July 15, 1952 T. G. McDOUGAL ET AL 2,603,045

SPARK PLUG CLEANER

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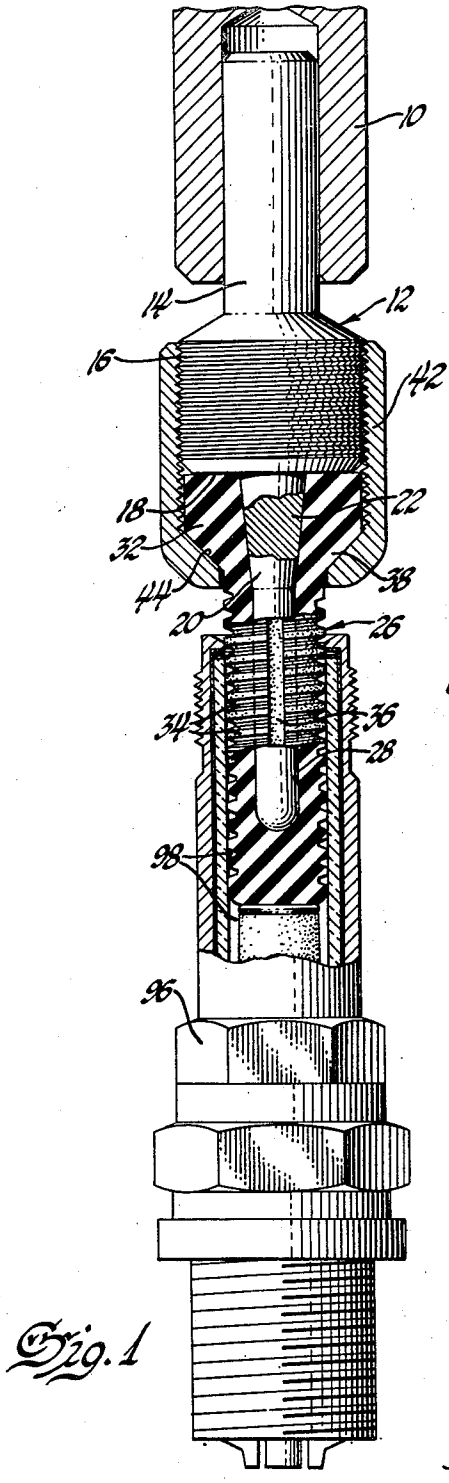


Fig. 1

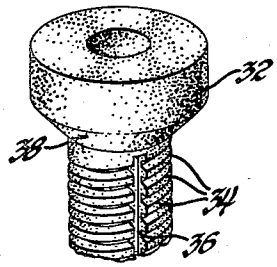


Fig. 2

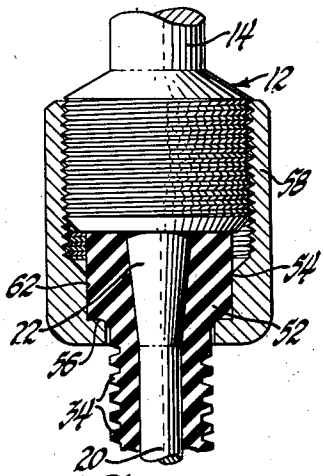


Fig. 3

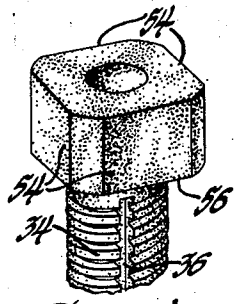


Fig. 4

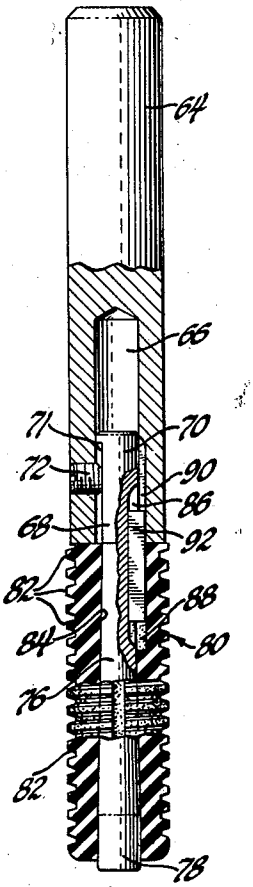


Fig. 5

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SPARK PLUG CLEANER

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12 Claims. (Cl. 51—190)

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This invention relates to a cleaning and polishing tool used in conjunction with an abrasive, and especially a cleaning tool for the terminal well of aircraft spark plugs.

This cleaning tool consists of a cylindrical rubber body with helical threads or grooves on the external surface and internal supporting and clamping means to rotate the tool. The internal surface of the well of the spark plugs is cleaned by employing an abrasive paste or suspension between the said surface and the rotating tool and causing the abrasive to move between the tool and the work to clean or polish the work.

The object of this invention is to provide a rotary cleaning and polishing tool formed with rubber and having helical threads to distribute an abrasive cleaning or polishing compound.

Another object of this invention is to provide a cylindrical rubber cleaning and polishing tool having a central support and securing member for rotatably driving the tool and for expanding the tool.

Another object of the invention is to provide a support for rotatably driving the rubber cleaning tool and holding the tool so that it may be conveniently replaced when worn.

These and other objects will be apparent from the following drawings and specifications.

Figure 1 is an elevation in partial cross section of the cleaning tool positioned on a drive shaft and in a spark plug well.

Figure 2 shows a partial perspective view of the rubber cleaning tool.

Figure 3 is a partial view of a modified cleaning tool.

Figure 4 is a partial perspective view showing the shank of the modified cleaning tool.

Figure 5 is a view in partial section of a modification having attaching means such as a chuck or sleeve.

This cleaning tool is rotatably driven by attaching it to a driven shaft. The attaching means may be a chuck or sleeve, or a bore in the end of the shaft 10 with a set-screw or keyway (not shown) to secure the tool therein. The tool consists of a main supporting element 12 having a stem portion 14 fitting into the bore for securing it to the shaft, and a central enlarged coaxial cylindrical portion 16. The surface of the cylindrical portion 16 is threaded, and the front face has a flat annular portion 18 to provide support for the rubber portion of the tool. A supporting core 20, coaxial with the cylindrical portion and extending from the center of the annular face 18 extends partially

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through the rubber cleaning tool. The supporting core has a frustro-conical portion 22 adjacent the face 18 and a cylindrical end portion. The rubber cleaning tool 26 has a central bore 28 with a frustro-conical portion and a cylindrical portion complementary to the core 20, and is fitted over the core with the enlarged shank portion 32 abutting against the face 18.

The main portion of the cylindrical cleaning tool 26 has a helical thread 34 formed therein to distribute the abrasive, and one or more axial grooves 36 extending the full length of the threaded portion of the cleaning tool to allow the air to escape when the tool is inserted in a spark plug well 98. The enlarged shank portion of the cleaning tool has a cylindrical section and a tapered or frustro-conical section 38 to provide an anchorage.

The cleaning tool 26 is held and clamped on the support by means of a cylindrical clamping sleeve 42, which is threaded on the enlarged cylindrical portion 16 of the support. The clamping sleeve has an internal tapered surface 44 at one end, which is complementary to the tapered surface 38 on the cleaning tool. After the cleaning tool 26 is positioned on the support 12, the sleeve 42 is positioned on the tool and threaded on the support. The sleeve engages the tapered and cylindrical sections of the shank 32 to compress and hold the shank against the frustro-conical portion 22.

In a modified form of the invention a similar supporting member 12 is employed having a shank 14 and a core 20. The cleaning tool 26 is similarly threaded throughout the cylindrical portion, but the shank 52 has flat sides 54 and a flat front face 56. The modified clamping sleeve 58 is threaded to secure it to the enlarged cylindrical portion of the support and has a square cavity 62 at the forward end with flat side walls and a flat front wall complementary to the squared end of the shank 52.

The spark plug 96 having a well 98 is the type generally employed on aircraft. Following a certain period of service it has been found that an adherent deposit forms on the interior surface of the well 98. In order to remove this deposit it has been found necessary to employ a cleaning process similar in some respects to a polishing or lapping operation, while at the same time applying a solvent to loosen the organic bond of the deposit and to aid in removing any oily or greasy constituents. The rubber cleaning tool, which is about the same diameter as the internal diameter of the spark plug well, is coated with cleaning compound and inserted in the spark plug well.

The cleaning tool is then rotated to clean deposit from the interior of the spark plug by the abrading action of the cleaning compound. The rotary action of the tool and the helical threads continuously move the cleaning compound over the surfaces.

The other type of cleaning tool illustrated in Figure 5 is expandable in order to adjust the diameter of the tool for wear. The tool has a cylindrical stem **64**, which is attached in any suitable manner to a rotating shaft to drive or rotate the tool. A bore **66** in the outer end of the stem slidably receives a tapered support **68** having a full sized cylindrical portion **70** which slidably fits in the bore **66** without play. A flat **71** is provided on the portion **70**. The support is secured in any set position by the set-screw **72** engaging the flat **71**. The support **68** has the inner end section **70** of uniform diameter, a tapered center section **76** and an outer section **78** of uniform diameter the same as section **70**. A cylindrical rubber tool **60** with similar helical threads **82** and a longitudinal groove similar to groove **36** has a central bore **84** with a tapered section and a cylindrical section similar to the tapered section **76** and the outer section **78** of the support. Complementary keyways **86** in the support, **88** in the rubber tool and **90** in the stem **64** provide a seat for key **92**, which prevents rotation of the rubber tool relative to the support.

This expandable tool is used to clean or polish an internal bore in the same manner as the above described tools. However, when the rubber wears due to the abrasive action, the rubber element may be expanded to its former diameter by loosening the set-screw **72** and moving or driving the support **68** inward. The coaction of the complementary tapered surface on the support and the tapered surface on the inside of the rubber tool will expand the tool. It will be appreciated that the tapered surfaces may extend for the full length of the rubber tool.

The cleaning compound is made of a fine abrasive material and a good solvent for the organic binders of the deposits together with a material to maintain the abrasive in suspension in the solvent constituent. It is preferred to use sufficient abrasive and suspending medium to form a thick paste which facilitates application to the rubber tool. Though the composition of the cleaning compound may be varied, we have successfully used a composition having by weight 52% of a powdered feldspar and 6% of 9% water suspension of bentonite and 42% of diethylene glycol monobutyl ether. A suitable cleaning compound may be made having the following ingredients within the specified ranges of percentages:

Bentonite	0.25 to 2.0
Water	2.8 to 23.0
Feldspar	40.0 to 65.0
Solvent	Balance

Though polyglycols and their mono or diethers are preferred due to their water solubility, other solvents, such as naphtha, benzene, carbon tetrachloride and chloroform, may be used.

The feldspar preferably should have a particle size as defined below:

	Per cent
0 to 5 microns	25 to 30
5 to 10 microns	22 to 25
10 to 20 microns	24 to 32
20 to 40 microns	18 to 22
Over 40 microns	0.5 to 1.5

A medium firm rubber compound, which preferably has a hardness of 50 to 70 on the Shore durometer is compounded to resist softening by the solvent content of the cleaning compound.

Though certain specific embodiments of the invention have been shown for the purpose of illustration, the invention is capable of various modifications within the scope of the claims.

We claim:

1. A tool having a stem member for connecting to a driven shaft, said stem having a threaded enlarged portion, a support portion fixed to and projecting axially from said enlarged portion, said enlarged portion providing an annular seat surrounding said support, a rubber member having an axial bore fitting over said support portion and a shank portion abutting said annular portion of said enlarged portion, a screw threaded ferrule positioned over said rubber member and threaded on said threaded enlarged portion to clamp the shank portion of the rubber member against the enlarged portion of the stem.

2. The invention defined by claim 1, said shank portion having a partial conical portion, and said ferrule having a complementary internal conical portion.

3. The invention defined by claim 1, said shank portion having a non-round section and said ferrule having a complementary internal opening.

4. A tool having a stem with a bore in one end, a support adjustably slidably mounted in said bore and having a tapered portion projecting from said stem, a round rubber member having a similarly tapered bore positioned on said support, so that axial movement of said support will expand said rubber element, a key in said support and rubber member to prevent relative rotation.

5. In a tool for applying an abrasive cleaning and polishing compound, a cylindrical rubber member, means to rotate said member about an axis, said member having a helical groove in the surface about said axis to distribute the abrasive compound over the work surface, and an axial groove to allow air to escape when the tool is inserted in a bore and to assist in distributing the abrasive compound.

6. In a cleaning tool for applying an abrasive cleaning and polishing compound, a stem having a bore and an end face surrounding said bore, a cylindrical rubber cleaning element having a central bore, a supporting element adjustably secured in said bore in the stem and having a portion positioned in said bore in said rubber element, cooperating tapered portions on said support and said rubber element to expand said rubber element, said rubber element having an end face engaging the end face of the stem, and an angular groove on said cylindrical rubber cleaning element to distribute the abrasive compound over the work surface.

7. In a tool having a stem member for connecting the tool to a driven shaft, said stem having a threaded enlarged portion, a thinner support portion fixed to and projecting axially from said enlarged portion, said enlarged portion providing an annular seat surrounding said support, a rubber member having an axial bore fitting over said support portion and a shank portion abutting said annular seat of said enlarged portion, and a screw threaded ferrule positioned over said rubber member and threaded on said threaded enlarged portion to clamp the shank

portion of the rubber member against said annular seat of the stem.

8. In a tool having a stem member for connecting the tool to a driven shaft, said stem having a threaded enlarged portion, a thinner support portion fixed to and projecting axially from said enlarged portion, said enlarged portion providing an annular seat surrounding said support, a rubber member having an axial bore fitting over said support portion, a thin working portion and a thicker shank portion abutting said annular seat of said enlarged portion, and a screw threaded ferrule positioned over said rubber member and threaded on said threaded enlarged portion to clamp the shank portion of the rubber member against said annular seat of the stem.

9. In a tool having a stem member for connecting the tool to a driven shaft, said stem having a threaded enlarged portion, a thinner support portion fixed to and projecting axially from said enlarged portion, said enlarged portion providing an annular seat surrounding said support, a rubber member having an axial bore fitting over said support portion, a thin cylindrical portion coaxial with said bore and a thicker shank portion abutting said annular seat of said enlarged portion, a shoulder between said cylindrical portion and said shank portion, and a screw threaded ferrule having a flange at one end positioned over said rubber member and threaded on said threaded enlarged portion, said flange on the ferrule engaging said shoulder to clamp the shank portion of the rubber member against said annular seat of the stem.

10. A tool having a stem with a bore in one end, a support slidably mounted in said bore and having a tapered portion projecting from said stem, means to secure said support in adjusted position

on said stem, a rubber member having a similarly tapered bore positioned on said support so that axial movement of said support will expand said rubber element, and means to prevent relative rotation between said support and rubber member.

11. A tool for cleaning and polishing including; a cylindrical resilient rubber compound member, means to rotate said member about an axis, said member having grooves in the surface thereof lying at an oblique angle to said axis to apply an abrasive compound over the work surface, and means to allow air to escape when said tool is inserted in a blind bore.

12. A tool for cleaning and polishing including; a cylindrical resilient rubber compound member, means to rotate said member about an axis, said member having generally helical grooves in the surface thereof to distribute an abrasive compound over the work surface as the tool is rotated to thereby provide substantially equal application of said compound to the entire inner wall of said bore.

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