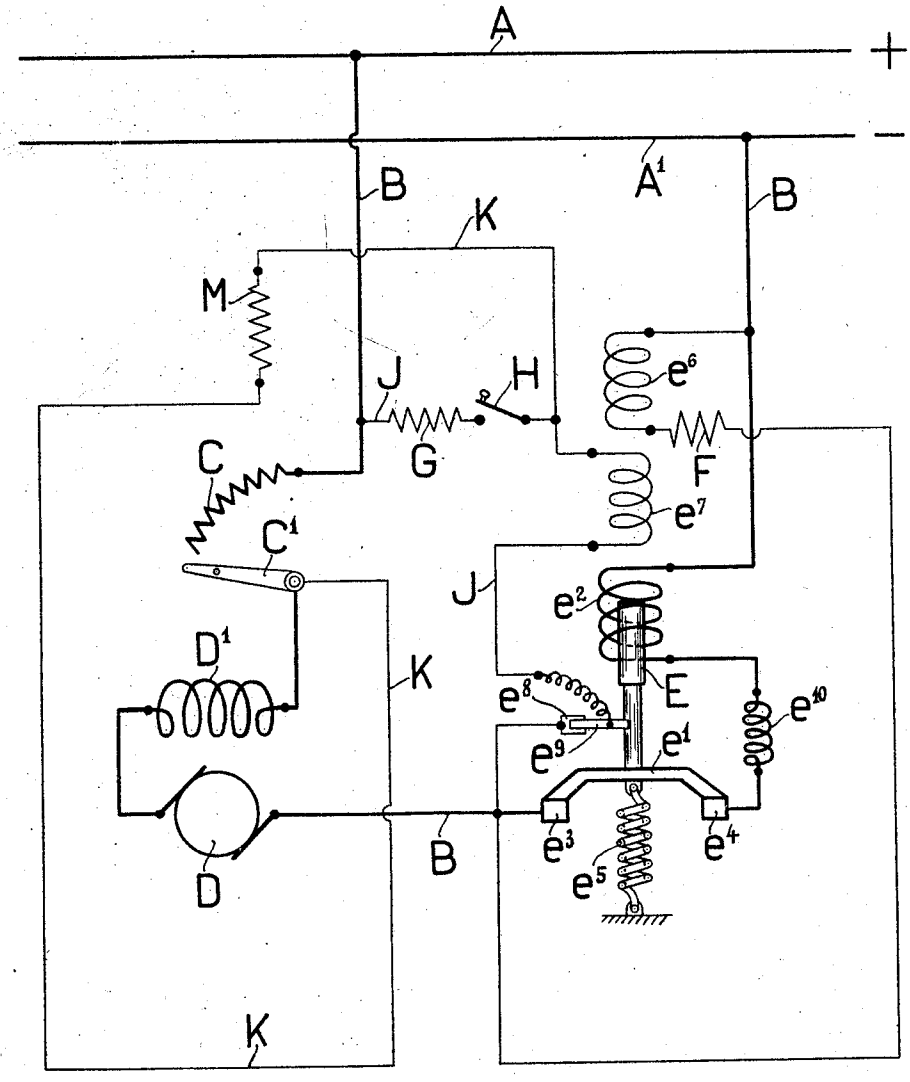
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F. TOBIEN

OVERLOAD CIRCUIT BREAKER

Filed June 12, 1922



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UNITED STATES PATENT OFFICE.

FELIX TOBIEN, OF ESSEN, GERMANY, ASSIGNOR TO FRIED. KRUPP AKTIENGESELLSCHAFT, OF ESSEN-ON-THE-RUHR, GERMANY.

OVERLOAD CIRCUIT BREAKER.

Application filed June 12, 1922. Serial No. 567,677.

To all whom it may concern:

Be it known that I, FELIX TOBIEN, residing at Essen, Germany, a citizen of the German Republic, have invented a certain new and useful Improvement in Overload Circuit Breakers, of which the following is a specification.

This invention relates to improvements in overload circuit-breakers of the kind in which the movable contact member is under the influence of a power accumulator, of a main current releasing coil and of a holding coil acting in the same sense as the main current releasing coil.

The invention has for its object to provide an overload circuit-breaker of the said kind with means containing an auxiliary switch and allowing a release of the overload circuit-breaker to take place even in case no overload prevails in the main circuit, without a disturbing arc-formation being produced at the auxiliary switch.

In order to obtain this object, in accordance with the invention the overload circuit-breaker possesses a second releasing coil connected in series with an auxiliary switch and likewise acting in the same sense as the main current releasing coil and being further connected to the circuit to be protected in such a manner that it will be able to receive the current necessary for the release when closing the auxiliary switch, and that it will become currentless when cutting out the overload circuit-breaker.

The drawing illustrates, as an embodiment of the subject-matter of the invention, a diagram of an overload circuit-breaker designed to protect a main current motor.

A A^1 designate the main lines which are connected to a source of direct current and from which is branched a line B which contains, in series connection, a starter C C^1, the field winding D^1 and the armature D of the main current motor D D^1 as well as the break formed by two contact members e^3 and e^4, a blowout-magnet coil e^{10} and the main current releasing coil e^2 of an overload circuit-breaker. The main current releasing coil e^2 is wound around a magnet core E which carries a contact member e^1 designed to bridge the break e^3 e^4. A spring e^5 engaging the contact member e^1 tends to hold the overload circuit-breaker in its cut-in position, shown in the drawing, the spring thus forming a power accumulator which acts oppositely to the main current releasing coil e^2. The magnet core E is, besides, encircled by two other coils e^6 and e^7 (indicated above the magnet core E for the sake of clearness). The coil e^6 serves as holding coil and, along with a series resistance F, it is connected in parallel to the section of the main current circuit containing the main current releasing coil e^2 and the break e^3 e^4. The other coil e^7 constitutes the second releasing coil of the overload circuit-breaker and is connected in series with a resistance G and the auxiliary switch H in a line J which is connected in parallel to the section of the main current circuit containing the motor D D^1 and the starter C C^1. The auxiliary switch H is constructed as a manual switch. The two coils e^6 and e^7 are wound in a sense and have connections such as to cause their numbers of ampere-turns to be added to the number of ampere-turns of the main current releasing coil e^2 when a current is flowing through said coils e^6 and e^7. The holding coil e^6 is made of the thinnest possible wire and is of a size such as to enable it to hold the opened overload circuit breaker in any case in its cut-out position contrary to the action of the spring e^5; the second releasing coil e^7 consists of thicker wire and is therefore able to receive a stronger current than the holding coil e^6.

Placed in the line J is a contact device consisting of a stationary contact member e^8 and of a movable contact member e^9 fastened to the magnet core E. The working conditions of the contact device e^8 e^9 are so that, on the overload circuit-breaker moving into open position, the movable member e^9 will be moved away from the stationary contact e^8 only for a distance so small that a short arc will be maintained between the two contact members e^8 and e^9 until the moment the main current circuit is broken. However, in the cut-out position of the overload circuit-breaker, the distance between the contact members e^8 and e^9 is large enough to bar the passage through the releasing coil e^7 of a current shock that might arise by self-induction of the motor D D^1 on switching off the main current.

The blowout-magnet coil e^{10} forms part of a spark blowout device designed to extinguish the break sparks produced at the contact members e^3 and e^4.

A conductor K including a resistance M,

leads from the lever C^1 of the starter C C^1 to the point of the line J at which the auxiliary switch H is connected to the releasing coil e^7. The releasing coil e^7 is thus connected in parallel to the motor D D^1 through the intermediary of the lines J and K. Therefore, when the motor is in operation, a current will permanently flow through the coil e^7, this current being proportional to the counter-electromotive force of the motor D D^1. The resistance M is of such a strength that the current permanently passing through the releasing coil e^7 will not suffice to cause the overload circuit-breaker to enter into operation as long as the current flowing through the main current releasing coil e^2 does not surpass a maximum value determined in advance. Owing to the parallel connection of the second releasing coil e^7 with the motor D D^1, this coil will receive a continuously increasing current during the starting of the motor D D^1, so that the sensibility of the overload circuit-breaker with respect to overload will be lowest at the beginning of the starting operation and highest upon finishing the starting operation.

The operation of the described device is as follows:

When the motor has been started, a current will normally flow through the main current releasing coil e^2 which is not so strong as to cause the release of the overload circuit-breaker. The holding coil e^6 will at first remain deenergized inasmuch as it is connected, along with the series resistance F, to two points of the line B between which no remarkable potential difference exists when the overload circuit-breaker is closed. At the moment the starting lever C^1 touches the starting resistance C and the motor D D^1 starts rotating, the second releasing coil e^7 will receive a current of gradually increasing strength which, however, owing to the resistance value chosen for the resistance M, even in combination with the effect of the main current releasing coil e^2, will not suffice to cause the release of the overload circuit-breaker, as long as no overload circuit will occur.

If the overload circuit-breaker should be caused to act without regard to the strength of the current flowing through the main circuit, the auxiliary switch H has to be closed. By doing this, the circuit + A, B, J, G, H, e^7, J, e^9, e^8, e^3, e^1, e^4, e^{10}, e^2, B, A^1 — will be closed and the current flowing through the releasing coil e^7 will be increased so much that the overload circuit-breaker will act and the main circuit be broken at the contact members e^3, e^4, arcs being thereby produced between the contact members e^3, e^4 and the member e^1. Upon releasing the overload circuit-breaker, the contact member e^9 fastened to the magnet core E will likewise be separated from the corresponding stationary contact member e^8. This, however, will not cause an immediate interruption of the current in the releasing coil e^7, but a short arc will be produced and maintained between the separated contact members e^8 and e^9 because of the slight distance between the same. This arc will, however, be caused to disappear again very rapidly, since the arcs formed at the contact members e^3, e^4 of the overload circuit-breaker and lying in series with the aforesaid arc, are being extinguished by the spark blowout device e^{10}. Owing to the rapid extinction of the arc at the contact members e^8, e^9, the wear of these members is reduced to a minimum. The effect of the break e^8 e^9 consists in that it allows, indeed, the releasing current to continue for a short time, but that it opposes to the current shock which the counter-electromotive force of the self-induction of the main current circuit (for example when the motor armature D is at rest) tends to send through the releasing coil e^7 in a reverse direction, a hindrance that cannot be overcome. If this current shock would be allowed to enter into action, it would cause the releasing current in the coil e^7 to disappear, the coil would be excited in a sense opposite to the former excitation, the action of the holding coil e^6 would be neutralized and a repeated cutting-in and out of the overload circuit-breaker would be caused. The afore-mentioned arc between the contact members e^8 and e^9 will extinguish along with the extinction of the arc at the contact members e^3 e^4 of the overload circuit-breaker.

After the overload circuit-breaker E to e^{10} has taken its open position, it is being held in that position, contrary to the action of the spring e^5, by the holding coil e^6 through which a current is now flowing. In this position of the overload circuit-breaker the auxiliary switch H may again be opened. The formation of an arc at the auxiliary switch is now impossible, since there is no longer any current flowing through the line B J B broken by the auxiliary contact device e^8 e^9 and the break e^3 e^4 of the overload circuit-breaker.

If it is desired to return the overload circuit-breaker into its cut-in position, shown in the drawing, it is only necessary to return the starting lever C^1 into the position indicated, in which it is no more in touch with the starting resistance C. Thereby, the circuit + A B C C^1 D^1 D F e^6 B A^1 — containing the holding coil e^6, will become currentless, and the movable contact member E e^1 will return into the cut-in position under the action of the spring e^5. The plant is now again ready for working and the motor D D^1 can be started anew.

The main advantage of the device form-

ing the subject-matter of the invention consists in that the overload circuit-breaker can be caused to act any time, without entailing the disadvantage that arcs are produced at the auxiliary switch H used for that purpose. This auxiliary switch can therefore be constructed as a press-button switch or as a relay, without it being necessary to make such press-button switch or relay of large dimensions.

Another advantage of the described device resides in the possibility to utilize the magnet coil e^7, which enables the release of the overload circuit-breaker, also for conforming the sensibility of the overload circuit-breaker to the changing conditions of working in such a manner that the overload circuit-breaker possesses a relatively low sensibility during the starting operation and that it reaches its full sensibility only with the increasing counter-electromotive force of the motor D D^1.

The fact that the wire used for the releasing coil e^7 is of larger diameter than the wire used for the holding coil e^6, offers the advantage that the magnet coil e^{10}, of the spark blowout device, which is dimensioned for a relatively high current strength, is able to extinguish the break arc formed at the contact members e^3, e^4, even if the overload circuit-breaker should be caused to act while the motor is currentless, such as for example upon switching off the starting lever C^1.

Without changing the spirit of the invention, the auxiliary contact device might be omitted and the line J coming from the releasing coil e^7, connected to the movable contact member e^1 of the overload circuit-breaker instead of to its stationary contact member e^3. The line J containing the releasing coil e^7 would then become currentless at the same moment the breaking of the main circuit at the contact members e^3 and e^4 will have been completed.

Claims:

1. The combination with an overload circuit-breaker for an electric circuit, comprising a movable contact member adapted to be acted upon by a power accumulator, a main current releasing coil and a holding coil wound to act in the same sense as the main current releasing coil, of another releasing coil likewise wound to act in the same sense as the main current releasing coil, an auxiliary switch connected in series with the second releasing coil, and electric connections between the second releasing coil and the circuit to be protected for allowing the second releasing coil to receive the current necessary for releasing the overload circuit-breaker upon closing the said auxiliary switch, and to become currentless upon opening the overload circuit-breaker.

2. In an electric system comprising a main current circuit containing a motor, a starter for the motor and an overload circuit-breaker including a movable contact member adapted to be acted upon by a power accumulator, a main current releasing coil and a holding coil, a second releasing coil arranged for co-operation with the movable contact member and wound to act in the same sense as the main current releasing coil, an auxiliary switch connected in series with the second releasing coil, electric connections between the second releasing coil and a section of the main current circuit containing the motor and the starter for allowing this releasing coil to receive, in the open position of the auxiliary switch a current continuously increasing in accordance with the increase of the counter-electromotive force of the motor, the branch line containing the second releasing coil having a resistance valve preventing this releasing coil from causing alone the release of the overload circuit-breaker when the auxiliary switch is in open position.

3. In an electric system comprising a main current circuit containing a motor, a starter for the motor and an overload circuit-breaker including two stationary contact members, a movable contact member, a main current releasing coil and a holding coil, a second releasing coil wound to act in the same sense as the main current releasing coil and an auxiliary switch connected in series with the second releasing coil, a branch line of the main current circuit containing the second releasing coil and the auxiliary switch, a break arranged in the said branch line and adapted to open and close along with the opening and closing of the overload circuit-breaker.

4. In an electric system comprising a main current circuit containing a motor, a starter for the motor and an overload circuit-breaker including a break formed by two stationary contact members and a movable contact member, a main current releasing coil and a holding coil, a second releasing coil wound to act in the same sense as the main current releasing coil and an auxiliary switch connected in series with the second releasing coil, a branch line of the main current circuit containing the second releasing coil and the auxiliary switch, and a break arranged in the said branch line and adapted to open and close along with the opening and closing of the overload circuit-breaker, and a spark blowout device connected in series with the break of the overload circuit breaker and adapted to be operated by the current passing through the branch line containing the second releasing coil and the auxiliary switch.

FELIX TOBIEN.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,474,694, granted November 20, 1923, upon the application of Felix Tobien, of Essen, Germany, for an improvement in "Overload Circuit Breakers," an error appears in the printed specification requiring correction as follows: Page 3, line 85, claim 2, for the word "valve" read *value;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of January, A. D., 1924.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.

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