Oct. 20, 1925. 1,558,101

G. LIEB

AUTOMATIC CIRCUIT BREAKING DEVICE

Filed Jan. 8, 1923

Fig. 1

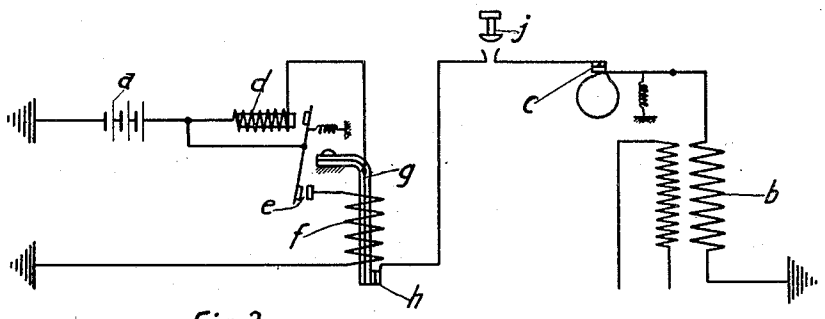


Fig. 2

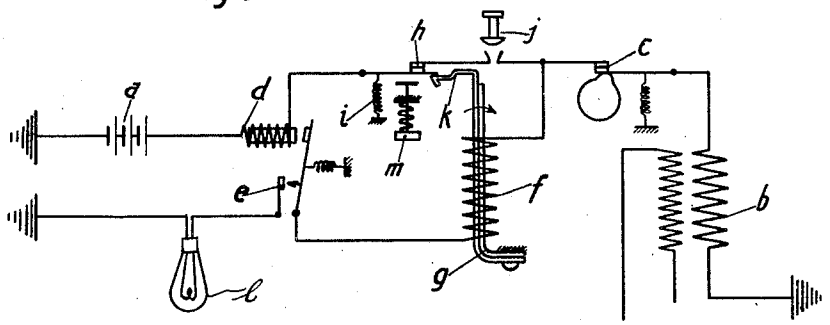
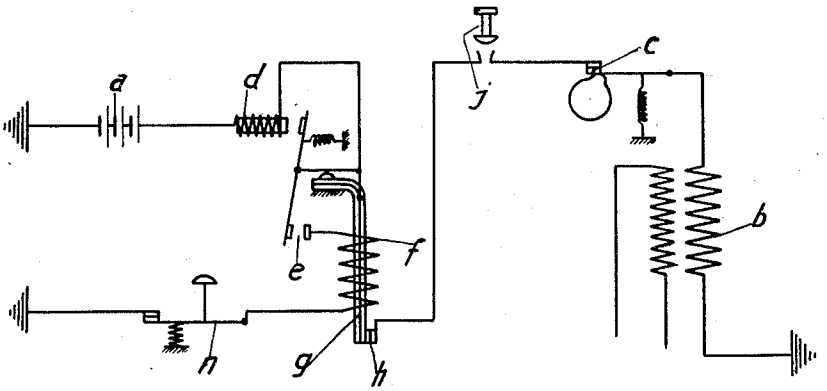


Fig. 3



Inventor.
Gustav Lieb
by Steward & McKay
his attorneys.

Patented Oct. 20, 1925. 1,558,101

UNITED STATES PATENT OFFICE.

GUSTAV LIEB, OF STUTTGART, GERMANY, ASSIGNOR TO ROBERT BOSCH AKTIEN-GESELLSCHAFT, OF STUTTGART, GERMANY.

AUTOMATIC CIRCUIT-BREAKING DEVICE.

Application filed January 8, 1923. Serial No. 611,529.

To all whom it may concern:

Be it known that I, GUSTAV LIEB, citizen of Germany, residing at Stuttgart, Germany, have invented certain new and useful Improvements in an Automatic Circuit-Breaking Device; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

There are already known ignition devices which operate with a battery current and are combined with a thermostat, the object of which is to prevent the battery from being exhausted by undue production and delivery of current. The thermostat interrupts the circuit as soon as the current flows continuously through it. Such a permanent current arises chiefly in the case where, after the engine has been stopped and the ignition switch is in closed position, the interrupter remains in that position in which its contacts are closed.

With the known arrangements of this kind the heating coil of the thermostat lies in the ignition circuit itself, that is to say, the same current which flows through the interrupter and the primary coil passes also through the heating coil of the thermostat. In such an arrangement, the dimensions of the heating coil of the thermostat must be determined with respect to the ignition coil and the interrupter contacts as well as to the electrical energy available for the heating coil. This restriction in the dimensioning of the heating coil of the thermostat generally results in failure to give the proper time interval from the initial closing movement of the interrupter to the automatic opening of the ignition circuit by the thermostat, that time interval under some conditions of operation being too short. Thus, the condition is very apt to occur where the time interval from the switching in of the ignition to the automatic cutting out of the same by the thermostat is insufficient to start the motor. This space of time is, in fact, even considerably reduced if the motor is to be again started shortly after the stopping because then the heating coil of the thermostat is preheated by the ignition current.

Now, according to the present invention, perfect freedom as regards determining the length of time between closing the ignition circuit and interrupting it automatically by the thermostat is obtained with aid of this latter itself by inserting its heating coil into an auxiliary circuit which is independent of the ignition current. This auxiliary circuit is switched in by a relay that lies in the ignition circuit and is so tuned that it responds only if the current is continually flowing.

My invention is illustrated by way of example in the accompanying drawings in which Figs. 1, 2 and 3 show respectively three different forms of execution of the invention in diagrammatical representation.

In Figure 1 the ignition circuit of the battery ignition device contains a battery *a*, the primary windings of an ignition coil *b*, the contacts of an interrupter *c*, a thermostat *g* with a contact *h*, and a relay *d*. This latter is so tuned that it does not respond at normal service of the ignition circuit, at which the duration of the closing of the current is but short. But as soon as a permanent current is flowing in the ignition circuit, which occurs when, in the case of the ignition-switch *j* being closed, the interrupter *c* comes to a standstill with its contacts closed, the relay responds and closes a contact *e*, whereby an auxiliary circuit is switched in, in which circuit the current flows from the battery *a* over the contact *e* and the heating coil *f* of the thermostat. Owing to this, the thermostat commences to operate after some time and opens the contact *h* of the ignition circuit. This contact is, in this form of construction, connected directly with the thermostat *g*. Simultaneously with the interruption of the ignition circuit also the auxiliary circuit is opened at the contact *e* by reason of the relay *d* becoming currentless.

In the just-described form of construction the case might arise that after a certain time, when the thermostat has cooled down, the ignition circuit is again closed, then, after another short time, is again opened, and so on. This may be obviated by checking the contact *h* in its open position or by making it independent of the thermostat, as illustrated, by way of example, in Figure 2. In this construction the contact *h* is subjected to the tension of a spring *i* which tends to separate the two contact members so as to open the contact. However, under ordinary conditions, that separation cannot

take place owing to a nose *k* of the thermostat locking the movable member of the contact.

If, with this connection, the relay *d* responds by reason of a permanent current arising in the ignition circuit, and the contact *e* of the auxiliary circuit is closed, the heating coil is again switched into the circuit of the thermostat. After a certain time the body of the thermostat commences to bend, the nose *k* then leaving the contact *h* which is then opened by the spring *i*, in consequence of which the ignition circuit, as well as the auxiliary circuit, are broken. Switching them in again can be effected only after the contact *h* has been closed by a hand-switch *m* or an equivalent means.

The arrangement and combination of parts may also be that illustrated in Figure 3 in which, on the thermostat responding, only the ignition circuit is broken, whereas the auxiliary circuit is further traversed by the current and holds the thermostat continually in working position. In order to prevent exhaustion of the battery *a*, the auxiliary circuit must be provided, of course, with an appropriate resistance which may be formed, for instance, by the heating coil *f*. Switching the ignition circuit in again can be effected in this instance only after the auxiliary circuit has been broken by a special cut-out *n*.

It is suited to the purpose to have a signalling device operated simultaneously with the action of the thermostat in order to call the attention of the driver to the improper state of the ignition circuit. Such a signalling device, consisting, in the present instance, of a lamp *l* in the auxiliary circuit, is shown in Fig. 2.

I claim:

1. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, an auxiliary circuit having the heating coil of said thermostat inserted into it, and a circuit closing device arranged in said auxiliary circuit and adapted to be actuated by the current flowing through the ignition circuit, as set forth.

2. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, of an auxiliary circuit having the heating coil of said thermostat inserted into it and so connected with the ignition circuit as to be broken together with it and a circuit closing device included in said auxiliary circuit and arranged to be actuated by the current flowing through the ignition circuit, as set forth.

3. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, an auxiliary circuit having the heating coil of said thermostat inserted into it, and a circuit closing device arranged in said auxiliary circuit and adapted to be actuated by the current flowing through the ignition circuit; said auxiliary circuit being so connected with the ignition circuit as to be broken together with it, as set forth.

4. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, said contact being arranged and adapted to automatically open upon movement of the thermostat but to be closed independently thereof, an auxiliary circuit having the heating coil of said thermostat inserted into it; and a circuit closing device arranged in said auxiliary circuit and adapted to be actuated by the current flowing through the ignition circuit.

5. In an automatic circuit-breaking device for internal combustion engines, the combination, with an ignition-circuit, a battery forming the source of current for it and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, said contact being arranged and adapted to automatically open upon movement of the thermostat but to be closed independently thereof, an auxiliary circuit having the heating coil of said thermostat inserted into it and so connected with the ignition circuit as to be broken together with it, and a circuit-closing device included in said auxiliary circuit and arranged to be actuated by the current flowing through the ignition-circuit.

6. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, an auxiliary circuit having the heating coil of said thermostat inserted into it; a circuit closing device arranged in said auxiliary circuit and adapted to be actuated by the current flowing through the ignition circuit; and an indicating device so arranged and connected with said circuits as to be adapted

to inform the driver of the state of the said ignition circuit, as set forth.

7. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, an auxiliary circuit having the heating coil of said thermostat inserted into it and so connected with the ignition circuit as to be broken together with it; and an indicating device so arranged and connected with said circuits as to be adapted to inform the driver of the state of the said ignition circuit, as set forth.

8. In an automatic circuit breaking device for internal combustion engines, the combination, with an ignition circuit, a battery forming the source of current for it, and a thermostat, of a contact arranged in the said ignition circuit and depending on the movement of the said thermostat, said contact being arranged and adapted to automatically open upon movement of the thermostat but to be closed independently thereof; an auxiliary circuit having the heating coil of said thermostat inserted into it; a circuit closing device arranged in said auxiliary circuit and adapted to be actuated by the current flowing through the ignition circuit, and an indicating device so arranged and connected with said circuits as to be adapted to inform the driver of the state of the said ignition circuit, as set forth.

In testimony whereof I have hereunto affixed my signature.

GUSTAV LIEB.