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E. A. TERPENING.

TELEPHONE SYSTEM.

APPLICATION FILED SEPT. 3, 1903.

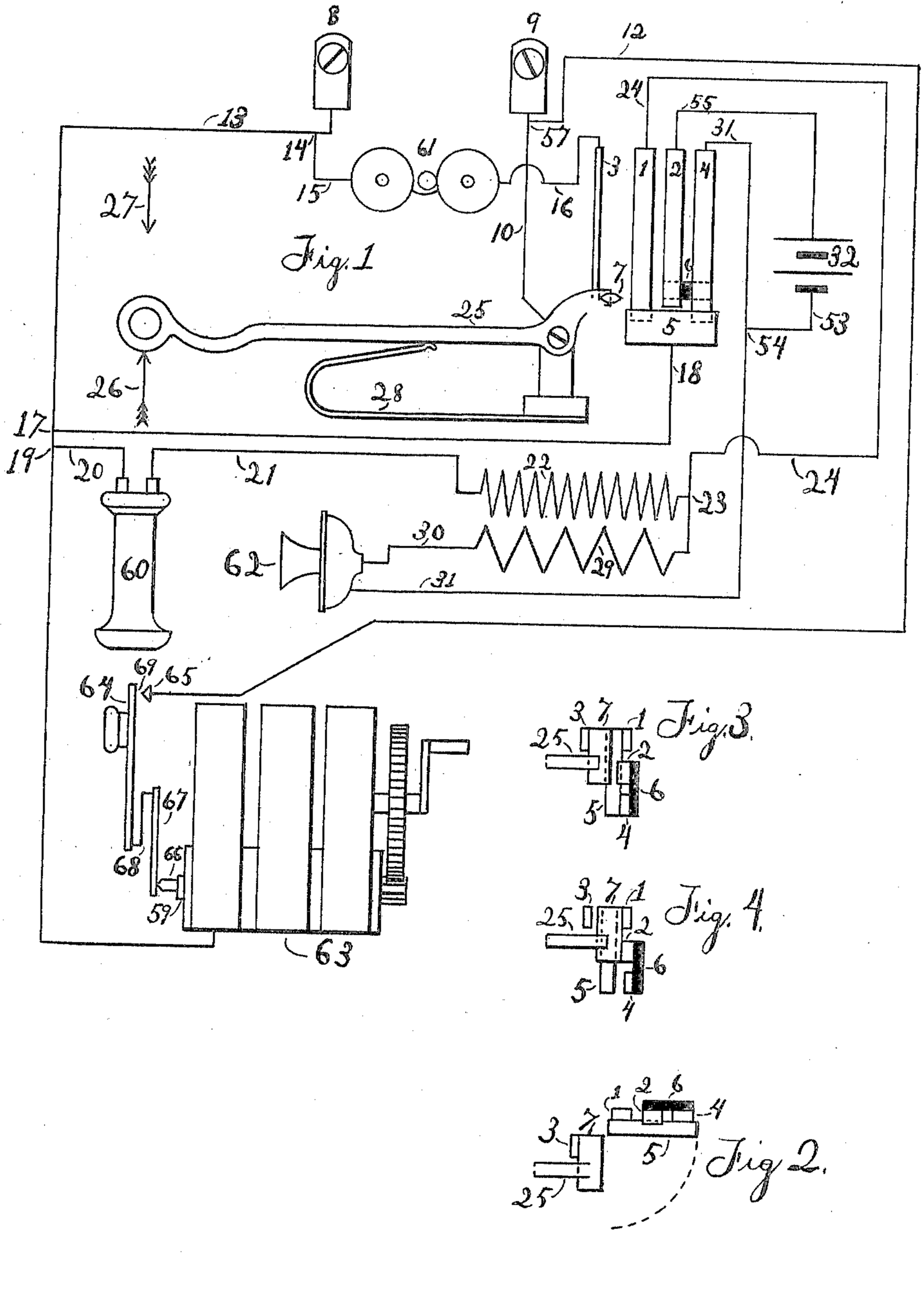

Fig. 1

Fig. 3

Fig. 4

Fig 2.

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, ELMER A. TERPENING, a citizen of the United States, residing at Geneseo, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a full, clear, and exact description.

My invention has for a primary object to provide for the protection of telephone instruments against the deleterious effects of high-static charges or static discharges induced by lightning or other stray electric currents or discharges of high potential.

Other and further objects of my invention may best be gathered from the following description.

In general I may state that for the protection of certain instrumentalities of a telephone installation I provide means for establishing closed circuits containing said instruments when such parts of the telephone installation are idle, or, as I may more briefly express it, I short-circuit the instruments to be protected upon themselves, preferably in circuits of low resistance extraneous to the instruments themselves.

I have found from actual experience that during electrical storms certain parts of the telephone apparatus, particularly the receiver and secondary-coil windings, are liable to be burned out, notwithstanding the fact that the circuit containing these elements is open at the switch-hook. Further, I have found from experience in many such cases that where the generator, secondary coil, and receiver windings have been burned out during an electric storm the bell, whose coils are connected squarely across the terminals of the line during all the time, has stood unharmed.

It is my belief that the damage under the foregoing conditions is not due directly to the lightning, but to the accumulation of high-static charges induced by the lightning in the open-circuited coils, such induced static charges being of sufficient intensity or strength to break down the insulation of the coils and discharge itself. It is therefore my theory that if means be provided for establishing closed circuits of low resistance including these coils during such time as the telephone set is idle no static charge of such high potential can be accumulated, as the closed path, or, as I term it, the "short circuit," of the instrument affords a convenient path of discharge.

The foregoing theory I believe to be quite in harmony with the electrical teachings of today; but I do not desire to be understood as basing my application upon theory, as actual practice has demonstrated the fact that the means which I employ for preventing damage to the telephone instruments to be protected are, in fact, very efficient and afford good protection whatever may be the proper theory of their operation.

Referring now to the specific embodiment shown in the drawings, Figure 1 is a diagrammatic view of a subscriber's telephone set, a set of three springs to the right of the switch-hook being shown in distorted position at an angle of ninety degrees to their actual working position for purpose of clearness of disclosure. The manner of this distortion may best be gathered from Fig. 2, which is a plan of the end of the switch-lever, showing the associated spring-tongues in full lines in the distorted position indicated in Fig. 1 and showing by dotted arc the movement from actual position necessary to secure the distortion shown in Fig. 1. Fig. 3 is a plan view of the end of the switch-hook and its associated parts as actually arranged, showing the coaction of the parts when the switch-hook is down or in its lowest position under the weight of the receiver. Fig. 4 is a plan view showing the relation of the parts when the switch-hook is raised to its uppermost position when relieved from the weight of the receiver.

Throughout the drawings like numerals of reference refer always to like parts.

In the specific construction shown, 25 represents a switch-hook provided with an elevating-spring 28 and upon the end opposite the fork provided with a cross-piece 7, of conducting material. Associated with the cross-piece 7 is a set of springs, herein illustrated as four in number, of which three springs 1, 2, and 4 are arranged on the side of the cross-piece 7 remote from the pivot of the hook-lever, and the single spring 3 is arranged on the opposite side of said cross-piece 7. The three springs numbered 1, 2, and 4 are arranged in conjunction with a plate 5, of conductive material, with which the springs 1 and 4 normally contact, but with which the central spring 2 at no time contacts, said central spring 2 being shorter than its fellows.

The springs 1 and 2 are so disposed relative to the cross-piece 7 that when the hook-switch is raised said springs 1 and 2 are electrically connected through and with the cross-piece and are moved rearwardly from normal position, so that the spring 1 is forced out of contact with the plate 5. I also provide means whereby the spring 4 is moved out of contact with the plate 5 whenever the switch-hook is raised, but without making electrical contact or connection with the cross-piece 7 of the switch-hook, the movement of spring 4 from contact with plate 5 taking place before the tongue 1 is engaged by the part 7 of the hook. To accomplish this result, I preferably arrange a rigid insulating connection 6 between the springs 2 and 4 and arrange the spring 2 with its front face nearer the cross-piece 7 than is spring 1, as shown.

On the opposite side of the cross-piece 7 the spring 3 is so arranged that when the spring-hook is down the cross-piece 7 contacts and makes electrical connection therewith, and when the switch-hook is raised the cross-piece 7 leaves and breaks connection with said spring 3. The operation of these springs in connection with the switch-hook cross-piece 7 may best be seen in Figs. 3 and 4, Fig. 3 indicating the relations assumed by the various parts when the switch-hook is down and showing the spring 3 in electrical connection with the switch-hook and the springs 1 and 4 in electrical connection with the conducting-plate 5, but out of contact with the switch-hook, while the spring 2 has no direct electrical connection with either of its fellows, the plate 5, or the switch-hook.

In Fig. 4 is shown the relation of the parts assumed when the switch-hook is elevated as by the removal of the receiver, connection being then broken between the spring 3 and cross-piece 7 of the switch-hook and between the springs 1 and 4 and the plate 5 and electrical connection being established between both the springs 1 and 2 and the cross-piece 7 of the switch-hook.

The usual parts of a subscriber's telephone set are conventionally shown in the drawings, 60 indicating the telephone-receiver, 61 the bell, 62 the telephone-transmitter, and 63 a magneto-generator.

The bell-circuit may be traced from one of the line-wires by binding-post 8, wire 15, bell 61, and wire 16 to the spring 3 and from the switch-hook 25 by wire 10 to the other line binding-post 9. It will be apparent that this circuit is closed only when the switch-hook is down and the spring 3 in contact with the cross-piece 7 of the hook, as shown in Fig. 3, and is opened when the parts assume their position shown in Fig. 4 upon the removal of the receiver from the hook.

The circuit of the generator 63 may be traced from the binding-post 8 by wire 13 to the generator-armature 59, through the commutator-pin 66, spring 67, wire 68, hand-switch 64, contact 65, and wire 12 to the other binding-post 9. It will be understood that this circuit is completed only when the hand-switch 64 is manually moved into contact with the point 65, the circuit otherwise being open, as at point 69.

The telephone receiver and transmitter are connected in circuit adapted when the switch-hook is raised to be connected in the usual manner with the line; but when the switch-hook is down and the line idle to be disconnected from the line and connected in closed circuits, through which, preferably, no current normally flows.

When the switch-hook is elevated, the talking-circuits are established as follows: from binding-post 8 by wire 13, junction 19, wire 20 to the receiver 60, thence by wire 21 to the secondary coil 22, and thence through junction 23 by wire 24 to the spring 1, which being now in contact with the part 7 of the receiver-hook is connected through said hook and the wire 10 with the terminal 9. This completes the closed receiver-circuit. The locally-energized transmitter-circuit may be traced from battery 32 through wire 55 to spring 2, through the conducting-plate 7, making connection between the springs 2 and 1 to the spring 1, through wire 24 to the primary coil 29, wire 30 to the transmitter, wire 31, back to junction 54, whence connection is made to the opposite terminal of the battery. It will be apparent now that both the receiver-circuit and the transmitter-circuit are closed, as above described, only when the receiver-hook is in raised position, as depression of the receiver-hook and removal of the part 7 thereof for contact with the springs 1 and 2 breaks the connection of spring 1 with the wire 10, thereby rupturing the receiver-circuit, and breaks the transmitter-circuit between the springs 1 and 2.

To provide circuit connections for including the receiver and transmitter and their associated secondary and primary coils in a closed dead circuit without including the battery 32 therein, I extend the wire 31 beyond the junction-point 54 to connection with the spring 4 and connect the stationary plate 5 by wire 18 to the wire 13 at point 17. Now it will be apparent that when the switch-hook is in depressed position its cross-piece 7 is out of contact with all of the springs 1 2 4, and springs 1 and 4 rest upon the plate 5, while spring 2 has no electrical connection at its free end, so that a dead closed circuit or, as I for convenience term it, a "short circuit" is established for the receiver from said receiver 60 by wire 21, coil 22, to juncture 23, by wire 24 to the spring 1, thence to contact-plate 5 by wire 18 and juncture 17, through a portion of wire 13, to the juncture 19, and back by wire 20 to the receiver 60. The

transmitter 62 and its primary coil 29 are included in a similar dead circuit which may be traced from the transmitter by wire 30 through the coil 29 to the juncture 23, by wire 24 to spring 1, through the plate 5 to spring 4, and by wire 31 back to the transmitter. It will be seen that the battery 32 is in an open circuit, and it will further be apparent that of the two alternative electrical paths from the transmitter the one through the spring 4 is closed in a dead circuit only when the receiver-hook is down, and the one through the battery 32 and spring 2 is closed through the talking-circuit only when the switch-hook is raised.

It will be noted that the battery 32 is never short-circuited through wires 31 and 55, as during the depression of the hook 25 spring 1 makes contact with plate 5 and loses connection with cross-piece 7 of the hook before spring 2 reaches normal position, and consequently before spring 4 strikes plate 5.

It is further to be observed that when the dead or short circuits are established for the transmitter and receiver element the line is not short-circuited through the means employed to establish such dead circuits.

I therefore desire it to be clearly understood that I do not intend to limit my invention to the specific devices and arrangements herein shown and described further than as clearly specified in the claims, and I further desire it to be understood that while I regard it as highly desirable to maintain the line-circuit open (except through the bell connections) when the telephone is idle I do not limit my invention thereto further than as specified in the claims.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a telephone set, a transmitter, a receiver, and a switch-hook, and means, including circuit connections, whereby the switch-hook, when in one position, connects said receiver and transmitter in closed local circuits, and when in another position operatively connects said transmitter and receiver to transmit and receive over the line.

2. In combination, in a telephone set, a transmitter, a receiver, and a switch-hook, means whereby said switch-hook when in one position operatively connects said transmitter and receiver for transmitting and receiving to and from the line, and means whereby the switch-hook when in another position connects said transmitter and receiver in dead closed local circuit.

3. In combination with a telephone transmitter and receiver, a switch-hook adapted to be moved to two positions, suitable circuit connections, and contact parts controlled by the switch-hook arranged and adapted when the hook is down to short-circuit the transmitter and receiver without thereby short-circuiting the line, and when the hook is raised to operatively connect the transmitter and receiver for transmitting to and receiving from the line.

4. In combination, in a telephone set, a local battery, a transmitter, an induction-coil having primary and secondary windings, a receiver and a switch-hook, suitable circuit connections, and contact parts associated with the switch-hook, all arranged and adapted to establish when the hook is down closed local circuits, including the receiver, transmitter, and induction-coil windings, and excluding the local battery, and when the hook is raised to establish a closed local circuit including the local battery, the primary winding of the induction-coil and the transmitter, and to connect the secondary coil and the receiver for inclusion in the line-circuit.

5. In a telephone set, a transmitter, a local battery, a switch-hook, means associated with the switch-hook for control thereby arranged to establish a closed circuit including the battery and transmitter when the hook is moved in one direction, and means associated with said hook for establishing a closed local circuit including the transmitter and excluding the battery when the hook is moved in the other direction.

6. In combination in a telephone system, a switch-hook, contacts 1 and 2, arranged to be closed by the switch-hook when in raised position, contact 3 adapted to be connected with the switch-hook when the latter is in depressed position, plate 5, disposed for connection with spring 1 when the latter is freed from the hook, and contact-spring 4, arranged for connection with the plate 5 only when the hook is depressed, line binding-posts, a bell connected between spring 3 and one binding-post, a constant connection between the hook and the other binding-post, a receiver constantly connected with the first said binding-post, and connected also with spring 1, a transmitter connected to springs 1 and 4, and a local battery connected with springs 2 and 4, as and for the purposes described.

In testimony that I claim the foregoing as my own I affix my signature in the presence of two witnesses.

ELMER A. TERPENING.

Witnesses:

JOHN C. FISCHER,

F. H. MCARTHUR.