

No. 636,062.

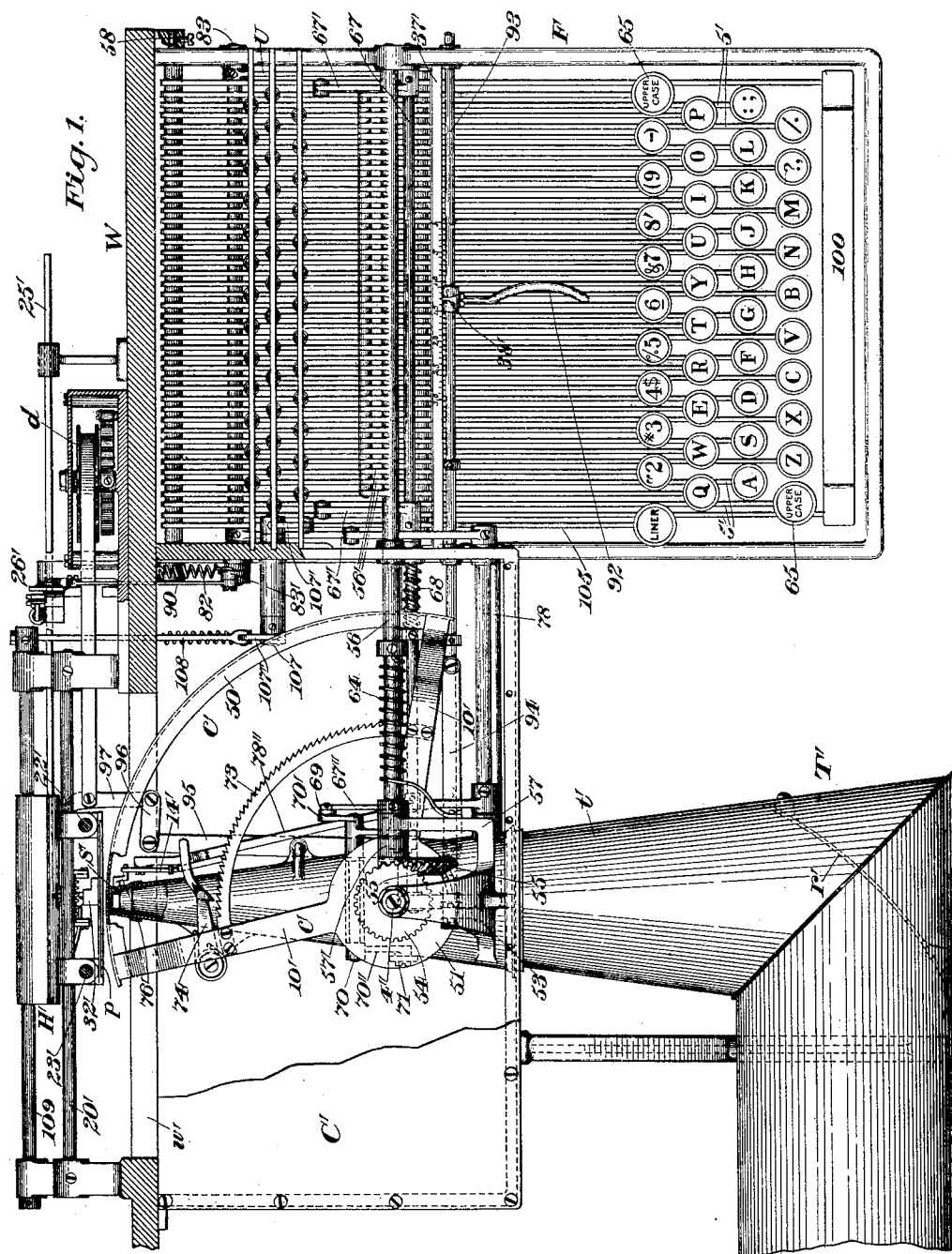
Patented Oct. 31, 1899.

F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(Application filed May 7, 1898.)

(No Model.)

9 Sheets—Sheet 1.



Witnesses;

A. B. Mattingly
J. L. Edwards Jr.

Inventor:

F. H. Richards.

No. 636,062.

Patented Oct. 31, 1899.

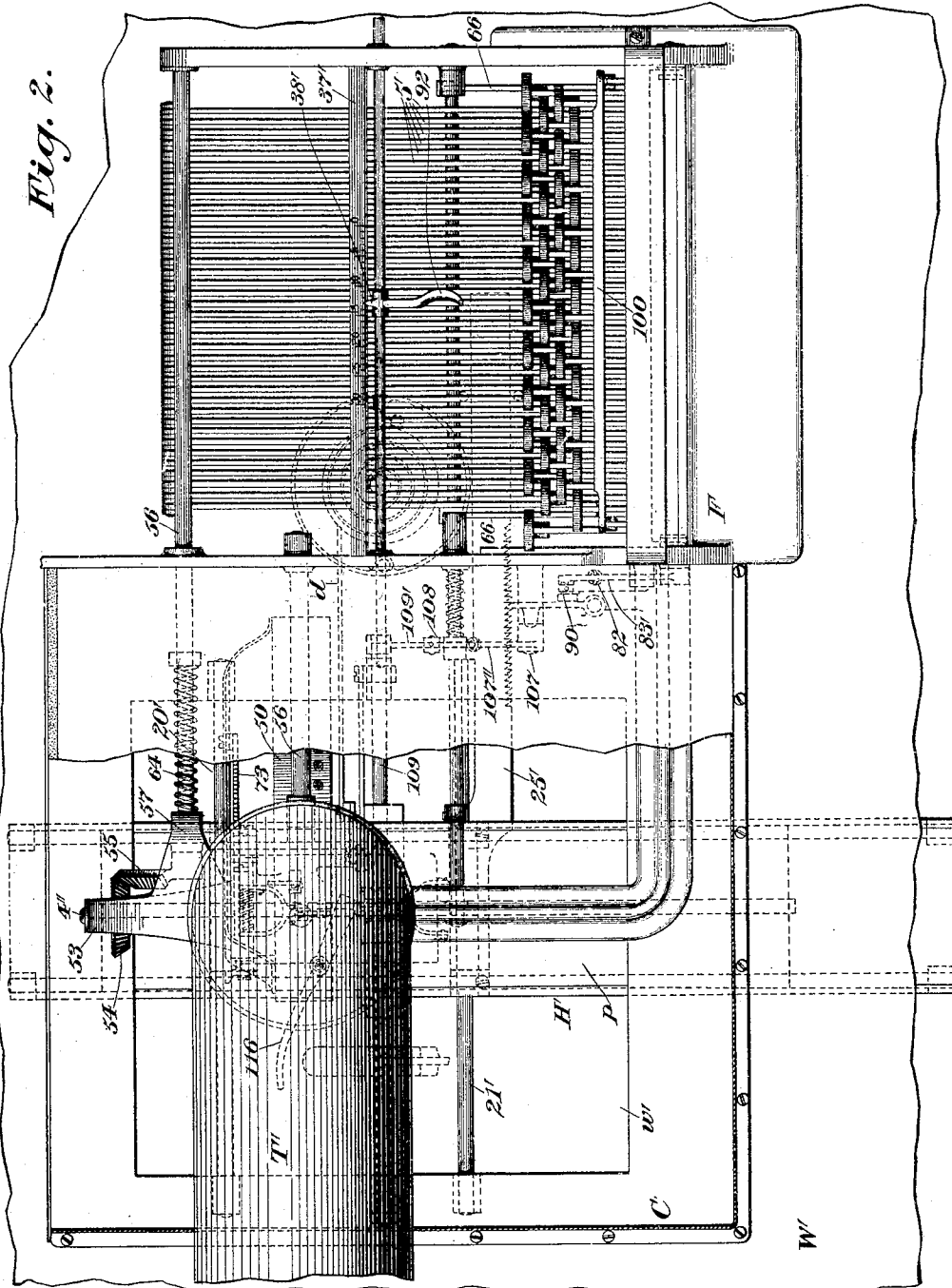
F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(No Model.)

(Application filed May 7, 1898.)

9 Sheets—Sheet 2.

Fig. 2.



Witnesses:

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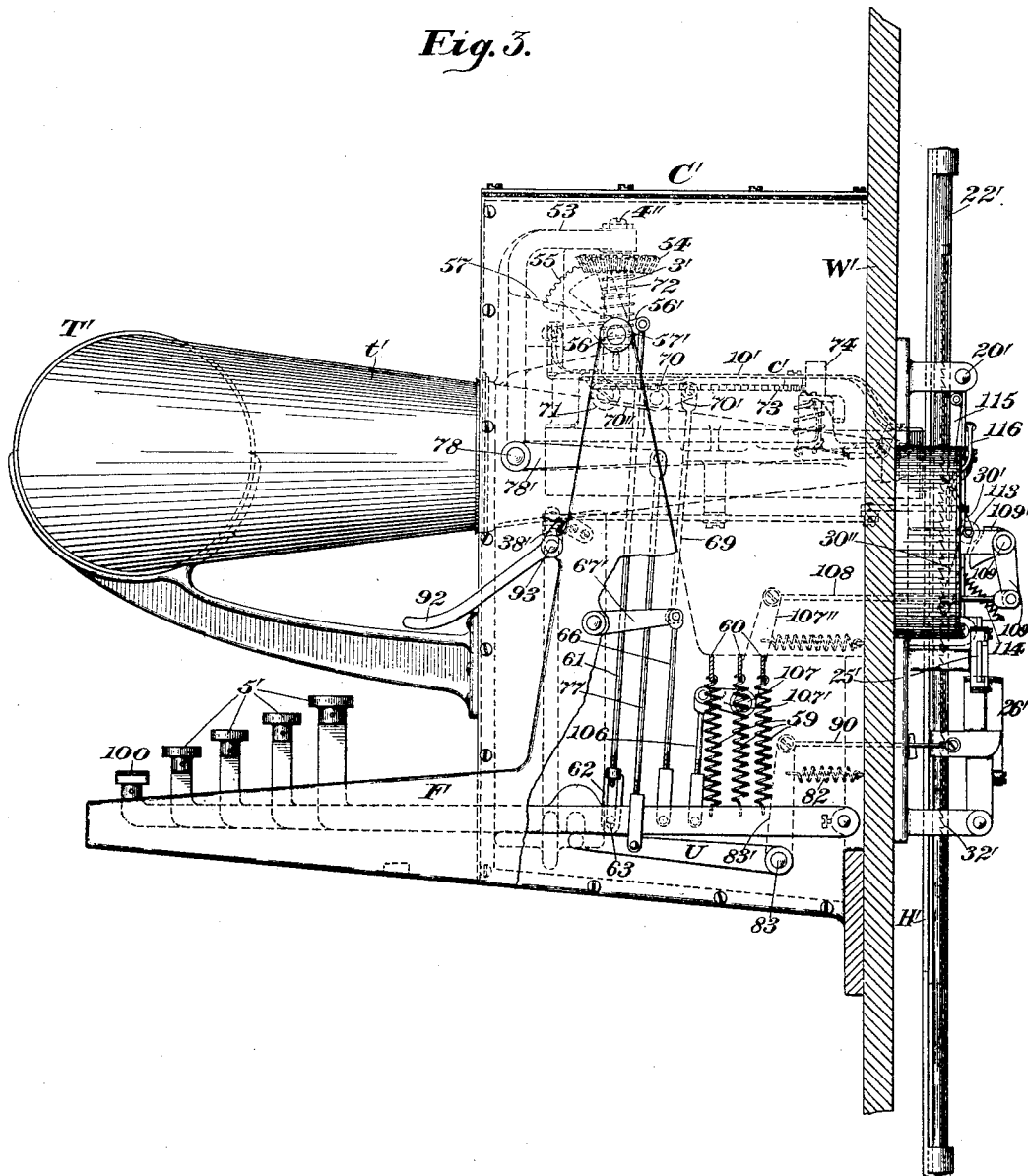
F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(No Model.)

(Application filed May 7, 1898.)

9 Sheets—Sheet 3.

Fig. 3.



Witnesses.

A. B. Grattlingly
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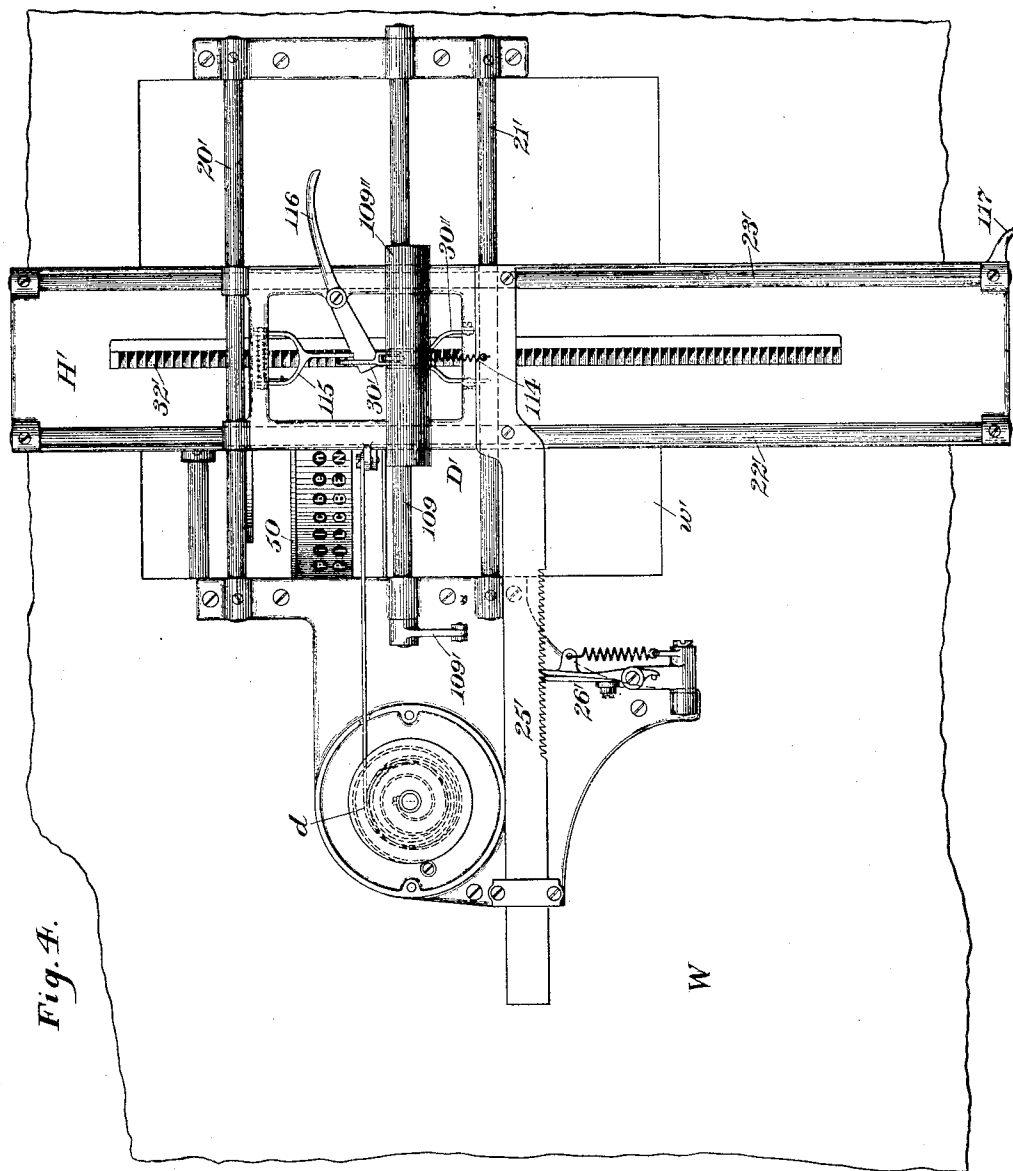
Patented Oct. 31, 1899.

F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(Application filed May 7, 1896.)

(No Model.)

9 Sheets—Sheet 4.



Witnesses.

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No. 636,062.

Patented Oct. 31, 1899.

F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(No Model.)

(Application filed May 7, 1898.)

9 Sheets—Sheet 5.

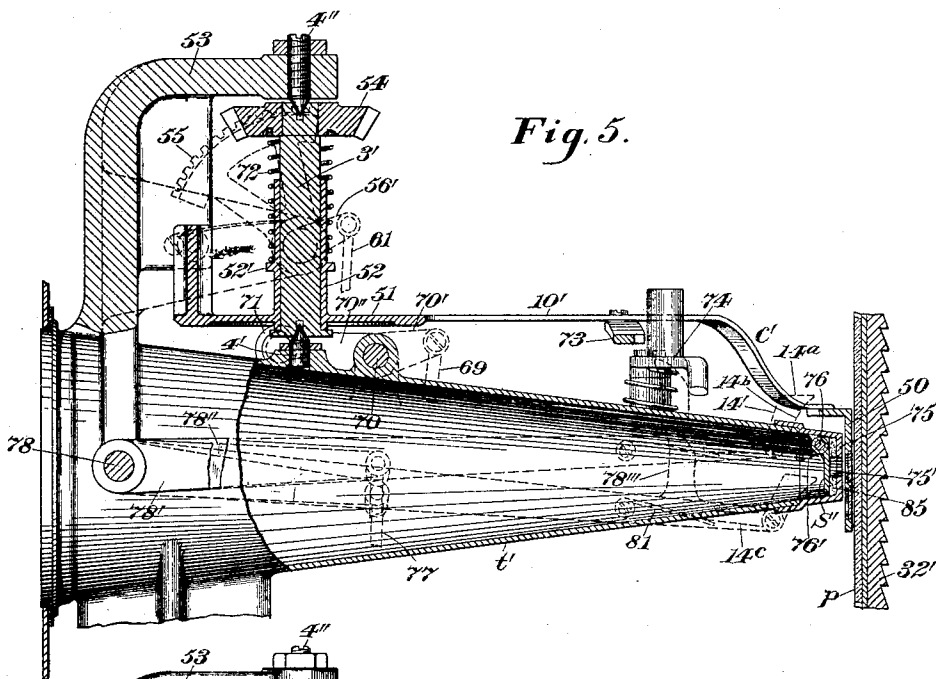


Fig. 5.

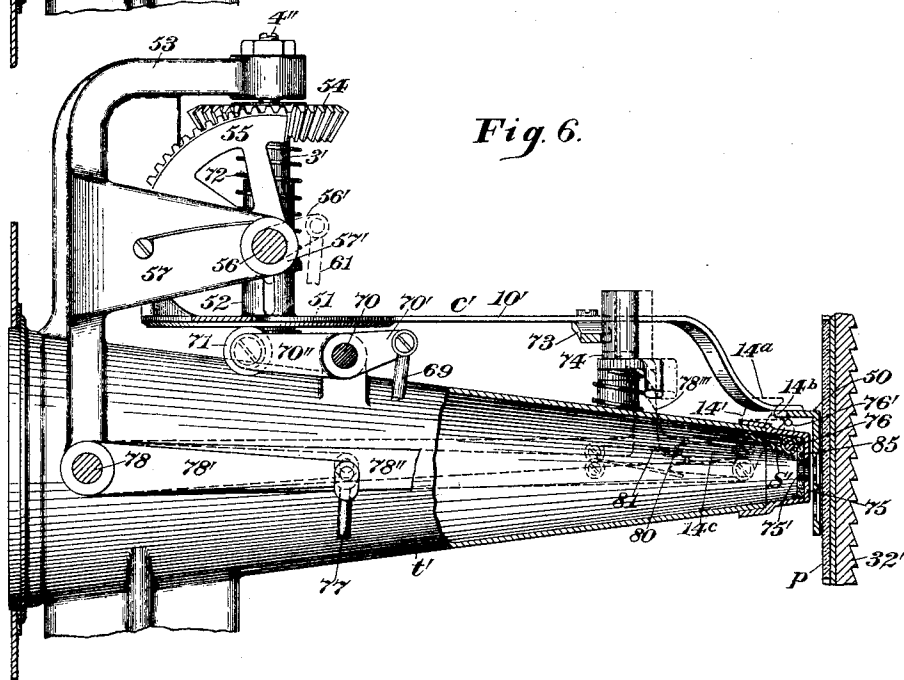


Fig. 6.

Witnesses.

A. B. Mattingly
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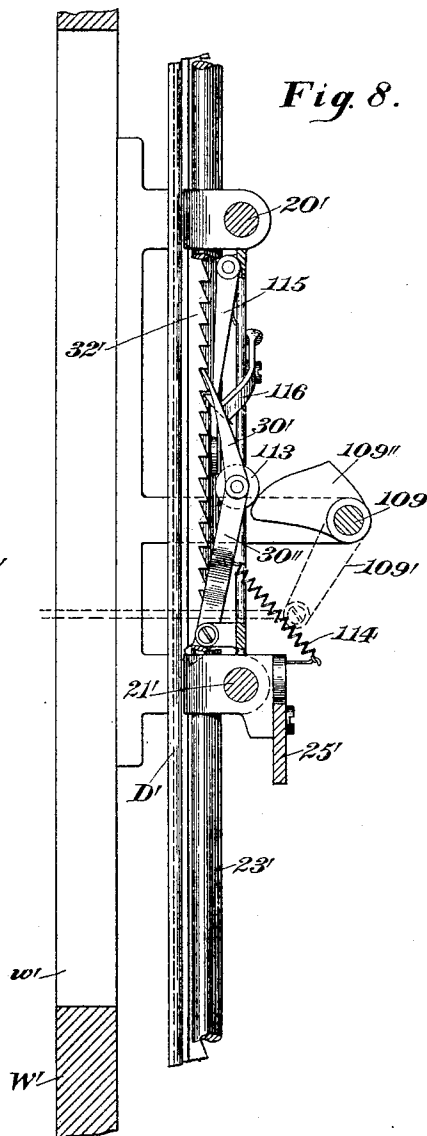
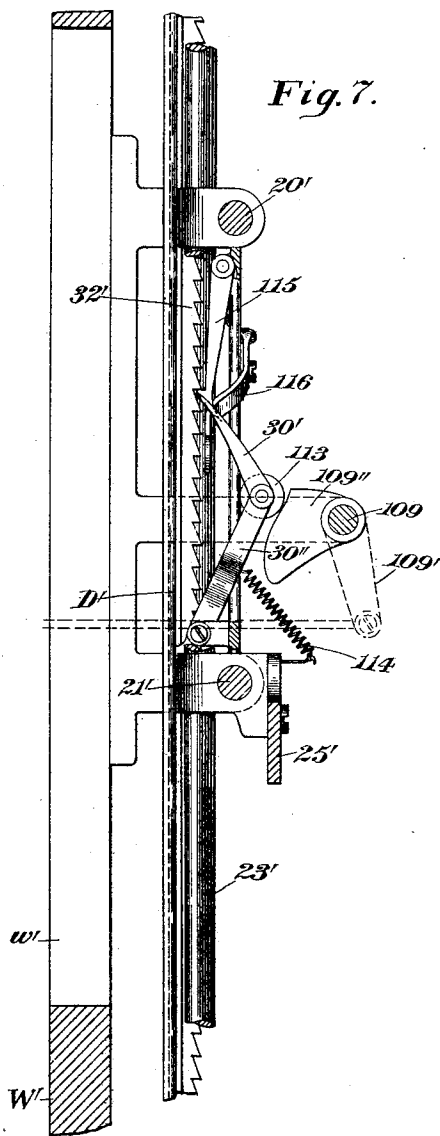
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IMAGE FORMING MECHANISM.

(No Model.)

(Application filed May 7, 1898.)

9 Sheets—Sheet 6.



Witnesses.

A. B. Mattingly
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No. 636,062.

Patented Oct. 31, 1899.

F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(Application filed May 7, 1898.)

(No Model.)

9 Sheets—Sheet 7.

Fig. 9.

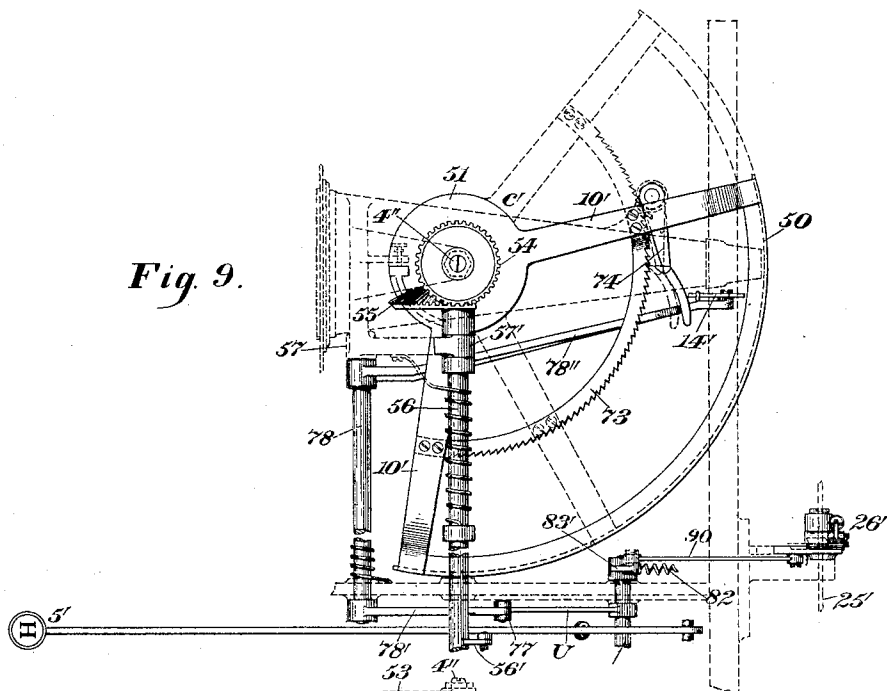


Fig. 10.

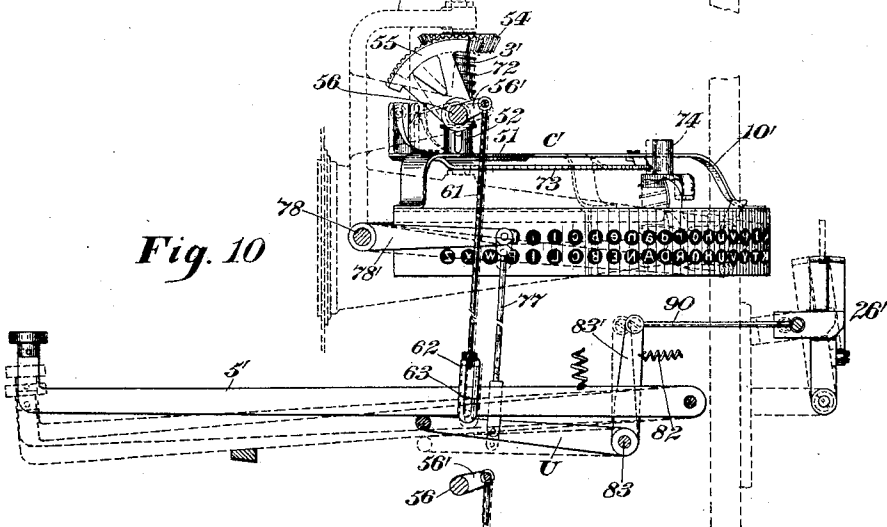
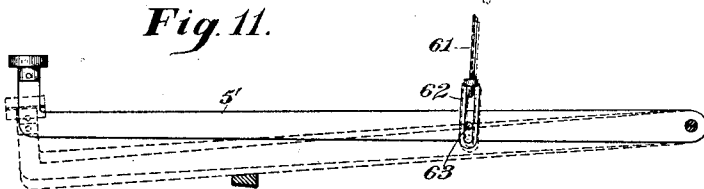


Fig. 11.



Inventor.

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Witnesses.

A. B. Mattingly
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F. H. RICHARDS.
IMAGE FORMING MECHANISM.

(No Model.)

(Application filed May 7, 1898.)

9 Sheets—Sheet 8.

Fig. 12.

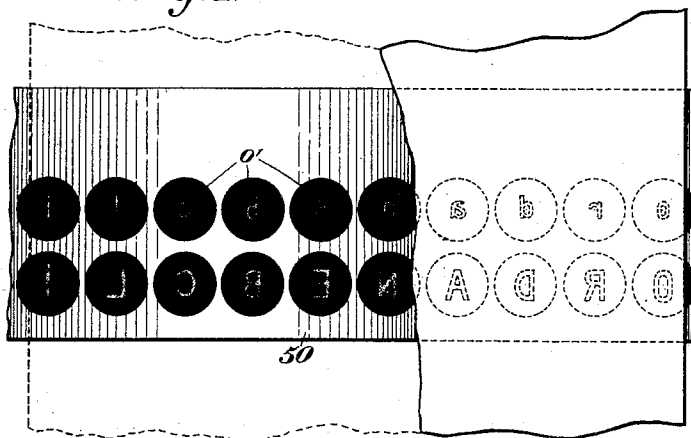


Fig. 13.

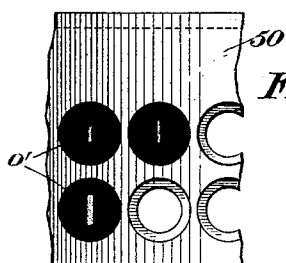
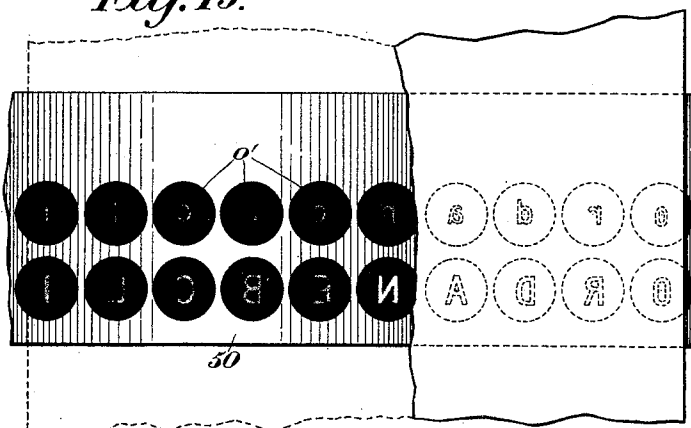


Fig. 14.

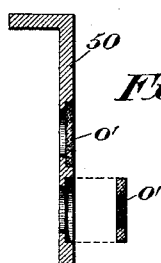


Fig. 15.

Witnesses;

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Patented Oct. 31, 1899.

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9 Sheets—Sheet 9.

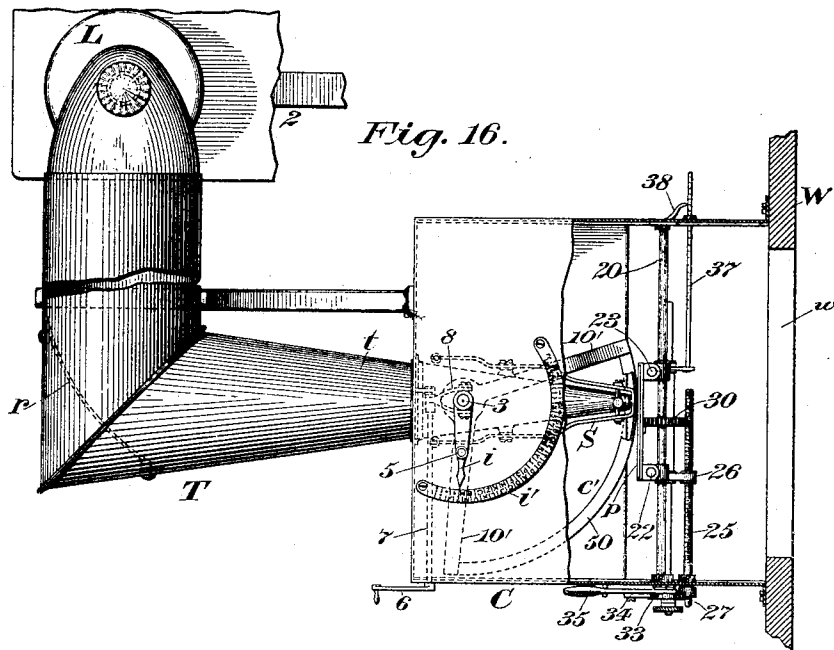
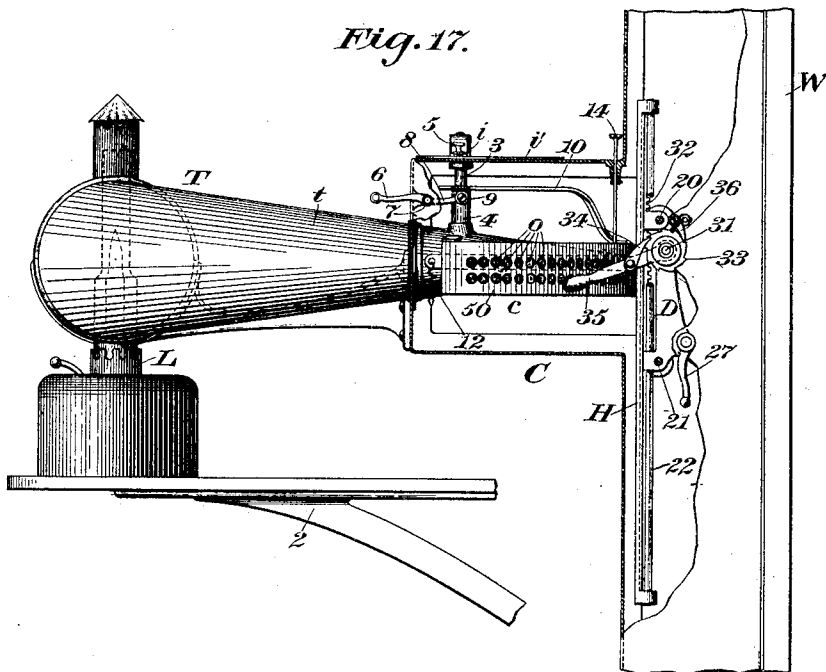


Fig. 17.



Witnesses:

A. B. Mattingly.
J. L. Edwards Jr.

Inventor:

F. H. Richards.

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT.

IMAGE-FORMING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 636,062, dated October 31, 1899.

Application filed May 7, 1898. Serial No. 680,079. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Image-Forming Mechanism, of which the following is a specification.

This invention relates to an image-forming mechanism, and more particularly to a photoprinting mechanism for projecting images onto a suitable receiving medium and especially onto a sensitized plate or film, which may be developed afterward in any suitable or usual manner.

In the art of mechanical composition as heretofore practiced many methods have been employed for selectively setting up by machinery type-matter or its equivalent to be printed afterward, either directly from the type, linotypes, or other devices set up by the machine or from stereotype or similar plates formed from such set-up matter; but in all of these, so far as I am aware, the reproduction of printed matter from mechanically-composed matter has been effected through the medium of such type, linotypes, or analogous devices, and no attempt has been made to apply mechanical composition directly to the art of photoprinting without the aid of photography; and it is the object of this invention to compose mechanically photoprinted as distinguished from photographed matter adapted for the production of printed impressions in a manner analogous to mechanical composition by type-setting, linotyping, and similar methods.

The chief object of this invention is to provide a mechanism by means of which objects may be successively or selectively brought to a working position between a source of light and an image-receiving medium and images thereof projected successively or selectively onto the receiving or sensitized medium in such a manner as to produce either a transitory image on a screen or other non-recording medium or a permanent record upon a sensitized plate or film, it being understood that the principal feature which distinguishes this invention from photoprinting and photographic apparatus heretofore used is the employment in a suitable apparatus or machine

of means controlled by the operation of such apparatus or machine for locating in a working position between the light and an image-receiving medium one or more of a plurality or multiplicity of objects to the exclusion of the other or others.

So far as I am aware no image-forming or photoprinting mechanism has been devised heretofore in which by the operation of the mechanism image-forming objects could be brought successively or selectively into working position at one side of a source of light and the images thereof projected successively or selectively onto a suitable receiving or sensitized medium at that side of the light opposite the positioned object, and hence I consider within the scope of my invention any mechanism or apparatus of this type in which by the operation of the mechanism image-forming objects may be selectively brought into position for use and the images thereof projected onto a suitable receiving or printing medium, between which and the light the object is positioned.

The most important practical use of a mechanism capable of operation in the manner hereinbefore described is for locating and printing selectively on a sensitized medium the images of the characters ordinarily employed in typographic composition, and the mechanism in which this invention is embodied will preferably be one having a plurality of characters—such as the usual letters, numbers, and other devices common to typography—all of which may be represented by objects or negatives through or around which light may pass to project upon the sensitized surface of the image-recording medium the images of such objects, either singly as they may be selected and brought to working position or in groups of any desired number. Usually these objects or negatives representing the characters referred to will form part of the operating devices of the apparatus, and such objects will ordinarily be brought to a working position one after another and the image of each projected and recorded upon the sensitized receiving medium as soon as the object is positioned, such object being shifted out of the way when it is photoprinted in order to permit the location of the next succeeding selected object or negative.

For the purpose of selecting readily the objects or negatives corresponding to the various characters to be printed or projected it is desirable to embody these parts in a key-operated machine having a keyboard analogous to that of a type-writer or similar mechanism, and hence in the preferred construction illustrated herein I have represented a key-operated image-forming or photoprinting machine the keys of which may control the several image-forming characters either singly or in groups, as may be desired. In this instance the mechanism is of the "double-case" type—that is to say, a single character-key corresponds to a pair of characters, one of which may be the upper-case and the other the lower-case one, as in writing-machines of the "Remington" type.

In photoprinting-machines of the ordinary construction the object to be printed is so disposed relatively to the light as to constitute a negative, and hence the image photoprinted on the prepared surface is also a negative. This feature of the ordinary photoprinting-machine is retained in the mechanism illustrated herein, and each object or character intended to serve as a means for projecting an image onto the receiving medium or sensitized surface is so formed or located as to constitute a negative capable of projecting a negative image onto the receiving medium, and thus form a negative photoprint in the sensitized medium, from which when properly developed or treated a positive may be obtained substantially in the same manner that positive prints are made from lithographic stones, zincographic plates, &c. Hence by the manipulation of the keys of a suitable keyboard in substantially the same manner that an ordinary type-writer is operated the matter to be photoprinted may be set up or composed letter by letter, and hence word by word, by the striking of the selected keys and characters photoprinted on the sensitized medium one by one or group by group in proper order and spaced in such a manner as may be determined by the operation of the mechanism for shifting one or more of the main three cooperating parts—viz., the negative, the sensitized medium, and a suitable image-governing light-controller—relatively to the other or others to permit the photoprinting of successive characters at successive points on the sensitized medium.

As it is of the utmost importance that light shall be excluded from all parts of the sensitized photoprinting-surface, except that which is to receive the image of a properly-located character or negative, some suitable light-controlling means must be employed for shutting out the light from the sensitized surface except at the time when the image of a character or negative is to be photoprinted. Any suitable image-governing light-controller may be employed for this purpose, but I prefer to make use of a shutter substantially similar to the shutters of photographic cam-

eras and controlling an inclosed space forming substantially a camera obscura, in which the image-forming object or negative may be located and properly focused before the shutter is operated to admit the light and print the exposed portion of the receiving-surface. It is to be understood, however, that the terms "light-controlling means" and "light-controller" are generic and are intended to include within their scope both a means for controlling the use of natural or an artificial light, and also any means for controlling the production and use of an artificial light, it being obvious that whether a natural or other substantially constant light is shut off intermittently or an artificial light is actually produced or turned on intermittently is immaterial.

I deem it advantageous to inclose the whole sensitized plate or film in a darkened chamber and to admit light past the shutter and confine the light-beam to the area of the object exposed at each operation of photoprinting a single character or group of characters on such surface. The light by which the photoprinting is effected may be derived from any suitable source and will usually be directed through an inclosed space confined, preferably, by a substantially funnel-shaped light-director constituting a camera lucida, separated from the camera obscura by the light-controller or shutter. It is to be understood, however, that while in the machine illustrated herein the objects to be photoprinted are so formed or located as to constitute negatives with respect to the source of light, and hence project images onto the sensitized medium which will be reproduced in the latter as negatives, my invention is embodied in any mechanism in which the image of a selected object can be projected by a source of light at one side of such object and photoprinted either as a negative or as a positive on a sensitized receiving medium controlled by the action of such mechanism and located at the other side of the selected positioned object.

I consider within the scope of my invention any mechanism in which the movements of image-forming objects are governed by object-selecting means of any kind, whether the objects are selected individually or in groups, and in which the projection of the images of such objects is determined by means of an image-governing light-controller or light-controlling medium between which and the receiving medium the objects are located; but as a mechanism embodying these elements alone is only operative for projecting object-delineating images onto a receiving medium, such as a screen, the combination does not constitute a complete photoprinting-machine, as in the latter a sensitized image-receiving medium must be supported to cooperate with the elements previously mentioned.

All of these features of my invention and many others which have not been described

hereinbefore in detail, but which will be set forth fully hereinafter, are shown in the drawings accompanying and forming part of this specification, in which—

5 Figure 1 is a plan, partly in section, of an image-forming or photoprinting mechanism, illustrating the preferred embodiment of my invention. Fig. 2 is a front elevation of the same with a portion of the casing removed.
 10 Fig. 3 is a side elevation of the same, also with parts broken away. Fig. 4 is a rear elevation illustrating the carriage and the holder for the sensitized image-receiving medium or plate. Figs. 5 and 6 are enlarged sectional
 15 side elevations of the shutter-actuating devices and other principal details and illustrate the operating parts in different positions. Figs. 7 and 8 are enlarged sectional
 20 side elevations of the line-spacing mechanism for shifting the plane vertically, these views illustrating the parts in different working positions. Fig. 9 is a plan of a portion
 25 of the mechanism, illustrating in detail the operation of the object-selecting means, the feeding mechanism for the plate-holder, and the light-controlling medium. Fig. 10 is a
 30 side elevation of the same, illustrating in full and dotted lines the effective and ineffective strokes of one of the keys and also the move-
 35 ments of the devices controlled thereby. Fig. 11 is a detail illustrating the effective and ineffective strokes of a different key having a shorter effective stroke than the key illus-
 40 trated in Fig. 10. Fig. 12 is an enlarged detail illustrating a group of negatives or characters and a portion of the carrier on which
 45 they are mounted as they appear when the shutter is closed. Fig. 13 is a similar view illustrating the appearance of one of the neg-
 50 atives when the shutter is open and the light shines through such negative. Figs. 14 and 15 are details in elevation and section, re-
 55 spectively, of a portion of the carrier with the negatives mounted thereon and illustrate the manner in which the negatives are sup-
 60 ported. Fig. 16 is a plan, with portions of the casing removed, of a simple image-forming or photoprinting mechanism in which all
 65 of the parts are separately operated by hand instead of being actuated automatically on the depression of the keys, as in the machine shown in the preceding views; and Fig. 17 is a side elevation of the same, also with parts
 70 of the casing removed.

Similar characters designate like parts in all the figures of the drawings.

As hereinbefore stated, my invention is embodied in any mechanism in which suitable image-forming objects may be brought to a
 60 working position by object-selecting means and the projection of the images of these objects onto an image-receiving medium permitted by a proper light-controller, between
 65 which and such receiving medium the objects are positioned.

When the invention is embodied in a photo-
 printing mechanism, I may employ also in

connection with these parts suitable feeding mechanism for a plate or plate-holder, and if it is desired the objects or characters may
 70 be double-case ones, controlled as to their case positions by suitable shifting means. Such a mechanism should also have line-
 spacing mechanism for shifting the image-receiving medium or plate after the line is
 75 finished.

In Figs. 16 and 17 I have illustrated an extremely simple mechanism embodying all of the various devices just referred to in which
 80 the several parts are operable independently of one another by hand. Here the image-forming mechanism is preferably almost completely inclosed within a suitable darkened
 chamber or camera obscura, (designated in a general way by C,) the casing which forms
 85 the sides of this chamber being secured in this case to a support, such as W, which may be a partition or the wall of a room. For the purpose of permitting access to the rear of
 the mechanism this wall may have therein an opening, as illustrated by *w'*, Fig. 16; but it
 90 should be understood, of course, that the portion of the casing C which is in advance of the rear side of the mechanism will so in-
 close the image-receiving sensitized medium or plate as to form a light-tight compartment.

Light may be obtained in any suitable manner—as, for example, from a lamp, such as L, which in this case may be mounted on a
 support or bracket, such as 2, and the light
 100 from the lamp may be directed through a suitable tube to the negative or the negatives the images of which are to be projected or
 photoprinted. This tube may be of any suitable construction, but in this instance is sub-
 105 stantially an elbow-tube of the type indicated by T, and may have a funnel-shaped member, as *t*, the small end of which is adjacent to the image-receiving medium.

A suitable reflector, such as *r*, may be dis-
 110 posed at the elbow in the tube.

The funnel-shaped tube *t* passes through the forward wall of the casing C in the construction illustrated and in connection with
 115 said casing may serve as the means for supporting the several operative devices which constitute the essential elements of the image-forming mechanism. These elements
 have been hereinbefore enumerated, and one of them is in this case a plurality of objects
 120 or characters in the form of negatives supported in the construction shown on a common carrier, which is movable to bring any
 one of the characters thereon into working position. This carrier is designated in a
 125 general way by *c*, and the objects or characters supported thereby are indicated by *o*. These objects or negatives may be of the
 double-case type, and hence as all of them are mounted on a common carrier they are
 130 preferably disposed in two rows located one above the other, and therefore the carrier may be shiftable in such a manner as to bring
 either one of any selected pair of double-case

characters or objects to the proper position for projecting an image of the selected object. In this case the carrier *c* is preferably segmental or arc-shaped and is mounted
 5 for oscillation about a suitable axis, the carrier being capable also of axial movement in order to shift from the upper to the lower case position, and vice versa. Here the carrier *c* is secured to a spindle or pin 3, supported by a step-bearing 4, which may rise
 10 from the tube *l*, the upper end of said spindle passing in this case through the upper side of the casing *C* and having fixed to its upper end a pointer or indicator *i*, which
 15 may be brought opposite any character on an arc-shaped indicating-scale *i'*, preferably secured to the upper side of the casing. When this pointer *i* is swung around, the carrier *c* will move with it, and the position of any
 20 character at the end of the funnel-shaped tube *l* will be determined by bringing the indicator *i* opposite the corresponding character on the scale *i'*, a suitable handle, such as 5, being provided usually for operating the indicating-arm.

In order to determine which one of a pair of double-case characters is to be projected and photoprinted, suitable shifting means should be provided for shifting the carrier *c*
 30 axially. The means indicated herein for this purpose may include a handle 6, secured to a shaft 7, suitably mounted in bearings and having preferably a forked arm 8 secured thereto, with antifriction-rollers 9 at the ends
 35 of the forks in position to engage the under side of the member 10 of the carrier *c* and raise said carrier bodily when the handle or lever 6 is manipulated properly. The normal position of the carrier will usually be the
 40 lower-case one, as indicated in Fig. 17, and when shifted to the upper-case position it will preferably be reactive to such normal position, the weight of the carrier being sufficient to return it.

After a character has been located in its working position and it has been determined by means of the devices just described which case character is to have its image projected, it becomes necessary to permit light to pass
 50 through or around the negative in accordance with the character of the latter to effect the projection of the image of the letter or other device and the photoprinting thereof.

Any suitable means may be employed for
 55 controlling the light radiated from the source *L*; but in this construction I have illustrated a substantially U-shaped frame, such as *S*, pivoted to opposite sides of the tube *l* for oscillation, the forward end of this frame controlling the small end of the tube and constituting the light-controlling medium or shutter proper. A push-rod, such as 14, may
 60 be secured to the forward end of this frame for depressing the shutter to expose a character or negative to the light, and this light-controller may also be reactive to its normal position, a spring 12 being employed in this

case for returning it quickly when the push-rod 14 is released.

It will be noticed that the effective portion
 70 of the light-controller, and therefore the light-controller proper, is located between the end of the light-directing tube *l* and a character the image of which is to be projected and
 75 printed and that both the light-controller and the character are between the tube and the image-receiving medium or sensitized plate.

The image-receiving medium will be usually a sensitized plate or film, and this sensitized medium and the other parts just described
 80 will be so supported and operable relatively to one another that characters may be photoprinted successively on different or successive portions of the sensitized surface. Preferably this image-receiving or photoprinting
 85 medium will be shiftable relatively to the other parts of the mechanism and especially relatively to the end of the tube *l*, said sensitized medium being carried ordinarily by a holder capable of being fed intermittently
 90 step by step after each opening of the shutter in order to bring successive points in the same line across the plate into printing position successively.

After a line has been finished on the receiving medium or plate by the printing of
 95 successive characters in this manner such receiving medium should be shifted to bring a new line or transverse portion thereof into position to be correspondingly operated upon,
 100 and hence in connection with the feeding mechanism for spacing the characters in a line it is advantageous to employ line-spacing means for shifting the plate or film to
 105 separate the lines of the photoprinted matter from one another.

In the mechanism shown in Figs. 16 and 17 I have illustrated at *H* a holder for a plate or film, this holder being supported in the present case for vertical movement on a carriage
 110 or slide, such as *D*, supported to have a step-by-step feed movement to bring successive portions in the same transverse segment of the sensitized surface into printing position successively. This carriage or slide *D* may
 115 be mounted to slide on a pair of rods 20 and 21, fixedly supported in any suitable manner, and the plate-holder *H* may in turn have one or more guide-rods, such as the pair of parallel rods 22 and 23, disposed at right angles to
 120 the rods 20 and 21 and working in parallel bores in the carriage *D* to permit the plate-holder to shift both vertically and horizontally to space the characters in the lines and to space lines of matter on the sensitized surface. Here I make use of any suitable devices for imparting these two shifting movements to the plate-holder. In this case a
 125 feed-screw 25 passes through a fixed nut 26 on the carriage *D* and has a bearing at one end in one wall of the casing *C*, a suitable
 130 handle, such as 27, being secured to the feed-screw to turn the latter. In this instance it is assumed that the pitch of the screw is such

as to cause the carriage to be fed an interval equal to the distance between two adjacent photoprinted characters when one complete turn is given to the handle 27.

5 For spacing between adjacent lines I may employ any suitable line-spacing means; but in this instance I have illustrated a rack-and-pinion lifting device operated by a pawl and ratchet for raising the plate-holder H the
10 proper height after each line has been photoprinted. A gear or pinion 30 is secured in this construction to a spindle 31, suitably supported in bearings, and meshes with rack-teeth 32, disposed vertically on the plate-holder
15 II. A ratchet-wheel 33 may also be secured to this spindle and intermittently partially rotated by a pawl 34, supported on an operating lever or handle 35, loosely mounted on the spindle 31, a stop-pawl 36 coacting with
20 the ratchet-wheel in the usual manner. When the handle 35 is operated to turn the ratchet-wheel the space of one tooth, the rack will be shifted vertically a distance corresponding to the interval between two lines. It is
25 not absolutely essential that the several operative devices of this hand-operated mechanism should be actuated in any special order or that any timing of the operations should be observed; but it is desirable to
30 bring the selected double-case character opposite the end of the tube *t* and then select whichever case character it is desired to print, after which the shutter may be operated to admit light, and when the shutter is closed
35 again the plate-holder may be fed forward by turning the handle 27, the handle 35 being operated only at the end of a line and after all of the other devices have been actuated.

In connection with the several parts just
40 described I may make use of a scale, such as 37, and a pointer, such as 38, to indicate the position of the carriage or slide D at any time.

In Figs. 1 to 15, inclusive, I have illustrated the preferred embodiment of my invention in
45 a key-operated image-forming or photoprinting machine, in which the operation of the several principal mechanisms or devices is semi-automatic and dependent only upon the striking of the keys. Here each object the
50 image of which is to be projected or photoprinted is controlled by a single key and only one object or negative is brought to working position at any given time, such selected object being shifted out of the way before another
55 is brought into position to be printed. As to this feature of my invention the operation of the object-locating mechanism is substantially similar to that of the type-locating mechanism of an ordinary type-writer, in
60 which the type are brought selectively and successively to a common printing-point, the objects or negatives in this case being brought in a similar manner selectively and successively to a common locus in the path of the
65 ray or beam of light by which the printing of the selected character is to be effected.

Many different types of object selecting

and locating mechanisms might be employed which would embody the essential features of my image-forming or photoprinting machine; 70 but as a simple and effective mechanism for this purpose I may make use of a key-operated carrier, on which may be mounted all of the characters to be used, and this carrier may be shifted in paths of different lengths to 75 bring the selected characters to a printing-point. In the preferred construction this carrier will reciprocate in front of the image-receiving medium and will preferably oscillate about an axis passing through the light- 80 directing tube of the apparatus, said carrier oscillating in different arcs in accordance with the location of the character to be printed. In this case the characters are mounted on a carrier substantially similar to that here- 85 inbefore described with reference to Figs. 16 and 17, and this carrier is designated by *c'*. The construction of this carrier is clearly shown in Figs. 1, 5, and 6, from which it will be seen that an arc-shaped carrying-plate 50 90 is secured to radial arms, such as 10', preferably integral with a disk-shaped member 51, surrounding a sleeve 52, mounted on a short spindle, such as 3', supported for oscillation in any suitable manner—as, for example, by 95 the pivot-pins 4' and 4'', the upper of which may be carried by a bracket 53, rising from a funnel-shaped tube, such as *t*, similar to that hereinbefore described, while the lower pivot is supported by said tube in the con- 100 struction shown.

The carrier *c'* may be oscillated in any suitable manner; but I prefer to secure to the spindle 3' a gear-wheel, such as 54, which may mesh with a gear-segment 55, secured to a 105 long rock-shaft 56, extending in this case from the tube *t'* to the opposite side of the keyboard of the machine (see Fig. 1) and suitably supported in bearings at different points in its length. Two of the bearings for 110 this rock-shaft may be in the opposite ends of the framework supporting the keys, while at its inner end it may be journaled in a bearing 57', forming part of a bracket-arm 57, integral with the main bracket 53. 115

By means of suitable connections between a proper keyboard and the rock-shaft 56 the latter may be oscillated in arcs of different lengths to bring any selected character on the arc-shaped strip 50 in front of the small 120 end of the tube *t'*. In the present case this rock-shaft has a plurality of rock-arms 56' projecting therefrom and connected, respectively, with key-operated members of the mechanism. These key-operated members 125 will be ordinarily key-levers substantially of the type employed in writing-machines and are designated in a general way by 5'. Said key-levers may be supported in any suitable manner—as, for example, by a rod 58 at the 130 rear of the keyboard—and may be held normally in their raised positions by means of springs, such as 59, connected thereto and to the proper one of a series of three cross-bars

60, fixed inside of the framework of the key-board, which frame is designated in a general way by F. The connections between the key-levers 5' and the rock-arms 56' may be of any
 5 suitable type, but are preferably plain connecting-rods, such as 61, (see Fig. 3,) preferably having at their lower ends turnbuckles, such as 62, capable of adjustment in the
 10 usual manner relatively to said connecting-rods. By varying the adjustments of these turnbuckles relatively to the connecting-rods and the key-levers the effective strokes of the levers may be varied, as desired, and the rock-shaft may be oscillated to a greater or less
 15 extent to bring the character controlled by a key into position at the small end of the light-directing tube *t*. This will be obvious by referring more particularly to Figs. 10 and 11, in the former of which one of the key-levers
 20 5' has an ineffective stroke from the full-line position to the intermediate dotted position and an effective stroke from the intermediate to the lower dotted position, while in Fig. 11 it will be seen that the ineffective stroke of
 25 another key 5' from the full-line position to the intermediate dotted position is greater than the corresponding ineffective stroke of the key shown in Fig. 10, and the effective stroke of the key illustrated in Fig. 11, which
 30 is represented by the interval between the two dotted positions of the key-lever, is less than the effective stroke of the corresponding key-lever shown in Fig. 10.

The manner in which the total stroke of
 35 the key-lever when a key is depressed is subdivided into an effective and an ineffective stroke will be obvious by referring to these views and to Fig. 3, and it will be seen that in the construction shown therein each of the
 40 keys operates an actuating-pin, such as 63, which preferably forms part of the corresponding key-lever and is so disposed as to work in the slot or slideway in the turnbuckle, its normal position in such slideway
 45 or slot being of course determined by the adjustment of the turnbuckle on its connecting-rod. Obviously in the normal position of the key-lever there is a considerable space
 50 between such actuating-pin and the lower end wall of the slot in the turnbuckle, and the key-lever when depressed will have a considerable range of ineffective movement before it strikes such end wall and becomes
 55 effective to draw down the turnbuckle and the connecting-rod, while when the actuating-pin is normally nearer to such lower end wall the ineffective stroke will be less and the effective stroke may be greater than in the former instance.

60 Of course it should be understood that the particular details of construction of the connections between the key-levers and the connecting-rods are immaterial so long as such connecting-rods are movable by the key-levers
 65 in paths of different lengths, each corresponding to the area to be traversed by the car-

rier *c'* to properly locate the selected character controlled by the key depressed.

Such a combination of devices as that just described constitutes a differentially-movable
 70 object-selecting mechanism capable of operation in such a manner as to select and locate in the working position at the small end of the tube *t'* any desired character regardless of its position on its supporting-carrier. 75

As it is apparent that the object-carrier should be returned to its normal position after each depression and release of a key that operates it, I prefer to employ some suitable means for rendering the carrier reactive—
 80 such, for example, as a spring 64, coiled around the rock-shaft 56 and in this instance connected at one of its ends to such shaft and at its other end to a fixed portion of the framework, such as the bracket 57. (See Figs. 1, 85 5, and 6.)

Although, of course, a single-case key-operated mechanism could be employed to advantage, I deem it desirable to make use of a double-case mechanism so operable as to
 90 permit the location of either one of any pair of double-case characters in the proper working position, and this double-case mechanism might be of any type suitable for the purpose and capable of shifting one of the main two
 95 image-forming or photoprinting elements—viz., the object and the image receiving medium—relatively to the other in substantially the same manner as the shifting operation is accomplished in type-writing machines. Here, 100 however, I deem it desirable to so shift the carrier on which objects or negatives are mounted as to bring either the upper-case or the lower-case character to a working position common to both of them. Hence in this embodiment
 105 of my invention illustrated in the drawings of this application the oscillatory carrier *c'* is shiftable axially and preferably in a vertical direction on the spindle 3', suitable shifting mechanism being employed for this purpose. 110
 110 As it is customary in key-operated mechanisms to accomplish this shifting movement by means of a shift-key at the side of the keyboard, I have illustrated herein also key-operated devices for this purpose. In
 115 the present case, however, I prefer to provide two shifting-keys or key-levers, one at each side of the keyboard, in order that the operator may effect the shift movement with a finger of either hand, and these two shift-keys
 120 (indicated herein by 65) may be secured to connecting-rods, such as 66, (see Figs. 2 and 3,) which may be secured to rock-arms, such as 67', carried by a rock-shaft 67, journaled in suitable bearings and of substantially the
 125 same length as the rock-shaft 56.

A coiled spring, such as 68, similar to that shown at 64 will be employed for returning the case-keys to their normal positions, which, it will be noticed, is the lower-case one, both
 130 of the case-keys being, as marked in the drawings, "upper-case" ones. (See Fig. 1.) At

its extreme inner end, as shown in said view, this rock-shaft may have another rock-arm 67'', pivoted to a connecting-rod 69, (see Figs. 5 and 6,) connected in turn to a rock-arm 70', secured to a short shaft 70, mounted in bearings on the upper side of the tube *t'* and having a projecting arm or lever 70'', carrying at its end an antifriction-roll 71, working in contact with the under side of the member 10' of the carrier *c'* at a point adjacent to the axis of movement of the latter. Obviously when either one of the upper-case keys 65 is depressed the carrier *c'* will be elevated by the intermediate shifting mechanism to the upper-case position to bring a character in the lower row of the carrier into working position at the small end of the tube *t*.

Any suitable means may be employed for returning the carrier to its normal lower-case position; but in the present instance I may make use of a coiled spring 72, surrounding the sleeve 52 and the spindle 3' and working between the under side of the gear-wheel 54 and a flange 52' on such sleeve.

When a character has been located in its working position, it is desirable to maintain it there, at least momentarily, and prevent movement thereof until its image shall have been projected upon the receiving medium, and hence I deem it necessary to employ some means for positively holding the character in such working position after the character shall have been located by the depression of the proper key. Any suitable means may be employed for this purpose; but in the present construction I employ a pawl-and-ratchet mechanism, one member of which—in this case a ratchet-segment or toothed rack—moves in unison with and is secured to the carrier *c'*, as shown at 73, while the pawl, which may be a spring-pressed one of the type indicated by 74, (see Figs. 1, 9, and 10,) may be a key-operated one controlled by all of the various character-keys. Normally this pawl will tend to hold the carrier in any position in which it may be, and until released it will prevent the return of the carrier to the normal position of the latter. The manner in which this pawl is operated will be described hereinafter in connection with the description of the light-controlling medium with which it coöperates.

In the present case, as in the construction shown in Figs. 16 and 17, light may be directed upon the object or negative from any suitable source through any suitable means—as, for example, an elbow-tube having a reflector *r'* at the elbow and the funnel-shaped tube *t'*, hereinbefore described.

In the construction illustrated the rear end of the tube *t'* is of relatively small diameter and is closed by an end wall 75, having therein a small opening 75', corresponding substantially to the area of the receiving medium which is to be uncovered at a single exposure. Within the tube *t'* I may locate the principal member of the light-controller,

this being in the present case a shutter, which may be of the type indicated herein by *S'*. (See Figs. 1, 5, and 6.) This light-controlling member is preferably a swinging shutter secured to a short rock-shaft, such as 76, journaled in the rear end of the tube *t'*, said rock-shaft having on its outer end a tappet-arm 76' in position to be operated by a suitable actuating device or mechanism, which may also be controlled by the various keys of the keyboard. Any suitable operating connections may be employed between these parts; but I prefer to actuate the shutter from a universal bar—such, for example, as that shown at *U*, (see Figs. 3 and 10,) this being substantially of the usual construction and operated on each depression of a character-key 5'.

In the construction shown a connecting-rod 77 is pivoted at its lower end to the frame of the universal bar and at its upper end to a rock-arm 78', secured to a rock-shaft 78, journaled at its opposite ends in bearings on the inner side of the framework of the keyboard and of the tube *t'*, respectively. (See Fig. 1.) This rock-shaft 78 has a long arm or lever 78'' secured thereto, and in this instance said lever carries at its outer end the member which serves directly as the actuator for the shutter.

In the construction shown the shutter-actuator is of the "by-pass" type and is designated in a general way by 14', (see Figs. 1, 5, and 6,) it being in this case an angle-lever pivoted on the arm 78'' near the extreme end of the latter, the working arm of the actuator having two faces, one of which is substantially horizontal and is indicated by 14^a, while the other is cam-shaped, as will be seen at 14^b, to ride over the coating portion of the tappet-arm 76'. The other arm of the actuator (indicated herein by 14^c) may be limited in its movement in one direction by a stop, such as 80, on the lever-arm 78'', and said arm may also have a spring 81 for returning the by-pass arm 14^c to its normal position when a character-key is depressed.

Normally, of course, the lever-arm 78'' will be held in the uppermost position (shown in Figs. 5 and 6) by some suitable means—as, for instance, a spring 82, connected to a rock-arm 83', secured to a rock-shaft 83, to which the universal bar *U* may be pivoted, the other end of this spring being attached to some part of the framework. (See Fig. 10.)

When a key is depressed, the by-pass face 14^b of the actuator 14' will pass down over the coating end of the tappet-arm 76' and after passing the same will assume the lowermost position. (Shown in dotted lines in Fig. 5.)

When a key is released, the actuator will rise and the working face 14^a thereof will engage the under side of the coating member of the tappet-arm and shift the shutter, as shown in Fig. 6, to open the latter. At the proper point in its upward movement this working face of the actuator will disengage the tappet, and the shutter may be returned

to its closed position by gravity, or it may be positively actuated, if desired.

A perforated disk 85, of felt or other material, may be interposed between the shutter 5 and the end wall 75 of the tube *l'* to prevent the passage of light and also to decrease the noise due to the striking of the shutter when closed.

It will be noticed that the extreme rear end 10 of the tube *l'* may be a cap separate from the body portion, although this is not essential.

It will be apparent from the foregoing description that the operation of the light-controlling medium is governed by the actuation 15 of the character-keys of the keyboard and that the opening of the shutter is dependent upon the proper positioning of an object or negative in the rear of the opening 75', thus rendering it practically impossible for the shutter to open in the ordinary operation of 20 the machine until the character shall have been properly located at the working point. Hence the operation of the shutter mechanism is entirely automatic after a character or 25 negative has been located and is dependent upon and will not occur until the release of the key corresponding to such character.

As hereinbefore stated, it is desirable that the shutter-actuating mechanism and the 30 means for releasing the locking-pawl 74 should cooperate with each other, and in the construction illustrated in the drawings the parts are so organized and the movements thereof are so timed that this holding or locking 35 pawl will be released automatically at the proper moment, but will not be released until the light-controller or shutter shall have closed, as otherwise the image to be photographed on the receiving medium would ordinarily be spoiled by the movement of the 40 negative.

In the present case the releasing means for the carrier-locking device or pawl is preferably an arm 78''', secured to the lever-arm 45 78'' and so positioned and having a working face so shaped as to release the pawl 74 after the shutter shall have been released from its actuator and closed and during the last portion of the upward movement of the lever-arm 50 78'' from the lowermost position to the uppermost one. (Shown in Fig. 6.) Hence the release of the carrier after it has been located properly for the projection of an image is also dependent upon the prior operation of 55 the object selecting and locating means and the opening and closing of the shutter, all in the order named.

While, as before mentioned, the feeding mechanism, by means of which a step-by-step 60 feed movement is obtained for permitting the characters to print successively on successive portions of the sensitized receiving medium, may be of any suitable construction and may impart such movement to any proper one of 65 the several coacting elements of the photoprinting mechanism, yet in the preferred construction it is desirable to shift the image-

receiving or photoprinting medium step by step on the depression of the character-keys. This feeding mechanism may be of any proper 70 type; but I deem it advantageous to make use of a step-by-step rack-and-escapement mechanism somewhat similar to mechanisms of this class embodied in type-writing machines. This feeding mechanism will there- 75 fore be operated to the best advantage from the universal bar hereinbefore described, and hence I have illustrated (see Figs. 3, 4, 9, and 10) a connecting-rod 90, pivoted to the upper end of the rock-arm 83' and also connected to an oscillatory escapement device, 80 such as 26', embodying a pair of dogs of well-known construction, one fixed and the other preferably movable, which dogs cooperate with ratchet-teeth of a rack, such as 25', forming part of or secured to a carriage or slide, (designated in a general way by 85 *D'*), on which carriage a holder for a plate, film, or other image-receiving medium is supported for movement relatively to the carriage and is designated in a general way by 90 *H'*. This carriage and also the plate-holder may be supported in substantially the same manner as has been hereinbefore described with reference to Figs. 16 and 17—that is to 95 say, the carriage may be supported for horizontal movement on a pair of horizontal guide-rods, such as 20' and 21', and the plate-holder may be guided in a vertical direction by a pair of vertical guide-rods, such as 22' 100 and 23', passing through parallel vertical bores in the carriage *D'*. The two guide-rods 20' and 21' are secured in a suitable manner to a fixed member or members at the rear of the machine, (see Fig. 4,) while the rods 22' 105 and 23' may be secured firmly to the body of the plate-holder *H'*. The supports on which the plate-holding devices are carried may be secured to the rear side of a suitable partition or wall, such as *W'*, while the keyboard 110 and the major portion of the casing *C'*, in which the parts should be inclosed, will be located at the forward side of such partition or wall.

As the machine shown in the drawings is designed especially as a photoprinting mechanism for producing a photoprinted negative on a sensitized surface, the direction of feed of the carriage *D'* is the reverse of that which takes place ordinarily in type-writing machines—that is to say, the movement of the carriage, 120 with its plate-holder in this case, will be step by step from left to right. In Fig. 4 the manner in which this feed movement is obtained is shown clearly. Here the carriage may be 125 normally under tension from any suitable source of power, which in this case may include a coiled spring and a driving-band of the usual type, (indicated in a general way by *L'*.) As the construction and operation of this driving mechanism are well known and are clearly shown in this view and in Fig. 1, a detailed description thereof is deemed unnecessary. As the several character-keys 130

are struck it will be apparent that the carriage D' will be fed step by step from left to right until it reaches a predetermined point, when the line-spacing mechanism may be operated to bring another and unexposed transverse portion of the plate into position.

In order to determine the points at which any line shall begin and end, a scale, such as that shown at 37', may be fixed on the forward side of the framework of the keyboard behind the keys, and with this a pointer or indicator 38', secured to a handle or reversing-arm, such as 92, fixed on a sliding rod, may cooperate. The sliding rod carrying this reversing arm or handle is indicated by 93, (see Figs. 1 and 3,) and may be suitably supported by the framework F', so as to reciprocate step by step as the carriage D' travels and so as to be operable also to return said carriage to a zero or other point. The connections between this slide-rod 93 and the carriage D' may be of any suitable type, but in this case include a link 94, connected to one end of a lever 95, pivoted substantially centrally at any fixed point, as the under side of the tube t', and pivotally connected at its other end with a link 96, which may be directly connected to a fixed arm, such as 97, projecting from the frame of the carriage.

It will be observed that the step-by-step movement of the indicator will be in the opposite direction to that of the carriage, and hence the scale 91 may be read in the usual direction.

By means of the handle 92, which is conveniently located for manipulation by the operator, the carriage D' may be shifted readily in a horizontal direction from one position to any other in which it may be desired to locate the plate.

In connection with the devices hereinbefore referred to I make use of suitable means for spacing between words and also between the lines of the matter to be photoprinted. To space between the words, I may make use of the usual form of space-bar, such as that shown at 100, and this may operate the universal bar U directly, and hence only those parts of the mechanism controlled by said bar, it being only necessary to operate the feed mechanism from such space-bar.

The line-spacing mechanism for spacing between the lines on the plate will preferably be controlled by a key separate from and independent of the character-keys, as are the two case-keys shown. In Fig. 1 this line-spacing key is designated by the word "Liner" and controls a key-lever 105, connected to a short rod 106, pivoted at its upper end to a rock-arm 107', secured to a short rock-shaft 107, having another rock-arm 107'', from which extends in this instance a long connecting-rod 108, which, passing through the wall W', is connected at its rear end to a rock-arm 109', secured to a shaft 109, suitably journaled in bearings at the rear of the machine.

(See Figs. 1, 3, 4, 7, and 8.) This cam-shaft may embody a cam the length of which will be at least as great as that of the maximum movement of the carriage D'. This cam is designated by 109'' and is clearly shown in Figs. 4, 7, and 8. It cooperates in this instance with a toggle the two members of which are designated by 30' and 30'' and both of which are yoke-shaped in such a manner as to support at the knuckle of the toggle an antifriction-roller 113, which coacts with the working face of the cam 109''. The lower member of the toggle is pivoted to the framework and may be normally held in the position shown in Fig. 7 by a spring, such as 114, while the upper member 30' is so shaped at its working end as to constitute a pawl, which may coact with a rack 32', forming part of the plate-holder H', and having ratchet-teeth inclined, so as to permit lifting of the rack by the pawl 30'. On each depression of the key-lever 105 the cam 109'' will be shifted from the position shown in Fig. 7 to that illustrated in Fig. 8 and the toggle straightened to lift the rack, and consequently the plate-holder H', a distance corresponding to one tooth of the rack. In order to maintain the rack, and therefore the plate-holder, in the new position, a spring-pressed holding-pawl, such as 115, may be employed.

The plate-holder H' is intended to be capable of sliding freely in a vertical direction when the rack is not engaged by the pawls, and hence it will be obvious that when the latter are released from engagement with the ratchet-teeth the weight of the plate-holder will be sufficient to cause it to drop. This function of the plate-holder may be employed to advantage as a means for bringing the latter into position for removing a completed plate therefrom and inserting a new one, and for the purpose of releasing the pawls 30' and 115 from engagement with such ratchet-teeth I may employ a simple releasing-lever, such as 116, which when depressed will throw both of the pawls out of engagement with the rack and permit the descent of the plate-holder. At its lower end the plate-holder may have a small thumb-piece, such as 117, for facilitating the positioning of the latter.

The manner in which the image-receiving medium, which when the mechanism is used as a photoprinting-machine may be either a plate, film, or other similar article, is supported is immaterial; but in the construction shown a sensitized photoprinting-plate, such as p, (see Fig. 1,) is supported in a dove-tailed channel in the forward face of the plate-holder H' and securely held therein.

In Figs. 12 to 15, inclusive, I have illustrated, on an enlarged scale and in detail, the construction of the preferred objects or negatives for use with my photoprinting mechanism. Here these objects or negatives, which are indicated by o', are represented by disks having opaque surfaces, except at that portion of each containing the device or charac-

ter to be projected or printed on the image-receiving medium or sensitized surface. The light directed through the tube *t'* and through the opening 75' is intended to shine through only that portion of the disk or object covered by the character or letter, and no light will pass through the opaque portion of such object or negative. Hence an exact and perfect image of the character or device will be projected upon the receiving medium and photoprinted on the latter if such medium is a sensitized surface from all other areas of which light is excluded, as should be the case. The appearance of one of these characters ordinarily when the shutter is closed is shown in Fig. 12, while the same character—viz., the letter *n*—is indicated in Fig. 13 by a white outline to represent how the character appears when the light is shining through it to project the image thereof. In Figs. 14 and 15 the manner in which these objects or negatives *o'* are set into the arc-shaped strip 50 of the carrier is clearly illustrated, this strip having therein the construction shown openings close together of the same contour as the objects. These objects or negatives may be held in place in any suitable manner, preferably by cement, and may be of any proper material, such as glass, having a developed film of collodion or other sensitive substance thereon, the opaque portions representing the exposed portion of the film and the character the unexposed portion.

The operation of the photoprinting-machine shown in Figs. 1 to 15, inclusive, will be clearly understood from the foregoing description, and it is only necessary at this point to set forth in a general way the successive stages of the operation.

It being understood that a plate has been properly positioned in the plate-holder at the zero or other point indicated on the scale, the character-keys will be struck one after another by the operator in the same manner as the keys of a type-writer to form words or other combinations of devices from successively-selected characters, the depression of a character-key effecting the oscillation of the carrier *c'* to the proper point for bringing the character controlled by such key into working position. Thereupon the carrier will be locked in place by the pawl 74, and on the release of the key the light-controller or shutter will be opened momentarily and light will shine through the character on the negative onto the sensitized plate and photoprint thereon a negative of such character. As soon as the shutter is closed, which will be practically instantaneously, the pawl 74 will be released by the arm 78^{'''} and the character *c'* will return to its normal position. Of course if the character struck should be an upper-case one one of the upper-case keys would be depressed and held down until the completion of the printing. On the rising of the character-key to its normal position the feed mechanism permits the carriage *D'* to

advance to the right a space equal to the length of one tooth on the rack 25', and thus the exposed portion of the plate *p* is shifted out of the path of the light-beam and a new unexposed area is brought to the printing position. As soon as a word or other combination of characters has been completed the space-key 100 will be struck in the usual manner to feed the carriage a step independently of the operation of a character-key, and no shifting of the carrier *c'* will take place at this time.

On the completion of a line of photoprinted matter on the plate the line-spacing key will be depressed and the plate-holder will be lifted to bring another transverse portion of the plate to the printing-line.

Either before or after the depression of the line-spacing key the reversing-lever 92 may be operated to return the carriage to the beginning of the new line or to any other predetermined point.

A machine constructed in accordance with my invention as hereinbefore described is not only capable of projecting the images of objects of different sorts, but also when used in connection with a sensitized image-receiving medium is capable of operation for setting up selectively typographic matter either for newspaper or book work, and the plates or films on which the matter is set up constitute when properly developed by the ordinary methods a perfect substitute for the plates usually printed by the indirect processes.

Having described my invention, I claim—

1. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; and object-selecting means.

2. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; and object selecting and locating means.

3. In an image-forming mechanism, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; and key-controlled object-selecting mechanism.

4. In an image-forming mechanism, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; and key-controlled object selecting and locating mechanism.

5. In an image-forming mechanism, the combination, with a key-controlled image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; and object-selecting means.

6. In an image-forming mechanism, the combination, with a key-controlled image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium, and key-controlled object-selecting mechanism.

7. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with image-forming objects each constructed to permit the passage of light for projecting an object-delineating image, of object-selecting means.

8. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with image-forming objects each constructed to permit the passage of light when placed in the path of a light-beam, and to modify the cross-sectional area and configuration of such light-beam for projecting a corresponding object-delineating image, of object-selecting means.

9. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with translucent image-forming objects each constructed to permit the passage of light therethrough for projecting an object-delineating image, of object-selecting means.

10. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects each locatable in working position between the light-controller and the image-receiving medium and substantially in juxtaposition with the latter, and object-selecting means.

11. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects, and object selecting and locating means for locating said objects selectively at a working point between the light-controller and the image-receiving medium and substantially in juxtaposition with the latter.

12. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with translucent image-forming objects, of object-selecting means, and an image-governing light-controller.

13. In an image-forming mechanism controlled in its operation by object-selecting means, the combination, with an object-locating medium, an image-governing light-controlling medium, and an image-receiving me-

dium, one of which media is shiftable relatively to the others after each projection of an image, of image-forming objects locatable in working position between the light-controller and image-receiving medium.

14. In an image-forming mechanism, the combination, with an object-locating medium, an image-governing light-controlling medium, and an image-receiving medium, two of which media are shiftable relatively to the others after each projection of an image, of image-forming objects locatable in working position between the light-controlling and image-receiving media.

15. In an image-forming mechanism, the combination, with an object-locating medium, an image-governing light-controlling medium, and an image-receiving medium, all of which media are shiftable after each projection of an image, of image-forming objects locatable in working position between the light-controlling and image-receiving media.

16. In an image-forming mechanism, the combination, with an image-governing light-controlling medium, an image-receiving medium, and an object-locating medium shiftable relatively to the other media after each projection of an image, of image-forming objects locatable in working position between the light-controlling and image-receiving media.

17. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the image-receiving medium, of an image-governing light-controller; a holder for a sensitized image-receiving medium; and means for shifting one of said elements after each projection of an image.

18. In an image-forming mechanism, the combination, with image-forming objects, each locatable in working position between the light-controller and the image-receiving medium, of object-selecting means; an image-governing light-controller; and a holder for a sensitized image-receiving medium.

19. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sensitized image-receiving medium; and means for shifting said holder after each projection of an image.

20. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sensitized image-receiving medium; and a step-by-step feeding mechanism for shifting said holder after each projection of an image.

21. In a photoprinting mechanism, the combination, with an image-forming negative locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sen-

sitized printing medium; and means for shifting one of said elements after each projection of an image.

22. In a photoprinting mechanism controlled in its operation by negative-selecting means, the combination, with image-forming negatives each locatable in working position between the light-controller and the holder, of negative-selecting means; an image-governing light-controller; and a holder for a sensitized printing medium.

23. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sensitized image-receiving medium; and means for feeding said holder in different directions.

24. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sensitized image-receiving medium; and means for feeding said holder in directions transverse relatively to each other.

25. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the holder, of an image-governing light-controller; a holder for a sensitized image-receiving medium; feeding means operable for shifting said holder after each projection of an image; and line-spacing means for said image-receiving medium.

26. In an image-forming mechanism, the combination, with an object-locating medium, of an image-governing light-controlling medium; a movement-controlling device common to said media; an image-receiving medium; and an image-forming object locatable in working position between the light-controlling and image-receiving media.

27. In an image-forming mechanism, the combination, with an object-locating medium, of an image-governing light-controlling medium; a key controlling the operation of said media; an image-receiving medium; and an image-forming object locatable in working position between the light-controlling and image-receiving media.

28. In an image-forming mechanism, the combination, with an object-locating medium, of an image-governing light-controlling medium; a shiftable image-receiving medium; a key controlling the operation of all of said media; and an image-forming object locatable in working position between the light-controlling and image-receiving media.

29. In an image-forming mechanism, the combination, with an object-locating medium, of an image-governing light-controlling medium; a shiftable image-receiving medium; feeding mechanism for the image-receiving medium; a key controlling the operation of the object-locating and light-controlling media and the feeding mechanism; and an im-

age-forming object locatable in working position between the light-controlling and image-receiving media.

30. In an image-forming mechanism, the combination, with an image-forming object, of object-locating means, and an image-governing light-controller governed in its operation by and dependent for its movement upon the prior operation of said object-locating means.

31. In an image-forming mechanism, the combination, with an image-forming object, of object-locating means; an image-governing light-controller governed in its operation by and dependent for its movement upon the prior operation of said object-locating means; and a shiftable image-receiving medium also controlled by said object-locating means.

32. In an image-forming mechanism, the combination, with an image-governing light-controller, of an image-receiving medium shiftable in different directions; an image-forming object locatable in working position between the light-controller and the image-receiving medium; and independently-operable controlling devices governing, respectively, said movements of the image-receiving medium.

33. In an image-forming mechanism, the combination, with an image-governing light-controller, of an image-receiving medium shiftable in different directions; an image-forming object locatable in working position between the light-controller and the image-receiving medium; and independent key-operated devices controlling, respectively, said movements of the image-receiving medium.

34. In an image-forming mechanism, the combination, with an image-governing light-controller, of a plate-holder; an image-forming object locatable in working position between the light-controller and the plate-holder; and means for actuating said plate-holder in directions transverse relatively to each other.

35. In an image-forming mechanism, the combination, with an image-governing light-controller, of a horizontally and vertically shiftable plate-holder; an image-forming object locatable in a working position between the light-controller and the plate-holder; and independent key-operated devices controlling, respectively, the vertical and horizontal movements of the plate-holder.

36. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the light-controller and the image-receiving medium, of object-selecting means including a plurality of keys; an image-governing light-controller; and a shiftable image-receiving medium controlled by each of said keys.

37. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the light-controller and the plate-holder, of object-se-

lecting means including a plurality of keys; an image-governing light-controller; a plate-holder; and plate-feeding means controlled by said keys.

5 38. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the light-controller and the plate-holder, of object-selecting means including a plurality of keys; 10 an image-governing light-controller; a plate-holder; plate-holder-feeding means; and a universal bar connected with said plate-holder-feeding means and controlled by said keys.

15 39. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the image-receiving medium, of an image-governing light-controller; 20 an image-receiving medium; and means for shifting said light-controller and image-receiving medium alternately.

25 40. In an image-forming mechanism, the combination, with an image-forming object locatable in working position between the light-controller and the image-receiving medium, of object-locating means; an image-governing light-controller; an image-receiving medium; and means for operating the 30 object-locating means, the light-controller, and the image-receiving medium in a predetermined order.

35 41. In an image-forming mechanism, the combination, with an image-forming object, of a reciprocatory object-carrier, and an image-governing light-controller.

42. In an image-forming mechanism, the combination, with an image-forming object, of an oscillatory object-carrier, and an image-governing light-controller. 40

43. In an image-forming mechanism, the combination, with a movable object-carrier having a plurality of image-forming objects, of an image-governing light-controller, and differentially-movable carrier-actuating means 45 for actuating said carrier in paths of different lengths to bring a selected object into working position.

44. In an image-forming mechanism, the 50 combination, with a reciprocatory object-carrier having a plurality of image-forming objects, of an image-governing light-controller, and differentially-movable carrier-actuating means for reciprocating said object-carrier in 55 paths of different lengths to bring a selected object into working position.

45. In an image-forming mechanism, the combination, with an oscillatory object-carrier having a plurality of image-forming objects, of an image-governing light-controller, 60 and differentially-movable carrier-actuating means for oscillating said object-carrier in arcs of different lengths to bring a selected object into working position.

65 46. In an image-forming mechanism, the combination, with a carrier movable in different directions and having double-case im-

age-forming characters, of an image-governing light-controller, and actuating means for shifting said carrier in different directions to 70 bring a selected character into working position.

47. In an image-forming mechanism, the combination, with an axially-movable oscillatory carrier having double-case image-forming 75 characters, of an image-governing light-controller, and actuating means for oscillating said carrier and for shifting the same axially to bring a selected character into working position. 80

48. In an image-forming mechanism, the combination, with an axially-movable oscillatory carrier having double-case image-forming 85 characters, of an image-governing light-controller; key-controlled carrier-oscillating means; and means for shifting said carrier axially.

49. In an image-forming mechanism, the combination, with an axially-movable oscillatory carrier having double-case image-forming 90 characters, of an image-governing light-controller; key-controlled carrier-oscillating means; and key-controlled means for shifting said carrier axially.

50. In an image-forming mechanism, the 95 combination, with an axially-movable oscillatory carrier having double-case image-forming characters, of an image-governing light-controller; a plurality of keys, one for each double-case character; differentially-movable 100 carrier-oscillating means controlled by said keys individually; and means for shifting said carrier axially.

51. In an image-forming mechanism, the combination, with an oscillatory carrier having 105 image-forming characters, of an image-governing light-controller; a carrier-oscillating rock-shaft; a plurality of keys corresponding to said characters, respectively; and connecting means between said keys and the rock-shaft for oscillating the latter in different arcs. 110

52. In an image-forming mechanism, the combination, with image-forming objects, of object-locating means for shifting said objects 115 one at a time to a working position between the light-controller and the image-receiving medium; an image-governing light-controller; and an image-receiving medium.

53. In an image-forming mechanism, the combination, with image-forming objects, of 120 object-locating means for shifting said objects one at a time to a common locus between the light-controller and the image-receiving medium; an image-governing light-controller operable after each location of an object; and 125 an image-receiving medium.

54. In an image-forming mechanism, the combination, with image-forming objects, of object-locating means for shifting said objects 130 one at a time to a common locus between the light-controller and the image-receiving medium; an image-governing light-controller operative after each location of an object; an image-receiving medium; and feeding means

operative for feeding said image-receiving medium after each location of an object.

55. In an image-forming mechanism, the combination, with double-case image-forming objects the objects of each pair of which face substantially in the same direction, of an image-receiving medium; shifting means for shifting one of said elements to either case position; and an image-governing light-controller.

56. In an image-forming mechanism, the combination, with double-case image-forming objects the objects of each pair of which face substantially in the same direction, of an image-receiving medium; shifting means for shifting one of said elements to either case position; an image-governing light-controller; and object-selecting means cooperative with said shifting means.

57. In an image-forming mechanism, the combination, with double-case image-forming objects the objects of each pair of which face substantially in the same direction, of an image-receiving medium; object-selecting means; object-shifting means for shifting a selected object to either case position; and an image-governing light-controller.

58. In a photoprinting mechanism, the combination, with an image-governing light-controller, of a plurality of image-forming characters; a holder for a sensitized printing medium; and character selecting and locating means for locating a selected character between the light-controller and the printing medium.

59. In a photoprinting mechanism, the combination, with an image-governing light-controller, of a holder for a sensitized printing medium; a carrier movable between the light-controller and the printing medium and having image-forming characters; and character-selecting means for shifting said carrier to bring a selected character into working position.

60. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the light-controller and the image-receiving medium, of object-selecting means; a key-operated image-governing light-controller cooperative with said object-selecting means; and an image-receiving medium.

61. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the light-controller and the image-receiving medium, of object-selecting means; an image-governing light-controller governed directly by the object-selecting means; and an image-receiving medium.

62. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the shutter and the image-receiving medium, of object-selecting means; a light-controlling shutter; a key-operated shutter-actuator; and an image-receiving medium.

63. In an image-forming mechanism, the combination, with image-forming objects, of object-selecting means; a light-controlling shutter; and a key-operated by-pass shutter-actuator.

64. In an image-forming mechanism, the combination, with image-forming objects, of object-selecting means; a self-closing light-controlling shutter; and a key-operated shutter-opening actuator.

65. In an image-forming mechanism, the combination, with image-forming objects, of object-selecting means; a self-closing light-controlling shutter; and a key-operated by-pass shutter-opening actuator unconnected with said shutter.

66. In an image-forming mechanism, the combination, with image-forming objects, of key-operated object-locating means operative on the depression of a key; a light-controlling shutter; and a shutter-opening actuator operative on the rising of said key.

67. In an image-forming mechanism, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; key-operated object locating and holding means operative on the depression of a key; and automatic object-releasing means.

68. In an image-forming mechanism, the combination, with an image-governing light-controller and with an image-receiving medium, of image-forming objects locatable in working position between the light-controller and the image-receiving medium; key-operated object locating and holding means operative on the depression of a key; and automatic object-releasing means operative on the rising of said key.

69. In an image-forming mechanism, the combination, with a movable carrier having a plurality of image-forming characters, of key-operated carrier-actuating means for actuating said carrier to bring a selected character into working position; a rack movable in unison with said carrier; a locking-pawl cooperative with said rack and controlled by the depression of a key; and releasing means for said pawl.

70. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the shutter and the image-receiving medium, of key-operated object locating and holding means operable on the depression of a key; a light-controlling shutter; an image-receiving medium; and a shutter-opening actuator and object-releasing means, both operative on the rising of said key.

71. In an image-forming mechanism, the combination, with image-forming objects locatable in working position between the shutter and the image-receiving medium, of key-operated object locating and holding means operable on the depression of a key; a light-

controlling shutter; an image-receiving medium; and a shutter-opening actuator and object-releasing means successively operative in the order named on the rising of said key.

72. In a photoprinting mechanism, the combination, with image-forming characters locatable in working position between the shutter and the image-receiving medium, of keys controlling the operation of said characters; a light-controlling shutter operative by said keys; a holder for a sensitized image-receiving medium; and holder-feeding mechanism operative by said keys.

73. In a photoprinting mechanism, the combination, with image-forming characters locatable in working position between the shutter and the image-receiving medium, of keys controlling the operation of said characters; a light-controlling shutter operative by said keys; a holder for a sensitized image-receiving medium; holder-feeding mechanism operative by said keys; line-spacing mechanism for said holder; and a separate key for operating said line-spacing mechanism.

74. In a photoprinting mechanism, the combination, with image-forming characters locatable in working position between the shutter and the image-receiving medium, of keys controlling the operation of said characters; a light-controlling shutter operative by said keys; a shiftable carriage; carriage-feeding mechanism operative by said keys; a holder supported on the carriage for movement transversely to that of the latter and adapted to carry a sensitized image-receiving medium; and line-spacing mechanism for said holder.

75. In a photoprinting mechanism, the combination, with image-forming characters locatable in working position between the shutter and the image-receiving medium, of keys controlling the operation of said characters;

a light-controlling shutter operative by said keys; a shiftable carriage; carriage-feeding mechanism operative by said keys; a holder supported on the carriage for movement transversely to that of the latter and adapted to carry a sensitized image-receiving medium; line-spacing mechanism embodying a pawl and a rack for actuating said holder; and a separate key for operating said line-spacing mechanism.

76. In a photoprinting mechanism, the combination, with double-case image-forming characters the characters of each pair of which face substantially in the same direction, of keys controlling the operation of said characters; a light-controlling shutter operative by said keys; a holder for a sensitized image-receiving medium; holder-feeding mechanism operative by said keys; shifting mechanism controlling the selection of either one of a pair of double-case characters; and a separate case-key for operating said shifting mechanism.

77. In a photoprinting mechanism, the combination, with double-case image-forming characters the characters of each pair of which face substantially in the same direction, of keys controlling the operation of said characters; a light-controlling shutter operative by said keys; a holder for a sensitized image-receiving medium; holder-feeding mechanism operative by said keys; line-spacing mechanism for said holder; shifting mechanism controlling the selection of either one of a pair of double-case characters; and separate line-spacing and case keys for operating said line-spacing and shifting mechanisms.

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