

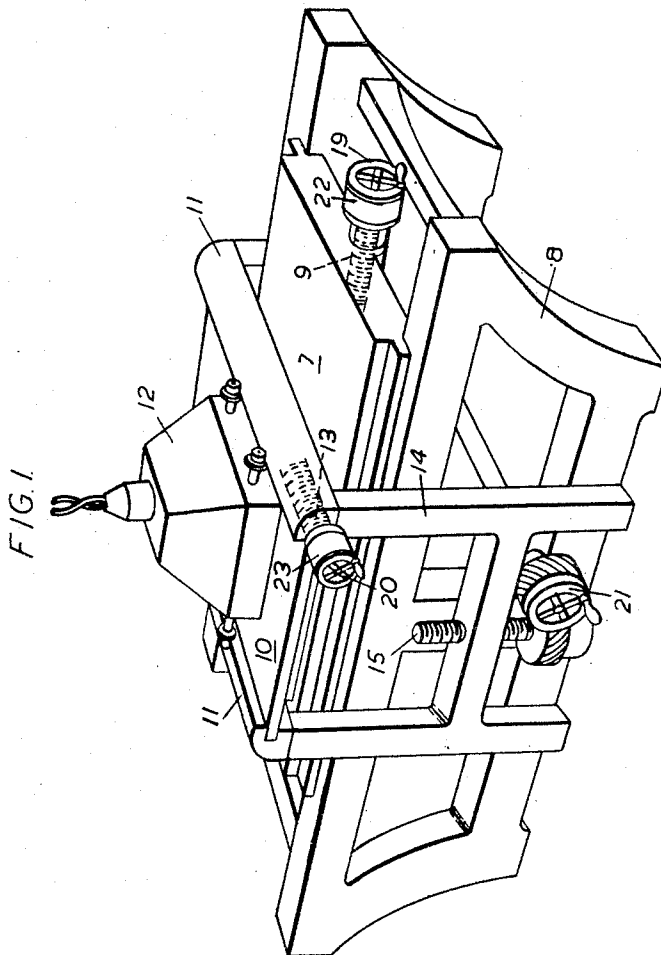
Jan. 9, 1951

A. R. KILMINSTER
CONTROL DEVICE FOR ASSOCIATION WITH AN
AUTOMATIC PROGRESSION MECHANISM FOR
REPETITIVE IMAGE PRODUCTION

2,537,353

Filed June 17, 1949

4 Sheets-Sheet 1



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Attorney

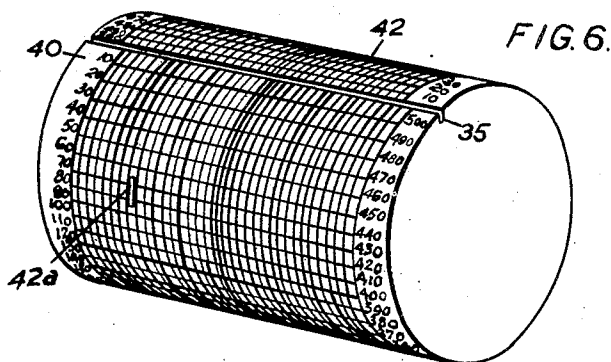
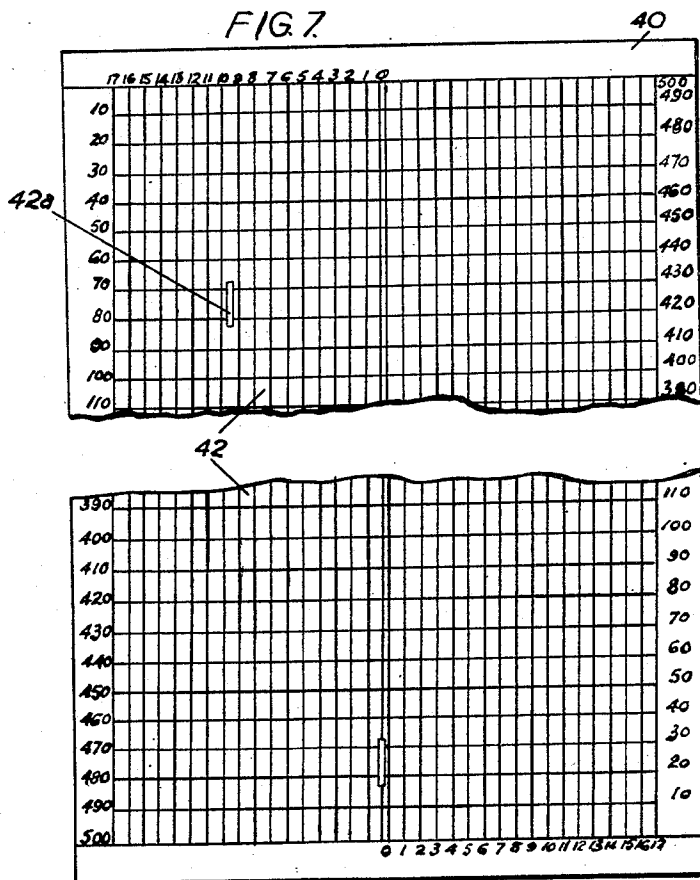
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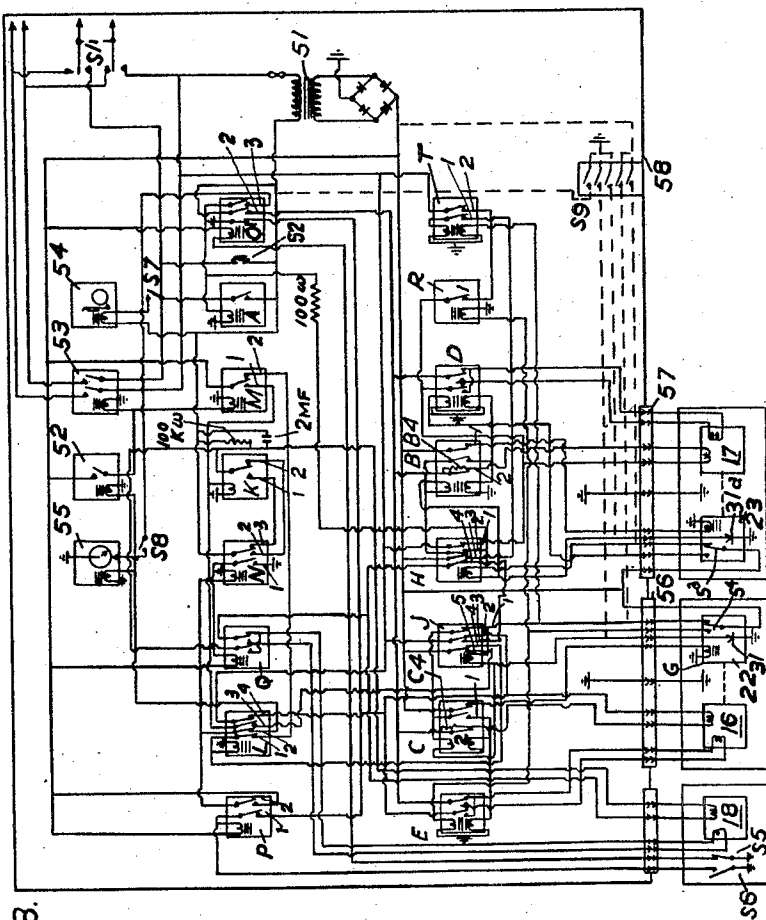


FIG. 8.

Inventor:

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By  Attorney

The operation of the complete device will now be described with reference to Figure 8 of the accompanying drawings for the control of a step and repeat machine of the kind illustrated and described with reference to Figure 1.

Assuming that the bed 7 and the negative carrying unit 10 are positioned somewhere before the first exposure position as determined by the insulating strip, then when the master switch S1 is placed in the "On" position and the starting button S2 is pressed a low tension transformer 51 energizes a relay A via the switch S3 associated with the control drum 22 or 23. The contacts on the relay A are in parallel with the starting button S2 thus when the button is released the circuit remains closed. At the same time a relay L is energised via contact J4 and is locked by contact L1 via contact M2, relay O is energised by switch S5 associated with the motor 18, and a relay T is energised and locked by contact T1 via contact H3.

Power is now available for the motors 16 and 17 which traverse the bed 7 and negative carrying unit 10 until the position for the first exposure as predetermined by the appropriate apertures in the insulating strips on control drums 22, 23 is reached. When this position is reached an electrical contact to earth is made through the apertures in the insulating bands by the contacts 31 and 31a respectively. This actuates high speed relays C and B but due to the momentum of the motors 16 and 17 the exposure position is overshoot. However relays C and B remain energised by the closing of the locking contacts C1 and B1. The closing of the contacts C1 and B1 energises the reversing switches E and D and brings into operation speed control devices by the de-energisation of the solenoids G and F; these speed control devices being of the kind described with reference to Figure 5 wherein the solenoid is designated 47. At the same time contacts C2 and B2 open and place resistances C4, B4 in series with the armatures of the motors 16 and 17 to prevent over-heating. The motors 16 and 17 thus traverse the bed 7 and negative carrying unit 10 in a reverse direction to the correct exposure position at a reduced speed. When the exposure position is again reached relays J and H are operated. These relays had not operated when the contact 31 was previously passing over the aperture in the insulating strip due to the fact that they require a comparatively long-time constant.

The operation of the relays J and H open the contacts J2 and H1, breaking the circuit to the motors 16 and 17 through the control drums 22 and 23 immediately and at the same time open the contacts J1 and H2 to release the relays C and B, thereby returning the reversing relays E and D to their original positions and energising the solenoids G and F to release the speed-control devices through contacts C3 and B3. The closing of contact J5 energises the relay K via the contact L3. Relay K forms one half of a two-way switch for the motor 18 the other half being formed by the relay N. The closing of the contact K1 completes the circuit to the motor 18 via contacts J3 and H4 which opens the switch S5 to de-energise relay O and thus open the contact O2. This breaks the circuit to the motors 16 and 17, thus it is impossible for these motors to operate whilst the motor 18 is operating.

When the negative unit 10 is in contact with the bed 7 the switch S6 is momentarily closed thus energising the relay P which is locked by the

contact P1. The closing of the contact P2 initiates the following operations:

Relay N is energised breaking the circuit to the motor 18, relay Q is energised via contact N1 which is a reversing switch for the motor 18. A timing unit 52 which is preferably of the photo-electric integrating type is switched on via the contact L2. This timing unit 52 controls the heavy duty switch 53 for an arc-lamp located in the lamp unit 12 and also energises the relay M. The opening of the contact M2 releases the relay L whilst the closing of the contact M1 prevents the relay K being released when contact L3 opens. At the end of the exposure, as determined by the timing-device 52, the arc-lamp is switched off and the relay M is released. The opening of the contact M1 releases the relay K thus the motor 18 is operated in reverse via the contacts K2 and N2 to move the negative unit 10 away from the bed 7. When the contact between the negative unit 10 and the bed 7 is removed the switch S5 is again closed energising relay O. The opening of the contacts O1 releases relay P which in turn releases relay N breaking the circuit to the motor 18 and releasing the reversing relay Q. The making of the contact O2 has meanwhile completed an alternative circuit for the motor 16 via the contact L4. The motor 16 is therefore operated and relay J is de-energised as the exposure position is passed. Closure of the contact J4 again energises relay L. The circuit to the motor 16 is therefore broken via the contact L4 but at the same time is made by the closing of the contact J2.

The foregoing completes the sequence of operations for the first exposure position and all relays and switches have returned to their initial positions. The motor 16 now traverses the bed 7 to the second exposure position and the above sequence of operations is repeated. This sequence of operations is continued until a complete row of exposures has been made, whereupon further operations are initiated as follows:

The switch S4 associated with the control drum 22 is operated by the bed having reached the end of its permitted travel, thus energising the reversing relay E to operate the motor 16 in reverse, the relays C and J remaining de-energised so that the speed-control device is inoperative. The relay R is energised forming an alternative circuit for the motor 17 via the contacts R1 and T2. When the motor 17 operates the relay H is released opening the contact H3 thereby releasing the relay T and breaking the alternative circuit. The basic circuit for the motor 17 is now completed however via the contact H1 and the motor 17 traverses the negative unit 10 to the second position as determined by the insulating strip on the drum 23. Meanwhile the motor 16 when it has completed its traverse in the reverse direction returns the switch S4 to its original position and commences its forward travel ready to start a second row of exposures.

The operations of the relays R and T in conjunction with the switch S4 ensure that the drum 23 effects only one move for every row completed by the drum 22. On a completion of all the rows as determined by the insulating strips, the drum 23 causes the position of the switch S3 to be changed to de-energise the relay A thereby opening the main switch. The mechanism is thus automatically switched off after the completion of the required number of exposures.

If desired a bell 54 controlled by the switch S7 may be connected across the contacts of the

relay A to give an audible warning of the completion of all the exposures.

A counting mechanism 55 is connected across the timing unit 52 to record the number of exposures made; this counting mechanism also incorporates an optional automatic stop controlled by the switch S3, whereby the control unit will switch off automatically after any predetermined number of exposures. This provision is provided for by a contact to earth or ground on the appropriate exposure which short-circuits the coil on the relay A thus opening the master switch S1.

If it is not desired to use full automatic control a switch S9 can be set so as to admit of the exposure positions being positioned manually by means of the hand-wheels 19 and 20. In this position of the switch S9, on pressing the starting button S2 the motor 18 lowers the frame to move the negative carrying unit 10 into contact with the bed, switches on the arc lamp in the unit 12 for the required exposure, switches off and removes the contact between the negative unit and the bed and then switches off automatically ready for the manual setting of the next exposure position.

The plug 56 connecting the motor 16 and control drum 22 to the control unit in the housing 58 is interchangeable with the plug 57 for the motor 17 and control drum 23 so that the rows of exposures can be made in the most advantageous direction according to the work.

What I claim is:

1. For a machine for repetitive image production, a control device to effect automatic progression of a traversable carrier unit to successive predetermined positions, the control device comprising an electric motor operatively connected to the unit to effect traversing of the carrier unit, a control drum having an electrically conductive peripheral surface and being mounted for operative connection and synchronous rotation with said motor, an electrical contact movable in timed relation with said drum in a path across the drum parallel to the axis thereof, an electrical control unit electrically connected to said contact in circuit with the motor to control the operation and direction of rotation of the motor; a strip of insulating material in which apertures are formed in predetermined spaced relation, and means to secure the strip around the periphery of said drum to receive the contact to determine the intervals at which contact is effected between the contact and the peripheral surface of the drum.

2. In a machine for repetitive image production, a control device to effect automatic progression of a traversable carrier unit, said control device comprising an electric motor operatively connected to the unit to cause traverse of the carrier unit, an electrical control unit operatively connected in circuit with the motor and including a delayed-action relay to control the motor for alternate rotation in a forward and a reverse direction, a speed control device operatively connected to the motor in said circuit to restrict the speed of the motor during rotation in a reverse direction, a control drum rotatable synchronously with the motor and having an electrically conductive peripheral surface, an electrical contact electrically connected with said control unit and movable in timed relation with the control drum in a path across the drum parallel to the axis thereof, means operable from the motor in timed relation with the control drum

to move the contact along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation and means for securing said strip around the periphery of said control drum for receiving the contact through the apertures thereof and determining the intervals at which contact is effected between the contact and the drum, said contact adapted to overshoot the apertures after making contact with the drum to reverse the motor, whereby the carrier unit is moved quickly to a position slightly in advance of a predetermined position and is slowly returned to the predetermined position.

3. In a machine for repetitive image production, a control device to effect automatic progression of a traversable carrier unit, said control device comprising an electric motor operatively connected to the unit to traverse the carrier unit, a rotatable shaft operatively connected to the motor and unit to impart movement to the carrier unit, an electrical control unit in circuit with the motor and including a delayed-action relay to control the motor for alternate rotation in a forward and a reverse direction, a speed control device for the motor to restrict the speed of the motor during rotation in a reverse direction, a control drum rotatable from and synchronously with the motor and having an electrically conductive peripheral surface, clutch means in the circuit and operative upon reversal of the motor to clutch the drum to said shaft, an electrical contact electrically connected with said control unit and movable in timed relation with the control drum in a path across the drum parallel to the axis thereof, means operable in timed relation with the control drum to move the contact along said path, and a strip of insulating material secured round the periphery of said control drum and in which apertures are formed in predetermined spaced relation to receive the contact therethrough for determining the intervals at which contact is effected between the contact and the drum to reverse the motor, whereby the carrier unit is moved quickly by the motor to a position slightly in advance of a predetermined position and is slowly returned to the predetermined position.

4. In a machine for repetitive image production, a control device to effect automatic progression of a traversable carrier unit, said control device comprising an electric motor operatively connected to the unit to traverse the carrier unit, an electrical control unit in circuit with the motor, including a delayed-action relay to control the motor for causing alternate rotation thereof in a forward and a reverse direction, a speed control device for the motor to restrict the speed of the motor during rotation in a reverse direction, a control drum rotatable synchronously from and with the motor and having an electrically conductive peripheral surface, an electrical contact electrically connected with said control unit and movable in timed relation with the control drum in a path across a drum parallel to the axis thereof, means operable from the motor in timed relation with the control drum to move the contact along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation, said control drum having a slot extending lengthwise thereof to receive the ends of said strip, said aperture adapted to receive the contact for determining the intervals at which contact is effected between the contact and the

UNITED STATES PATENT OFFICE

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CONTROL DEVICE FOR ASSOCIATION WITH
AN AUTOMATIC PROGRESSION MECHANISM
FOR REPETITIVE IMAGE PRODUCTION

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13 Claims. (Cl. 95—73)

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This invention has reference to a control device for association with an automatic progression mechanism for repetitive image production and more particularly to a control device for rendering the operation of what is known as a photographic or photo-lithographic step and repeat machine automatic, such machines being utilised for the repetitive photographic printing of a photographic negative in predetermined spaced relationship on a sensitized plate which is subsequently developed and/or etched.

The object of the present invention is to provide a control device which renders the operation of the step and repeat machine automatic and positions to a high degree of accuracy any number of prints of one or more photographic negatives or positives on to the sensitized plate in any predetermined positions.

The invention consists of a control device for effecting automatic progression of a traversable carrier unit to successive predetermined positions for association with a machine for repetitive image production, the control device comprising an electric motor to effect traversing of the carrier unit, operation of the motor being determined by a control drum rotatable synchronously therewith and having an electrically conductive peripheral surface, in association with an electrical control unit electrically connected to an electrical contact movable in timed relation with the drum in a path parallel to the axis thereof, the control drum being adapted to have secured round its periphery a strip of insulating material in which apertures are formed in predetermined spaced relation for determining the intervals at which contact is effected between the contact and the peripheral surface of the drum.

The invention will now be described with particular reference to the accompanying diagrammatic drawings in which:

Figure 1 is a general perspective view of a step and repeat machine incorporating a control device in accordance with the present invention,

Figure 2 is a part sectional plan of a control drum and associated traversable contact,

Figure 3 is a sectional end elevation of the traversable contact as seen from the left of Figure 2.

Figure 4 is an end sectional view through a portion of the drum showing one means whereby the insulating band may be secured to the periphery of the drum.

Figure 5 is a side elevation of the speed limiting device.

Figure 6 is a perspective view of a control drum

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showing an insulating strip in position around the periphery thereof.

Figure 7 is a view of a part of an insulating strip before attachment to the drum.

Figure 8 is a wiring diagram for use in association with the control mechanism.

In Figure 1 there is shown a known form of step and repeat machine wherein there is provided a bed 7 for carrying a sensitized plate, said bed being traversable horizontally in one direction on the fixed frame 8 through the agency of a worm screw 9, co-operating with a captive nut, nut shown, on the bed. Superimposed above the bed 7 is a negative carrying unit 10 which is traversable in guides 11 together with the lamp unit 12 in a horizontal direction at right angles to the direction of traverse of the bed 7, by means of a worm screw 13 in a manner similar to bed 7 as by a captive nut, not shown, the guides 11 being mounted upon a framework 14 which is movable vertically by means of a worm screw or screws 15 to admit of the unit 10 being moved into contact with the bed 7. According to the present invention the worm screws 9, 13 and 15 respectively are rotatable independently by means of electric motors 16, 17 and 18, Figure 8, and are provided with hand-wheels 19, 20 and 21 whereby manual rotation of the respective worm screws may be performed. On one end of each of the worm screws 9 and 13 is mounted a control drum 22 and 23 respectively which drums are exactly similar and will therefore only be described with reference to the control drum 22 which is shown more particularly in Figures 2, 3 and 4.

In Figure 2 the control drum 22 has an electrically conductive peripheral surface, is shown freely rotatable upon an extension 22a of the worm screw 9 and is capable of being locked thereto by means of a screw pin 24 located in the hand wheel 19 which is fast on the extension 22a. The drum 22 carries a spur pinion 25 in mesh with a pinion 26 fast upon a worm screw 27 journaled in a frame member 28. The worm screw 27 meshes with a traversable carriage 29 carrying a spring loaded rocker arm 30 having an electrical contact shown as a roller 31 which is spring urged against the periphery of the drum by means of the spring 32, Figure 3. A worm screw 33 in mesh with a worm wheel 34 fast on the extension 22a transmits the drive from the electric motor 16 to the worm screw 9. The drum 22 is provided with a longitudinal peripheral slot 35, Figures 4 and 6, adjacent which are intumed flanges 36 in which are formed apertures for receiving the hook ends of spring loaded rocker



drum, and locking means disposed within said drum to engage through locating apertures in the end portions of an insulated strip to secure it in position round the periphery of said drum, whereby under the action of the motor, the carrier unit is moved quickly to a position slightly in advance of a predetermined position and upon engagement of the contact with the drum, the motor is reversed and the carrier unit is slowly returned to the predetermined position.

5. In a machine for repetitive image production in which two carrier units are traversable in directions normal one to the other, a control device to effect the automatic progression of the carrier units to predetermined positions, the control device comprising two electric motors, each operatively connected to a unit to effect traversing thereof, an electrical control unit including a delayed-action relay in circuit with and to control the motors for rotation in forward and reverse directions, a speed control device for each motor to restrict the speed thereof during its rotation in a reverse direction, two control drums associated one with each said motor for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across its drum parallel with the axis thereof, means operable in timed relation with each drum to move the contact associated therewith along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation to determine the intervals at which contact is effected between the contact and the drum, and means on each said drum to secure a strip round the periphery thereof, whereby the carrier units are traversed in predetermined order and each is moved quickly by a motor under its momentum to a position slightly in advance of a predetermined position and upon reversal of its motor is slowly returned to the predetermined position.

6. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, a first and a second electric motor, one for each carrier unit to effect traversing thereof and a third electric motor for said frame to effect reciprocation thereof, an electrical control unit in circuit with the motors including a delayed-action relay to control the motors for rotation in forward and reverse directions, a speed control device for each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across its drum parallel with the axis thereof, means operable from a motor in timed relation with each drum to move the contact associated therewith

along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation, means on each said drum to secure said strip around the periphery thereof to determine the intervals at which contact is effected between the contact and the drum, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed in predetermined order and each is moved quickly to a position slightly in advance of a predetermined position due to the momentum of the respective motor and is reversed by its contact engaging a drum through an aperture and is slowly returned to the predetermined position and the frame is movable under the action of its motor at predetermined intervals to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit.

7. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, a first and a second electric motor, one for each carrier unit in operative connection therewith to effect traversing thereof and a third electric motor for said frame in operative connection therewith to effect reciprocation thereof, an electrical control unit in circuit with the motors including a delayed-action relay to control the motors for rotation in forward and reverse directions, a speed control device for each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across its drum parallel with the axis thereof, means operable in timed relation with each drum to move the contact associated therewith along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation, means on each said drum to secure a strip around the periphery thereof to receive a contact through an aperture to determine the intervals at which contact is effected between the contact and the drum to reverse its motor, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed in predetermined order and each is moved quickly to a position slightly in advance of a predetermined position by overrunning of its motor and contact with respect to an aperture and on reversal of its motor is slowly returned to the predetermined position and the frame is movable at predetermined intervals under the action of its motor to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit, and means in said control unit electrically connected with said lamp to determine the periods

and duration of the illumination provided by the lamp.

8. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, a first and second electric motor, one for and operatively connected to each carrier unit to effect traversing thereof and a third electric motor for and operatively connected to said frame to effect reciprocation thereof, an electrical control unit in circuit with the motors including a delayed-action relay to control the motors for rotation in forward and reverse directions, a speed control device for and operatively connected to each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across its drum parallel with the axis thereof, means operable in timed relation with each drum to move the contact associated therewith along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation, means on each said drum to secure a strip round the periphery thereof for passage of a contact through the aperture to determine the intervals at which contact is effected between the contact and the drum, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed in predetermined order and each is moved by its motor quickly to a position slightly in advance of a predetermined position and upon reversal of its motor is slowly returned to the predetermined position and the frame is moved by its motor at predetermined intervals to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit, means in said control unit electrically connected with said lamp to determine the periods and duration of the illumination provided by the lamp, signal means electrically connected to the control unit to give an indication of the end of a predetermined cycle of image reproductions, and means in the control unit to actuate said signal means.

9. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, a first and second electric motor, one for each carrier unit to effect traversing thereof and a third electric motor for said frame to effect reciprocation thereof, an electrical control unit in a electrical circuit including a delayed-action

relay to control the motors for rotation in forward and reverse directions, a speed control device for and operatively connected to each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across a drum parallel with the axis thereof, means operable in timed relation with each drum to move the contact associated therewith along said path, a strip of insulating material in which apertures are formed in predetermined spaced relation, a slot extending lengthwise of each control drum to receive the ends of a strip, said apertures adapted to register with a contact for engagement of the latter with a drum surface to determine the intervals at which contact is effected between the contact and the drum to reverse its motor, locking means disposed within said drum to engage through locating apertures in the end portions of an insulated strip to secure it in position round the periphery of said drum, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed by their motors in predetermined order and by continued operation of the motors with their contacts passing an aperture, each is moved quickly to a position slightly in advance of a predetermined position and by reversal of its motor by engagement of a contact with its drum is slowly returned to the predetermined position and the frame is movable at predetermined intervals to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit.

10. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, a reversible first and a second electric motor, one for and operatively connected to each carrier unit to effect traversing thereof and a reversible third electric motor for and operatively connected to said frame to effect reciprocation thereof, an electrical control unit including a delayed-action relay in circuit with the motors to control the motors for rotation in forward and reverse directions, a speed control device for and operatively connected to each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with and driven from each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable from and in timed relation with its associated drum in a path across a drum parallel with the axis thereof, means associated with and operable in timed relation with each drum to move the contact associated therewith along said path, a strip of in-

insulating material in which apertures are formed in predetermined spaced relation, each drum having a slot extending lengthwise thereof to receive the ends of a strip, locking means disposed within said drum to engage through locating apertures in the end portions of an insulated strip to secure it in position round the periphery of said drum, the location of said apertures serving to determine the intervals at which contact is effected between the contact and the drum, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed in predetermined order and each is moved quickly to a position slightly in advance of a predetermined position by overrunning of its motor and passing of its contact with respect to an aperture and by reversal of its motor by engagement of its contact with its drum at an aperture before passing same, is slowly returned to the predetermined position and the frame under the action of its motor is movable at predetermined intervals to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit, and means in said control unit electrically connected with said lamp to determine the periods and duration of the illumination provided by the lamp.

11. In a machine for repetitive image production in which two carrier units are traversable in directions normal one to the other, a control device to effect the automatic progression of the carrier units to predetermined positions, the control device comprising two electric motors, one for and operatively connected to each carrier unit, to effect traversing thereof, an electrical control unit in an electric circuit with the motors including a delayed-action relay to control the motors for rotation in forward and reverse directions, a speed control device for and in operative connection with each motor to restrict the speed thereof during its rotation in a reverse direction, two control drums associated one with each said motor for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across a drum parallel with the axis thereof, means operable by a motor in timed relation with each drum to move the contact associated therewith along said path, an apertured insulating strip for each drum, the apertures in each strip being so predisposed lengthwise and laterally of the strip that on securing the strip round the periphery of a drum the apertures lie on a spiral line as traced round the periphery of the drum by said contact during rotation of the drum and movement of the contact along its path so that the contact is permitted successively to enter apertures in the strip at predetermined intervals, and means to retain said strip in position round the periphery of the drum, whereby upon sequential operation of the motors in the circuit, the carrier units are traversed in predetermined order and by overrunning of its motor, each is moved quickly to a position slightly in advance of a predetermined position and is slowly returned to the predetermined position by reversing of its motor by engagement of a contact with its associated drum at an aperture.

12. In a machine for repetitive image production, a first carrier unit for a sensitized plate, a second carrier unit traversable in a path normal

to that of said first carrier unit and arranged to support an image to be reproduced on a sensitized plate on said first carrier unit together with a lamp for effecting image reproduction, a frame for said second carrier unit mounted for reciprocation to effect movement of the second carrier unit towards and away from the first carrier unit, an electrical circuit, a first and a second electric motor, one for each carrier unit to effect traversing thereof and a third electric motor for said frame to effect reciprocation thereof, an electrical control unit in circuit with said motors including a delayed-action relay to control the motors for rotation in forward and reverse directions, a speed control device for and operatively connectable to each said first and second motors to restrict the speed thereof during movement in a reverse direction, two control drums associated one with each said first and second motors for synchronous rotation therewith, each said drum having an electrically conductive peripheral surface, an electrical contact for each said drum, each contact being electrically connected with said control unit and movable in timed relation with its associated drum in a path across a drum parallel with the axis thereof, means operable by a shaft in timed relation with each drum to move the contact associated therewith along said path, an apertured insulating strip for each drum, the apertures in each strip being so predisposed lengthwise and laterally of the strip that on securing the strip round the periphery of a drum the apertures lie on a spiral line as traced round the periphery of the drum by said contact during rotation of the drum and movement of the contact along its path so that the contact is permitted successively to enter apertures in the strip at predetermined intervals to engage a drum and successively cause reversal and stopping of its motor, means to retain said strip in position round the periphery of the drum, and means in said control unit electrically connected to said third motor to effect operation thereof in timed relation with said first motor, whereby the carrier units are traversed in predetermined order and each is moved by its motor quickly to a position slightly in advance of a predetermined position and upon reversal of its motor is slowly returned to the predetermined position and the frame is movable at predetermined intervals under control of its motor to move an image carried by the second carrier unit into and out of engagement with a sensitized plate carried by the first carrier unit.

13. In a machine for repetitive image production having a traversable sensitized plate carrying bed unit, a negative carrying unit having a lamp unit and traversable over the bed in a direction intersecting the direction of traverse of the bed and toward and away from the bed, an electrical control device to effect the automatic progression of the bed and unit to predetermined positions relatively, said control device comprising electrical drive means one operatively connected to each unit to cause traversing thereof relatively and another to cause movement of the second unit and its lamp toward and away from the bed unit, an electrical control unit in an electrical circuit with the drive means and lamp and including a delayed-action relay to control the drive means independently in timed relation and to cause operation thereof in forward and reverse directions, a speed control device in the circuit for each drive means to reduce the speed thereof in the reverse direction, a control drum for each

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unit associated one with each drive means for synchronous rotation therewith and each having an electrically conductive peripheral surface, an electrical contact movable across each drum and connected in normally open circuit with the driving means and speed control device for reversing the drive means, a strip of insulated material removably mounted around each drum and having spirally successive apertures in predetermined spaced relation, and means to cause said contacts to engage a drum surface when passed by an aperture during rotation of a drum to close the circuit to the speed control and reversing means to reverse the drive means and subsequently stop same, whereby the drums are disposed with a contact through an aperture and the units are traversed in timed relation relatively in predetermined order under the action of its drive

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means and moved from positions slightly in advance of predetermined positions slowly to the predetermined positions in sequence upon reversal of the drive means to accurately position said units, and plate and negative thereon for exposure successively.

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