March 9, 1943. S. BRAND 2,313,119

LINE JUSTIFYING DEVICE

Filed Sept. 30, 1941 10 Sheets-Sheet 1

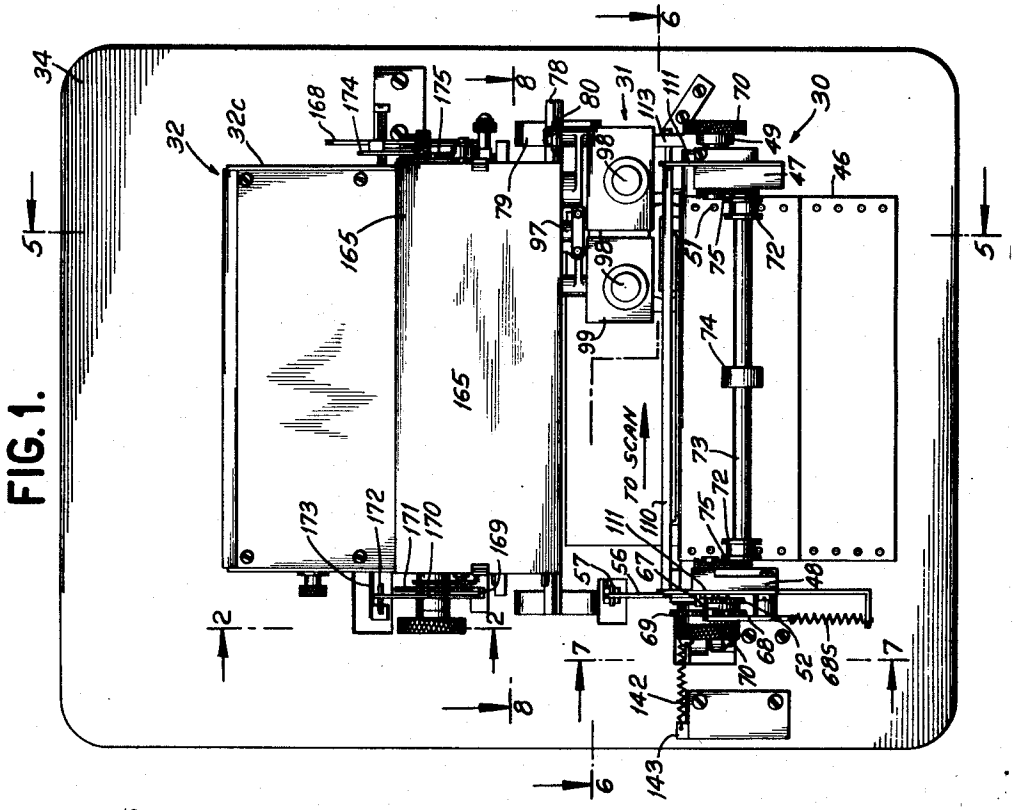


FIG. 1.

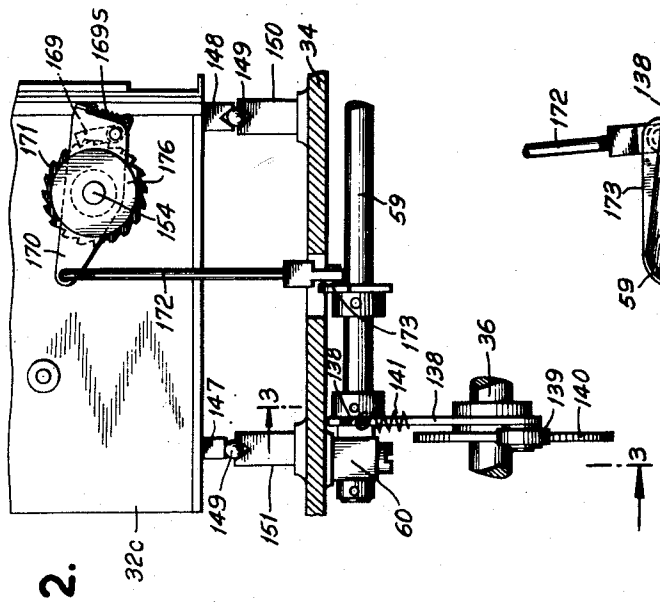


FIG. 2.

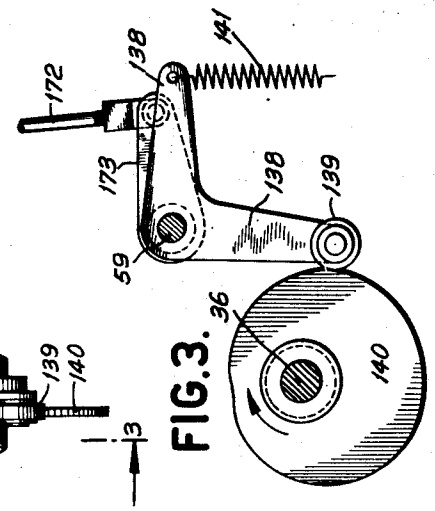


FIG. 3.

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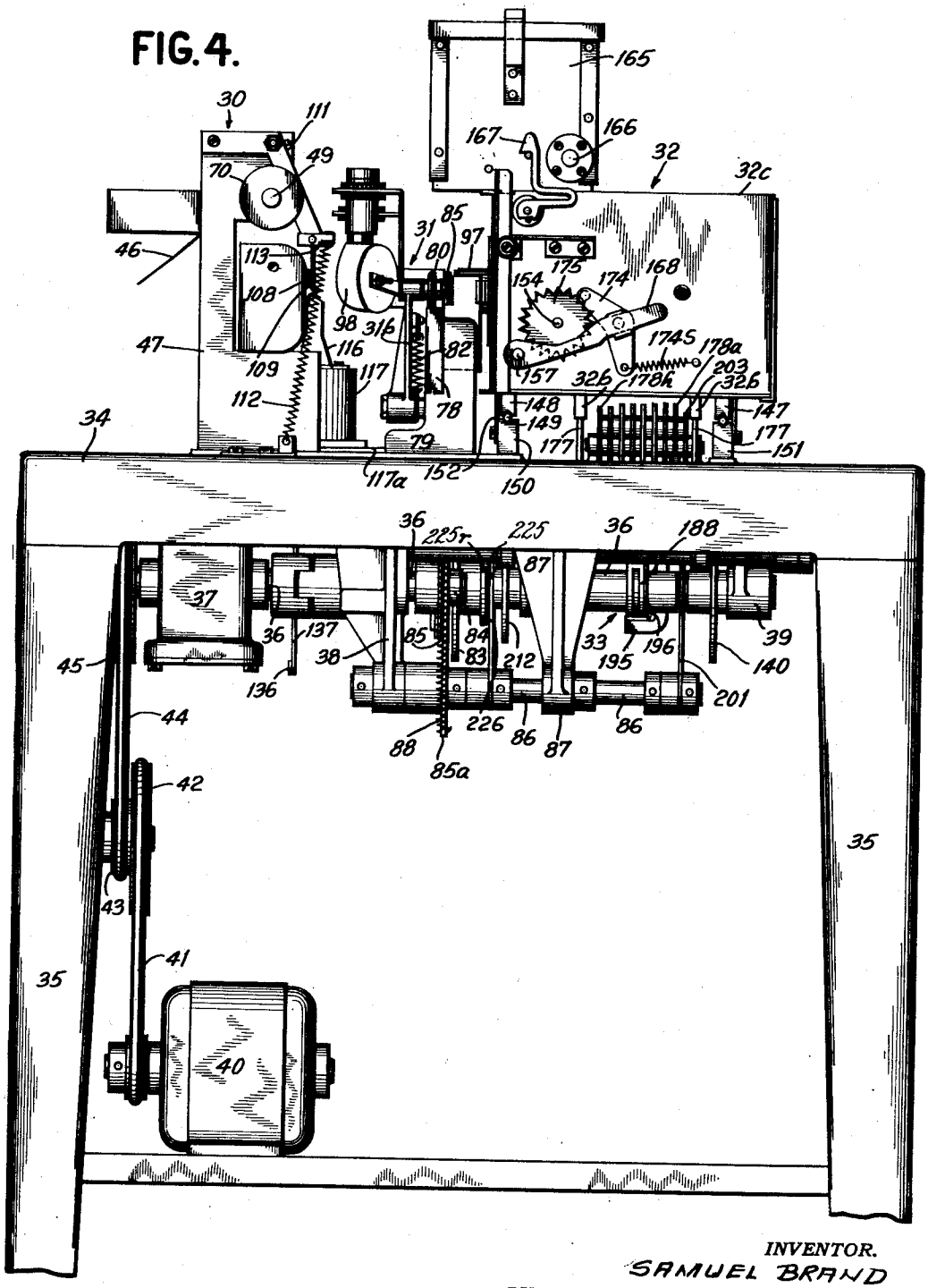
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FIG. 4.



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LINE JUSTIFYING DEVICE

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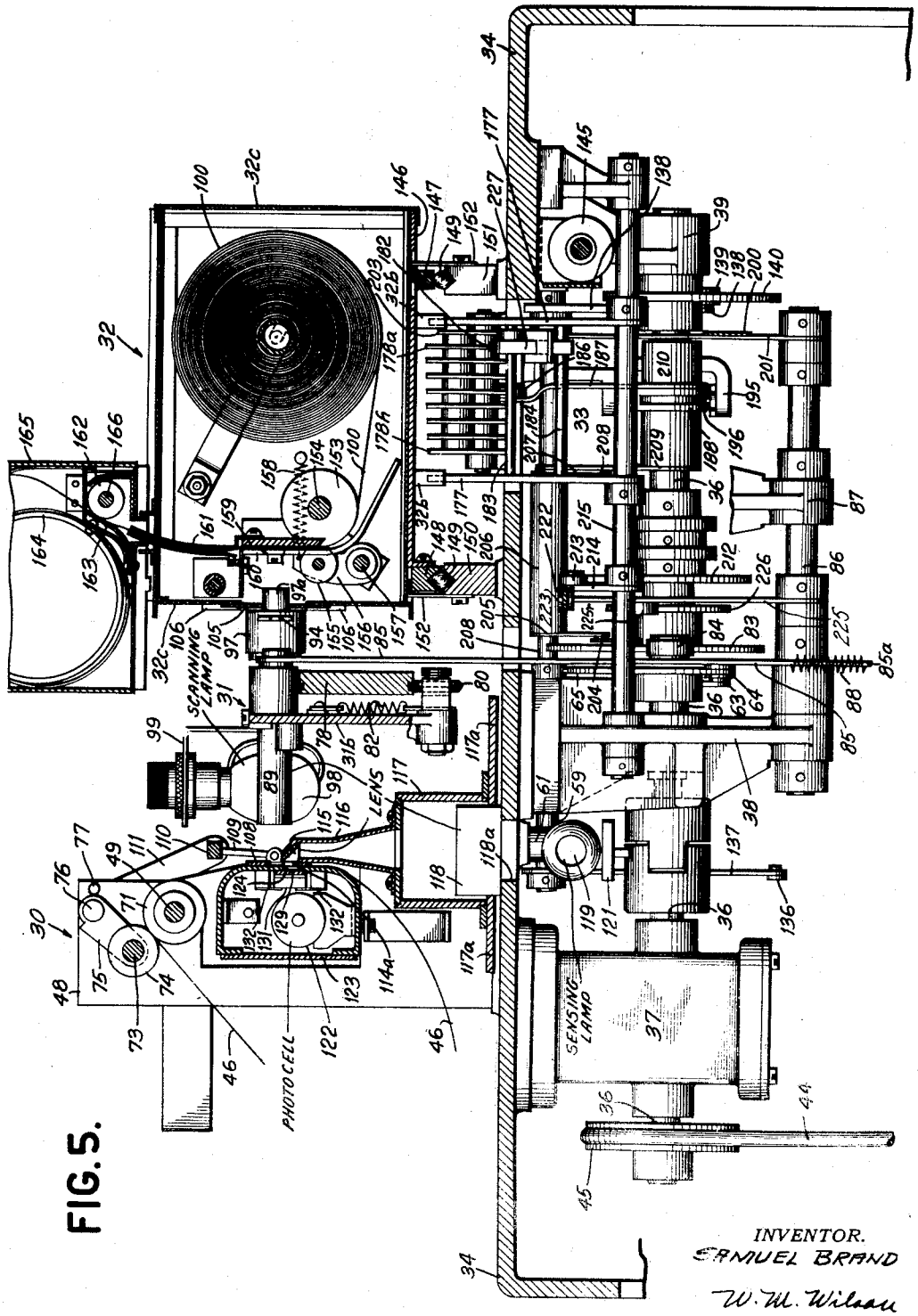


FIG. 5.

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LINE JUSTIFYING DEVICE

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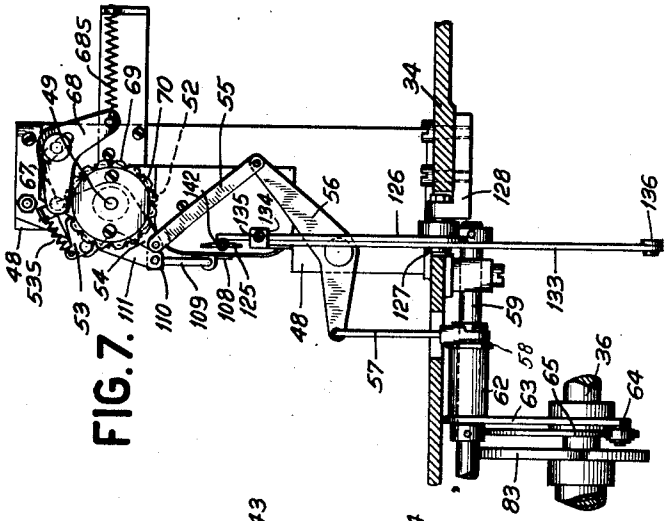


FIG. 7.

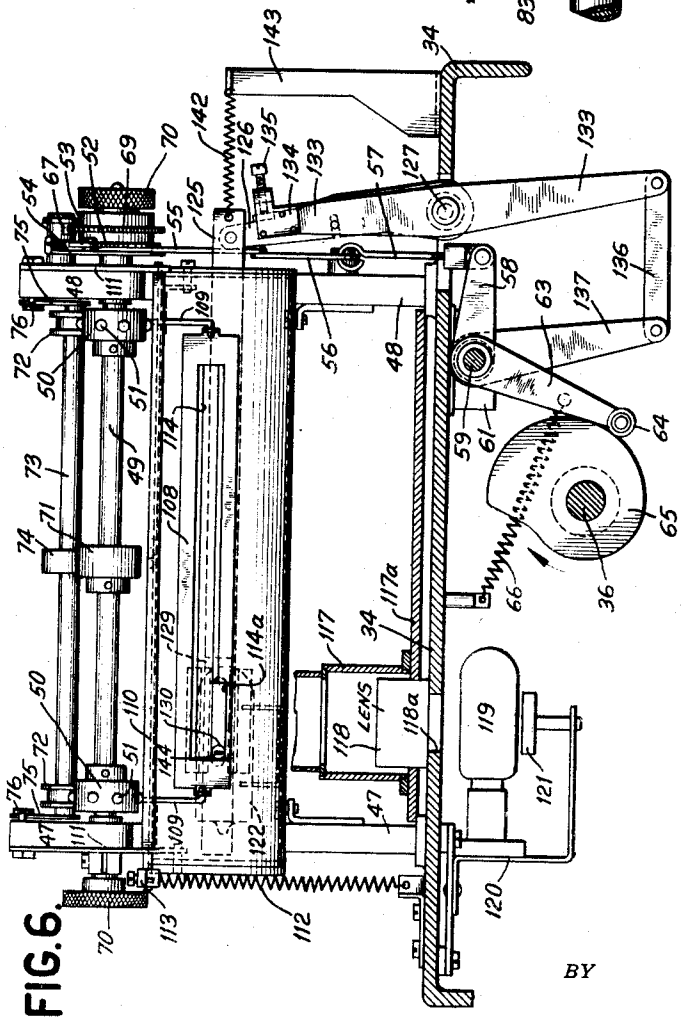


FIG. 6.

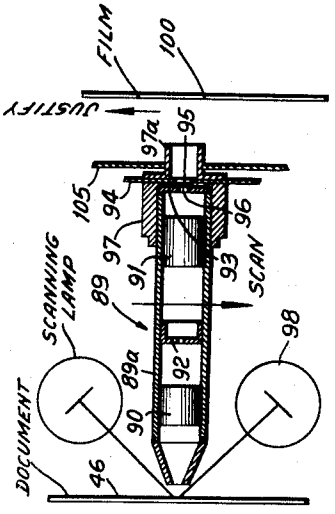


FIG. 10.

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LINE JUSTIFYING DEVICE

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FIG.8.

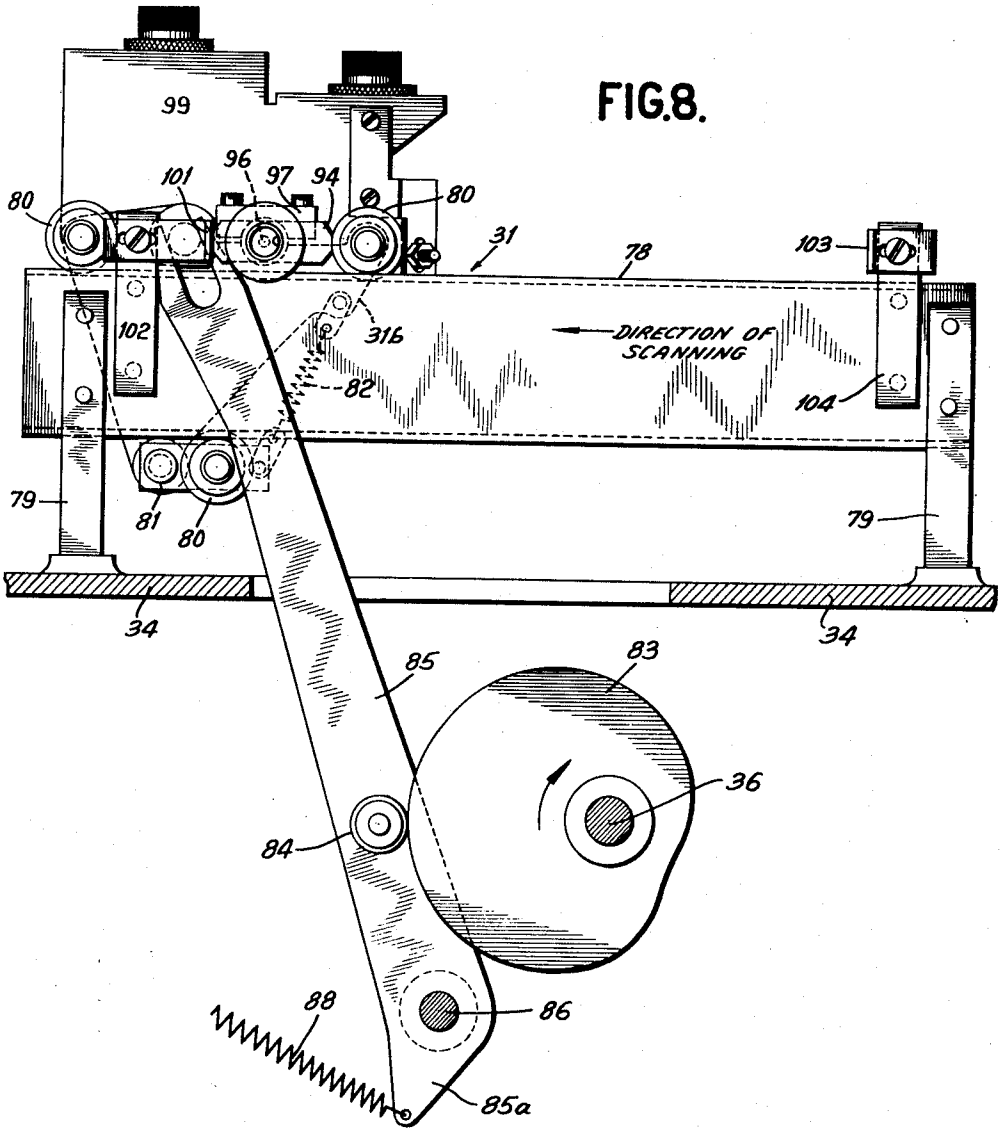
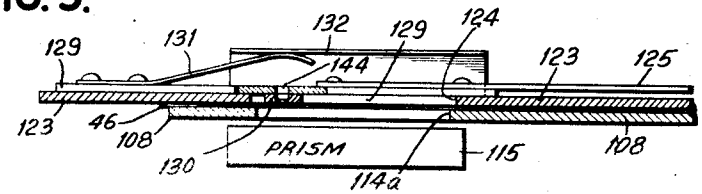


FIG. 9.



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LINE JUSTIFYING DEVICE

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FIG. 11.

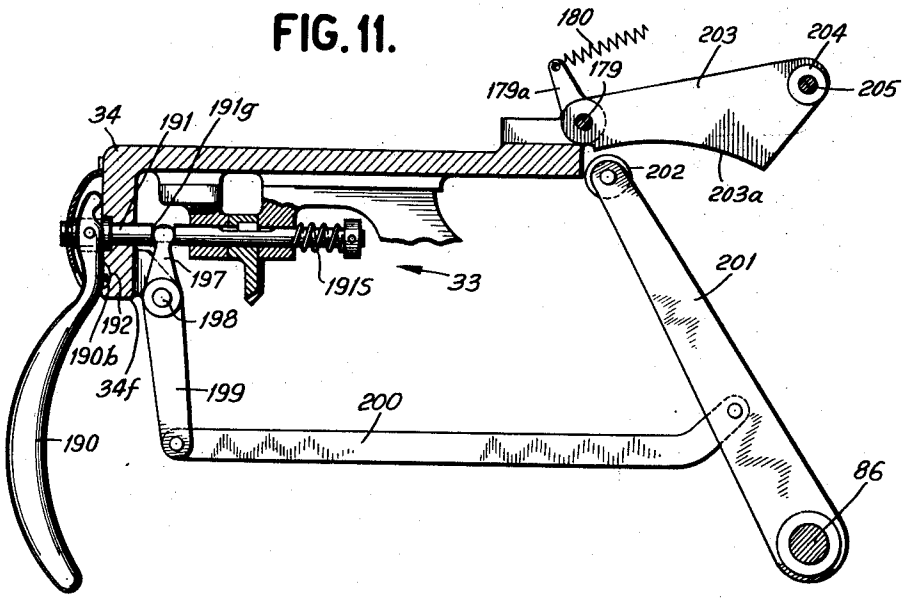
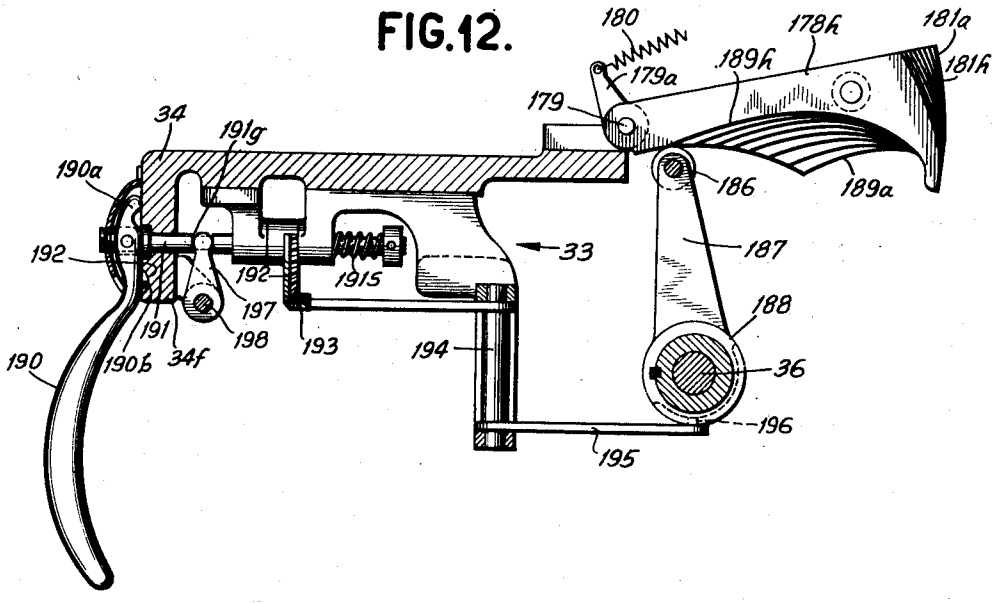


FIG. 12.



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LINE JUSTIFYING DEVICE

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FIG. 14.

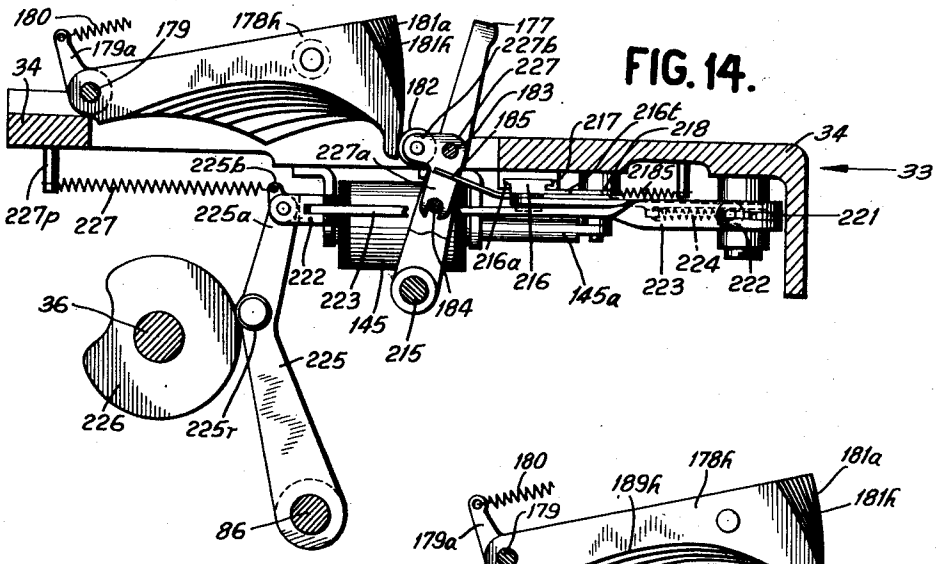


FIG. 15.

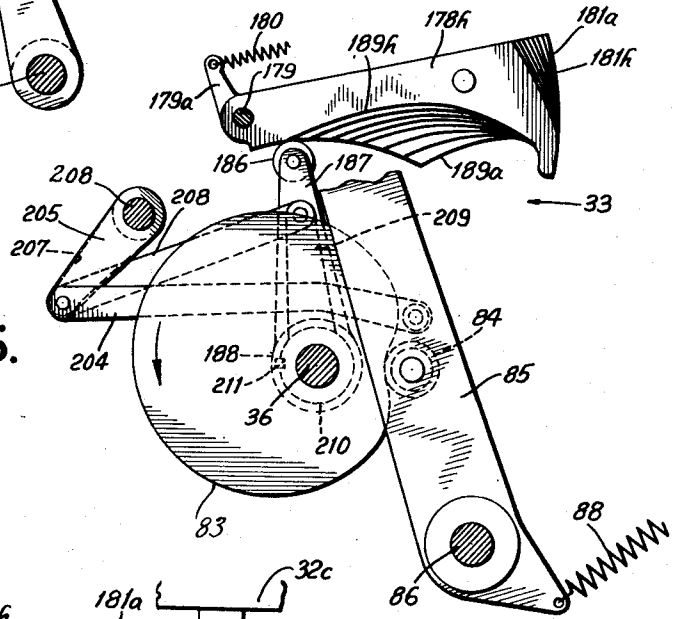
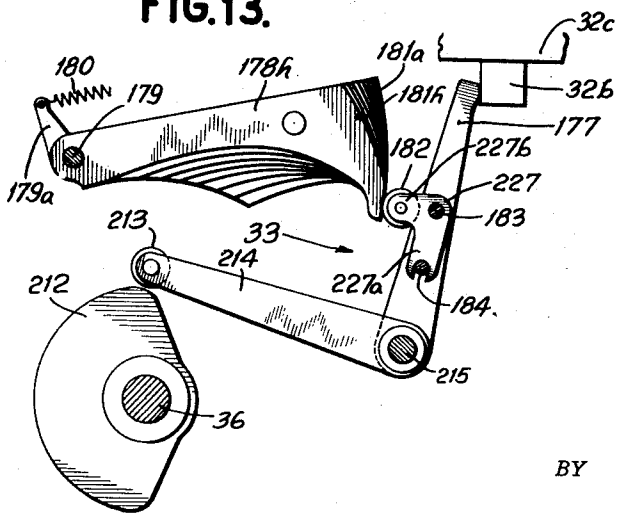


FIG. 13.



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LINE JUSTIFYING DEVICE

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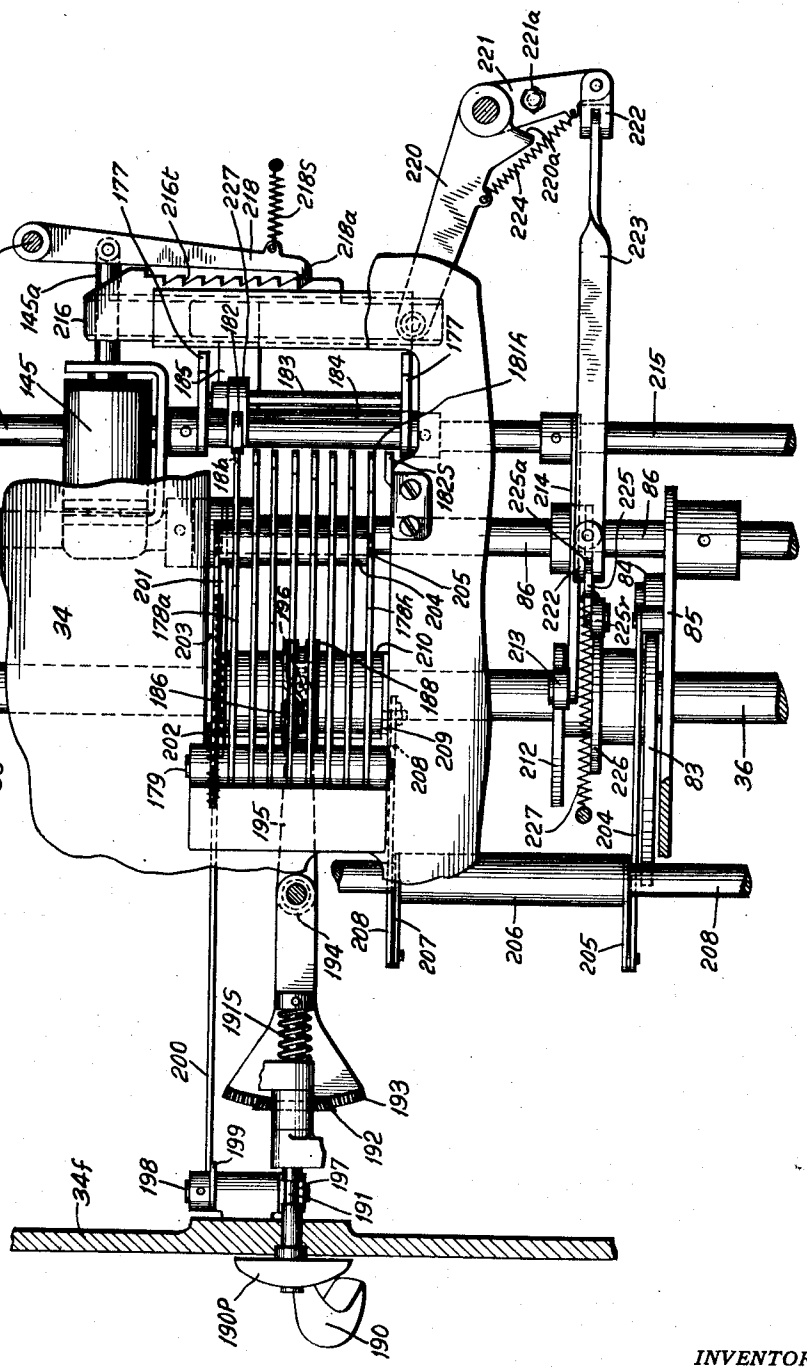


FIG. 16.

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LINE JUSTIFYING DEVICE

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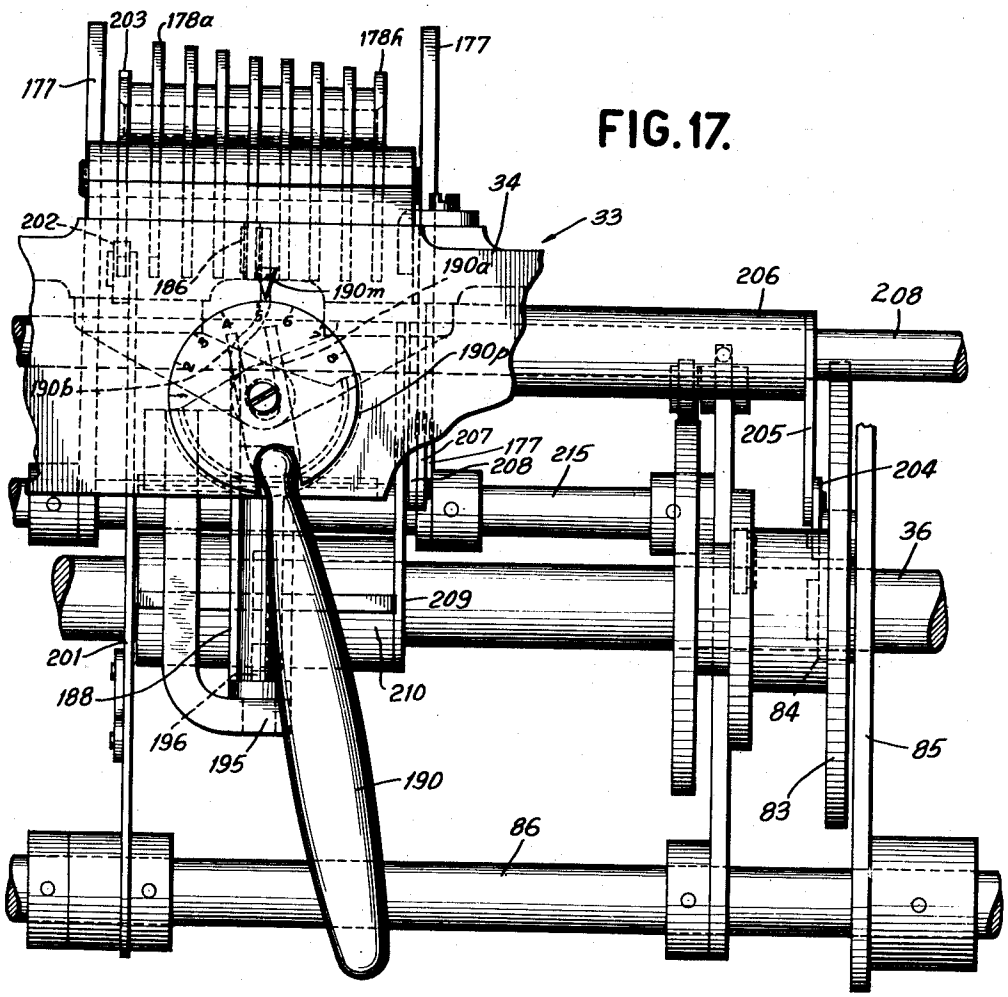


FIG. 17.

FIG. 18.

This line is 3 points short, and is justified accordingly 107
This line does not need to be justified as it is full length
This line must be justified, it being 8 points short 107 107

This line is 3 points short, and is justified accordingly
This line does not need to be justified as it is full length
This line must be justified, it being 8 points short

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LINE JUSTIFYING DEVICE

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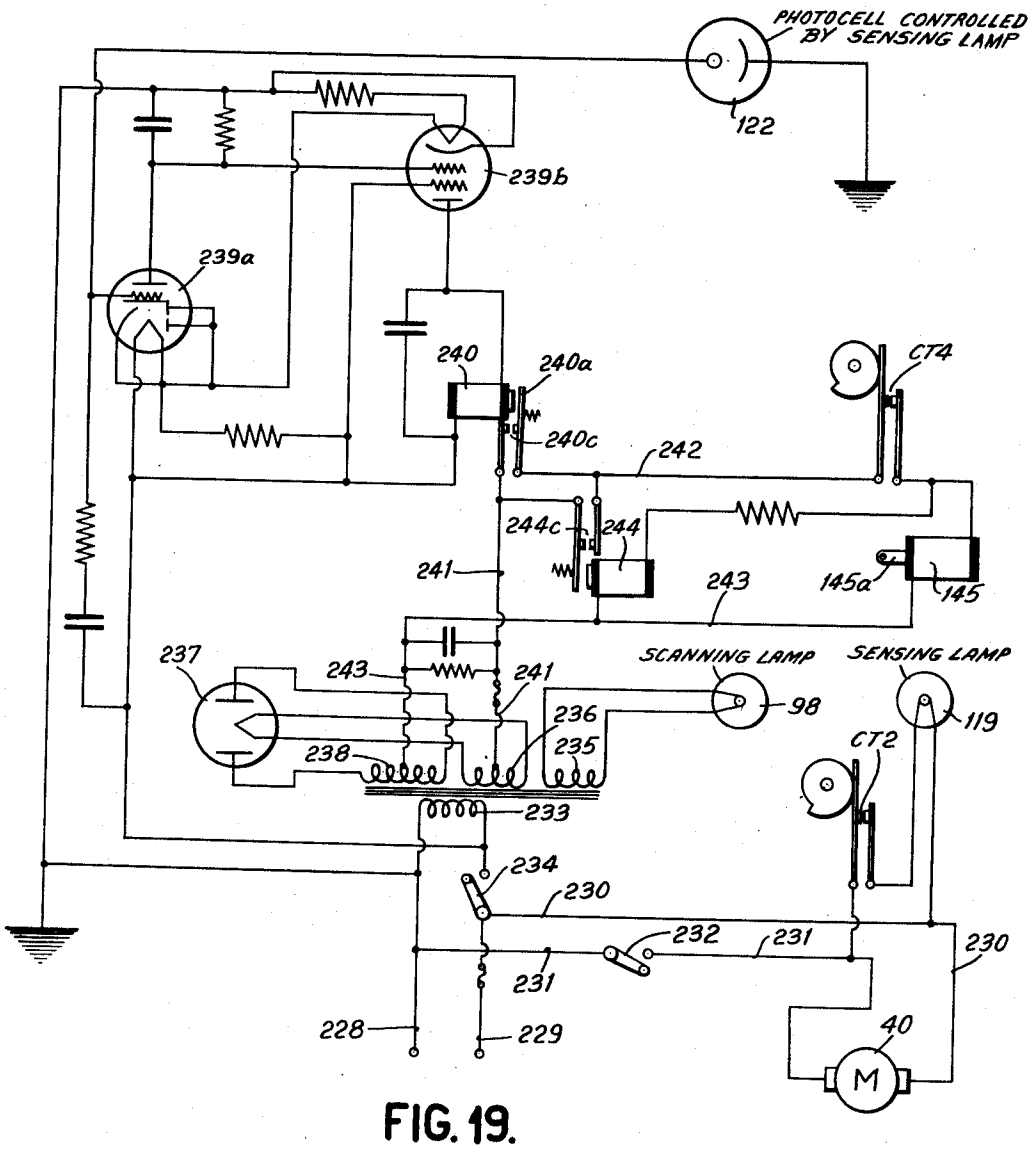


FIG. 19.

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Patented Mar. 9, 1943

2,313,119

UNITED STATES PATENT OFFICE

2,313,119

LINE JUSTIFYING DEVICE

Samuel Brand, Binghamton, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application September 30, 1941, Serial No. 412,946

31 Claims. (Cl. 95—4.5)

The present invention relates to devices for justifying lines of typewritten matter, and is a continuation in part of applicant's copending application Serial No. 255,250, filed February 8, 1939, now patent No. 2,261,538 granted November 4, 1941.

In devices of the prior art, such as is exemplified, for example, by said copending application, justifying mechanism has been provided which is suitable for justifying one length of line of a copy. When the same device was employed, for example, on a much shorter line of a nonjustified copy, the justification would not be limited to a length coextensive with that portion of the line composed of actual characters but would be distributed throughout an extent, equal to the length of the line for which the machine was originally designed. Thus, the justifying mechanism would not only be operated to produce justification, when no actual characters were being scanned, but due to the different amounts of justification required by lines differing, by a "justifiable" amount, from the chosen length, the left-hand margin of the justified copy would be irregular.

One of the objects of the present invention, therefore, is to produce mechanism which will distribute the justification, only throughout the extent of the actual typed part of the line and will not produce any justification in that portion of the line in which no actual typing exists. The justification is, therefore, efficiently distributed, only where needed, and further, the left-hand margin of the justified copy is maintained in alignment.

In justifying certain types of copy, such as a series of narrow short paragraphs of a column, similar to a newspaper column; in devices of the prior art it has been impossible to maintain the alignment of the paragraph indentations, unless the machine employed was designed especially for such narrow columns, since otherwise justification would begin prior to scanning of the print itself. By setting the device of the present invention so that justification begins only at that width of column indicated by the paragraph indentation, no justification is produced until the indentation is reached by the scanning mechanism, and the alignment of the paragraph indentations is maintained. Accordingly, another object of the present invention is to provide an adjustable justifying device wherein the point or time of initiation of justification can be controlled and alignment of indentation of paragraphs can be maintained.

Still another object is to provide a novel line justifying mechanism which is adjustable to properly justify different lengths of copy.

A further object is to provide novel line justifying mechanism which is adjustable to maintain alignment of the left-hand side of columns of different lengths of lines of copy.

Another object is to provide novel justifying mechanism which will produce justification accurately, and in a relatively simple manner.

Still another object is to produce a novel justifying mechanism which is settable to justify different lengths of copy and which automatically uniformly distributes the total justification throughout that part of the line only, which contains characters.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a top plan view of the device comprising the invention.

Fig. 2 is a fragmentary detailed sectional view, on an enlarged scale, taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary detailed sectional view, taken on line 3—3 of Fig. 2.

Fig. 4 is a side view of the right-hand side of the device of Fig. 1.

Fig. 5 is a sectional view, on an enlarged scale, taken on the line 5—5 of Fig. 1.

Fig. 6 is a sectional view, on an enlarged scale, taken on the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary detailed sectional view, on an enlarged scale, taken on the line 7—7 of Fig. 1.

Fig. 8 is a detailed view illustrating the scanning mechanism.

Fig. 9 is a fragmentary detailed view of a part of the sensing mechanism for determining the amount of justification required.

Fig. 10 is a partially schematic view illustrating the optical system employed in scanning the copy and producing a photographic justified reproduction.

Fig. 11 is a sectional view illustrating some of the adjusting mechanism employed in presetting the device, so as to adjust the mechanism to justify a chosen length of line.

Fig. 12 is a view, generally similar to Fig. 11, but illustrating the portion of the justifying

mechanism employed in selecting one of eight substantially different lengths of line to be justified.

Fig. 13 is a view, generally similar to Fig. 11, but illustrating the portion of the justifying mechanism employed in moving the film compartment casing.

Fig. 14 is a view, generally similar to Fig. 11, but illustrating the portion of the mechanism employed in automatically setting the machine to produce the amount of justification required by the sensed line of copy.

Fig. 15 is a view, generally similar to Fig. 11, but illustrating the portion of the mechanism for operating the justifying and scanning mechanism in synchronism.

Fig. 16 is a plan view of the adjusting mechanism of Figs. 11 to 15, inclusive.

Fig. 17 is an end view of the device of Fig. 16.

Fig. 18 illustrates examples of different lengths of lines of typed copy, before and after justification.

Fig. 19 is a circuit diagram of the operating mechanism of the device.

Referring to the drawings and more particularly to Figs. 1, 4, 5 and 11 to 17, inclusive, the machine comprises generally a carriage **30** to support the original document or non-justified copy and the sensing apparatus; a carriage **31**, to support the scanning apparatus; a carriage **32** to support the photographic material; and mechanism generally designated as **33** comprising the novel adjustable justification producing mechanism (Figs. 11 to 17, inclusive) for adjusting the machine to the length of line to be scanned and for producing automatically a required amount of justification.

Carriages **30**, **31** and **32** are mounted on a base **34** supported by legs **35**, and the novel adjustable justifying mechanism is, in the most part, mounted beneath the base **34** (Figs. 11, 12 and 14, for example). A main drive shaft **36** (Fig. 5) is mounted in a housing **37** and bearings **38** and **39**, beneath the base **34**, and is driven by a motor **40** (Fig. 4) belt **41**, pulley **42**, pulley **43**, belt **44** and pulley **45** driving the gear reduction mechanism (not shown) enclosed in housing **37**, to in turn drive shaft **36**.

Document carriage

Carriage **30**, in which the original document or non-justified copy **46** is mounted, comprises a pair of upright frames **47** and **48** (Figs. 1, 4 and 5) secured to base **34**. A shaft **49** (Fig. 6) is rotatably mounted between the frames and has attached thereto feed rollers **50** provided with radially extending pins **51** cooperating with holes along the edges of the document **46** to thereby align and advance the document.

Document feeding mechanism comprises a ratchet **52** (Figs. 6 and 7) secured to the right-hand end of shaft **49** to drive the same, a pawl **53**, mounted on member **54** pivoted on shaft **49**, which cooperates with ratchet **52** to drive the ratchet and shaft **49** upon oscillation of member **54**. Pawl **53** is spring pressed into engagement with ratchet **52** by a spring **53***s*. A link **55** is pivotally connected at one end to member **54** and at the other end to one arm of lever **56** (Fig. 7) pivotally supported on the frame **48**. A rod **57** is connected at one end thereof to the other arm of lever **56** and is pivotally connected by a threaded connection to an arm **58** (Fig. 6) pivotally mounted for oscillation on shaft **59**. Shaft **59** (Figs. 2 and 5) which is also oscillatable, as described presently, is supported in brackets **60** and **61** secured to the underside of base **34**. A hub **62** (Fig. 7) rigidly connects the arm **58** to a cam follower **63** provided at its free end with a roller **64** cooperating with a cam **65** (Fig. 6) mounted on shaft **36**. A spring **66** urges the roller **64** constantly into engagement with the cam **65**.

Referring to Fig. 6, rotation of cam **65** in the direction of the arrow, rocks the arms **63** and **58** counter-clockwise about shaft **59** which movement is transmitted; through rod **57**, lever **56**, link **55** and member **54**; to retract the feed pawl **53** one tooth. When the high portion of cam **65** passes roller **64**, spring **66** reverses the movement of the linkage just described to advance the pawl **53** to in turn advance ratchet **52** one tooth to rotate the shaft **49** and rollers **50** whereby document **46** is advanced one line space. A roller **67** (Fig. 7) carried by retainer pawl **68** spring biased by spring **68***s*, cooperates with a notched disk **69** secured to ratchet **52** to align and yieldingly hold shaft **49** and the document, in position. Knurled knobs **70** (Fig. 6) are attached to the ends of shaft **49** for manual adjustment of the document. To maintain the document **46** in close engagement with the feed rollers **50**, and with a roller **71**, a pair of rollers **72**, formed with annular grooves to clear the feed pins **51**, is provided, one roller on each end of shaft **73**. Also mounted on shaft **73** is a roller **74** cooperating with roller **71**. Shaft **73** is supported between the arms **75** pivotally supported on studs **76** projecting inwardly from frames **47** and **48**. Arms **75** may be rotated manually to facilitate insertion of a new document, stops **77** (Fig. 5) being provided in the frames to limit their movement. The original document or non-justified copy may comprise a letter or other typewritten document or it may be in the form of a comparatively long strip of paper comprising a roll, which is fed, line by line, past the scanning mechanism.

Scanning carriage

The scanning carriage, generally designed as **31**, is mounted to travel on a bar **78** (Fig. 8) supported by uprights **79**—**79** secured to the base **34**. The carriage is provided with three knife edged rollers **80**, two of which travel in a groove along the upper edge of the bar **78**, the remaining or lower roller travelling along a groove in the bottom edge of bar **78** (Fig. 5). In order to maintain an accurate alignment of the scanning carriage, the lower roller **80** is mounted on an arm **81** (Fig. 8) which is pivotally supported on the carriage body **31***b*. A spring **82** tensioned between the carriage body and the free end of arm **81** presses the rollers **80** into the respective grooves. The movement of the carriage body **31***b* of the scanning carriage **31** is controlled by a cam **83** mounted on the drive shaft **36** for rotation therewith. Cam **83** cooperates with a roller **84** on a lever **85** mounted for oscillation on a rock-shaft **86** mounted in bracket **38** and in a bracket **87** (Fig. 5) secured to the base **34**. A spring **88** having one of its ends fast to an extension **85***a* of lever **85** presses the roller **84** into engagement with the periphery of cam **83**. As cam **83** rotates in the direction of the arrow (Fig. 8), spring **88** rocks the lever **85** clockwise, shifting the body **31***b* of the scanning carriage toward the right until the low portion of the cam **83** is under the roller **84**, at which point the carriage body **31***b* is in its extreme right-hand po-

sition. Continued rotation of the cam 83 reverses the direction of movement of the lever 85 and of the scanning carriage body 31b, moving it from right to left. It is during this latter movement, as indicated by the arrow (Fig. 8), that the actual scanning occurs.

Mounted on carriage body 31b for reciprocation therewith is an optical system 89 (Figs. 5 and 10). This system comprises a tube 89a in which are mounted lenses 90 and 91. Between the lenses is mounted a masking disk 92, while a second masking disk 93 is fixed to the right-hand end of the tube 89a. Adjacent disk 93 is a shutter 94 provided with an opening 95 to be aligned with the opening 96 in disk 93. Shutter 94 is slidably mounted in a sleeve 97 forming a part of the lens mounting. Upon operation of the shutter 94, as described presently, the aperture 95 thereof is moved out of alignment with aperture 96 in disk 93 to render the optical system ineffective during the return movement of the scanning carriage. Lamps 98 (Figs. 4 and 5) mounted on a bracket 99 (Fig. 8) secured to the carriage body 31b, provide illumination on the original document 46, the image of whose typewritten characters is projected by the lens system (Fig. 10) onto a film 100 to produce the photographic reproduction of the characters.

During the reciprocation of the carriage body 31b by the lever 85, as described above, the shutter 94 is operated to render the lens system inoperative during the return movement of the carriage. Shutter 94 is slidably mounted in sleeve 97, as stated above, and as the carriage body 31b travels to the left (Fig. 8) the shutter 94 strikes a stop 101, adjustably mounted on a plate 102 secured to the bar 78, preventing the shutter from moving farther to the left. The carriage body 31b, however, travels a short distance after the shutter 94 is stopped, so that the shutter is slidably shifted and its aperture 95 is moved out of line with aperture 96 in masking disk 93 (Fig. 10) thereby rendering the optical system inoperative. The shutter remains in its new position during the return movement of the carriage and until the carriage body 31b approaches the right hand limit of its travel (Fig. 8) at which time shutter 94 engages stop member 103 adjustably supported on a plate 104, secured to the bar 78, thereby shifting the shutter to bring its aperture 95 into alignment with the masking aperture 96 to render the optical system operative. As the carriage body moves to the left (Fig. 8) during this actual scanning stroke, the line of typed matter is scanned and reproduced in photographic negative form on film 100.

An elongated opening is provided in the casing 32c of the film carriage (Fig. 5) through which projects the reduced end 97a of the sleeve 97 as the scanning carriage body 31b is reciprocated during the operation of the machine. In order to protect the unexposed film 100 against exposure to extraneous light, a slide 105 is provided. This slide is of sufficient length so that the opening in casing 32c is covered at all times, regardless of the position of the scanning carriage body 31b. Slide 105 is mounted in grooves, formed by the plates 106 secured to casing 32c and by the casing itself. The reduced end 97a of sleeve 97 projects through the slide 105 and into the casing 32c, as stated above, so that the reciprocatory movement of the scanning carriage body 31b is transmitted to the slide, which slide thereby travels back and forth with the scanning carriage body.

Sensing mechanism

Sensing mechanism, for automatically determining the amount of justification required for any length of line of typing, is provided and is illustrated in the present embodiment as separate from the scanning means and comprising a portion thereof mounted on the document carriage 30 and another portion mounted beneath the base 34. Referring to Fig. 18, three lines of typed copy, before and after justification, are illustrated therein. At the end of each line of typing, there is typed an opaque spot indicated as 107. This spot is sensed, by mechanism to be described presently, in order to automatically determine the extent of justification required for each line. Justification is then automatically effected by moving the film carriage in the opposite direction to and in synchronism with the scanning carriage movement during the actual scanning stroke, as described in detail later, whereby there is produced a photographic copy or replica whose lines are uniformly justified throughout their respective extents.

A pressure plate 108 (Figs. 5 and 6) is pivoted on arms 109 depending from a bar 110 which in turn is pivotally supported in brackets 111 secured to the sides of members 47 and 48 (see also Fig. 7). A spring 112 (Fig. 6) having one end fast on an arm 113 secured at a right angle to one end of bar 110, presses the plate 108 into engagement with the copy 46. An elongated opening 114 in plate 108 exposes a single line of typed matter, the image of which is to be projected by the lens system 89 onto film 100, as the scanning carriage sweeps across the copy 46. At the left end of pressure plate 108 (Fig. 6), the opening 114 is enlarged, at 114a, to expose the next lower line to be sequentially scanned. Directly to the right of enlarged opening 114a (Fig. 5) is mounted a prism 115 in a housing 116 mounted on a condenser housing 117 supported by plate 117a mounted on base 34. A condenser lens 118 is mounted within housing 117 above an opening 118a in base 34. Directly below the condenser lens is located a light source 119 supported on a bracket 120 secured to the underside of base 34 (Fig. 6). Also supported on the bracket 120 is a reflector 121.

A photocell 122 (Fig. 5) is mounted in a housing 123 supported by frames 47 and 48 of the document carriage 30. Photocell 122 lies directly opposite the prism 115 (Fig. 5) so that the light from source 119 is projected through condenser lens 118 and into prism 115, which changes its direction, to project the light rays upon photocell 122. The opening 114a in plate 108 coincides with a slot 124 (Fig. 9) in the casing 123.

A slide 125 (Figs. 6 and 9) located within casing 123 opposite the prism 115 is pivotally connected at one end to an arm 126 (Fig. 6) pivoted on a stud 127 projecting from a bracket 128 (Fig. 7) secured to the base 34. Secured to the other end of slide 125 is a plate 129 (Fig. 5) having a disk 130 (Figs. 6 and 9) fast thereon. The disk 130 fits into the slot 124 and is adapted to be reciprocated therein to thereby support and guide the combined slide 125—129.

The plate 129 of slide 125—129 is pressed into close engagement with the inside surface of the casing 123 by means of two springs 131 (only one shown Fig. 9) attached to plate 129 and tensioned between two angle members 132 (Fig. 5) disposed one above and one below the plate 129.

A lever 133 (Figs. 6 and 7) is pivoted on stud

127 adjacent the arm 126 and has secured to its upper end a formed member 134 embracing the arm 126. Member 134 carries an adjusting screw 135 which serves to adjust the position of the combined slide 125—129. A link 136 (Fig. 6) connects the lower arm of lever 133 to an arm 137 fast on shaft 59, to which shaft, as described presently, is fastened an arm 138 (Fig. 3).

As described in detail later, upon rotation of a cam 140 (Fig. 3), a spring 141 cooperating with cam 140 rocks the roller 139, arm 138, and shaft 59, first clockwise and then counterclockwise, to feed the film 100 in order to bring an unexposed portion thereof in line with the optical system. Clockwise movement of shaft 59 and of arm 137 (Fig. 6), is transmitted to link 136 to in turn rock lever 133 clockwise (Fig. 6). Upon clockwise movement of lever 133, a spring 142; tensioned between the slide 125—129 and a bracket 143, secured to base 34; draws the slide 125—129 to the right, maintaining arm 126 in engagement with the adjusting screw 135.

An aperture 144 (Figs. 6 and 9) is provided, extending through the plate 129 and the disk 130, and the rays of light from the source 119 are projected through opening 118*a*, condenser lens 118, prism 115, aperture 114*a*, through the copy 46, and aperture 144 to the photocell 122. As the aperture 144 is moved, towards the end of a line of typing, photocell 122 is energized until the aperture 144 coincides with an opaque spot 107 at the end of a line of typed material, at which time the light rays reaching photocell 122 are interrupted thereby deenergizing the cell. This deenergization controls a solenoid 145 (Fig. 19), as described in detail later, which controls the novel justifying mechanism, described in detail later, to predetermine the distance that the film casing carrying the film is to be moved during the next succeeding scanning operation, that is, the amount that the next line is to be justified is automatically predetermined.

The amount of justification required to bring all lines of approximately one chosen length, to the same length, is therefore determined by the opaque spot 107 at the end of the line of typed material. It has been found that this amount of justification usually falls within a limit of eight character spaces, with the exception of the last line of a paragraph, which may be of any length. As described later, novel mechanism is provided whereby the justifying means of the present invention can be manually adjusted to justify substantially different chosen lengths of typed lines and any line whose spot 107 falls within the extent of eight character spaces of the right-hand end, of the chosen length of line, will be lengthened an amount determined by the sensing of the opaque spot 107, as described above.

Film carriage

The film carriage, generally designated as 32, comprises the light tight casing 32*c* in which is supported a roll of the film 100, so that the film may be unrolled and fed, by means described presently, past the lens system 89, whose reduced end portion 97*a* extends into the casing 32*c*, as described above. Casing 32*c* is mounted on a base plate 146 which is secured to cross bars 147 and 148 extending transversely of the machine. The underside of bar 148 is provided with a longitudinally extending groove which embraces and rests upon anti-friction balls 149 carried in the groove in the upper edge of a rail 150 secured to base 34. Bar 147 is also mounted on anti-friction balls 149 supported in a groove in the upper edge of a rail 151 supported by base 34. Retaining clips 152 (Fig. 5) secured to the rails 150 and 151 have their upper ends bent over the bars to prevent displacement of the film carriage casing but permit movement of the casing along the rails 150 and 151 by the novel justifying mechanism to be presently described.

When the film 100 is unwound from its roll, it passes around a pair of feed rollers 153 (only one shown, Fig. 5) secured to a shaft 154 supported in the side plate of the casing 32*c*. Tension rollers 155 (Fig. 5) carried on arms 156 mounted on a shaft 157 are urged by springs 158 against the feed rollers 154 to provide sufficient tension for feeding the film. The film passes between a guide plate 159 (Fig. 5) and a cross bar 160 suitably supported in the casing 32*c*, thence upward through a chute 161 and between a roller 162 and a deflector plate 163, where it is coiled as indicated at 164 in a receiving box 165. The roller 162 is mounted on shaft 166 supported in the end pieces of the film receiver 165. The film receiver 165 is detachably held in position on top of the film supply chamber 32*c* by two spring retainers 167 (Fig. 4), one of which is disposed on each end of the chamber 32*c*, which retainers cooperate with pins projecting from the end pieces of the receiver. When in this position, receiver 165 forms a light tight connection with the film chamber 32*c*.

In order to introduce the leading end of the film between the feed rollers 153 (Fig. 5) and the tension rollers 155, the end of the shaft 157 projects beyond the casing 32*c* and has secured thereto arm 168 (Fig. 4). By moving this arm counterclockwise, the operator may rotate the shaft 157 in the same direction, to move the rollers 155 out of contact with the feed roller.

Referring now to Fig. 2, a feed pawl 169, carried on one end of a lever 170 pivotally mounted on the shaft 154, is spring urged by spring 169*s*, into engagement with a ratchet wheel 171 secured to the shaft 154. A link 172 connects the other end of the lever 170 to the free end of an arm 173 secured to the shaft 59 (see also Fig. 3). The bell-crank 138 also secured to the shaft 59 carries the anti-friction roller 139 which is maintained in cooperative relation with the cam 140, fast on the shaft 36, by a spring 141 having one end fast to the bell-crank 138.

As the cam 140 (Fig. 3) rotates in a clockwise direction, as indicated by the arrow, the spring 141 cooperates with the cam to rock the bell-crank 138, shaft 59 and arm 173 also clockwise, thereby lowering the link 172. This rocks the lever 170 counterclockwise (Fig. 2) to advance the ratchet 171, shaft 154 and feed roller 153 (Fig. 5), one step. In this manner the film is advanced one line space. Further rotation of cam 140 reverses the direction of movement of the train just described, retracting the feed pawl 169 one tooth.

A retaining finger 174 (Fig. 4) is spring urged by spring 174*s* into engagement with a serrated disk 175, fast on the opposite end of shaft 154, to align the feed rollers 153 and consequently the film.

A knob 176 (Fig. 1) secured to the shaft 154 adjacent the ratchet 171 (Figs. 1 and 2) permits manual operation of the feed rollers 153. While means for feeding a roll of film, step by step, have been disclosed, it is to be understood that this is merely indicative of any equivalent means

for feeding sensitized material, step by step, one line space at a time.

Novel justifying mechanism is also provided, as will now be described, whereby the film casing **32c** is moved in synchronism with the scanning system **89** and in the opposite direction, so that the length of the photographically reproduced copy is properly automatically justified in accordance with the amount of justification needed, as determined by the sensing mechanism, as described above.

Justifying mechanism

Justification is effected by laterally moving the film upon which the image is being projected. The film is moved in the opposite direction to the movement of the scanning lens and in synchronism with the scanning movement of the lens. The novel justifying means of the present invention comprise not only means for producing justification automatically under control of the sensing mechanism, as described above, but also means whereby the justifying mechanism can be manually preset, in accordance with the length of printed line to be scanned, so that the justification is initiated at such a time as to distribute the justification, only over that portion of the reproduced line which contains printed matter, so that the evenness of the left-hand margin of the column of printed matter is retained, despite the justification of different lengths of copy.

Referring to Fig. 5, it is seen, as described in detail above, that the film casing **32c** is mounted for lateral movement on the rails **150** and **151**. Projecting downwardly from the bottom of the casing are a pair of blocks **32b**, **32b**, (only one shown in Fig. 13). The casing **32c** is spring biased (by means not shown) to continually urge the blocks **32b** against the levers **177** (Fig. 13) these levers **177** being controlled in their movement by the novel justifying mechanism to be presently described, to permit the spring biasing means, controlling the lateral movement of casing **32c**, to move the casing in accordance with the controlled movement of levers **177**. The levers **177** are also rotated clockwise (Fig. 13) to move the blocks **32b**, and therefore casing **32c**, against the force of the biasing means, to reset the film carriage to zero or normal position.

The novel justifying mechanism comprises a plurality of eight cam plates **178a** to **178h**, inclusive (Fig. 16), mounted for rotation in a group about a pivot **179** (Fig. 12) and spring biased for clockwise rotation as a group by spring **180** acting on arm **179a**. Each of the cam plates is provided with an end cam surface **181a** to **181h**, respectively, adapted to engage a slidable roller **182** (Figs. 14 and 16) mounted for sliding movement on rods **183** and **184** under control of a fork **185**. The roller **182** is slidably actuated into alignment with one of the cam surfaces **181a** to **181h**, inclusive, selectively in accordance with the amount of justification required by the particular line sensed. Fork **185** is adjusted in position in accordance with the time of energization of solenoid **145** (Figs. 16 and 19) which time is determined by the position of the opaque spot **107** (Fig. 18) of the line sensed. The positioning of the fork **185** is controlled by mechanism to be described presently.

The oscillation of the plate cams **178a** to **178h**, inclusive, is controlled by a roller **186** (Fig. 12) mounted on an arm **187** connected to the slidable hub member **188**. Hub **188** is slidable axially with respect to shaft **36** to adjust the position of roller **186** beneath a selected one of the cam plates by means of mechanism to be described presently.

Roller **186** is thereby selectively set to engage one out of the group of lower cam surfaces **189a** to **189h**, inclusive, each respectively on cam plates **178a** to **178h**, inclusive. The cam surfaces **189a** to **189h**, inclusive, have different cam contours whereby the movement of roller **186**, as it is oscillated under and in engagement with the selected cam surfaces, cooperates with these cam surfaces to produce, respectively, different amounts of dwell, during which dwell the cam plates **178a** to **178h**, inclusive, are not permitted to oscillate clockwise. This dwell is synchronized with the scanning of that part of the scanned line which has no typed characters therein, so that no justification occurs at this time, justification occurring only when characters are actually scanned whereby the entire justification is distributed, over that portion only, of the reproduced line, which contains typed characters. For example, plate cam **178a** has no effective dwell and its cam surface **189a** is so designed that the roller **186** passes immediately, during its clockwise oscillation, onto the active portion of cam surface **189a**, so that plate cam **178a** begins to oscillate in a clockwise direction, immediately, whereby the amount of justification; selected by the slidable adjustment of roller **182** under control of fork **185**; is distributed throughout the length of the line reproduced on the film. Roller **186**, therefore, is selectively positioned under plate cam **178a**, when the longest desired length of typewritten line is to be scanned.

Plate cam **178h** is provided with the greatest amount of dwell and its lower cam surface **189h** is therefore so designed that during a great portion of the oscillation of roller **186**, which is synchronized with the scanning movement of the scanning lens, no justification is produced. During the latter portion of the scanning movement, however, the roller **186** will engage with the active part of the surface **189h** and will permit clockwise rotation of the plate cams **178a** to **178h** to initiate justification. It is seen, therefore, that roller **186** will be selectively positioned beneath plate cam **178h** when the shortest desired length of typewritten line is to be justified. The other plate cams **178b** to **178g**, inclusive, are selectively chosen by movement of roller **186**, when lengths of line, intermediate between the longest and the shortest desired, are to be scanned.

The roller **186** is rotated by the arm **187** and the hub assembly **188**, in a manner described in detail later. Means, now to be described, are provided for axially sliding the hub **188** so that roller **186** may be adjusted to a position beneath a selected one of the plate cams, in accordance with the length of line to be justified.

A curved lever **190** (Fig. 12) is provided with forked ends **190a** and **190b** (Fig. 17) embracing a shaft **191** and is attached thereto, at an intermediate portion of the lever **190**, to control the axial and rotative movement of this shaft. As lever **190** is pulled outwardly, (Fig. 12) a pin **190b** is disengaged from and clears a cooperating indentation **192**, formed in a flange **34f** of the base **34**. A series of these indentations **192** is provided, one for each of eight uniformly distributed rotative positions of the lever **190**.

As lever **190** is rotated, its calibrated end plate **190p** (Fig. 17) is also rotated and in conjunction with the index mark **190m** presents a visual indication of the length of line to be justified and for which the mechanism is set.

As lever 190 is rotated, the shaft 191 (Fig. 12) is similarly rotated to oscillate the gear sector 192, mounted on, and for rotation with, shaft 191. The sector 192 meshes with the gear sector 193, pivoted at 194, for oscillation upon rotation of shaft 191 and sector 192. Pivot 194 is suitably mounted for rotation, and upon rotation of this pivot, its arm 195 carrying pin 196 is oscillated. Pin 196 engages a grooved cooperating element in the hub 188 whereby the hub is axially shifted so that the roller 186 carried by arm 187 of hub 188 is located beneath a chosen one of the plate cams 178*a* to 178*h*, inclusive, in accordance with the amount of rotation of lever 190, as indicated by the index plate 190*p* and index mark 190*m*. By the proper setting of lever 190, the roller 186 will be positioned to engage with that one of the cam surfaces 189*a* to 189*h*, inclusive, corresponding to the length of line to be scanned.

As lever 190 is pulled outwardly, and prior to rotative adjustment thereof, shaft 191 (Fig. 11) is slidably axially actuated against the restoring force of spring 191*s*. A circumferentially extending groove 191*g* is engaged by a U-shaped member 197, fastened to one end of shaft 198 (Fig. 16) suitably mounted for rotation. As shaft 191 is axially shifted, member 197 is oscillated to in turn oscillate the shaft 198. A lever member 199 (Figs. 11 and 16) is attached to shaft 198 for rotation therewith. Movement of lever 199 is transmitted by a link 200 pivotally connected to lever 201, mounted for oscillation on shaft 86. Lever 201 carries, at its upper extremity, a roller 202, and upon oscillation of lever 201, roller 202 engages the cam surface 203*a* of a cam plate 203 connected to the cam plates 178*a* to 178*h*, inclusive, which are all joined together for simultaneous oscillation about pivot 179, by means of spacers 204 and rivet 205. When lever 190 is pulled outwardly, as stated above, roller 202 is oscillated clockwise over the cam surface 203*a*, to thereby lift the cam plate 203 and the attached cam plate assembly 178*a* to 178*h*, inclusive, until the plate assembly is entirely free of its controlling roller 186, so that the roller 186 may be manually adjusted in position beneath the desired plate cam, as described above. After lever 190 is pulled outwardly and also rotated to selectively position roller 186, it is released, and under the restoring force of spring 191*s*, pin 190*b* is held in a cooperating indentation 192, corresponding to the index setting of the lever 190, until lever 190 is again pulled outwardly to rotatably adjust its position in accordance with another desired length of line to be justified.

Means are provided for oscillating the roller 186, in step with the scanning of the copy to be justified, and comprise a link 204 (Fig. 15) pivotally connected to the scanning arm 85 which is oscillated under control of cam 83, as described above. Link 204 is also pivotally connected to lever 205 (Fig. 16) which is integrally connected to lever 207 by a sleeve member 206 mounted for rotation on shaft 208. Lever 207 is pivotally connected to a lever 208 (Figs. 15 and 16) which, in turn, is pivotally connected to a lever 209, integral with a sleeve member 210 mounted for rotation on shaft 36. Sleeve member 210 is mounted concentrically within the hub member 188 and is connected to this hub member, to rotate the same, by means of a key 211. The hub 188, therefore, is rotatable under control of the sleeve 210 but is freely and slidably positionable, axially of shaft 36, by slidable movement upon sleeve 210.

After roller 186 has been selectively positioned beneath the chosen plate cam and lever 190 has been released so that the chosen one, of the plate cam surfaces 189*a* to 189*h*, inclusive, is in engagement with roller 186, oscillation of lever 85 to produce scanning movement of the scanning lens is also transmitted via linkage 204 and elements 205, 206, 207, 208 and 209 to the sleeve member 210 and via the key 211 to the hub 188 whereby roller arm 187 and roller 186 are oscillated, beneath the chosen plate cam and in engagement with the proper cam surface, in synchronism with the scanning movement. As roller 186 oscillates beneath the chosen plate cam, the plate cam assembly is first permitted to dwell, for a period dependent upon the length of dwell surface of the selected plate cam, and is then permitted to oscillate clockwise to initiate justification by moving the selected one of the cam surfaces 181*a* to 181*h*, inclusive, over the roller 182 (Figs. 14 and 16) which roller is adjustably positioned in accordance with the degree of justification required, so that the levers 177 (Fig. 13) which carry roller 182 and whose movement is controlled by roller 182 and the chosen cam surface, are oscillated in accordance with the positions of roller 182, as determined by the selected one of the engaging cam surfaces 181*a* to 181*h*, inclusive.

Means are provided, which will now be described, to oscillate the levers 177, whereby the blocks 32*b* and the casing 32*c* are reset, at the proper time in the cycle, and to release the levers 177 for movement under control of the roller 182 and the selected cam surface upon initiation of scanning movement. A cam 212 (Fig. 13) is mounted on shaft 36 for rotation therewith and cooperates with the roller 213 connected to arm 214 attached to shaft 215. The pair of arms 177 are connected to shaft 215 so that the position of arms 177 at one portion of a cycle is determined by the coaction of roller 213 and the cam surface of cam 212. In the position, as illustrated in Fig. 13, the roller 213 is held, free of the cam surface of cam 212, since roller 182 is riding on the extreme lower end of one of the plate cams. When the plate cams are lowered, roller 213 will engage the surface of the cam 212 which at the proper time in the cycle of operation oscillates levers 177 clockwise to restore the film carriage to its zero or normal position against the force of its biasing means. During scanning of the copy, however, the low portion of the cam 212 is presented to roller 213, so that the engagement of roller 182 and the selected one of the controlling cam surfaces 181*a* to 181*h*, inclusive, determines the movement of the arms 177 and therefore the degree of movement of the casing 32*c*, during the scanning of the copy. Casing 32*c* and the film 100 are therefore moved, in the opposite direction to the scanning movement, and to a degree dependent upon the particular one of the cam surfaces 181*a* to 181*h*, inclusive, with which roller 182 is engaged. The selection of the particular cam surface is controlled by the sensing mechanism and that portion of the novel justifying mechanism, now to be described.

Fork 185 (Fig. 14) is attached to a slidable member 216 (see also Fig. 16) mounted for sliding movement in grooves 217 by projections 216*a* integral with member 216. Member 216 is provided with a plurality of teeth 216*t*, (Fig. 16) each of which is engageable by the hooked end 218*a* of arm 218 pivoted at 219. Armature 145*a* of solenoid 145 is pivotally connected to arm 218 to thereby oscillate the arm 218 about the pivot 219

against the resistance of a spring 218s, when solenoid 145 is energized. Upon sensing of an opaque spot 107 (Fig. 18) the solenoid 145 is energized, as described later, armature 145a is attracted to pull the hooked end 118a of arm 118 into engagement with the particular tooth 216t of slidable member 216 which is aligned with the hooked end 218a. Means are provided, as described presently, to move the slidable member 216 in synchronism with the sensing mechanism. While the sensing slide 125—129 (Figs. 6 and 9) is being moved from left to right (Fig. 6), the slidable member 216 (Fig. 16) is moved downwardly, in synchronism with the movement of sensing slide 125—129. The position of member 216 is therefore continuously coordinated with that of the sensing slide 125—129 so that the position of member 216, when an opaque spot 107 (Fig. 18) is sensed, is a measure of the amount of justification required as indicated by the position of spot 107, which position is automatically ascertained by the sensing mechanism, as previously described.

The means employed to actuate member 216 in synchronism with the slide 125—129 comprise a link 220 (Fig. 16) pivotally connected to member 216 and to a link 221, which, in turn, is connected by the universal connecting member 222 to a link 223. Link 220 is provided with an abutting section 220a (Fig. 16), which abuts an eccentric cam member 221a mounted on link 221, upon clockwise rotation of link 221. The eccentric member can be rotatably adjusted to determine the exact time at which link 220 is positively driven by link 221. A spring 224 interconnects the links 220 and 221 and continuously urges the cam member 221a towards the abutting section 220a. When slidable member 216 is held, by engagement between a tooth 216t and the hooked end 218a of arm 218, the spring 224 holds the tooth 216t against the hooked end 218a while the links 220 and 221 are further separated against the force of spring 224 (as shown in Fig. 16) during continued operation of the driving mechanism. Link 223 is connected by a second universal connecting member 222 to one end 225a of a bell-crank member 225. Bell-crank 225 is pivoted for rotation about shaft 86 (Fig. 14) and is provided with a driven roller 225r held in engagement with cam 226 by spring 227 connected at one end to a lug 225b of bell-crank 225 and at the other end to pin 227p connected to frame 34. Cam 226 is fastened to shaft 36, so that this cam 226 which controls the driving mechanism for slidable member 216, is driven by the shaft that rotates shaft 59 (Fig. 3) which shaft 59 through arm 137 (Fig. 6), link 136 and arm 133, controls the reciprocation of the sensing slide 125—129. Rotation of cam 226 oscillates bell-crank member 225 clockwise about shaft 86, while spring 227 pulls the member 225 counterclockwise when roller 225r engages the depressed portion of cam 226. Counterclockwise rotation of member 225 pulls the link 223 (Fig. 14) to the left to actuate link 221 (Fig. 16) so that cam member 221a engages the abutment 220a of link 220 to shift the member 216 upwardly, as viewed in Fig. 16, to return the slide to its normal position. As the sensing slide 125—129 moves from left to right (Fig. 6) to automatically determine the position of the opaque spot 107 (Fig. 18), roller 225r (Fig. 14) is engaged by the rising portion of cam 226 to oscillate member 225 clockwise to shift the lever 223 (Fig. 14) to the right, to actuate link 221. As link 221 is urged counterclockwise (Fig. 16), spring 224 similarly rotates link 220 to pull the slide 216 downwardly, in synchronism with the movement of sensing slide 125—129. The teeth 216t of member 216 move, one by one, past the hooked end 218a, until a spot 107 (Fig. 18) is sensed, whereupon solenoid 145 is energized, as described presently, to attract its armature 145a to oscillate arm 218 clockwise (Fig. 16) to thereby engage the hook 218a with the chosen tooth 216t, to hold the slide member in position. Spring connection 224 permits continued operation of the driving mechanism, while the slide 216 is held in the chosen position. As the slide 216 was moved, roller 182 carried thereby was similarly moved by fork 185, so that the roller 182 was positioned in accordance with the amount of justification required. The fork 185 engages an arm 227a (Fig. 14) of a member 227, which arm is provided with a slot riding on the rod 184. Member 227 is also mounted for movement axially of rod 183. Arm 227b of member 227 carries the roller 182 which is thereby selectively positioned in line with the proper one of the cam surfaces 181a to 181h, inclusive, (Fig. 16) in accordance with the degree of justification required. As the cam plates oscillate downwardly, the levers 177 (Figs. 13 and 14) are moved in accordance with the selected cam contour, as previously described, and the blocks 32b attached to spring biased film casing 32c (Figs. 5 and 13) are shifted transversely and in the opposite direction to scanning, whereby the casing is similarly shifted and the reproduced photographic copy of the line of characters scanned is elongated to the extent required to produce the desired amount of justification.

Wiring diagram

Referring to Fig. 19, the wiring diagram of the operating mechanism of the device is illustrated therein. Power is supplied by the mains 228 and 229. Lines 230 and 231 controlled by a switch 232 supply energy to the motor 40 and to lamp 119 for sensing the spots 107 (Fig. 18). A pair of cam operated contacts CT2 are connected in series with lamp 119 to control the energization thereof after power is supplied. Contacts CT2 are timed to close, during the sensing period only, and are opened at the end of the sensing stroke of slide 125—129 thereby rendering photocell 122 inoperative during the return stroke of sensing slide 125—129.

A transformer primary 233 is connected by switch 234 to bus bars 228 and 229. One secondary coil 235 supplies energy to the scanning lamps 98 (only one shown in Fig. 19). Another secondary coil 236 supplies energy to the filament of a full wave rectifier 237 whose plate current is supplied by another secondary winding 238. An amplifier comprising tubes 239a and 139b is controlled by the photocell 122, in turn controlled by sensing lamp 119 and the opaque spots 107 of the sensed copy. The amplifier in turn controls the energization of relay coil 240. When the sensing aperture 144 (Fig. 6) senses an opaque spot 107 (Fig. 18), current through photocell 122 decreases, to produce plate current flow in the amplifier and energization of coil 240. Energization of the relay coil 240 attracts its armature 240a to close a circuit, from the center tap of the secondary 236, line 241, contacts 240c of relay 240, line 242, cam contacts CT4, which are closed at this time by a suitable timed cam drive, solenoid 145, line 243 to the center tap of secondary 238. Solenoid 145 is thereby energized to

attract its armature 145a (Fig. 16) to lock the slide member 216 in position to thereby locate roller 182 in alignment with the proper justifying cam surface, as previously described.

Since the relay 240 is energized, momentarily only, closure of contacts 240c is also employed to energize a relay 244 provided with contacts 244c, which are closed upon energization of relay 244, to establish a holding circuit for relay 145 to hold it energized for the duration of the scanning operation, in order to hold the hooked end 218a of arm 218 (Fig. 16) in engagement with a tooth of member 216, thereby maintaining roller 182 in engagement with its selected cam surface, throughout the justifying portion of a complete cycle. Shortly after scanning and justifying are completed, the cam contacts CT4 open, deenergizing the solenoid 145, whereupon spring 218s (Fig. 16) disengages the hooked end 218a of arm 218 from the engaged tooth 216t of member 216, and member 216 is released to be controlled by its actuating mechanism whereby it is restored to its initial position, as described above, preparatory to initiation of another justifying operation.

If the line scanned is of the same length as that to which the line is to be justified, the point in the cycle of operations at which slot 144 coincides with this particular spot 107; as, for example, in the second line of Fig. 18; is such that cam contacts CT4 have not yet been closed, so that energization of relay 240 produces no energization of relay 145. The teeth of the slide member 216, therefore, are not engaged by the hooked end 218a of member 218 and roller 182 drops (Fig. 16) until it is aligned with the stop bracket 182s, which is the limit of movement of the roller 182. In this position, oscillation of the roller 182 about the shaft 215 (Fig. 14) is prevented, so that the levers 177, blocks 32b and the film casing 32c, are maintained in the normal position throughout the entire scanning cycle. Likewise, if the amount of justification required is more than eight units, the roller 182 is similarly moved into alignment with stop 182s, and no justification ensues.

Operation

At the end of a cycle, the scanning carriage body 31b (Fig. 8) is in its extreme left-hand position, having just completed scanning of a line of copy and being about to return to its original position. The film casing 32c has been moved the full justifying amount permitted by the roller 182 and the particular chosen cooperating cam surface, and cam 212 (Fig. 13) acting through roller 213 and arm 214, is about to rotate the levers 177 clockwise, to restore the casing 32c to its normal non-justifying position. The slide member 216 has been returned to its upper (Fig. 6) or normal position and roller 182 is in line with the cam surface 181a. During the first part of the cycle; the scanning carriage body 32b is restored towards the right (Fig. 8); the film feed mechanism advances the film one line space to bring an unexposed portion in line with the scanning lens system; and during this portion of the cycle, the sensing slide 125—129 (Fig. 6) moves to the right to sense the line of copy, beginning beyond its end and moving towards an opaque spot 107 (Fig. 18). As the slide 125—129 is moved to the right (Fig. 6), slidable member 216 is maintained for one unit justification amount, in the position as shown in Fig. 16, and if the line sensed requires one unit of justification, lever 218 will be actuated, as in Fig. 16. When more than one unit amount of justification is required, member 216 is pulled downwardly, in synchronism with slide 125—129 until an opaque spot 107 is sensed whereupon photocell 122 (Figs. 5 and 19) is rendered operative to produce a plate current flow in amplifier 239a, 239b, to energize the relay coil 240. If the sensing slot 144 has passed that position corresponding to the end of a length of line in which no justification is required (under which condition, member 216 drops into alignment with stop 182s, since solenoid 145 is not energized, all as described above), cam contacts CT4 are now closed and solenoid 145 is energized to attract its armature 145a to engage the hooked end 218a and a tooth 216t to stop the slide member 216, so that roller 182 is aligned with the proper cam surface for the amount of justification required. As soon as sensing is completed, the document feed rollers are actuated to advance the copy 46, one line space, to bring the line, just sensed, into scanning position or in alignment with opening 114 in plate 108. Contacts CT2 open at the end of the sensing stroke to deenergize lamp 119 (Figs. 6 and 19).

At the completion of its restoring movement, the scanning carriage begins its scanning stroke and simultaneously the film casing 32c is moved synchronously therewith, under control of the arms 177, whose oscillation is controlled by roller 182 cooperating with the particular selected cam surface. The scanning stroke is fixed, so that in scanning short lines, the scanning lens will be aligned merely with the blank part of a line, during a portion of the scanning stroke. The length of the justifying stroke of the film carriage, however, may vary from one to eight points, depending upon the variation of the length of the line scanned from the true full length, which scanned line was previously sensed to determine its required justification, as described above. It is to be particularly noted, that this justification is not coextensive with the scanning movement but that due to the manual adjustment of lever 190 to the chosen index point position, as indicated by index plate 190p and index mark 190m, roller 186 cooperates with the proper one of the cam surfaces 189a to 189h, so that no justification ensues until the printed matter of a line, is actually being scanned, and the justification is therefore distributed only, throughout the length of the scanning of actual printed matter in any line. This justification is produced by movement of the film casing 32c simultaneously with, and in the opposite direction to, scanning of the actual printing only. In this manner the image of the scanned line, projected upon the film, is reproduced, lengthened the amount required for justification, and further, the left-hand margin of a reproduced copy is maintained in alignment. By adjusting the device to the length of line as measured by an indentation of a paragraph, in a series of short narrow columns of typed matter, no justification is produced until the scanning lens reaches the paragraph indentation, so that the left-hand margin is maintained in alignment and the paragraph indentations are also so maintained.

Novel justifying mechanism is therefore provided whereby substantially different lengths of lines of copy may be justified efficiently, and wherein the left-hand margin of all justified copies are maintained in alignment.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated, and in its operation, may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to scan said copy and project the image of the line thereof upon said material, means to produce a relative movement between said support means and said copy and comprising a plurality of cam surfaces, and means to select any one cam surface in accordance with the amount of justification required.

2. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to scan said copy and project the image of the lines thereof upon said material, means to produce a relative movement between said support means and said copy and comprising a plurality of cam surfaces, means to select any one of said cam surfaces in accordance with the degree of justification required, a second plurality of cam surfaces, and means to render effective a selected one only of said second plurality, in accordance with the average length of line to be scanned.

3. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to scan said copy and project the image of the lines thereof upon said material, and means to produce a relative movement between said support means and said copy comprising double acting cam means for determining the amount of and distribution of said relative movement.

4. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to produce a relative movement between said copy and support means including a plurality of cam plates, cam surfaces on one portion of each of said plates, means cooperating with said portions to control said relative movement, cam surfaces on another portion of each of said plates, and settable means, settable to cooperate with a chosen one of said last-named surfaces to control the effect of said first-named surfaces.

5. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to produce relative movement between said copy and support means and including a plurality of cam plates, cam surfaces carried by each of said plates respectively, and settable means, settable in accordance with the degree of justification required to cooperate with a chosen one of said cam surfaces to regulate said relative movement.

6. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to produce relative movement between said copy and support means and including means for determining the distribution of said movement comprising a plurality of cam elements, and means for manually positioning a cooperative element in engagement with a chosen one of said cam elements, in accordance with the length of line to be justified.

7. In a device of the character described, a plurality of cam plates, means mounting said plates for oscillation about a common pivot, means mounted adjacent said plates and movable into cooperative position adjacent a chosen one of said cam plates, and means for oscillating said cam plates to permit movement of said mounted means.

8. In a device of the character described, a plurality of cam plates, means mounting said plates for oscillation about a common pivot, means mounted adjacent said plates and movable into cooperative position adjacent a chosen one of said cam plates, and means for oscillating said cam plates to permit movement of said mounted means, said oscillating means including an axially movable member.

9. In a device for producing justified replicas of non-justified lines of copy, a plurality of cam plates, means mounting said cam plates for oscillation about a common pivot, means mounted adjacent said plates and movable transversely thereof into cooperative position adjacent a chosen one of said plates, said means including a sleeve member mounted for axial movement, an arm mounted on said sleeve member, a roller carried by said arm adjacent said cam plates, and means for axially shifting said sleeve member in proportion to the length of line to be justified.

10. In a device for producing justified replicas of non-justified lines of copy, a plurality of cam plates, means mounting said cam plates for oscillation about a common pivot, means mounted adjacent said plates and movable transversely thereof into cooperative position adjacent a chosen one of said plates, said means including a sleeve member mounted for axial movement, an arm mounted on said sleeve member, a roller carried by said arm adjacent said cam plates, and means for axially shifting said sleeve member in proportion to the length of line to be justified, said means including a rotatably adjustable member for axially shifting said sleeve member in proportion to the length of line to be justified.

11. In a device for producing justified replicas of non-justified lines of copy, a plurality of cam plates, means mounting said plates for oscillation about a common pivot, a plurality of cam surfaces on each of said plates, means manually positioning a cooperative element in engagement with an adjacent one of said cam elements in accordance with the length of line to be justified, means mounted adjacent said plates and movable into cooperative position adjacent a chosen one of said cam surfaces, and means for oscillating said cam plates to permit movement of said mounted means.

12. In a device for producing justified replicas of non-justified lines of copy, a plurality of cam plates, means mounting said plates for oscillation about a common pivot, means mounted adjacent said plates and movable into cooperative position adjacent a chosen one of said cam plates and including a rotatable member, adjustable in proportion to the length of line to be justified, and means including an axially movable member for oscillating said cam plates to permit movement of said mounted means.

13. In a device of the character described, means to support a copy having non-justified lines thereon, means to support a light sensitive material, scanning means for incrementally

scanning the respective individual lines and projecting images of said lines upon said material to thereby affect said material accordingly, justifying means to produce relative shifting of said respective supporting means, and adjustable means controlling the operation of said justifying means to limit their operation to a chosen portion of a scanning operation.

14. In a device of the character described, the combination of a copy bearing a non-justified line of characters, means to support a light sensitive material, means including an image forming optical system to automatically project, progressively, images of said characters in the line onto said sensitive material, and adjustable means to produce a relative movement, between said copy and material to modify the length of the line of character images received by said material, only during actual scanning of characters in a non-justified line.

15. In a device of the character described, means to support a copy having non-justified lines of printed characters, means to support a light sensitive material, scanning means for continuously scanning the separate individual lines and projecting images of the characters in said lines upon said material and thereby affecting said material accordingly, means automatically determining the degree of justification required, and adjustable means, preset in accordance with a desired length of line to be justified and controlled by said automatic means, to produce a relative shifting of said respective support means only when an image of a character is actually being projected.

16. In a device of the character described, means to support a copy having non-justified lines thereon, means to support a light sensitive material, scanning means for continuously scanning the respective individual lines and projecting images thereof upon said material and affecting said light sensitive material accordingly, justifying means for producing a uniform relative shifting of said respective support means, and adjustable means to limit said shifting to a portion only of the reproduction of said lines scanned.

17. In a device of the character described, means to support a copy having non-justified lines of chosen average length, means to support a light sensitive material, scanning means for progressively scanning the individual lines of the copy and projecting images of said lines upon said material, and means to cause relative shifting between said respective supporting means in a direction longitudinally of said lines, said shifting means being settable to determine the time of initiation of said relative shifting.

18. In a device of the character described, means to support a copy having non-justified lines of chosen average length, means to support a light sensitive material, scanning means for progressively scanning the individual lines of the copy and projecting images of said lines upon said material, and means to cause relative shifting between said respective supporting means in a direction longitudinally of said lines, said shifting means being settable to determine the amount and time of initiation of said relative shifting.

19. In a device of the character described, means to support a copy having non-justified lines thereon, means designating a point on each of said lines, means to support a light sensitive material, scanning means for progressively scanning said copy and designating means, said scanning means projecting images of said lines upon said material and thereby affecting said light sensitive material in accordance with the character of said copy scanned, means controlled by said scanning means for moving said sensitive material in accordance with the location of said respective designation points, said controlled means being adjustable to predetermine the time of initiation of said movement.

20. In a device of the character described, means to support a copy having non-justified lines of characters, means to support a light sensitive material, scanning means for continuously scanning each line respectively of said copy and projecting images of the characters upon said material, and means effective during scanning of each line to produce a relative readjustment between the spacing of at least two components of each line of copy and the spacing of at least two components of the replica of said lines to thereby produce justification of said copy, said last-named means being adjustable to predetermine the time of initiation of said respective readjustment.

21. In a device of the character described, means to support a copy having a plurality of non-justified lines thereon, means to support a light sensitive material, scanning means for scanning said lines individually and projecting images of said lines upon said material to affect said sensitive material accordingly and presensing the next succeeding line to determine the amount of justification required for said next line, and adjustable means controlled by said scanning means, for producing a relative shifting of said support means, during a predetermined portion only of the scanning of the next line, and in accordance with said predetermined amount.

22. In a device of the character described, means to support a copy having non-justified lines thereon, means to support a light sensitive material, means to support scanning means, means for producing movement of said last support means for incrementally scanning the respective individual lines and projecting images of said lines upon said material to thereby affect said light sensitive means accordingly, and justifying means to produce an effective change in the relative movement of said last support means and one of said other support means, said justifying means being adjustable to limit the duration of said effective change to a portion only of the period of movement of said last support means.

23. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, an image forming optical system, means to automatically impart scanning strokes of invariable extent to the optical system to cause said optical system to project images of successive lines of copy onto the sensitive material, and means automatically controllable according to the length of the scanned line of copy to automatically produce relative movement between said copy and material of variable extents in accordance with the amount of justification required, said last-named means being adjustable to limit said movement to a portion only of said stroke of invariable extent.

24. In a device of the character described, a copy having non-justified lines of characters thereon, means to support a light sensitive material, an image forming optical system, means to move the optical system transversely of a copy to

scan a line of copy and to cause said optical system to project an image of the scanned line onto the light sensitive material, and means adjustable to move the light sensitive material during a portion only of the movement of the optical system to produce a change in the length of that portion of the image only which contains images of the characters in a line.

25. In a device of the character described, a copy having non-justified lines thereon, means to support a light sensitive material, an optical system to scan the copy, line by line, and to project images of the scanned line onto the light sensitive material, operative means to move the optical system an invariable extent to scan a line of copy, means automatically determining the amount of justification required, and adjustable means controlled by said automatic means to alter the length of the image received by the light sensitive material during a portion only of said movement of invariable extent.

26. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, an image forming optical system, means to move the optical system an invariable extent to scan a line of copy and to project an image of said line onto the light sensitive material, means to produce relative movement between said material and copy, means automatically determining the amount of justification required, and means actuated by said automatic means and adjustable to produce said relative movement, during a portion only, of said invariable movement.

27. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, an image forming optical system, means cooperating with said system to produce scanning of a line to project an image of said line onto the light sensitive material, operating means to produce a relative movement between said support means and said copy and including adjustable means, means for automatically determining the amount of justification required by said copy and controlling said adjustable means, and additional adjustable means for determining the distribution of the justification within a single scanning operation.

28. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, an image forming optical system movable over a predetermined path to scan a line of copy and to project the image of said line upon said material, means for relatively moving said material and copy, and adjustable means for distributing said relative movement during movement of said system over chosen portions only of said predetermined path.

29. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means for scanning said copy and projecting the image of lines thereof upon said material, differentially settable means for producing relative movement of said copy and support means to an extent, proportional to the amount of justification required, and adjustable means for controlling the distribution of said relative movement while maintaining the selected proportional extent thereof constant.

30. In a device of the character described, a copy bearing non-justified lines, means to support a light sensitive material, means to project the images of said lines upon said material, means determining the deviation of any line from a norm to measure the amount of justification required, means controlled by said determining means to alter the length of the image of any line in proportion to the justification required, and means, adjustable in advance, to distribute said alteration over a chosen portion only of the length of any such line.

31. In a device of the character described, a copy bearing non-justified lines, means determining the amount of justification required by any line, means supporting a light sensitive material, means for scanning said copy and projecting the images thereof upon said material, means controlled by said determining means and altering the distribution of said images upon said material, and adjustable means for limiting said alteration to a chosen portion only of the projected image of a scanned line.

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