

G. L. ANDERS & T. A. WATSON.

TELEPHONE SIGNAL.

No. 245,600.

Patented Aug. 16, 1881.

Fig:1.

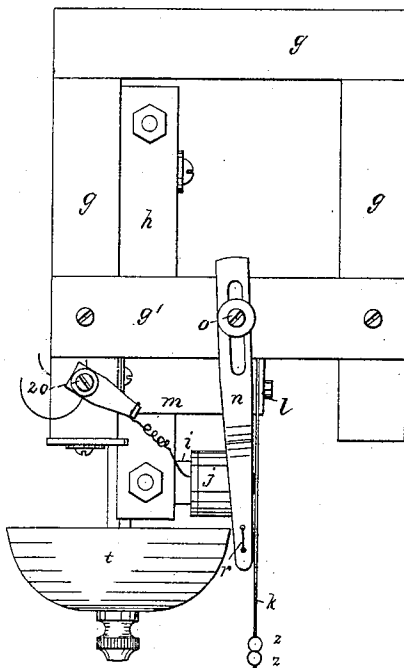
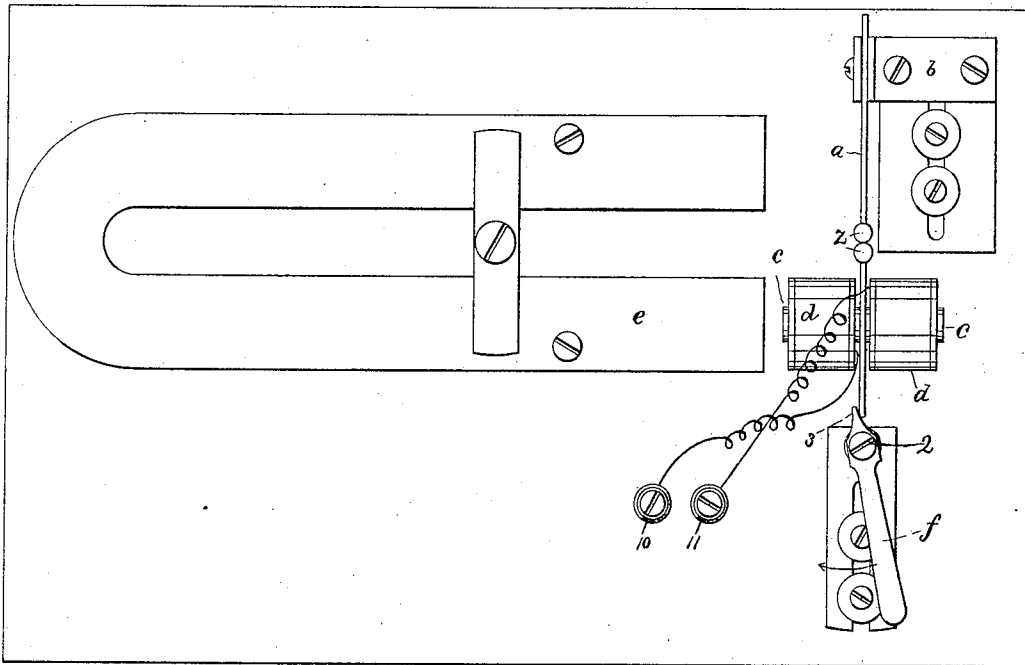


Fig:2.

Fig:3

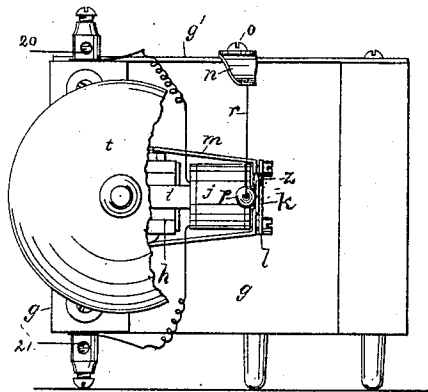


Fig:5.



Witnesses.

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Fig:4.

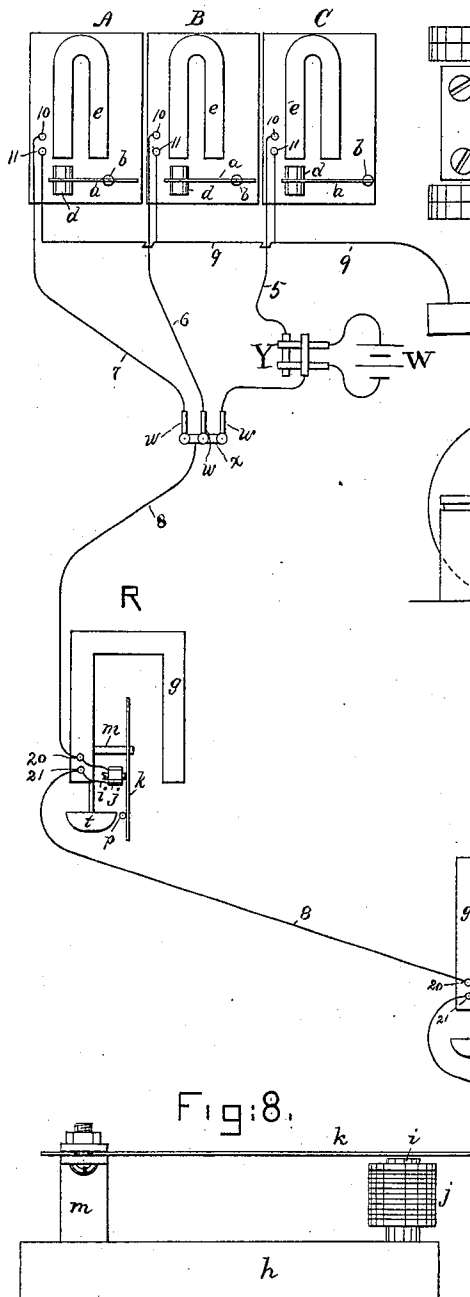


Fig:6.

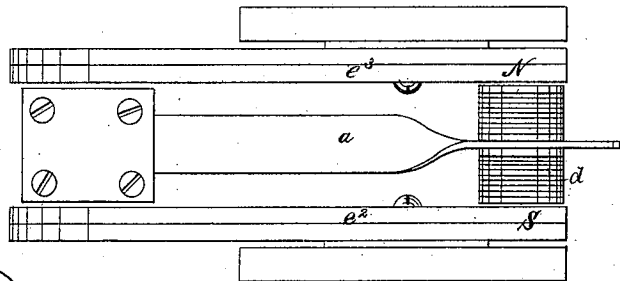


Fig:7.

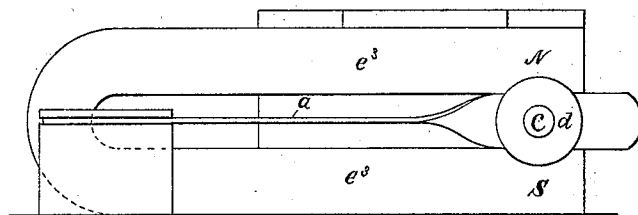
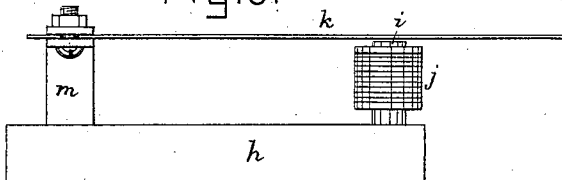


Fig:8.



Witnesses.

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UNITED STATES PATENT OFFICE.

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TELEPHONE-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 245,600, dated August 16, 1881.

Application filed July 21, 1880. (No model.)

To all whom it may concern:

Be it known that we, GEO. LEE ANDERS, of Boston, county of Suffolk, and THOMAS A. WATSON, of Everett, county of Middlesex, State of Massachusetts, have invented an Improvement in Telephone-Signals, of which the following description, in connection with the accompanying drawings, is a specification.

Our invention relates to telephone-signals, and has for its object to produce an individual signal more certain in its operation than those at present in use.

The individual signals now in use are mostly controlled mechanically by devices having a step-by-step movement, so arranged as to let only one signal of a series sound at a time after a definite number of step movements; or they are operated by relays or switches, each arranged to be properly actuated to close a local or signaling circuit by a current of certain character, which will not so affect the other relays in the circuit.

It is well known that a flexible tongue or reed or other musical instrument (as a tuning-fork or string) adapted to vibrate with a certain definite rapidity to thereby give out a sound of a definite pitch will be set in vibration by a series of impulses, as the magnetic impulses derived from an electro-magnet intermittently charged by electric impulses of the same frequency or rapidity as the vibrations of the said musical instrument—or, in other words, in accord therewith—but will not be thus set in vibration by impulses of different rapidity or not in accord with the said instrument. This principle has hitherto been employed for telegraphic purposes, different messages being sent simultaneously over a single wire by means of transmitting-instruments, each adapted to send intermittent currents of a characteristic rapidity different from the others, and receiving-instruments each tuned to accord with, and consequently adapted to respond to, a corresponding one of the transmitting-instruments, and to no other. In this manner an operator listening to any one of the said receiving-instruments will hear its characteristic note when its corresponding transmitting-

instrument is in operation, whether the other instruments are at the same time in operation or not, and will thus be enabled to receive a message independently of other messages, which may be received on other instruments. The receiving-instrument has also been used as a relay to control a local circuit in which the usual Morse sounder is placed, the telegraphic messages being received in the usual manner. Neither of these plans will answer for the purposes of telephonic signaling, since the musical note of the receiver, while being suitable for use by an operator who is constantly listening to, is not sufficiently loud to attract the attention of a person who is not on the alert, which is the special function of a call-signal, and when used as a relay its local circuit is normally closed, being opened when the transmitting-instrument operates—an arrangement which is not adapted for economical operation in telephone-exchange systems.

Our invention consists, chiefly, in adapting signaling-instruments operated on the above-described so-called "harmonic" principle to cause a sound to be given sufficiently loud to attract attention, the instruments being constructed to ring a signal-bell of the kind commonly used for telephonic signaling. This we accomplish in this instance by suspending by the side of the vibrating portion of the receiving-instrument—herein shown as a reed or tongue of steel or other magnetic material—one or more small balls suitable for bell-hammers, and placing one or more bells adjacent to, but not in contact with, the said balls. A small electro-magnet is suitably situated to act on the said tongue, and when an intermittent or vibratory current in accord or harmony with the said reed passes through the coils of the said magnet the reed is set in vibration and violently agitates the bell-hammer, causing it to sound the bell in the usual manner, such operation not perceptibly interfering with the vibration of the reed.

We are aware that it has been attempted to ring a bell by the vibrating body directly, which has been constructed as a tuning-fork or pendulum for this purpose; but such arrange-

ments do not give a sufficiently loud sound, or are too slow in operation, and we are not aware that several bells have been individually operated in the same circuit.

5 Our invention further consists in a novel kind of transmitting-instrument for producing the vibratory current, the said current being in this instance undulatory. The transmitting-instrument used by us consists of a vibrating
10 tongue or reed having connected with it a core-piece and a coil thereon, arranged to be vibrated with the said reed in front of the poles of a strong permanent magnet, to thus induce an undulatory current in the said coil, which is
15 placed in circuit with the electro-magnets of the receiving-instruments just described. Receiving-instruments with reeds tuned each to a different pitch from the others are used at the different stations to be signaled, and corresponding transmitting-instruments with reeds
20 tuned each to the pitch of its corresponding receiving-instrument are used at the central station, the coils of all the instruments being in the same circuit, and when one of the transmitting-reeds is vibrated the undulatory current induced in its coil will, in passing through the coils of the receiving-instrument, set the reed of the corresponding instrument in vibration and sound its bell, the others remaining
25 silent, in accordance with the principle hereinbefore stated.

The invention also consists in details of construction of the apparatus, and the means for tuning the reeds, as will be hereinafter more fully described; also, in polarizing the reed of the receiving-instruments, as hereinafter described, whereby two such instruments of the same pitch with a transmitting-instrument may be operated independently by sending impulses of opposite polarity.

30 Figure 1 is a plan view of a transmitting-instrument constructed in accordance with our invention; Fig. 2, a plan, and Fig. 3 an end elevation, of one of the receiving-instruments; Fig. 4, a diagram showing three transmitting and corresponding receiving instruments in a circuit arranged to be operated individually; Fig. 5, a detail to be referred to; Fig. 6, a top
45 view of a modified form of transmitting-instrument having two signals; Fig. 7, a side view thereof with one magnet removed, and Fig. 8 a modified form of signaling-instrument having a polarized vibrator.

The transmitting-instrument, Fig. 1, has a
55 reed or vibratory tongue, *a*, of any suitable material, fastened at one end to a bracket, *b*, adjustably attached to the frame-work and provided with a core-piece, *c*, and coil *d* thereon, placed opposite to the pole of a strong permanent magnet, *e*.

60 A lever, *f*, pivoted at 2, opposite to the end of the reed *a*, has a projecting point, 3, which extends toward and beyond the range of the end of the reed *a*, it normally remaining at either side thereof. When the long or handle
65 portion of the lever *f* is turned to bring its

point 3 against the end of the reed *a*, as shown by the arrow, it bends or springs the said reed aside until the movement is sufficient to let the point 3 pass the end of the reed, which is suddenly released and vibrates by its own elasticity, carrying the core *c* toward and from the pole of the magnet *e*, and thereby generating a series of electric impulses in the coil *d*, the terminals whereof are connected with the binding-screws 10 11, which may be connected with the line-wire and ground, respectively. The point 3 will now be on the other side of the reed *a*, and a movement in the other direction will again set it in vibration. The frame *g* of the receiving-instrument, Figs. 2 and 3, sustains at one side a permanent magnet, *h*, having a pole-piece, *i*, and induction-coil *j* thereon, the terminals of which are connected with the binding-screws 20 21, to which the main-line wire on either side of the said instrument is connected.

A reed, *k*, of magnetic material, secured at one end in a clamp, *l*, on a bracket, *m*, on the frame *g*, extends from the said clamp by the end of the pole-piece *i* passing through the magnetic field-of-force thereof.

A cross-bar, *g'*, on the frame *g* has an arm, *n*, connected therewith by a screw, *o*, the said arm being slotted, as shown, to enable it to be readily adjusted in position, and sustaining at its extremity a ball, *p*, suspended therefrom by a thread, *r*, or other flexible support, in proper position to hang just in contact with the reed *k* at the side thereof. A bell, *t*, is supported on the frame *g*, at the side of, but not in contact with, the ball *p*, which serves as a hammer to strike and sound the said bell. When the reed *k* is set in vibration, as hereinafter described, it throws the ball *p* against the bell *t*, causing it to give out a loud chiming sound. This arrangement answers very well when but few signals are to be operated in a circuit; but when a large number are to be employed it is sometimes desirable to adopt the following plan, (illustrated in Fig. 8:—) Two instruments are provided having reeds tuned to the same pitch, and the brackets *m*, sustaining the said reeds, are of magnetic material, and connected with the pole of the magnet *h* opposite to the pole-piece *i*, to thereby polarize the said reed. The poles *i* in the two instruments are of unlike polarity, so that when a series of electric impulses of one polarity are sent through the coils *j* they will increase the magnetic force in one of the instruments, giving its reed a strong vibration, which has a tendency toward the magnet, and consequently affects the bell-hammer and bell which are on that side of it, while the same impulses merely neutralize the magnetic force of the other magnet, giving its reed a feeble vibration mainly away from it, and consequently not affecting its bell. It will be seen that when these signaling-instruments are used with a transmitting-instrument, such as illustrated in Fig. 1, both bells will ring, since the generator produces impulses of both polari-

ties alternately; but when it is desired to operate either of the instruments independently of the other an intermittent battery-current, such as usually employed, may be used, of the proper polarity to affect the instrument it is desired to sound; or the magneto-generator may be used and a battery thrown in circuit with it to neutralize either set of impulses, as desired.

10 In the form of transmitting-instrument or generator shown in Figs. 6 and 7 two horseshoe magnets, $e^2 e^3$, are employed, placed with unlike poles opposite each other, as indicated, to strongly magnetize the core c on the reed a ,
15 placed between the said magnet in suitable position to carry in its vibrations the core c and coil d thereon from a position between one pair of opposite poles of the two magnets to a position between the other pair, thus completely reversing the polarity of the core c at
20 each vibration and producing very strong currents. In its normal position at rest the core c is at an intermediate position between the four poles.

25 In Fig. 4 three transmitting-instruments, A B C, are shown, constructed similar to the one hereinbefore described in connection with Fig. 1, their reeds a having different rates of vibration, or being tuned to different pitches, not in harmony with one another, but each in accord with the reed k of the corresponding one of the signaling-instruments R S T+ T—, respectively, the last two both being of the same pitch as the transmitter C, but of opposite polarity, as indicated therein by the letters N S.
35 The binding-screws 10 are connected by wires 5 6 7 with the main line 8, passing through the coils j of the instrument R S T+ T— to the ground, while the binding-screws 11 are
40 connected with branches of a wire, 9, leading to the ground. When one of the reeds a is vibrated an undulatory current is induced in the coil d thereon, which, in passing through the coils j of the signaling-instruments, induces similar variations in the magnetic force of the pole-pieces i therein, and the said variations, in acting on the reeds k , will set the one of which the pitch is the same as that of the reed a operated in vibration, but will not affect
50 the others not in harmony therewith, so that if the instrument A is operated the signal R will sound, or the instrument B will cause signal S to operate, and so on for as many as may be employed.

55 When the instrument C is operated in the usual manner both signals T+ T— will sound, and in order to sound either one without the other the battery W is interposed in the circuit by the reversing-key Y, with its poles in either
60 direction, as desired, it neutralizing one or the other set of alternate positive and negative pulsations induced in the coil d , and leaving the other set to operate the proper one of the signals T+ or T—, the other remaining silent,
65 as hereinbefore described. When the battery-current is thrown on in one direction the bell

T+ will sound, and when in the other direction the one T— will sound.

The circuit might be made continuous through the instruments A B C; but it is preferable to arrange them in branches, as shown, and to connect them with keys w , having a common anvil, x , connected with the line, so that by closing the proper key when one of the instruments is operated the electric impulses are confined to that instrument and the signaling-instruments R S T.
75

The different reeds are shown in Fig. 4 as tuned by varying the position of their points of support or changing their effective lengths; 80 but we prefer in practice to tune them on the plan shown in Figs. 1 and 2, the parts being made precisely similar in all the instruments, the reeds being cut out by suitable dies, and made to give the highest pitch which it is found practicable to use, and the different instruments of a series being tuned to lower pitch by placing small weights z thereon, the weights being all alike, and a different number used for each instrument. The weights z 90 (see Fig. 5) are provided with a slot, 15, adapted to fit tightly on the reed, as shown, to retain it in position, the tuning being more economically and quickly performed by this method than by the common method shown in Fig. 4. 95

It is obvious that the herein-described polarized receiving-instruments may be used for other purposes than telephone signaling.

We claim—

1. In an individual signal apparatus, a series 100 of electric generators, each adapted to produce a vibratory electric current, or series of electric impulses of different rapidity from the others, and a series of receiving-instruments affected by the said impulses to produce corresponding magnetic impulses, and each provided with a vibrator having a rate of vibration isochronous with the impulses produced by a corresponding electric generator, and adapted to be set in vibration by the magnetic impulses produced thereby, and a bell-hammer adapted to be actuated by the said vibrator to sound a bell, substantially as described. 105

2. A magneto-electric generator to produce an undulatory or vibratory current, consisting 115 of a permanent magnet and an elastic reed or vibrator, provided with a core and induction-coil in the magnetic field of the said magnet, and a lever to deflect the said reed and thereafter suddenly release it, to allow it to vibrate by its own elasticity and move the said core and coil in the magnetic field, substantially as described. 120

3. The combination, with a reed or vibrator adapted to be set in vibration by magnetic or electric impulses, of a bell-hammer suspended in contact therewith, and a bell, whereby, when the said reed is set in vibration, it agitates the said hammer to ring the bell, substantially as described. 125

4. In a magneto-generator to produce a vibratory or undulatory current, two horseshoe- 130

magnets placed parallel to one another, with unlike poles opposite, and a vibratory reed between the said magnets and electro-magnet thereon, with its core extending between the said magnets, and adapted, in the vibration of the said reed, to be brought first under the influence of one pair of opposite poles of the said two magnets and then of the other pair, to cause a complete reversal of its polarity at each vibration, substantially as described.

5. In a harmonic-transmission apparatus, two receiving-instruments, each having magnetic vibrators or reeds of the same pitch or rapidity of vibration, but of opposite polarity, and a transmitting-instrument adapted to send electric impulses of either polarity, as desired, whereby either of the said receiving-instruments may be operated independently of the other, substantially as described.

6. A permanent magnet and vibratory reed, in magnetic connection with one pole thereof and polarized thereby, combined with a pole-piece or core and induction-coil thereon, connected with the other pole of the said magnet and adapted to act on the said reed and with

a bell-hammer and bell, substantially as described.

7. The combination, with an electric circuit, of polarized signaling-instruments provided with suitable magnetic vibrators or reeds, the said instruments being some of one and some of the opposite polarity, and being constructed substantially as described, so as to give a signal by the passage of electric impulses of the proper polarity, as set forth.

8. In an electric circuit, a series of three or more harmonic receiving-instruments, part of one and part of the opposite polarity, the magnetic vibrators or reeds of those instruments which respond to electric impulses of the same polarity having different rates of vibration, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GEORGE LEE ANDERS.
THOMAS A. WATSON.

Witnesses:

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N. E. C. WHITNEY.