

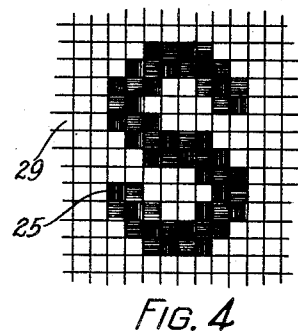
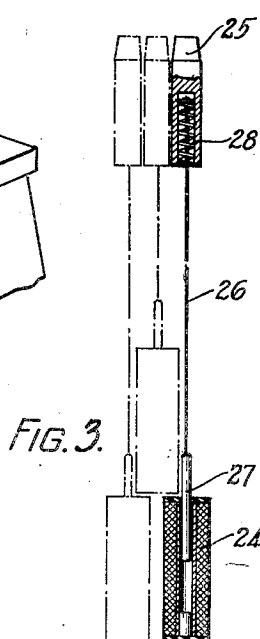
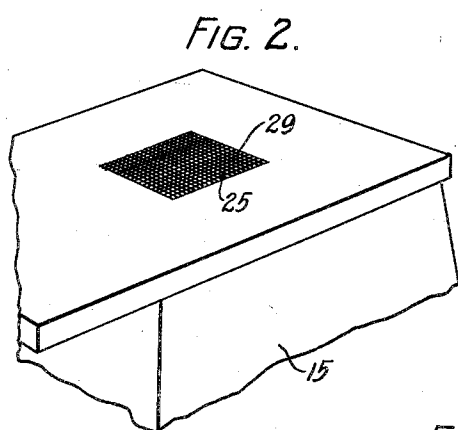
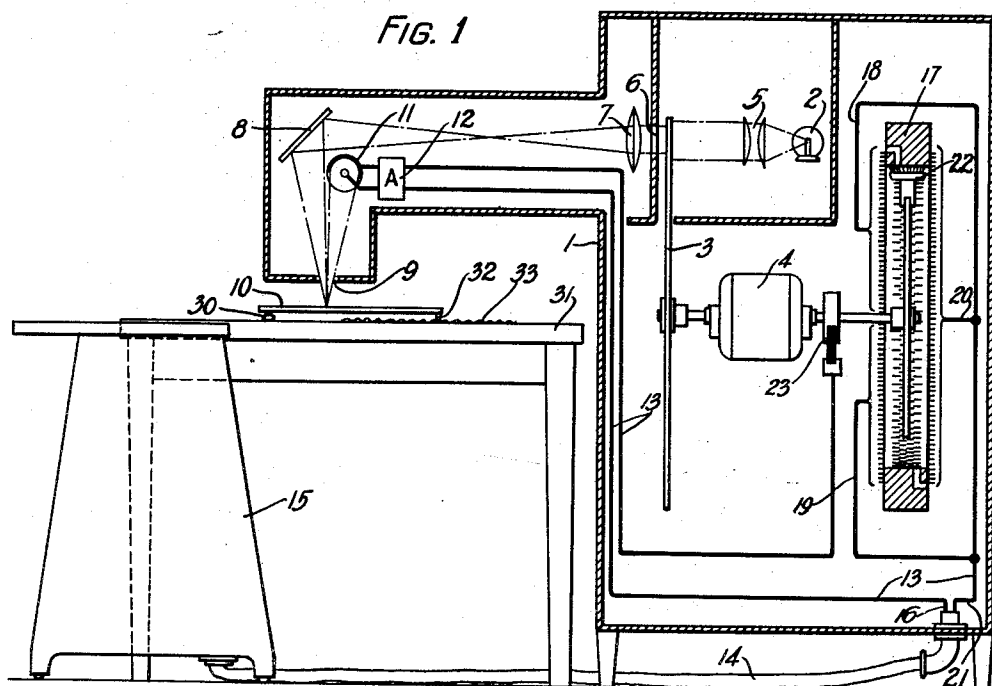
Nov. 29, 1932.

H. C. SNOOK

1,889,576

APPARATUS TO ENABLE THE BLIND TO READ

Filed Nov. 9, 1928



INVENTOR
H. C. SNOOK
BY *C. Sprague*
ATTORNEY

UNITED STATES PATENT OFFICE

HOMER C. SNOOK, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

APPARATUS TO ENABLE THE BLIND TO READ

Application filed November 9, 1928. Serial No. 318,125.

This invention relates to systems and devices for producing in relief a representation of written or printed characters, two-tone drawings, pictures, etc., and particularly to an arrangement for enabling a blind person to read ordinary news print or book print by the sense of touch.

An object of the invention is to produce in relief by optical, electrical and mechanical agencies, a representation of written or printed characters, two-tone pictures, line cuts, zinc etchings, half tone illustrations, etc., and a further object is to produce for the use of blind persons representations of this general character in which the reproduced field at any instant is of large size compared with discernible details therein, such as a portion of a printed page, whereby the blind person, by the sense of touch may readily comprehend the relationship of the various portions of the field as well as the character of each portion.

Television has already been accomplished by directing light through one aperture at a time of a scanning disc and causing the light beam thus formed to sweep across the field of view from which a portion of the light is diffusely reflected to a photoelectric cell or cells; the photoelectric currents thus generated being transmitted, after amplification, to the receiving station and there caused to control a bank of lamps which are successively associated with the transmission line by a rotary distributor or switch which rotates synchronously with the scanning disc. It has been suggested that, in place of lamps, in a system of this type, a bank of plungers be provided which are successively moved more or less into the path of a beam of light positioned to illuminate the front of the bank. The amount of light reflected from the face of each plunger is then determined by its position. In accordance with the present invention such a television system is modified in a manner which adapts it to the use of persons who are blind. In place of the lamp bank or the bank of reflecting plungers a bank of small plungers is provided, each plunger of which may be displaced a slight amount so that the displacements may be de-

tected by the sense of touch. Furthermore, whereas in a television system the persistence of vision is relied upon to produce the illusion of continuous motion, the entire field of view being reproduced from 16 to 20 times per second, in accordance with this invention the speed of scanning is in general reduced. For example, a few square inches of a newspaper or other printed page may be placed opposite an opening through which a scanning beam passes. The scanning beam has a cross sectional area less than the smallest element of detail in the printed character that it is desired to resolve. The bank of movable elements may consist of a bank of small rods or plungers which may be pushed up through the action of electromagnets individual thereto, these electromagnets being successively operated (through relays if necessary) by means of a synchronous switch mounted on the same shaft as the scanning disc.

The invention will be better understood from the following description of the embodiment herein chosen for the purpose of illustration, and the accompanying drawing in which

Fig. 1 is a diagrammatical elevational view, partly in section of apparatus for carrying out the invention;

Fig. 2 is a detail perspective view of a portion of the table in the top of which is fitted the bank of plungers;

Fig. 3 is a diagrammatic enlarged detail view of a plunger and its actuated magnet, with the positions of adjacent plungers and magnets indicated in broken lines; and

Fig. 4 is an enlarged view of a portion of the reproduced field showing the letter S in relief.

Referring to Fig. 1, the apparatus comprises a cabinet 1 which contains all of the apparatus except the bank of plungers and its actuating magnets and the means for holding the paper or drawing or other matter to be "read". The apparatus within cabinet 1 is similar to that disclosed in U. S. patent of F. Gray, No. 1,759,504, of April 6, 1927, and in U. S. patent application of F. Gray, Serial No. 227,649, filed October 21, 1927,

(which is a continuation of Serial No. 181-538, filed April 6, 1927), but with the transmitting and receiving television apparatus brought together and simplified and the receiving lamps omitted. A lamp 2 supplies the light for scanning. A scanning disc 3 rotated by motor 4 has the usual row of apertures arranged spirally near its periphery, through which passes light collected by the lens 5. The beams thus formed pass through the rectangular opening 6, lens 7 to mirror 8 and thence through opening 9 in the cabinet wall to the object 10 to be scanned. As one aperture after another of the scanning disc sweeps across the opening 6, thin beams or pencils of light rays sweep in parallel lines across the portion of the object which is being scanned. Photoelectric cell 11 collects a part of the light reflected from the object. If the object is ordinary news print, very little light is reflected from the print and a maximum amount from the white surface of the paper. The corresponding photoelectric current variations of different amplitude are amplified by amplifier 12, and pass over line 13, a portion of which is in the form of a cable 14 to the table or cabinet 15 containing the reproducing apparatus. One side of the circuit 13 within cable 14 is a single conductor 16 while the other side 21 consists of as many conductors as there are plungers in the reproducing apparatus, these conductors being successively brought into circuit. These conductors originate in the contacting segments of distributor 17, are then formed into three groups represented by lines 18, 19 and 20 and together form the conductor 21. The moving contact element 22 of distributor 17 is on the shaft of motor 4. While an aperture of disc 3 is passing across opening 6, contact element 22 will successively associate a large number of conductors 21 with line 13, the circuit being completed through brush 23. For purposes of illustration it may be assumed that there are 25 apertures in disc 3 and 25 contacts in distributor 17 for each aperture, making a total of 625 contacts. One end of the line 21 terminates within the cabinet 15 in an electromagnet 24 (Fig. 3) controlling the plunger 25 through rod 26. Electromagnet 24 has an armature 27 of the plunger type which projects upwards beyond the winding when the magnet is not energized and is drawn downward upon the energization of the magnet. Spring 28 tends to throw plunger 25 upward but the plunger is normally in its depressed position when a white surface is underneath the opening 9 of cabinet 1, magnets 24 then being energized. The plungers 25 are banked together with their uppermost faces in the same plane and are supported in an opening 29 (Fig. 2) in the top of cabinet 15 with the plunger faces flush with the upper surface of the cabinet top when the magnets 24

are energized. Alternate rows of magnets 24 may be arranged in staggered relation as indicated in Fig. 3 to conserve space.

An enlarged top view of a portion of the upper surface of the plunger 25 is shown in Fig. 4, each square representing a plunger. Actuated plungers are shown in black and unactuated in white. The plungers are actuated to reproduce the letter S.

The object to be scanned such as a newspaper is placed upon a light movable frame work 30 which may be in turn supported on top of a table 31. Frame work 30 may be readily moved by hand, the rear legs 32 registering with one or another of the grooves in the corrugated element 33 attached to the top of table 31. Cabinet 15 is movable with respect to the table 31 and is preferably of the same height.

The operation of the apparatus is as follows. The blind person who wishes to read newspaper print, for example, takes a seat to the left of table 31 with his left hand in position to move frame work 30 upon which the newspaper 10 rests and with his right arm resting on the top of cabinet 15 in such position that the fingers of his right hand rest upon the top of the bank of plungers 25. Motor 4 and the other apparatus within the cabinet 1 is kept in operation by an attendant. The portion of the paper underneath the opening 9 is then repeatedly scanned by the light beam, as in television operation. The scanning period, however, may be greater. Assuming that there are 25 apertures in the scanning disc 3 and 625 of the plungers 25, there are 625 elemental areas in the portion of the newspaper which is being scanned at any one time. This portion may, for example, comprise a strip of news print surface one-half inch square. The blind person wishing to read the first column of news print beginning at the top would move the newspaper supporting member 30 toward him until the upper white margin of the news sheet is reached, which is indicated to him by the depression of all of the plungers 25. In doing this the legs 32 move over the elevations of the corrugated surface 33. He then moves support 30 away from him until the first line of print comes well within the field of view. Support 30 is then moved to his right until the left hand margin is reached. The first word of the first column of print is then in the field. Adjacent words and the lines below are also in the field. The carriage 30 is then moved to his left at an approximately uniform rate while the fingers of the right hand explore the plunger tops 25. As each elemental area is scanned the corresponding plunger is maintained in a depressed position if the elemental area is white and is slightly elevated if the area is black. As the scanning takes place very rapidly each letter is quickly reproduced as

it enters the field. A single line only will, of course, be read at one time but it is of material assistance to the reader to have adjacent lines also within the field whereby if the support 30 is accidentally misguided to a slight amount the position can be corrected through the sense of touch.

The operation of the mechanism within the cabinets 1 and 15 should be apparent from the above description of this apparatus. When the scanning beam is upon one of the elemental areas of the field of view which is at that moment white, a maximum amount of light is reflected from this area and the photoelectric current which is amplified in amplifier 12 passes over line 13. At this particular instant the movable contact 22 of distributor 17 is upon the stationary contact which controls the electromagnet 24 which operates the plunger 25 corresponding to that elemental area, causing it to be depressed. In the same way, as the scanning proceeds, the various stationary contacts of distributor 17 are brought successively into contact with movable contact 22 and in this manner all of the electromagnets controlling the plungers 25 are successively brought into operation.

The apparatus herein shown by way of illustration may obviously be modified in many respects without departing from the spirit of the invention. For example, if the available current through distributor 17 is not large enough to effectively operate magnets 24 a relay may be inserted in circuit with each electromagnet. It may sometimes be desirable to have the electromagnets 24 of such size that rods 26 will slightly converge upwardly. The electromagnets 24 may take any form which will best serve the purpose in hand. Frame work 30 may be omitted, in which case the reader guides the subject matter scanned by noting any slight movement of the line of print in a direction to take it out of the scanning field and immediately corrects the direction of movement. A little practice will enable this to be readily accomplished.

What is claimed is:

1. A device for enabling a blind person to read, comprising light sensitive means, optical means for scanning a field of view in which the matter to be read is placed and for affecting said light sensitive means in accordance with the tone values of the elemental areas of said field of view to set up current variations, a large number of compactly arranged movable elements in the form of a bank and means controlled by said variable current for displacing selected ones of said movable elements in accordance with the variations in said current to produce a representation in the form of the characters scanned which may be read by touch.

2. A device for enabling a blind person to

read, comprising light sensitive means, optical means for repeatedly scanning a plurality of times per second, a field of view in which the matter to be read is placed and for affecting said light sensitive cell to generate current varying in accordance with the tone values of elemental areas of said field, a large number of compactly arranged movable elements in the form of a bank, and means controlled by said variable current for repeatedly displacing at the rate at which said field is scanned, selected ones of said movable elements for producing a representation in the form of the characters scanned which may be read by touch.

3. Means for enabling a blind person to read, comprising a beam of light for repeatedly scanning a plurality of times per second, a field of view in which the matter to be read is placed, light sensitive means receiving light reflected from said field of view, a transmission line associated with said light sensitive means, a large number of compactly arranged movable elements in the form of a bank, actuating means controlled by the current in said transmission line for displacing selected ones of said elements for producing a representation in the form of the characters scanned which may be read by touch, a circuit for each of said actuating means, and means operating synchronously with said scanning means for selectively operating said circuits of said actuating means.

4. Means for enabling a blind person to read, comprising a beam of light for repeatedly scanning a plurality of times per second, a field of view in which the matter to be read is placed, light sensitive means receiving light reflected from said field of view, a transmission line associated with said light sensitive means, a large number of compactly arranged movable elements in the form of a bank, actuating means controlled by the current in said transmission line for displacing selected ones of said elements for producing a representation in the form of the characters scanned which may be read by touch, a circuit for each of said actuating means, and means mechanically coupled to the movable elements of said scanning means for synchronous operation therewith for selectively operating said circuits of said actuating means.

5. A device for enabling a blind person to read, comprising light sensitive means, optical means for scanning a field of view in which the matter to be read is placed and for affecting said light sensitive means in accordance with the tone values of the elemental areas of said field of view to set up current variations, a large number of compactly arranged movable elements in the form of a bank, means for holding said movable elements with their faces in alignment when the field of view has its maximum tone value, and means controlled by said variable cur-

rent for projecting forward selected ones of said movable elements in accordance with the variations of current to produce a representation in the form of the characters scanned which may be read by touch.

5 6. Means for enabling a blind person to read, comprising a beam of light for repeatedly scanning a plurality of times per second, a field of view in which the matter to be read is placed, light sensitive means receiving
10 light reflected from said field of view, a transmission line associated with said light sensitive means, a large number of compactly arranged movable elements in the form of a
15 bank, means for maintaining the faces of said elements in alignment when the field of view has its maximum tone value, actuating means controlled by current in said transmission line for displacing forwardly selected ones
20 of said elements for producing a representation in the form of the characters scanned which may be read by touch, a circuit for each of said actuating means, and means mechanically coupled to the movable elements of
25 said scanning means for synchronous operation therewith for selectively operating said circuits of said actuating means.

In witness whereof, I hereunto subscribe my name this 8th day of November, 1928.

30 HOMER C. SNOOK.

35

40

45

50

55

60

65