July 5, 1949. C. W. HARROLD ET AL 2,475,497

PHOTOTYPOGRAPH FILM ADVANCING AND FLASH CONTROL MEANS

Filed Nov. 15, 1944

4 Sheets-Sheet 1

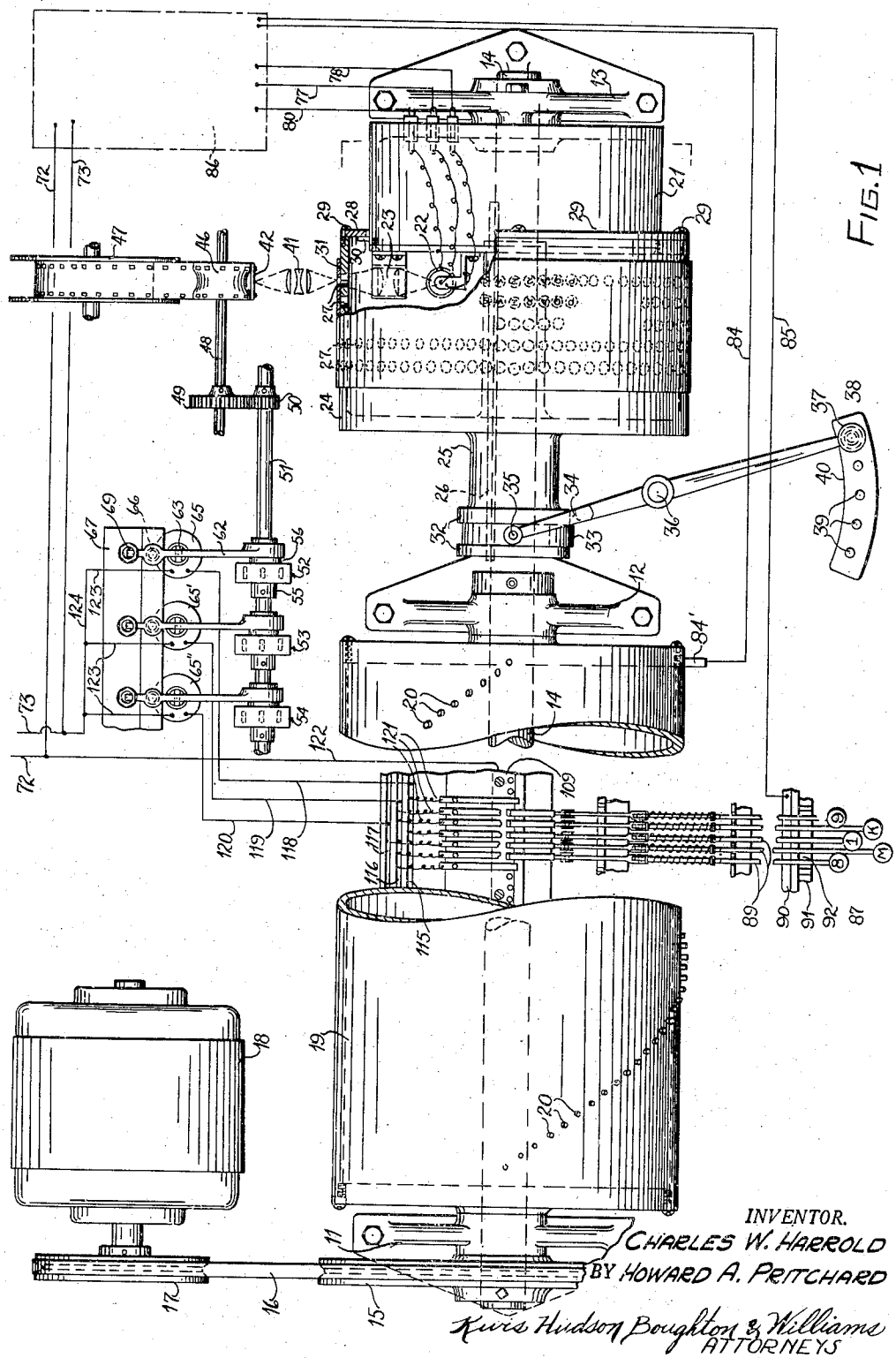


FIG. 1

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4 Sheets-Sheet 2

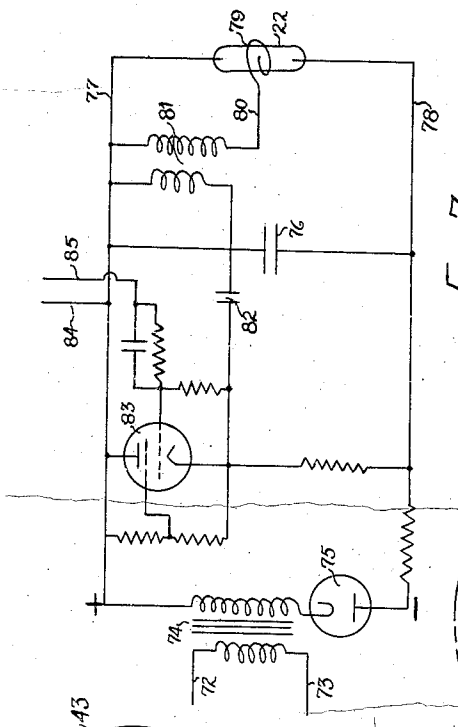


FIG. 7

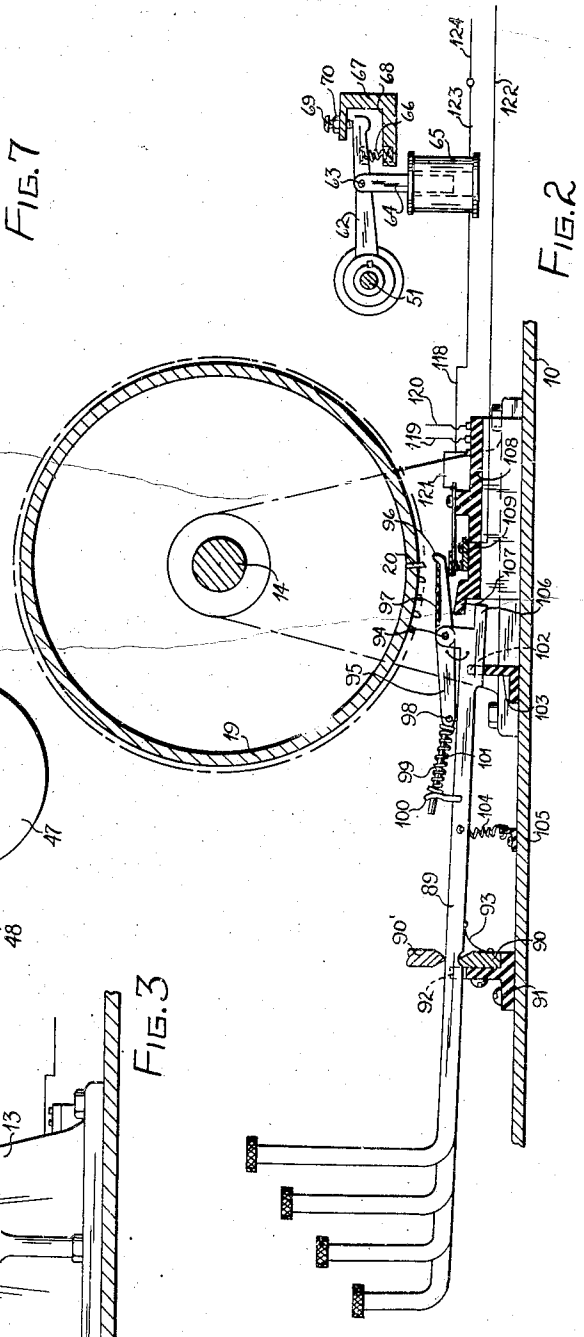


FIG. 2

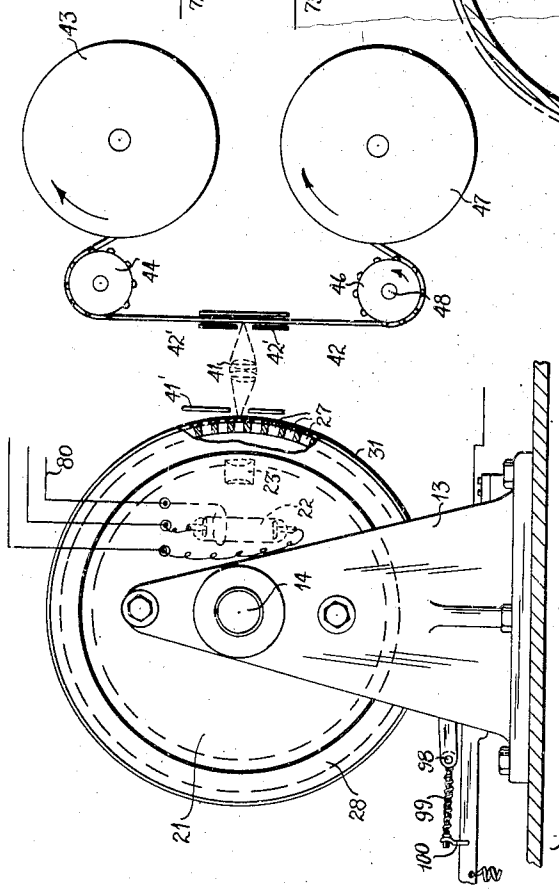


FIG. 3

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4 Sheets-Sheet 3

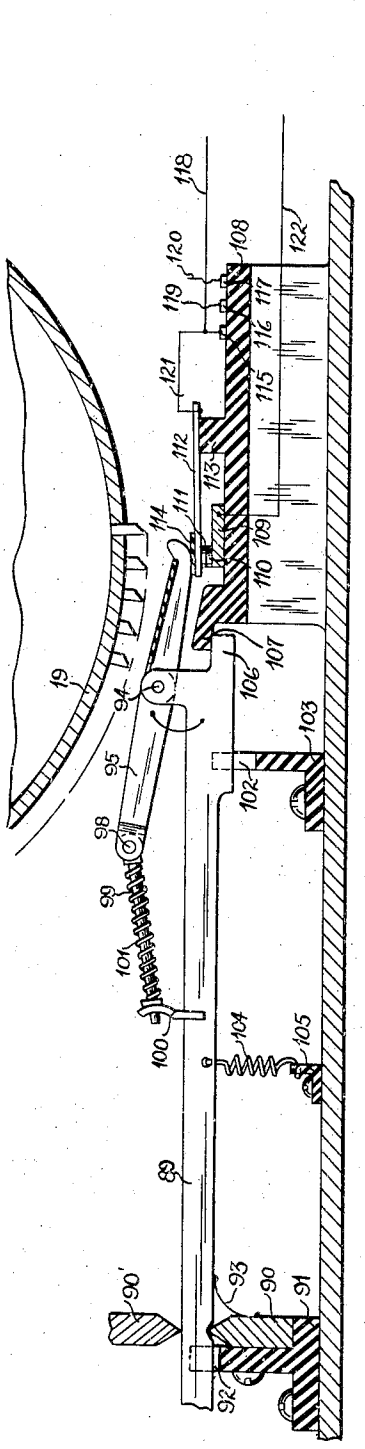


FIG. 6

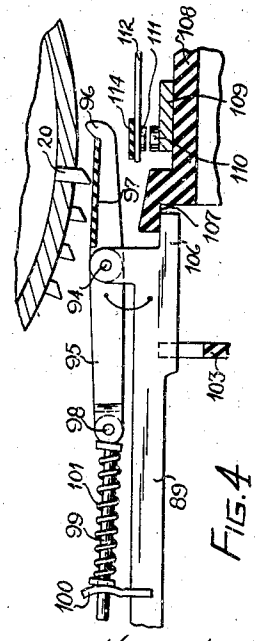


FIG. 4

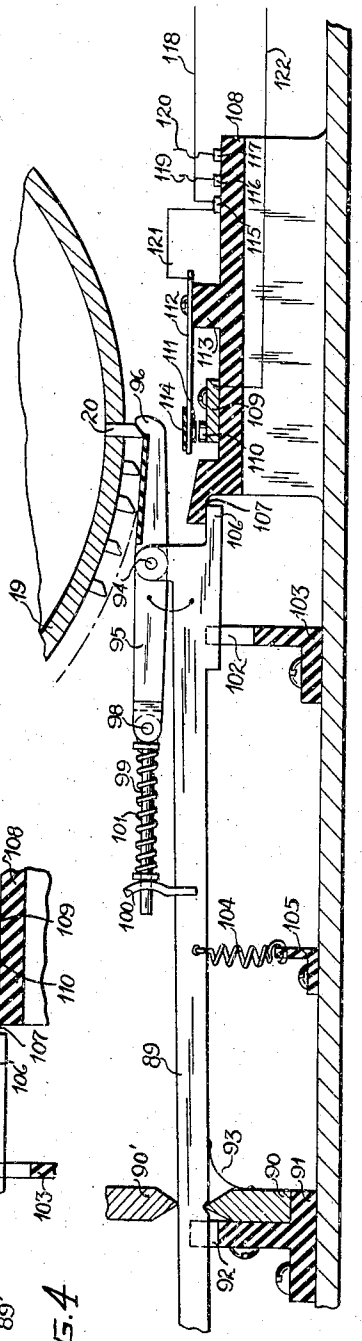


FIG. 5

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PHOTOTYPOGRAPH FILM ADVANCING AND FLASH CONTROL MEANS

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4 Sheets-Sheet 4

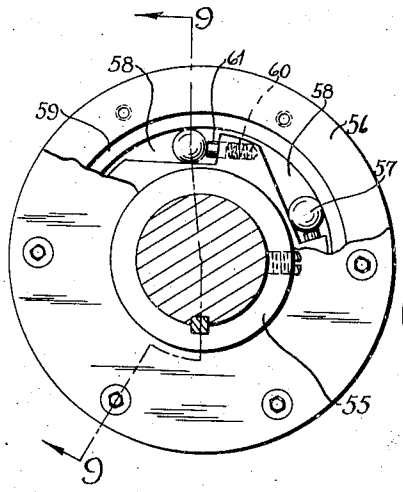


FIG. 8

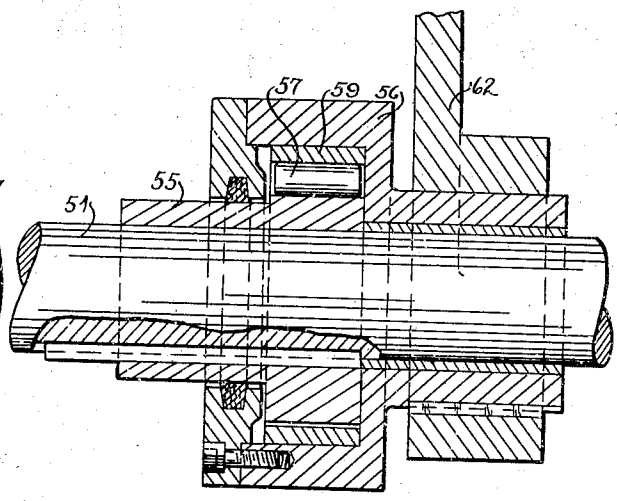


FIG. 9

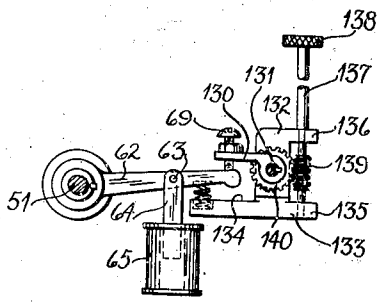


FIG. 10

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Patented July 5, 1949

2,475,497

UNITED STATES PATENT OFFICE

2,475,497

PHOTOTYPOGRAPH FILM ADVANCING AND FLASH CONTROL MEANS

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Application November 15, 1944, Serial No. 563,578

18 Claims. (Cl. 95—4.5)

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This invention relates to improvements in machines for assembling copy, that is to say machines for arranging characters in desired orderly sequence for purposes of reproduction in printing machines. The invention has to do more particularly with means for composing text matter photographically and makes use of high speed light flashes in order to accomplish the purpose rapidly and in a simple manner.

Various attempts have been made to compose type characters photographically. In some cases the usual automatic type setting machines have been provided with photographable matrices which are photographed line by line after assembly and justification; in other cases an entire font of type faces is provided for each character position of a line, and the line is photographed after the proper character for each position has been moved into place; in still other cases a master stencil or font containing all the characters is provided and the stencil is moved until the desired character is in line with an optical system, an exposure of that character is made, the stencil is moved into a new position for the next character and so on until the line is completed. Such machines have employed mechanical shutters for controlling the time and duration of illumination employed for exposing the light sensitive surface.

The known means of composing text material photographically are subject to numerous serious disadvantages, such as imperfections in the background due to photographable lines of demarcation between characters, high cost of equipment, complicated nature of the mechanism, imperfect alignment of characters, difficulty of justification of lines, slow speed of operation due to use of reciprocating or intermittently moving parts, etc. Disadvantages such as the above have heretofore prevented the general utilization of such machines, their usage being mainly confined to setting display type used in advertising copy and to similar specialized fields.

One of the objects of our invention is to overcome these and other disadvantages of previous machines for the photographic composition of text material.

Another object is the provision of a new method and means for the purpose stated, having advantages in speed and efficiency of operation, simplicity of construction, and superiority of finished product.

Another object is the provision of mechanism of the kind described involving character bearing means and a photographic medium having

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relative movement, a high speed flash lamp for illuminating the characters thereof, and means for causing the lamp to flash when a selected character is in desired position relative to the photographic medium during the course of said relative movement.

Another object is the provision of means to be actuated by the operator for causing a control mechanism, which moves in synchronism with a continuously moving row of characters, to function at the proper instants for flashing images of selected characters upon a photographic medium.

Another object is the provision of mechanism of the kind described wherein the duration of exposure of a character image upon a photographic film is determined by the duration of the light flash emitted by a gaseous discharge type of light source.

Another object is the provision in a machine of the character stated of means for automatically advancing the photographic medium immediately after each flash, and preferably regulating the amount of advance in accordance with the width of the character imaged.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which

Fig. 1 is a more or less diagrammatic general plan view showing a complete machine embodying the invention;

Fig. 2 is a vertical cross-sectional view through the control mechanism showing a key member and related parts in normal or idle position;

Fig. 3 is an end elevational view, partly in section, showing the rotating carrier upon which the characters to be reproduced are mounted and the film or other photographic medium which receives the image;

Fig. 4 is a fragmental view showing the key bar raised by the operator and the snap lever thereon rocked to a slight extent by a control pin;

Fig. 5 is a similar view but showing a control pin at the moment of completing an electric circuit for flashing the lamp;

Fig. 6 is a similar view wherein the snap lever has been thrown over center by the action of the control pin, and wherein an electric switch has been closed to effect a feeding movement of the photographic film;

Fig. 7 is a conventional wiring diagram which

may be followed in setting up electrical connections for flashing the lamp;

Fig. 8 is an end view, partly broken away, of an over-running clutch which may be employed in connection with the film feed.

Fig. 9 is a transverse section taken substantially on the line 9—9 of Fig. 8, and

Fig. 10 is an elevation of a modified film advancing means.

In the drawings the base of a suitable supporting structure is indicated at 10. Secured to this base are three standards 11, 12 and 13, which rotatably support a shaft 14, upon one end of which there is fixed a pulley 15. The latter is driven continuously during the operation of the machine by a belt 16 running over a pulley 17 on the shaft of an electric motor 18. Keyed or pinned to shaft 14 between the standards 11 and 12, there is an element 19 hereinafter sometimes called a support. As illustrated, this element is in the form of a drum of electrically conductive material, but any other form which will carry controls arranged spirally is within the spirit of the invention. The controls illustrated are pins 20 of electrically conductive material, such as a metal, mounted in the drum and projecting radially therefrom, each pin being disposed at a point which is different axially and angularly from that of every other pin, and being preferably beveled or rounded slightly for a purpose which will be evident later.

Standard 13 carries a stationary cylindrical member 21, closed at its ends, which surrounds the shaft 14. This member supports a pair of condensing lenses 23 and a light source 22 in the form of a high speed flash lamp. Between the standards 12 and 13 there is a cylindrical carrier 24 with a hub 25 which is slidably keyed to shaft 14 as indicated at 26. Carrier 24 is hollow and is provided with several circular rows of holes 27 in its peripheral shell. A ring 28 is secured by screws 29 to the periphery of carrier 24, the inner diameter of the ring being only slightly greater than the outer diameter of member 21, and the joint between the latter member and the ring being made substantially light tight by suitable means such as a felt seal 30 secured to the ring. The opposite end of the carrier is closed.

A character bearing element 31 is secured by any suitable means, such as cement, to the outer peripheral wall of the carrier. This element bears the characters, such as letters, numerals, punctuation marks, etc., which are to be assembled photographically into desired linear arrangement by the machine. Element 31 may be constructed in various forms, such as a cut-out stencil in which the characters comprise apertures in an opaque sheet of material, or a photographic stencil in which the characters are either transparent or opaque. As illustrated, element 31 comprises a photographically prepared stencil on flexible film, the characters being transparent and the background opaque. Each circular row of characters includes a lower case alphabet, an upper case alphabet, numerals 0 to 9 inclusive, a series of punctuation marks and any other desired special charactres. The different rows have characters of different forms, corresponding to different fonts of type, but the characters in the different rows are arranged in similar order and similar characters are arranged in longitudinal alignment. Each of the characters of the element 31 is arranged in radial alignment with an opening 27 in the carrier 24, so that light from flash lamp 22 may pass through the stencil to illuminate the character. Preferably the position of each character on element 31, considered in the direction around the carrier 24, is determined by reference to one side edge of the character rather than its center in order that the characters may appear in properly spaced condition on the film 42.

If desired, the element 31 may be omitted and the carrier 24 made of transparent material without holes 27. The characters to be printed may then be formed directly on carrier 24.

Hub 25 of cylindrical carrier 24 is provided with two flanges 32, between which lies a shifting collar 33, the position of which is determined by a yoke 34 connected to collar 33 by two pins 35. Yoke 34 is mounted to swing upon a stud 36 fixed in the supporting structure of the machine. At its outer end it carries a spring-pressed pin 37 having a reduced extremity 38 which engages selectively each of a series of holes 39 in a plate 40 fixed to the machine frame. The number of holes 39 correspond to the number of rows of characters in the character bearing element 31, and it will be noted that by moving yoke 34 into its various positions corresponding to holes 39, the drum 24 may be moved along shaft 14 into positions which bring different rows of characters into the transverse plane which cuts lamp 22 and lenses 23.

A suitable lens diagrammatically illustrated at 41 is arranged to project an image of an illuminated character of stencil 31 onto a strip of film 42 which is caused to move past the field of projection of lens 41 intermittently following each exposure of a character so that a line of characters is photographically formed on the film. The film is fed from a supply spool 43, and around a toothed sprocket 44 provided with suitable means such as a friction brake (not shown) to prevent over-running, past the field of projection of lens 41, around toothed driving sprocket 46 and thence to take-up spool 47. Suitable shielding means indicated at 41′ and 42′ are provided to limit stray light from lamp 22 and protect film 42 from undesired exposure.

Driving sprocket 46 is fixed upon a shaft 48 carrying a gear 49 meshing with gear 50 keyed to shaft 51. Shafts 48 and 51 are rotatably supported in bearings not shown. Upon shaft 51 are mounted a series of over-running clutches of known design of which three only are shown, these being designated generally, together with their actuating and limiting mechanism, as 52, 53, 54. Only one such clutch mechanism will be described in detail since the others are of similar construction. Any desired number of such clutches may be provided as required to accomplish the purpose described.

Referring particularly to Figs. 8 and 9, each of these over-running clutches may comprise a driven member 55 keyed to shaft 51 and a driving member 56 freely oscillatable upon shaft 51. A plurality of rolling elements such as rollers 57 are mounted within cavities 58 in the periphery of driven member 55, and are adapted to bear against the internal surface of a hardened ring 59 carried by the driving member 56. Springs 60 and plungers 61 tend to move rollers 57 into gripping position. When the driving member 56 turns in the counterclockwise direction, as viewed in Fig. 8, the driven member 55 is turned through the same angle, but when the driving member 56 turns in the clockwise direction, the driven member remains stationary.

Keyed to driving member 56 is an arm 62 which

is connected by pivot pin 63 (see Fig. 2) to one end of an iron armature 64 arranged to move freely in solenoid 65 in response to an electric current in the latter. Arm 62 is normally urged upward by spring 66 supported in a socket in channel bar 67 which is fixedly mounted on the frame of the machine. Downward movement of arm 62 is limited by contact of the end of the arm against surface 68 of channel 67 and upward movement is limited by contact against adjustable stop screw 69 threaded into the upper part of channel 67 and locked in desired position by nut 70. The stop screws 69 for the different clutch mechanisms are adjusted to different positions so that arms 62 are caused to move through different distances by action of their respective solenoids 65. Thus through clutches 52, 53 and 54, different amounts of angular movement are imparted to shaft 51 and through the driving connections illustrated to the film driving sprocket 46. As is more fully described later, each of the solenoids 65 is operatively related to those control mechanisms which are associated with characters of substantially the same width, so that in the operation of the machine each character selecting mechanism causes actuation of the proper clutch to advance the film driving sprocket and hence the film an amount corresponding to the width of the character selected. Thus, in accordance with good type-setting practice, the characters are arranged closely together and undesirable variable gaps between characters are avoided. The actuation of clutches 52, 53, 54 is controlled by switching mechanism described later.

Light source 22 is a high speed flash device of known type suitable for the production of flashes of light of extremely short duration, for example of the order of $^1/_{20,000}$ second to $^1/_{1,000,000}$ of a second or less. Various forms of such devices are known and various electrical circuits are employed for their actuation. In general such devices are actuated by the discharge of a condenser charged to relatively high voltage through gas between electrodes as in an open spark gap or gas filled tube. Preferably we employ as our light source a gaseous discharge device of the type having a glass or quartz flash tube containing a suitable gas such as argon, neon, xenon, etc., into which tube two electrodes project and adjacent which tube a trigger plate or coil is provided for initiating the flash. In devices of this type, the illumination is provided by the discharge of electrical energy of relatively high voltage, for example in the region of about 2000 volts, through the ionized gas of the tube from a condenser in which the energy has previously been stored. In Fig. 7 we have shown a wiring diagram which is suitable for the purpose of this invention, it being understod that this part of the disclosure per se, forms no part of the present invention. 72 and 73 are line wires from which current is fed to a step-up transformer 74. 75 is a rectifier tube. By this means high tension current is supplied to charge a condenser 76 which is connected by leads 77 and 78 with the ends of flash tube 22. The starter coil 79 surrounding this tube for the purpose of initiating the discharge is connected by a conductor 80 with the high tension side of a transformer 81, the low tension side of which is in circuit with a condenser 82. 83 is a strobotron tube. The trip switch of the circuit is not shown in Fig. 7. There are in fact a series of such switches to be presently described, any one of which is adapted

to connect two conductors 84 and 85 for setting up the impulse which fires tube 22. The electrical system includes various resistors and other parts which need not be described for the purposes of this application. Most of these parts, together with some of those specifically mentioned, may be conveniently mounted on an instrument board indicated at 86 of Fig. 1.

The control mechanism or character selecting mechanism comprises a plurality of keys 87, 88, arranged in any preferred manner, as for example in the manner of a linotype machine keyboard, or typewriter keyboard. Key 88, for example, comprises a lever portion 89 which rests upon the knife edge pivot-bar 90, a notch being cut in lever 89 to prevent displacement thereof, and a bar 90' being provided above the lever to hold it in position. Pivot-bar 90, which is of metallic composition, is secured to a T-shaped support bar 91 of insulating material secured to base 10 of the machine. The upper part of bar 91 is formed into spaced upright projections 92 which form guides for properly positioning levers 89 along bar 90. Lead 85 from instrument board 86 is electrically connected to bar 90 and through it to each of the levers 89. To insure uniform electrical connection between bar 90 and levers 89, each of the latter is connected by flexible wire 93 to bar 90.

The forward end of lever 89 carries a pin 94 on which is pivotally mounted a snap lever 95 whose forward arm is formed into an upwardly extending nose 96 forming a contact point for engagement with one of the pins 20. Nose 96 is preferably slightly beveled or rounded for a purpose which will appear. In some of its aspects the element 95, 96 partakes of the character of a trigger. Adjacent nose 96 there is secured to snap lever 95 a strip of insulating material 97. In the opposite end of lever 95 there is pivotally mounted on pin 98 a rod 99 whose other end is freely slidable in a hole in abutment plate 100 secured to lever 89. A compression spring 101 surrounds rod 99 and urges lever 95 to swing in one direction or the other away from the line joining pin 94 and the hole in abutment plate 100. Rod 99 and one half of lever 95 therefore constitute a toggle. The counterclockwise movement of lever 95 is limited by contact of the latter with lever 89.

The forward end of lever 89 is guided between spaced upwardly extending projections 102 of a bar 103 of insulating material secured to base 10. Spring 104 secured to lever 89 and insulating angle bar 105 biases lever 89 in the clockwise direction.

Lever 89 is provided at its forward end with a projection 106 which engages an abutment 107 formed in a bar of insulating material 108 which extends parallel to support 19 throughout the length of the latter, and is suitably mounted upon base 10. Contact of extension 106 with abutment 107 limits the upward movement of lever 89 to an amount sufficient to cause nose 96 to be lifted the proper distance into the path of the corresponding pin 20.

On bar 108 is secured a conducting strip 109 extending lengthwise of cylindrical support 19, which strip is provided with a series of lower contact points 110, one for each of the levers 95. Cooperating with each contact point 110 is an upper contact point 111 on a conducting spring arm 112 secured to rib 113 of bar 108. Spring arm 112 is provided with a pad 114 of insulating material to preclude electrical connection between

lever 95 and spring arm 112. Secured to bar 108 are a plurality of bus bars 115, 116 and 117. These bus bars are connected by wires 118, 119 and 120 respectively to solenoids 65, 65' and 65'' of clutches 52, 53, 54. Only three bus bars are shown but the number of such bars is made equal to the number of clutches. Each of the spring arms 112 is connected by a wire 121 to a selected one of the bus bars 115, 116 or 117. Strip 109 is connected by wire 122 to line wire 72 and each of the solenoids 65, 65' and 65'' is connected by a wire 123 to a common wire 124 leading to the line wire 73. By the arrangement and connections indicated, when a given pair of contacts 110 and 111 are closed, a certain one of the solenoids 65, 65' or 65'' is caused to act upon its armature 64 with the result that the clutch 52, 53 or 54 associated therewith is turned through its particular angle and the film 42 is advanced a specific amount associated with that pair of contacts.

Operation

In the operation of the device, motor 18 drives shaft 14 continuously and preferably at substantially constant speed, thereby causing continuous rotation of carrier 24 with its character stencil 31 and drum 19 with its pins 20. To reproduce the image of a given character of stencil 31 upon the film 42, the key 87 or 88 for that character is depressed by the operator. This action causes the forward end of lever 89 to be raised until its extension 106 strikes against abutment 107. With lever 89 in this position the nose 96 on the free end of snap lever 95 extends into the path of rotation of one of the pins 20. As the latter pin approaches nose 96 it comes first into contact with insulating strip 97, as indicated in Fig. 4, thereby avoiding electrical contact with lever 95. Then as the pin reaches the end of lever 95, it comes into electrical contact with nose 96, as in Fig. 5. Owing to the fact that pin 20 is connected to lead 84 through drum 19 and a brush 84', and nose 96 is electrically connected to lead 85 through pivot bar 90, the contact of pin 20 and nose 96 connects leads 84 and 85 to each other. A current is thereby caused to flow through the primary of transformer 81 thus energizing the starter coil 79. The latter initiates ionization of the gas in tube 22 whereupon the main condenser 76 discharges through tube 22 producing a brief but intense flash of light. The flash of light thus emitted is of such short duration that a substantially stationary image of the character corresponding to the key 88 which was depressed, is projected by lens system 41, onto film 42, and is recorded thereby for later photographic development.

The action of pin 20 striking nose 96 not only fires tube 22 but also, by virtue of the beveled or rounded surfaces of these members, forces nose 96 out of the path of the pin 20 thereby swinging lever 95 from the position shown in Fig. 5 to the position shown in Fig. 6, the spring 101 acting to force the forward end of lever 95 downward after the pin 98 passes the line between pin 94 and the hole in plate 100. Upon being forced downward, the forward end of lever 95 strikes pad 114 on spring arm 112 forcing contact points 110 and 111 into contact with each other, thereby completing the electrical circuit to one of the solenoids 65, 65' and 65''.

This solenoid, acting through its clutch 52, 53 or 54, and shafts 51 and 48 causes film 42 to be advanced a predetermined distance. It is apparent that the advancing of film 42 occurs closely following the firing of tube 22.

As soon as lever 95 has been contacted and rocked by the corresponding pin 20, the operator releases pressure upon key 88 and spring 104 draws the forward end of lever 89 downward. During the first part of this downward movement, lever 95 begins to rock counterclockwise because of the pressure of its forward end against pad 114. Further downward movement of the forward end of lever 89 brings the forward end of lever 95 into contact with the upper surface of abutment 107 and the rear end of lever 95 into contact with the upper surface of lever 89. This condition, shown in Fig. 2, limits the downward movement of lever 89. As lever 95 is rocked counterclockwise during the downward movement of the forward end of lever 89, it releases its pressure against pad 114 so that spring arm 112 lifts contact point 111 away from point 110 thus breaking the electrical circuit to solenoid 65, 65' or 65'', as the case may be, in preparation for the next cycle of operation. Thus, as is apparent, each time a key 87 or 88 is depressed and released, the corresponding snap lever 95 is raised into contact with its pin 20, is rotated clockwise to cause operation of contacts 110 and 111, is lowered, and during its lowering movement is rotated counterclockwise to its original position. Lever 95 comes into contact with its pin 20 only once for each actuation of its key 88, even though drum 19 may make several revolutions while the key is depressed, and is reset each time in preparation for the next usage of that key.

In order to produce images of other desired characters in order upon film 42, the appropriate keys 87 are depressed in succession by the operator. Each time a key is depressed a series of events such as is described above takes place. A key is provided for each character it is desired to reproduce, and one or more spacer keys for the purpose of advancing film 42 without exposing thereon an image of a character. In cooperation with the latter keys, the stencil 31 may be provided with one or more opaque portions overlying openings 27 so that no image will be projected when the corresponding key is depressed.

After projection of the desired series of characters upon film 42, preferably in the form of groups corresponding approximately to the length of line desired and separated by spaces of appropriate extent, the film 42 is photographically developed and the lines are assembled in column form, page form or other form, in any desired manner. If justification of the lines is desired this may be accomplished by any known or desired method.

It is to be noted that the movement of film 42 takes place in the plane of movement of the row of characters of stencil 31 being utilized. Thus the disposition of the character images in the line, considered transversely of the direction of the line, is accomplished with the same accuracy as that of the characters in the stencil, and any slight variation in the timing of the flashes of lamp 22 will result only in a slight shifting of the images relative to each other in the direction of the line. It is well known that misalignment of characters is easily detected by the human eye, whereas slight differences in spacing are not objectionable. It is within the scope of the invention, however, to provide for movement of film 42 in a direction transverse to the plane of movement of the row of characters.

The speed of rotation of shaft 14 is preferably such that the operator may depress keys 87, 88 in succession as rapidly as he can do so while achieving the desired arrangement of character images. If an operator speed of 200 characters per minute be assumed, a speed of 5 revolutions per second for drum 19 may be employed for example. Thus each key 87, or 88 need be depressed only .2 second by the operator to allow time for the corresponding pin 20 to travel the maximum possible part of its circular path before striking nose 96. The high speed flash devices and control circuits described produce such short flashes that the images of characters on carrier 24 traveling at the above speed projected onto film 42 are substantially stationary and, upon development, are sharp and clear. As an example, drum 19 may be 6 inches in diameter, giving it a peripheral speed at five revolutions per second of approximately 94 inches per second. If, for example, the electric circuit is designed to produce a light flash of $1/200,000$ second duration, the movement of a character of stencil 31 during such a flash is less than .0005". A shorter duration of flash would, of course, correspond to still less movement of the character.

The device may of course be arranged to operate at lower or higher speeds than suggested above, without departing from the invention, since the advantages thereof are numerous and important irrespective of any precise speed of operation which may be used.

Any number of rows of characters may be provided in stencil 31, but in the form of device illustrated only one such row may be brought into line with the optical system at a time. The characters of different rows may be arranged in identical order and differ only in form. Thus the characters in one row may be formed of Caslon regular type and the characters in another row of Caslon italic. Alternatively, the characters of two or more rows may differ from each other in connotation as well as form, so as to include, for example, mathematical symbols, or alphabets of different languages, under which circumstances the keys 87, 88 would preferably be provided with more than one identifying character to identify them with the corresponding characters of the stencil.

Each of the pins 20 of drum 19 is associated with one of the levers 89 and with one of the characters in a row on stencil 31, the pins being spaced longitudinally of drum 19 in accordance with the spacing of levers 89 and spaced angularly about the axis of drum 19 in accordance with the spacing of the characters of the stencil 31. Each pin is so arranged angularly in drum 19 that the time of its contact with the corresponding nose 96 and hence the time of firing of lamp 22, corresponds to the time when the character associated with that pin is in proper alignment with the axis of the optical system 41. Thus different pins cause firing of the lamp at different angular positions of the carrier 24 and different characters are imaged on the film 42.

It is convenient to locate the electrical trip switches at the base of the machine in vertical alignment with the shaft 14, while the lens system 23, 41 is conveniently disposed horizontally. Consequently, the stencil 31 is so disposed on the carrier 24 that each character comes into position to be imaged on the film at about 90° from the position of the corresponding control pin 20. This angle may be varied of course where it becomes desirable to adopt different arrangements of parts.

Although in the embodiment herein disclosed we have employed pins 20 as the controls for the flashing of the different characters and the advancing of the film or other photographic medium, it should be understood that other controls may be used, for example the drum 19 may be provided with holes in its periphery located at the same positions as the pins 20, and a source of light within the drum may be caused to act through these holes upon one or a series of selenium cells functioning to actuate the flash lamp, the levers 89 operating shutters or the like for masking the cell or cells except when a selected character is to be projected upon the film. The type of flash lamp 22 and the electrical equipment for firing the same may be selected and arranged in accordance with practices known to those familiar with the art of high speed photography. As indicated above, various types of gas filled lamps are available or, if desired, an open spark gap may be used. Various electrical circuits also are known for effecting a lamp flash, which circuits may be varied in accordance with the type of light source, the intensity and duration of the flash desired, the period available for recharging the flashing condenser between successive flashes, and the method employed for initiating the flash. The values of the various electrical elements of the circuit are so chosen as to produce a flash of the desired intensity and duration and to cause recharging of the main flash condenser 76 within the desired time interval. The latter time interval will be shorter than the interval between successive actuations of keys 87, 88, so that each time a key is depressed the main flash condenser 76 will be fully charged and in condition to produce a flash in lamp 22.

In a modification of the devices for advancing the film between exposures, we construct these devices to permit adjustment of the character spacing by the operator, for example, as illustrated in Figure 10. In this form each of the stop screws 69 by which the adjustment and setting of the different arms 62 is obtained is threaded in a supporting arm 130 keyed to a shaft 131, which is journaled in two or more bearings 132 in the support bar 133, which has a surface 134 corresponding to surface 58 of channel 67 of Figure 2. Support bar 133 is formed with ears 135 and 136 which rotatably carry shaft 137. The latter shaft has secured thereto a knurled thumb nut 138 at one end for turning the shaft and a worm gear 139 between ears 135 and 136 which meshes with a worm wheel 140 keyed to shaft 137. It is apparent that by turning thumb nut 138 the upper limit of movement of all of the arms 62 is adjusted simultaneously and by equal amounts toward or away from surface 134, thus changing the throws of all arms 62 by equal amounts. In this way the spacing between characters may be increased or decreased as desired by the operator.

Having thus described our invention, we claim:

1. In a machine of the class described, a rotating carrier bearing characters arranged in a circle, means for rotating said carrier about the axis of said circle continuously during the operation of the machine, a high-voltage condenser-discharge light source for illuminating by flash one character at a time, a photographic film, means for imparting thereto a latent image of the illuminated character, control mechanism comprising a series of continuously rotating controls one for each of the characters in said circle, said

controls being arranged seriatim with respect to the direction of movement of the control mechanism and rotating at the same angular speed as said carrier, and electrical connections adapted to be energized by each of said controls for governing the timing of light flashes, whereby actuation of said control mechanism by a selected control causes illumination of a given character at a predetermined position in its rotation.

2. In apparatus of the character described, a frame, a continuously rotating support mounted thereupon, a series of controls on said support each control having an angular position and a circular path different from those of every other control, a series of triggers carried by said frame each adjacent the path of one of said rotating controls, means for setting any one of said triggers in position to be acted upon by the corresponding rotating control for instituting an electrical impulse, and a high-voltage condenser-discharge lamp arranged to be flashed by said impulse, whereby the timing of the flash is dependent upon the angular position of the control in said support.

3. In apparatus of the character described, a frame, a continuously rotating drum carried thereby, a series of controls on said drum, each control spaced axially and angularly from every other control, a series of triggers carried by said frame each in the plane of the path of one of said rotating controls, means for setting any one of said triggers in position to be acted upon by the corresponding rotating control for instituting an electrical impulse, and a high-voltage condenser-discharge lamp arranged to be flashed by said impulse, whereby the timing of the flash is dependent upon the angular position of the control in said drum.

4. In apparatus of the character described, a frame, a continuously rotating support mounted thereupon, a series of controls on said support each control having an angular position and a circular path different from those of every other control, a series of triggers carried by said frame each adjacent the path of one of said rotating controls, means for setting any one of said triggers in position to be acted upon by the corresponding rotating control for instituting an electrical impulse, a high-voltage condenser-discharge lamp arranged to be flashed by said impulse, a photographic medium, means for imparting thereto a latent image from said flash, and means set in motion by said control for advancing said medium following each flash.

5. In a machine of the class described, a photographic film, a movable support for said film, means for imparting latent images of characters in succession to said film, means for advancing said movable support between flashes, said last named means comprising a shaft, a plurality of overrunning clutches operatively connected with said shaft, separate actuating means for each of said clutches set to impart rotation to said shaft through different angles, and selective means for operating said clutch actuating means, whereby said film may be advanced different distances in accordance with the dimensions of said images in the direction of movement of said film.

6. In a machine of the class described, a photographic strip film, sprocket means upon which said film is mounted for endwise movement, means for flashing a latent image on said film, and means for advancing said film by turning one of said sprockets, said last named means comprising a shaft, a plurality of overrunning clutches surrounding said shaft, separate actuating means for each of said clutches set to impart rotation to said shaft through different angles, and selective means for operating said clutch actuating means, whereby the film may be advanced different distances in accordance with the dimensions of the images lengthwise of the film.

7. In apparatus of the character described, a frame, a continuously rotating support mounted thereupon, a series of pins on said support each having an angular position and a circular path distinct from that of every other pin, a series of triggers carried by said frame, means for projecting any one of said triggers into the path of a pin, each of said triggers when struck by its pin being adapted to close a circuit for instituting an electrical impulse, a lamp arranged to be flashed in response to said impulse, a photographic medium, and means timed with said rotating support for imparting a given latent image to said medium when the lamp is flashed by any one of said triggers.

8. In apparatus of the character described, a frame, a continuously rotating support mounted thereupon, a series of pins on said support each disposed to rotate in a path distinct from that of every other pin, a series of triggers carried by said frame, means for projecting any one of said triggers into the path of a pin, each of said triggers when struck by its pin being adapted to close a circuit for instituting an electrical impulse, a lamp arranged to be flashed in response to said impulse, a photographic medium, means timed with said rotating support for imparting a given latent image to said medium when the lamp is flashed by any one of said triggers, each trigger when struck by its pin being shifted to produce a second electrical impulse, and means responsive to said second impulse for advancing said medium.

9. In apparatus of the character described, a frame, a continuously rotating support mounted thereupon, a series of pins on said support each disposed to rotate in a path distinct from that of every other pin, levers mounted on said frame one for each of said pins, a trigger pivotally mounted on each lever, each of said levers being movable to project its trigger into the path of one of said pins, each of said triggers when struck by its pin being adapted to institute an electrical impulse, a lamp arranged to be flashed in response to said impulse, a photographic medium, means timed with said rotating support for imparting a given latent image to said medium when the lamp is flashed by any one of said triggers, a switch disposed adjacent each of said triggers adapted to be closed by the movement of the trigger on its pivot when struck by its pin, and electrically operated advancing means for said medium in circuit with each of said switches, whereby the medium is advanced after each flash of the lamp.

10. In a machine of the class described, a shaft, a support and a carrier keyed to said shaft, a circular band of characters mounted upon said carrier, a flash lamp fixedly disposed within the carrier adapted to illuminate any one of said characters by a properly timed flash, a control on said support for each of said characters, each said control having the same angular relation to its character as every other control, said controls being spirally arranged on said support, electrical connections for flashing said lamp, and means for causing any one of said controls to

effect the energization of said electrical connections.

11. In a machine of the class described, a shaft, a drum and a cylindrical carrier keyed to the shaft, a circular band of characters mounted upon said carrier, a flash lamp fixedly disposed within the carrier adapted to illuminate any one of said characters by a properly timed flash, a control on said drum for each of said characters, each of said controls having the same angular relation to its character as every other control, and having an axial and a circumferential position different from that of every other control, electrical connections for flashing said lamp, and means for causing any one of said controls to effect the energization of said electrical connections.

12. In a machine of the class described, a shaft, a cylindrical carrier slidably keyed thereto, a plurality of bands of characters on said carrier spaced apart axially, the angular disposition of the characters of the different bands being the same, a flash lamp fixedly disposed within the carrier adapted to illuminate any one of the characters in a given band in response to a properly timed flash, a support mounted upon said shaft, a control on said support for each of said characters, said controls being spirally arranged and each having an angular position corresponding to the angular position of corresponding characters in said bands, electrical connections for flashing said lamp, means for causing any one of said controls to effect the energization of said electrical connections, and means for shifting said carrier axially upon said shaft to bring a selected one of said bands into operative relation with said lamp.

13. In a machine of the class described, a photographic film, a movable support for said film, means for imparting images of characters in succession on said film, means for advancing said movable support between flashes, said last named means comprising a shaft, a plurality of overrunning clutches operatively connected with said shaft, separate actuating means for each of said clutches set to impart rotation to said shaft through different angles, selective means for operating said clutch actuating means, whereby said film may be advanced different distances in accordance with the dimensions of said images in the direction of movement of said film, and means for simultaneously increasing or decreasing by a like amount the angle of throw of each of said separate actuating means.

14. In apparatus of the character described, a frame, a continuously rotating support thereon, a series of controls on said support, each control having an angular position and a circular path different from those of very other control, manually operated triggers carried by said frame equal in number to said controls, each trigger being disposed adjacent the path of one of said rotating controls, means for projecting any one of said triggers into the path of the corresponding control for instituting an electrical impulse, and means for causing said trigger to move out of said path automatically after said impulse is instituted, whereby accidental repetition of said impulse during a succeeding rotation of said support is avoided, and a high-voltage condenser-discharge lamp arranged to be flashed in response to said impulse.

15. In a machine of the character described, a frame, a shaft journaled therein, a support and a carrier keyed to said shaft, a circular band of characters mounted upon said carrier, a flash lamp disposed within the carrier adapted to illuminate any one of said characters by a properly timed flash, a photographic medium, means for imparting a given latent image to said medium when the lamp is flashed, a control on said support for each of said characters, each said control having the same angular relation to its character as every other control, said controls being spirally arranged on said support, triggers carried by said frame equal in number to said controls, each trigger being disposed adjacent the path of one of said controls, means for projecting any one of said triggers into the path of the corresponding control for instituting an electrical impulse, means for causing said trigger to move out of said path automatically after said impulse is instituted, and means responsive to the last named movement of said trigger for advancing said medium between successive flashes.

16. In a machine of the character described, a horizontal shaft, a drum mounted thereupon, means for rotating the drum, spirally arranged controls on said drum, a trigger disposed beneath the path of each of said controls, a keyboard comprising a key for each of said triggers, means responsive to the operation of each key for projecting a corresponding trigger into operative relation with a control for instituting an electrical impulse, and means for flashing a lamp in response to said impulse.

17. In a machine of the character described, a horizontal shaft, a drum mounted thereupon, means for rotating the drum, spirally arranged controls on said drum, a trigger disposed beneath the path of each of said controls, a corresponding number of levers for projecting said triggers into operative relation with said controls for instituting electrical impulses, means for flashing a lamp in response to said impulses, and a keyboard for the operation of said levers.

18. In a machine of the class described, a carrier moving in an endless path continuously during the operation of the machine, a row of characters on said carrier, a single high voltage condenser discharge light source mounted opposite said row for illuminating by flash one character at a time, a photographic medium, means for imparting thereto a latent image of the illuminated character, a series of transversely spaced moving control devices, one for each of the characters of said row, said carrier and said control devices being operatively connected to begin and complete their cycles simultaneously, a series of switch devices comprising an individual switch device for each control device operatively associated with that control device, and each adapted when selectively actuated to be closed by the corresponding control device, one of said series of devices being arranged seriatim in an endless path, and electrical connections adapted to be energized by any one of said switch devices for governing the timing of said flash, whereby each of said control devices may be caused to energize said electrical connections at a time corresponding to the presence of a given character at a given position in the path traversed by said row of characters.

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