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(54) A SOCKET FOR A SOCKET WRENCH

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DOUILLE POUR CLE A DOUILLES

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Description

Introduction

[0001] The present invention relates to socket wrenches and in particular to the sockets forming part of such socket wrenches.

[0002] It is well known to provide a wrench in the form of a socketed head having a hollow end to fit over a multi-sided head of a nut or bolt, generally a hexagonally sided nut or bolt. The socket may be permanently attached to an actuating handle in which case generally only one size or at most only two sizes of sockets may be provided, or there is provided a plurality of removable socket heads or as they are more generally called sockets. The latter type of wrench namely one comprising a handle and a plurality of removable sockets is the more commonly provided type of socket wrench since the latter is more versatile allowing a plurality of sizes of nut or bolt to be handled by the one set of sockets. Indeed, the term "a set of sockets" is commonly used to include not just the socket heads or sockets per se, but also the combination of the socket heads and the actuating handle, which actuating handle in turn often comprises a rod having pivotally mounted on one end thereof a square sectioned male spud, each individual socket having on the end opposite to its hexagonally formed portion a square sectioned hole or more properly socket adapted to receive the socket.

[0003] The versatility of sets of sockets has long been appreciated, however, the main disadvantage with them is that they tend to be mislaid. There is nothing more frustrating for a workman than to find when he goes to look for a particular socket that it is unavailable to him or her. It may simply have been mislaid previously in which case there is no possibility of using it immediately, or, alternatively it has been mislaid in around the workplace requiring a search to be carried out and therefore delay.

[0004] A further minor problem is when one wishes to use more than one size of socket one is forced to carry on one's person possible sizes of sockets so that they may be available when required.

[0005] Another problem with using sets of sockets is that it is necessary to provide a large number of sockets to accommodate a wide range of size of hexagonal bolts and nuts. This problem is exacerbated in countries where previously some other standard for size of bolt head or nut head was used such as imperial rather than the metric sizes more commonly used now.

[0006] Attempts have been made in the past to provide a socket for a socket wrench which will overcome these problems. A typical example of these attempts is a socket imitating wrench carrying a plurality of pins which are movable inwards against individual spring biasing so that a bolt head after the socket is pushed onto it is subsequently surrounded by the pins remaining. Unfortunately these pins do not provide adequate grip on the bolt head, the pins damage the bolt head, the pins do not transmit the torque adequately or positively, the pins fail under high torque and finally, the so-called socket wrench will in many instances grip the nut off centre with respect to the applied torque. Generally speaking it is an unsatisfactory construction.

[0007] Patent Specification Nos. US 1471451 and US 5157995 each show a socket assembly comprising a tubular body with a set of nesting individual sockets retained on the body, each adjacent pair of nesting sockets comprising an inner socket and an outer socket, said inner socket being movable axially inwardly relative to the outer socket to expose said outer socket for use, the body having means for engagement with a lever for rotation of the sockets. Patent Specification No. US 2322856 discloses a wrench having a socket at each end within which can be mounted one or more inserts to reduce the size of the socket.

[0008] The present invention is directed towards overcoming these and other problems.

Statements of Invention

[0009] According to the invention, there is provided a socket for a socket wrench of the type comprising an actuating handle carrying the socket, the socket comprising a tubular body with a set of nesting individual sockets on the body, each adjacent pair of nesting sockets comprising an inner socket and an outer socket, said inner socket being movable axially inwardly relative to the outer socket to expose said outer socket for use, the body having means for engagement with a lever for rotation of the sockets, characterised in that a set of nesting individual sockets is provided at each end of the body and an outer surface of the body at each end of the body is adapted for engagement by the lever for rotation of the sockets.

[0010] It will be appreciated that there is considerable advantage in having a set of nesting sockets, instead of having to carry a large number of separate sockets on one's person. For example, if there are three sockets, it is possible to push two of the sockets inside the outermost socket and similarly it is possible to push the outermost socket backwards and pull the innermost socket outwards, leaving the outermost and intermediate sockets both nesting rearwardly of the outwardly projecting innermost sockets.

[0011] Ideally it will be appreciated that there will be more than two nesting sockets. In general there will be a plurality of nesting sockets.

[0012] Preferably each nesting socket engages resiliently the other nesting socket or sockets, to require positive disengagement and reinforcement thus preventing the sockets from falling in and out of engagement by providing a force fit of an inner socket within the outer socket. One way of achieving this is to provide on each socket a spring on the outer surface thereof to engage on the inner surface of the next outermost socket. Var-

ious forms of springs may be provided such as are often seen conventionally in socket sets being resiliently mounted ball bearings or the like, indeed anything which provides a resistance against relative movement is sufficient.

[0013] Ideally the springs when used vary in strength decreasing from the outermost socket to the innermost socket of the set to ensure when the innermost socket is pushed inwards within the other socket, that the other socket it will not carry the outermost sockets with it.

[0014] In another embodiment of the invention, each of the nesting sockets is biased outwardly, preferably by means of a spring. For example, each movable socket may be connected to a rear of the outermost socket by means of a helical spring thus providing in the central portion of the outer socket a nest of helical springs each of which biases a corresponding socket outwardly or alternatively they may be biased in a cascade effect.

[0015] Ideally, restraining means in the form of a stop are provided to prevent a nesting socket fully withdrawing from its surrounding sockets. The advantage of this is that it is then impossible to lose the sockets of the set.

[0016] In one embodiment of the invention, an exposed end of each socket is bevelled inwardly. Further, each successively smaller socket in a nest will be slightly recessed with respect to an adjacent larger socket.

[0017] In a particularly preferred embodiment of the invention, the two separate sets of sockets are axially spaced apart within an elongate body member, said body member having a hollow central portion between end portions within which each set of sockets is mounted. Preferably, the spacing between the sets of sockets is chosen to accommodate only one set of sockets.

[0018] The advantage of this is that pushing a socket or sockets from one end into the other end will naturally push out the socket or sockets from the other end. A further advantage in having sockets at both ends is that in addition to providing a versatile range of sockets it is also possible to provide for example metric and imperial sized sockets in the one set which is exceptionally advantageous. For example, having fourteen sockets from 6mm to 32mm means that while fitting fourteen sizes exactly you are only 1mm out on the intermediate sizes. The same will apply to imperial sizes.

[0019] Ideally each external surface surrounding the end portion is regular sided to form a male portion to engage a female socketed portion of a handle or an adaptor for mounting on the handle. This, it will be appreciated is advantageous, because it means that an easy connection between a handle and the body portion may be achieved.

[0020] Ideally the body portion itself has each end portion in the form of a socket thus utilising the body member itself as a socket.

[0021] In one embodiment of the invention the handle is a two-part handle comprising a rod having pivotally mounted on one end thereof a square sectioned male spud and a hollow adapter sleeve, one end of which is socketed to engage the external surface of a set of nesting sockets and the other end of which is socketed to receive the male spud. The advantage of this is that now the conventional handle of a conventional set of sockets may be used.

[0022] One of the particular advantages of the present invention is that where a wide range of sizes of sockets are required, they can be relatively easily provided.

Detailed Description of the Invention

[0023] The invention will be more clearly understood from the following description of an embodiment thereof given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is an partially exploded perspective view of a socket with part of a socket wrench;

Fig. 2 is a partially cut-away view of portion of an individual socket of Fig. 1;

Figs. 3(a), 3(b) and 3(c) illustrates the socket of Fig. 1 in use;

Figs. 4 and 5 illustrate the socket also in use;

Fig. 6 is a perspective view of an assembled socket wrench according to the invention.

Fig. 7 is an exploded perspective view of another socket and part of an actuating handle according to the invention;

[0024] Referring to the drawings and initially to Figs. 1 to 6 thereof there is illustrated portion of a socket for a socket wrench the socket being indicated generally by the reference numeral 1 comprising two sets of sockets indicated by the reference numeral 2, including a hollow adapter 3 and portion of an actuating handle 4. The actuating handle 4 may house a ratchet mechanism as is common and is of generally conventional construction and the sockets according to the invention are for use with such handles which is obvious unless otherwise stated.

[0025] The two separate sets of sockets 2 are housed within a hollow body member 10 having two opposed end portions 11 on either side of a hollow central portion 12. Each end portion 11 itself forms a hollow socket and has a hexagonal outer surface 13. A plurality of individual nesting sockets 15, 16, 17, 18, 19 and 20 are provided in each end portion 11. The individual socket 15 is the innermost socket and the individual socket 20 is the outermost socket. While the innermost socket 15 is an inner socket with respect to the next individual socket 16 in which it nests and the socket 16 therefore forms with respect to the innermost socket 15 an outer socket, the outer socket 16 in turn becomes an inner socket with

respect of the next outer socket 17 which is therefore an outer socket with respect to the inner socket 16. It will be noted that only one set 2 of sockets is illustrated. Each socket 15-20 carries a spring 21, not all of which are shown. In effect the spring 21 forms a force-fit between an inner and outer socket. Each socket 15 to 20 inclusive nests inside its next outer socket, thus as stated above the socket 15 nests inside the socket 16, the socket 16 nests inside the socket 17, and so on. Each socket is provided with a stop 22 which engages in a slot 23 in its next outer socket. The stops 22 and slots 23 thus provide restraining means preventing full withdrawal in an axially outwards direction. Not all of these stops 22 or slots 23 are illustrated. It will be noted that each spring 21 engages a recess 24 in its next adjacent socket.

[0026] The adapter 3 comprises a hexagonally socketed hollow head 30 terminating in a square sectioned end hole 31 which is adapted to engage a square section spud 32 which is pivotally mounted by a pin 33 on the handle 4 only portion of which is shown. It will be appreciated in use that the adapter 3 and handle 4 may engage the hexagonal outer surface 13 to rotate the socket wrench 1 as illustrated in Fig. 6.

[0027] When all the sockets 15-20 nest inside the body member 10 it will be noted that no sockets 15-20 will project into the central portion 12. To select a particular size of socket, for example the sockets of lower or smaller size i.e. if you wish to select socket 18, sockets 17, 16 and 15 would be pushed together inwards so as to expose the socket 18 ready for use which would then be surrounded by the sockets 19 and 20 within the end portion 11. The socket wrench 1 may then be used. This is particularly illustrated in Fig. 3. Referring now specifically to Fig. 3 there is illustrated the socket being offered up to three different sizes of bolt 35(a), 35(b) and 35(c) having different sizes of hexagonal head 36(a), 36 (b) and 36(c) respectively. It will be seen how the different sizes of individual socket are required and may be used.

[0028] If it is desired to bring any set of sockets back to the original position the sockets are merely depressed in the other set which will then push the socket on the other side outwards to the flush position. This is illustrated in Figs. 4 and 5.

[0029] Referring now to Fig. 7 there is illustrated an alternative construction of socket indicated generally by the reference numeral 40 having a hollow body member 41 having a cylindrical outer surface carrying a plurality of open slots 42 for engagement with axially arranged radial ribs 43 within an adaptor 44 which in turn has a square hole 45 for engagement with a spud 46 mounted on an actuating handle 4.

[0030] While all the sockets above have been described with reference to hexagonal headed nuts and bolts and undoubtedly hexagonal headed nuts and bolts constitute the majority of units which need to be actuated by a socket wrench it will be appreciated that any other shape of multi-sided unit and corresponding socket could be provided.

[0031] The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

Claims

1. A socket (1, 40) for a socket wrench of the type comprising an actuating handle (4) carrying the socket (1), the socket comprising a tubular body (10, 41) with a set (2) of nesting individual sockets (15-20) retained in the body (10, 41), each adjacent pair of nesting sockets (15, 20) comprising an inner socket and an outer socket, said inner socket being movable axially inwardly relative to the outer socket to expose said outer socket for use, the body (10, 41) having means (13, 42) for engagement with a lever (4) for rotation of the sockets (15-20), **characterised in that** a set (2) of nesting individual sockets (15-20) is provided at each end (11) of the body (10, 41), and an outer surface (13, 42) of the body (10, 41) at each end of the body (10, 41) is adapted for engagement by the lever for rotation of the sockets (15-20).

2. A socket (1, 40) as claimed in claim 1 in which each inner socket is a force-fit within the next adjacent outer socket.

3. A socket (1, 40) as claimed in claim 2 in which the force-fit is provided by a spring urged means (21) interposed between the inner and outer sockets.

4. A socket (1, 40) as claimed in claim 2 in which the force-fit is provided by a leaf spring (21) secured to the outer surface of the inner socket and cantilevered upwards to bear against the inner surface of the outer socket.

5. A socket (1, 40) as claimed in any preceding claim in which there is provided restraining means (22, 23) for preventing full withdrawal of an inner socket from an outer socket in an axially outward direction.

6. A socket (1, 40) as claimed in any preceding claim in which there are more than two sockets (15-20) and the force-fit provided decreases from the outermost socket to the innermost socket.

7. A socket (1, 40) as claimed in any preceding claim in which the outer surface of each individual socket (15-20) is cut away adjacent its inner bore to provide a smooth lead-in engagement surface.

8. A socket (1, 40) as claimed in any preceding claim

in which the outer and inner surface of each individual socket (15-20) are hexagonal.

9. A socket (1, 40) as claimed in any preceding claim in which each individual socket (15-20) is spring biased axially outwards.

10. A socket (1, 40) as claimed in any preceding claim in which there is provided an adaptor (3, 44) for engaging with each outer end of the body (10, 41) which adaptor (3, 44) terminates in an actuating handle engagement hole (31, 45).

11. A socket (1, 40) as claimed in any preceding claim, wherein the two separate sets (2) of sockets (15-20) are axially spaced apart within an elongate body member (10, 41), said body member (10, 41) having a hollow central portion (12)between end portions (11) within which each set (2) of sockets (15-20) is mounted.

12. A socket (1, 40) as claimed in claim 11 in which the spacing between the sets (2) of sockets (15-20) is chosen to accommodate only one set (2) of sockets (15-20) whereby pushing an individual socket (15-20) into the hollow central portion (12) will eject any other facing individual socket it contacts.

13. A socket (40) as claimed in any preceding claim in which the body member (41) has a cylindrical outer surface having a plurality of open slots (42) adjacent each end for engagement with axially arranged radial ribs (43) in a bore of an adaptor (44).

14. A socket (1, 40) as claimed in any preceding claim, in combination with an adaptor (3, 44) which is engagable with an outer surface (13) of each end portion (11) of the body (10, 41), the adaptor (3, 44) terminating in an actuating handle (4) engaging hole (31, 45).

Patentansprüche

1. Steckschlüsseleinsatz (1, 40) für einen Steckschlüssel der Art, die einen Betätigungsgriff (4) umfasst, der den Steckschlüsseleinsatz (1) trägt, wobei der Steckschlüsseleinsatz einen röhrenförmigen Körper (10, 41) mit einem Satz (2) ineinandergesteckter einzelner Steckschlüsseleinsätze (15-20) umfasst, die im Körper (10, 41) gehalten werden, jedes benachbarte Paar von ineinandergesteckten Steckschlüsseleinsätzen (15, 20) einen inneren Steckschlüsseleinsatz und einen äußeren Steckschlüsseleinsatz umfasst, der innere Steckschlüsseleinsatz im Verhältnis zum äußeren Steckschlüsseleinsatz axial einwärts beweglich ist, so dass er den äußeren Steckschlüsseleinsatz zur Verwendung freigibt, und der Körper (10, 41) Mittel (13, 42) zum Eingriff in einen Hebel (4) zur Drehung der Steckschlüsseleinsätze (15-20) aufweist, **dadurch gekennzeichnet, dass** ein Satz (2) ineinandergesteckter einzelner Steckschlüsseleinsätze (15-20) an jedem Ende (11) des Körpers (10, 41) bereitgestellt ist und eine äußere Fläche (13, 42) des Körpers (10, 41) an jedem Ende des Körpers (10, 41) für den Eingriff durch den Hebel zur Drehung der Steckschlüsseleinsätze (15-20) ausgelegt ist.

2. Steckschlüsseleinsatz (1, 40) nach Anspruch 1, bei dem jeder innere Steckschlüsseleinsatz formschlüssig in dem nächsten benachbarten äußeren Steckschlüsseleinsatz angebracht ist.

3. Steckschlüsseleinsatz (1, 40) nach Anspruch 2, bei dem die formschlüssige Verbindung durch ein unter Federdruck stehendes Mittel (21) bereitgestellt ist, das zwischen dem inneren und dem äußeren Steckschlüsseleinsatz angeordnet ist.

4. Steckschlüsseleinsatz (1, 40) nach Anspruch 2, bei dem der Festsitz durch eine Blattfeder (21) bereitgestellt ist, die an der äußeren Fläche des inneren Steckschlüsseleinsatzes befestigt und aufwärts vorkragend ist, um gegen die innere Fläche des äußeren Steckschlüsseleinsatzes zu drücken.

5. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem ein Haltemittel (22, 23) bereitgestellt ist, um das vollständige Herausziehen eines inneren Steckschlüsseleinsatzes aus einem äußeren Steckschlüsseleinsatz in einer axialen Richtung nach außen zu verhindern.

6. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem mehr als zwei Steckschlüsseleinsätze (15-20) vorhanden sind und die bereitgestellte formschlüssige Verbindung vom äußersten zum innersten Steckschlüsseleinsatz abnimmt.

7. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem die äußere Fläche jedes einzelnen Steckschlüsseleinsatzes (15-20) benachbart zu seiner inneren Bohrung weggeschnitten ist, um eine glatte Einführungseingriffsfläche bereitzustellen.

8. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem die äußere und die innere Fläche jedes einzelnen Steckschlüsseleinsatzes (15-20) hexagonal sind.

9. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem jeder einzelne

Steckschlüsseleinsatz (15-20) axial auswärts unter Federspannung steht.

10. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, bei dem ein Adapter (3, 44) zum Eingriff in jedes äußere Ende des Körpers (10, 41) bereitgestellt ist, wobei der Adapter (3, 44) in einem Eingriffsloch für den Betätigungshebel (31, 45) endet.

11. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche, wobei die beiden getrennten Sätze (2) von Steckschlüsseleinsätzen (15-20) in einem länglichen Bauteil (10, 41) axial voneinander beabstandet sind, wobei das Bauteil (10, 41) einen hohlen mittleren Abschnitt (12) zwischen Endabschnitten (11) aufweist, in dem jeder Satz (2) von Steckschlüsseleinsätzen (15-20) angebracht ist.

12. Steckschlüsseleinsatz (1, 40) nach Anspruch 11, bei dem der Abstand zwischen den Sätzen (2) von Steckschlüsseleinsätzen (15-20) so gewählt ist, dass er nur einen Satz (2) von Steckschlüsseleinsätzen (15-20) aufnimmt, wobei das Drücken eines einzelnen Steckschlüsseleinsatzes (15-20) in den hohlen mittleren Abschnitt (12) einen anderen zugewandten einzelnen Steckschlüsseleinsatz, mit dem dieser in Kontakt ist, ausstößt.

13. Steckschlüsseleinsatz (40) nach einem der vorhergehenden Ansprüche, bei dem das Bauteil (41) eine zylindrische äußere Fläche mit einer Vielzahl von offenen Nuten (42) benachbart zu jedem Ende für den Eingriff in axial angeordnete radiale Rippen (43) in einer Bohrung eines Adapters (44) aufweist.

14. Steckschlüsseleinsatz (1, 40) nach einem der vorhergehenden Ansprüche in Kombination mit einem Adapter (3, 44), der in eine äußere Fläche (13) jedes Endabschnitts (11) des Bauteils (10, 41) eingreifen kann, wobei der Adapter (3, 44) in einem Eingriffsloch (31, 45) für den Betätigungsgriff (4) endet.

Revendications

1. Douille (1, 40) pour clé à douille du type comprenant un manche d'actionnement (4) portant la douille (1), la douille comprenant un corps tubulaire (10, 41) avec un jeu (2) de douilles individuelles emboîtées (15 à 20) retenues dans le corps (10, 41), chaque paire adjacente de douilles emboîtées (15, 20) comprenant une douille interne et une douille externe, ladite douille interne pouvant se déplacer axialement vers l'intérieur par rapport à la douille externe afin d'exposer ladite douille externe à utiliser, le corps (10, 41) ayant un moyen (13, 42) destiné à s'engager avec un levier (4) pour la rotation des douilles (15 à 20), **caractérisée en ce qu'**un jeu (2) de douilles individuelles emboîtées (15 à 20) est fourni à chaque extrémité (11) du corps (10, 41), et une surface externe (13, 42) du corps (10, 41) à chaque extrémité du corps (10, 41) est adaptée en vue de son engagement par le levier pour la rotation des douilles (15 à 20).

2. Douille (1, 40) selon la revendication 1, dans laquelle le chaque douille interne est un ajustement serré à l'intérieur de la douille externe voisine adjacente.

3. Douille (1, 40) selon la revendication 2, dans laquelle l'ajustement serré est fourni par un moyen forcé par ressort (21) interposé entre les douilles interne et externe.

4. Douille (1, 40) selon la revendication 2, dans laquelle l'ajustement serré est fourni par un ressort à lame (21) fixé à la surface externe de la douille interne et en porte à faux vers le haut pour porter contre la surface interne de la douille externe.

5. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle est fourni un moyen de retenue (22, 23) pour empêcher le retrait complet d'une douille interne d'avec une douille externe dans un sens axialement vers l'extérieur.

6. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle il existe plus de deux douilles (15 à 20) et l'ajustement serré fourni diminue de la douille la plus externe à la douille la plus interne.

7. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle la surface externe de chaque douille individuelle (15 à 20) est découpée à proximité de son alésage interne pour fournir une surface d'engagement à ouverture lisse.

8. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle les surfaces externe et interne de chaque douille individuelle (15 à 20) sont hexagonales.

9. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle chaque douille individuelle (15 à 20) est chargée préliminairement par ressort axialement vers l'extérieur.

10. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle est fourni un adaptateur (3, 44) destiné à s'engager avec chaque extrémité externe du corps (10, 41), lequel adaptateur (3, 44) se termine dans un orifice d'engage-

ment de manche d'actionnement (31, 45).

11. Douille (1, 40) selon l'une quelconque des revendications précédentes, dans laquelle les deux jeux distincts (2) de douilles (15 à 20) sont espacés axialement au sein d'un élément de corps allongé (10, 41), ledit élément de corps (10, 41) ayant une partie centrale creuse (12) entre des parties d'extrémité (11) dans laquelle chaque jeu (2) de douilles (15 à 20) est monté.

12. Douille (1, 40) selon la revendication 11, dans laquelle l'espacement entre les jeux (2) de douilles (15 à 20) est choisi pour n'accepter qu'un seul jeu (2) de douilles (15 à 20) si bien que la poussée d'une douille individuelle (15 à 20) dans la partie centrale creuse (12) éjectera n'importe quelle autre douille individuelle opposée qu'elle contactera.

13. Douille (40) selon l'une quelconque des revendications précédentes, dans laquelle l'élément de corps (41) a une surface externe cylindrique ayant une pluralité de fentes ouvertes (42) adjacentes à chaque extrémité destinées à s'engager avec des nervures radiales disposées axialement (43) dans un alésage d'un adaptateur (44).

14. Douille (1, 40) selon l'une quelconque des revendications précédentes, en combinaison avec un adaptateur (3, 44) qui est engageable avec une surface externe (13) de chaque partie d'extrémité (11) du corps (10, 41), l'adaptateur (3, 44) se terminant dans un trou d'engagement (31, 45) du manche d'actionnement (4).

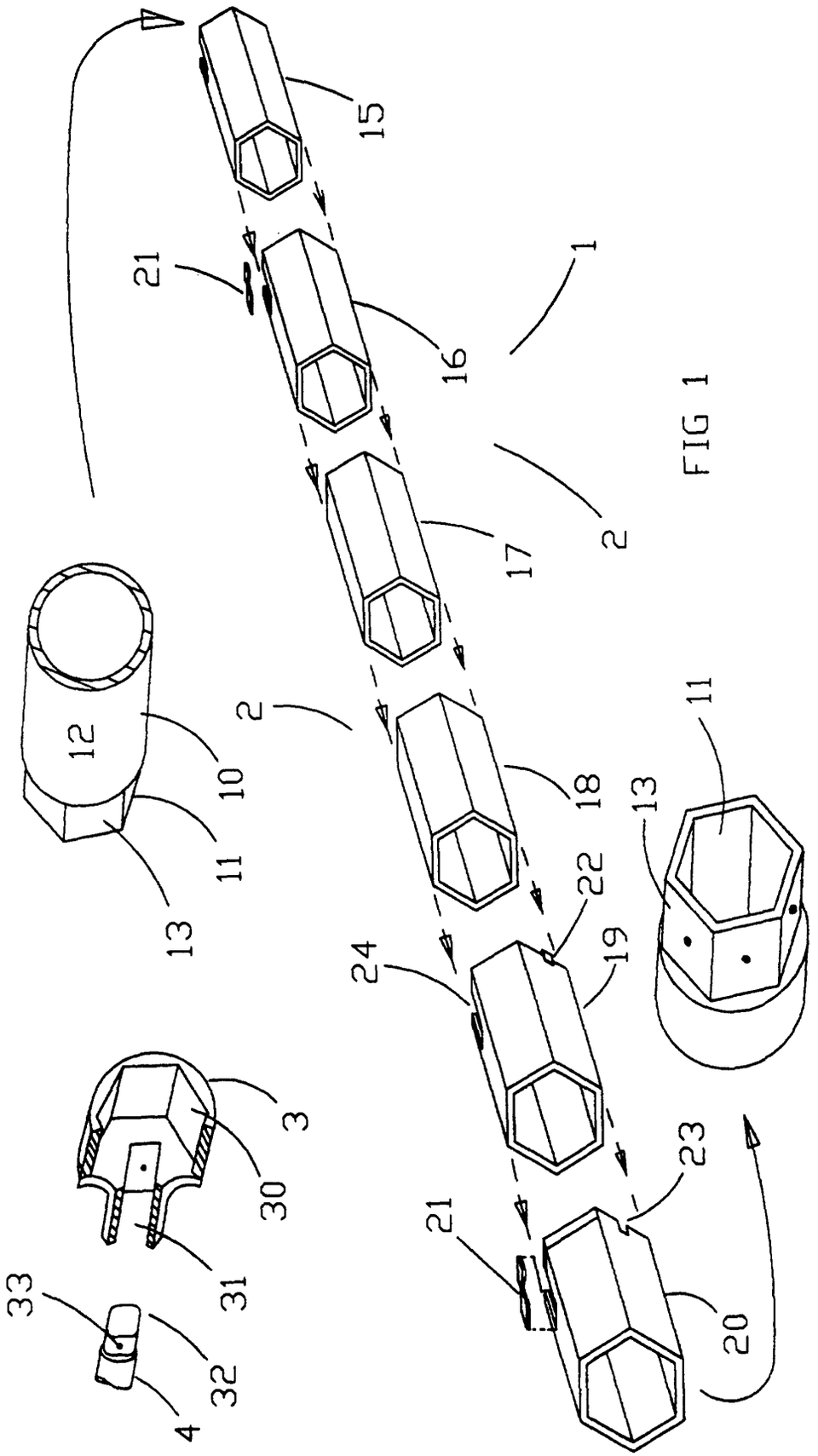

FIG 1

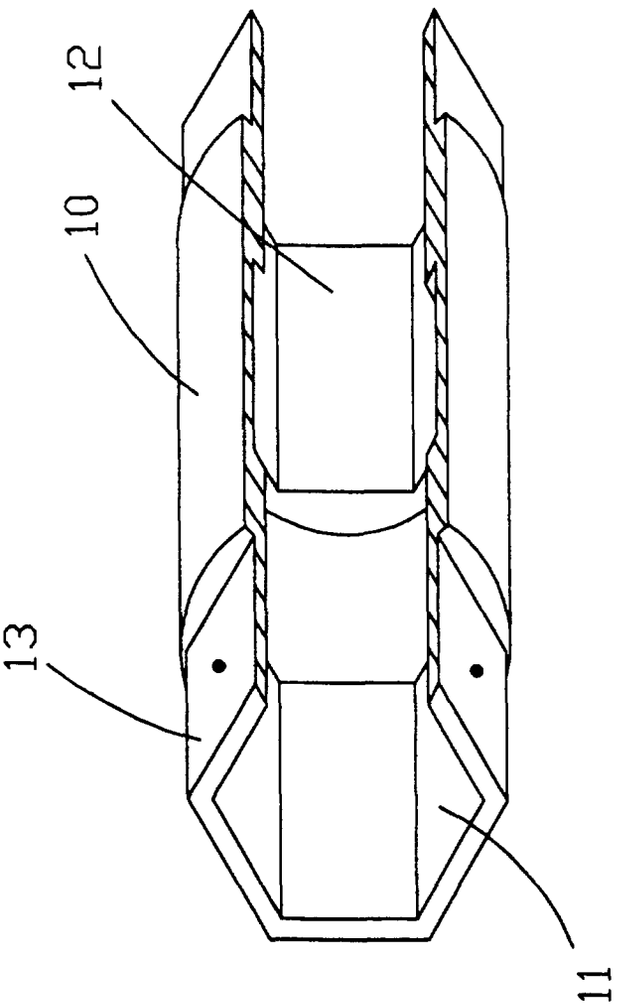

FIG 2

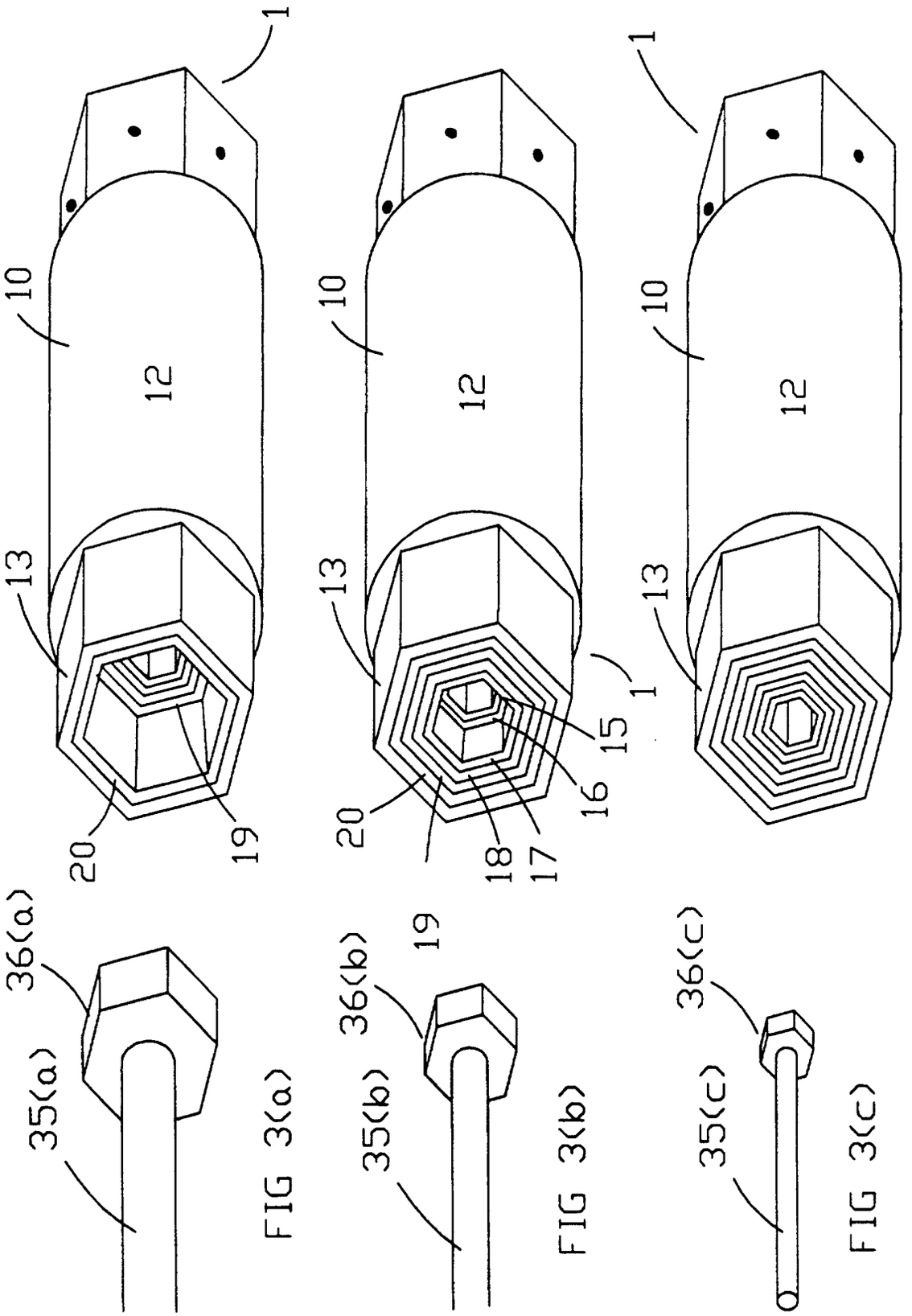

FIG 3(a)

FIG 3(b)

FIG 3(c)

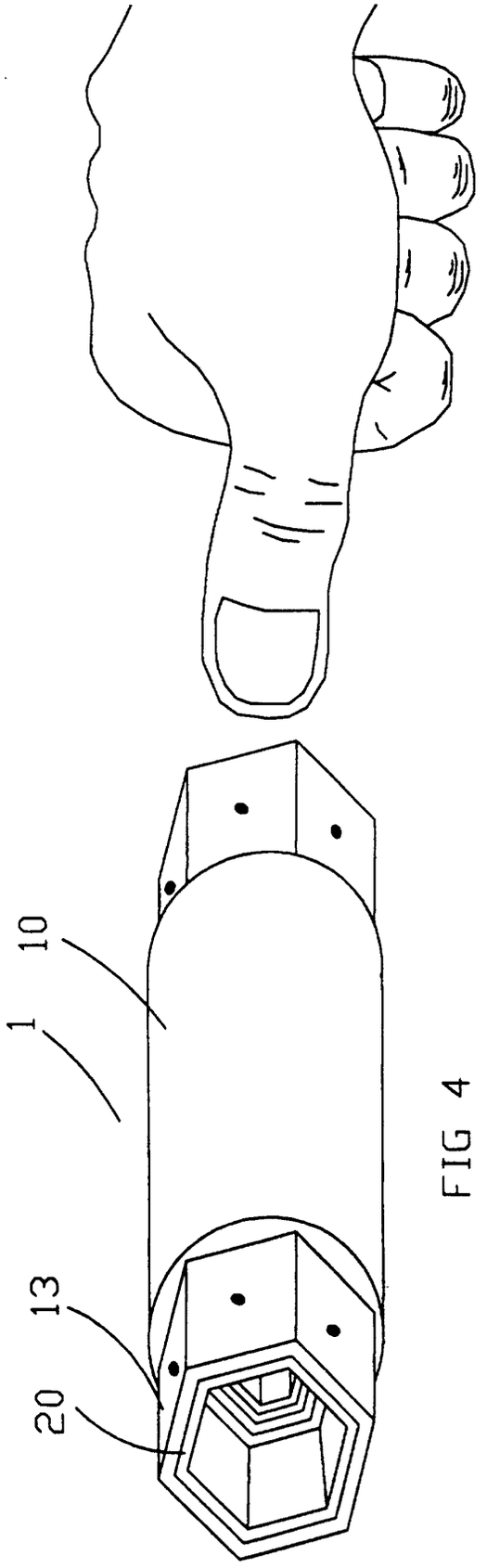

FIG 4

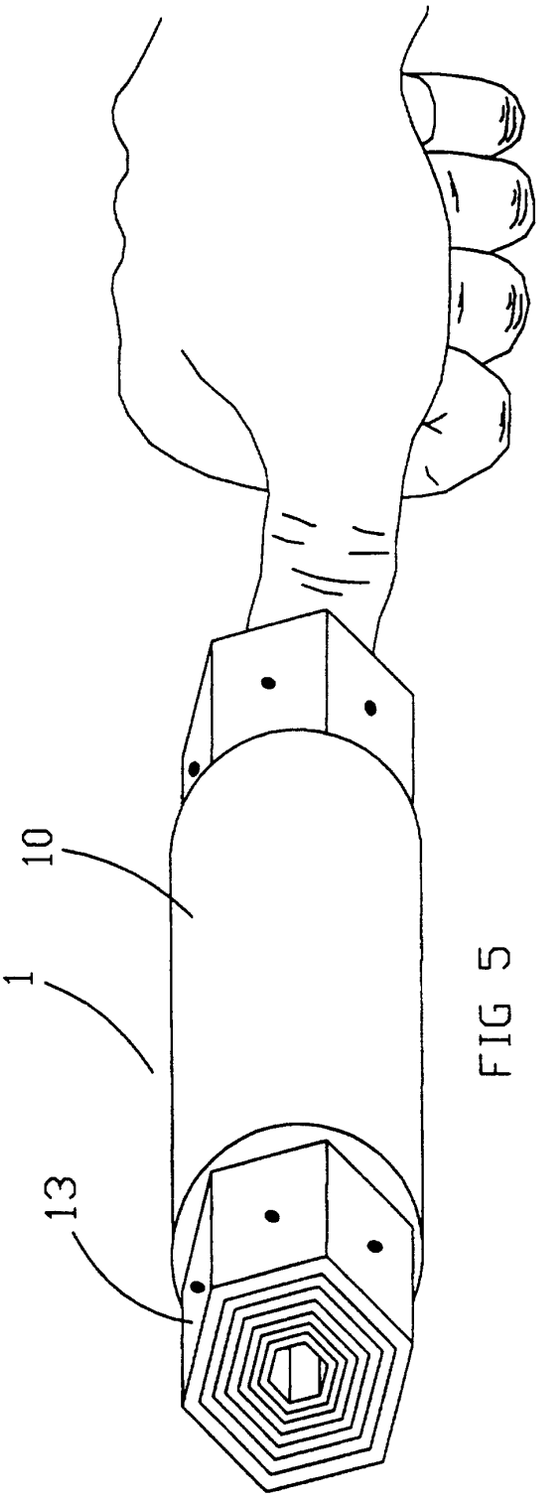

FIG 5

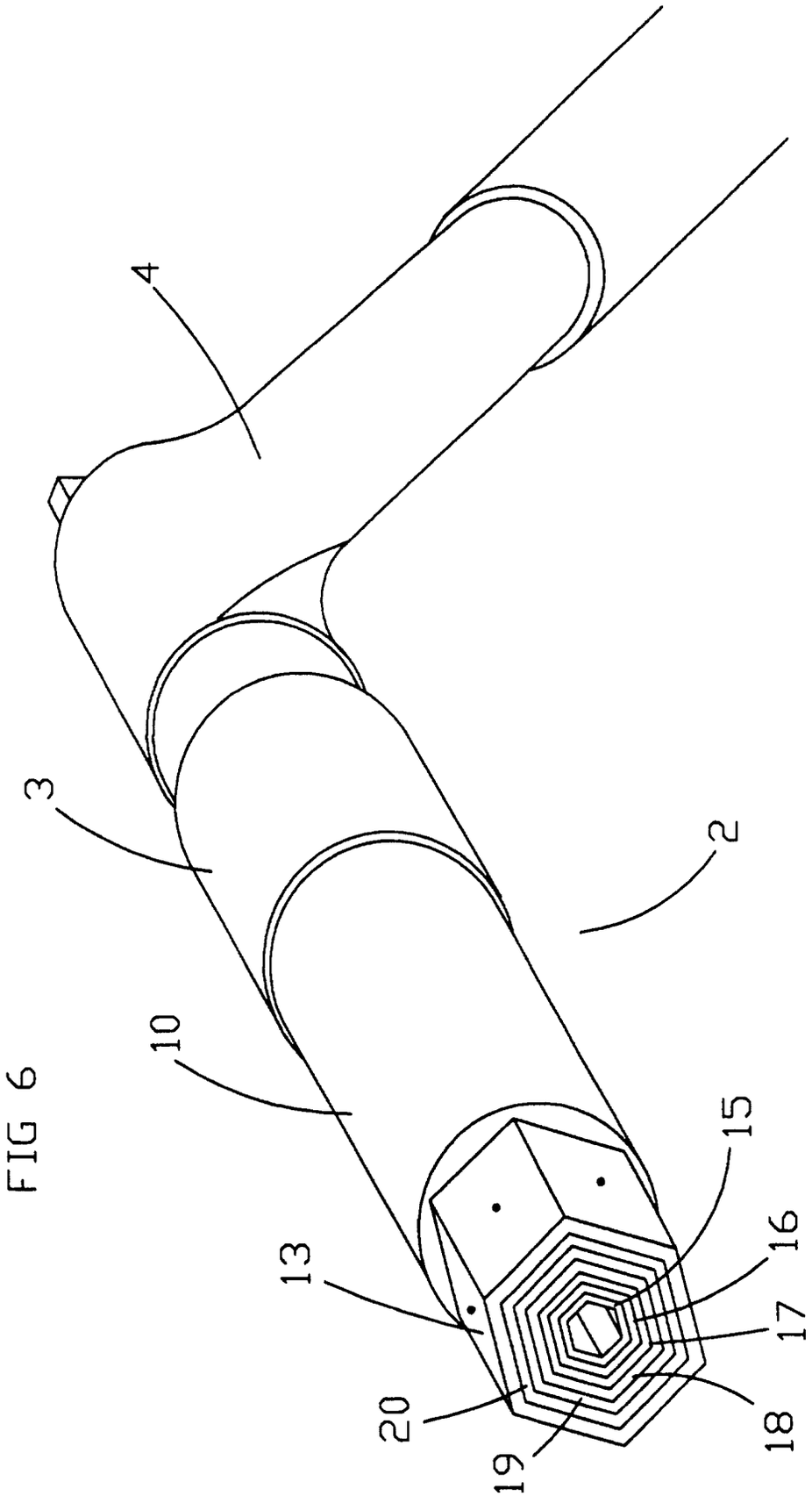

FIG 6

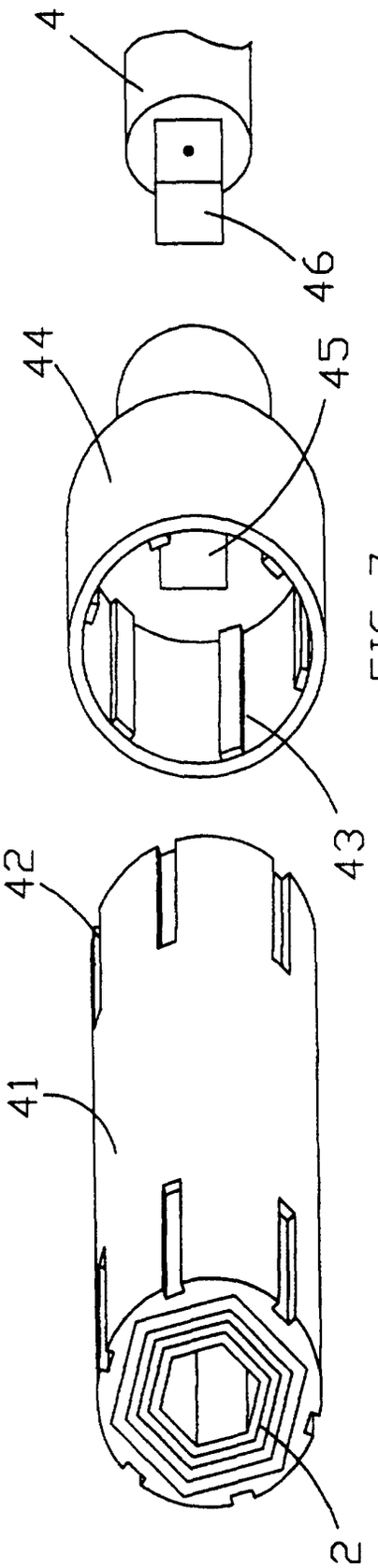

FIG 7