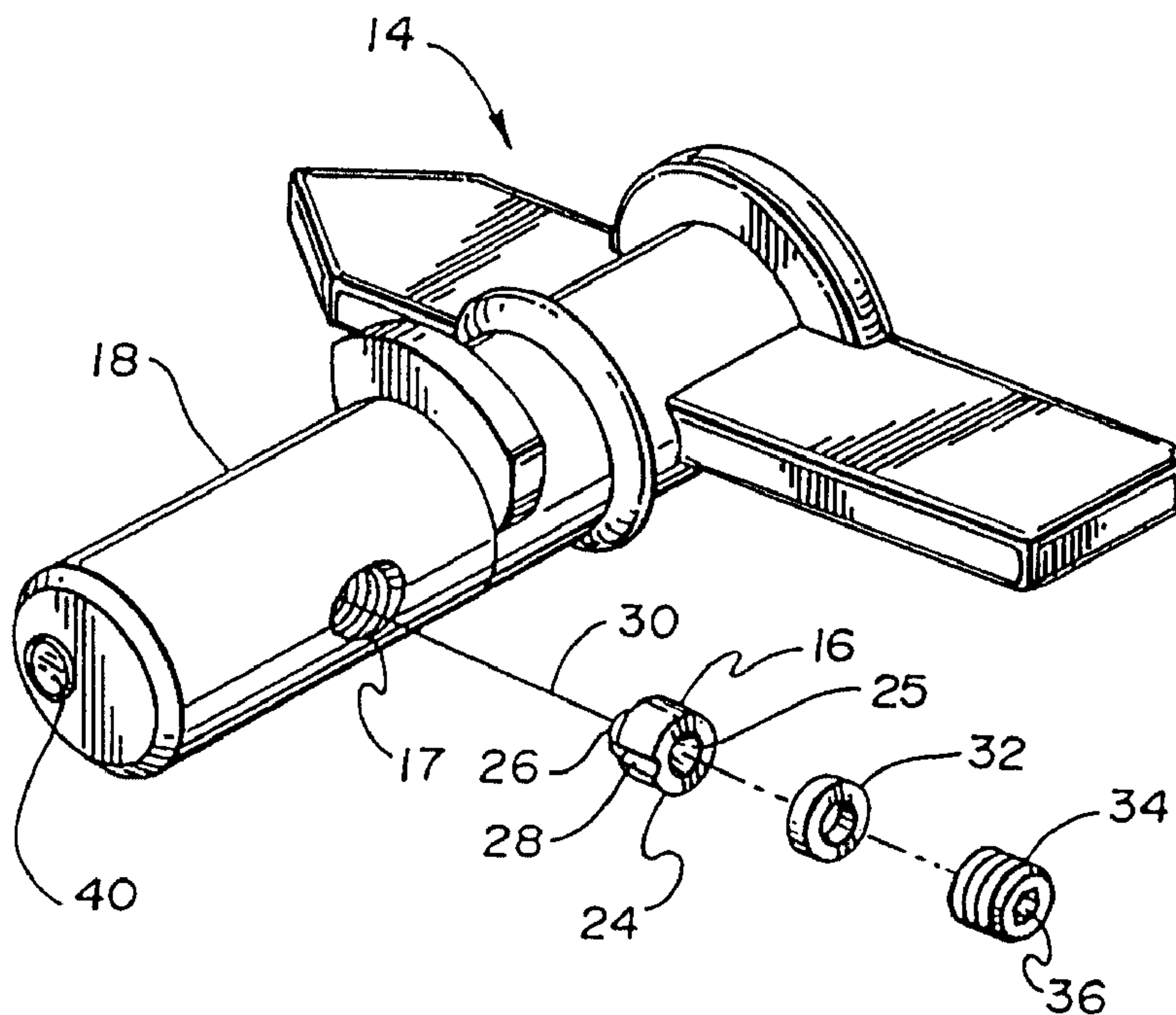




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 (54) Title: DUAL MODE REVERSIBLE TIP SEAL



(57) Abrégé/Abstract:

A dual mode reversible spray tip seal includes a tip-retaining set screw (34) and a resilient washer (32) in a transverse passageway in a turret of a portable paint spray gun. A coneshaped taper (80) on the set screw simultaneously urges the washer both axially and radially to axially seal the upstream end of the tip and radially seal the passageway of the turret.



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<p>(21) International Application Number: PCT/US98/11316</p> <p>(22) International Filing Date: 8 June 1998 (08.06.98)</p> <p>(30) Priority Data: 08/871,365 9 June 1997 (09.06.97) US</p> <p>(71) Applicant: WAGNER SPRAY TECH CORPORATION [US/US]; 1770 Fernbrook Lane, Minneapolis, MN 55447 (US).</p> <p>(72) Inventor: KIEFFER, Joseph, W.; 14460 Grouse Lane, Rogers, MN 55374 (US).</p> <p>(74) Agents: HAURYKIEWICZ, John, M.; Faegre & Benson, LLP, 2200 Norwest Center, 90 South Seventh Street, Minneapolis, MN 55402-3901 (US) et al.</p>		<p>(81) Designated States: CA, CN, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i></p>
<p>(54) Title: DUAL MODE REVERSIBLE TIP SEAL</p> <p>(57) Abstract</p> <p>A dual mode reversible spray tip seal includes a tip-retaining set screw (34) and a resilient washer (32) in a transverse passageway in a turret of a portable paint spray gun. A coneshaped taper (80) on the set screw simultaneously urges the washer both axially and radially to axially seal the upstream end of the tip and radially seal the passageway of the turret.</p> <div style="text-align: right;"> </div>		

DUAL MODE REVERSIBLE TIP SEAL

Background of the Invention

This invention relates to the field of portable paint spraying equipment, more particularly to a seal for a high pressure, airless spray tip in a reversible turret.

5 The present invention is directed to the field of rotatable tips held in holders permitting rotation and replacement of a turret carrying a tip. Conventionally, such turrets were not offered commercially in a version allowing replacement of the tip in the rotatable turret. Such designs typically had the tip permanently installed in the turret, obviating the need for a replaceable seal behind the tip, because the tip was typically press-fitted into the turret, thereby sealing the tip/turret interface. Such a design is exemplified by U.S. Patent 5,294,053 to Perret, Jr. Another approach was to provide a gasket between an orifice tip and an annual lock sleeve, illustrated by U.S. Patent 5,340,029 to Adams. Still further alternatives are illustrated by U.S. Patent 4,116,386 to Calder and WO 82/02501 to Hellman which have, respectively, an orifice tip member or nozzle with a threaded lock nut or locking screw holding the tip in the holder. In addition to the structures described above, the patents to Perret and Calder each have a sealing washer located immediately behind the orifice tip member.

 The present invention provides for a replaceable tip assembly and method of sealing a replaceable tip in a reversible turret. More specifically, the invention provides for a reversible tip assembly comprising a rotatable, generally cylindrical turret having a transverse bore therethrough and a handle at one longitudinal end thereof; a replaceable tip element having a spray orifice therein located in the transverse bore of the turret; a resilient washer-like seal located upstream of the replaceable tip element; and a hollow set screw located upstream of the seal and threaded into the transverse bore of the turret wherein the hollow set screw has a cone-shaped profile on a downstream surface thereof in contact with the resilient seal such that the cone-shaped profile urges the seal both axially against the tip element and radially outward against the transverse bore of the turret to prevent leakage past the tip.

 Furthermore, the method of sealing a replaceable tip in a reversible turret according to the present invention comprises the steps of:

- a) inserting a replaceable tip in a transverse bore of a reversible turret;
- b) inserting a washer-like seal behind the tip in the transverse bore of the turret;

- 1a -

5 c) threading a hollow set screw into a set of mating threads in the transverse bore of the turret wherein the set screw has a cone-shaped profile adjacent the seal, such that the seal is urged axially against the tip and radially against the bore of the turret by the cone-shaped profile of the set screw.

Brief Description of the Drawings

Figure 1 is a perspective view of a spray gun carrying the reversible tip assembly of the present invention.

10 Figure 2 is a view of a turret and user-replaceable parts exploded useful in the practice of the present invention.

Figure 3 is a detail view of a portion of the turret of Figure 2.

Figure 4 is a fully exploded view of the turret and associated parts useful in the practice of the present invention.

15 Figure 5 is an exploded view of the reversible tip holder assembly useful in the practice of the present invention.

Figure 6 is an assembly view in section of the reversible tip (without the tip guard) taken along line 6-6 of Figure 1.

Figure 7 is an enlarged view of a set screw useful in the practice of the present invention.

20 Figure 8 is an enlarged view of the tip seal assembly of the present invention.

Figure 9 is a section view of a tip seal useful in the practice of the present invention shown in a relaxed state.

Figure 10 is an enlarged partial section view of a portion of Figure 8 showing operation of the tip seal.

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Detailed Description of the Invention

Referring to the Figures and most particularly to Figure 1, a replaceable tip assembly 11 useful in the practice of the present invention may be seen. Replaceable tip assembly 11 is shown attached to an airless spray gun 12 useful for spraying paints and other similar coating materials under relatively high pressure. In such spraying applications, it has been found useful to provide a reversible mounting for the spray orifice to clear blockages. In the past, such mountings were provided by a turret assembly which had a tip with a desired orifice permanently installed in the turret. Once the orifice was worn to an unacceptable extent, the entire turret was required to be replaced, even though only the tip was worn. Because of this, it has been found desirable to permit replacement of the tip (and usually a tip seal) without replacing the remainder of the turret assembly.

Figure 2 illustrates a turret assembly 14 which has a spray tip 16 which may be replaced by an operator. Spray tip 16 is received in a threaded bore 17 of a barrel 18 of the turret assembly 14. Spray tip 16 is preferably formed of carbide and has a "cat's eye" orifice therein requiring proper orientation to the barrel 18 to align the orifice with the spray guard wings 20 and 22. Tip 16 preferably has a generally cylindrical base 24 and a hemispherical or domed top portion 26. Base 24 also has a groove or indentation 28 aligned with the cylindrical axis 30 of the base portion 24. A resilient washer-like seal 32 (preferably formed of a type Delrin II 500 plastic, available from DuPont) is located behind the base portion 24 of tip 16. A hollow set screw 34 is threaded into bore 17 to retain tip 16, and seal 32 in barrel 18. It is to be understood that set screw 34 preferably has a hexagonal bore 36 therethrough to receive an Allen wrench (not shown) for installation and removal of the set screw 34 from barrel 18.

Referring now also to Figure 3, barrel 18 preferably has a locator pin 38 received therein in a bore 40 aligned parallel to a cylindrical axis 42 of barrel 18. Pin 38 preferably has an interference fit with bore 40 and is pressed into bore 40, resulting in a permanent installation.

Referring now also to Figure 4, the bore 17 of barrel 18 is threaded in region 42, and preferably has a smooth-walled section 44 ending in a shoulder 46. Barrel 18 also preferably has a reduced diameter stem 48 having a transverse bore 50 therethrough to mount

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handle 52 using a roll pin 54. Barrel 18 and set screw 34 are preferably formed of stainless steel and pin 38 is preferably formed of stainless steel. Handle 52 is preferably formed of Delrin plastic.

Referring now also to Figures 5 - 7, the reversible tip assembly 11 also includes a molded guard 56 formed of polypropylene or nylon or other suitable material and has perforated ears or wings 20, 22 (see also Figure 1). Assembly 11 also includes a seal retainer 60 preferably formed of stainless steel, and an aluminum nut 62, which may have a fluted, knurled or hexagonal exterior to secure the reversible tip assembly 11 to the gun 12. Assembly 11 also has a turret saddle seal 64 preferably of stainless steel, and either a rubber washer-like seal 66 (see Figure 6) or a lip-type Delrin plastic seal 68 (see Figure 6). It is to be understood that rubber is preferred especially for latex paint spraying applications where water is used for clean-up, and the Delrin plastic seal is preferred for oil-based paint applications, where relatively active solvents such as MEK or lacquer thinner may be used and which would attack a rubber seal. Whether rubber or synthetic plastic material is used for the saddle seal, it has been found preferable to make the seal thickness sufficient to cause the saddle 64 to seal against the turret barrel 18 when compressed. Most desirably, the nut 62 is tightened until the saddle seal 64 is in metal-to-metal contact with the front surface of the gun 12, causing a predetermined amount of compression of seal 66 or 68 such that turret assembly 14 may be rotated between spraying and cleaning positions without loosening nut 62, while at the same time providing sufficient sealing to prevent leakage between turret barrel 18 and saddle seal 64.

Referring now to Figures 7, 8, 9, and 10 the present invention includes a modified set screw 34 having at least a portion of its downstream end tapered in a cone-like profile 80. The angle 82 of profile 80 is preferably 5 degrees. Tip seal 32 is preferably shaped like a washer with flat, parallel sides with seal in a relaxed state. As may be seen most clearly in Figures 8 and 10, when set screw 34 is tightened against seal 32 (indicated by arrow 88 in Figure 10), seal 32 is urged against tip 16, and seal 32 will deform to a trapezoidal cross section. In particular, it has been found that forming the cone-shaped profile 80 on the downstream end of the set screw 34 results in the seal 32 acting both axially against the tip 16 (as indicated by arrow 90 in Figure 10) and radially against the transverse bore 17 of the turret barrel 18 (as indicated by arrow 92 in Figure 10). This dual action of radial and axial sealing by seal 32 caused by the cone shaped profile 80 of set screw 34

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provides the benefit of two seals, blocking radial leakage of paint between seal 32 and tip 16 while simultaneously blocking axial flow of paint between seal 32 and turret barrel 18. Thus two potential leak paths are blocked by the dual mode seal assembly of the present invention without adding substantial cost or complexity.

Referring now most particularly to Figures 2 and 3, tip 16 is installed by aligning indentation 28 on tip 16 with a dome 58 formed on the end of pin 38 and which projects into bore 17. Tip 16 is then moved toward turret barrel 18 along axis 30 until tip 16 engages shoulder 46 in barrel 18. Seal 32 is then inserted behind the base 24 of tip 16 in bore 17. Finally set screw 34 is threaded into the matingly threaded portion 42 of bore 17 in barrel 18 until secure, using a hexagonal Allen wrench received in the hexagonally shaped bore 36 in set screw 34. It is to be understood that once the above installation procedure is completed, set screw 34 will be completely within the cylindrical outer surface of barrel 18, permitting rotation barrel 18 when the barrel 18 is installed in the seal retainer 60 and resides against saddle 64. Tip 16 is removed from turret assembly 14 by unthreading set screw 34 using an Allen wrench, and withdrawing seal 32 and tip 16 axially away from barrel 18 along axis 30. When a new tip 16 is installed in barrel 18, a new seal 32 is preferably installed and the old seal is discarded. Also, a corresponding plug 70 is also preferably installed to identify the orifice characteristics of the tip 16 then installed in turret assembly 14.

In initial assembly at the factory, it has been found preferable to tighten the set screw 34 to 15 inch pounds of torque. For replacement in the field where a torque wrench is typically not available, it has been found satisfactory to tighten the set screw 1/4 turn past the condition where the set screw 34, seal 32, and tip 16 are all in contact with each other.

The invention is not to be taken as limited to all of the details thereof as modifications and variations thereof may be made without departing from the spirit or scope of the invention. For example, it is within the spirit and scope of the present invention to provide an axial stop or shoulder between set screw 34 and barrel 18, if desired, to limit the amount seal 32 can be compressed and thus avoid over-tightening. Such an axial stop, may, for example, be provided by the range of travel of interengaging threads 94, 96 on the set screw 24 and threaded bore 17 of barrel 18.

CLAIMS:

1. A reversible tip assembly comprising;
 - a) a rotatable, generally cylindrical turret (14) having a transverse bore (17) therethrough and a handle (52) at one longitudinal end thereof;
 - 5 b) a replaceable (16) tip element having a spray orifice (25) therein located in the transverse bore of the turret (14);
 - c) a resilient washer-like seal (32) located upstream of the replaceable tip element (16); and
 - d) a hollow retainer (34) located upstream of the seal in the transverse bore of
10 the turret (14),
characterized in that the hollow retainer is a set screw (34) threaded into the transverse bore (17) and has a cone-shaped profile (80) on a downstream end surface thereof in contact with the resilient seal (32) such that the cone-shaped profile (80) urges the seal both axially against the tip element and radially outward against the
15 transverse bore (17) of the turret (14) to prevent leakage past the tip.
2. The assembly of claim 1 wherein the cone-shaped profile (80) is tapered at an acute angle (82).
3. The assembly of claim 2 wherein the acute angle (82) is about 5 degrees.
4. The assembly of any one of claims 1 to 3 further including a turret holder
20 (60,62) having a transverse bore sized to receive the turret.
5. The assembly of claim 4 wherein the turret holder (60,62) further comprises a tip guard (56) having a pair of spray guard wings (20,22) extending in front of the turret holder.
- 25 6. The assembly of claim 4 further including a spray gun connected to the turret holder.

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7. The assembly of claim 1 wherein the turret (14) includes a turret barrel (18), the assembly further comprising:

5 e) an axial stop between the transverse bore (17) in the turret barrel (18) and the set screw (34) to limit axial travel of the set screw (34) into the transverse bore of the turret barrel.

8. The assembly of claim 7 wherein the axial stop comprises a predetermined limit of the range of travel of a set of threads on the set screw and a set of threads in the transverse bore (17) of the turret barrel (18).

9. A method of sealing a replaceable tip in a reversible turret comprising the steps
10 of:

a) inserting a replaceable tip (16) in a transverse bore (17) of a reversible turret (14);

b) inserting a washer-like seal (32) behind the tip (16) in the transverse bore of the turret;

15 c) threading a hollow set screw (34) into a set of mating threads in the transverse bore of the turret wherein the set screw has a cone-shaped profile (80) on a downstream end surface adjacent the seal

such that the seal (34) is urged axially against the tip (16) and radially against the bore (17) of the turret by the cone-shaped profile.

20 10. The method of claim 9 wherein step c) further comprises monitoring a torque while threading the set screw into the transverse bore and stopping when a predetermined torque setting is reached.

11. The method of claim 10 wherein the predetermined torque setting is about 15 inch pounds (1.695 N·m).

25 12. The method of claim 9 wherein step c) further comprises turning the set screw a predetermined amount of rotation past a condition where the set screw, tip and seal are

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all in contact.

13. The method of claim 12 wherein the predetermined amount of rotation is about one quarter turn.

14. Use of a reversible tip assembly according to any one of claims 1 to 8 in a
5 portable, airless paint spray gun.

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Fig. 1

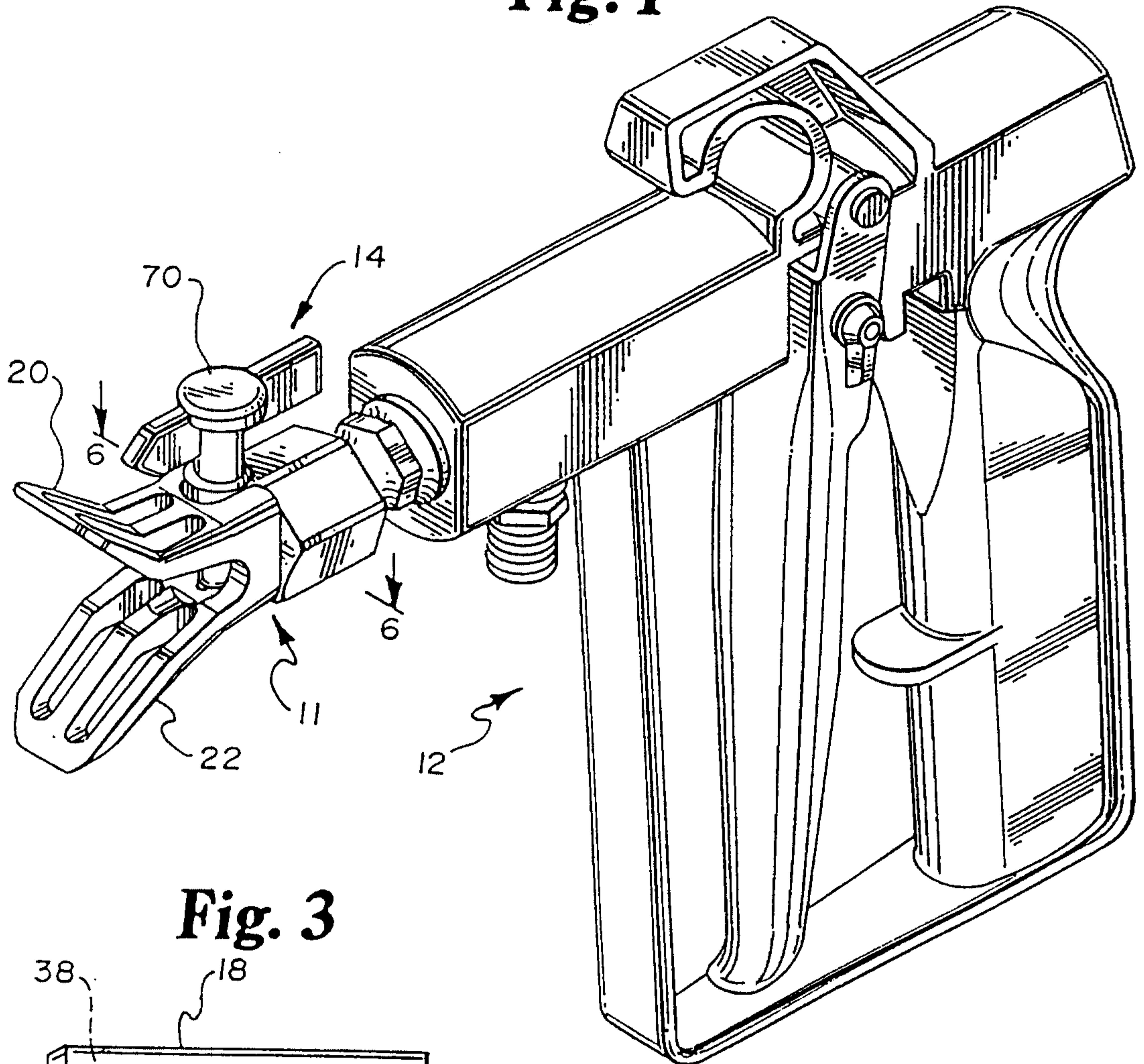


Fig. 3

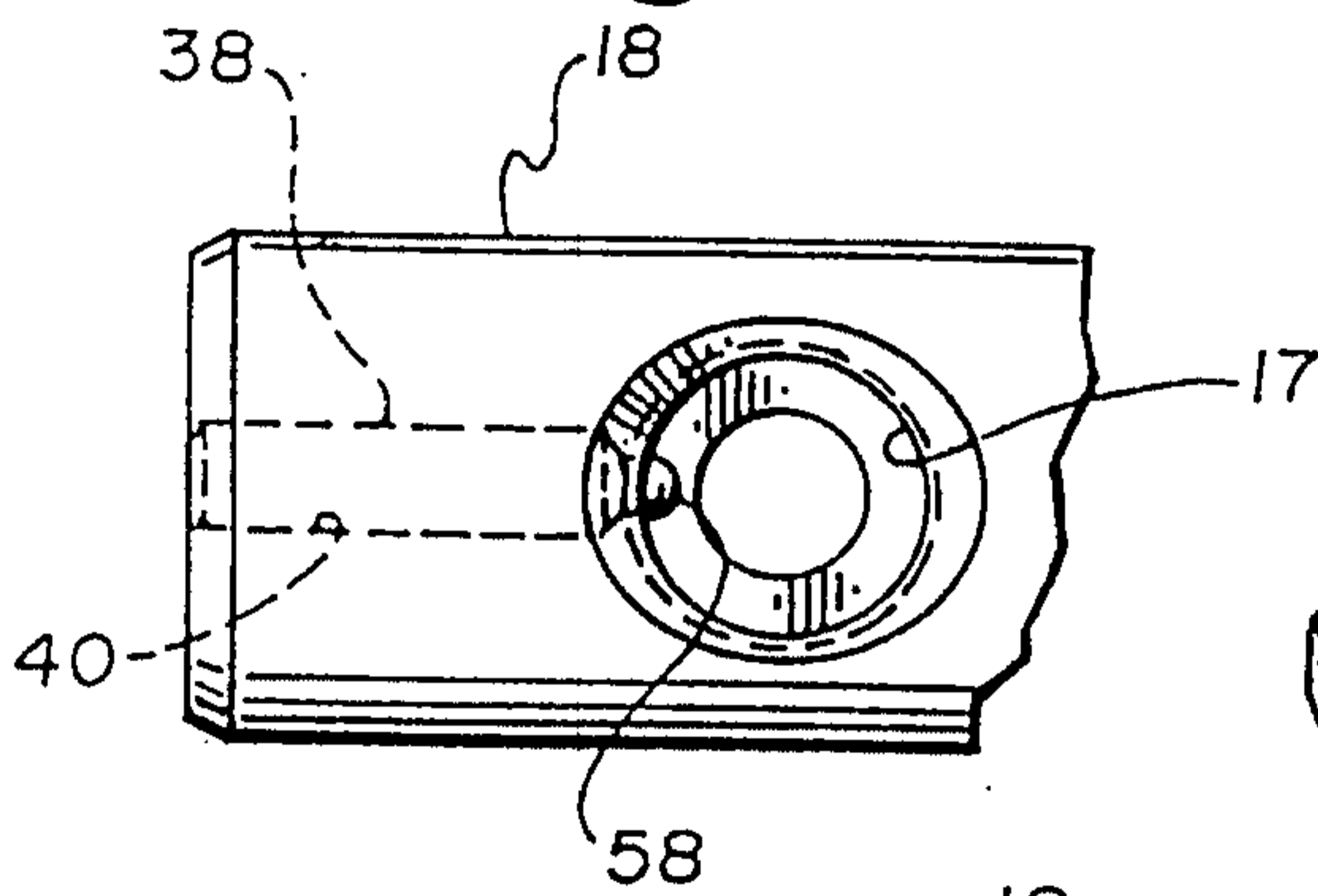


Fig. 2

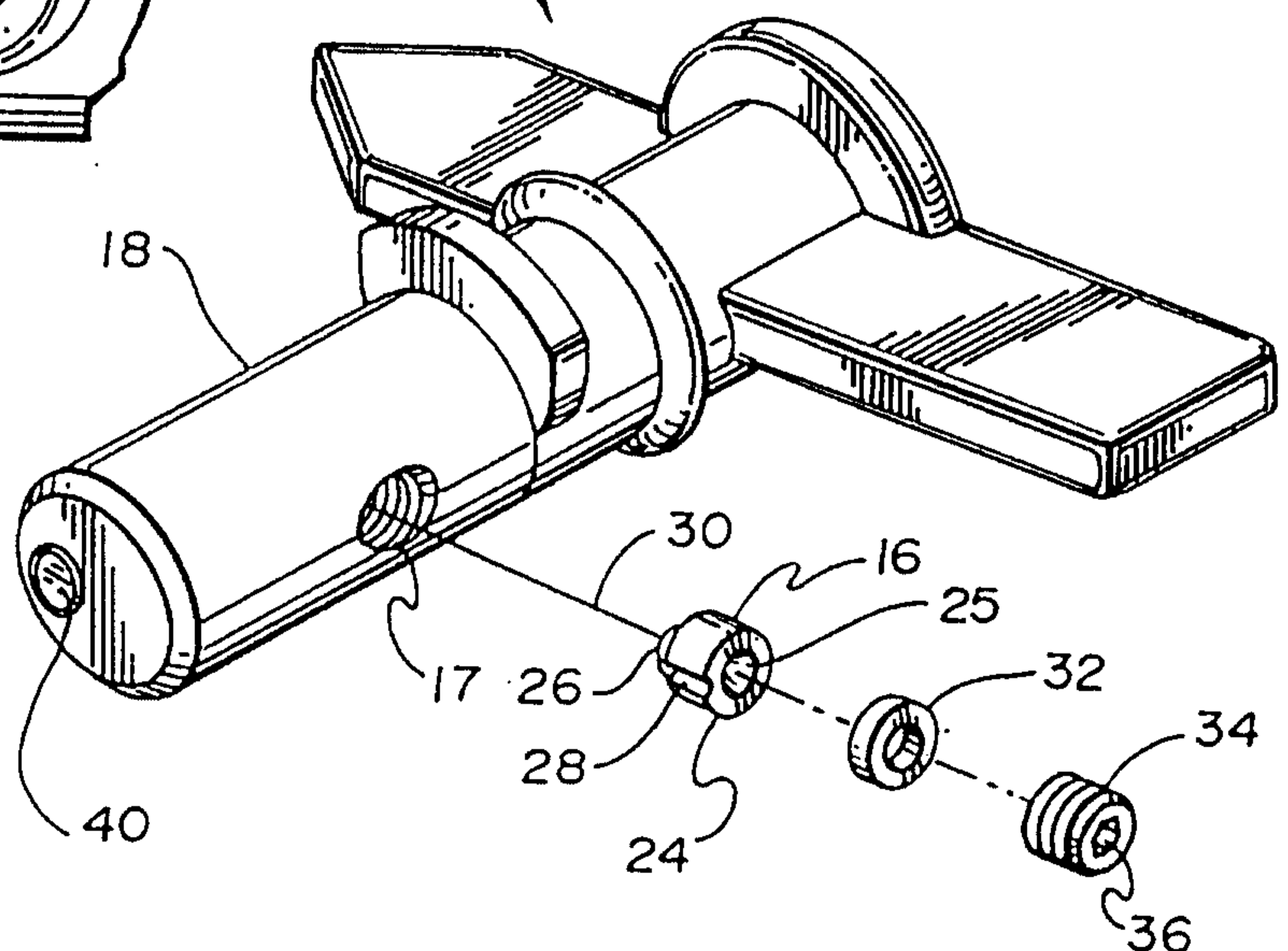


Fig. 4

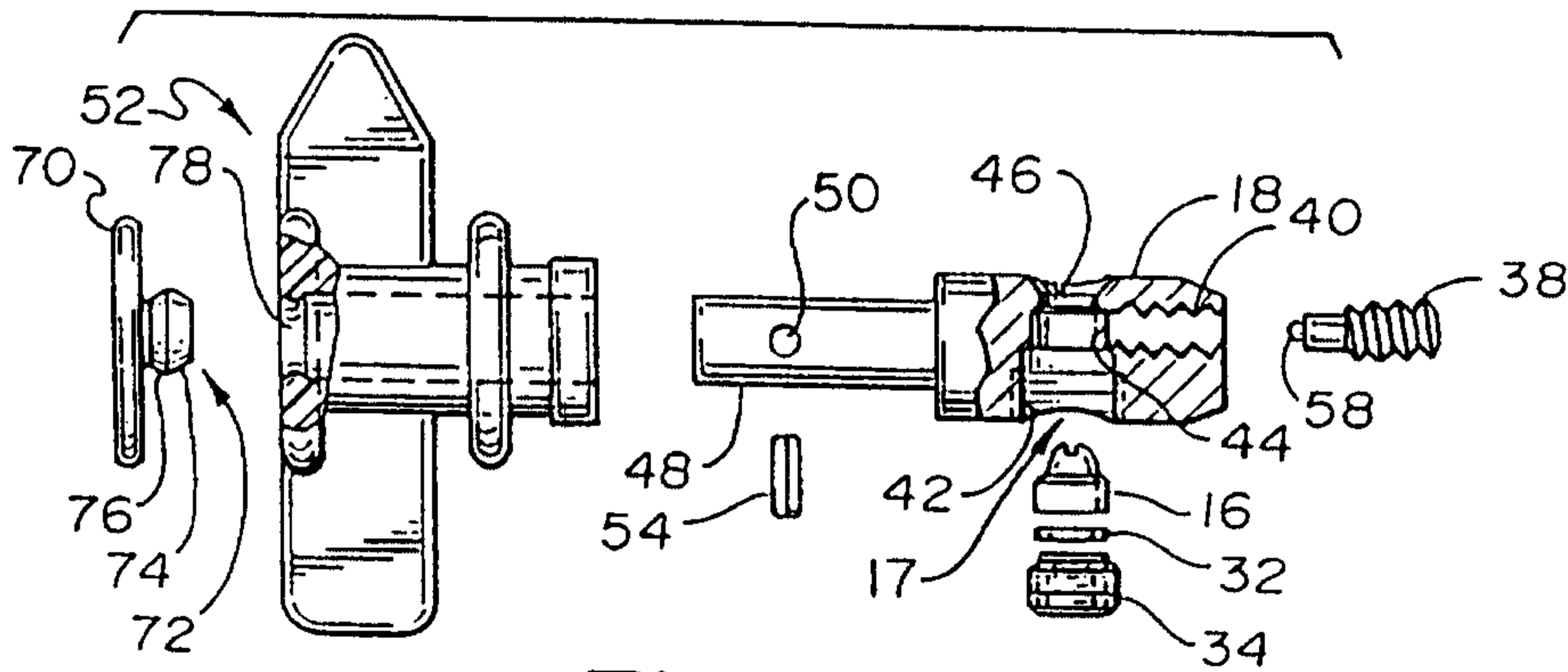


Fig. 5

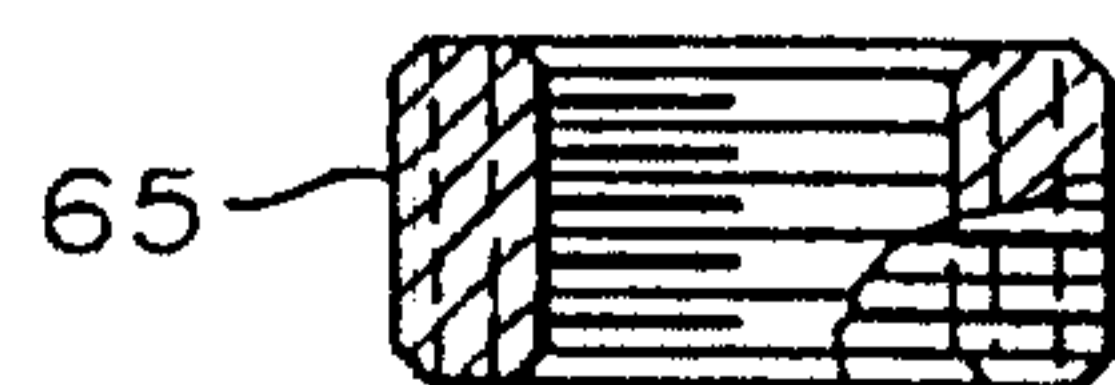
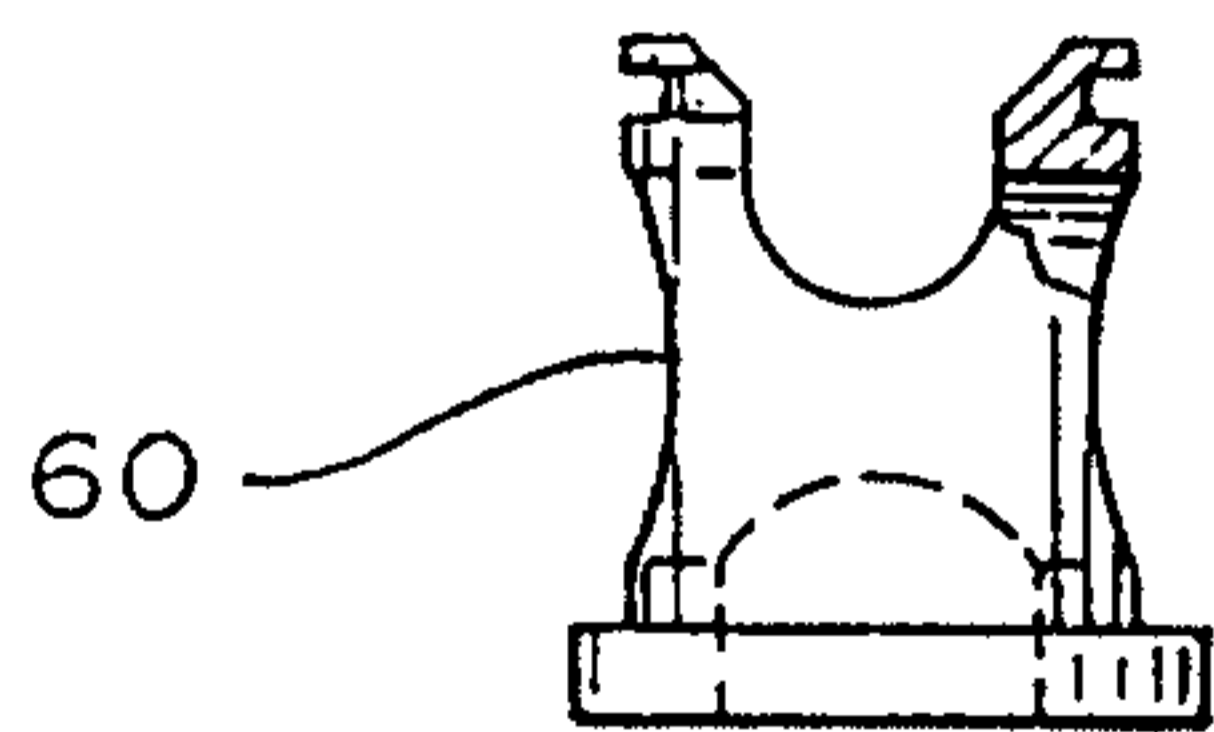
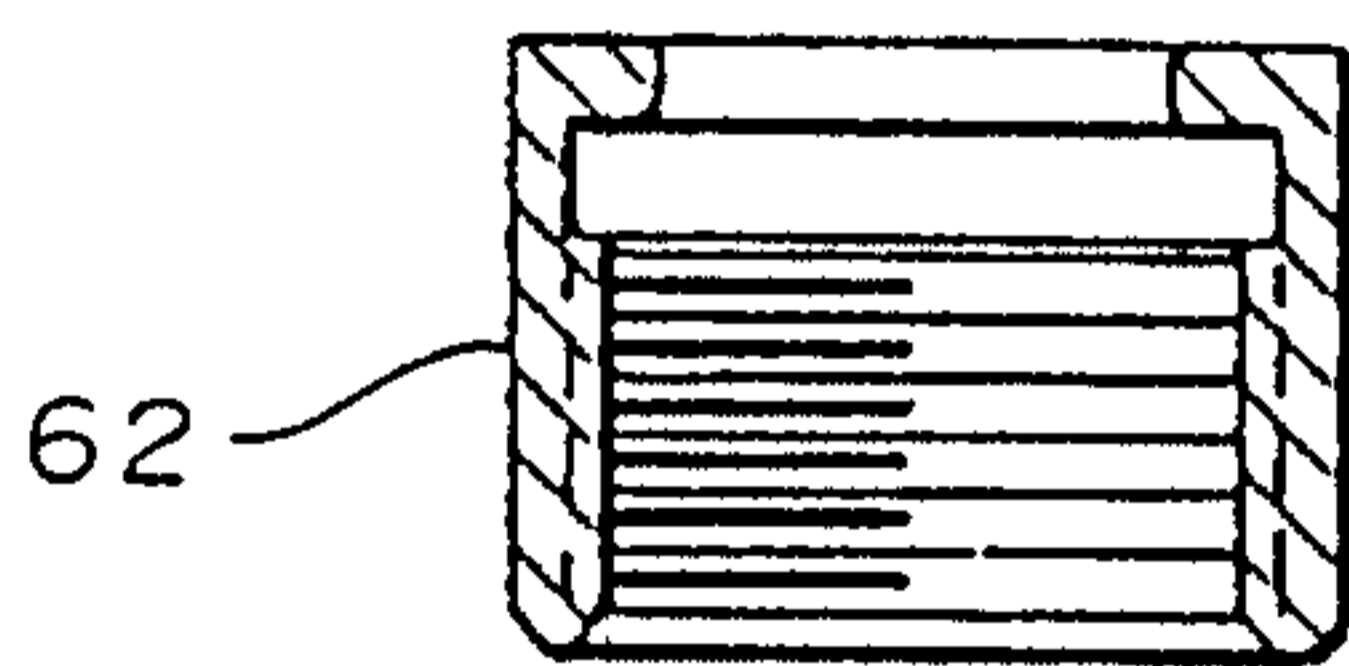
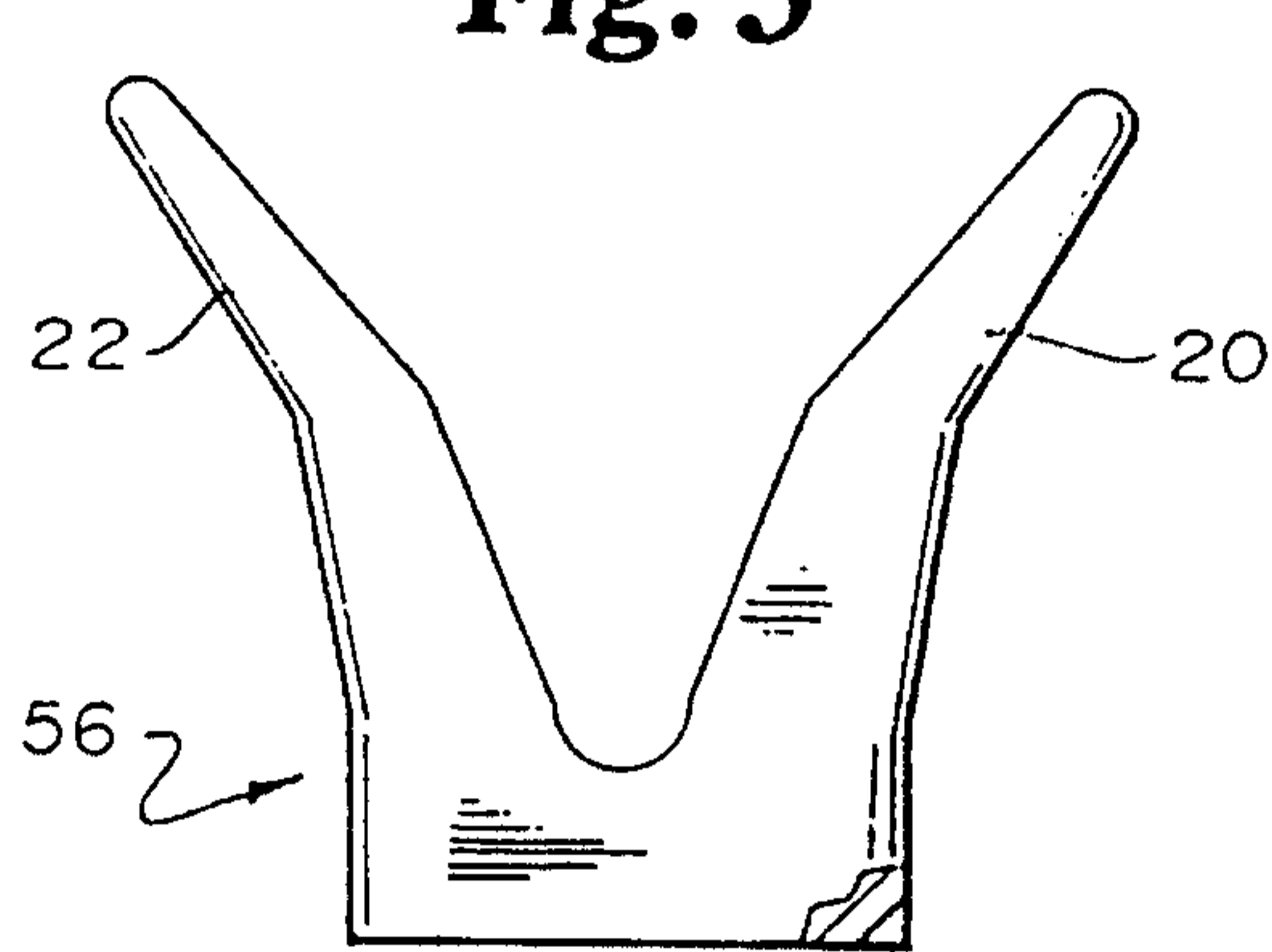
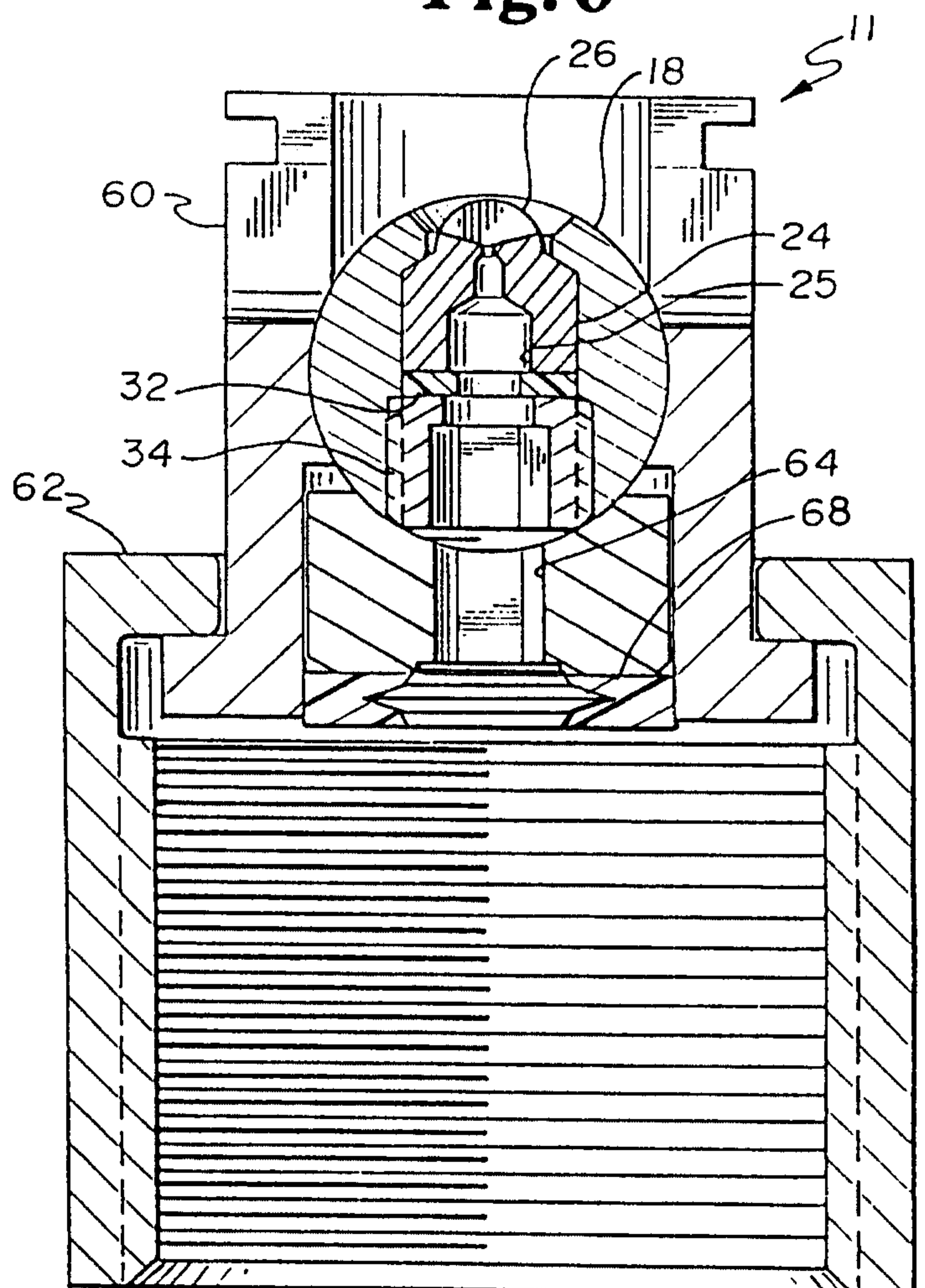


Fig. 6



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Fig. 7

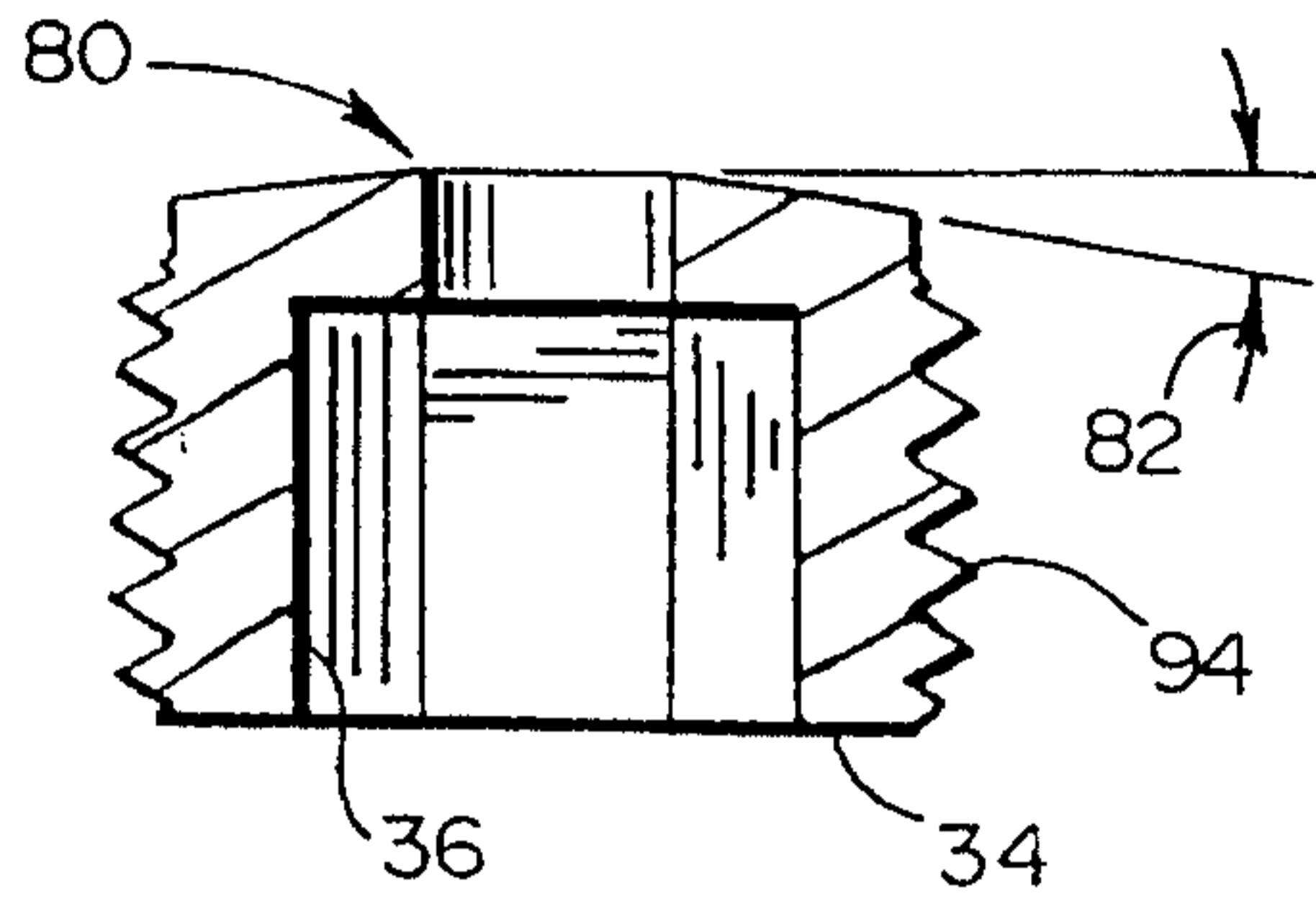


Fig. 8

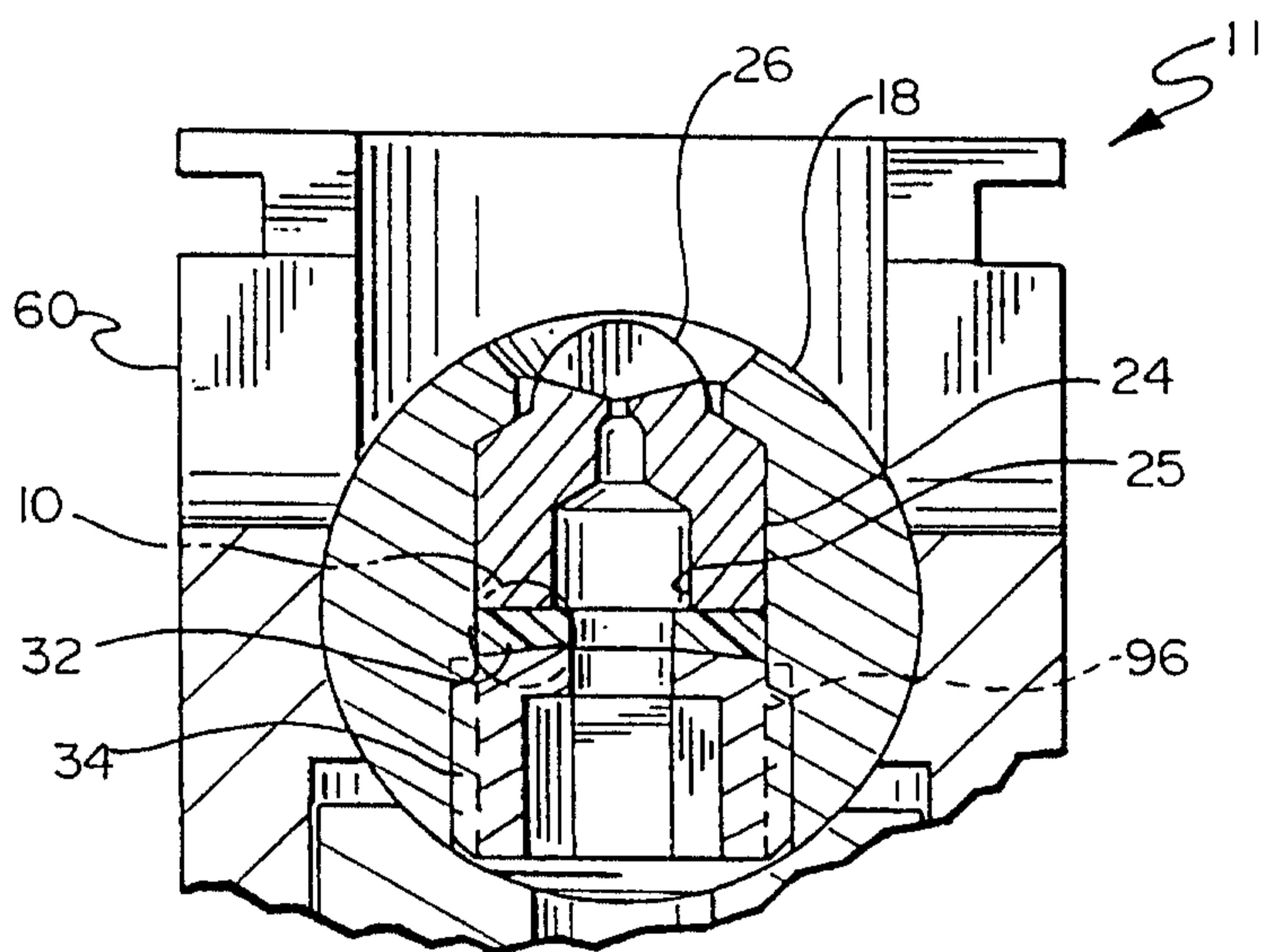


Fig. 9

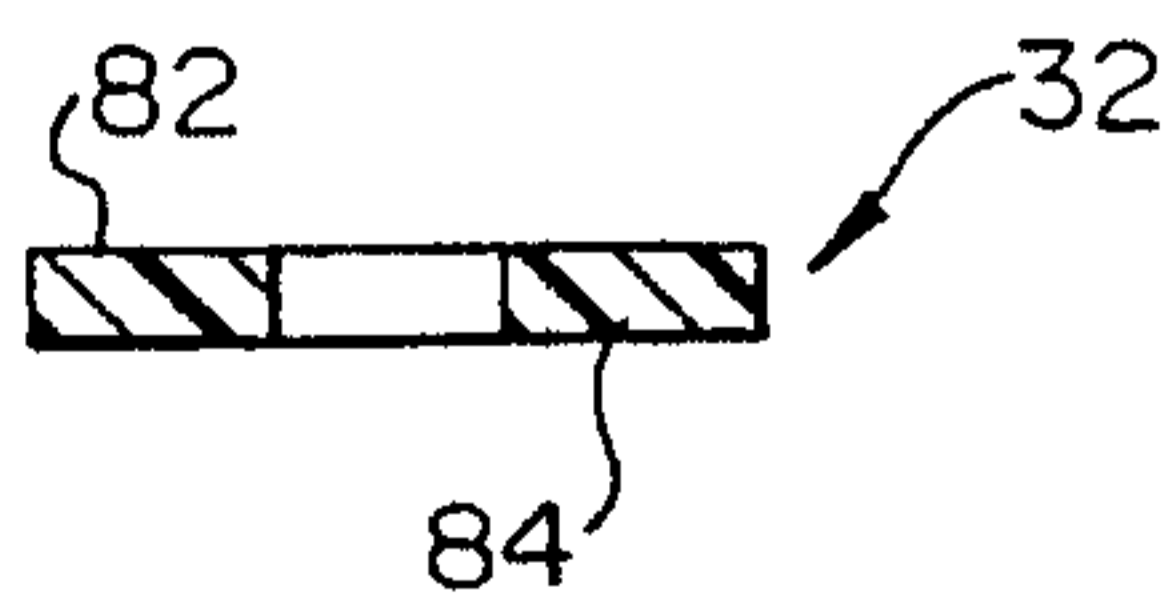


Fig. 10

