(No Model.)

C. C. DRAKE.

TELEGRAPH AND TELEPHONE PROTECTOR.

No. 336,040. Patented Feb. 9, 1886.

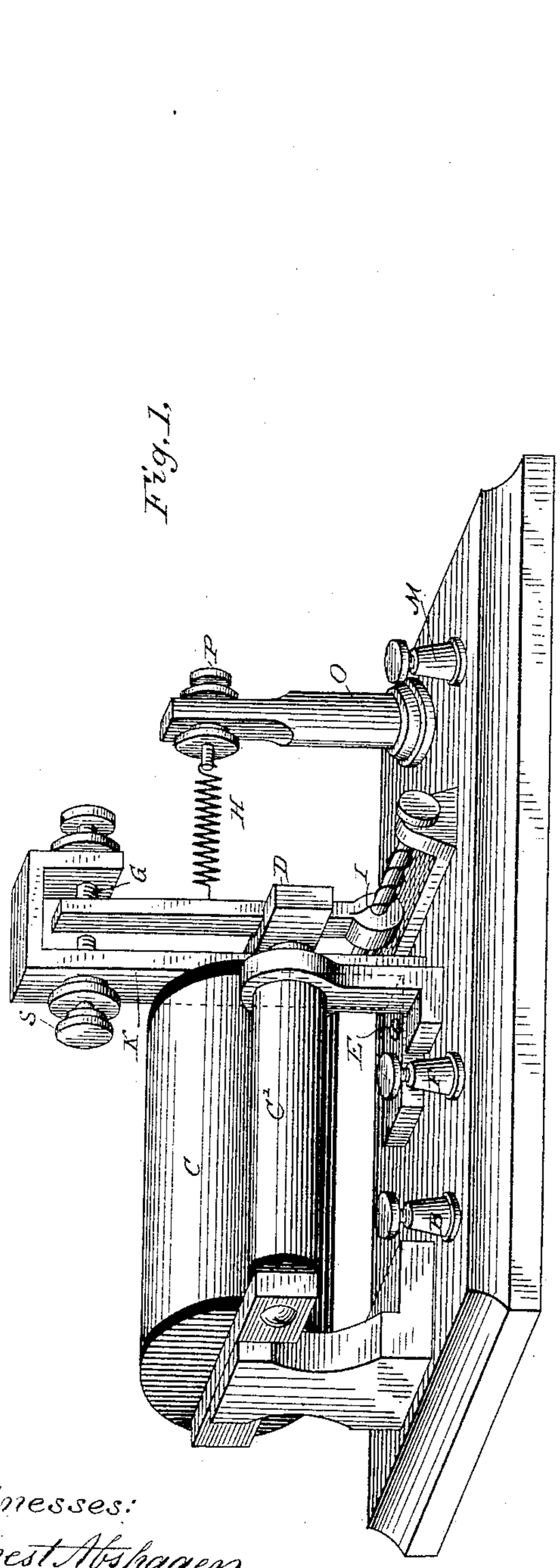

Fig. 1.

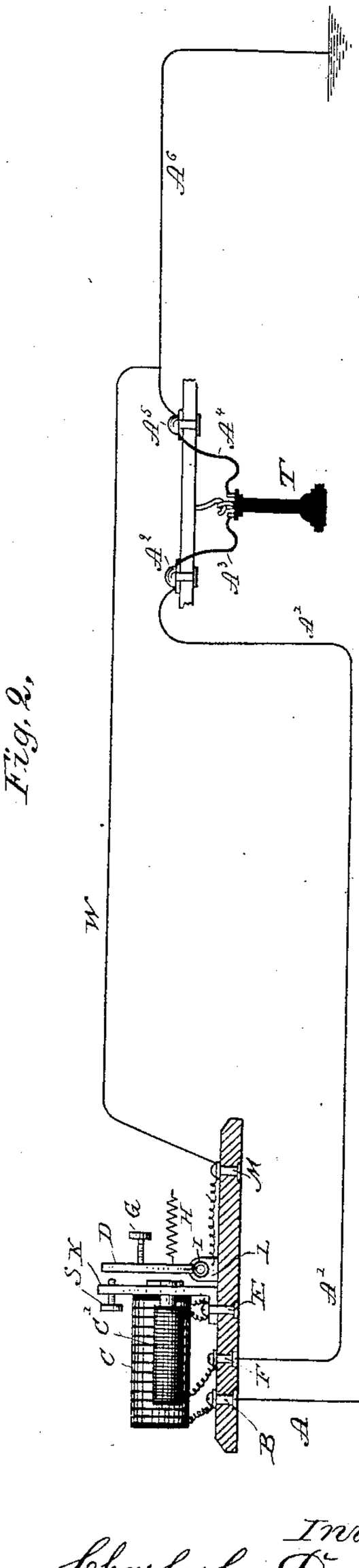

Fig. 2.

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UNITED STATES PATENT OFFICE.

CHARLES C. DRAKE, OF TRENTON, NEW JERSEY.

TELEGRAPH AND TELEPHONE PROTECTOR.

SPECIFICATION forming part of Letters Patent No. 336,040, dated February 9, 1886.

Application filed October 24, 1883. Serial No. 109,929. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. DRAKE, a citizen of the United States, residing at Trenton, county of Mercer, State of New Jersey, have invented certain new and useful Improvements in Protectors for Telephonic and Telegraphic Instruments, of which the following is a specification.

My invention relates to a device adapted to be placed in circuit with telephonic, telegraphic, or other similar instruments, and by means of which they are protected from the injurious or destructive action of electric currents of greater potential or quantity than those with which they are designed to work, and which normally traverse the circuits in which such instruments are included.

It is a matter of frequent occurrence in locations where conductors convey currents of electricity having a considerable difference of potential or quantity, and where such conductors are arranged near to one another, that they may become, from various causes, entangled, or a conductor by becoming detached from its support may fall and so "cross" the conductor or conductors of other circuits. Thus, for instance, conductors conveying heavy currents—such as are used for electric lighting systems—may in this manner be brought into contact with the conductors conveying the relatively weak and feeble currents employed with telegraphic or telephonic system, and the latter become media for conveying currents of abnormal intensity or quantity. Static charges may also during atmospheric electrical disturbances acccumulate on the conductors and be discharged with serious effect. Hence it is desirable to arrive at a means for diverting such excessive or abnormal currents from that portion of the main circuit in which the instrument or instruments it is desired to protect are located. At the same time it is also desirable that the instrument or instruments should be not cut out of circuit, but should always be in a condition to perform its or their normal functions irrespective of any excess of current above the normal amount circulating in the main line.

To attain this object I have devised the herein-described instrument or protecting device, which consists, essentially, of two electro-magnets, one of which has its coil or coils formed from a few turns of coarse wire of low electrical resistance, and the other its coils formed from a number of turns of fine wire of high electrical resistance; or but a single core may be used and the helices of different resistances wound thereon and provided with an armature arranged between an adjustable contact-point over the electro-magnets and an insulated adjustable back stop and adapted to be normally held away from its electro-magnet by means of its own weight, or by a retractile spring, which can be so adjusted as to prevent the armature from responding to currents traversing the magnet or magnets not exceeding the ordinary working-current.

The present application relates to a protecting device similar to that described in United States Letters Patent granted to me July 10, 1883, and numbered 280,916, the only difference being that I include a fine-wire magnet, which shall act in conjunction with the coarse-wire magnet, and thus render the instrument more sensitive in its action. As before stated, the coils on the electro-magnets are in the main-line circuit, and hence any current which circulates in the main line must necessarily pass through the coils of the magnets. After passing through the magnets the circuit is divided into two parts or paths—one of high resistance, within which is included the telegraphic, telephonic, or other instruments to be protected, and the other of low resistance, normally open, but adapted to be closed when the current circulating in the main line imparts sufficient energy to the electro-magnet to enable it to attract its armature. It will be readily understood that the currents in the paths or branches will be in the inverse ratio of their resistances, and hence, if the resistances be properly proportioned, a current which will be sufficient to enable the telegraphic, telephonic, or signaling instruments to perform their normal functions, but not sufficient to injure them, will at all times be transmitted through the instruments, the strength or quantity of the current so transmitted varying with that of the main line, and all excess of current will be diverted through the path of low resistance around the protected instruments to ground or back to the main-line conductor.

In the accompanying drawings, which illus-

trate my invention, similar letters of reference indicate like parts.

Figure 1 shows a view in perspective of a protector constructed according to my invention. Fig. 2 is a diagrammatic view illustrative of the different circuits and connections.

In the drawings, A represents the main-line conductor, connected to the binding-post B. To the binding-post B, I attach one end of a coarse copper wire, which is wound around the core of the magnet C to form its coil or coils, ending at the screw E, which passes through and secures the conducting-upright K to the base of the instrument. Attached by one end to the screw E is a fine copper wire, which is wound around the core of the magnet C′ to form its coil or coils, the other end being carried to the binding-post F. I prefer to wind the magnet C with but few convolutions of a coarse copper wire, whose electrical resistance for any given length shall be equal to or less than that of a similar length of the main-line conductor. The amount of fine wire used upon the magnet C′ should be sufficient to offer a resistance to the passage of the normal current, so that any slight increase of current transmitted through the circuit will cause the magnet to become energized and attract the armature.

I do not limit myself to the particular arrangement of the magnets. The fine and coarse wire helices may be wound on the same core, or arranged in relative positions other than that shown and described. Located in front of the magnet, and supported upon an insulated axis, I, is the armature D, the end of which projects upward between two set-screws, S G, arranged in the head of the upright K. The set-screws are so arranged as to be adjustable, and to determine or limit the play of the armature. One of the set-screws, G, is provided with a tip of insulating material, which serves to insulate the armature, which is wholly of conducting material, from the upright K, when the armature rests against the set-screw, that being its normal position when uninfluenced by the magnets. The lower end of the armature is connected through the copper wire L with the binding-post M.

On the end of the instrument, arranged in a line with the armature, is a suitable support, O, for the tension-screw P.

H is a tension-spring, connected at one end to but insulated from the armature D, and attached at the other end to the tension-screw P.

Having thus described the invention so far as relates to its mechanical construction, I will now describe its connections and operation when included in the main-line circuit and in circuit with the telegraphic, telephonic, or other instruments which it is designed to protect. The main-line conductor A is connected to the binding-post B, and the current traversing such conductor is carried through the coils of the electro-magnets C and C′, and out through the binding-post F, and thence by the conductor A′ to the binding-post A^2, by the telephone-cord A^3 to telephone T, by cord A^4 to binding-post A^5, to return main-line conductor A^6. It will be understood that the main-line conductor A′ A^6 can be a closed metallic circuit, or the ends of the conductors may be connected to ground. The path of the current as described is the path of the normal current, which is sufficient in amount to operate the instruments included in the circuit. It is obvious that the conductors A′ and A^6 can be connected directly to the instrument or instruments to be protected without the intervention of any cord, such as those at A^3 and A^4. A current of the amount described traversing the normal circuit and the coil of the electro-magnet or magnets will not impart sufficient energy to it or them to attract the armature, which is normally held away from the magnets by the tension of the spring H. The tension of this spring can be so adjusted as to exert more or less pull upon the armature, and thus provides a means of regulating the amount of current which can be transmitted through the normal circuit. Should any abnormal current be thrown upon the main line A, all of such current will pass through the magnets C and C′, instantly energizing them, so as to attract the armature D and overcome the tension of the spring H and bring the end of the armature in contact with the adjustable contact-point S on the upright K. By making such contact a path of low resistance—from binding-post B through the magnet C to screw E, by conducting upright K, screw S, armature D, wire L to binding-post M, and thence by the conductor W to the return main line conductor A^6 or to ground—is provided, and the current will divide and circulate through the two paths, the amount of current transmitted through the separate paths being in the inverse ratio of their resistances. Should any abnormal current be thrown upon the return main-line conductor A^6, the path of the current will first be through the telephone by conductor A′ to the magnets, which will attract the armature as before and close the path of low resistance, the path of the current then being from A^6 by conductor W to binding-post M, wire L, armature D, screw S, screw E, magnet C to main conductor A, which may be connected to ground. It will be noticed that when any abnormal current is thrown upon the conductors A or A^6 and the armature attracted, the current divides at the screw E, and the magnet C′ is included in the path of high resistance.

I wish it understood that I do not limit myself to the particular mechanical construction of the device shown in the drawings and described in the specification, as it is obvious that many changes can be made therein without departing from the intent of my invention.

I am aware that various devices have heretofore been constructed for automatically

breaking the circuit or for cutting the instruments to be protected out of the circuit; but, so far as I am aware, I am the first to construct a device which will automatically divert abnormal currents to earth from the main circuit without breaking or otherwise interfering with the circuits in which the instruments to be protected are located; or, in other words, a device located in the main circuit, and through which all the currents circulating on the main circuit pass, which is inactive and non-responsive to the normal current, but instantly responsive to an abnormal current, whereby the current is split up or divided into two parts and caused to travel two paths of unequal resistance.

I claim as my invention—

1. The combination of an electric circuit and electrical instruments included therein, through which a path of high resistance is always maintained, with an automatic electro-magnetic device consisting of high and low resistance magnets, and connections constructed to automatically close a path of low resistance around said instruments when the current traversing the main line exceeds the normal amount.

2. The combination of an electric circuit and electrical instruments included therein with a pivoted armature, two electro-magnets, one of high and the other of low resistance, both of which are in the main-line circuit, and the means controlled by the armature to divert through a path of low resistance around the electrical instruments any excess of current above that normal to the line.

3. The combination of an electric circuit and electrical instruments included therein, through which a path of high resistance is always maintained, with an automatic electro-magnetic device consisting of a magnet having high and low resistance helices, and connections, substantially as described, constructed and connected to automatically close a shunt-circuit of low resistance around the receiving-instrument when the main line is overcharged, and mechanism, substantially as set forth, to retract the armature to its normal position when current in the main line again becomes normal.

4. The combination, with an electric circuit and the electrical instruments included therein, of the means whereby excessive currents are divided and caused to traverse two paths of unequal resistance, consisting of two electro-magnets, one of high and the other of low resistance, a pivoted armature and its connections, and a conductor of low resistance connected to the return main-line conductor, substantially as described.

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