June 16, 1931. W. A. ATWOOD 1,810,591

TIME ELEMENT DEVICE

Filed July 24, 1929

Fig. 1.

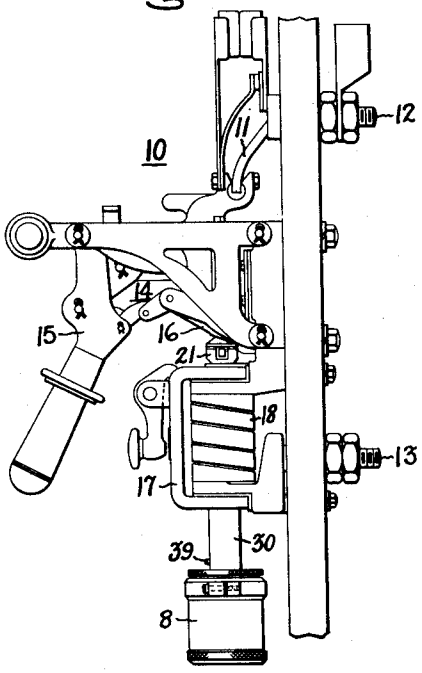


Fig. 2.

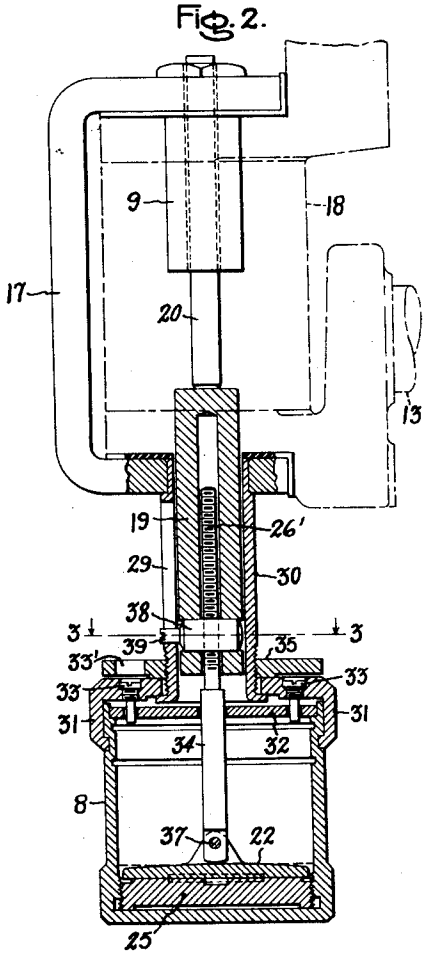


Fig. 4.

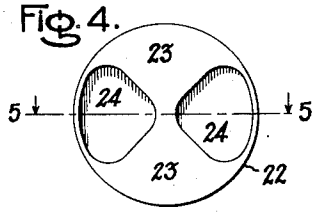


Fig. 5.

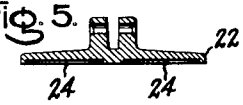


Fig. 6.

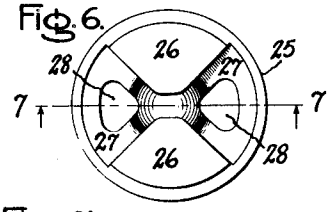


Fig. 7.

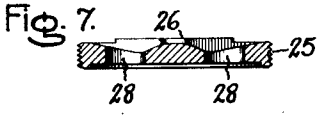
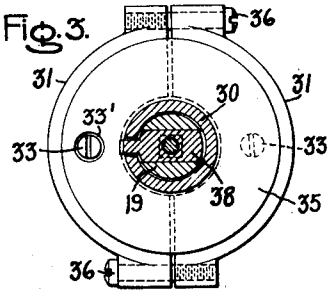


Fig. 3.



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His Attorney.

Patented June 16, 1931 1,810,591

UNITED STATES PATENT OFFICE

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TIME ELEMENT DEVICE

Application filed July 24, 1929. Serial No. 380,723.

My invention relates to improvements in time element devices and more particularly time element devices of the so-called "sucker" or start-delaying type as disclosed for example in United States Letters Patent 830,537. In devices of this type two relatively movable members have engaging surfaces immersed in a viscous fluid such as oil. One of the members is arranged to be actuated by an electromagnet which in response to energization above a predetermined value breaks the adhesion between the engaging surfaces and the liquid film between them after a time dependent on the intensity of the energization and the amount of surface in engagement. Such devices may be built either as relays or as tripping attachments for circuit breakers. An object of my invention is to provide an improved time element device of this type whereby the time of operation can be varied independently of the setting or pick-up point of the controlling electromagnet. Another object of my invention is to provide an improved arrangement of circuit breaker and time element tripping devices such that, when the circuit breaker is closed and carries current, the heating of the circuit breaker parts will not materially affect the viscosity of the fluid used in the timing device and thereby change its operation.

My invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a side elevation of a circuit breaker embodying my invention; Fig. 2 is a sectional elevation on a larger scale of the time element device shown in Fig. 1; Fig. 3 is a section on the line 3—3 of Fig. 2; Fig. 4 is a detail, showing the engaging surface of and recesses in the movable member of the time element device; Fig. 5 is a section on the line 5—5 of Fig. 4; Fig. 6 is a detail, showing the engaging surface of and recesses in the relatively stationary member of the time element device and Fig. 7 is a section on the line 7—7 of Fig. 6.

In Fig. 1, I have shown for the purpose of illustrating an application of my invention an air circuit breaker 10 of the carbon break type, examples of which are well known to the art. As shown, the circuit breaker 10 includes a movable contact 11, upper and lower terminal studs 12 and 13 and an operating mechanism indicated generally as 14 and including an operating handle 15 and a latch 16 which when released allows the operating mechanism to collapse under the bias of gravity and the spring pressure of the contact 11. For actuating the latch 16 in response to abnormal circuit conditions, the circuit breaker 10 is provided with electro-responsive tripping means which, as shown best in Fig. 2, includes a magnetic frame 17, a trip coil 18 in series with the circuit breaker, an armature 19, a cooperating pole piece 9, a trip pin 20 arranged to be actuated by the armature and in case of a plural pole circuit breaker a tripping bar 21 in the path of movement of the trip pin 20.

In order to delay the opening of the circuit breaker 10 on the occurrence of an overcurrent condition, I provide a time element device of the start-delaying or "sucker" type which in accordance with my invention is independently adjustable for time and pick-up current. As shown this device includes two relatively rotatable members such as a disk 22 and a pot 8 having cooperative engaging surfaces between which is a film of a liquid, such as oil, contained in the pot 8 to a suitable depth. The engaging or lower surface of the disk 22 includes two diametrically opposite engaging portions 23 between which are the non-engaging or recessed portions 24 as shown in Figs. 4 and 5. While the engaging surface of the pot 8 may be integral therewith, I may, as a matter of practical construction, use a separate plate 25 which screws into the pot at the bottom thereof as shown in Fig. 2. This plate like the disk 22 has two diametrically opposite engaging portions 26 between which are the non-engaging or recessed portions 27. The latter may include holes 28 for insertion of a tool to remove and replace the plate 25.

In order to adjust the time of operation of the device independently of the pick-up cur-

rent, I so arrange the parts that the amount of the surface engaging portions 23 and 26 can be varied independently of the position of the armature 19. For this purpose, the armature 19 may be adjustably positioned on a rod 26′ which is loosely pivoted to the disk 22 to insure that it will seat more uniformly on the plate 25. The connection between the rod 26′ and the armature 19 may be of the screw and nut type as shown, the threaded portion of the rod 26′ extending through a cylindrical threaded pin 38 set into the armature transversely. As shown, the bearing pin 38 has a portion 39 projecting through a calibrating slot 29 in the calibrating member or tube 30 for the armature 19.

In order to prevent relative rotation of the disk 22 and the pot 8, I support them by means of a clamping mechanism which includes a split clamping ring 31 and a plate 32 which rests on a shoulder within the pot 8 and is secured to the clamping ring 31, so as to prevent rotation relatively thereto, by means of screws 33. The plate 32 is so arranged that upon rotation, the disk 22 turns with it. For this purpose, the rod 26′ may include a square portion 34 passing through a square hole in the plate 32. As shown, the clamping ring 31 includes two halves or segments which have flanges arranged to engage a recess in the pot 8 and a lip or flange on the calibrating tube 30.

In order to prevent movement of the parts and thus disturbing the adjustments when once made, I provide a clamping nut 35 which, as shown, is threaded onto the calibrating tube 30 and is adapted to bear against the upper flange of the clamping ring 31 so as to hold the clamping ring firmly against the calibrating tube. The clamping nut 35 is provided with an opening 33′ so arranged as to permit access to the screws 33 whereby these may be removed to allow the mechanism to be disassembled.

Assuming the parts positioned as shown in Fig. 2, then the armature 19 occupies a definite position in the calibrating tube from which position it will be actuated on the occurrence of a predetermined current in the winding 18 in a time dependent on the amount of surface engaging portions 23 and 26 of the disk 22 and the plate 25 assuming of course that there is a suitable amount of fluid in the pot 8. These adjustments will be maintained so long as the clamping nut 35 is down tight against the clamping ring 31. Assuming now that it is desired to change the pick-up or current setting of the electromagnet then the clamping nut 35 is loosened. This permits a free rotation of the clamping ring 31 and the parts secured thereto but no relative rotation between the disk 22 and the plate 25. Consequently, as the pot 8 is turned in one direction or the other, the armature 19 will be raised or lowered on the rod 26′ to change the pick-up point as desired. If, however, it is necessary to change the time setting for any given value of current then the retaining screws 36 and thereby the clamping ring 31 are released. When this is done, the clamping ring can be held from turning with one hand and the pot 8 turned by the other hand thus rotating the engaging surfaces 23 and 26 relatively to each other and thereby varying the amount of surface in engagement. In this way the disk 22 and, consequently, the armature 19 do not move relatively to each other and the pick-up point remains unchanged. When the adjustment is completed, the clamping ring screws 36 are again tightened and the clamping nut 35 also.

With the arrangement shown, it will be noted that the pot 8 which contains the liquid for providing the film between the disk 22 and the plate 25 is mounted below the circuit breaker mechanism so that the change in temperature of the mechanism from the circuit open or deenergized position to the circuit closed position carrying current, has little, if any, effect on the viscosity of the liquid. Consequently, the timing action of the device remains substantially unaffected by temperature changes in the circuit breaker mechanism. Moreover, as the parts of the timing mechanism are well enclosed, it is substantially dust tight. Furthermore, since the parts form a substantially rigid assembly, the adjustments are easily maintained.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A time element electroresponsive device including a rotatable disk, an electromagnet having an armature adjustably mounted on said disk whereby on rotation of the disk to vary the pick-up point of the electromagnet, a pot within which said disk is longitudinally movable, said disk and pot having cooperative engaging surfaces, and supporting means for the pot including means for restraining the disk and pot against relative rotation adapted to be operated to permit rotation of the pot independently of the disk whereby to vary the extent of surface engagement between the disk and pot.

2. A time element electroresponsive device including two relatively rotatable members having cooperating engaging surfaces with an intermediate liquid film, one of said members forming a chamber within which the other member is longitudinally movable, an electromagnet having an armature adjustably mounted on said other member whereby on rotation of the member to vary the pick-up point of the electromagnet, and

supporting means for said one member including means for restraining the members against relative rotation adapted to be operated to permit rotation of said one member independently of the other whereby to vary the extent of surface engagement between the members.

3. A time element electroresponsive device including a rotatable disk, an electromagnet having an armature adjustably mounted on said disk whereby on rotation of the disk to vary the pick-up point of the electromagnet, a pot within which the disk is longitudinally movable, said disk and pot having cooperative engaging surfaces, a calibrating member for the armature of the electromagnet and means for securing said pot to the calibrating member including a clamping mechanism for restraining the disk and pot against relative rotation adapted to be released to permit rotation of the pot independently of the disk whereby to vary the extent of surface engagement between the disk and pot.

4. A time element electroresponsive device including a rotatable disk, an electromagnet having an armature adjustably mounted on said disk whereby on rotation of the disk to vary the pick-up point of the electromagnet, a pot within which the disk is longitudinally movable, said disk and pot having cooperative engaging surfaces with an intermediate liquid film, a calibrating tube for the armature, means for securing the pot to the calibrating tube including a clamping mechanism rotatably mounted on said tube for restraining the disk and pot against relative rotation adapted to be released to permit rotation of the pot independently of the disk whereby to vary the extent of surface engagement between the disk and pot and means for restraining the clamping mechanism and calibrating tube against relative rotation.

5. A time element electroresponsive device including two relatively rotatable members having cooperating engaging surfaces, an electromagnet having an armature adjustably mounted on one of said members and supporting means for the other member including means for restraining the members against relative rotation adapted to be operated to permit rotation of said other member independently of said one member whereby to vary the extent of surface engagement between the members.

In witness whereof, I have hereunto set my hand this 20th day of July, 1929.

WINFIELD A. ATWOOD.