To all whom it may concern:

Be it known that I, Peder Wessel, a subject of the King of Norway, residing at Ljøan, near Christiania, Norway, have invented certain new and useful Improvements in Hot-Wire Alternating-Current Limiters; 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My present invention relates to hot wire alternating current limiters, and the object of my invention is to provide a current limiter of the type referred to in which the hot wire is not exposed to the total electric current consumed, but to a considerably weaker secondary current which is induced by means of the transformer shunted on the first named current and cut in as soon as it reaches the limit for which the apparatus is adjusted.

A further object of my invention is to provide a current limiter the sensibility of which will not be affected by wear or by over-load such as for instance by short circuiting and which will maintain its adjusted limit of consumption irrespective of wear.

A further object of my invention is to provide a current limiter in which the intervals of interruptions will increase in length, when a continuous overload on the apparatus is maintained so as to prevent the current consumers from getting more energy than the limiter is adjusted for by keeping a large over-load on the limiter.

On the drawings: Figure 1 illustrates a diagram of connections for a current limiter according to my invention. Fig. 2 illustrates another diagram of connections according to my invention and Fig. 3 illustrates a preferred form of the apparatus.

Referring to Fig. 1, 2, 3, and 4 are the incoming leads. The current passes through the lead 1 to a contact screw 8 and from there through line 4 to the stationary end of a lever 5 the free end of which contacts normally with a point 6. From this point the current passes through line 7 to the coil 8 of an electromagnet and from there through the contact screw 9 to the consuming line 10. From the other lead 2 the current passes directly to the consuming line 12, the lead having a branch to the contact screw 11.

At a suitable distance from the core 13 of the coil 8 is located the free end of a lever 14 pivoted at 15 and provided on its other end with a weight 16 by means of which it is made to rest on the point of an adjusting screw 17, the weight 16 counter-balancing the attraction of the magnet 9-13 on the free end of the lever 14. It is clear that when the current passing through the coil 8 has reached a certain limit the attraction upon the lever 14 will be sufficient to lift the weight 16 and by adjusting the screw 17 this limit may be varied. The core 13 is connected by line 20 with the contact screw 9.

The lever 14 is connected at its point of pivot by means of line 21 with the primary 22 of a transformer, said primary being at its other end connected by means of line 23 to the contact screw 11. The secondary 24 of the said transformer is connected with both ends to a hot wire 25, which is mounted directly above the lever 5, and is connected to the middle of the same by means of a link 26. The hot wire 25 is so mounted that ordinarily it keeps the end of the lever 5 in contact with the point 6 against the influence of its own gravity, which tends to pull it away from the contact 6. The lever 5 may also be formed as a plate 95 spring or it may be shown be influenced by a coiled spring to assist the influence of its gravity.

The operation of this arrangement is the following: Normally the current passes from lead 2 directly to the consuming line 12, and from lead 1 through contact screw 8, line 4, lever 5, contact 6, line 7, coil 8, contact screw 9 to consuming line 10. When the limit of consumption has been reached the lever 14 will be attracted by the electromagnet 9-13 and form a contact with the core 13 by means of the point 18 on its free end whereby the primary 22 of the transformer is supplied with current from contact screw 9 through line 20, contact 18, lever 14, line 21 and from contact screw 11.
through line 23. A corresponding current is induced in the secondary 24, and this current is short-circuited through the hot-wire 25, so that the latter is heated and accordingly expanded. Thereby the lever 5 is allowed to be pulled off with its end from the contact 6 and the supply current is broken. This also interrupts the current supplying the primary 22 of the transformer and accordingly no current is produced therein, the hot wire receives no current and is cooled and accordingly contracted, thereby reestablishing the contact between the free end of lever 5 and contact point 6. It will be noticed, that the hot wire is not exposed to the full current, but only to the current produced in the transformer 22—24, and that only when the current limiter is over-loaded so that interruptions of the current should take place. It is therefore evident that the said hot wire may be made far more sensitive than is the case when the hot wire is to take up the total current and also it will be noticed, that owing to the same reason if the current limiter is short circuited between the points 9, 11, the hot wire will not have to act as a safety fuse, which is the case in most of the known hot wire limiters. According to the modification illustrated on the diagram Fig. 2, the lever 5 in its normal position forms contact with the main line 7 at two points, viz., first at the contact point 6 with a contact point 27 and secondly at a contact point 28 with a yielding contact 29. The current is first interrupted at 6 and then at 28. Above the lever 5 is mounted a plate spring 30, which carries on its free end a contact 31 that is maintained normally a short distance above the stationary contact 6 by means of a plate 34 or the like of insulated material on the lever 5. The other end of the spring 30 is connected by means of line 32 comprising a resistance 33 with the contact screw 9. When the lever 5 is lowered owing to the expansion of the hot wire, the contact between 6 and 27 is first interrupted and then a contact is established between point 31 and contact 6, before the current is interrupted at 28. In this way there is formed a connection between lever 5 and contact screw 9 parallel to the connection over the electromagnet 8—13, and this connection will be established also when after an interruption point 29 contacts again with the contact 28 so that at first only part of the current will pass through the electromagnet 8—13 when the circuit is closed again after having been interrupted. The object of this arrangement is to equalize the lessened resistance of the lamps when the filament of the latter has been cooled. Apart from this, the operation of the arrangement shown on Fig. 2 is exactly similar to the operation of the arrangement shown on Fig. 1 and will therefore be understood without further description.

Referring to the form of the apparatus shown on Fig. 3 the operation of this apparatus will be understood with reference to the description of Fig. 2, as the said apparatus is constructed exactly in accordance with the diagram shown on Fig. 2.

On Fig. 3 it will be noticed that the yielding end of the lever 5 carrying the contact point 29 is not fixed directly on the end of said lever as shown on Fig. 2, but the end of the lever 5 is bent so as to form a groove 35, and in this groove the.part 36 carrying the contact point 29 rests by means of a knife edge; a coiled spring 37 acting to keep the two points 5 and 36 together. It will be understood that when the lever 5 has been lowered a certain distance the coiled spring 37 will tend to pull the piece 36 upward instead of downward, and then the contact 28, 29 will be broken; the piece 36 resting against the insulated screw 38 until the lever 5 is again brought back toward its normal position.

The hot wire 25 as will be seen is located in the proximity of the core 39 of the transformer 22, 24. As the said core will be heated, when the transformer is in use, it will be understood, that when the current limiter is exposed to a continuous over-load the temperature of the hot wire will gradually rise and so the interruptions of the current caused by the expansion of the hot wire will gradually increase in length, the object of this arrangement being to prevent a customer from obtaining a larger amount of energy for instance for cooking purposes by over-loading the interrupter heavily.

Claims:
1. In a hot wire alternating current limiter the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, the secondary of said transformer supplying current to a hot wire which upon being heated effects an interruption of the main current as well as of the current to the primary of said transformer, thus causing a periodical interruption of the current until the consumption has again been brought down below the said limit.
2. In a hot wire alternating current limiter the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of said transformer, a lever provided with a main contact, means for interrupting said contact on the hot-
wire being expanded, with the object of causing a periodical interruption of the current until the consumption has again been brought down below the said limit.

3. In a hot wire alternating current limiter the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of said transformer, a lever provided with a main contact located below said hot wire, means connecting said hot wire with said lever keeping the lever in position and maintaining the contact, and means to move said lever to interrupt the contact on the hot wire being expanded with the object of causing a periodical interruption of the current until the consumption has again been brought down below the said limit.

4. In a hot wire alternating current limiter, a transformer shunted on the main current, means for cutting in the primary of said transformer on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of said transformer, and means for effecting an interruption of the main current, when the hot wire is expanded.

5. In a hot wire alternating current limiter, the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of the said transformer, a lever provided with a main contact and an auxiliary contact for the main current, means actuated by the hot wire for keeping said lever in position and maintaining said main and auxiliary contact, means for moving the lever on the hot wire being expanded thereby first interrupting the main contact and then the auxiliary contact, a circuit comprising a resistance shunted to the main current relay and means for closing said shunted circuit between the interruption of said main and auxiliary contacts and for interrupting it again between the reestablishment of said contacts in order to reduce the current passing through the main current relay on the main circuit being reopened so as to equalize the lessened resistance of the lamps when their filaments are cooled.

6. In a hot wire alternating current limiter the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of the said transformer, a lever provided with a main contact and an auxiliary contact for the main current, means actuated by the hot wire for keeping said lever in position and maintaining said main and auxiliary contact, means for moving the lever on the hot wire being expanded, thereby first interrupting the main contact and the auxiliary contact, a circuit comprising a resistance, shunted to the main current relay, an arm carrying a contact inserted in said circuit, means on said lever for keeping said contact interrupted as long as the said main contact is closed, and means allowing the arm to close the said shunted circuit on interruption of the main contact and keeping it closed until after the said auxiliary contact has been reestablished in order to reduce the current passing through the main current relay on the main circuit being reopened so as to equalize the lessened resistance of the lamps when their filaments are cooled.

7. In a hot wire alternating current limiter the combination with a main current electromagnetic relay, a transformer shunted on the main current cut in by the said relay on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of said transformer, a lever mounted below said hot wire, a main contact on said lever, an auxiliary contact yieldingly connected with said lever, means connecting said hot wire with said lever keeping the lever in position and maintaining the contact, and means to move said lever to interrupt first the main contact and then the auxiliary contact on the expansion of the hot wire.

8. In a hot wire alternating current limiter, a transformer, means for cutting in the primary of said transformer on the current limit for which the apparatus is adjusted being reached, a hot wire connected to the secondary of said transformer, means for effecting an interruption of the main current, when the hot wire is expanded, and means for heating the hot wire so located as to be heated also by transmission of heat from the core of the transformer with the object of causing the periods of interruption to increase in length when a continuous overload is maintained.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

PEDER WESSEL.

Witnesses:

M. GUTTJORNSEN,
THS BERG.