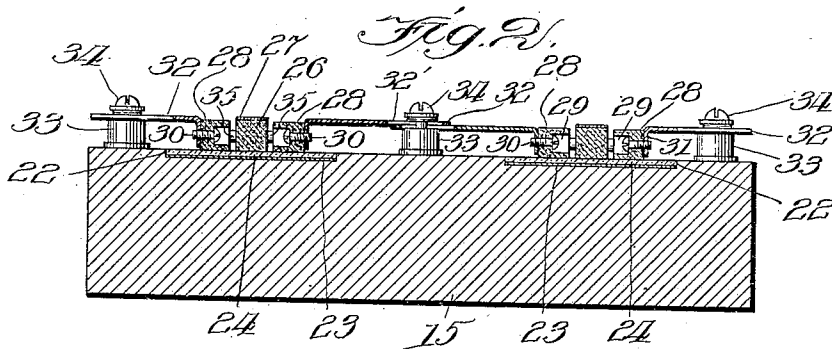
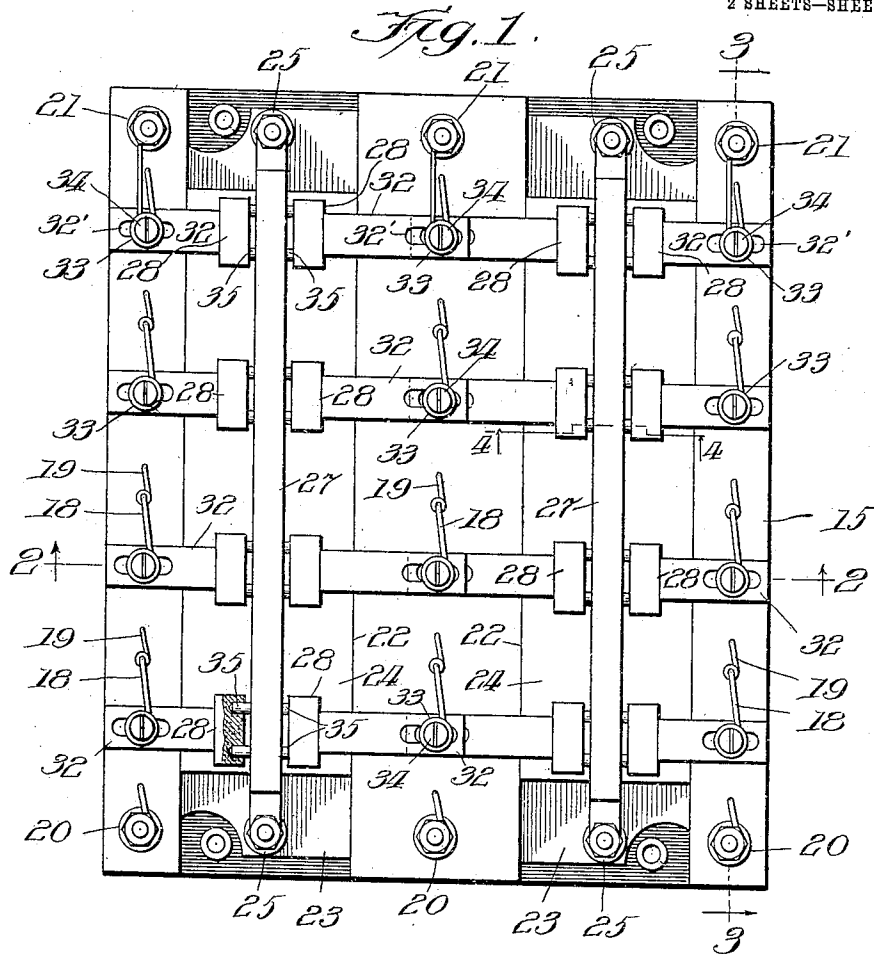


B. H. MANN.
LIGHTNING ARRESTER.
APPLICATION FILED AUG. 18, 1909.

963,233.

Patented July 5, 1910.

2 SHEETS—SHEET 1.



Witnesses:

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Henry A. Parks

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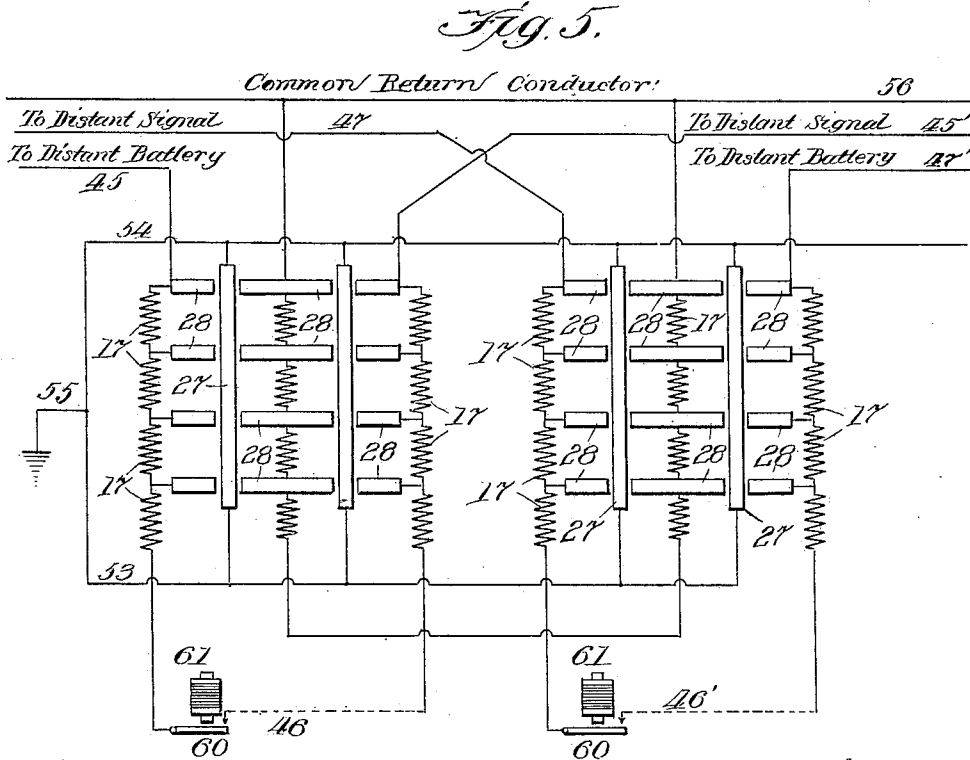
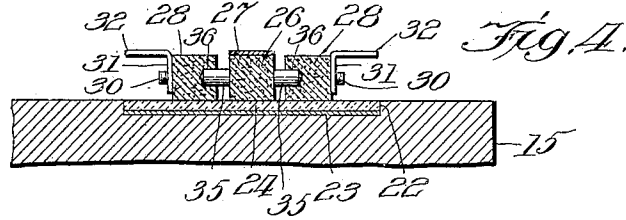
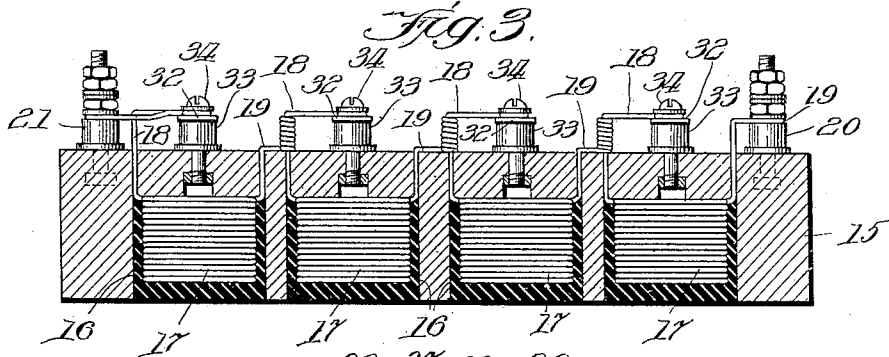
by Shindon Wilkinson & Deeds
attys

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2 SHEETS—SHEET 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

BERTRAM H. MANN, OF WEBSTER GROVES, MISSOURI.

LIGHTNING-ARRESTER.

963,233.

Specification of Letters Patent.

Patented July 5, 1910.

Application filed August 19, 1909. Serial No. 513,599.

To all whom it may concern:

Be it known that I, BERTRAM H. MANN, a citizen of the United States, residing at Webster Groves, in the county of St. Louis and State of Missouri, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is a specification.

The object of my invention is to provide a new and improved device to protect electrical apparatus from damage by excessive surges of electric current in conductors connected to such apparatus.

In its more specific aspects, my invention has reference to the protection of certain elements of signaling apparatus, such as relay contacts and terminals, from damage by electric surges in line wires leading to such apparatus.

My invention consists of the combination of elements as defined in the appended claims, but for the purpose of illustration, I have disclosed in this specification one specific embodiment thereof.

In automatic block signal systems for railways, there may be one or more conductors which extend along beside the track and which convey electric currents to operate the signals at certain points along the tracks. These circuits are actuated by the presence of a car at other points more or less remote from the signals. The circuits comprising such conductors are line wires and ordinarily work at comparatively low voltages. At certain points, these circuits may be controlled by relays and it is important to protect the relay contact terminals from injury by any excessive flow of current across the same. At other points, these circuits may include relay magnets to actuate the signals and of course there are also batteries interposed in such circuits. It is common to have three line wires extending along beside the track, one of these wires controlling the signal at one end of the block and the other wire controlling the signal at the opposite end of the block. At intervals along the length of the block there are switches normally held closed by relays, but these relays may be deenergized and the switches opened by the presence of a car on a track in their neighborhood. A third line wire

serves as a common return to complete the circuits for the line wires already mentioned.

As shown in the accompanying drawings and described in this specification, my lightning arrester is especially designed to protect the relay contacts and other apparatus in such a system.

Under the particular circumstances stated, it is important that surges of electric current should be reduced as much as possible, because the apparatus to be protected is comparatively delicate, and further because it is of the utmost importance that the protection should be absolute; for if the system breaks down, then the working of the signals will fail and the whole system of traffic will be deranged. It is not enough to merely arrest excessive lightning discharges, but it is important to protect the apparatus against comparatively small induced or other discharges.

The particular apparatus which I disclose herein has been very thoroughly tested for the purposes stated and has been found to be highly efficient. This invention is the result not only of theoretical considerations, but of much experimental work.

Referring to the drawings—Figure 1 is a plan view of the particular embodiment of my invention which I have chosen to illustrate in the drawings. Fig. 2 is a cross section on the line 2—2 of Fig. 1. Fig. 3 is a section on the line 3—3 of Fig. 1. Fig. 4 is an enlarged detail sectional view on the line 4—4 of Fig. 1. Fig. 5 is a diagram showing the circuit connections for the lightning arrester.

The common return conductor is indicated in Fig. 5 by the reference numeral 56 and the other two line wires by 45—46—45' and 47—46'—47'. The conductors 46 and 46' shown at the bottom of Fig. 5 are supposed to lead to the contact terminals 60 of the relays 61 which control the circuits 45—46—45' and 47—46'—47', as well as to other apparatus interposed in said circuits.

I will now describe the structure of the lightning arrester in detail, and the relation of the parts thereof to the circuits will be readily apparent from Fig. 5. A solid wooden block 15 has a plurality of holes

16 bored in its under side and in each hole there is an inductance coil 17 embedded in paraffin. Of course if preferred this block can be made of any suitable insulating material, and also if preferred the coils can be mounted upon the block instead of being incased therein. The two wires 18 and 19 for each coil 17 extend up through little holes in the block 15 and project up from the top surface thereof. At the ends of the block 15 are binding posts 20 and 21, and a set of coils 17 is connected in series between these binding posts as shown in Fig. 3. In the particular embodiment of my invention illustrated in the drawings, there are three such series of inductance coils 17 connected in between each of the three pairs of binding posts 20, 21. Each one of the three series of coils 17 is connected in a respective one of the three conductors 45, 45' and 56. This lightning arrester as just described is also duplicated and connected in a similar manner to the respective conductors 47, 47' and 56. These connections are shown in Fig. 5.

In the top surface of the block 15 are shallow channels 22 and in the bottom of each channel 22 is laid a piece of sheet metal 23 and over this a glass or porcelain plate 24. A long bar of carbon 26 lies upon each glass plate 24 and is overlaid by a strip of sheet metal 27, both ends of which are attached to respective binding posts 25, which also connect with the metal plates 23. Conductors 53 and 54 (see Fig. 5) are attached to give a ground connection 55. Thus it will be seen that the long carbon blocks 26 are grounded.

Little rectangular carbon blocks 28 lie alongside the bar 26. These little blocks 28 have porcelain studs 35 embedded in sockets 36 and projecting therefrom so as to abut against the bar 26 and definitely space the blocks 28 therefrom. Each carbon block 28 is attached to the downturned end 31 of a sheet metal strip 32 by means of a screw 30 having its head in the countersunk depression 29 of the block 28. Each metal strip 32 has a slot 32' which is engaged by a screw 34 that serves to clamp the strip 32 to the respective binding post 33. As shown in Fig. 3, the binding posts 33 are connected alternately between the successive serially arranged inductance coils 17. This is also apparent from Fig. 5.

It will be seen on referring to Fig. 5 that each line wire leads to the local apparatus through a series of inductance coils 17, and that contact terminals 28 alternate with the coils 17. Adjacent to each series of such contact terminals 28 is a grounded bar 26. In case a current surge comes over any one of the line conductors, it will on the way to the local apparatus, which it is desired to

protect, be opposed by the first inductance coil 17. Adjacent to this first inductance coil 17 is the first spark gap terminal 28. Therefore, a considerable portion of the discharge current may jump across from the carbon block 28 to the grounded carbon bar 26. On the other hand, some of the current surge will pass through the first inductance coil 17, but it will be further opposed by the second inductance coil 17 and thus another discharge will be forced across from the second carbon block 28 to the carbon bar 26 and thence to ground. Finally by means of the successive inductance coils and the successive alternate spark gaps, practically the entire surge or discharge current will be sent to ground and the most delicate apparatus will be sufficiently protected against lightning discharges. This result is greatly facilitated by making the spark gap terminals of carbon and spacing them as shown and described, also by arranging the metal plate close to the multiple spark gap terminals.

On referring to Fig. 5, it will be observed that normally a circuit leads from a distant battery through the conductors 45, 46, 45' to a distant signal in the opposite direction, and thence the circuit is completed back over the common return conductor 56. The outgoing conductor 45-46-45' is looped in at 46, where it passes through relay contacts 60, or other apparatus not shown. Each branch of the loop referred to is provided with a series of inductance coils 17 and alternate spark gap terminals 28. It will further be observed from Fig. 5 that the common return conductor 56 is connected in between the two branches of the loop 46. It accordingly follows that if in any case a lightning discharge should tend to jump clear across from one branch of the loop to the other branch of the loop, it would on the way necessarily connect with the common return conductor 56. An advantage of this will now be explained. With lightning arresters it occasionally happens that a lightning discharge causes a permanent closure of the gaps in the lightning arrester. In case the spark gap terminals are of metal, this metal is liable to be built out as a result of a lightning discharge until it bridges across the spark gap terminals. In the case of carbon gap terminals, small particles of carbon may be detached from the terminals and built across the gap. It will be observed that in case the two branches of the loop referred to should become permanently connected together as the result of a lightning discharge, then the opening of the relay contact 60, due to the deenergization of the magnet 61 by a train in the neighborhood, would have no effect, because the circuit would be closed between

the conductors 45 and 45' by the bridging across already referred to. However, by interposing a branch from the conductor 56 between the two sides of the loop, it is necessarily insured that any conductive connection across from one side of the loop to the other will also connect with the return conductor 56. Thus the circuit from the distant battery over the conductor 45 will be closed, by such bridging across, into the return conductor 56. This will have the same effect on the distant signal to which the conductor 45' leads, to deprive it of current, as if the relay contact 60 were opened; that is, the distant signal to which the conductor 45' leads will thus indicate danger, or in other words will give the same indication as if a train were in the block. Thus it will be seen that any permanent short circuit due to a lightning discharge which would tend to render the system inoperative in the normal manner will thereby cause the signals to indicate danger. Thereupon the usual rules for procedure in case of delayed danger signals will be resorted to; that is, a train waiting to enter the block will proceed with caution after a certain time, will report the condition and a repair man will be sent out, who will find the trouble and remedy it.

Entirely aside from short circuits due to lightning discharges, it is to be observed that if a metal wire, for example, happened to bridge across from one side of the loop to the other, it would be highly probable that it would include the intermediate common return branch, and thus the effect would be as already described. If desired, the successive spark gaps proceeding from the main line in toward the local apparatus may be made of gradually decreasing width so that they shall thus cooperate to sift out all the lightning surge, even to the smallest traces. It would be impossible for the lightning to jump across from one side of the loop to the other without going through the branch that connects to the common return conductor 56. As is well known, the lightning discharge does not readily turn sharp corners in a conductor, and therefore any discharge from one of the terminals 28 would go directly through all the terminals in alinement therewith in case it did not get diverted to ground 55 on the way.

In describing the arrangement of my lightning arrester by which the common return conductor extends between the two branches of a loop in the outgoing conductor, I do this largely by way of example, for many variations of the same structure may be advantageously employed. Thus it may not only be desirable to put a conductor of opposite polarity between the two branches of a loop of the other conductor of

the same circuit, but it may be desirable to put the common return conductor between the other two conductors of the two circuits in a single lightning arrester. I have tried a great many different combinations of apparatus to effect this result and have practically demonstrated the superiority of the combination defined in the appended claims.

I claim:

1. A lightning arrester comprising an insulating block having serially arranged inductance coils mounted therein, a metal plate on said insulating block, a glass plate overlying the same, an earth connected carbon bar on said glass plate, and a series of members connected in alternation with the inductance coils and coacting with said bar to form spark gaps therewith.

2. A lightning arrester comprising a carbon bar, a glass plate adjacent thereto, a metal plate adjacent to the glass plate, a sheet metal strip attached to the carbon bar along its length and adapted to be connected to ground, and a plurality of carbon blocks slightly spaced from said carbon bar so as to form spark gaps therewith.

3. In combination, a circuit comprising an outgoing conductor and a return conductor, a loop in said outgoing conductor leading to certain local apparatus, and a lightning arrester having three spark gap terminals in series, the intermediate one being connected to the return conductor and the others being connected respectively to the branches of said loop.

4. In combination, a circuit comprising an outgoing conductor and a return conductor, a loop in said outgoing conductor leading to certain local apparatus, and a lightning arrester having five spark gap terminals in series, the intermediate one being connected to the common return conductor, the extreme ones being connected respectively to the two branches of the loop, and the remaining terminals being connected to ground.

5. In combination, a circuit comprising an outgoing and a return conductor, local apparatus to be protected, a loop leading from the outgoing conductor to said local apparatus, alternating successive inductance coils and spark gap terminals in each side of the loop, and ground connections and connections to the return conductor interposed between the spark gap terminals in the two sides of the loop.

6. In combination, two conductors and a third conductor of opposite polarity to both of them, and spark gap terminals connected to each of the three conductors, that terminal connected to the third conductor having a position intermediate between the other two.

7. In combination, two conductors, and a

third conductor of opposite polarity to both
of them, spark gap terminals connected to
each of the three conductors, that terminal
connected to the third conductor having a
5 position intermediate between the other two,
and a ground connected spark gap terminal
also connected in an intermediate position.

In testimony whereof, I have subscribed
my name.

B. H. MANN.

Witnesses:

JNO. A. GREENLAW,
GEO. W. MARRIOTT.