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Oct. 26, 1926. 1,604,255

H. BLAIR

AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 1

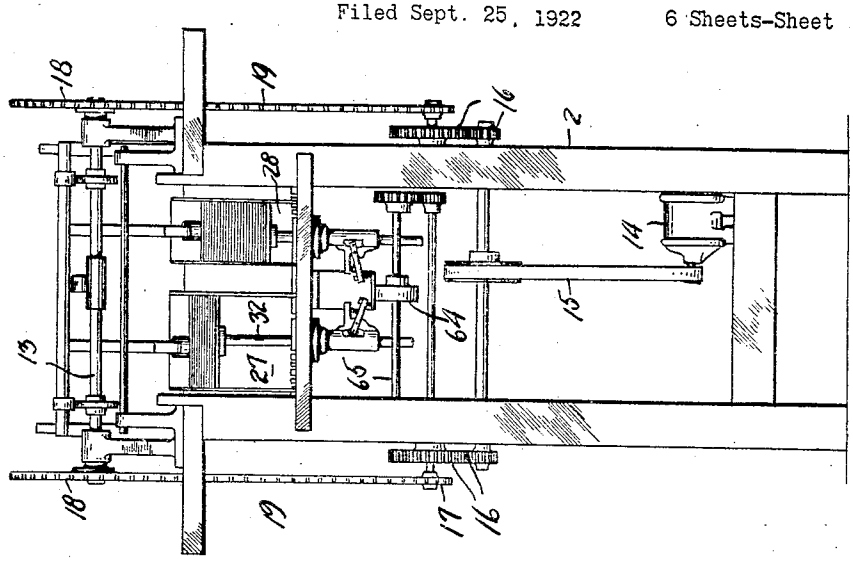


Fig. 2

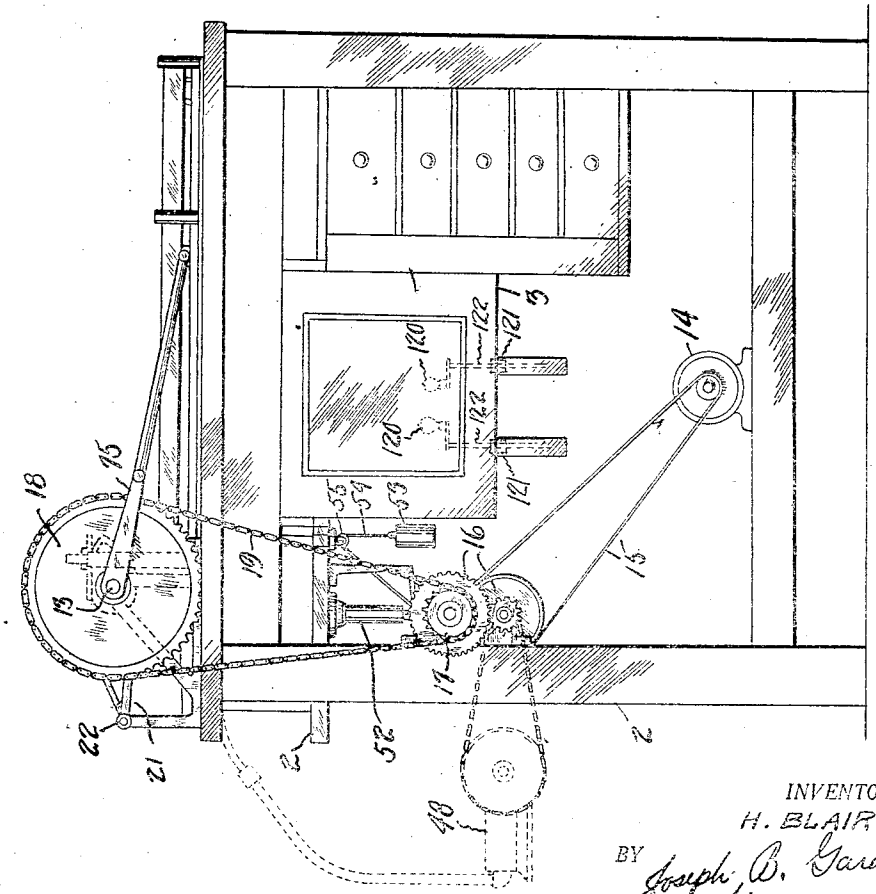


Fig. 1.

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AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 2

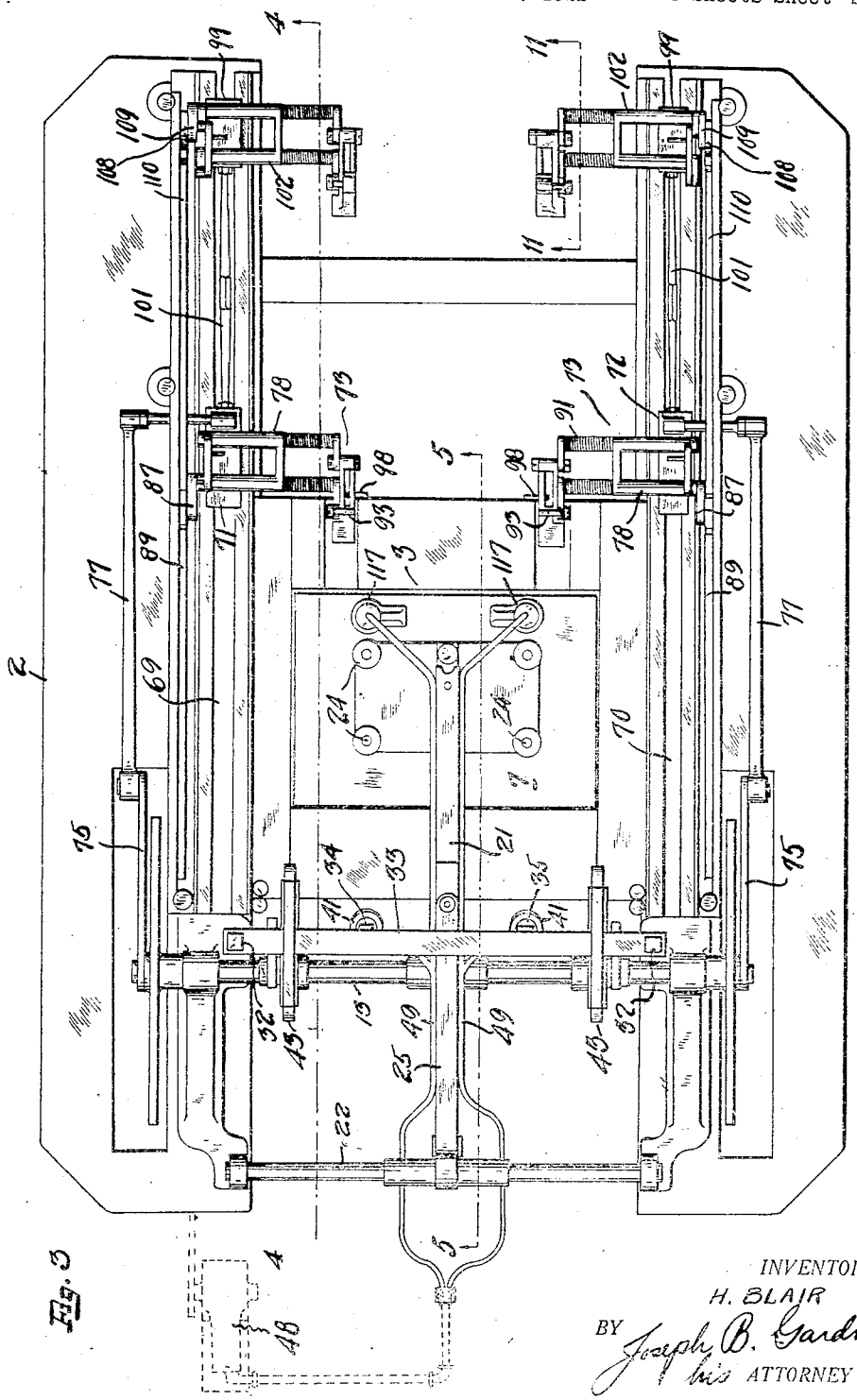


Fig. 3

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1,604,255

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AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 3

Fig. 4

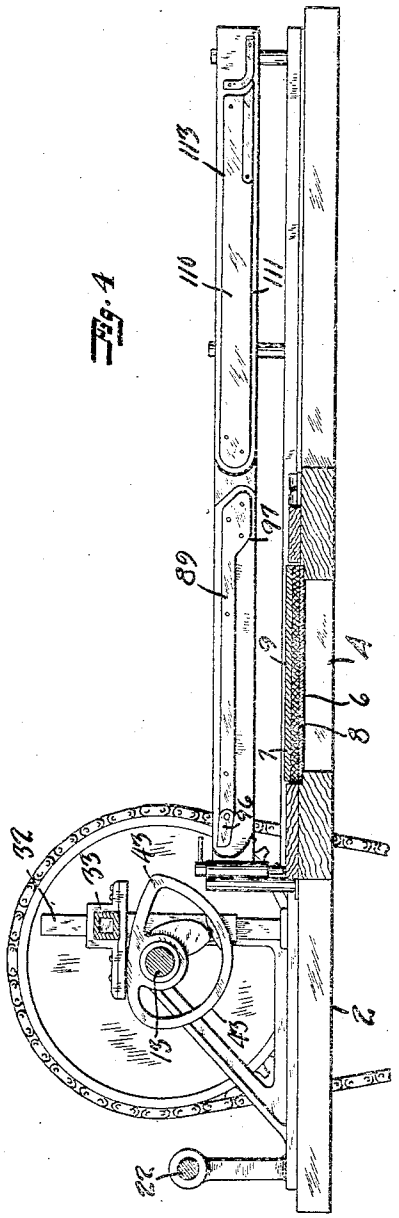
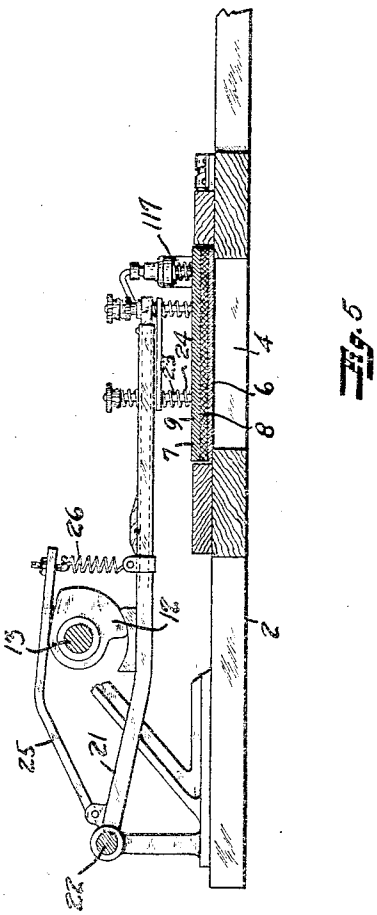


Fig. 5



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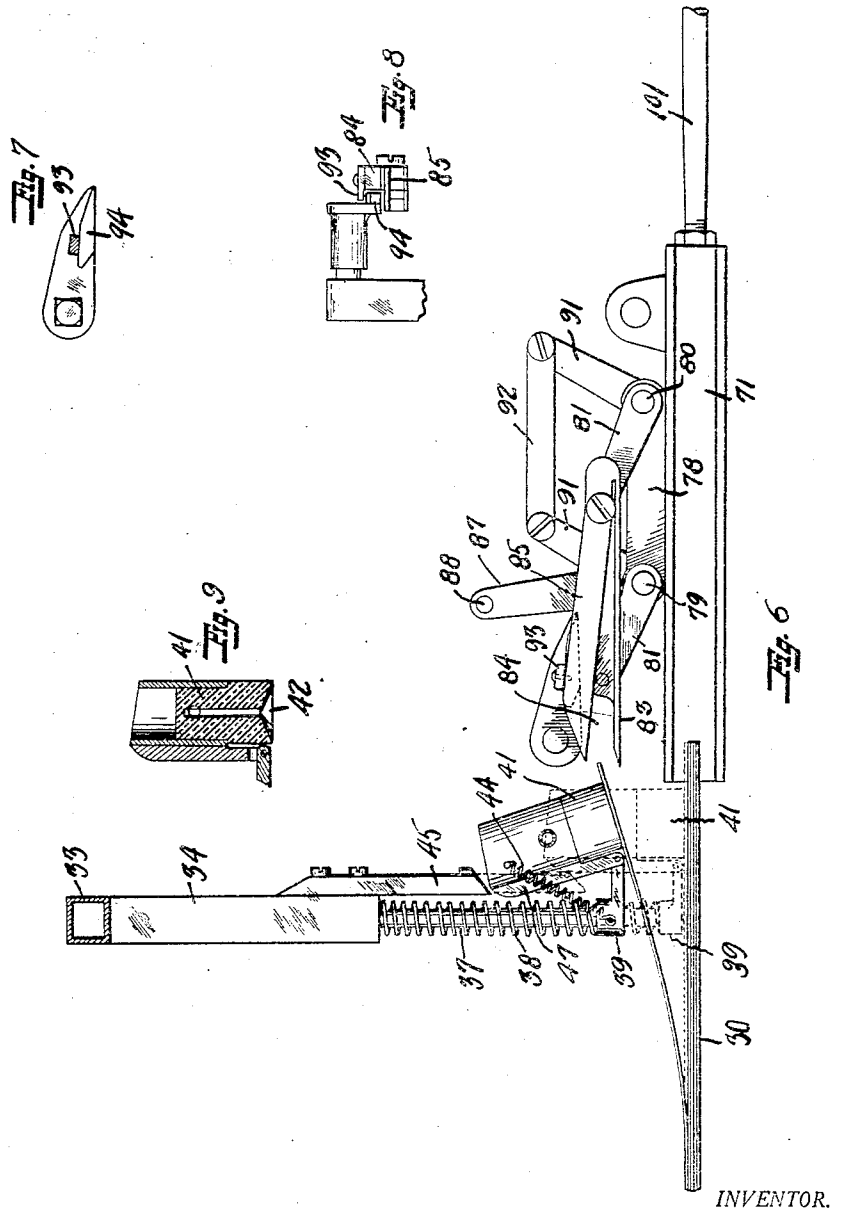
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AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 4



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AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 5

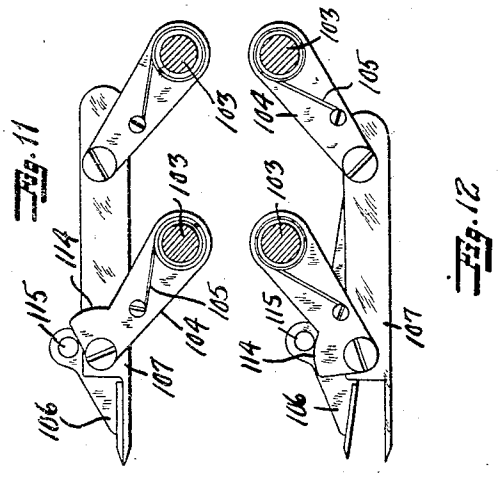


Fig. 11 Fig. 12

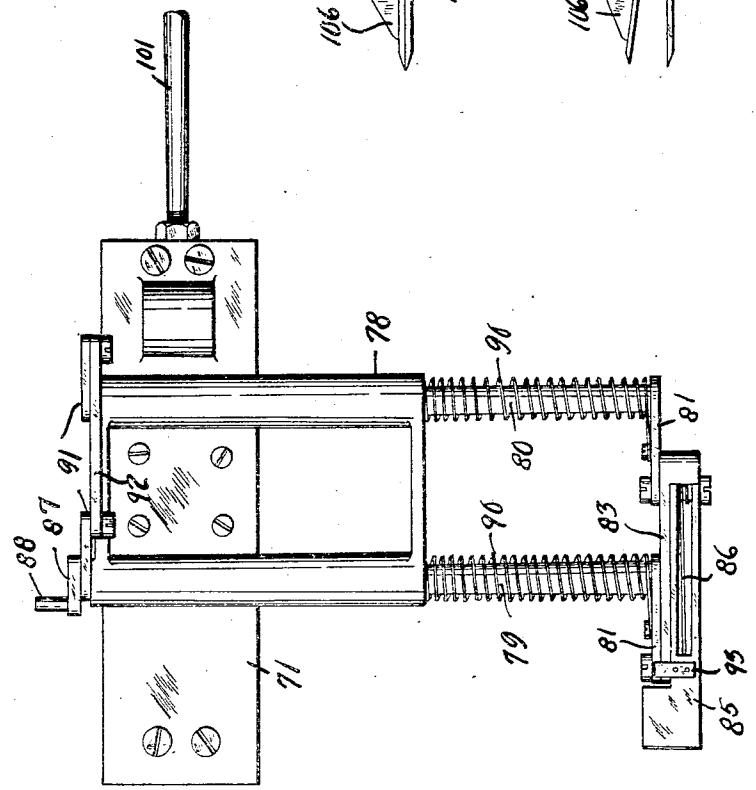


Fig. 10

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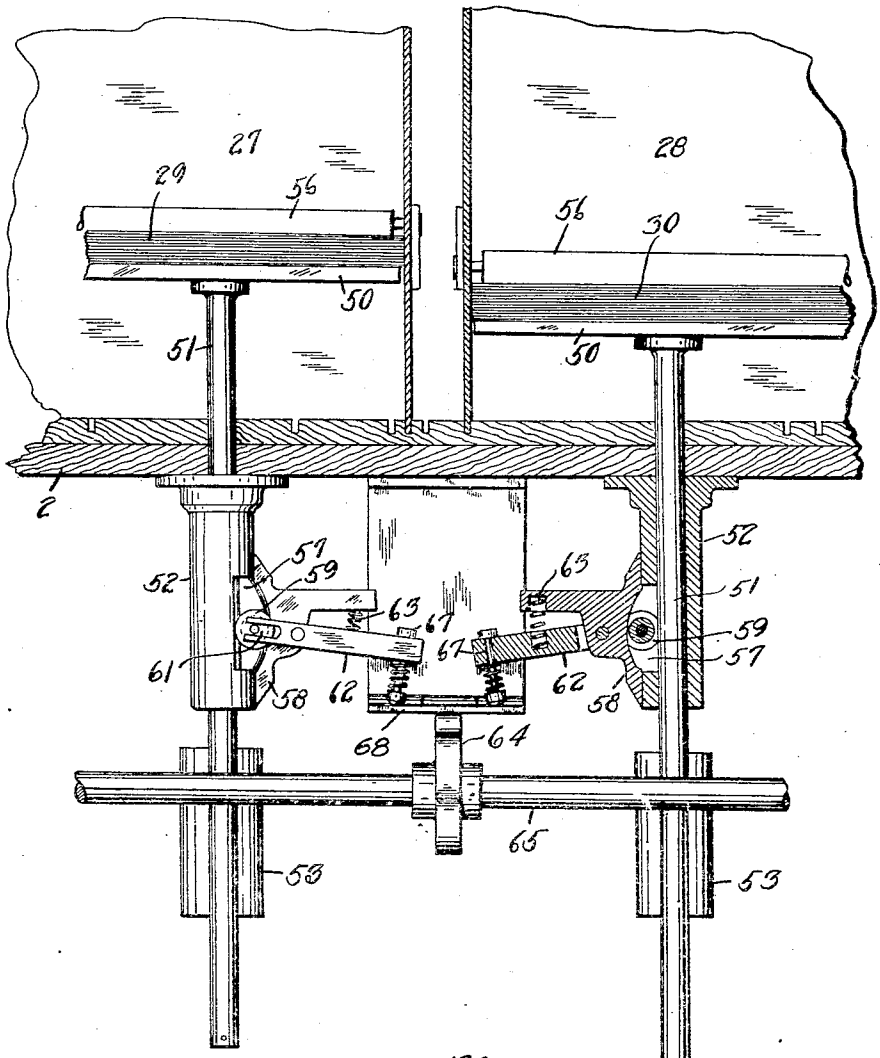
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AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE

Filed Sept. 25, 1922 6 Sheets-Sheet 6

Fig. 13



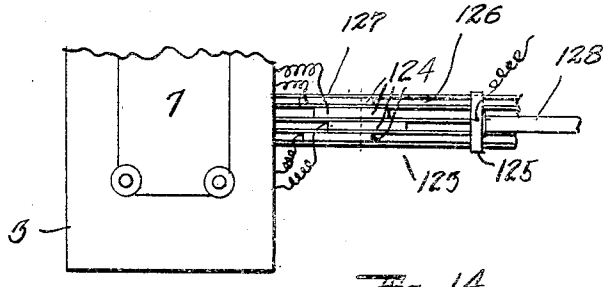


Fig. 14

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Patented Oct. 26, 1926. 1,604,255

UNITED STATES PATENT OFFICE.

HOSEA BLAIR, OF SAN FRANCISCO, CALIFORNIA.

AUTOMATIC PHOTOGRAPHIC-PRINTING MACHINE.

Application filed September 25, 1922. Serial No. 590,413.

My invention relates to a machine for automatically printing a large number of photographs of one or more kinds.

An object of the invention is to provide a machine of the character described which will handle a maximum number of sheets at the same time.

Another object of the invention is to provide an automatic photographic printing machine which will handle sheets of widely different sizes.

A further object of the invention is to provide a device of the character described in which the sheet feeding mechanism will positively cause but one sheet to be removed from each magazine at a time.

A still further object of the invention is to provide a light box for the machine, in which the light may be concentrated or distributed in any manner desired.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of my invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawings and description, as I may adopt variations of the preferred form within the scope of my invention as set forth in the claims.

Referring to said drawings:

Figure 1 is a side view of the machine.

Figure 2 is an end view of the machine looking from the feed end.

Figure 3 is a plan view of the machine.

Figure 4 is a vertical longitudinal sectional view of the upper portion of the machine, taken on the line 4—4 of Figure 3, a portion of the mechanism being omitted to show the hidden parts more clearly.

Figure 5 is a vertical longitudinal sectional view of machine taken on the line 5—5 of Figure 3 showing the pad for covering the opening or negative in the light box, and the means for raising and lowering the pad over the opening.

Figure 6 is a side view of the means for separating the outermost sheet from one of the magazines, and the means for withdrawing said sheet therefrom.

Figure 7 is an elevation of the trip for opening the sheet gripping device as it approaches the magazine.

Figure 8 is an end view of the trip shown in Figure 7, and a part of the gripping device.

Figure 9 is a vertical sectional view of the vacuum cup used for raising a sheet from the magazine.

Figure 10 is a plan view of the gripping device.

Figures 11 and 12 are sectional views of the sheet gripping device used for withdrawing the printed sheets from the negative or opening in the light box.

Figure 13 is a vertical transverse sectional view partly in elevation showing the magazines.

Figure 14 is a plan view, somewhat diagrammatically, showing the means of varying the time of exposure.

Briefly expressed the machine in its present form comprises a frame, a light box in said frame provided with a light opening, a plurality of magazines adjacent one end of said frame each adapted to contain sheets of the same or different size than the other, means employing a vacuum for elevating a portion of the outermost sheet in each magazine, a pad adapted for covering said light opening, means for alternately raising and lowering said pad over the opening, a reciprocating member mounted on the frame, gripping devices attached to said member adapted to withdraw the elevated sheets in the magazines and deposit them over said light opening, second gripping devices attached to said reciprocating member adapted to withdraw the sheets from the light opening while the first devices are carrying other sheets thereto, and means for raising the sheets as a whole in the magazines so that the outermost sheets will invariably be at the same height.

A detailed description follows:

The machine comprises a suitable frame 2 in which is held a light-box 3 provided with an opening 4. The latter is provided with a glass or other transparent base plate 6 on which the photographic negative is suitably positioned or mounted. Arranged to cover the negative or opening is a pad 7 which includes a felt lining 8 and a plate 9 properly held together. The pad is raised from or lowered down upon the negative by means of a cam 12 fixed on a shaft 13 mounted on the frame. The shaft 13 is preferably driven by a motor 14 thru the intervening belt 15, reduction gears 16, sprockets 17 and 18, and chain 19, a set of

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said sprockets and chain being preferably provided at each side of the machine so as to provide a more balanced drive. The pad is supported by an arm 21 which is pivoted to a rod 22 fixed at the feed end of the machine. When the peak of the cam 12 engages the arm, the latter is depressed and the pad will be forced against the negative, a resilient pressure between the cam and negative being afforded by the use of springs 23 which encircle the posts 24 that support the pad from the arm. The upward movement of the pad may be accomplished by allowing the peak of the cam to engage a second arm 25 preferably pivoted to the first at one end and connected at its other end thereto by a spring 26. It will thus be seen that when the shaft rotates the pad will alternately be held spaced from and lowered on the negative so that the sheet or card to be printed may be placed over the negative while the pad is raised, printed when the pad is lowered, and withdrawn when the pad is raised again.

Suitably held in the frame at the feed end of the machine, are a plurality of magazines 27 and 28 which as here shown are two in number and adapted to contain a quantity of the cards or sheets to be printed. In the present embodiment the sheets 29 in one magazine are of different size than the sheets 30 in the other magaine. The sheets in each magazine are preferably positioned horizontally and arranged in laminæ, and means are provided for raising a portion of the uppermost sheet so that the sheets from each magazine may be withdrawn one at a time and placed over the opening in the light-box. Mounted for reciprocation on the vertical guides 32 adjacent each side of the machine is a cross member 33 from which depend plungers 34 and 35 associated with the respective magazines and positioned over the sheets. Each plunger is provided with a rod 37 which is movable vertically with respect to the plunger and is normally retained in extended relation by a spring 38. Pivotally attached to an arm 39 which is fixed to the rod is, what may be conveniently termed, a vacuum cup 41 formed of rubber or the like, whose orifice 42 faces the sheets in the magazine. By referring particularly to Figure 6, it will be noted that the cup is pivoted to the arm practically at the lower extremity of the cup, or in other words, substantially at the side of the orifice. The cross piece, and consequently the plungers are reciprocated by means of cams 43 fixed on the shaft 13. When the plunger is in the elevated position, as indicated by the solid lines in Figure 6, the cup is caused by means of a spring 44 to assume an oblique position, but when the plunger is completely lowered a finger 45 fixed thereto engages the pivot lug 47 of the cup and causes the cup to assume the vertical position indicated in Figure 6 by the broken lines. Assuming that the plunger is at its lower position, the orifice of the cup will be fully engaged with the upper surface of the uppermost sheet in the magazine. At this time a vacuum pump 48 or other suitable means is adapted to create a partial vacuum in the cup and thereby cause said sheet to adhere to the cup. The pump is connected to each cup by flexible tubes 49 and is preferably driven from the gears 16 so that it may readily be timed to produce or release the vacuum in the cup. Upon the plunger now is slightly raising the finger 45 will become disengaged from the cup and the latter will swing to its oblique position, the rod 37, and consequently the pivotal point of the cup being still retained in their lower positions. With the arm 39 thus held solidly against the sheets, the uppermost sheet will have become flexed due to the adherence thereof to the now tilted cup. Owing to the flexure of the top sheet, any tendency of the adjacent sheets to flex and rise with the top sheet, will produce a slight relative motion of the lower sheets with respect to the top sheet, thereby breaking the vacuum which may exist between the sheets. In this manner when the plunger ascends to its uppermost position but one sheet will cling to the cup. With the top sheet thus practically separated from the others, the pump is timed so that the vacuum in the cup may be released just as soon as the sheet is properly engaged such as by means for withdrawing it from the magazine.

Means are provided for maintaining the top sheet of each magazine at predetermined height regardless of the number of sheets contained in the magazine, and furthermore at the same time supporting said sheets absolutely rigidly when the plunger and cup is pressed against them. Supporting the sheets in each of the magazines is a plate 50 from which depends a rod 51 slidably fitting in a bearing 52. The rod is urged upward by means of a weight 53 which is secured to a cable 54 that passes over a pulley 55 and is suitably connected to the rod. Upward movement of the sheets as a whole is limited by an adjustably mounted roller 56. Formed in the bearing is an opening 57 which exposes a portion of the supporting rod to the segmental surface of a bridge member 58. Engaging in said opening between the segment and surface of the rod is a roller 59 which is adapted to be moved upwardly or downwardly so as to wedge between the surfaces or lie loosely therebetween, thereby respectively locking the rod against movement or allowing it to move in the direction urged by the weight 53. The roller is mounted in

a slot 61 formed in one end of a lever 62, and the roller is normally retained in wedged position by means of a spring 63 pressing against the other end of the lever. When a sheet has been withdrawn from a magazine a cam 64 fixed on the shaft 65 will momentarily raise the last mentioned end of the lever sufficient to place the roller in released position. The cam preferably exerts its force against each lever of the magazine thru the spring pressed posts 67 which press against the hinged plate 68 that rides on the cam.

Means are provided for withdrawing the uppermost sheet from each magazine after the sheet has been elevated, and depositing it over the negative while the pad is raised. Slidably mounted in slots 69 and 70 at the opposite sides of the machine frame are blocks 71 and 72 on each of which is mounted a sheet gripping device 73 for clutching the sheets and moving them as required. The blocks are reciprocated by means of the crank 75 which is fixed to the shaft 13 and is connected to the blocks by the rod 77. To each block there is fixed a double bearing 78 in which is rotatably mounted a pair of parallel spindles 79 and 80, having crank arms 81 provided at their inner ends. Pivoted to both arms 81 is the lower jaw 83 of the sheet gripper 84, and pivoted to the rear arm 81 is the upper jaw 85 of the gripper. The jaws are normally held closed by means of a spring 86. Means are associated with the grippers for causing them to pass over the pad when moving toward the magazine, and causing them to pass under the pad when returning from the magazine with the sheet to be printed. Fixed to the outer end of the spindle 79 is a crank arm 87 which is provided at its free end with a pin 88. The pin is arranged to engage in a guide 89 fixed to the frame and positioned outwardly and above each of the slots 69 and 70. Encircling the spindles are springs 90 which serve to hold the pin 88 pressed against the upper and lower riding surfaces of the guide 89 while the grippers are reciprocating to and from the magazines. In order that the gripping devices may operate smoothly and the various crank arms readily maintain their proper relations, parallel cranks 91, are fixed to the spindles at their outer end and connected by a link 92. The operation of the gripping devices is as follows: Assuming that the grippers are moving toward the magazine the pin 88 will engage on the upper riding surface of the guide. As the jaws near the magazine, a projection 93 on the upper jaw encounters a fixed trip 94 which causes the upper jaw to rise and thus as the jaws reach for the elevated sheet in the magazine they are fully open and the sheet is enabled to enter between them. When the sheet is actually positioned in the jaws, the vacuum in the cup is allowed to break, and immediately thereafter the projection 93 leaves the trip 94 and jaws close tightly on the sheet. At this time the gripper is ready to withdraw from the magazine and the pin 88 slips by the spring pressed track-piece 96 of the guide and rides back under the lower riding surface of the guide. The gripper with the sheet firmly clutched therein thus moves toward the negative, over which the pad is now arranged to be elevated. As the sheet is drawn over the negative the pin 88 meets the downwardly extending portion 97 of the guide and the sheet is lowered into the light opening. With the sheet then positioned over the negative, the projection 93 encounters another trip 98 and the sheet is released. After releasing the sheet the pin 88 moves up again on the top riding surface of the guide and the grippers are again on their way toward the magazine. With the grippers thus travelling toward the magazine, the pad is lowered over the sheet and negative, and the printing is effected.

Means are also provided for withdrawing the sheet from the negative after the former has been printed. In the present form of the invention a second set of gripping devices are used for this purpose, which are somewhat similar to the first grippers and are movable therewith. The second set of grippers are mounted on blocks 99 which engage in the slots 69 and 70 and are secured to the blocks 71 and 72 by means of the adjustable rods 101. A double bearing 102 with spindles 103, cranks 104, springs 105, upper and lower jaws 106 and 107, are also provided on the blocks. A pin 108 and crank 109 similar to the pin 88 and crank 87 are arranged at the outer end of the spindles, the pin being adapted to engage on the riding surfaces of a guide 110. When the second gripper is moving toward the printed sheet, it rides against the lower face 112 of the guide, and when withdrawing from the negative it rides on the upper face 113 of the guide. The crank 104 is provided with a cam portion 114 which when the grippers are advancing toward the printed sheet, engages a pin 115 on the upper jaw and causes the jaws to be held in open position, whereas when the gripper is moving away from the negative the cranks 104 are shifted from the position shown in Figure 12 to that shown in Figure 11, or in other words the pin 115 becomes released and the jaws close. In the operation of the second grippers, assuming that they are approaching the printed sheet, the jaws will be open. As they near the sheet, the pad is elevated and a set of vacuum cups 117 simultaneously raise the sheet or sheets from the negative in position to enter between the second gripper jaws. The cups 117 are

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adapted to be operated by the same pump or mechanism which control the cups associated with the magazine. In this manner when the printed sheet is actually between the jaws the vacuum is broken and the grippers begin their withdrawal movement, at which time the jaws will close and the printed sheet will be withdrawn from the negative. When the gripper reaches the extreme rearward position the pin 115 moves around the guide preparatory to returning to the negative for another printed sheet. The jaws are thus opened again and the sheet is released. The printed sheet may then be removed from the machine in any manner desired.

The light box as used in connection with the machine possesses many advantageous features. As here shown a plurality of lights 120 are mounted on transversely movable blocks 121. The lights are supported on crank-like tubular members 122 which may be rotated and adjusted toward and from the opening. In this manner practically any distribution or concentration of the light may be had.

Any suitable switching means for operating the lights to effect a properly timed exposure of a sheet may be utilized. As particularly shown in Figure 14, proper timing of the lights is adapted to be secured by means of a switch 123 which is so arranged that both the time and duration of lighting of each lamp may be individually effected. As here shown, the switch 123 comprises adjustably positioned insulated contacts 124 each of which is connected in the circuit of a different light, and a common contact member 125 also included in the light circuits and which is arranged to be moved to establish electrical contact with one or more of the contacts 124 and thereby close the circuits therethrough. The contacts 124, it will be noted, are here shown slidably and frictionally engaged in parallel guideways 126 provided in a block 127 formed of insulating material so that they may be held positioned where desired. Movement of the member 125 in proper synchronism with the operative cycle of the sheet handling mechanism is preferably effected by attaching it by means of a connecting rod 128 to any reciprocating portion of the device such as the blocks carrying the sheet gripping mechanism. It will now be noted that by positioning the contacts 124 in their guideways in proper relation to the range of travel of the movable member 125, that the desired length of exposure of the sheets may be exactly obtained.

I claim:

1. In a photographic printing machine, a light box having an opening, a pad arranged to cover said opening, means for alternately placing the pad on the opening and withdrawing it therefrom, means for moving a sheet to engage said opening and having a sheet gripping device arranged to successively pass over and under said pad.

2. In a photographic printing machine, a light box having an opening, a pad adapted to cover said opening, means for alternately placing the pad on said opening and withdrawing it therefrom, and means for moving a sheet to engage said opening including a sheet gripping device arranged to pass between said opening and the pad when the latter is withdrawn from the opening and arranged to pass over both the opening and pad when the latter is engaged over the opening.

3. In an automatic photographic printing machine, a light box having an opening, a pad adapted to be held engaged in said opening or disengaged therefrom, and a sheet gripping device arranged to pass on the inner side of the pad when the latter is disengaged from the opening and arranged to pass on the outer side of the pad when the latter is engaged with the opening.

4. In an automatic photographic printing machine, a light box provided with an opening, means for fixing a negative over said opening, a magazine adapted to hold a plurality of sheets, means including a sheet gripping device for withdrawing a sheet from said magazine and placing it over said negative, and means including a sheet gripping device adapted to move a sheet from said opening while said first means is moving a sheet toward said opening.

5. In a photographic printing machine, a frame, a light box supported thereon and having a light opening, a plurality of magazines each adapted to contain sheets of the same size or of different size than the other, and independent sheet gripping devices associated with the respective magazines adapted to withdraw the sheets from said magazines and deposit them over said light opening.

6. In an automatic photographic printing machine, a frame, a light box mounted in said frame and having an opening, a magazine adjacent one end of said frame adapted to contain a plurality of cards to be printed, means for raising a portion of the outermost sheet in the magazine, a reciprocating member mounted on said frame, a pad adapted for covering said opening, means for alternately raising and lowering said pad whereby it may respectively lie spaced from and engaged over said opening, means for moving the sheets from the magazine to said light opening and including a gripping device adapted to clutch said raised sheet and deposit it over the opening after moving it thereto, means for raising said sheet over the opening, and means for removing said sheet from said opening including a

gripping member adapted to clutch said raised sheet and deposit it after withdrawing it from the opening.

7. In an automatic photographic printing machine, a frame, a light box in said frame having a light opening, a magazine adjacent one end of said frame adapted to contain a plurality of cards to be printed, means employing a vacuum for raising a portion of the outermost sheet in the magazine, a reciprocating member mounted on said frame, a pad adapted for covering said light opening, means for alternately raising and lowering said pad whereby it may respectively lie spaced from and engaged over said opening, means for moving the sheets from the magazine to said light opening, including a gripping device adapted to clutch said raised sheet and deposit it over said opening after moving it thereto, means employing a vacuum for raising the sheet engaging the opening, and means for removing the sheet from the opening including a gripping member adapted to clutch said raised sheet and deposit it after withdrawing it from the opening.

8. In an automatic photographic printing machine, a frame, a light box in said frame having a light opening, a magazine adjacent one end of said frame adapted to contain a plurality of cards to be printed, means for elevating the outermost sheet in the magazine, a pad for covering said light opening, means for alternately raising and lowering said pad, means including a gripping device for withdrawing said raised sheet and depositing it over said opening, said gripping device being adapted to pass under said pad in effecting said operation and over said pad when returning for another sheet, a second gripping device movable with the first and adapted to withdraw the sheet from the opening while said first device is carrying another sheet thereto.

9. An automatic photographic printing machine comprising a frame, a light box in said frame having an opening, a magazine adjacent one end of said frame adapted to contain a plurality of cards to be printed, means employing a vacuum for raising a portion of the outermost sheet in the magazine, a reciprocating member mounted on said frame, a pad adapted for covering said opening, means for alternately raising and lowering said pad whereby it may respectfully lie spaced from and engaged over said opening, means including a gripping device for withdrawing said raised sheet and depositing it over said opening, said gripping device being adapted to pass under said pad in effecting said operation and over said pad when returning for another sheet, means employing a vacuum for raising the sheet engaging said opening, and a second gripping device movable with the first and adapted to withdraw the sheet from over the opening while said first device is carrying another sheet thereto.

10. An automatic photographic printing machine comprising a frame, a light box in said frame provided with a light opening, a plurality of magazines adjacent one end of said frame each adapted to contain sheets of the same or different size than the other, means employing a vacuum for elevating a portion of the outermost sheet in each magazine, a pad adapted for covering said light opening, means for alternately raising and lowering said pad over the opening, a reciprocating member mounted on the frame, gripping devices attached to said member adapted to withdraw the elevated sheets in the magazines and deposit them over said light opening, second gripping devices attached to said reciprocating member adapted to withdraw the sheets from the light opening while the first devices are carrying other sheets thereto, and means for raising the sheets as a whole in the magazines so that the outermost sheets will invariably be at the same height.

11. In a photographic printing machine, a frame, a light box supported thereon and provided with an opening, a plurality of magazines adapted to contain sensitized sheets, independent sheet gripping devices associated with the respective magazines arranged to withdraw the sheets from said magazines and deposit them over said opening, and means for raising a sheet in a magazine so that it may be gripped by the gripping device associated with its magazine.

12. In a photographic printing machine, a frame, a light box supported on said frame and provided with an opening, a magazine adapted to contain sensitized sheets, a sheet conveying device mounted in said frame and arranged to move a sheet from said magazine to position it over said opening, and a second sheet gripping device mounted in said frame and arranged to convey said sheet away from said opening.

13. In a photographic printing machine, a frame, a light box provided with an opening, a magazine adapted to contain sensitized sheets, a sheet conveying device arranged to move a sheet from said magazine to position it over said opening, a second sheet conveying device arranged to convey said sheet away from said opening, and means for raising a portion of the outermost sheet in said magazine so that it may be gripped by said first sheet conveying device.

14. A photographic printing machine comprising a light box provided with an opening, a magazine adapted to contain sensitized sheets, a sheet conveying device arranged to move the outermost sheet from said magazine to position it over said opening, a sec-

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ond sheet conveying device arranged to move said sheet away from said opening, and means operating on said sheet to position a portion thereof so that it may be gripped by said sheet conveying devices previous to movement thereby.

15. A photographic printing machine comprising a light box provided with an opening, a magazine adapted to contain sensitized sheets, a sheet conveying device arranged to move successive sheets from said magazine to a position over said opening, a second sheet conveying device arranged to successively move said sheets from said opening, and means employing a vacuum for successively arranging said sheets to be gripped by said devices.

In testimony whereof, I have hereunto set my hand at Logansport, this 22 day of Sept., 1922.

HOSEA BLAIR.