

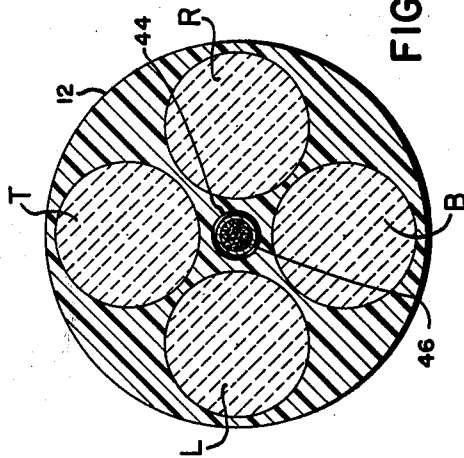
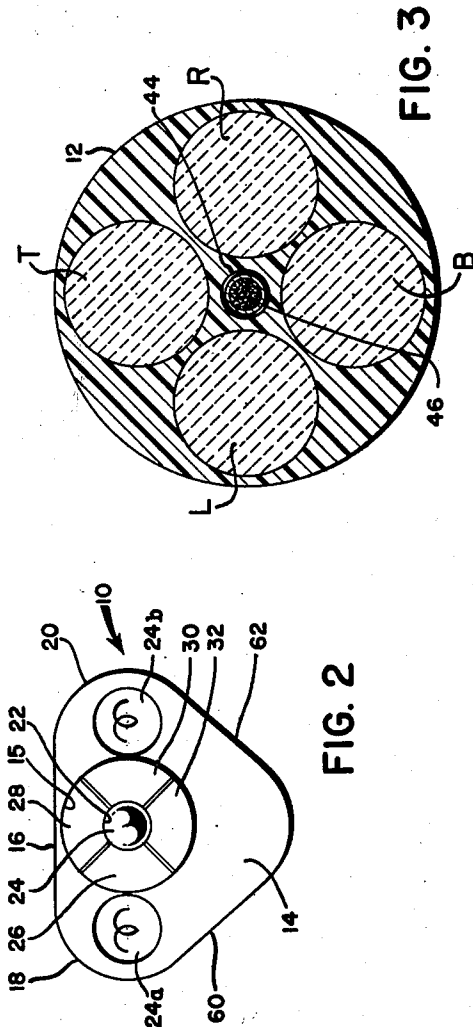
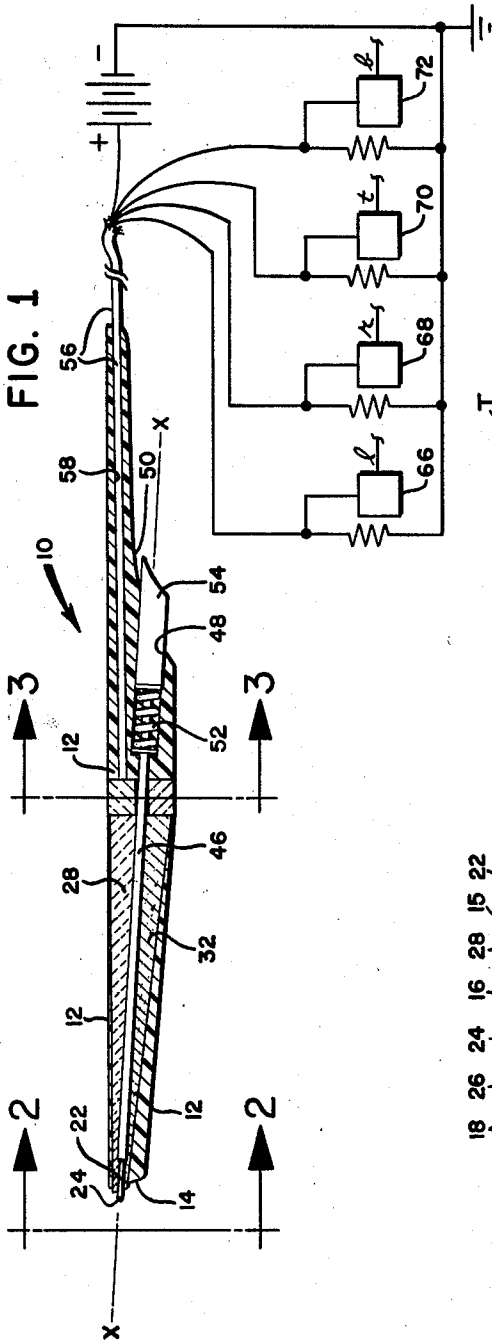
May 4, 1965

E. G. NASSIMBENE  
UTENSIL FOR WRITING AND SIMULTANEOUSLY  
RECOGNIZING THE WRITTEN SYMBOLS

3,182,291

Filed Aug. 25, 1961

3 Sheets-Sheet 1



INVENTOR.  
ERNIE G. NASSIMBENE  
BY

*Kurt H. H. H. H.*

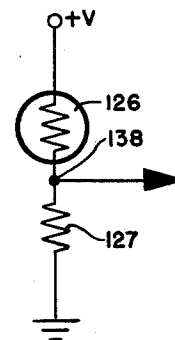
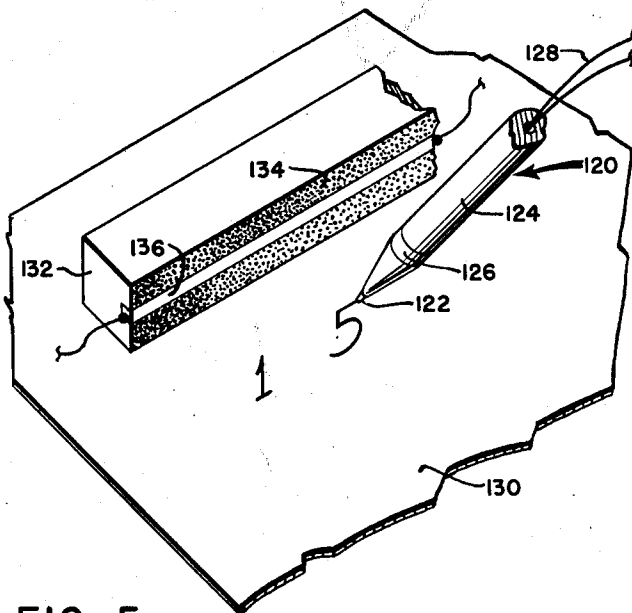
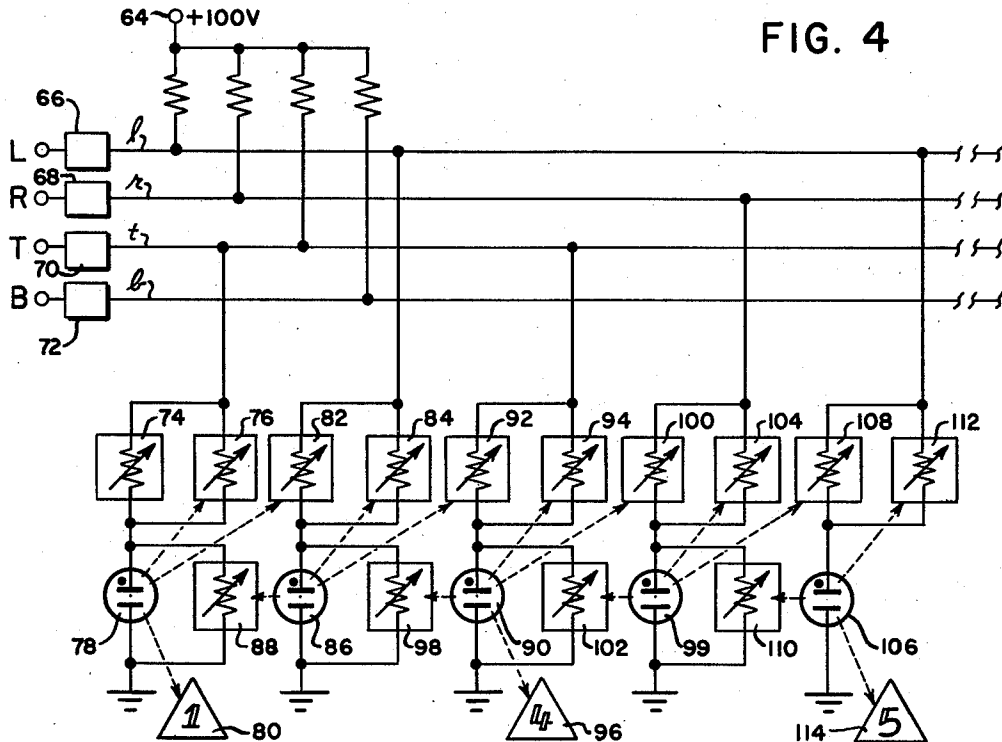
May 4, 1965

E. G. NASSIMBENE  
UTENSIL FOR WRITING AND SIMULTANEOUSLY  
RECOGNIZING THE WRITTEN SYMBOLS

3,182,291

Filed Aug. 25, 1961

3 Sheets-Sheet 2



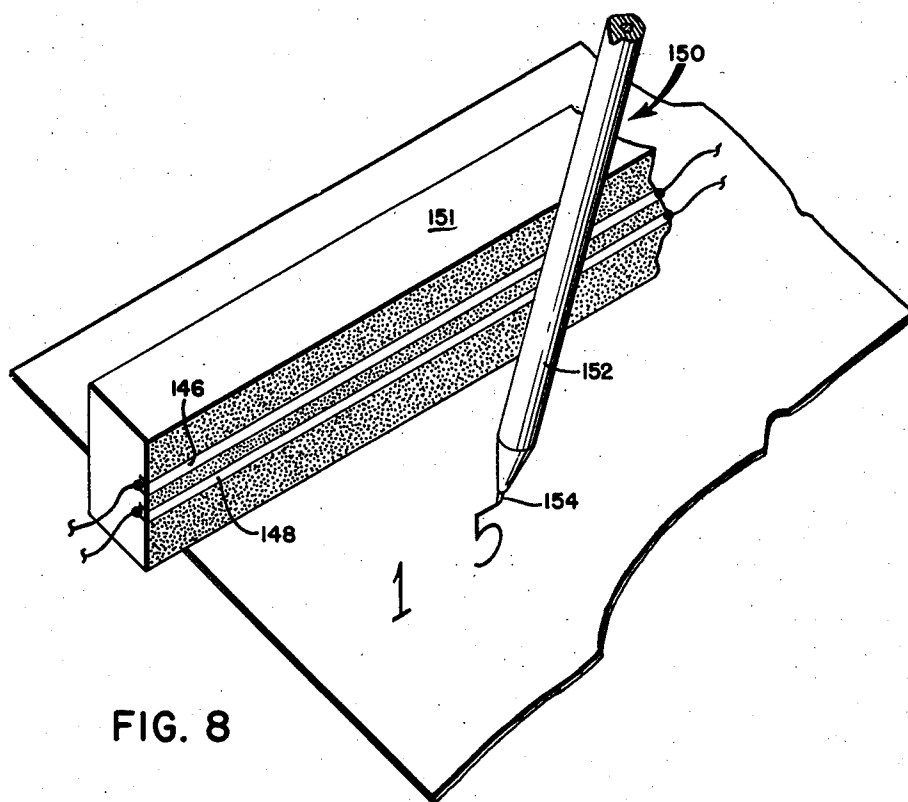
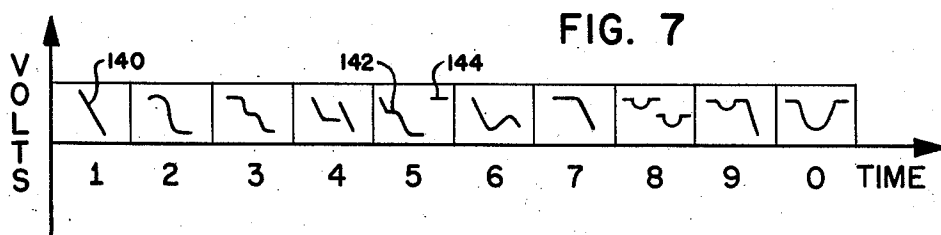
May 4, 1965

E. G. NASSIMBENE  
UTENSIL FOR WRITING AND SIMULTANEOUSLY  
RECOGNIZING THE WRITTEN SYMBOLS

3,182,291

Filed Aug. 25, 1961

3 Sheets-Sheet 3



1

3,182,291

## UTENSIL FOR WRITING AND SIMULTANEOUSLY RECOGNIZING THE WRITTEN SYMBOLS

Ernie G. Nassimbene, San Jose, Calif., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

Filed Aug. 25, 1961, Ser. No. 133,987

5 Claims. (Cl. 340-146.3)

The present invention relates to writing utensils, and aims to provide means for indicating instantaneously at remote points whatever message is being written with the utensil. There is an ever-increasing demand for devices of this type in many fields of endeavor, such as in the reservation services of transportation enterprises.

It is an object of the invention, therefore, to provide a writing utensil with means for recognizing the symbols written therewith.

More particularly, it is an object of the present invention to provide a writing utensil which recognizes a symbol as it is being written therewith, and converts it into electric pulses that permit recognition of the symbol and immediate conversion of said pulses into the same symbol at points remote from the place of writing.

Another object of the invention is to provide a utensil of the type referred to that is of simple construction and convenient to handle.

Yet another object of the invention is to provide an arrangement for representing written characters by electric pulses as they are being written and for indicating by said pulses at a remote point the characters which they represent.

These and other objects of the present invention will be apparent from the following description of the accompanying drawings which illustrate certain preferred embodiments thereof and wherein

FIGURE 1 is a longitudinal section through a writing utensil embodying my invention;

FIGURES 2 and 3 are enlarged cross-sections through the utensil taken along lines 2-2 and 3-3, respectively, of FIGURE 1 and viewed in the direction of the arrows associated with said lines;

FIGURE 4 is a circuit diagram of an arrangement for indicating characters written by the utensil at points remote from the place of writing;

FIGURE 5 is an isometric view of a modified embodiment of the invention;

FIGURE 6 is a circuit diagram representing the electric components of the writing utensil shown in FIGURE 5;

FIGURE 7 is a chart illustrating the characteristic voltage variations obtained from the utensil shown in FIGURE 5 when writing the ten Arabic characters of the decimal system; and

FIGURE 8 is an isometric view illustrating yet another embodiment of the invention.

In accordance with the invention I provide a writing utensil, such as a pencil or fountain pen, with a source of light so located as to illuminate the area upon which the point of the utensil writes, and I arrange around the center axis of said utensil a plurality of photo-sensitive elements that are exposed to the light reflected from the writing area and respond to changes in the brightness of said area caused by the ink path that is layed thereon as the utensil is employed to write letters or characters upon it; and depending upon the direction of movement of the

2

utensil necessary in writing a certain symbol, any newly formed line is exposed to, and causes a variation in the resistance of a particular one of said photo-sensitive elements. Hence, every letter or character, as it is being written, affects the photo sensitive elements of the utensil in a characteristic sequence by which it may be identified and which may be employed to indicate the character at a remote point.

Having now reference to FIGURE 1, the utensil 10 of the invention comprises an enclosure 12 of plastic material, wood or the like, which may have the form of a fountain pen. The front end 14 of the utensil has the shape of an equi-lateral triangle with rounded corners as shown in FIGURE 2, and slidably received in an aperture 15 provided in said front end adjacent the flat top 16 thereof and midway between its rounded corners 18 and 20 is the tubular writing pin 22 which carries the ball point 24. Located in said corners 18 and 20 at either side of the writing pin 22 are two miniature light bulbs 24a and 24b. Arranged within the enclosure 12 concentrically around a longitudinal axis  $x-x$  determined by the writing pin 22, are four tapering rods 26, 28, 30 and 32 of a light-conducting material such as the material known under the trade name Lucite. The front ends of said rods rest in the annular window 15 provided in the front wall 14 of enclosure 12 around the pin 22, and the rear ends of said rods terminate adjacent four photo sensitive elements L, T, R and B, respectively, that are arranged within the enclosure 12 at annularly equi-spaced intervals about the longitudinal axis  $x-x$  in a region about midway between the opposite ends of said enclosure (FIGURES 1 and 3). The rods 26, 28, 30 and 32 and the photo sensitive elements L, T, R and B define a centrally located tubular space 44 for the reception of the ink cartridge 46 which carries at its front end the hereinbefore mentioned writing pin 22. For inserting said cartridge into space 44, a suitable aperture 48 is provided in the arched rear wall 50 of the enclosure, and outer portion of said aperture may be radially expanded to form a chamber for the reception of the usual spring 52 that opposes ordinarily projection of the writing pin 22 beyond the aperture 15 in the front end of the pen; and a latchable plug 54 may slidably be received in the outer end of the chamber 48 in the conventional manner to effect projection of the writing pin 22 upon depression, and to maintain said pin in projected position as long as it is desired. The electric leads for the bulbs 24a and 24b in the front end 12 of the pen and for the photo sensitive elements in its middle may be combined into cable 56 that passes through a longitudinally extending passage 58 in the rear half of the pen to the outside, as shown in FIGURE 1.

Due to the cross sectional contour of the front half of the pen, it can only be used in the position illustrated in FIGURE 2, i.e. with the writer's index finger resting upon the flat top surface 16 thereof, and his thumb and middle finger engaging the converging flanks of the utensil defined by the sides 60 and 62, respectively, of triangle 14.

As apparent from FIGURES 2 and 3, the photo sensitive elements L, T, R and B and the tapering rods 26, 28, 30 and 32, respectively, which conduct light from the area adjacent the tip of the pen to said elements, are arranged in such a manner that they form observation posts at the left side of, above, at the right side of, and

below the ball point 24, which view the areas to the left, above, to the right, and below the ball point when said point is employed to form symbols in ink upon a suitable base. Thus, when the point of the pen is set upon a white sheet of paper and moved to mark out a descending line, such as is the case when the character "1" is written upon the sheet, the top element T registers a reduction in the amount of light initially transmitted to it through rod 28, since the front end of said rod passes over the written line directly after it is formed by the point of the pen. When the pen is used to write the character 2, however, it is first moved to the right which causes the left photo sensitive element L to register a decrease in illumination, then it is moved downwardly causing the photo sensitive element T at the top to register a decrease in illumination, and finally it is again moved to the right which causes the left photo sensitive element L to register another decrease in illumination. Thus, in writing with the utensil of the invention, any character or letter written upon a bright base affects one, some, or all of the photo sensitive elements in a characteristic manner or sequence.

The changes in the conductivity of the photo cells thus effected are sensed in the customary manner as voltage changes in suitable circuitry, and by transmitting any voltage changes produced by illumination variations of the photo cells in the proper sequence to a remote place, the characters or letters written by the pen of my invention may be identified, and/or visibly reproduced at the remote place at practically the same moment as they are being written.

When employing the particular embodiment of the invention illustrated in FIGURE 1, which has four angularly equi-spaced observation points arranged above, below and at either side of the tip of the pen, as illustrated in FIGURES 2 and 3, the writing of the ten Arabic symbols of the decimal system causes the four photo cells to respond in the following characteristic sequences:

1-T	4-TL-TB(RL)	7-LT
2-LTL	5-TLTL-L	8-RTLRL-RTLBRTL
3-LTRLTR	6-TLBRB	9-RTLTL
	0-RTLBRL	

In the above table, the symbol "-" means that the pen has been lifted from the paper for a brief moment, and the bracket ( ) means that the photo cells enclosed in the bracket respond at the same time, i.e., they both "see" the line formed.

FIGURE 4 illustrates by way of example suitable circuitry for indicating visibly at a remote point characters written with the utensil of the invention shown in FIGURES 1, 2 and 3. For the sake of simplicity, FIGURE 4 shows only the circuitry necessary to indicate the Arabic characters 1, 4 and 5. Said circuitry comprises four lines *l*, *r*, *t* and *b* corresponding to the four photo sensitive elements L, R, T and B, respectively, of the utensil 10 and applied to said lines is a predetermined voltage, say 100 volts, from a source indicated at 64. Through suitable intermediate circuitry represented by the blocks 66, 68, 70 and 72 (FIGURES 1 and 4) the photo sensitive elements of the writing utensil operate to increase the voltage in the corresponding lines *l*, *r*, *t* and *b*, respectively, whenever the appearance of a dark line on the light-reflecting surface viewed by said photo sensitive elements reduces the illumination and hence increases the resistance of one or the other of said photo sensitive elements.

Connected in series between the line *t* controlled by the photo sensitive element T, and ground are two parallel photo conductors 74 and 76 and a glow discharge tube 78. The "dark" resistance of said photo conductors is so chosen that the discharge tube 78 will not fire under the voltage normally carried by line *t*. The photo-conductor 74 acts as the start switch of the system; and upon illumination of said photo-conductor by means of a suitably placed, controlled source of light (not shown), the resistance of said conductor is lowered to a level whereat a slight in-

crease in the voltage carried by line *t* will cause the tube 78 to fire. The system is thus readied for operation.

Let it now be assumed that the pen 10 is used to make a downward stroke upon a piece of white paper. This causes its top most photo cell T to register a decrease in illumination which is effective to increase the voltage in line *t* and as a result thereof, the discharge tube 78 fires and begins to glow. The second photo conductor 76 is arranged in such a manner that it is exposed to the light emitted by discharge tube 78 as indicated by a dotted arrow in FIGURE 4. Hence, when the tube 78 glows, the resistance of said second photo conductor 76 drops to an extent wherein the voltage ordinarily carried by line *t* is sufficient to keep the discharge tube 78 illuminated; in other words, the second photo conductor 76 acts as an operational latching device for discharge tube 78 causing said tube to glow even if illumination of the first photo conductor 74 should cease. If a downward stroke is the only writing performed by the utensil of the invention, the character written with said utensil is obviously as Arabic "1." The glow discharge tube 78 may therefore be arranged to illuminate a signalling device bearing the character :1: as schematically indicated at 80 in FIGURE 4.

Let it be assumed, however, that the writer wishes to write the character "4," in which case the initial downward stroke of the pen 10 is followed by a horizontal stroke to the right. This stroke reduces the illumination of the left photo cell L of the pen and causes an increase in the voltage carried by line *l*. Connected in series between line *l* and ground are two parallel photoconductors 82 and 84 and another glow discharge tube 86. The photo conductor 82 is exposed to the first-mentioned tube 78 as indicated by a dotted arrow in FIGURE 4 so that its resistance is lowered and the second discharge tube 86 thus readied for firing whenever said first tube 78 is illuminated. Hence, whenever the pen 10 is moved to the right and the voltage in line *l* increases, the second tube 86 fires and begins to glow, and the light from said tube illuminates the second photo conductor 84 so that the tube 86 is latched in operating condition.

Tube 86, however, is arranged to illuminate yet another photo conductor 88 that is shunted across the first tube 78 as indicated by a dotted arrow in FIGURE 4. Hence, whenever the second tube 86 lights up, the current from line *t* to ground is shunted around the first tube 78 and said tube goes out and extinguishes the sign 80 indicating that the pencil is being used to write more than just a downward stroke. Since a horizontal stroke added to a downward stroke does not complete an Arabic character, there is no sign associated with the second glow tube 86. In completing the character "4," the horizontal stroke to the right is followed by a final downward stroke. Connected between line *t* and ground is therefore another glow discharge tube 90 in series with two parallel-connected photo conductors 92 and 94 corresponding in function to photo conductors 82 and 84 of tube 86. Said tube 90 illuminates a sign 96 showing the character "4" when it lights up. At the same time it lowers the resistance of a photo conductor 98 shunted across the second tube 86, and in this manner causes said second tube to go out.

Let it now be assumed that the writer marks the character "5" upon the paper. As is apparent from the hereinafore given table of the characteristic sequences in which the resistances of the photo sensitive elements of pen 10 are varied when writing the Arabic characters, the reaction of the photo sensitive elements of the pen 10 in writing the character "5" differs from the reaction thereof in writing the character "4" by two additional resistance changes, one in photo cell R and a final one in photo cell L when the horizontal top stroke is added to the character. Therefore, yet another glow discharge tube 99 is connected in series with a photo conductor 100 between line *r* and ground. When the directly preceding glow discharge

5

tube 90 is illuminated, the resistance of photo conductor 100 is lowered and glow discharge tube 99 is readied for operation. Now, as soon as the writer moves the pen to the left, glow discharge tube 99 fires and extinguishes the preceding glow discharge tube 90 by illuminating a photo conductor 102 that is shunted across said preceding glow discharge tube. At the same time it latches itself in operative condition by illuminating a photo conductor 104 that is connected in parallel with photo conductor 100. Since the sequence of reactions of the photo conductors, which results in the illumination of glow discharge tube 99 does not complete a character, there is no signaling device associated with glow discharge tube 99.

Connected between line *l* and ground is yet another glow discharge tube 106 in series with a photo conductor 108 that is exposed to the directly preceding glow tube 99 and which readies glow tube 106 for operation whenever said preceding glow tube 99 is illuminated. When the writer marks out the final horizontal stroke of character "5," and the voltage in line *l* increases as a result thereof, glow discharge tube 106 fires, and causes the preceding glow discharge tube 99 to go out by illuminating a photo conductor 110 that is shunted across said preceding discharge tube. It also latches itself in illuminated condition by illuminating a photo conductor 112 that is connected in parallel with the photo conductor 108 and therefore continues to glow, even after the voltage in line *l* has returned to its normal value, to illuminate a signaling device 114 which displays the character "5."

Other character display arrangements operative in response to characteristic sequences in resistance changes of the photo cells comprised in the utensil of my invention will readily occur to those skilled in the art.

FIGURE 5 illustrates another embodiment of the invention which is of a simpler construction than the embodiment illustrated in FIGURES 1, 2 and 3, but depends upon an external source of light. The reference numeral 120 identifies a writing utensil which may be a pen or pencil, and which has a writing point 122. Arranged around the stem 124 of the utensil in an area adjacent its point 122 is an annular photo-sensitive element 126 which forms part of a detector circuit such as illustrated in FIGURE 6, through the leads indicated at 128 in FIGURE 5. Placed upon the sheet of paper 130 upon which it is intended to write, is an elongated block 132 which may be of wood, plastic, or metal, and which has a dark front surface as shown at 134. Set into said surface is a horizontally disposed strip-shaped source of light 136 which may be formed by a neon light or merely a strip of light-reflecting foil or paint. When writing with utensil 120 upon sheet 130, the voltage developed at point 138 (FIGURE 6) of the photo-cell circuit depends upon the degree of illumination of the photo cell 126, which in turn depends upon the propinquity of the pencil 120 to the source of light 136. Hence, as the pencil is moved closer to, and/or farther away from said source of light in writing a character or letter upon the sheet of paper 130 in the area directly below block 132, a characteristic voltage change develops at point 138 of the detector circuit depending upon the particular character or letter written at the moment.

The chart of FIGURE 7 shows these characteristic voltage changes plotted against time for the ten Arabic characters of the decimal system. For instance, when the character "1" is written, the writing utensil is withdrawn from the source of light which causes the resistance of the photo cell 126 to increase and consequently the voltage developed across resistor 127 of the detector circuit decreases as indicated by the slanting rectilinear line 140 in FIGURE 7. On the other hand, when the character "5" is written, the pencil is first withdrawn from the source of light, then it moves for a brief period almost parallel to the source of light, whereupon it is again withdrawn from said source of light only to move again in a nearly parallel direction to said source. As a result there-

6

of, the voltage developed at point 138 drops in two steps as indicated at 142 in FIGURE 7. In finishing the character "5," the pencil is returned to its initial position close to the source of light and is briefly moved parallel to said source causing a brief uniform pulse of a relatively high voltage to appear after line 142, as indicated at 144 in FIGURE 7. Thus, every character or letter produces its characteristic voltage change at point 138, which may be transmitted to a distant point and may there be recognized in suitable circuitry and reconverted by conventional mechanism into the symbol which it represents.

While the writing utensil illustrated in FIGURE 5 is of a simpler construction than the writing utensil illustrated in FIGURES 1, 2 and 3, it has the disadvantage of requiring an external source of illumination. This may make it necessary to move the block 132 further down the sheet of paper whenever a new line is commenced so as to obtain responses of equal distinctness from the detector circuit. Alternatively, means may be provided for moving the paper in steps past the source of light whenever the writer has completed a line.

FIGURE 8 shows yet another embodiment of the invention. In said embodiment, both the source of light 146 and the photo-sensitive element 148 are located externally of the writing utensil 150 and are mounted upon a suitable support 151 in such a manner that the former has ordinarily no significant effect upon the latter. The actual utensil is provided with a light reflecting outer surface 152 near its writing point 154 so that it may reflect the light received from the lamp 146 onto the photo cell 148. The embodiment of the invention illustrated in FIGURE 8 operates in a manner very similar to the embodiment illustrated in FIGURE 5, over which it has the advantage of free movability because the writing utensil 150 does not require any electrical leads. However, as compared with the embodiment of the invention illustrated in FIGURE 1, it has the same disadvantages as the embodiment illustrated in FIGURE 5 in that a member supporting both the source of light 146 and the photo-sensitive element 148, must be moved upon the sheet of paper whenever a new line is commenced, in order to obtain equally strong character identifying responses for all the lines written upon the paper.

While I have described my invention with the aid of certain preferred embodiments thereof, it will be understood that the invention is not limited to the specific constructional details shown and described by way of example, which may be departed from without departing from the spirit and scope of the invention.

Now, having described my invention, what I claim is:

1. Arrangement for indicating written symbols at a point remote from where they are being written comprising the combination of a member containing a source of light, with a writing utensil having a writing point, a light-sensitive element in an area exteriorly adjacent to said point, and a circuit containing said light-sensitive element for developing voltages varying in response to variations in the degree of illumination of said light-sensitive element by said source of light.

2. Arrangement for indicating written symbols at a point remote from where they are being written comprising the combination of a member containing a horizontally disposed strip-shaped source of light, with a writing utensil having a writing point, an annular light-sensitive element arranged exteriorly around said utensil in an area adjacent to said point, and a circuit containing said light-sensitive element for developing voltages varying in response to variations in the degree of illumination of said light-sensitive element as said utensil is moved closer to and farther away from said source of light.

3. Arrangement according to claim 2 wherein said source of light is a strip-shaped light reflecting surface.

4. A utensil for writing and at the same time recognizing the written symbols comprising a stem, a writing point at one end of said stem, and a light-sensitive element ar-

ranged exteriorly on said stem in an area adjacent said point.

5. A utensil for writing and at the same time indicating the written symbols at a remote point as they are being written, comprising a stem, a writing point at the end of said stem, an annular light-sensitive element arranged exteriorly around said stem in an area adjacent said point, and a circuit containing said light-sensitive element for

developing varying voltages as the position of the utensil relative to a source of light is varied.

References Cited by the Examiner

UNITED STATES PATENTS

2,420,716	5/47	Morton	-----	250—277
3,078,373	2/63	Wittenberg	-----	250—213

MALCOLM A. MORRISON, *Primary Examiner.*