(No Model.)

C. E. SCRIBNER.

TEST SIGNAL FOR MULTIPLE SWITCHBOARDS.

No. 544,385. Patented Aug. 13, 1895.

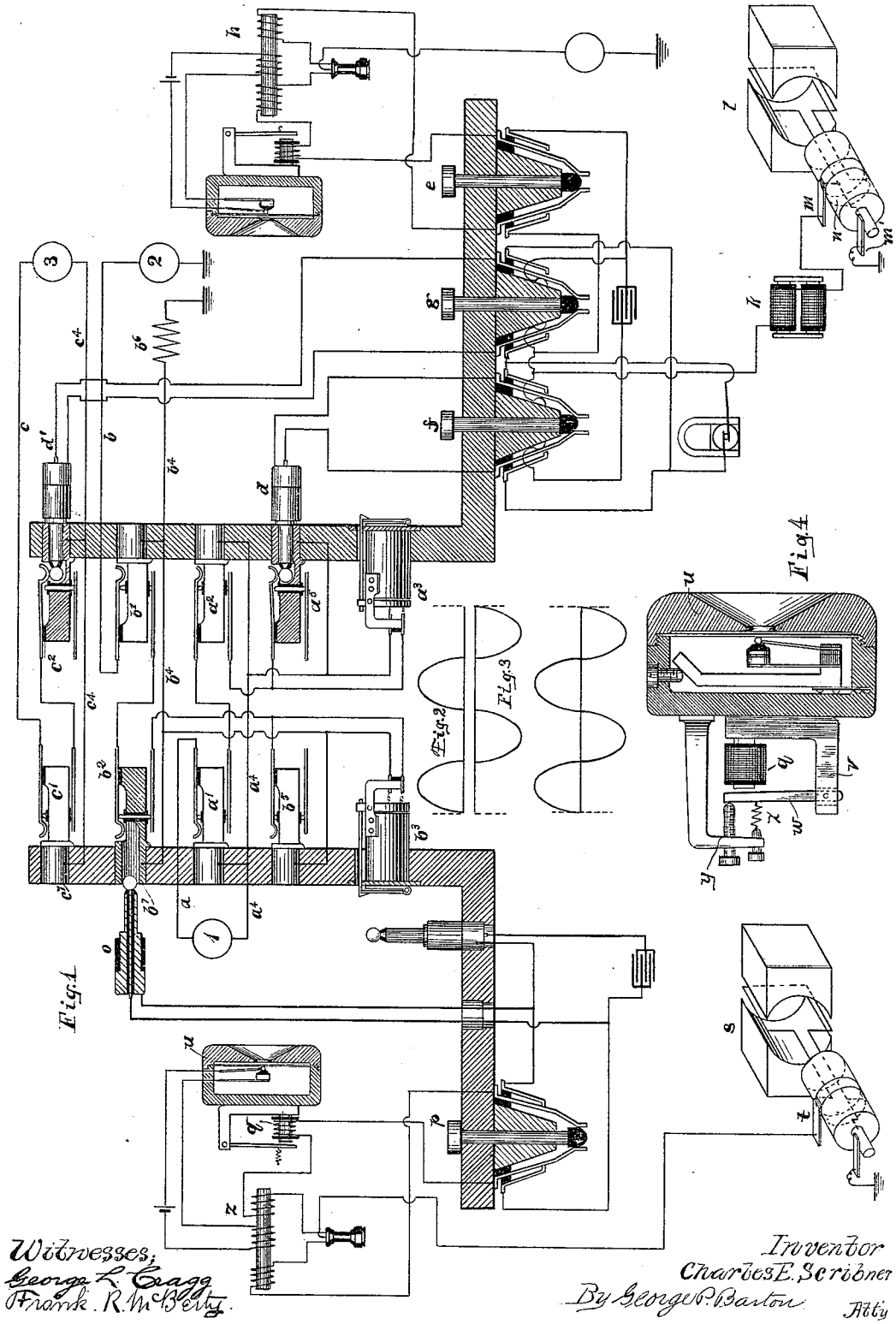

Fig. 4

Fig. 2

Fig. 3

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TEST-SIGNAL FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 544,385, dated August 13, 1895.

Application filed July 7, 1891. Serial No. 398,717. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Test-Signals for Multiple Switchboards, (Case No. 263,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to testing apparatus for multiple switchboards of telephone-exchange systems. Its object is to provide simple and effective means for producing a signal in response to a current of proper character in the test-circuit.

Heretofore in testing circuits for multiple-switchboard systems it has been customary to rely upon the click or sound produced in a telephone by the passage of a current through the testing-circuit as a signal to indicate the passage of a current. This method is sometimes found insufficient, inasmuch as no means exist of causing the telephone to respond to currents of proper strength and character only. Thus a static charge or a weak induced current which may accidentally exist upon the line will produce a sound in the telephone as well as the stronger current from the test-battery of the testing system, and may sometimes produce a sound which is not distinguishable from the genuine test-signal. Moreover, in some cases the battery of a testing system is replaced by a dynamo or other source of electric energy giving an alternating or intermittent current of such character and period as not to be audible in a telephone included in the testing-circuit. In such systems some special device is required either to give a signal independent of the telephone or to interrupt a current through the telephone. Such a system as this is described in my application for Letters Patent, Serial No. 277,557, filed June 19, 1888. To this class of test systems my invention is especially applicable.

My invention may be generally described as follows: In connection with the operator's telephone-transmitter, preferably upon the back thereof, I mount a small electromagnet whose coil is included in the test-circuit and which is furnished with an armature adapted to oscillate between fixed stops attached to the transmitter. As the armature actuated by the electromagnet strikes the one or the other of the limiting-stops or oscillates between, the sonorous vibrations are carried to the transmitter contacts and affect it in the usual manner to vary the current and thus cause a characteristic sound in the telephone of the testing-operator. When the testing-current is of constant direction, this armature may be held by an adjustable spring away from the poles of the electromagnet, and the spring may be given such a tension as to allow the armature to approach the magnet only in response to a current of predetermined or known strength, as the normal testing-current. If, however, the testing-current is of alternating character, the armature of the responsive device is preferably polarized, so as to be thrown into vibration only by the alternating test-current, and to remain uninfluenced by any other.

My invention will be more readily understood by reference to the accompanying drawings, which are illustrative thereof, and in which—

Figure 1 is a view showing it applied to a multiple switchboard; Figs. 2 and 3, graphical illustrations of the character of my testing-current, and Fig. 4 a sectional view of the operator's transmitter.

In Fig. 1 I have shown my invention as applied to the system of testing in my application mentioned. This system is fully described and explained therein. Therefore, I will only briefly describe the apparatus employed in it and the operation thereof.

In the drawings I have shown three substations 1, 2, and 3 connected with two sections of multiple switchboard of a telephone-exchange, stations 1 and 3 by metallic circuit, and station 2 by a grounded line. The lines from stations 1 and 2 are shown connected to their respective spring-jacks, answering-jacks, and annunciators at the first and second boards. Lines from station 3 are also shown connected to their spring-jacks at the first and second boards, but are not shown extended to any answering-jack or individual

annunciator. The line a from station 1, for example, may be traced through the line springs and contacts of spring-jacks a' and a^2, thence through individual annunciator a^3, returning by line a^4 to station 1. The answering-jack a^5 is connected between the lines a and a^4 in the usual manner. The return line a^4 is connected to the frames of jacks a' a^2. Line b from station 2 may likewise be traced, extending through spring-jacks b' b^2, annunciator b^3, and returning by line b^4, resistance b^6, earth to station 2, and line c from station 3, through spring-jacks c' c^2, thence through the annunciator, (not shown,) returning by line c^4 to station 3.

The operator's outfit, consisting of connecting-plugs d d', listening-key e and calling-keys f g, telephone set h, and testing apparatus, is shown complete at the second board at the right of the drawings. The construction, connections, and use of the connecting-cords and the various keys are too well known to need description, and are fully described in numerous patents.

In the drawings the subscribers' stations 1 and 2 are shown connected together for conversation through the connecting-plugs d d', connecting-cords, and the closed contacts of the ringing-keys.

I will now briefly outline the testing system. That strand of the connecting-cord which joins the sleeves of the connecting-plugs d d', and which is therefore in connection with the test rings or frames of the spring-jacks of a line to which a connection is made by means of it, is connected to earth through a retardation-coil k and a dynamo l, which is adapted to give an intermittent current, whose character will be most readily understood by reference to Fig. 2. The rate of fluctuation or the period of the pulsations of the current is such that the effects of the separate pulsations upon a telephone included in circuit with the dynamo do not blend into a musical tone. The increase and decrease of current strength are so gradual that no sudden disturbance occurs in the telephone, and the brush m is set in a position to leave the collector-segment n, from which it takes current, at exactly the instant when there is no electromotive force in the armature. The collector-segments are so arranged that current flows from the brush m during one half the period of pulsation and during the other half period the brushes m m' are short-circuited. Thus it will be evident that when connections are made between two subscribers' stations, as shown between stations 1 and 2 in the drawings, an intermittent electromotive force, whose character is shown graphically in Fig. 2, tends to cause a current of similar character to flow through the lines connected to the test-rings of the spring-jacks to which the connections are made, as a^4 and c^4, to earth. If by being connected to a grounded line, as line b^4, a current actually flows, it is inaudible in a telephone.

The operator's testing apparatus comprises in addition to that described means for completing a circuit from the test-ring of any spring-jack at one board through a polarized responsive device through a dynamo giving an intermittent current similar to that described, but of opposite direction in the testing-circuit, and whose periods of intermission coincide with the periods of flow of the first current. This means of completing the circuit, as described, sometimes consists in a special testing-plug adapted to be applied to the test-ring of a spring-jack; but I have preferred to adapt one of the operator's connecting-plugs to this purpose. The testing-plug o and its circuit to earth and to the other plug of the pair are shown at the first board at the left of the drawings. The calling-keys, which are in practice included in the circuit joining the connecting-plugs, are omitted for the sake of clearness. The circuit extends from the tip of testing-plug o through the contacts on one side of listening-key p, thence through the coil of the polarized responsive device q, through one half of the coil of the operator's telephone, thence through the commutator of dynamo s and to earth. The commutator of dynamo s is also arranged to allow current to flow from the armature to the brush t and to earth during one half-revolution, and to close the circuit directly from brush t to earth during the second half-revolution. The character of this current is graphically represented in Fig. 3. It will now be evident that if the tip of testing-plug o be applied to the test-ring of a line which is in use, as ring b^7 of line b from station 2, a circuit will be completed from brush m of dynamo l through the sleeve-strand of the connecting-cord to the sleeve of plug d', thence to the test-ring or frame of jack b', thence by a part of line b^4 to test-ring of jack b^2, thence through tip of test-plug o to earth, as traced. The circuit so completed I term the "test-circuit." It is thus evident that when the test-circuit is completed current therein flows alternately from one dynamo in one direction through the short-circuited brushes of the other dynamo, and the reverse.

Having thus described the character of the current to which the polarized device is adapted to respond, I will now proceed to describe more fully the device itself, which is shown in Fig. 4. In this figure I have shown an operator's telephone-transmitter u in vertical section. Upon the back of the transmitter is mounted a bent bar of iron v. To one end of this bar, at right angles to it, is a small electromagnet q. To the other end of bar v is pivoted by one end an armature w of iron, whose other extremity faces the end of electromagnet q. Armature w is normally held away from electromagnet q and against a fixed stop y by the adjustable spring x. The bar v, when the device is to be employed in connection with a test system whose test-current is of alternating character, is permanently polarized. Hence when an alternating current flows through the electromagnet

q, the armature w is alternately attracted and released, and as it vibrates it strikes alternately its stop y and electromagnet q. The blows against these stops disturb the transmitter-contacts and cause undulations to be impressed upon the current flowing through the transmitter.

The diagram, Fig. 1, shows the relations between the test-circuit and the operator's local telephone set and the polarized responsive device of Fig. 2. The coil q is connected, as described, in the circuit between the tip of the test-plug and the earth. The transmitter u is connected in circuit with a local battery and the primary of an induction-coil z, whose secondary is included in the circuit of the operator's telephone. Thus the sonorous disturbances imparted to the transmitter-contacts affect the testing-operator's telephone through the medium of induction-coil z in the usual manner.

When it is desired to employ my invention in connection with a test system in which the test-current is of constant direction, the bar v is not magnetized and the spring x is adjusted to such tension that the armature is allowed to respond only to currents of predetermined strength.

It is obvious that when a separate test-plug is employed to complete the test-circuit to earth the circuit from test-plug to earth may include only the coil q of the responsive device, and the dynamo s and the blows from the armature w will still affect the operator's telephone through the induction-coil z.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In combination, in a test circuit for multiple switch board systems, a connected series of test rings of spring jacks, a branch circuit from one of the test rings, including a source of electric energy, to earth, a second branch circuit from another of the test rings including the coil of an electro magnet provided with an armature adapted, when actuated, to strike a telephone transmitter, and with means for adjusting the armature to respond to different degrees of attraction to its magnet, and a telephone adapted to respond to changes in the current of the transmitter, substantially in the manner and for the purpose specified.

2. In a test system for multiple switch boards, the combination of a connected series of test rings of spring jacks, with a branch circuit from one of the test rings to earth including a source of intermittent or pulsatory current of constant direction, and a second branch connection from another of the test rings to earth through the coil of a polarized electro magnetic responsive device adapted, when actuated, to strike a telephone transmitter, a telephone adapted to respond to variations in the strength of the current which is electrically connected with the transmitter, and through a source of intermittent current whose direction is opposite to that of the first and whose periods of flow coincide with the periods of intermission of the current from the source in the first branch, in the manner and for the purpose specified.

3. In a test circuit for multiple switch boards, the combination of a source of intermittent current of constant direction, and a second source of current of opposite direction to that of the first, and whose periods of intermission coincide with the periods of flow of the current from the first source, with a polarized electro magnetic responsive device whose coil is included in the test circuit adapted, when actuated, to strike a telephone transmitter, and a telephone having a coil included in the test circuit, and adapted to be affected in response to disturbances in the transmitter, substantially in the manner and for the purpose specified.

In witness whereof I hereunto subscribe my name this 3d day of June, A. D. 1891.

CHARLES E. SCRIBNER.

Witnesses:
FRANK R. MCBERTY,
GEORGE L. CRAGG.