2 Sheets—Sheet 1.

# R. E. HOUSE.

## ELECTROPHONETIC TELEGRAPH.

No. 77,882. Patented May 12, 1868.

Fig. 3.

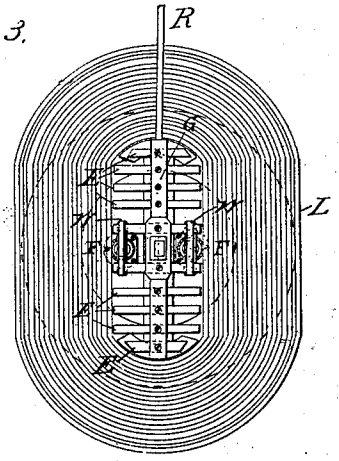



Fig. 1.

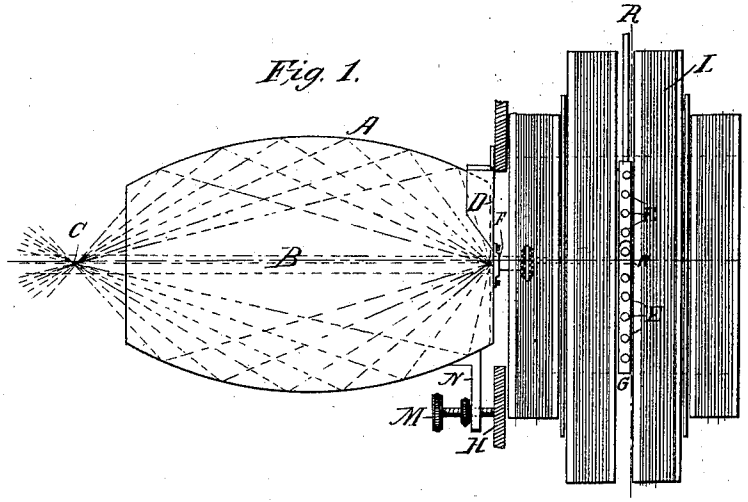
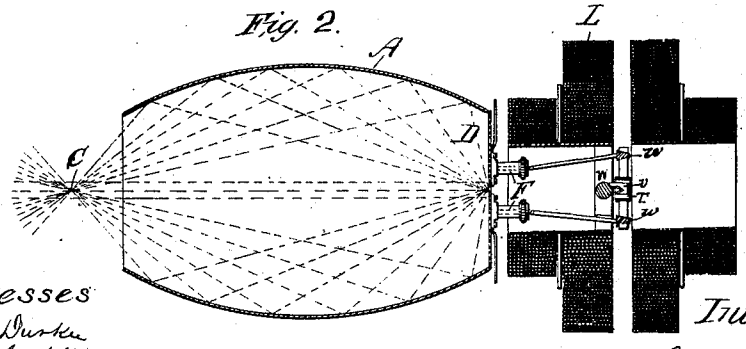



Fig. 2.




Witnesses
F. A. Durkee
M. P. Conklin

Inventor.
Royal E. House.

2 Sheets—Sheet 2.

# R. E. HOUSE.

## ELECTROPHONETIC TELEGRAPH.

No. 77,882. Patented May 12, 1868.

Fig. 4.

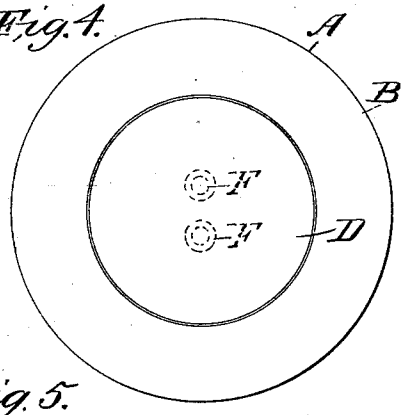



Fig. 5.

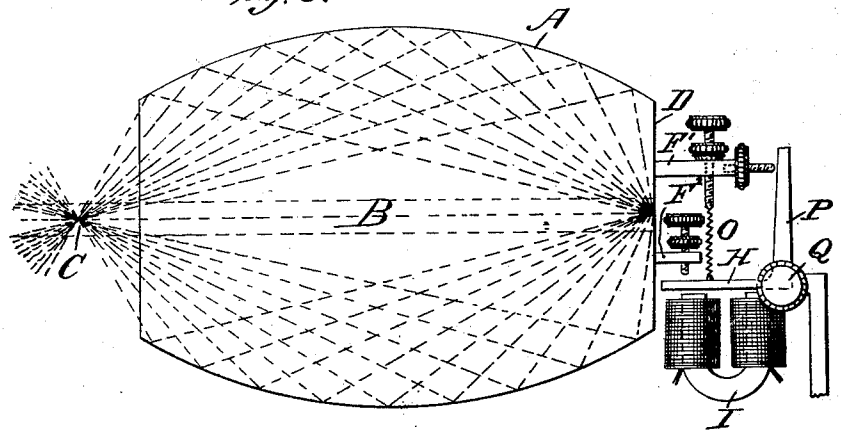
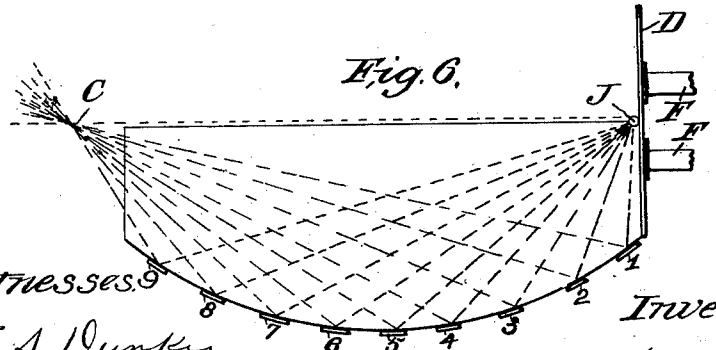



Fig. 6.




Witnesses.

F. A. Dunker

M. E. Conklin

Inventor

Royal E. House

# UNITED STATES PATENT OFFICE.

ROYAL E. HOUSE, OF BINGHAMTON, NEW YORK.

## IMPROVEMENT IN ELECTRO-PHONETIC TELEGRAPHS.

Specification forming part of Letters Patent No. **77,882**, dated May 12, 1868.

*To all whom it may concern:*

Be it known that I, ROYAL E. HOUSE, of Binghamton, in the county of Broome and State of New York, have invented new and useful Improvements in the Electro-Phonetic Telegraph; and I do hereby declare that the following, taken in connection with the drawings, is a full, clear, and exact description thereof.

In the drawings, which are on two sheets, Figure 1 is a side elevation of the sounder and helix with their accessories. Fig. 2 is a horizontal and longitudinal section through a helix and sounder on the red line in Fig. 1. Fig. 3 is a section through a helix on a vertical red line in Fig. 1, showing a set of deflective needles, and an interior view of the helix which is nearest the needles in the direction of the sounder. Fig. 4 is an end elevation of a sounder. Fig. 5 is a side elevation of an electro-magnet, sounder, and accessories. Fig. 6 is a diagram showing the mode of ascertaining by the action of light the inside curve of the reflector for any given length and diameter.

The feature of my present invention may be divided into three heads, and are, first, a sounder so constructed and arranged as to regulate the loudness of the sounds and to intensify them by a single reflection to a point most convenient to the operator's ear, by which means greater distinctness of sound is secured; second, a deflective needle-helix constructed and arranged with reference to bringing a greater length of insulated wire in closer proximity to the permanent deflective magnetic force to be deflected by the passage of an electric current through the insulated wire of the helix than heretofore practiced; third, increasing the permanent deflective magnetic force which is to be deflected in proportion to the increased inertia of the material employed for that purpose, which enables me to augment the force, so as to produce sufficiently rapid and heavy blows, by moving through exceedingly short distances, which removes the difficulty of bounding.

I shall now proceed to describe the sounder and its accessories.

The sounder A, Figs. 1, 2, 4, and 5, is composed of a reflector, B, somewhat barrel-shaped and closed at the end opposite the intensified point C, as shown in Figs. 1, 2, and 5, by the insertion of sounding-head D, which has adjustable limiters F F or F' F', attached for the purpose of limiting the motion of an armature, H, Fig. 5, of an electro-magnet, I, or the motion of a set of deflective needles fixed in shaft G, Figs. 1, 2, and 3.

In the construction of reflectors that intensify the sound by a single reflection, as practiced in the present invention, it becomes a matter of importance to have some easy mode for determining the exact curve of the inside of a reflector of any given length and required diameter. Knowing that the laws of sound correspond with those of light, the particular form of the curve of the sides of the reflector for any given length may be ascertained by the reflection of light.

I generally use a desirable number of small mirrors, arranged as shown in Fig. 6, in which the eye is placed at the intensified point C, and a candle, J, or some other suitable object is placed at a point equidistant from each limiter F F on sounding-head D, and reflected by a single reflection to the intensified point C by mirrors 1 2 3 4 5 6 7 8 9, placed at suitable angles, thus fixing the position of each point of a curve so as to be averaged and give the shape to a pattern extending the entire length and embracing one-half the diameter of the reflector B.

I now proceed to make the reflector of tin or any suitable material, being careful to have the inside shaped to correspond with the pattern.

The sounding-head D may be made of wood or glass or any suitable material. I prefer pine wood. One made one-quarter of an inch thick and eight inches diameter, stiffened by being well saturated with shellac in varnish, and fixed in its respective end of the reflector, answers a good purpose, providing the size of the pattern of the reflector is made with reference to that diameter.

The limiters F F, Figs. 1, 2, and 3, should be made stiff and light, of suitable-sized thin brass tubing, and fixed in an adjustable manner to sounding-head D, and closed at the ends which are to receive the blows from the set of deflective needles fixed in shaft G.

The sounder A is suspended in a proper position by being suitably hinged to the case which holds the helix L. Two detached sections of the case K K are represented in Fig. 1. The opposite side of the sounder is adjusted

by thumb-screw M, which rests against the case K and screws through the projecting arm N, Fig. 1, which is fixed on the lower side.

The withdrawal or moving up of limiters F F (represented in Figs. 1, 2, and 3) is accomplished by screwing up or unscrewing the adjusting-screw M. I have sometimes used a cam against the end of screw M, arranged so that moving the cam backward or forward produced the same effect as moving the screw.

I have now described the sounder and the mode of using it in combination with deflective needles, and will now give another mode of using it in combination with a receiving electro-magnet of a telegraph-line without a local circuit.

I have found, by experiments, that when the force of an armature of a receiving-magnet is expended on limiters $F' F^2$, by limiting the motion of the armature a distinct audible sound is produced, even when the electrical power is only sufficient to produce motion.

I have combined a very good arrangement, which is represented in Fig. 5, in which one limiter is struck on the end and the other on the side, which, for distinctness of sound, answers an excellent purpose. The method of striking one limiter on the side and the other on the end to produce distinctness of sound is not new; but has been long in use in local circuits where the magnetic force was sufficient without the employment of an intensifying sounder.

Fig. 5 represents the combination of the old arrangement with reflector B and sounding-head D, which may be placed in a stationary manner on the frame which holds the temporary electro-magnet I, Fig. 5, which has an armature, H, with an adjustable reacting spring, O, and a fixed arm, P, projecting from the armature at right angles and working on an axis at Q, so that when the magnet I is charged with magnetism the armature H brings the fixed arm P in contact with the end of limiter F', and when discharged the reacting spring pulls the end of armature H against the side of limiter $F^2$.

I shall now proceed to describe the second and third parts of the feature of my invention.

In the construction of a permanent deflective magnetic force, Figs. 1, 2, and 3, designated by the letter E, I select the best material of cast-steel, of suitable size and length for permanently holding an amount of magnetism which shall be the largest in proportion to the weight of steel employed for that purpose. I then multiply the number of such pieces to any extent desirable, or at least until suitable weight is attained to make audible sounds by arresting their motion against the ends of limiters F F, Figs. 1, 2, and 3, after being deflected through an exceedingly short distance, say, one-hundredth of an inch. They are then arranged with similar poles side by side and at such distances apart as will allow each deflective needle to retain its full force of magnetism, in which relative position they are fixed to the oscillating shaft G, Figs. 1, 2, and 3, which has a suitable-sized aperture provided with a set-screw for each needle, (designated by the letter E.)

The necessary distance between each consecutive needle may be ascertained by measurements made by the deflection of an ordinary compass-needle placed at a proper distance and in a suitable position from the north or south poles of two or more magnetized needles, arranged parallel with each other, and their similar poles side by side in a movable manner, so as to increase or diminish the distance between them as desired, the experimenter being careful to note the degrees of deflection of the compass-needle which exists at the several distances through which they are moved, and then selecting for use the distance between the magnetized needles when a maximum charge of permanent magnetism was shown by the compass-needle to exist.

The number of deflective needles which compose a set may be increased according to the length and insulation of the telegraph-line in which they are used. When combined with a line of ordinary length and construction, the number shown in the drawings would answer a good purpose; but if used in connection with a very long submarine-telegraph line, in which extreme sensitiveness becomes important, the number of deflective needles should be correspondingly increased.

The oscillating needle-shaft G, Figs. 1, 2, and 3, may be held in any frictionless manner that will allow it to oscillate freely without trembling. I have used it with much success with the needle-shaft in a vertical position, suspended by a suitable torsion-suspensory apparatus, which acts as a reacting power, and which may be regulated by torsion to meet the exigencies of a waste-current of a telegraph-line.

The connection of the torsion-suspensory apparatus is made by connecting its lower end to the upper end of wire R, Figs. 1 and 3, which is fixed in the upper end of the oscillating needle-shaft G. This arrangement requires the use of a frictionless device to secure the center of motion of the deflecting needles at a fixed point in the center of the axial aperture of the deflective needle-helix L, Figs. 1, 2, and 3, and I have selected for this purpose a knife-edge, S, Figs. 2 and 3, fixed in an opening, T, of the oscillating needle-shaft G in a suitable manner to secure the axis of motion by lightly bearing against the bottom of a suitably-shaped cavity formed in arm U, which may be fixed to the helix L in any suitable manner.

The force to keep the knife-edge resting against the bottom of the cavity V may be increased by carrying the point of suspension of the suspensory apparatus out of a vertical line in an opposite direction from the limiters, or dimished by moving it back toward them. It is important that the force be so regulated as to produce the desired effect without dimin-

ishing the sensitiveness with which the knife-edge acts in its bearing.

I will now explain the mode of obviating the difficulty in the arrangement previously patented, in which the deflective needle had a tendency to slightly stick to the limiters, which limited its motion by coming in contact with its magnetized parts, so as to diminish its sensitiveness when operated on a telegraph-line having a heavy escape-current. This difficulty is removed in my present invention by arranging the limiters F F, Figs. 1, 2, and 3, so as to be struck with device W, made of demagnetic metal and fixed to each end of the two deflective needles nearest the center of the set in shaft G.

The deflective needle-helix L, used in combination with the set of deflective needles, is constructed with an axial aperture, the shape and size of which is made with reference to the length, size, and number of deflective needles (arranged in a row parallel with each other) and with each consecutive needle separated from the other at such distances apart as to allow each needle to retain its full amount of deflective magnetic force. A good idea of this part of the invention may be gained by examining Fig. 3, in which is represented half of the deflective needle-helix, showing an axial aperture constructed and relatively arranged and combined with a set of deflective needles, in accordance with the principles of this part of my invention.

The axial aperture in deflective needle-helices heretofore constructed for telegraphic purposes have had an oblong shape with a deflecting needle placed in the center, with its poles in a parallel position with the sides of the oblong and at right angles to the axis of the helices. The amount of helical wire of a given size used in constructing such helices has been regulated by the length and size of a single or compound deflective needle and the number of layers of helical wire having a given number of convolutions. In the present invention, the poles and intervening spaces of the set of deflective needles are relatively arranged at right angles to the sides of the oblong aperture and at right angles to the axis of the helix, as shown in Fig. 3.

The amount of helical wire of a given size used in forming a fixed number of layers with a given number of convolutions in the construction of such helices is regulated by the number, size, and length of the deflective needles and the space allotted to each needle respectively. The principle used in the latter arrangement admits of increasing the length of helical wire in the construction of a deflective-needle helix by augmenting the number of deflective needles and spaces by which the increased length of helical wire will be correspondingly acted upon by the increased number of deflective magnetic needles.

The present invention relates to improvements in a previously-granted patent, numbered 48,408, on the electro-phonetic telegraph; and the parts herein specified are to be substituted for analogous parts therein described for the purpose of increasing distinctness of sound and remedying the bounding of the needle and tendency to stick to the limiters when used with a heavy escape-current, and to increase the deflecting power of the helix by increasing the length of helical wire and permanent magnetic force; or some of the parts of the present invention or all of them may be combined with suitable parts of a magnetic telegraph-line now in public use, and operated either by breaking or closing the circuit of electricity, or by changing the current by the use of a key or commutator.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. The use of the reflector, shaped and proportioned in accordance with the principles described, and for the purposes set forth.

2. The respective arrangement and combination of the reflector and sounding-head, as described.

3. The combination of the reflector with sounding-head and limiters, as described, and for purposes set forth.

4. Hinging the sounder and adjusting its angle, as described, for the purpose of regulating the distance through which the permanent magnetic force shall move.

5. The use of a set of deflecting magnetized needles, constructed as described, and relatively arranged, as described, for purposes set forth.

6. Constructing the axial aperture of a deflecting-needle helix as described, and for the purposes set forth.

7. The combination of a deflective needle-helix constructed with an axial aperture, as described, with a set of deflective needles, constructed and relatively arranged, as described, for purposes set forth.

ROYAL E. HOUSE.

In presence of—
F. A. DURKEE,
M. E. CONKLIN.