

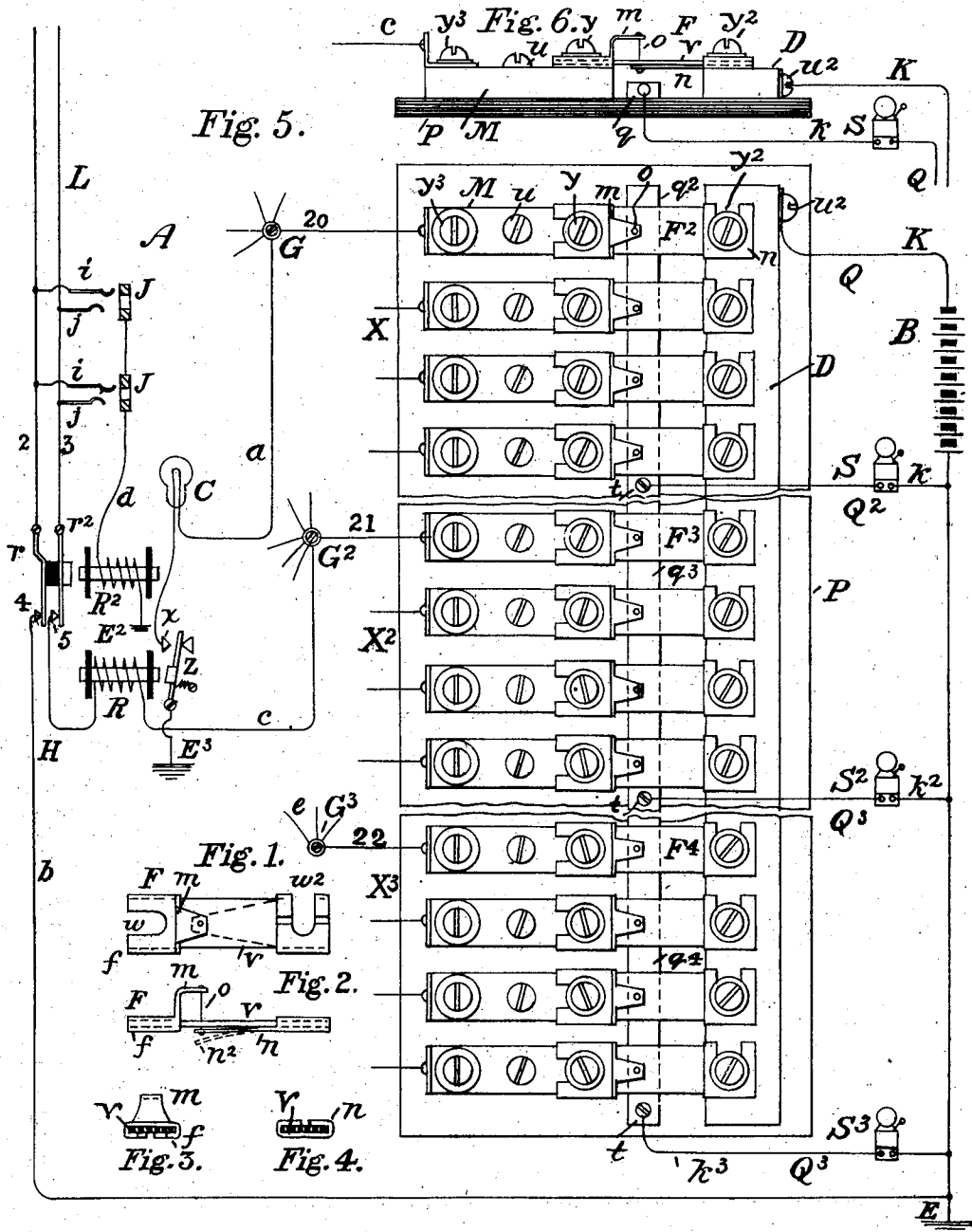
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PROTECTIVE DEVICE FOR TELEPHONE CIRCUITS.

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NO MODEL.



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PROTECTIVE DEVICE FOR TELEPHONE-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 761,916, dated June 7, 1904.

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To all whom it may concern:

Be it known that we, MALCOLM C. RORTY, residing at Boston, in the county of Suffolk, and GEORGE K. THOMPSON, residing at Newton, in the county of Middlesex, State of Massachusetts, have invented certain Improvements in Protective Devices for Telephone-Circuits, of which the following is a specification.

This invention relates to telephone-exchange central-station apparatus, and more particularly to switchboard-circuits or circuit-continuations and to such telephone apparatus as is included therein or associated therewith.

In a central telephone-station, especially of a common battery system, there are a number of circuits and circuit-conductors extending between the battery or common source of electrical energy and the switchboard for a variety of purposes. Current from said source, for example, is supplied to the substation main circuits through continuation-conductors for the operation of the call-signal or line-relays, while again other circuit-conductors lead through the contacts of said relays and the line-lamp or other ultimate signal device. Owing to crossing, short-circuiting, and other faults which not infrequently occur in masses of closely-packed conductors carrying currents, the current in any of these circuits is liable to suddenly attain an undue strength which may prove damaging or injurious to the insulation of the conductors themselves and to the electroreceptive devices or other telephonic apparatus connected in the circuits constituted of the said conductors. It has therefore become customary to provide these circuits with fuses having terminal pieces and connected to the circuit-conductors in any convenient way. Such fuses, however, as have heretofore been commonly used in conjunction with telephonic switchboard-circuits have not in any sense been organized devices especially arranged for this class of work and adapted for easy and ready attachment, and when a circuit fitted with them has been opened pursuant to their operation it has not been customary to provide means for manifesting

the fact, and attention is only called thereto by the failure of some portion of the apparatus to operate in the desired and appropriate manner. It is, however, most desirable that a compact, easily-attached, and interchangeable fuse appliance should be provided and that means should be associated with all such appliances when in place, whereby the operation of any fuse device shall be at once announced and its location indicated to the persons in general charge of the switchboard apparatus.

The objects of the present invention are the protection of switchboard-circuits and apparatus from the injurious effects of unduly strong electric currents, the accomplishment of the same by simple, convenient, and easily-applied devices, and the provision of means for calling attention to the operation of such protective devices and for readily determining and indicating the particular device of a number mounted together, which may have operated, and the circuit to which such protective device belongs. Looking toward the accomplishment of these objects, there is provided in this invention a protective-fuse device comprising a rigid terminal attachment, preferably of bracket form, an elastic or resilient attachment, an alternative or complementary contact-piece for said resilient attachment, and a fuse-conductor connected in the circuit to be protected between said rigid and resilient attachments and holding the latter in tension in such manner as to prevent it from engaging the said complementary contact-piece, the protective fuse thus constituted being as a whole or unit readily connectible between and removable from the severed ends of an electrical circuit-conductor. Such a fuse appliance in accordance with this invention may be included in each switchboard-circuit or circuit continuation, so that when the current in such circuit becomes unduly strong the fuse will be melted or disrupted, and the resilient attachment, no longer held thereby, will move in virtue of its own resiliency into engagement with the said alternative or complementary contact-piece. When there

are many switchboard-circuits, they are divided into groups, and with each such group there is associated a normally open or discontinuous alarm-circuit containing an electric bell or similar electric alarm which is adapted to be operated when any fuse of the group having been disrupted, melted, or volatilized releases the resilient attachment of its protective device. The said resilient attachment, therefore, taken together with its complementary contact, is, in effect, a spring-switch held in one position as long as the integrity of the sustaining-fuse is maintained, but adapted to move to its second position, where it closes the alarm-circuit and admits current from the common source thereto when released by said fuse. The alarm-circuit when quiescent and open, as stated, normally terminates in a conducting contact-bar which passes beneath the several resilient attachments or spring-switches of a group and serves as a complementary contact common to the several switches of the group. Thus when any fuse operates and the resilient attachment is released and permitted to yield to its own resiliency it engages with its complementary contact and closing the alarm-circuit simultaneously connects the battery therewith, so that the operation of the fuse not only opens the switchboard-circuit to be protected, but also closes the alarm-circuit associated with the group of which such switchboard-circuit is a member, to indicate and approximately determine the location of the circuit whose fuse has been operated and which, therefore, has been opened. Obviously instead of terminating the alarm-circuit of the group in a common contact bar each spring-switch of a group may have a separate complementary contact and the several complementary contacts of the group of spring-switches may be connected by a conductor passing them successively and forming the normal terminal conductor of the alarm-circuit, such an arrangement being a well-known and recognized alternative construction.

In the drawings which accompany this specification, Figure 1 is a view of the upper side of the protective device ready for connection with the conductors of a circuit. Fig. 2 is a side view of the same. Fig. 3 is an end view of one terminal of the protective appliance, and Fig. 4 an end view of the opposite terminal. Fig. 5 is a representation, partly diagrammatic, of a panel or frame supporting a plurality or series of groups of the fuse devices employed in a switchboard-circuit protective system and illustrating the electrical arrangement of circuits to be protected, the connection of the fuse device with such circuits and the arrangement of the associated alarm-circuit; and Fig. 6 is an end view of the panel represented in Fig. 5, showing in side elevation a fuse device mounted thereon, its connection with the switchboard-circuit to

which it belongs, and its relation to the associated alarm-circuit.

Referring to the drawings, A is the main central-station switchboard.

P is the panel-frame or base-board, on which any sufficient number of fuse devices are mounted, as shown.

F is the fuse device, forming of itself a complete appliance adapted for ready and convenient connection with any switchboard-circuit or circuit continuation.

B is the central-station source of electrical energy or current, generally a battery of storage-cells.

L is the central-station end of a substation-circuit, having switch-socket contact-springs i and j placed in the rear of jack or switch-socket rings or frames J, which in the present instance sufficiently represent the switchboard A.

R is the line-relay, C the line lamp-signal controlled by said relay, and R^2 the cut-off relay of circuit L.

The switch-socket contact-springs i and j are branched from the main conductors 2 and 3, respectively, of the substation-circuit, the said main conductors being normally extended through the movable and fixed contacts r , r^2 , 4, and 5 of the cut-off relay R^2 to the two poles of the central source of current B by means of continuation-conductors b and c , which together compose the continuation-circuit H. This continuation-circuit H is adapted to be disconnected by the action of the cut-off relay R^2 when the line is switched to another, the said cut-off relay being included in a well-known manner in a local circuit d , whose fixed portion extends through the coils of said relay from the several switch-socket frames J to the earth or return connection E^2 and which is adapted to be completed when a switch-plug is inserted in any of the said socket-frames by plug and cord conductors (not shown) in the usual way. The line or signal relay is connected in the conductor c of the continuation-circuit H, and is therefore normally in the main or substation circuit, being adapted to operate for the production of the call-signal when the said substation-circuit is closed. The line signal-lamp C is in a switchboard-circuit a , connected with the common battery and leading through the contacts x and z of line-relay R, so as to be controlled thereby. For the purposes of this specification the continuation-circuits H and the lamp-circuits a of any number of substation-circuits L are termed "switchboard-circuits," and it is to be understood that such term is applicable to and includes any circuit connected or associated with the switchboard, which has a fuse device interposed for its protection in its general battery connection, the said continuation and lamp circuits being selected for illustrative purposes only. Under conditions which prevail in practice, but which

sustain no necessary relation to the present invention, the source of current B is grounded at one of its poles, and this being so it is unnecessary to extend the return-conductors of circuits supplied with current from one pole of such source completely back to the other pole, and such return-conductors may therefore be attached to a common return or to an earth connection at any convenient point. Accordingly the switchboard-circuits H, d , and a are shown as being grounded at E, E², and E³, respectively.

The fuse device, which constitutes a characteristic feature of the invention, is particularly illustrated by Figs. 1, 2, 3, 4, and 6 and comprises as its essential elements a bracket m , of brass, German silver, or like metal or alloy, constituting a stiff or rigid terminal attachment, a spring-tongue n , of German silver, mounted below said bracket and forming an elastic or resilient terminal attachment fixed at one end and extending below the end of said bracket at the other, a fuse link or wire o , attached at its ends by soldering or otherwise to the said terminal attachments, respectively, in such manner as to establish conductive continuity with and between them, and a contact-stop q for said resilient attachment in the line of retraction thereof and within the range limit of such retraction. The said metallic bracket m and spring-tongue n are both mounted on a base or strip of non-conducting and preferably non-combustible material, and the fuse-link o in a plane normal to both passes through an aperture or small hole in the said base. A strip or plate v of mica has in practice been used as the non-conducting base of the fuse device and is found to answer well. The metallic bracket is mounted at one end and on one side of said strip or plate v , and the edges of its supporting-foot f are bent round to inclose the end of said mica strip, as shown in Fig. 3. The spring-tongue n is mounted at the other end and on the other side of said mica strip, and the edges of the fixed end thereof are bent upward (see Fig. 4) and in a similar way are caused to enfold the other end of said mica strip. Metal terminal connections for the said bracket and spring and formed integral therewith and enfolding the ends of the mica strip are thus provided, and slots $w w^2$, formed in the said terminal connections by punching or stamping, afford ready means for connecting the fuse device as a complete appliance between the severed ends of an electrical circuit-conductor. It will be seen that the end of the said spring-tongue which projects under the end of the bracket tends when free to assume the retracted position indicated by the broken lines at n^2 in Fig. 2 and is then in engagement with the contact-stop q ; but when held in tension by its union with the fuse-link the said spring-tongue lies flat against the under side of the mica base plate or strip. The fuse

device thus constructed is a compact appliance complete in itself, the several conducting portions being all held together by their association with the mica strip, and is very convenient in standard practice, being of standard size for switchboard-circuit work, and therefore readily interchangeable. Thus when any particular fuse device comes into action and opens its circuit it is the work of but a few minutes to unscrew the disabled appliance and substitute a new one. The said devices, moreover, being, as stated, complete appliances, may be made in quantity very economically, and since they have no points or projections extending beyond the width of the mica strip are adapted to be conveniently and safely carried about by operatives.

The general mode of circuit connection is perhaps best illustrated by Fig. 6. Here P is a non-conducting general base-board, panel, or frame. M is a metal block (secured in any preferred way, as by a screw u , to said board) having attached to it by the binding-screw y^3 the conductor of the circuit c , which is to be protected, and D is a second metal block similarly united, as at the binding-screw u^2 , with the main battery-conductor K. The rigid terminal attachment m of the fuse appliance F is fastened by the screw y to the circuit-block M and the resilient terminal attachment n thereof by the binding-screw y^2 to the battery-block D, so that current is applied to the circuit c through the said fuse appliance.

Q is an alarm-circuit including a bell S or any appropriate electromagnetic alarm device, and its conductor k is connected with the contact-stop q , which is fixed on the base-board below the end of the resilient terminal attachment n . As long as the current in the switchboard-circuit c is normal the fuse device will remain inactive; but if for any reason it rises to a strength liable to cause injury to any part of the circuit or to the instruments thereof the fuse-link o will melt or disrupt, opening the circuit and releasing the spring-tongue n . The said tongue then flies toward the stop q and making contact therewith serves as a spring-switch which closes the alarm-circuit and directs the battery-current thereto. The alarm device is thereupon operated, calling attention to the action of the fuse, and the fault may thus at once be rectified and a new fuse appliance substituted.

In Fig. 5 is illustrated the disposition or arrangement of a number of the fuse appliances to constitute a system of protection for a plurality or series of switchboard-circuits. The said switchboard-circuits are divided into groups X X² X³, and these groups may each comprise any convenient number of switchboard-circuits. Thus group X may comprise a number of line-lamp circuits a , group X² a number of line-relay circuits or circuit continuations c , and group X³ a number of other circuits—for example, test-circuits e —these

being merely indicated. Moreover, under practical conditions one fuse device may be so arranged as to protect several switchboard-circuits. Such an arrangement is illustrated in the figure, where the particular fuse devices F^2 , F^3 , and F^4 in groups X, X^2 , and X^3 , respectively, are shown as being united on the circuit-conductor side by conductors 20, 21, and 22 to junction connections G, G^2 , and G^3 , to which may be connected the conductors of any desired number of switchboard-circuits a , c , and e . Each group of switchboard-circuit fuse appliances has its own associated alarm-circuit and its own alarm device. Thus with group X is associated alarm-circuit Q and alarm S contained therein, with group X^2 is associated the alarm-circuit Q^2 and its alarm S^2 , and with group X^3 the alarm-circuit Q^3 and alarm S^3 . The several alarms are therefore each adapted to operate and give the alarm whenever any of the fuse appliances of its own group becomes active. By this means not only is the operation of a fuse duly announced, but its group or approximate location is also indicated.

The base-board, panel, or frame P may be as large as is required and convenient. The metal block D of Fig. 6, to which the battery-conductor K is attached at u^2 , takes the form of a bus-bar extending at one edge of said base-board for its whole length. For each group of fuse appliances there is a collective complementary contact constituting the normally discontinuous terminal of the associated alarm-circuit. This is formed as a contact-bar extending lengthwise on the base-board and crossing the several fuse appliances of its associated group below the elastic ends of the spring-tongues n thereof. The bar q^2 , for instance, is extended below the fuse appliances of group X and is the common complementary contact for all the spring-switches of the fuse appliances of that group. In the same manner the contact-bars q^3 and q^4 form the alarm-circuit terminal-contacts for the fuse appliances of groups X^2 and X^3 . The several alarm-circuit conductors k , k^2 , and k^3 are each connected with their several contact-bars in any preferred way, as by soldering or by a binding-screw t .

We do not broadly claim the combination of a fuse device in one circuit with an alarm device in another, the said alarm being operated by and responsive to the action of said fuse; but

We do claim—

1. As an article of manufacture, a protective device comprising a base or support, a rigid terminal attachment mounted thereon, a resilient terminal attachment also mounted thereon, and a fuse link or conductor connecting said terminal attachments, said base or support and the parts carried thereby being movable as a whole and being provided with

means for connecting the same between the severed ends of an electrical conductor.

2. As an article of manufacture, a protective device comprising a non-conducting support, a rigid terminal attachment mounted thereon, a resilient terminal attachment also mounted thereon, and a fuse-link connecting said attachments, said support and the parts carried thereby being movable as a whole and being provided at its ends with means for connecting said ends respectively between the terminals of an electrical conductor.

3. A protective appliance comprising a non-conducting support, a rigid terminal attachment mounted thereon, a resilient terminal attachment also mounted thereon, and a fuse-link connecting said attachments, said support and the parts carried thereby being movable as a whole and being provided with slotted ends for connection with the terminals of an electrical conductor.

4. A protective appliance consisting of a strip or base of insulating material; a rigid bracket mounted at one end and on one side of said strip and having an arm extended toward the other end thereof; a spring-tongue mounted at the other end and upon the other side of said strip and extending under the arm of said bracket; a fuse link or wire extending through the said insulating-strip, secured to the said bracket and tongue uniting them conductively, and holding the said spring in tension, and at a distance from the point to which it is adapted by its own resiliency to move when freed; the said bracket and tongue being each provided with circuit connections whereby the appliance may readily be included in an electric circuit; substantially as set forth.

5. A protective appliance consisting of a strip or base of mica; a rigid conducting-bracket mounted upon one end of said mica strip and having an arm extending over one side thereof; a spring-tongue mounted on the other end of said mica strip, extending over the other side thereof and under said arm; a fuse wire or link extending through an orifice in said mica strip and having its ends conductively attached to the said bracket-arm and spring-tongue respectively, whereby the latter is held in tension; and metal terminal connections formed integral with said bracket and spring, infolding the respective ends of the said mica strip, and adapted for attachment to the conductors of an electric circuit; substantially as set forth.

6. In the central-station apparatus of a telephone-exchange, the combination with a switchboard-circuit containing an electroreceptive device; and a source of electrical energy supplying current thereto; of a protective appliance included in said switchboard-circuit between said source and the working instruments thereof, said appliance compris-

ing rigid and resilient terminal attachments the latter being immediately connected with said source, a fuse wire or link uniting them normally and holding the said resilient attachment in tension, and a contact-stop with which said resilient terminal attachment is adapted to engage when released by the operation of said fuse; an electric alarm device associated with said protective appliance; and an alarm-circuit containing said alarm device and said source of electrical energy normally terminating in and open at the said contact-stop but adapted to be closed through the said resilient terminal attachment when the same is released by the operation of said protective appliance; whereby the impairment of the switchboard-circuit consequent on the operation of the fuse may be at once announced by the operation of the alarm; substantially as set forth.

7. The combination in a protective and alarm system for the central-station apparatus of a telephone-exchange, with a series of groups of switchboard-circuits, each circuit containing telephonic apparatus; and a battery or other source of current for the said circuits; of a protective fuse link or wire in each circuit; a spring-switch for each switchboard-circuit normally held by the fuse-link of such circuit in position to maintain the continuity of said circuit and the connection of the battery therewith; a complementary contact for each group common to the several spring-switches thereof, and adapted to be engaged by the said switches when released by their respective fuse-links; an alarm-circuit for each group of switchboard-circuits of which the said complementary contact forms a terminal conductor, the said circuit containing the battery or other source of current and being normally open at each spring-switch and adapted to be closed by the operation thereof;

and an alarm device included in said alarm-circuit; substantially as and for the purpose specified.

8. The combination in a protective and alarm system for the central-station apparatus of a telephone-exchange; of a series of groups of switchboard-circuits, each circuit containing telephone apparatus; a battery or other source of current for the said circuits; a fuse link or wire in each switchboard-circuit to protect the same from unduly-strong currents; a spring-switch for each circuit normally held in tension by said fuse-link, and thereby maintaining the connection of the said battery with the said circuit but having a second position which it is adapted to assume when released from said fuse-link; a contact-bar crossing all the said spring-switches of each group, and serving as a common complementary contact therefor, to be engaged by said switches when in their second position; and an alarm-circuit for each group of switchboard-circuits containing an electric bell or like alarm, the same being normally open and terminating discontinuously in the contact-bar of the corresponding group, but adapted to be closed for the operation of said alarm, when the spring-switch of any circuit of the group is released by the operation of the corresponding fuse and engages said complementary contact; substantially as described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 11th day of December, 1902.

MALCOLM C. RORTY.
GEORGE K. THOMPSON.

Witnesses:

GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.