

[54] **PROJECTION TYPE DUPLICATOR**

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abandoned.

[52] U.S. Cl. **355/69, 355/67**

[51] Int. Cl. **G03b 27/54, G03b 27/72**

[58] Field of Search **355/67, 69**

References Cited

UNITED STATES PATENTS

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[57]

ABSTRACT

The present invention relates to a projection type duplicator and more particularly, in a duplicator changeable of the magnification a projection type duplicator in which the quantity of light of radiation from a light source for lighting up a manuscript is set up corresponding to the magnification and although the magnification is changed the proper exposure for a photo-sensitive paper is radiated.

3 Claims, 7 Drawing Figures

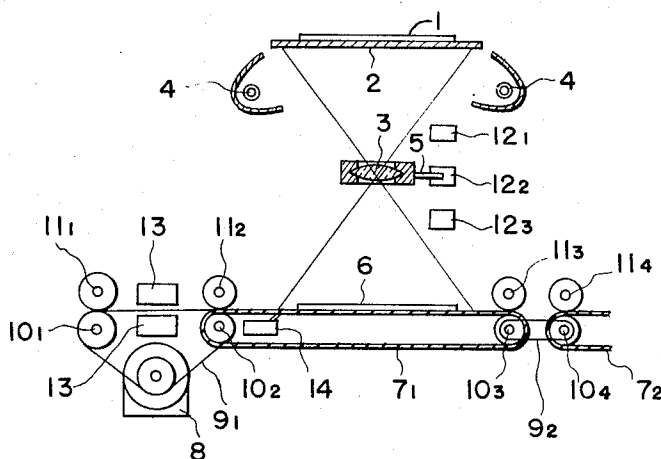


FIG. 3

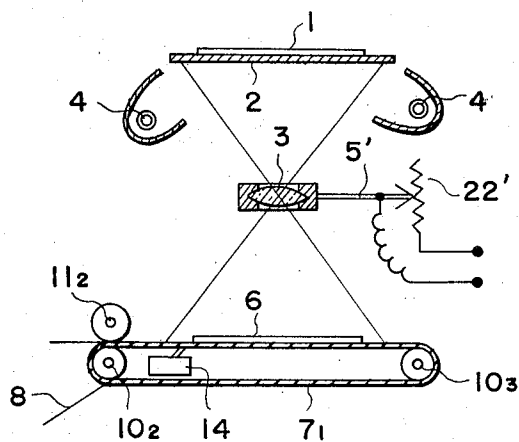
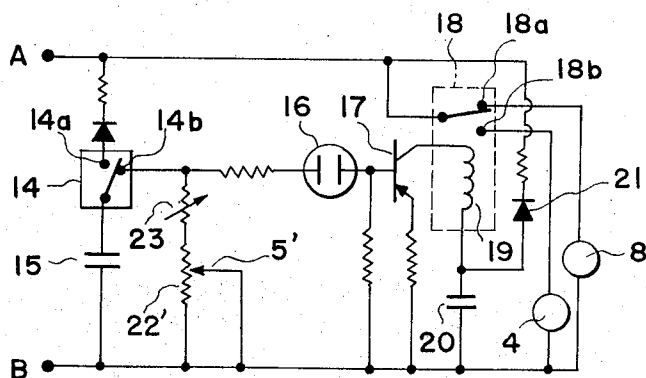


FIG. 4



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FIG. 5

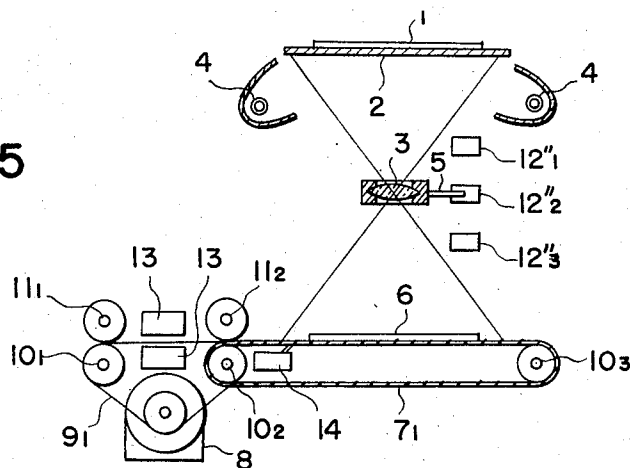
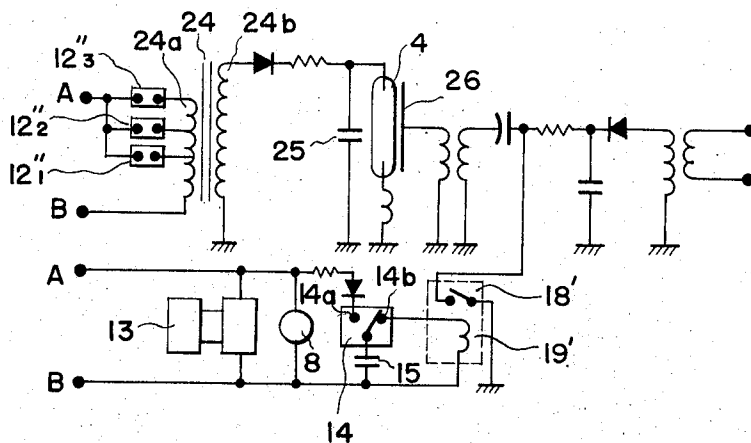
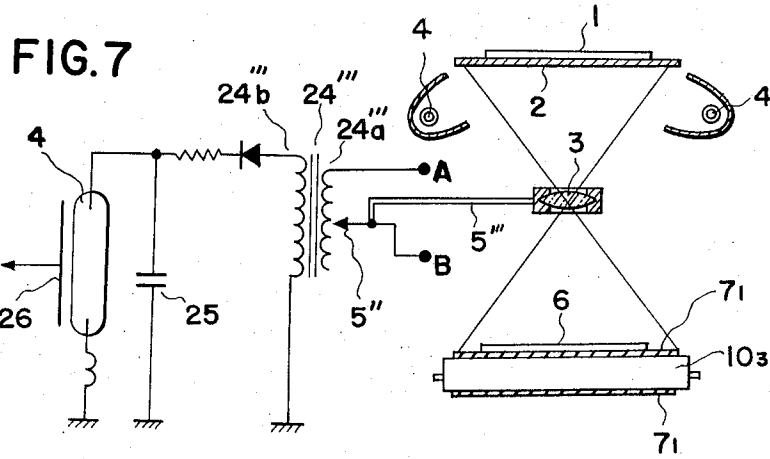


FIG. 6



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PROJECTION TYPE DUPLICATOR

This is a continuation of application Ser. No. 872,548, filed Oct. 30, 1969, now abandoned.

BACKGROUND OF THE INVENTION

A projection type duplicator has an advantage in permitting the magnification of duplication thereof to change, however, when the magnification is changed keeping the brightness of a light source constant, the lightness of image of the manuscript projected is changed in inverse proportion to a square of the magnification plus 1.

When duplicating by using a projected image, therefore, it is necessary to change the lightness of the projection image in accordance with the magnification or to change the exposure time of the photosensitive paper. For this purpose, in the prior art it has been necessary to provide a diaphragm for a projection lens for duplication or to restrict the exposure time in accordance with the intensity of illumination on the image forming surface of the manuscript, or to control the flow speed in a flow type duplicator.

However, when the contrast of the manuscript is nearly fixed, making use of such steps complicates the mechanism of the duplicator to no purpose.

SUMMARY OF THE INVENTION

The present invention relates to a projection type duplicator which is not provided separately with a diaphragm, timer, and other parts for adjusting the exposure and yet controls the quantity of light of radiation from a light source in accordance with the magnification set up for a lens through the lighting time or the brightness of radiation, by interlocking a member for setting up the magnification with a duplication lens changeable in accordance with the magnification, such a member may comprise an adjusting member for different lens positions or a transmitting member for the lens magnification, together with an electrical element for controlling the quantity of light of radiation from a light source.

The primary object of the present invention is to provide apparatus for keeping the exposure of a photosensitive paper for duplication constant by controlling the quantity of light radiation from a light source in accordance with the magnification set up for a duplication lens.

The second object of the present invention is to eliminate a diaphragm in a lens system, a shutter, and a photometer and a control device for controlling a shutter or the lighting time of the light source by receiving light of the intensity of illumination for forming an image of the manuscript by, except for controlling radiation given by a light source.

The third object of the present invention is to provide apparatus for changing the lighting time of a light source for giving light in a fixed brightness in accordance with the magnification set up for a duplicator.

The fourth object of the present invention is to provide apparatus for changing the brightness of a light source lighting for a given period of time in accordance with magnification set up for a duplicator.

The fifth object of the present invention is to provide apparatus for controlling the quantity of light radiation from a light source in accordance with the

focal distance adjustment of a lens for duplication, in a modification changeable duplicator in which the interval between a manuscript and a photosensitive paper is kept nearly constant.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of an embodiment illustrating the relationship between the lighting time of a light source with the magnification set up for a duplication lens in accordance with the present invention.

FIG. 2 is a circuit diagram of the timer of the same embodiment as in FIG. 1.

FIG. 3 is a side view of the second embodiment of the present invention.

FIG. 4 is a circuit diagram of the timer of the same embodiment as in FIG. 3.

FIG. 5 is a side view of the third embodiment using a flash discharge tube as a lighting source and relationship between the brightness of radiation with the magnification set for a duplication lens in accordance with the present invention.

FIG. 6 is a circuit diagram for controlling the brightness of radiation in the same embodiment as in FIG. 5.

FIG. 7 is a side view of the fourth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the first embodiment shown in FIGS. 1 and 2 in accordance with the present invention, manuscript 1 is held on manuscript holding glass base 2 and lighted by light source 4, and its image is projected by duplication lens system 3.

Photosensitive paper 6 is held between driving transmission rollers 10₁, 10₂ interlocked by motor 8 and belt 9₁ and rollers 11₁, 11₂ pressed respectively to contact with rollers 10₁, 10₂ so as to be transmitted from the left to the right in FIG. 1, and meanwhile charged by charging devices 13, 13. Photosensitive paper 6 is placed on belt 7₁ mounted over driving transmission roller 10₂ and transmission roller 10₃. Photosensitive paper 6 is stopped at the image forming position at duplication lens system 3 for manuscript 1 to receive the exposure from light source 4 lighted at that time and transmitted again by belt 7₁ after light source 4 is extinguished. Photosensitive paper is transferred onto belt 7₂ mounted over roller 10₄ interlocked by transmission roller 10₃ and belt 9₂ to be delivered to the developing section not shown in the figures.

Within the range where duplication lens system 3 moves in accordance with the magnification there are provided a plurality of switches (3 switches shown in FIG. 2) 12₁, 12₂, 12₃ so as to be closed by working member 5 of the lens barrel corresponding to the up and down movement of lens system 3. That is, ordinarily opened switches 12₁, 12₂, 12₃ are adapted to close by means of working member 5. As shown in figures in the equivalent magnification condition switch 12₂ is closed, for example, when the magnification is decreased one half switch 12₃ is closed and when the magnification is increased two times switch 12₁ is closed.

Next, with reference to the circuit diagram shown in FIG. 2, between terminals A and B connected to a power source microswitch 14 and condenser 15 are connected in series. In FIG. 2, when the front end of a photosensitive paper 6 moves past microswitch 14

the actuator thereof is operated to come into contact with contact 14a and capacitor 15 is charged, and when the trailing end of photosensitive paper 6 moves past the actuator turns over to come into contact 14b and the voltage charged in condenser 15 is impressed on the base of transistor 17 through neon tube 16 to make transistor 17 conductive. The collector circuit of transistor 17, includes coil 19 of relay 18. And, coil 19 is connected to the emitter through condenser 20 and to the electrode on the opposite side thereof through rectifier 21. Ordinarily closed contact 18a of relay 18 connects motor 8 to the power source, and contact 18b is connected to light source 4.

Between contact 14b of microswitch 14 and neon tube 16 there are connected resistors 22₁, 22₂, 22₃, respectively through switches 12₁, 12₂, 12₃, switched by means of working member 5 of the lens barrel of lens 3 in parallel through variable set resistance 23.

Therefore, when lens 3 is set in the position shown in FIG. 1 in order to duplicate in the equivalent magnification, switch 12₂ is closed by working member 5 and switches 12₁, 12₃ are left open. In this situation the relay is in contact with contact 18a and the circuit of motor 8 is closed and accordingly driving transmission rollers 10₁, 10₂ are running. Thereby, a photosensitive paper inserted from the left side is transmitted to the right, in turn charged by charging devices 13, 13. The photosensitive paper is put on belt 7₁ to be carried by belt 7₁, and thus, when the front end of photosensitive paper 6 comes to the position of the actuator of microswitch 14, microswitch 14 is changed over to contact 14a and capacitor 15 is charged. Motor 8 continues to rotate so as to carry photosensitive paper 6 to the image forming position in the equivalent magnification by duplication lens system 3 for manuscript 1. At this juncture, the trailing end of photosensitive paper 6 stops pressing the actuator of microswitch 14, so that microswitch is changed over to contact 14b, and the voltage charged in capacitor 15 is impressed on the base of transistor 17 by discharging neon tube 16 to make transistor 17 conductive to excite coil 19 in the collector circuit. Thereby relay 18 is changed from contact 18a to contact 18b to break the circuit of motor 8 and at last to close the circuit of light source 4. At the same time the voltage charged in capacitor 15 starts to discharge through variable set resistance 23, switch 12₂ and resistance 22₂. Upon receiving the proper quantity of the exposure of manuscript 1 lighted up with the given brightness by turning on light source 4, the voltage in capacitor 15 drops due to the above-mentioned discharge and the discharge of neon tube 16 is stopped to the cut-off condition due to the voltage drop in the base of transistor 17. Coil 19 is deenergized so that relay 18 changes over again to contact 18a, the light source extinguished, and motor 8 starts again to rotate so as to carry exposed photosensitive paper 6 by means of belt 7₁ and transfer it onto belt 7₂ mounted over roller 10₄ interlocked by roller 10₃ and belt 9₂ to be delivered to the developing section not shown in the figures.

When the duplication is two times as much as the previously described condition, by setting the duplication lens system for this new magnification, working member 5 opens switch 12₂ and closes switch 12₁. At this juncture, the voltage charged in capacitor 15

flows through variable set resistance 23 and resistance 22₁, so that by setting up the respective resistance so that the time to the stoppage of discharge of neon tube 16 may be 9/4 times as much as the previous time it is possible to obtain automatically the proper exposure also in this case. Also, by adjusting variable set resistance 23 it is possible to compensate for the fluctuation of the manuscript contrast or the sensitivity of the photosensitive paper.

In the second embodiment shown in FIG. 3 and FIG. 4, for changing over resistances 22₁, 22₂, 22₃ by means of switches 12₁, 12₂, 12₃, working member 5 of lens barrel is formed into a brush, and variable resistance 22' is provided on which the brush slides. And also in the circuit instead of switches 12₁, 12₂, 12₃ and resistances 22₁, 22₂, 22₃ in parallel with each other one slidable and variable resistance 22' is inserted in series with variable set resistance 23 so as to allow the light source to radiate the proper quantity of light of radiation corresponding to the continuous change of the duplication magnification. Such a type of light source has an advantage in a flow type duplicator which provides exposure while moving a photosensitive paper and a light source or a manuscript in parallel with each other and at a fixed speed ratio.

In the third embodiment shown in FIG. 5 and FIG. 6, the brightness of radiation of a light source is changable corresponding to the duplication magnification, and a switch mechanism switched by means of working member 5 and a mechanism for feeding photosensitive papers by means of motor 8 are the same as those in the first embodiment and the same symbols are used to denote the same parts.

Primary circuit 24a of transformer 24 connected to terminals A, B of a power source is so constructed that a portion thereof is short-circuited by opening and closing switches 12'₂, 12'₁. That is, when the duplication magnification is changed in the following sequence magnification → equivalent magnification → contraction, the number of turns of primary winding 24a of transformer 24 is changed as follows: small → middle → large, and the voltage generated in secondary winding 24b thereof is changed as follows: large → middle → small. The voltage is charged in capacitor 25 and the actuator of microswitch 14 is changed over to contact 14a by the passing of photosensitive paper 6. Capacitor 15 is charged by the power current, photosensitive paper 6 moves past the actuator and comes to the position just under duplication lens 3, and at this juncture the actuator of microswitch 14 returns again to contact 14b. The photoelectric current of capacitor 15 flows through coil 19' of relay 18' to close the relay switch. On trigger electrode 26 of flash discharge tube 4 a trigger pulse is impressed, the electric charge in capacitor 25 is discharged through discharge tube 4, and discharge tube 4 instantaneously turns on a light.

And, the brightness of radiation is changed in accordance with the quantity of energy charged in capacitor 25. Provided the capacity of capacitor 25 is C and the voltage charged is V, the quantity of energy E charged therein is shown as follows:

$$E = \frac{1}{2} CV^2$$

In the fourth embodiment shown in FIG. 7, slidable brush 55' is provided for primary winding 24''a

of transformer 24''' so as to interlock 5''' with displacement of duplication lens 3 in the duplicator, and the voltage charged in capacitor 25 is made changeable continuously in accordance with the magnification of duplication. The intensity of illumination of an image formed on the photosensitive paper of manuscript 1 irradiated by a light source in any magnification is made continuously invariable.

In the above-mentioned third and fourth embodiments, when a flash discharge tube the lighting time of which is momentary and can not be controlled is used as a light source for the duplicator the brightness of radiation can be controlled. Accordingly, it is of great advantage to the duplicator making use of such a kind of light source, and in such a kind it is possible to expose while transmitting the photosensitive paper without stopping it, therefore, there is no need of controlling the running and stopping of driving motor 8.

I claim:

1. A projection type duplicating apparatus, comprising:

a transparent member mounted to said apparatus for positioning source material to be duplicated;

means for transporting photosensitive means along a path spaced from said transparent member and including an image receiving position;

a flash discharge light source for providing radiant energy to said source material on said transparent member;

a projecting lens system movable between said transparent member and said image receiving position for projecting an image of said source material to said photosensitive means at said image receiving position in accordance with a desired magnification;

a number of switches positioned in spaced relationship with respect to said optical axis and individually actuated by said movable projecting lens system in accordance with said desired magnification;

a number of control circuits, each one of said control circuits is connected to a respective one of said

switches for controlling the lighting energy of said light source in proportion to the square of the quantity represented by said magnification plus one;

a control switch mounted along said path in a position whereby said photosensitive means engages said control switch before reaching said image receiving position, said control switch having a first position and a second position, said control switch is in said first position with said photosensitive means entering said image receiving position and in said second position with said photosensitive means at said image receiving position; and

a circuit for controlling the energy of said light source and including a first capacitor connected in series with said control switch and a relay actuated by the discharging of said first capacitor for energizing said light source upon arrival of said photosensitive member at said image receiving position, said first capacitor is connected to said power source and with said control switch in said first position said first capacitor is connected to said selected one of said control circuits for discharging said first capacitor with said control switch in said second position, and said relay energizing said means for transporting after completion of an exposure to remove said photosensitive means from said image receiving position.

2. A projection type duplicating apparatus as in claim 1 wherein said number of control circuits each include a resistance and a variable resistance connected therewith.

3. A projection type duplicating apparatus as in claim 1 wherein said light source further includes a second capacitor for energizing said light source and wherein said control circuits each comprise a portion of the primary winding of a transformer, said transformer having a secondary winding connected across said second capacitor, said transformer controlling the charging voltage of said second capacitor.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,992 Dated June 11, 1974

Inventor(s) Masaya Ogawa

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority

Nov. 17, 1968 Japan Utility Model 100036/1968

Nov. 17, 1968 Japan Utility Model 100037/1968

Signed and sealed this 6th day of May 1975.

(SEAL)

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,992 Dated June 11, 1974

Inventor(s) Masaya Ogawa

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[30] Foreign Application Priority

Nov. 17, 1968 Japan Utility Model 100036/1968

Nov. 17, 1968 Japan Utility Model 100037/1968

Signed and sealed this 6th day of May 1975.

(SEAL)
Attest:

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Attesting Officer

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