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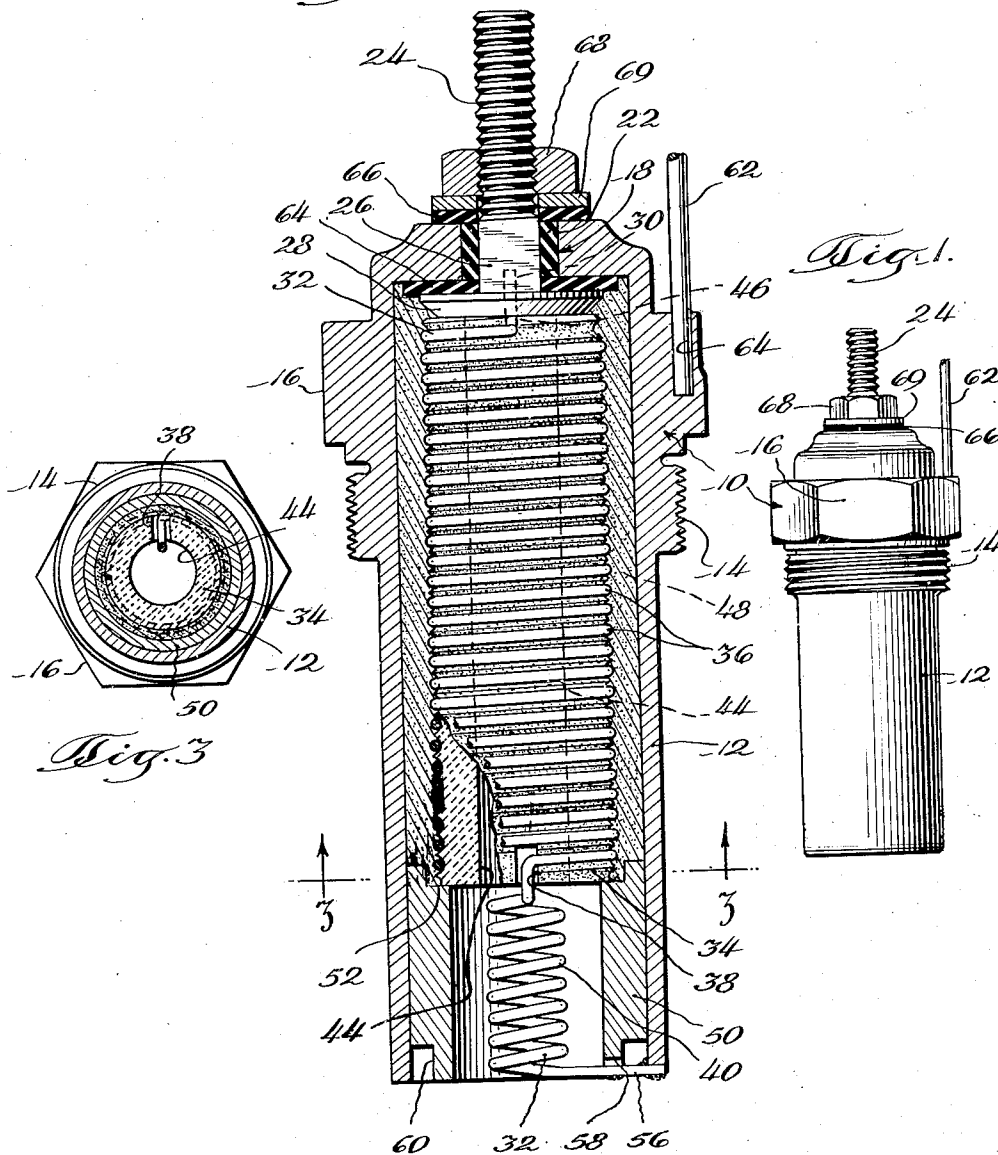
H. J. DE N. McCOLLUM

2,492,755

IGNITER

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Fig. 2.



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IGNITER

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3 Claims. (Cl. 219—32)

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The invention relates generally to igniters of the electrical resistance wire type such as are particularly adapted for use as parts of various types of combustion apparatus, for example, oil, gas, and gasoline burning heaters for use in vehicles as well as in stationary installations.

In burners for the combustion of gasoline, oil, and gas, it has become common practice to use an igniter of the electrical resistance wire type, usually in the form of a coil of high resistance wire, located in or adjacent the combustion chamber, and heat it to incandescence by passing an electrical current therethrough. In burners used in heating installations in which a low voltage current source is available such as the 6 volt storage battery of an automobile, the igniter wire may be of reasonable gauge (diameter) and length so that the coil into which it is formed may be of dimensions favorable to prompt and effective ignition of the fuel mixture in the combustion chamber. After combustion has been established, it is the customary practice to de-energize the igniter, not only to relieve the load on the electrical energy source, but also to reduce the temperature of the igniter and thus extend its useful life.

Under such use of an igniter of this type, the surfaces of the igniter wire coil may be at a lower temperature than other parts in or adjacent the combustion chamber, and if the combustion of fuel is not perfectly complete, particles of carbon soot may be deposited upon the wire. After some period of use of the heating apparatus, this deposit of soot upon the igniter wire coil may become sufficiently thick that the carbon forms a conducting bridge across two or more turns of the coil. This reduces the resistance of the bridged turns with the result that the voltage drop across the remaining turns is increased, and the latter become heated to an excessively high temperature. In time, such high temperatures will cause the igniter coil to "burn out" due to oxidation and vaporization of the wire.

This problem of providing an electrical resistance wire igniter which will have a long useful life, is accentuated when it is endeavored to make an igniter of this type which will operate from a higher voltage source such, for example, as the 24 volt system commonly employed in aircraft. It has been found that the portion of the igniter wire which is exposed to the flow of the fuel mixture and products of combustion is preferably of certain dimensions. If there is a substantial departure from these dimensions, oxidation of the igniter wire coil takes place quite rapidly with a resultant early failure of the igniter. Some of the factors which have been found appreciably to affect the useful life of the igniter relate to the gauge of the wire, the diameter of the coil, the

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spacing of the turns of the coil, the emissivity of the coil due to the character of its surface finish, the surface finish of the shell surrounding the coil, the distance of this shell from the coil, as well as the composition of the alloy of which the resistance wire is made. These factors have been found to be so critical in the design of a low voltage (6 volt) igniter that it was deemed advisable, in the construction of an igniter for a 24 volt source, to utilize an ignition coil of the dimensions found to be practical, and to provide a ballast coil for obtaining the desired 18 volt potential drop necessary to the application of a 6 volt potential to the ignition portion of the coil. However, igniters employing such ballast coil exposed to the flow of fuel mixture and products of combustion, rapidly became covered with carbon, as previously described, with the result that these igniters failed after unsatisfactorily short periods of use.

It is thus an object of the invention to provide an improved electrical igniter having a ballast coil to secure the necessary voltage upon the ignition coil, in which access of fuel vapor and products of combustion to the wire of the ballast coil is substantially prevented, with the result that the ballast coil maintains a generally uniform overall resistance throughout the life of the igniter and the igniter coil therefore has the voltage for which the coil was designed, impressed thereon throughout the life of the igniter.

A further object is to provide an improved igniter structure including a shell, in which is located a ballast coil as well as the igniter coil.

A further object is to provide an improved igniter for operation at relatively high voltages, which is small and compact.

A further object is to provide an igniter structure employing an igniter coil and a ballast coil in a unitary structure, in which the heat generated in the ballast coil is effectively utilizable for the vaporization of fuel.

A further object is to provide an improved igniter structure which may be quickly and easily assembled, which will have a long useful life, and which may be operated at relatively high impressed voltages.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a complete igniter, shown to a somewhat enlarged scale;

Fig. 2 is a central longitudinal sectional view of the igniter, shown to a greatly enlarged scale; and

Fig. 3 is a transverse sectional view thereof, taken on the line 3—3 of Fig. 2.

As best illustrated in Fig. 2, the igniter comprises a shell 10 having an elongated hollow cy-

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lindrical skirt portion 12. The shell 10 is provided with a threaded section 14 by which the igniter is secured to the burner, with the skirt portion 12 projecting into the combustion chamber, or a passageway communicating with the combustion chamber. The shell also has a hexagonal portion 16 for engagement by a wrench, and its head is provided with a noncircular opening 18 for the reception of a complementally shaped insulating bushing 22 through which a terminal stud 24 projects. This stud has a shank portion 26 which may be square or of any other suitable noncircular shape, and fits into the similarly shaped opening formed in the bushing 22. The stud 24 has a head 28 which may be formed integrally therewith, the stud preferably being formed by a heading operation. The head 28 and shank 26 have a centrally drilled hole 30 for the reception of the end of a resistance wire 32, which is mounted upon a form 34 having a helical groove upon its external surface for the reception of the wire 32. The portion of the wire 32 which is wound upon the form 34 will hereinafter be referred to as the ballast coil 36.

The wire 32 passes through a radial slot 38 formed in the form 34 and continues as a smaller diameter coil 40, hereinafter termed the igniter coil.

The form 34 is made of a suitable electrical insulating and heat resistant ceramic, such as Isolantite, and has a bore 44 extending therethrough, this bore engaging a short projection 46 on the head 28, thus locating its inner end centrally of the shell 10. After the form 34, with the wire 32 wound therearound, has thus been inserted in the shell 10, the space surrounding the ballast coil 36 is filled with a powdered Alundum cement 48 (preferably type RA-305). After the cement has thus been filled in these spaces, the igniter is tapped so as to compact the powdered cement, and a loose fitting retaining sleeve 50 is dropped into the end of the shell skirt 12, this sleeve having a shoulder 52 engaging the end of the form 34 so as to locate and hold the latter in position. After the sleeve 50 is in place, the radially extending end portion 56 of the wire 32 is brazed to the end of the skirt portion 12, so as to establish a good electrical contact and limit the movement of the sleeve 50 in the skirt 12. The sleeve 50 has a suitable notch 58 through which the end portion 56 of the wire projects.

A ground wire 62 projects into a suitable drilled hole 64 formed in the hexagonal portion 16 of the shell and is secured therein by a swaging operation. The stud 24 is insulated from the shell 10, not only by the bushing 22 heretofore described, but also by suitable insulating washers 64 and 66. A nut 68 and metal washer 69 are provided for clamping the stud 24 in position. The stud 24 forms the binding post for the attachment of one of the conductors leading to the source of electrical energy, the other terminal of the source being grounded and thus connected to the ground wire 62.

After the igniter has been assembled in the manner described, electrical connections to a source of electrical energy at a potential of 22 volts is effected between the wire 62 and the terminal stud 24, and the igniter thus electrically heated for a period of approximately 45 minutes. The resultant heat causes the Alundum cementitious material to coalesce and form a rigid mass, filling the space between the bore of the shell 10 and the outer surface of the ballast coil 36 and

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its form 34. Thereafter the voltage is increased to 25 volts for approximately fifteen minutes, after which the voltage is further increased to 28 volts for approximately two minutes. With the parts still hot from these firing operations, the nut 68 is tightened.

The resultant igniter structure is found to be substantially impervious to the flow of air through it since the cementitious material forms a seal between the skirt portion 12, the wire 32, and the form 34. Since the portion of the wire 32 forming the ballast coil 36 is thus sealed against the corrosive influences of the products of combustion and the atmosphere, this ballast coil will not deteriorate during long periods of use, and it will be only the igniter coil 40 which will be subject to oxidation and to a deposit of soot thereon. However, this coil 40 will have a voltage of 6 volts impressed across it when the igniter is connected to a 24 volt source and the size of the wire, the spacing and diameter of the turns, is such that such soot deposits do not present a serious problem.

The inner cylindrical surface of the retaining sleeve 50 is spaced sufficiently from the turns of the igniter coil 40 that the latter is not locally overheated by heat reflected from the surface of the sleeve to the coil. The igniter coil 40 is of sufficiently large gauge wire and its turns of sufficiently small diameter that it presents a non-sagging, rigid element which will retain its form even though subjected to severe shock and vibration when heated to incandescence. It may thus be used in aircraft heaters where shock and vibration forces may be quite severe.

While a large proportion of the heat generated by the current flow through the ballast coil 36 is not permitted to be conducted from this coil, due to the heat insulating effect of the cementitious material 48, sufficient heat may be conducted through this material to heat that portion of the shell 12 which surrounds the ballast coil. Because of the lack of possibility of free radiation of heat from the ballast coil 36, this coil may operate at a slightly higher temperature than the igniter coil 40, but since the ballast coil is hermetically sealed, its high temperature does not influence its useful life. The relative resistances of the ballast coil 36 and the igniter coil 40 are such that when subjected to a voltage source of 24 volts for a short period of time, the voltage division between the two coils will be such that the voltage across the igniter coil 40 will be substantially 6 volts.

In using the igniter, the igniter coil 40, being open to the air, will, upon being supplied with energizing current, evaporate the gasoline before a temperature is attained at which carbonization of the gasoline will take place. Any gasoline which may have penetrated the ceramic material will likewise be vaporized, although at a slower rate. As a result neither the igniter coil 40 nor the ballast coil 36 will accumulate carbon deposits and the useful life of the igniter is materially extended.

While a preferred embodiment of the invention has been shown and described, it will be apparent that numerous variations and modifications thereof may be made without departing from the underlying principles of the invention. It is therefore desired, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of the invention may be obtained.

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through the use of substantially the same or equivalent means.

The invention claimed is:

1. An igniter for the ignition of gaseous and liquid fuels adapted for operation from the relatively high potential source of electrical energy comprising a coil at least half of which constitutes a ballast coil and the remaining portion of which constitutes an igniter coil, a casing to contain said ballast coil, a refractory ceramic material mounting the ballast coil within the casing out of contact therewith, said material completely enveloping said ballast coil to exclude said coil from atmospheric exposure, the free extremity of said igniter coil being connected to said casing, and means for effecting electrical connection with the free end of said ballast coil and said casing, said igniter coil being freely suspended and supported by its connections to said casing and said ballast coil.

2. An igniter as set forth in claim 1 wherein said casing includes means for mounting said igniter within an ignition chamber such that a substantial portion of said ballast coil lies within said chamber.

3. An igniter for the ignition of gaseous and liquid fuels adapted for operation from a relatively high potential source of electrical energy comprising a connected ballast coil and an igniter

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coil, a casing to contain said coils, a refractory ceramic material filling the portion of said casing containing the ballast coil, said material completely enveloping said ballast coil to exclude that coil from atmospheric exposure, the free extremity of said igniter coil being connected to said casing, and means for effecting electrical connection with the free end of said ballast coil and said casing, said igniter coil being freely suspended and supported by the connections to said casing and said ballast coil.

THELMA MCCOLLUM,

*Executrix of the Last Will and Testament of
Henry J. De N. McCollum, Deceased.*

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