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Description

The present invention relates to a starter for an internal combustion engine.

The JOURNAL OF NIPPONDENSO TECHNICAL DISCLOSURE, No. 36-070, published July 15, 1984 discloses an engine starter that has a self-heating bimetallic element connected electrically in series to a starter switch and to be moved into contact with a first stationary contact electrically connected to a point between attracting and holding coils which form exciting coils for a plunger. The starter switch is connected to an electrical power source formed by a battery. When electrical current has passed through the bimetallic element and the holding coil to a starter motor for a predetermined time period, the bimetallic element is heated to a predetermined temperature level sufficient to cause the bimetallic element to snap away from the first stationary contact into electrical contact with a second stationary contact which is grounded through a resistor. Heat is produced continuously in the bimetallic element by the electrical current continuously passing therethrough. Thus, the bimetallic element is kept separate from the first stationary contact so long as the starter switch is kept closed. This advantageously prevents the starter motor from being damaged by overheating or over-run which would otherwise be caused when the starter switch accidentally fails to be opened.

In the starter described above, however, electrical current from a DC power source of 12V will flow at 20A through the holding coil and at 160A through the attracting coil. This is because the bimetallic element is electrically connected to the point between the holding and attracting coils. Thus, there is a large difference between the currents passing through the attracting and holding coils. Accordingly, if the capacity of the bimetallic element (i.e. the temperature level at which the bimetallic elements snaps after the current has passed therethrough for a certain time period) is selected on the basis of the current passing through the holding coil, the snapping of the bimetallic element will take place in a very short period of time. Thus, the plunger cannot be electro-magnetically driven. On the other hand, if the capacity of the bimetallic element is determined based on the current flowing through the attracting coil, the bimetallic element will not snap, so that current passes continuously through the holding coil eventually causing damage to the holding coil. In addition, the starter requires two stationary contacts i.e. the first and second contacts associated with the bimetallic element. This disadvantageously increases the size of the temperature sensor formed by the bimetallic unit.

One object of the present invention is to eliminate these problems and shortcomings.

According to the present invention we propose a starter for an internal combustion engine having a ring gear, the starter comprising a starter switch electrically connected to an electrical power source; a pinion axially movable into and out of meshing engagement with the ring gear; a plunger for moving the pinion towards the ring gear and hav-

ing a first movable contact at one end; first and second stationary contacts both so positioned as to be contacted by the first movable contact; exciting coil means for moving the plunger towards the first and second stationary contacts, the exciting coil means comprising a first holding coil and a second attracting coil; a starter motor adapted to be energised when the first contact is moved into contact with the first and second stationary contacts forming an electrical connection therebetween, the starter motor being drivingly connected to the pinion; and a temperature sensor for detecting the temperature of one of the first and second coils; characterised in that the first and second coils have windings electrically connected in series at their one ends; a relay includes normally open contacts electrically connected in series to the electrical power source and the connection between the windings of the first and second coils, and a third coil electrically connected in series to the starter switch and the temperature sensor and adapted to be energised when the starter switch is turned on to close the normally open contacts; the temperature sensor is electrically connected in series to the third coil and ground and comprising a third stationary contact, a bimetallic element having a second movable contact electrically connected to the bimetallic element and so positioned as to be moved by the bimetallic element into and out of contact with the third stationary contact, and an electrically energisable heater disposed in heat conductive relationship with the bimetallic element, the bimetallic element being disposed adjacent the said one of the first and second coils and operative to move the second movable contact away from the third stationary contact when the said one of the first and second coils is heated to a first predetermined temperature, to deenergise the third coil whereby the normally open contacts of the relay are opened to interrupt the electrical supply from the power source to the starter motor.

As stated above, the bimetallic element of the temperature sensor is disposed adjacent one of the first and second coils of the plunger exciting coil means. In addition, the temperature sensor is electrically connected in series to the relay coil and the ground. Thus, the temperature level at which the bimetallic element snaps can advantageously and easily be set on the basis of the temperature level to which the one of the first and second coils of the exciting coil means is heated after the energisation thereof for a predetermined time.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a part-sectional front elevation of a starter according to the present invention;

Figure 2 is a diagrammatic illustration of a normally closed switch incorporated in the starter shown in Figure 1;

Figure 3 is similar to Figure 2 but with the normally closed switch in its open position;

Figure 4A is an underside view of a retainer member incorporating in the starter to retain the normally open switch on a plunger casing;

Figure 4B is a plan view of the retainer member;

Figure 4C is a cross-section taken along line IVC-IVC in Figure 4A;

Figure 5 is an underside view of a cover member for the retainer member;

Figure 6 is an electrical circuit diagram of the starter;

Figure 7 is an enlarged fragmentary side view of a plunger casing with a part thereof cut away to show a part of a holding coil, the normally open switch, the retainer member and the cover member; and

Figure 8 is similar to Figure 2, but illustrates a modification to the normally open switch shown in Figure 2.

Referring to Figure 1, an engine starter includes a motor 13 having an armature 13a mounted on a shaft 14 for rotation therewith. The shaft 14 is rotatably supported at one end by a motor housing and at the other end by a starter housing 22 and carries a spline tube 15 mounted for rotation with the shaft 14 and for axial movement with respect to the shaft 14. A uni-directional clutch 16 is mounted on the outer periphery of the spline tube 15 axially outwardly of a retainer 19 formed on the outer peripheral surface of the spline tube 15. A pinion 17 is rotatably mounted on the shaft 14 between the said other end thereof and the unidirectional clutch 16 and adapted to be drivingly connected to and disconnected from the spline tube 15 by the operation of the unidirectional clutch 16.

A lever 21 is pivotally mounted by a pivot pin 21a on the starter housing 22 and has an end engaged with a joint section 8 of a plunger 7 to be described later. The other end of the lever 21 is slidably engaged with an annular groove in the outer peripheral surface of the retainer 19 so that, when the lever 21 is pivoted clockwise (in Figure 1) by the plunger 7, the spline shaft 15 is axially moved on the shaft 14 leftwards to bring the pinion 17 into mesh with a ring gear 18 of an associated internal combustion engine (not shown) to start the engine.

The plunger 7 is axially movably mounted in an annular bobbin 2 which is housed in a plunger casing on the starter housing 22. The plunger 7 has an annular flange 7d adjacent to the joint section 8 and a return spring 10 (a compression coil spring) around the plunger 7 is interposed between the flange 7d and one end of the casing 1. The end of the plunger 7 remote from the joint section 8 carries a movable contact 9 movable with the plunger 7 into and out of electrically conductive engagement with first and second stationary contacts 11a and 11b mounted on a magnet switch casing 11 fixed to the other end of the plunger casing 1.

A part of the generally cylindrical outer peripheral wall of the plunger casing 1 is exposed at the top of the starter and is formed with a rectangular hole or opening 1a in which a switch 4 mounted by means of a retainer member 5 and a cover member 6, as will be described in more detail later. Inner attracting coil 3a and an outer holding coil 3b are wound on the bobbin 2 and enclosed by the plunger casing 1, as shown in Figure 1. One end of the winding of the housing coil 3b is grounded.

The switch 4 which is of the normally closed type

and forms a temperature sensor, may be for example, a self-holding, plastic type thermal protector manufactured by Matsushita Electric Industrial Co. Ltd., Japan. It includes a third stationary contact 4b connected by a lead 4d to a positive terminal and a bimetallic element 4c disposed in substantially parallel relationship with the stationary contact 4b and connected by another lead 4e to a negative terminal, as shown in Figure 2. A heater formed by a PTC element 4a is disposed between one end of the stationary contact 4b and the bimetallic element 4c. A movable contact 4g is secured to the free end of the bimetallic element 4c and normally held in electrically conductive engagement with the free end of the stationary contact 4b to close a circuit.

Referring to Figures 4A, 4B and 4C, the retainer member 5 by which the switch 4 is mounted on the plunger casing 1, is formed from an elastomeric material such as rubber and includes an outer peripheral flange section 5a of an arcuate cross-section suited for intimate and sealing engagement with the cylindrical outer surface of the plunger casing 1. A rectangular recess 5b is formed in the inner side of the retainer member 5 centrally thereof to receive and retain the switch 4 in the manner shown in Figure 1. The retainer member 5 is mounted on the plunger casing 1 with the recess 5b facing inwardly. A guide section 5c in the form of a rectangular projection or bead disposed outwardly of and surrounding the rectangular recess 5b, projects into the opening 1a in the plunger casing 1. A pair of protrusions 5d are formed integrally with the two opposed shorter sides of the rectangular recess 5b. A pair of generally cylindrical projections 5g on the outer side of the retainer member 5 in the flange section 5c thereof have through-holes 5e for the leads 4d and 4e of the switch 4. The recess 5b is laterally enlarged by notches or cutouts 5f formed in the longer sides of the recess 5b. A pair of screw holes 5h are formed in the longitudinal end portions of the flange 5a. The rectangular guide section 5c is slightly cut or recessed at 5i between one of the protrusions 5d and the lead holes 5e to provide space for the switch leads 4d and 4e extending from the recess 5b to the lead holes 5e.

Referring to Figure 5, the cover member 6 by which the retainer member 5 is fixed to the plunger casing 1 is made of metal and serves to protect the retainer member 5. It is superposed upon the retainer member 5, as will be seen in Figure 1, and for this reason, includes an outer flange section 6a extending in face-to-face engagement with the flange 5a of the retainer member 5, a recess 6b snugly receiving the top or roof 5b' of the recess 5b of the retainer member 5, a first pair of through-holes 6c through which the projections 5g of the retainer member 5 extend outwardly, and a second pair of holes 6d formed in the flange section 6a in alignment with the screw holes 5h in the retainer member 5.

For mounting the switch 4 on the plunger casing 1, the switch 4 is fitted into the recess 5b in the retainer member 5 with the two switch leads 4d and 4e extending through the groove 5i in the guide section 5c into and through the lead holes 5e. This assembly is mounted on the plunger casing 1 with the guide

section 5c fitted into the opening 1a. The cover member 6 is then placed on the retainer member 5 and fixed with the retainer member to the plunger casing 1 by means of screws 12, as shown in Figure 1. The resiliency of the projections 5d urges the switch 4 into thermally conductive engagement with the outer peripheral surface of the outer holding coil 3b, as best seen in Figure 7. However, a space 5j is formed between the switch 4 and the inner surface of the roof of the recess 5b of the retainer member 5 to thermally isolate the outer surface of the switch 4 from the roof of the recess 5b of the retainer member 5. Since the cylindrical projections 5g are made of rubber, breakage of the switch leads 4d and 4e by repeated flexion is prevented. The retainer member 5 also serves to seal the opening 1a against water, dusts and so forth.

As will be seen from Figure 6, the electrical circuit includes the first stationary contact 11a which is electrically connected to the positive terminal of the battery 23, and the second stationary contact 11b electrically connected through a field coil 13b to the armature 13a of the motor 13. The attracting coil 3a is electrically connected at one end to the second contact 11b and to the holding coil 3b at the other end. A relay 25 includes normally open contacts 25a one of which is electrically connected to the positive terminal of the battery 23 and the other of which is electrically connected to the connection between the attracting and holding coils 3a and 3b. The lead 4d of the normally closed switch or temperature sensor 4 is electrically connected to one end of a coil 25b of the relay 25, the other end of the coil 25b being connected through a starter switch 24 to the positive terminal of the battery 23. The other switch lead 4e is grounded.

In operation, when the starter switch 24 is closed, the relay coil 25b is energised to close the normally open contacts 25a of the relay, so that DC current now passes through the relay 25 to the attracting coil 3a and the holding coil 3b. Thus, the coils 3a and 3b are energised to move the plunger 7 towards the first and second stationary contacts 11a and 11b. At the same time, the plunger 7 pulls the upper end of the lever 21 engaged with the joint section 8 of the plunger 7, so that the lever 21 is rotated clockwise about the pivot pin 21a to axially move the spline tube 15, the unidirectional clutch 16 and thus the pinion 17 towards the ring gear 18.

A low-torque rotation of the motor 13 caused by the current passing through the attracting coil 3a cooperates with the axial thrust applied by the lever 21 to bring the pinion 17 into mesh with the ring gear 18. At the same time, the axial thrust acts to move the plunger 7 until the movable contact 9 is brought into electrical contact with the first and second stationary contacts 11a and 11b to electrically connect them together. Thus, DC current flows to the motor 13 and the armature 13a rotates to drive the shaft 14. The rotation is transmitted by the spline tube 15 and the unidirectional clutch 16 to the pinion 17 which in turn drives the ring gear 18 to start the engine.

When the engine has started, the starter switch 24 opens to disconnect the relay coil 25b, so that

the relay contacts 25a move to their normal open positions whereby the attracting and holding coils 3a and 3b are isolated. Thus, the return spring 10 moves the plunger 7 and the lever 21 to their initial positions and the pinion 17 and ring gear 18 are disengaged.

Were the starter switch 24 not to be turned off (mechanically and electrically), the starter would operate continuously. In such circumstances, the movable contact 9 would remain in contact with the first and second stationary contact 11a and 11b, with the attracting coil 3a and the second stationary contact 11b at the same potential, so that no electrical current can pass through the attracting coil 3a. However, because current would continue to flow through the holding coil 3b, its temperature would gradually increase. The normally closed switch or temperature sensor 4 is designed to be opened when the temperature of the holding coil 3b reaches substantially 100°C. This temperature is chosen because the temperature sensor 4 must be kept closed for a time (typically, two minutes) sufficient to start the engine, but the sensor 4 should be opened in good time (less than about five minutes) to prevent damage to the unidirectional clutch 16 and the starter motor 13 by overrunning. The temperature of the holding coil 3b reaches about 100°C by continuous supply of current to the coil for five minutes.

When the holding coil 3b is heated to a temperature at which the temperature sensor or normally closed switch 4 is opened, the bimetallic element 4c snaps to move the contact 4g away from the stationary contact 4b (Figure 3) which is grounded through the PTC heater 4a, the bimetallic element 4c and the lead 4e. Then, the flow of the electrical current through the relay coil 25b is decreased by the PTC heater 4a with the result that the relay contacts 25a are moved to the normally open position to interrupt the electrical supply to the holding and attracting coils 3b and 3a. Thus, operation ceases to prevent the starter from being damaged by overrun.

Also, the PTC heater 4a is immediately heated due to the PTC characteristic thereof to maintain the temperature of the bimetallic element higher than the temperature (about 80°C) at which the bimetallic element 4c resumes its initial position. Therefore, the normally closed switch 4 is kept open even if the temperature of the deenergised holding coil 3b drops (by natural radiation) below the temperature at which the bimetallic element 4c resumes its initial position. The saturation current passing through the PTC heater 4a at this time is about 15mA which is much less than the current (2A) at which the relay 25 is operated.

When the temperature of the holding coil 3b drops below 80°C and the starter switch 24 is manually opened, the PTC heater 4a of the normally closed switch 4 is deenergised to allow the bimetallic element 4c to cool by radiation of heat through the holding coil 3b, the retainer member 5 and the cover member 6. When the temperature drops below 80°C, the bimetallic element returns to its normally closed position to move the movable contact 4g into contact with the stationary contact 4b, so that the start-

er is once again ready for use about 10 seconds after the starter switch 24 is turned off.

If the starter switch 24 is repeatedly turned on and off either when the pinion 17 is not well engaged with the ring gear 18 or when the movable contact 9 on the plunger 7 is not brought into a good electrical conductive contact with the first and second stationary contacts 11a and 11b, the attracting coil 3a is supplied with current. However, because of the high current flowing, the attracting coil 3a is heated rapidly and the normally closed switch 4, is heated by the heat produced in both the attracting and holding coils 3a and 3b. Accordingly, the electrical supply to the attracting and holding coils 3a and 3b is interrupted for the reasons

described above. Where the normally closed switch 4 is designed to be opened at 100°C, a continuous supply of current at 12V for about one minute is sufficient to open the normally closed switch 4.

In the described and illustrated embodiment, the normally closed switch or temperature sensor 4 is disposed in contact with the outer periphery of the holding coil 3b. However, the holding coil 3b may alternatively be disposed radially inwardly of the attracting coil 3a and the temperature sensor 4 may be disposed in contact with or adjacent to the outer peripheral surface of the outer attracting coil 3a.

In the modified temperature sensor 4 of Figure 8, the PTC heater 4a is replaced by a heating coil 4f wound around the bimetallic element 4c and electrically connected between the stationary contact 4b and the bimetallic element 4c. When the bimetallic element 4c is snapped to move the movable contact 4g, the coil 4f is energised to keep the bimetallic element 4c at a temperature higher than that at which the bimetallic element is returned to the closed position.

Claims

1. A starter for an internal combustion engine having a ring gear (18), the starter comprising a starter switch (24) electrically connected to an electrical power source (23); a pinion (17) axially movable into and out of meshing engagement with the ring gear; a plunger (7) for moving the pinion towards the ring gear and having a first movable contact (9) at one end; first and second stationary contacts (11a, 11b) both so positioned as to be contacted by the first movable contact (9); exciting coil means (3a, 3b) for moving the plunger towards the first and second stationary contacts, the exciting coil means comprising a first holding coil (3b) and a second attracting coil (3a); a starter motor (13) adapted to be energised when the first movable contact (9) is moved into contact with the first and second stationary contact (11a, 11b) forming an electrical connection therebetween, the starter motor (13) being drivingly connected to the pinion (17) and a temperature sensor (4) for detecting the tem-

perature of one of the first and second coils (3b, 3a), characterised in that the first and second coils (3b, 3a) have windings electrically connected in series at their one ends; a relay (25) includes normally open contacts (25a) electrically connected in series to the electrical power source (23) and the connection between the windings of the first and second coils, and a third coil (25b) electrically connected in series to the starter switch (24) and the temperature sensor (4) and adapted to be energised when the starter switch (24) is turned on and to close the normally open contacts; the temperature sensor (4) is electrically connected in series to the third coil (25b) and ground and comprising a third stationary contact (4b), a bimetallic element (4c) having a second movable contact (4g) electrically connected to the bimetallic element (4c) and so positioned as to be moved by the bimetallic element into and out of contact with the third stationary contact (4b) and an electrically energisable heater (4a) disposed in heat conductive relationship with the bimetallic element (4c), the bimetallic element being disposed adjacent the said one of the first and second coils (3b, 3a) and operative to move the second movable contact (4g) away from the third stationary contact (4b) when the said one of the first and second coils (3b, 3a) is heated to a first predetermined temperature, to deenergise the third coil (25b) whereby the normally open contacts of the relay (25) are opened to interrupt the electrical supply from the power source (23) to the starter motor (13).

2. A starter according to claim 1, wherein the third stationary contact (4b) is electrically connected to the third coil (25b), the bimetallic element (4c) is grounded and the heater (4a) is electrically connected in series with the third stationary contact (4b) and the bimetallic element (4c), the heater (4a) having a self-heating characteristic to keep the bimetallic element (4c) at a temperature higher than a second predetermined level at which the bimetallic element (4c) returns to its initial position, whereby the second movable contact (4g) is kept out of contact with the third stationary contact (4b) to keep the normally open contacts of the relay open even if the temperature of the said one of the first and second coils (3b, 3a) is lowered to the second predetermined temperature when the starter switch (24) is kept closed.

3. A starter according to claim 1 or claim 2, further including a retainer member (5) for holding the temperature sensor (4) in position adjacent the said one of the first and second coils (3b, 3a), the retainer member being formed therein with a recess (5b) in which the temperature sensor (4) is received and having at least one protrusion (5d) operative to keep the retainer member (5) spaced a distance from the bottom of the recess (5b) whereby said space (5j) is left between the temperature sensor (4) and the bottom of the recess.

4. A starter according to claim 3, whereby the retainer member (5) is formed of an elastomeric material and the protrusion (5d) has a resiliency by which the temperature sensor (4) is resiliently urged into heat-conductive contact with the said one of the first and second coils (3b, 3a).

5. A starter according to claim 3 or claim 4, wherein the retainer member (5) further comprises a guide section (5c) formed around the recess (5b) and operative to retain the temperature sensor (4) in position.

6. A starter according to claim 3, further including electrical leads (4d, 4e) couples to the temperature sensor (4), and wherein the retainer member (5) is formed thereon with means (5g) for protecting said leads.

7. A starter according to claim 3, further including a casing (1) surrounding the exciting coil means and formed with an opening (1a) in which the temperature sensor (4) is retained by the retainer member (5), the retainer member (5) being disposed such that the recess (5b) is positioned in the opening (1a) and directed towards the exciting coil means and a cover member (6) disposed in superposed relationship with the retainer member (5).

Patentansprüche

1. Anlasser für eine Brennkraftmaschine mit einem Zahnkranz (18), welcher Anlasser einen Anlasserschalter (24), der elektrisch mit einer elektrischen Energiequelle (23) verbunden ist, ein Ritzel (17), das axial in eine kämmende Ineingriffnahme und aus einer kämmenden Ineingriffnahme mit dem Zahnkranz bewegbar ist, einen Kolben (7), zum Bewegen des Ritzels zum Zahnkranz, der einen ersten beweglichen Kontakt (9) an einem Ende aufweist, einen ersten und einen zweiten ortsfesten Kontakt (11a, 11b), die beide so angeordnet sind, daß sie vom ersten beweglichen Kontakt (9) in Kontakt genommen werden können, eine Erregungsspuleneinrichtung (3a, 3b) zum Bewegen des Kolbens zum ersten und zweiten ortsfesten Kontakt, wobei die Erregungsspuleneinrichtung eine erste haltende Spule (3b) und eine zweite anziehende Spule (3a) umfaßt, einen Anlassermotor (13), der mit Energie versorgt werden kann, wenn der erste bewegliche Kontakt (9) in einen Kontakt mit dem ersten und dem zweiten ortsfesten Kontakt (11a, 11b) bewegt ist, so daß dazwischen eine elektrische Verbindung hergestellt ist, wobei der Anlassermotor (13) in Antriebsverbindung mit dem Ritzel (17) steht und einen Temperatursensor (4) umfaßt, um die Temperatur der ersten oder der zweiten Spule (3b, 3a) zu erfassen, dadurch gekennzeichnet, daß die erste und die zweite Spule (3b, 3a) Wicklungen aufweisen, die an ihren Enden elektrisch in Reihe geschaltet sind, ein Relais (25) einen Schließerkontakt (25a) aufweist, der elektrisch in Reihe zur elektrischen Energiequelle (23) und zum Verbindungspunkt zwischen den Wicklungen der ersten und der zweiten Spule geschaltet ist, und eine dritte Spule (25b) elektrisch in Reihe zum Anlasserschalter (24) und zum Temperatursensor (4) geschaltet ist und erregt werden kann, wenn der Anlasserschalter (24) angeschaltet ist, und die als Schließer ausgebildeten Kontakte schließen kann, wobei der Temperatursensor (4) elektrisch in Reihe zur dritten Spule (25b) und Masse geschaltet ist und einen dritten ortsfesten Kontakt (4b), ein Bimetallelement (4c) mit einem zweiten beweglichen Kontakt (4g), der elektrisch mit dem Bi-

metallelement (4c) verbunden und so angeordnet ist, daß er durch das Bimetallelement in einen Kontakt und aus einem Kontakt mit dem dritten ortsfesten Kontakt (4b) bewegt werden kann, und eine elektrisch mit Energie versorgbare Heizung (4a) umfaßt, die in wärmeleitender Beziehung zum Bimetallelement (4c) angeordnet ist, das Bimetallelement neben der ersten oder der zweiten Spule (3b, 3a) angeordnet ist und so arbeitet, daß es den zweiten beweglichen Kontakt (4g) vom dritten ortsfesten Kontakt (4g) wegbewegt, wenn die erste oder die zweite Spule (3b, 3a) auf eine erste bestimmte Temperatur erhitzt sind, und die dritte Spule (25b) entregt, wodurch die als Schließer ausgebildeten Kontakte des Relais (25) geöffnet werden, um die elektrische Energieversorgung von der Energiequelle (23) zum Anlassermotor (13) zu unterbrechen.

2. Anlasser nach Anspruch 1, bei dem der dritte ortsfeste Kontakt (4b) elektrisch mit der dritten Spule (25b) verbunden ist, das Bimetallelement (4c) an Masse liegt und die Heizung (4a) elektrisch in Reihe zum dritten ortsfesten Kontakt (4b) und dem Bimetallelement (4c) geschaltet ist, wobei die Heizung (4a) eine Selbstheizcharakteristik hat, um das Bimetallelement (4c) auf einer Temperatur über dem zweiten bestimmten Wert zu halten, an dem das Bimetallelement (4c) in seine Anfangsposition zurückkehrt, so daß der zweite bewegliche Kontakt (4g) außer Kontakt mit dem dritten ortsfesten Kontakt (4b) gehalten wird, um die als Schließer ausgebildeten Kontakte des Relais selbst dann offen zu halten, wenn die Temperatur der ersten oder der zweiten Spule (3b, 3a) unter die zweite bestimmte Temperatur abgenommen hat, während der Anlasserschalter (24) geschlossen gehalten ist.

3. Anlasser nach Anspruch 1 oder 2, bei dem ein Halteelement (5) zum Halten des Temperatursensors (4) in einer Lage neben der ersten oder der zweiten Spule (3b, 3a), wobei das Halteelement mit einer Aussparung (5b) ausgebildet ist, in der der Temperatursensor (4) aufgenommen ist, und wenigstens einen Vorsprung (5d) aufweist, der so wirkt, daß er das Halteelement (5) in einem Abstand vom Boden der Aussparung (5b) hält, so daß ein Zwischenraum (5j) zwischen dem Temperatursensor (4) und dem Boden der Aussparung bleibt.

4. Anlasser nach Anspruch 3, bei dem das Halteelement (5) aus einem elastomeren Material gebildet ist und der Vorsprung (5b) eine Elastizität hat, durch die der Temperatursensor (4) elastisch in einen wärmeleitenden Kontakt mit der ersten oder der zweiten Spule (3b, 3a) gedrückt ist.

5. Anlasser nach Anspruch 3 oder 4, bei dem das Halteelement (5) weiterhin einen Führungsteil (5c) umfaßt, der um die Aussparung (5b) herum ausgebildet ist und so wirkt, daß der Temperatursensor (4) in seiner Lage gehalten ist.

6. Anlasser nach Anspruch 3, welcher weiterhin elektrische Leitungen (4d, 4e) aufweist, die mit dem Temperatursensor (4) verbunden sind, und bei dem das Halteelement (5) darin mit Einrichtungen (5g) zum Schützen der Leitungen ausgebildet ist.

7. Anlasser nach Anspruch 3, welcher weiterhin ein Gehäuse (1) aufweist, das die Erregungsspulen-

einrichtung umgibt und mit einer Öffnung (1a) ausgebildet ist, in der der Temperatursensor (4) durch das Halteelement (5) gehalten ist, wobei das Halteelement (5) so angeordnet ist, daß sich die Aussparung (5b) in der Öffnung (1a) befindet und zur Erregungsspuleneinrichtung gerichtet ist, und ein Deckelement (6) über dem Halteelement (5) angeordnet ist.

Revendications

1. Démarreur pour moteur à combustion interne ayant une couronne (18), le démarreur comprenant un commutateur (24) relié électriquement à une alimentation électrique (23); un pignon (17) mobile axialement pour venir en prise avec la couronne et s'en désengager; un plongeur (7) pour déplacer le pignon vers la couronne et comportant un premier contact mobile (9) à une extrémité; des premier et second contacts fixes (11a, 11b) placés de façon à être touchés par le premier contact mobile (9); un moyen de bobine d'excitation (3a, 3b) pour déplacer le plongeur vers les premier et second contacts fixes, le moyen de bobine d'excitation comportant une première bobine de maintien (3b) et une seconde bobine d'attraction (3a); un moteur (13) de démarreur destiné à être mis sous tension lorsque le premier contact mobile (9) est amené en contact avec les premier et second contacts fixes (11a, 11b) formant une liaison électrique entre eux, le moteur (13) du démarreur étant relié de manière motrice au pignon (17) et à un détecteur de température (4) pour détecter la température de l'une des première et seconde bobines (3b, 3a), caractérisé en ce que les première et seconde bobines (3b, 3a) ont des enroulements reliés électriquement en série à une première de leurs extrémités; un relais (25) comprend des contacts normalement ouverts (25a) reliés électriquement en série à l'alimentation électrique (23) et la liaison entre les enroulements des première et seconde bobines, et une troisième bobine (25b) reliée électriquement en série au commutateur (24) du démarreur et au détecteur de température (4) et destinée à être mise sous tension lorsque le commutateur (24) est fermé et à fermer les contacts normalement ouverts; le détecteur de température (4) est relié électriquement en série à la troisième bobine (25b) et à la masse et comprend un troisième contact fixe (4b), un élément de bilame (4c) ayant un second contact mobile (4g) relié électriquement à l'élément du bilame (4c) et placé de façon à être déplacé par l'élément de bilame pour venir en contact et hors de contact d'avec le troisième contact fixe (4b), et un élément chauffant (4a) pouvant être mis électriquement sous tension, disposé en relation de conduction de chaleur avec l'élément de bilame (4c), l'élément de bilame étant disposé en étant contigu à ladite bobine des première et seconde bobines (3b, 3a) et pouvant fonctionner pour déplacer le second contact mobile (4g), afin de l'éloigner du troisième contact fixe (4b) lorsque ladite bobine des première et seconde bobines (3b, 3a) est chauffée à une première température prédéterminée, pour désexciter la troisième bobine (25b), d'où il résulte que les contacts normalement ouverts du relais (25) sont

ouverts pour interrompre l'alimentation électrique à partir de la source d'énergie (23) du moteur (13) du démarreur.

2. Démarreur selon la revendication 1, dans lequel le troisième contact fixe (4b) est relié électriquement à la troisième bobine (25b), l'élément de bilame (4c) est lié à la masse et l'élément chauffant (4a) est relié électriquement en série avec le troisième contact fixe (4b) et l'élément de bilame (4c), l'élément chauffant (4a) ayant une caractéristique d'auto-échauffement pour maintenir l'élément de bilame (4c) à une température supérieure à une seconde valeur prédéterminée à laquelle l'élément de bilame (4c) revient à sa position initiale, d'où il résulte que le second contact mobile (4g) est maintenu hors de contact d'avec le troisième contact fixe (4b) de manière à maintenir les contacts normalement ouverts du relais à l'état ouvert même si la température de ladite bobine des première et seconde bobines (3b, 3a) est abaissée jusqu'à la seconde température prédéterminée lorsque le commutateur (24) du démarreur est maintenu fermé.

3. Démarreur selon la revendication 1 ou la revendication 2, comprenant en outre un élément de retenue (5) pour maintenir le détecteur de température (4) dans une position contiguë à ladite une des première et seconde bobines (3b, 3a), l'élément de retenue présentant intérieurement un évidement (5b) dans lequel est reçu le détecteur de température (4) et ayant au moins une saillie (5d) servant à maintenir l'élément de retenue (5) espacé d'une certaine distance du fond de l'évidement (5b), d'où il résulte que l'espace (5j) est laissé entre le détecteur de température (4) et le fond de l'évidement.

4. Démarreur selon la revendication 3, dans lequel l'élément de retenue (5) est constitué d'un matériau élastomère et la saillie (5d) a une élasticité grâce à laquelle le détecteur de température (4) est sollicité élastiquement pour venir en contact conducteur de la chaleur avec ladite bobine des première et seconde bobines (3b, 3a).

5. Démarreur selon la revendication 3 ou la revendication 4, dans lequel l'élément de retenue (5) comprend en outre une section de guidage (5c) formée autour de l'évidement (5b) et servant à maintenir en position le détecteur de température (4).

6. Démarreur selon la revendication 3, comprenant en outre des fils électriques (4d, 4e) reliés au détecteur de température (4), et dans lequel l'élément de retenue (5) comporte sur leur dessus un moyen (5g) pour protéger lesdits fils.

7. Démarreur selon la revendication 3, comprenant en outre un boîtier (1) entourant le moyen de bobine d'excitation et présentant une ouverture (1a) dans laquelle le détecteur de température (4) est maintenu par l'élément de retenue (5), l'élément de retenue (5) étant disposé de façon que l'évidement (5b) soit placé dans l'ouverture (1a) et dirigé vers le moyen de bobine d'excitation et un élément de couvercle (6) disposé en relation superposée avec l'élément de retenue (5).

FIG. 1

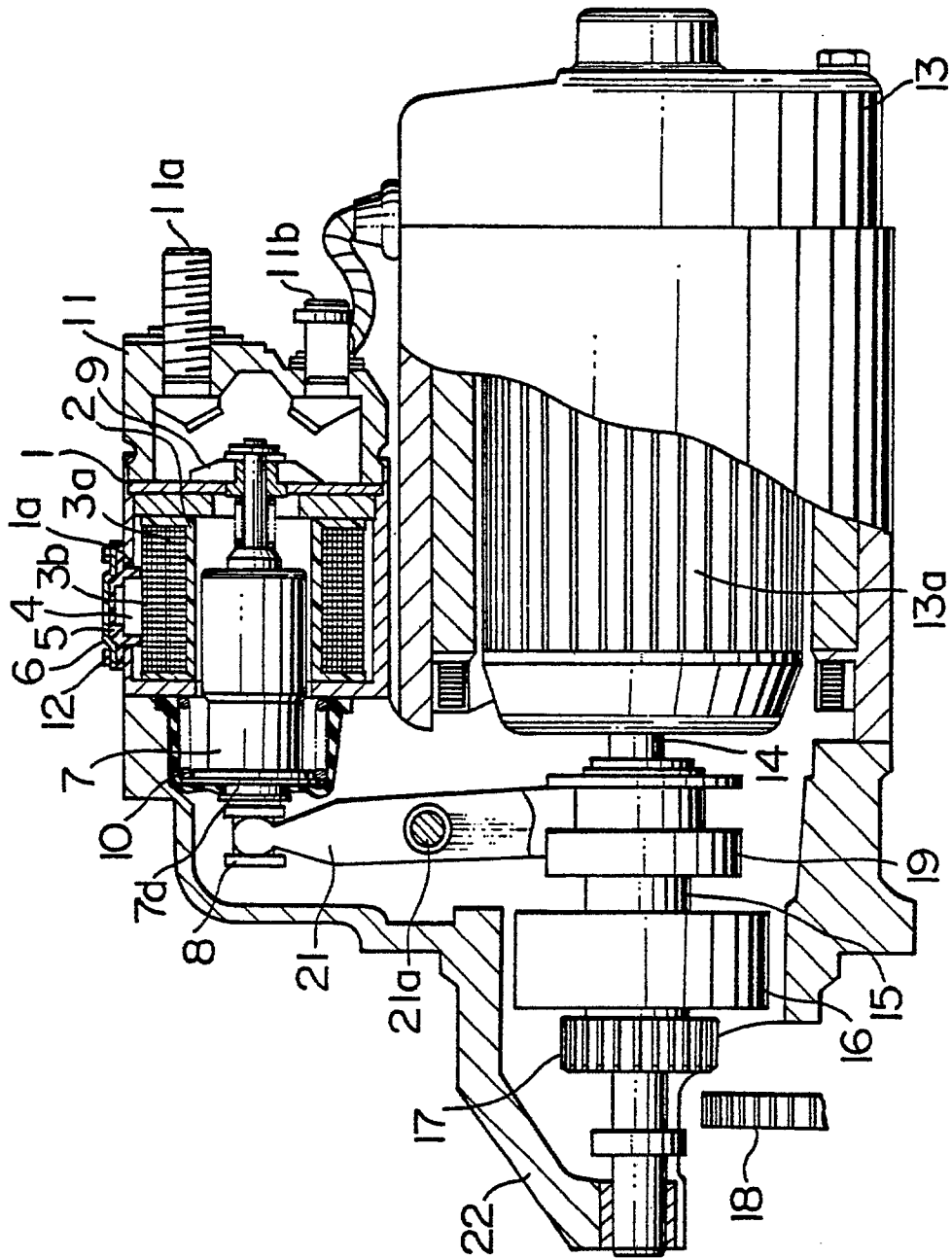


FIG. 2

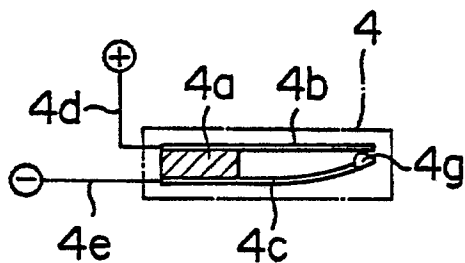


FIG. 3

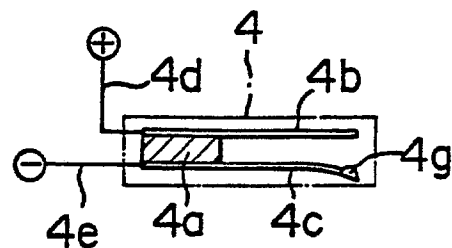


FIG. 4A

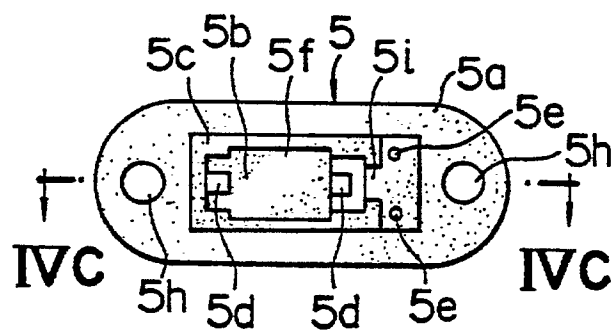


FIG. 4B

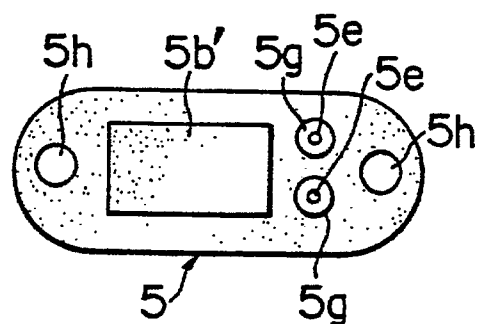


FIG. 4C

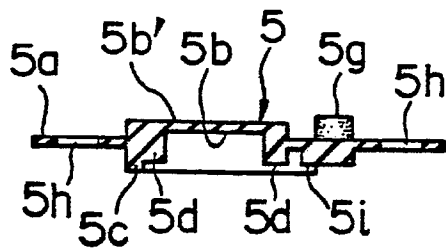


FIG. 5

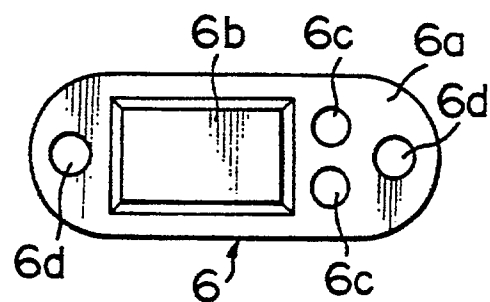


FIG. 6

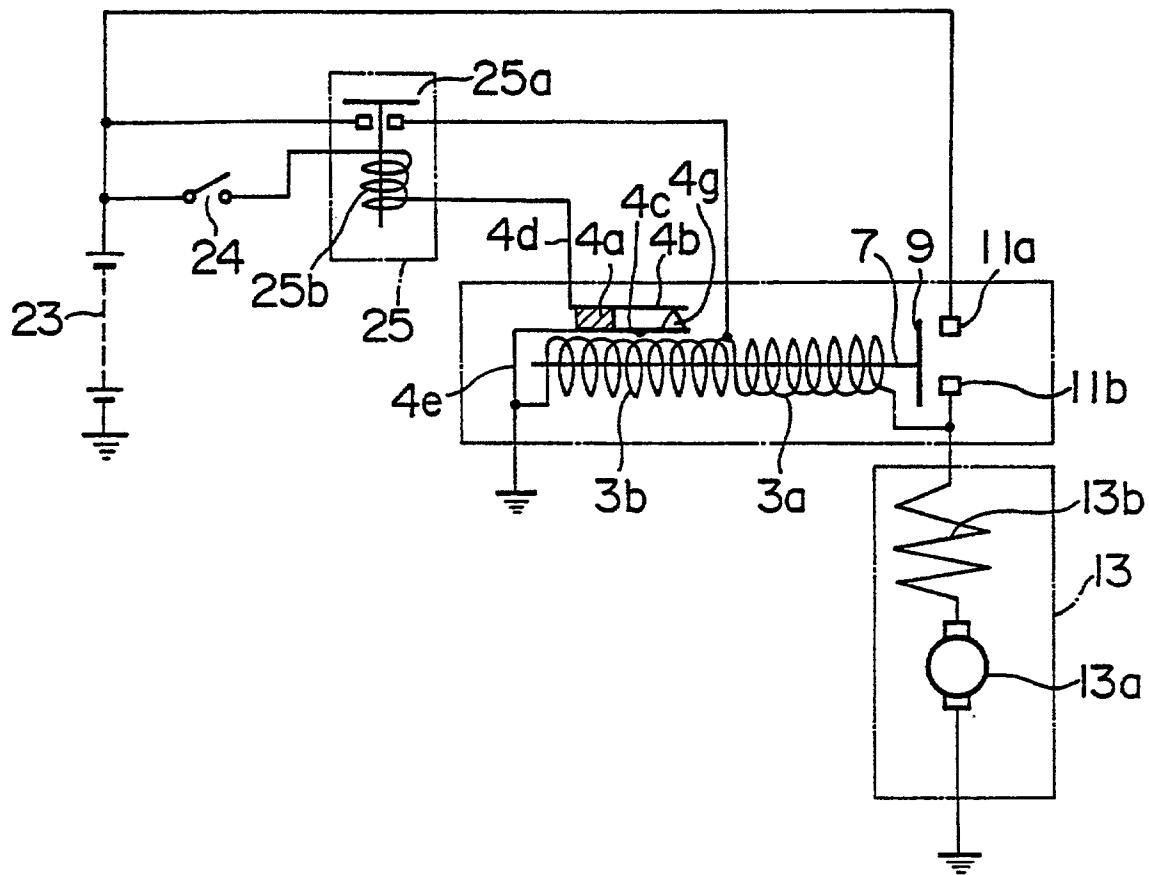


FIG. 7

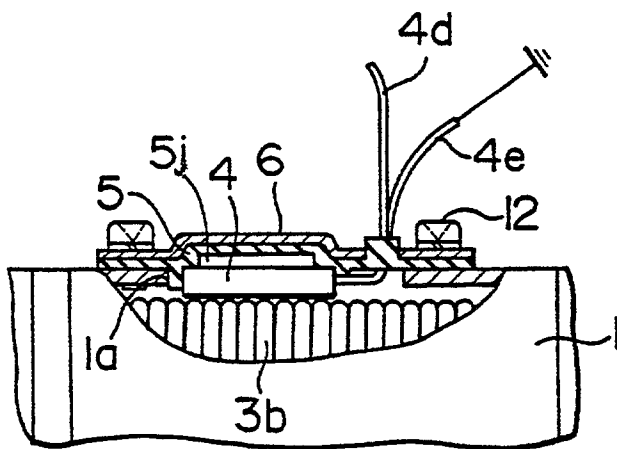


FIG. 8

