

F. C. BROWN.
OPTIPHONE.
APPLICATION FILED JULY 31, 1916.

1,352,940.

Patented Sept. 14, 1920.

Fig. 1.

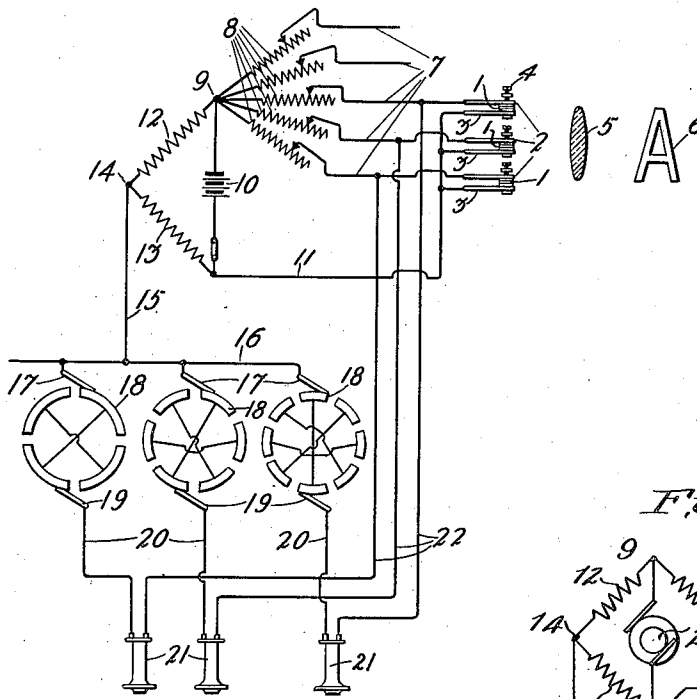


Fig. 2.

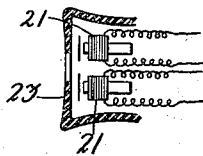
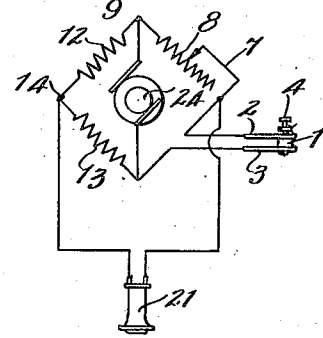


Fig. 3.



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UNITED STATES PATENT OFFICE.

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OPTIPHONE.

1,352,940.

Specification of Letters Patent. Patented Sept. 14, 1920.

Continuation of application Serial No. 26,357, filed May 6, 1915. This application filed July 31, 1916.
Serial No. 112,294.

To all whom it may concern:

Be it known that I, FAY C. BROWN, a citizen of the United States, residing at Berkeley, in the county of Alameda and State of California, have invented certain new and useful Improvements in Optiphones, of which the following is a full, clear, concise, and exact description.

This invention has reference to optiphones; that is, an instrument whereby an appreciation of the shape or certain characteristics of an object, due to the effect of light either emitted thereby or reflected therefrom or transmitted therethrough, may be obtained through the sense of hearing. One application of this is that a person who is blind or nearly so may be enabled to "see" by the aid of the ear, or may be enabled to obtain some appreciation of the effect obtained through vision.

The present invention in its preferred form is based upon an electrical characteristic of metallic selenium, in that light causes a reduction in the electrical resistance of selenium. It is not, however, limited to the use of selenium, as other light sensitive substances or devices may be employed.

In the present invention when selenium is employed advantage is taken of the improved response of selenium to light when the selenium is under pressure, and, moreover, the further improvement in the responsiveness to light when the selenium is employed in relatively large crystals, commonly distinguished as large by the term "macroscopic" crystals either single crystals or groups thereof. Advantage is also taken of the fact that with individual crystals of selenium used as bridges, light rays from a definite portion of an object may be focused upon the selenium crystal with any degree of exactness desired.

The present invention contemplates the employment of an association of selenium crystals in different circuits, each of which is so arranged as to have a different tone characteristic from the others, and the group of selenium cells is so organized that the relation of light from different parts of the object to be observed with respect to other parts thereof determines the locations of such parts. By this means a letter of the alphabet, for instance, if moved progressively, say, from right to left, so that its image is sharply thrown upon a group of

selenium cells or crystals, each included in an electric circuit characteristic thereto, will affect the group of selenium crystals in a certain order. The order of arrangement of the selenium crystals being known to an individual, it becomes an easy matter, even though he be blind, to gain a comprehension of the shape of the letter, the image of which is caused to progress across a screen made up of the group of associated selenium crystals controlling corresponding electric circuits. Such circuits must, of course, be charged circuits and each circuit is made to produce a sound characteristic of it by any suitable means, as by an interrupter producing a characteristic tone, or by taking advantage of the effect of resonance, or otherwise, so that considering the letter to be observed as a white or light letter, the observer hears by means of instruments, such as telephones, a series of tones locating the altitude with relation to some basic point of the different parts of the letter. By such means the hearer may readily learn to appreciate the shape of the letter similarly as a blind person is enabled to appreciate the shape of a letter by the sense of touch. Such an instrument enables a blind person to read print with considerable rapidity and to gain an appreciation of the shape and intensity of illumination by a source of light or the intensity of reflection therefrom. The general idea of the optiphone, as herein described, is not new, being described, for example, in an article entitled "The optophone" in the English Mechanic and World of Science, page 481, volume 95, and an article entitled "The differential optiphone" in the English Mechanic and World of Science, page 75, volume 96. This invention has for its objects, the provision of certain improvements in such devices, the particular improved means being described herein and pointed out in the appended claims.

The preferred form of the invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification, with the further understanding that while the drawings show a practical form of the invention, the latter is not confined to any strict conformity with the showing of the drawings, but may be changed and modi-

fied so long as such changes and modifications make no material departure from the salient features of the invention.

In the drawings:—

5 Figure 1 is a diagram illustrating the optiphone.

Fig. 2 is a diagram illustrating a multi-telephone receiver useful in connection with an instrument constructed in accordance with the showing of Fig. 1.

Fig. 3 is a diagram illustrating a modified form of optiphone.

Referring to the drawings there is shown at 1 representations of crystals of selenium without any attempt to show the actual forms thereof. These crystals are each in bridging relation to contacts 2, 3 and either or both of said contacts is capable of movement to exert pressure upon the crystal 1. In the drawings the contact 2 is shown as under the control of a screw 4 by means of which the contact may be pressed into engagement with the crystal 1 and the latter forced against the contact 3, so that any desired degree of pressure may be exerted upon the crystal.

Several crystals 1 are grouped together in close relation so as to form what may be termed a screen. Associated with the selenium screen is a lens 5 so arranged as to focus the object to be observed upon the selenium screen. The lens 5 typifies any suitable arrangement of focusing and reflecting means for directing rays from a definite portion of an object upon the selenium crystals. Selenium resistances have heretofore been used which consisted of a heterogeneous mass of selenium upon which light could not be accurately focused because they had sensitive and insensitive portions and were very uncertain in their action. By the use of lenses for focusing the light upon bridges consisting of a single definite crystal, smaller objects may be scanned with greater accuracy and speed than has been possible with arrangements used heretofore. In the drawings such object is represented by a letter 6.

A selenium crystal or crystals 1 with a pair of contacts 2 and 3 may be considered as a selenium cell, and one contact of each cell, say, the contact 2, is connected by a conductor 7 individual thereto, to one side of a variable resistance 8. The other terminals of the resistances 8 are all connected together at a common point indicated at 9 and to this common point is connected one side of a battery 10 which may be taken as representative of any suitable source of electrical current, which, in the diagram of Fig. 1, may be direct current.

The other side of each selenium cell has the contact 3 connected to a common conductor 11, which in turn is connected to the other side of the battery 10.

Also connected to the opposite terminals of the battery 10 is a branched circuit including in series with each other the fixed resistances 12 and 13, their junction point being indicated at 14. From the junction 14 is a conductor 15 leading to a conductor 16 which in turn is connected to brushes 17 of different interrupters 18, corresponding in number to the number of selenium cells 1. Each current interrupter 18 of the particular type illustrated in Fig. 1 has another brush 19 connected by a conductor 20 to one side of a telephone receiver 21. The other side of each telephone receiver is connected by a conductor 22 to a respective conductor 7.

It will be seen that the arrangement thus far described constitutes a plurality of Wheatstone's bridges or networks in which the four arms of any one bridge consist of one selenium cell 1, the corresponding resistance 8, and the resistances 12 and 13. The expression "Wheatstone bridge" will, for the purposes of this specification, be understood to define a network of any nature having a branch included therein and capable of such adjustment that the said branch will be conjugate with respect to another branch. The corresponding interrupter 18, and telephone 21, and the battery 10, are connected in the usual manner for a Wheatstone bridge, and this bridge or network may then be balanced for the desired condition by varying the resistance 8. The remaining networks are similar in every respect to the one thus described. It is apparent that each selenium cell may be in a Wheatstone network, which is entirely independent and separate from each other network, but inasmuch as the necessary balancing of any one network may be accomplished by the adjustment of the arm 8 alone, it is possible and convenient to combine the networks in such a manner as shown in the drawing and disclosed above, in which case the resistance arms 12 and 13, and the battery 10 are common to all the Wheatstone networks or bridges.

It will be advantageous to have two or more of the receivers 21 so grouped as to be readily heard by one ear, and such a grouping is shown in Fig. 2 where there are indicated two receivers 21 housed in an ear piece 23 and this showing may be taken as indicative of any suitable number of receivers 21, for each ear piece 23, whereby the listener may, without effort, listen to the sounds produced by a relatively large number of telephone receivers covering a considerable extent of surface represented by the grouping of the selenium cells or crystals 1. This novel form of receiver, which is especially adapted for use in optiphones, constitutes one improvement therein which is hereinafter claimed.

It may be assumed that the selenium

crystals 1 are in darkness or very dim light, and that the current interrupters 18 are running in a manner each to produce in the telephone receivers 21 individual thereto a characteristic hum when current is flowing. The resistances 8 are properly adjusted so that each Wheatstone's bridge is balanced and no current flows through the telephones 21 and they are, accordingly, silent.

Suppose, now, that the image of the letter represented at 6, which representation is of the letter A, be caused to move over the selenium screen, and let it be further assumed that the letter is a white letter upon a black or dark background. Considering the letter as seen in the drawing and moving from right to left, which is in opposition to the reading movement of the eyes, the lower left hand corner of the letter will first engage the selenium screen, thus affecting the corresponding one or more of the selenium crystals 1 and destroying the bridge balance and causing the corresponding telephone to respond.

When the effect of the passing letter or character is present upon the selenium screen made up of separate crystals or groups of crystals in separate circuits, the progress of the image of the letter across the screen is made known to the listener by successive characteristic sounds or hums due to the action of the different interrupters 18 or other means of producing impulses at audible rates, and these characteristic sounds impart to the listener corresponding impressions which, the listener has learned, have to do with different positions, so that the general impression on the ear of the listener is similar to the impression of the character upon the eye of one capable of seeing. It is because of this variation of impression upon the ear that those unable to see may, by the aid of the invention, understandingly "read" printed matter or gain a correct idea of the shape and other characteristics of an object which, when illuminated, affects the instrument of the present invention in the manner described.

While it is possible, as suggested above, to use white letters on a black back-ground, it is in practice desirable to reverse this, and use black letters on a white back-ground in conformity with usual practice in printing. In this case the various telephones are brought to silence by adjustment of resistance 8, when the crystals are illuminated by light reflected from the plain white back-ground. When a portion of a black letter is brought into the field of the screen, the intensity of light reflected from that portion to the corresponding crystal or crystals is diminished, the corresponding conditions of balance are upset, and the characteristic tone or tones are produced as a result.

It is obvious, of course, that the adjust-

ment of the circuits may be such that normally one or more of the telephones is emitting its characteristic tone with a certain intensity, which intensity may be either increased or decreased when the image comes within the field.

While the source of current 10 has been shown as a direct current source, which is interrupted by some suitable form of interrupter, it is to be understood that such source may be replaced by a source of alternating current of any desired frequency as shown in Fig. 3. Such an arrangement is suitable either in case the various Wheatstone bridges or networks are independent and separate, or in case a telephone receiver of the type shown in Fig. 2 and common to all or a plurality of the bridges is employed.

The present invention in the preferred form contemplates the use of relatively large selenium crystals which are free from complexities found in amorphous selenium and the greatly increased conductivity of selenium under light when the selenium crystal is subjected to pressure.

While the present invention is designed more particularly for enabling those unable to see to obtain intelligible impressions by the aid of hearing corresponding to the impressions obtained by sight, some features of the invention are capable of wider use, these features including the employment of single selenium crystals of large size and the employment of such crystals under pressure, whereby the light sensitiveness is increased many fold.

In this specification a new form of selenium cell or bridge is briefly described but is not claimed herein, since the method of producing the crystals and their use as selenium cells or bridges is made the subject-matter of my application Serial No. 82,782, filed March 7, 1916, and Letters Patent No. 1,219,432, issued to me March 20, 1917.

What is claimed is:

1. An optiphone comprising a group of circuits each including a resistance, means for producing electrical impulses in the different circuits at audible rates and of different characteristics from each other, telephonic receiving means individual to each circuit for translating the electrical impulses into audible sounds, and a common ear-piece for said receiving means.

2. An optiphone comprising a plurality of circuits each having means therein for producing electrical impulses differing in character from those of the other circuits and at audible rates, separate telephonic translating means for the electrical impulses, a common means for applying said translating means to the ear, and a resistance included in each of the circuits and individual thereto with the resistances grouped into close association to individually and collectively re-

ceive corresponding parts of a light image directed upon the group of resistances.

3. An optiphone comprising a group of Wheatstone networks or bridges, each including a resistance element as one arm, and means for balancing said bridges, an electromagnetic receiver as an indicator in each bridge, a common casing for said receivers, and an audio frequency interruptor in series with each telephone, in combination with means for focusing on the respective resistances certain portions of an image.

4. In an optiphone, the combination of a selenium bridge comprising a single crystal of selenium and a lens for focusing an image upon said crystal.

5. An optiphone comprising a plurality of circuits, and means in each circuit for producing impulses differing in character from those of the other circuits and at audible rates, telephonic translating means for the electrical impulses, a resistance in each of said circuits, said resistances each comprising an individual selenium crystal, and means for focusing on the respective resistances certain portions of an image.

6. An optiphone comprising a series of electric circuits each including a macroscopic crystal of selenium with the crystals of the different circuits closely associated one with respect to the other, means for directing images of selected distinctive portions of an object respectively upon the associated crystals, means for producing electrical impulses in the electric circuits of in-

dividually different characteristics, and a telephone receiver in each circuit.

7. An optiphone comprising a group of Wheatstone bridges, each including a macroscopic crystal of selenium as one arm, and means for balancing said bridges, a telephone receiver as an indicator in each bridge, and an audio frequency interrupter in series with each telephone, in combination with a lens for focusing on the respective crystals certain portions of an image.

8. An optiphone comprising means for the electrical production of sounds of definite characteristics, and separate resistance devices individual to the different means included in circuit therewith to control such means by the action of light upon the resistance devices, said resistances being associated in linear relation so that when passed before a series of characters of the kind used in printing or writing they will be affected differently and in a manner characteristic of the individual characters.

9. An optiphone comprising a plurality of light sensitive elements, individual means responsive to each of said elements to produce a distinct effect in accordance with the light falling upon the respective element, and a common receiver connected to each of said individual means to blend said distinct effects into a composite audible effect.

In witness whereof, I hereunto subscribe my name this twentieth day of July, A. D. 1916.

FAY C. BROWN.