to the position of the slip ring 20a, adjusted by the motor 4 for driving the drum 2, the amplifier 33 only receives a part of the comparison voltage supplied to the amplifier 32, so that it responds earlier. The response of this amplifier causes the transfer from blue exposure to yellow exposure by means of a filter change, the switch 23 being simultaneously shifted so that the value set at the resistor 21 for the yellow sensitivity of the material, comes into effect. The current coming from the resistor 19 is furthermore stored by the capacitor 27 until the amplifier 32 also responds and terminates the exposure. By means of a signal from the device 29, the transistor 28 is then switched through again and the capacitor 27 discharged.

After the development of the exposed copy has been effected in the same manner as the test film, corresponding density values are obtained in this copy, that is to say, the density range of the copy corresponds exactly to the desired limiting values established by adjusting the resistors 11 and 13.

To expose another original, it is, therefore, necessary only to adjust the corresponding original density values at the scale 5, and to proceed as described above.

WHAT WE CLAIM IS:—

1. Apparatus for controlling the exposure to two colours of printing light of a printing material the gradation of which is

different for each colour, which apparatus comprises electronic timer means, first means for adjusting the timer means to control a total exposure time and second means for adjusting the timer means to control the ratio of exposures in each of the two colours, first carrier means arranged to support a test exposure, second carrier means on which are adjustably mounted first and second photo electric means arranged in use to determine the optical density of points on the test exposure when supported by the first carrier means, control means for comparing the output of each photo electric means with a different predetermined value corresponding respectively to the maximum and minimum densities required in the copy and arranged to control drive means for varying the relative positions of the carrier means, the arrangement being such that when the first and second photo-electric means are set to predetermined positions on the second carrier means corresponding to the maximum and minimum densities of the original to be copied, the control means is arranged to halt the drive means when the output of each photo-electric means bears a fixed relationship to the respective predetermined value, the carrier means being so coupled to the adjuster means that the adjuster means are set in accordance with the relative positions of the carrier means.

2. Apparatus as claimed in claim 1, wherein the second carrier means comprises a scale on which are marked optical density values and the photo-electric means are so mounted on the scale that their positions can be adjusted to positions corresponding to the maximum and minimum optical densities of an original to be printed.

3. Apparatus as claimed in claim 1 or claim 2, wherein the drive means includes means for driving the first carrier in a first direction and means for driving the second carrier in a second direction at right angles to the first direction.

4. Apparatus as claimed in claim 3, wherein the first carrier means comprises a drum mounted to rotate about its axis and the second carrier means comprises a scale lying parallel to the axis of the drum and movable parallel to the axis of the drum.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the control means is arranged to compare the output of a first one of the photoelectric devices with a first predetermined value and so to operate the drive means that the output of the first photo-electric device is caused to become, and then to remain at during further operation of the drive means, a value which bears a fixed relationship to the first pre-

device 14, so that the timer is ready to operate, as described with reference to Fig. 3.

To start the rotary movement of the drum 2, a switch 37 may be connected to the sum-and-difference amplifier 10, which switch switches on the amplifier 12 if there is balance. If the operation of the servo system 8, 10 and 7 is sufficiently quick, the two amplifiers can be switched on simultaneously.

The beginning of an exposure, for example, by the opening of a shutter, with simultaneous blocking of the transistor 28, can also be triggered by the switching device 14. Initially, for example, a blue filter may lie in the copying light beam so that the film sensitivity in blue may be allowed for by adjustment of the slip ring 22a. The adjustment of the slip ring 19a is effected by the motor 7 driving the scale 5, and alters the voltage supplied to the integrating amplifier 26 so that limiting values set at the comparison amplifiers 31 and 32 may be reached more or less quickly, that is to say, the resistor 19 determines the total exposure time. The voltage integrated by the amplifier 26 in the capacitor 27, is compared by both amplifiers 32 and 33 with the respective reference values. According to the position of the slip ring 20a, adjusted by the motor 4 for driving the drum 2, the amplifier 33 only receives a part of the comparison voltage supplied to the amplifier 32, so that it responds earlier. The response of this amplifier causes the transfer from blue exposure to yellow exposure by means of a filter change, the switch 23 being simultaneously shifted so that the value set at the resistor 21 for the yellow sensitivity of the material, comes into effect. The current coming from the resistor 19 is furthermore stored by the capacitor 27 until the amplifier 32 also responds and terminates the exposure. By means of a signal from the device 29, the transistor 28 is then switched through again and the capacitor 27 discharged.

After the development of the exposed copy has been effected in the same manner as the test film, corresponding density values are obtained in this copy, that is to say, the density range of the copy corresponds exactly to the desired limiting values established by adjusting the resistors 11 and 13.

To expose another original, it is, therefore, necessary only to adjust the corresponding original density values at the scale 5, and to proceed as described above.

WHAT WE CLAIM IS:—

1. Apparatus for controlling the exposure to two colours of printing light of a printing material the gradation of which is

different for each colour, which apparatus comprises electronic timer means, first means for adjusting the timer means to control a total exposure time and second means for adjusting the timer means to control the ratio of exposures in each of the two colours, first carrier means arranged to support a test exposure, second carrier means on which are adjustably mounted first and second photo electric means arranged in use to determine the optical density of points on the test exposure when supported by the first carrier means, control means for comparing the output of each photo electric means with a different predetermined value corresponding respectively to the maximum and minimum densities required in the copy and arranged to control drive means for varying the relative positions of the carrier means, the arrangement being such that when the first and second photo-electric means are set to predetermined positions on the second carrier means corresponding to the maximum and minimum densities of the original to be copied, the control means is arranged to halt the drive means when the output of each photo-electric means bears a fixed relationship to the respective predetermined value, the carrier means being so coupled to the adjuster means that the adjuster means are set in accordance with the relative positions of the carrier means.

2. Apparatus as claimed in claim 1, wherein the second carrier means comprises a scale on which are marked optical density values and the photo-electric means are so mounted on the scale that their positions can be adjusted to positions corresponding to the maximum and minimum optical densities of an original to be printed.

3. Apparatus as claimed in claim 1 or claim 2, wherein the drive means includes means for driving the first carrier in a first direction and means for driving the second carrier in a second direction at right angles to the first direction.

4. Apparatus as claimed in claim 3, wherein the first carrier means comprises a drum mounted to rotate about its axis and the second carrier means comprises a scale lying parallel to the axis of the drum and movable parallel to the axis of the drum.

5. Apparatus as claimed in any one of claims 1 to 4, wherein the control means is arranged to compare the output of a first one of the photoelectric devices with a first predetermined value and so to operate the drive means that the output of the first photo-electric device is caused to become, and then to remain at during further operation of the drive means, a value which bears a fixed relationship to the first pre-



determined value, the control means being arranged to halt the drive means when the output of the second photo-electric device bears a fixed relationship to a second predetermined value.

5 6. Apparatus as claimed in claim 5, wherein the control means includes a first comparison amplifier one input of which is connected to the first photo-electric device
10 and the other input of which is connected to a potentiometer the value of which is arranged to be set to the first predetermined value, the output of the first comparison amplifier being connected to
15 motor drive means for one of the carrier means.

7. Apparatus as claimed in claim 6, wherein the control means includes a second comparison amplifier one input of
20 which is connected to the second photo-electric device, the other input of which is connected to a second potentiometer the value of which is arranged to be set to the second predetermined value and the output
25 of which is connected to motor drive means for the other carrier means.

8. Apparatus as claimed in any one of claims 5 to 7, wherein each of the adjusting means comprises a variable resistor
30 sliding tapping of which is mechanically coupled to a different one of the carrier means and the control means includes switch means arranged to connect the variable resistors into the timer means
35 when the drive means is halted.

9. Apparatus as claimed in any one of claims 1 to 8, which includes means for illuminating the first carrier means at least
40 in the area adjacent to the photoelectric devices.

10. Apparatus as claimed in claim 9, wherein the first carrier means is translucent and the illuminating means is arranged on the side of the first carrier
45 means opposite the photoelectric devices.

11. Apparatus as claimed in any one of claims 1 to 10, wherein the photoelectric devices are photocells.

12. Apparatus as claimed in any one of
50 claims 1 to 11, wherein the control means is arranged to halt the drive means when the output of each photo-electric means equals the respective predetermined value.

13. Apparatus for controlling the exposure of a printing material substantially as hereinbefore described with reference to, and as shown in the accompanying drawings.

14. A method of controlling the exposure, to two colours of printing light, of
60 a printing material the gradation of which is different for each colour, which comprises so making a test exposure of a piece of material from a batch to be printed that
65 the total exposure of the material varies

in a first direction and the ratios of the exposures in each colour vary in a second direction at right angles to the first direction, scanning the test exposure with two photo-electric devices, arranged to lie on a line lying at a fixed angle to the first direction and whose positions on that line are predetermined in accordance with the maximum and minimum density values in an original to be
75 copied, determining when the positions of the photo-electric devices relative to the test exposure are such that the output of each photoelectric device bears a fixed relationship to a different predetermined
80 value corresponding respectively to the maximum and minimum densities required in the copy to be made of the original, and controlling the total exposure and the ratio of exposures in each colour in accordance
85 with the said relative positions.

15. A method as claimed in claim 14, wherein the test exposure is mounted on a first carrier and the photoelectric devices are adjustably mounted on a second carrier, the carriers being moved relative to one another until the output of each photoelectric device bears the said fixed relationship to the respective predetermined
95 value.

16. A method as claimed in claim 15, which comprises comparing the output of one photoelectric device with a first predetermined value, so moving the carriers relative to one another that the output of
100 the one photoelectric device is caused to become, and then to remain at during further operation of the drive means, value which bears a fixed relationship to the first predetermined value, comparing
105 the output of the other photoelectric device with a second predetermined value during movement and halting movement when the output of the other photo electric device bears the said fixed relationship to the
110 second predetermined value.

17. A method as claimed in claim 15 or claim 16, wherein the output of each photoelectric device is compared with the respective predetermined value by means
115 of a different comparison amplifier and the output of each amplifier is arranged when non-zero to operate drive means for a different one of the carrier means.

18. A method as claimed in any one of
120 claims 15 to 17 wherein the exposure is controlled by electronic timer means and the carriers are coupled to means for adjusting the timer means to control the total exposure time and the ratio of exposures in each colour.
125

19. A method as claimed in any one of claims 14 to 18, which comprises determining when the positions of the photo-electric devices relative to the test exposure
130



are such that the output of each photo-electric device is equal to a different pre-determined value, corresponding respectively to the maximum and minimum 5 densities required in the copy to be made of the original.

20. A method carried out substantially

as hereinbefore described with reference to the accompanying drawings.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303-306 High Holborn,
London, WC1V 7LH.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1976.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

