

H. R. STUART.
 APPARATUS FOR RECORDING AND REPRODUCING BY THE TELEGRAPHONE PRINCIPLE.
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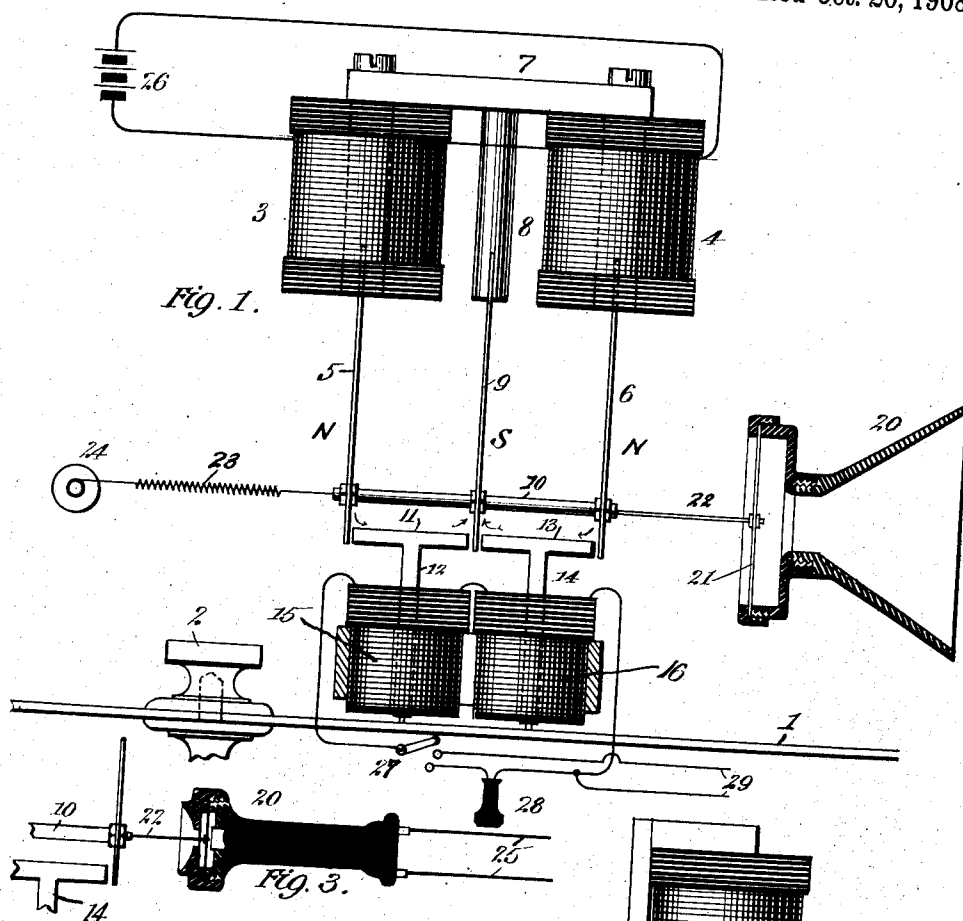


Fig. 1.

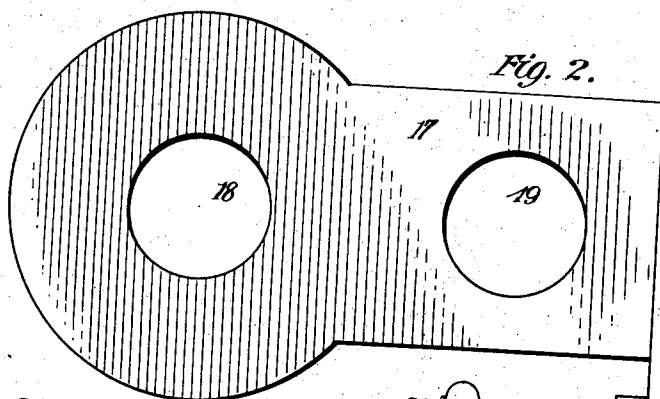


Fig. 2.

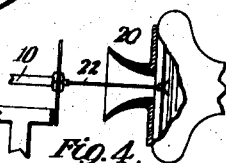
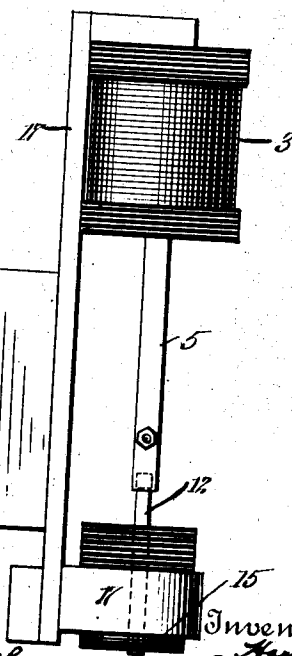


Fig. 4.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR RECORDING AND REPRODUCING BY THE TELEGRAPHONE PRINCIPLE.

No. 901,397.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARVE R. STUART, a citizen of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented certain new and useful Improvements in Apparatus for Recording and Reproducing by the Telegraphone Principle, of which the following is a full, clear, and exact description.

This invention relates to means for recording and reproducing speech, sounds and signals, under the telegraphone principle, and has for its object the provision of means whereby the record can be strongly impressed upon the recording body so that the reproduction will be correspondingly louder.

According to the principle of the telegraphone, the recording magnet is influenced by the telephonic currents only, and the strength of the record is therefore dependent upon the comparatively weak magnetism which such currents are capable of developing.

According to the present invention the electro-magnetism which is used to record the message is derived from an independent source which may be either a permanent magnet or an electromagnet, and this independent field of force is manipulated and directed so as to affect the recording disk, band or body by the mechanical movements of a diaphragm which are created by the voice or signal currents. In this way the permanent or electro-magnet may be a comparatively strong one, so that the available power for recording purposes is practically unlimited.

My invention is illustrated in the accompanying drawing in which the apparatus is illustrated somewhat conventionally.

Figure 1 is a front elevation of my improved apparatus, the parts being shown in section; Fig. 2 is a side elevation of the magnet system; Figs. 3 and 4 illustrate modifications of the flux-controlling mechanism.

The recording body of a telegraphone is illustrated by 1, being for convenience in the form of a steel disk shown in edge view and supported upon a centrally rotated axis 2. Mounted adjacent to the disk are two electromagnet coils 3 and 4, surrounding soft iron cores, which have steel spring extensions 5 and 6, forming parts of the magnetic circuit. The cores of the two magnets are connected by a back yoke 7, from the

middle point of which extends a bar of iron 8, similar to the cores, and likewise having a steel spring extension 9. These steel springs are of substantially the same shape and resiliency and are connected together near their lower ends by a cross bar 10, of non-magnetic material, which holds them in fixed relation to each other.

Between the extremities of the springs 5 and 9 is a soft iron bar or piece 11, having a stem 12 projecting midway therefrom and resting at its extremity upon the face of the recording body 1, the extremity of this piece being reduced so as to cover only a small area of the recording body. Likewise between the extremities of the springs 9 and 6 is a similarly T-shaped soft iron piece, indicated by 13 and 14, the extremity of which is also reduced and rests upon the face of the recording body 1. The two parts 12 and 14 serve as cores of electric coils 15 and 16 respectively, and the entire system of coils 3, 4, 15, 16, springs and cores, are mounted upon a single frame 17, so as to move together in a radial or other suitable direction across the face of the disk 1 while the latter is in rotation. This movement of the magnet system may be controlled by a suitable feed screw which may operate in one of the openings 18 or 19 of the frame, and a guiding rod in the other, similar to any of the usual telegraphone or phonograph feeding mechanisms.

20 indicates an instrument containing a vibratory diaphragm 21, the center of which is rigidly connected through link 22 with the rod 10, or some other part of the structure 5, 9, 6, 10, so that the movement of the diaphragm will be communicated to the springs 5, 9, and 6, equally and simultaneously. At the opposite side of the springs may be interposed a tension spring 23, secured at one end to the rod 10, and at the other to an adjusting screw 24. By adjusting the tension of this spring and the position of the instrument 20, the extremities of the springs 5, 9 and 6 are brought to neutral positions or distances from the ends of the soft iron pieces 11 and 13. That is to say, the air gaps between the spring 6 and the piece 13, between 9 and 13, between 9 and 11, and between 5 and 11, are all normally equal.

The instrument 20, as shown in Fig. 1, is merely a casing carrying the diaphragm, and having a mouthpiece into which speech or other sounds are to be directed. In Fig.

3, the instrument 20 is an ordinary telephone receiver having the usual diaphragm which is moved by voice currents coming from a distance over the circuit 25, either from being serviceable for the purposes of the invention.

The two coils 3 and 4 are connected in circuit with a constant source of electricity 26, of considerable power, and the direction of winding, or flow of current through, the coils is such as to establish two independent fields of force, the middle core 8 and spring 9 being common to both and having say an S polarity, whereas the outer cores or springs 5 and 6 each have an N polarity. Thus one magnetic circuit is completed or nearly completed through the cross piece 11, while the other is completed or nearly completed through the cross piece 13, and so long as the gaps between the springs and the cross pieces remain uniform, as described, there will be no tendency of the lines of force in the two fields to take different courses.

In the operation of making a record of a message or signals, the coils 15 and 16 are not in use. That is to say, they are open circuited, and for this purpose a small switch 27 is used, and placed in the open position shown. When the diaphragm 21 is vibrated by the sound waves entering directly into the instrument 20, shown in Fig. 1, or coming from a distance to the instrument, shown in Fig. 3, the movements thereof are imparted to the springs 5, 9 and 6 uniformly and coincidentally, a movement of the diaphragm to the left causing spring 6 to approach piece 13, spring 9 to recede from spring 13 and approach piece 11, and spring 5 to recede from piece 11. Thus the lines of force induced by the two coils 3 and 4 which before traveled uniformly across the respective pieces 11 and 13 will now be deflected because of the fact that the air gaps instead of being uniform are now narrower at one end of the iron piece and wider at the other, and lines of force which always take the path of least reluctance, will now travel from the end of spring 6 into the piece 13, thence through the core 14, then through the material of the recording body 1 to the other core 12, then through the piece 11, and across the narrow gap to the spring 9, the remainder of the circuit being the same as before. At the same instant, the magnetic circuit of the coil 3 will remain substantially the same as before, because no path of less reluctance is afforded. A record of the movement of the diaphragm to the left will therefore be impressed upon the steel body, which will have a strength depending upon the strength of the magnet 4, and the sum of the air gaps between 13 and 6, and 11 and 9, this record being represented by a line of magnetism permanently localized in the body 1 between the ends of the cores 12 and

14. When the diaphragm 21 moves in the opposite direction, or to the right, spring 6 recedes from 13, spring 9 approaches 13 and recedes from 11, and spring 5 approaches 11. The conditions then being reversed the lines of force from coil 3 are caused to travel from spring 5 to piece 11, core 12, recording body 1, core 14, piece 13, and spring 9, the lines from coil 6 continuing through 13 the same as normally. Thus the movement of the diaphragm to the right is recorded in the body 1 by a polarity opposite to that of the movement to the left, and likewise of an intensity depending upon the strength of the magnet and the sum of the air gaps between 5 and 11 and 9 and 13. Since the magnets 3 and 4 are of constant and equal strength, the strength of the recorded impulses with respect to each other will be due to the differences in air gaps to which their production is due, and this will be determined by the amplitude of the respective vibrations.

With this apparatus the record of a message will be impressed upon the disk 1 in a series of closely adjacent radial lines each of a length equal to the distance between the extremities of the bars 12 and 14. It will be seen that if the movable springs and the cross pieces constitute a switching device for the fields of force of the two constant magnets 3 and 4, which device is controlled by the diaphragm. In reproducing the record thus made, the bars or pole pieces 12 and 14 are caused to retrace the same path on the disk as when the record was made in accordance with the usual telegraphophone method. The record may then be made audible in either of two ways: First, the coils 15 and 16 may be connected in circuit either with the receiver 28 or with a distant receiver through the circuit wires 29, by means of the switch 27, in which case the magnetic record will create currents in the coils 15 and 16, which will affect the receiver in circuit with them and thus reproduce the record; or, second, the coils 15 and 16 may be left open-circuited, in which case the successive polarities of the magnetic record will be alternately added to those of the coils 3 and 4, causing the system of springs 5, 9 and 6 to be moved alternately to the right and left by a process the converse of that by which the record was originally made. The diaphragm 21 will therefore be correspondingly vibrated and the record made audible in the instrument 20. If the instrument 20 is substituted by a microphone, as indicated in Fig. 4, the instrument will act as a relay and the sounds reproduced at the more or less distant station may be amplified through the addition of battery in the microphone circuit. By this arrangement of the constant and independent field magnets 3 and 4, a magnetic flux of comparatively large power is avail-

able, and is readily manipulated or utilized for the purpose of making records by means of the delicate springs 5, 9 and 6, or their equivalent, which the voice currents or vibrations are amply able to move. The result is that the record magnetism will be stronger and the reproduction thereof commensurately loud. Furthermore, in this particular arrangement of the bars or pole pieces 12 and 14 impinging upon the recording body at considerable distances from each other, the lines of force traverse larger areas of the recording body and will absorb correspondingly more magnetism, and this without seriously decreasing the capacity of the recording body, for it is found that the turns of the spiral path traced by the magnets upon the face of the disk can overlap without interference so long as the record of one turn is not exactly superposed upon that of the preceding turn.

Having described my invention, I claim:

1. In a telegraphone, the combination of a recording body, a vibratory diaphragm, two magnets of constant force, and means whereby the vibrations of said diaphragm will alternately cause the lines of force of said magnets to traverse the recording body, substantially as described.
2. In a telegraphone, the combination of a recording body, a vibratory diaphragm, two magnets of constant force whose magnetic circuits are normally exterior to the recording body, and means whereby the vi-

brations of the diaphragm will cause said magnetic circuits to include the recording body, substantially as described.

3. In a telegraphone, the combination of a recording body, two magnets of constant force, and means whereby the vibrations corresponding to the message or signal will cause said magnets to alternately act upon the recording body.

4. In a telegraphone, the combination of a recording body, two pole pieces resting thereon, two magnets of constant force, a magnetic switching device for alternately directing the field of force of said magnets through said pole pieces, and means whereby the impulses corresponding to the message or signal will actuate said magnetic switching device.

5. In a telegraphone, means for reproducing the record in the recording body, comprising two magnetic circuits independent of that of the record means for alternately augmenting said magnetic circuits by the magnetic circuit of the record, and a vibratory diaphragm influenced alternately by said two magnetic circuits, substantially as described.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

HARVE R. STUART.

Witnesses:

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