

May 3, 1938.

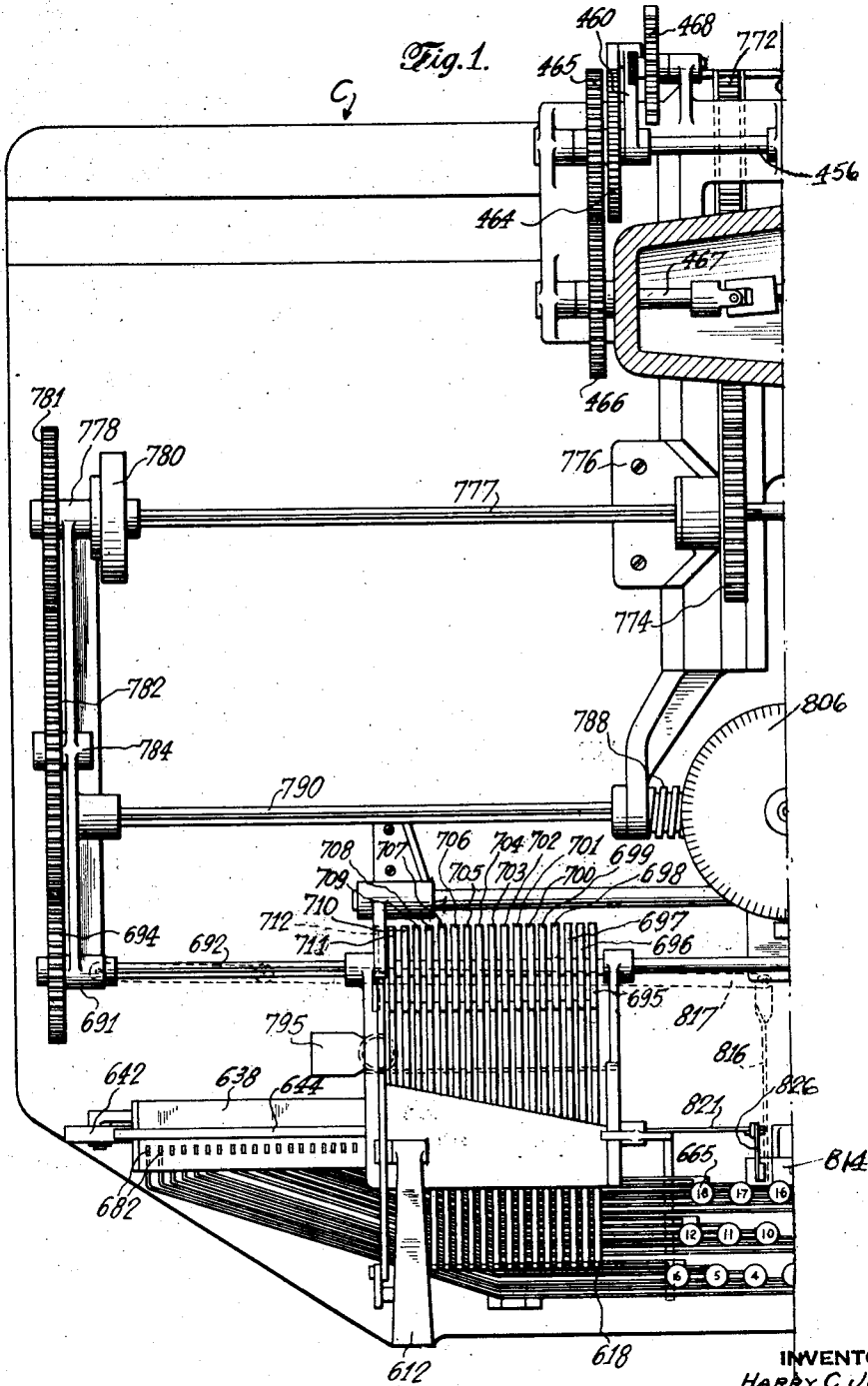
H. C. JONES

2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 1



INVENTOR
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BY *Harry C. Jones*
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May 3, 1938.

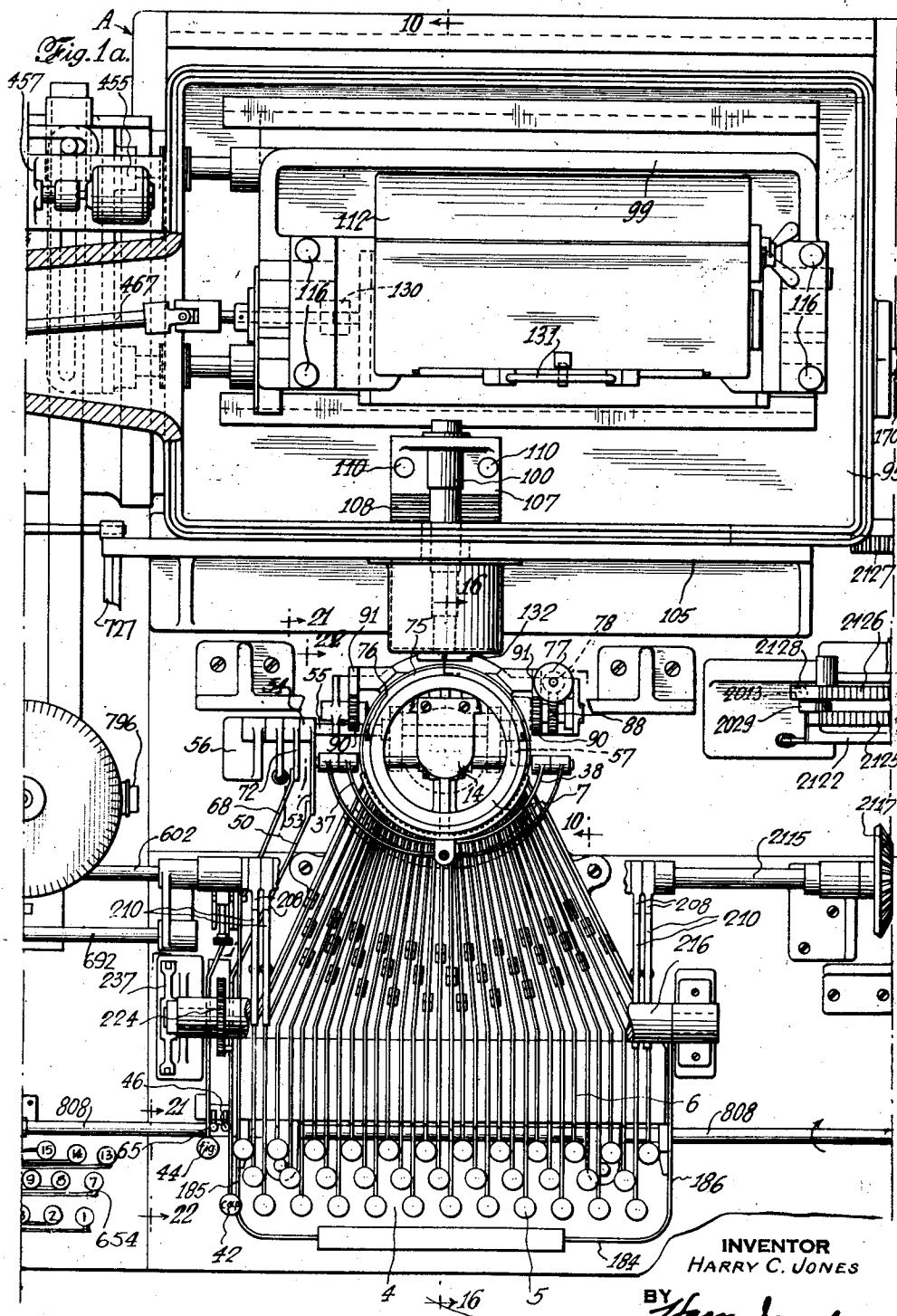
H. C. JONES

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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 2



May 3, 1938.

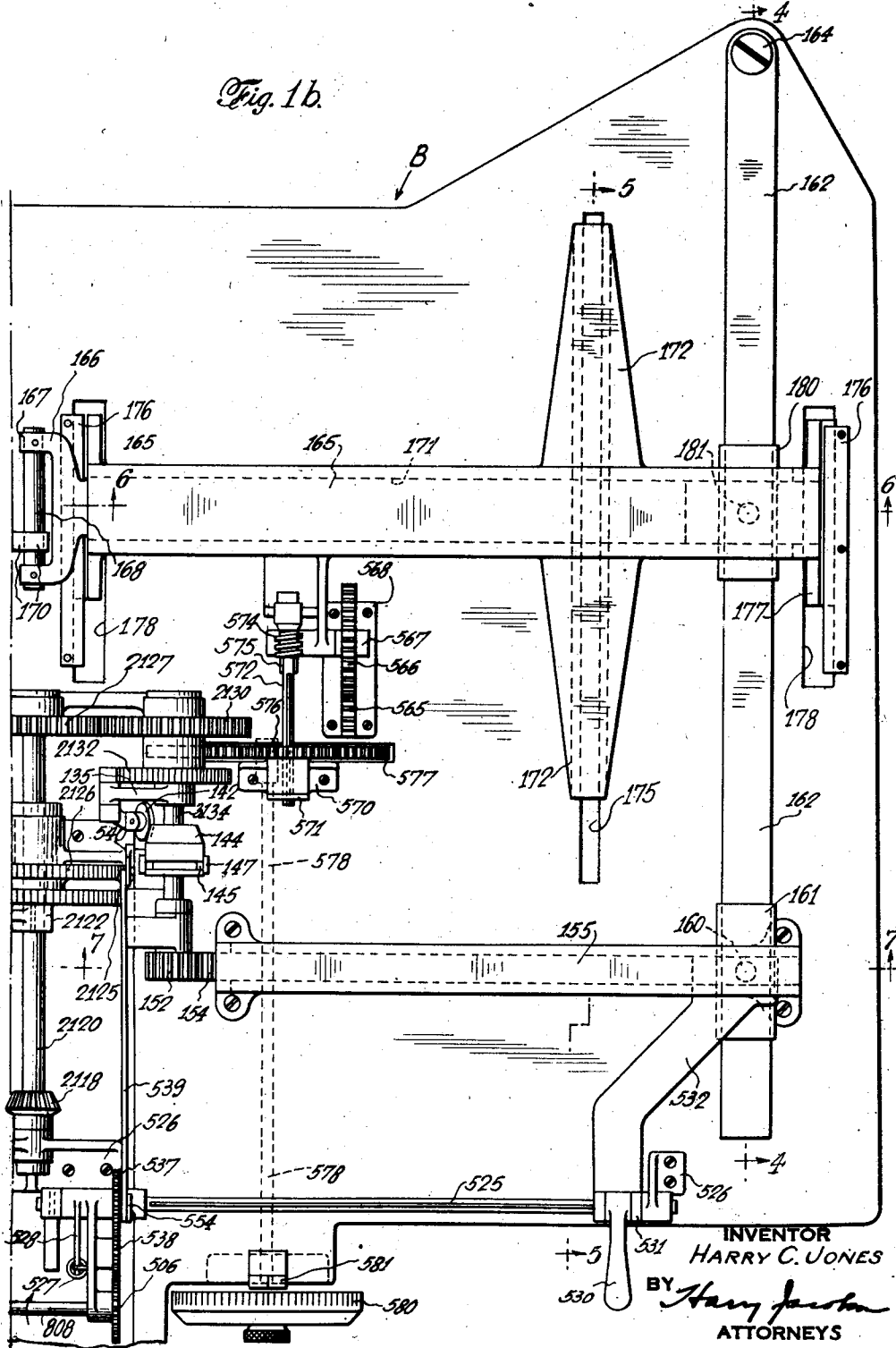
H. C. JONES

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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 3



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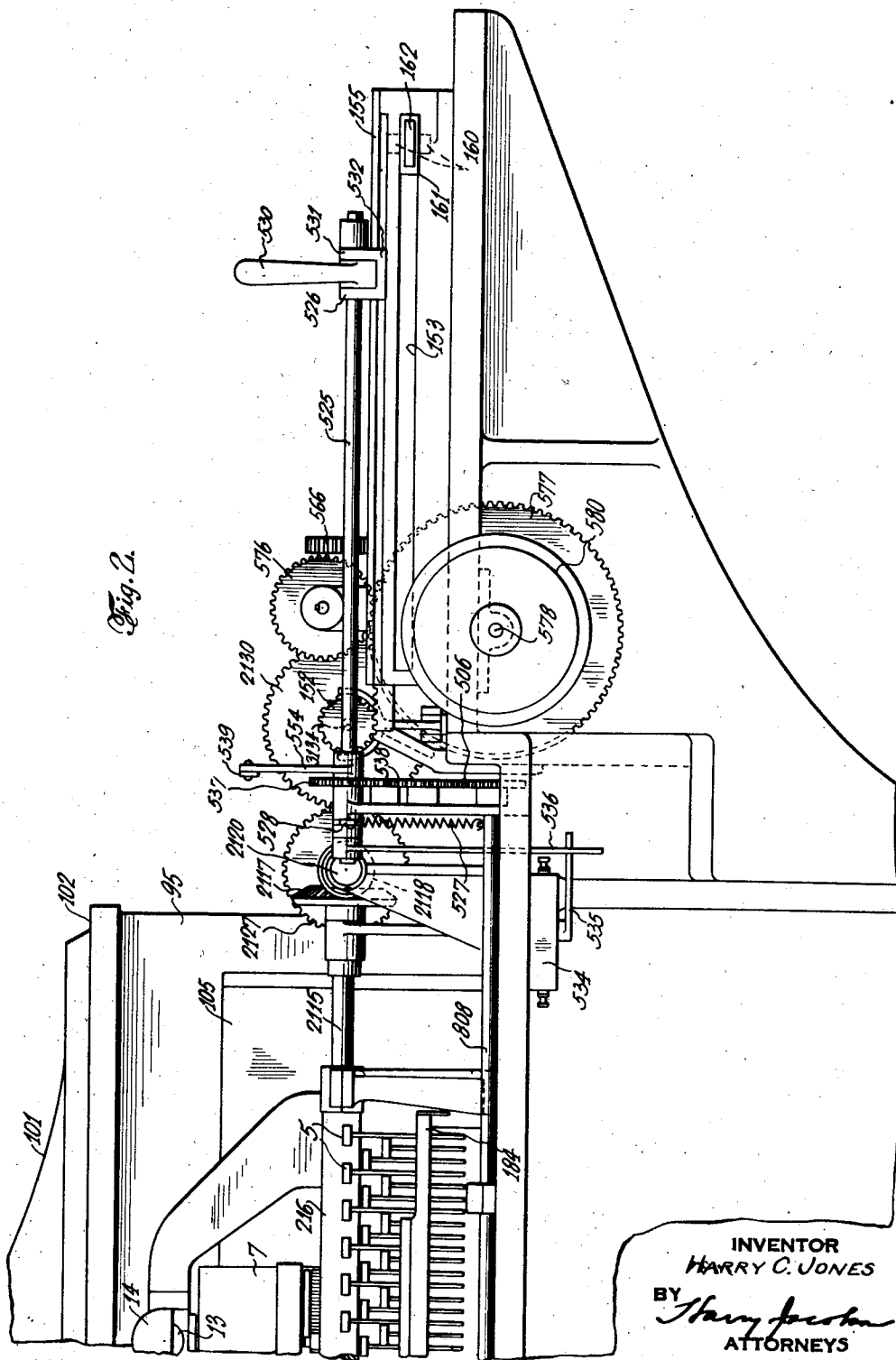
H. C. JONES

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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 4



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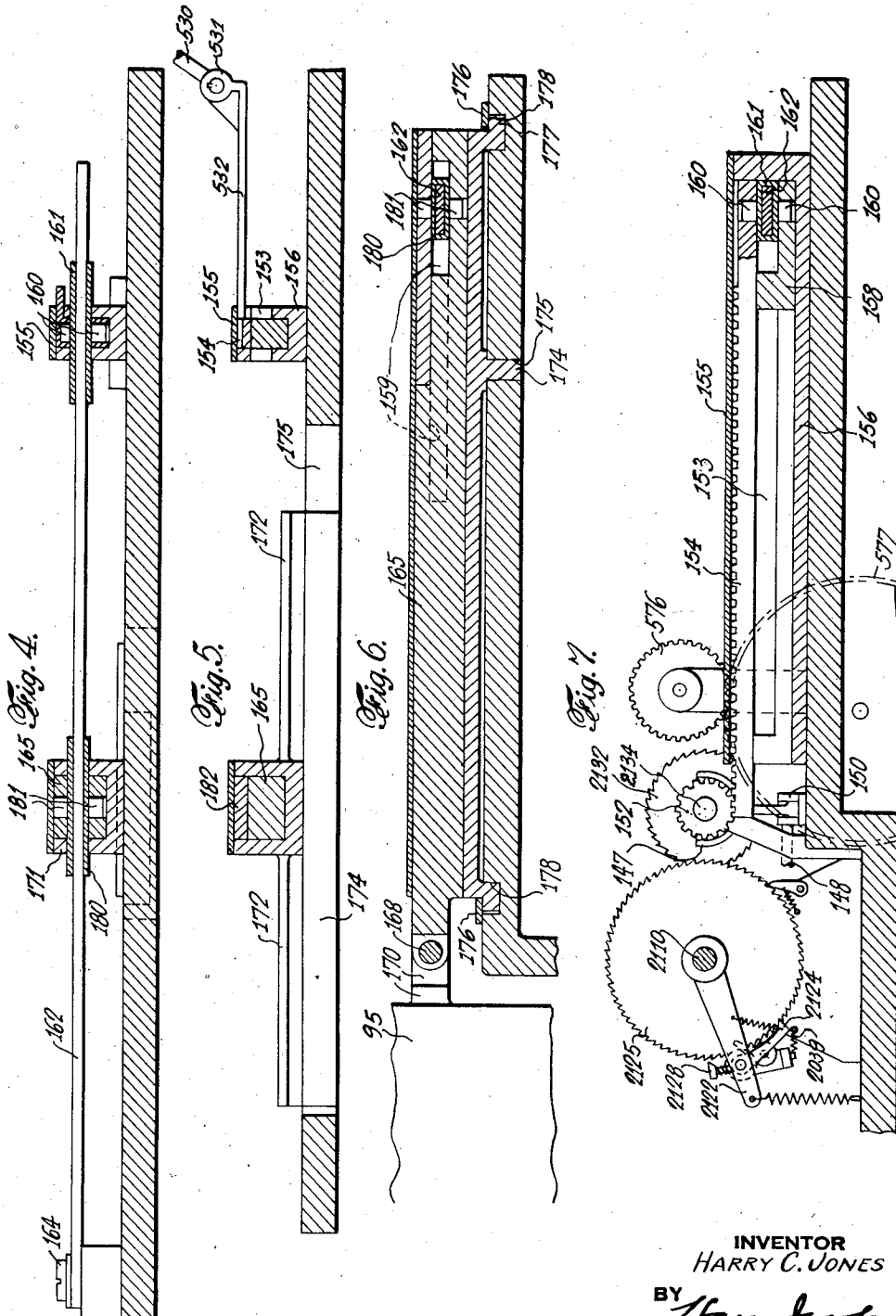
H. C. JONES

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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 6



May 3, 1938.

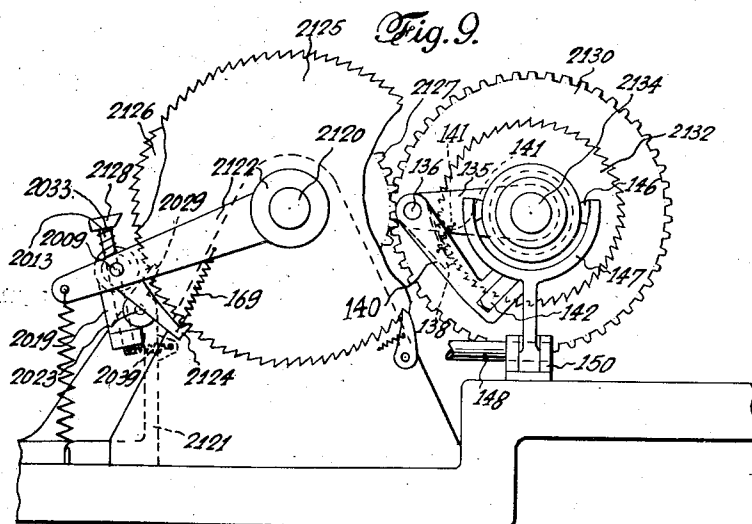
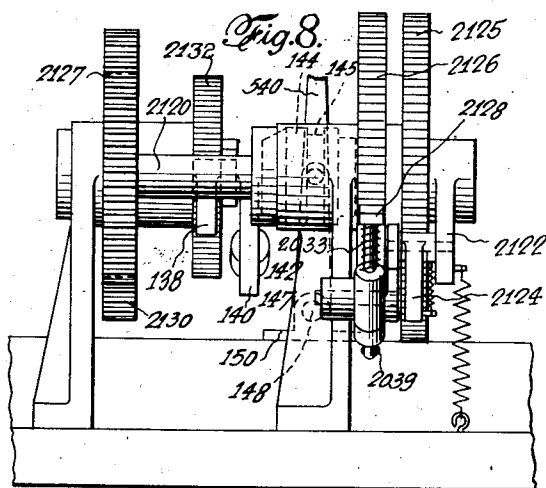
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 7



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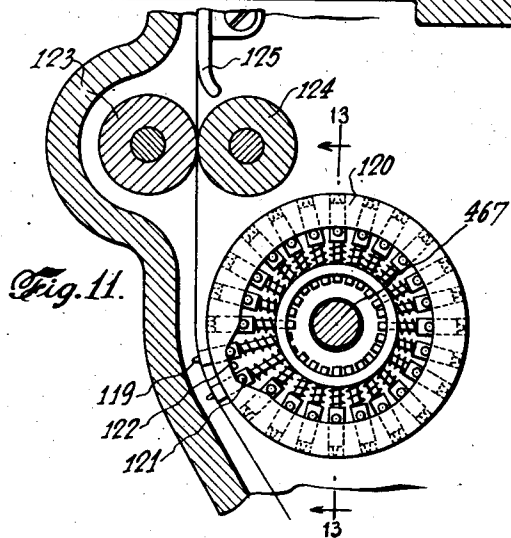
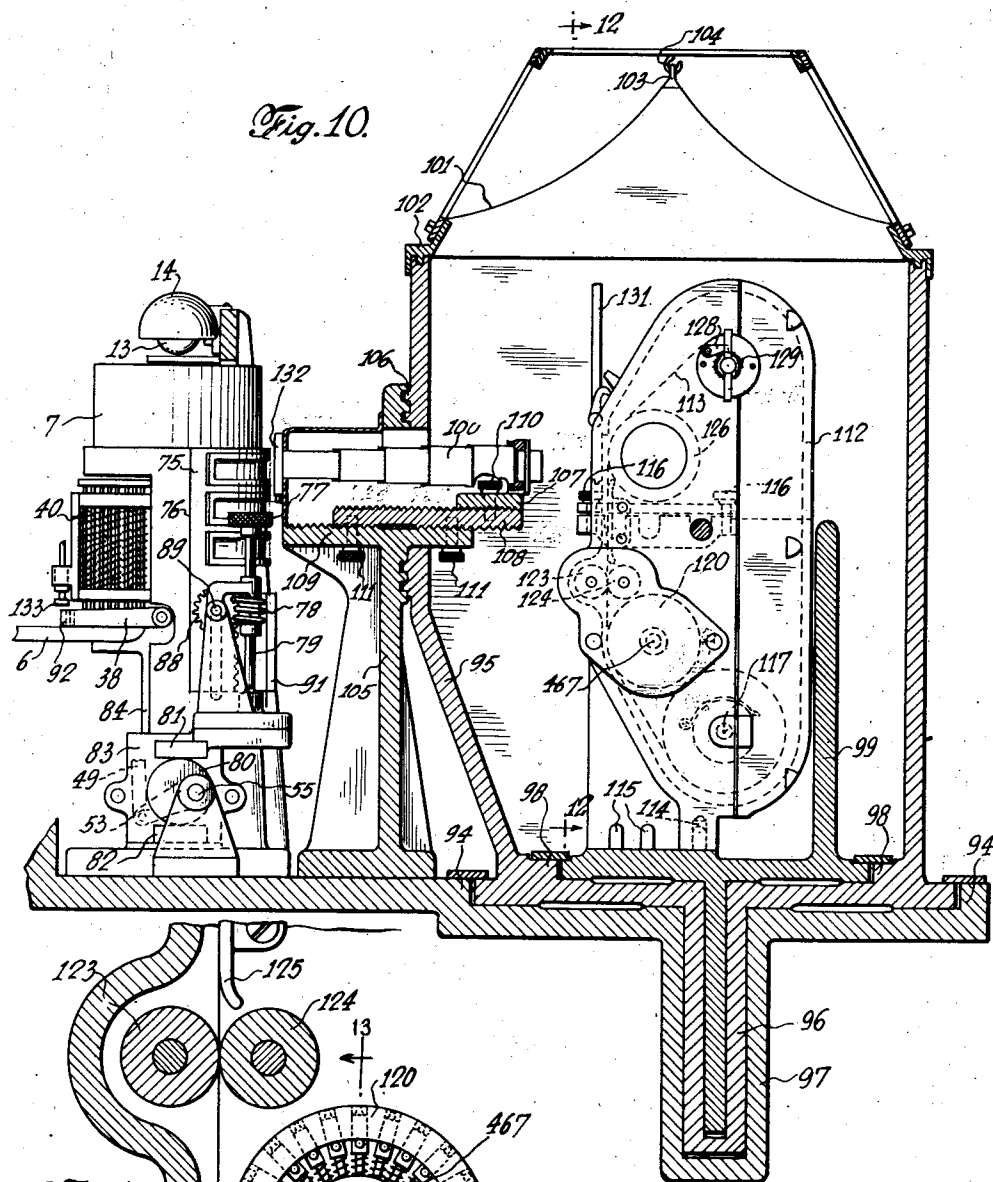
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 8



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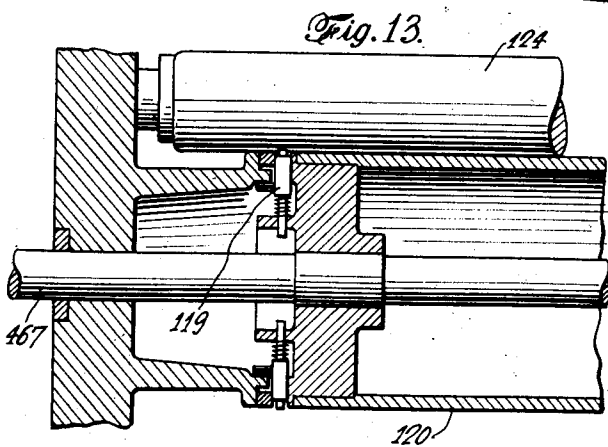
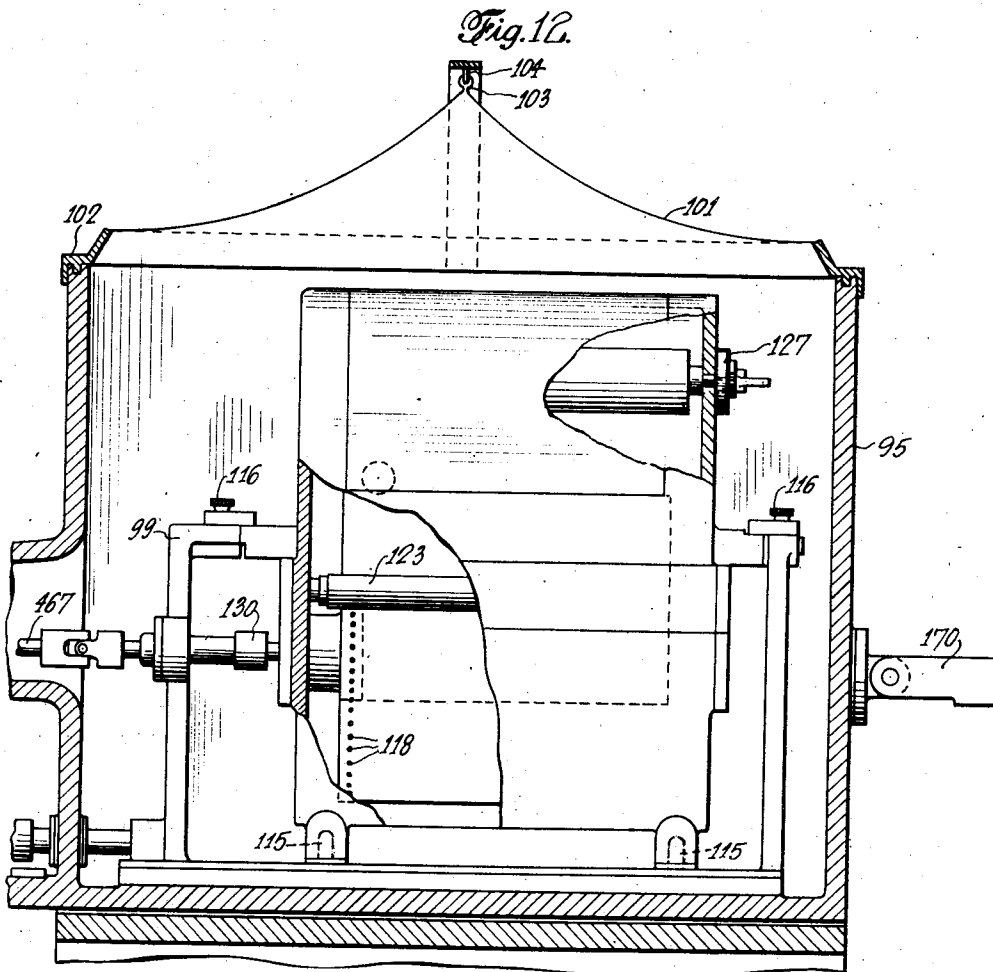
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 9



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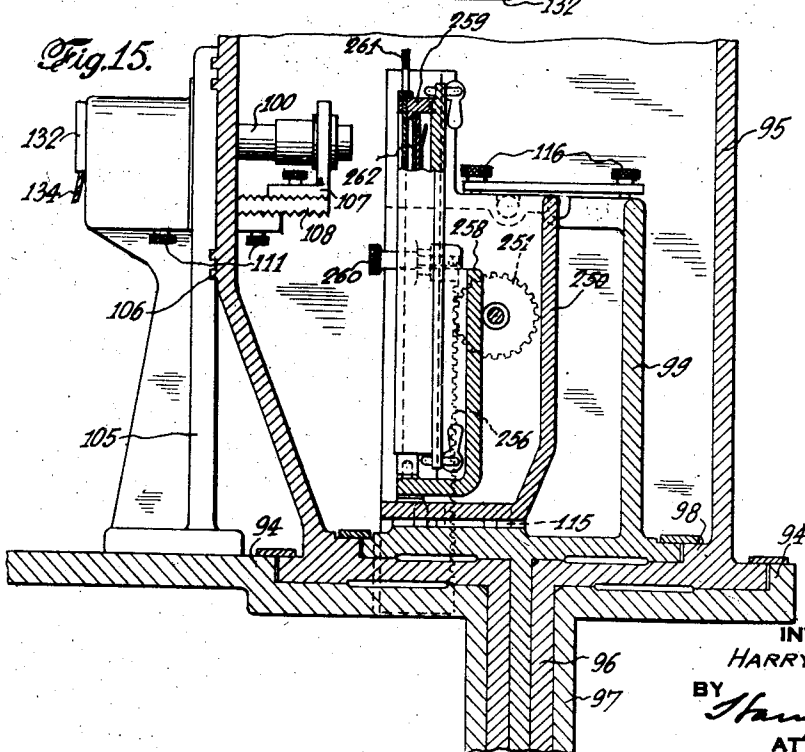
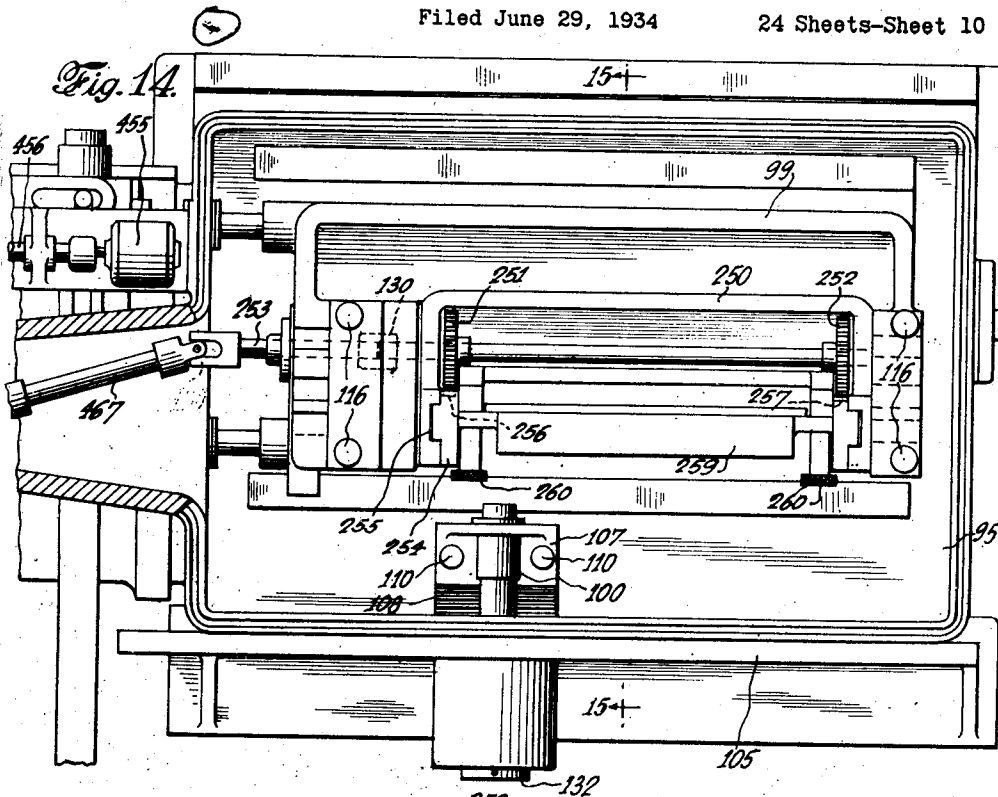
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 10



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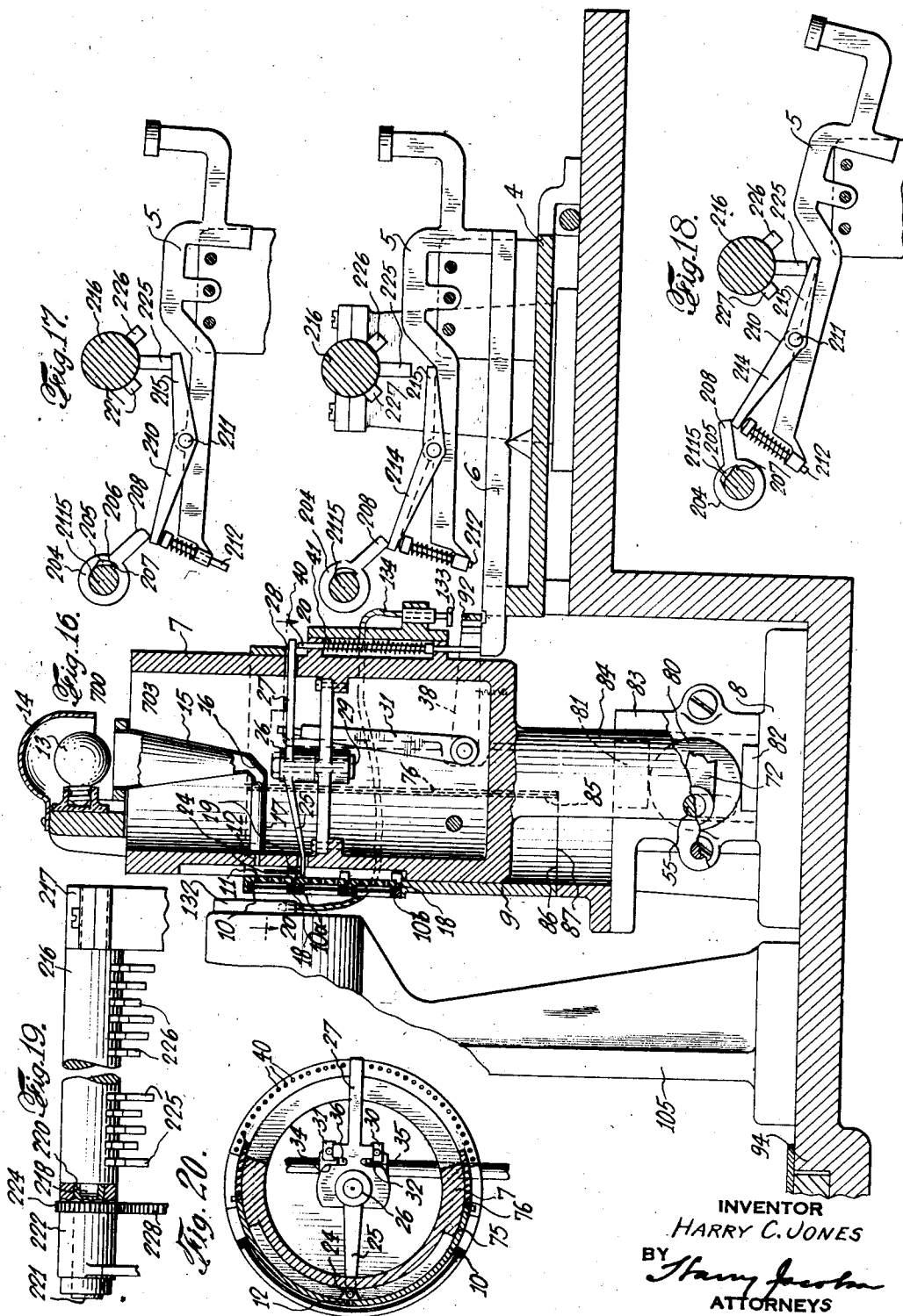
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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 11



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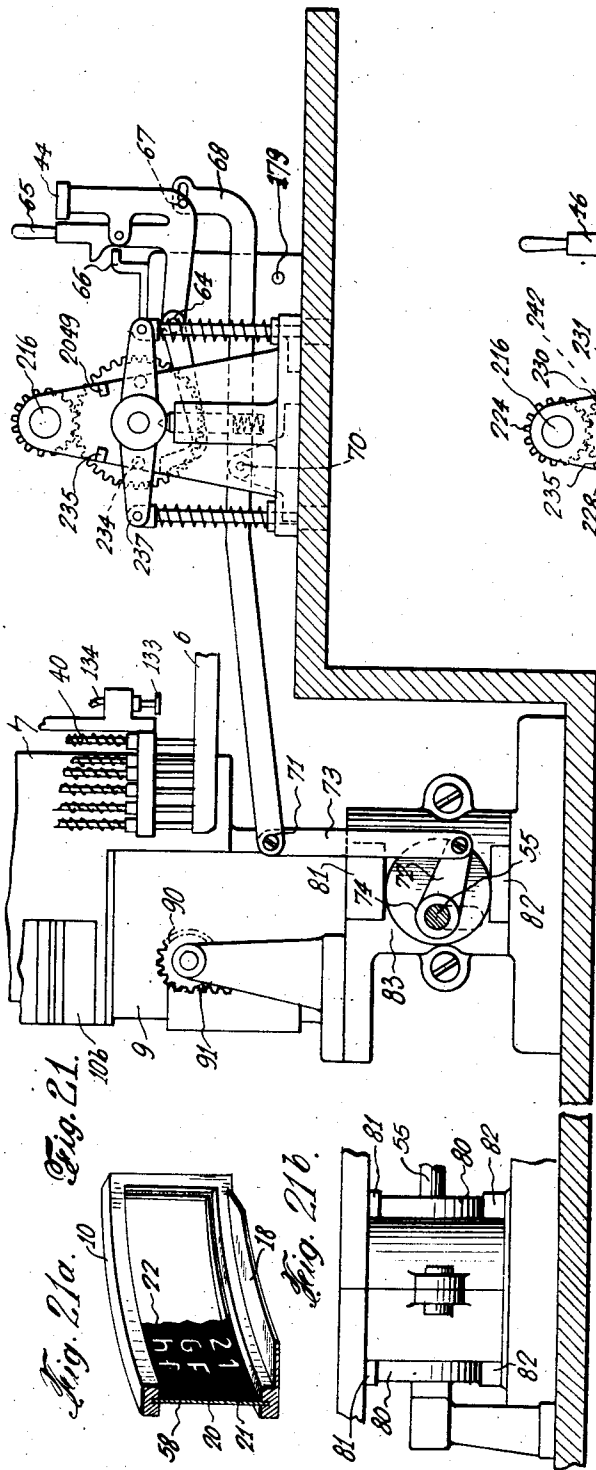
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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 12



May 3, 1938.

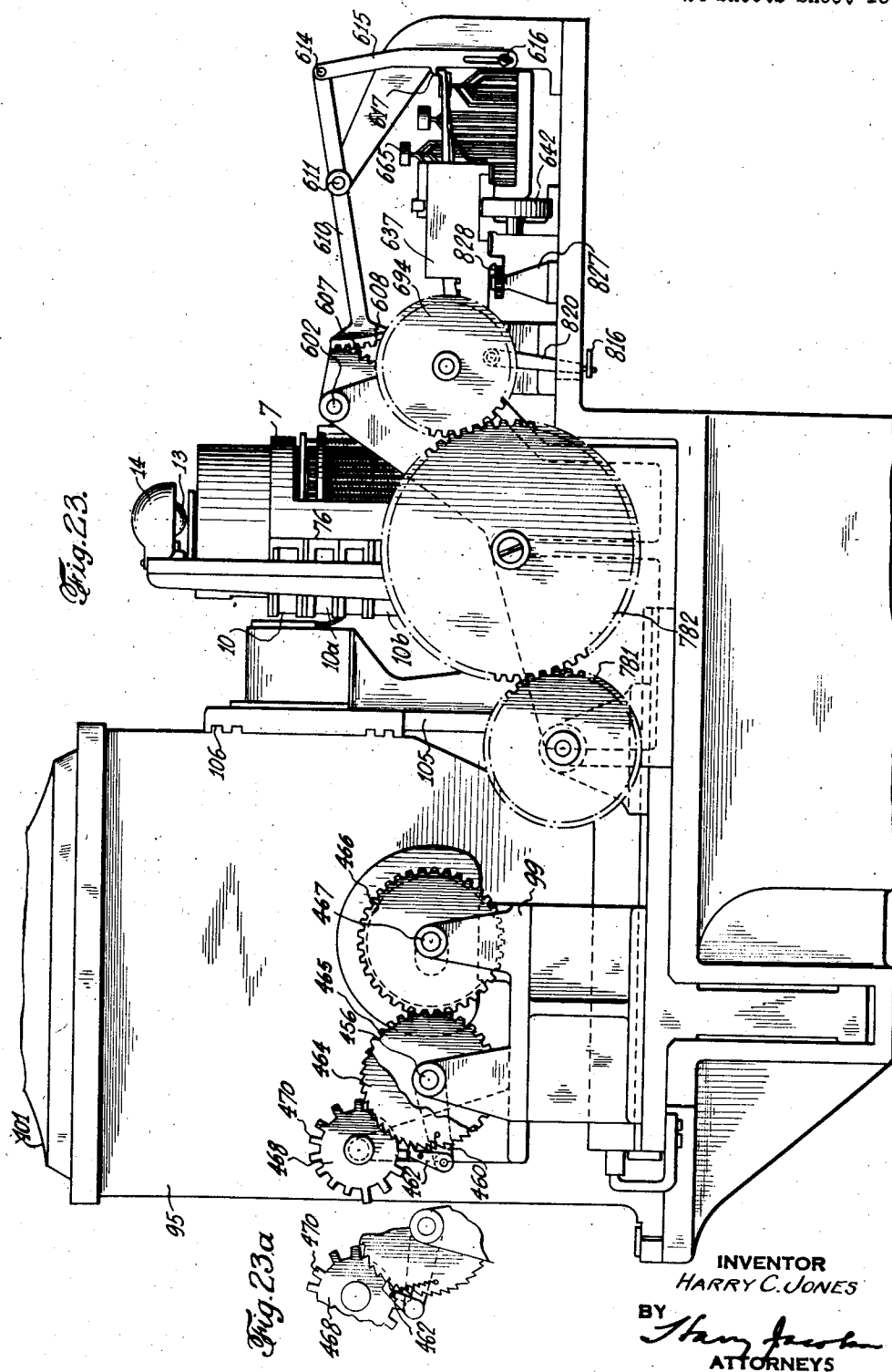
H. C. JONES

2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 13



May 3, 1938.

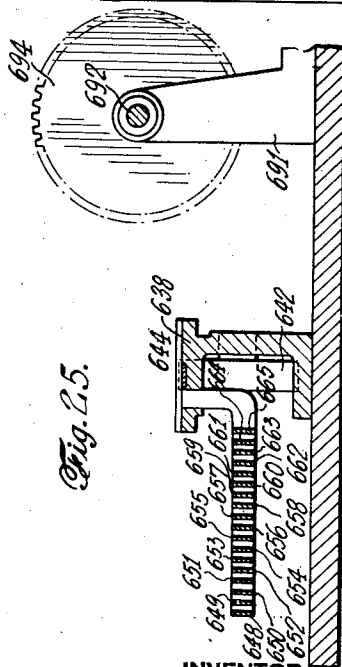
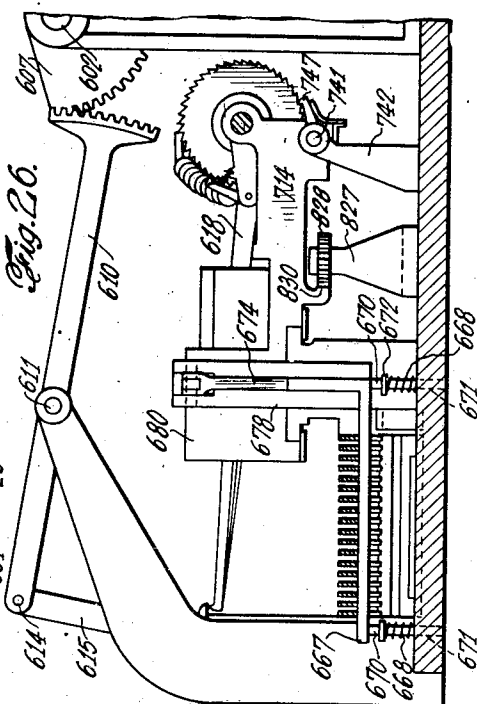
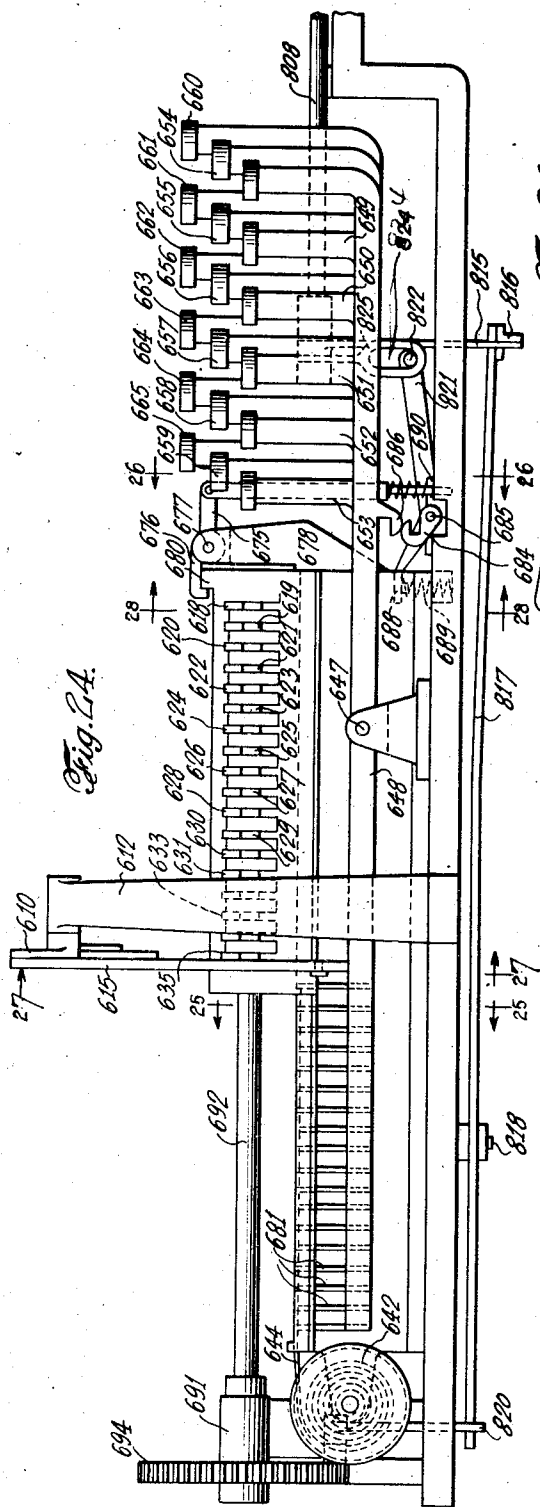
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 14



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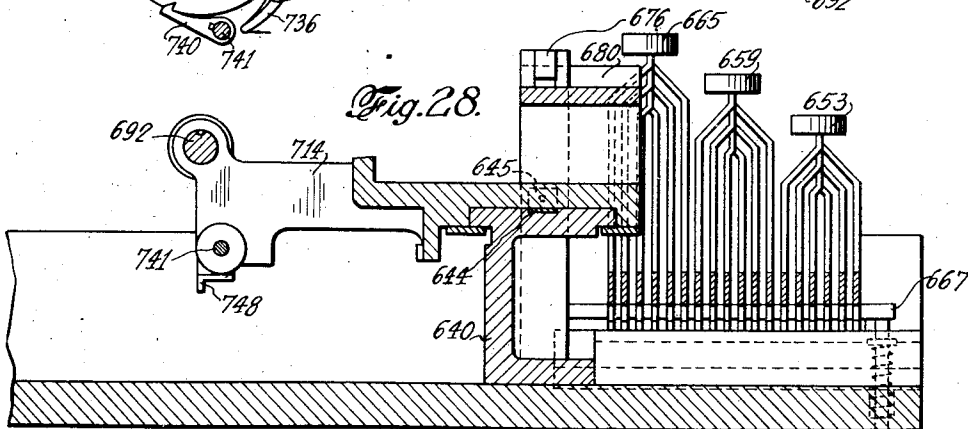
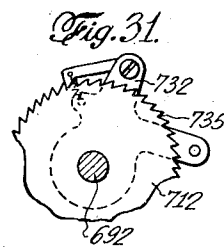
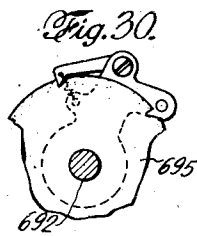
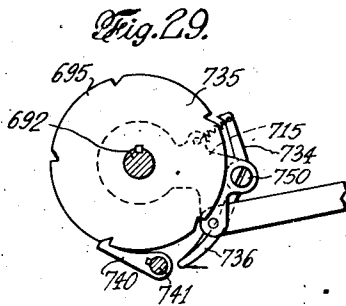
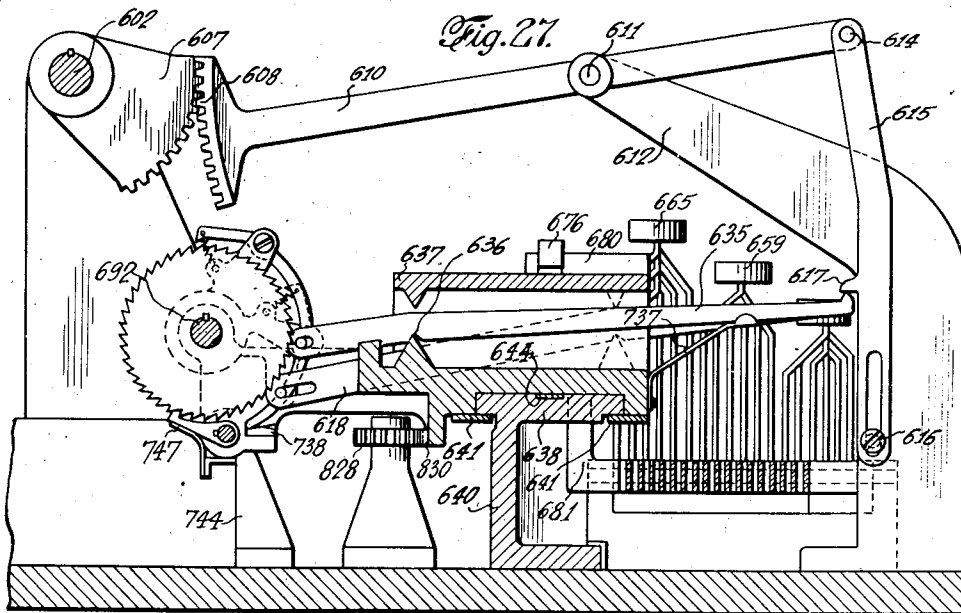
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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 15



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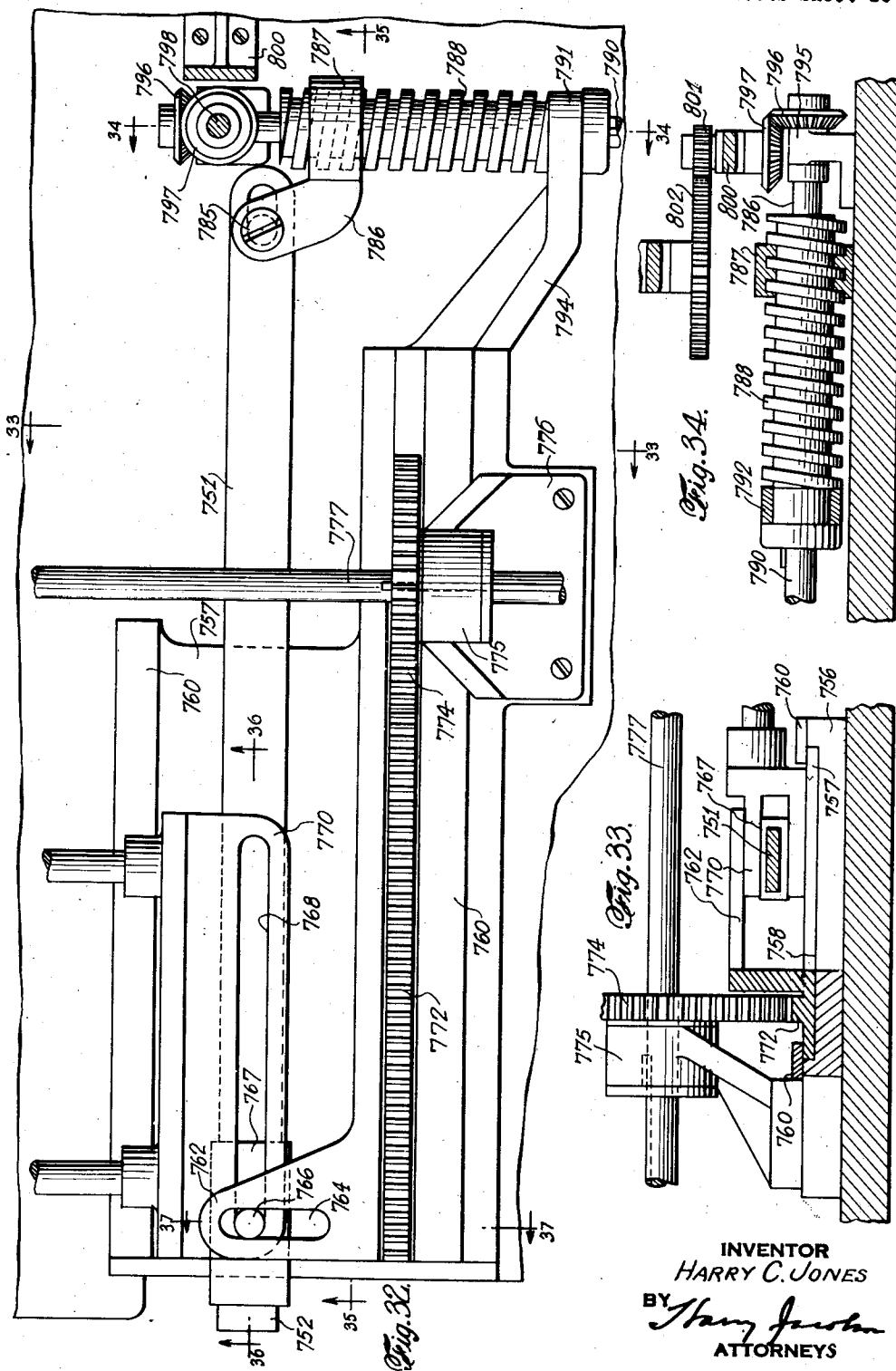
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H. C. JONES
PHOTOTYPING MACHINE

2,115,990

Filed June 29, 1934

24 Sheets-Sheet 16



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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 17

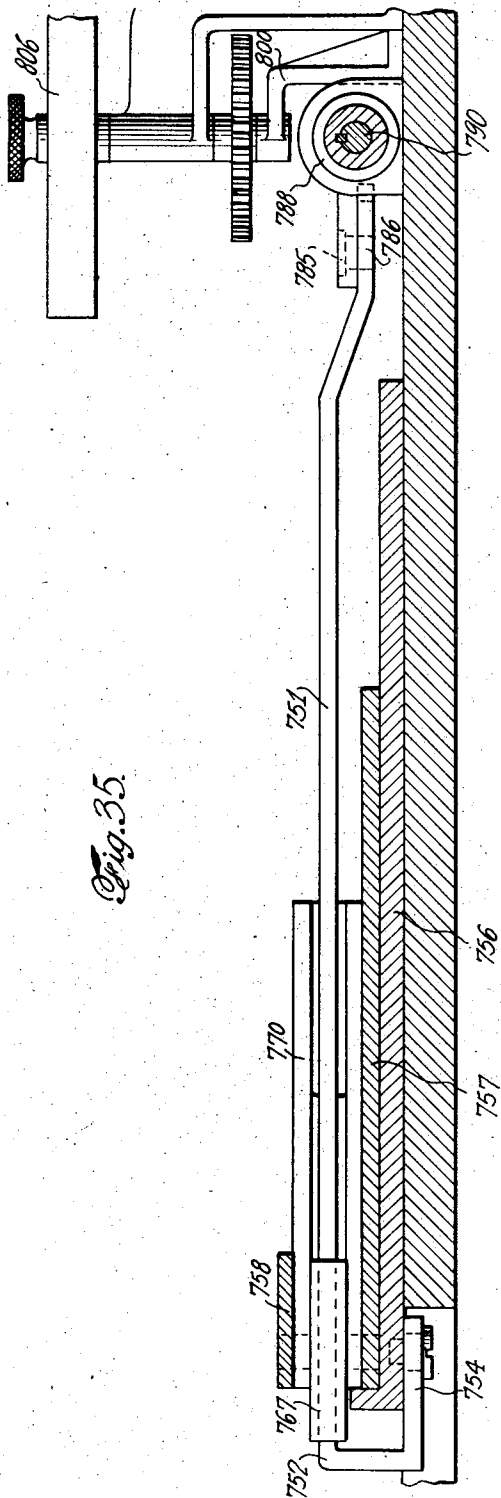


Fig. 35.

Fig. 37.

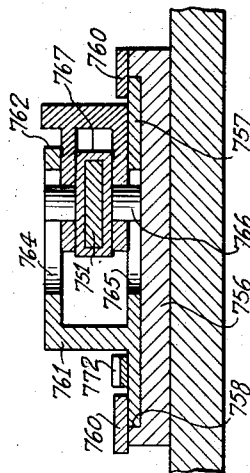
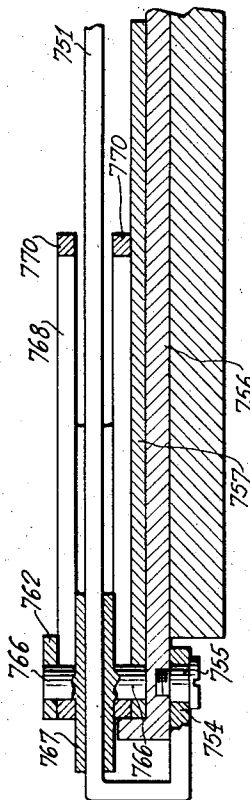


Fig. 36.



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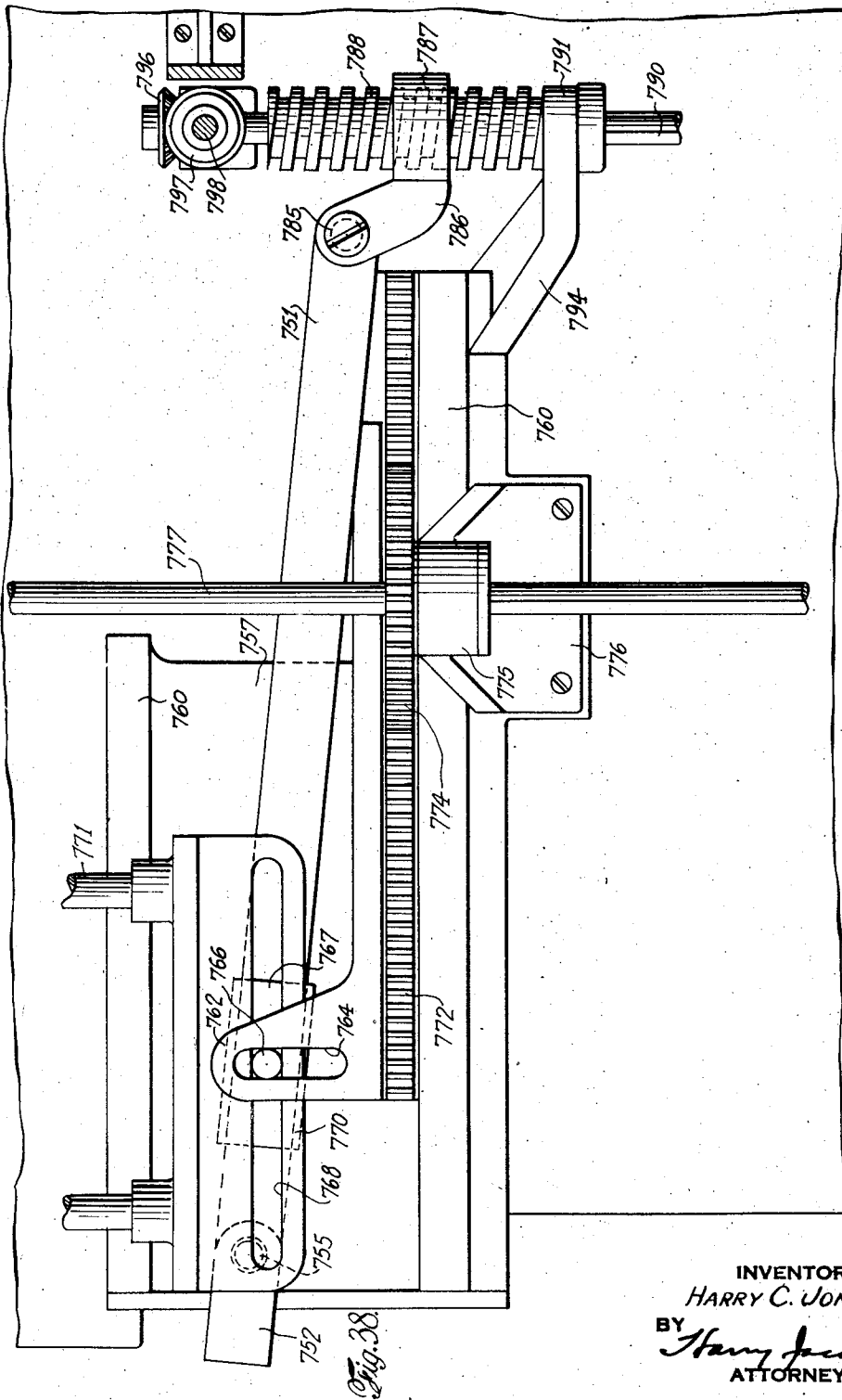
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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 18



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H. C. JONES
PHOTOTYPING MACHINE

2,115,990

Filed June 29, 1934

24 Sheets-Sheet 19

Fig. 40.

Fig. 39.

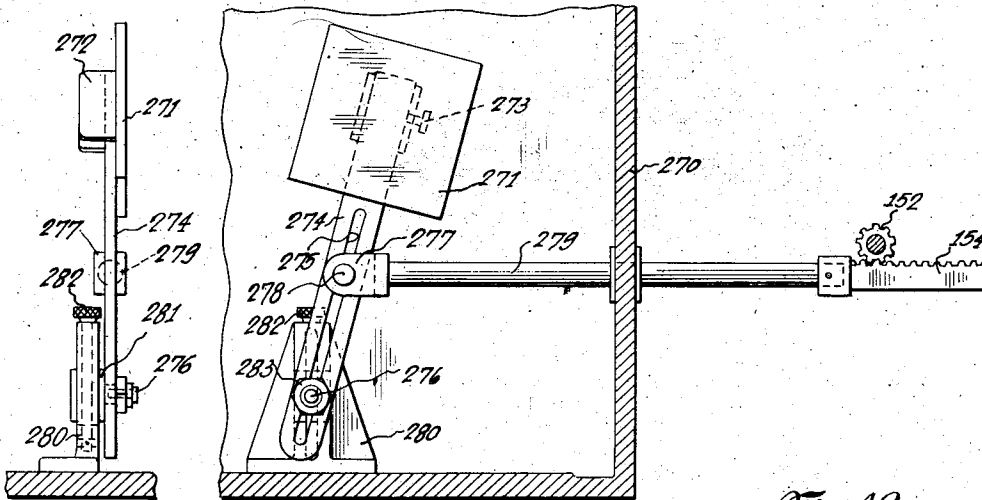
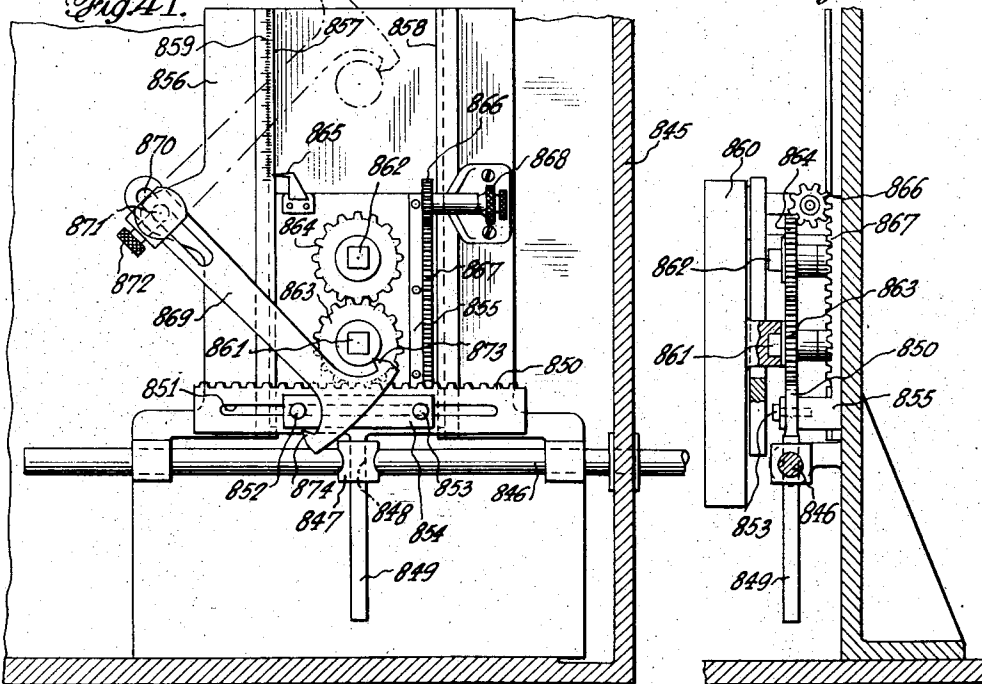


Fig. 41.

Fig. 42.



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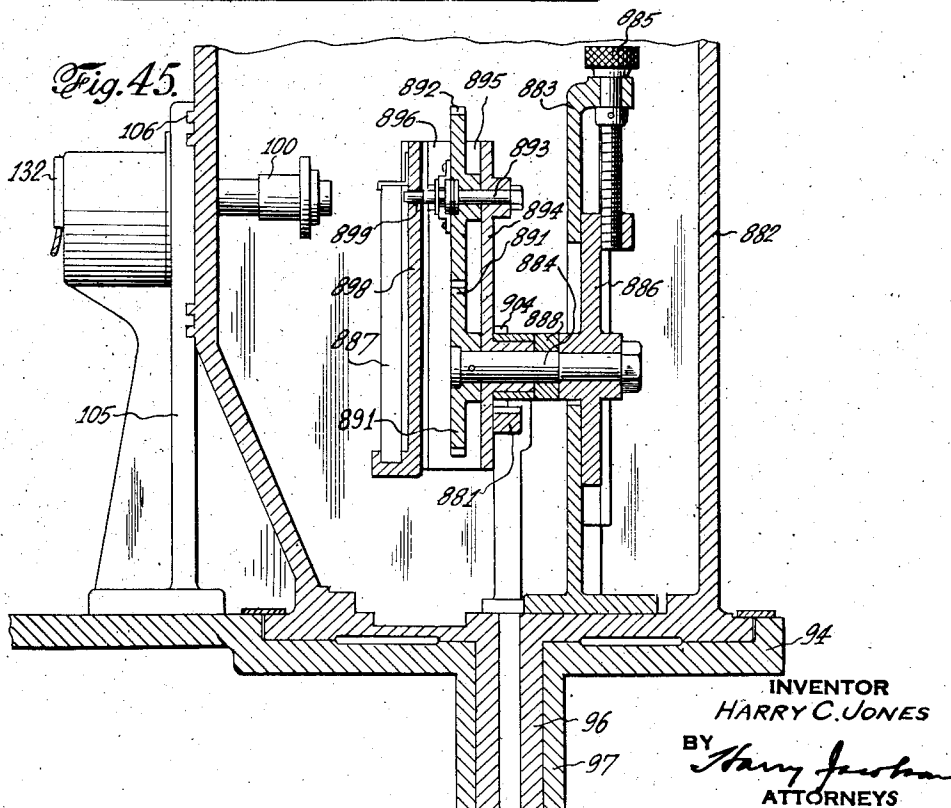
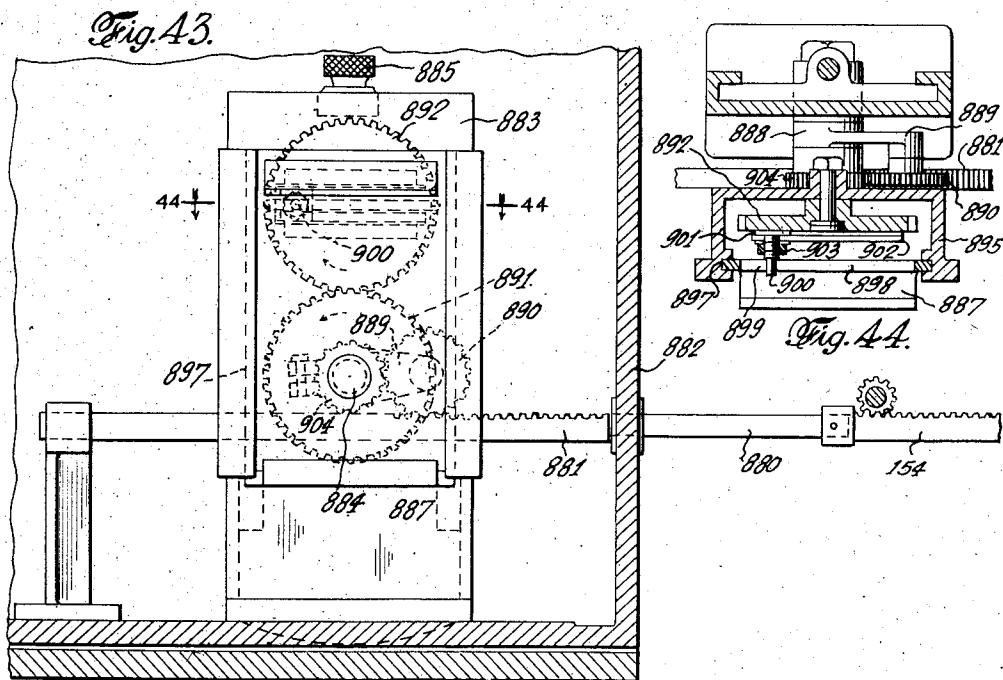
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 20



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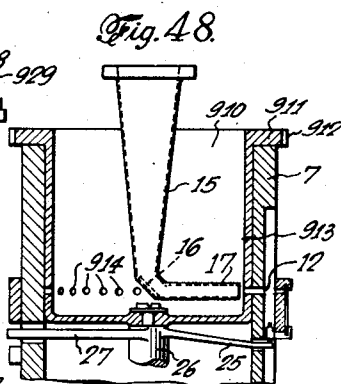
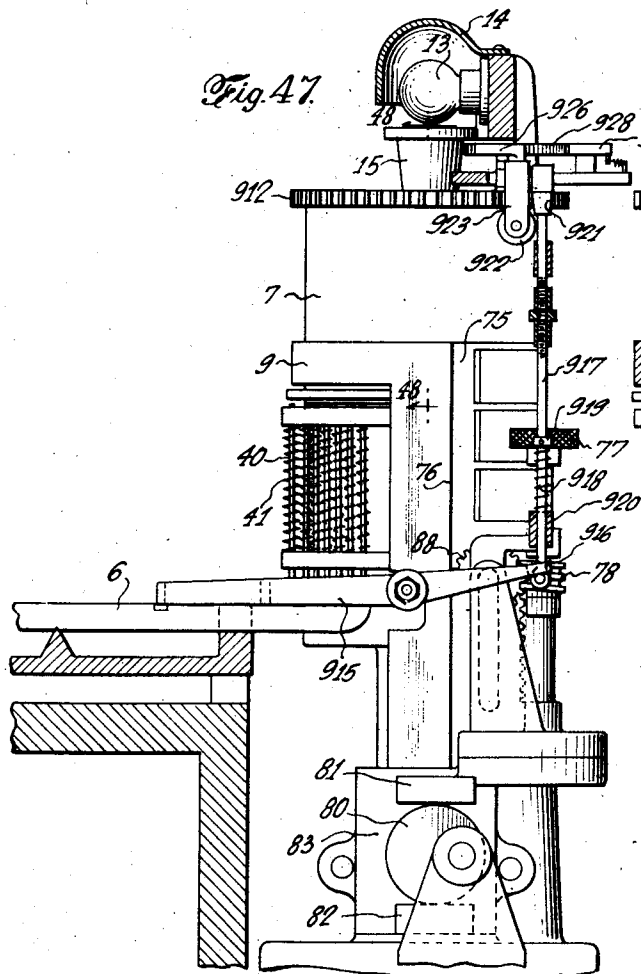
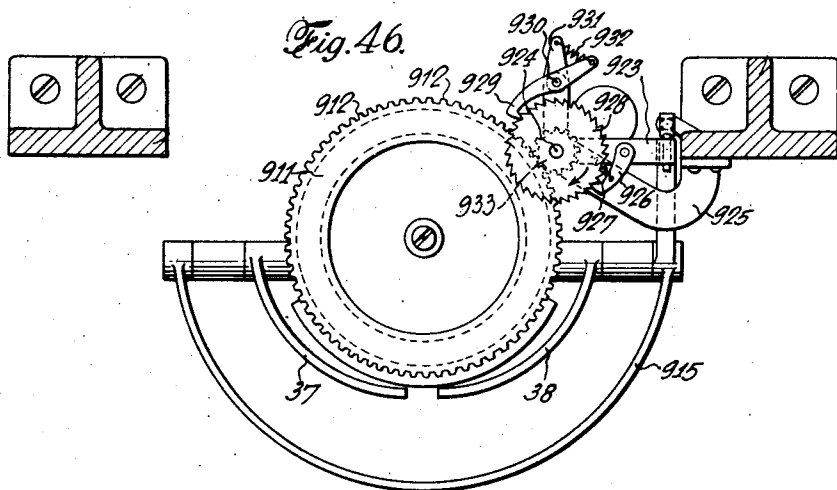
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PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 21



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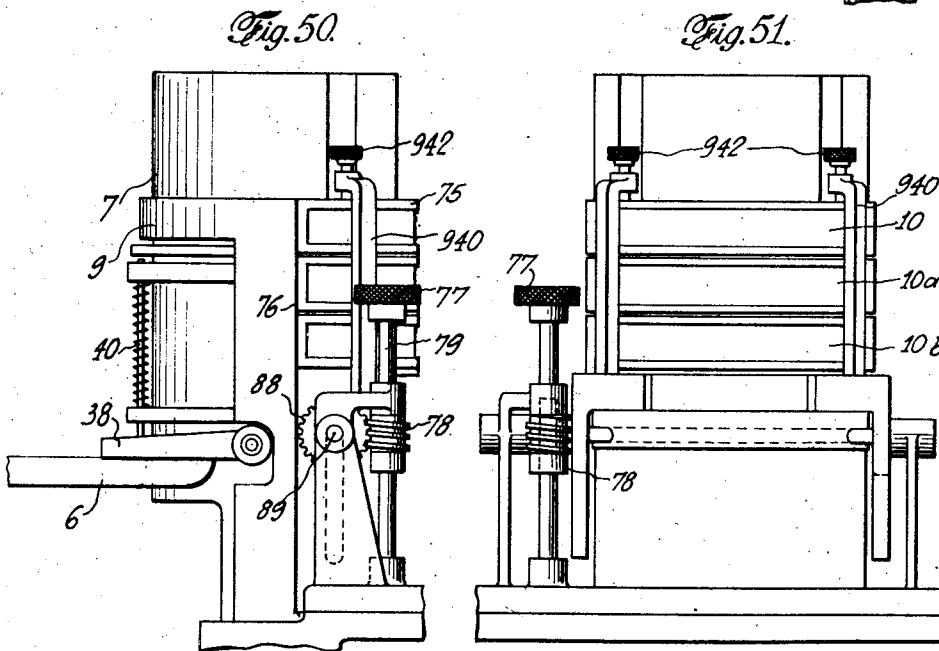
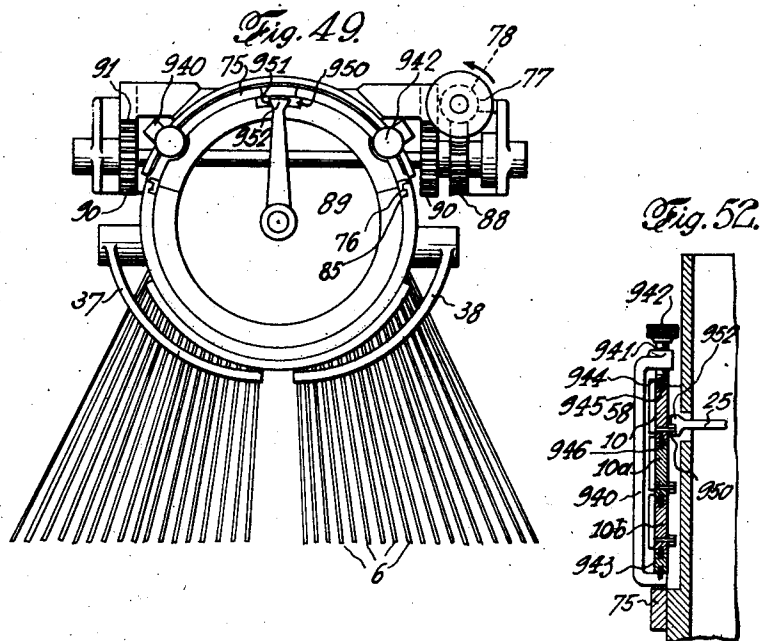
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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 22



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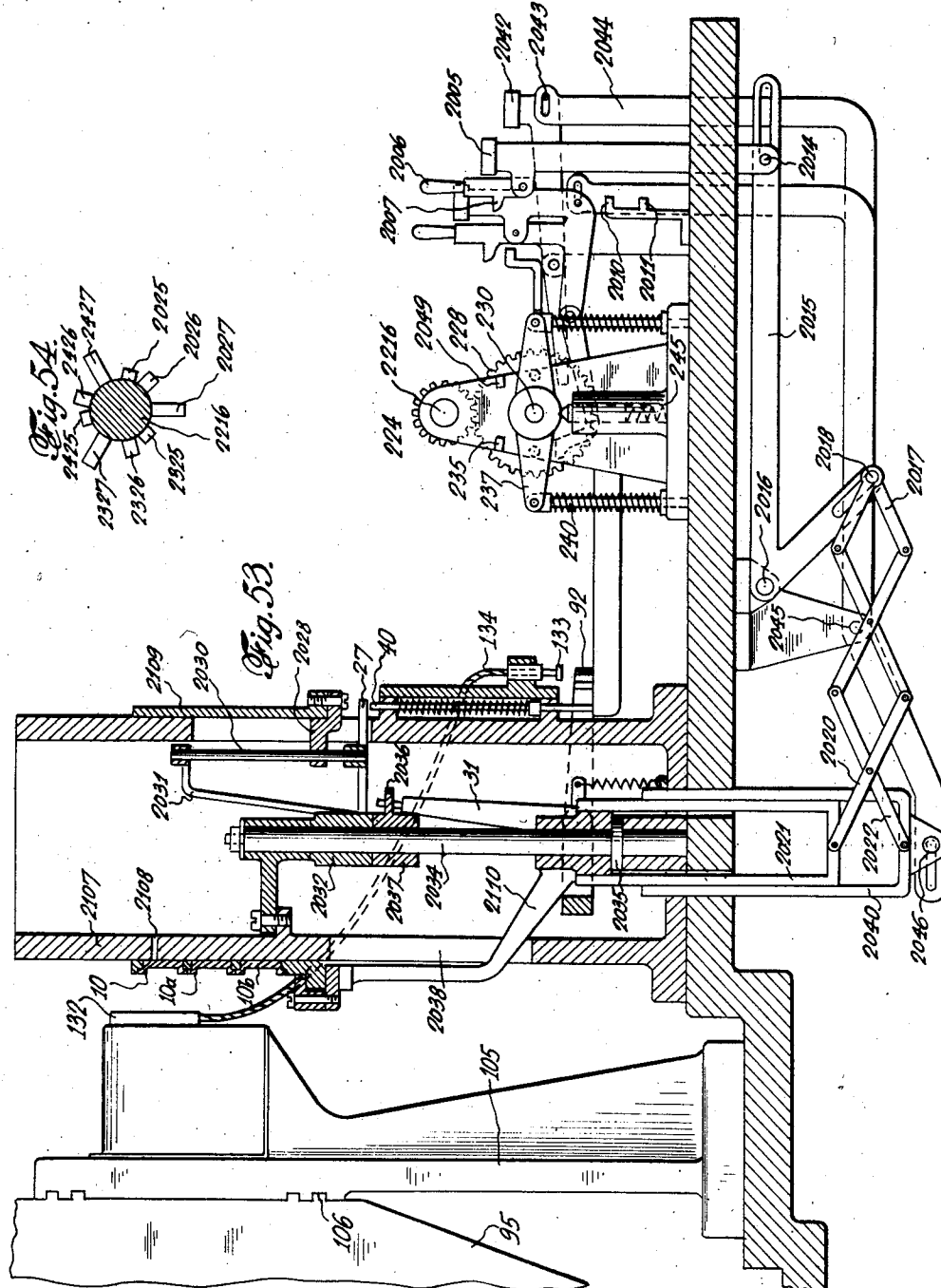
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PHOTOTYPING MACHINE

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24 Sheets-Sheet 23



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2,115,990

PHOTOTYPING MACHINE

Filed June 29, 1934

24 Sheets-Sheet 24

Fig. 55.

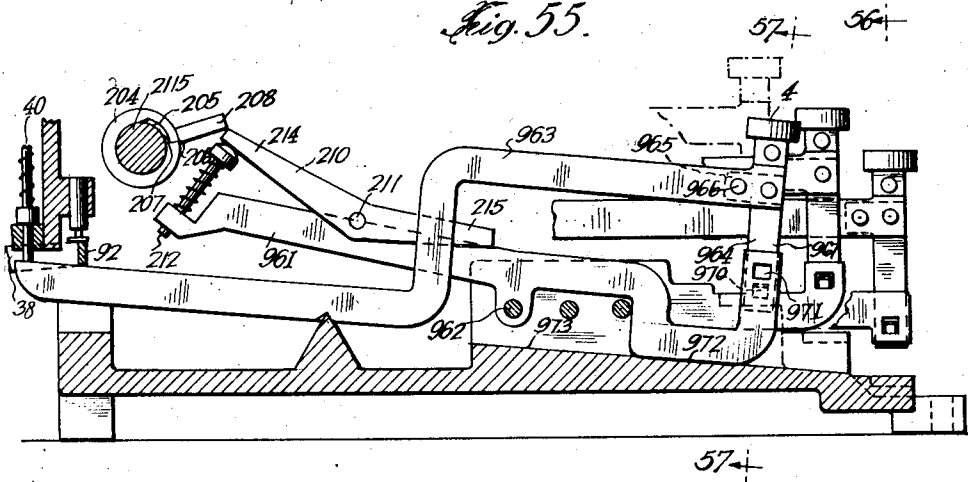


Fig. 56.

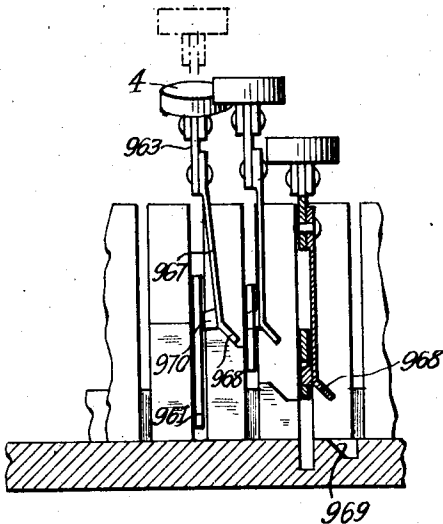
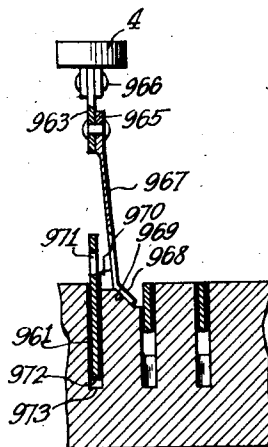


Fig. 57.



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UNITED STATES PATENT OFFICE

2,115,990

PHOTOTYPING MACHINE

Harry C. Jones, New York, N. Y.

Application June 29, 1934, Serial No. 733,012

64 Claims. (Cl. 95—4.5)

This invention relates to type selecting and printing machines of the kind generally known as typewriters and is an improvement of my co-pending application for patent for Typing machines, Serial No. 723,467, filed May 2nd, 1934.

In my said co-pending application, I have disclosed a machine adapted to effect justification of a line of predetermined column width, whereby the justified line may be typed by printing the same on a sheet through an ink or similar medium. Reference is here made also to another co-pending application for patent for Typewriting machines which I have filed on March 18th, 1933, Serial No. 661,558.

This invention, however, contemplates the provision of means for printing selected characters photographically, as distinguished from mechanically, after the character has been selected by any suitable machine designed for that purpose, as by means of the key board of a justifying or other typewriter, which typewriter may be designed to select a style or size of type from a variety of such styles and sizes. The typewriter may also include means providing differential spacing between characters of type and may be adjustable to a wide range of column widths and through a wide range of composition closely approaching the range of hand type composition.

Since my invention has a wide range of utility in the graphic arts and since its various uses and practical applications will occur to those skilled in the art, it is unnecessary to point out any particular field of usefulness except to say that my invention may be employed for the production of justified copy which may later be used in connection with any suitable reproduction process, or in any other manner found to be useful.

The various objects of my invention will be clear from the description which follows, and from the drawings, in which,

Fig. 1 is a top plan view of the left portion of a machine embodied in my invention and showing the justifying unit C; Fig. 1a is a similar view of the central portion of the machine, the canopy over the dark box having been removed to show the interior structure, said view showing the typewriter unit A, it being understood that Fig. 1a is to be arranged to the right of Fig. 1, with the vertical dash-dot lines thereof coincident so that said Fig. 1a and Fig. 1 may be read together.

Fig. 1b is a similar view of the justifying unit B forming the right part of the machine and intended to be arranged at the right of Fig. 1a so that Figs. 1, 1a and 1b may be read together to disclose the entire machine.

Fig. 2 is a front elevation of the justifying unit B and of part of the typewriter unit A.

Fig. 3 is a side elevation of the machine as viewed from the left in Fig. 1b.

Fig. 4 is a vertical section, taken on the line 4—4 of Fig. 1b.

Fig. 5 is a similar section, taken on the line 5—5 of Fig. 1b.

Fig. 6 is a similar section, taken on the line 6—6 of Fig. 1b.

Fig. 7 is a similar section, taken on the line 7—7 of Fig. 1b.

Fig. 8 is a side elevational view of part of the carriage-operating means.

Fig. 9 is a front elevational view of the same.

Fig. 10 is a vertical section taken on the line 10—10 of Fig. 1a and showing the photographic printing means.

Fig. 11 is an enlarged vertical section of a detail of the means for holding and feeding the sensitized material.

Fig. 12 is a vertical section of the feeding and holding means for the sensitized material, taken on the line 12—12 of Fig. 10.

Fig. 13 is a vertical section, taken on the line 13—13 of Fig. 11.

Fig. 14 is a top plan view similar to Fig. 1a, and with the canopy removed, of a modified form of the photographic unit.

Fig. 15 is a vertical section of the same, taken on the line 15—15 of Fig. 14.

Fig. 16 is a vertical section, taken on the line 16—16 of Fig. 1a.

Fig. 17 is a fragmentary elevational view showing the character key of Fig. 16 as having moved to an intermediate position in a type selecting operation, and also showing the relation of its associated differential lever at that instant.

Fig. 18 is a view similar to Fig. 17 showing the character key as having completed its movement incident to the type selecting operation, and showing the relation of a differential lever to such key at that instant.

Fig. 19 is an elevational view of the differential shaft appearing in Figs. 16, 17 and 18.

Fig. 20 is a plan view, partly in section on the line 20—20, Fig. 16, of the support for the type negative as it appears in neutral position.

Fig. 21 is a vertical section, taken on the line 21—21 of Fig. 1a and showing means for moving the negative support to select a row of characters on the type mechanism.

Fig. 21a is a fragmentary perspective view of the negative support or shuttle.

Fig. 21b is a side elevation of the lower part of Fig. 21.

Fig. 22 is a vertical section, taken on the line 22—22 of Fig. 1a and showing the means for so moving the negative support as to select a row of upper case characters.

Fig. 23 is a side elevation of the justifying unit C as viewed from the left of Fig. 1, and Fig. 23a is a similar fragmentary view showing the advanced positions of the pawl and ratchet.

Fig. 24 is a side elevation of the left hand side of a machine, the view terminating at the rear of the bank of stop levers included in the justifying unit C.

Fig. 25 is a fragmentary vertical section, taken on the line 25—25 of Fig. 24.

Fig. 26 is a similar section, taken on the line 26—26 of Fig. 24.

Fig. 27 is a similar section, taken on the line 27—27 of Fig. 24 and showing in detail, the relation of certain differential levers to their associated ratchet wheels.

Fig. 28 is a similar section, taken on the line 28—28 of Fig. 24 and showing certain details of construction peculiar to the bank of stop levers.

Fig. 29 is an elevational view of one of the ratchet wheels of Fig. 27.

Fig. 30 is a fragmentary elevational view of the ratchet wheel of Fig. 29 showing the driving pawl thereof in advanced position.

Fig. 31 is a similar view, showing another of the ratchet wheels.

Fig. 32 is a plan view of the actuating means of the justifying unit C for moving the auxiliary carriage with reference to the main carriage.

Fig. 33 is a vertical section, taken on the line 33—33 of Fig. 32.

Fig. 34 is a similar section, taken on the line 34—34 of Fig. 32.

Fig. 35 is a similar section, taken on the line 35—35 of Fig. 32.

Fig. 36 is a similar section, taken on the line 36—36 of Fig. 32.

Fig. 37 is a similar section, taken on the line 37—37 of Fig. 32.

Fig. 38 is a view similar to Fig. 32 showing the control arm thereof positioned for a given justifying operation, and showing the connector member as having moved from its normal position toward the front of the machine in response to space bar operations.

Fig. 39 is an elevational view, partly in section, of a modified form of the means for advancing the sensitized surface, the modification here involved being intended for the composition of curved lines.

Fig. 40 is a side elevation of the same.

Fig. 41 is a view similar to Fig. 39 of another modified form of the means for feeding the sensitized surface, this modification being designed to permit the composition of type in a circular arrangement.

Fig. 42 is a side elevation of the same, partly in section.

Fig. 43 is an elevational view of the means for feeding the sensitized surface in a direction to compose the type along elliptical lines.

Fig. 44 is a horizontal section of the same, taken on the line 44—44 of Fig. 43.

Fig. 45 is a central vertical section of the same on an enlarged scale.

Fig. 46 is a top plan view of a modified form of the negative support operating means for selecting the character of a row and of a modified shutter.

Fig. 47 is a side elevation of the same.

Fig. 48 is a vertical section of the same, taken on the line 48—48 of Fig. 47.

Fig. 49 is a view similar to Fig. 46 of a modified form of the support for the type negative.

Fig. 50 is a side elevation of the same.

Fig. 51 is a rear elevation of the same.

Fig. 52 is a vertical section of the negative support of Fig. 49.

Fig. 53 is a vertical section of part of a modified form of the negative holder and the associated mechanism of the typewriter unit A showing the means for changing from one font of type to another.

Fig. 54 is a vertical section of the differential bar modified to permit the use and selection of three fonts of type.

Fig. 55 is a vertical section of the key board portion of the typewriter unit A, showing the means for releasing the carriage translating mechanism from the carriage keys to insure movement of the carriage independently of the lifting or release of the carriage keys.

Fig. 56 is a vertical section of the same taken on the line 56—56 of Fig. 55.

Fig. 57 is a vertical section taken on the line 57—57 of Fig. 55 and showing the carriage keys depressed and released from the carriage translating mechanism.

It will be understood that the machine shown and described is merely one of the practical embodiments of my invention and as shown, comprises the unit A which I will term the typewriter unit, the unit B which I will call the line justifying unit and which controls the word spacing and character spacing operations, and a line justifying unit C which controls the word spacing.

It will further be understood that since the justifying units B and C are in many respects identical with the corresponding units shown and described in my said co-pending application Serial No. 723,467 above mentioned, reference is hereby made to the said co-pending application for the details of said mechanism not fully described herein. It may be well to point out here, as hereinbefore indicated, that one of the primary differences between this invention and that of my said co-pending application is in the method and means for printing the character after a character has been selected by the operation of the proper key or keys. In the present invention, the printing is preferably done photographically by means of light permitted to pass through a selected character of a type carrying negative on to a suitable light sensitive surface.

Typewriter unit A

The typewriter unit A, in that embodiment of my invention shown, is adapted to serve a three-fold purpose. First, it may be employed if desired in the same manner as any typewriter, but particularly to obtain a draft copy of the subject matter in line formation, and to determine the extent of necessary justification for a definite column width. Second, it may be employed to obtain either a record or indication of the required justification for each line when used in connection with the recording or indicating means set forth for that purpose in my said co-pending application Serial No. 723,467. Third, it may be employed to obtain a justified copy by means either of the justifying unit B or the justifying unit C, and this third use of my invention is here the most important.

Said unit A (Fig. 1a) includes the key board, the respective character keys of which are piv-

otally supported intermediate their ends and co-operate with companion levers 6 pivotally supported intermediate their ends. At the rear of the key board 4 is located the stationary sleeve support 7 (Fig. 16) provided with a base 8 by means of which it is secured to the frame of the machine. The sleeve 9 is arranged to slide vertically on the support 7 and carries a series of negative holders 10, 10a and 10b. The negative holders will be more fully described hereinafter. Suffice it to say at this time that each of the holders carries a suitable negative provided with a number of rows of characters as for example, a row of lower case letters, a row of upper case letters, and a row of figures. The row of any particular negative is selected on the depression of the proper row-selecting key of the key board, at which time the sleeve 9 is raised or lowered to the proper extent to carry the proper aperture 11 of the negative holder into registration with the aperture 12 of the support 7 whereby the light passing through the aperture 12 passes through the aperture 11 and through the character on the negative thus selected by the operation of the proper key of the keyboard.

Light is obtained from any suitable source as for example, the lamp 13, the light from which is projected by the reflector 14 into the tube 15. The mirror 16 arranged in the tube reflects the light through the light tube 17 and thence through the aperture 12.

The negative holders are operated in much the same manner as the shuttles of the well known typewriters of the Hammond type and will therefore be referred to hereinafter as the shuttles. As illustrated, three shuttles 10, 10a and 10b are suitably secured to the sleeve 9, preferably in vertically aligned position. Each of said shuttles is inserted into a suitable groove made in the upper portion of the sleeve, in which the shuttle slides horizontally during its selection of a character. Between the shuttle holding grooves, the sleeve is slotted for the passage of the horizontal flange 18 of the negative holder, or shuttle (Fig. 21a), said flange being provided with a perforated lug 19 through the perforation of which is passed the vertical pin 24, carried by the shuttle actuating arm 25 secured to a hub 26, which is free to rotate on the stud 27. Said stud is supported through a suitable connection by the support 7 (Fig. 16). To the hub 26 there is connected an impedance arm 27, the outer end of which is free to move in a horizontal slot 28 formed in the upper part of the support 7.

It will be seen that when the hub 26 is rotationally moved in either direction, the shuttle is moved in the same direction as the hub. The means for actuating the hub 26 and in turn, the shuttle 10 includes a pair of arms 30, 31 which are pivotally supported with respect to the support 7 and the upper ends of which are adapted to normally assume the respective positions shown in Fig. 20 adjacent a pair of shoulders 32, 34 formed on the hub 26 and adjacent to which are provided arm-receiving slots adapted to respectively accommodate the upper ends of the arms 30, 31 under certain conditions of operation. Forward movement of the arm 30 is effected to move a shuttle 10 in a clockwise direction as viewed in Fig. 20 by reason of the fact that said arm is connected to the actuating segment 37 (Fig. 1a) which overlies the inner ends of the levers 6 associated with the character keys 5 at the left of the key board whereas forward movement of the arm 31 is effected by reason of its

connection to an actuating segment 38 overlying the inner ends of those levers 6 at the right of the key board.

In order to so limit the movement of the shuttle 10 as to effect proper selection of a character corresponding to the depression of any one of the character keys 5, there are provided a plurality of stop pins 40 mounted on the support 7 for vertical movement, there being one stop pin for each lever 6. It is to be noted that said stop pins are located in direct alignment with the rear ends of the respective lever 6 and are normally held in depressed position (Fig. 16) by their associated compression springs 41. From the relation of the stop pins to the respective lever 6 and the relation of such levers to the respective character keys 5, it will be understood that when a given character key is depressed, its corresponding stop pin will be moved upwardly and into the path of the impedance arm 27 so that the character on the shuttle 10 corresponding to the depressed character key will be properly positioned in the character selecting position. It will be understood that the stop pins 40 function as described regardless of whether the printing operation is being carried out with respect to lower case letters, capital letters, or figures.

As will be appreciated from Fig. 16, the normal position of the shuttle support or sleeve 9 is such as to render the upper row of characters, namely, the lower case letters, effective. If it is desired to so position the shuttle support or sleeve 9 to render the intermediate row of characters, namely, the capital letters 20 (Fig. 21a) effective, the sleeve 9 is slightly elevated whereas if it is desired to render the lower row of characters, namely, the figures 21 effective, the sleeve 9 is elevated to a somewhat greater extent.

Shuttle support elevating mechanism

Referring to Fig. 1a, it will be noted that there are provided within easy reach of the operator, a pair of sleeve elevating key levers 42 and 44, the former of which may be labeled "Cap", and is operable to so elevate the sleeve 9 as to render the row of capital letters 20 effective, and the latter of which is labeled "Fig." and is operable to raise the sleeve into position to render the row of figures 21 effective.

As shown in Fig. 22, the lever 42 is pivotally connected intermediate its ends to a suitable support as shown at 45, and is provided with a latch 46 by which it may be held in a depressed position, the latch 46 being adapted to interlock with a cooperating hook or keeper 47 suitably supported in a fixed position. The forward end of the key lever 42 is pivotally and slidably connected as at 48 to the upturned portion of a fulcrum arm 50, which is pivotally connected intermediate its ends to a suitable support as shown at 51, the rear end of the arm being suitably connected as shown at 52 to a crank arm 53 as by means of the link 49. Said crank arm 53 is provided with a hub 54 mounted on a horizontally disposed shaft 55 journaled at its ends in bearings 56 and 57 respectively, as shown in Fig. 1a. In order that the fulcrum arm 50 may be limited in its downward movement and thus limit rotation of the shaft 55 in a counterclockwise direction as viewed in Fig. 22, there may be provided a suitably supported stop lug 62 which is disposed in such relation to the fulcrum arm as to permit the latch 46 to be moved into locking engagement with its associated hook or keeper 47 at or about

the instant the fulcrum arm reaches its limit of downward movement.

As shown in Fig. 21, the key lever 44 is pivotally connected intermediate its ends to a suitable support as at 64 and is provided with a latch 65 by which the lever may be held in a depressed position, the latch 65 being adapted to interlock with a cooperating hook 66 suitably supported in a fixed position. The key lever 44 is slidably and pivotally connected as at 67 to the upturned portion of a fulcrum arm 68 which is pivotally connected intermediate its ends to a suitable support as at 70, the rear end of the arm being suitably connected as at 71 to a crank arm 72 as by means of the link 73. Said crank arm 72 is provided with a hub 74 mounted on the shaft 55. In order that the fulcrum arm 68 may be limited in its downward movement, thus limiting the rotation of the shaft 55 in a counter-clockwise direction as viewed in Fig. 21, there is provided a stop lug 179 which is suitably supported in such relation to the fulcrum arm 68 as to permit the latch 65 to be moved into locking engagement with its associated keeper or hook 66 at or about the instant the fulcrum arm reaches its lowermost position.

Carried by the shaft 55 is a pair of cams 80 (Fig. 21b) each of which is maintained in engagement with the opposed cooperating lugs 81, 82 formed on the sleeve part 83. Said sleeve part embraces the stationary cylindrical lower part 64 of the support 7 for sliding movement thereon, and is connected with the remainder of the sleeve 9 for normal elevation and rotation therewith, as by means of the tongue and groove connection 76, 35 to permit relative vertical adjustment thereof, it being understood, however, that when the negative shuttle 10 is in operation, the lowermost edge 36 of the sleeve is in contact with the uppermost edge 87 of the sleeve support, though not in contact when the other shuttles are operative.

From the foregoing description of the sleeve elevating mechanism, it will be apparent that if the key lever 42 is depressed a sufficient distance to move the fulcrum arm 50 into engagement with the stop lug 62 and so permit the latch 46 to move into engagement with its associated keeper 47 the shaft 55 will be rotated a sufficient distance in a counter-clockwise direction as viewed in Fig. 22 to cause the row of capitals 20 carried by the shuttle 10 to assume a position wherein the desired capital of the row may be selected for printing, such positioning of the capitals being effected by reason of the fact that the sleeve 9 together with its associated sleeve part 83 are moved in response to the action of the cams 80 on the lugs 81 and 82 carried by the sleeve part. Moreover, it will be understood that the correct positioning of the capitals is insured by reason of the presence of the stop lug 62 which definitely limits the movement of the fulcrum lever 50 in a downward direction.

As to the key lever 44, it will be understood that when it is depressed a sufficient distance to engage the stop lug 179 (Fig. 21) and permit the latch 65 to move into locking engagement with its associated keeper 66, the shaft 55 will be rotated a sufficient distance in a counter-clockwise direction to cause the row of figures 21 carried by the shuttle 10 to assume an operative position for the selection of the character in said row.

Negative selecting mechanism

As has been hereinbefore indicated, the window part of the sleeve 9 carries three negative holders 75 10, 10a and 10b. In each of the holders is set

a negative 58 (Fig. 21a). The negative is preferably made of any suitable transparent or translucent material such as photographic film adapted to permit the passage of light and of sufficient stiffness and resiliency to be adequately held in its holder. Arranged horizontally on each of the negatives are three rows 22, 20 and 21 of lower case characters, upper case characters and figures respectively. I prefer that the characters in each row be transparent and light-pervious and that the background of the characters be impervious to light. It will be understood that by the arrangement of a plurality of negative holders, it becomes possible to change readily from a font of type carried by one of the negatives to a different font of type carried by a different negative. The means for accomplishing this end will now be described.

As shown in Figs. 1a, 10, 16 and 21, a window carrying the negative holders forms part of the sleeve 9 but is adjustable relatively to the remainder of the sleeve as by means of a vertically arranged tongue and groove connection 76, 85, (Figs. 1a, 16, 49), between the edges of the window and the adjacent edges of the remainder 83 of the sleeve. Vertical adjustment of the window relatively to the sleeve is effected by means of the thumb screw 77 which rotates the worm 78 on the shaft 79 and therethrough rotates the worm wheel 88. Mounted on the shaft 89 and on opposite sides of said window are the pair of pinions 90 which engage the racks 91 carried by the window 75, it being understood that the shaft 39 is supported by a suitable bearing carried by the sleeve 9.

On the manual operation of the thumb screw 77, the window 75 is raised or lowered the proper amount to bring its row of lower case letters 22 into registration with the aperture 13 of the support 7 whereafter the operation of the machine may proceed in the manner hereinbefore described.

In order that the pin 24 may be disengaged from the negative holder with which it has been previously in engagement and in order that it be re-engaged with a different negative holder, it will be understood that after the thumb screw 77 has been operated sufficiently to remove the pin 24 from the lug 19, any character key may be depressed to swing the arm 25 and the pin 24 carried hereby out of the way of the lug on the other negative holder which it is desired to bring into operative position, whereafter the remainder of the movement is imparted to the negative holder by the thumb screw 77 and the character key then released to bring the pin 24 into registration with the aperture of the lug 19 of the negative holder to be re-engaged by the pin.

To change the shuttles or negative holders, the thumb screw 77 is turned in the proper direction to disengage the pin 24 from the negative holder, after which said holder may be readily removed from the window 75, the flange 18 thereof during removal sliding out of the slot in the sleeve. A different negative holder may be then inserted in the sleeve groove previously occupied by the removed holder and the lug 19 thereof reengaged by the pin 24.

Paper carriage unit

Suitably supported on the base of the machine for translatory movement in a horizontal direction, (Figs. 1a, 10, and 23) intermediate a pair of guides 94 is a main carriage 95 which is pro-

vided with a depending web 96 operating within a depending guide channel 97. Mounted on the main carriage 95 for movement longitudinally thereof intermediate a pair of guides 98 is an auxiliary carriage 99. In order to avoid possible inaccuracies, these parts are made substantially rigid, thereby to eliminate vibration. The upper part of the carriage 95 constitutes a dark box from which light is excluded except such light as may pass through the lens after having passed through the negative.

In order, however, to provide access to the interior of the box, a canopy 101 of opaque flexible material closes the upper end of the box, being connected thereto in light-imperious relation by means of the frame 102. The canopy is provided with a suitable screw eye as 103 by means of which it may be suspended from the hook 104 carried in the upper part of the frame 102. It will be understood that the frame 102 may be removed from the top of the dark box or carriage 95 in order that the dark box may be loaded with light-sensitive material.

To provide a light-proof slidable connection between the carriage 95 and the lens support, the rear part of the support 105 and the front part of the carriage 95 are connected by a suitable interlocking connection such as the multiple tongue and groove connection 106 (Fig. 10). The front end of the lens unit or lens 100 is suitably supported by an extension of the support 105 while the rear end of said lens is carried by a member serrated at its under surface. The serrated member 107 in turn engages the correspondingly serrated member 108, said member 108 being serrated also on its under surface to engage corresponding serrations 109 on the upper part of the lens support 105. It will be seen that the lens may be focussed by loosening the clamp screw 110 and moving the member 107 along the serrated member 108 to its proper position. Additional adjustment is obtainable by loosening the clamp screw 111 and similarly adjusting the serrated member 108 relatively to the serrations 109, it being understood that the serrations above described are preferably made along transversely spaced lines and may be triangular in cross-section.

Mounted on the auxiliary carriage 99, is the holder 112 for the sensitized material, which in the present instance is shown in the form of a sheet 113 of paper or any other suitable material provided with a coating sensitive to light. Said holder 112 is operatively connected, as viewed in Fig. 1a, at its left side to the justifying mechanism by means soon to be described, and is given the proper movement so that light passing through the various characters of the negative as the printing operation proceeds is focussed on to the sheet 112 in the proper position to affect the sensitive coating thereon and thereby to permit printing of the characters in their proper justified position on the sheet.

The holder 112 is provided at its lower end with a suitable perforation adapted to receive any one of a series of dowels 115 on the base of the auxiliary carriage 99, whereby the holder may be set in any one of a number of possible positions at various distances from the lens 100 to effect the printing of characters of different sizes on the sheet 113. The holder is clamped in position (Fig. 12) in cooperation with the selected dowel 115 by means of a suitable clamp 116.

The roll of sensitized material is mounted on the shaft 117 and is preferably provided with a

series of spaced edge perforations 118 (Fig. 12) adapted to be engaged by a predetermined number of spring-pressed pins (Fig. 11) carried by the feed roll 120. Suitable cross pins as 121 on the paper-engaging pins, engage the cam surface 122 of the feed roll and thereby normally hold the pins 119 in their retracted positions. When, however, said pins reach the cut-out portion 122 of the feed roll, the pins 119 under the influence of the springs thereon, move outwardly and engage the perforations of the sheet. Rotation of the feed roll thereby feeds the sheet upwardly in between the guide rolls 123, 124.

To maintain the sheet under tension after the sheet has been threaded past the guide plate and the guide roller 126, a suitable wind-up mechanism is provided to hold and wind up the upper end of the sheet. Said wind-up mechanism comprises a suitable roller to which the end of the sheet is attached and which roller is urged in the proper direction to tension the sheet by means of a suitable spring such as the clock spring 127 (Fig. 12). In order to maintain the sheet against possibility of reverse movement, the pawl 128 on the casing for the spring 127 engages a ratchet wheel 129 on the shaft of the wind-up roll. The spring may be wound up by means of a suitable handle, after the pawl 128 has been disengaged from its ratchet wheel.

From the above, it will be seen that to load the dark box constituting part of the carriage 99, a roll of sensitized material is arranged on the shaft 117 of the holder 112, this being preferably done in a dark room, the sheet being threaded past the feed roll 120, and past the guide rolls 123, 124 and 125 and the end of the sheet engaged in the roll of the wind-up mechanism. The holder is now arranged so that its perforation 114 receives a selected dowel pin 115 and is then clamped in place by the clamps 116. The lens 100 is now focussed as by moving the end thereof and moving the serrated members 107 and 108, if necessary, after which the clamps 110 and 111 are utilized to clamp the lens in its focussed position. The coupling 130 (Fig. 1a) which connects the feed roller to the mechanism for operating the carriage is then slipped into place whereafter the canopy 101 is arranged on top of the dark box and hung and fastened in position, the eye 103 being passed over the hook 104. The operator may then grip the slide 131 through the flexible canopy to remove said slide and thereby to expose the sheet 113 to the action of light passing through the lens 100.

It will be understood that normally, the light passing through the negative cannot enter said lens by reason of the interposition of a shutter 132 between the negative and the receiving end of the lens. Said shutter, however, is temporarily opened on the operation of any character selecting key 5. The companion lever 6 for the character key at its inner end (Fig. 16) engages the crank arm 92 and raises said arm on the depression of the character key to move the shutter button 133 and thereby to operate the shutter cable 134 to actuate the shutter 132. Said shutter being of well known construction, and being illustrated as cable operated, need not be described in detail except to say that it may be suitably regulated to make an exposure of a predetermined time interval in a well known manner.

Carriage unit translating mechanism

In order that the carriage may be moved during the printing operation, there is provided a main

drive shaft 2115 (Fig. 1a) which is disposed longitudinally of the machine at the rear of the key board and is suitably supported for rotation. Said shaft is adapted for step-by-step rotation during the printing operation through the instrumentality of means hereinafter more particularly described and is provided at one end with a bevel gear 2117 meshing with a similar gear 2118 (Fig. 1b) carried by a horizontally arranged and exposed shaft 2120. On said shaft is carried a pawl carrying arm 2122 (Figs. 1a, 1b) carrying a pin 2009 (Fig. 9) on which is pivotally supported a spring tensioned pawl 2124 adapted to cooperate with a driving ratchet wheel 2125. Said ratchet wheel is loose in the shaft 2120 and is connected to a holding ratchet wheel 2126 which is also loose on the shaft 2120 and the hub portion of which is connected to a spur gear 2127 adapted to move with the ratchet wheel 2126 and in relation to the shaft 2120.

It is to be noted that the pawl 2124 is such that when the arm 2122 is moved against the action of its associated return spring 169 in a clockwise direction, as viewed in Fig. 9, the pawl 2124 will ride over the teeth of the ratchet wheel 2125, but will engage one of the teeth of that wheel on reverse movement of the arm and thus effect rotation of that ratchet wheel, the ratchet wheel 2126 and the spur gear 2127. In order that the spur gear 2127 may be held against rotation under the influence of momentum at the time the shaft 2120 completes its return movement, there is associated with the ratchet wheel 2126 a holding pawl 2128. This holding pawl is carried by a shank 2013 slidably mounted within a barrel 2019 pivotally connected to the bearing 2121 by a shaft 2023 to which is secured a trigger lever 2029. Surrounding the pawl shank 2013 is a compression spring 2033 which serves to urge the pawl upwardly, and secured to the lower end of the barrel 2019 is a tension spring 2039 which tends to move the barrel in a counter-clockwise direction about its pivot as viewed in Fig. 9.

The trigger lever 2029 is normally engaged by a pin 2009 carried by an arm 2122 so that the pawl 2128 is held in engagement with its associated ratchet wheel 2126. As the arm 2122 is moved in a counter-clockwise direction, however, the pawl 2128 is moved into engagement with the ratchet wheel 2126 against the influence of the tension spring 2039. From the foregoing description of the pawl 2128 and its associated elements, it is obvious that as the arm 2122 completes its return movement, the pawl 2128 will be moved into engagement with its associated ratchet wheel 2126. Should the momentum of the carriage 95 to which the gear 2127 is operatively connected, as will hereinafter more clearly appear, slightly over-run its intended extent of movement upon completion of the return movement of the arm 2122, the spring 2039, associated with the pawl 2128 will serve as a buffer for the pawl which is then in engagement with one of the teeth of its associated ratchet wheel 2126 and will return that wheel to such a position as to effect an abutting relation between the pawl 2124 and the particular tooth of the ratchet wheel 2126 with which that pawl cooperated during the return movement of the arm 2122.

Meshing with the spur gear 2127 is a similar gear 2130 carried by the shaft 3134 arranged coaxially of the shaft 2134. The shaft 2134 carries a ratchet wheel 2132 rigid thereon. On the drive shaft 3134 is rigidly connected an arm 135 hav-

ing journaled in its outer end a pin 136 to which is secured a driving pawl 138 and a trip arm 140, the pawl being normally held in engagement with the ratchet wheel 2132 by suitable means such as a tension spring 141. The trip arm 140 is provided at its outer end with a roller 142 which is adapted to cooperate with the inclined face of a cone-like cam 144, splined to the shaft 2134 for longitudinal movement thereon and provided with an annular groove 145 adapted to receive a pair of pins 146 carried by a yoke-like actuating element 147 secured to a shaft 148 journaled in a bearing 150 which is mounted on the base of the machine and is provided at its outer end with an arm 540 (Fig. 8), the function of which will hereinafter more clearly appear.

As shown in Figs. 1b and 7, the shaft 2134 in alignment with the shaft 3134, and adapted to be operatively connected thereto by the cam 144, is provided at its forward end with a pinion 152 which is adapted to mesh with a rack 154 mounted for horizontal movement within a pair of guides 155 and 156, supported on the base of the machine, the side walls of the latter of which guides is slotted as at 153.

That end of the rack 154 which is most remote from the pinion 152 is secured to and supported by a guide block 158 mounted for horizontal movement within the guide 156. The rack 154 and the guide block 158 are connected by a pair of pins 160 to a sheath-like slide 161, one of which pins is journaled to the rack 154 and the other of which is journaled in the guide block 158 so as to permit the slide 161 to oscillate to a slight extent under certain conditions of operation as will hereinafter become apparent. The slide 161 is adapted to slidably receive one end of the translating arm 162 which is pivotally connected to the base of the machine as shown at 164, and is adapted to move in a horizontal plane in order to move the carriage step-by-step during the printing operation. The arm 162 is connected to the main carriage 95 through the medium of a tongue-like connector element 165, which at one end is provided with a yoke 166 (Fig. 1b), the arms 167 of which carry a pin 168, to which is connected a lug 170 attached to the carriage 95, it being noted that the arms 167 of the yoke are separated from each other a sufficient distance to permit the connector element 165 to be moved transversely of the carriage to various positions of adjustment. The connector element 165 is mounted for longitudinal movement within a trough-like guide 171, the side walls of which are slotted as shown at 159 (Fig. 7), and to the bottom wall of which are connected a pair of transversely extending wings 172 (Fig. 5) carrying an elongated arm 174 in cooperation with the longitudinal walls of the slot, serving to insure a straight line adjustment of the trough-like guide 171 when it is moved transversely of the connector 165 to its various positions of adjustment, as and for the purpose hereinafter more particularly described. The trough-like guide 171 is held on the base of the machine by a pair of gibs 176 (Fig. 6), secured to the base and overlying the marginal portions of a pair of depending rib-like extensions 177 carried by the guide 171 at opposite ends thereof and projecting into slots 178 formed in the base. In order that the connector 165 may be moved transversely while maintaining a cooperative relation to the arm 162, the connection afforded between the connector 165 and the arm 162 is similar to the connec-

tion between that arm and the rack 154 in that it includes a guide 180 provided with a pair of pins 181, one of which is journaled in a connector and the other of which is journaled in a keeper plate 182 (Fig. 5) carried thereby.

Control means for the carriage-unit translating mechanism

The control means for the carriage-unit translating mechanism includes the character keys 5 and a U-shaped space bar 184 (Fig. 1b), which is arranged within easy reach of the operator and the side arms 185 and 186 of which are pivotally supported. The side arms 185 and 186 are operatively connected to the shaft 2115 by suitable means permitting adjustment of the extent of movement of said shaft in response to space bar operations, as for example, for various sizes of type although the space bar 184 is limited in each of its downward movements by a suitable stop or abutment. Since the operative connection just mentioned is adequately shown and described in my co-pending application Serial No. 723,467, reference is made to said application for a detailed description thereof. It will be understood that when the space bar 184 is depressed, the shaft 2115 is moved in the proper direction to advance the carriage and it will also be understood as fully explained in my said co-pending application that said shaft 2115 may be moved without disturbing the normal position of the space bar through the shaft actuating means associated with the character keys and hereinafter more particularly described.

The character-key control actuating means for the shaft 2115 are adapted to impart differential movement to that shaft and include (Figs. 16, 17 and 18) a plurality of driving hubs 204 mounted for individual movement on the shaft. These hubs correspond in number to the number of character keys 5 and each is provided internally with a recess 205, accommodating a driving lug 206 carried by the shaft and adapted to engage an abutment 207 provided adjacent the recess. An arm 208 is carried by each hub 204 and is adapted to cooperate with a bell-crank-lever 210 pivotally connected to its associated character key 5 as shown at 211. Each of these bell-crank levers is held in its normal position as shown in Fig. 16 by a spring-pressed pin 212, slidably supported in the rear end of its associated character key 5, the pin 212 being disposed directly beneath one arm 214 of the bell-crank-lever, whereas the other arm 215 of that lever is disposed directly beneath a removably supported abutment shaft 216 disposed above the key board.

This shaft is journaled at one end in a removable bearing 217 as shown in Fig. 19 and is provided at its other end with a square stud 218 adapted to be interposed into and readily removed from a square socket 220, carried by a rotatable hub 221 journaled in a suitable bearing 222 and provided with a driving gear 224, the function of which will hereafter more clearly appear. The shaft 216 is provided with a series of lower case letter lugs 225, a series of capital letter lugs 226, and a series of figure lugs 227, it being noted that the lugs 225 differ in length, that the lugs 226 differ in length, and that the lugs 227 differ in length. The lugs 225 correspond in number to the number of lower case letters provided on the shuttle or negative holder 10, and the lugs 226 correspond to the number of capital letters provided on the shuttle, and the number of lugs 227 corresponds to the number of figures provided on

the shuttle. As will hereinafter more clearly appear, the shaft 216 is automatically positioned to render either the lower-case letter lugs 225, or the capital-letter lugs 226, or the figure lugs 227 effective with respect to the bell-crank-lever 210, depending upon whether a character key is actuated with respect to the lower-case letters or with respect to the capital letters or with respect to the figures provided on the shuttle 10.

Assuming that the shaft 216 occupies its normal position shown in Figs. 16, 17 and 18, and the character keys 5 are being operated, the operation of any given key will move the shaft 2115 to an extent proportional to the length of the lug 225 corresponding to that key. In this connection it is to be noted that as the key is depressed, the bell-crank-lever 210 will swing in a counter-clockwise direction, as viewed in Figs. 16, 17 and 18, without moving the shaft 2115 until such time as the arm 215 of the bell-crank-lever engages its corresponding lug 225, as shown in Fig. 17, whereupon further movement of the key will cause the bell-crank-lever to move in a counter-clockwise direction at the same time it is moved upwardly in its entirety, with the result that the shaft 2115 will be moved to a definite extent, as shown in Fig. 18.

It will be appreciated that by the novel means herein employed for translating motion to the shaft 2115 through the medium of the character keys 5, the extent of the rotation of said shaft may be made to correspond to the width of the character peculiar to the character key by proportioning the lengths of the lugs 225, 226 and 227 according to the width of the characters to which these lugs and the respective character keys correspond. It will therefore be seen that the shaft 2115 will be moved different distances and the carriage 95 will also be moved corresponding distances to conform to the different character widths.

In order that the shaft 216 may be rotated in a clockwise direction as viewed in Fig. 17, when the printing operation is to be carried out with respect to capital letters, there is provided a positioning gear 228 (Fig. 22) which meshes with the gear 224 and which is carried by a shaft 230 suitably supported directly beneath the shaft 216. The gear 228 is provided at one side with a pin 231, into engagement with which the rear end of the key lever 42 is adapted to move when that lever is depressed to elevate the shuttle support to operating position with regard to the row of capital letters.

It will be understood that as the key lever 42 is depressed, the gear 228 is rotated in a counter-clockwise direction as viewed in Fig. 22, thereby moving the abutment shaft 216 through the driving gear 224 in a clockwise direction as viewed in Figs. 16 to 18, the shaft 216 being brought to rest, by means hereinafter more particularly described, as the capital-letter lugs 226 assume a vertical position.

In order that the shaft 216 may be rotated in a counter-clockwise direction as viewed in Figs. 16 to 18 when the printing operation is to be carried out with respect to the row of figures provided on the shuttle 10, the gear 228 is provided with a pin 234 arranged diametrically opposite the pin 231 and on the opposite side of the gear, the pin 234 being adapted to cooperate with the rear end of the key lever, as shown in Fig. 21, when that lever is depressed to so elevate the shuttle as to position the row of figures for operation. As the key lever 44 is depressed, the gear

228 is moved in a clockwise direction as viewed in Fig. 21 with the result that the shaft 216 is rotated in a counter-clockwise direction, thus vertically positioning the figure lugs 227, the shaft 216 being limited in its counter-clockwise movement as one of the arms 237 moves into engagement with a stop lug 235 suitably supported in the path of travel of that arm and corresponding to a similar stop lug 2049 positioned in the path of travel of the other arm 237 to limit the shaft 216 in its movement in a clockwise direction, as when the capital-letter lugs 226 are being moved into vertical position as previously described.

Upon the release of either the key lever 42 or the key lever 44, the gear 228 is returned to its normal position shown in Figs. 21 and 22, by reason of the fact that the shaft 230 to which that gear is connected carries a hub 236 having a pair of diametrically opposed arms 237 which are normally held in horizontal position by a pair of springs 238, carried by a pair of rods 240, pivotally connected to the arms 237 and slidable within the openings 241 formed in the base of the machine, the springs 238 being confined intermediate such base and the upper shouldered ends of their associated rods. In order to lend stability to the gears 224 and 228 and to the shaft 216 when that shaft is normally positioned as shown in Figs. 16 to 18, the hub 236 to which the arms 237 are connected, is provided with a detent 242 adapted to receive the upper pointed end of a detent plunger 244, carried within a suitable housing 245 and yieldably supported by a compression spring 246.

From the foregoing description of the character-key actuated means and the space bar actuated means, both with reference to the drive shaft 2115, it will be understood that said shaft is moved in a counter-clockwise direction as viewed in Figs. 17 and 18, once for each character key operation and once for each space bar operation, and is returned pursuant to each operation to its normal position by the return spring 169, connected to the pawl carrying arm 2122 of the shaft 2120, which is moved in accordance with the shaft 2115, the spring 169 serving on the return movement of the arm 2122 to impart rotation, through the pawl 2124 and its cooperatively associated ratchet wheel 2125 to the carriage-actuating pinion 152.

Here it may be well to remark that although only one abutment shaft 216 is herein shown, it is obvious that for this shaft, other similar shafts may be substituted according to the nature of the character spacing required, in which cases the length of the respective lugs 225, 226 and 227 would be proportioned according to the spacing desired with reference to the characters corresponding to those lugs. To illustrate in this connection, it will be assumed that the arm shaft 216 herein shown and described is such that a given carriage movement is produced with respect to the letter *i* and that a greater carriage movement is effected with regard to the letter *m*, and that it is desired to change the character spacing so as to obtain, for example, a greater carriage movement with regard to the letter *i* and a correspondingly greater carriage movement with relation to the letter *m*. Such a requirement could be satisfied by substituting for the differential shaft 216 a similar shaft on which the lug controlling carriage movement peculiar to the letter *i* is longer and on which the lug controlling the carriage movement peculiar to the letter *m* is correspondingly longer.

Modification of carriage movement control shaft

As shown in Fig. 54, however, an abutment shaft 2216 may be provided to take care of the different fonts of type carried by the negative holders 10, 10a and 10b. In this case, three sets of lugs are provided, one set for each font of type. For example, the lugs 2025, 2026 and 2027 corresponding to the lugs 225, 226 and 227 may be provided for the negative 58 carried by the negative holder 10. Similarly, the lugs 2325, 2326 and 2327 may be used for the various characters carried by the negative holder 10a and the lugs 2425, 2426 and 2427 may be used in connection with the negative holder 10b.

When the abutment shaft 2216 is used, it becomes possible to select a desired font of type merely by the depression of a suitable key. As seen in Fig. 53, the font change key 2005 is in its normal position wherein the negative holder 10 has been selected for operation. Said key is provided with a pivoted latch 2006 provided with a locking projection 2007 adapted to engage either of the locking lugs 2010 or 2011 when the key 2005 is sufficiently depressed to select the negative holders 10a or 10b respectively and to maintain the parts in the thus selected positions thereof.

It will be understood that where means are thus provided for selecting a font of type, suitable provision should be made for selecting a particular row of characters such as lower case, upper case or figure characters in each of the negative holders, and that the means heretofore described for this purpose should preferably be somewhat modified. Toward this end, as will be seen from Fig. 53, I have shown a modified form of row selecting means in connection with the font selecting means. Said means will now be described. The character key 2005 is connected at its lower end as by the pin and slot connection 2014 to the lever 2015. Said lever is pivoted as at 2016 to the frame or base of the machine and at its rear end is pivotally connected to the pantagraph arm 2017 as by the pin and slot connection 2018. At its rear end one arm 2020 of the pantagraph is pivotally secured to the inner sleeve 2021, the other arm 2022 being secured to the outer sleeve 2040.

During ordinary operation of the machine, said sleeves 2021 and 2040 move vertically as a unit but during the font selecting operation, said sleeves move relatively to each other. The negative carrying sleeve 2109 is suitably connected to the inner sleeve 2021 as by means of the arm 2110. Said sleeve 2109 is mounted for vertical movement relatively to the stationary support 2107 which is provided with the light aperture 2108 corresponding to the aperture 12 in the support 7 hereinbefore described. The sleeve 2109 is provided with an extension 2028 which carries the rod 2030, said rod connecting the impedance arm 27 to the arm 2031 extending from the hub 2032 secured to the post 2034, which is in turn provided with a suitable shoulder 2035 for engaging the inner sleeve 2021 and limiting the lowermost position of said sleeve. The arm 31 by its engagement with the projection 2036 on the hub 2037, which is secured to the post 2034, serves to rotate said post and through the sleeve 2021 and the arm 2110 rotates the negative holding sleeve 2109 for the selection of a character, it being understood that a suitable slot as 2038 is provided in the support 2107 for the passage of said arm 2110, said slot being of sufficient

width to permit rotation of said arm to the entire extent needed to select any one of the characters of the negative.

The capital row selecting key 2042 is connected by the slot and pin connection 2043 to the lever 2044, which lever is pivoted as at 2045 to the frame of the machine and at its rear end is suitably connected to the outer sleeve 2040 as by means of the slot and pin connection 2046.

From the above description, it will be seen that operation of the capital row selecting key 2042 serves to raise the sleeves 2040 and 2021 as a unit and thereby operates to select the desired row of the operative negative. When it is desired to change from one font of type to another, the font change key 2005 is depressed until the locking projection 2007 engages either the projection 2010 or the projection 2011 depending on which of the remaining negatives is to be selected. In either case, depression of said key 2005 rotates the lever 2015 about its pivot 2016 to change the effective length of the pantagraph and thereby to change the vertical distance between the rear ends of the arms 2020 and 2022 of the pantagraph. Such change in distance between the arms causes relative vertical movement of the sleeves 2021 and 2040, thereby raising the arm 2110 and the sleeve 2109 connected thereto to the required extent to carry either the negative holder 10a or 10b into registration with the aperture 2108.

After such selection of the font of type has been accomplished, the row selecting keys may be operated in the manner hereinbefore described to effect the selection of a desired row. At the same time, the abutment shaft 2116 may be rotated manually into the proper position to bring the desired lugs into operative position corresponding to the particular negative holder with which said set of lugs is designed to operate. Or, in the case where the abutment shaft 216 is used, said shaft may be removed and replaced by a similar shaft provided with lugs corresponding to the newly arranged negative holder.

Line spacing mechanism

In order that the character-imprint receiving material which is illustrated in Fig. 10 as a sheet of paper 113 supplied to the machine in the form of a roll, may be held against creeping with respect to the feed roller 120 and thus insure accuracy in line spacing, each longitudinal marginal area of the paper, as has been hereinbefore indicated, is provided with a series of perforations 118 which are adapted to accommodate and receive the pins 119 provided on the feed roller at opposite ends thereof. Said feed roller is automatically actuated by a stall motor 455 (Fig. 1a) pursuant to each line printing operation, in a manner hereinafter more particularly described, to rotate the feed roller in a clockwise direction as viewed in Fig. 10, a predetermined distance corresponding to the space desired between the respective lines of subject matter.

The motor 455 is suitably supported at the rear of the machine base and is connected to a shaft 456 journaled in bearings 457 and carrying an actuating arm 460 (Figs. 1, 1a and 23). Said arm 460 carries a pawl 462 spring-pressed into engagement with the teeth of the ratchet wheel 464 and adapted to rotate said ratchet wheel. On the shaft 456 is the gear wheel 465 meshing with the gear wheel 466 on the feed roll shaft 467.

It will be understood that the shafts 456 and

467 are suitably supported by suitable brackets on the auxiliary carriage 99. Suitably supported on said carriage is a stop wheel 468 which is adapted to be moved with said carriage and which is provided with a plurality of abutment pins 470, the abutment pins being of different lengths, as shown, and adapted to be selectively positioned to engage the hub of the pawl 462 (Fig. 23a) and thereby limit the upward movement of said pawl and of the arm 460 and consequently, to limit the extent of rotation of the feed roll 120 according to the space desired between typewritten lines of subject matter.

From the foregoing, it will be understood that each time the motor 455 is operated, the feed roll 120 will be advanced according to the setting of the stop wheel 468, the motor being brought to a stall the instant the hub of the pawl 462 moves into engagement with one of the abutment pins 470.

Reset mechanism

Upon completion of each line-printing operation, with the aid of either the justifying unit B or the justifying unit C and in the manner hereinafter more particularly described, it becomes desirable to condition or reset certain mechanisms of the machine preparatory to initiating the next line-printing operation, and to this end there is provided a reset shaft 525 (Figs. 1b and 2) which shaft is journaled in bearings 526 (Fig. 1b). Said shaft 525 is held in a normal position by a tension spring 527, one end of which is attached (Fig. 2) to the base of the machine and the other end of which is attached to an arm 528 secured to the shaft. Splined to the shaft 526 is an operating handle 530, the hub portion of which is confined intermediate the forked end 531 of an arm 532 which is secured to the rack 154 and adapted for movement therewith (Figs. 2 and 5), the forked end of the arm being slidable on the shaft 525. Disposed beneath the base of the machine, is a normally open switch 534 (Fig. 2) having an actuating lever 535, with which is adapted to cooperate a depending arm 536 secured to the shaft 525 which is normally positioned to hold the switch arm in open circuit position. Secured to the shaft 525 is a spur gear 537 meshing with a similar intermediate gear 538 which in turn meshes with the gear 506 on the shaft 808.

From the foregoing description, it will be understood that upon the completion of a line-printing operation, the handle 530 is moved in a clockwise direction as viewed in Fig. 3 with the result that the switch 534 is closed, thereby closing the circuit of and energizing the motor 455 whereupon the shaft 456 of that motor is moved in a clockwise direction as viewed in Fig. 23 to move the arm 460 and the pawl 462 and through the ratchet wheel 464 and gearing associated therewith to rotate the feed roller shaft 467 a distance corresponding to the position of the stop wheel 468 which determines the extent of the line spacing movement of the feed roll 120.

Substantially simultaneously, the driving connection between the ratchet wheel 2126 and the shaft 2134 is severed. Such interruption of the driving connection is accomplished by reason of the fact that as the arm 554 on the shaft 525 (Figs. 1b, 2 and 3) is rotated in a clockwise direction as viewed in Fig. 3, said arm moves the link 539 and therethrough, the arm 540 in a clockwise direction as viewed in Fig. 3, thereby moving the cone-like cam 144 over the face of the roller 142 carried by the arm 140, and thus

- causing that arm to so move together with its associated pin 136 as to release the pawl 138 from driving engagement with its associated ratchet wheel 2132 which is carried by the shaft 2134.
- 5 It will be appreciated that the setting of the mechanism in the manner hereinbefore described takes place expeditiously upon rotating the handle 530 in a clockwise direction, as viewed in Fig. 3, this allowing ample time for the resetting operations to be carried out before the paper carriage is returned to its original or starting position, it being understood that the handle 530 may be employed to facilitate return movement of the carriage inasmuch as it is confined, between the yoke-like end of the bracket 531, which embraces the shaft 525 to which the handle 530 is splined. It will also be understood that so long as the handle 530 is maintained in resetting position unobstructed return movement of the carriage is permitted, the shaft 3134 being operatively disconnected from the shaft 2134. Upon release of the handle 530, the shaft 525 is returned to its normal position under the influence of its associated spring 527 with the result that the shaft 3134 is operatively connected to the driving mechanism therefor preparatory to carrying out the next line-printing operation.

Justifying unit B

- 30 As in my said co-pending application, the column of matter to be printed is theoretically divided in its width into $1/18$ em for purposes of justification. It will be understood that a draft copy having been made and the operator advised in terms of $1/18$ em as to the extent of justification required with respect to a given column width, this information is utilized to effect justification by adding a positive or negative increment to each character movement and to each word space movement of the carriage by the justifying unit B. Said unit includes means for setting or adjusting the connector element 165 (Figs. 1b, 3, 4 and 5), at the beginning of each line-printing operation according to the extent of justification required for each line, the element 165 being shown for example in Fig. 1b in a normal position of adjustment, that is, in a position such that the carriage is translated a normal distance for a given movement of the arm 162. The adjusting means for the element 165 comprises a rack 565 (Figs. 1b, 2 and 3) secured to the base of the machine and adapted to cooperate with a spur gear 566 secured to a shaft 567 journaled in a bracket 568 secured to a side wall of a trough-like guide 171, within which the element 165 is adapted to move longitudinally to advance the carriage during the printing operation. Secured to the base of the machine in proximity to the rack 565 is a bracket 570 within which is journaled a hub 571, to which is splined a shaft 572 provided at one end with a worm 574 meshing with a worm gear 575 carried by the shaft 567, the shaft 572 being held against longitudinal movement with relation to the bracket 568 within which it is journaled and adapted for sliding movement within the hub 571 to which it is splined. Carried by the hub 571 is the spur gear 576 meshing with a similar gear 577 carried by a shaft 578 journaled to the base of the machine and adapted for the reception of any one of a plurality of actuating dials, one of which is shown in Figs. 1b and 2 and is there indicated by the numeral 580, the dials being graduated for reasons hereinafter more apparent, in terms of $1/18$ em, and according to the column

width, measured in terms of $1/18$ em with respect to which line justification is to be carried out and being adapted to cooperate with a suitably supported index bearing element 581, by which accuracy may be promoted when setting the dial according to the extent of justification required.

From the foregoing, it will be understood that when the dial 580 is rotated, for example, from its zero position shown in Fig. 1b, the trough-like guide 171 within which the element 165 is mounted for longitudinal movement will be moved toward the front of the machine from its neutral or zero position, thereby increasing the length of the fulcrum between the pivotal connection of the lever 162 with the base of the machine and the pivotal connection of that lever with the connector element 165, said element being permitted to move transversely of the carriage 95 due to the space afforded between the arms 167 which support the pin 168 for sliding connection with the lug 170 attached to the carriage 95.

Operation of the justifying unit B

In describing the operation of the justifying unit B, it will be assumed, for example, that the column-width with respect to which line justification is to be effected is equal to $823-1/18$ em, and that the printing operation is to be carried out, for example, with 6-point type. Under the foregoing assumed conditions, care is exercised to see that the ratio between the gears 2127 and 3130 is of a proper value with respect to the aforementioned size of type, it being noted, as hereinbefore pointed out, that these gears are readily removable to permit substitutions when changing from one size type to another to obtain the proper gear ratios; and care is also exercised to see that there is employed a dial 580 appropriate to the column-width with respect to which justification is to be effected, as for example, a column-width of $828-1/18$ em. With the proper gears 2127 and 2130 in position and with the proper dial 580 provided, line justification may be effected with ease and precision in carrying out each line printing operation with respect to which the extent of justification has been determined. To that end, the operator before beginning a line printing operation, sets the dial 580 to a position corresponding to the extent of justification required for that line, it being noted that when the dial 580 is so set, the carriage is moved, for each character key operation and each spacing bar operation a distance equal to its normal extent of movement plus a positive or negative increment, the total summation of which increments equals, upon the completion of the line-printing operation, the extent of justification required.

In the foregoing example, where the column-width is $828-1/18$ em and the extent of justification required for a given line with relation to that column width is $28-1/18$ em, a fractional part of that missing space value is added to each movement of the carriage, the summation of which fractional parts equals, upon the completion of the line-printing operation, $28-1/18$ em.

In further describing the operation of the justifying unit B, it will be assumed for example, that it is desired to change from 6-point type to 12-point type, but that the column-width with respect to which justification is to be effected is to remain equal to $828-1/18$ em. To make the desired type change in those cases where the machine is provided with only a single negative

holder 10, or in those cases where none of the negative holders 10, 10a and 10b contain characters of the desired type size, the 6-point type negative is removed and a 12-point type negative substituted. Pursuant to making the shuttle change, in the manner above described, the change gears 2127 and 2130 previously used in carrying out printing operation with 6-point type, are removed, and for them are substituted other gears having a proper gear ratio for use in connection with the 12-point type, namely, a ratio twice that of the change gears employed in carrying out the printing operation with 6-point type. In effecting justification when using 12-point type, where, as assumed, the column-width remains the same, namely $828\frac{1}{18}$ em, no change of the dial 580 is required for the reason that the factor, namely, the column width which determines the character of the dial to be employed remains the same as in the example where the use of 6-point type was assumed.

Aside from the foregoing assumed examples employed in the description of the operation of the unit B, it may be well for the sake of clarity to assume a further example wherein the column-width is say, $414\frac{1}{18}$ em, and wherein the printing operation is to be carried out with the same size type, namely, 12-point, employed in the second of the foregoing examples, it being noted that in the present instance, the column-width of $414\frac{1}{18}$ em is one-half, when measured in terms of ems, the column-width of $828\frac{1}{18}$ em employed in each of the foregoing examples. In the present instance, the same size gears 2127 and 2130 are employed which were used in the second of the foregoing examples, inasmuch as the present illustration assumes that the typing operation is to be carried out with the same size type, measured in points, as were assumed in the second illustration.

Due, however, to the fact that the column-width in the present instance differs from the column-width previously assumed, it becomes desirable to substitute for the previously employed dial 580 another of such dials which is graduated according to the column width, $414\frac{1}{18}$ em, in order to effect the desired justification between a given line of subject matter and that column width.

Although only a few definite examples are herein assumed for the purpose of illustration, it will be understood that the machine may be conditioned for use in the justifying operation regardless of the size, measured in points, of type to be used in producing justified copy, and regardless of the column width, measured in terms of ems, by the use of a proper gear ratio, corresponding to the desired type measure in points, between the change gears 2127 and 2130 and by the use of a proper dial 580, corresponding to the desired column width. It will be understood, of course, that the gear ratio between the change gears 2127 and 2130 bears no relation to the column-width, inasmuch as these gears are depended on to effect movement of the carriage in accordance with the size, measured in points, of the particular type employed in the justifying operation. For example, if 6-point type is to be employed, the gear ratio between the change gears is one-half the gear ratio required when 12-point type is employed in the justifying operation. It will also be understood that the dial 580 bears no relation to the size, measured in points, of type employed in the justifying operation, but that it does bear a definite re-

lation to the column width measured in terms of ems with respect to which justification is desired. For example, if the dial is provided with 72 graduations each representing $\frac{6}{18}$ em, such graduations will be spread out over a definite arcuate length on a given size dial where the column-width is $828\frac{1}{18}$ em (46 ems), whereas if the column width is $414\frac{1}{18}$ em, (23 ems), the 72 graduations, each representing $\frac{1}{18}$ em, will be spread out over a greater arcuate length on the same size dial. The reason for the greater arcuate length over which the graduations extend on the dial employed in connection with the column-width of $414\frac{1}{18}$ em (23 ems) will be readily understood when it is taken into account that where the missing space is equal, for example, to 4 ems, that value represents a greater proportion of the column-width, 23 ems, than is represented by the relation of that missing space to a column-width of 46 ems, with the consequence that the compensating movement of the carriage, in terms of ems, must be greater with relation to the column-width of 23 ems than the compensating movement, in terms of ems, with relation to the column-width of 46 ems. That greater compensating movement is effected, under the conditions just named by reason of the fact that when the dial 580 is set to compensate for a missing space of 4 ems in a column-width of 46 ems, such difference in the positions of the connector element 165 being accounted for by reason of the fact that the 72 graduations on the dial employed in the first instance are spaced farther apart than are the 72 graduations on the dial employed in the second instance. As to the number of graduations, namely, 72, just mentioned by way of example, it may be well to point out that any number of graduations may be employed, so long as each represents $\frac{1}{18}$ th em, but it is believed that 72 such graduations are ample, inasmuch as they represent missing spaces to the value of 4 ems, it being observed that the extent of justification required as between a given line and a definite column-width is unlikely under any conditions to exceed a value equal to 4 ems.

It is to be noted that the dial 580 is graduated in opposite directions from the zero point, thus making possible justification with the unit B by either adding increments to the character and word-spaces, as when a given line of subject-matter falls short of the column-width, or by subtracting from the character movements and the word-space movements of the carriage fractional portions thereof, as when a given line of subject-matter overruns the column-width: it being understood that when justification is to be effected by subtraction, the dial is set at the minus side of the zero point according to the extent of negative justification required or, in other words, according to the extent to which the line of subject matter to be justified exceeds the column-width with respect to which justification is to be effected.

Justifying unit C

When it is desired to effect justification of a given line of subject-matter with respect to a given column-width by adding an increment to each word-space, the information given by the draft copy regarding the missing spaces in the line and the word-spacing in the line is utilized by the justifying unit C. Inasmuch as the justifying unit C is operable to effect justification by adding an increment to each word-space only,

it becomes desirable to so control that unit that it will respond in its operation to each space bar operation to the exclusion of all character key operations, and to that end, there is provided

5 a control shaft 602 which as shown in Fig. 1a is disposed in alignment with the main shaft 2115 hereinbefore described. Said shaft is journaled in suitable bearings and at its right end, as viewed in Fig. 1a, is adjustably connected to

10 the side arm 185 of the space bar 184 in such a manner that depression of the space bar to the same extent may effect variable rotation of the shaft 602, all as clearly pointed out in my said copending application.

15 Said shaft 602 is adapted to serve in itself, when the main shaft 2115 is rotated in response to character key operation, as a bearing for the main shaft, whereas when the shaft 2115 is rotated in response to a spacing bar operation, the shafts

20 602 and 2115 then rotate in unison. To the end of the shaft 602 (Fig. 27) is connected a segmental gear 607 which is adapted to cooperate with a similar gear 608 carried at one end of a rocker arm 610, pivotally connected as at 611 to a

25 supporting bracket 612 and pivotally connected at its other end as at 614 to the vertically movable actuating arm 615. This actuating arm is pivotally and slidably connected, as shown at 616, to the supporting bracket 612 and is provided intermediate its ends with a contact lug 617, adapted to

30 cooperate, in a manner hereinafter more particularly described, with the outer end of any predetermined one of 18 differential levers, 618 to 635 inclusive. These differential levers are

35 pivotally supported intermediate their ends, as at 636, on a lever translating carriage 637, mounted on the T-piece 638 of a carriage support 640, which T-piece serves as a guide or track for the carriage, which is held against removal by a pair

40 of shims 641, secured to the carriage and overlying the lower outer margins of the T-piece. The carriage 637 is adapted to be moved from its normal position, shown in Fig. 24, to any one of 18 positions, corresponding to the levers 618 to 635

45 inclusive, under the influence of a spring actuated drum 642, carrying a suitable tape 644, which is connected to the carriage, as at 645, and is accommodated in a longitudinal groove 646, formed in the T-piece 638.

50 Pivotally supported, as at 647, are a plurality of stop levers 648 to 665 inclusive, which correspond in number to the number of differential levers 618 to 635 inclusive, and which carry at their upturned

55 ends keys bearing indicia 1 to 18 inclusive. Disposed beneath these keys, is a release bar 667, which is held in its normal position by a pair of compression springs 668, carried by guide rods 670, secured to the release bar and adapted for vertical

60 movement within guide openings 671, formed in the base of the machine, the springs 668 being confined intermediate that base and a pair of abutments 672 carried by the guide rods. One end of the release bar 667 carries an upwardly extending arm 674, which is pivotally and slidably

65 connected, as at 675, to a latch 676, pivotally supported, as at 677, by a stationary arm 678, the latch 676 being normally held by a suitable compression spring in latching engagement with a lug 680 provided on the carriage 637.

70 It is apparent from the foregoing that when any one of the stop levers 648 to 665 inclusive is depressed, the release bar 667 will be correspondingly moved, with the result that the latch 676 will be swung about its pivotal connection in a clock-

75 wise direction, as viewed in Fig. 24, to release the

carriage 637, so that it may be moved to a definite position under the influence of the spring drum 642. The position to which the carriage is moved is determined by one of a plurality of stop lugs 681, carried by the respective stop levers 648 to 665 inclusive, which lugs are adapted to be projected upwardly through a plurality of openings 682, provided in the T-piece 638 in the path of travel of the carriage 637 and in an off-set relation to the carriage actuating tape 644, as shown

10 most clearly in Fig. 25. From the foregoing, it will be apparent that if the stop lever 654, bearing the numeral 7 on its key, is depressed, its corresponding stop lug 681 will be projected into the path of travel of the carriage 637, with the result

15 that that carriage will be brought to rest in such a position that the differential lever 624, corresponding to the stop lever 634 will be positioned directly beneath the contact lug 617 carried by the actuating arm 615.

20

In order to insure the carriage 637 against undue movement under the influence of the spring drum 642 after it has moved into a predetermined position in response to the operation of one of the stop levers as described, means are provided

25 for latching the selected lever in its depressed position. This latching means includes a horizontally disposed latch bar 684, which is pivotally supported as at 685 and is of sufficient length to accommodate all of a plurality of latch lugs 686, carried by the stop levers 648 to 665 inclusive and

30 disposed in alignment parallel to the latch bar with which they are adapted to cooperate. The latch bar 684 is normally held in its position, shown in Fig. 24, by a compression spring 689, confined intermediate the base of the machine

35 and the outer end of an arm 688 connected to the latch lever at one end thereof, the movement of the latch lever in a clockwise direction past its normal position being prevented by a stop lug 690, carried thereby and adapted to abut an adjacent area of the base of the machine or other

40 suitable fixed stop.

Journalled in a bearing support 691, Fig. 24, is a ratchet drive shaft 692, which at its left-hand end is provided, as shown in Figs. 24 and 25, with

45 a spur gear 694. Splined to the shaft 692 and slidable longitudinally thereon, are a plurality of ratchet wheels 695 to 712 inclusive, corresponding to the differential levers 618 to 635 inclusive and to the stop levers 648 to 665 inclusive. These ratchet wheels 695 to 712 inclusive are held

50 in a grouped relation for longitudinal movement on the shaft 692, by reason of the fact that they are confined intermediate a pair of arms 714, carried by the carriage 637, which is mounted for

55 horizontal movement on the T-piece 638 of the carriage support 640, it being noted that the arms 714 embrace the ratchet shaft 692 on which the ratchet wheels are splined. Mounted for rotation

60 on the shaft 692 adjacent the ratchet wheels 695 to 712 inclusive, are a plurality of pawl-carrying arms 715 to 732 inclusive, to the outer ends of which are pivotally connected spring tension

65 pawls 734, adapted to cooperate with the teeth 735 provided on the periphery of the respective ratchet wheels. The pawls 734 are provided with tail pieces 736, which, as the arms 715 to 732 inclusive are returned to their normal position

70 shown in Fig. 27, under the influence of return springs 737 (Fig. 27), supported by the carriage 637 in a cooperative relation to the respective differential levers 618 to 638 inclusive, are adapted to engage and move over the inclined

75 surface of a longitudinally extending release cam

738, which is supported by the arms 714 of the carriage 637 for movement therewith, it being understood that as any one of the tail pieces 736 rides over the cam 738 its associated pawl 734 will be disengaged from its corresponding ratchet wheel.

Such disengagement, however, does not in itself permit return movement of the shaft 692 inasmuch as there is associated with each of the ratchet wheels 695 to 712 inclusive a holding pawl 740, carried by a horizontally disposed shaft 741, which extends through and is journaled in the arms 714 of the carriage 637 and which is held against longitudinal movement by reason of its connection with the bearing support 691, the shaft being connected, by means hereinafter more particularly described, to the reset shaft 525 so that the holding pawls 740 may be moved out of engagement with their associated ratchet wheels against the influence of the pawl-actuating springs 747, which are carried by a spring support 748, extending longitudinally of the shaft 741 and connected to the arm 714 of the carriage 637.

Referring particularly to the ratchet wheels 696 to 712 inclusive, it is to be noted that although they are similar to each other, their respective number of teeth vary and that the throw of their respectively associated pawl-carrying arms 715 to 732 inclusive, which are pivotally and slidably connected, as shown at 750, to the differential levers 618 to 635 inclusive, is so determined by the fulcrum lengths of those differential levers that the number of lever actuations required to move the shaft 692 a predetermined distance corresponds to the indicia provided on the keys of the stop levers 648 to 665 inclusive which correspond to the differential levers 618 to 635 inclusive.

For example, one operation of the differential lever 618, associated with the ratchet wheel 695, is sufficient to move that ratchet wheel, together with its associated shaft 692 through 72 degrees, whereas 18 operations of the differential lever 635, associated with the ratchet wheel 712, is required to move that ratchet wheel and the shaft 692 through 72 degrees, it being noted, as will readily appear from Fig. 29, that the pawl-carrying arms 715 to 732 inclusive are required to move a slight distance before their respective pawls 734 move into driving engagement with the ratchet wheels, as will be readily understood when it is taken into account that a slight movement of the pawl-carrying arms is required to permit the tail pieces 736 of the pawls to disengage the pawl-releasing cam 738, shown in Fig. 27.

Before proceeding with the description of the auxiliary carriage actuating mechanism next to be described, it may be well to bear in mind that the number of operations of the shaft 692 for a given line of subject-matter is determined by the number of word-spaces contained in that line, as indicated by the draft copy upon completion of the initial line printing operation of the subject-matter to be justified by the addition of increments to the word-space carriage movements when employing the justifying unit C; and it may be well to further note that the number of operations of the shaft 692 during the printing operation of a given line is controlled by depressing which ever one of the stop levers 648 to 665 inclusive corresponds to the number of word-spaces in that line.

The means for effecting justifying movement of the subsidiary carriage 99 includes a control arm

751, shown in Figs. 32 and 38, the rear end of which, as shown in Fig. 35, is provided with a depending leg 752, carrying at its lower end a connector lug 754, provided with a lag screw 755, by which the control arm is pivotally connected to a carriage supported table 756, connected to the main carriage 95 for movement in a horizontal plane. The control arm 751 is adapted to be moved, by means hereinafter more particularly described, from its normal position shown in Fig. 32 to various positions of adjustment, one of which is shown in Fig. 38. Supported by the table 756 for movement transversely of the machine is a sliding connector member 757, which is adapted to move within a channel 758, formed in the table 756, the connector member being retained within that channel by suitable shims 760, carried by the table and overlying the margins of the connector member. The sliding connector member 757 is provided at one of its margins with an upstanding flange 761, carrying a horizontally disposed wing 762, having provided therein an elongated opening 764, which registers with a similar opening 765, formed in the connector member 757, as shown most clearly in Fig. 37. These openings are adapted to slidably and pivotally receive a pair of aligned trunnions 766, carried by a sleeve 767, slidably mounted on the control arm 751, the trunnions being adapted to traverse a pair of aligned elongated slots 768, formed in a pair of connector wings 770 which are disposed intermediate the connector member 757 and the wing 762 associated therewith and are carried by the horizontally disposed arms 771, which constitute an extension of the base of the auxiliary carriage 99 hereinbefore described.

Carried by the connector member 757, is a rack 772, which is adapted to cooperate with a pinion 774, having a hub 775, journaled in and adapted to move with a bearing 776, carried by the table 756, the hub 775 being splined to a shaft 777, supported as shown in Fig. 1, in a bearing 778 mounted on the base of the machine. The shaft 777 is provided with a reset spring, not shown, carried within a suitable housing 780 adjacent the bearing 778, and is provided at its outer end with a gear 781, meshing with an intermediate gear 782, supported as at 784 and meshing with the gear 694 hereinbefore described as connected to the shaft 692, which is adapted to respond to operation of the differential levers 618 to 635 inclusive, hereinbefore described. The forward end of the control arm 751 is pivotally and slidably connected, as shown at 785, in Fig. 32, to a connector lug 786, carried by a screw-threaded follower 787, embracing a worm 788, splined to a horizontally disposed control shaft 790, the worm 788 being provided at one end with a groove 791, adapted to receive the yoke-like end 792 of an arm 794, carried by the table 756, the arm 794 being adapted to insure movement of the worm 788 longitudinally on the shaft 790 so as to maintain the control arm 751 in any given position of adjustment as the table 756 is translated in unison with the main carriage 95 to which that table is connected. The shaft 790 is supported at opposite ends in suitable bearings 795 mounted on the base of the machine, which is shown in Figs. 32 and 34, the shaft being provided at its right-hand end, as viewed in Figs. 1a, 32 and 34, with a bevelled gear 796, meshing with a similar gear 797, carried by a vertical shaft 798, journaled in a bracket 800 fixed to the base of the machine.

The upper end of the shaft 798 carries a pinion 801, meshing with a spur gear 802, carried by a

shaft 804, Fig. 35, supported in a bracket 805, fixed to the base of the machine, the upper end of the shaft 804 being adapted for the reception of a plurality of removable dials, one of which is shown in Figs. 1a and 35 and is there indicated by the numeral 806, a suitable index pointer 867 being provided if desired adjacent the dial, by means of which pointer correct dial settings may be facilitated in the justifying operation of the unit C.

From the foregoing, it will be understood that as the shaft 692 is rotated, under the influence of any one of the differential levers 618 to 635 inclusive, in a clockwise direction, as viewed in Fig. 29, the shaft 777, to which the gear 774 is splined, is rotated in the proper direction with the result that the connector member 757, is moved from its normal position shown in Fig. 32 toward the front of the machine. Moreover, it will be understood that the extent to which the connector member 757 is moved during all line printing operations, where justification is required, will be the same inasmuch as the extent of rotation of the shaft 692 is the same for all line printing operations, as hereinbefore explained. Thus, it will be apparent that the extent to which the auxiliary carriage 99 is moved with relation to the main carriage 95 during a line printing operation is dependent upon the angle to which the control arm 751 is adjusted with relation to its normal position, shown in Fig. 32, it being understood that as the connector member 757 is advanced forwardly from its normal position the trunnions 766, as they are moved along the control arm 751 in response to movement of the connector member 757 toward the front of the machine, will impart translatory movement to the auxiliary carriage in a direction at right angles to the movement of the connector member. In a machine here shown as embodying the present invention the extent to which the connector member 757 is moved and the extent to which the control arm 751 may be adjusted are such that the auxiliary carriage 99 may be moved relatively to the main carriage a distance of one inch, it being understood, however, that such value has been arbitrarily selected and is mentioned primarily to facilitate one's appreciation of the factors necessitating the use of differently graduated dials 806 under varying conditions.

Inasmuch as the justifying unit C is employed for effecting justification by modifying each normal word-space movement of the carriage rather than each normal character-movement and each normal word-spacing movement of the carriage as in the case of the justifying unit B, the dial 806 is graduated according to the size of type, measured in points, to be employed in the justifying operation. To illustrate, let it be assumed that one printing operation is to be carried out with 12-point type and that another printing operation is to be carried out with 6-point type. In the first instance, a dial is employed which is provided at its peripheral margin with graduations equi-distantly spaced from each other and collectively representing the maximum movement of the auxiliary carriage 99 with relation to the main carriage 95, the distance between adjacent graduations representing a linear movement of the carriage equal to 1/18th em based on 12-point type, whereas in the second instance a dial is employed which is provided at its peripheral margin with graduations equi-distantly spaced from each other and collectively representing the maximum movement of the auxiliary carriage 99 with rela-

tion to the main carriage 95, the distance between adjacent graduations, which is of course only one-half the distance between corresponding graduations of the dial in the first instance, representing a linear movement of the carriage equal to 1/18th em based on 6-point type. From the foregoing, it will be appreciated that if the extent of justification required for a given line is, for example 28 1/18th em, as determined by the printing dial 256 or the missing-space counter 388 upon completion of the initial printing, the dial 806, when set at 28 preparatory to carrying out a line printing operation with 12-point type will give an angular adjustment of the control arm 751 twice as great as would be obtained by the corresponding setting of a dial graduated in accordance with 6-point type. It follows, therefore, that the extent of movement of the auxiliary carriage 99 in the justifying operation, when employing 12-point type, would be twice as great, in terms of linear measure, for any line of subject-matter as the extent of justifying movement of the auxiliary carriage when carrying out a line printing operation with 6-point type, despite the fact that the extent of movement of the auxiliary carriage in both instances would be the same in terms of 1/18th em. Although only two examples are herein given in illustrating the underlying principles necessitating different dials 806 for use with different size type, it is deemed unnecessary to elaborate further on the factors which determine the respective characteristics of the dial graduations other than to mention the fact that a dial properly graduated with respect to any given size type, measured in points, may be produced with accuracy when it is borne in mind that the arcuate extent of the graduations bears a definite relation to the linear justifying movement of the supplemental carriage and that such graduations are separated from each other a distance representing a linear movement of the supplemental carriage equal to 1/18th em based on given size type measured in points.

When carrying out the line justifying operation with the use of the justifying unit C, it is of course advisable to recondition the machine for use pursuant to each line printing operation, and to that end the reset handle 530, employed in resetting the justifying unit B in the manner described, is utilized. Upon moving that handle in a clockwise direction as viewed in Fig. 3, the shaft 525 is similarly moved with the result that an auxiliary reset shaft 808 is rotated in the direction of the arrow shown in Fig. 1b, the shaft 808 being operatively connected to the shaft 525 by a suitable train of gears interposed between both shafts. The auxiliary reset shaft 808 is journaled in a bearing 814 (Fig. 1) and is provided adjacent the bearing with a depending arm 815 (Fig. 24), which is connected by a link 816 to a horizontally disposed release arm 817, pivotally connected to the base of the machine as at 818, the arm 817 being adapted to cooperate with a depending arm 820 carried by the shaft 741, whereby that shaft is rotated in a counter-clockwise direction as viewed in Fig. 29 when the reset handle 530 is operated to return the carriage to its normal position.

As the shaft 741 is thus actuated, its associated pawls 740 are released from holding engagement with the ratchet wheels 695 to 712 inclusive, thus permitting the ratchet wheels to be returned to their normal positions under the action of the return spring, not shown, which is associated with the shaft 777 and is confined within the drum or

housing 780 hereinbefore described. Coincident with the release of the pawls 740, the latch bar 684 is moved in a counter-clockwise direction, as viewed in Fig. 24, by reason of the fact that it is connected to a release arm 821, carrying at its outer end a pin 822, positioned within an elongated slot 824, formed in a depending actuating link 825, pivotally connected at its upper end to an arm 826, secured to the auxiliary reset shaft 808, it being noted that the slot 824 is of sufficient length to permit the pin 822 to move such distance as is required when the latch bar 684 is cammed about its pivot point by any one of the latch lugs 686 carried by the stop levers 648 to 665 inclusive when conditioning the machine for a line printing operation. Upon release of the latch bar 684 from engagement with the latch lug 686 holding one of the stop levers 648 to 665 inclusive in controlling position, that lever is permitted to return to its normal position under the influence of the return springs 668 associated with the release bar 667, and the latch 676 is at the same time moved under the action of the spring 668 into latching position so as to engage the lug 680 provided on the carriage 637. In order that the carriage 637 may be returned to its normal position, there is provided an electric motor 827 to the shaft of which is connected a pinion 828, meshing with a rack 830 carried by a depending portion of the carriage.

The circuit of this motor is under the control of the switch 534, hereinbefore described, with the result that when that switch is closed upon movement of the reset handle 530 in a clockwise direction, as viewed in Fig. 54, the motor becomes effective to return the carriage to its normal position, it being understood that the motor, like the motor 455, is of the "stall" type, each of the motors being adapted to carry out their respective functions in a relatively short period, with the result that ample time is allowed for them to perform their respective operations before the reset handle 530 is returned to its normal position.

Operation of justifying unit C

In carrying out a line justifying operation by the aid of the justifying unit C, the machine is initially conditioned for operation by providing change-gears 2127 and 2130 of a proper ratio with relation to the size type, measured in points, to be employed, and by providing a dial 806 graduated in accordance with the size of type to be employed. With the connector element 165 set at its neutral or zero position, the dial 806 employed in connection with the justifying unit C is set preparatory to each line printing operation according to the extent of justification required for that line as previously determined; and one of the stop levers 648 to 665 inclusive is depressed, the stop lever selected being in accordance with the number of word-spaces as previously determined. Upon depressing the selected stop lever, the carriage 637 is released and is moved under the action of its associated spring actuated type 644 into engagement with the stop lug 682 moved into the path of travel of the carriage in response to the stop lever operation.

Thus, one of the differential levers 618 to 635 inclusive, corresponding to the depressed stop lever is moved into a cooperative relation to the lug 617 carried by the actuating arm 615. As the space bar 184 is actuated, the shaft 602 is rotated, imparting motion to the arm 610 through the gear segments 607 and 608, the arm 610 serv-

ing, as hereinbefore described, to impart, through one of the differential levers 618 to 635 inclusive, rotation to the shaft 692. As the shaft 692 is rotated, the connector member 757 is moved in response to the rotation of the shaft 777, in a manner hereinbefore described, from its normal position shown in Fig. 32 toward the front of the machine, with the result that for each word-spacing movement of the connector member the auxiliary carriage 99 is moved relatively to the main carriage 95 a definite distance depending upon the angular position of the control arm 751, as determined by the setting of the dial 806 preparatory to the line printing operation, the movement of the auxiliary carriage, as effected by the justifying unit C, being additional to such movement as is imparted to it by reason of its connection with the intermittently actuated shaft 134 by way of the pinion 152, its associated rack 154, the control arm 162 and its associated connector element 165. In the event it so happens that no justification is required for a given line of subject matter, the carriage 637 is permitted to remain in its normal or retracted position, in which case the differential levers 618 to 635 inclusive remain inactive, due to the fact that each of them is then positioned out of the path of travel of the contact lug 617 of the actuating arm 615, with the result that the space bar operations may be carried out without displacing the connector member 757 and consequently without effecting movement of the auxiliary carriage 99 relatively to the main carriage 95 regardless of what may then be the position of the dial 806. It is to be noted that inasmuch as the dial 806 is graduated in opposite directions from the zero point, as explained in connection with the dials 580, it is possible to not only effect justification by adding increments to each normal word-space movement of the carriage, as when a given line of subject matter falls short of the column-width with respect to which justification is to be effected, but it is also possible to effect justification, as when a given line of subject matter exceeds the column width with which justification is to be effected, by subtracting from the normal word-space movement of the carriage fractional portions thereof, it being understood that when justification is to be effected by subtraction the dial 806 is set at the minus side of the zero point according to the extent of negative justification required, or, in other words, according to the extent to which the line of subject matter to be justified exceeds the column width with respect to which justification is to be effected. It is to be further noted that if the stop lever bearing numeral 1, and corresponding to the ratchet wheel 695, is employed, as when the line of subject matter to be typed contains only one word space, the entire justification to which the dial 806 is set, and regardless of whether such justification is of a positive or a negative character, is effected in response to one space bar operation, whereas two space bar operations are required when stop lever No. 2 is employed, and so on up to 18 space bar operations, as when stop lever No. 18 corresponding to the ratchet wheel 712, is employed.

Upon completing each line printing operation, when employing the justifying unit C, the reset handle 530, which is employed to return the carriage to its starting position, is rotated in a clockwise direction, with the results, as previously described and here summarized, that the imprint-receiving material, such as paper supported

by the carriage is advanced to receive the next line of subject matter to be typed, that the previously employed stop lever is returned to its normal position, that the connector member 757 is returned to its normal position, and that the carriage 637 is returned to and latched in its normal position, it being understood that when the reset handle 530 is released the switch 534 is operated to open the circuit to the motors 454 and 827 following such time as these motors have completed their respective functions in the resetting operation.

Although it has been pointed out that when the justifying unit C is being employed, the connector element 165 is maintained in a neutral or zero position of adjustment, with the result that all carriage movements effected by that element are then of a "normal" character, it should be noted that when the justifying unit B is being employed the connector member 757 is maintained in its neutral or zero position of adjustment, as determined by the dial 860 and as shown in Fig. 32, with the result that the auxiliary carriage is maintained stationary with relation to the main carriage 95 at all times.

Modifications of the sensitized material holder

In the description of Figs. 10 to 13, I have set forth that form of my invention wherein the printing of characters is performed on a sheet unwound from a roll. It will be understood, however, that the printing may be accomplished on flat sensitized material whether in the form of paper, photographic film, plates, glass or any other suitable material. In Figs. 14 and 15, I have shown a now preferred form of the holder for such material, the mechanism for effecting translatable movement of the carriage being as shown and described hereinbefore.

Similar to that form of my invention shown in Fig. 10, the auxiliary carriage 99 by means of which the holder is moved intermittently between the printing of characters, is provided with a plurality of dowel pins 115, a selected one of which is adapted to enter a corresponding perforation in the holder support 250, whereby the support may be positioned a greater or lesser distance from the lens 100 to facilitate focussing and to vary the sizes of the printed characters. Said support 250 carries the feed gears 251 and 252 mounted on a separable extension 253 of the line-space operating shaft 467, which extension is adapted to be removably coupled to said shaft by the slip coupling 130, whereby the line-spacing mechanism hereinbefore described and actuated by the motor 455 becomes effective to move the holder through the mechanism, about to be described.

Mounted for vertical sliding movement on the support 250 and connected thereto by the slide joint 255 is the rack frame 254 provided with a pair of racks 256 and 257 meshing respectively with the gears 251 and 252. The frame 254 is further provided with a support 258 for the plate holder 259, which is removably secured to the frame 254 in any suitable manner as by means of the clamp screws 260. A removable protecting slide as 261 is provided on the plate holder for guarding the sensitized sheet or plate 262 against exposure prior to the printing operation. It will be understood that the parts are moved into the proper positions to focus the characters on the sheet and to print characters of the required size on the sheet, whereafter the canopy 101 is loosened and the slide 261 removed from the plate holder through the flexible canopy to expose the

sheet and plate 262 to any light permitted to pass through the lens 100. The canopy is then hooked in place to light-seal the dark box.

In Figs. 39 and 40, I have shown a modified form of the mounting of the holder for the sensitized material wherein said holder is designed to be moved intermittently along a predetermined arcuate path for the purpose of printing characters on the sensitized material along an arcuate line instead of a straight line.

In this form of my invention, the dark box 270 is secured in fixed position to the machine. The plate holder 271 is provided with a pair of outstanding parallel flanges 272, one of which carries the set screw 273 by means of which the plate holder is removably secured to the arm 274. Said arm is provided with a longitudinal slot 275 receiving the adjustable pivot 276 near its lower end and the bifurcated member 277 intermediate its ends. Passing through said member and through the slot 275 is the pin 278 forming an operative sliding connection between the arm 274 and the rod 279 which carries the member 277 at one of its ends. At its other end, the rod 279 is connected to the main carriage rack 154 whereby the rod is given an intermittent movement.

The pivot 276, being adjustable in the slot 275 as well as in the pivot support 280, it will be understood that the effective length of the arm 274 may be varied, thereby to determine the radius of the arm through which any designated point of the plate holder 271 may move. To provide an adequate range of adjustment of the pivot 276, said pivot is carried by a cross-head 281 slidably carried by the support 280, and adapted to be secured in its adjusted position on the support by a suitable adjusting screw 282. Proper line spacing may be obtained by the operation of the screw 282 as will be obvious, without disturbing the radius of the arcuate path of the holder. A nut and bolt connection 283 to the cross-head permits movement of the arm 274 relatively to the pivot to vary the arcuate path of movement of the holder 271.

Referring now to Figs. 41 and 42, I have there shown means for rotating the holder for the sensitized material whereby the characters are printed in a circular arrangement or in circles as distinguished from straight lines or arcs.

In this form of my invention, the dark box 845 is fastened against movement, and receives the rod 846 which is secured to the carriage rack in the same manner as the rod 279 (Fig. 39) is secured, whereby the rod 846 is given an intermittent straight line movement. Secured to the rod 846 for movement therewith is the bearing 847 which is provided with a vertical hole 848 for the reception of the elongated pin 849, which is adjustable vertically in said hole and which carries the horizontal rack 850 at its upper end. Through the slot 851 of said rack through the rack clamp plate 854 are passed the rack supporting pins 852, 853, said pins securing the rack to the rack frame 855. The rack frame is guided for vertical movement in the standard 856 as by means of the side guides 857, 858, one of which as 857 may be provided with suitable graduations or scale indicia 859 indicating, in cooperation with a suitable pointer 865, the distance between the center of rotation of the plate holder 860 and the center of the beam of light emerging from the lens 100.

The rack frame carries a pair of vertically spaced shafts 861, 862, each terminating in a square outer end and each carrying a gear as 75

863, 864 respectively, the gear 863 being constantly in mesh with the rack 850, and the gears being in mesh with each other. It will be seen from the above that horizontal movement of the carriage-connected rod 846 causes intermittent rotation of the plate holder 860, which is provided with a square opening in its hub by means of which the holder is mounted on the square end of the shaft 861. Characters may be thereby printed about a circle on the sensitized material carried by the plate holder, the characters being preferably arranged radially with the bottoms thereof facing the center of the circle.

As has been hereinbefore indicated, the diameter of the circle of characters is variable as desired, and depends upon the distance between the printing light beam and the center of the shaft 861 as indicated by the position of the pointer 865 relatively to the scale 859. To vary said distance, the pinion 866, mounted for rotation on the standard 856 and meshing with the rack 867 on the rack frame 855, is rotated through the thumb wheel 868 thereby raising or lowering the rack frame and the parts carried thereby the required distance as indicated by the pointer 865, the pin 849 moving at this time in the hole 848 without disturbing the operative connection between the gear 863 and the rod 846.

Should it be desired to print the characters in a circle wherein the bottoms of the characters in the upper half circle face inwardly or toward the center of the circle and the characters in the lower half circle face outwardly or in the opposite direction, then the operator proceeds as follows. First, the upper half circle of characters is printed as above described with the plate holder mounted on the shaft 861 carrying the lower gear 863. At the end of this part of the operation, and before removing the plate holder from the lower shaft 861, the feeler guard 869 is set into gauging position. Said gauge is provided with a slot 870 near one end through which is passed a pin 871 projecting from the standard 856 and serving as adjustable pivot for the gauge. The center of the pivot pin 871 is in exact horizontal alignment with the center of the beam of light emerging from the lens 100. A suitable clamp entering and slidable in the slot 870 of the gauge is adapted to receive the pin 871 and to be clamped to the gauge by the set screw 872, thus determining the effective distance between the pin and the spaced, symmetrical caliper points 873, 874. The set screw being loosened, the point 873 is now brought into contact with the hub of the gear 863, after which the set screw is tightened to fix the clamp in the slot 870. The plate holder 860 is now removed from the lower shaft 861 and arranged in proper position on the upper shaft 862. The pinion 866 is then rotated in the proper direction to raise the rack frame 855 to a position in which the hub of the upper gear 864 (which is of the same diameter as the hub of the lower gear 863) in its thus raised position, makes contact with the caliper point 874 after the gauge has been swung on its pivot 871 in a counterclockwise direction toward the hub of the upper gear, whereafter the printing of the lower half circle of characters may proceed.

It will be seen that since the center of rotation of the plate holder is now as much above the center of the light beam (determined by the center of the pin 871) as it was previously below the center of the light beam during the printing of the upper half circle, the upper half circle of characters will be of precisely the same diameter

as that of the lower half and the characters will match up accurately. It will also be seen that since the upper gear 864 rotates in a direction opposite to that of the lower gear 863, the plate holder is rotated in the proper direction on movement of the rod 846 to print the characters in the proper position to fill in the upper half circle of characters.

As shown in Figs. 43, 44 and 45, means are provided for so moving the plate holder when desired as to print the characters along circular, elliptical, or oval lines. In this form of my invention, the rod 880 connects the main carriage rack 154 to the operating rack 881 of the plate holding and moving mechanism.

Said mechanism comprises the dark box 882 fixed to the machine against movement and within which is mounted the standard 883. A slide 886 movable vertically in the standard carries the shaft 884 and is fixed to the shaft, whereby said shaft may be adjusted vertically. The adjustment is effected by means of the adjusting screw 885 threaded to the shaft supporting slide 886, said slide operating in suitable vertical grooves in the standard 883. It will be obvious that rotation of the adjusting screw 885 in the desired direction raises or lowers the shaft 884 about which the plate holder 887 (Fig. 44) and the supporting parts therefor are designed to rotate.

Freely mounted on the shaft 884 is the hub 888 provided with an arm 889 carrying a suitable stud upon which the idler pinion 890 is rotably mounted to mesh with the rack 881. Fixed to the end of the shaft 884 is the gear 891 meshing with the gear 892 on the shaft 893. Said shaft 893 is mounted for rotation in the rear portion 894 of the U-shaped frame 895, which frame is provided with a pair of forwardly extending flanges 896, each provided with a suitable groove 897 for the reception of the slide member 898 carrying the plate holder 887. The frame 895 is provided with a hub loosely mounted on the shaft 884. To said hub is fixed the pinion 904 whereby rotation of said pinion causes rotation of the frame 895. Arranged transversely in said slide member 898 is a groove 899 into which is inserted a suitable pin 900 carried adjustably by the gear 892. Said pin 900 is provided with a head 901 arranged in the T slot of a member 902 carried by the gear 892. Said pin is provided with a threaded portion engaging the nut 903 by means of which the head 901 of the pin may be secured in adjusted position in the T slot of the member 902 at any desired position relatively to the center of the gear 892.

Assuming that the pin 900 has been moved along and clamped in the T slot in coaxial alignment with the center of the gear 892, it will be understood that the frame 895 is intermittently rotated with the shaft 884 as the racks 154 and 881 are intermittently moved. Said rotation is effected through the idler pinion 890 and the frame pinion 904. As the frame 895 rotates about the shaft 884, the gear 892 is carried around the fixed gear 891 and is also rotated about its shaft 893. Such rotation of the gear 892, however, causes no movement of the slide 898 when the pin 900 is arranged at the center of the gear 892, in which case the intermittent rotation of the frame 895 results in the printing of characters in the form of a circle upon the sensitized material carried by the plate holder 887. When, however, the pin 900 is moved out of alignment with the center of the gear 892, and clamped in place by

means of the nut 903, the rotation of the gear 892 as above described, causes similar rotation of the pin 900 about the shaft 893, whereby said pin travelling as it does in the transverse groove or slot 899 causes movement of the slide 898 in the grooves 897 of the frame. The slide 898 is thereby not only rotated with the frame 895 but is also given a movement relatively to said frame by the pin 900 whereby any given point on the sensitized material carried by the plate holder is moved in an elliptical path. The eccentricity of the elliptical path, or in other words, the difference between the major and the minor axes thereof depends upon the distance at which the pin 900 is set from the center of the gear 892.

Modification of the light shutter

As has been described in connection with Figs. 10 and 16, the light passing through the negative is controlled by a cable operated shutter of the usual type to permit printing of a character on the sensitized material only after the selected character has been properly positioned.

In Figs. 46, 47 and 48, I have shown a modified form of the light controlling means comprising the shutter for the lens 100.

Said means as shown, is utilized in connection with a series of negative holders and negatives carried by a window 75 forming part of the sleeve 9 and slidable on the support 7, and also in connection with means comprising the thumb screw 77, the worm 78 and the associated work wheel, pinions and racks for adjusting the window relatively to the remainder of the sleeve 9 and thereby to select a particular negative from the plurality of negatives.

The means for controlling the light reaching the lens 100 comprises a hollow cylinder 910 provided with a flange 911 resting on the uppermost edge of the support 7 and having formed on the peripheral edge thereof the gear teeth 912. The cylindrical portion 913 of the cylinder 910 is fitted into the support 7 for rotary movement relatively thereto, and is provided with a series of light apertures 914 adapted to pass the aperture 12 of the support whereby light from the lamp 13 is reflected through said apertures at the moment they are in registration and as they pass each other, said light passing through the negative holder and through the negative and lens on to the sensitized material. It will be understood that the apertures 914 are of the proper size and pass the aperture 12 only when a character key 5 is depressed and that in the normal positions of said keys, said apertures are out of registration and no light passes into the lens.

Suitable mechanism is provided for carrying the various apertures 914 successively past the aperture 12 on the successive operations of the character keys 5.

Said means comprises a lever 915 having one arm arranged for engagement with the character lever 6 and pivoted intermediate its ends to the same shaft on which the levers 37 and 38 are pivoted (Fig. 46). At its other end 916, the lever 915 is suitably connected to the lower end of the upright rod 917. Said rod is maintained normally in its uppermost position by means of a suitable spring 918 acting against the collar 919 on the rod and against a suitable stationary bearing 920 in which the rod is supported. At its upper end, a tapered cam 921 is provided on the rod. Said cam on its downward movement, is arranged to engage the roller 922 mounted on the arm 923, which arm is pivoted on the upright

shaft 924 carried by the stationary bracket 925. On said arm 923 is mounted the pawl 926 pulled by the spring 927 into engagement with the teeth of the ratchet wheel 928 on the shaft 924.

A suitable stop pawl 929 pivoted at 930 to an extension 931 of the bracket 925 and spring-pulled by the spring 932 into engagement with the ratchet wheel, prevents overrunning of said wheel and limits the rotation thereof to a predetermined amount sufficient to rotate the cylinder 910 through the distance equal to the precise distance between the apertures 914. Movement of said cylinder is effected by means of the pinion 933 fixed to the shaft 924 and engaging the teeth 912 of the cylinder.

It will be understood that on the depression of any character key, the left end of the lever 915 is raised, thereby lowering the end 916 and pulling the rod 917 downwardly against the action of the spring 918 to cause the cam 921 to engage the roller 922 and thereby to swing the arm 923 about the shaft 924 as a pivot. Swinging movement of the arm 923 causes the pawl 926 to rotate the ratchet wheel 928 through a predetermined distance and thereby to rotate the shaft 924, the pinion 933 and the cylinder 910. On the release of the character key, the spring 918 raises the rod 917 to carry the cam 921 out of engagement with the roller 922 ready for the depression of the next character key.

It will be understood that by proportioning the sizes of the apertures 914 and the speed at which the cylinder 910 is rotated on the depression of the character key, the precise amount of light necessary to effect the desired exposure of the sensitized material may be readily effected.

Modification of negative holding means

As shown in Figs. 49, 50, 51 and 52, I have provided means for permitting a quick change in the negatives carried by the window part 75 of the sleeve 9 and for permitting a quick change from one negative to another when the font of type is to be changed on the machine. In this form of my invention, a U-shaped clamp 940 extends from the window 75 and is provided with a threaded opening 941 at its upper end for the passage of the clamp screw 942. Said clamp screw is arranged to clamp together the negative holders 10, 10a and 10b, with the guide 943, underneath the negative holder 10b, and a similar guide above the negative holder 10.

The operative negative holder, however, may be rotated relatively to the window 75 independently of the others when properly engaged by the shuttle operating arm 25, in order to select any character of the negative held by the particular operative holder. Toward this end, the guide 944 is grooved at its lower edge and the negative holder 10 similarly grooved at its upper edge. A suitable annular guide key 945 is inserted in the grooves and serves as a guide support whereby the negative holder 10 may be oscillated relatively to the guide 944. A similar guide key 946 is inserted in similar grooves made in the lower edge of the negative holder 10 and the upper edge of the negative holder 10a. The remaining negative holders and the guide 943 are similarly grooved and keyed together for relative sliding and oscillating movement.

Each of the negative holders is provided with an inwardly extending flange 950 provided with an upright dovetailed groove or mortise 951. The end 952 of the negative shuttle operating arm 25 is correspondingly tapered in the form

of a dovetailed tenon to fit into the dovetailed mortise 951.

It will be seen that owing to the dovetailed connecting described, the negative holders may be readily removed and one or more different holders substituted merely by loosening the clamp screw 942 and disengaging the dovetailed end of the arm 25 from the holder. This is done by raising or lowering said holder through the operation of the adjusting screw 77, after which a different holder may be substituted and the arm 25 reengaged with the dovetailed mortise of the thus substituted holder or of any of the other holders in the set. It will also be seen that by reason of the key and groove connection between the holders and the guide keys therefor, the particular holder engaged by the arm 25 may be readily operated for the selection of a character and that the change from one negative to the other of the set may be quickly and easily effected by the manipulation of the screw 77, since vertical movement of the window 75 resulting from the operation of said screw 77 automatically disengages the dovetailed end of the arm 25 from the negative holder and causes said end to reengage the similarly dovetailed groove of the other holder in the set which it is desired to carry into operative position.

Release of carriage unit translating mechanism

In order to insure the proper movement of the carriage, no matter how rapidly the typewriter character keys 4 and the spacing bar are operated, and regardless of whether the operator fails to release the key before the operation of the next succeeding key, as may occur under certain circumstances, I have shown in Figs. 55 to 57 inclusive, means for releasing the lever controlling the movement of the carriage from its associated character key, as said key approaches its fully depressed position.

Toward this end, the lever 961, corresponding to the character key lever 5 (Figs. 16, 17 and 18, hereinbefore described) is disassociated from and mounted separately from the lever 963 (corresponding to the lever 6 hereinbefore described). It will be understood that the lever 961, pivoted at 962, operates the shaft 2115 and the carriage translating parts connected thereto through the intermediary of the pin 212, the lever 210, the lug 208, the abutment 207 and the lug 206. It will further be understood that the lever 963 is fixed to the character key 4, and by its engagement with the member 92, operates to raise a selected stop 40 into the path of the shuttle and thereby to select a character.

As has been hereinbefore indicated, the device now being described is intended to disconnect the carriage moving lever 961 from the shuttle operating and character selecting lever 963 at about the time the character key 4 reaches its fully depressed position. Arranged at the right end of the lever 963, as viewed in Fig. 55, is the L-shaped member 964 having a substantially horizontal leg 965, secured to said lever as at 966 and having a substantially upright leg as 967 of resilient material adapted to be temporarily distorted laterally, as will hereinafter appear. At its lower end, the leg 967 is provided with a laterally bent and inclined cam portion 968 adapted to engage the correspondingly inclined surface 969 of the machine frame when the character key approaches its fully depressed position. Said surface 969 is arranged in the path of the portion 968 and at such height that

contact between said portion and the surface 969 occurs prior to the fully depressed position of the character key, whereby the leg 967 is sprung laterally for the purpose soon to be described. Above the portion 968 is arranged the lug 970 projecting in a direction opposite to that in which said portion is directed. Said lug 970 normally enters the correspondingly proportioned aperture 971 in the right end of the lever 961 (Figs. 55 and 56).

On the depression of the character key 4, the lug 970, being arranged in the aperture 971, engages the lower wall of said aperture and rotates the lever 961 in a clockwise direction, as viewed in Fig. 55, to rotate the shaft 2115 and thereby to position the carriage operating pawls preparatory to the return movement of said pawls, which effects the carriage movement. The lowermost edge 972 of said lever 961 engages the surface 973 of the machine frame, however, prior to the time when the character key 4 reaches its fully depressed position, such engagement halting the movement of said lever 961. Nevertheless, the engagement of the portion 968 with the surface 969 and the consequent lateral springing of the leg 967, withdraws the lug 970 from the aperture 971 on the continued movement of the character key 4 after the movement of the lever 961 has been stopped.

It will thus be seen that the lever 961 is completely freed of the character key 4 and of the lever 963 just prior to the time when the character key 4 reaches its fully depressed position, whereby the lever 961 is free to return to its initial position regardless of the fact that the character key 4 may not yet have been released by the operator. Such freeing of the lever 961 independently of the raising of the character key 4 permits the return movement of the carriage operating pawls and thereby insures the proper movement of the carriage under all circumstances.

On the release of the character key 4 by the operator, the lug 970 slides along the apertured portion of the lever 961, being urged into pressed engagement therewith by the resiliency of the leg 967, until the lug reenters the aperture 971 in the initial or fully raised position of the character key.

It will be understood that where I have referred to a negative hereinbefore, I meant by that term any means carrying light-pervious and light-impervious areas defining type characters, whether said means is in the form of a single strip, or in separate strips for each character, or in the form of strips each carrying a predetermined number of characters, and whether said member comprises all the characters in a row or not.

From the foregoing description of my invention, it will be seen that I have provided a machine adapted to do ordinary type printing of the usual kind if desired, but particularly adapted to do justified printing photographically in a wide range as to sizes and styles of type, and of various column-widths, and to print characters in straight lines, circles, ovals, ellipses and other forms, whereby it will be seen that my invention is adapted to compose type photographically through a range closely approaching the range of hand type composition.

While I have shown and described certain specific embodiments of my invention, I do not wish to be understood as limiting myself thereto, but intend to claim my invention as broadly as may

be permitted by the state of the prior art and the scope of the appended claims.

I claim:

1. In a machine of the character described, means for selecting a character from a plurality of such characters including an axially adjustable sleeve, a plurality of negative holders removably carried by the sleeve, a negative in each holder, means for axially adjusting the sleeve to select a holder, and means for moving the selected holder circumferentially on the sleeve to select a character of the negative of the selected holder, means for supporting a light-sensitive surface, means for light-printing the selected character on said surface, and means controlled by the character-selecting means for imparting a differential movement to the surface in accordance with the width of the selected character and along a predetermined path between each operation of the printing means.

2. In a machine of the character described, means for selecting and printing a character on a light-sensitive surface, means for adjusting said selecting and printing means to effect focusing of the selected character on said surface and to determine the size of the printed character, and means for intermittently moving said surface a predetermined differential distance corresponding to the width of the character after the selecting and printing of each character, including a main carriage, an auxiliary carriage movable relatively to the main carriage and carrying said surface, and means settable in advance of the printing operation to control the relative movement of said carriages and thereby to justify a line printed by said printing means.

3. In a typewriter, means for photographically printing selected characters including a light source, a rotatable negative provided with translucent characters, means for removably supporting the negative means for moving the negative to select a character, movable means for supporting a light sensitive surface, means for imparting differential movement to the movable means corresponding to the different widths of selected characters and means operatively connected to the character selecting means for controlling the passage of light from said source through a selected character of the negative on to said surface.

4. In a typewriter, a plurality of light pervious type characters, movable means for supporting said characters, means for moving said movable means to select a character, means controlled by the selecting means to permit the passage of light through the selected character and thereby to print the character on a light-sensitive surface, and means controlled by the selecting means to impart differential movement to said surface.

5. In a machine of the character described, wherein characters are selected and photographically printed, a type-carrier light-pervious in part and light-impervious as to the remaining thereof, said light-pervious and impervious parts being arranged to define a series of type characters, a holder for said type-carrier, a support for movably and removably supporting the holder, and means for moving the holder on the support to select a character including character-levers and stops operatively connected to the levers and interposable in the path of movement of the holder.

6. In a machine of the character described, a series of members each having light-pervious and

light-impervious areas arranged to define rows of type characters, means for moving said members in one direction to select one of said members, and means for moving the members in another direction to select a character for printing said character on a light-sensitive surface, said last-mentioned means including character levers and stops interposable by said levers in the path of movement of said members in the last-mentioned direction.

7. In a machine of the character described, a series of movable type-carriers each having light-pervious and light-impervious areas thereon defining a multiplicity of characters, means for selecting a type-carrier from the series of carriers, means for selecting a character from a selected carrier including character levers, a stop for each lever, and means for interposing a selected stop in the path of movement of the character on the operation of a character lever, and means for photographically printing the selected character by passing light directly therethrough and on to a sensitized surface, and means for moving said surface.

8. A machine for the photographic printing of type comprising a key board for selecting characters, a member carrying light-pervious characters, means for supporting a light-sensitive surface, and means for operatively connecting the keyboard to the sensitive surface-supporting means and to the member to select a character on the member and to permit the passage of light through the selected character onto the sensitive surface and thereafter to move differentially the sensitive surface-supporting means a predetermined distance, said last-mentioned means including character levers, a carriage carrying the supporting means, means operatively connecting the levers to the carriage to move the carriage on each operation of said levers, and means controlled by the levers for moving said member a selected distance on each operation of a lever to select a character.

9. In a typewriter of the character described, a series of light-pervious characters, means for selecting and for photographically printing a character, and selective means for justifying the character and word spaces or the word spaces only of a line of such characters.

10. In a justifying typewriter, means for photographically printing characters on a light-sensitive surface, means for controlling the arrangement and spacing of said characters and the word spaces thereof to print the characters in a justified line of predetermined column width, and alternative justifying means for automatically varying the word-spaces only in accordance with an advance setting of said alternative means.

11. In a typewriter, a shuttle, a holder in said shuttle for a series of characters defined by adjacent light-pervious and light-impervious areas, means for moving the shuttle to select a character, means for printing the selected character on a light-sensitive surface, and means controlled by the shuttle-moving means for moving the surface a predetermined distance in a predetermined direction.

12. In a typewriter, a series of movable character carrying shuttles, light pervious characters on each of the shuttles, means including character levers and a stop for each of the levers interposable in the path of movement of the shuttles, said means operating a shuttle to select a character thereon, a movable support for the shuttle, and manually operated means for moving

the support to select one of the shuttles for operation.

13. In a typewriter, a series of light pervious characters, a series of character selecting levers, a carriage, and means for predetermining the movement of the carriage to print characters selected by the levers along a justified line of predetermined column width, said means including a series of spring operated ratchet and pawl connections interposed between a character lever and the carriage.

14. In a typewriter, a carriage for material to be printed, key controlled means for predetermining the differential movement of the carriage, to arrange the carriage in position to print on said material a justified line of characters of predetermined column width, said means being positive in its action, and means for photographically printing selected characters on said material.

15. In a typewriter, a plurality of light-pervious type characters, means for selecting a character for printing on a sheet, means for controlling the selecting means, a carriage for said sheet, and means controlled by the controlling means for moving the printing point of the sheet along a predetermined line other than linear.

16. In a typewriter, a plurality of type characters, means for photographically selecting and printing a character on a light-sensitive sheet, a carriage for said sheet, and means operatively connected to the selecting means for moving the printing point of the sheet along a predetermined line and for predetermined distances between the printing of each character to print a justified line of such characters.

17. In a typewriter, character selecting levers, means controlled by the levers for selecting and photographically printing a character on a light-sensitive sheet, and means controlled by the levers for moving the sheet to print a justified line of such characters along a line of predetermined shape.

18. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, an escapement-free carriage, key levers, and means for positively moving the carriage on the depression and release of any selected key lever including a ratchet wheel, means operatively connecting the wheel to the carriage whereby only rotational movement of the wheel imparts movement to the carriage, and means for rotating the wheel a predetermined distance on the release of the selected key lever.

19. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, an escapement-free and spring-free carriage and positive drive means for the carriage comprising a key-operated shaft, a ratchet wheel, a pawl adapted to be set into operative position on the wheel on the operation of the shaft in one direction and a spring acting on the pawl to move the pawl and the wheel on the return movement of the shaft in the other direction.

20. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a carriage, key levers and differential spacing means for moving the carriage different distances on the operation of different key levers corresponding to characters of different width including a differential lever pivoted to and shorter than each key lever, means for swing-

ing the differential lever through a predetermined angle on the depression of the corresponding key lever.

21. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, justifying means for automatically varying the widths of word spaces in a line in accordance with an advance setting of said means comprising a space bar, a main carriage, a subsidiary carriage slidable on the main carriage, a series of numeral-carrying levers each corresponding to a different number of word-spaces in the line, a shaft, means controlled by the depression of a lever rotating the shaft through a predetermined angle in response to operation of the space bar, a justifying lever pivoted to and carried by the main carriage, a slotted extension on the subsidiary carriage, a pin entering the slots of said extension and slidable on the justifying lever, means for operatively connecting the shaft and the pin, setting means for predetermining the angularity of said justifying lever to the direction of movement of said carriages, and means for moving said main carriage whereby an increment of movement is imparted to the subsidiary carriage in accordance to the setting of the justifying lever.

22. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, a subsidiary carriage slidable on the main carriage, means for moving the main carriage and thereby correspondingly moving the subsidiary carriage, a space bar, and means for automatically varying the widths of word-spaces in a line to justify the line in accordance with an advance setting of said means and in response to space-bar operation comprising a lever pivoted to the main carriage and normally arranged transversely to the direction of movement of said carriages, means for determining the position of said lever, and means for operatively connecting the lever to the subsidiary carriage.

23. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, a subsidiary carriage slidable on the main carriage, means for moving the main carriage different distances corresponding to different character widths and thereby correspondingly moving the subsidiary carriage, a space bar, and means for automatically varying the widths of word-spaces in a line to justify the line in accordance with an advance setting of said means comprising means for moving the subsidiary carriage relatively to the main carriage a predetermined distance on each operation of the space bar.

24. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, a subsidiary carriage and means for moving the subsidiary carriage independently of the movement of the main carriage to effect word-space justification.

25. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, means for effecting justification of character and word-spacing, means selectable as an alternative justification, means for effecting justification of word-spaces only,

and means for effecting the differential spacing of characters of different widths.

26. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a space bar, means for effecting the differential spacing of characters of different widths, means responsive to space bar operation for automatically varying the word-spaces in accordance with an advance setting of said means for justifying a particular line, and means for setting the justifying means in advance of the typing of a line in accordance with the number of word-spaces in the line and with the number of missing spaces necessary to complete the line to a predetermined width.

27. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, character key levers, escapement-free carriage operating means set into operation by said levers, a main carriage adapted to remain stationary when freed of said operating means, means carried by said levers for moving the operating means different amounts in accordance with the different widths of characters, and word-space justifying means independent of the operating means and operable independently of the movement of the carriage.

28. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, a subsidiary carriage slidable on the main carriage and having an initial position with respect thereto, means for moving the subsidiary carriage relatively to the main carriage to justify word-spaces of a line of type including a slidable pin operatively connecting the main carriage to the subsidiary carriage, means for controlling the movement of the pin from an initial position thereof, and means for resetting said pin to its initial position to return said subsidiary carriage to its initial position between the typing of lines.

29. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a carriage, and means for moving said carriage including an extensible spring, said spring having no tendency to cause operation of said means until said spring is first extended and then released.

30. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a carriage, a yieldable member having no carriage-moving tendency until stressed, and means for operatively connecting the member to the carriage to move the carriage only after said member has been stressed.

31. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a carriage, means for moving said carriage including an extensible spring, and means independent of the carriage for extending the spring, said carriage-moving means being subjected to a carriage-moving force by said spring only when the spring is extended by said extending means.

32. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a carriage, means for moving said carriage including an extensible spring, and

means independent of the carriage for extending the spring different distances in accordance with variations in character spacing, said carriage-moving means being subjected to a carriage-moving force by said spring only when the spring is extended by said extending means to different distances for each individual movement of the carriage.

33. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a first movable member, means for moving said member different distances comprising a lever having uniform movement for each operation, a second movable member operated by said lever and interposed between the lever and the first movable member, and an adjustable stop constituting a third part arranged in the path of said second member.

34. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, means for moving said main carriage, a second carriage connected to said main carriage, means for moving said second carriage, the means for moving said first carriage causing movement of both of said carriages as a unit, and the means for moving said second carriage causing no movement of said main carriage whereby both of said carriage-moving means are independently operable.

35. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, an adjustable stop member provided with a plurality of different stop extensions, means for moving said member to carry a selected one of said extensions into operative position, a movable member, and means cooperating with the selected extension to move the movable member, the movement of such movable member being dependent on the selected extension.

36. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a main carriage, a second carriage, an adjustable part carried on one of said carriages, a part on the other carriage connected to the adjustable part, means for moving one of said parts, and means for setting said moving means to so move one of the carriages relatively to the other that the total relative movement consists of a variable selected number of equal movements.

37. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a set of character levers, character positioning means operatively connected to the levers, a carriage, and means for moving the carriage on the operation of a selected character lever including a second set of levers, one of which is selected for operation with the operation of the selected character lever.

38. In a machine of the general nature described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, a rotatable stop member, a plurality of stops on said member, means for rotating the member to carry a selected stop into operative position, movable means controlled in the movement thereof by said stops, and means cooperating with the selected stop

for moving the movable means a distance dependent upon the selected stop.

39. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, movable keys for controlling the selection of the character to be printed, means controlled by the key for moving the surface, and means for disconnecting the selected key from the surface moving means on the movement of the selected key through less than the full stroke thereof.

40. In a machine of the character described, a plurality of light pervious characters, means for light printing a selected character upon a light sensitive surface, movable keys for controlling the selection of the character to be printed, means controlled by the key for moving the surface, means for disconnecting the selected key from the surface moving means on the movement of the selected key through less than the full stroke thereof including a bendable extension on the key, a perforated lever, a lug on the extension normally entering the perforation of the lever, and means for bending the extension to remove the lug from the perforation at a predetermined point in the movement of the key.

41. In a machine of the character described, a plurality of light-pervious characters, means for light-printing a selected character upon a light-sensitive surface, a carriage, means slidable on and movable with the carriage for carrying said surface, a word-space controlling lever, means operatively connecting the lever to the carriage for imparting a word-space movement to the carriage and to the slidable means on each operation of the lever, and means operatively connecting the lever to the slidable means for adding an equal positive or negative increment to each of the word-spacing movements of the slidable means on the operation of the word-space lever.

42. In a machine of the character described, a plurality of light-pervious characters, means for light-printing a selected character upon a light-sensitive surface, a main carriage, a subsidiary carriage adapted to carry said surface and slidably mounted on the main carriage for character-spacing movement therewith as a unit and for word-spacing movement relatively thereto, and word-space justifying means adapted to be set in advance for automatically distributing the difference between a given line of subject matter and a definite column-width among the word-spaces of the line, said means being operatively connected to the subsidiary carriage and controlling the relative movement of said subsidiary carriage and the main carriage.

43. In a machine of the character described, for imprinting in line formation on character-imprint receiving material, a series of characters of different widths, a plurality of light-pervious characters of different widths, means for light-printing a selected character upon said character-imprint receiving material, a carriage for the reception of said material, means for effecting differential character-spacing movement of the carriage according to the width of a selected character including a series of character levers, a shaft adapted to be rotated by any selected lever of the series, means operatively connecting the shaft to the carriage to move the carriage on the rotation of the shaft, and means responsive to the operation of a selected lever for controlling the amount of rotation of the shaft.

44. In a machine of the character described,

a plurality of light-pervious characters, means for light-printing a selected character upon a light-sensitive surface, a space key, a main carriage, an auxiliary carriage supporting said light-sensitive surface and slidably mounted on the main carriage, and adjustable means operated by the space key for varying the relative movement of said carriages to determine the spaces between words imprinted upon said surface.

45. In a machine of the character described for imprinting in line formation on character-imprint receiving material a series of characters of various widths, a plurality of light-pervious characters of different widths, means for light-printing a selected character upon said material, a carriage adapted for the reception of said material, means to effect character-spacing movement of the carriage, and to limit each character-spacing movement of the character according to the width of the selected character including a series of character levers, a lever pivoted to each of the character levers, a shaft rotatable by said character levers, and means for determining the swing of the pivoted levers and the consequent angle of rotation of the shaft.

46. In a machine for imprinting in line formation on light-sensitive material a series of characters of various widths and for effecting line justification of subject-matter, the required extent of justification for each line of which is known in terms of divisor units of a predetermined line length, a carriage adapted for the reception of light-sensitive material, means for imprinting characters on said material, including a light source, and light pervious characters, carriage control means adapted for operation in effecting varying character spacing movements of said carriage in accordance with the varying widths of different characters including a key lever for each character, a shaft operating lever pivoted to the key lever, means for determining the swing of the operating lever, a shaft rotatable by the operating lever, and operatively connected to the carriage, means responsive to each operation of said control means to effect character spacing movement of the carriage pursuant to each imprinting operation, and means cooperating with said control means to limit each character spacing movement of the carriage according to the width of the corresponding character plus an increment, the summation of which increments equals said required extent of justification.

47. In a machine for light-printing in line formation on light-sensitive material a series of characters of various widths and for effecting line justification of subject-matter, the required extent of justification for each line of which is known in terms of divisor units of a predetermined column-width, a carriage adapted for the reception of light-sensitive material, means for light-printing characters on said material, carriage control means adapted for operation in effecting character spacing movements and word spacing movements of the carriage, means under the control of said control means to effect varying character spacing movement of the carriage pursuant to each light-printing operation and to periodically effect word spacing movements of the carriage including a shaft operatively connected to the carriage and lever means for imparting predetermined amounts of rotation to the shaft and means cooperating with said control means to limit each character spacing movement of the carriage according to the width

of the corresponding character plus a selected positive or negative increment and to limit each word spacing movement of the carriage to a definite value plus the aforementioned increment, the summation of which increments equals said required extent of justification.

48. In a machine for light-printing in line formation on light-sensitive material a series of characters of various widths and for effecting line justification of subject-matter, the required extent of justification for each line of which is known in terms of divisor units of column-width, a main carriage, a subsidiary carriage slidable on the main carriage and adapted for the reception of light-sensitive material, carriage control means adapted for operation in effecting character spacing movements and word spacing movements of the main carriage, including character levers and a word-space lever, means under the control of said control means to effect character spacing movement of the main carriage pursuant to each light-printing operation and to periodically effect word spacing movements of the main carriage, means cooperating with said control means to limit each character spacing movement of the main carriage according to the width of the corresponding character, and means controlled by the word-space lever to limit each word spacing movement of the subsidiary carriage to a definite value plus a selected positive or negative increment, the summation of which increments equals said required extent of justification.

49. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, justifying means for automatically varying the widths of word spaces in a line in accordance with an advance setting of said justifying means comprising a space bar, a main carriage, a subsidiary carriage slidable on the main carriage, a series of numeral-carrying levers each corresponding to a different number of word-spaces in the line, a shaft, means controlled by the depression of a lever for rotating the shaft through a predetermined angle in response to operation of the space bar, a justifying lever pivoted to and carried by the main carriage, a slotted extension on the subsidiary carriage, a pin entering the slots of said extension and slidable on the justifying lever, means for operatively connecting the shaft and the pin, setting means for controlling the angularity of said justifying lever to the direction of movement of said carriages, and means for moving said main carriage whereby an increment of movement is imparted to the subsidiary carriage in accordance to the setting of the justifying lever.

50. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a subsidiary carriage slidable on the main carriage, means for moving the main carriage and thereby correspondingly moving the subsidiary carriage, a space bar, and means for automatically varying the widths of word-spaces in a line to justify the line in accordance with an advance setting of said means and in response to space-bar operation comprising a lever pivoted to the main carriage and normally arranged transversely to the direction of movement of said carriages, means for positioning said lever, and means for operatively connecting the lever to the subsidiary carriage.

51. In a machine of the character described,

means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a subsidiary carriage slidable on the main carriage, a space-bar, and means for automatically varying the widths of word-spaces in a line to justify the line in accordance with an advance setting of said means comprising means for moving the subsidiary carriage relatively to the main carriage, a predetermined distance on each operation of the space bar.

52. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a subsidiary carriage slidably mounted on the main carriage and movable therewith, means for moving the main carriage to provide a space between words, and means responsive to the operation of the main carriage moving means for moving the subsidiary carriage on and relatively to the main carriage to effect word-space justification.

53. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a space bar, means responsive to space bar operation for automatically varying the word-spaces in accordance with an advance setting of said means for justifying a particular line, and means for setting the justifying means in advance of the typing of a line in accordance with the number of word-spaces in the line and with the number of missing spaces necessary to complete the line to a predetermined width.

54. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, character key levers, carriage operating means set into operation by said levers, and including a ratchet wheel and a pawl in driving relation to said wheel, a main carriage adapted to remain stationary when said pawl is inoperative to rotate said wheel, means carried by said levers for moving the pawl different amounts in accordance with the different widths of characters, means for moving the pawl a definite distance to effect predetermined word-spacing movement of the carriage, and word-space justifying means independent of the operating means and operable on each word-spacing movement of the carriage.

55. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a subsidiary carriage slidable on the main carriage and having an initial position with respect thereto, means for moving the subsidiary carriage relatively to the main carriage to justify word-spaces of a line of characters including a slidable pin operatively connecting the main carriage to the subsidiary carriage, means for controlling the movement of the pin from an initial position thereof, and means for resetting said pin to its initial position to return said subsidiary carriage to its initial position after the exposure of a line has been completed.

56. In a machine of the general nature described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, means for moving said main carriage for effecting character-spacing and word-spacing, a second carriage slidably mounted on said main carriage, and means for moving said second carriage rel-

actively to the main carriage on the word-spacing movement of the main carriage only.

57. In a machine of the general nature described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a second carriage, an adjustable part carried on one of said carriages, a part on the other carriage connected to the adjustable part, means for moving one of said parts to effect word-spacing movements and character-spacing movements of said carriages, and means for setting said moving means to so move one of the carriages relatively to the other that the total relative movement consists only of a variable selected number of equal word-spacing movements.

58. In a typing machine, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, means for justifying a given line of subject matter with respect to a definite column-width, including a plurality of stop levers, means adapted to be set in advance on the selection of a stop lever for adding a positive or negative increment to the number of word-spaces corresponding to a numeral on the lever, a dial, and means controlled by the advance setting of the dial for automatically distributing the difference between the column-width and the length of said given line equally among the word-spaces of the line on the operation of the machine, said distributing means including a lever and means for setting said lever at a required angle.

59. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a carriage, means slidable on and movable with the carriage for carrying light-sensitive material, a word-space controlling lever, means operatively connecting the lever to the carriage for imparting a word-spacing movement to the carriage and to the slidable means on each operation of the lever, and means operatively connecting the lever to the slidable means for adding an equal positive or negative increment to each of the word-spacing movements of the slidable means on the operation of the word-space lever.

60. In a machine of the character described, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, a subsidiary carriage adapted to carry a light-sensitive sheet and slidably mounted on the main carriage for character-spacing movement therewith as a unit, and for word-spacing movement relatively thereto, and word-space justifying means adapted to be set in advance for automatically distributing the difference between a given line of subject matter and a definite column-width among the word

spaces of the line, said means being operatively connected to the subsidiary carriage and controlling the relative movement of said subsidiary carriage and the main carriage.

61. In a typewriter including a space key, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, an auxiliary sheet-supporting carriage slidably mounted on the main carriage, and adjustable means operated by the space key for varying the relative movement of said carriages to determine the spaces between words typed by said typewriter.

62. In a typewriter, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, an auxiliary sheet-supporting carriage slidably mounted on the main carriage, and adjustable means for varying the relative movement of said carriages to determine the spaces between words typed by said typewriter, including a lever pivoted to the main carriage, means for operatively connecting the auxiliary carriage to the lever, and means for setting said lever at a predetermined angle to the direction of movement of said carriages.

63. In a typewriter, means for light-printing upon a light-sensitive surface a character selected from a plurality of such characters, a main carriage, key-controlled means for moving the main carriage, an auxiliary sheet-supporting carriage slidably mounted relatively to the main carriage, and adjustable operating means for the auxiliary carriage operatively connected to the main carriage to control the movement of the auxiliary carriage including a swingable lever pivoted at one end thereof and an adjustable connection connecting a point on the lever intermediate its ends to the auxiliary carriage.

64. In a machine of the character described, means for selecting and photographically printing a character on a light-sensitive sheet, means for effecting line justification of subject matter, the required extent of justification for each line of which is known, comprising a main carriage, key-operated carriage control means for effecting different normal spacing movements of the carriage for characters of different widths, a subsidiary carriage slidable on the main carriage, and means for advancing the subsidiary carriage a definite distance between words equal to the movement of the main carriage between words plus an increment, the summation of which increments equals said required extent of justification including a lever pivoted to the main carriage, means for setting said lever at a predetermined angle to the direction of movement of the carriages, and means slidable on the lever and connecting the lever to the subsidiary carriage.

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