J. A. ESSLINGER.

TELEGRAPHY.

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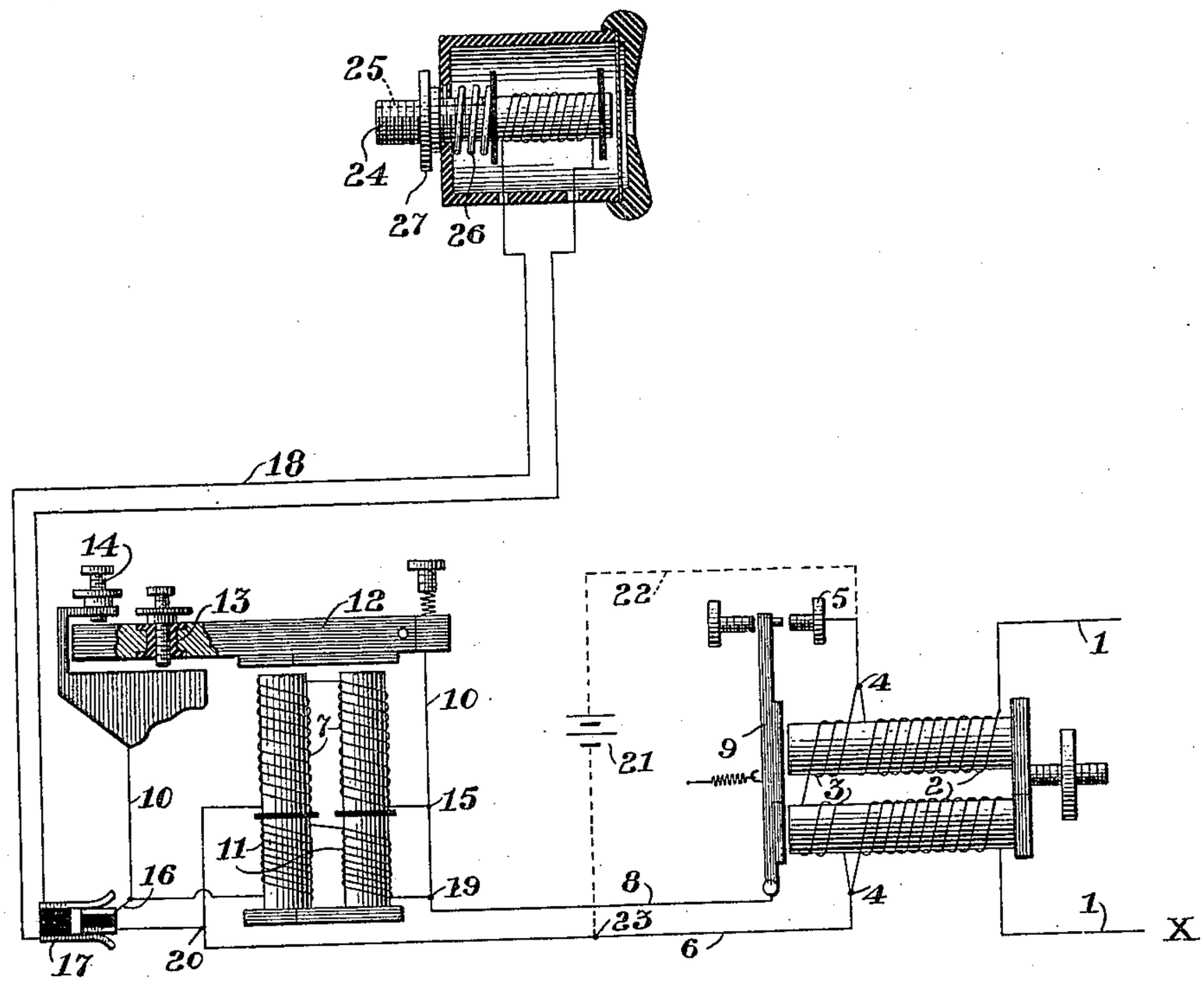

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UNITED STATES PATENT OFFICE.

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TELEGRAPHY.

993,442. Specification of Letters Patent. Patented May 30, 1911.

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To all whom it may concern:

Be it known that I, JOHN A. ESSLINGER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Telegraphy, of which the following is a specification.

My invention relates to a system in telegraphy in which an interacting relay shunts induced and main line currents through its break-points to operate a reciprocating electro-magnetic inductive sounder which in turn operates a diaphragm receiver, and the objects of my invention are, first, to provide relay control and static use for a main line sounder; second, to utilize electro-magnetic resultants to simulate up and down strokes with a diaphragm receiver, and, third, to make possible the use of either a sounder or a diaphragm receiver, or both. The accompanying drawing illustrates how I attain these objects, in which the instruments are of the common type now in general use except in particulars pointed out.

1 is the main line, 2 the relay energizing coils superimposed upon and connected with the inductive circuit preserving resistance coils 3, which are in series wound in two layers each next adjacent to the cores, the respective coils joined at 4 4, from which junctions lead taps, one to the armature break-point 5, the other to the sounder actuating coils 7, the return 8 to the armature 9, thus forming a shunt away from the resistance coils 3 controlled by the armature break-points. The connection 10 is a means for short-circuiting the anomalous bridging induction coils 11 when the sounder armature lever 12, having a hard annular insulation 13 to accommodate an adjustment screw which is designed not to detract from the necessary clang and prevent circuit when the lever strikes the anvil, is in contact with the anvil break-point 14, and extending from the junction 15 to the tap 16 at the open jack 17 to furnish a parallel through the conductor 18 to the diaphragm receiver and from 19 to 20 with the sounder actuating coils 7 the instant the lever severs the contact at 14 to throw the induction coils 11 into the diaphragm circuit.

The sounder being of the large magnet variety permits of core partitioning, the actuating coils 7 are wound nearest the pole ends and of suitable convolutions to operate with varying currents, while the induction coils 11 are of fine wire wound contiguous to the yoke to effect a magnetic ring in order to minimize line disturbances, particularly dynamo hum, to offer enough resistance for the proper break required to affect the diaphragm when the contact at 14 is broken, and to cut sufficient lines for the magneto-electric current to produce the desired upstroke when the whole circuit is broken.

The diaphragm receiver is of the ordinary single pole permanent magnet watch case type provided with a wide range of adjustment because of the extreme variation in telegraph lines and currents. The electro-magnet has a screw core extension 24, a groove 25 cut longitudinally to fit a pin in the case perforation to prevent the magnet from turning when the tension of the stiff spiral spring 26 is acted upon by the nut 27 to readily increase or decrease the field bebetween the pole end and the diaphragm. To further facilitate increased or decreased volume of sound in the diaphragm receiver, and give opportunity for easy attachment and detachment, the jack 17 is fixed to an accessible place on the sounder and with the suitable spring arrangement at the terminal of the diaphragm conducting cord, the polarity of the current to the diaphragm magnet can be changed by the mere reversal at the jack. This is made desirable owing to the uncertainty from which direction the current comes, and that like current polarity in the diaphragm electro-magnet produces a much stronger effect than that of the opposite polarity.

Should necessity call into service any one of the numerous relays now in use having simply a local armature arrangement, my sounder and diaphragm receiver can be operated by local battery as shown by the dotted lines in the drawing, viz, one pole of the battery 21 connected by the conductor 22 to the break-point 5, the other pole by the connection 23 to the sounder circuit, thus making a purely local connection with practically the same results as if the main line furnished the working energy.

In the operation of my system I turn impedances to advantageous application by availing myself of these facts: The escape and induction on long single telegraph lines which cause the variation in current from zero to maximum when the circuit is alternately made and broken at the home office to barely under maximum to maximum when

the most distant office is sending and which render directly connected main line sounders and diaphragm receivers inefficient, especially in bad weather, I surmount by the interaction of a relay to shunt into and cut off short the energy through the action of the relay armature break-points. This is made possible because in a telegraph line in which there are electro-magnets the current is retarded in rising when the circuit is closed, and that its fall is prolonged when the circuit is opened, thus producing a retardation of signals, which allows ample time for the relay armature points to close the shunt, supply the necessary current to operate the receiving instruments and on the other hand, to break the shunt clean, effecting practically a local circuit.

As the joint resistance of circuits in multiple is equal to the reciprocal of the sum of the reciprocals of the respective resistances of the circuits, and the strength of current in the branches of a divided circuit is inversely proportional to the respective resistances of each branch, by placing the two layer coils 3 of suitable resistance wire in circuit with the relay energizing coils 2, I momentarily increase the line resistance, but as the shunt is closed, the multiple is formed which materially reduces that resistance and gives the sounder circuit the proportional strength of current. Furthermore, as the numerous turns in relay energizing coils develop a high self-induction, augmented by the magnetization of the cores, all of which increase the resistance of the relay coils and impede action, with the making of a shunt away from the inside of these coils, the condensed static force is removed from the relay coils and profitably discharged into the sounder coils. Therefore, I insert the sounder shunt between the relay coils to obtain uniformity regardless from which direction the current comes and limit the number of lines cut by the circuit preserving resistance coils 3, for as the current rises from zero to maximum a much greater electromotive force is self-induced than if the variation is nominal, which is decidedly noticeable in the diaphragm receiver.

When, as in the sounder, a bar of iron having a coil of insulated wire around it—induction coils 11—is suddenly magnetized or demagnetized an electromotive force is developed in the wire, which produces a current of electricity if the ends of the wire are connected, the more powerful at the demagnetization, which difference is shown in a joined diaphragm receiver and sharply accentuated when a charged electro-magnet circuit is abruptly broken.

By progressively following my arrangement, in view of the foregoing, assuming the charge to enter the main line 1 at X, it successively passes through the energizing coil 2 first in order, the immediate resistance coil 3, the mediate resistance coil 3 and thence the second energizing coil 2 to the main line 1, and with its entrance into the coils self-induction begins to set up a counter electromotive force. With the rise of the working current, the rise of the self-induced current markedly so in the resistance coils 3 which are magneto-electrically affected by the magnetizing cores, the attracting power of the cores increases to the point where it overcomes the tension of the retractile adjustment spring and the armature 9 is drawn to the front stop 5 where the break-points are put in contact. Under normal conditions the shunt from the tap 4, through the lead 6, the sounder coils 7, the return 8, the armature 9, the break-point 5 to the corresponding tap 4, is thus thrown into circuit with the energizing coils 2, parallel to the resistance coils 3, before the current has attained maximum in the relay coils. At the making of this shunt the proportional main line energy is diverted from and around the resistance coils, the accumulating static charge in the coils tending toward the direction whence the energy comes, being relieved of the former pressure at the junction 4, enters the shunt conduit with the working force, but being of a much higher potential precedes the main line current both now traveling in the same direction into the sounder coils 7, unburdening the relay coils of its counter-force the static charge adds to the main line force with the result that the sounder responds like a locally operated instrument and without affecting the magnetic traction of the relay cores. In this respect it advantageously differs from directly operated main line sounders, for by the interaction of the relay armature break-points the current rise in the sounder coils is from zero to maximum at the closing, and the fall is from maximum to zero, no matter whether the line and consequently the relay coils remain almost choked or fully discharge themselves, at the opening. It is on this account that my reciprocating sounder with its inductive scheme, coincident with the act of coercion, furnishes the necessary make and break for a high electromotive force to loudly produce telegraph signals on a diaphragm receiver and shortening the "sender's interval" thereby considerably relieving the "pull" on the arm.

Until the diaphragm receiver is cut in at the open jack 17 the sounder actuating coils 7 alone are directly in circuit with the shunt. However, as the entire system is ready for service with the diaphragm receiver's connection at the jack, a second parallel is made in my shunt system, but by using a receiver of sufficiently high resistance it will not interfere with the actuating coils of any sounder winding the receiver

attachment must parallel. This is to give opportunity for operators to use their individual receivers in connection with sounders of different resistances, and still permit when the shunt in my system is made the static discharge to follow its well known characteristics of following any path offered it. Therefore, at the appulsion of the relay armature break-points at 5 in the manner already described, the static discharge from the relay coils, beside having the actuating coils as a course, also finds its way by means of the now existing by-path from the tap 20, through the jack 17, into and out of the diaphragm receiver by the cord 18, thence the connection 10 to the anvil point 14, the armature lever 12, the second connection 10 to the tap 15. This discharge excites the receiver electro-magnet to give the diaphragm an instantaneous click, but the working current of greater amperage following so closely draws the diaphragm toward the electro-magnet. The sounder actuating coils in the meantime having started the armature lever 12, the short-circuiting contact with the point 14 is broken and the diaphragm records the break as the circuit of considerable resistance from the tap 16 through the induction coils 11 to the tap 19 is thrown in. The induction coils having taken up a magneto-electric force from the magnetization of the sounder cores add their quota, the armature increasing the magnetic density as it approaches the cores, and with the multiple proportion of the current from the shunt to finally hold down the diaphragm, the whole blends so well that when the sounder itself is properly adjusted the rapidity with which these several forces follow one another, a resultant is obtained which causes the diaphragm to emit ringing metallic vibrations similar to the down stroke of a clear working electro-magnetic sounder. And then, since the induction coils and the diaphragm receiver are in multiple with the actuating coils, the induction coils' passage around the sounder cores produces a choking effect on the inducing current in developing an induced current of opposite polarity by the magnetic action of the cores, individual manifestations of variation in current are neutralized, the line disturbances are almost entirely eliminated when the line stands closed.

At the opening of the line the relay armature cuts off clean the energy for the sounder which freely releases the armature lever, gives the diaphragm electro-magnet the impulse of the high electromotive force at the break of the direct connection and the influence of that magneto-electrically generated in the induction coils at the demagnetization of the cores by the discharge of the actuating coils, likewise the reformation of the contact of the armature lever with the anvil break-point, allowing a confused circulation of the static to considerably dissipate itself in the local connections and producing a distinct up-stroke on the diaphragm.

The ringing vibrations on the diaphragm at signal making are such that when the receiver has a telephone adjustment a 50 milliampere or greater current renders the vibrations unbearable to the ear in present operating room noises, but such an adjustment is necessary under like conditions when the current is of 15 milliamperes or less, with the usual potential assigned to the telegraph lines. Therefore the wide range of adjustment is given my receiver. Furthermore, if an operator should suffer from defective hearing he can increase the volume of sound without sacrifice to the working of the receiver as would be the case in a sounder, and, without annoyance to a neighbor by using a "turned-up" sounder, for I find that the reverse pole in the diaphragm electro-magnet is sufficiently loud enough for general use.

My system in its entirety is peculiarly well adapted for branch office loops or way stations where local leads or bothersome batteries are necessary to operate local sounders. As the resistance in my system decreases with the rising of the current and the paralleling of the circuits the line resistance is not greatly altered by the added instruments, while on the other hand, the condensed self-induction of the relay coils is discharged into the sounder and its attachments, the "extra-current" is noticeably reduced at the opening of the main line. Again, on multiplex sets where balancing resistance is employed, by inserting in the ground resistance arrangement an electro-magnet wound either like my relay or sounder, and with the break-points of either a polar or neutral relay suitably connected to make and break the shunt my reciprocating sounder and the diaphragm attachment can be operated as on a single line and to the economy of local current. Yet, if a local is preferred to the above, the same results can be obtained thereby, as I have already indicated.

I am aware that in telegraph systems interacting relays with shunts for sounders and diaphragm receivers heretofore have been resorted to, but

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a sounder with an interacting relay having resistance and energizing coils joined in series, shunt taps from the junctions of the respective coils, an armature provided with break-points, one of said taps leading to one of said break-points, suitable connections with the sounder to the relative break-point for the corre-

sponding tap, said energizing coils disposed to operate said armature, said break-points arranged to control said shunt, substantially as described and for the purposes set forth.

2. The combination of a reciprocating inductive sounder of the kind described with an interacting shunt relay having resistance and energizing coils joined in series, shunt taps from the junctions of the respective coils, an armature provided with break-points, suitable connections with the sounder to the relative break-point for the corresponding tap, said energizing coils disposed to operate said armature, said break-points arranged to control said shunt, substantially as described and for the purposes set forth.

3. The combination of a relay with a reciprocating inductive sounder having actuating and induction coils in multiple, a contact armature lever containing an insulated adjustment screw, an anvil provided with a contact point, a diaphragm receiver and means for attaching said diaphragm receiver, a source of electrical energy, suitable connections for said actuating coils to control said armature lever, said armature lever and anvil contact point to short-circuit and be bridged by said induction coils, the resultants thereof to be accentuated in said diaphragm receiver when attached, substantially as described and for the purposes set forth.

4. The combination of a diaphragm receiver with a reciprocating inductive sounder having actuating and induction coils in multiple, a contact armature lever containing an insulated adjustment screw, an anvil provided with a contact point, means for attaching a diaphragm receiver, a source of electrical energy, suitable connections for said actuating coils to control said armature lever, said armature lever and anvil contact point to short-circuit and be bridged by said induction coils, the resultants thereof to be accentuated in the diaphragm receiver when attached, substantially as described and for the purposes set forth.

5. The combination of a diaphragm receiver with a reciprocating inductive sounder of the kind described and an interacting shunt relay having resistance and energizing coils joined in series, shunt taps from the junctions of the respective coils, an armature provided with break-points, one of said taps leading to one of said break-points, suitable connections with the sounder to the relative break-point for the corresponding tap, said energizing coils disposed to operate said armature, said break-points arranged to control said shunt, substantially as described and for the purposes set forth.

6. The combination of a relay with a diaphragm receiver and a reciprocating inductive sounder having actuating and induction coils in multiple, a contact armature lever containing an insulated adjustment screw, an anvil provided with a contact point, means for attaching the diaphragm receiver, a source of electrical energy, suitable connections for said actuating coils to control said armature lever, said armature lever and anvil contact point to short-circuit and be bridged by said induction coils, the resultants thereof to be accentuated in the diaphragm receiver, substantially as described and for the purposes set forth.

7. The combination with a telegraph line of an interacting shunt relay having energizing and resistance coils in series, a shunt around the resistance coils through an armature provided with break-points, a sounder included in said shunt, a source of electrical energy, signals to alternately charge and discharge the line, the energizing coils to control the armature thereby, the break-points to impart said signals by means of said energy to said sounder, substantially as described.

8. The combination with a telegraph line of an interacting shunt relay having energizing and resistance coils in series, a shunt around the resistance coils through an armature provided with break-points, a reciprocating inductive sounder comprising actuating and induction coils, a source of electrical energy, signals to alternately charge and discharge the line, the energizing coils to control the armature thereby, the break-points to impart said signals by means of said energy to said sounder, an insulated armature lever to resound said signals on an anvil and suitable connections therefor, included in the shunt, substantially as described.

9. The combination with a telegraph line of an interacting shunt relay having energizing and resistance coils in series, a shunt around the resistance coils through an armature provided with break-points, a reciprocating inductive sounder comprising actuating and induction coils, a source of electrical energy, signals to alternately charge and discharge the line, the energizing coils to control the armature thereby, the break-points to impart said signals by means of said energy to said sounder, an insulated armature lever to resound said signals on an anvil and suitable connections therefor to produce resultants which consonantly influence a diaphragm receiver, included in the shunt, substantially as described and for the purposes set forth.

10. The combination with a telegraph line of an interacting shunt relay having energizing and resistance coils in series, a shunt around the resistance coils through an armature provided with break-points, a reciprocating inductive sounder comprising actuating and induction coils, a source of electrical energy, signals to alternately charge

and discharge the line, the energizing coils to control the armature thereby, the break-points to impart said signals by means of said energy to said sounder, an insulated armature lever to resound said signals on an anvil and suitable connections therefor to produce resultants which consonantly influence an adjustable diaphragm receiver of the kind described, included in the shunt, substantially as described and for the purposes set forth.

11. The combination in an electro-magnetic shunt device of a pair of resistance coils wound next adjacent to the cores, a pair of superimposed energizing coils, joined in series, line terminals for the joint coils, taps from the junctions of the respective coils, a relay armature provided with break-points, one of said taps leading to one of said break-points, suitable connections for the corresponding tap to form a shunt around said resistance coils controlled by said break-points, a sounder and electrical energy to operate said sounder in circuit with said shunt, substantially as described and for the purposes set forth.

12. The combination in an electro-magnetic inductional multiple comprising a pair of continuity preserving actuating coils, a pair of reciprocating induction coils, an attachable diaphragm receiver, a common terminal for one side of the joint coils, suitable connections at the corresponding side to provide means with the aid of electrical energy and break-points to effect a momentary short-circuit of said induction coils and reciprocally throw said diaphragm receiver in circuit with said induction coils arranged to vibrate the diaphragm of said receiver, substantially as described and for the purposes set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN A. ESSLINGER.

Witnesses:
ERNEST W. EMERY,
JOHN P. GAVIT.