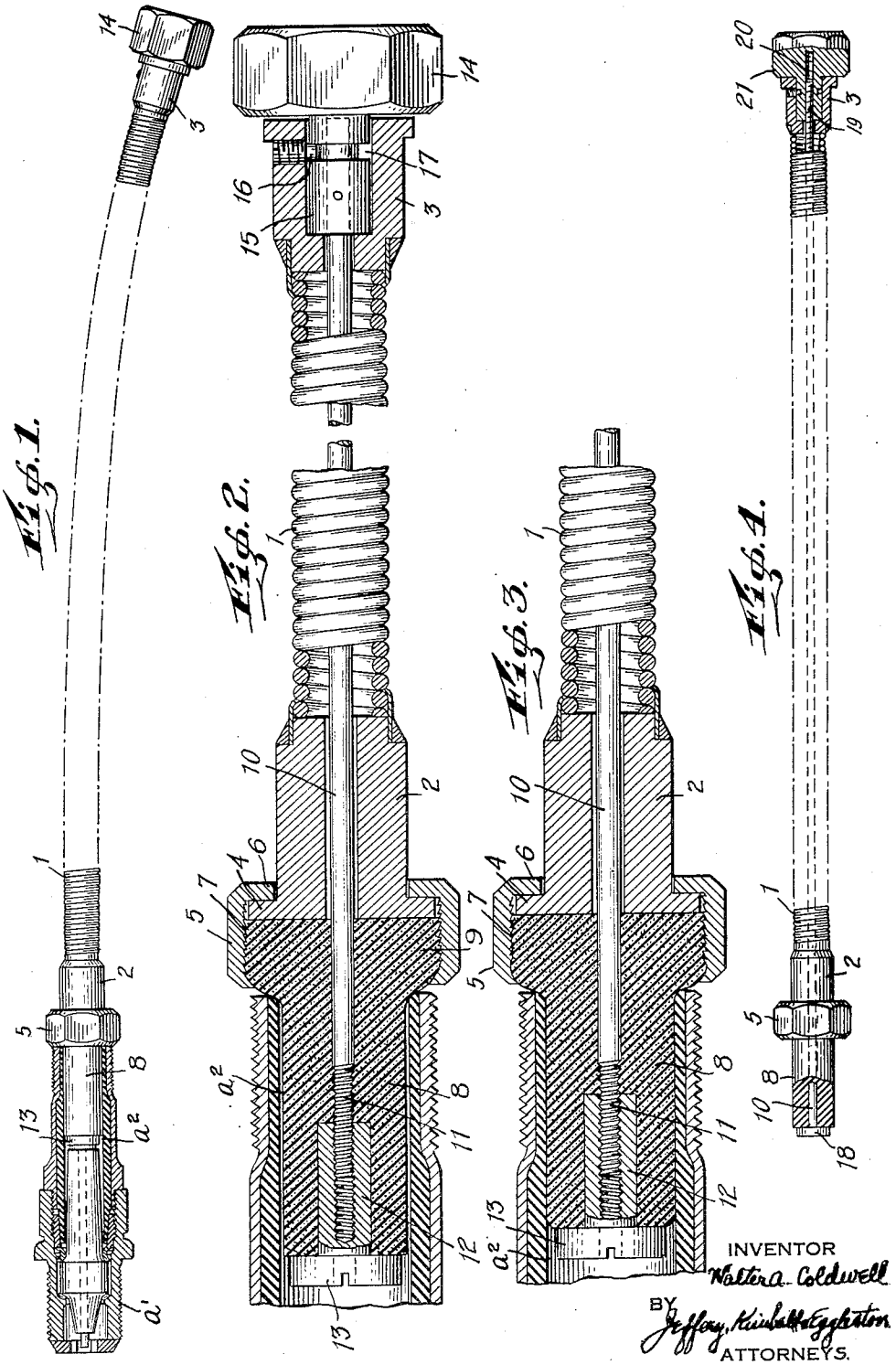
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INTERNAL-GRIP WRENCH HAVING A FLEXIBLE SHANK AND A RESILIENT, COMPRESSIBLE, GRIPPING MEMBER

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INTERNAL-GRIP WRENCH HAVING A FLEXIBLE SHANK AND A RESILIENT, COMPRESSIBLE, GRIPPING MEMBER

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The invention is a tool for releasably holding and manipulating objects, like spark plugs, in aviation engines, to start them in their sockets where access is limited. Owing to the multiplicity of parts in restricted space the locating and starting of spark plugs in such engines has been difficult and time-consuming. The instant tool makes this and comparable operations easy and rapid. It consists of a flexible, that is to say bendable, holder or shank having on its end holding means insertable into a hole in the spark plug or other object and expansible into gripping contact with the inside of the hole. In addition to being bendable the holder or shank is also resilient on flexure, by which is meant that when bent to one side it has a tendency to move or spring back in the opposite direction, or if prevented from doing so, to press in that direction against any obstruction. The object when gripped to the tool in the manner stated can be readily manipulated and inserted into its socket and well started therein by rotation of the tool as a whole. It is then freed from the tool, and tightened in the conventional way.

Referring to the drawings:

Fig. 1 is an elevation of the tool illustrating its application to an aviation engine spark plug of familiar type shown in section at the left of the figure.

Fig. 2 is an enlarged central longitudinal section partly in elevation, the holding means on the end of the tool being shown as inserted freely into the hole in the spark plug and not yet in gripping relation thereto.

Fig. 3 is a central longitudinal section corresponding generally to Fig. 2 but showing only the front end of a tool with the holding means expanded into gripping relation to the wall of the hole, and

Fig. 4 is a sectional elevation on the scale of Fig. 1 showing a modification.

Figs. 1, 2 and 3 show an important and typical use of the tool, viz. its application to an aviation spark plug of known type having its end a^1 screw threaded for reception in its socket and its other end provided with a hole a^2 into which the holding means on the end of the holder is shown as having been inserted.

The tool has a flexible holder or shank shown in the drawings as having a flexible housing and a flexible core housed therein. This housing is constituted by a flexible metal compression tube 1 of spring steel wire coiled spirally, as indicated, or of some other of the various kinds of such tubes on the market, to the ends of which tube

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are brazed respectively sleeves 2 and 3, which complete the housing. The sleeve 2 has a head 4 within the collar 5 and seats against its flange 6. These parts form a socket shown as internally screw threaded at 7 to receive and secure a holding member or gripper 8 which is a resilient and compressible male member, shown as a cylindrical plug of live rubber or elastic rubberlike material whose enlarged base 9 also shown as screw threaded is reinforced as may be necessary for that purpose. It may be vulcanized into the socket. The plug 8 should be oil resistant. As the enlarged base 9 is of greater diameter than the hole a^2, it may seat against the rim of the hole, when the plug 8 is inserted by the tool. Within the housing described above and which is constituted by the parts 1, 2, 3, is located a flexible connecting and operating core, the rod 10 of flexible, resilient material, as spring steel wire. This rod has sufficient stiffness to assist in supporting the tool, and the core and housing, to secure most satisfactory utility, should be sufficiently resilient on flexure to resume its straight shape when not in use. Rod 10 extends into the plug 8 and, in the form shown in Figs. 2 and 3, terminates in a screw threaded tip 11. This tip cooperates with a correspondingly threaded bore, through the stem 12 and head of a follower 13, which is vulcanized into the plug 8. The follower is associated with the resilient and compressible male member and opposes a bearing surface to the resilient and compressible male member. The tip 11 may be a separate threaded piece of metal permanently united to the flexible core. A knob or operating handle 14 is illustrated in Fig. 2 as fast to the other end of the rod 10, with its shank 15 rotatably received in the socket formed by sleeve 3 and held for turning therein by screw pin 16 extending into groove 17, in the shank. The knob or handle 14 may be of any material capable of withstanding the strain of torque and threading. This knob mounted on the other end of the shank from the gripper 8 is a manual gripper actuator being a part of the operative connections therefrom to the gripper which connections include a follower 13 opposing a bearing surface to the resilient and compressible gripper member.

As will be apparent from Figs. 2 and 3, in the construction as there illustrated, right handed rotation of the knob 14 will, owing to the threaded connection, draw the follower 13 which acts as a compression head axially toward the knob, thereby compressing the plug 8 endwise and expanding it radially outward thus causing it to

fit and closely grip the entire surface of the wall of the hole and thereby hold the spark plug or other object firmly. In the manipulating and starting action, the tool, now holding the spark plug, is conveniently held in the right hand of the operator with the end of the shank or housing remote from the spark plug gripped, at or near the sleeve 3, between the thumb and fingers. The exact position will vary with the individual and with the particular job. Where desirable the left hand may of course be used to supplement the right to steady, guide or grasp and hold stationary any accessible part of the housing. The tool with the resilient push of the shank gives active participation in the manipulation and starting of the plug in the socket, as if an assistant were helping the operator hold or move the spark plug where, how and when the operator wished. The tool thus gives greater freedom and exactness of position in manipulating it, and with the aid of the flexible, yielding but somewhat resilient support furnished by the tool, the spark plug can be applied to and started in its socket, which without the tool might be difficult to reach or locate, and by turning the entire assembly, tool and spark plug, as a whole the spark plug may be screwed into its socket until well started. The sleeve 3 of the housing and closely adjacent parts of the tube 1 are always accessible and may be held stationary by one hand of the operator while the control handle 14 is turned reversely by the other thus precluding unscrewing of the spark plug. Reverse turning of the knob releases the resilient plug 8 which contracts radially as it expands axially, thereby freeing the spark plug and tool. The spark plug is then tightened by other means in the usual way. In this application and starting of individual spark plugs in their various locations, the resilience of the tool plays its important part. Without its resilience the versatility of the tool would be lost. Each spark plug offers a different pattern of approach with the tool. Speed and ease of manipulation in all situations is a prime factor in the use of this tool.

In the modification shown in Fig. 4 the rod 10 instead of being an extension of the knob, as in the other figures, is shown as an extension of the follower 18 that is to say secured thereto and has its end remote from the follower screw threaded at 19 to cooperate with the internal screw threading 20 within the knob 21. As in Fig. 2, the knob is shown as socketed and rotatably secured in sleeve 3, whereby the internal gripping holder is expanded into gripping position or released, on turning the knob in the required direction. The operation is similar in both forms of the tool, the knob being in each part of the operating means and one of the screw threaded members being fixed against rotation with respect to the shank.

I claim:

1. A tool for starting spark plugs and like objects in their sockets where access is limited, having a flexible shank resilient on flexure, said shank having a housing terminating at its front end in a socket holding and retaining a resilient and compressible male member, a follower associated therewith and opposing a bearing surface to the resilient and compressible male member, the housing terminating at its other end in a sleeve, a rotatable handle at that end of the tool, and a flexible rod housed by said housing and connecting said handle and follower in screw-threaded relation, one of the screw threaded members being fixed against rotation with respect to the shank to alter the relative position of the follower and the handle axially and thereby expand the male member to grip the wall of a hole in the spark plug, and to release it to free the tool from the object.

2. A tool as set forth in claim 1, the turning handle included therein being internally threaded and the connecting rod being fixed to the follower and in threaded relation with the handle.

3. A tool as set forth in claim 1, the follower included therein having a head and a stem within the male member of lesser diameter than the head and having an internally threaded tubular bore and the connecting rod being flexible and resilient on flexure and threaded into said internally threaded bore.

4. A tool for starting spark plugs and like objects in their sockets where access is limited, having a flexible shank resilient on flexure, said shank having a housing terminating at its front end in a socket holding and retaining a resilient and compressible gripper member, a follower associated therewith and opposing a bearing surface to the resilient and compressible gripper member, the housing terminating at its other end in a sleeve, a manual gripper actuator mounted for movement on the other end of the shank, and operative connections from the gripper actuator to the gripper including a follower opposing a bearing surface to the resilient and compressible gripper.

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