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NASA CASE NO. MSC-22329-1  
PRINT FIG. 1

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(NASA-Case-MS-22329-1) PUSH TYPE  
FASTENER Patent Application  
(McDonnell-Douglas Aerospace) 13 p

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**AWARDS ABSTRACT**

Push type fasteners wherein the fastener is inserted through aligned holes in parts to be fastened together, pushed on one end to cause an expansion of a fastener component, thereby securing the parts together are well known. However, for decoupling the secured parts, the fastener is typically released by pulling. Such "push to latch" and "pull to unlatch" fasteners are suitable for "blind applications" where access is available from one side only. However, their small head size makes them unusable when the head cannot be grasped to pull due to wearing of bulky gloves or limited dexterity. In many fastener applications size and weight are critical such that a large-head modification of the fastener would not be practical.

The invention relates to a push type fastener where the coupling and decoupling actions are both push-type operations. The latch consists of a plunger component having a rounded end and a threaded end, an expandable grommet, and a round head which is securable to the threaded end of the plunger. The plunger is extensible through the grommet and is structurally configured with an external camming surface which is cooperatively engageable with an internal surface of the grommet so that when the plunger is inserted in the grommet, the relative positioning of the cooperatively engageable surfaces determines the expansion of the grommet.

For attaching a removable part to a fixed part by the fastener of this invention, it is necessary that the two parts be provided with holes through which the fastener can be inserted to effect their attachment. The round head is of a slightly smaller size than the hole through the fixed part so that it easily passes therethrough. As a preliminary step in a fastening operation, the grommet is inserted into the hole in the removable part. A radial flange on the grommet prevents the grommet from passing completely through the hole. The plunger is then inserted, threaded end first, into the grommet to an extent such that the grommet remains in unexpanded condition. The round head, which is slightly smaller than the hole through the fixed part, is then attached to the threaded end of the plunger. The removable part is then aligned with the fixed part by alignment of their respective holes, the fastener with the grommet in non-expanded condition thereon is then inserted, round head first, through the holes until the grommet flange engages the removable part. Fastening of the two parts is accomplished by simply pushing the plunger head, causing the expansion of the grommet on the side of the fixed part opposite the radial flange, thereby clamping and fastening the two parts together. The fastener has the unique feature that it can be decoupled without pulling on the plunger, since only a push on the round head is required to break the coupling. This makes the fastener ideal for low-dexterity situations while still retaining the small size and weight of the existing conventional "push to latch" and "pull to unlatch" fasteners.

Novelty is believed to exist in a fastener for latching and unlatching whereby only "push" type motions are required for operation.

**TITLE:** Push Type Fastener

**INVENTOR'S NAME:** Steven A. Jackson - McDonnell Douglas

**SERIAL NUMBER:** 08/338,111

**FILE DATE:** 11/09/94

## PUSH TYPE FASTENER

### ORIGIN OF THE INVENTION

The invention described herein was made in the performance of work under a NASA contract and is subject to the provisions of Section 305 of the National Aeronautics and Space Act of 1958, Public Law 85-568 (72 Stat.435; 42U.S.C. 2457).

### FIELD OF THE INVENTION

This invention relates to fasteners and, more particularly, to a plunger type fastener for attaching a readily removable part to a fixed part where access may be available from both sides of the coupling.

### BACKGROUND OF THE INVENTION

Push type fasteners wherein the fastener is inserted through aligned holes on parts to be fastened together and pushed at one end to cause an expansion of a fastener component and thereby secure the parts together are well known. However, for decoupling the secured parts, the fastener is released by pulling. Such "push to latch" and "pull to unlatch" fasteners are suitable for "blind applications" wherein access is available from one side only. However, their small head size makes them unusable when the head cannot be grasped to pull due to wearing of bulky gloves and limited dexterity. In many fastener applications size and weight are critical such that a large-head modification of the fastener would not be practical.

SUMMARY OF THE INVENTION

The invention relates to a push type fastener wherein the coupling and decoupling actions are a push-type operation. The latch consists of a plunger component having a rounded end and a threaded end, an expandable grommet, and a rounded head which is securable to the threaded end of the plunger. The plunger is extensible through the grommet and is structurally configured with an external camming surface which is cooperatively engageable with an internal surface of the grommet so that when the plunger is inserted in the grommet, the relative positioning of said cooperatively engageable surfaces determines the expansion of the grommet.

For attaching a removable part to a fixed part by the fastener of this invention, it is necessary that the two said parts must be provided with holes through which the fastener can be inserted to effect their attachment. The rounded head, which is securable to one end of the plunger, is of a slightly smaller size than the hole through the fixed part so that it easily passes therethrough.

As a preliminary step in a fastening operation, the grommet is inserted into a hole provided in the removable part. A radial flange on the grommet prevents the grommet from passing completely through the hole in the removable part. The plunger is then inserted, threaded end first into the grommet to an extent such that the grommet remains in unexpanded condition. The rounded head, which is slightly smaller than the hole through the fixed part, is then attached to the threaded end of the plunger. The removable part is then aligned with the fixed part by alignment of the holes provided respectively therein, and the fastener with the grommet in non-expanded condition thereon, is then inserted rounded head first through the hole in the fixed part to where the grommet

flange engages the removable part. To accomplish fastening of the two parts, simply pushing the plunger head causes the expansion of the grommet on the side of the fixed part opposite the radial flange thereby clamping and fastening the two parts together. The fastener is also provided with the unique feature that it can be decoupled without pulling on the plunger, since only a push on the rounded head is used to extract the plunger and thereby break the coupling. This makes the fastener ideal for low-dexterity situations while still retaining the small size and weight of the existing conventional "push to latch" and "pull to unlatch" fasteners.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view in perspective of the fastener of the invention being shown in proximity to two structural parts to be coupled;

FIG. 2 is another exploded view of the fastener of the invention showing internal surfaces of the expandable grommet and attachable head of the fastener;

FIG. 3 is a view of the fastener of the invention showing the plunger component of the fastener inserted to a limited extent in the fastener grommet and the grommet installed in unexpanded condition in a hole in a first structural part which is aligned with a second structural part to which it is to be coupled;

FIG. 4 is a view showing the fastener of FIG. 3 with unexpanded grommet installed in two structural parts to be coupled;

FIG. 5 is a view showing the fastener installed in fastened condition in two structural parts which are coupled thereby; and

FIG. 6 is an end view of the expandable grommet of the fastener of the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, there is shown in exploded view, a fastener 10 which comprises a plunger 12, an expandable grommet 14 and a readily attachable rounded ball head 16. The plunger 12 is provided with a cylindrical shank portion 20 of circular radial cross section and a large rounded manipulating head 18 integrally attached thereto at one end. The shank portion 20 comprises a large diameter section 22 which connects to the manipulating head 18, an intermediate diameter section 23, a large diameter section 24 equal in diameter to the section 22, and a reduced diameter section 26. The reduced section 26 has a threaded end portion 26a, and a smooth surface portion 26b with an annular radial flange 28 located intermediate the threaded end of the plunger and the large diameter section 24. The flange 28 serves as a stop for the threads on the threaded end of the plunger.

The grommet 14 is provided with a large annular radial flange 30 at one end 31, a central cylindrical section 32 of circular cross section, an axial opening 33 extending therethrough, and two pair of flexible jaws or tabs 34, each jaw of which is integrally connected at one end to the cylindrical section 32. The jaws of each pair are in diametrically opposed relation to one another, and are formed by four slots 35 extending from the opposite end 37 of the grommet to its cylindrical section 32. When viewed in a transverse radial plane through the grommet, the slots are at locations in 90° angular relation. Each jaw 34 has an external tapered surface 36 which extends from the free end of the jaw in a divergingly outward direction to approximately

the mid-length point of the jaw and in configuration is one-half of a frusto-conical surface. The remaining external surface 36a of the jaw extends from the cylindrical surface of section 32 as a frusto-conical extension thereof.

5           The axial opening 33 through the grommet flange 30 and its cylindrical section 32 is circular in radial transverse cross section and of a complementary size and shape sufficient to accommodate the enlarged diameter portions 24, 22 of the plunger in an easy sliding fit therein. As shown in FIG. 2,  
10 the inner surface of each jaw 34 comprises a cylindrical portion, which is quarter-circular in transverse cross section and extends from the grommet end 31 at the opening 33 through the grommet section 32 to an inner camming surface 38 which tapers and converges inwardly towards the end of the jaw 34.  
15 Each tapered surface 38 is approximately one-quarter of a frusto-conical surface which is divided by a pair of diametral planes through its longitudinal axis and in orthogonal relationship to one another as best seen in FIG. 6.

          The material of which the grommet is made, whether it be  
20 metallic, plastic or the like, is sufficiently pliant such that the jaws are adapted to be cammed open and away from one another by forces applied to their internal camming surfaces 38, each of which forces includes a component in a radially outward direction of the longitudinal axis of the grommet.

25           The attachable rounded head 16 is of spherical shape truncated by an annular planar surface 15 which approximates an annular chamfered surface 25 which is provided on the end of the large diameter shank section 24 and which faces the plunger flange 28. This head 16 is provided with an inwardly  
30 extending blind bore 17 having an internally threaded section 19 and an enlarged diameter threaded-relief smooth bore section 21 connecting therewith which opens at the planar surface 15.

The fastener 10 of the invention is particularly intended for use in removably joining a perforated first structural member, such as a panel 41, to a perforated second structural panel, such as a fixed panel 43. To be joined by the fastener 5 10, both of the panels 41, 43 must be provided with a hole such as holes 45 and 46 through which the fastener can be inserted to effect their attachment and the holes must be sized appropriately. In particular, the hole 45 in the removable structural part 41 must be smaller in size than the 10 radial flange 30 of the grommet, but sufficiently large to accommodate passage of the grommet jaws such that the grommet cannot pass completely therethrough. Also, the hole 46 in the fixed structural part 43 must be slightly larger than the attachable head 16 and also slightly larger than the largest 15 transverse dimension of the cylindrical section 32 of the grommet and the grommet jaws 34 when in unexpanded condition.

As a preliminary step in a fastening operation, the grommet 14 is inserted into the hole 45 in the removable part 41. The radial flange 30 on the grommet 14 prevents the 20 grommet from passing completely through the hole 45 in the removable part. The plunger 12 is then inserted, threaded end first, into the grommet to an extent such that the grommet remains in unexpanded condition. The rounded head 16, which is slightly smaller than the hole 46 through the fixed part 25 43, is then attached to the threaded end of the plunger. The removable part 41 is then aligned with the fixed part 43 by alignment of the holes 45, 46 provided respectively therein, and the fastener 10 with the grommet in non-expanded condition thereon, is then inserted with rounded head 16 first through 30 the hole 46 in the fixed part 43 to where the grommet jaws 34 engage the fixed part 43 as shown in FIG. 4.

As a further step to accomplish fastening of the two parts 41, 43 requires pushing the plunger head 18 to cause



axial movement of the plunger 12 in the grommet 14 to where  
the camming surface 25 on the plunger engages the four  
internal camming surfaces 38 of the grommet jaws 34 and  
applies a force thereto which drives the jaws apart and places  
5 the grommet in expanded condition, as shown in FIG. 5. It is  
to be noted that the application of force by the plunger  
*CAMMING SURFACE 25*  
~~flange 28~~ on the camming surfaces of the jaws includes a  
component directed radially outward from the plunger axis and  
thereby causes each jaw 34 to flex at its junction with the  
10 grommet cylindrical section 32. The resultant opening of the  
jaws 34 causes expansion of the grommet such that the outer  
surfaces 36a of the jaws engage the circular edge provided by  
the hole 46. The engagement of the jaws 34 against the fixed  
part 43 and the engagement of the grommet flange 30 against  
15 the removable part 41 thereby locks parts 41, 43 in a tightly  
secured fastened relationship.

It is also desirable to secure the plunger in the grommet  
against vibration by providing circumferential ridges (not  
shown) around the cylindrical portion of the shank camming  
20 section 24 and corresponding ridges on the internal camming  
surface 38 of the grommet jaws. The provision of such ridges  
is a standard feature in some commercial fasteners.

When decoupling of the structural parts 41, 43 is  
desired, the decoupling requires only a push be applied on the  
25 rounded head 16 of the fastener with a force component in the  
general axial direction of the plunger whereby the cooperative  
camming surfaces of the plunger and grommet are disengaged and  
the grommet returns to its unexpanded condition. Complete  
decoupling of the parts 41, 43 is accomplished by releasing  
30 all fasteners securing them and grasping the removable part  
and removing it. There is normally no need to remove the  
fastener from the part 41.

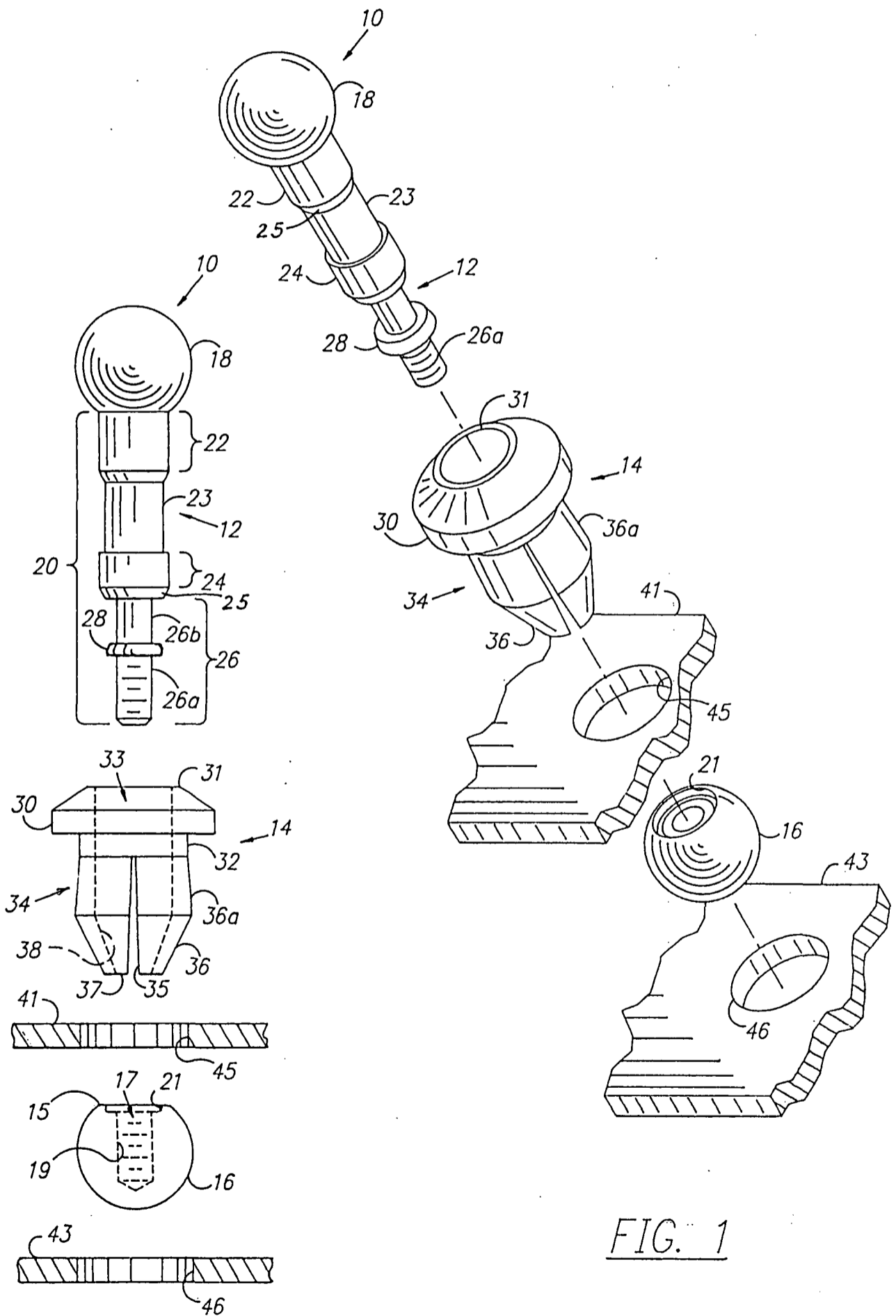
It is to be noted that the fastener of the invention

which requires special care and skill at installing the ball end 16, is particularly useful where the person applying the fastener has low dexterity capability as when wearing gloves in cold or other hostile environments, or if the person is  
5 handicapped. It is also well suited for fastener applications in underwater operations and in extra-vehicular activities in manned space operations. Although a relatively snug fit of fastener parts is desirable but not always present, misalignment tolerance is provided by a slightly looser fit  
10 between plunger, grommet and the holes in the parts to be attached.

It is also to be understood that the foregoing description of a preferred embodiment of this invention has been presented for purposes of explanation and illustration  
15 and is not intended to limit the invention to the precise form disclosed. For example, the rounded heads could be other than spherical, and the grommet flange, could be much larger and of different shape than shown herein. The grommet might also be provided with one or several pairs of jaws rather than  
20 two. The rounded heads could also be attached to the plunger by means other than threads. If the parts are plastic, the plunger tip could terminate in a small spherical tip adapted to be snapped into a corresponding receptacle provided in the truncated rounded head. Accordingly, it is to be appreciated  
25 that many changes may be made in the structure and materials by those skilled in the art without departing from the spirit of the invention.

ABSTRACT

A push type fastener for fastening a movable structural part (41) to a fixed structural part (43), wherein the coupling and decoupling actions are both a push type operation, the fastener consisting of a plunger (12) having a shank (20) with a plunger head (18) at one end and a threaded end portion (26a) at the other end, an expandable grommet (14) adapted to receive the plunger shank (20) therethrough, and an attachable head (16) which is securable to the threaded end of the plunger shank (20). The fastener (10) requires each structural part (41, 43) to be provided with an aperture (45, 46) and the attachable head (16) to be smaller than the aperture (46) in the second structural part. The plunger (12) is extensible through the grommet (14) and is structurally configured with an external camming surface (25) which is cooperatively engageable with internal surfaces (38) of the grommet so that when the plunger is inserted in the grommet, the relative positioning of said cooperable camming surfaces determines the expansion of the grommet. Coupling of the parts is effected when the grommet is inserted in the aperture (46) in the fixed structural part (43) and expanded by pushing the plunger head (18) and plunger at least a minimal distance through the grommet. Decoupling is effected by pushing the attachable head (16).



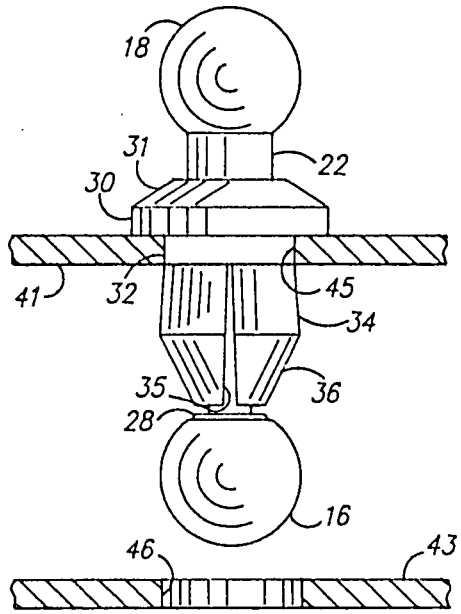


FIG. 3

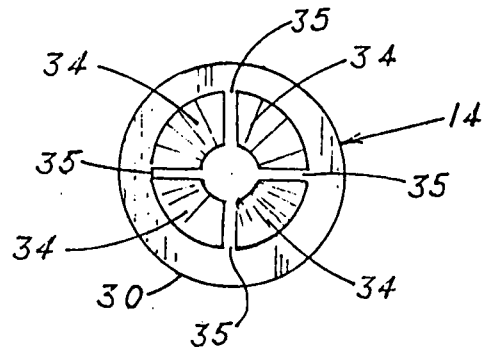


FIG 6

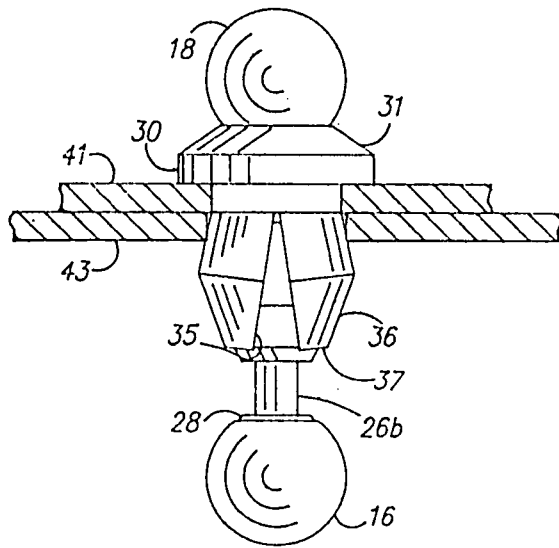


FIG. 5

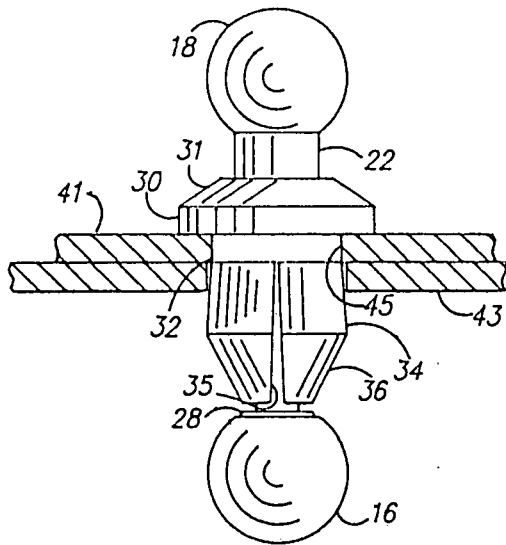


FIG. 4