The Type-Reading Optophone

An Instrument Which Enables the Blind to Read Ordinary Print

THE SCIENTIFIC AMERICAN SUPPLEMENT *of August* 3, 1912, *contained a description of an instrument for converting light into sound, which was designed to enable the blind to see by ear. This instrument, known as the optophone, was the invention of Dr. E. E. Fournier d'Albe of Birmingham University. Dr. d'Albe later developed a type-reading instrument by which the blind could read large print. Recently the instrument has been greatly improved in coöperation with Messrs. Barr and Stroud of Glasgow, the well-known instrument makers. It can now be adjusted for any ordinary type.*

FIG. 1. A BLIND MAN READING BY EAR

The following description of the instrument is taken from an article by Dr. d'Albe appearing in Nature (London). We are indebted to the author and to Nature for the photographs reproduced herewith. The drawing on the opposite page is taken from The Electrician (London), which contains a very complete description of the optophone in the issue of August 13, 1920.—EDITOR.

The general principle of the apparatus is shown by Fig. 2. A siren disk, D, is run at about 30 revolutions a second by means of the small magneto-electric motor shown. It contains five circles of square perforations, the innermost circle having twenty-four perforations, the outermost forty-two, the other circles being intermediate and corresponding to the relative frequencies of certain notes of the diatonic scale. A line of light in a radial direction is provided by the festoon lamp L, and the image of the filament of this lamp is thrown upon the print by a system of three lenses on the other side of the selenium tablet S. The axis of the concavo-convex lens C is slightly tilted out of the axis of the other lenses for a purpose which is specified below. The general result of the optical system is to give a line of luminous dots on the print, each dot having a different musical frequency. The light constituting these dots is diffusely reflected back on to the selenium, which is put in circuit with a battery and a high-resistance telephone receiver. Those dots which fall on white paper produce a note of their own musical frequency in the telephone, while those which fall on black are extinguished. We thus get what may be called a "white-sounding" optophone, in which the black letters are read by the notes omitted from the scale rather than by the notes which remain sounding. All the reading demonstrations hitherto undertaken have been given with a "white-sounding" optophone.

A modification of this principle, introduced by Messrs. Barr and Stroud in consultation with the writer, is the provision of a second selenium preparation in the form of a cylindrical rod, the top of which can be seen at B (Fig. 2). This rod receives the light reflected by the concave surface of the lens C, which produces a real image of the line of dots on a generator of the cylindrical rod, and by turning this rod about its axis the image can be made more or less effective as desired. By balancing the effect on B against the effect on S, when white paper alone is exposed, a silence can be produced in the telephone, and the effect of the passage of a black letter is to make a sound which varies in accordance with the formation of the letter. This is the principle of what may be called a "black-sounding" optophone, and although its advantage over the white-sounding type has yet to be proved, there is little doubt that the learning of the alphabet sounded on the new principle will be easier, though in the writer's opinion the ultimate speed acquired by either black-sounding or white-sounding will be approximately the same. It is interesting in this connection to note that Miss Mary Jameson, the blind girl who gave the demonstrations at the 1918 Exhibition, now reads habitually at a speed of about

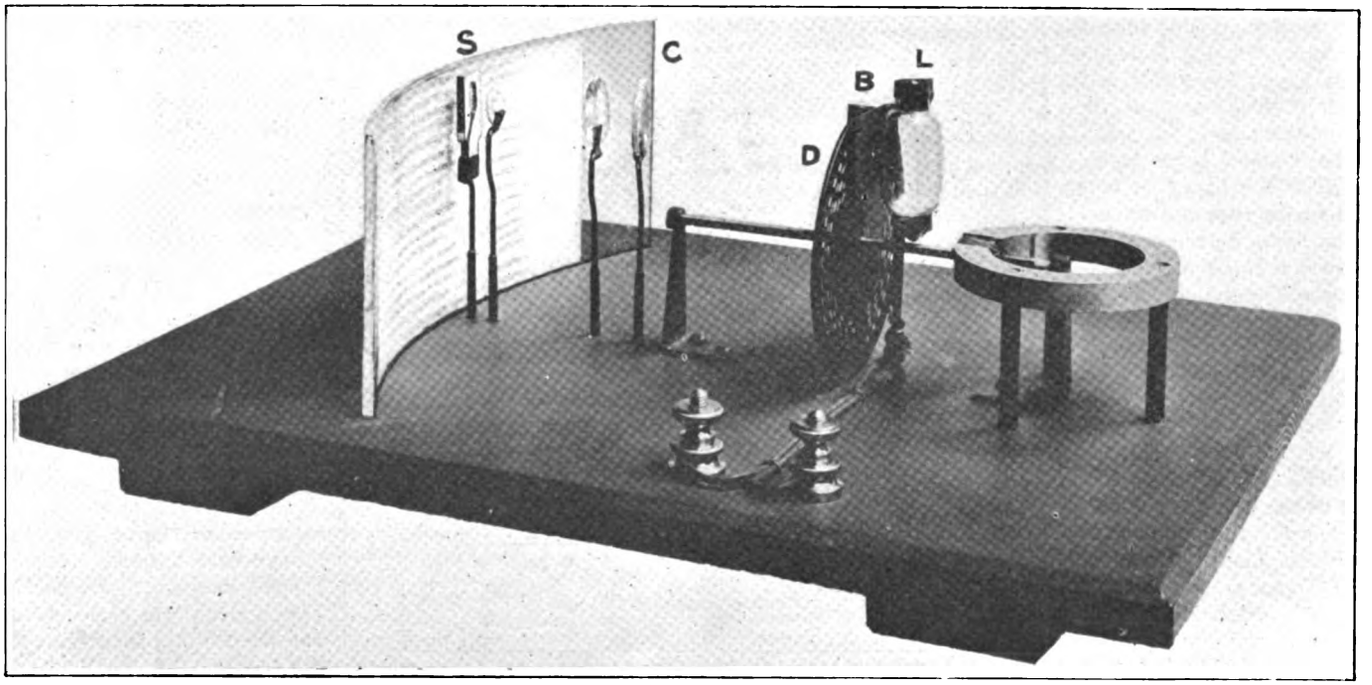

FIG. 2. SKELETON APPARATUS SHOWING THE PRINCIPLE OF THE OPTOPHONE

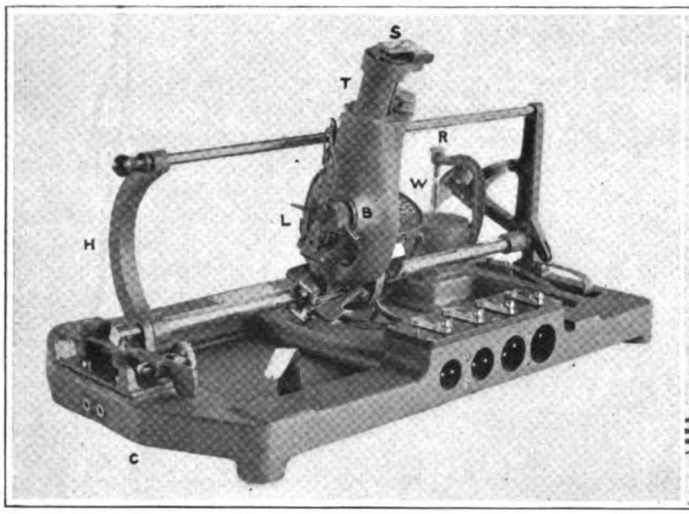

FIG. 3. THE OPTOPHONE WITH BOOK REST REMOVED

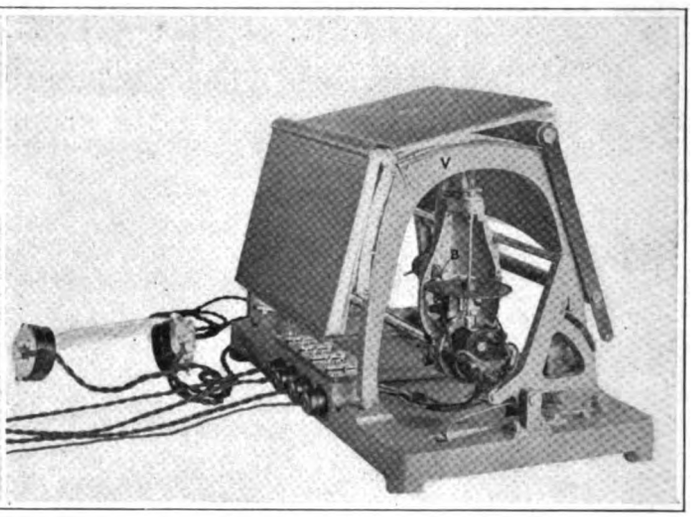

FIG. 4. THE OPTOPHONE COMPLETE WITH BOOK REST

twenty-five words a minute with a "white-sounding" optophone made by Messrs. Barr and Stroud, and finds, indeed, that when the instrument is adjusted for a lesser speed reading becomes more difficult.

The present construction adopted by Messrs. Barr and Stroud is shown in Fig. 3. The disk, lamp, lenses, and selenium, as well as the motor, are all mounted in the swinging "tracer," which can be brought over to the right by means of the reading-handle H. It then returns to the left with a slow, silent, and steady motion regulated by the worm gearing W, which drives a small paddle inserted in a viscous liquid. This paddle can be inserted more or less deeply into the liquid by the regulating nut R, and such is the range of adjustment possible that a line can be read in anything from five seconds to five minutes, according to the proficiency of the reader. When the line is read, the next line is brought into focus by the change-bar C, which works a friction grip inside the bar on which the "tracer" is pivoted, and can be adjusted for any desired line space by means of the screw attached to the change-bar. A lever attached to the "tracer" enables the operator to reverse this motion or to release the whole "tracer" from the friction gear, so that it may be quickly brought to the top of the page.

The festoon lamp is inserted at L, where it is held by a spring clip, and whence it can easily be removed for renewal even by a blind operator. The balancer is inserted at B, and can be adjusted for silence by means of the small handle shown.

Fig. 4 shows the apparatus from the top page end and with telephone and flex connections attached, as well as the book-rest V holding a book. The adapters of these flex connections are all of different sizes, and fit into different-sized holes in such a manner that they cannot be wrongly inserted—which is an important consideration with blind operators.

The various connections with their switches are for the motor, the lamp, and the two selenium circuits respectively. When the adapters are removed, a cover can be placed over the whole instrument, which clips on to the aluminum base, and the optophone can thereupon be carried about like a typewriter.

Special mention ought to be made of a contrivance for adjusting for various sizes of type. The middle lens of the three shown in Fig. 2 is mounted in a nut which can be screwed up and down within the "tracer" by means of two gaps cut in the upper cylindrical portion at T (Fig. 3). The nut is provided with six nicks across the rim, which enable a blind operator to count the number of turns of the nut, and thus to adjust for any definite size of type. This ingenious contrivance is, I believe, due to Dr. Stroud.

In practice it is found that, with the new apparatus, the various adjustments for size of type, length of line, and line interval are quite easily made by blind persons, and that the instrument, with all its delicate adjustments, can remain in use for a long time without anything getting out of order. It is therefore safe to say that the problem of opening the world's literature to the blind is now definitely solved.

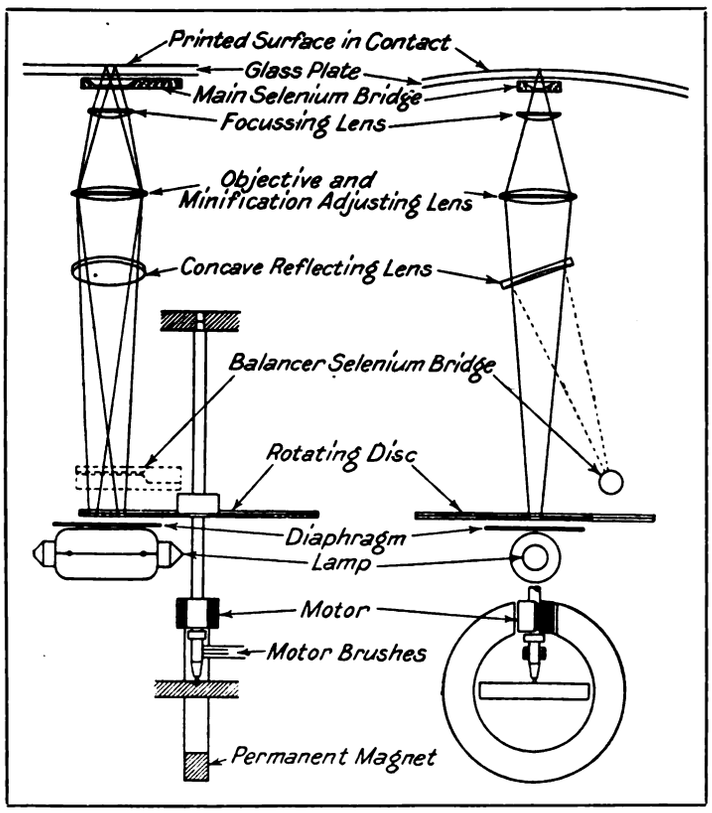

FIG. 5. DIAGRAM OF THE ARRANGEMENT OF THE OPTOPHONE

[We learn from The Electrician that the numbers of perforations in the siren disk are in proportion to the notes G, C,' D,' E,' G' (sol, do, re, me, sol) of the musical scale. The spot of light corresponding to low G falls on the lowest points of such letters as j, p, y, etc., the high G falling on the tops of capitals and high letters. The three intermediate spots cover the body of the lower case letters. With a "black-sounding" optophone the letter V is represented by the motif sol, me, re, do, re, me, sol.—EDITOR.]