Feb. 23, 1943. T. J. WATSON 2,312,138

DISPLAY DEVICE FOR TYPEWRITERS

Original Filed Sept. 27, 1940 3 Sheets-Sheet 1

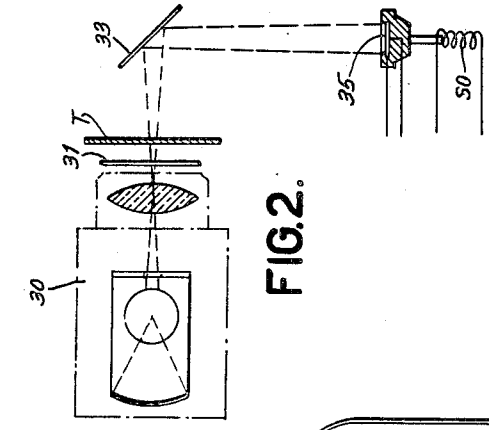


FIG. 2.

FIG. 1.

FIG. 3.

INVENTOR.
Thomas J. Watson

BY

ATTORNEY.

Feb. 23, 1943. T. J. WATSON 2,312,138

DISPLAY DEVICE FOR TYPEWRITERS

Original Filed Sept. 27, 1940 3 Sheets-Sheet 2

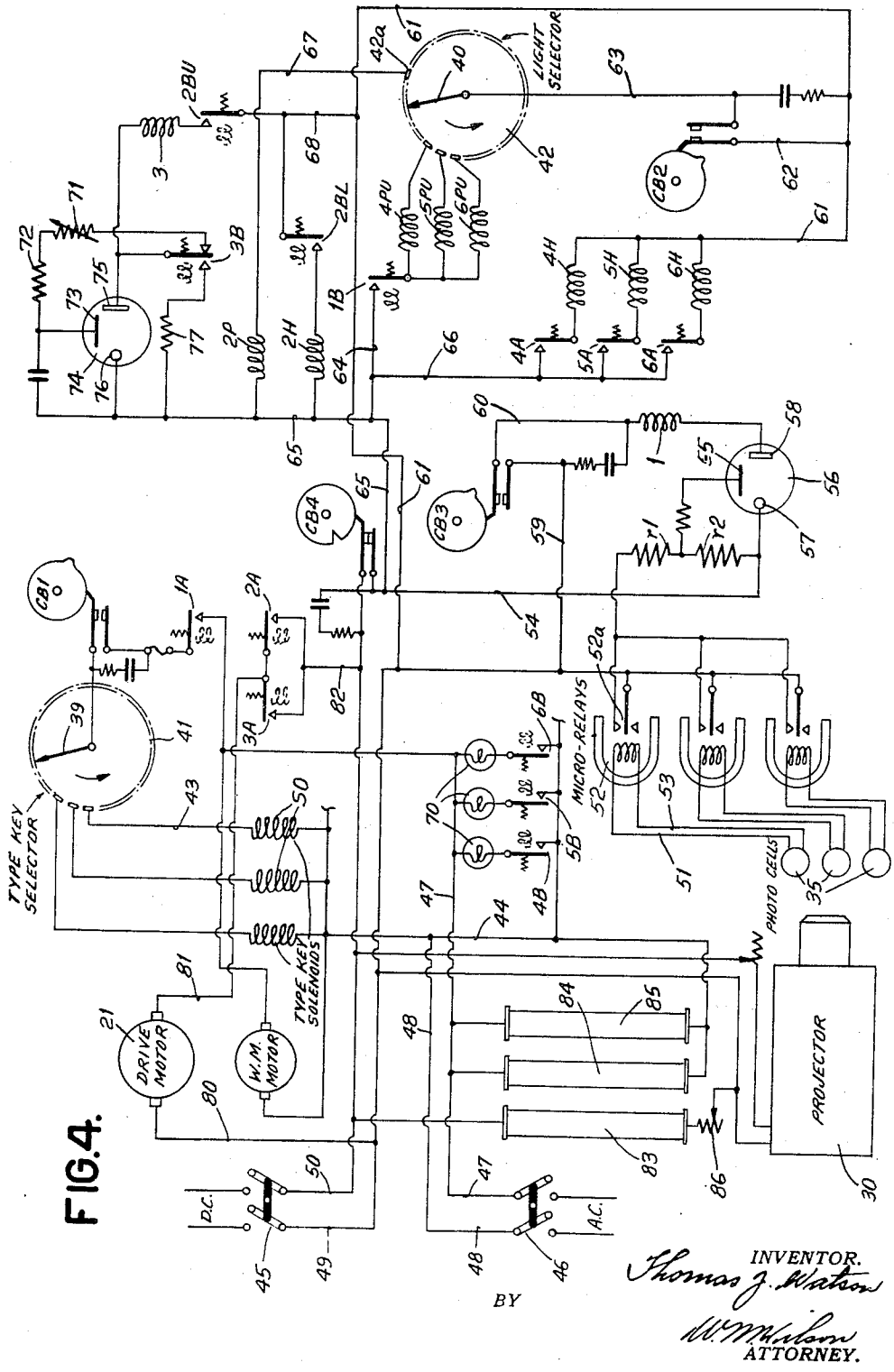


FIG. 4.

INVENTOR.
Thomas J. Watson

BY

W. W. Watson
ATTORNEY.

Feb. 23, 1943. T. J. WATSON 2,312,138

DISPLAY DEVICE FOR TYPEWRITERS

Original Filed Sept. 27, 1940 3 Sheets-Sheet 3

FIG. 6.

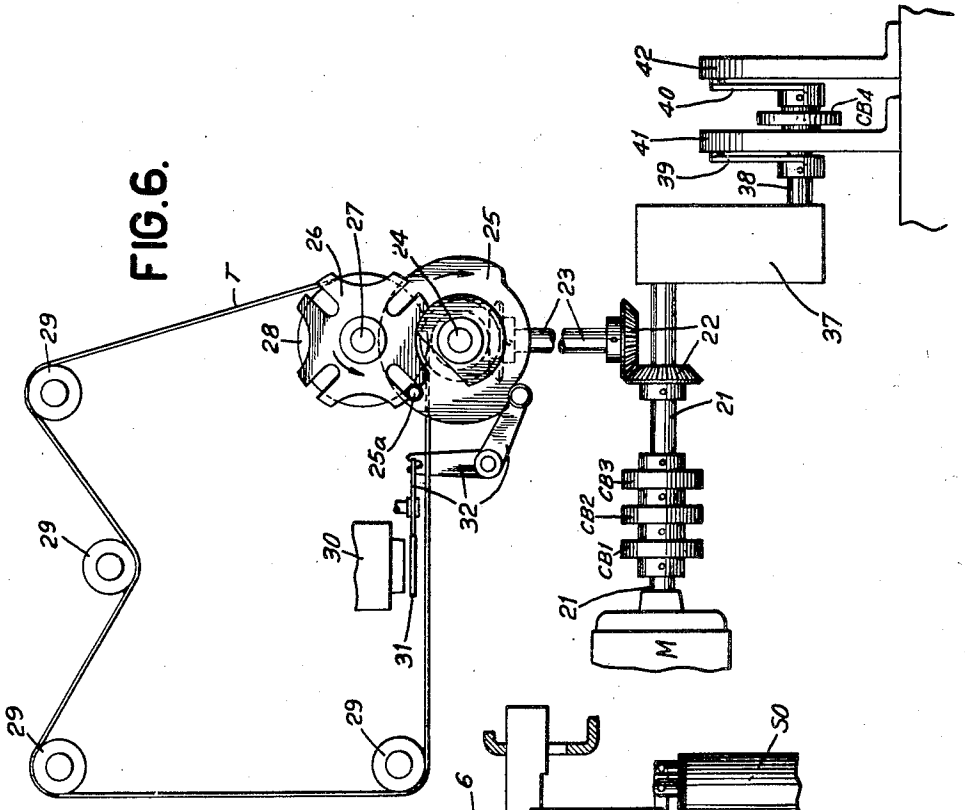
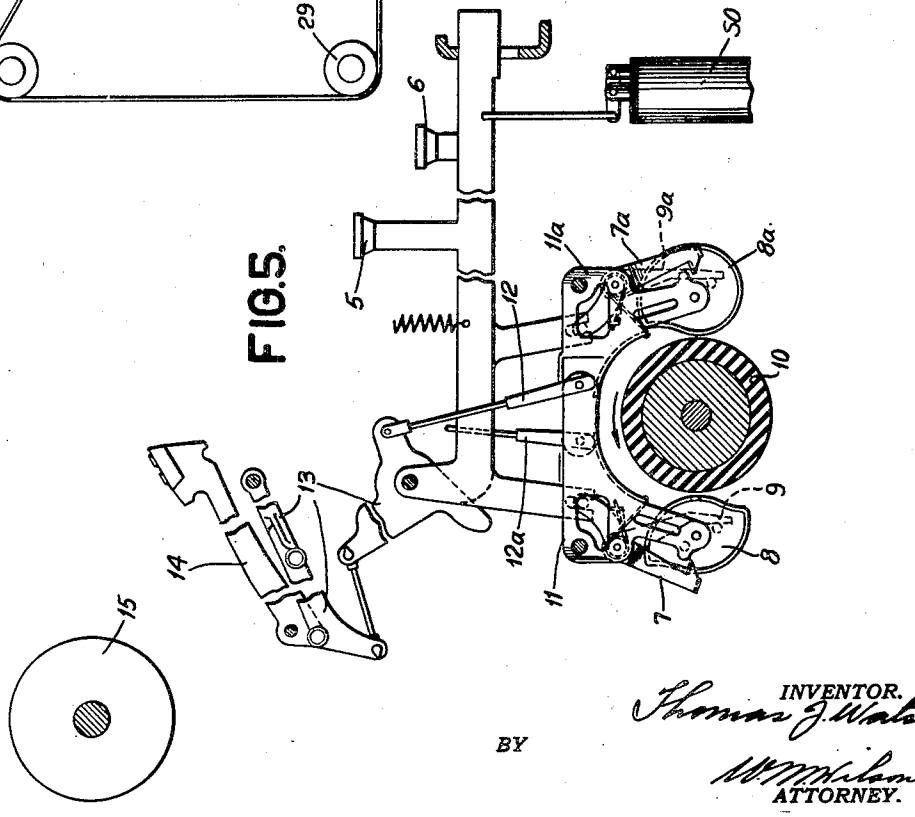


FIG. 5.



INVENTOR.
Thomas J. Watson

BY

ATTORNEY.

Patented Feb. 23, 1943

2,312,138

UNITED STATES PATENT OFFICE

2,312,138

DISPLAY DEVICE FOR TYPEWRITERS

Thomas J. Watson, New York, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Original application September 27, 1940, Serial No. 358,572. Divided and this application August 30, 1941, Serial No. 408,973

4 Claims. (Cl. 35—49)

This invention relates to a display device for directing attention to the ease of operation of the individual keys of a typewriter or other key-controlled machine. The present case has been divided out of my copending application Serial No. 358,572 filed September 27, 1940.

The primary feature to which attention is directed by the instant invention is commonly referred to in the art as lightness of "touch." To arouse interest in this feature most effectively, it is contemplated to provide for the operation of the typewriter keys by the action of light beams originating from a common light source mounted above the keyboard.

It is further contemplated to provide for mounting a photo-voltaic cell in the head of each key so that each cell, when acted upon by a light beam, effects control of circuits for operating the key in which it is mounted. The impression thus conveyed to an observer is that the light beams are actually depressing the keys by the exertion of a very slight mechanical pressure. This illusion lends an air of mystery to the display which attracts the observer and impresses on his mind that the machine advertised is claimed to have a light "touch."

It is also within the contemplation of the invention to provide light means to illustrate the characters as they are printed, and it is proposed that the light means remain lighted until a predetermined number of such characters is printed.

According to the invention, a perforated metal tape is mounted for intermittent movement in front of a projector lamp. Between the tape and the lamp is a shutter which is operated intermittently from the same driving means as the tape. The operation is such that the shutter is held in front of the lamp while the tape is being advanced and is moved away from the lamp as the tape stops. When the shutter moves away, light passes through a perforation in the section of the tape immediately in front of the lamp. As this occurs, light is reflected by an inclined mirror in such a manner as to fall on one of the typewriter keys. Upon receiving the light beam, a photocell within the head of the key becomes active to generate a very small current, which current is amplified to energize a key solenoid and thus depress the key. A key selector is provided and has segments connected to the individual key solenoids in a predetermined manner in accordance with the information which is to be printed. As the key selector rotates, it contacts the various segments in order and, if a light beam is received on a key at a certain time, a circuit is completed through the selector to energize that particular key solenoid to print a character. A display panel is provided with a plurality of indicating lamps for indicating the characters which are to be printed. A lamp selector, mechanically connected with the key selector to insure synchronous operation, serves to control completion of a lamp circuit each time a light beam falls on a key. A holding circuit is provided for maintaining the lamps lighted until a predetermined number of characters has been printed, at which time the circuit is opened to darken the lamps.

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 schematic view of apparatus showing the general relationship of the units.

Fig. 2 shows diagrammatically the elements for controlling the light beam for one typewriter key.

Fig. 3 shows a portion of the control tape.

Fig. 4 is a circuit diagram of the entire device.

Fig. 5 is a sectional view of the principal operating mechanism of the typewriter.

Fig. 6 is a plan view showing the principal parts of the drive mechanism.

The invention is shown in the drawings as applied to a power driven typewriter of a well known type, the principles of which are disclosed in Patents Nos. 1,777,055 and 1,873,512, although its use is not limited to such machines. In the illustrated machine, briefly, depression of a character key 6 releases a latch 7 from a cam 8 permitting a spring-pressed lever 9 to move the cam against a continuously rotating motor-driven power roller 10. The cam is rotated by frictional contact with the power roller in a clockwise direction, as viewed in the drawings, to cause the rocking of the cam carrier member 11 to depress a link 12. Depression of link 12 rocks a linkage 13 to propel the type bar 14 towards the platen 15, causing the type on the type bar to print on the sheet positioned on the platen.

The carriage return key 5 operates carriage return means such as disclosed in Patent No. 1,955,614. Depression of key 5 releases latch 7a from cam 8a to permit spring-pressed lever 9a to move the cam into engagement with power roller 10. It will be noted that cam 8a differs in shape from cam 8 in that it is a single rather than double lobe cam. The reason for this is

simply to permit cam 8a to turn one complete revolution upon engagement with the power roller rather than one half revolution as does cam 8. Rotation of cam 8a in a counterclockwise direction by power roller 10 causes rocking of cam carrier member 11a and depression of link 12a to effect a carriage return operation. In this type of machine, carriage return operations are accompanied by an automatic line spacing of the sheet positioned on the platen 15.

A robot mechanism, represented diagrammatically by rectangle 20 in Fig. 1 contains a suitable drive motor M (Fig. 6) for driving a shaft 21 that carries three cams which operate control contacts and which are designated CB1 to 3. The cams are fixed to the shaft so as to rotate therewith and are shaped to control the time of opening and closing of their associated contacts to operate circuits which are described hereinafter. Shaft 21 is connected by gears 22 to a shaft 23. Shaft 23 in turn is geared to a vertical shaft 24 to which is fastened a cam 25 carrying a pin 25a. The pin 25a engages with a Geneva gear 26 rotatably mounted on a supporting stub shaft 27. Integral with the Geneva gear 26 is a drive wheel 28 which engages with a metal tape T for feeding the tape intermittently in accordance with the movement of Geneva gear 26. Guide spools 29 take up the slack in the tape and support a portion of the tape directly in front of the projector lamp 30. A shutter 31 is provided between the tape and the lamp and is arranged to be moved back and forth by the cam 25 acting through connected linkage 32. The contour of cam 25 is such that it moves the shutter out of alignment with the lamp while the tape is not being advanced by the Geneva drive gear 26. At all other times the shutter remains in alignment with the projector lamp so as to intercept any light beams from the lamp which may pass through the tape. A mirror 33 (Fig. 2) is provided and is supported at an angle to reflect light beams from the projector lamp in the direction of the keys.

The tape T comprises a plurality of sections which are successively presented at the projector lamp by the Geneva drive movement. A perforation may appear in any one of a number of predetermined locations in a section of the tape but only one perforation is allocated to a section since only one typewriter key is adapted for operation at a time. The sections of the tape are made sufficiently large to accommodate perforations in as many different positions as there are keys on the typewriter.

In the top of each typewriter key is embedded a tiny photocell 35 which becomes active to generate a small current when a light beam strikes upon the top of the key. The circuits will be described later, it being sufficient for the present to state that a solenoid SO, located directly beneath the key contacted by the light beam, becomes energized to depress the key. Also connected with the drive motor 21 through a reduction gearing 37 and shaft 38 are two arms 39 and 40 which cooperate with the segments of disks 41 and 42, respectively. The arms are kept in exact synchronism by virtue of the fact that each is fixed to shaft 38. Thus, corresponding segments of their respective disks are contacted by the arms 39 and 40 at the same time. Disk 41 and selector arm 39 serve to select the solenoids for energization, and disk 42 and arm 40 control the lighting of the lamps on the display panel. Shaft 38 also carries circuit breaker cam CB4.

The electrical circuits will now be described with reference to Fig. 4. There it will be noted that the closure of switch 45 connects wires 49 and 50 to opposite terminals of the DC supply. This completes the following circuit to start the drive motor 21: from wire 49, through wire 80, drive motor 21, wire 81, normally closed switch 2A, wire 82, to wire 50. Then, when a hole in the tape is encountered by a light beam from the projector lamp 30 and this light beam is directed by mirror 33 upon one of the photocells 35, a live circuit is completed by the photocell through wire 51 to a micro-relay coil 52, and returned by way of wire 53. The micro-relay 52 is energized to close its contacts 52a to complete a circuit from wire 49, contacts 52a, resistances r1, r2, wire 54, contacts CB4, to wire 50. The potential drop across resistances r1, r2 causes an increase in potential of starter anode 55 of tube 56 with respect to the cathode 57, thereby causing current to flow through this tube to the anode 58 to complete a circuit when contacts CB3 close, through relay coil 1 as follows: wire 49, wire 59, contacts CB3 now closed, wire 60, relay coil 1, anode 58, cathode 57, wire 54, contacts CB4, and wire 50. Energization of relay coil 1 closes its contacts 1A. Assuming that switch 46 is closed to connect wires 47 and 48 to the AC line, when contacts CB1 close, a circuit is completed from wire 47, contacts 1A now closed, contacts CB1 also now closed, selector arm 39, to one of the segments of disk 41, wire 43, solenoid SO, to wire 48. Energization of the solenoid SO causes depression of its associated key to print a character.

Energization of relay coil 1 also closes its contacts 1B to complete, when contacts CB2 close, a circuit as follows: wire 49, wires 61, 62, contacts CB2, wire 63, selector arm 40, through a segment of disk 42, through one of the coils 4P, 5P or 6P, contacts 1B now closed, wires 64, 65, contacts CB4, to wire 50. Energization of relay coil 4P, for example, closes points 4A to provide a holding circuit from wire 49, wire 61, coil 4H, contacts 4A now closed, wires 66, 64, 65, contacts CB4 to wire 50. This holding circuit is under control of contacts CB4. Energization of relays 4P and 4H, respectively, closes and holds contacts 4B, thereby completing a circuit to light one of the lamps 70 as follows: wire 48, wire 44, contacts 4B now closed, lamp 70 connected thereto, and wire 47.

The display panel comprises a plurality of lamps 70 arranged in rows as shown in Fig. 1. A predetermined message such as, for example, "This is a light touch typewriter" is printed on the inside of the panel, and the letters of the message are normally invisible from the outside of the panel. However, by providing a lamp 70 for each letter, the message is rendered visible letter by letter when the lamp are lighted, as circuits described above are completed through the lamp selector arm 40 and the normal segments of disk 42.

After the lamps have been lighted to render the entire message visible, the lamp selector arm 40 contacts a special segment 42a to energize relay 2P over the following circuit: wires 49, 61, 62, contacts CB2 now closed, wire 63, selector arm 40, segment 42a, wire 67, coil 2P, wire 65, contacts CB4, and wire 50. Energization of coil 2P closes contacts 2BL to energize coil 2H by a circuit which is traceable from wire 49,

wire 61, wire 68, contacts 2BL now closed, coil 2H, wire 65, contacts CB4, to wire 50. Contacts 2BU are also closed to effect a circuit through relay coil 3, from wire 49, wires 61, 68, contacts 2BU, coil 3, normally closed contacts 3B, resistances 71, 72, to starter anode 73 of tube 74. This builds up the potential on the starter anode 73 which fires the tube, so that current passes through the tube from relay coil 3, plate 75, cathode 76, wire 65, contacts CB4, to wire 50. As soon as relay coil 3 is energized by the above circuit, contacts 3B are transferred so that the circuit is held through resistance 77. Contacts 3A also close to complete a circuit through the drive motor as follows: wire 49, wire 80, drive motor 21, wire 81, contacts 3A now closed, wire 82 and wire 50. The motor now causes arm 40 to be moved off segment 42*a*, thereby breaking the holding circuit for relay coils 2 and 3 and permitting contacts 2A to close and hold the motor circuit during the movement of arm 40 past the remaining segments of disk 42. The last segment on the disk is generally connected to the carriage return key solenoid so as to effect a carriage return and line space when light passes through the last hole in the tape and falls on the carriage return key. Contacts CB4 open to darken lamps 70 at this time.

The above described mechanism creates a time delay at the end of each revolution of the selector arm 40 as it contacts segment 42*a*. During this time delay, the motor and all the connected mechanism are stopped for a brief period. Then when relay 3 is picked up, the motor resumes its normal operation through contacts 3A and then through contacts 2A which close upon deenergization of relay 2 when arm 40 moves off of segment 42*a*.

It has been found that for proper operation of the photocells a certain amount of artificial light is necessary. This is provided by lamps 83, 84 and 85 suitably located around the typewater and out of view of the observer. A variable resistor 86 is provided to adjust the intensity of the light from lamp 83 in accordance with the amount of stray light falling on the typewriter. Lamps 84 and 85 are connected across the AC line and lamp 83 is connected across the DC line in series with the resistor 86, as shown in Fig. 4.

While there have 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 display device for a typewriter or other machine controlled by keys, illuminating means, means for regulating said illuminating means so as to project concentrated beams of light on said keys in a predetermined sequence, photocells mounted in the keys rendered active by said beams, means controlled by the photocells for operating said keys, a display panel containing systematically arranged lamps for indicating characters, and means also controlled by the photocells for causing illumination of said lamps to indicate said characters in such a manner as to correspond with the operation of said keys including means for maintaining each lamp so illuminated until a predetermined number of said lamps have been illuminated.

2. In a display device for a typewriter or other machine controlled by keys, a light source, means for projecting beams of light from said source to said keys in predetermined sequence, a plurality of photocells, one for each key, rendered active by the light beams as said beams are projected upon the keys, means controlled by the active photocells for operating the keys substantially simultaneously with the contacting of the light on said keys, a plurality of indicating lamps, a selector disk for selecting said lamps for operation in the same sequence as the operation of the keys, and means also controlled by the active photocells for lighting the lamps selected by said disk including means for maintaining each of the selected lamps lighted until a predetermined number of said lamps are so lighted at a time.

3. Apparatus of the character described comprising, in combination, a keyboard having a plurality of depressible keys, illuminating means for said keyboard, means for directing light from said illuminating means to the tops of said keys in a predetermined sequence, a plurality of photocells, one for each key, responsive to the light as it is directed to the associated key, means controlled by the photocell for depressing the keys substantially simultaneously with the contacting of the light on said keys, a display panel containing indicating lamps, and means also controlled by said photocells for lighting said lamps to correspond with the depression of said keys.

4. In a display device for a typewriter, illuminating means, means for projecting light from said illuminating means upon said keys in a prearranged order, individual means for operating said keys, a selective distributor for preparing said individual operating means for operation in the same order, a plurality of indicating lamps, a photocell carried by each key, means controlled by the photocell for causing operation of the related keys by the individual operating means as prepared by the distributor and means also controlled by the photocells to light the lamps in such a manner as to correspond with the operation of the keys.

THOMAS J. WATSON.