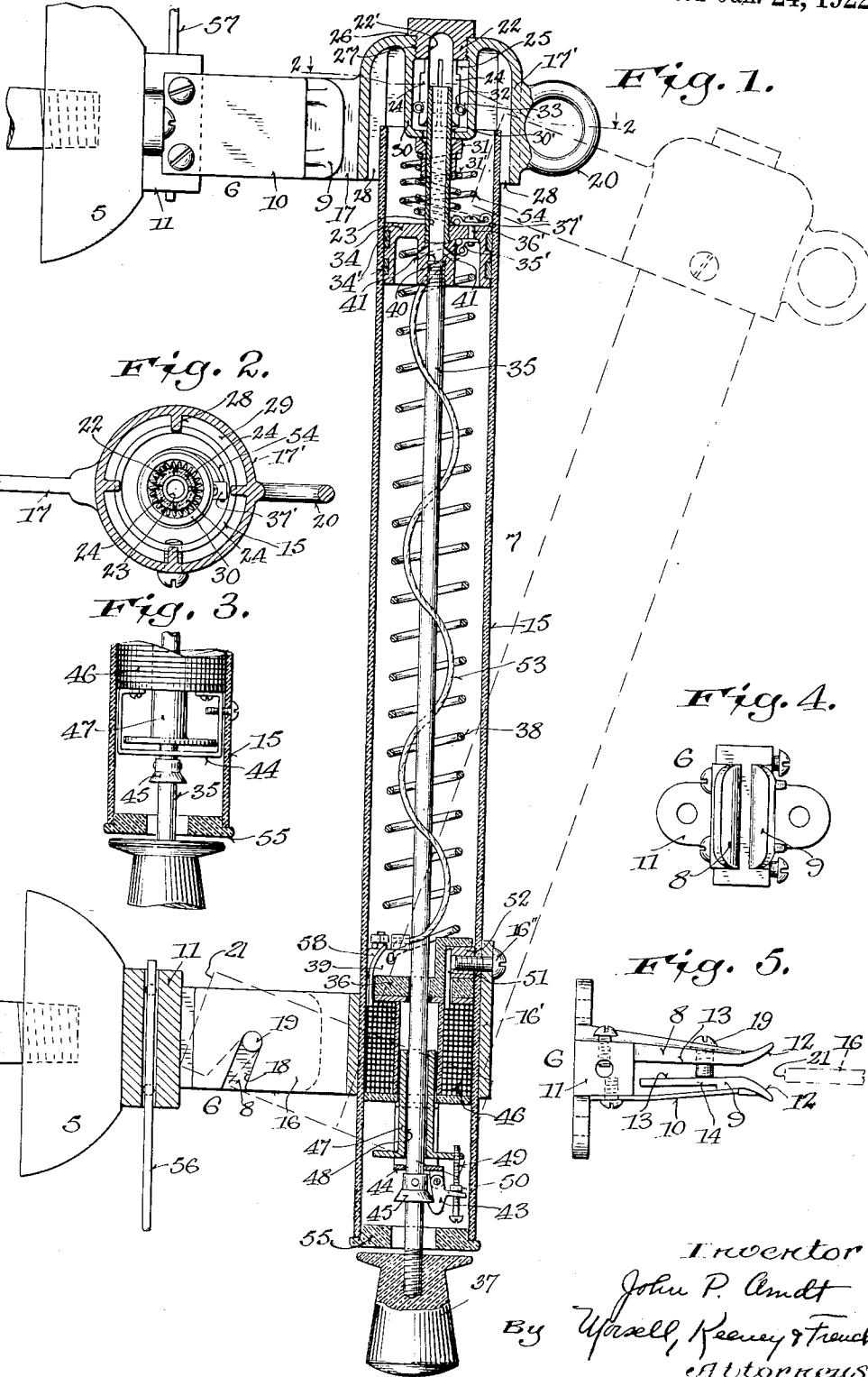


J. P. ARNDT.
CIRCUIT BREAKER.
APPLICATION FILED NOV. 15, 1917.

1,404,564.

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JOHN P. ARNDT, OF MILWAUKEE, WISCONSIN.

CIRCUIT BREAKER.

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Specification of Letters Patent. Patented Jan. 24, 1922.

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To all whom it may concern:

Be it known that I, JOHN P. ARNDT, a citizen of the United States, and resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Circuit Breakers, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

The invention relates to circuit breakers.

One of the objects of the invention is to provide a circuit breaker adapted for use with contact clips.

Another object is to provide a circuit breaker which may be readily placed and held in operative position without the use of threaded or auxiliary fasteners.

Another object is to provide an improved circuit breaker wherein the circuit may be interrupted at will, or automatically upon the occurrence of predetermined abnormal conditions.

Another object is to provide a circuit breaker which may be reset and replaced with minimum trouble and danger.

Another object is to provide an improved circuit breaker for use with heavy duty circuits.

Another object is to provide an improved circuit breaker arranged to control and interrupt the arc.

Other objects and advantages will appear from the specification and claims.

One embodiment of the invention is shown in the accompanying drawing in which—

Fig. 1 is a vertical sectional view of the device embodying the invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1;

Fig. 3 is a detail view, the casing being shown in section;

Fig. 4 is a front view of one of the fixed contact clips; and

Fig. 5 is a top view of one of the fixed contact clips.

In the drawings, the numeral 5 designates the usual insulators carried by a suitable support, 6 the fixed spring contact clips secured to the insulators, and 7 the circuit breaker as a whole.

Each of the fixed contact clips consists of a stationary contact finger 8 and a movable contact finger 9 carried by a flat spring 10 secured to the base 11 of the contact. Each of the fingers has an outwardly flared end 12 and a straight blade contacting side 13.

The spring 10 is normally inclined inwardly and is secured to the finger 9 near its upper portion by welding or by suitable fastening means. In order that the contact finger 9 may lie flat against the blade to produce a good contact, the finger below its point of connection with the spring has a portion 14 spaced away from it so that the spring is not only bent as a whole from its point of connection with the base but also is bent between its point of connection with the finger and base on the engagement by the flat face 13 of the finger with the switch blade.

The movable circuit breaker comprises a support in the form of a hollow cylinder or tube 15 of insulating material, blade contacts 16 and 17 secured to the cylinder, and a circuit interrupter within the cylinder. Contacts 16 and 17 cooperate with spring contact clips 6 to hold the circuit breaker in operative position and to complete the circuit therethrough.

The blade contact 16 has an inclined slot 18 to removably receive the end of a screw 19 carried by the stationary finger 8 of one of the fixed contacts. The blade contact 17 is formed integral with a cap 17' which has a ring 20 which may be used as a handle with which to move the arm about the screw as a pivot to release the blade 17 from its fixed contact. The end 21 of the blade 16 engages the base to limit the outward swinging movement of the support which is shown in open position by the dotted lines in Fig. 1. The support thus forms a switch whereby the circuit between contact clips 6 may be opened at will independently of the operation of the circuit interrupter. The blade contact 16 is provided with an integral sleeve 16', of magnetic material, surrounding the cylinder and secured to it by means of a screw 16'' passing through a lug on the sleeve.

The circuit interrupter within the cylinder has a pair of main contacts through which the circuit is primarily closed, and a pair of auxiliary or arcing contacts between which the circuit is finally opened. The main and auxiliary contacts are normally maintained in closed relation but are adapted to be opened upon the occurrence of predetermined abnormal conditions. When the contacts are opened, a blast of air is provided between the auxiliary contacts to aid in preventing or interrupting any arc which may tend to form or persist therebetween.

The main contacts comprise a relatively fixed contact 22, having a bore 22' and a relatively movable contact in the form of a tube 23.

- 5 The fixed contact 22 is in the form of a tube having a closed outer end. The inner end of tube 22 is split to form segments 24 which are made more flexible by a circumferential groove 25 intermediate the ends of the tube. The end 26 of the tube is threaded to removably fit into a threaded aperture 27 in the cap 17'. The cap 17' is provided with spacing lugs 28 to provide a series of channels 29 through which the air and arc products may pass on the separation of the contacts. The contact 22 may be readily renewed if occasion requires it. The segments 24 have an annular groove 32 therein to receive a coiled spring ring 33. The end of the contact 23 is adapted to pass into the socket formed by the segments 24 and is closely held thereto by the yielding spring pressed segments.

- In the case of very heavy currents in order to prevent damage to the main contacts through repeated operation auxiliary contacts are preferably employed. These auxiliary contacts consist of a fixed tubular contact 30 and a movable tubular contact 31. The fixed contact 30 is formed integral with the cap 17' and is provided, at its lower end, with an opening 30' through which the upper end of the tube 23 may extend. The movable contact 31 is slidably mounted upon the tubular contact 23 and is yieldingly supported by a spring 31' which normally holds it against the contact 30. With this construction there is a relative movement between the contacts 23 and 31 so that the contact 23 separates from the contact 22 before the contacts 30 and 31 separate so that the final break takes place upon the separation of the auxiliary contacts 30 and 31 and the contact-faces of the main contacts are protected from the arc.

- The means for producing a current of air against the contacts on their separation comprises a piston 34 having piston rings 34' and slidably mounted in the cylinder 15 and carrying the tube 23. This piston compresses the air in the cylinder when the contacts are separated to provide a blast of air which is blown against and between the auxiliary contacts to prevent the formation of an arc or to quench an arc which may tend to persist.

- The piston 34 is secured to one end of a rod 35, which is slidably mounted in a disk 36 of insulating material secured within the cylinder, and carries an insulated handle 37, the piston being moved to compress the air by means of a coiled or tension spring 38 surrounding the rod 35 and secured at one end by a clip 35' to said piston and at the other to an insulating terminal block

39 carried by the disk. The clip 35' is secured to the piston by a screw 36' which also holds a clip 37' to the piston, said clip 37' securing the spring 31' to the piston.

The tube 23 communicates with a bore 40 in the piston which communicates with the interior of the cylinder behind the piston through passages 41.

The means for releasably maintaining the contacts in circuit closing position consists of means for holding the piston against actuation by the spring 38. This means comprises a detent 43 pivotally secured to a yoke 44 in the tube 15 and releasably engaging a beveled collar 45 on the rod 35.

The means for controlling the release of the spring maintaining means comprises circuit controlled means for releasing the detent 43. This consists of a coil 46 secured within the tube 15, an armature or core 47 slidably mounted in the coil 46 and having a bore 48 through which the rod 35 passes, a screw 49 secured to the free end of the core passing through an elongated slot in the detent and carrying an adjustable nut 50 to adjust the position of the core 47 for different current values. When the spring 38 is under tension and the contacts are in engagement with each other the detent will hold the rod and piston in their upper position. One end 51 of the coil is connected to a contact block 52 inset in the disk 36 and secured to the screw 16'', and the other end 58 to the block 39 which is connected by a conductor 53 to the piston 34. The sleeve 16' surrounds the tube adjacent the coil 46 and, since it is composed of magnetic material, it acts like a core to decrease the reluctance of the magnetic circuit of the solenoid so that the flux produced is greater than would be the case if the magnetic circuit was composed entirely of air, or other non-magnetic substance.

A conductor 54 extends between auxiliary contact 31 and clip 37'. This conductor provides a bath of comparatively low resistance so that the current flowing through contact 31, either before or after the separation of the main contacts, does not pass thereto through tube 23 and the intervening air gap. Without this low resistance path current could readily flow from plunger 34 through tube 23, across the air gap between tube 23 and contact 31 to contact 31'. The current flowing in this path in crossing the air gap would tend to arc which might cause injurious burning or pitting of tube 23, with the result that this contact might become so roughened that it would not easily slide within its cooperating main contact 24.

An apertured cap 55 of insulating material closes up the bottom end of the tube 15.

When the circuit breaker is in operative position and the circuit interrupter is closed, as shown in Fig. 1, the current passes from 130

the line conductor 56 to one of the fixed contacts 6, blade 16, sleeve 16', screw 16'', block 52, coil 46, block 39, conductor 53, piston 34, tubes 23 and 22, tube contacts 31 and 30, cap 17', blade contact 17, other fixed contact to line conductor 57. While the coil 46 is energized under ordinary working conditions it will not pull up the armature but in the event of an excessive load being imposed upon the circuit the rise in current will cause the coil 46 to overcome the detent lock and pull the armature 48 toward it and release the detent 43 from engagement with the collar 45, the coil first moving the screw 49 upwardly until its head strikes the detent 43 so that the armature is nearer the coil when the detent is released and a greater pulling force thereby obtained. On the release of the detent 43 the tension spring 38 pulls the piston 34 toward the coil 46 thereby separating the contacts 22 and 23 and then the contacts 30 and 31 and at the same time compressing the air in the tube behind the piston which then passes through the passages 41 and bore 40 to the inside of tube 23 through which it is delivered in a stream against and between the auxiliary contacts 30 and 31 as these contacts are separated. The blast of air extinguishes the arc caused by the separation of the contacts and removes the arc-products through the tube 22 and apertured contact 30 and out through the channels 29. Destructive prolongation of the arc is thus prevented and the contacts are preserved. To reset the device the operator may push the piston back to circuit closing position while the circuit breaker is connected to the terminal clips or he may open the breaker and reset the circuit interrupter.

This invention does away with the usual thermo-electric fuse which has to be replaced

every time the circuit is broken by an overload.

I am aware that the details of construction of the device herein shown and described are subject to some modification and change, and I therefore desire it to be understood that such changes as come within the scope of the appended claims I deem to be within the spirit of my invention.

What I claim as my invention is:

1. A circuit breaker comprising a pair of relatively movable main contacts, an electromagnet for causing the separation thereof upon the passage of excess current, a pair of relatively movable auxiliary contacts also controlled by said electromagnet to open subsequently to the separation of the main contacts, and a plunger for creating a blast of air against and between said auxiliary contacts.

2. A circuit breaker comprising an electromagnet operatively responsive to the occurrence of abnormal conditions, a pair of main contacts, a spring for separating said main contacts, a latch controlled by said electromagnet for holding said main contacts in closed relation against the force of said spring until said electromagnet is affected by abnormal conditions, a pair of auxiliary contacts also controlled by said electromagnet for opening subsequently to the separation of the main contacts, a conductor for providing a low resistance path for said auxiliary contacts in parallel with the path through the main contacts, and a plunger for creating a blast of air against and between said auxiliary contacts to quench an arc forming therebetween and remove the arc products.

In testimony whereof, I affix my signature.

JOHN P. ARNDT.