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H. E. KELCHNER

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LIGHT RESPONSIVE PHOTO-OPTICAL KEYBOARD

Filed Aug. 31, 1960

2 Sheets-Sheet 1

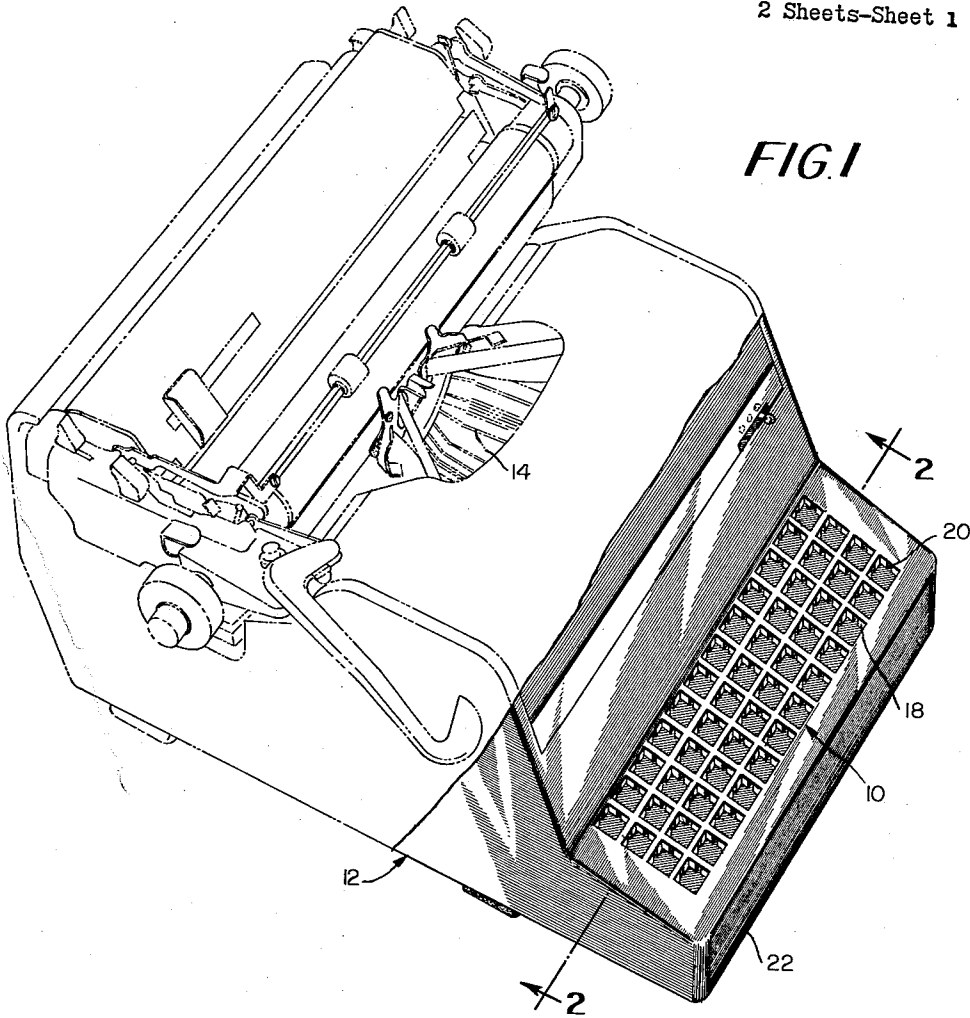
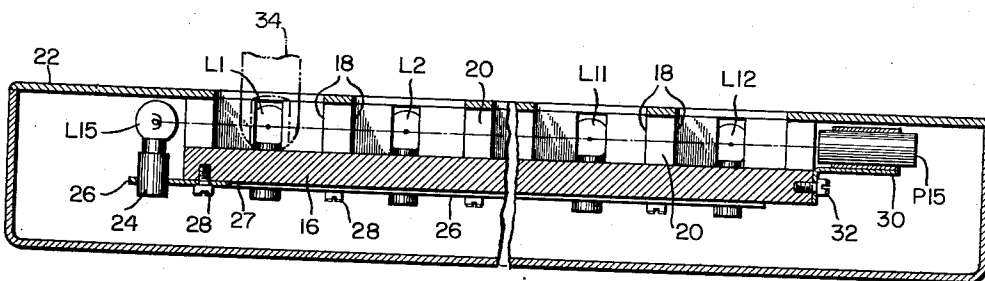


FIG. 1

FIG. 2



INVENTOR.

HARLEY E. KELCHNER

BY

AGENT

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H. E. KELCHNER

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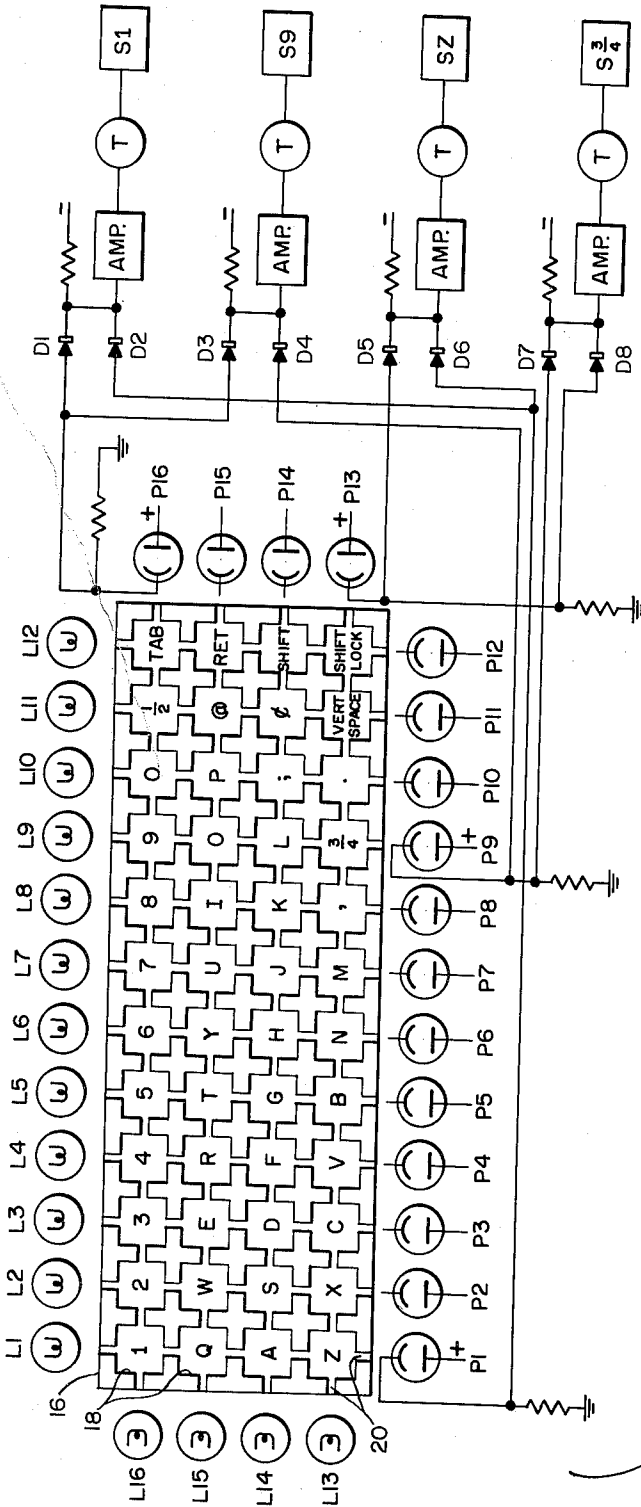


FIG. 3

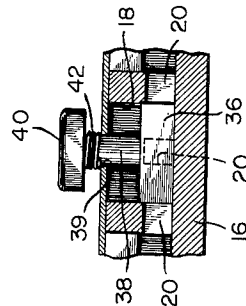


FIG. 5

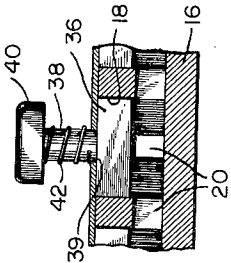


FIG. 4

INVENTOR.
HARLEY E. KELCHNER

BY *Harley E. Kelchner*
AGENT

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3,056,030

LIGHT RESPONSIVE PHOTO-OPTICAL KEYBOARD

Harley E. Kelchner, Bridgeport, Pa., assignor to Burroughs Corporation, Detroit, Mich., a corporation of Michigan

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The invention hereafter described and claimed relates to keyboards, but more specifically it has to do with light responsive photo-optical keyboards which are particularly, but not exclusively, useful in business machines such as typewriters, calculators and the like.

Most manually operable keyboards for entering information in such machines include a number of associated linkages which are quite noisy. In fact, large sums of money have been spent in efforts to silence such machines. These keyboard linkages are also subject to wear and therefore must frequently be repaired.

Another difficulty and annoyance in these known keyboards is the manual effort needed to "pound the keys" for long periods of time often resulting in broken fingernails and tired and sore fingers.

Therefore, it is the primary object of the present invention to provide a keyboard which overcomes these and other difficulties attendant with the operation of such known keyboards.

Another important object of the invention is to provide a keyboard characterized by its relatively effortless and silent operation, and its simple, inexpensive construction.

More specifically it is an object of the invention to provide a light responsive keyboard operable by the interception of light beams to effect is intended purpose.

In accordance with the above objects and first briefly described, a keyboard in accordance with the present invention comprises a coordinate optical system or matrix consisting of rows and columns of "key" positions formed at the intersections of crossing light beams directed across the keyboard from two adjacent sides thereof to photo-optical devices on the opposite sides thereby to energize the photo-optical devices and to provide signals corresponding to each light beam. Interception of the light beams at their crossing points, or "key" positions, is effective through appropriate circuitry to change the signals in a manner to produce the desired results corresponding to the particular "key" position at which the beams were intercepted.

The invention may be more clearly understood when considered in connection with the preferred embodiment illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view of a typewriter partially shown in broken lines and incorporating the present invention;

FIG. 2 is a sectional view taken along the line 2-2 of FIG. 1;

FIG. 3 is a diagrammatic plan view of the invention including a portion of associated circuitry for effecting the desired result from the keyboard;

FIG. 4 is a fragmentary sectional view of a modified form of the invention in its inoperative condition; and

FIG. 5 is a view similar to FIG. 4 but showing the operative condition of this modification.

Now with particular reference to the details of the drawings, and first to FIG. 1, it will be understood that while the keyboard, designated by the numeral 10, is shown incorporated in a typewriter 12, it is also adapted for use in other business machines such as calculating machines or cash registers, or even as a remote control keyboard for effecting certain functions in associated apparatus remote from the keyboard.

The invention employs the interception of light beams

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to activate desired circuitry for actuating associated apparatus, which in the present embodiment comprises the type bars 14 of the typewriter. To this end, and with reference to FIGS. 2 and 3, it is seen that the keyboard is formed as a panel 16 with a plurality of recesses or pockets 18 disposed in rows and columns. While the recesses are shown in square shape, it will be understood that they may be formed in other suitable shapes, as desired. The recesses are numbered or otherwise designated generally in accordance with the arrangement of the keys on a normal typewriter. Certain liberties have been taken with the normal arrangement in order to simplify the description and without detriment to a clear understanding of the invention, it being understood that these are by way of example, and that other designations may be used according to the particular use of the keyboard.

Positioned across the top and the left side of the keyboard, as seen in FIG. 3, are light sources comprising a plurality of lamps L1 through L12 and L13 through L16, respectively, one for each column 1-2, 2-X, 3-C, etc. and each row 1-TAB, Q-RET, etc. Similarly a plurality of photo-optical devices, such as photocells P1 through P12 and P13 and P16, are positioned across the bottom and right side respectively of the keyboard, one for each column and row and positioned to receive light directed from the lamps through the light paths formed by the recesses and the slots or apertures 20 through the walls of the recesses. As shown in FIG. 2 the keyboard is secured within the housing shell 22 of the typewriter by suitable means, not shown. The lamps are mounted in sockets 24 carried by a flange member 26 secured to the bottom surface 27 of the keyboard panel 16 as by screws 28. The photocells are mounted on angle members 30 secured to the edges of panel 16 as by screws 32.

In its operation, as stated above, the invention employs the principle of interception of light beams to activate desired circuitry electronically thus to accomplish the conveying of information to the associated machine or other processing equipment, the typewriter in this case.

In the preferred form of the invention such interception is accomplished merely by inserting the finger tips in recesses 18 as indicated in broken lines 34 on FIG. 2. Sometimes for physiological or other reasons it is desired to have the operator press a key. In these cases the modified form of the invention shown in FIGS. 4 and 5 may be employed. Instead of the operator's finger tips intercepting the light beam, a plunger 36 is provided in each of the recesses 18 for this purpose. Each of the plungers is connected to the lower end of a connecting rod 38 extending through an aperture 39 in shell 22, and which has a key 40 on its upper end. Light spring pressure normally to maintain the key in its raised or inoperative condition, as seen in FIG. 4, is provided by a light spring 42 surrounding the rod 38 between the housing shell 22 and the key 40. Light finger tip pressure on the key is effective to depress a plunger in its recess, as seen in FIG. 5, thus to intercept the crossing light beams at any coordinate point. Removal of the pressure will, of course, permit the spring to return the plunger to its inoperative condition.

During operation of the apparatus the lamps S1 through S16 will be energized from a suitable source of electrical energy, not shown. The light beams from the lamps will pass through the slots 20 and the matrix of recesses 18 thus causing their respective photocell P1 through P16 to be in an "ON" condition. Interception of the light beams at any coordinate position in the matrix, as by a finger tip or plunger, is effective to actuate its associated utilization device, in this case a solenoid actuated type bar 14, in the manner now to be described. The circuitry for only four of the forty-eight coordinate

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positions shown in FIG. 3 has been illustrated, and as the operation of all is effected in the same manner, only one is described in detail.

In its normal condition with the lamps L1 through L16 energized, but without any light beams being intercepted, the light beam from lamp L1 passes through the column light path formed by slots 20 and recesses 18 in the 1, A, Q and Z positions to place photocell P1 in its "On" condition. Thus the positive source of voltage (+) as shown at the anode of photocell P1 would appear as a high or conducting condition at the diode D2. Also in the normal condition, the light beam from lamp L16 passes through the row light path formed by the slots and recesses in the 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, Blank and Tab Key positions causes the photocell P16 to be in the "On" condition. Thus, the source of positive voltage (+) shown at the anode of P16, appears at diode D1 causing it to be in a conducting position.

Should the light beams at the recess labeled "1" in the upper left hand corner of the keyboard be intercepted, the light beams from L1 and L16 to their respective photoelectric device P1 and P16 would be cut off. Under these conditions the positive condition would no longer appear at the anode of the diodes D1 and D2, and the mutual conduction point between the cathodes of these diodes assumes a lower voltage condition near the negative source of potential shown by the minus sign (=). This negative source is effective to operate a utilization device, which in turn causes the corresponding type bar 14 to be actuated. More specifically, an amplifier AMP, in the circuit is triggered by the drop in voltage to trigger a thyratron device T which is used to actuate a solenoid S1 to operate the type bar in a manner well known in the typewriter art, so not shown here.

From the above it is now evident that the invention provides a simply constructed, inexpensive keyboard which is characterized by its relatively effortless and silent operation enabling its substantially tireless and un-irritating operation for long periods of time.

What is claimed is:

1. A keyboard for business machines or the like comprising a coordinate matrix of crossing light beams, each beam terminating at and received by a photoelectric device energized thereby to produce an electric signal for use in an associated circuitry whereby interception of the light beams at a crossing point to prevent them from striking their associated photoelectric devices is effective to change said signals in a manner to effect action in said circuitry indicative of the particular crossover at which the beams were intercepted.

2. A keyboard for business machines or the like comprising, means establishing a coordinate matrix of crossing light beams, and photoelectric means for receiving each beam and energized thereby to produce an electric signal for use in associated circuitry whereby interception of a pair of the light beams at a crossing point to prevent them from striking their associated photoelectric device is effective to change said signals and affect said circuitry in a manner indicative of the particular crossing at which the beams were intercepted.

3. A keyboard for business machines and the like com-

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prising, means establishing two groups of light beams wherein the beams in each group are individual and separate from each other, the beams of one group crossing those of the other group from a direction substantially normal thereto, and photoelectric means for receiving light from each beam to be energized thereby to produce an electric signal for use in an associated circuit whereby interception of a pair of light beams at a crossing point to prevent them from striking the associated photoelectric device is effective to change said signals thus to effect said circuit in a manner indicative of the particular crossing at which the beams were intercepted.

4. A keyboard comprising a panel member having a plurality of apertures therein arranged in rows and columns to form a coordinate matrix, the walls of said apertures being slotted to form with said apertures light paths through said rows and columns, a source of light positioned at one end of the light paths to direct a beam of light through each of said light paths, and photoelectric means positioned at the other ends of said light paths to receive said beams of light and to produce an electrical signal.

5. A keyboard comprising a panel member having a plurality of recesses arranged in rows and columns in a surface thereof to form a coordinate matrix, the walls of said recesses being slotted or apertured to form with said recesses light paths through said rows and columns, a source of light positioned at one end of each light path to direct beams of light through each of said recesses from two directions and crossing in said recesses, photoelectric means positioned at the other end of said light paths to receive said beams of light and to produce an electrical signal corresponding to each light path, and means utilizing said signal whereby interception of said light beams at any of said recesses is effective to change said signals to operate said utilization device in a manner indicative of the recess at which the beams were intercepted.

6. A machine keyboard comprising a panel member having a plurality of recesses arranged in rows and columns in a surface thereof to form a coordinate matrix for instruction input to said machine, the walls of said recesses being slotted or apertured to form with said recesses light paths through said rows and columns, a plurality of lamps, means mounting said lamps on said panel, one at one end of each row and column to direct beams of light through said light paths to cross in said recesses, a plurality of photocells, one positioned at the other end of each row and column to receive said beams of light and to produce an electrical signal corresponding to each light path, and means for utilizing said signal whereby interception of said light beams at any of said recesses is effective to change said signals in a manner to effect operation of said utilization device in accordance with the recess in which the beams were intercepted.

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