Oct. 25, 1949. R. K. CHRISTIE 2,485,699

SHIELDED SPARK PLUG

Filed Nov. 22, 1946

FIG-1-

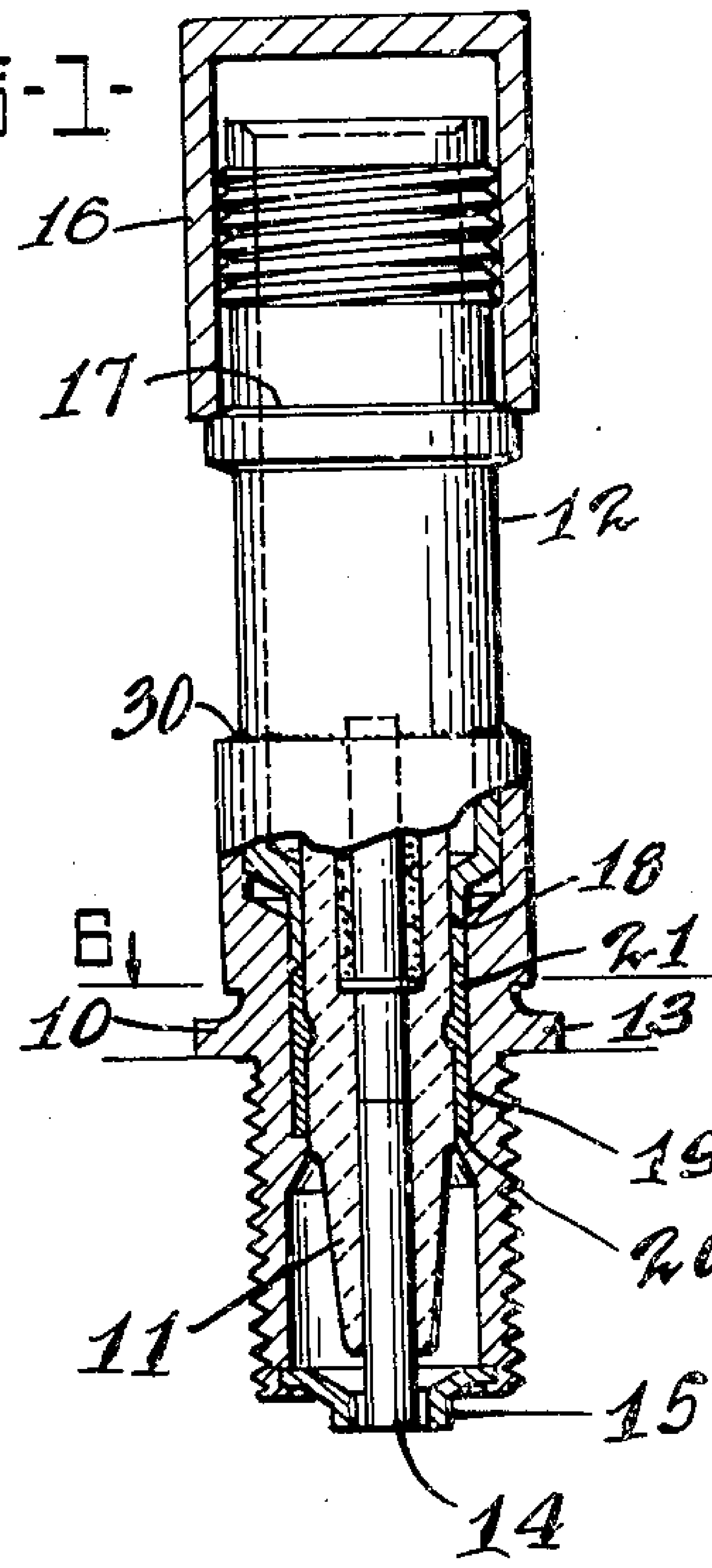
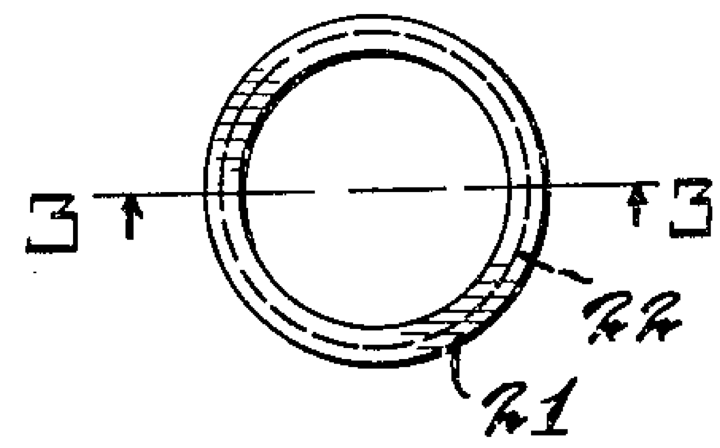


FIG-2-



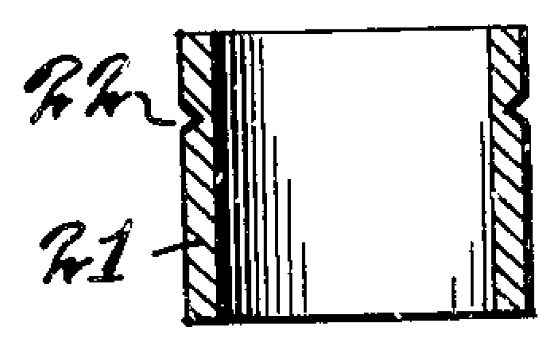


FIG-3-

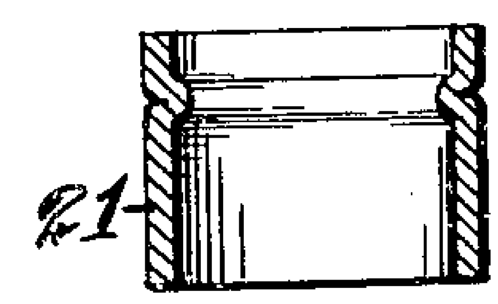


FIG-4-

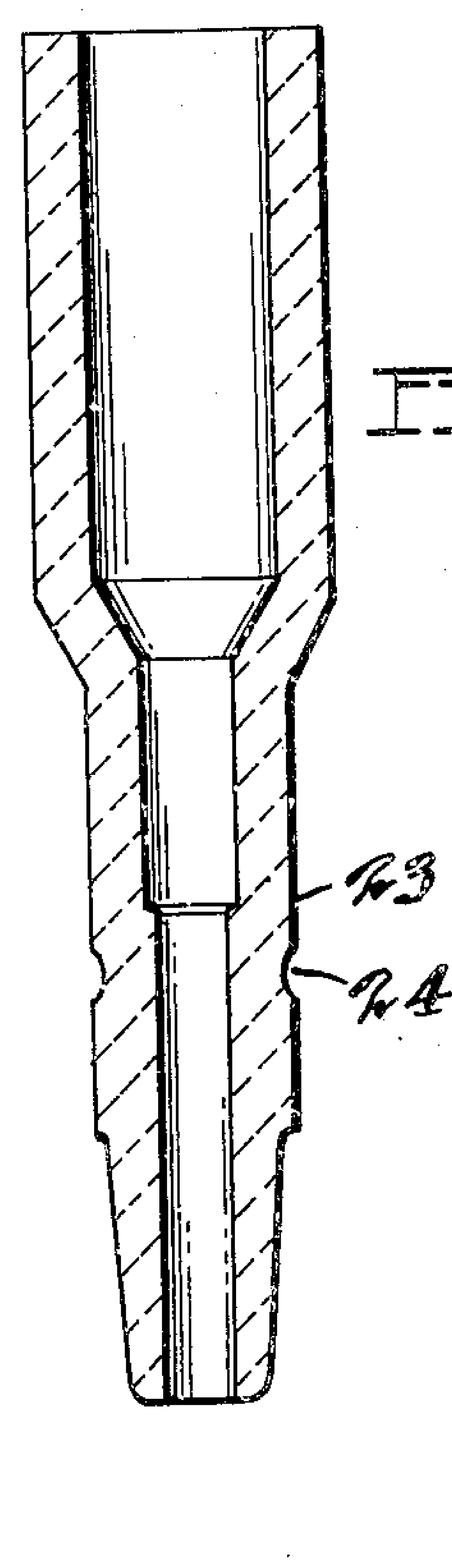


FIG-5-

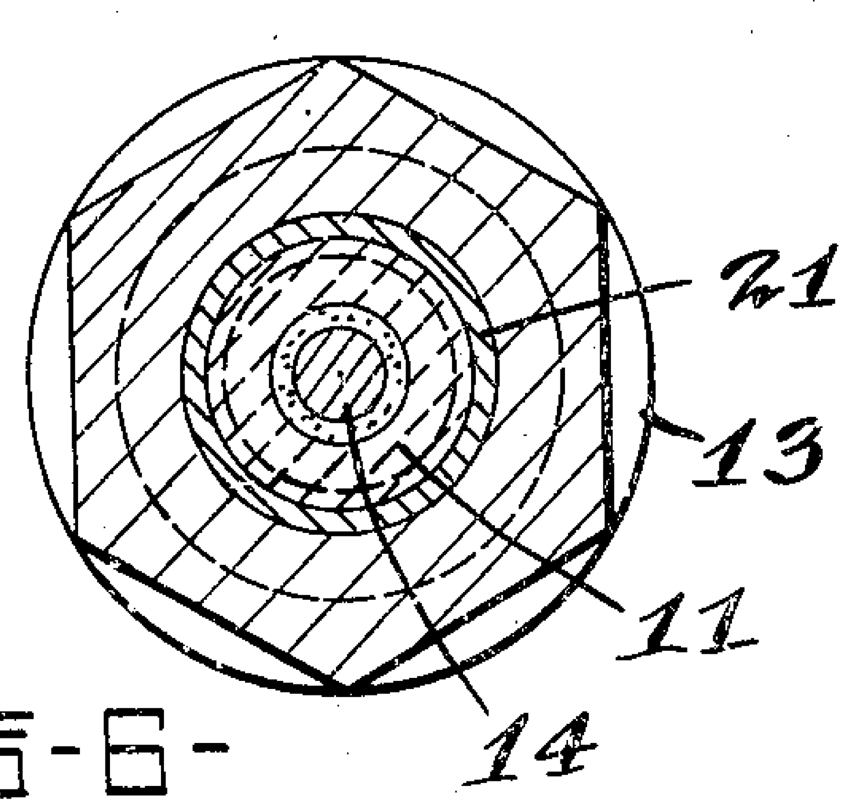


FIG-6-

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Patented Oct. 25, 1949

2,485,699

UNITED STATES PATENT OFFICE

2,485,699

SHIELDED SPARK PLUG

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Application November 22, 1946, Serial No. 711,497

2 Claims. (Cl. 123—169)

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This invention relates to a shielded spark plug of the type used in aircraft and is particularly directed to a manner of assembling the component parts of such a spark plug.

It has heretofore been proposed to use a sleeve of malleable metal, either formed in situ or separately introduced and compressed, as a sealing and holding medium between the core and shell of a spark plug. The bond formed by such a sleeve is quite satisfactory in use and because of its high thermal conductivity has proved useful in installations where it is important that heat pass rapidly away from the core into the shell.

At high altitudes the tendency for a radio shielded spark plug to fail is increased because of the formation of corona within the upper portion of the barrel to the extent that an electrically conductive path is formed between a part at high potential and some other plug part that is at a lower potential. To overcome this tendency to flash-over, many expedients have been tried including attempts to occlude air from the barrel by completely filling this space with some flexible and deformable insulating substance such as a silicone resin. While the introduction of such material successfully prevents the ionization of a complete discharge path it poses other problems. For example, the thermal expansion of the confined resin body is so great that pressures exceeding 9000 pounds per square inch may be developed which are more than sufficient to unseat a core held by a metal sleeve seal.

It is the primary object of the present invention to provide a shielded spark plug in which the core is held in place so firmly that it cannot be unseated by any pressure likely to be encountered in practice.

Another object of the invention is to provide a shielded spark plug in which the parts are assembled under pressure.

Other objects and advantages of the invention will become apparent from the following specification, reference being had to the accompanying drawings in which:

Figure 1 is a side elevation, with parts in section, of a spark plug embodying the present invention, the parts being shown during assembly; Fig. 2 is a top view of a locking sleeve; Fig. 3 is a section on line 3—3 of Fig. 2; Fig. 4 is a view similar to Fig. 3 showing the sleeve in its compressed form; and Fig. 5 is a central vertical section of a spark plug insulator, and Fig. 6 is a section on line 6—6 of Fig. 1.

Referring to the drawings, a spark plug embodying the invention comprises generally a shell

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10 threaded for engagement with an engine cylinder head, a core 11 within the shell and a shield barrel 12 extending upwardly around the upper end of the core to form a recess in which electrical connection to the usual ignition lead is established. The shell 10 is provided with the usual hex portion 13 by which the spark plug is positioned in an engine.

A center electrode 14 is fixed in the center of the core and projects outwardly therefrom to form a spark discharge gap with one or more side electrodes 15.

The shield barrel 12 has, at its top, a threaded area 16 for engagement with an ignition harness, then an integral shoulder 17, next, a portion of uniform diameter, and at its lower end a reduced axial extension 18. The outside diameter of the major portion of the barrel corresponds to the inside diameter of the upper part of the shell 10 so that the two parts fit into close telescoping engagement over a part of the length of the barrel and shell.

The shell 10 is further provided with an intermediate bore 19 the diameter of which corresponds to the outside diameter of the axial extension 18 of the barrel 12. The bore 19 terminates in a shoulder 20 and receives a locking sleeve 21 between the end of extension 18 and the shoulder.

The locking sleeve 21 is preferably made of copper or other malleable metal of high heat conductivity and as shown in Figs. 3 and 4 is initially a uniform cylindrical member having an undercut or groove 22 in one of its surfaces. In the form shown groove 22 is in the outside surface of the ring.

The insulator or core 11 may be of any suitable form at its upper and lower ends, but intermediate the ends is provided with a substantially cylindrical portion 23 in which is formed a groove 24. The groove is preferably of parti-circular cross section, but is at least curved so that it forms no sharp shoulders against which expanding metal may bear to stress the core in tension.

In assembling the parts the core 11 is slipped into the barrel 12 and the locking ring 22 dropped into the bore 19 of the shell. The barrel and core are then inserted the proper distance so that the center electrode 14 properly coincides with the side electrodes. The parts are then put into a press one element of which may conveniently bear against the under side of the hex portion 13 and the opposite element of which places a closing force on shoulder 17 as indicated in Fig. 1. It will be seen that as the press is closed, all of the force is exerted by the axial extension 18 of the barrel 12 to compress the locking sleeve 21 against shoulder 20. Being of a malleable metal the sleeve 21 is deformed and flows into groove 24. This action is facilitated by groove 22 in the locking sleeve since this latter groove is initially opposite the groove in the core and deformation of the locking sleeve will start at this point of smallest section.

The core is now held firmly in place with relation to the locking ring. While the press is still closed or after the operation has been transferred to another press and the parts are under pressure, the assembly is completed by brazing or otherwise uniting the barrel 12 and the shell 10. The braze is indicated at 30 in Fig. 1. It will be seen that, in effect, the plunger used to compress the locking ring remains in place as a part of the assembly and is not withdrawn as is the usual practice.

As previously stated, the groove 24 is made rounded so that the metal with which it is filled does not exert a direct tensile stress on the core when it expands under heat. The metal has a much greater rate of thermal expansion than does the core. The material of which cores of this type are ordinarily fabricated is relatively weak in tension but very strong in compression. It will be apparent that forces tending to move the core axially in either direction with respect to the shell put the core in compression. Cores locked in this manner have been found to resist pressures in the order of 12,000 pounds per square inch in the barrel, being about the limit of bursting strength of the barrel, without appreciable unseating.

The present invention thus provides a spark plug assembly which is readily accomplished, strong in resistance to displacement of the parts

and yet unlikely to be destroyed by heating and cooling cycles in use. While the invention has been described in conjunction with a specific form and disposition of the parts, it should be expressly understood that it is capable of numerous modifications and changes without departing from the spirit of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. In a spark plug of the type described, a shell having an internal shoulder, a core received in said shell and having a circumferential groove, a locking sleeve for uniting said shell and core comprising an initially substantially cylindrical body of malleable metal seated on said shoulder and having a circumferential weakening groove in one of its surfaces adjacent the groove in said core, and means actuated by external pressure to deform said locking ring in such a manner that the shell and core are functionally united and a portion of the metal of the ring flows into the groove in said core.

2. A spark plug as defined in claim 1 in which the circumferential groove in said core is so rounded in cross section that thermal expansion of the locking sleeve material does not set up tensile stresses in the core material.

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