L. WYGODSKY.

IGNITER.

APPLICATION FILED DEC. 26, 1916.

1,237,851. Patented Aug. 21, 1917.

Fig. 1.

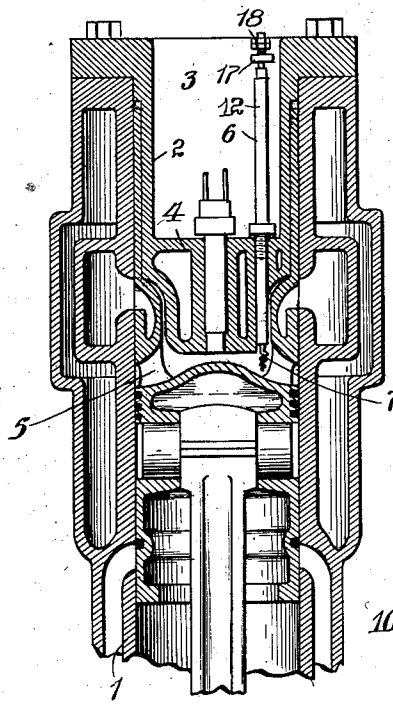


Fig. 2.

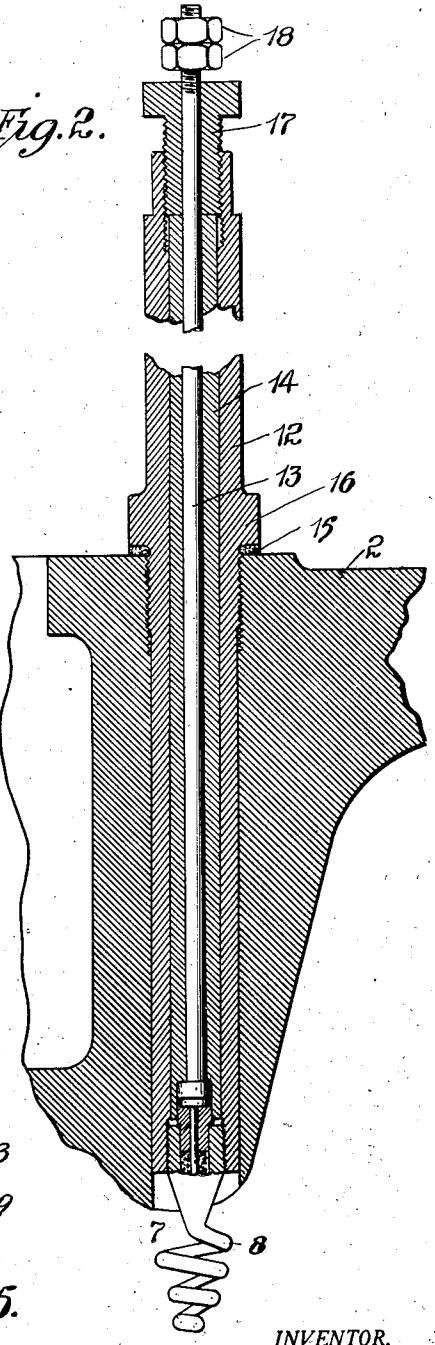


Fig. 6.

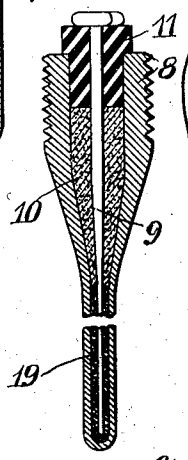


Fig. 4.

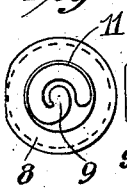


Fig. 3.

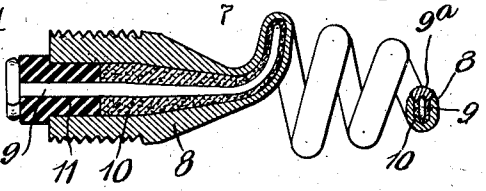


Fig. 5.



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IGNITER.

1,237,851. Specification of Letters Patent. Patented Aug. 21, 1917.

Application filed December 26, 1916. Serial No. 138,990.

To all whom it may concern:

Be it known that I, LEON WYGODSKY, a citizen of the United States of America, and a resident of the city of Baltimore, Maryland, have invented a certain new and useful Improvement in Igniters, of which the following is a specification.

My invention relates to igniters for internal combustion engines, and comprises a duplex conductor of peculiar form adapted to be brought to incandescence at or near one end by the passage of an electric current through it, and adapted by reason of the high temperature thus imparted to such end of the duplex conductor, to ignite oil vapor or the like, brought into contact with it.

For certain types of gas and oil engines, particularly the type in which the fuel is injected into the engine cylinder at or near the end of the compression stroke, a hot wire igniter is preferable to a jump spark igniter. The spark of a jump spark igniter exists for an instant only and at that the spark may not be hot enough to ignite the vapors of heavy fuel oils; moreover, the spark may not occur at just the best time for ignition. A hot wire igniter remains hot continuously; and such an igniter, in an injection type engine, cannot cause preignition because ignition begins only when the injection of the fuel begins. The hot wire igniter has various other advantages; for example, no spark coils or current distributers or the like are required, the ignition apparatus being of extreme simplicity. Heretofore, however, such hot wire igniters have not been of the rugged and relatively massive construction which such an igniter should have, and have not permitted the simple and rugged connection to the engine cylinder which is desirable.

A body which may be brought very quickly to a high heat by the passage of an electric current through it may be produced by first producing a body consisting of an outer tube or sheath, of conductive material, and of considerable thickness, an inner conductor and a separating or insulating layer of refractory insulating material, which insulating material may or may not be a complete insulator, and then drawing down the compound body thus produced to small dimensions; relatively large dimensions of the body being preferably retained at one end (which may be termed the butt end) so that this butt end is strong and massive and of suitable thickness to have screw threads cut in its sheath and to have a suitable terminal formed on it for the internal conductor. If the said insulating material be one which is practically a non-conductor, then at the smaller end of the device the internal conductor and the external sheath should be electrically connected in order that the heating current may pass through the one conductor to the small end thereof and thence returned through the other conductor. However, it is convenient to employ for the said insulating material, particularly at the smaller end of the device, a material which is not an absolute insulator. Pulverized carbon, such as graphite or coke, is an example of one material of moderately low conductivity which may be used to separate the inner and outer conductor, particularly at the tip or small end of the device. The use of a separating material of low conductivity but nevertheless of some conductivity, is particularly desirable, because when such material is employed for connecting the inner and outer conductors, the heating effect of the electric current will first develop where such low-conductivity separating material is located, and will develop very quickly there; which is of prime importance in an igniter such as herein described.

My invention consists in the ignition device above briefly described, and described more in detail hereafter, and the novelties of which are pointed out in the appended claims.

The object of my invention is to improve the construction of ignition devices, particularly ignition devices of the hot wire type.

I will now proceed to describe my improved igniter with reference to the accompanying drawings, illustrating one embodiment thereof. In said drawings:

Figure 1 shows a fragmentary vertical section of the cylinder and cylinder head and associated parts of a heavy oil engine of the type described in my application for Letters Patent Sr. No. 100,769, filed May 31, 1916, the cylinder head being provided with an igniter such as herein described.

Fig. 2 shows on a much larger scale a central vertical section of the igniter and of

proximate portions of the cylinder head, the lower portion of the igniter tip, or igniter proper, being shown in elevation.

Fig. 3 shows a partial longitudinal section and partial side view of one form of igniter tip or igniter proper, embodying my invention.

Fig. 4 shows an end view of the head thereof, and Fig. 5 a fragmentary side view of the tip thereof.

Fig. 6 shows a longitudinal section of a partially formed igniter tip of alternative construction.

In the drawings, 1 designates the engine cylinder and 2 designates the cylinder head, which is of peculiar construction, since it projects a considerable distance into the cylinder and is provided with a central recess 3. 4 designates a fuel spraying device set into the central portion of the cylinder head and adapted to project a wide-spread spray stream into the space above the piston 5. 6 designates the igniter as a whole, set into the cylinder head, and 7 designates the igniter tip or igniter proper.

In the form shown in Figs. 3, 4 and 5, this igniter tip 7 comprises a sheath 8, and a central conductor 9, insulated from one another by refractory insulating material 10. At its left hand end, (as seen in Fig. 3) the cross section of this igniter tip is relatively large, and the thickness both of the sheath 8 and of the central resistance conductor 9 is relatively great; so much so that quite deep screw threads may be cut in the butt or base end of the igniter tip, as shown in Fig. 3; while at the opposite end both the central conductor 9 and the outer conductor or sheath 8 have been drawn down to such a degree that heat developed in the conductor 9 will cause sheath 8 to become incandescent with the passage of a relatively moderate current; the insulation material 10 nevertheless persisting between the conductors 8 and 9. I have indicated at the right hand side of Fig. 3, that the central conductor 9 has been connected electrically to the sheath 8, by a piece of conductive material 9^a, preferably welded both to conductor 9 and to sheath 8; the sheath being cut away partly to receive the connector 9^a.

Preferably, at the butt end of the device, the central refractory insulating material is dug out sufficiently to permit the entry of an insulating bushing 11, which may be of fiber, mica, or other suitable insulating material; and the resistance conductor 9 may be coiled flat over the end of this bushing to form a terminal.

The ignition device as a whole may comprise besides this tip 7, an outer tube 12 adapted to be fitted into a suitable bore in the cylinder head or cylinder wall; a central rod 13 of relatively high conductive material, such as brass, making contact at its lower end with the coiled over portion of the resistance conductor 9; and a tube 14, of fiber or other suitable insulating material, separating the tube 12 from the internal conductor 13. Suitable packing 15, compressed by a shoulder 16, forms a gas tight joint between tube 12 and the head 2 of the cylinder. A bushing 17 holds the fiber tube 14 in place, and by pressing down tube 14, holds the headed lower end of conductor 13 in electrical contact with the coiled rear end of conductor 9; and suitable binding nuts 18 may be provided, at the top of the rod 13, for the connection to such rod of one conductor of the ignition circuit. It will be understood that the engine frame, including the cylinder and cylinder head, constitutes in part the other conductor of the ignition circuit, the current passing from the rod 13 to the central conductor 9 of the ignition tip, or igniter proper, thence to the lower end of such tip and to the sheath 8, and thence to the tube 12, cylinder head 2, and so to the frame of the engine. As will be seen from Fig. 1, the ignition tip, or igniter proper, 7, projects into the clearance space in the rear or upper end of the cylinder, in such a position as to be in the path of fuel injected into that cylinder by the spraying device 4. This ignition device is therefore well located to ignite the stream of fuel as it enters the cylinder. It will be noted that the construction of the ignition device is extremely massive and substantial, and is such that the ignition device will not be affected detrimentally by shock or jar. The ignition device proper, 7, is of such nature that it will endure repeated heating to incandescence for very long periods of time without burning out and without suffering any depreciation whatever.

In the alternative and preferred form of ignition tip, shown in a partly completed state in Fig. 6, there is a sheath 8 and a central conductor 9 separated by a refractory insulating material 10, which material 10 exists, between said sheath and central conductor, nearly to the smaller end of the device; but near this smaller end of the device there is employed, instead of the material 10, another material 19 of such conductivity that it will permit the passage of a heating current of low or moderate voltage (say six to ten volts) at a rate which will cause an immediate and marked rise of temperature in this material 19; the heat thus developed being transmitted immediately to the outer sheath, and raising that sheath, at and near the smaller end of the device, to a temperature such as will ignite a fuel spray contacting with it. In this form of igniter tip shown in Fig. 6, there is no occasion for welding a connecting body 9^a to the inner conductor 9 and sheath 8, as in Fig. 3; but the outer tube or sheath may be closed over,

at its smaller end, in any suitable manner, so long as the closure be sufficiently tight to prevent the escape of the pulverulent material 19. The igniter tip shown in Fig. 6 may be used in the straight form shown in that figure; but preferably, it is wound into a helix, so as to present practically the same external appearance as the device shown in Fig. 3. Figs. 1 and 2, are, therefore, equally illustrative of the igniter tip shown in Fig. 3, and of the completed igniter tip shown, in a partly completed state, in Fig. 6.

Both the igniter tip shown in Fig. 3, and the igniter tip shown in Fig. 6, may be said to be composed of "sheathed wire."

In the form of heaters shown in Fig. 3, the inner conductor 9 is preferably of a material of much higher specific resistance than the outer sheath 8; and therefore in that form of the device the heat is developed primarily in the smaller diameter portion of the resistance conductor 9, and must be transmitted through the separating material 10 (which is of low heat conductivity, besides being practically a complete electrical insulator) to the sheath 8, the sheath 8 being of low electrical resistance at the smaller end of the device. For this reason, other conditions being equal, the smaller end of the device of Fig. 3 does not heat up as rapidly as does the smaller end of the device of Fig. 6. In the device shown in Fig. 6, however, since the material 19 is itself a conductor of high resistance as compared with conductors 8 and 9, the heat is developed primarily in the material 19 which is in immediate contact with the sheath 8, and therefore communicates its heat rapidly to that sheath 8; with the result that the device shown in Fig. 6 heats up much more rapidly than does the device of Fig. 3, and the heat is concentrated just in the portion of the device in which the material 19 is located.

This material 19 may be of various compositions. I have previously referred to the use of pulverized coal or graphite for the material 19; but various other materials may be used, for example, various pulverized metals, which, because of their pulverulent condition, are poorer conductors than the same materials in rod or tube form.

My invention, in the form shown in Fig. 6, comprises also a sheath wire wherein a material preferably pulverulent, which is a low conductor, but nevertheless a conductor, may extend through any desired portion of the space between the inner conductor 9 and the outer sheath 8; may even occupy the entire length of the space between such conductors 9 and 8.

What I claim is:

1. An igniter such as described, comprising "sheathed wire" having a large section at one end and a small section at the other end, and having the central conductor electrically connected to the outer sheath at the smaller end.

2. An igniter such as described, comprising "sheathed wire" having a large section at one end and a small section at the other end, and having the central conductor electrically connected to the outer sheath at the smaller end, such sheathed wire being wound into a coil.

3. An igniter such as described, comprising "sheathed wire" comprising an outer conductive envelop, an inner conductor, and an intermediate layer of refractory insulating material, the inner conductor being connected to the outer sheath at one end of the device.

4. An igniter such as described, comprising "sheathed wire" comprising an outer sheath, an inner conductor and an intermediate layer of refractory material, the said several component members of the wire having a large section at one end and thence tapering to a relatively small section at the other end, at which end the outer sheath and the inner conductor are connected, the outer sheath being provided, at the larger end of the device, with means for attachment.

5. An igniter such as described comprising "sheathed wire" comprising an outer sheath, an inner conductor and an intermediate layer of refractory material, the said wire having a large section at one end and thence tapering to a relatively small section at the other end, and being wound, for a portion of its length, into a helix, the said outer sheath and the inner conductor being electrically connected at the smaller end of the device.

6. An igniter such as described comprising "sheathed wire" comprising an outer sheath, an inner conductor, and an intermediate layer of refractory material, the said wire having a large section at one end and thence tapering to a relatively small section at the other end, the sheath being grooved at such smaller end to form a pocket for an igniter body, and a connecting body in such pocket electrically connecting the sheath and inner conductor.

7. An igniter such as described comprising "sheathed wire" comprising an outer sheath, an inner conductor and an intermediate layer of refractory material, the sheath and inner conductor being electrically connected at one end, there being between the sheath and inner conductor, at the other end of the device, a recess, and a plug of insulating material in such recess having a bore through which the inner conductor passes, said inner conductor having at such end of the device a head adapted to form an electric terminal.

8. An igniter such as described, comprising an igniter tip of "sheathed wire," a tube to one end of which the butt of such tip is connected, a rod within said tube and spaced

away from the walls thereof and electrically connected to the inner conductor of the "sheathed wire" and an insulating tube in the space intermediate said first mentioned tube and said conductor.

9. An igniter such as described, comprising an igniter tip of "sheathed wire," a tube to one end of which the butt of such tip is connected, a rod within said tube and spaced away from the walls thereof and electrically connected to the inner conductor of the "sheathed wire" and an insulating tube in the space intermediate said first mentioned tube and said conductor, said conductor having a head pressing against the inner conductor of the igniter tip, said insulating tube pressing against said head and so holding the latter against the said inner conductor.

10. In an internal combustion engine, the combination with an engine cylinder having a spraying device arranged to spray fuel into said engine cylinder and to produce therein a widespread spray stream, and an igniter projecting into said engine cylinder and having an ignition tip arranged to be heated by an electric current and composed of "sheathed wire."

11. In an internal combustion engine, the combination with an engine cylinder having a spraying device arranged to spray fuel into said engine cylinder and to produce therein a widespread spray stream, and an igniter projecting into said engine cylinder and having an ignition tip arranged to be heated by an electric current and wound into a helix.

12. An igniter such as described, comprising an outer sheath, an inner conductor, and an intermediate layer of separating material, such separating material being, in one portion at least of the igniter, a material of low conductivity as compared with the sheath and inner conductor, in which material, because of its low conductivity, the heating effect of an electric current passed through said sheath and inner conductor will first develop.

13. An igniter such as described comprising an outer sheath, an inner conductor, and an intermediate layer of separating material, both said sheath and inner conductor having a relatively large section at one end and thence tapering to a relatively small section at the other end, the said separating material, at or near the small end of the device, being a material of low conductivity as compared with the conductivity of the sheath and inner conductor.

14. "Sheathed wire" comprising an outer sheath of conductive material, an inner wire of conductive material, and an intermediate layer of separating material, which, through a greater or less proportion of its length, is a material of low conductivity as compared with the outer sheath and inner wire, but is of a conductivity sufficient to cause development of heat in such separating material upon the passage of a heating current therethrough.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LEON WYGODSKY.

Witnesses:
H. M. MARBLE,
PAUL H. FRANKE.