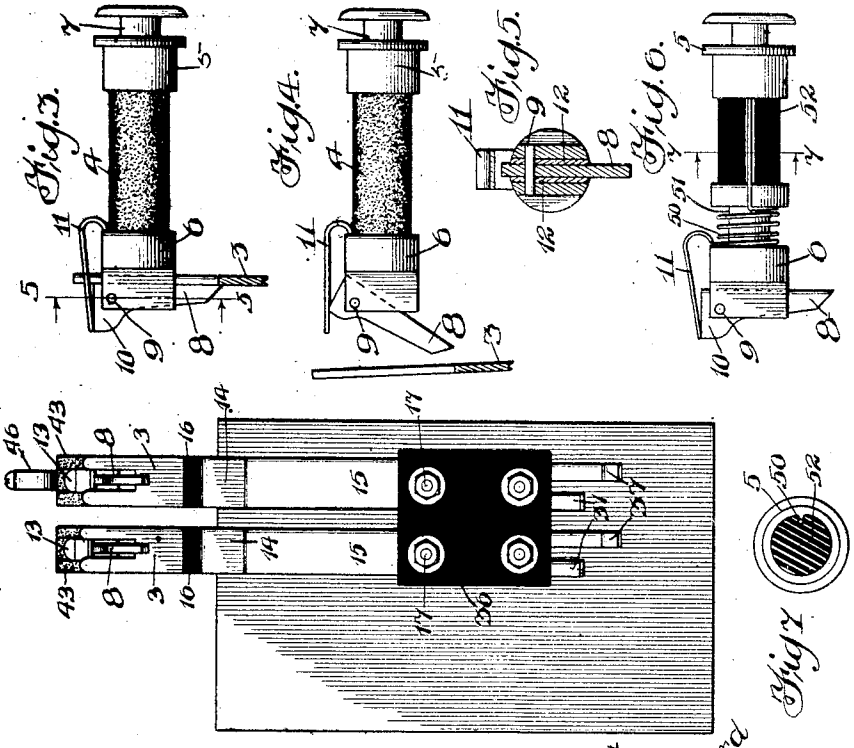
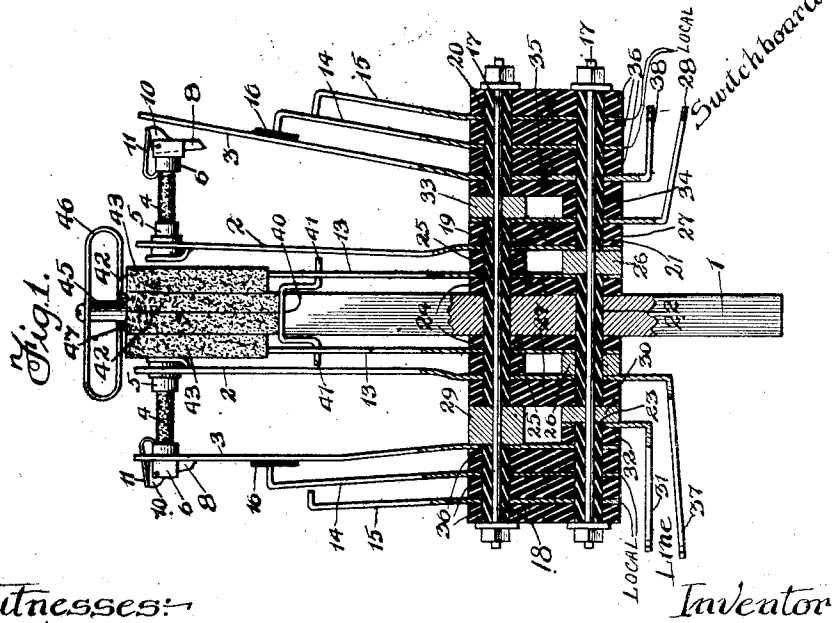
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C. A. ROLFE.

ELECTRICAL PROTECTIVE APPARATUS.

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ELECTRICAL PROTECTIVE APPARATUS.

No. 845,010. Specification of Letters Patent. Patented Feb. 19, 1907.

Original application filed April 21, 1902, Serial No. 104,021. Divided and this application filed February 4, 1905. Serial No. 244,238.

To all whom it may concern:

Be it known that I, CHARLES A. ROLFE, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Electrical Protective Apparatus, 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 electrical circuit protective apparatus for protecting electrical instruments and circuits from the injurious effects of unduly-strong currents.

In an application filed by me April 21, 1902, Serial No. 104,021, Electrical-circuit protector, I have shown and described an electrical-circuit protective apparatus involving the novel form of protective device which can be used either in an individual protector or in bank and have shown this protective device mounted in bank for use at telephone-exchanges and the like.

The present application is a division of my said other application, the latter containing the claims for the protective device, whereas the present application contains the claims for the mounting or arrangement of protectors, with their connecting instrumentalities, upon a switchboard or similar bank device.

In the accompanying drawings, Figure 1 is a view, partly in elevation and partly in vertical section, of a section of electrical-circuit protective apparatus comprising a plurality of protectors and lightning-arresters mounted in accordance with the invention of my present application. Fig. 2 is a side elevation of the same. Figs. 3, 4, and 5 are views of certain parts of one of the protectors, Fig. 5 being a section taken on line 5 5 in Fig. 3. Fig. 6 is a view similar to Fig. 3 of a modified form of device, and Fig. 7 is a section taken on line 7 7 in Fig. 6.

In the drawings I have shown a section of an apparatus intended for a telephone-exchange or other place where a plurality of lines are assembled and where it is desirable to group the protectors for the various lines together. The apparatus shown comprises a supporting plate or structure 1, which is conveniently made of metal covered with insulating material, as shellac. This plate has a series of protective devices arranged on each side of it. In Fig. 1 the end protectors of the two series appear on opposite sides of the plate, and in Fig. 2 two protectors are shown on one side of the plate, it being understood that there are any desired number in the series and that the number of protectors in the two series on opposite sides of the plate are desirably the same.

Each protector comprises a pair of spring-arms 2 and 3, which tend to swing or separate from one another. The upper ends of each pair of spring-arms 2 and 3 support what I shall term a "heat-cartridge," in this case conveniently consisting of a graphite stick 4 and caps 5 and 6 soldered to the opposite ends of the graphite stick by hard solder—that is, solder which melts at a comparatively high temperature.

The cap 5 is made with an annular recess 7, as shown in Figs. 3 and 4, which permits it to be slid into a slot formed in the spring-arm 2. The cap 6 has its end slotted, as shown in Fig. 5, and a swinging lever 8 is arranged between the slotted portions and pivoted near its upper end by a pivot 9. This lever 8 is constructed with an outwardly-extending portion 10 at its upper end, and a spring 11 is secured to the inner end of the cap 6 and extended over the projection 10 of the lever 8 and adapted to press downwardly upon the same, so as to tend normally to move the lever so as to swing its lower end inwardly. The lever 8 is longer than the width of the cap, so that a portion of it projects below the same, and the spring-arm 3 is slotted, as shown in Fig. 2, so that the narrowed slotted portion of the cap 6 can fit therein, while the lower end of the lever will engage the arm at the end of the slot. The lever is soldered in position between the forked or slotted portion of the cap 6 by layers 12 12 of soft solder—that is, solder which will melt or soften at a comparatively low temperature. The graphite stick 4 is of such internal resistance that it will become sufficiently heated by an unduly-strong current to melt or soften the layers 12 12 of soft solder, but not to melt the solder by which the caps 5 and 6 are secured to its ends. When the device is in normal condition, the spring-arm 2 is engaged by the cap 5 and the spring-arm 3 by the lower end of the lever 8,

whereby these spring-arms are held in restraint, as shown at the left-hand side of Fig. 1.

In between the protectors and the supporting-plate 1 are lightning-arrester contact-springs 13 13, and on the outer sides of the protectors are local-circuit contact-strips 14 14 and 15 15. The contact-strips 14 14 15 15 have their upper ends bent inwardly, as shown in Fig. 1, and the strips 14 14 rest upon insulation-pieces 16 16 on the spring-arms 3 3. The contact-strips 13 13, 14 14, and 15 15 and the spring-arms 2 2 3 3 are held and supported in proper position by long screws 17 17, which extend transversely through the plate 1, it being understood that for each set or pair of protectors and coöperating contact-strips on opposite sides of the plate 1 there is a set or pair of holding-screws 17 17. These screws 17 17 are insulated at intervals by insulating-tubes 18, 19, 20, 21, 22, and 23. Between the contacts 13 13 and the plate 1 are insulating-strips 24 24, which are properly perforated for the inclosing tubes 19 and 22. Outside of the contact-strips 13 13 are insulating-strips 25 25 and metal nuts 26 26. Outside of the spring-arms 2 2 are insulating-strips 27 27. On the outer side of the right-hand strip 27 is a switchboard-strip 28, projecting below the same, and on the outer side of the left-hand strip 27 are metallic nuts 29 and 30, the latter being in contact with a line-strip 31, which is interposed between the metallic nut 30 and another insulating-strip 32. The metallic nut 29 is in contact with the spring-arm 3 of the left-hand protector. On the outer side of the switchboard-strip 28 are a metallic nut 33 and an insulating-strip 34, and on the outer side of these is an insulating-strip 35. Outside of the spring-arms 3 3 and supporting the same and the local contacts 14 14 and 15 15, respectively, are insulating-strips 36 36 36. The nuts for the screws 17 17 are applied to the outer insulating-strips 36 36 and suitably tightened, so as to draw and hold the entire structure securely together. The spring-arm 2 of the left-hand protector and the spring-arm 3 of the right-hand protector are extended below the insulating-strips, so as to form line and switchboard connectors 37 and 38, respectively. These, together with the line and switchboard connectors 31 and 28, are the connectors to which the wires of the circuit are connected.

The circuits for the two protectors can be traced as follows: For the right-hand protector connection is made from the spring-arm 3, to whose lower end a switchboard-wire is connected to the cap 6, graphite stick 4, cap 5, spring-arm 2, metallic piece 21, lower screw 17, metallic piece 30, and line-connector 31. For the left-hand protector the circuit is from the switchboard-connector 28 to metallic piece 33, upper screw 17, metallic piece 29, spring-arm 3, cap 6, graphite 4, cap 5, and spring-arm 2, to whose lower end 37 connection is made with a line-wire.

A ground connection with each of the two protectors is provided by a metallic piece 40, arranged on top of the plate 1 and having outwardly-projecting ends 41 41, located in the rear of the spring-arms 2 2, but at a slight distance away from the same. In this arrangement it is understood that the plate 1 is connected with the ground, so that the ground-contact 40 by resting upon and being connected with the plate 1 makes the proper ground connection.

The lightning-arrester arrangement is located above the plate 1 and between the upper ends of the two protectors constituting each pair. The lightning-arrester comprises two ground-electrodes 42 42, desirably in the form of carbon plates, and two line-electrodes 43 43, also desirably carbon plates. These two electrodes 43 43 are understood to be suitably insulated from the ground-electrodes 42 42 by a layer of mica, silk, or other insulating material arranged between them in the usual manner. The line-electrodes 43 43 are held in position against the ground-electrodes 42 42 by the lightning-arrester contact-strips 13 13, which also serve to connect such line-electrodes with the lines, through metallic strips 26 26, the electrodes 43 43 being grooved, as shown in Fig. 2, so as to accommodate the contacts 13 13. A post 45 is extended up from the ground-plate 1 between the ground-carbons 42 42, which are suitably grooved for it. A spring 46 is secured to the upper end of the post 45 and made in the form of a loop, so that its ends are located above the electrodes 42 42 and 43 43. They are held out of contact with electrodes 43 43 by small masses 47 47 of readily-softenable material, preferably solder. The ends of the spring 46 tend to become depressed, so that when one or both of the small masses 47 47 become softened or melted the ends of the spring 46 again come into contact with either or both of the line-electrodes 43 43.

The operation of the apparatus thus constructed is as follows: When an unduly-strong current passes through one of the circuits, one or both of the protective devices which that circuit contains will be operated. As the operation of both is the same, that of but one will be here described. The unduly-strong current causes the graphite stick of the heat-cartridge of the device which operates to become so heated as to melt or soften the solder 12, whereupon the lever 8 will be released or uncemented, as it were, by the softening of the solder, thereby allowing the spring-arm 3 to move outwardly. This spring-arm will thereupon proceed to move or spring outwardly and will continue such motion until it passes the lower end of the lever 8, and thereby becomes freed from

such lever and from the heat-cartridge of which the lever forms a part. This opens or breaks the circuit by the formation of an opening or gap between the end of the lever 8 and the spring-arm 3, as shown in Fig. 4. The spring-arm 3 comes to rest in an outward position free and disconnected from its coöperating heat-cartridge, as well shown in Fig. 1; but the lever 8 of the heat-cartridge is immediately returned or restored to its original or normal position by the spring 11 coöperating with said lever. This is permitted because the solder is still in a melted or softened condition. The release of the spring-arm 3, the freeing of the same from the lever 8, and the swinging of the latter back to its original condition, all take place in an exceedingly-short period of time, so short that the graphite stick and solder do not have time to cool. In a few moments the graphite 4 and layer of solder 12 will cool sufficiently to allow the solder to become hardened, whereupon the lever 8 is again held rigidly in position to engage and restrain the spring-arm 3. It is only necessary, therefore, to place the arm 3 in engagement with the lever 8 to put the entire protective device in its normal condition, assuming that only one heat-cartridge has operated. Another unduly-strong current passing the line will again heat the graphite 4 of one of the cartridges to an extent to melt or soften the solder thereof, whereupon the lever 8 will again be swung by the spring 3, so as to cause the release of the latter and the consequent breakage of the circuit, and immediately after this the lever 8 will be again restored to its original condition and held there by the hardening of the solder. Sometimes both heat-cartridges will operate at the same time on the passage of an excessive current, in which case both of the levers 8 8 are reset and resoldered preparatory for another operation. In this way the device can be operated time after time without any replacement or substitution of parts or without manual or machine labor to repair the same.

Whenever one of the heat-cartridges operates and its spring-arm 3 is released, the arm 2 also moves inwardly a little and comes into contact with the ground connection 40, thereby grounding one side of the circuit, and the arm 3 swings the contact 14 against contact 15, thereby closing the local circuit, which is understood to be connected in any suitable or usual manner with these contacts 14 and 15.

The lightning-arrester normally remains in the condition shown in Fig. 1. When, however, lightning intrudes upon one of the lines, it escapes from the line-carbon 43 to the spring 46, following the path of least resistance, and from thence to the ground, and this arcing action across the space between the line-carbon and the spring causes the melting or softening of one of the balls or masses of softenable material 47, whereupon the end of the spring 46 descends upon the line-carbon 43, thereby making connection between the line-carbon and the ground by way of the spring 46. The lightning-arrester is restored to its normal position by inserting a new ball or mass of softenable material 47 between the end of the spring and the ground-carbon 42.

In Figs. 6 and 7 I have shown a modified form of heat-cartridge for use in the form of protector illustrated. In the form shown in these figures I employ a coil of fine wire 50 as a heat-concentrating device instead of the graphite stick 4. This coil of wire 50 is wound upon a suitable core 51, which is desirably an extension of the cap 6. The two ends of the device are connected by an insulating-cylinder 52, provided with a groove through which the wire of the coil 50 is extended to connect with the cap 5. The cap 6 is provided with a lever 8, soldered in place and with the spring 11 as before.

It will be understood that changes and modifications may be made in the structure herein set forth without departing from the spirit of my invention.

What I claim is—

1. The combination of supporting member 1, protectors arranged on opposite sides thereof, and each comprising spring-arms 2 and 3 and a heat-responsive device supported at the upper ends of said arms and adapted to release the same upon the passage of an unduly-strong current, a ground connection 40, adapted to make contact with the opposite arms 2, 2, a lightning-arrester comprising ground-carbons 42, 42, line-carbons 43, 43, a post 45 having a spring 46, a mass 47 of insulating heat-susceptible material, line lightning-arrester contacts 13, 13, suitable insulating-strips, and screws 17, 17, binding said insulating-strips, spring-arms and contacts together, substantially as described.

2. In a device of the character described, the combination of a support, a row of heat-coil devices mounted at each side of said support, line-terminals connected with the said heat-coil devices and all mounted at one side of said support, and switchboard-terminals also suitably connected with said heat-coil devices and all mounted at the other side of said support.

In witness whereof I hereunto subscribe my name this 1st day of February, A. D. 1905.

CHARLES A. ROLFE.

Witnesses:
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