

C. A. ROLFE.  
ELECTRICAL PROTECTIVE APPARATUS.  
APPLICATION FILED MAY 18, 1903.

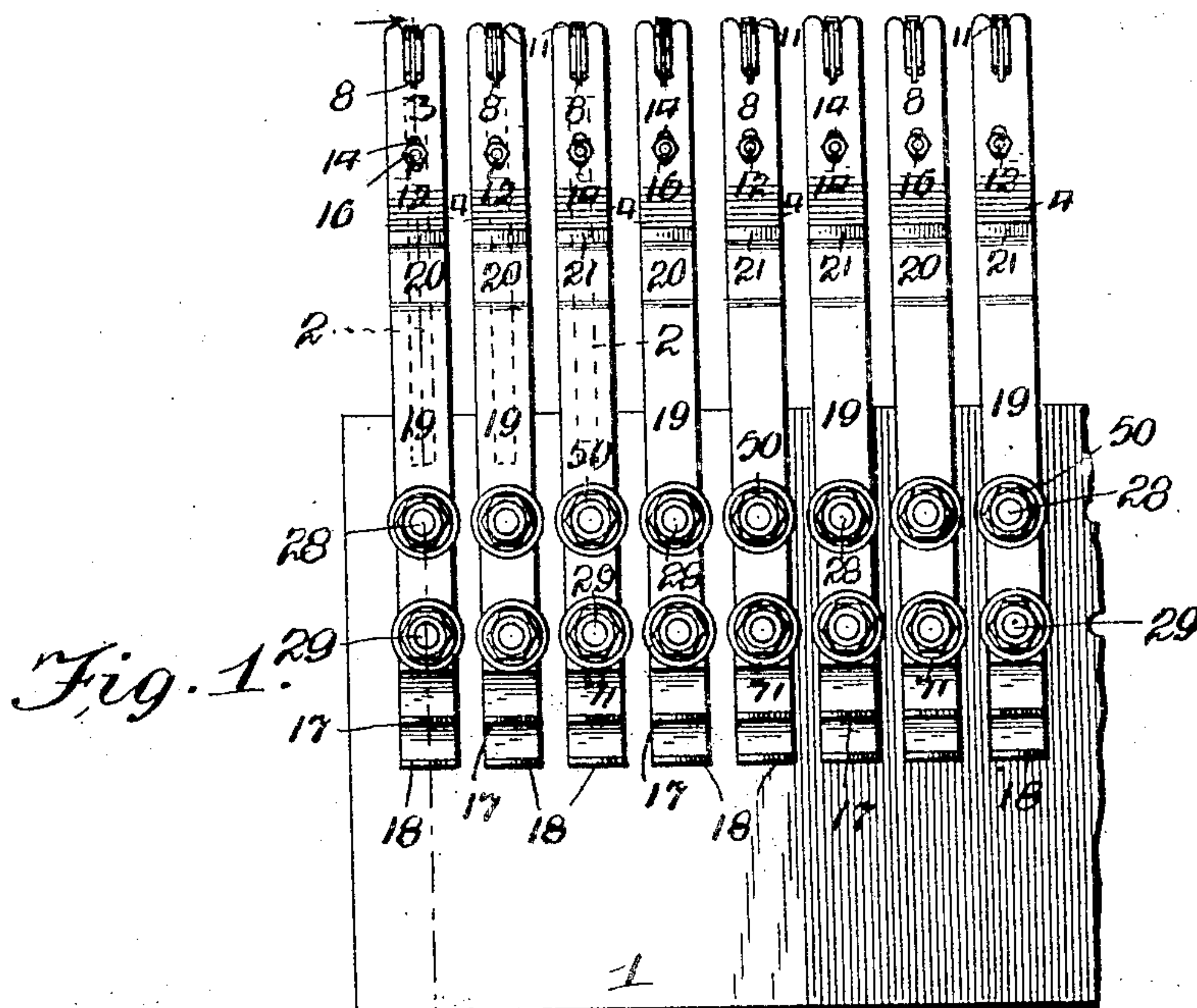


Fig. 2.

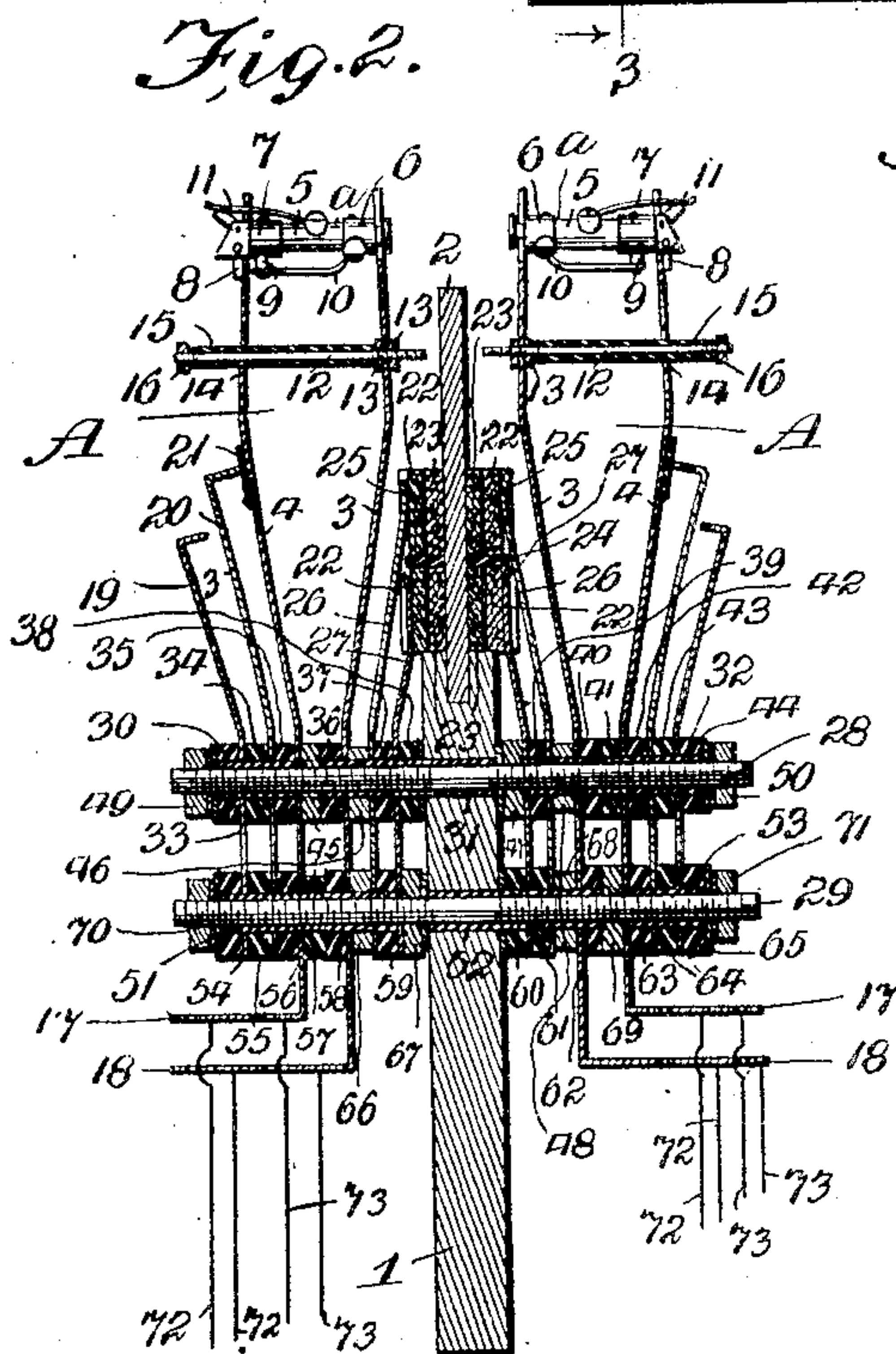
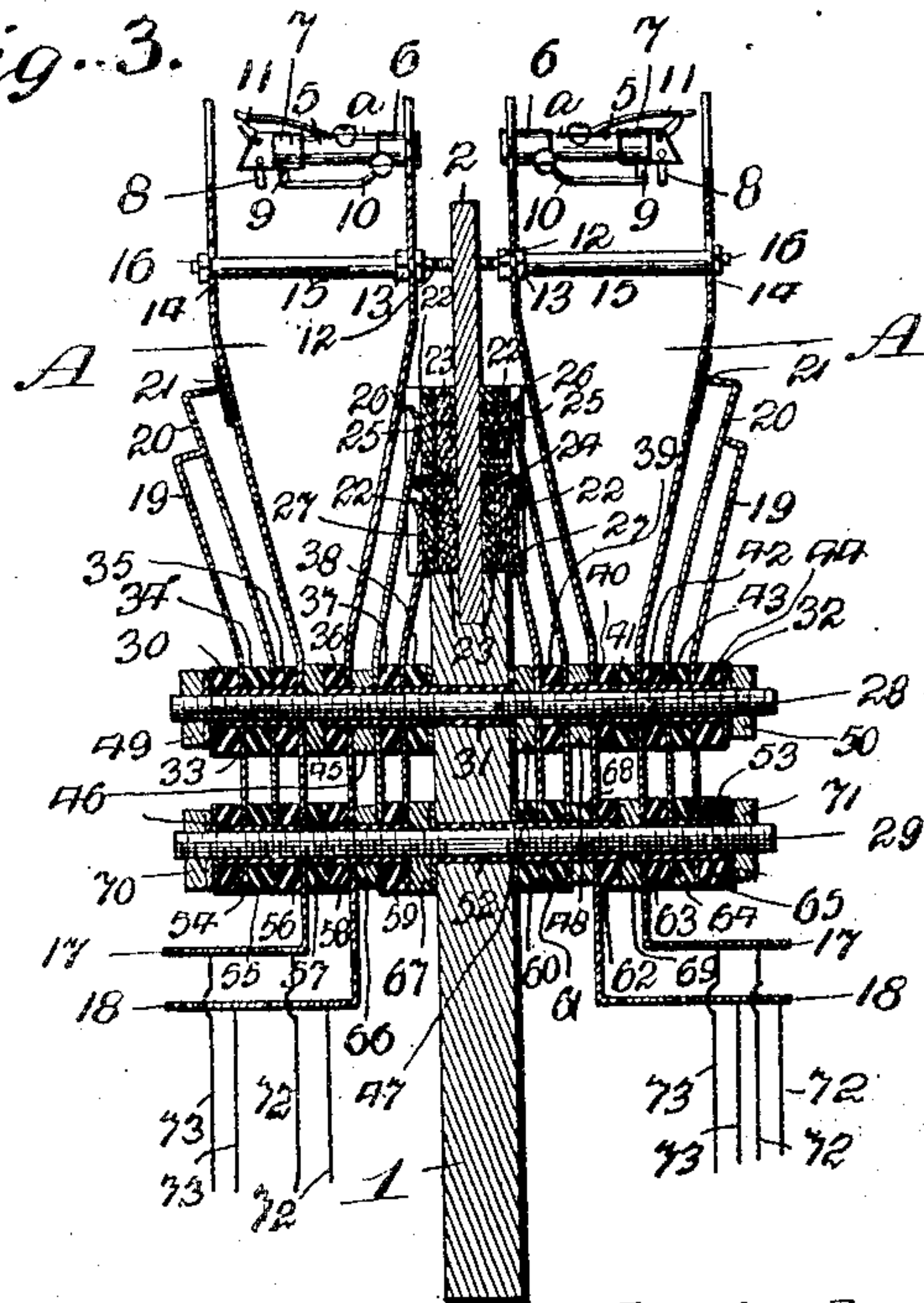


Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## ELECTRICAL PROTECTIVE APPARATUS.

No. 800,827.

Specification of Letters Patent.

Patented Oct. 3, 1905.

Application filed May 18, 1903. Serial No. 157,732.

*To all whom it may concern:*

Be it known that I, CHARLES A. ROLFE, a citizen of the United States, residing at Adrian, in the county of Lenawee and State of Michigan, 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 apparatus for protecting electrical instruments and circuits from unduly-strong currents.

Prominent objects of the invention are to provide a simple, practical, and inexpensive form of apparatus, to reduce the expense of manufacture and maintenance, and to secure these results in a practical and effective manner.

In an application filed by me, Serial No. 154,371, filed April 25, 1903, electrical protective system, I have illustrated and described a system of electrical protection by which effective protection for an electrical instrument and circuit is secured by a single protective device in place of the two commonly employed heretofore, one in each side of the circuit. By such arrangement it will be seen that the cost of protection is materially reduced—in fact, is practically cut in half—a single protector serving the purpose of two heretofore employed. In my said other application I have claimed the system of protection therein set forth and have referred briefly to a form of protector which is especially adapted for use in such system, but have not claimed such protector therein. In the present application I shall describe and illustrate more in detail such protector and shall claim the same.

The system which I have set forth in my said other application involves the placing of a protective device in shunt across the terminals of the instrument and arranging the same so that when operated it will short-circuit the circuit across the instrument, thereby affording a direct low-resistance path for the current, by which the instrument is protected. The protector herein set forth therefore embodies an excess-current-operated device capable of being actuated by an excess current in the shunt-circuit and means by which a short circuit is formed upon the operation of such excess-operated device. In this applica-

tion I show such device arranged and mounted in bank form—that is, a plurality of devices associated and mounted together in a bank or series, so that the whole can be employed in a central station, as opposed to individual devices for use in outlying stations.

In the accompanying drawings, Figure 1 is a view of a portion of a bank of protectors embodying my present invention. Figs. 2 and 3 are views taken on line 2-3 in Fig. 1, Fig. 2 showing the protectors in their normal condition and Fig. 3 showing the same operated.

The apparatus shown in the drawings is constructed with a heavy supporting-plate 1, which is conveniently made of iron and provided with posts 2 2, fitted in its upper edge. On each side of the plate 1 are mounted protective devices A A, arranged in rows with the protectors in the two rows opposite one another. Each protective device consists of a pair of springs 3 and 4, which tend to spring away from one another, and a heat-cartridge *a*, mounted at the upper ends of the springs 3 and 4 and holding the same normally under restraint.

The heat-cartridge *a* is of the kind shown, described, and claimed in other applications of mine, Serial No. 104,021, filed April 21, 1902, and Serial No. 143,224, filed February 13, 1903, and so will be described here only briefly. It consists of a body 5, of insulating material, having end caps 6 and 7, whereof the cap 6 is adapted to engage the spring 3, and the cap 7 is provided with a pivoted trigger 8, adapted to engage the spring 4. A stick 9, of graphite, is extended through one end of the body 5 and also through the lower edge of the cap 7, making contact with the top thereof, and a spring 10 is attached to the cap 6 and extended across to the graphite stick 9, with which it makes connection. A spring 11 is secured to the insulating-body 5 and extended over to the bent end of the trigger 8, against which it presses. The trigger 8 is held in position in the slotted end of the cap 7 by solder, which is normally held, but is melted or softened by heat generated by an unduly strong current in the graphite stick 9, so as to permit the trigger 8 to swing and the spring 4 to be released. The spring 3 carries a metal rod 12, which is secured by nuts 13 13 and extends toward the spring 4 and through an aperture or slot 14 therein. The metal rod



12 is surrounded by an insulating-sheath 15, conveniently made of ebonite or the like, and is provided at its outer end with a metal nut 16. The ends of the springs 3 and 4 are extended downwardly and bent so as to form terminals 17 and 18.

Outside of the protectors A A are local-circuit contacts 19 and 20, having their upper ends bent laterally, the contact 20 resting against a piece of insulation 21 on the spring 4 and the contact 19 being adapted to make connection with the contact 20 when the latter is sprung outwardly by the outward movement of the spring 4.

Four pairs of lightning-arrester electrodes, preferably in the form of carbon blocks 22 and 23, are mounted upon the plate 1, two pairs on each side of the plate 2, and the members of each pair being arranged the one above the other. Between the upper and lower pairs of carbons is an insulating-strip 24, and between the carbons of each pair are insulating-strips 25, made of mica or the like. The outer carbons 22 are line-carbons and are provided with longitudinally-extending slots, and the inner carbons 23 are the ground-carbons, which by contact with the plates 1 and 2 connect with the ground. Lightning-arrester line-strips 26 and 27 are located between the protectors and in contact with the line-carbons 22, the strips 26 making contact with the upper line-carbons and the strips 27 with the lower ones. These strips also serve to hold the carbons in place by pressing against them. The protector-springs 3 and 4, the local-circuit strips 19 and 20, and the lightning-arrester strips 26 and 27 are held in position and secured to the plate 1 by bolts 28 and 29. Insulating-sleeves 30, 31, and 32 are arranged on the bolt 28, as are also insulating-disks 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, and 44 and metal nuts or disks 45, 46, 47, and 48 with nuts 49 and 50 at the ends. The bolt 29 is provided with insulating-sleeves 51, 52, and 53 and insulating-disks 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, and 65 and metal disks 66, 67, 68, and 69 and end nuts 70 and 71.

The protectors being connected in shunt, as previously set forth, the terminals 17 and 18 are connected with both the jumper or cross-connecting wires 72, running to the switch-board, and with the cable-wires 73. The left-hand lightning-arrester contact 26 is connected with the left-hand spring 3 by means of the metal disks 46 and 66, and the spring 4 is connected with the right-hand lightning-arrester contact 27 by the metal disk 45, the rod 28, and the metal disk 47. In a similar way the right-hand springs 3 and 4 are connected, respectively, with a right-hand contact 26 and the left-hand contact 27. The two protectors shown in Fig. 2 are understood to be for two different circuits.

The operation is as follows: Under normal

conditions the protectors are in the position shown in Fig. 2, in which arrangement they are in shunt with the circuits, respectively, containing the instruments they are intended to protect. Under normal conditions a small portion of the current traversing each circuit, the proportion depending upon the relative resistance of the circuit and the protector, passes through the latter, while the remainder traverses the instrument. Under normal working conditions the amount traversing each protector is insufficient to operate it, in which case it remains as shown in Fig. 2. When, however, the current in either circuit becomes unduly strong, enough passes through the protector of that circuit to heat the graphite stick 9 thereof sufficiently to melt or soften the solder holding the trigger in position, in which case the spring 4 is released, thereby allowing the springs to separate, as shown in Fig. 3. The spring 4 springs outwardly until it engages the nut 16 on the end of the bar 12, and the spring 3 springs inwardly until it strikes the upper end of the post 2. At the same time the contact 20 is thrown against the contact 19. The action of the springs 3 and 4 obviously forms a short circuit between such springs by way of the bar 12, and in the arrangement shown the same bar makes connection with the post 2. If the arrangement is used on a metallic circuit, this circuit is obviously short-circuited through the bar 12 and the instrument virtually cut out by said short circuit and the circuit grounded at the same time. If the arrangement is used on a grounded circuit, a short circuit to ground is formed by the bar 12 making contact with the post 2, in which case the instrument is likewise short-circuited and protected. The connection of the contacts 19 and 20 operates a local alarm in any suitable or desired manner.

After operation the heat-cartridges are automatically restored to operative condition by the levers 8 being reset by the springs 11 and being resoldered in their reset condition.

The lightning-arresters 22 and 23 operate in the usual manner to relieve the circuit of any high potential. In Fig. 3 both protectors are shown operated, it being understood that both circuits have been transversed by unduly strong currents.

It will be seen that the apparatus is simple, practical, and effective and that it affords effective protection by the use of a single instrument on each circuit.

What I claim is—

1. An electrical-circuit protector comprising a single thermally-operable circuit-protective device having provisions for short-circuiting the circuit on the passage of an unduly-strong current, and having provisions whereby it is automatically restored to operative condition.

2. An electrical-circuit protector, compris-



ing a single-circuit protective device having solder-secured means releasable on the passage of an unduly-strong current, to short-circuit the circuit, and also having provisions for automatically resetting itself at each operation for a subsequent operation, and for resoldering itself in reset condition.

3. An electrical-circuit protector, comprising a circuit-protective device having a solder-joint heat-cartridge having provisions for automatically resetting and resoldering itself, and supporting members for said cartridge, one of which is a spring held normally in restraint by said cartridge, and having provisions for forming a low-resistance electrical connection between said supporting members on the release of said spring by said heat-cartridge.

4. In protective apparatus for electrical circuits, the combination with a pair of springs, of an excess-current-operated device holding the same in restraint, and means for establishing a low-resistance connection between said springs upon the operation of said device, substantially as described.

5. In protective apparatus for electrical circuits, the combination with a pair of springs, of a heat-cartridge supported by said springs and holding the same in restraint, and a conductor connected with one of said springs and adapted to make connection with the other upon the operation of said heat-cartridge, substantially as described.

6. In protective apparatus for electrical circuits, the combination of springs 3 and 4, a conductor 12 connected with one of the same and insulated from the other, said conductor being provided with an abutment 16, a heat-cartridge carried by said springs and provided with a heat-concentrating device, a body or mass of heat-susceptible material, and a movable abutment held in position by said material, substantially as described.

7. In protective apparatus for electrical circuits, the combination with a pair of springs 3 and 4, of a metallic rod 12 connected with one of the same and provided with an insulating-sheath 15 passing through an aperture in the other spring, an abutment 16 on said rod 12, a heat-cartridge consisting of an insulating-body 5 having caps 6 and 7, whereof the cap 6 is adapted to engage the spring 3 and the cap 7 is provided with a trigger 8, a spring 11 engaging the trigger 8, a stick of graphite 9, and a contact 10 connecting there-with and with the cap 6, substantially as described.

8. In protective apparatus for electrical circuits, the combination of a support, a pair of protectors one on each side of said support, each protector consisting of line-springs 3 and 4, local contact-strips 19, 19, and 20, 20, outside of said protectors, lightning-arresters on said support, lightning-arrester strips 26, 26 and 27, 27 extending to the lightning-arresters, bolts 28 and 29 for securing the protectors to the support, insulating-sleeves 30, 31 and 32, arranged over the bolt 28, insulating-disks 33, 34, 35, 36 37, 38, 39, 40, 41, 42, 43 and 44 on the bolt 28, for separating and insulating the line-springs, local contact-strips and lightning-arrester strips from one another, insulating-sleeves 51, 52 and 53, on the bolt 29, and insulating-disks 54, 55, 56, 57, 58, 59 60, 61, 62, 63, 64 and 65, and nuts 66, 67 68 and 69 on the bolt 29, said disks 54, 55, &c., being to insulate the said springs and strips from one another, and said nuts 66, 67, &c., being to connect the line and lightning-arrester strips with said bolt 29.

In witness whereof I hereunto subscribe my name this 27th day of January, A. D. 1903.

CHARLES A. ROLFE.

Witnesses:

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I. C. LEE.