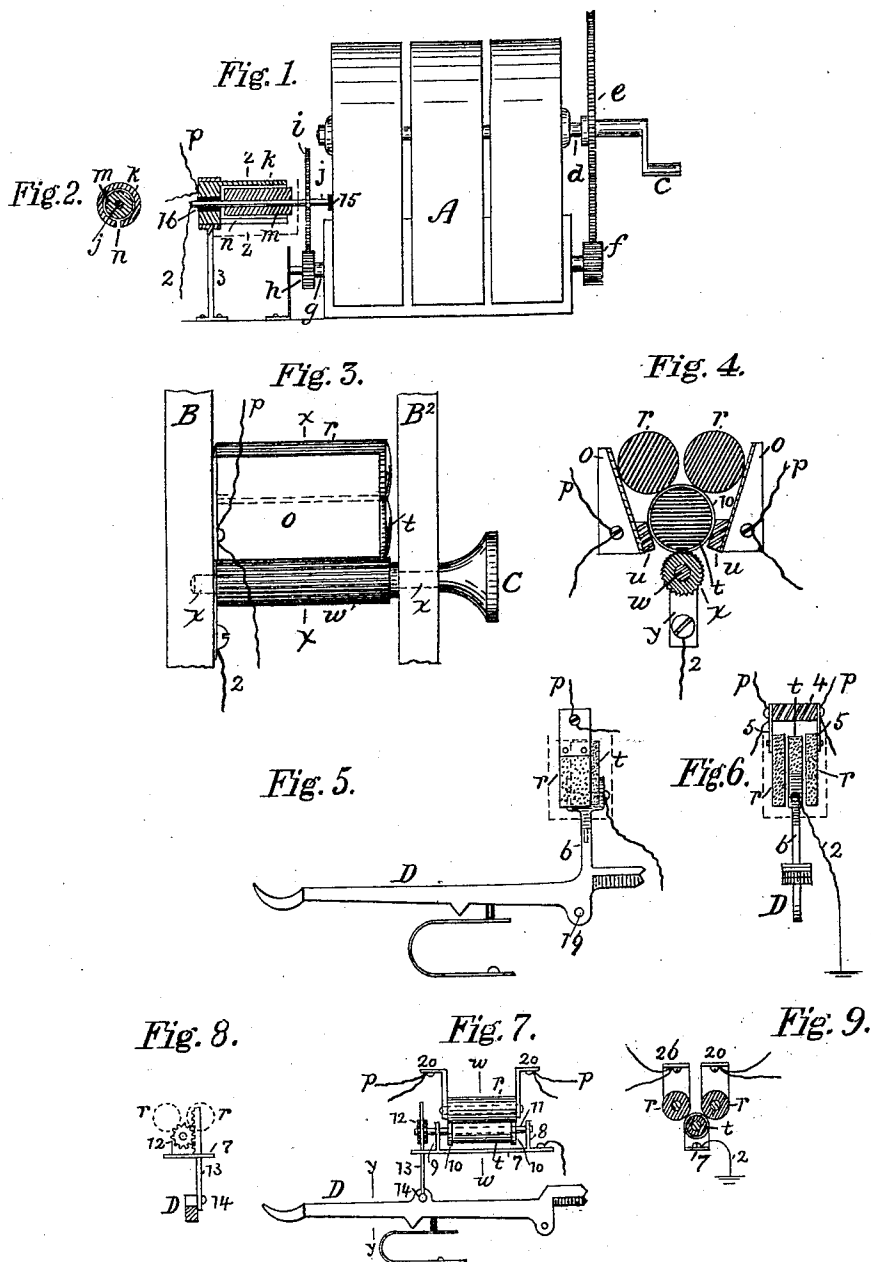


(No Model.)

A. H. McCULLOCH.
ELECTRIC PROTECTIVE APPLIANCE.

No. 550,192.

Patented Nov. 19, 1895.



Attest.

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ELECTRIC PROTECTIVE APPLIANCE.

SPECIFICATION forming part of Letters Patent No. 550,192, dated November 19, 1895.

Application filed January 24, 1895. Serial No. 536,082. (No model.)

To all whom it may concern:

Be it known that I, ALFRED H. McCULLOCH, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Electric Protective Appliances, of which the following is a specification.

This invention relates to electric protective appliances associated with electric circuits to guard the instruments connected therein from destruction from lightning discharges and the damaging effects of powerful currents from electric light and power circuits, and has special reference to those forms of appliance in which opposed carbon surfaces are employed.

In such electric protective appliances it has been found by experience that to make the protector of any value against currents or charges under a potential of three hundred volts, which has been determined as the allowance of pressure to be provided for, the parallel carbon plates or cylinders must be placed within .0035 of an inch of each other. The smallness of this distance gives rise to occasional contacts between the plates and to consequent grounding of the circuits, either by particles of carbon which are loosened by jarring of the plates from various causes or by the formation of cones of carbon particles by the disruptive discharges between the plates of lightning or heavy currents. In large towns and cities, where apparatus is frequently inspected, such contacts between carbon plates are not troublesome, but in the sparsely-settled country places, where such inspection is made but infrequently, serious trouble and annoyance are often occasioned thereby.

My invention provides means for dislodging the carbon particles, howsoever formed, from between the carbon plates, automatically or otherwise; and it consists in devices for changing or moving the contiguous surfaces of the protector-plates relatively to each other by oscillating, rotating, or agitating one or all of the said plates, while maintaining the predetermined and proper distance apart or the same width of the separating and insulating air gap or space.

When used in connection with telephonic apparatus, I prefer to place the protector in

association with the magneto call-box, either upon or within it, and automatically to produce the agitation of the plates simultaneously with the operation of some part of the apparatus contained in the box and by means thereof—as, for example, I may connect one of the protector-carbons with the rotating mechanism of the magneto-generator in such a way that when the crank thereof is turned the carbon may be rotated while the other carbon surface remains quiescent, or all of the plates, pencils, or surfaces may be rotated, or I may provide means in connection with the automatic telephone-switch whereby when the telephone is removed from or replaced upon the hook, occasioning a to-and-fro movement of the same, the protective surfaces are agitated and all loose carbon particles dislodged from between them, and the carbon surfaces thus rendered clean and free. I also provide means for manually agitating either or both of the plates, pencils, or blocks to free their surfaces from disintegrated carbon particles.

In the accompanying drawings, Figures 1 and 2 represent a means of agitating the opposed elements of a protective appliance automatically simultaneously with and by means of the operation of the magneto call-generator, the carbon cylinders in Fig. 1 being shown in longitudinal section and in Fig. 2 in cross-section on line $z z$ of Fig. 1. Fig. 3 is a side view of a manually-operated protector, and Fig. 4 is a section thereof on line $x x$. Figs. 5 and 6 are side and end views, respectively, of a protector whose plates are vibrated relatively to each other by means of the hook-switch; and Figs. 7, 8, and 9 are respectively side, end, and sectional views of a protector whose carbon cylinders are rotated by means of the movement of the hook-switch.

Referring to Fig. 1, A represents a magneto-generator with its crank c upon shaft d , the gear-wheel e thereupon meshing into pinion f on the armature-shaft g , which bears upon its opposite end a pinion h . j is a small spindle, one end of which bears in an insulated block 15, supported by the generator, and has a gear i , which meshes with the pinion h , the other end of the spindle having a bearing

in the insulation 16 upon the support 3. Upon the spindle *j* is a carbon cylinder or pencil *m*, and a wire 2 connects the same to ground through the substance of the spindle. *k* is a tubular carbon plate, which may be closed at one end and secured to the support 3, and has fixed in its end the insulating bearing 16. The tubular part has a slit *n* extending along its under side. *p* is the line conductor secured to the tubular carbon at any point in its length, and should there occur thereon a rush of current or a discharge of high potential a path is found from the wire *p* to carbon *k*, across the air-gap to the carbon *m*, spindle *j*, and wire 2 to earth.

It will be seen that the carbon *m* is rotated every time the crank *c* is turned, and if there should be any particles of carbon which have lodged between the surfaces, forming or tending to form a permanent short circuit or bridge, they will be carried around and dropped through the slot *n* and may be collected in a closed receptacle. (Indicated in dotted lines.)

In Figs. 5 and 6 D represents an automatic telephone-switch, pivoted at 19 and having an upwardly-projecting arm 6, terminating in a fork of insulating material, in which is secured an oblong block of carbon *t*. On both sides of block *t* are blocks *r*, of carbon, suspended by metal strips 5 5 from a strip of non-conducting material 4, one conductor *p* of each side of the metallic line-circuit is connected with each metal strip 5, and a wire 2 unites the carbon to earth. When the telephone is removed from or replaced upon the switch-hook, the carbon *t* is caused to vibrate back and forth between the blocks *r* and to dislodge any carbon particles which may have rested between it and the surfaces of the said blocks *r r*. A receptacle for such particles may be placed as indicated in dotted lines.

In Figs. 7, 8, and 9 a modified device operated by the automatic switch is shown. Two carbon pencils or cylinders *r r* are each suspended between bearings 20 20. A third carbon cylinder *t* is suspended between bearings 8 and 9 upon plate 10 below and between the other carbons, whose peripheries touch the insulating bands 10 10 on each end of the carbon *t*. The spindle 11 of the carbon *t* has upon one end a pinion 12, which meshes with a gear-rack 13, which extends through a guide-hole in the plate 7 and is pivoted to the hook-switch D at 14. As the hook-switch passes up and down, the rack 13 rotates the pinion 12 and the carbon *t* and also the carbons *r r*, and dislodges any carbon particles adhering to or between the pencil-surfaces.

Figs. 3 and 4 show a manually-operated protector consisting of three loose carbon pencils or cylinders *r r* and *t*, held in a trough composed of two inclined metal plates *o o*, having a flange at one end by which they are secured to a back B of wood. The lower carbon *t* rests upon insulating-strips *u u*, secured to the inner sides of the plates *o o*. The

upper carbons *r r* do not touch each other, but both rest upon thin non-conducting bands 10 at each end of the carbon *t*. Directly under the carbon *t* is a metal cylinder *w*, having its surface roughened by longitudinal teeth or ridges, one end having a bearing in the backing B and in contact with metal plate *y*, from which extends a ground-wire 2, its other end having a bearing in the front or cover B² and being provided upon the face thereof with a turning button C. When the button C is rotated in either direction, the cylinder *w* bearing upon the under side of the carbon cylinder *t* rotates it and also the two carbons *r r*.

It is desirable that a protector be included in both sides or conductors *p p* of the circuit, as intrusive or foreign currents are liable to enter on either side; and in Figs. 3, 4, 5, 6, 7, 8, and 9 the conductors *p p* are each looped to make contact with plates *o o*, so that an abnormal current coming on either conductor will find a path through the appropriate cylinder *r* to ground by the wire 2.

By means of the manual rotating operation the cylinders *r r* and *t* are brought into new superficial relation, and any connection by loose carbon particles or conical accretions is removed.

Having now fully described my invention, I claim—

1. An electric protective appliance consisting of three carbon plates or surfaces separated and insulated from each other, two of the carbons being connected respectively with the sides of a main circuit, and the other being connected to ground; and means as described for changing or moving the contiguous surfaces of the said carbons relatively to each other to dislodge accumulated particles from between the same, substantially as described.

2. In electric protective appliance located in or upon the box of a magneto call and switching apparatus, comprising carbon plates or cylinders having their contiguous surfaces separated by a thin air gap, one of the carbons being connected to the main circuit and the other to the ground; and an agitating or surface changing device for imparting relative motion to one or both of said carbons, the said device being automatically actuated by the normal operation of the said call or switch apparatus; substantially as specified.

3. In an electric protective appliance located on or upon the box of a magneto call and switch apparatus, two carbon plates, blocks or cylinders capable of relative movement having their contiguous surfaces separated and insulated from each other, one of the said carbons being conductively connected with the main circuit, and the other with the ground; and mechanism for imparting relative rotatory or vibratory motion to the surfaces of said carbons; combined with an actuating mechanism common to the said call

and switch apparatus, and the said carbon moving mechanism, whereby the relative motion of the latter, may be produced simultaneously with, and by the act of operating
5 the former, substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of

two subscribing witnesses, this 17th day of January, 1895.

ALFRED H. McCULLOCH.

Witnesses:

GEO. WILLIS PIERCE,
FRANK C. LOCKWOOD.