March 1, 1966 D. S. DOUGAN ETAL 3,237,514

MACHINE FOR PHOTOGRAPHICALLY REPRODUCING DATA

Filed Feb. 12, 1963 5 Sheets-Sheet 1

FIG. 1

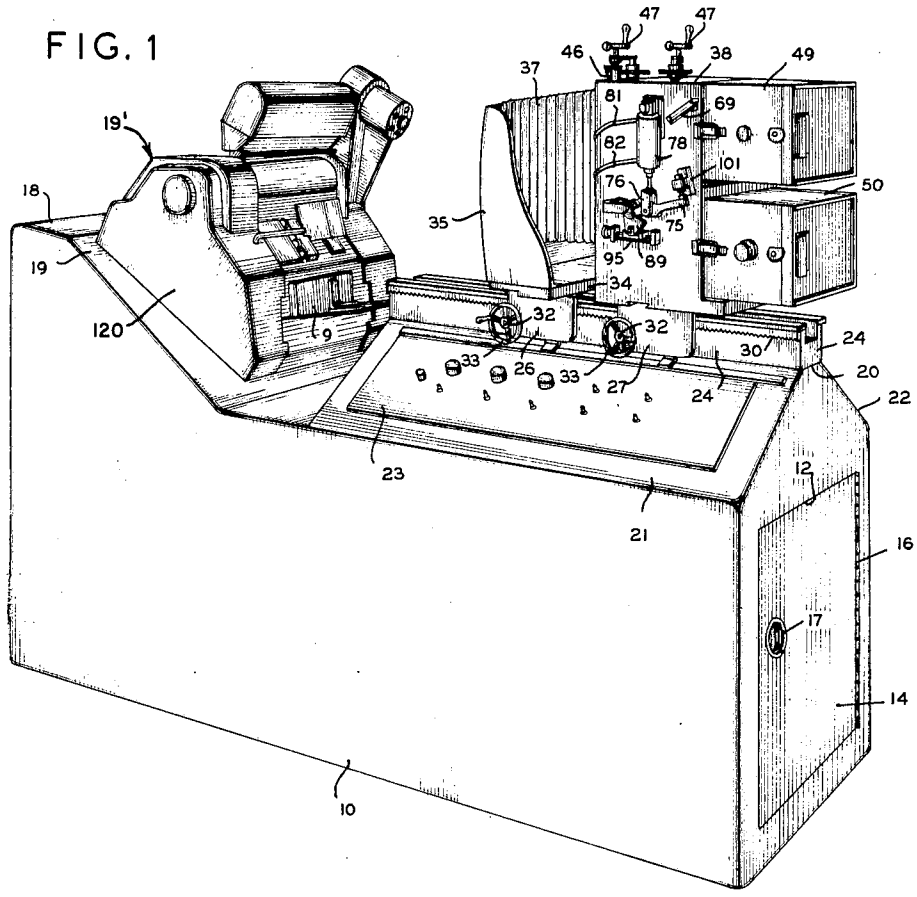
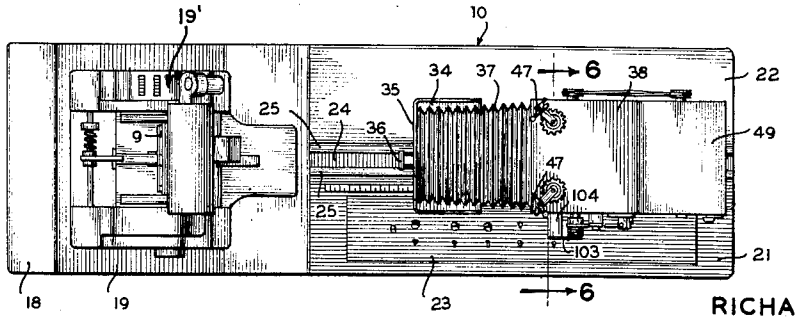


FIG. 2



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Filed Feb. 12, 1963

5 Sheets-Sheet 2

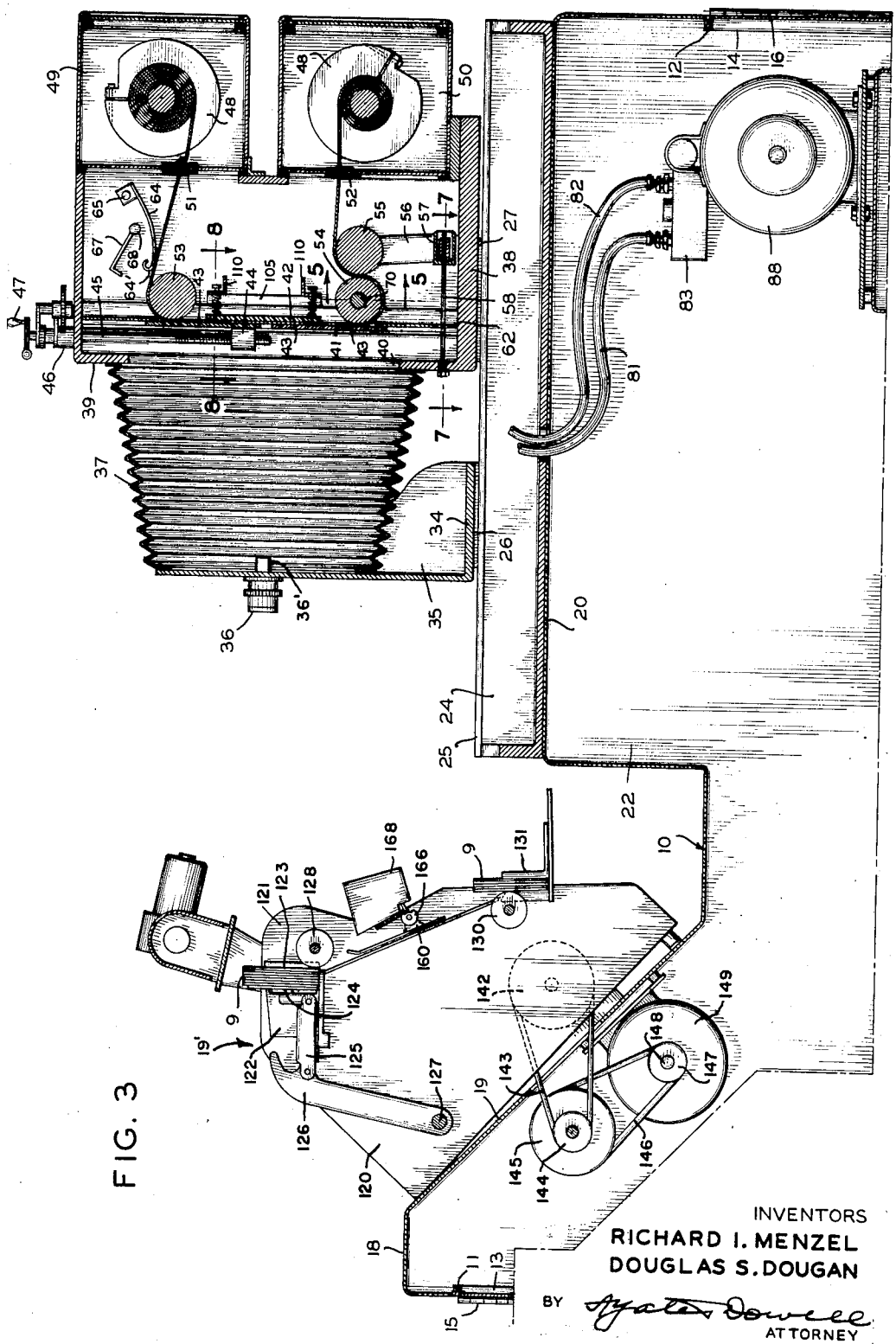


FIG. 3

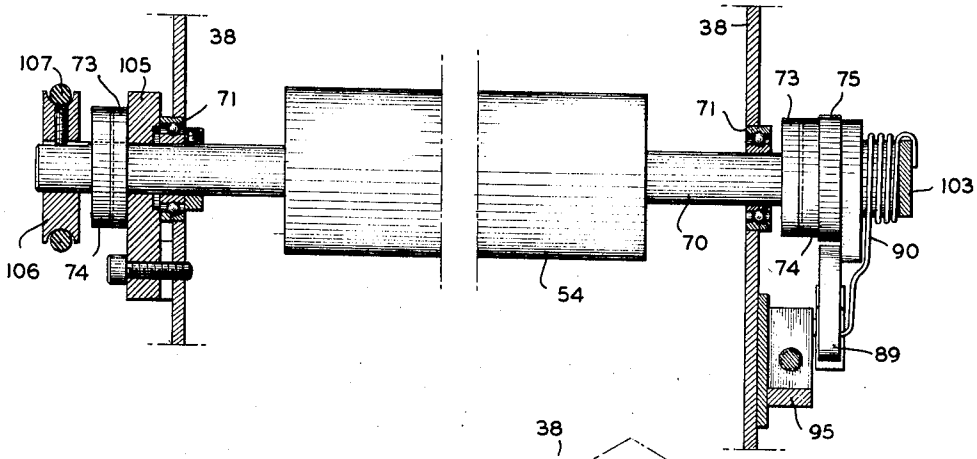
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MACHINE FOR PHOTOGRAPHICALLY REPRODUCING DATA

Filed Feb. 12, 1963 5 Sheets-Sheet 5

FIG. 5



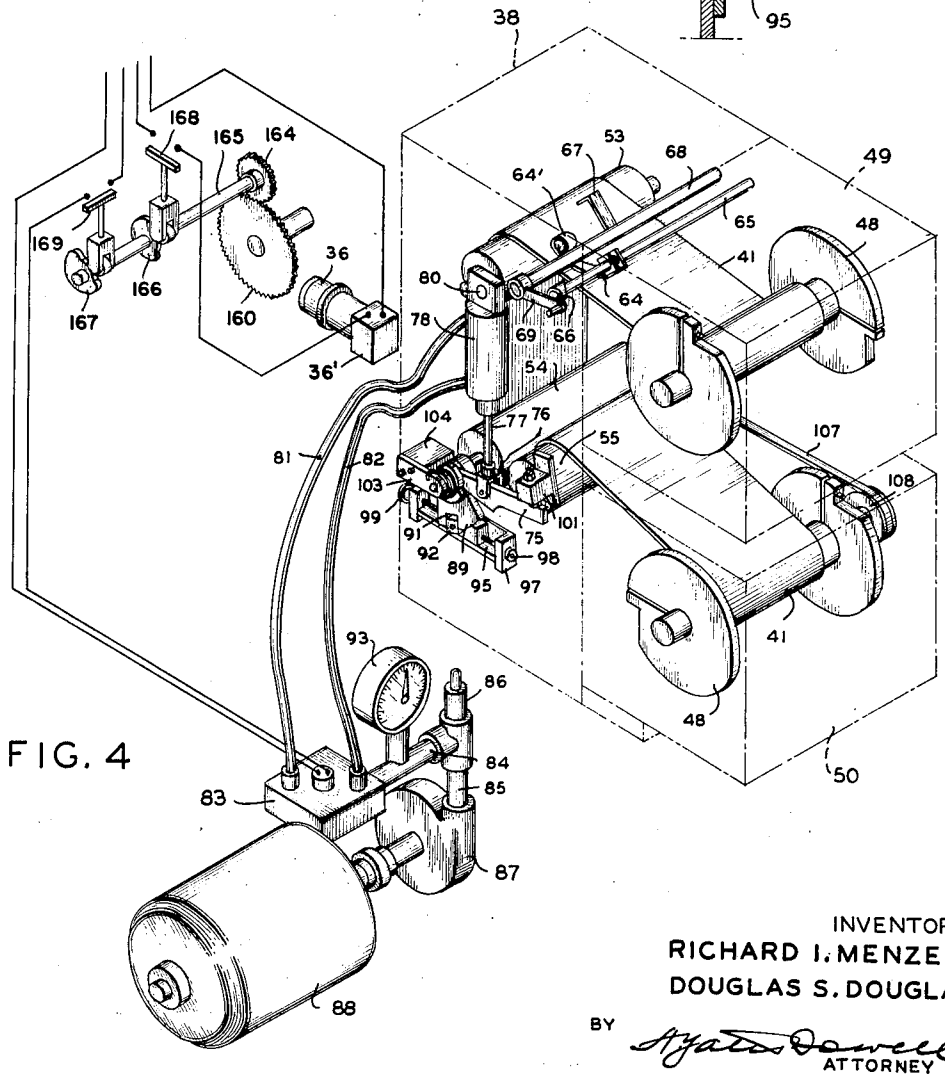


FIG. 4

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MACHINE FOR PHOTOGRAPHICALLY REPRODUCING DATA

Filed Feb. 12, 1963 5 Sheets-Sheet 4

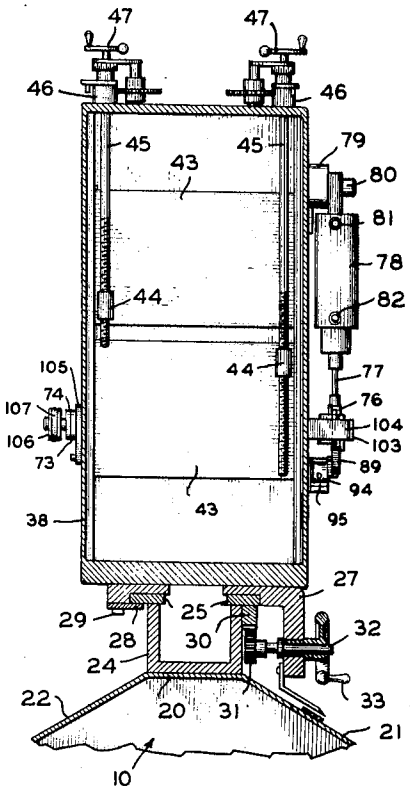


FIG. 6

FIG. 7

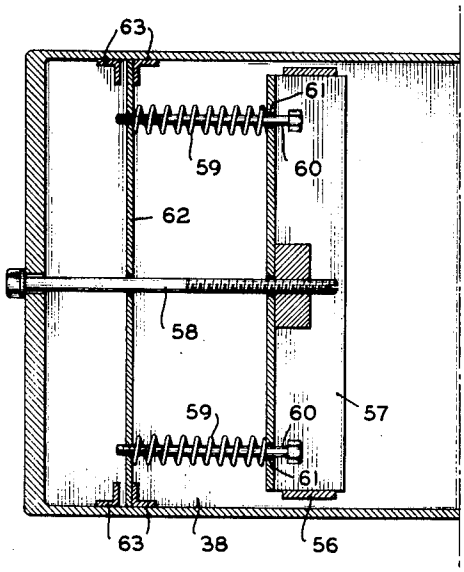
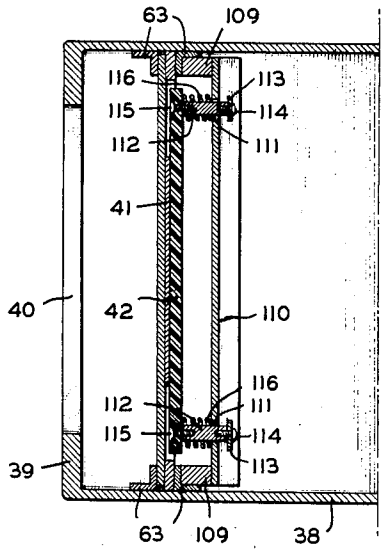


FIG. 8



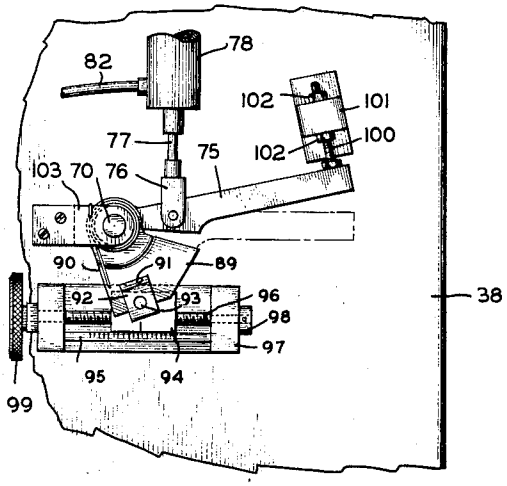


FIG. 9

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MACHINE FOR PHOTOGRAPHICALLY REPRODUCING DATA

Filed Feb. 12, 1963 5 Sheets-Sheet 5

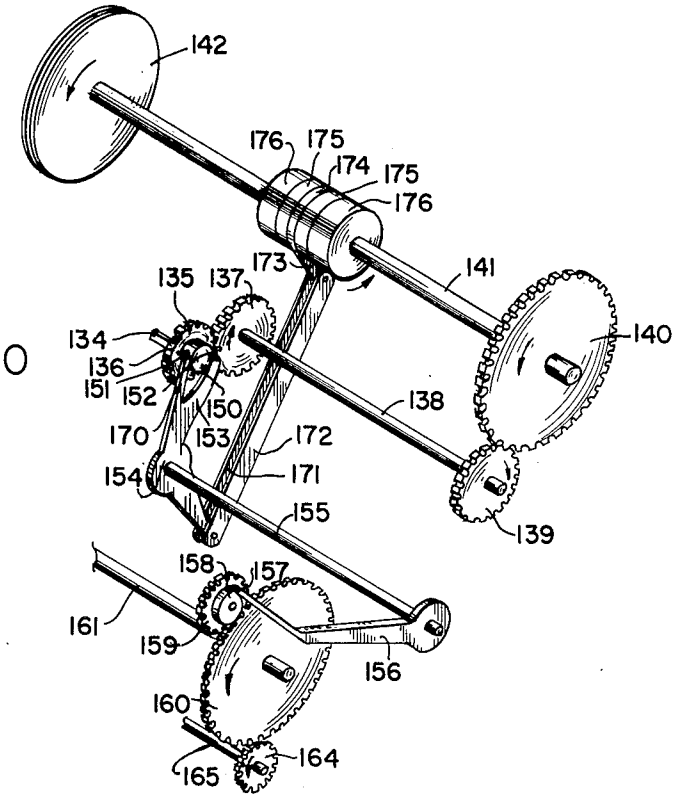


FIG. 10

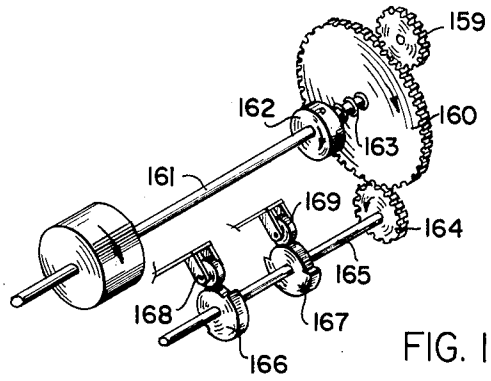


FIG. 11

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United States Patent Office 3,237,514 Patented Mar. 1, 1966

3,237,514

MACHINE FOR PHOTOGRAPHICALLY REPRODUCING DATA

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Filed Feb. 12, 1963, Ser. No. 258,005
10 Claims. (Cl. 88—24)

This invention relates to the reproduction of data from one source onto a photographic medium on which it can be retained until it is desired to use the same and then it can be transferred onto a printing plate for use in imparting such data for making multiple impressions or reproductions.

The invention also relates to the preparatory steps in the printing process including the transfer of data from one source such as from a series of cards onto a photographic film or negative in timed relation with the actuation of the shutter of a camera and the intermittent synchronous movement of the film.

Data has been reproduced on photographic film for storage and for offset printing; however, the results have not been entirely satisfactory for various reasons including quality, camera speed and operation, inflexibility of size of the image reproduced, limit on production, sticking or jamming of the cards resulting in chronological displacement, inferiority of the finished negatives due to inadequate lighting or the like, limitations on the area photographed, and excessive cost and bulk.

Certain of the prior machines have been of equal or greater speed at a sacrifice of other desired qualities such as the ability to reproduce only a small portion of the data contained on the surface of an especially prepared sheet or carrier, and consequently these machines were not suitable for the purpose desired due to such limitations in use and application.

An object of the invention is to provide a relatively simple compact machine by which data on sheets, cards or other surfaces can be reproduced on a photographic film sequentially, rapidly and with the photographic equipment adjustable to vary the number of lines photographed at each operation of the shutter of the camera and in which a conventional counter is modified and supported in an unusual position and employed to feed the cards during the photographing of the same.

Another object of the invention is to provide a device for reproducing data from a series of cards or sheets onto a film and in which device the several parts are controlled by an electronic system and actuated electronically and pneumatically, with the cards supported more positively by a post at each side instead of in the usual manner by contact merely with the bottom and side edges thereof.

A further object of the invention is to provide a relatively simple practical machine by which data on individual cards, sheets or the other surfaces can be reproduced on a photographic film for offset printing, with such a machine having means for feeding the cards or sheets, a copy board to maintain the cards or sheets in a fixed position relative to the adjusted position of the camera and illuminated to avoid shadows when they are photographed, and providing the desired adjustment as to size of the image reproduced on the film as well as the triggering or actuating the movement of the film and the shutter of the camera and the counting of the cards or sheets and keeping the same in chronological order coordinated in a manner to provide a simple fast operation and a superior finished photographic film.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing wherein:

FIG. 1 is a perspective illustrating one application of the invention;

FIG. 2, a top plan view;

FIG. 3, an enlarged longitudinal section;

FIG. 4, a schematic layout of the film feed and camera actuating mechanism;

FIG. 5, an enlarged section on the line 5—5 of FIG. 3;

FIG. 6, a section on the line 6—6 of FIG. 2;

FIG. 7, a section on the line 7—7 of FIG. 3;

FIG. 8, a section on the line 8—8 of FIG. 3;

FIG. 9, an enlarged detail of the film feed mechanism;

FIG. 10, a schematic diagram of the card tripping mechanism; and

FIG. 11, a schematic diagram of shutter and film feed trigger mechanism.

Briefly stated the present invention is a machine for reproducing data on a photographic film for use in offset printing. The data is first placed upon a series of cards, sheets or other surfaces in a stack and moved one at a time to a predetermined location and position to be photographed. The machine is composed of a base with card handling equipment on one end, camera equipment mounted for movement toward and from the cards along the major portion of the remainder of the cabinet, and with conveniently located control panel. The card handling mechanism is basically a conventional counting machine with its base set at an unusual angle of substantially 30° to the horizonal coordination with the photographic mechanism to dispose the cards in a position to facilitate the presentation of the same for photographing and handling. The counting machine is adapted to present the cards one by one to a predetermined position and each card illuminated so that it can be photographed without shadows, and with the heat dissipated. The card handling part of the machine also is used to actuate the photographic mechanism. A camera is mounted for longitudinal movement on the base at an elevation substantially corresponding to that of the card handling mechanism and includes lens and film handling mechanism connected by a bellows and independently adjustable. Masks are provided which are adjustable to enlarge or reduce the vertical spacing and total amount of the image exposed. The shutter is electronically activated and is controlled by a microswitch on the card handling mechanism. The film handling portion of the camera is activated by fluid under pressure as for example by compressed air in a cylinder supplied by a motor driven pump, the piston of such cylinder oscillating a clutch employed to drive a roller shaft which moves the film, such operation having been found more accurate and satisfactory than the use of the equipment such as a solenoid. The machine is a compact unitary structure composed of a base on and within which the necessary parts are supported.

With continued reference to the drawings, the present invention is a machine by which data may be photographically reproduced for storage and for use in offset printing or in any other desired manner.

The machine comprises a housing forming a base **10** having an opening **11** in one end and an opening **12** in its other end with doors **13** and **14** mounted on hinges **15** and **16**, and with fastening means **17** by which the doors may be opened, closed, or maintained in closed position.

The housing or base **10** is of a size to enclose certain portions of the mechanism and to support upon the same other portions of the mechanism. The housing or base is provided with an elevated ledge **18** at one end with an adjoining downwardly inclined surface **19** disposed at an angle of substantially 30° to the horizontal on which is mounted a card handling mechanism **19'** for presenting the data carrying cards **9** to be photographed and with the remaining portion of the housing **10** adapted to support a camera.

The housing is provided centrally and longitudinally

with a ledge 20 at an elevation somewhat lower than the ledge 18 and of a length substantially ⅔ of the length of the housing, the housing having sides 21 and 22 tapered downwardly one from each side of the ledge 20 for attractiveness and symmetry of design and with one side adapted to accommodate a control panel 23.

A camera bed 24 is mounted along the ledge 20 such bed being in the form of a U-shaped channel member having its free edges supporting a pair of rails 25 on which are slidably supported lens and camera mounts 26 and 27 respectively. These mounts are retained on the rails 25 by means of a retaining plate 28 held by fasteners 29 on one side and by a rack 30 on the other side, such rack being engaged by a pinion 31 fixed to a shaft 32 having a handwheel 33 for rotating the same to change the adjustment or the distance between the lens and film carrying mechanism.

The lens mount 26 comprises a transverse plate 34 and an upstanding bracket 35 which in turn supports the lens 36 on electronically operated shutter 36' and a light excluding bellows 37 attached to a film housing 38. Such film housing 38 is provided with a front 39 having an opening 40 so that the image may reach a film 41 carried between a spring mounted pressure plate 42 and an adjustable two part mask 43 having upper and lower plates. Each of said plates is provided with a boss 44 which is threadedly engaged by a bolt 45 extending through a bearing 46 on the top of the film housing 38 and operable by means of a handle 47 attached to its upper end for vertically adjusting the plates relative to each other. By rotating the handles 47 the upper and lower sections of the mask may be raised and lowered independently to vary the distance therebetween.

The film 41 is mounted on rollers 48 and is adapted to be unwound from one and wound upon another, such rollers being mounted in independent light excluding boxes 49 and 50. The film passes through a light excluding member 51 in the wall of the box 49 and through a similar member 52 in the wall of the box 50. The film passes over an upper idler roller 53 and then over a lower feed roller 54 in contact with a lower idler roller 55 by which the desired tension is maintained on the film.

The lower idler roller 55 is carried by a pair of upright arms 56 the lower ends of which are connected to a transverse channel 57 mounted in housing 38 in a manner to be slidable lengthwise of the camera. The channel member 57 is movable relative to the camera by a bolt 58 against the tension of spaced springs 59 on bolts 60 extending through openings 61 in the channel member and are threaded into a plate or light shield 62 located between brackets 63 at opposite sides of the housing 38 for varying the tension on the film.

A film indicator finger 64 is supported by the film 41 in the upper portion of the film housing 38 and such finger is provided with a curled portion 64' at one end. The end of the finger 64 opposite the curled end is mounted on a shaft 65 journaled in opposite sides of the housing 38 and such shaft is adapted to have one end project through the side of such housing and have an indicator 66 disposed exteriorly of the camera for observation so that when the film in the film box 49 is exhausted, the finger 64 will drop down and raise the indicator on the exterior of the camera to indicate the absence of film in the camera.

A film marker 67 in the form of a knife blade attached to the end of a finger is mounted on a shaft 68 which is journaled in opposite side of the housing 38. One end of the shaft 68 projects through the side of such housing and is adapted to carry a crank 69 by means of which the shaft and its associated marker may be rotated to mark a particular location on the film such as the end of a page, paragraph, etc.

The film is advanced by the feed roller 54 which is mounted on a shaft 70 supported by bearings 71 on each side of the housing 38. A portion of a conventional one way clutch 73 is attached to one end of the shaft 70 outside of the housing 38 and the remainder 74 of such clutch is rotatably mounted on the shaft 70 and is adapted to support an arm 75. The movement of the arm 75 and consequently the shaft 70 and feed roller 54 is controlled by a yoke 76 connected to a piston 77 operable by a cylinder 78. The cylinder 78 is pivotally mounted on a supporting member 79 by a pivot pin 80 and such supporting member is mounted on the wall of the camera housing 38. Fluid is supplied to the cylinder 78 through lines 81 and 82 from a solenoid operated control valve 83 connected by fluid lines 84 and 85 through a conventional safety valve 86 to a pump 87 driven by a motor 88.

The amount of oscillation of the arm 75 is governed by an adjustable stop 89 which is pivotally mounted on the shaft 70 and such stop is biased downwardly by a torque spring 90. In order to regulate the position of the stop 89, such stop is adapted to have a recess 91 in its lower edge to slidably receive a rotating block 92 which in turn is pivotally mounted on a pin 93 carried by a sliding block 94. Such sliding block is mounted on a plate 95 and is adapted to be moved by a screw 96 threadedly received in the block 94. The screw 96 is rotatably carried by a substantially U-shaped bracket 97, mounted on the wall of the camera housing and which supports the ends of such screw as well as the plate 95. The screw is restrained from axial movement by a collar 98 attached to one end and a knob 99 at the opposite end of the screw to rotate the same and move the block 94 along the plate 95.

A second adjustable stop is provided to limit the upward movement of the arm 75. Such second adjustable stop is in the form of a screw 100 threadedly engaging a block 101 mounted on the wall of the camera housing and a pair of lock nuts 102 to maintain the screw 100 in fixed adjusted position.

The outer end of the shaft 70 adjacent the arm 75 is supported by a plate 103 attached to a mounting block 104 on the camera housing 38. The opposite end of the shaft 70 is adapted to have a portion of a conventional one way clutch 74 attached thereto in cooperative relation with a fixed portion 73 secured to a plate 105 mounted on the wall of the camera housing opposite the arm 75. A pulley 106 is fixed to the end of the shaft 70 and is adapted to carry a belt 107 and drive a pulley 108 to wind the film on the roller 48 carried within the box 50.

The spring mounted pressure plate 42 comprises a pair of side members 109 (FIG. 8) mounted on the brackets 63 and connected at their top and bottom by a pair of angle brackets 110. Each of such angle brackets is provided with an opening 111 adjacent each of its ends in the vertical flange thereof and such openings are of a size to permit a spacer 112 to freely pass therethrough. One end of such spacers is adapted to carry a washer or retaining plate 113 attached to spacers 112 by fasteners 114. The opposite ends of the spacers are secured to the pressure plate 42 by fasteners 115 and such pressure plate is urged away from the angle brackets 110 by a spring 116 located around the spacers 112 between the pressure plate 42 and the angle brackets 110.

The card handling mechanism 19' includes a housing 120 having a recess 121 in which a stack of data bearing cards 9 are adapted to be placed between side panels 122. The cards 9 are advanced to a photographing station 123 by a plate 124 pivotally connected to a link 125 which in turn is connected to a spring loaded arm 126 carried by a shaft 127. A friction roller 128 bears against the lower portion of the card which has been presented at the photographing station and upon rotation of such roller, the cards are removed from the photographing station and directed downwardly beneath a plate 129 and over a roller 130 at a lower elevation. The cards are received between the roller 130 and an L-shaped slide member 131 in such a manner that the cards remain in substantially the same continuity so that when the stack of cards has

been photographed, such stack may be removed from the machine and stored.

As the cards are fed beneath the plate **129**, they strike a lever **134** which will partially rotate a gear **135** having flattened areas **136** devoid of teeth. The rotation of the gear **135** causes the teeth on such gear to engage the teeth of a gear **137** mounted on a shaft **138** on the opposite end of which a gear **139** is mounted. The gear **139** meshes with a drive gear **140** mounted on a shaft **141** and such shaft is driven by a pulley **142** which in turn is driven by a belt **143** from a pulley **144** on a speed reducer **145** driven by a belt **146** from a pulley **147** mounted on the shaft **148** of an electric motor **149**. Through this connection it will be seen that the gear **137** is continuously rotating as long as the motor **149** is operating and when the teeth of the gear **135** mesh with the teeth of the gear **137**, the gear **135** will be rotated until a flattened portion **136** is disposed adjacent to the gear **137** and the teeth are no longer in mesh.

The gear **135** is provided with a hub **150** from which a pair of diametrically opposed lugs **151** and **152** project outwardly from such hub and when the gear **135** is rotated, the lug **151** is rotated by the hub **150** and strikes a fork **153** located on one arm of a bell crank **154**. When the lug **151** strikes the fork **153**, the bell crank is oscillated which in turn oscillates a shaft **155** to one end of which the bell crank is attached. To the oposite end of the shaft **155** is mounted an arm **156** which projects outwardly therefrom. The outer end of the arm **156** engages a shoulder **157** on a cam **158** connected to a gear **159** which meshes with a gear **160**.

The gear **160** is freely rotatable on a shaft **161** which is being continuously rotated through a connection (not shown) with the motor **149** and such shaft is provided with a collar **162** fixed to such shaft adjacent to the gear **160** and in communication with such gear through a spring **163**. The gear **160** is normally prevented from rotating by the gear **159** and the cam **158** but when the arm **156** is removed, the spring **163** will apply sufficient tension to the gear **160** to rotate such gear and the rotation of such gear causes rotation of a gear **164** which meshes with the gear **160**.

The gear **164** is mounted on a shaft **165** on which a pair of cams **166** and **167** are mounted. The cams **166** and **167** are in engagement with microswitches **168** and **169** so that upon rotation of the shaft **165**, such microswitches are closed sequentially to operate the electronic shutter **36'** and the film feed control valve **83** respectively. As illustrated in FIG. 4 the microswitch **168** is operated first to trigger the shutter mechanism and subsequently the microswitch **169** is activated to open the control valve **83** and advance the film.

As soon as the cam **158** has been released by the arm **156**, the lug **152** on the hub **150** will strike a fork **170** on the bell crank **154** and move such bell crank back to its inoperative position so that when the cam **158** makes a complete revolution the shoulder **157** will engage the arm **156** and prevent further rotation of the gears **159**, **160** and **164** until such time as the trigger **134** is again engaged by a card. The lower arm of the bell crank **154** is pivotally connected by a pair of arms **171** and **172**, the opposite ends of which are pivotally connected to a lug **173** depending from a disk **174**. Such disk is mounted between a pair of leather washers **175** and carried between a pair of collars **176** fixed to the shaft **141**. The washers **175** are saturated with lubricant so that the disk **174** will not be rotated when the collars **176** are rotated by the shaft **141**.

In the operation of the machine, a stack of data bearing cards are placed in the card handling mechanism **19'** and advanced to the photographing station **123**. If desired, one or more blank cards may be placed at the beginning and end of the stack of cards to provide for a margin at the top and bottom of the page of printed matter. When the card handling mechanism is activated, one card is fed through the machine at a time and in its passage through the machine such card will trip the lever **134** and move the bell crank **154** to pivot the arm **156** from beneath the cam **158** and permit one rotation of the shaft **165** with the cams **166** and **167** thereon. Such cams first trip the shutter mechanism to momentarily expose the film and subsequently trigger the film feed control valve to advance the film a predetermined distance. This operation is repeated until such time as all the cards have been photographed automatically by the camera. In the event that a card does not pass through the card handling mechanism, the film will not be exposed nor will it be advanced until such time as the difficulty has been alleviated and the cards again pass through the machine. The stack of cards normally contains sufficient cards to fill one page of printed matter and the operator of the machine can load a stack of cards therein and devote his attention elsewhere, secure in the knowledge that the machine will automatically photograph the entire stack of cards after which no further advance of the film feed or exposure of the film will take place.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is illustrated in the drawings and described in the specification, but only as indicated in the accompanying claims.

What is claimed is:

1. A machine for automatically reproducing data on a photographic film for use in offset printing comprising a housing providing a base, card handling mechanism on one end of said base, photographic mechanism having shutter and film holding portions mounted on said base for movement toward and from said card handling mechanism, a plurality of cards for presentation one by one to a predetermined position and remaining in said position until photographed, means for actuating the photographic mechanism and for driving the film subject to the card handling mechanism, means for independently adjusting the shutter and film holding portions of the photographic mechanism toward and from each other, said photographic mechanism including masks to enlarge and reduce the amount of the image exposed, said means for actuating the photographic mechanism including microswitches operatively associated with said card handling mechanism and operable by said cards as the cards are removed from said predetermined position.

2. A machine for automatically reproducing data on a photographic film for use in offset printing comprising a housing providing a base, card handling mechanism on one end of said base, photographic mechanism having shutter and film holding portions mounted on said base for movement toward and from said card handling mechanism, a plurality of cards carried by said card handling mechanism and presented one by one to a predetermined fixed position and remaining in said position until photographed, means for actuating the photographic mechanism subject to the card handling mechanism, means for adjusting the shutter and film holding portions of the photographic mechanism independently toward and from each other, said means for actuating the photographic mechanism including means for electronically actuating the shutter of the photographic mechanism and for driving the film holding portions, said last mentioned means including switch means carried by said card handling mechanism operable by said cards as they are removed from said predetermined position.

3. The structure of claim **2** in which said film holding portions include a photographic film mounted on rollers within said photographic mechanism, said rollers including, a feed roller mounted on a shaft, a one-way clutch mounted on one end of said shaft to permit rotary movement of said feed roller in one direction only, an

operating arm carried by said clutch, a fluid operated cylinder for causing movement of said arm which moves said clutch and said feed roller to cause said film to be advanced, and adjustable stop means to limit the movement of said arm whereby the amount of film moved by said feed roller may be altered.

4. A machine for automatically reproducing data on a photographic film for use in offset printing, comprising a cabinet forming housing with one or more access openings therein, card handling mechanism mounted on one end of said housing, photographic mechanism having shutter and film holding portions mounted on the opposite end of said housing, said card handling mechanism being disposed at an angle substantially 30° to the horizontal for coordination with the photographic mechanism to dispose the cards within said card handling mechanism in a predetermined position, electrical means on the card handling mechanism for actuating the shutter of the photographic mechanism, means for adjusting the shutter and the film holding portions of the photographic mechanism toward and from each other, said photographic mechanism including masks to alter the amount of the image exposed, a film feed comprising a feed roller having a shaft, a one way clutch mounted on said shaft, an operating arm carried by said clutch, a fluid operated cylinder for causing movement of said arm which in turn moves said feed roller through said clutch, an electrically operated control valve for supplying fluid to said cylinder, and means operatively associated with said card handling mechanism for operating said valve.

5. A machine for automatically reproducing data on a photographic film for use in offset printing comprising a housing providing a base, card handling mechanism on one end of said base, said card handling mechanism being disposed at an angle to present a plurality of cards one by one in a predetermined location, photographic mechanism mounted on said base for movement toward and from said card handling mechanism, said photographic mechanism including an automatic film feed comprising a feed roller mounted on a shaft, a one-way clutch mounted on said shaft, an operating arm carried by said clutch, a fluid operated cylinder for causing movement of said arm which moves said clutch and said feed roller, a pulley mounted on the end of said shaft remote from said fluid operated cylinder, a pair of independent light excluding boxes, a film discharge roller carried by one of said boxes and a film winding roller carried by the other of said boxes, a photographic film mounted on said film discharge roller, said winding roller being mounted on a shaft one end of which extends outwardly of the independent box, a pulley mounted on said roller shaft exteriorly of said box, driving means connecting said roller pulley and said film feed shaft pulley whereby when the film is advanced by the film feed said winding roller will be caused to rotate and wind the film thereon.

6. The structure of claim 5 including means for indicating when the film in said photographic mechanism is exhausted.

7. The structure of claim 5 including means for selectively marking the film.

8. A machine for automatically reproducing data on a photographic film comprising a housing, card handling mechanism carried at one end of said housing, photographic mechanism carried at the opposite end of said housing, said photographic mechanism including photographic film, an adjustable film feed, and a shutter, means mounting said photographic mechanism for longitudinal movement on said housing, data bearing cards receivable within said card handling mechanism, means for moving said cards to a predetermined location on said card handling mechanism and remaining at said location until photographed, means for removing said cards one by one from said predetermined location, electrical means on said card handling mechanism operable by the cards removed from said predetermined location for sequentially operating said shutter and film feed.

9. The structure of claim 8 in which said photographic mechanism includes at least one mask to alter the amount of image exposed to said photographic film.

10. Apparatus for reproducing data on photographic film comprising an elongated housing, card handling mechanism mounted on one end of said housing, photographing mechanism mounted on said housing in spaced relation to said card handling mechanism, said photographing mechanism including, an adjustable film feed, a lens and an electronic shutter, means for producing relative movement between said photographing mechanism, and said card handling mechanism, a plurality of cards bearing data in a predetermined location on said cards and receivable within said card handling mechanism, said card handling mechanism including a photographing station, means for advancing said cards to said photographing station and remaining at said station until photographed, means for removing said cards one at a time from said photographing station, a first switch means mounted on said card handling mechanism and engageable with said removed card for operating said electronic shutter, a second switch means mounted on said card handling mechanism and engageable with said removed card for subsequently operating said film feed to advance the film a selected distance through said photographing mechanism whereby said electronic shutter and said film feed are operated by said card which has been removed to photograph the next succeeding card at the photographing station.

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