United States Patent

Lipinski

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[54] HEATED LOCK FOR MOTORCARS

[72] Inventor: **Reinhard Lipinski,** Altbach, Germany

[73] Assignee: **Pebra GmbH Paul Braun,** Esslingen, Germany

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[58] **Field of Search**.....219/200, 201, 202, 504, 505; 70/431

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Primary Examiner—A. Bartis
Attorney—Kelman and Berman

[57] **ABSTRACT**

At least one PTC thermistor whose resistance rises abruptly at a temperature near 32° F. is mounted on the casing or cylinder of a car lock and permanently connected to the car battery for heating the lock by the ohmic resistance of the thermistor without draining the battery at higher temperatures to prevent freezing of the lock. "In one embodiment, the thermistors, enveloped in a minimum amount of potting compound, are locked within radially extending blind bores provided in the outer surface of the casing. In another embodiment, the thermistors are positioned in any available recess on the outer surface of the casing and held in close thermal contact therewith by a split ring clamp. As a further alternative, the thermistors may be installed in a normally movable lock part, such as the cylinder."

5 Claims, 3 Drawing Figures

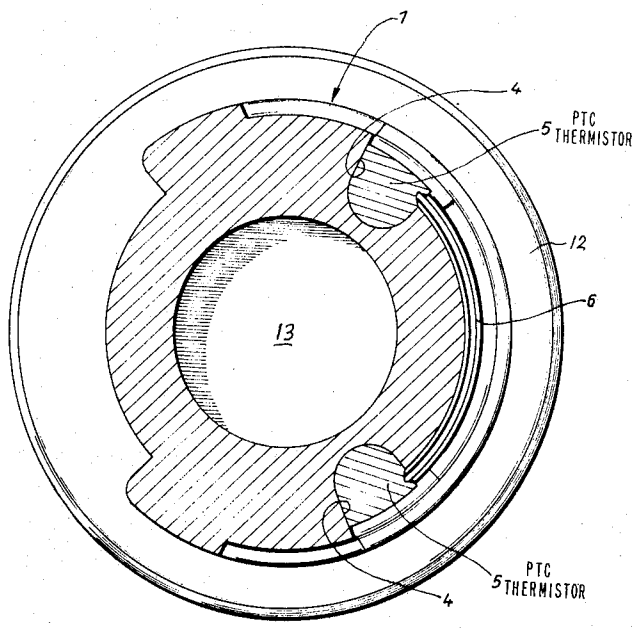
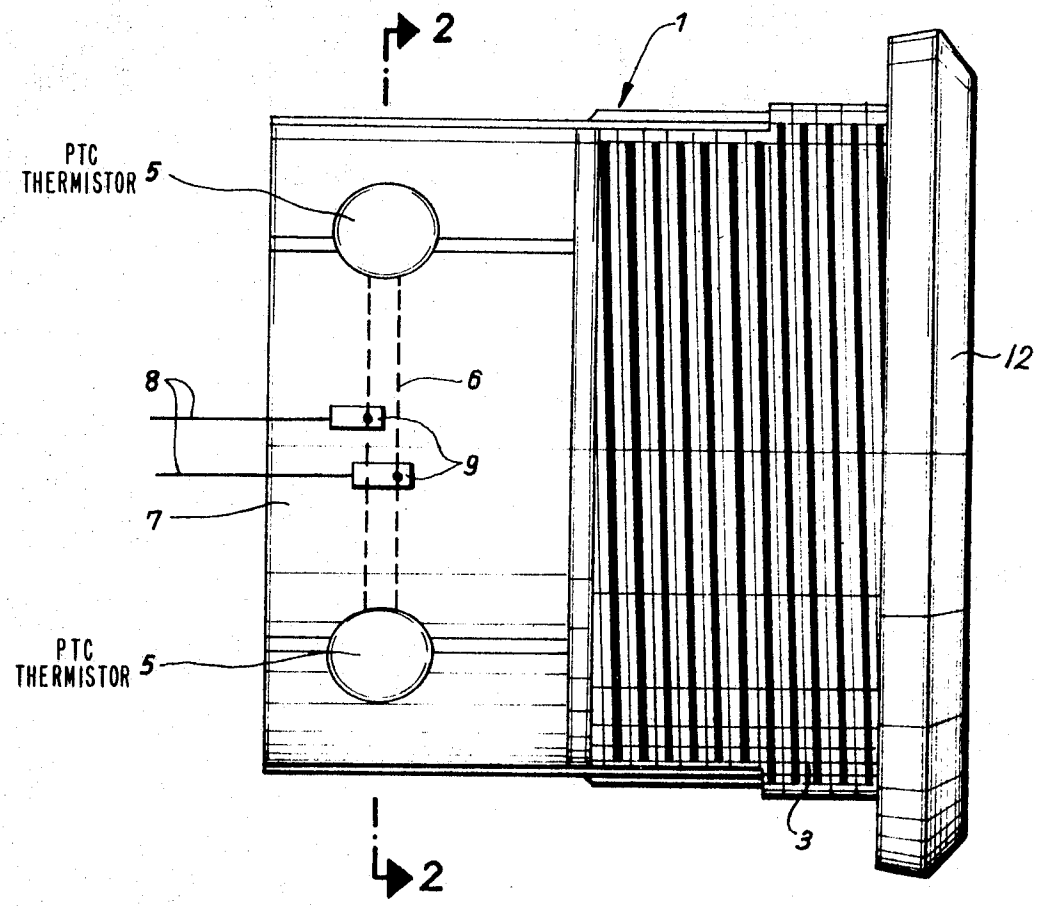
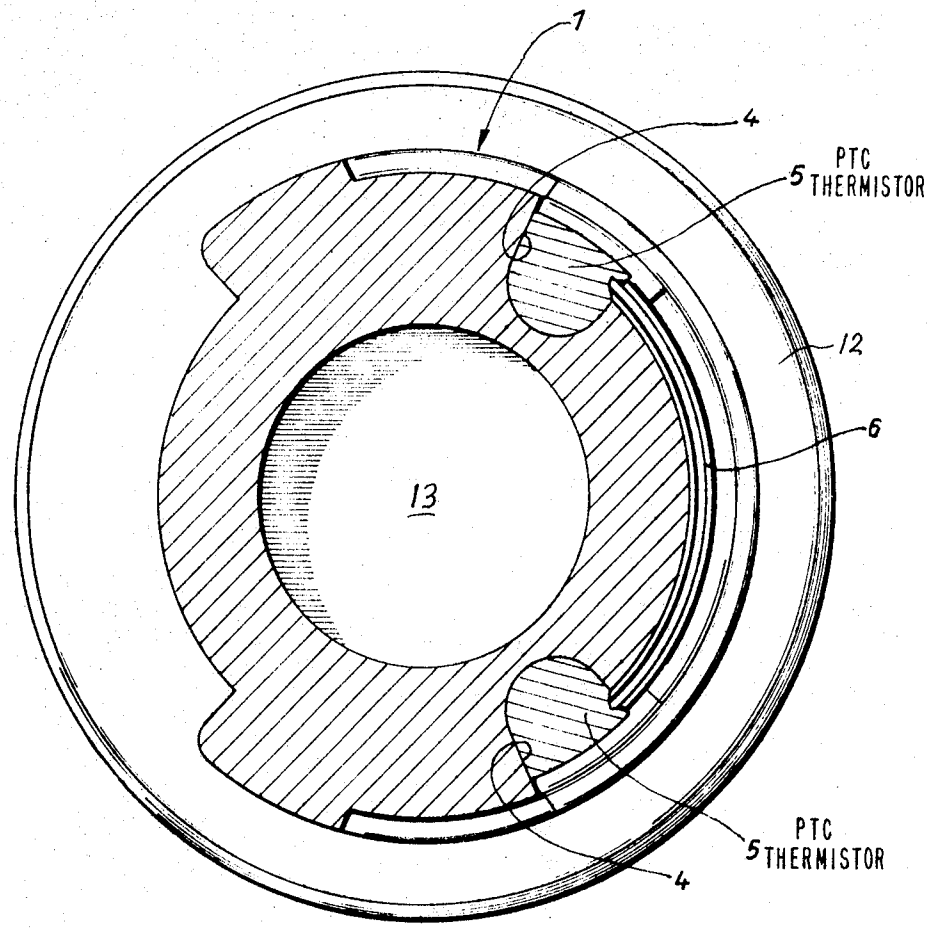


Fig. 1



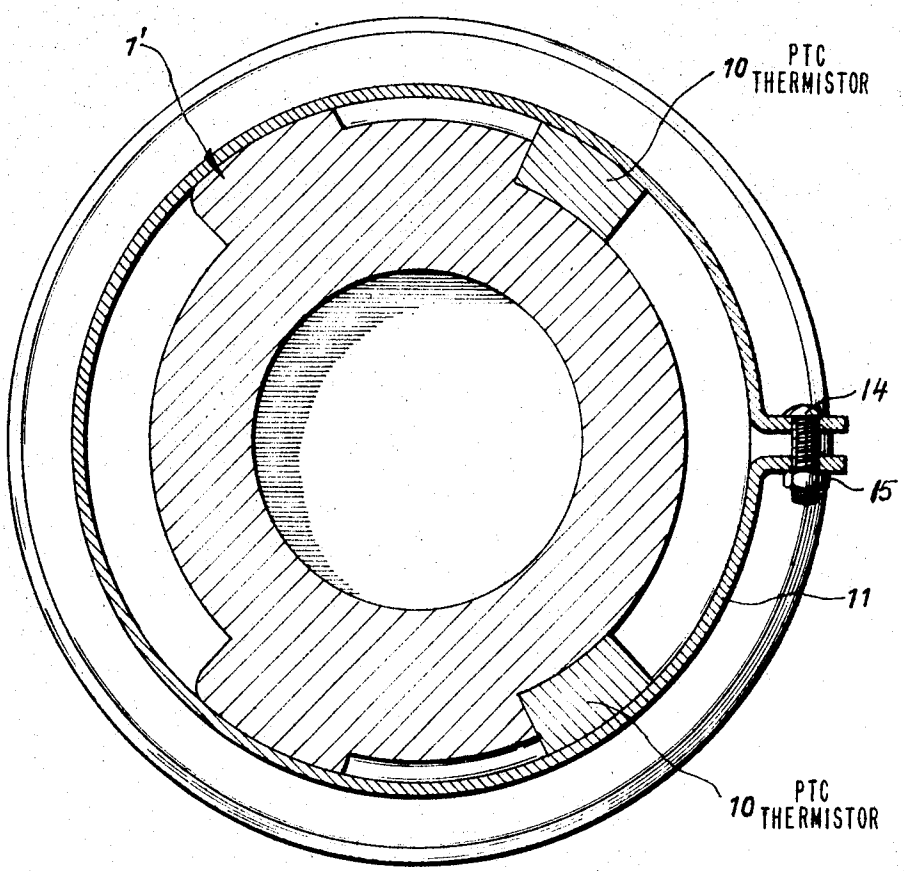
Inventor:
Reinhard Lipinski
By: Kelman and Berman
AGENTS

Fig. 2



Inventor:
Reinhard Lipinski
By: Kelman and Berman
AGENTS

Fig. 3



Inventor:
Reinhard Lipinski
By: Kleman and Berman
AGENTS

HEATED LOCK FOR MOTORCARS

This invention relates to locks having normally fixed and movable parts, and particularly to locks, such as locks on motor-cars, in which moisture may penetrate the interface of the fixed and movable parts, freeze at low temperatures, and thus make the lock inoperative.

Moisture may enter the lock of a car during washing, but also by condensation from the atmosphere. The clearance between a lock cylinder and the associated casing of a conventional car lock is so small that external moisture is drawn by capillary forces to the interface, and may reach the tumblers from there.

It would be possible to provide an ordinary electric heater on the lock to prevent freezing, but such a heater would require a switched circuit in order to avoid unnecessary drain of battery current, the switch would have to be located in the car, and the switch would not be accessible if all door locks are frozen.

An important object of the invention is the provision of a lock which is protected from freezing under the conditions found in an ordinary motorcar. More specifically, the invention is directed to the provision of an electric heating arrangement for such a lock which occupies so little space that it does not require significant changes in the dimensions of the lock or of associated elements, and which automatically controls its current consumption as the temperature changes.

With these objects and others in view, as will presently become apparent, the lock arrangement of the invention provides a source of electric current and permanently connecting the source in an energizing circuit with a thermistor having a high positive temperature coefficient above 32°F. and mounted in intimate thermal contact on the movable, or preferably on the fixed part of the lock, the lock being opened and closed by relative movement of the frictionally engaged parts.

Other features and the attendant advantages of this invention will readily become apparent from the following detailed description of a preferred embodiment when considered in connection with the appended drawing in which:

FIG. 1 shows the casing of a cylinder lock equipped with a heating device of the invention in side elevation;

FIG. 2 shows the device of FIG. 1 in section on the line 2—2; and

FIG. 3 illustrates a modified cylinder arrangement in a fragmentary view corresponding to that of FIG. 2.

Referring now to the drawing in detail, and initially to FIGS. 1 and 2, there is seen only as much of an otherwise conventional cylinder lock as is needed for an understanding of the invention. The casing 1 of the lock is integrally diecast with an annular shield 12 which abuts against the car door or other wall in which the lock casing 1 is installed.

The casing 1 is approximately cylindrical and has a coaxial cylindrical bore 13 in which the lock cylinder, not shown, is rotatably received in the installed lock. The axially terminal front portion of the casing 1 adjacent the shield 12 is provided with threads 3 whose turns extend only over parts of the casing circumference. The structure described so far is commonly known.

The rear terminal portion of the casing 1 has two radially open recesses or blind bores 4 which extend in a common plane so that the cylinder, when installed in the bore 13, is nearer to the thermistor than to the outer casing surface. Each of the recesses receives a thermistor assembly 5 which essentially consists of a PTC thermistor and a minimal amount of potting compound enveloping the thermistor and locking it in the recess 4. The terminals of the thermistors 5 are connected by a pair of insulated wires 6, and solder lugs 9 on the wires 6 connect the wires to a source of direct current represented in the drawing by cables 8 which respectively lead to the terminals of the non-illustrated car battery. A shallow circumferential groove 7 in the casing 1 provides adequate space for the conductors 6, 8 and the lugs 9. A body of thermoplastic insulating material which normally fills the groove 7 and prevents heat loss from the thermistors to the ambient atmosphere and the adjacent metal parts of the car has been omitted from the drawing for the sake of clarity.

The arrangement illustrated in FIGS. 1 and 2 normally requires installation of the thermistors 5 prior to initial installation of the lock in the motorcar although later modification of the lock casing is possible. The modified arrangement illustrated in FIG. 3 is capable of being assembled after installation of a conventional lock.

The lock casing 1′ carries two insulated thermistors 10 installed in close thermal contact with the outer casing wall in an available recess in the rear end of the casing 1′. The thermistors are held in position by means of a small pipe clamp 11 which is a split ring whose circumferential ends are connected by a bolt 14 and nut 15.

The conductors which connect the thermistors 10 with each other and with the car battery have been omitted from FIG. 3, and will be understood to be identical with those shown in FIGS. 1 and 2. FIG. 3 also does not show the layer of synthetic resin composition having thermal insulating properties which is preferably applied as a laquer to the electrical elements only partly shown in FIG. 3 in such a manner that the solidified synthetic resin composition covers the thermistors and at least the portion of the lock casing 1′ contiguously adjacent the thermistors, but is also applied to advantage to the clamp 11 because the clamp transmits some heat from the transistors 10 to the casing 1′.

Thermistors having suitable temperature characteristics are staple articles of commerce. They have a positive temperature coefficient (PTC) which increases abruptly at a temperature which is characteristic of the specific thermistor, so that the thermistor has a relatively high conductivity below the characteristic temperature and is heated because of its ohmic resistance under an applied potential of 12 volts, usual in car batteries, while having only negligible conductivity at a temperature only a few degrees above the characteristic temperature.

The thermistors employed in actual embodiments of the invention consist of semi-conducting ferroelectric ceramic material in which the semi-conductor mechanism cooperates with the ferroelectric properties of the material to produce the desired effect. Below the Curie temperature, the resistivity of these PTC thermistors is relatively low, and may be of the order of 200 ohm-cm or less. Above the Curie temperature, blocking layers are formed at the grain boundaries of the ceramic material and cause a sudden increase in conductivity with rising temperature. Below the characteristic or Curie temperature, the resistivity changes little with temperature.

The PTC thermistors preferred for use in this invention have Curie temperatures near 32° F. so as automatically to maintain a lock temperature barely above the freezing point of water and do not draw current from the battery when the ambient temperatur is significantly above the freezing point. At lower temperatures, a heating arrangement including two PTC thermistors in parallel circuit, as shown in the drawing, is effective when it consumes approximately 2 watts.

In a cylinder-type lock, the lock casing is exposed and lends itself readily to the installation of heating thermistors. In other lock types, it may be more advantageous to install a thermistor or thermistors in a normally movable lock part for keeping the interface of frictional engagement between the fixed and movable lock parts at a temperature above 32° F., and such a location for the thermistors is specifically contemplated, but not illustrated.

Other modifications and variations of the present invention are obviously possible in the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically disclosed.

What is claimed is:

1. In a lock having a metallic casing formed with a bore and a cylinder received in said bore for rotation about an axis for opening and closing said lock, said cylinder frictionally engaging said casing during said rotation, the improvement which comprises:

a. a source of electric current,

1. said casing being formed with at least one blind bore extending from the outer surface of said casing in a substantially radial direction toward said cylinder;

b. a thermistor having a positive temperature coefficient;

c. fastening means fastening said thermistor in said recess in intimate thermal contact with said casing, said cylinder being nearer to said thermistor than to said outer surface; and

d. conductor means connecting said thermistor to said source for constant energization.

2. In a lock as set forth in claim 1, said fastening means including a potting compound in said recess and enveloping said thermistor.

3. In a lock as set forth in claim 2, said casing being formed with external threads extending about said axis on one axially terminal portion of said casing, the other axially terminal portion of said casing being formed with said recess

4. In a lock as set forth in claim 2, the resistivity of said thermistor increasing steeply when the temperature of said thermistor is raised above approximately 32° F., and changing little upon cooling of said thermistor below said temperature.

5. In a lock as set forth in claim 4, the conductivity of said thermistor below approximately 32° F. being sufficient to cause transmission of thermal energy by ohmic heating of said thermistor to said one part when said source applies a voltage of approximately 12 volts to said thermistor, the transmitted energy being sufficient to keep said one part above 32° F.

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