

D. ECHELSON ET AL
STEP AND REPEAT MACHINE

Filed Sept. 9, 1958

3 Sheets-Sheet 2

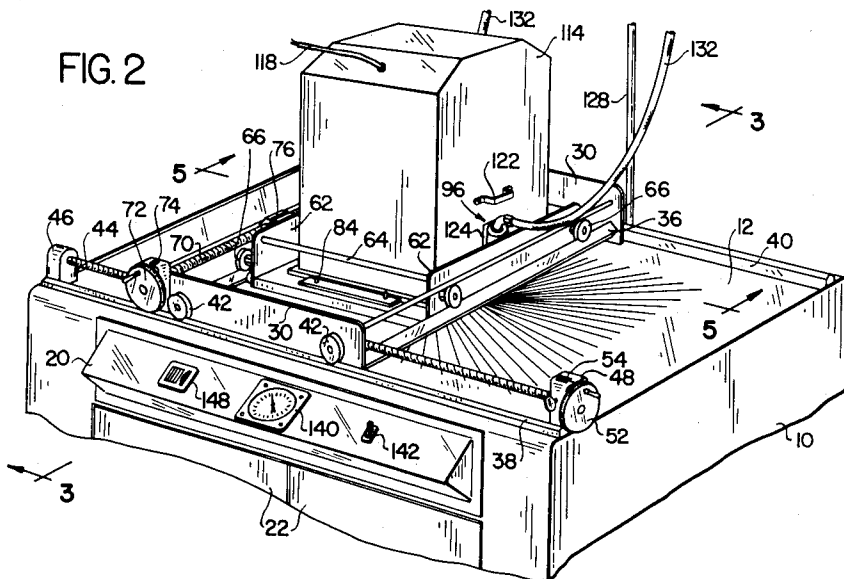


FIG. 3

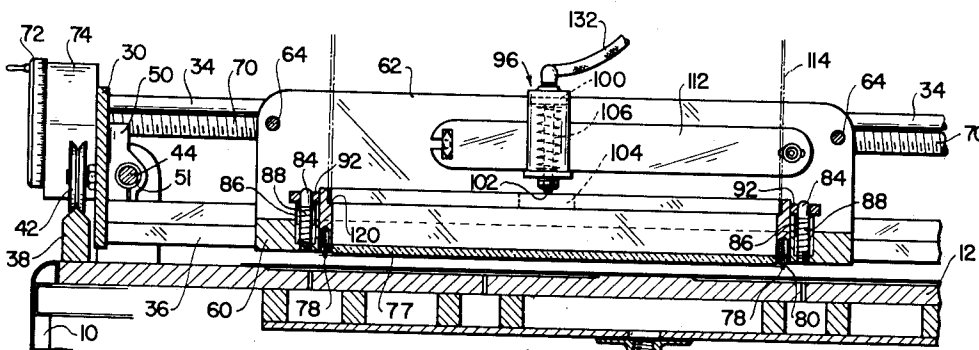
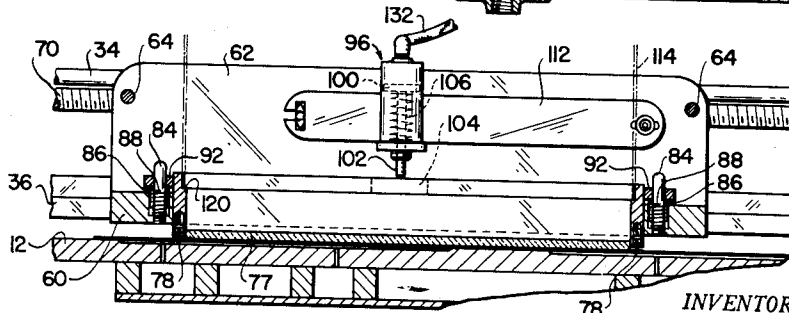


FIG. 4



78 INVENTORS
BY DAVID ECHELSON
RALPH H. BUGBEE

Teller & McCormick
ATTORNEYS

March 14, 1961

D. ECHELSON ET AL
STEP AND REPEAT MACHINE

2,974,579

Filed Sept. 9, 1958

3 Sheets-Sheet 3

FIG. 5

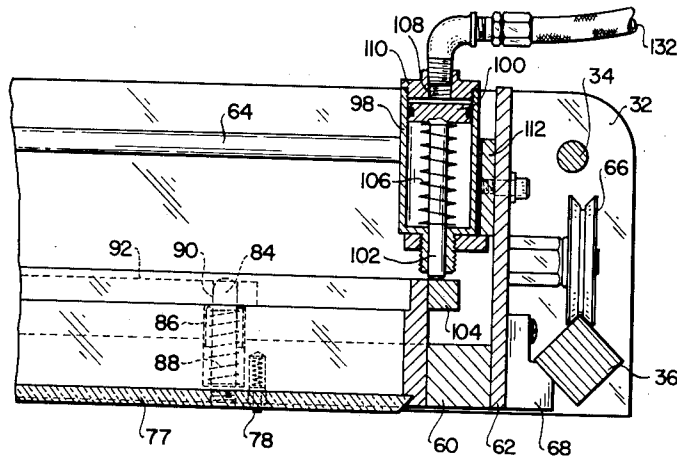


FIG. 6

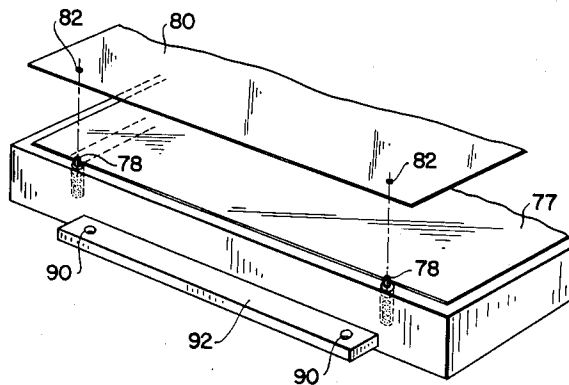
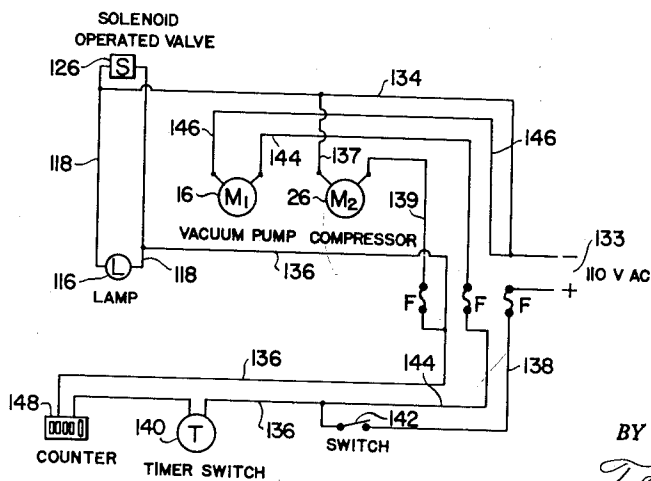


FIG. 7



INVENTORS
DAVID ECHELSON
RALPH H. BUGBEE
BY *Teller & McCormick*
ATTORNEYS

1

2,974,579

STEP AND REPEAT MACHINE

David Echelson, Windsor, and Ralph H. Bugbee, Meriden, Conn., assignors to Mercury Precision Equipment Co., Incorporated, Hartford, Conn., a corporation of Connecticut

Filed Sept. 9, 1958, Ser. No. 759,939

8 Claims. (Cl. 95—73)

This invention relates to a step and repeat machine for reproducing an image successively on different portions of a sheet of image receptive material such as a sheet of film or a printing plate or the like. More specifically, the invention relates to a step and repeat machine which is particularly adapted to position a means carrying an image adjacent different portions of a sheet of unexposed photographic film in succession and to expose the different portions of said film sheet in succession whereby to provide a plurality of like reproductions of the image thereon.

It is the general object of the present invention to provide an image reproducing machine of the type referred to wherein movement of an image carrying means from one position to another adjacent a sheet of image receptive material may be accomplished readily and with a high degree of accuracy, and wherein automatically operable means is provided for maintaining the image carrying means in engagement with or in closely spaced relationship with portions of the sheet of image receptive material during reproduction of the image thereon and for maintaining said image carrying means a substantial distance from the said sheet of image receptive material during movement of said means relative thereto.

The drawings show a preferred embodiment of the invention and such embodiment will be described, but it will be understood that various changes may be made from the construction disclosed, and that the drawings and description are not to be construed as defining or limiting the scope of the invention, the claims forming a part of the specification being relied upon for that purpose.

In the drawings:

Fig. 1 is a perspective view of a step and repeat machine which constitutes the presently preferred embodiment of the invention, the principal components of the machine being shown in exploded relationship;

Fig. 2 is a fragmentary perspective view of the step and repeat machine with the components thereof shown in assembled relationship;

Fig. 3 is an enlarged fragmentary transverse vertical section taken as indicated by the lines 3—3 in Fig. 2 and showing the carriage and chase assembly in greater detail;

Fig. 4 is a view similar to Fig. 3 but showing the chase in its lower position;

Fig. 5 is an enlarged fragmentary longitudinal vertical section taken as indicated by the lines 5—5 in Fig. 2 and showing the carriage and chase assembly in greater detail along with the chase actuating means;

Fig. 6 is a fragmentary perspective view of the chase in an inverted attitude; and

Fig. 7 is a wiring diagram of the electrical control system of the step and repeat machine.

Although the present invention is not so limited, the step and repeat machine which constitutes the presently preferred embodiment thereof is particularly adapted to reproduce an image successively on different portions of

2

a sheet of photographic film. The sheets of film with a plurality of like reproductions of an image thereon which are provided by the machine are useful for a variety of purposes and find particular utility in the printing and allied fields. Printing plates or the like made from the film sheets can be used to produce a number of image reproductions simultaneously and thus printing operations may be accelerated and costs reduced.

In accordance with the present invention, there is provided a table having a flat upwardly exposed surface for supporting a sheet of image receptive material. In the preferred embodiment of the invention shown, the step and repeat machine includes a cabinet 10 which supports a vacuum table or plate 12. The vacuum table or plate 12 has a substantially flat upwardly exposed surface and is provided with a plurality of small apertures arranged in series, said apertures being indicated generally in Figs. 1 and 2 of the drawings by radial lines 14—14 which extend outwardly from the center of said table or plate.

For holding a sheet of photographic film or the like flatly on the plate 12, there is provided means for creating a vacuum beneath said plate. A vacuum pump 16 supported within the cabinet 10 is connected by air passage means 18 with means defining a suitable vacuum chamber beneath the plate 12. The means defining the vacuum chamber are not shown and may, for the purposes of the invention, comprise any suitable enclosure of conventional construction.

As shown, the machine cabinet 10 has a substantially vertical front wall and substantially vertical side walls, a pair of access doors 22, 22 preferably being provided in the front wall. A shelf 24 may be provided inside the cabinet 10 for supporting the vacuum pump 16 and a compressor 26 which has a function to be disclosed hereinafter.

In further accord with the present invention, means movable longitudinally in a plane parallel to the plane of the vacuum plate 12 is provided. In preferred form, said means comprises a carriage 28 having a generally rectangular frame which includes vertical front and rear plates 30 and 32. The plates 30 and 32 extend longitudinally and are rigidly connected together by two transversely or laterally extending upper connecting bars 34, 34 and by two transversely or laterally extending lower connecting bars 36, 36.

For supporting the carriage 28 over the vacuum plate 12 for longitudinal movement there is preferably provided a longitudinally extending front guide and support bar 38 which is rigidly secured along the front edge of the vacuum plate 12. There is also preferably provided a longitudinally extending rear guide and support bar 40 which is rigidly secured along the rear edge of said plate. Two small wheels 42, 42 mounted on the front plate 30 of the carriage 28 ride on the front guide and support bar 38 and two similar wheels (not shown) which are mounted on the rear carriage plate 32 ride on the rear guide and support bar 40. As best illustrated in Fig. 3, the guide and support bars 38 and 40 are formed at their upper portions to an inverted V-shape. The wheels 42, 42 as well as the similar wheels mounted on the rear carriage plate 32 are each provided with annular recesses having a V-shape complementary to the V-shape of said guide and support bars.

For moving the carriage 28 longitudinally relative to the vacuum plate 12, there is preferably provided a lead screw 44 which is connected with the plate 12 and carriage 28 and which is adapted to be turned manually. As shown, the lead screw 44 extends longitudinally adjacent the front edge of the vacuum plate 12 and is rotatably supported at its ends respectively by first and second mounts 46 and 48. The mounts 46 and 48 are rigidly

secured to and extend upwardly from the vacuum plate 12. Fixedly mounted on the front plate 30 of the carriage 28 are a pair of screw blocks 50, 50. Each of the blocks 50, 50 has a longitudinally extending opening 51 wherein which is provided internally with threads complementary to the threads of the lead screw 44. Secured to the end of the lead screw 44 adjacent the mount 48 is a small hand wheel 52 and disposed within the mount 48 and connected to the lead screw 44 is a counter which has an indicator 54 visible through a suitable aperture in the said mount.

From the foregoing, it will be apparent that with the carriage 28 mounted for longitudinal movement on the guide and support bars 38 and 40, as shown in Fig. 2, and with the lead screw 44 extending through the threaded openings in the screw blocks 50, 50, the hand wheel 52 may be turned to move the carriage to a desired longitudinal position relative to the vacuum plate 12. As the hand wheel 52 is turned to move the carriage longitudinally of the plate 12, the counter is operated by rotation of the lead screw 44 and the indicator 54 thereof registers whole or decimal numbers representing the longitudinal position of the carriage. A number of commercially available counters are suitable for the purposes of the present invention and a detailed description is therefore deemed unnecessary.

Also included in the step and repeat machine is means supported on the carriage 28 for transverse or lateral movement in a plane parallel to the plane of the vacuum plate 12. Said laterally movable means in turn supports an image carrying means for movement normal to the plane of said vacuum plate. In preferred form, the laterally movable means comprises a chase holder 56 which is supported for lateral movement on the carriage 28 in a manner similar to the manner in which said carriage is supported over the vacuum plate 12. The image carrying means comprises, in preferred form, a chase 58 which has a frame to which there is attached a transparent plate which is disposed in a plane parallel to the plane of the vacuum plate 12. The lower surface of the transparent plate of the chase 58 is exposed to the vacuum plate and is adapted to have mounted thereon sections of exposed film or other image carriers. The frame of the chase 58 is supported on the chase holder 56 for movement normal to the vacuum plate 12, the transparent plate being moved thereby flatly toward and away from said plate.

The reason for the provision of a normally movable image carrying means such as the chase 58 is to permit an image carrier such as a section of exposed film to be positioned in engagement or in closely spaced relationship with a portion of a sheet of film while the image is being reproduced thereon and to permit the image carrier to be positioned a substantial distance from the film sheet while the said carrier is being moved relative thereto. As will be seen more clearly hereinafter, actuating means is provided for automatically positioning the exposed film section or other image carrier in engagement or closely spaced relationship with the film sheet and for automatically positioning said exposed film or other image carrier a substantial distance from the film sheet and said actuating means is operable in timed relation with means for exposing and reproducing images on the said film sheet.

In preferred form, the chase holder 56 has a flat bottom plate 60 disposed in a plane parallel to the plane of the vacuum plate 12. Two laterally extending side plates 62, 62 are rigidly secured respectively to the laterally extending side edges of the plate 60 and extend upwardly therefrom in vertical planes. Extending longitudinally between upper portions of the side plates 62, 62 are two connecting bars 64, 64. Mounted on each of the side plates 62 are two small wheels 66, 66 which are adapted to ride on the lower connecting bars 36, 36 of the carriage 28. The bars 36, 36 thus serve as guide and support rails for the chase holder 56. Preferably, the bars

36, 36 present an inverted V-shaped surface to the wheels 66, 66 and said wheels are provided with annular V-shaped recesses similar to the recesses in the wheels 42, 42 on the carriage 28. There is preferably also mounted on each of the side plates 62 adjacent each of the wheels 66 a guide block 68. The blocks 68, 68 engage the bars 36, 36 when the chase holder is mounted on the carriage 28 to prevent misalignment between said carriage and holder and to prevent the wheels 66, 66 from becoming disengaged from said bars.

For moving the chase holder 56 transversely or laterally, there is preferably provided a transversely or laterally extending lead screw 70 which is connected with the chase holder and with the carriage 28. As shown, one end of the lead screw 70 is supported for rotation in the longitudinally extending rear plate 32 of the carriage 28 and the other end thereof is similarly supported in the longitudinally extending front plate 30 of said carriage. A hand wheel 72 and a counter 74 are connected with the forward end of the lead screw 70 in a manner similar to the manner in which the counter and hand wheel 52 are connected to the longitudinally extending lead screw 44. Two screw blocks 76, 76 are mounted on the side plate 62 of the chase holder which is disposed adjacent the lead screw 70, each of said blocks including internally threaded openings for receiving said lead screw.

From the foregoing, it will be apparent that rotation of the hand wheel 72 will effect lateral movement of the chase holder 56 in the same manner that rotation of the hand wheel 52 effects longitudinal movement of the carriage 28. The counter indicator 74 provides readings of the lateral position of the chase holder 56 relative to the carriage 28 and to the vacuum plate 12 in the same manner as the counter indicator 54 provides readings of the longitudinal position of the carriage 28.

The frame of the chase 58 is preferably generally rectangular and formed of four flat plates rigidly connected together and disposed in vertical planes to constitute longitudinally extending front and rear walls and two laterally extending side walls. The aforementioned transparent plate 77 is rigidly secured to the bottom edges of the frame walls in a plane parallel to the plane of the vacuum plate 12 and is preferably of colorless glass.

As best illustrated in Fig. 6, there are preferably disposed in suitable recesses in the bottom of the front chase wall first and second spring-backed pins 78, 78. The pins 78, 78 facilitate the proper alignment of sections of exposed film or other image carriers on the glass mounting plate of the chase. Said pins are spring biased out of their respective recesses to permit a section of film or the like mounted on the glass plate to be moved into engagement or closely spaced relationship with a film sheet disposed on the vacuum plate 12 when the chase 58 is moved downwardly. A section of exposed film 80 is shown in Fig. 6 and is provided with suitably punched holes 82, 82 for receiving the pins 78, 78. Sections of exposed film may be attached to the glass mounting plate of the chase 58 when suitably aligned thereon as by taping along the edge portions thereof.

In accordance with the presently preferred practice, the chase 58 is resiliently supported on the chase holder 56 for movement normal to the vacuum plate 12. A plurality of pins 84, 84 are disposed in suitable recesses in the bottom plate 60 of the said holder. Each of the pins 84 has a sleeve 86 which embraces a portion of the pin and which is urged upwardly about the pin by a spring 88 as best illustrated in Fig. 5. The pins 84, 84 are respectively received in a like number of openings 90, 90 provided in first and second lugs 92, 92 formed respectively on the front and rear walls of the frame of the chase 58. The openings 90, 90 are of sufficient size to receive the pins 84, 84, but are not large enough to allow the sleeves 86, 86 associated with said pins to pass there-through.

A generally rectangular opening 94 formed in the bot-

5

tom plate 60 of the chase holder 56 receives the chase 58 for movement normal to the plane of the vacuum plate 12. When the chase 58 is disposed in the opening 94 in the bottom plate 60 of the chase holder 56, it is supported by the sleeves 86, 86 associated with the pins 84, 84. The walls of the opening 94 prevent movement of the chase 58 relative to the chase holder 56 in a plane parallel to the vacuum plate 12. Said chase is, however, movable normal to the plate 12, the springs 88, 88 resiliently urging the sleeves 86, 86 and the chase upwardly and permitting the said chase to be moved downwardly.

In preferred form, the aforementioned actuating means which moves the chase 58 normal to the vacuum plate 12 comprises pneumatically actuated plunger means, a pair of plungers 96, 96 being shown in the drawings respectively mounted on the side plates 62, 62 of the chase holder 56. As best illustrated in Fig. 5, each of the plungers 96 includes a housing 98 in which there is disposed a plunger piston 100. Each piston 100 has formed integrally thereon a plunger 102 which extends through a suitable aperture in the lower end of the housing 98 associated therewith. The plungers 102, 102 respectively engage one of two lugs 104, 104 which are formed respectively on opposite side walls of the chase 58.

A spring 106 disposed within each plunger housing 98 biases the piston 100 and plunger 102 disposed therein upwardly. Air under pressure introduced through a suitable aperture 108 in a plug 110 provided at the upper end of each of the housings 98, 98 urges the piston and plunger therein downwardly. As best illustrated in Figs. 3 and 4, the plungers 96, 96 are preferably supported respectively on the laterally extending side plates 62, 62 of the chase holder 56 by means of pivotally mounted adjusting arms 112, 112.

It will be apparent that when air under pressure is introduced to the plunger housings through the apertures 108, 108 in the plugs 110, 110 thereof, the pistons 100, 100 are urged downwardly against the bias of the springs 106, 106. The plungers 102, 102 acting respectively on the lugs 104, 104 of the chase 58 urge the chase downwardly as shown in Fig. 4 and a section of exposed film or the like mounted on the transparent plate of the chase engages or nearly engages a portion of a film sheet held on the vacuum plate 12. When pressure is relieved on the upper sides of the pistons 100, 100, the springs 106, 106 within the plunger housings and the springs 88, 88 associated with the chase mounting pins 84, 84 and sleeves 86, 86 cooperate to urge the chase 58 upwardly to the position shown in Fig. 3.

When the step and repeat machine of the present invention is adapted to provide a plurality of reproductions of an image on a sheet of photographic film as described herein, the machine is located in a dark room or the like and means is provided for exposing portions of a sheet of unexposed film held on the vacuum plate thereof when such portions are engaged by a section of exposed film or the like mounted on the chase 58. The film exposing means is operable in timed relation with the above described actuating means for the chase 58 and comprises, in preferred form, a shielded electric lamp associated with the chase 58. Portions of a film sheet disposed beneath a section of exposed film or the like mounted on the said chase may thus be selectively exposed and images reproduced thereon.

In preferred form, the film exposing means comprises a hood 114 which is mounted on the chase 58 and which has disposed therewithin an electric lamp 116. The lamp 116 is connected with a source of electrical power by a conductor 118 in a manner to be described more fully hereinbelow. The hood 114 is formed to fit tightly within the upper portions of the walls of the chase frame and rests on a narrow shoulder 120 which extends internally along each of said walls. Provided adjacent the bottom edge of each side wall of the hood 114 is a recess 124

6

adapted to receive a plunger 96. On each side wall of the hood 114 there may be provided a handle 122.

It will be seen from the foregoing that when the lamp 116 is energized, only the portion of a film sheet which is immediately below the chase 58 is exposed. In this connection, it is to be noted that where exposed film sections or the like having areas substantially smaller than the area of the transparent plate of the chase 58 are mounted on said plate, the area of the plate which is not covered by the film section or the like is preferably made opaque. For example, masking tape or the like may be placed on said plate area so that only the portion of a film sheet beneath the exposed film section will be exposed by energization of the lamp 116.

The manner in which the lamp 116 and the chase actuating plungers 96, 96 are operated in timed relation so that the lamp is energized to expose a portion of a film sheet when the chase is moved downwardly toward such portion may be varied widely. The presently preferred practice is to provide an electrically operable valve for controlling the operation of the said plungers and to provide an electrical control system for controlling operation of the valve and the lamp. The electrically operable valve, indicated by the reference numeral 126, is disposed in a pipe 128 which extends from the compressor 26 to a pair of branch pipes 130, 130. The branch pipes 130, 130 are connected respectively to the caps 110, 110 of the plungers by tubes 132, 132 for supplying pressurized air respectively to the cap apertures 108, 108.

Preferably, the valve 126 is of the solenoid operated type and is adapted to direct air under pressure from the compressor 26 to the plungers 96, 96 in one position whereby to move the chase 58 downwardly. In its other position, the valve 126 is adapted to close the pipe 128 and vent air from said plungers to atmosphere whereby to cause the chase 58 to be moved upwardly. A number of solenoid operated valves suitable for the purposes of the invention are available commercially and a detailed description of the valve is therefore deemed unnecessary.

With particular reference now to the wiring diagram of the electrical control system shown in Fig. 7, it will be observed that the solenoid operated valve 126 and the film exposing lamp 116 are connected in parallel with each other. The valve and lamp are connected to an electrical power source 133 by a conductor 134 and by conductors 136 and 138. The compressor 26 is also shown connected between the conductors 134 and 136 in parallel with the valve 126 and the lamp 116 by conductors 137 and 139, but it is not necessarily so connected as will be seen hereinafter.

Connected in the conductor 136 is a switch means which preferably comprises a timer switch 140 which is adapted to be manually closed and to open automatically after a selected period of time. When the timer switch is manually closed, a circuit is completed through the conductors 134, 136 and 138 and the compressor 26 is operated to supply air under pressure to the valve 126, the valve 126 is opened to direct the compressed air to the chase actuating plungers 96, 96 to move the chase downwardly, and the lamp 116 is energized to expose a portion of a film sheet beneath the chase. When the switch 140 opens a selected period of time after actuation thereof, operation of the compressor 26 is terminated, the valve 126 is closed and vents the air in the plungers 96, 96 to atmosphere to move the chase 58 upwardly, and the lamp 116 is de-energized. Timer switches suitable for the purposes of the invention are commercially available and therefore the switch 140 need not be described in detail.

Connected in the line 138 which supplies electrical power from the source to the line 136 is a manually operable switch 142. The switch 142 is adapted for manual actuation and is normally moved to its closed position as a first step in the operation of the step and repeat machine and is allowed to remain closed

throughout the time that the machine is in operation. When closed, the switch 142 arms the circuit for the compressor 26, the valve 126 and the lamp 116 so that the timer switch 140 can operate thereafter to energize and de-energize the lamp and to move the chase 58 upwardly and downwardly. In addition, the switch 142 starts the vacuum pump 16 when it is moved to its closed position. Said pump is connected with the source of electrical power through the conductor 138 and switch 142, a conductor 144 and a conductor 146. It is to be noted at this point that the compressor 26 may alternatively be connected in parallel with the vacuum pump 16. In this event, the compressor will operate throughout the time the step and repeat machine is in operation as does the pump 16. When the switch 142 is opened, it de-energizes the entire electrical control system of the machine.

There is preferably also connected in the line 136 a counter 148. The counter 148 may be of a conventional type adapted to record and indicate the number of times that the timer switch 140 is actuated. The number of actuations of the timer switch, of course, represents the number of times that the chase 58 is moved downwardly and the lamp 116 energized to expose a portion of film sheet and reproduce an image thereon. Thus, the machine operator may determine the total number of images reproduced on a film sheet at any time by reference thereto.

In using the step and repeat machine, the machine operator places a sheet of unexposed film on the vacuum table 12 and mounts a section of exposed film or the like on the glass plate of the chase 58. The carriage 28 and the chase holder 56 are moved by means of the hand wheels 52 and 72 respectively to position the exposed film section supported on the chase over a selected portion of the film sheet, preferably a corner portion thereof. A schedule of positions of the chase 58 is then established by using the counter indicators 54 and 74. If, for example, an image is to be reproduced six times on a film sheet, the chase may be moved to six different positions over the film sheet and readings taken from both the indicator 54 and the indicator 74 at each of the positions.

If the chase is positioned initially over an upper left-hand corner of the film sheet as mentioned, the readings of the indicators 54 and 74 are taken and the hand wheel 52 then is turned to move the carriage 28, the chase holder 56 and the chase 58 longitudinally so as to position the film section over a portion of the film sheet adjacent the right-hand edge of said upper left-hand corner portion. The reading of the indicator 74, of course, remains unchanged and it is only necessary to record the new reading of the indicator 54. This procedure is then repeated to establish a third longitudinal position for the chase 58 and the reading of the indicator 54 for this position is recorded. The hand wheel 72 is then turned to move the chase 58 laterally toward the operator over the film sheet to establish a second row of positions. The reading is taken from the indicator 74 and recorded for each longitudinal position in the second row and the machine operator is then prepared to initiate reproduction of images on one or more film sheets.

With reference to the schedule of positions formulated above, the machine operator places the section of exposed film in the upper left-hand corner or first position. The manual switch 142 on the control panel is actuated to start the vacuum pump whereupon the film sheet is fixedly held in position on the vacuum plate 12. The timer switch 140 is then actuated whereupon the chase is moved downwardly so that the exposed film section engages said upper left-hand corner portion of the film sheet and the lamp is energized to expose said portion of the film sheet and to reproduce the image thereon. The machine operator then turns the hand

wheel 52 with reference to the schedule of positions until he is advised by the indicator 54 that the film section has reached the No. 2 position, i.e., that said section is over the portion of the film sheet adjacent the right-hand edge of the upper left-hand corner portion. The timer switch 140 is again actuated and the image is reproduced on the second portion of the film sheet. The operator then successively and by means of the above-described step and repeat operation effects reproduction of the image on the No. 3, 4, 5 and 6 portions of the film sheet.

While the step and repeat machine described above is particularly adapted for use in transferring images from sections of film or the like to a sheet of unexposed photographic film, it will be apparent that the said machine may be readily adapted for other image transferring processes. For example, the machine may be adapted to provide a plurality of reproductions of an image directly on a printing plate. In such case, suitable means for burning the image on the film plate would be substituted for the film exposing lamp 116. The machine would be operated in a manner similar to the operation described above to reproduce a desired image successively on different portions of the film plate. Similarly, numerous other image transferring processes may be greatly facilitated by the use of a suitably modified form of the step and repeat machine of this invention.

The invention claimed is:

1. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, means supported on the carriage for lateral movement in a plane parallel to the table, image carrying means supported on said laterally movable means for movement normal to the table, spring biased means for holding said image carrying means in spaced relationship with said table and a sheet of film thereon, fluid actuated plunger means for urging said image carrying means downwardly toward said table and film in opposition to said spring biased means, fluid passage means connecting said plunger means with a source of fluid under pressure, an electrically operable valve connected in said fluid passage means between said plunger means and said source of pressurized fluid for controlling the operation of said plunger means, a shielded electric lamp associated with said image carrying means and operable when energized to expose the portion of a film sheet disposed beneath said image carrying means, and switch means connected with a source of electrical power and connected in circuit with said valve and lamp, said switch means being adapted to be closed manually to operate said valve to cause said plunger means to move the image carrying means downwardly toward a sheet of unexposed film on the table and to energize said lamp and said switch means being further adapted to open automatically a selected period of time after being manually closed whereby to de-energize said lamp and to operate said valve to cause said plunger means to move upwardly so that said image carrying means is moved upwardly by said spring biased means.

2. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, a longitudinally extending lead screw connected with the table and the carriage and adapted to be turned manually to adjust the longitudinal position of the carriage relative to the table, a counter connected with said longitudinally extending lead screw for indicating the longitudinal position of said carriage relative to the table, means supported on the carriage for lateral movement in a plane parallel to the

table, a laterally extending lead screw connected with the carriage and with the movable means supported thereon and adapted to be turned manually to adjust the lateral position of said movable means relative to the table, a counter connected with said laterally extending lead screw for indicating the lateral position of said movable means relative to the table, image carrying means supported on said laterally movable means for movement normal to the table, actuating means operatively connected with said laterally movable means and said image carrying means and operable to move said image carrying means toward and away from a sheet of unexposed film supported on the table, and means operable in timed relation with said actuating means for exposing portions of the sheet of film when said image carrying means is moved toward said portions.

3. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, a longitudinally extending lead screw connected with the table and the carriage and adapted to be turned manually to adjust the longitudinal position of the carriage relative to the table, means supported on the carriage for lateral movement in a plane parallel to the table, a laterally extending lead screw connected with the carriage and with the movable means supported thereon and adapted to be turned manually to adjust the lateral position of said movable means relative to the table, image carrying means supported on said laterally movable means for movement normal to the table, pneumatically actuated plunger means operatively connected with said laterally movable means and said image carrying means for moving said image carrying means toward and away from a sheet of unexposed film supported on the table, air passage means connecting said plunger means with a source of air under pressure, an electrically operable valve disposed in said air passage means for controlling operation of said plunger means, a shielded electric lamp associated with said image carrying means for exposing portions of the film sheet disposed beneath the image, and switch means connected with a source of electrical power and connected in circuit with said lamp and valve for operating said valve to cause said plunger means to move the image carrying means toward a sheet of unexposed film supported on the table and for substantially simultaneously energizing said lamp to expose the portion of the film sheet beneath said image carrying means.

4. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, a longitudinally extending lead screw connected with the table and the carriage and adapted to be turned manually to adjust the longitudinal position of the carriage relative to the table, a chase holder supported on the carriage for lateral movement in a plane parallel to the table, a laterally extending lead screw connected with the carriage and with the chase holder and adapted to be turned manually to adjust the lateral position of said chase holder relative to the table, a chase comprising a frame supporting a transparent plate in a plane parallel to the table, the said plate having its lower surface exposed so that a section of exposed film or the like may be mounted thereon and the said frame being resiliently supported on the chase holder for movement normal to the table, actuating means operatively connected with the chase holder and chase for moving said chase normal to the table toward and away from a sheet of unexposed film supported on the table, and means operable in timed relation with said actuating means for exposing

portions of a sheet of film supported on the table when a section of exposed film mounted on the chase is moved toward said portion.

5. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, a longitudinally extending lead screw connected with the table and the carriage and adapted to be turned manually to adjust the longitudinal position of the carriage relative to the table, a chase holder supported on the carriage for lateral movement in a plane parallel to the table, a laterally extending lead screw connected with the carriage and with the chase holder and adapted to be turned manually to adjust the lateral position of said chase holder relative to the table, a chase comprising a frame supporting a transparent plate extending in a plane parallel to the table, the said plate having its lower surface exposed so that a section of exposed film or the like may be mounted thereon and the said frame being resiliently supported on the chase holder for movement normal to the table, pneumatically actuated plunger means operatively connected with said chase holder and chase for moving said chase normal to the table so that a section of exposed film mounted on the transparent plate thereof is moved flatly toward and away from portions of a sheet of unexposed film supported on the table, air passage means connecting said plunger means with a source of air under pressure, an electrically operable valve disposed in said air passage means for controlling the operation of said plunger means, a shielded electric lamp associated with said chase for exposing portions of the film sheet beneath a section of film mounted on the chase plate, and switch means connected with a source of electrical power and connected in circuit with said lamp and valve and operable in one position to cause said plunger means to move said chase and a section of exposed film thereon toward portions of the film sheet and to energize said lamp to expose said film sheet portions and operable in another position to cause said plunger means to move said chase and film section away from said film sheet and to de-energize said lamp.

6. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, means supported on the carriage for lateral movement in a plane parallel to the table, image carrying means supported on said laterally movable means for movement normal to the table, spring biased means for holding said image carrying means in spaced relationship with said table and a sheet of film thereon, fluid actuated plunger means for urging said image carrying means downwardly toward said table and film in opposition to said spring biased means, fluid passage means connecting said plunger means with a source of fluid under pressure, an electrically operable valve connected in said fluid passage means between said plunger means and said source of pressurized fluid for controlling the operation of said plunger means, a shielded electric lamp associated with said image carrying means and operable when energized to expose the portion of a film sheet disposed beneath said image carrying means, a switch means movable to one and another position connected with a source of electrical power and connected in circuit with said valve and lamp, said switch means being operable in one position to operate said valve to cause said plunger means to move said image carrying means downwardly toward a sheet of unexposed film on the table and to energize said lamp, and said switch means being operable in another position to de-energize said lamp and to

11

operate said valve to cause movement of said plunger means permitting said image carrying means to be moved upwardly by said spring biased means.

7. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, first manually operable means connected with the table and the carriage for adjusting the longitudinal position of the carriage relative to the table, a chase holder supported on the carriage for lateral movement in a plane parallel to the table, second manually operable means connected with the carriage and with the chase holder for adjusting the lateral position of said chase holder relative to the table, a chase comprising a frame supporting a transparent plate in a plane parallel to the table, the said plate having its lower surface exposed so that a section of exposed film or the like may be mounted thereon and the said frame being resiliently supported on the chase holder for movement normal to the table, actuating means operatively connected with the chase holder and chase for moving said chase normal to the table toward and away from a sheet of unexposed film supported on the table, means operable automatically in timed relation with said actuating means for exposing portions of a sheet of film supported on the table when a section of exposed film mounted on the chase is moved toward said portion, and manually operable means connected with said actuating means and said last mentioned means for selectively effecting operation thereof.

8. A machine for reproducing an image successively on different portions of a sheet of photographic film comprising in combination, a table having a flat upwardly exposed surface for supporting a sheet of unexposed film, a carriage supported over the table for longitudinal movement in a plane parallel to the table, first manually operable means connected with the table and the carriage for adjusting the longitudinal position of the carriage

12

relative to the table, a chase holder supported on the carriage for lateral movement in a plane parallel to the table, second manually operable means connected with the carriage and with the chase holder for adjusting the lateral position of the chase holder relative to the table, a chase comprising a frame supporting a transparent plate extending in a plane parallel to the table, said plate having its lower surface exposed so that a section of exposed film or the like may be mounted thereon and said frame being resiliently supported on the chase holder for movement normal to the table, fluid actuated plunger means operatively connected with said chase holder and chase for moving said chase normal to the table so that a section of exposed film mounted on the transparent plate thereof is moved flatly toward and away from portions of a sheet of unexposed film supported on the table, air passage means connecting said plunger means with a source of air under pressure, an electrically operable valve in said fluid passage means for controlling the operation of said plunger means, a shielded electric lamp associated with said chase for exposing portions of the film sheet beneath a section of film mounted on the chase plate, a switch means connected with a source of electrical power and connected in circuit with said lamp and valve, said switch means being operable in one position to cause said plunger means to move said chase and a section of exposed film thereon toward a portion of the film sheet and to energize said lamp to expose said film sheet portion, and said switch means being operable in another position to de-energize said lamp and to cause said plunger means to move said chase and film section away from said film sheet.

References Cited in the file of this patent

UNITED STATES PATENTS

1,682,845	Koppe	Sept. 4, 1928
1,809,274	Huebner	June 9, 1931
2,374,469	Wekeman	Apr. 24, 1945
2,393,567	Ringer	Jan. 22, 1946