

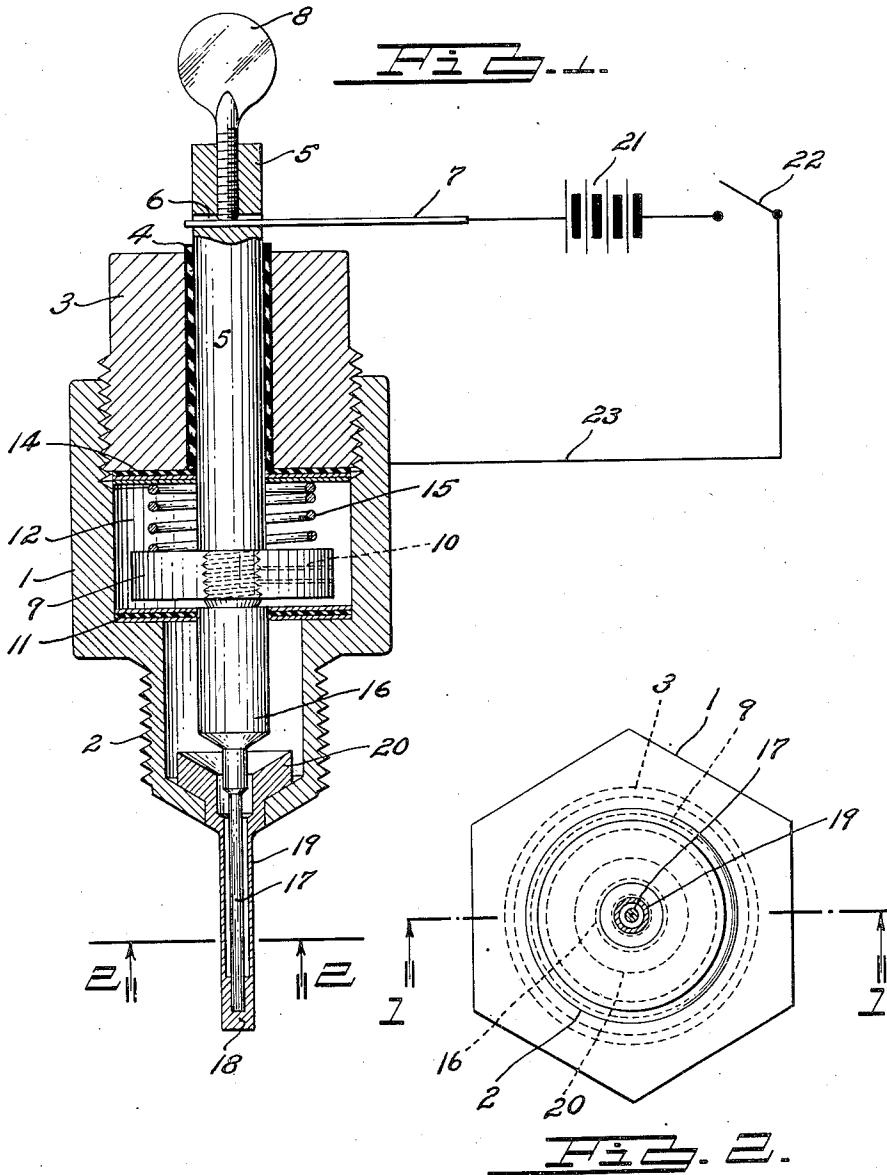
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GLOW PLUG FOR INTERNAL COMBUSTION ENGINES

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GLOW PLUG FOR INTERNAL COMBUSTION
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This invention relates to glow plugs for internal combustion engines and the object of the invention is to provide a means for igniting fuel in an internal combustion engine by a hot or glowing metallic surface, the initial heat of which is produced by an electric current.

Another object of the invention is to provide a metallic plug within the cylinder of an internal combustion engine which can be heated to a glowing temperature by means of an electric current for starting the engine and will continue to be heated by the combustion within the engine to fire the charge.

A further object of the invention is to provide a glow plug in the shape of a closed tube which cannot be short-circuited by dirt, grease or oil within the combustion chamber of an internal combustion engine.

It is a further feature of this invention to construct a glow plug in which the temperature of the plug end will by expansion at a predetermined temperature break the electric circuit used to generate its initial heat and so arranged as to break the circuit upon reaching said predetermined temperature whether the heat is produced by an electric current or by the heat of the combustion chamber.

It is also a feature of this invention to construct a glow plug of a high heat withstanding metal in which the initial glowing temperature is produced by an electric current, the construction being such that the heat of combustion in a combustion chamber will maintain the plug at a glowing temperature.

Another object of the invention is to construct a glow plug of such form that the terminal glowing end may be easily removed and replaced in case of damage or injury due to over-heating.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the accompanying drawing in which—

Fig. 1 is a longitudinal section through a glow plug embodying my invention and showing the electric circuit therefor diagrammatically.

Fig. 2 is a section taken on line 2—2 of Fig. 1. The glow plug consists of a hollow body member 1 having a threaded lower end 2 of smaller diameter arranged to be threaded into the cylinder wall of the internal combustion engine. The body member 1 is preferably hexagonal shape on the exterior to allow the body to be threaded into position in the cylinder wall by means of a wrench as will be understood from Fig. 2. A nut

3 is threaded into the top of the body member 1 as shown in Fig. 1 and the nut 3 is provided with an insulating sleeve 4 through which the copper contact rod 5 extends. This contact rod at the upper end is provided with an aperture 6 for the electrical conductor 7 and a set screw 8 is threaded into the upper end of the rod 5 to engage the electrical conductor and make proper contact therewith.

At the lower end, an adjustable collar 9 is secured to the contact rod 5 by the set screw 10 so that this collar may be threaded to the desired position and then locked in place by the set screw. An insulating washer 11 is provided in the bottom of the recess 12 in the body member 1 and an insulating washer 14 is provided in the top of the said recess and is held in engagement with the nut 3 by the spring 15 which is compressed between the collar 9 and the washer 14. By means of the spring 15, the lower end of the contact rod 5 is held in engagement with the conductor 16.

This conductor 16 is provided with a lower end 17 secured in the closed end 18 of the glow tube and this glow tube is provided with a thin cylindrical wall 19 of a metal which will glow upon passage of electric current therethrough. The portion 17 of the conductor is out of metallic contact with the tube 19 except at its lower end and thus an insulating space exists between the body of the member 17 and the tube to thereby insure flow of current longitudinally of the member 17 to the end 18 of the tube and thence in reverse direction longitudinally of the tube 19 to the portion 2 of the body 1. This thin wall portion 19 of the glow plug has a resistance which is many times that of the conductor rod 17 and is so designed as to glow under passage of electric current therethrough. The base 20 of the member 19 is fitted in an aperture provided therefor in the end 2 of the body member as shown in Fig. 1. This is preferably a tight fit in the member 2 to provide electrical contact between the member 2 and the base 20 and the glow tube may be replaced in case of damage or injury due to over-heating.

The conductor 7 is electrically connected to a source of current supply such as a battery 21 and the opposite side of this battery is connected to a switch 22 on the grounded side of the circuit.

When the switch 22 is closed, the current will flow through the conductor 7 and through the contact rod 5 to the conductor 16, thence through the end 17 of the conductor to the end 18 of the

glow tube, thence through the thin wall 19 of the glow tube and back through the body member and through the wire 23 to the switch 22. Passage of current through the thin wall 19 causes this thin wall to heat and as this wall begins to glow the portion 19 expands longitudinally thus drawing the conductor 16 downwardly. As the conductor 16 moves downwardly, the adjustable collar 9 engages the insulating washer 11 under action of the spring 15 and as the conductor 16 moves downwardly from this point it moves away from the end of the contact rod 5 thus breaking the circuit. As the glow tube 19 extends into the combustion chamber of the internal combustion engine which is preferably of the Diesel type, it will fire the charge in the combustion chamber due to the fact that it is glowing. The combustion in the combustion chamber of the engine will keep the glow tube 19 heated to continue to fire the charge and as long as the portion 19 is maintained in a heated condition the circuit will remain broken. Upon stopping the engine, the portion 19 will cool allowing this portion to contract longitudinally and move the conductor 16 up into contact with the rod 5 thus raising it against the tension of the spring 15 and returning it to a position for succeeding operation by closing the switch 22. By adjusting the collar 9 on the rod 5 the movement of this contact rod may be accurately adjusted to cooperate with the movement of the conductor 16 so that the circuit will be broken when the portion 19 reaches a predetermined temperature.

Thus, whether the thin shell 19 is heated by electricity or by the heat of the combustion chamber, the result is the same, the circuit will be broken as long as this portion 19 remains above a predetermined temperature. It is to be noted that dirt, oil or grease in the combustion chamber cannot short circuit the glow plug as the entire heated portion of the circuit is composed of a closed tube which shields the working parts of the thermal circuit breaker from outside gases or dirt. The pressure on the spring 15 can be accurately adjusted by the screw plug 3 and the initial clearance between the adjustable collar 9 and the washer 11 regulates the temperature at which expansion of the thin tube wall 19 will break the circuit. The form of glow plug illustrated is one form of the invention but it will be evident that various changes in structure may be made without departing from the spirit of the invention.

The foregoing description has indicated the use of my improved glow plug in an internal combustion engine but the device is not limited to such specific use as it may be used in the ignition of any combustible mixture required to be ignited by positioning the glow tube in the area in which the gases are in combustion whereby the tube is maintained heated subsequent to the initial heating by means of an electric circuit and by such heating and consequent expansion of the tube 19, the electric circuit remains broken. Thus, in any of the usual oil burners or other structures wherein a combustible mixture is to be ignited, my improved glow plug may be utilized by locating the same at a point wherein the tube may be heated by the mixture in combustion.

From the foregoing description, it becomes evident that the device is very simple and efficient in operation, cannot be short circuited by dirt, oil or grease, will operate automatically

as soon as the switch is closed and provides a device which accomplishes the objects described.

Having thus fully described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is:

1. In a glow plug for internal combustion engines, a body member having a portion adapted to be threaded into the wall of the internal combustion engine, a glow tube of resistance metal extending from the end of the body member into the combustion chamber and being closed at the end, a conductor extending through the tube in spaced relation therewith and secured in the closed end thereof, a contact rod normally engaging the conductor, an adjustable collar on the contact rod, a spring engaging said collar, an adjustable nut engaging the spring and adjustable in the body member to vary the tension of the spring, means for passing an electric current through the contact rod and conductor and through the glow tube to heat the glow tube, the glow tube being arranged to expand under heat and when expanded to a predetermined extent being arranged to move the conductor out of contact with the contact rod and break the electric circuit.

2. In a glow plug for internal combustion engines, a body member adapted to be threaded into the wall of the internal combustion engine, a glow tube of resistance metal extending from the end of the body member into the combustion chamber and being closed at the end, a conductor extending through the tube in spaced relation therewith and secured in the closed end thereof, a contact rod, yieldable means urging the contact rod into contact with the conductor, an adjustable stop on the contact rod limiting movement of the contact rod by said yieldable means, means for passing a current through the contact rod and conductor and through the glow tube, the glow tube being arranged to expand under heat and upon expansion to move the conductor away from the contact rod and break the electric circuit.

3. In a glow plug for an internal combustion engine, a body member, a tubular glow element of resistance metal closed at one end and removably fitted at the other end to the body member, a centrally disposed conductor connected at one end to the closed end of the glow element, an adjustable spring pressed rod engaging the other end of the conductor, means for limiting the motion of the spring pressed rod, means for passing electric current through the spring pressed rod, conductor and glow element to heat the glow element, the arrangement being such that the glow element upon reaching a predetermined temperature will break the circuit between the rod and centrally disposed conductor.

4. A glow plug for internal combustion engines comprising a body member adapted to be threaded into the wall of an internal combustion engine, a glow tube extending from the end of the body member having a thin tubular wall of resistance metal arranged to heat under passage of electric current therethrough, the glow tube having a closed end, a conductor extending through the glow tube and secured in said closed end, means for passing an electric current through the conductor and through the glow tube and means for breaking the electric circuit upon expansion of the glow tube to a predetermined point.

5. In a glow plug for internal combustion en-

gines, a body member adapted to be threaded into the wall of the internal combustion engine, a glow tube of resistance metal extending from the end of the body member into the combustion chamber, the tube being provided with a closed end, a conductor extending through the tube and secured in the closed end, a contact rod normally contacting the conductor, means for passing electric current through the contact rod and conductor and through the glow tube to heat the same, the arrangement being such that expansion of the glow tube under heat will separate the contact rod and conductor to break the electric circuit.

6. In a glow plug for internal combustion engines, a hollow metal glow tube having a thin wall of resistance metal and closed at the end, a metallic conductor extending through the tube and secured at one end in metallic contact with the closed end of the tube, the metallic conductor being spaced from the thin wall of the glow tube, means for passing an electric current through the metallic conductor and through the thin wall of the metal glow tube to heat said thin wall to glowing temperature.

7. In an ignition device for internal combustion engines of the fuel injection type, an element projecting into the combustion chamber of the engine and adapted to be heated by the gases of combustion, an electric circuit for initially heating the same, and means actuated by the heating and consequent expansion of the element to break the electric circuit.

8. Means for igniting a combustible mixture, comprising an ignition device including an element positioned in the mixture in combustion whereby it may become heated, an electric circuit for initially heating the said element to thereby ignite the mixture and cause an expansion of the said element, and means actuated by the expansion of said element to break the electric circuit whereby the heat of the mixture while in combustion maintains the circuit open.

9. In a glow plug for internal combustion engines, a body member adapted to be threaded into the wall of the engine, a hollow tube of

electrically resistant metal impervious to gas flow through its wall and extending from the end of the said body into a combustion chamber of the engine, a conductor extending into the tube and secured at its end in metallic contact with the inner end of the tube, a contact rod normally engaging the conductor, means for passing electric current through the contact rod and conductor and the wall of the tube to heat the same, the arrangement of the parts being such that expansion of the tube by the heating thereof separates the conductor and contact rod to break the electric circuit.

10. In a glow plug for internal combustion engines, a metal tube having a thin impervious wall of high electrical resistance and closed at one end, a central metallic conductor of a low resistant metal extending into the tube and to metallic contact at its end with the closed end thereof and with the body of the conductor in insulated relation with the tube wall, the arrangement being such that, in passing an electric current through the conductor and the tube, the tube will be heated to a greater degree than the conductor whereby the expansion of the tube will be greater than that of the conductor and thereby break the circuit as the tube expands.

11. In an ignition device for internal combustion engines of the fuel injection type, a hollow metal element of a high electrical resistant metal impervious to gas flow and projecting into the combustion chamber of the engine to be heated by the gases of combustion, an electric circuit for initially heating the same to ignite the fuel of the engine, and means actuated by the heating and consequent expansion of the element to break the electric circuit.

12. A glow plug for the ignition of a combustible mixture in an enclosed space including an element forming part of the plug and projecting into said space, an electric circuit for initially heating said projecting element, and means actuated by the heating and consequent expansion of the element to break the electric circuit.

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