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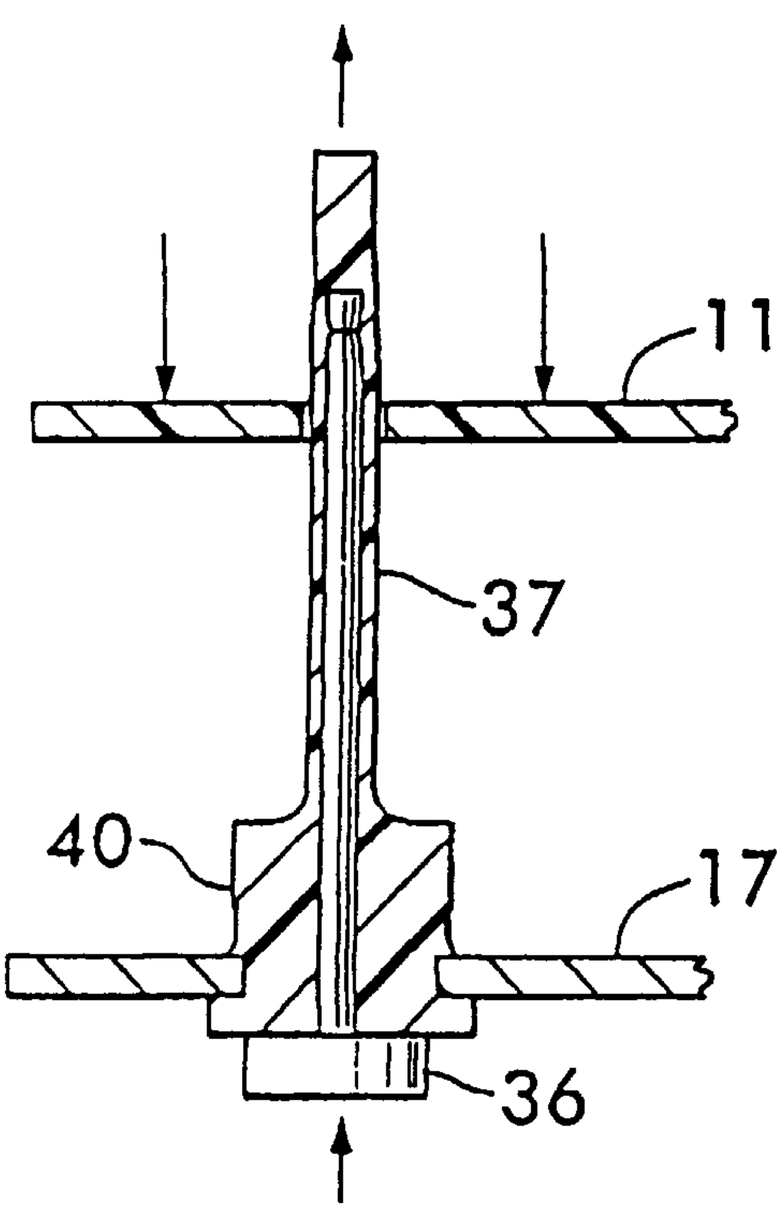

(57) Abrégé/Abstract:
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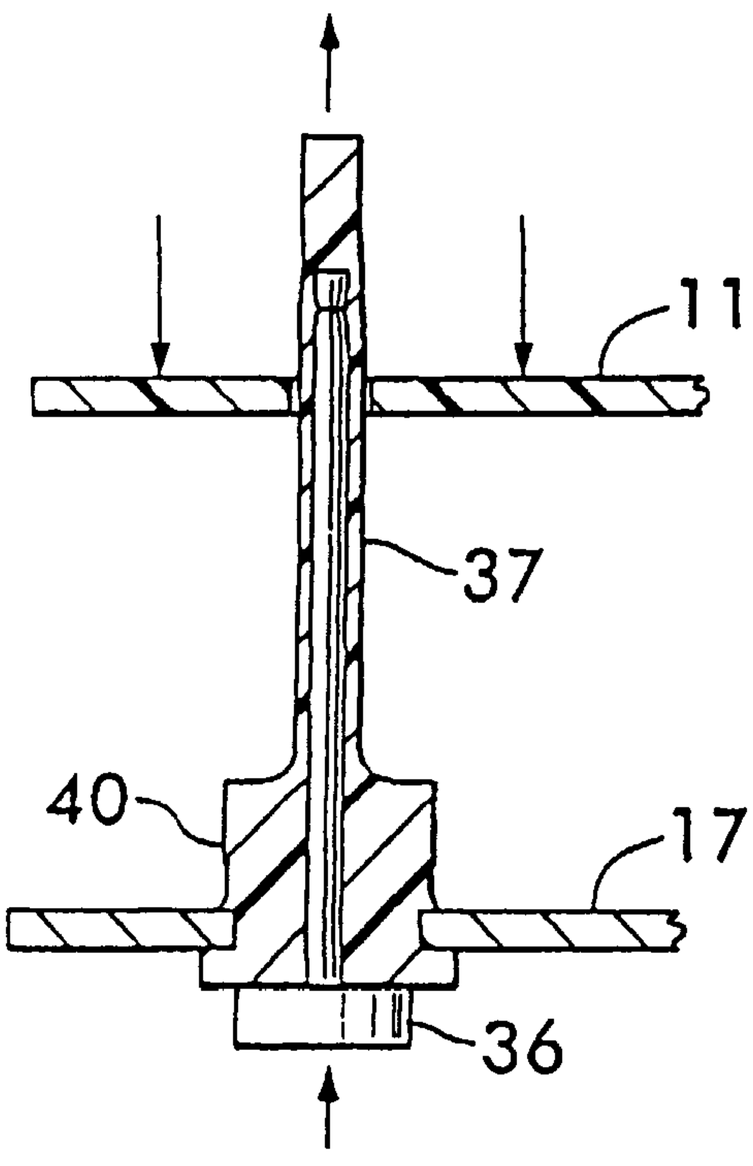

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RESILIENT STANDOFF FASTENER

Priority based upon provisional application serial number 60/255,374 filed on December 15, 2000, entitled "RESILIENT STANDOFF FASTENER" is hereby claimed.

FIELD OF THE INVENTION

This invention relates to a resilient fastener including standoff-type fasteners that assemble two flat panels a spaced distance apart. More specifically, it relates to an elastomeric fastener that provides panel grasping and spacing functions solely by its resilience.

BACKGROUND OF THE INVENTION AND PRIOR ART

A standoff fastener is an element that attaches two panels a spaced distance apart. The panels are generally attached through some type of clipping mechanism, or clamping by threaded fasteners or screws and generally include two types: those that are machined or formed from metal, and those made from plastic. However, whether the fasteners are metal or plastic, the various types of standoffs presently available pose problems. Problem areas include the use of metal standoffs to separate two printed circuit boards. When a printed circuit board is standing off from a metal chassis, the fastener is usually attached to the chassis using methods such as self-clinching or riveting which require tools. The attachment of threaded fasteners is also time consuming, requires a loose mating component such as a screw, and increases the time required to repair items in the

field.

When self-clinching fasteners are used, several other problems can also be encountered. The chassis metal must be ductile, limiting the choice of materials used in the chassis, and removal of these fasteners is a destructive process leaving either the chassis or the fastener unusable after removal. Also, the installation or removal of the fastener requires specific tooling which is relatively expensive, or not readily available in the field. And finally, when the fastener is required to make grounding contact between a printed circuit board and the chassis, metal fasteners must be used but have other disadvantages noted above with regard to mounting circuit boards.

The use of plastic fasteners does not solve many of the problems encountered with metal fasteners. When a plastic standoff utilizes threads, debris can fall into the assembly and the plastic standoffs that do not utilize threads are often not resistant to shock, heat, and vibration. Plastic fasteners that do not require special installation tooling are often damaged upon removal so the fastener becomes unusable for re-assembly. Plastic fasteners are also unable to provide electrical conductivity in the event a grounding contact is needed.

Debris or accidental screw contact on sensitive equipment during the manufacturing process is also a problem. Another disadvantage is that if the threaded hole is stripped, the entire panel becomes useless. Furthermore, the location of the holes in the panels to be separated in the assembly can be critical and the tolerance between the holes of the first panel and second panel can be cumulative causing misalignment of the holes so the panels cannot be assembled.

While there have been many attempts in the art to solve the problems above, none to date have been successful. There is therefore a need in the art of panel fastening systems for a fastener that provides new advantages and solves the problems in the art stated above.

SUMMARY OF THE INVENTION

The present resilient standoff invention addresses and solves many of the problems with the various types of standoffs mentioned above. This fastener has an elastomeric portion, hereinafter the "tail," that provides retention of the attached panel by the compressive radial grip of displaced tail material. A base of the fastener, which in some embodiments includes a head and a barrel section, provides a positive stop against the further insertion of the tail into the hole of a panel. The base can also function to positively space two panels apart, providing a standoff function. A third embodiment allows the tail-elongation to occur from the opposite side of the fastener by the use of a push-pin extending through the base. All three embodiments as well as other modifications are independent but will also work in conjunction with each other.

Given a panel with a hole having a diameter less than the relaxed diameter of the tail, the tail can fit into the hole of the panel when the tail is stretched to a reduced diameter. When the stretching force is released, the tail grips the interior surface of the hole as well as the surfaces of the panel around it. This occurs because when the tail is released it attempts to return to its original diameter, however the material of the tail restricted by the panel causes the tail to expand or bulge on either side of the panel. This

bulge retains the panel at the location along the tail when the stretching was relaxed. The expansion or bulging is also assisted by the tendency for the tail to return to its free length. To remove the panel, the tail is stretched again until the diameter reduces to an amount sufficient to pass the panel back over the tail.

Although useful as a standoff, the simplest form of the fastener invention is its application to a single panel where the protruding base on one side of the panel may serve a useful function such as a support foot commonly found on household or electronic appliances. In this embodiment, the majority of the tail expansion (i.e. bulge) occurs on the side of the panel opposite the annular underside surface of the fastener base which abuts the panel. In more complex embodiments, the base can also include various other structures such as a retainer or a sleeve to achieve additional functions of electrical conductivity, rigid spacing, or other functional characteristics as mentioned further herein.

More specifically, the applicant has invented a new elastomeric fastener which provides an assembly of panels without the use of threaded structures. The fastener includes a base of enlarged diameter and an elongate elastomeric shank extending from the base providing two states of dimension. The first is a relaxed state wherein the shank is substantially free of all external forces. The second state is tensile, wherein an axial tensile force applied to the shank stretches the shank into a condition of reduced diameter. In addition, there may be attachment means adjacent the base of the fastener securing it to a first panel.

A second panel has an aperture with a diameter greater than the second tensile state of the shank, but less than the diameter of the shank at the first relaxed state. During

assembly, a bulge in the shank forceably contacting a backside of the second panel in the direction of the first panel is formed by first passing the shank through the aperture in the second panel while in the second tensile state, and then releasing the applied tensile force. The bulge provides a clamp force to the second panel so that the panels become secured together.

The fastener may further include an internal axial blind bore having an endwall proximate the distal end of a pin slidable within the bore and extending through to the outside of the opposite end of the fastener. Pushing the pin into the bore causes the longitudinal extension of the tail. This provides the above-described tail-stretching function and allows use of the fastener from one side of a panel only. Other aspects of the present invention will be more clearly shown from the following drawings and description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1-3 are a series of side partial sectional views showing, step-wise, the process of assembling panels utilizing the fastener of the invention.

Figure 4 is a side partial sectional view showing an alternate embodiment of the invention.

Figures 5-7 are a series of side sectional views showing step-wise the application of the attachment of a panel to an alternate embodiment of the invention.

Figure 8 is a side sectional view of an alternate embodiment of the invention.

Figure 9 is a side sectional view of an alternate embodiment.

The preferred embodiments shown in the drawings depict fasteners which are substantially circular in lateral cross-section at all points along their length. Because they have axial symmetry, the side views shown in the above-described figures of drawing are sufficient to convey an understanding of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figures 1-3, a simplistic embodiment of the invention is shown. The resilient standoff in these figures depicts a fastener with a head **13** that has an adhesive **15** applied to its end surface. Thus, no holes are required in panel **17** for assembly, thereby eliminating location tolerance requirements with the holes in either of the attached panels. The standoff can be assembled to panel **17** before or after it is attached to panel **11**.

Assembly then proceeds as follows. First, the lead **10** is aligned and inserted into the hole **12** in panel **11**. Once the tip of the tail **19** protrudes through the hole **12** in the panel **11**, the tail can be stretched by manually pulling the lead **10**. As the diameter of the tail **19** reduces to less than the diameter of the hole **12**, the panel **11** will be able to slide freely over the tail **19** as shown in Figure 2. If attached to panel **11** first, the first panel and fastener may be set onto panel **17** using the adhesive and the panels will be precisely located. The adhesive bond should be strong enough to withstand the repeated stretching force of the tail portion **19**.

As shown in Figure 3, once the desired position of the panel **11** is achieved, the tail **19** is relaxed and the diameter and length of the tail **19** will attempt to return to its

original size, creating a gripping, bulged condition of the tail against the panel. The surface of the tail is preferably entirely smooth so that the gripped panel may be attached at any point along the length of the tail such as the location shown by the alternate location of panel **11** depicted in phantom lines. The result is bulges **14** and **16** formed on both sides of the panel **11** holding the panel firmly where it was located when the tail **19** was relaxed. The ability to vary the location of the attachment point along the tail may be utilized to achieve different spacing or degree of lateral resilience between the panels. To remove the panel **11**, the tail **19** is stretched again thus eliminating the bulges **14** and **16** and allowing the panel to slide over the tail in either direction. If the tail is relaxed when the panel **11** is in the position depicted in solid lines, bulge **18** retains the panel against the base **13** which firmly determines the amount of space between the panels **11** and **17**. This procedure described with regard to this form of the invention is applicable to the other embodiments which all function on the same elastomeric grip principle.

Refering now to Figure 4, an additional embodiment is similar to the fastener shown in Figures 1-3, however another tail **21** has been added to the opposite side of the base **13**. After following the procedures described regarding Figures 1-3 on one side, the procedure is repeated on the other side of the base **13** providing the positive separation of two panels **11** and **17** equal to the height of the base **13** held between them. With this panel placement, when the tails **19** and **21** are relaxed, two bulges **23** and **25** are formed holding the panels in place.

Referring now to Figure 5, a more complex embodiment of the invention is depicted in which the base **31** of the fastener includes a head **33** and a push-pin actuator

35. The headed base of the fastener is first inserted through a hole in a first panel to which it is retained by groove **34** adjacent the underside of the head.

Referring to Figures 6 and 7, a second panel is then attached by the stretching and bulging of the elastomeric tail portion of the shank as described in the previous embodiments, however a push-pin provides means of stretching the fastener with access to only one side of the panel **17**. The push-pin can be either molded-over by the resilient material or assembled in a later operation. The pin preferably has a shank **38**, head **36**, and the end of the pin may have a retention groove **41** that corresponds to a narrowed retention sleeve in the bore of the fastener to captivate the pin.

As shown in Figure 6, pressing the head **36** of the push-pin at the base of the fastener stretches the tail **37** at the opposite end allowing the fitting-over of panel **11**. When force against the push-pin **35** is relaxed as shown in Figure 7, the bulge **39** retains and presses panel **11** against the annular underside of base **40**. To remove the panel **11**, the push-pin **35** is pressed again, eliminating the bulge **39** and allowing the panel **11** to slide back over the tail **37**. In this embodiment, a barrel portion of the base **40** provides spacing means between the panels.

Referring now to Figure 8, an alternate embodiment is shown in which electrical contact is provided between two spaced panels by using the resilient standoff in combination with a metal retainer **51**. The metal retainer **51** may be permanently attached to a first ductile panel **53** by clinch means **55**. In addition to the self-clinching feature **55**, the retainer has a counterbore **57**, and through-hole **59**. The resilient portion of the standoff may be assembled either before or after the self-clinching retainer **51** is installed

into ductile panel **53**. It can attach itself to the retainer by gripping bulge **52** prior to assembly with panel **54** since the retainer through-hole, like the panel hole, is undersized with respect to the relaxed diameter of the tail **50**. By assembling the panel as described above with regard to Figures 1-3, the panel **54** will make firm contact with the retainer **51**, providing electrical contact between panels **53** and **54** if desired. Electrical conductivity can also be achieved by molding conductive material directly in the material of resilient standoff eliminating the need for the retainer. A simple metal sleeve or compression bushing inserted over the base **56** of the resilient standoff can also be used.

Referring now to Figure 9, another insert configuration utilizes a snap-in retainer rather than the self-clinching retainer shown in Figure 8. This retainer **61** can be temporarily inserted into any panel which therefore is not required to be ductile like the self-clinching embodiment of Figure 8. The retainer **61** has a counterbore and a through-hole much the same as the retainer of Figure 8 except that a snap protrusion **63** and a head **65** combine to provide snap-in attachment means which replaces the clinch feature. This embodiment can be employed to assembly panels much the same as described above with regard to the embodiment in Figure 8.

In considering the above preferred embodiments, it will be realized that the many objectives and advantages of the invention have been achieved. The resilient standoff of the invention is not limited to use with any specific material. The resilient standoffs will not introduce metal chips or debris that can be damaging to electronics. There is no screw to accidentally drop onto sensitive equipment. No special tooling is required to assemble or disassemble the panels. The ease of assembly and disassembly reduces the

time to repair an item by eliminating a loose screw. The fastener can be easily removed and re-assembled without damaging either the panels or the fastener. Also, the resilient material of the fastener can serve as an electrical insulator or conductor. Metal components can be over-molded or later assembled to the fastener in order to provide electrical contact or a ground. An adhesive can be added to part of the fastener thus eliminating the need to punch holes in one of the panels. The means by which this fastener retains components also makes this fastener resistant to loosening due to shock and vibration, unlike known plastic snap-in fasteners. Thus, it will be apparent that many of the problems in the prior art of panel fastening systems have been overcome.

It should be understood that there may be other modifications and changes to the present invention that will be obvious to those of skill in the art from the foregoing description, however, the present invention should be limited only by the following claims and their legal equivalents.

CLAIMS

What is claimed is:

1. An assembly of panels secured by a non-threaded fastener composed of an elastomeric material, comprising:

an elastomeric fastener comprising:

a base of enlarged diameter at one end of a shank; and

an elongate elastomeric shank extending from said base, said shank providing two states of dimension: a first state being a relaxed state, wherein said shank is substantially free of all external forces and a second state of said shank being a tensile state, wherein an axial tensile force applied to said shank stretches the shank into a condition of reduced diameter;

attachment means on said fastener attaching a first panel thereto;

a second panel having an aperture with a diameter greater than said second tensile state of said shank, but less than the diameter of said shank at said first relaxed state, said shank passing through said aperture in said second panel; and

a bulge in said shank forceably contacting a backside of said second panel in the direction of said first panel, said bulge formable by first passing said shank through said aperture in said second panel while in said second tensile state, and then releasing said applied tensile force.

2. The assembly of panels of claim 1 further including spacing means, being an area of increased diameter of said shank greater than the diameter of said second aperture and located between said panels holding them a spaced distance apart.

3. An elastomeric fastener comprising:

a head of enlarged diameter at one end of an axially-extending shank, said head including an end surface;

attachment means adjacent said head for attaching said fastener to a panel; and

a longitudinally-extending elastomeric tail portion of said shank of reduced diameter providing two states of dimension: a first relaxed state, wherein said shank is substantially free of all external forces and a second tensile state of said shank, wherein an axial tensile force applied to said shank stretches the shank into a condition of reduced diameter.

4. The fastener of claim 3 further including a base portion of increased diameter

integral with said shank, said base portion extending axially along said shank being located between the head of said fastener and said tail, and having a diameter less than the diameter of said head.

5. The fastener of claim 4 wherein said attachment means is a deformable circumferential

groove adjacent said base of said head.

6. The fastener of claim 4 further including a retainer surrounding said base portion, said

retainer including attachment means at one end thereof adjacent the end surface of said head.

7. The fastener of claim 6 wherein said retainer is metal.

8. The fastener of claim 7 wherein said attachment means is clinch means.

9. The fastener of claim 4 further including an internal axial blind bore having an endwall

proximate the distal end of said shank, and a pin within said bore having a length greater than said bore, said pin extending through to an outside of said head whereby pushing said pin into said bore causes the longitudinal extension of said elastomeric tail.

10. The fastener of claim 2 wherein said spacing means is in abutment with said second

panel.

11. The fastener of claim 5 being composed entirely of an elastomeric material.

12. An assembly of panels secured by a non-threaded fastener composed of an elastomeric

material, comprising:

an elastomeric fastener comprising:

a head of enlarged diameter;

a base adjacent said head, said base being a portion of said shank of increased diameter less than the diameter of said head; and

an elongate shank extending from the base, said shank having an entirely smooth outer surface and providing two states of dimension: a first relaxed state, wherein said shank is substantially free of all external forces and a second state of said

shank being a tensile state wherein an axial tensile force applied to said shank stretches the shank to a condition of reduced diameter;

a first panel affixed to said head;

a second panel having an aperture with a diameter greater than said second tensile state of said shank, but less than the diameter of said shank at said first relaxed state, said shank passing through said aperture; and

a bulge in said shank forceably contacting a backside of said second panel in the direction of said first panel, said bulge formable by passing said shank through said aperture in said second panel while in its second tensile state and then releasing said tensile forces.

13. The fastener of claim 3 wherein said shank includes a distal end suitable for grasping

to apply a tensile force thereto.

14. The fastener of claim 3 wherein said tail portion of said shank has an entirely smooth

outer surface.

15. The fastener of claim 7 wherein said attachment means is rivet means.

16. The assembly of claim 1 further described in that said attachment means is an adhesive

applied to the base.

17. The fastener of claim 7 wherein said retainer is metal and affixed to said base portion

of said shank.

18. The assembly of claim 1 wherein said attachment means includes a retainer affixed to

said base, said retainer being snap-fit into said first panel.

19. The assembly of claim 18 wherein said retainer is composed of metal.

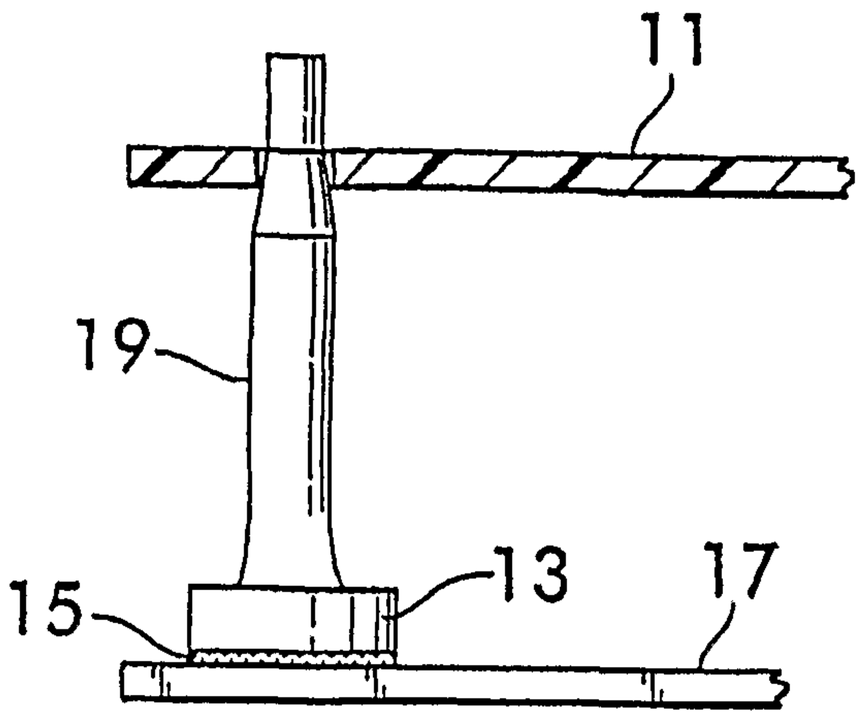


FIG.1

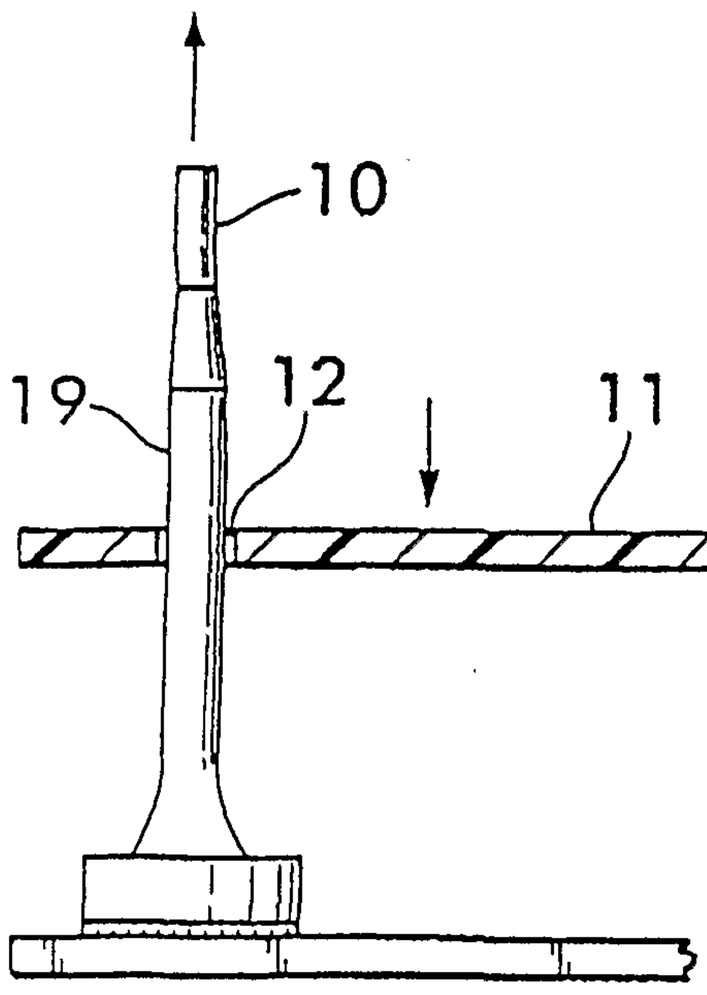


FIG.2

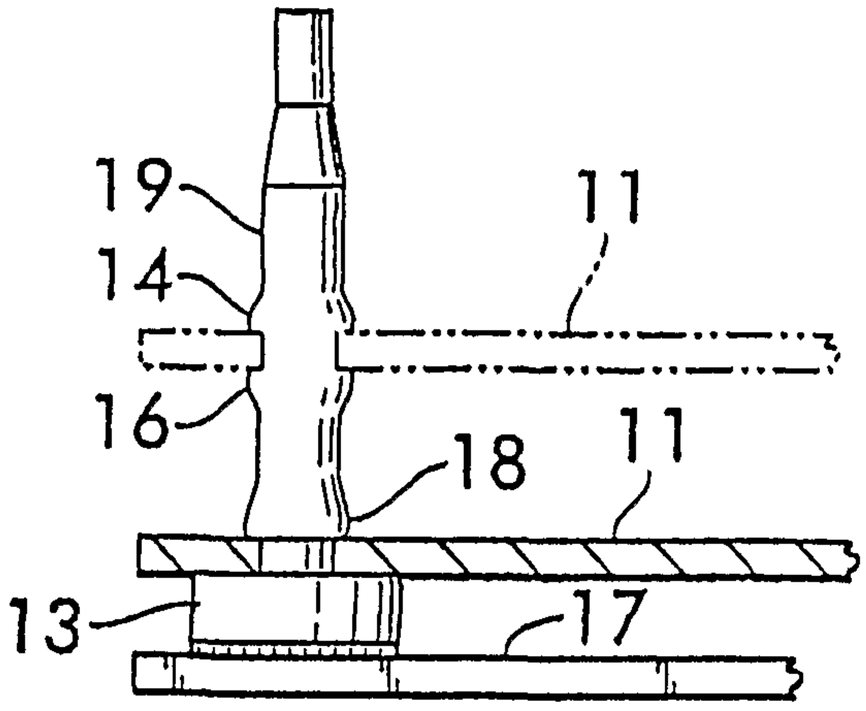


FIG.3

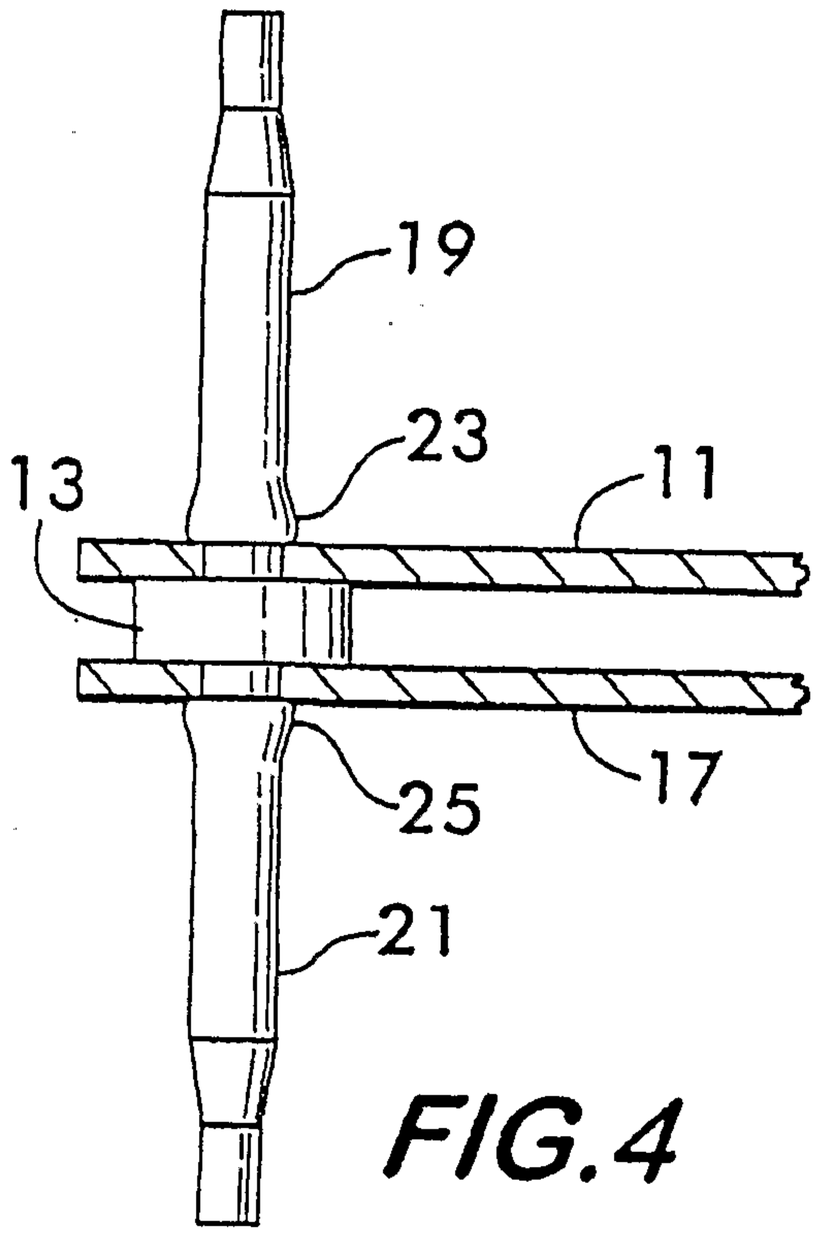


FIG.4

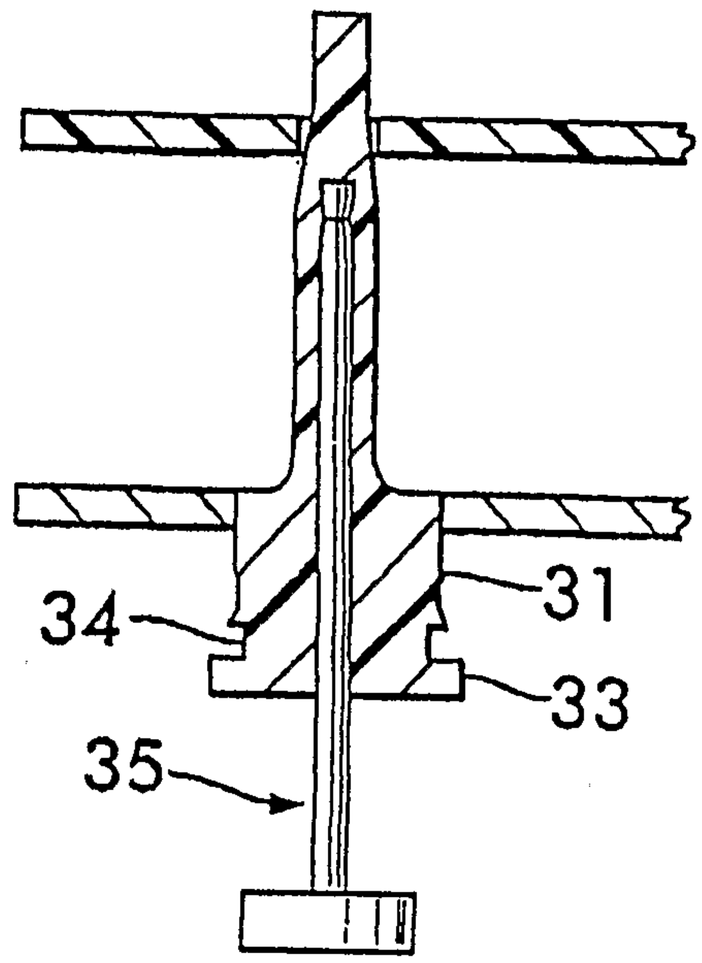


FIG.5

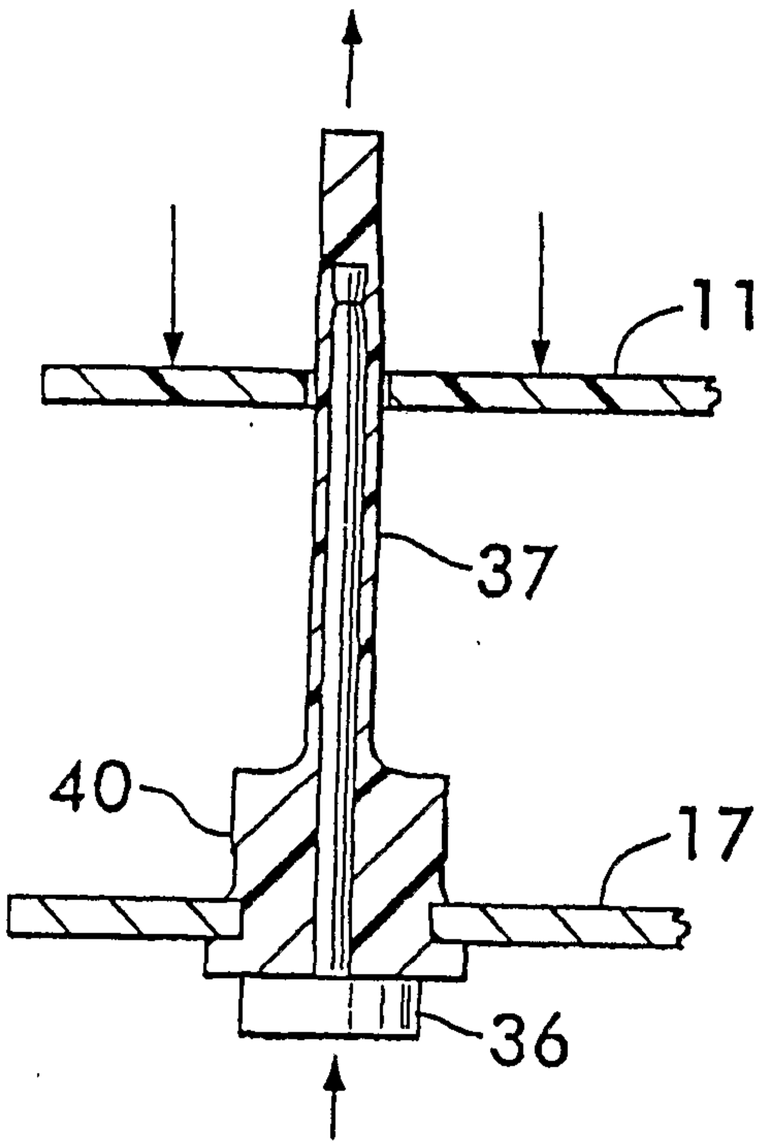


FIG.6

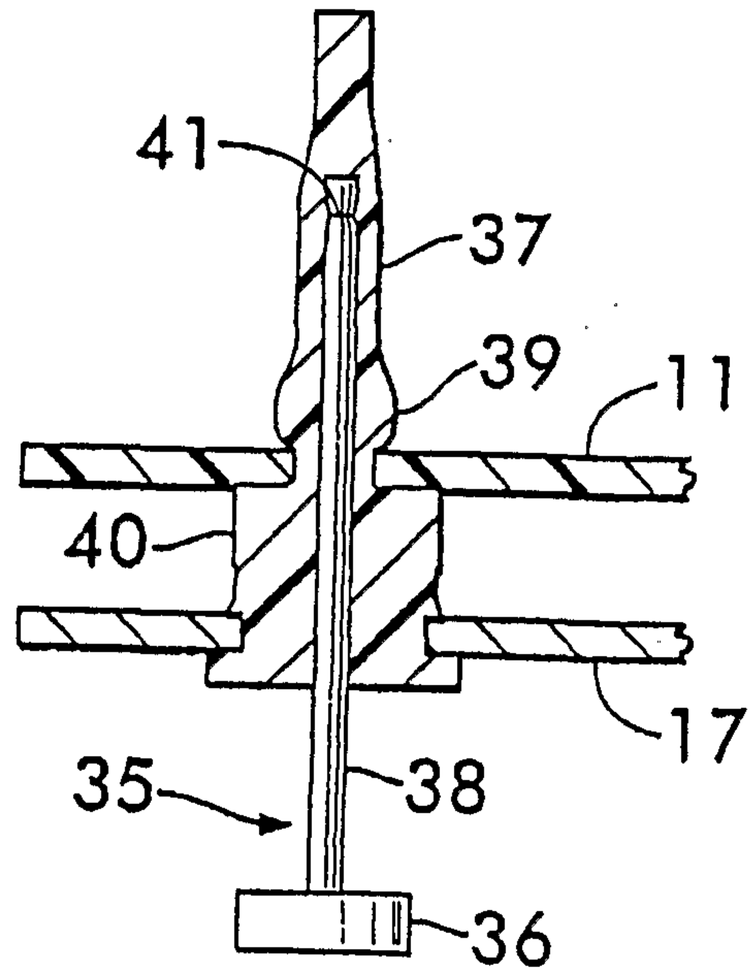
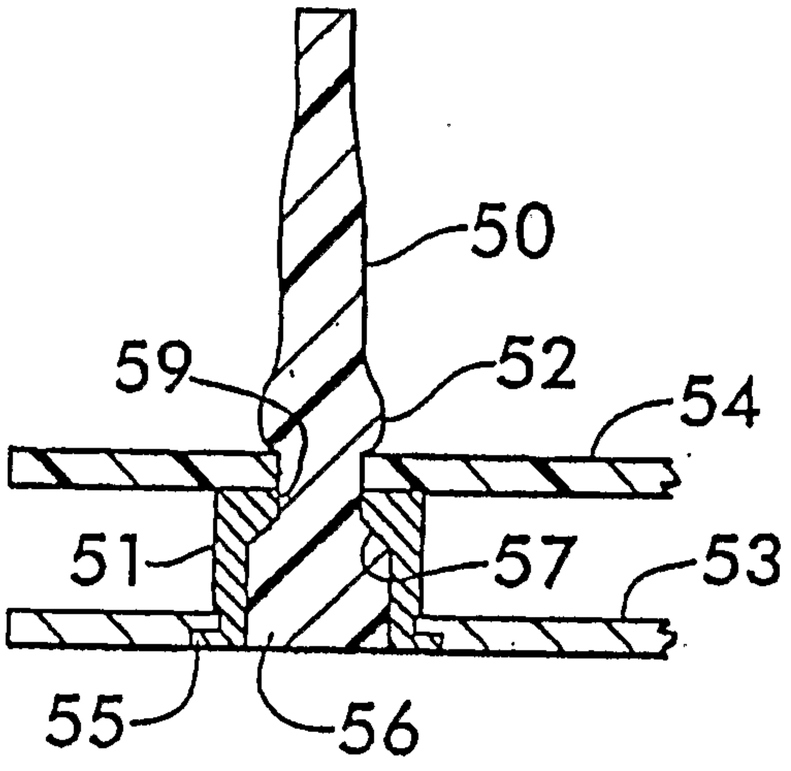


FIG.7

FIG.8



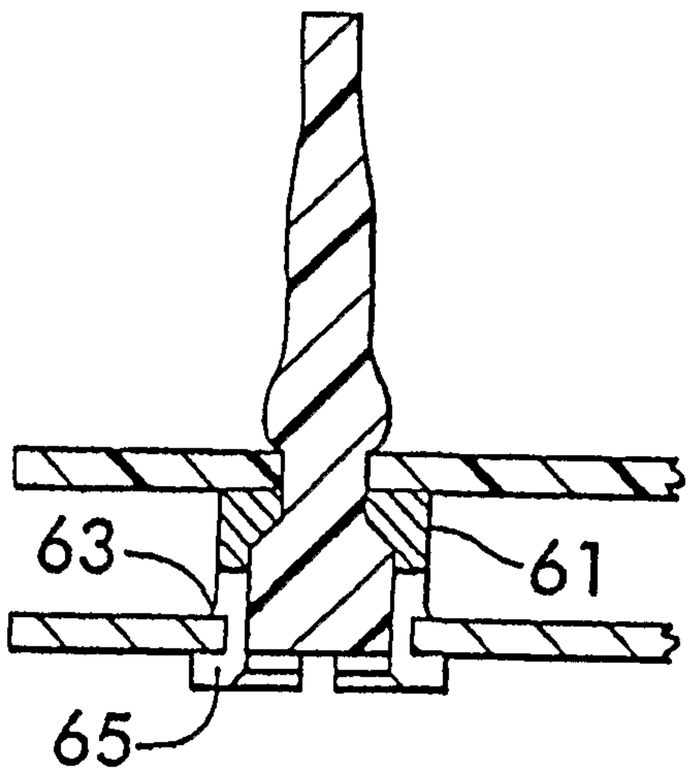
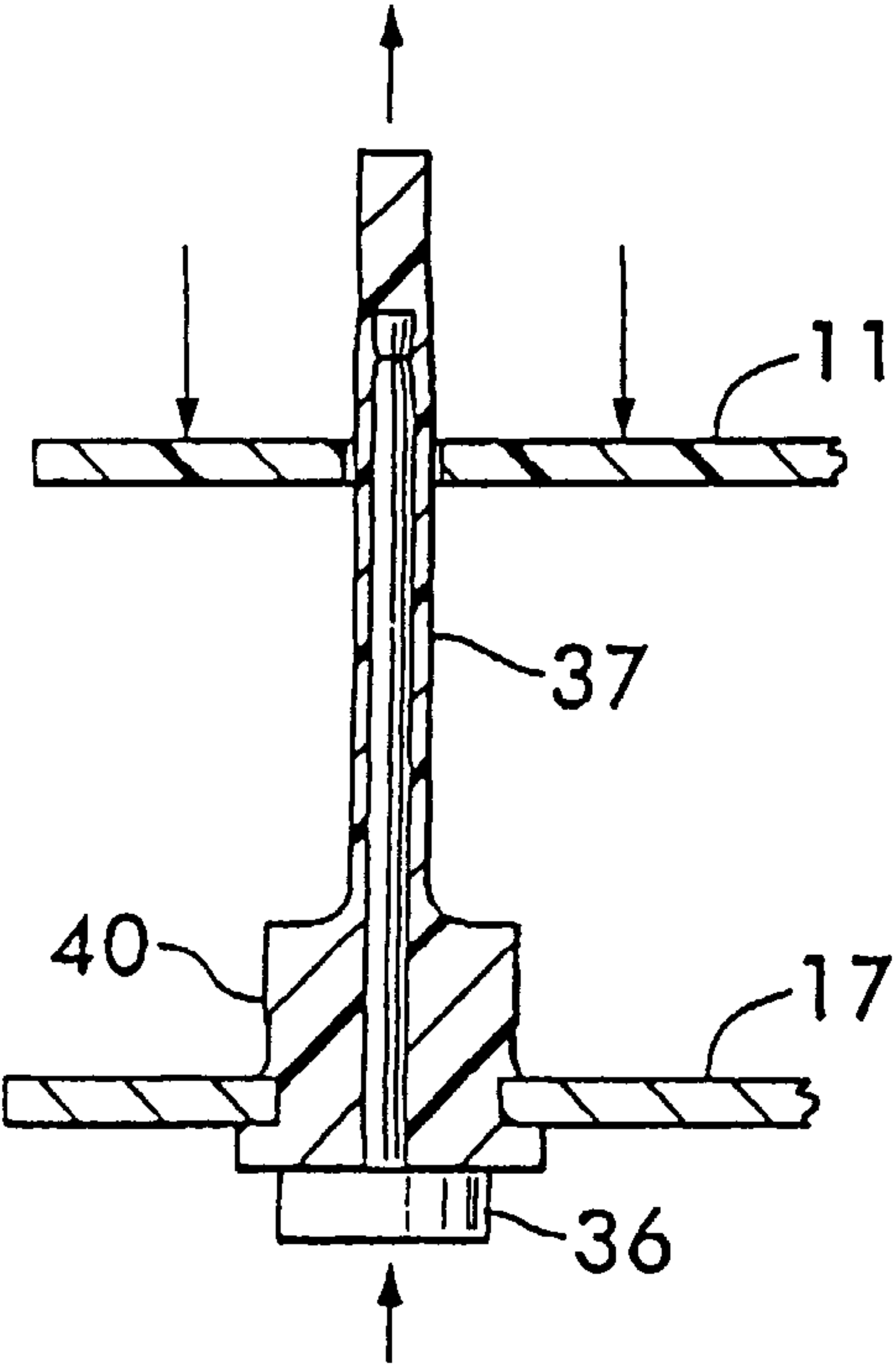


FIG.9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