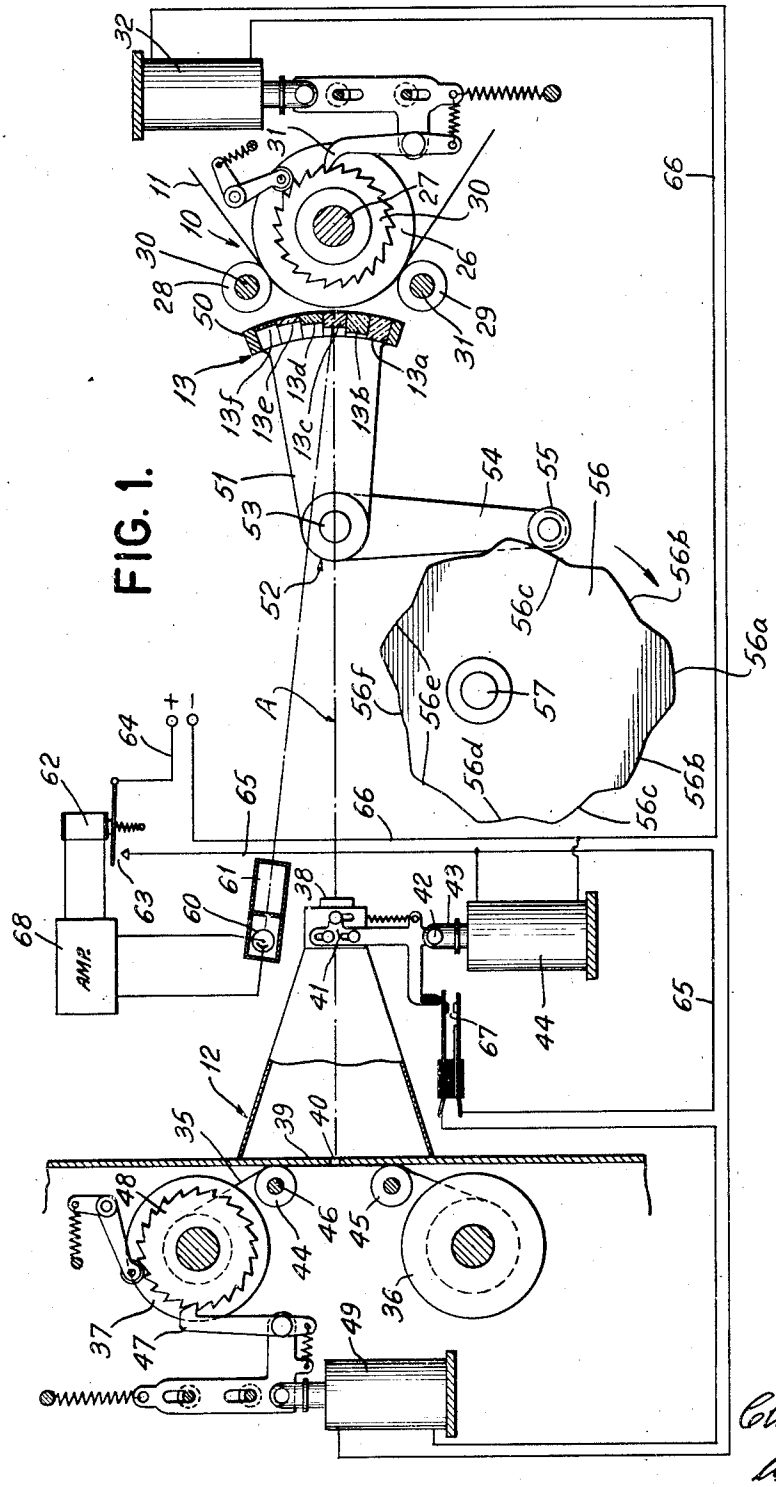
June 3, 1947. C. C. SMITH 2,421,656

PHOTOGRAPHIC JUSTIFYING APPARATUS

Filed Oct. 27, 1944 4 Sheets-Sheet 1

FIG. 1.



INVENTOR
Clarence C. Smith
ATTORNEY

June 3, 1947. C. C. SMITH 2,421,656

PHOTOGRAPHIC JUSTIFYING APPARATUS

Filed Oct. 27, 1944 4 Sheets-Sheet 2

FIG. 2a.

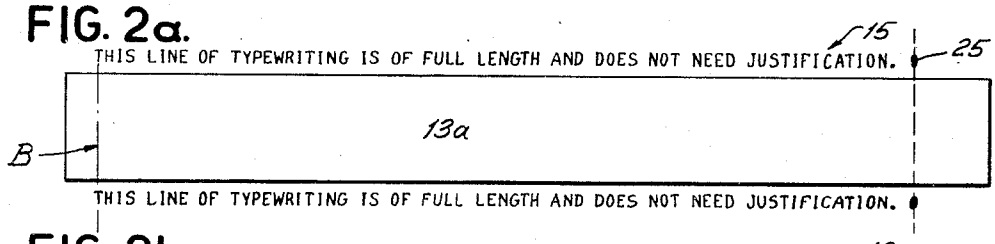


FIG. 2b.

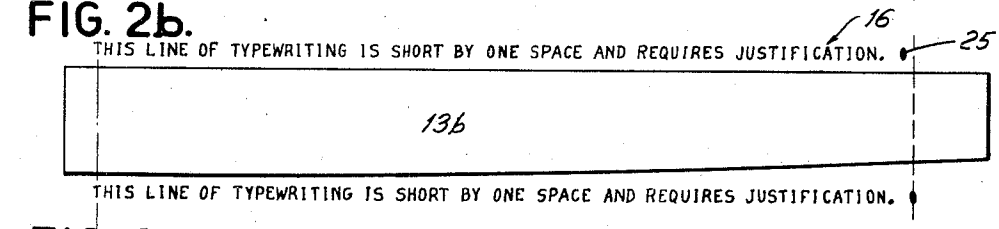


FIG. 2c.

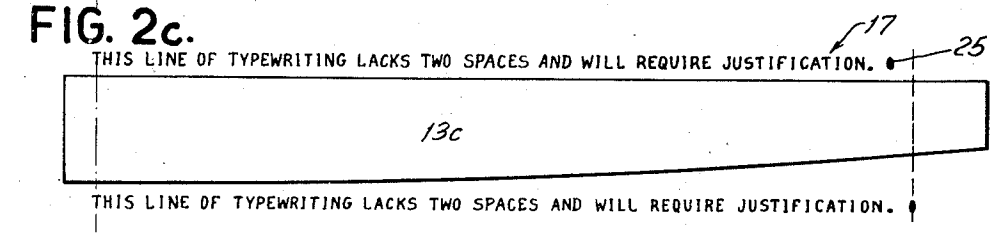


FIG. 2d.

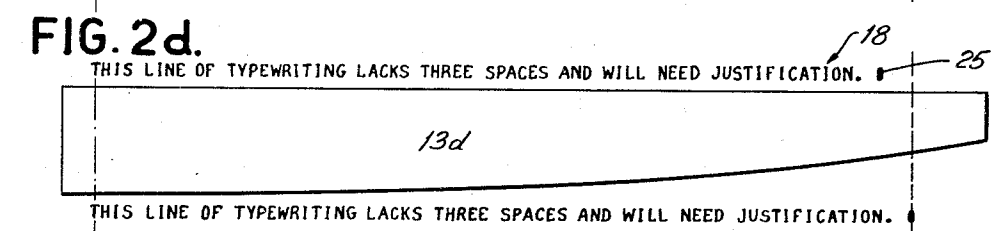


FIG. 2e.

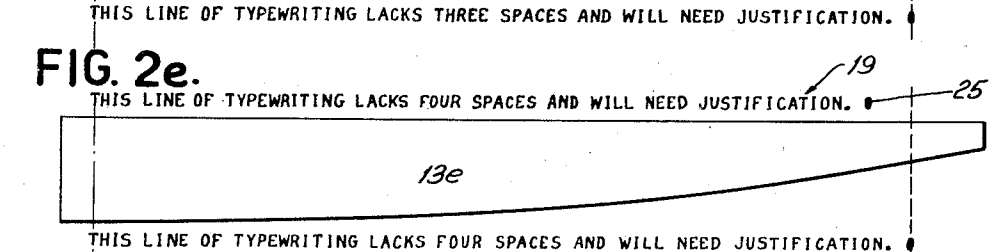
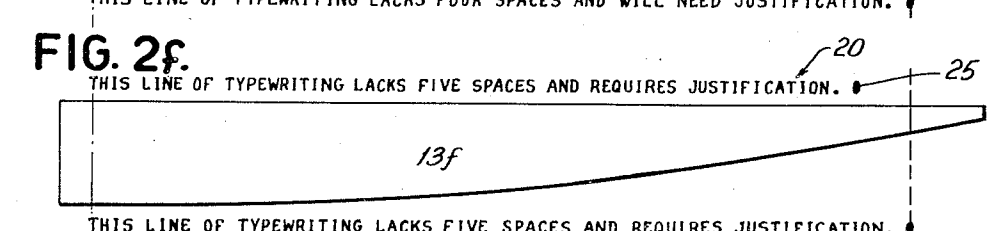


FIG. 2f.



INVENTOR

Clarence C. Smith

BY

W. M. Wilson

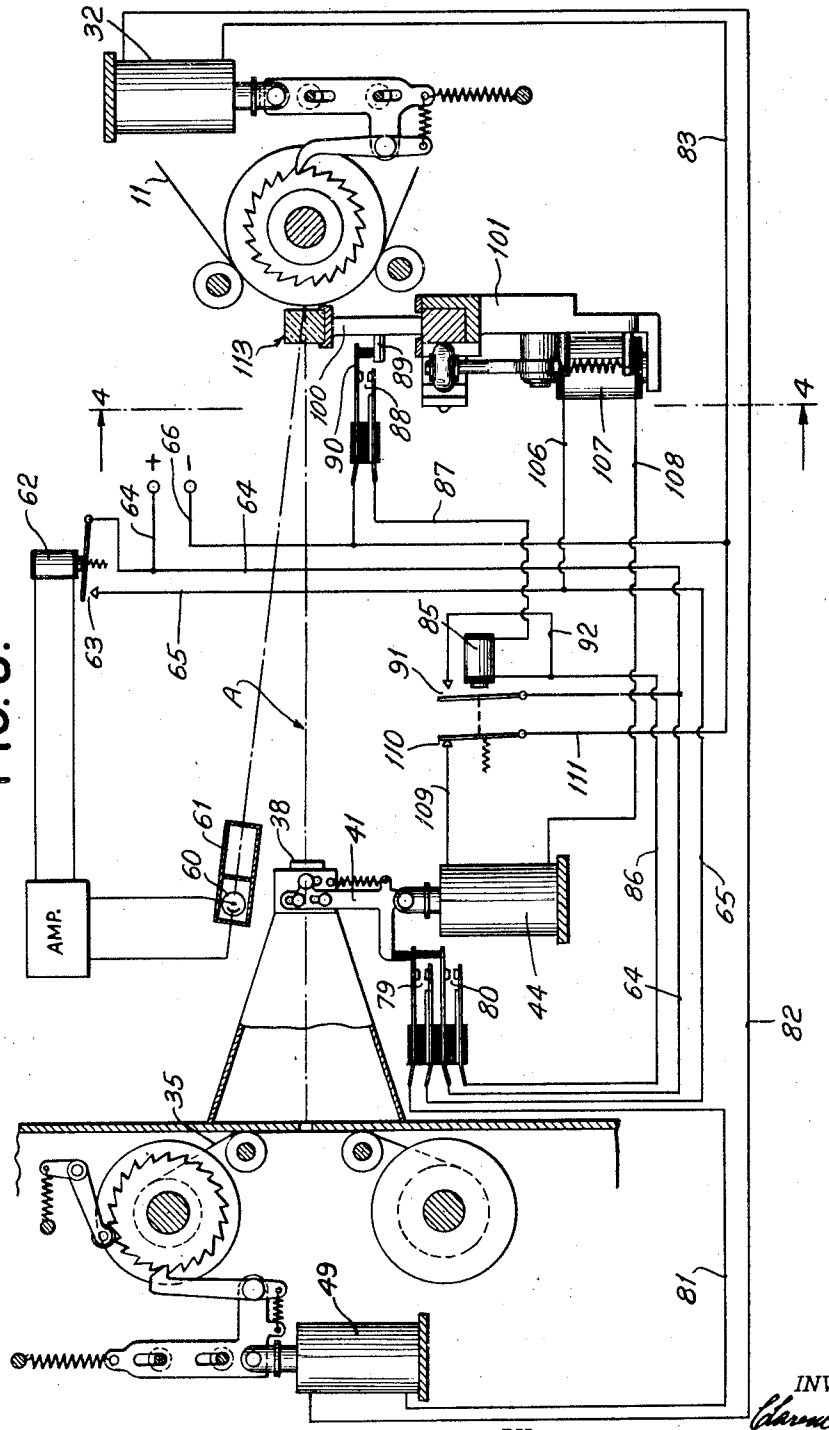
ATTORNEY

June 3, 1947. C. C. SMITH 2,421,656

PHOTOGRAPHIC JUSTIFYING APPARATUS

Filed Oct. 27, 1944 4 Sheets-Sheet 3

FIG. 3.



INVENTOR
Clarence C. Smith
BY
W. M. Wilson
ATTORNEY

June 3, 1947. C. C. SMITH 2,421,656

PHOTOGRAPHIC JUSTIFYING APPARATUS

Filed Oct. 27, 1944 4 Sheets-Sheet 4

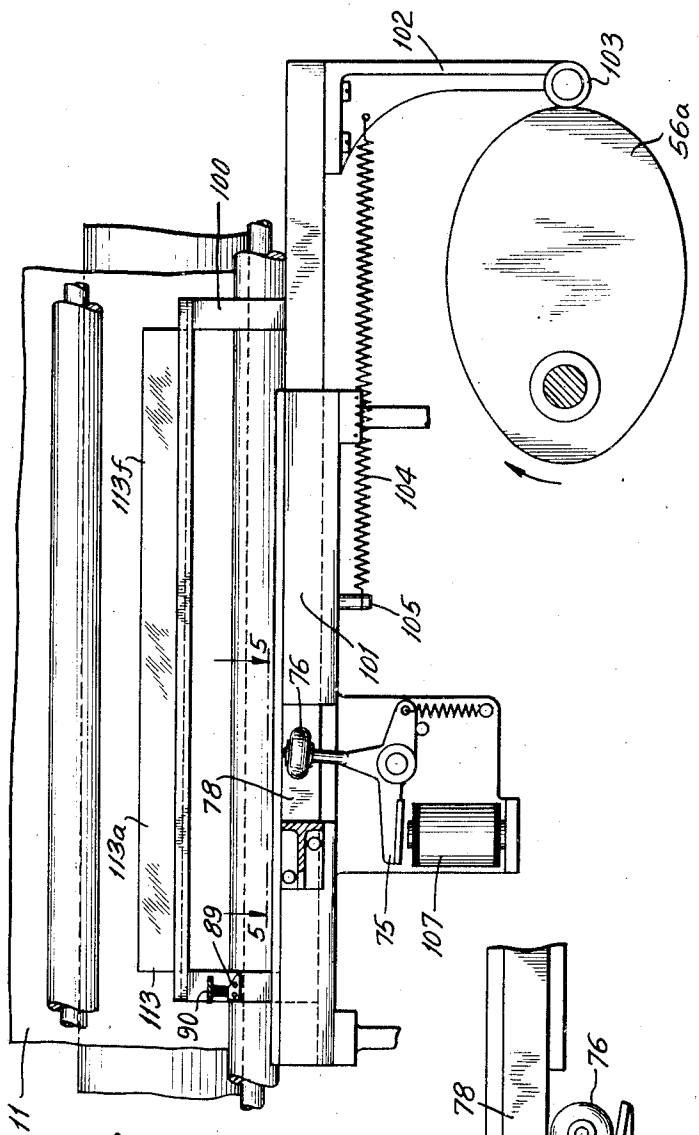


FIG. 4.

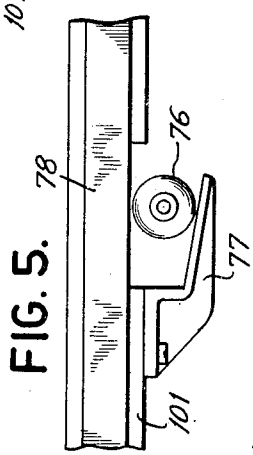


FIG. 5.

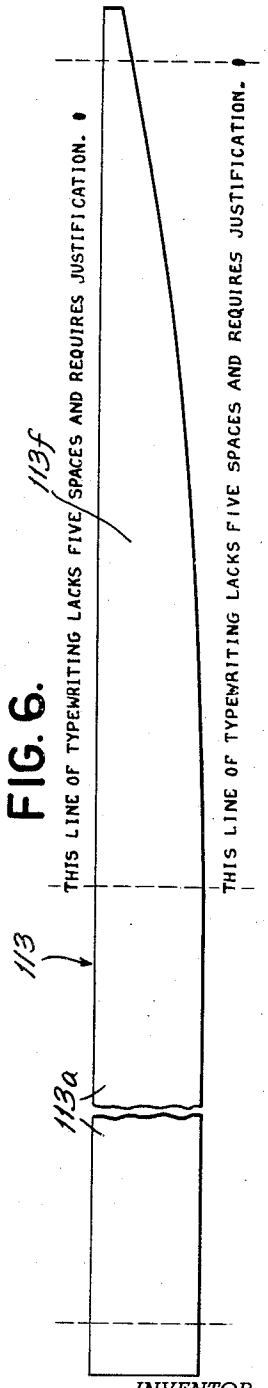


FIG. 6.

INVENTOR
Clarence C. Smith
BY
W. M. Mitchell
ATTORNEY

Patented June 3, 1947 2,421,656

UNITED STATES PATENT OFFICE

2,421,656

PHOTOGRAPHIC JUSTIFYING APPARATUS

Clarence C. Smith, Flushing, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application October 27, 1944, Serial No. 560,547

11 Claims. (Cl. 95—4.5)

1

This invention relates to photographic justifying apparatus of the type wherein lines of typewriting on a copy sheet are successively photographed, line-by-line and at a predetermined justified length, on a suitable light-sensitive medium, such as a film or plate. As is well known, a film or plate exposed in such a manner and bearing the lines of photographed data at the justified length, may be used advantageously in offset printing.

An object of this invention is to provide apparatus of the type referred to, which is relatively simple in its construction and which is highly effective in its operation.

A further object is to provide apparatus of the above type which is composed of relatively few parts and which is durable and dependable in operation and one which is very unlikely to get out of order.

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 diagrammatic view illustrating the several elements of a photographic justifying apparatus constituting one preferred embodiment of the present invention;

Fig. 2*a* is a plan view showing one transparent element of a lens means forming a part of the apparatus shown in Fig. 1 and illustrating that a line of typewriting of a predetermined justified length is not varied in length when viewed through such element;

Figs. 2*b* to 2*f* inclusive are plan views showing respectively, five different cylindrical lenses which are also transparent elements of the lens means forming a part of the apparatus shown in Fig. 1, and which are formed with different degrees of curvature so that a line of typewriting when viewed through the different lenses is elongated different amounts;

Fig. 3 is a diagrammatic view illustrating a modified form of photographic justifying apparatus;

Fig. 4 is a fragmentary elevation illustrating somewhat diagrammatically a part of the apparatus shown in Fig. 3, the plane of the view being indicated by the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary plan, the plane of the view being indicated by the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary plan view of the lens means used to elongate the lines of typewriting in the apparatus shown in Fig. 3.

Referring now in detail to the construction illustrated and first to the embodiment shown in Fig. 1 and Figs. 2*a* to 2*f* inclusive, the photographic justifying apparatus disclosed therein

2

comprises generally a device 10 which is operable to hold a copy sheet 11 bearing lines of typewriting thereon and also to successively move such lines into a photographing position; a camera 12 operable to photograph successively the lines of typewriting on the copy sheet as they occupy the photographing position; and a lens means 13 which is interposed between the camera 12 and the copy and is movable along a path extending transversely of the optical axis indicated by the dot-and-dash line A, and which is so constructed that as it is so moved the line of typewriting occupying the photographing position, as viewed by the camera through such lens means, varies progressively in length. Means is also provided for selectively positioning the lens means 13 along its path of movement, so that each line occupying the photographic position can be photographed on a film at a predetermined justified length.

The copy to be photographically justified is prepared on a typewriter having book type and at a speed which should be very little, if any, less than is usually had in the preparing of typewritten matter in the normal manner. As in conventional typing, the left-hand margin is maintained the same for all lines, except, of course, where the line is indented such for example as a line beginning a paragraph or a heading. With the exception of lines ending a paragraph, headings, and similar necessarily shorter lines which do not need to be justified, the variation in the right-hand margin of all lines is kept within five letter spaces, ranging from a predetermined extreme right-hand letter space position to a position five letter spaces shorter. It is believed that a typist can do this with little if any sacrifice in speed. Those lines which end at such extreme right-hand letter space positions also require no justification. An example of such a line appears at 15 above the transparent element 13*a* shown in Fig. 2*a*. Lines which are shorter than the one shown in Fig. 2*a* and which are within the five letter space range are the ones requiring justification. Examples of the latter are indicated at 16, 17, 18, 19, and 20, appearing, respectively above the lenses 13*b*, 13*c*, 13*d*, 13*e*, and 13*f* shown in Figs. 2*b* to 2*f* inclusive.

For the purpose of controlling the operation of the justifying apparatus, in a manner which will presently appear, a black control spot 25 is placed at a certain fixed distance from the last character in the maximum length line 15 shown in Fig. 2*a* and at the same fixed distance from the last character in each of the lines 16, 17, 18, 19 and 20 shown in Figs. 2*b* to 2*f* as requiring justification. In the very much shorter lines referred to above as requiring no justification, like the last line in a paragraph, the black control spot is placed in the same letter space position as it would be placed were the line of the maxi-

mum length, like the line 15. The typist places the black control spot 25 in the places indicated by means of a special type element on the typewriter which is provided for this purpose and which is operated by one of the little used keys of the typewriter.

In so far as the broader aspects of the present invention are concerned, the device 10 for holding and positioning the copy sheet 11 may be of any suitable construction. It is herein shown as comprising a cylindrical platen member 26 rotatably supported on a shaft 27, and a pair of pressure rollers 28 and 29 rotatably supported on the shafts 30 and 31, respectively, and holding the sheet 11 in position against the platen 26. A feed ratchet 30 is fixed to the end of the platen 26 and is operated by a pawl 31 under the control of a line-spacing solenoid 32, to feed the lines of typewriting on the copy sheet successively into photographing position.

The camera 12 may be of any suitable construction and is shown herein as comprising a holder for a suitable roll type film 35 which holder includes a supply spool 36 and a storage spool 37. The camera also comprises an objective lens 38 positioned to focus on the film 35 an image of the line of typewriting in photographing position. The camera also includes a wall element 39 having a mask opening 40 which confines the area of film exposed to that just sufficient for photographing a line at the predetermined justified length and without the control spot 25 appearing on the film. A shutter operating element 41 is slidably mounted on the camera and is connected by a pin 42 to an armature 43 of a shutter controlling solenoid 44. The film 35 is held in position against the back of the wall 39 by suitable pressure rolls 44 and 45 mounted to rotate on axles 46. The film 35 is advanced or line-spaced by a feed pawl 47 coacting with a ratchet 48 fixed to the end of the storage roll 37. The pawl 47 is operated by the solenoid 49.

The lens means 13 is shown in Fig. 1 as comprising the six transparent elements 13*a*, 13*b*, 13*c*, 13*d*, 13*e*, and 13*f*, mounted in juxtaposed relation in a holder 50. The holder 50 is supported by the outer end of one arm 51 of a bell crank 52, and the latter is fulcrumed on a suitably supported fixed shaft 53 and is formed with a second arm 54 carrying a roller 55 at its outer end which is constantly held in engagement with the peripheral face of a specially designed cam 56. The cam 56 is mounted on a shaft 57 which may be rotated by a suitable means (not shown).

The cam 56 is formed with a low cylindrical dwell portion 56*f*, a high cylindrical dwell portion 56*a*, and four pairs of intermediate cylindrical dwell portions 56*b*, 56*c*, 56*d*, and 56*e*, respectively, which are between the low dwell portion 56*f* and the high dwell portion 56*a* with the dwell portions of each pair being on opposite sides of the cam. The radii of curvature of the cylindrical dwell portions increase progressively in equal amounts from the low dwell portion 56*f* to the high dwell portion 56*a*. When the roller 55 engages the high dwell portion 56*a* the holder 50 is in the position where the transparent lens element 13*a* lies across the optical axis A and all portions of the line of typewriting in photographing position are viewed by the camera lens 38 through such element 13*a*. When the roller 55 engages either of portions 56*b*, the element 13*b* lies across the axis A. Likewise, with the roller 55 engaging either of the portions 56*c*, 56*d*, and 56*e*, the elements 13*c*, 13*d*, and 13*e*, respectively, lie across the optical axis A; and, with the roller 55 engaging the low dwell portion 56*f*, the element 13*f* is across the optical axis A and thereby covers the line of typewriting in photographing position. It is, therefore, apparent that, as the cam 56 is rotated the lens elements 13*a* to 13*f* inclusive are moved successively into positions where they cover the line in photographing position. All of the dwell portions are formed as cylindrical surfaces so that each of their related elements 13*a* to 13*f* inclusive is held in position covering the line of typewriting for sufficient time to permit such line to be photographed through each of such elements.

The six transparent elements 13*a* to 13*f* of the lens means 13 appear separately in plan in Figs. 2*a* to 2*f* inclusive. It is noted that in each of these views a line of typewriting, as it will appear on the copy sheet, is shown above the lens element shown therein and below such lens element the same line appears as it will when viewed through such element by the camera lens 38. The element 13*a* is in the form of a glass prism rectangular in cross section. Consequently, the line 15, which is of full length and does not require justification, is shown in Fig. 2*a* as being the same in length both above and below the element 13*a*. The elements 13*b* to 13*f* inclusive are each formed as cylindrical lenses and are adapted to be arranged so that the flat sides thereof will lie next to the line to be photographed and the curved sides toward the camera. The radii of curvature of the lenses 13*b*, 13*c*, 13*d*, 13*e*, and 13*f* are progressively smaller considered in the order named, and consequently these lenses function to magnify the length of a line progressively increasing amounts in the order named. The centers about which the cylindrical surfaces of the elements 13*b* to 13*f* are formed all lie within a line B passing through the left-hand ends of the lens elements as viewed in Figs. 2*b* to 2*f*. Consequently, the left-hand margin of all lines does not appear displaced when viewed through any of the lens elements 13*a* to 13*f* inclusive. The lenses 13*b* to 13*f* inclusive are so formed that a line of typewriting is elongated one letter space when viewed through the lens element 13*b*, two letter spaces when viewed through the element 13*c*, three letter spaces when viewed through 13*d*, four spaces through lens element 13*e*, and five spaces when viewed through the lens element 13*f*. It will be apparent from an examination of Figs. 2*a* to 2*f* that for the purposes of illustration the length of the line appearing above each of the lens elements 13*a* to 13*f* inclusive has been so chosen that when each such line is viewed through its lens element by the camera lens such line appears to be the predetermined justified length.

Control means is provided for automatically operating the camera to photograph the line in photographing position when the particular lens element which will elongate such line so that it will appear to the camera lens 38 at the predetermined justified length, is positioned across the optical axis and covers such line. This control means comprises the above-mentioned control spot 25 located at the fixed distance from the last character in each line, and also comprises a light-sensitive cell 60, a collimating means 61 which restricts the light rays affecting the cell 60 to those flowing through the lens means 13 and emanating from a part of the copy sheet which is in longitudinal alignment with the line in photographing position and at the right-

hand margin adjacent its control spot 25. The collimating means 61 is so arranged and directed that when the particular element of the lens means is in front of the line in photographing position which makes such line appear at the justified length to the camera lens 38, the control spot 25 at the end of such line appears through such particular lens element at a point where it interrupts the flow of light rays through the collimating means 61 to the cell 60. The control means also includes electrical relays and circuits affected by the just mentioned change in flow of light rays to the cell and are operable when so affected to actuate the camera and then line-space the copy sheet 11 and film 35.

The operation of the apparatus shown in Fig. 1 will be apparent. With the cam 56 rotating in the direction of the arrow in Fig. 1, the lens means 13 is moved in steps back and forth across the optical axis A. When the element of the lens means is positioned in front of the line of typewriting in photographing position which makes such line appear at the predetermined justified length to the camera lens 38, the control spot in such line interrupts the flow of light rays to the cell 60 and thereby deenergizes a relay 62. As a result, the switch 63 is closed by a suitable spring and thereby causes electric current to flow from a suitable source (not shown) through a positive conductor 64, a conductor 65, the solenoid 44 and to the negative conductor 66, thereby energizing the solenoid 44 and operating the shutter of the camera to photograph the line in photographing position. The solenoid 44 when operated also closes the switch 67 and thereby connects the solenoid 49 and the solenoid 32 across the electric power source. The solenoid 49 acting through the pawl 47 and ratchet 48 line-spaces the film 35, and the solenoid 32 acting through the pawl 31 and ratchet 30 line-spaces the copy sheet 11 to bring the next line of typewriting into photographing position. The just-described operation occurs while the roller 55 is in contact with a cylindrical dwell portion of the cam 56. The movement of the copy sheet results in the control spot passing out of line with the collimating means 61 and the light rays again flow and energize the cell 60, and the latter through the amplifier unit 68 again energizes the relay 62 to open the switch 63 and deenergize solenoids 44, 49, and 32. With the next line in photographing position, the operation just described is repeated.

In Figs. 3 to 6 inclusive, a modified form of photographic justifying apparatus is disclosed. The main difference between the apparatus shown in Figs. 3 to 6 and the previously described modification lies in the construction of the lens means 113 and in the means for supporting and moving the lens means 113 across the optical axis A. The construction and operation of the copy holder and camera are exactly the same in both modifications and consequently the same reference characters are used to identify the parts thereof.

In Figs. 3 to 6 inclusive, the lens means 113 comprises one transparent element which is substantially twice the length of any one element of the previously described lens means 13. The left-hand half 113*a* of the lens element 113 is formed as a glass prism, rectangular in cross section, and is constructed substantially the same in its dimensions as the lens element 13*a* of Fig. 2*a*. The right-hand half 113*f* of the lens element 113 is formed as a cylindrical lens with its length and

radius of curvature the same as lens element 13*f* of Fig. 2*f*. It is, therefore, apparent that with the portion 113*a* fully covering a line of typewriting held in photographing position, there will be substantially no change in its dimensions as it appears through the portion 113*a* to the camera lens 38, and that with the portion 113*f* fully covering a line, as shown in Fig. 6, such line will appear to the camera lens 38 to be elongated for the maximum required amount, herein assumed to be five character spaces. Thus, with a line of typewriting occupying a photographing position and starting with the part 113*a* fully covering such line, if the lens means 113 is moved toward the left as viewed in Figs. 4 and 6 and in a path extending in the same direction as the line of typewriting, progressively increasing amounts of such line become visible to the camera lens through the portion 13*f* and are enlarged thereby. Consequently, the length of the line as a whole as viewed by the camera lens is progressively increased as the lens means is moved toward the left, and this continues until the part 113*f* completely covers the line where the maximum elongation of the line is effected.

Means is provided for holding and moving the lens 113 so that after the copy sheet is line-spaced to bring a new line of typewriting into photographing position, the lens 113 will occupy an initial position where it is at the right-hand end of its travel and where the line of typewriting is completely covered by the part 113*a*. This is the position of the parts shown in Fig. 4. From this initial position, the lens means 113 is moved toward the left. If the line requires justification, the movement of the lens means 113 toward the left will continue until enough of the lens portion 113*f* covers the line for the control spot 25 to interrupt the flow of light to the cell 60. When the latter happens, the line appears at the justified length to the camera and the movement of the lens 113 is stopped and the camera 12 operated to photograph the line. If the line in photographing position is of full length and requires no justification, the control spot 25 will interrupt the flow of light to the cell 60 and soon after such movement of the lens means has started the movement of the lens will be stopped and the lens held in such a position and the camera 12 operated to photograph the line.

The means for effecting the operation just explained will be apparent from an examination of Figs. 3, 4, and 5. The lens 113 is fixedly mounted in a carriage 100 and the latter is mounted to slide longitudinally in a stationary bracket member 101. An arm 102 depends from the right-hand end of the carriage, as viewed in Fig. 4, and is provided at its lower end with a roller 103 held in engagement with a continuously rotating cam 56*a* by a tension spring 104 connecting a pin 105 on the fixed bracket 101 and the arm 102. With the parts in the position shown in Fig. 4 and with a new line in photographing position, as the cam 56*a* rotates in the direction of the arrow, the spring 104 keeps the roller 103 in contact with the cam and thereby moves the carriage 100 and lens 113 toward the left. If the line is less than full length and thereby requires justification, the movement of the lens 113 will continue until its spot 25 interrupts the flow of light to the cell 60. When the latter happens the line is sufficiently elongated so that it appears at the justified length to the camera lens 38. Upon the interruption of light flow to the cell 60, it becomes deenergized and drops out the relay 62 to close the switch 63.

When the latter happens, current flows from the positive conductor 64 through the switch 63, conductor 65, conductor 106, clutch solenoid 107, conductor 108, shutter operating solenoid 44, conductor 109, normally closed switch blade 110, conductor 111, to negative conductor 66.

The energizing of clutch solenoid 107, attracts its armature 75 and moves the clutch roller 76 toward the left as viewed in Figs. 4 and 5 and into wedging engagement between the inner inclined face of a bracket 77 carried by the bracket 101 and the face of the bar 78 forming a part of the carriage 100. This will lock the carriage bar 78 and carriage 100 against further movement to the left and thereby hold the lens means against further movement.

The solenoid 44 when thus energized, actuates the shutter operating element 41 to photograph the line in photographing position as it appears at the predetermined justified length through the lens means 113 at its above-described stopped position.

The actuation of element 41 closes pairs of contacts 79 and 80. The closing of contacts 79 establishes an energizing circuit for the film-spacing solenoid 49 and the solenoid 32 for line-spacing the copy sheet, by a circuit traceable as follows: from positive conductor 64, switch 63, conductor 65, contacts 79, conductor 81, solenoid 49, conductor 82, solenoid 32, and conductor 83 to negative conductor 66. As explained previously the energizing of solenoid 49 line-spaces the film 35 and the energizing of solenoid 32 line-spaces the copy sheet to bring a new line into photographing position.

The closing of contacts 80 energizes a relay 85 by a circuit traceable as follows: from positive conductor 64, contacts 80, conductor 86, relay 85, conductor 87, now closed contacts 88, to negative conductor 66. The contacts 88 are held open when the carriage 100 occupies the extreme right-hand or initial position shown in Fig. 4 which, as stated previously, is the position occupied at the beginning of a line scanning operation. This is effected by a wedge-shaped projecting element 89 on the carriage 100 engaging and holding open a movable spring blade 90 of the contacts 88. As soon as the carriage 100 begins its above described movement toward the left, the element 89 moves out of engagement with spring blade 90 and permits the latter to close the contacts 88.

When relay 85 becomes energized its contact blades 91 and 110 move to the right, as shown in Fig. 3, thereby closing at 91 a holding circuit for relay 85, including the now closed contacts 88, and opening at 110 the energizing circuit for the solenoid 44 and the solenoid 107. The holding circuit for relay 85 is as follows: positive conductor 64, now closed switch blade 91, conductor 92, relay 85, conductor 87, contacts 88, to negative conductor 66. When the solenoid 44 is deenergized by the opening of switch blade 110, the element 41 returns to the position shown, and thereby opens switch 79 to deenergize solenoids 49 and 32, and opens switch 80 and the previously described pickup circuit for relay 85.

The above-described stopping of lens means 113, the photographing of the line, and the line-spacing of the film 35 and copy sheet 11 take place in a very short period of time. The cam 56a continues rotating in a clockwise direction until it again engages the roller 103. The cam then moves the carriage 100 back to its extreme right-hand position shown where the element 89 engages blade 90 and opens contacts 88 and the holding circuit for relay 85.

When the copy sheet 11 is line-spaced by the energizing of solenoid 32, the spot 25 passes from behind the lens means 113 and the flow of light to cell 60 is resumed. This will energize the relay 62 and open the switch 63. If the new line brought into photographing is of full length and therefore does not require justification, the spot 25 at the end thereof will interrupt the flow of light to cell 60 and close switch 63 as soon as the part 113a of the lens means covers the line. At the moment however, this will have no effect on the operation of the camera because the relay 85 remains energized and holds open at 110 the circuit for solenoids 44 and 107. The relay 85 remains energized until the carriage reaches its initial position and the contacts 88 are opened thereby. When the relay 85 drops out and 110 closes, the solenoids 44 can be energized to photograph the line and the solenoid 107 energized to stop movement of the carriage 100 and lens 113. Consequently, the relay 85 and contacts 88 assure that the carriage 100 will return to its initial position each time before the new line in photographing position can be photographed.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the several embodiments, 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. Apparatus for photographically reproducing typewritten copy line-by-line in justified form and comprising a copy holder for moving each line of the copy into a photographing position; a camera for photographing the lines of copy in succession on a light sensitive medium; lens means interposed between said camera and said copy holder and being movable along a path extending transversely of the optical axis and being so constructed that as said lens means is so moved the length only of the line in photographing position is varied as it appears to the camera; said lens means comprising a plurality of lens elements having different line-elongating characteristics, and supporting means for said lens elements and operable to move said lens elements along said path and successively across the optical axis; and means for selectively positioning said lens elements across the optical axis so that each line in photographing position may be photographed at a predetermined justified length.

2. In photographic justifying apparatus of the type comprising a copy holder for successively moving lines of typewriting on a copy sheet to a photographing position, and a camera including an objective lens and operable to photograph successively the lines in photographing position on a light-sensitive medium, the combination of lens means interposed between said camera and said copy holder and being mounted for movement along a path extending transversely of the optical axis and being so constructed that as said lens means is so moved the length only of the line in photographing position is varied as it appears to the camera lens; said lens means including a

plurality of separate lenses having different line-elongating characteristics and supporting means for holding the last-named lenses in juxtaposed relation and operable to move said lenses along said path and in succession across the optical axis; and means for selectively positioning said lenses across the optical axis so that each line may be photographed at a predetermined justified length.

3. In photographic justifying apparatus of the type comprising a copy holder for successively moving lines of typewriting on a copy sheet to a photographing position, and a camera including an objective lens and operable to photograph successively the lines in photographing position on a light-sensitive medium, the combination of lens means interposed between said camera and said copy holder and being mounted for movement along a path extending transversely of the optical axis and being so constructed that as said lens means is so moved the length only of the line in photographing position is varied as it appears to the camera lens; said lens means including a plurality of cylindrical lenses having their cylindrical surfaces formed with different degrees of curvature and a device for holding said lenses so that as each lens is moved into position across the optical axis the general direction of extent of its cylindrical surface is substantially the same as the line in photographing position; and means for selectively positioning said lens means along its said path of movement so that each line may be photographed at a predetermined justified length.

4. Apparatus for photographically reproducing typewritten copy line-by-line in justified form and comprising a device for holding a copy sheet having a plurality of lines of typewriting thereon arranged with one margin being the same and the lines varying in length from a predetermined maximum to a minimum, and a control spot at the other margin of each line and the spots being spaced longitudinally from their respective lines and equal distances from the last character therein; line-spacing means for successively moving said lines into a photographing position; a camera for photographing the lines of copy in succession on a light-sensitive medium; lens means mounted for movement along a path extending transversely of the optical axis and between said copy sheet and said camera, and said lens means being so constructed that as it is so moved the line of copy in photographing position appears through said lens means, from a point adjacent said camera, to vary progressively in length with said one margin remaining fixed and with said other margin and related control spot moving to the right or left, depending upon the direction of such movement; means for moving said lens means along said path; a light-sensitive control element; fixed collimating means restricting the light rays affecting said control element to those flowing through said lens means and emanating from a part of the copy spaced longitudinally from said other margin of the line in photographing position and in the area occupied by the control spot for such line, and said collimating means being so arranged that when said lens means is moved to a position where the last-named control spot varies the flow of light to said control element, such line when photographed on said medium will be a predetermined justified length; and means responsive to a control spot varying the light flow to said control element for stopping movement of said lens means and for effecting a photographing operation of said camera.

5. Apparatus according to claim 4 wherein said lens means comprises a plurality of lenses having different magnifying characteristics.

6. Apparatus according to claim 4 wherein said lens means comprises a plurality of cylindrical lenses having curved surfaces with different degrees of curvature and being so mounted that as each such cylindrical lens is moved to a position between the line in photographing position and said camera the curved surface thereof extends in the same general direction as such line.

7. Apparatus for photographically reproducing typewritten copy line-by-line in justified form and comprising a device for holding a copy sheet having a plurality of lines of typewriting thereon arranged with an even left-hand margin and the line varying in length from a predetermined maximum to a minimum, and a control spot at the right-hand end of each line and the spots being spaced equal distances from the last character in their respective lines; line-spacing means for successively moving said lines into a photographing position; a camera for photographing the lines of copy in succession on a light-sensitive medium; lens means mounted for movement along a path extending transversely of the optical axis and between said copy sheet and said camera and said lens means being so constructed that as it is so moved the line of copy in photographing position appears through said lens means, from a point adjacent the camera, to vary progressively in length with its left-hand margin remaining fixed and with its right-hand end character and related control spot moving to the right or left depending upon the direction of movement of said lens means; means for moving said lens means along said path; a light-sensitive control element; fixed collimating means restricting the light rays affecting said element to those flowing through said lens means and emanating from a part of the copy beyond the right-hand end of the line in photographing position, and said collimating means being so adjusted that when the lens means is moved to a position where the control spot for the line in photographing position varies the flow of light rays to said element, such line when photographed on said medium will be at a predetermined justified length; means responsive to a control spot varying with light flow to said element for rendering said lens moving means ineffective and for effecting a photographing operation of said camera.

8. Apparatus for photographically reproducing typewritten copy in justified form comprising a device for holding a copy sheet having a plurality of lines of typewritten matter thereon arranged with one margin being the same and the lines varying in length from a predetermined maximum to a minimum, and a control spot at the other margin of each line and the spots being spaced longitudinally from their respective lines and equal distances from the last character therein; means for line-spacing the copy sheet to bring successively the lines into a photographing position; a camera containing a light-sensitive medium on which the lines are successively photographed and comprising means for line-spacing said medium, a stationary objective lens arranged to focus on said medium only the image of the line in photographing position, and control means for operating said camera; lens means; means for moving said lens means back and forth between said copy sheet and said objective lens and

in a direction extending transversely of the optical axis; said lens means being so constructed that as it is moved the line of copy in photographing position appears through the lens means to vary progressively in length with said one margin remaining fixed and with the other margin and related control spot moving to the right or left, depending upon the direction of movement of the lens means; a light-sensitive control element; stationary collimating means restricting the rays of light affecting said element to those flowing through said lens means and emanating from a part of the copy in longitudinal alignment with the line in photographing position and at said other margin thereof where its related control spot is located and said collimating means being so directed that when the lens means is moved to a position where the control spot of the line in photographing position varies the flow of light to said light-sensitive element, the image of such line when focused by the camera lens on said medium will appear at a predetermined justified length; means responsive to a control spot varying the light flow to said element, for stopping movement of said lens means and for operating said camera control means; means operable upon the operation of said last-named means, for operating said line spacing means for said copy sheet and for said medium and effective thereafter to resume operation of said lens moving means.

9. Apparatus according to claim 8 wherein said lens means comprises a plurality of cylindrical lenses having different degrees of curvature and being so mounted that as each lens is moved into position between the line in photographing position and said camera lens the curved surface thereof extends in the same general direction as said line.

10. Apparatus for photographically reproducing typewritten copy line-by-line in justified form and comprising a copyholder for moving each line of the copy into a photographing position; a camera for photographing the lines of copy in succession on a light sensitive medium; lens means movable along a path extending transversely of the optical axis and between the line of copy in photographing position and said camera, and said lens means comprising a plurality of cylindrical lenses mounted in side-by-side relation and being formed, respectively, with curved surfaces having different degrees of curvature and being arranged so that as each lens is moved into a position between the line of copy in photographing position and the camera lens, the curved surface of such lens extends in the same general direction as the said line of copy; and means for selectively positioning said cylindrical lenses along said path so that the lines may be photographed on said medium at a predetermined justified length.

11. Apparatus for photographically reproducing typewritten copy line-by-line in justified form and comprising a copyholder for moving each line of the copy into a photographing position; a camera for photographing the lines of copy in succession on a light sensitive medium; lens means movable along a path extending transversely of the optical axis and between the line of copy in photographing position and said camera, and said lens means comprising a cylindrical lens having a curved surface extending in the same general direction as the line of copy in photographing position and said lens being movable in said general direction and between said camera lens and said line of copy so that varying amounts of said line of copy may be photographed through said cylindrical lens; and means for selectively positioning said cylindrical lenses along said path so that the lines may be photographed on said medium at a predetermined justified length.

CLARENCE C. SMITH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,084,450	Paris	June 22, 1937
2,160,277	Neidich	May 30, 1939
2,222,257	Fetter	Nov. 19, 1940
2,356,620	Schade	Aug. 22, 1944
1,937,228	Jordan	Nov. 28, 1933