July 21, 1959 H. SPITTLER 2,896,120

IGNITION NOISE SUPPRESSOR

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FIG. 1

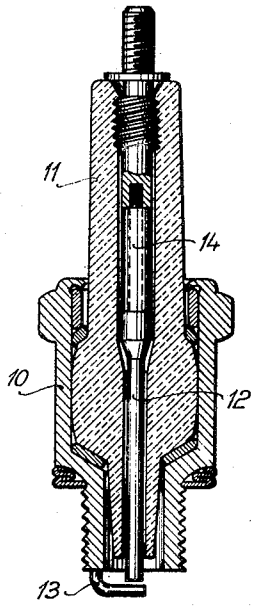
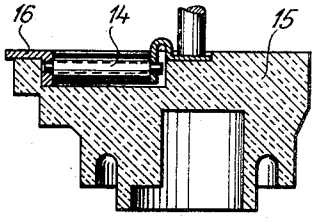


FIG. 2



INVENTOR
Heinrich Spittler
by Michael S. Striker
agt.

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IGNITION NOISE SUPPRESSOR

Heinrich Spittler, Hohenacker, Kreis Waiblingen, Germany, assignor to Robert Bosch G.m.b.H., Stuttgart, Germany

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10 Claims. (Cl. 315—85)

The present invention relates to a structure for supressing ignition noises in wireless equipment.

At the present time such ignition noises are suppressed by damping the interference waves with a high ohm resistor which operates aperiodically or by conducting the interference waves away with condensers. However, such conventional suppression of ignition noise is very expensive and does not operate in a fully satisfactory manner. The conventional means for suppressing ignition noise places an undesirably large load on the electrical installation with the result that at least a part of the latter must be made larger and stronger in order to take care of the larger load.

One of the objects of the present invention is to overcome the above drawbacks with a structure which is far less expensive and far simpler than the conventional structures and which also operates in a fully satisfactory manner.

Another object of the present invention is to provide a device capable of accomplishing the above objects and having such dimensions that the conventional structures which carry the device of the invention need not be basically changed from their conventional form.

With the above objects in view the present invention mainly consists of an apparatus for suppressing ignition noise in wireless equipment, this apparatus including an electrical source of interference and electrical conductors respectively leading to and from the source of interference. A ferrite tube surrounds one of these conductors so that the latter passes through the ferrite tube, and the latter tube cooperates with the conductor to act principally as a resistance at relatively high frequencies.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a sectional elevational view of the device of the invention incorporated into a sparkplug; and

Fig. 2 is a sectional elevational view of the device of the invention incorporated into a distributor of an internal combustion engine.

The present invention is based upon the discovery that ferrite has properties which enable it to suppress ignition noises. As is well known, ferrite is composed for the most part of a crystalline mixture or union of iron oxide and oxides of other metals, such as for example, manganese, nickel, and zinc, as well as others. A mixture of these oxides which is in the form of a powder can be pressed into any desired shape such as that of a tube. The pressed members are sintered at temperatures of approximately 1300° C., and in this way they become hard and brittle and can only be worked either by grinding or polishing.

Coils having ferrite cores have a complex permeability

which can be split up into an inductive permeability and a real resistive permeability. Both of these components are dependent upon the frequency, and the real resistive permeability component predominates at high frequencies such as, for example, frequencies greater than 1 megacycle. The absolute values of the inductance and resistance of the ferrite assembly can be controlled by varying the additions to the iron oxide.

Ferrite has proved to be particularly suitable for suppressing ignition noise in devices for wirelessly transmitting electrical signals or pictures at the above relatively high frequency range. On the other hand, ferrite does not damp the lower frequencies used, for example, for the ignition spark of a sparkplug of an internal combustion engine.

The sparkplug which is shown in Fig. 1 includes a housing **10** which is insulated from the center electrode **12** of the sparkplug by the body **11** of ceramic insulating material. The ignition spark jumps from the center electrode **12** to an electrode **13** which is a ground electrode and which is fixed to the housing **10**. A relatively small ferrite tube **14** is placed on a section of the center electrode **12** located within the insulating body **11**, so that the electrode **12** passes through the tube **14**. This tube **14** may, for example, have a length of 15 mm., an inner diameter of 1.6 mm., and an outer diameter of 3.6 mm., and this arrangement provides a resistance of between 50 and 5000 ohms at frequencies which are greater than the ferromagnetic resonance frequency (greater than 1 megacycle).

In the example illustrated in Fig. 2, a ferrite tube **14** of similar properties is incorporated into the rotor **15** of the distributor of an internal combustion engine. The rotor includes a contact member **16** which is adapted to successively engage the points of the distributor, and the contact member **16** is electrically connected with a high voltage conductor on which the tube **14** is placed so that this conductor extends through the tube. It will be noted that the ferrite tube **14** is located close to the contact member **16**.

A particular advantage of the present invention resides in the fact that the size of the ferrite tube does not necessitate basic changes in the form of the ignition assemblies into which it is incorporated.

The uses of the ferrite tube are, of course, not limited to the above described examples. It may be of advantage, for example, to place the ferrite tube on a high voltage conductor leading to or from a distributor in close proximity to the spark gap. Such an arrangement is of particular advantage when, for example, a sparkplug with a built in ferrite tube according to Fig. 1 or a distributor rotor with a ferrite tube according to Fig. 2 are not available.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of ignition noise suppressors differing from the types described above.

While the invention has been illustrated and described as embodied in ignition noise suppressors for high frequency electrical signal equipment, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are in-

tended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for suppressing ignition noise in wireless equipment, comprising, in combination, an electrical source of interference; electrical conductors respectively leading to and from said source; and a ferrite tube of predetermined composition through which one of said conductors passes, said composition of said tube providing a real resistance at high frequencies through the cooperation of said tube with said conductor.

2. Apparatus for suppressing ignition noise in wireless equipment, comprising, in combination, an electrical source of interference; electrical conductors respectively leading to and from said source; and a ferrite tube of predetermined composition through which one of said conductors passes, said composition of said tube providing a real resistance at relatively high frequencies through the cooperation of said tube with said conductor.

3. Apparatus for suppressing ignition noise in wireless equipment, comprising, in combination, a spark plug having a center electrode; and a ferrite tube of predetermined composition through which said electrode extends said composition of said tube providing a real resistance at high frequencies through the cooperation of said tube with said electrode.

4. Apparatus for suppressing ignition noise in wireless equipment, comprising, in combination, a distributor for an internal combustion engine, said distributor including a rotor having a contact member adapted to successively engage the distributor points and a high voltage conductor connected to said contact member; and a ferrite tube of predetermined composition located adjacent said contact member and through which said conductor passes said composition of said tube providing a real resistance at high frequencies through the cooperation of said tube with said conductor.

5. Apparatus for suppressing ignition noise in wireless equipment, comprising, in combination, a distributor for an internal combustion engine, said distributor including a rotor having a contact member adapted to successively engage the distributor points and a high voltage conductor connected to said contact member; and a ferrite tube of predetermined composition located adjacent said contact member, said composition of said tube providing a real resistance at high frequencies through the cooperation of said tube with said conductor.

6. In an internal combustion engine, in combination, an ignition system having a high voltage conductor; at least a pair of electrically conductive portions which are spaced from each other at least part of the time during the operation of the engine and between which electricity is conducted at least part of the time during the operation of the engine, said electrically conductive portions being located adjacent said conductor; and a ferrite tube located in the vicinity of said electrically conductive portions and through which said conductor passes, said tube having a composition which provides a real resistance at high frequency by cooperation of said tube with said conductor.

7. In an internal combustion engine, a device as recited in claim 6, said pair of electrically conductive portions having a pair of spaced spark plug electrodes defining the spark gap between themselves.

8. In an internal combustion engine, a device as recited in claim 6, one portion of said pair of electrically conductive portions being a stationary distributor point and the other electrically conductive portion being the movable point of the distributor.

9. Apparatus for suppressing radio noise, comprising, in combination, a spark source of radio noise; an elongated conductor connected at one end to said spark source and conveying current when sparking occurs; and a tubular ferrite element through which said conductor extends at only a portion of said conductor which is adjacent to said end thereof.

10. Apparatus for suppressing propagation of radio noise from a spark source of radio noise, said apparatus comprising, in combination, an elongated conductor adapted to be connected at one end to the spark source and adapted to convey current during sparking of the spark source; and a tubular ferrite element through which said conductor extends at only a portion of the conductor which is adjacent to said end thereof.

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