Jan. 4, 1966 T. C. TREMBLAY 3,227,015

EXTENDING SOCKET WRENCH

Filed June 14, 1965 2 Sheets-Sheet 1

FIG. 1

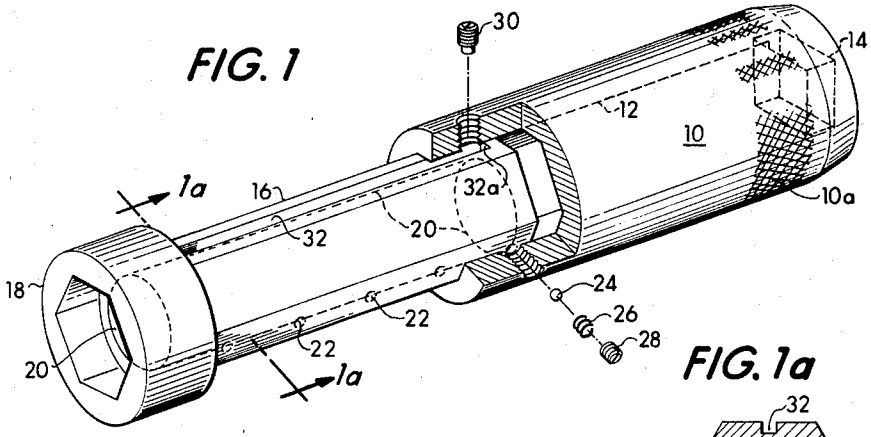

FIG. 1a

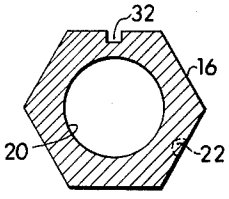

FIG. 3

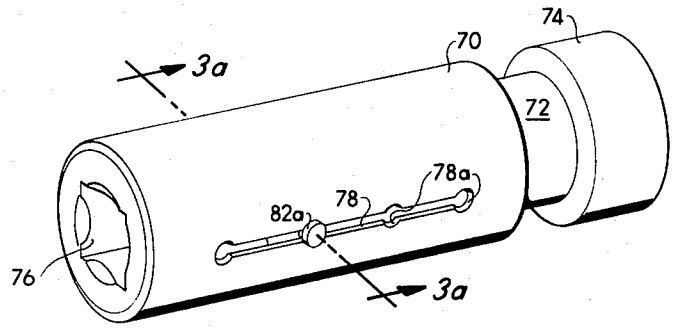

FIG. 3a

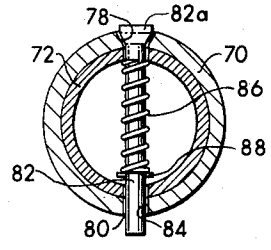

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FIG. 2

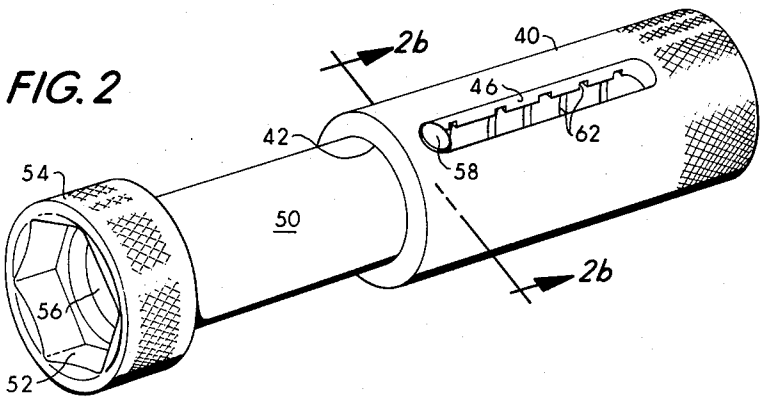


FIG. 2a

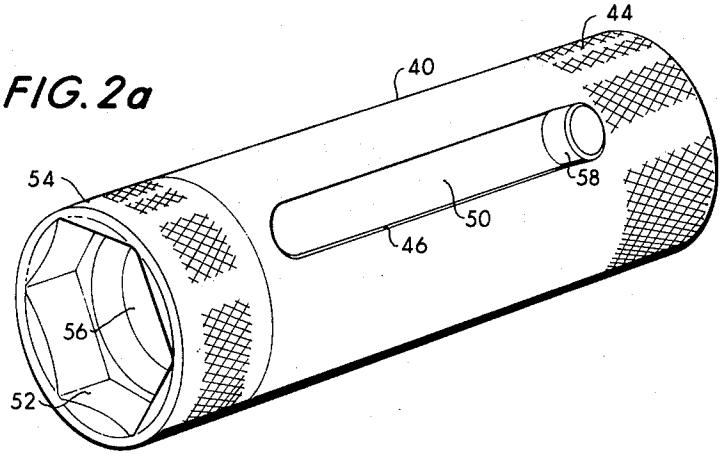
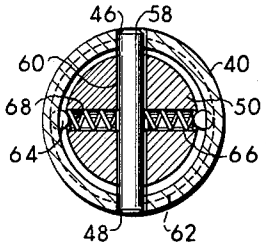


FIG. 2b



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EXTENDING SOCKET WRENCH

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6 Claims. (Cl. 81—177)

This application is a continuation-in-part of my copending application Serial No. 396,962 filed September 16, 1964, entitled, "Extending Socket Wrench," now abandoned.

This invention relates to hand tools such as wrenches and the like, and more particularly to socket wrenches.

Socket wrenches have long been known, being the basic and most useful of wrenches for most automotive work. Extensions and adapters are available which can be combined with sockets in a variety of configurations to reach almost any nut in today's complex engine. There are situations, however, for which suitable extenders are either unavailable or are inefficient to use. Spark plug sockets, for example, to which the present invention has particular applicability, must be of a predetermined minimum length to accommodate the hexagonal base of a spark plug and its porcelain parts. In some present day motors, the spark plugs are situated deep in the block and/or behind accessories of the engine, presenting different conditions of accessibility from one plug to the next. For instance, on some motors, to remove a spark plug located behind the generator it is necessary to use a socket of standard length plus a one-half inch extender, whereas a plug behind the steering column requires a one and one-half inch extender. An extender having a minimum length of one-half inch obviously cannot be extended to a length of one and one-half inches, and accordingly, two or more extenders would be required in the situation described, which, in turn, would require changing from one extender to another several times during what should be the relatively simple job of changing a set of spark plugs.

It is the primary object of the present invention to provide a unitary socket wrench so constructed that it may be readily adjusted in length from a predetermined minimum length to different longer lengths.

Another object of the invention is to provide a unitary extending socket wrench of simple and relatively inexpensive construction.

A more specific object of the invention is to provide an improved socket wrench of adjustable length for the removal and installation of the relatively inaccessible spark plugs of an internal combustion engine.

Briefly, the socket wrench according to the invention is constructed of two main body portions, a tubular drive body slightly shorter than a standard spark plug socket and having a "drive" in one end thereof for receiving the square shank of a suitable handle, and a shank longitudinally adjustable within the body portion and terminating at its free end in a socket of desired size and shape. The shank is hollow for a portion of its length to accept the porcelain parts of a spark plug. The shank is held in a number of different positions within the body portion by a detent mechanism, and relative rotation between shank and body portion under driving conditions is prevented by forming the shank to have the same cross-section as the bore in the drive body, or by a pin extending transversely through the shank and engaging longitudinal slots in the wall of the drive body.

Other objects, features and advantages of the invention will become apparent, and its construction and operation better understood, from the following detailed description, considered in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view, partially cut away, of one embodiment of the invention, showing the wrench in fully extended position;

FIG. 1*a* is a cross-sectional view of the shank taken along line 1*a*—1*a* of FIG. 1;

FIG. 2 is a perspective view of a preferred embodiment of the invention, showing the socket in fully extended position;

FIG. 2*a* is a perspective view of the embodiment of FIG. 2 in closed position;

FIG. 2*b* is a cross-sectional view taken along line 2*b*—2*b* of FIG. 2;

FIG. 3 is a perspective view of an alternate construction of the embodiment of FIG. 2; and

FIG. 3*a* is a cross-sectional view taken along line 3*a*—3*a* of FIG. 3.

Referring now the the drawings, FIGS. 1 and 1*a* illustrate one construction of an extensible socket according to the invention which comprises a drive body **10** formed of suitable material having a bore **12** of uniform cross-section throughout substantially its entire length. At the right end of the drive body, as viewed in FIG. 1, there is provided a square opening **14** of a size (e.g., ⅜ inch) to receive the square shank of a ratchet handle or adapter. In this embodiment, the bore **12** is of polygonal cross-section, for example, hexagonal, and the outer surface is shown as being cylindrical in cross-section and having a knurled area **10***a* near the right end to facilitate handling of the tool. However, the outer surface of body **10** may be square, or may conform to the shape of the bore **12**, if desired.

The other principal part of the wrench is a shank **16** of a length substantially equal to the length of bore **12** and having a socket **18** of conventional hexagonal (or other) shape integrally formed on the free end thereof. Shaft **16** is of the same uniform cross-section as the bore **12** and slightly smaller so as to be received by and easily slidable in the bore. The bore **12** is preferably broached after boring so as to provide angularly disposed faces coinciding with corresponding faces of the shank. Thus, while a sliding fit is provided between the shank **16** and the driver body **10**, the engaged faces prevent turning of the shank within the body under driving conditions. A cylindrical bore **20** extends inwardly from the free end of shank **16**, coaxially with the socket head, being of a length and diameter to accommodate the porcelain portions of a spark plug.

In order that the shank **16** may be held in a number of different longitudinal positions within drive body **10** to vary the overall length of the tool between socket and driver, the shank is provided with a series of spaced recesses **22** cut in one of the faces of the shank. These recesses are spaced at regular intervals, for example, every half inch, any one of which is adapted to be engaged by a retaining detent, such as a ball **24** urged against the shank by a spring **26** and screw **28** secured in a radial opening in the wall of the drive body **10**. In order to prevent the shank from being entirely pulled out of the body portion, a stop screw **30** extends through the wall of the body **10** and engages a groove **32** machined in another one of the faces of the shank. The groove **32** terminates short of the inner end of shank **16**, so that when the shank is fully extended, the screw **30** engages the shoulder **32***a* at the end of the groove to prevent withdrawal of the shank. The shoulder **32***a* is positioned sufficiently in from the inner end of shank **16** that even when the shank is fully extended, a sufficient portion of the shank will be disposed within the driver body to be held against turning with respect to the body portion. It will be obvious that removal of screw **30** is all that is necessary to disassemble the shank from the body portion of the tool.

Referring now to FIGS. 2, 2*a* and 2*b* there is shown construction of an extensible socket wrench embodying the principles of the just-described embodiment, but offering the advantages of simpler and less costly construction. In this embodiment, the drive body **40** comprises a cylindrical tubular member of circular cross-section having a coaxial cylindrical bore **42** of circular cross-section throughout substantially its entire length. At the right end of the body, as viewed in FIGS. 2 and 2*a* there is provided a square opening (corresponding to opening **14** in the device of FIG. 1) for receiving the shank of a drive handle. The outer surface of body **40** is knurled at **44** to facilitate adjustment of the length of the tool. A pair of longitudinal slots **46** and **48**, diametrically opposite each other, are formed, as by milling, in the wall of body **20**, and extend from essentially the bottom of the square drive opening to just short of the other end of the body.

The shank **50** is of circular cross-section throughout and has a diameter slightly smaller than bore **42** so as to be easily slidable therein. At its outer end, and integral with the shank, is a socket head **52** of hexagonal shape, for example, having a circular outer surface of a diameter substantially equal to the outer diameter of body **40** such that when the shank is fully inserted, the tool presents a smooth surface throughout its length. The peripheral surface of the socket head **52** is also knurled at **54**, and a cylindrical bore **56** extends inwardly from the socket end of the shank to a depth sufficient to accommodate the porcelain portions of a spark plug. The shank is prevented from turning within the body portion by a pin **58** extending through a diametral opening **60** in shank **50**, near the inner end thereof, the pin being of a length slightly less than the outside diameter of the body portion and of a diameter to be freely slidable in slots **46** and **48**. Thus, the elongated slots allow the shank to be freely inserted and withdrawn, and the pin **58** extending radially into and engaging the sides of the slots prevents turning of the shank within the body. The termination of slots **46** and **48** short of the inner end prevents withdrawal of the shank in its fully extended position.

In order that the shank may be held in a number of different positions within drive body **40** to vary the length of the tool, the inner surface of the body portion is provided with a series of spaced recesses **62**, which may be a series of peripheral cuts, which are conveniently made on a lathe. Each of these recesses, which may be spaced a half inch apart, for example, is adapted to be engaged by a detent mechanism, such as a ball **64** supported at the outer end of a diametral opening **66** through shank **50** and urged against the inner wall of the body portion by a spring **68** disposed between the ball and pin **58**. It will be obvious that opening **68** lies in the same transverse plane as opening **60**, the openings preferably intersecting each other at right angles. To assemble the detent retaining mechanism, the ball and spring are first inserted in opening **66**, the shank inserted in the bore **42** with opening **60** aligned with slots **46** and **48**, and pin **58** inserted in opening **60**. Pin **58** engages opening **60** with a press fit, thereby maintaining the spring **68** in position. While a single spring and ball is adequate to maintain the shank in adjusted position, if greater retaining force is desired, a second ball and spring may be inserted in opening **66** at the other side of pin **58**, as shown.

FIGS. 3 and 3*a* illustrate an alternate construction of the embodiment of FIG. 2, the modification consisting mainly in different means for retaining the shank in different adjusted positions within the body portion. As in the embodiment of FIG. 2, the drive body **70** comprises a cylindrical tubular member of circular cross-section having a coaxial cylindrical bore throughout substantially its entire length for receiving the shank **72** which is of circular cross-section throughout and of a diameter to be easily slidable in the bore. The shank has a socket head **74** of the same configuration as the tools of FIGS. 1 and 2, and the free end of drive body **70** has a square opening **76** therein for receiving the shank of a drive handle.

The body has a pair of longitudinal slots **78** and **80** formed therein which extend for essentially the full length thereof. One of the slots, for example slot **78**, is provided with a series of spaced recesses **78***a*, which are conveniently formed with a counter-sinking tool. Each of these recesses, which may be spaced a half inch apart, is adapted to engage the tapered head **82***a* of a pin **82** extending through a diametral opening **84** in shank **72**, near the inner end thereof. The pin **82** is of a length slightly greater than the outer diameter of drive body **70** and of a diameter to be freely slidable in slots **78** and **80**. The slots allow the shank to be freely adjusted, and the pin engaging the slots prevents turning of the shank within the body.

The pin **82**, in cooperation with recesses **78***a*, permit the shank to be held in a number of different positions within the drive body. As best seen in FIG. 3*a*, the tapered head is urged into engagement with the edges of slot **78** by a spring **86** surrounding pin **82** and held in compression against the inner wall of shank **72** by a holding pin **88** extending through pin **82**. When the tapered head **82***a* engages one of the recesses **78***a*, the spring holds the pin in locked position. The lock is released to allow adjustment to another position to vary the length of the tool by application of sufficient pressure to the other end of the pin to overcome the force of the spring and lift the tapered head out of the engaged recess **78***a*. The spring **86** is preferably of a size that release can be accomplished by thumb pressure.

From the foregoing it will be evident that applicant has provided a unitary socket wrench, of relatively simple and inexpensive construction, which is readily adjustable to different lengths. Although several embodiments of the invention have been shown and described, it can be expected that minor modifications will now be suggested to ones skilled in the art. It is to be understood, therefore, that the specific details and terminology are not intended to be restrictive except insofar as they appear as limitations in the appended claims.

What is claimed is:

1. An extensible socket wrench comprising, in combination, a cylindrical drive body having a bore of uniform circular cross-section extending from one end thereof to substantially the other end, said other end of said body having an opening therein for receiving a drive handle, said body having a pair of diametrically opposite longitudinal slots in the wall thereof each terminating short of the ends of said body, a shank of uniform circular cross-section longitudinally movable within the bore in said drive body formed with an integral socket head at the end thereof beyond said body portion, said shank having a coaxial bore therein, the length of said shank inwardly of said socket head being substantially equal to the length of the bore in said drive body, a pin extending transversely through said shank near the end thereof opposite said socket head and engaging the slots in said drive body to prevent relative rotation between said shank and drive body under driving conditions, and spring-loaded retaining means within said shank arranged to engage one of a plurality of longitudinally spaced recesses in said drive body to releasably hold said shank in a number of different longitudinal positions within said drive body, the engagement of said pin with the ends of said slots nearest said one end of said drive body preventing complete withdrawal of the shank from the drive body.

2. An extensible socket wrench in accordance with claim **1** wherein the bore in said shank extends inwardly from the socket end thereof for a portion of the length of said shank, said recesses are formed in the surface of the bore in said drive body, and said retaining means comprises a ball disposed at the outer end of a radial opening in said shank near the end thereof opposite said socket

head, and a compression spring in said opening arranged to urge said ball into contact with the surface of the bore in said drive body.

3. An extensible socket wrench in accordance with claim 1 wherein the bore in said shank extends throughout the length of said shank, said recesses are formed in the outer surface of said drive body along one of said slots, and said retaining means comprises a tapered head on the end of said pin which engages the slot having said recesses formed therealong, and a compression spring within the bore in said shank and surrounding said pin and arranged to urge said tapered head into a selected one of said recesses.

4. An extensible socket wrench in accordance with claim 1 wherein the length of said slots is substantially equal to the distance between said socket head and said pin.

5. An extensible socket wrench in accordance with claim 1 wherein said socket head has a cylindrical outer surface of outside diameter substantially equal to the outside diameter of said drive body.

6. An extensible socket wrench comprising, in combination, an elongated drive body having a bore of uniform polygonal cross-section extending from one end thereof to substantially the other end, said other end of said drive body having an opening therein for receiving a driver handle, a shank of uniform polygonal cross-section longitudinally movable within the bore in said drive body and formed with in integral socket head at the end thereof beyond said body portion, said shank having a coaxial bore therein extending inwardly from the socket end for at least a portion of the length of said shank, the length of said shank inwardly of said head being substantially equal to the length of the bore in said drive body, the surfaces of said shank engaging corresponding surfaces of the bore in said drive body to prevent relative rotation between said shank and drive body under driving conditions, one of the surfaces of said shank having a plurality of longitudinally spaced recesses formed therein, spring-loaded detent means in the wall of said drive body arranged to engage one of said recesses to releasably hold said shank in a number of different longitudinal positions within said drive body, another of the surfaces of said shank having a slot formed therein extending from said socket head and terminating in a shoulder near the opposite end of said shank, and means secured in the wall of said drive body and projecting into said slot a distance to allow longitudinal movement of said shank within the bore in said drive body but to engage said shoulder to prevent complete withdrawal of the shank from the drive body.

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