



(86) Date de dépôt PCT/PCT Filing Date: 2003/08/12  
(87) Date publication PCT/PCT Publication Date: 2004/02/19  
(45) Date de délivrance/Issue Date: 2012/12/11  
(85) Entrée phase nationale/National Entry: 2005/02/14  
(86) N° demande PCT/PCT Application No.: US 2003/025210  
(87) N° publication PCT/PCT Publication No.: 2004/015212  
(30) Priorités/Priorities: 2002/08/12 (US60/402,757);  
2002/11/13 (US10/295,007)

(51) Cl.Int./Int.Cl. *F16B 21/00* (2006.01),  
*E02D 29/14* (2006.01)  
(72) Inventeur/Inventor:  
STADLER, DAVID M., US  
(73) Propriétaire/Owner:  
STADLER, DAVID M., US  
(74) Agent: MACRAE & CO.

(54) Titre : DISPOSITIF ET PROCEDE DE VERROUILLAGE POUR COUVERCLES DE PUISARD ET D'EGOUT, ET  
INSTALLATIONS SIMILAIRES  
(54) Title: LOCKING DEVICE AND METHOD FOR CATCH BASIN AND MANHOLE COVERS, AND THE LIKE

(57) **Abrégé/Abstract:**

A locking device and method for securing a cover as for a catch basin or manhole in position including two elongate members pivotally connected together end to end so as to be able to articulate. The members are held aligned while being inserted through a cover opening suspended in Said opening an a flange an the upper member, the lower member then released to be angled by a spring force to wedge against sidewall and an edge of the cover opening. A holt extending through the top threaded into a trunnion extending across an intermediate space of the lower member draws the lower member up to create a powerful wedging action to prevent cover removal. The holt head is recessed into the flange and configured with a special shape engageable only with a special tool to be tamper resistant. A protective plastic cap covers the bolt head and has protrusions sheared off when the cap is removed to provide a tamper indication. A miniature radio transmitter can be installed beneath the cap to transmit an alarm signal when the cap is removed. The locking device is used with a modified manhole cover by installing an adaptor sleeve defining a rectangular opening through which the locking device is inserted, and by connecting an extension arm to the lower member bottom end by use of a shear pin and pivot holt allowing release of the locking device and cover in the event of an explosion.

**LOCKING DEVICE AND METHOD FOR CATCH BASIN AND  
MANHOLE COVERS, AND THE LIKE**

Abstract of the Disclosure

A locking device and method for securing a cover as for a catch basin or manhole in position including two elongate members pivotally connected together end to end so as to be able to articulate. The members are held aligned while being inserted through a cover opening suspended in said opening on a flange on the upper member, the lower member then released to be angled by a spring force to wedge against sidewall and an edge of the cover opening. A bolt extending through the top threaded into a trunnion extending across an intermediate space of the lower member draws the lower member up to create a powerful wedging action to prevent cover removal. The bolt head is recessed into the flange and configured with a special shape engageable only with a special tool to be tamper resistant. A protective plastic cap covers the bolt head and has protrusions sheared off when the cap is removed to provide a tamper indication. A miniature radio transmitter can be installed beneath the cap to transmit an alarm signal when the cap is removed. The locking device is used with a modified manhole cover by installing an adaptor sleeve defining a rectangular opening through which the locking device is inserted, and by connecting an extension arm to the lower member bottom end by use of a shear pin and pivot bolt allowing release of the locking device and cover in the event of an explosion.

**LOCKING DEVICE AND METHOD FOR CATCH BASIN AND  
MANHOLE COVERS, AND THE LIKE**

**Background of the Invention**

This invention concerns locking devices and methods, more particularly such devices and methods as applied to covers used for catch basins and manholes installed in roadways for access to utilities, i.e., water, gas, communications, electricity. These covers are provided in order to keep out debris but also to present a supporting surface for pedestrians and vehicles on the surrounding roadway surface. If the covers are removed, the opening to a catch basin or manhole presents a severe hazard to vehicles and pedestrian traffic. Removal of these covers by vandals or scavengers has become an increasing problem which has created an urgent need for some means for securing the covers in place. There are no locking devices incorporated in existing catch basin and manhole covers such that providing a simple retrofit for existing covers is highly desirable. Such devices must be rugged to withstand traffic and weather and the efforts of vandals or terrorists to remove them. The large numbers involved dictate a simple installation method to minimize labor costs. The device must not present an obstruction in the roadway, particularly for snow plows, nor a tripping hazard to pedestrians.

It is the object of the present invention to provide a locking device and method which can quickly be installed to provide a simple retrofit to existing manhole and catch basin covers.

It is a further object to provide such a device which is rugged and able to withstand abuse and heavy traffic and reliably secure such covers in place without creating an obstruction in the roadway.

1 Summary of the Invention

2           These objects and others which will be appreciated upon a reading of the  
3 following specification and claims are achieved by providing a locking device insertable into  
4 an opening in the cover adjacent a sidewall of the cover frame. The device is comprised of an  
5 upper and a lower member which are connected to each other end-to-end so as to allow  
6 articulation of the lower member to install the device, the members are initially set in an end-  
7 to-end alignment and are inserted into the cover opening. The members are held in end to  
8 end alignment with a detent mechanism including interfit detent features and the respective  
9 members held in that position by one or more springs so as to connected exert a force pulling  
10 the members together to maintain the interfit detent features in engagement.

11           A bolt having a tamper resistant head extends through a hole in the upper  
12 member and is left hand threadably received in a trunnion member rotatably mounted to the  
13 lower member extending across a space defined by space sidewalls included in the lower  
14 member. The bolt can be pushed down against a bottom wall of the upper member to counter  
15 the spring force and thereby allowing disengagement of the interfit detent features. The  
16 spring or springs then cause the lower member to be pivoted on the trunnion with respect to  
17 the upper member and thereby angled towards the sidewall adjacent the opening until the  
18 bottom end of the lower member engages the same. Teeth are preferably formed along the  
19 bottom end edge of the lower member engaged with the sidewall.

20           Notch contours on the upper end of the lower member at the same time are  
21 moved to engage an edge of the cover opening through which the device is inserted.

22           The bolt is then driven on its threaded connection to the trunnion by a special  
23 tool socket to draw the lower member up, the upper member having a flange overlying the

1 cover to provide a reaction surface. This creates a powerful wedging of the lower member  
2 between the sidewall and opening edge, preventing lifting of that side of the cover. By  
3 installing four locking devices, two on each side of the cover, the cover is wedged securely in  
4 its opening to prevent its removal.

5 The bolt head is received within a recess in the top of the upper member and  
6 has driving contour requiring a special tool to prevent removal of the locking device by the  
7 use of standard tools.

8 A plastic cap is placed over the bolt head and in the recess to prevent  
9 weathering of the bolt threads and the entrance of plugging dirt and debris. Special features  
10 on the cap provide a tamper indication if the cap is removed.

11 A special version of the device is used for manhole covers, in which an  
12 adapter sleeve is fitted into a round hole bored into the manhole cover and secured to the  
13 cover with bolts received in threaded holes formed into the underside of the manhole cover.  
14 The upper member is received in a central rectangular opening in the adapter sleeve, the  
15 upper member having a round flange smoothly overlying the adapter sleeve top surface  
16 adjacent the rectangular opening.

17 An extension arm is secured to the bottom end of the lower member to enable  
18 the toothed bottom edge of the extension arm to reach a sidewall edge located further from  
19 the manhole cover opening in which the locking device is inserted. The extension arm is  
20 attached using a pivot bolt and a shear pin so that the cover can be released and blown free in  
21 the event of a gas explosion to prevent structural damage. The adapter sleeve presents an  
22 opening wall which projects downwardly to present an edge engageable with the lower  
23 member notched contours to establish a wedging lock as in the catch basin version of the

locking device.

A special radio signaling device can also be built into the cap, able to provide a remote alarm via a repeater amplification to a central station if tampering is detected, which can also be used to locate a catch basin or manhole when a cover has been removed or tampered with.

### Description of the Drawings

Figure 1 is an exploded perspective view of a locking device according to the present invention.

Figure 2 is a front view of a locking device according to the present invention.

Figure 3 is a rear view of the locking device shown in Figures 1 and 2.

Figure 4 is a side view of the locking device shown in Figures 1-3 inserted in a catch basin cover, shown with the adjacent sidewalls in fragmentary form.

Figure 5 is a side view of the inserted locking device of Figure 4 in the articulated condition of the upper and lower members.

Figure 6 is a top view of the upper member showing the tamper resistant bolt shape.

Figure 7 is a side view of the upper member in phantom lines, showing the tamper resistant bolt seated with a cap in place on the bolt head covering the upper member recess.

Figure 8 is a perspective view of the plastic flanged cap shown installed in Figure 7.

Figure 9 is a top view of a catch basin cover with four locking devices

1 according to the invention installed therein.

2 Figure 10 is a diagrammatic view of an installed cap with a radio transmitter  
3 monitor.

4 Figure 11 is a side view of an installed modified locking device having a  
5 configuration suited to the manhole covers shown, with adjacent fragmentary portions of the  
6 manhole cover frame sidewall shown in section.

7 Figure 12 is a plan view of a manhole cover with the locking device installed.

8 Figure 13 is a front view of the lower member of the manhole cover locking  
9 device shown in Figure 11, with a fragmentary portion of the extension arm installed thereon.

10 Figure 14 is a sectional view of fragmentary portion of the manhole cover and  
11 adapter sleeve showing one of the attachment ears and bolts.

12  
13 Detailed Description

14 In the following detailed description, certain specific terminology will be  
15 employed for the sake of clarity and a particular embodiment described in accordance with  
16 the requirements of 35 USC 112, but it is to be understood that the same is not intended to be  
17 limiting and should not be so construed inasmuch as the invention is capable of taking many  
18 forms and variations within the scope of the appended claims.

19 Referring to the drawings, the locking device 10 according to the present  
20 invention is designed to be installed by being first inserted into an opening 12 in a catch basin  
21 cover 14 overlying an opening defined by a sidewall 16.

22 The locking device 10 includes a generally rectangular upper and lower  
23 moderately elongated members 18, 20, which are preferably constructed of high strength steel

1 and connected together end-to-end in a manner allowing articulation therebetween. Prior to  
2 installation, the members 18, 20 are set in an end-to-end aligned position as shown in Figures  
3 2 and 4. The upper member 18 has a flange 22 at the top which overlies the cover structure  
4 adjacent the opening 12 to suspend the locking device hanging through the opening 12 and  
5 into the space below the cover 14. The edges of the flange 22 are is rounded to present a  
6 smooth contour.

7           The upper member 18 is generally rectangular and is sized to be received  
8 between a pair of spaced upstanding walls 24 included in the lower member 20. The upper  
9 member 18 has a depending rectangular tab 26 on one side of a radiused bottom wall 28  
10 which is interfit to a rectangular recess 30 in a cross web 32 at the rear of the bottom member  
11 20 extending between the walls 24. The tab 26 and recess 30 comprise detent features of a  
12 detent mechanism for releasably holding the upper and lower members 18, 20 in their initially  
13 set aligned position by preventing rotation of the lower member 20 about a trunnion 40. The  
14 detent mechanism also includes one or more coil springs 34 which are each connected at  
15 either end to the upper and lower members 18, 20.

16           For this purpose, slotted ears 36 are formed on the bottom of one side of the  
17 upper member 18 and slotted ears 38 are formed on the inside of the spaced walls 24 on the  
18 opposite side of bottom member 20. The springs 34 thus extend down and around trunnion  
19 40 and over to the lower tabs 38, exerting an end to end pulling force on the members 18, 20  
20 tending to maintain engagement of the tab 26 and recess 30.

21           The springs 34, since they are wrapped around the trunnions 40 also urge  
22 relative rotation of the upper and lower members 18, 20, but this is resisted by the interfitting  
23 engagement between the tabs 26 and recess 30 preventing rotation of the upper and lower

1 members 18, 20 about the trunnion 40.

2 The upper member 18 has a recess in its upper end comprised of cylindrical  
3 bore 42 extending into the top thereof down to a bottom wall 44. An aligned smaller  
4 diameter through hole 46 extends through the bottom wall 44 and slidably receives a bolt 48  
5 therein. Bolt 48 has a tamper resistant shaped head 50 (seen in Figure 6) and a left hand  
6 threaded body 52 which is threadably engaged with a through cross bore 54 extending  
7 through the trunnion 40. Trunnion 40 is rotatable in aligned bores 56 in the spaced walls 24.  
8 The bolt 48 is initially installed so as to not engage the bottom wall 44.

9 After insertion of the locking device 10 in the opening 12, the bolt head 50 is  
10 pushed down against the bottom wall 44 to push the lower member 20 down and away from  
11 the upper member 18 against the resistance of the springs 34.

12 This repositions the recess 30 down to disengage the tab 26, which allows the  
13 springs 34 to rotate the lower member 20 about trunnion 40 as shown in Figure 5 until the  
14 toothed bottom end 58 engages the catch basin sidewall 16.

15 At the same time, a notch contour 60 in the top of each spaced wall 24 are  
16 both angled towards the bottom edge 62 of the opening 12 in the cover 14 to engage the same  
17 (Figures 4 and 5).

18 The bolt 48 is then rotated by use of a special socket tool (not shown)  
19 contoured to engage the angled unequal flats 64 on the bolt head 50 (Figure 7). The size of  
20 the bore 42 allows the tool to engage the bolt head 50 but leaves insufficient clearance to be  
21 engaged by adjustable tools to be tamper resistant.

22 Advance of the bolt 48 causes its left hand thread engagement to lift the now  
23 articulated lower member 18 to securely wedge the same tightly between the sidewall 16 and

1 edge 62. When four devices 10 are installed, two on each side of the catch basin cover, this  
2 will preventing removal of the cover 14.

3 A plastic cap 66 (Figures 7, 8) is provided to be fit over the bolt head 50 to  
4 prevent debris to enter the space around the bolt head 50.

5 The cap 66 has protrusions 68 on portions 69 defined by slots 67 snap fit into  
6 drain openings (not shown) provided in the bottom of the bore 42 the upper member 18. The  
7 bore 42 is formed with shallow grooves 65 to aid in aligning the protrusions 68 and a shallow  
8 counterbore 61 to accommodate a cap flange 63. The protrusions 68 are broken off when the  
9 cap 66 is removed by use of a pronged tool engaging pockets 72 in the cap to give evidence of  
10 tampering.

11 Figure 10 shows a miniature radio transmitter-battery unit 78 installed beneath  
12 the cap 66, which can transmit a signal via a repeater amplifier system to a remote location.  
13 Upon removal of the cap 66, the radio signal is interrupted so that an intrusion alarm can be  
14 triggered at the remote location. This signal can also be varied to locate a catch basin without  
15 a cover.

16 The device 10 can be adapted for use with a modified manhole cover 80, as  
17 shown in Figure 11, in which a hole 82 bored into the under side of the manhole cover 80 to  
18 be able to receive an adapter sleeve 84 fixed in the hole 82 by ears 85 and bolts 87 threaded  
19 into holes 89 machined into the underside of the cover 80 (Figure 14). A rectangular opening  
20 86 is formed in the adapter sleeve 84, extending completely through the sleeve 84. An edge  
21 88 is created on a lower side of the sleeve 84 positioned to be engaged by the notch contours  
22 60 as described above. The lower end of the adapter sleeve 84 is cut off at an angle as shown  
23 in Figure 11 to provide clearance for proper articulation of the lower member 20.

1           The lower member 20 has an extension arm 90 secured thereto with a pivot  
2 bolt 91 and a shear pin 92 and has a toothed end engageable with manhole sidewall 94. If an  
3 explosion occurs, the shear pin 92 is severed, the extension arm 90 swings free about the axis  
4 of the pivot bolt 91 and the cover 80 is allowed to blow free.

5           A second bolt 96 is installed on the underside of the manhole cover 80, closely  
6 to the opposite side of the manhole cover flange 100. Optionally, a second sleeve and lock  
7 assembly can be installed in lieu of bolt 96 180° apart from each other.

8

**WHAT IS CLAIMED IS:**

1. A locking device for a cover structure overlying an opening defined in part by a sidewall, said cover structure recessed within a perimeter frame extending around said opening and having a through opening adjacent a side thereof, said device comprising:

an upper elongated member having a flange at a top end configured to suspend said upper member on said cover extending into said through opening;

a recess extending into said flange and terminated by a bottom wall;

a hole extending into said bottom wall and through a lower end of said upper member;

a threaded bolt slidably received into said hole and protruding out said lower end of said upper member, said bolt having a head received into said recess;

a lower elongate member having spaced walls defining a space having said lower end of said upper member fit therein, said threaded bolt threadably received into a threaded hole in a trunnion rotatably supported in said lower member and extending across said space;

at least one spring connected at one end to said upper member and at another end to said lower member, said at least one spring located to urge said members together in an end to end direction and also to urge relative rotation of said members about said trunnion;

a detent mechanism comprising a first detent feature on the lower end of said upper member and a second detent feature on said lower member engaging said first detent feature with said members in end to end abutment so as to prevent relative rotation about said trunnion;

said bolt able to push said lower member away from said upper member against said spring force to cause disengagement of said detent features allowing said members to articulate by relative rotation about said trunnion; and

wherein said lower member is configured to be rotatable relative to said upper member to enable engagement between said lower member and said sidewall and between said lower member and an edge of said cover structure.

2. The locking device according to claim 1 wherein said lower member is formed with at least one notched contour on an upper end rotated to engage said edge of said cover structure upon disengagement of said detent features and rotation of said lower member by said at least one spring.
3. The locking device according to claim 2 wherein a bottom end of said lower member is formed with teeth engaging said sidewall upon articulation of said upper and lower members to establish a wedging action between said lower member, said sidewall, and said cover structure.
4. The locking device according to claim 3 wherein advance of said bolt in said threaded hole of said trunnion causes raising of said lower member to increase said wedging action by the reaction of said head on said bolt engaging said bottom wall of said recess in said upper member to increase the pressure of said teeth on said lower end of said lower member against said sidewall and said notched contour against said cover structure.
5. The locking device according to claim 1 wherein said bolt head is formed with an irregular contour engageable only with a special tool to be tamper resistant after said bolt is tightened.
6. The locking device according to claim 5 wherein said bolt head is substantially enclosed in said recess after said bolt is tightened.
7. The locking device according to claim 6 further including a molded plastic cap received over said bolt head in said recess.

8. The locking device according to claim 7 wherein said cap has at least one protrusion contoured in a pocket in said recess upon being installed, said at least one protrusion deformed upon removal of said cap to provide a tamper indicator.

9. The locking device according to claim 1 wherein said lower member has a pair of spaced apart parallel walls defining said space receiving said upper member, said sides connected at a bottom end of said lower member, said trunnion received in aligned bores in said sides.

10. The locking device according to claim 9 wherein each wall of said lower member is formed with a bore aligned with the bore in the other wall, said trunnion slidably received in said bores.

11. The locking device according to claim 10 wherein said trunnion is located at an intermediate location along the length of said lower member.

12. The locking device according to claim 1 wherein the at least one spring includes two springs, and the two springs are each connected at either end to said upper and lower members respectively, said springs connected at one end to one side of one member and at the other ends to an opposite side of the other member to create said rotational force resisted by said detent mechanism.

13. The locking device according to claim 12 wherein the two springs are located so as to urge said members together in an end to end direction and also so as to urge relative rotation of said members about said trunnion, and wherein both of said springs are partially wrapped around said trunnion in extending from said upper member to said lower member.

14. The locking device according to claim 1 wherein said detent features comprise a flat tab projecting from one member and wherein the recess is formed in the other member and configured for receiving the tab therein, said flat tab overlying said recess with said members in said end to end aligned position.

15. The locking device according to claim 7 further including a radio transmitter located beneath said cap and activating a transmitted signal upon removal of said cap.

16. The locking device according to claim 1 wherein said cover is a manhole cover and further including an adaptor sleeve fixed in said manhole cover having said cover opening formed thereon.

17. The locking device according to claim 16 further including an extension arm fixed to the lower end of said lower member to be engageable with a manhole sidewall.

18. The locking device according to claim 17 wherein said extension arm is connected to said lower member by a shear pin which will be severed by a predetermined force to allow release of said locking device in the event of an explosion.

19. A method of securing a cover structure in position over a space below said cover defined in part by a sidewall, said cover structure recessed within a frame and having a through opening adjacent said sidewall, comprising the steps of:

pivotally connecting an upper and a lower elongated members together end to end so as to able to be articulated;

providing at least one spring coupled to said upper and lower members in locations configured for producing a force tending to cause said members to articulate by angling said lower member with respect to said upper member about said pivotal connection, said at least one spring member being configured for angling said lower member so as to enable engagement between said lower member and said sidewall and between said lower member and an edge of said cover structure;

forming detent features on said upper and lower members, said detent features being engageable to hold said members in an aligned condition, said detent features being disengageable to allow articulation of said members;

providing a detent release mechanism configured for disengaging the detent mechanism to allow articulation of said members after insertion of said members into said cover opening;

suspending said connected members on said cover structure extending through said cover opening;

actuating said detent release mechanism to disengage said detent mechanism, thereby releasing said members to allow articulation thereof; and

engaging said sidewall with said lower member and simultaneously engaging said lower member with an edge of said cover structure so as to wedge lower member therebetween to secure said cover in place.

20. The method according to claim 19 further including the step of drawing said lower member up towards said upper member after engagement of said lower member with said sidewall and cover structure to increase a wedging force of said lower member between said sidewall and said cover structure, to join said cover against said frame.

21. The method according to claim 20 wherein said step of pivotally connecting said upper and lower members together comprises the step of installing a rotatable trunnion in said lower member and threadably engaging said trunnion with a threaded bolt extending through a hole in a wall in said upper member and a threaded cross hole in said trunnion, said bolt having a head seatable on said bottom wall.

22. The method according to claim 21 wherein said step of drawing said lower member towards said upper member comprises the step of rotating said bolt in said threaded hole in said trunnion with said bolt head abutting said bottom wall.

23. The method according to claim 19 wherein said step of suspending said members includes the step of forming a flange on said upper member configured to rest on surfaces adjacent said cover opening.

24. The method according to claim 21 further including the step of forming engagement surfaces on said bolt engageable only with a special tool and advancing said bolt with said special tool to be tamper resistant.

25. The method according to claim 24 further including the step of recessing said bolt head within a flange formed on said upper member.
26. The method according to claim 25 further including the step of installing a tamper indicator plastic cap over said bolt head.
27. The method according to claim 26 further including forming a contour on said lower member to securely be captured by said cover structure.
28. The method according to claim 19 wherein said cover structure comprises a cover and an adaptor sleeve mounted to said cover, the adapter sleeve having a portion formed with a rectangular opening configured for receiving said connected members therein.
29. The method according to claim 28 further including the step of attaching an extension arm engageable with a sidewall of said manhole to said lower member bottom end by a shear pin able to release said locking device in the event of an explosion.
30. The method according to claim 19 further including the step of installing a plurality of said locking devices on opposite sides of said cover.
31. The method according to claim 30 further including the step of installing a bolt on the underside of said manhole cover adjacent a manhole cover flange to prevent lifting of both sides of said manhole cover.

32. A system for locking down an enclosure comprising:
- a cover for said enclosure;
  - a locking device received in a cover opening, the locking device including:
    - a first member;
    - a second member rotatably coupled to the first member;
    - at least one spring member coupling the first member with the second member so as to urge rotation of the second member with respect to the first member due to forces exerted by the at least one spring member;
    - a bolt coupling the first member to the second member such that the second member is engaged with the first member so as to prevent rotation of the second member due to forces exerted by the at least one spring member when the bolt is in a first position, and such that rotation of the bolt to place the bolt in a second position different from the first position disengages the second member from the first member so as to enable rotation of the second member due to forces exerted by the at least one spring member;
    - said bolt having a special head shape;
    - a socket tool adapted to mate with said special shaped bolt head; and
    - a seal covering said bolt head and having a tamper indicator when removed.
33. The locking device of claim 1 wherein the cover structure comprises a cover and an adapter sleeve fixed in a hole formed in the cover, and wherein the lower member is configured to be rotatable relative to said upper member to enable engagement between said lower member and an edge of said adapter sleeve.

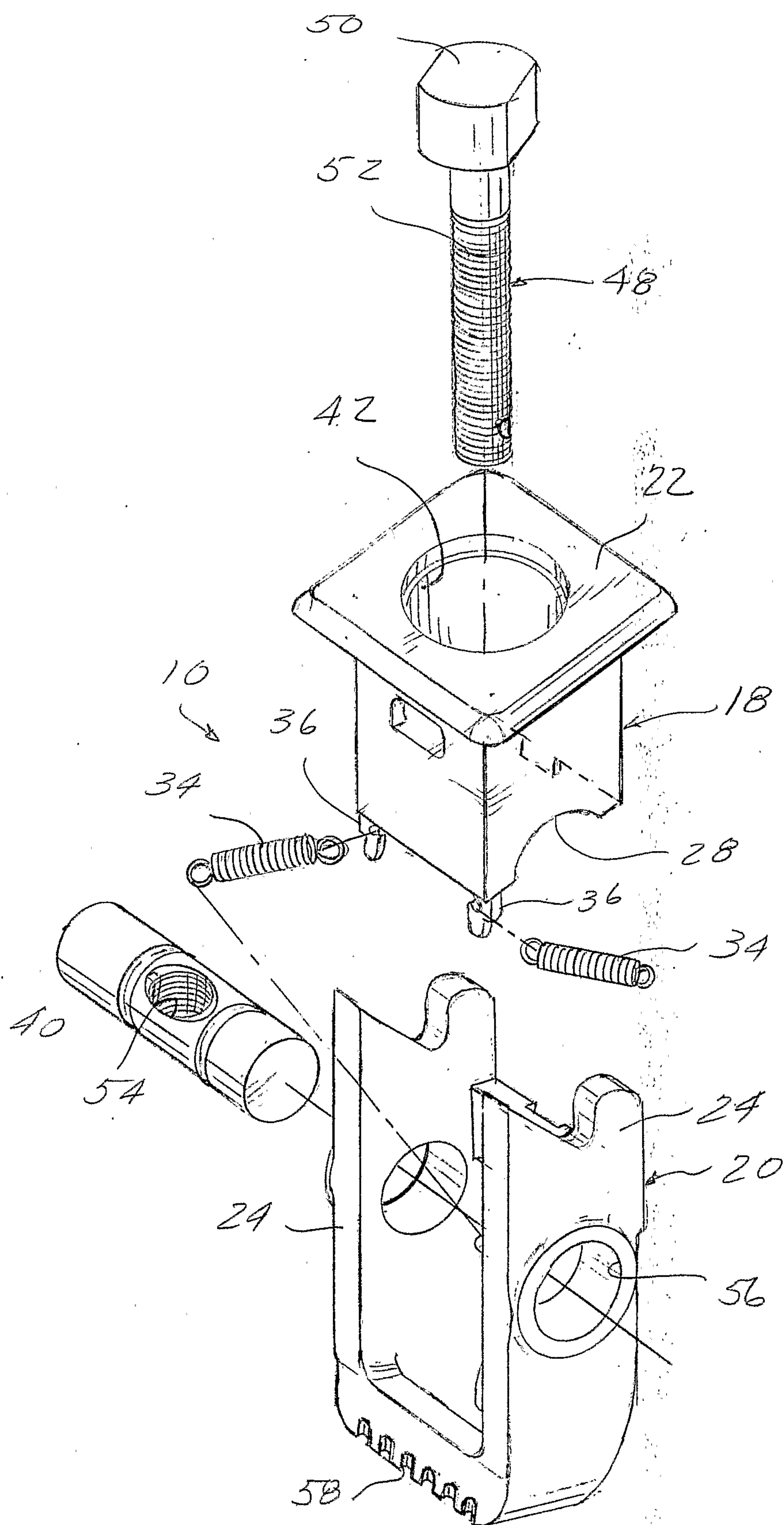
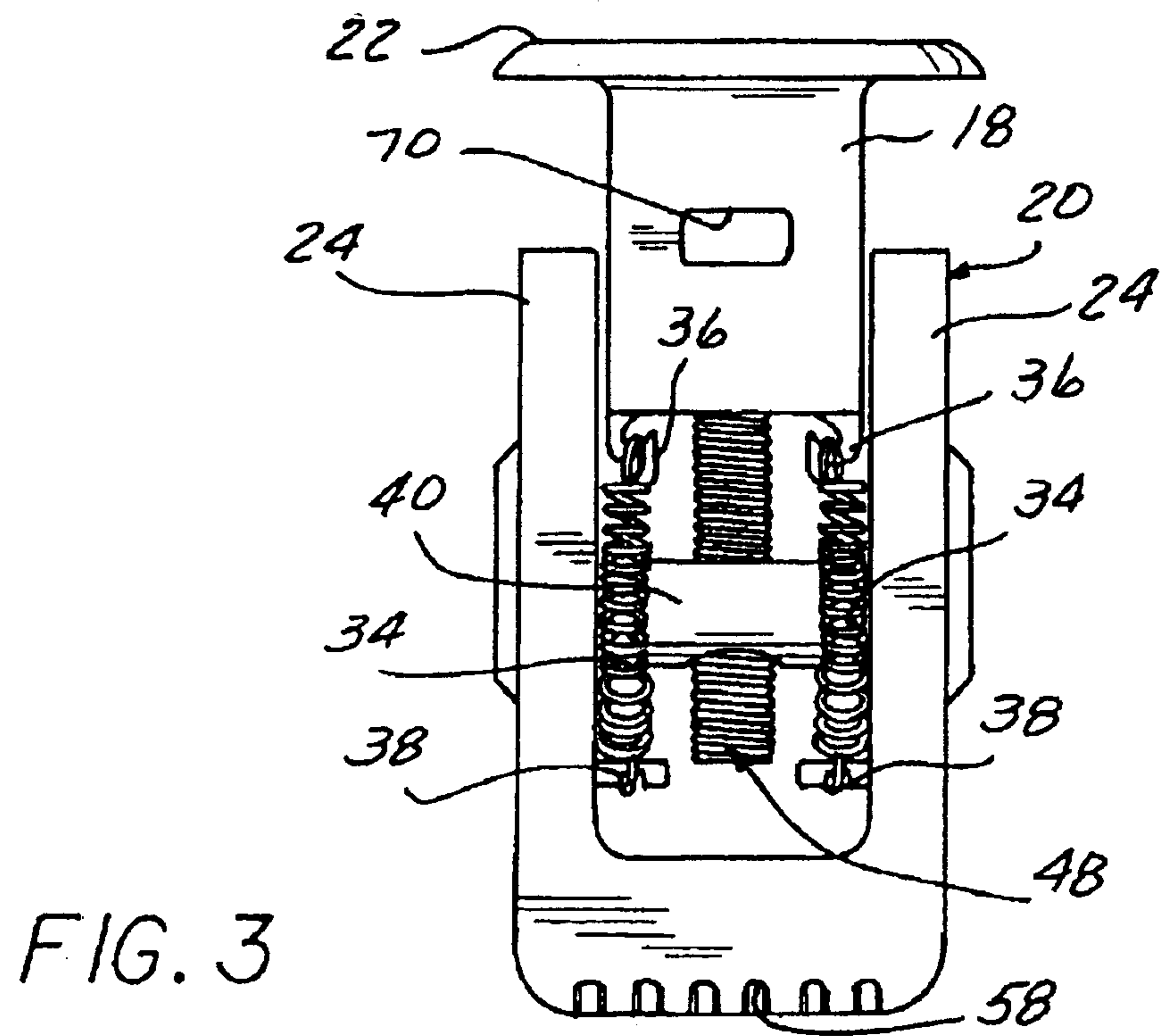
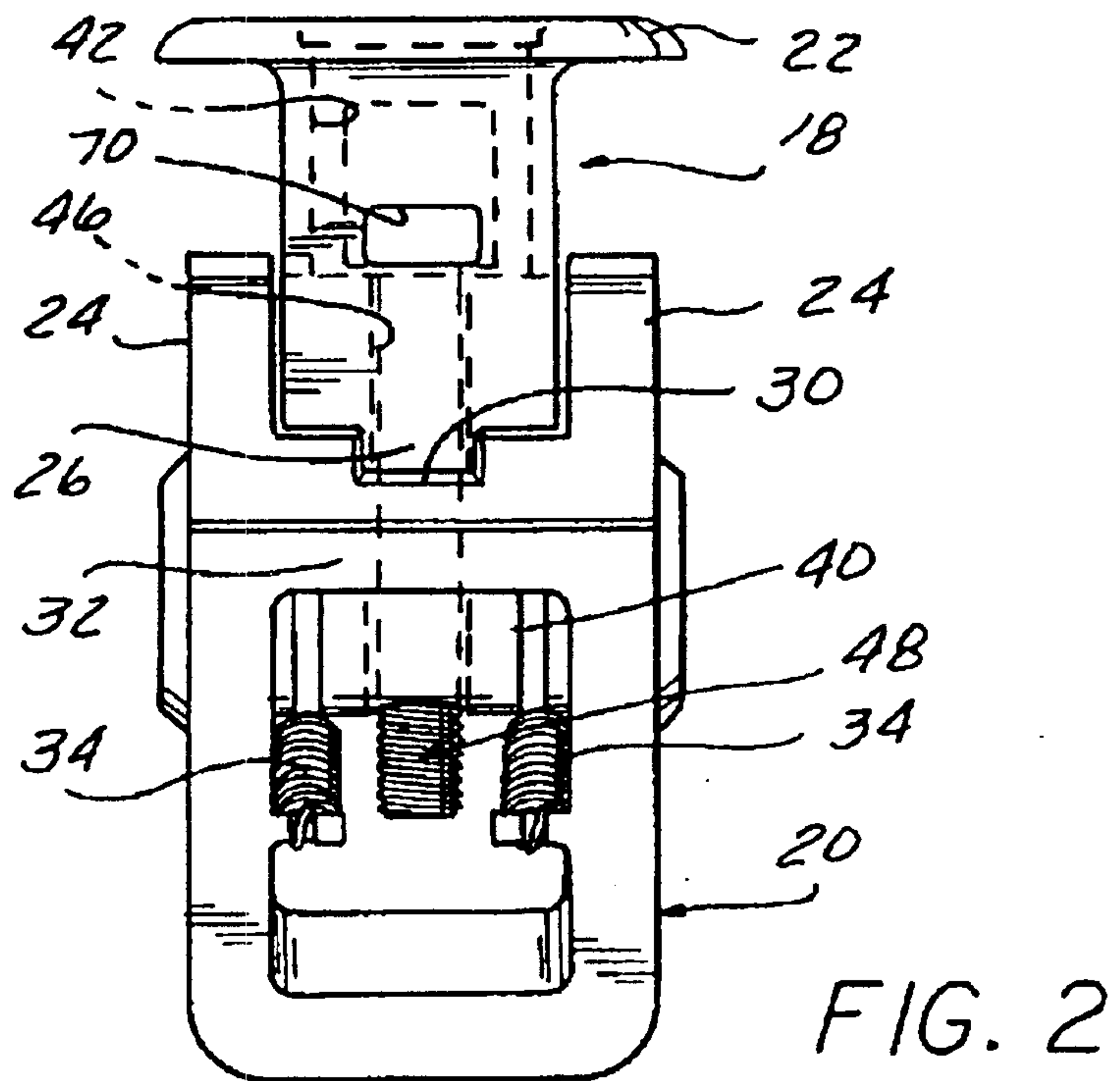
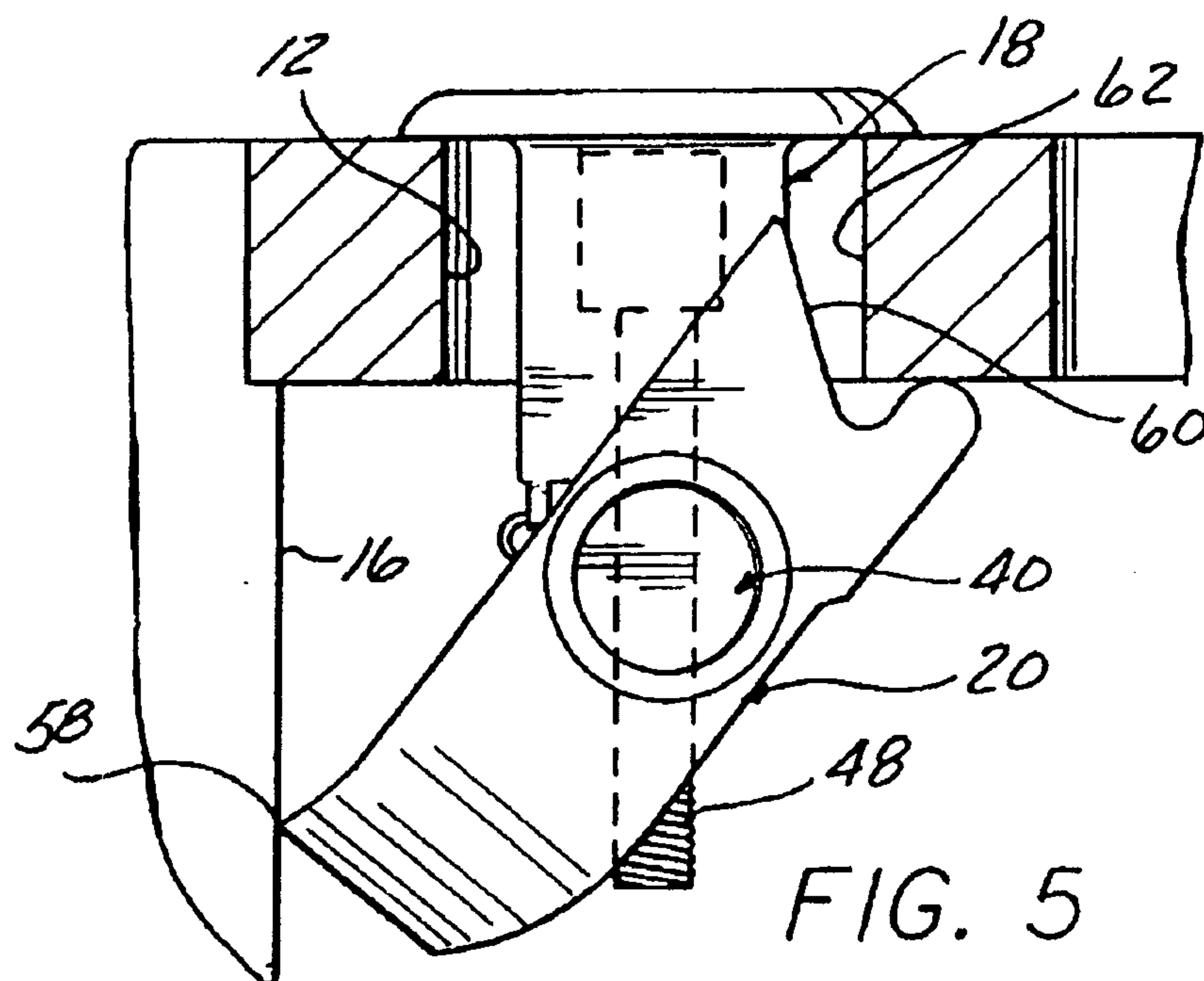
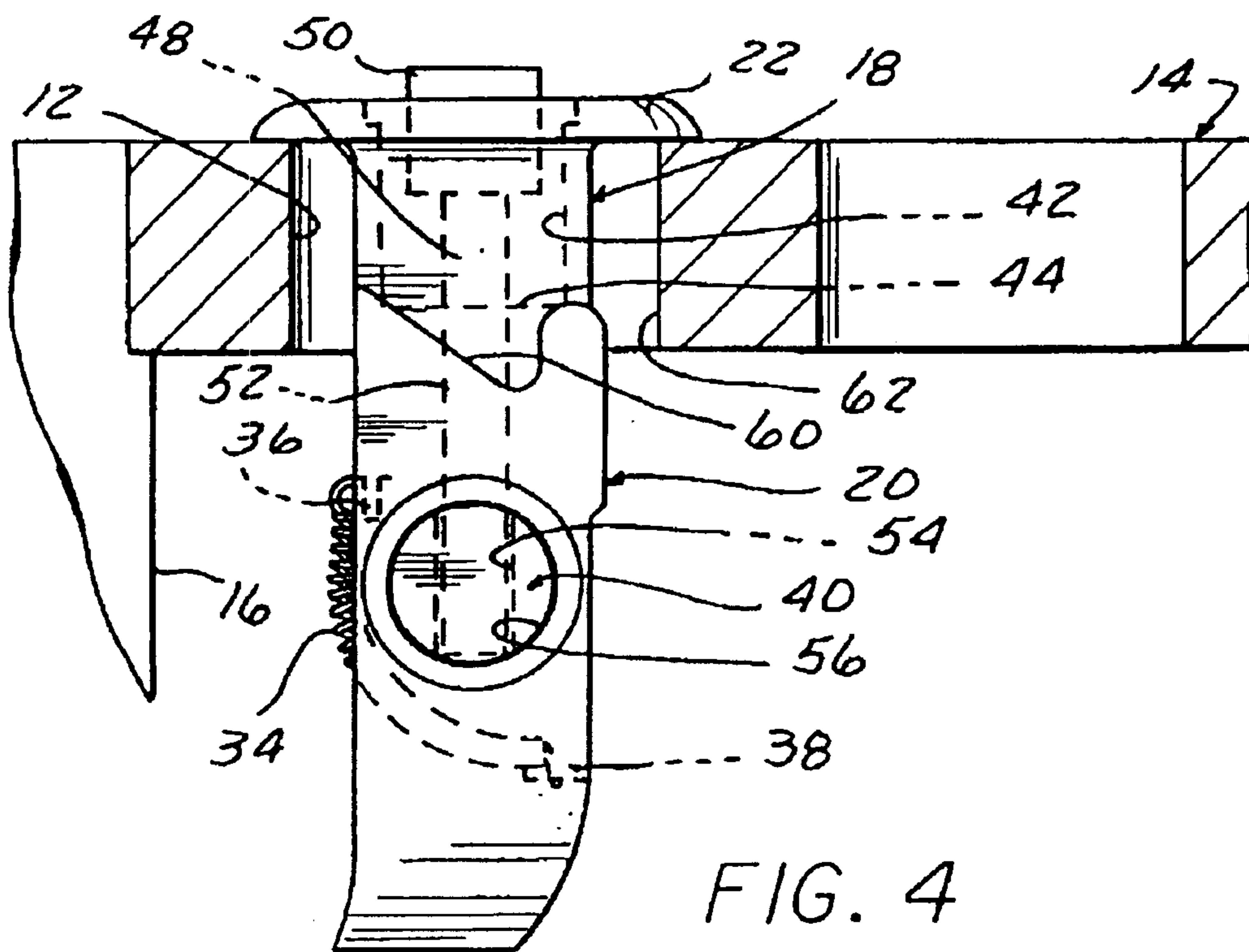
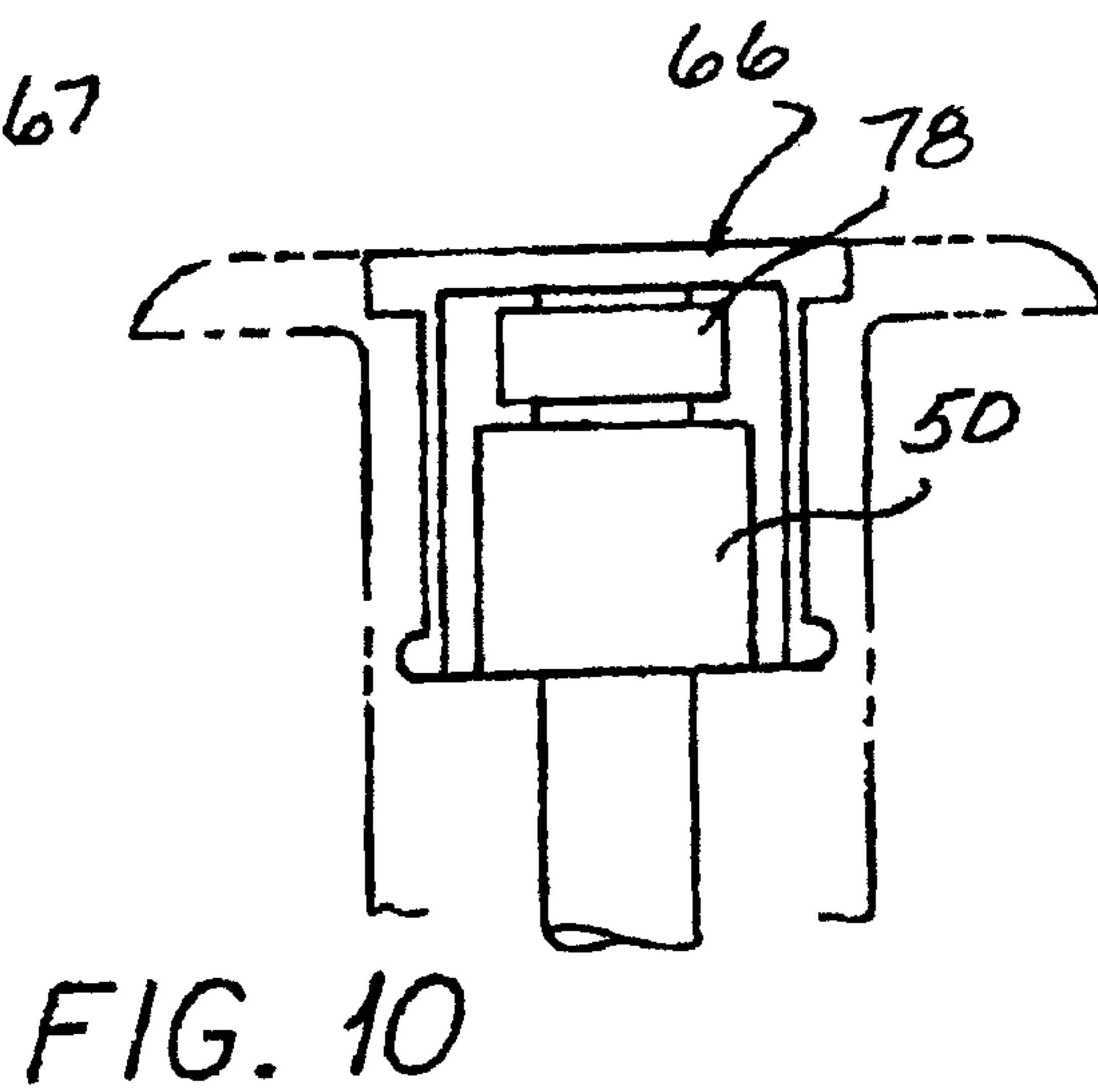
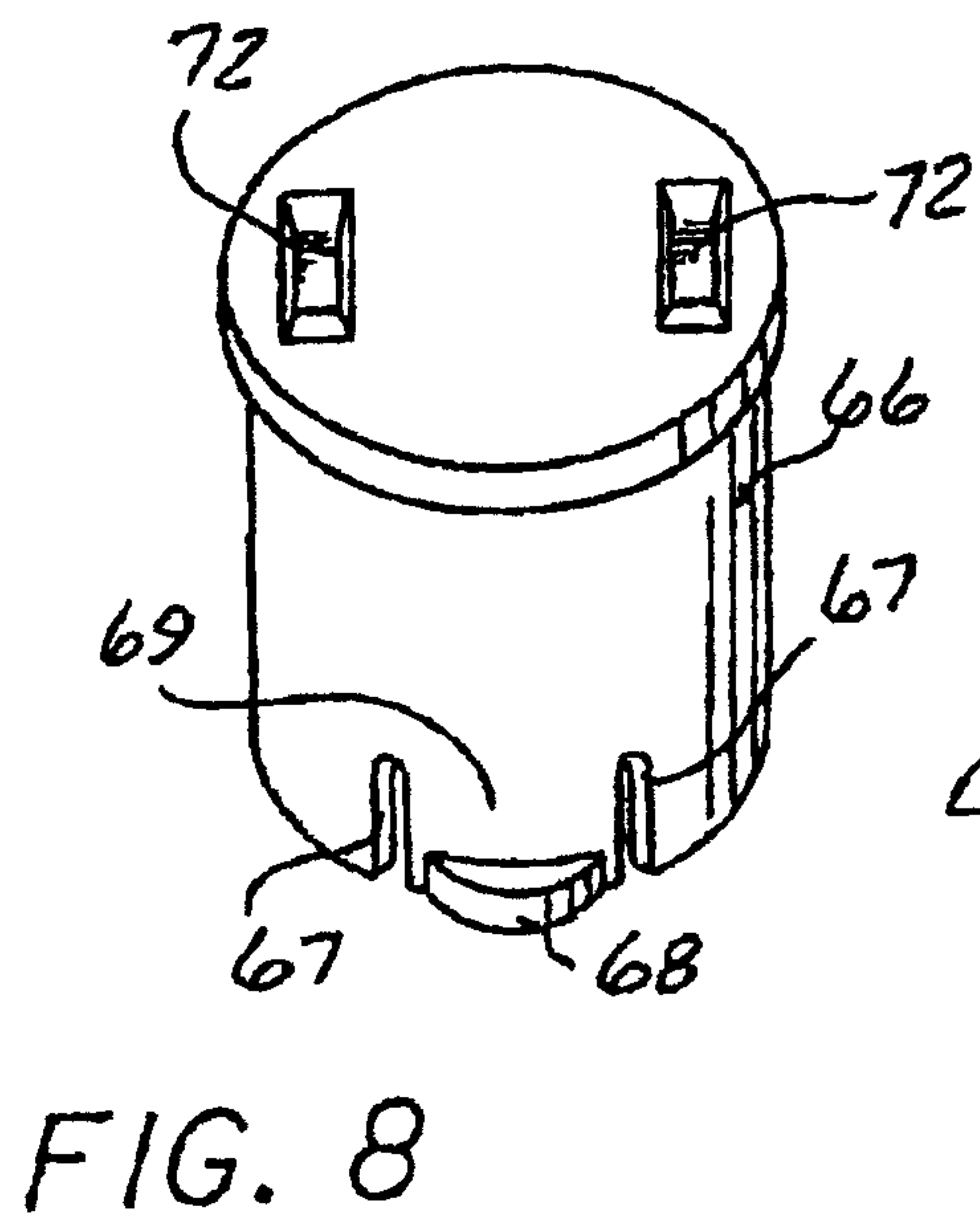
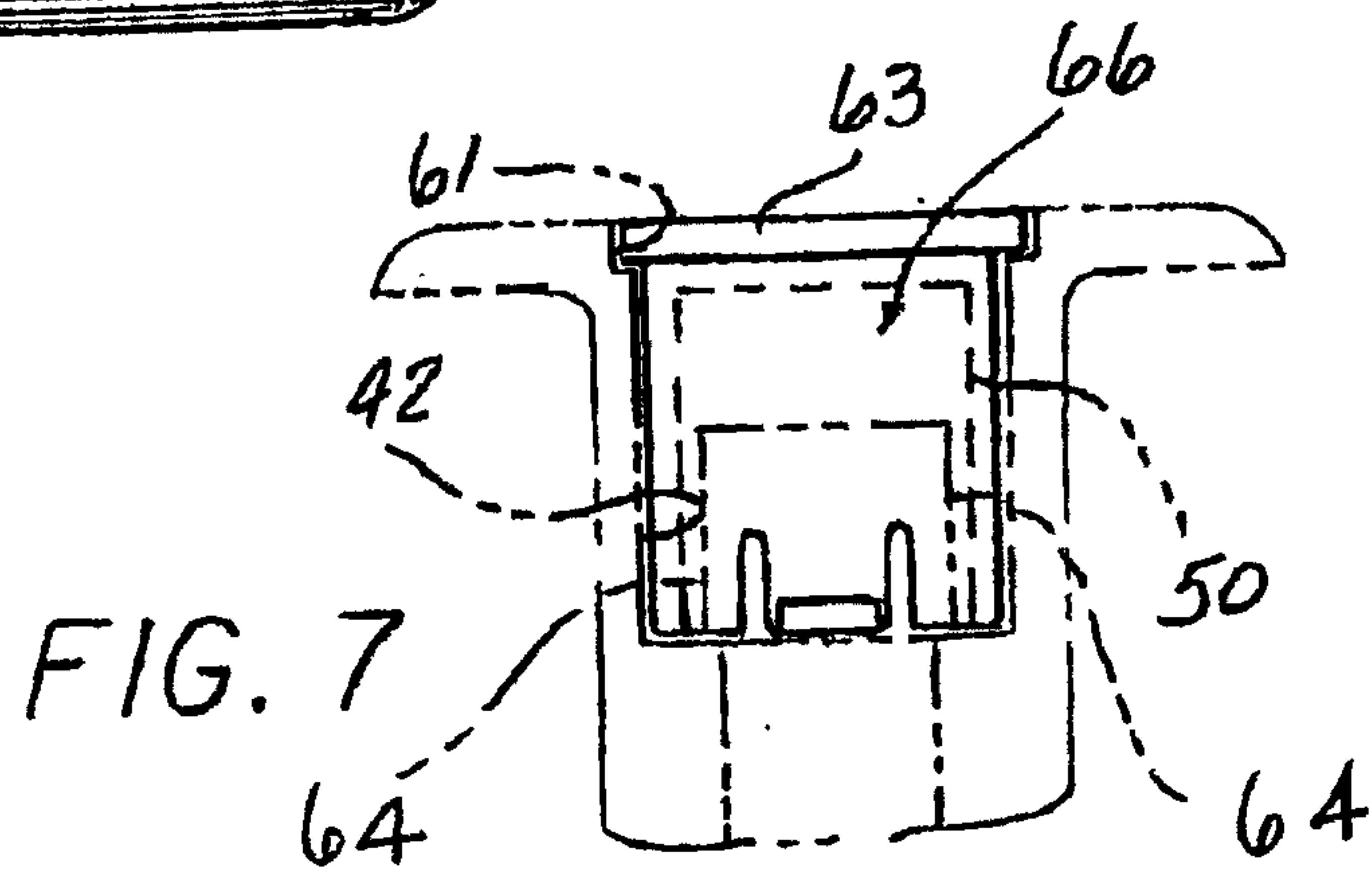
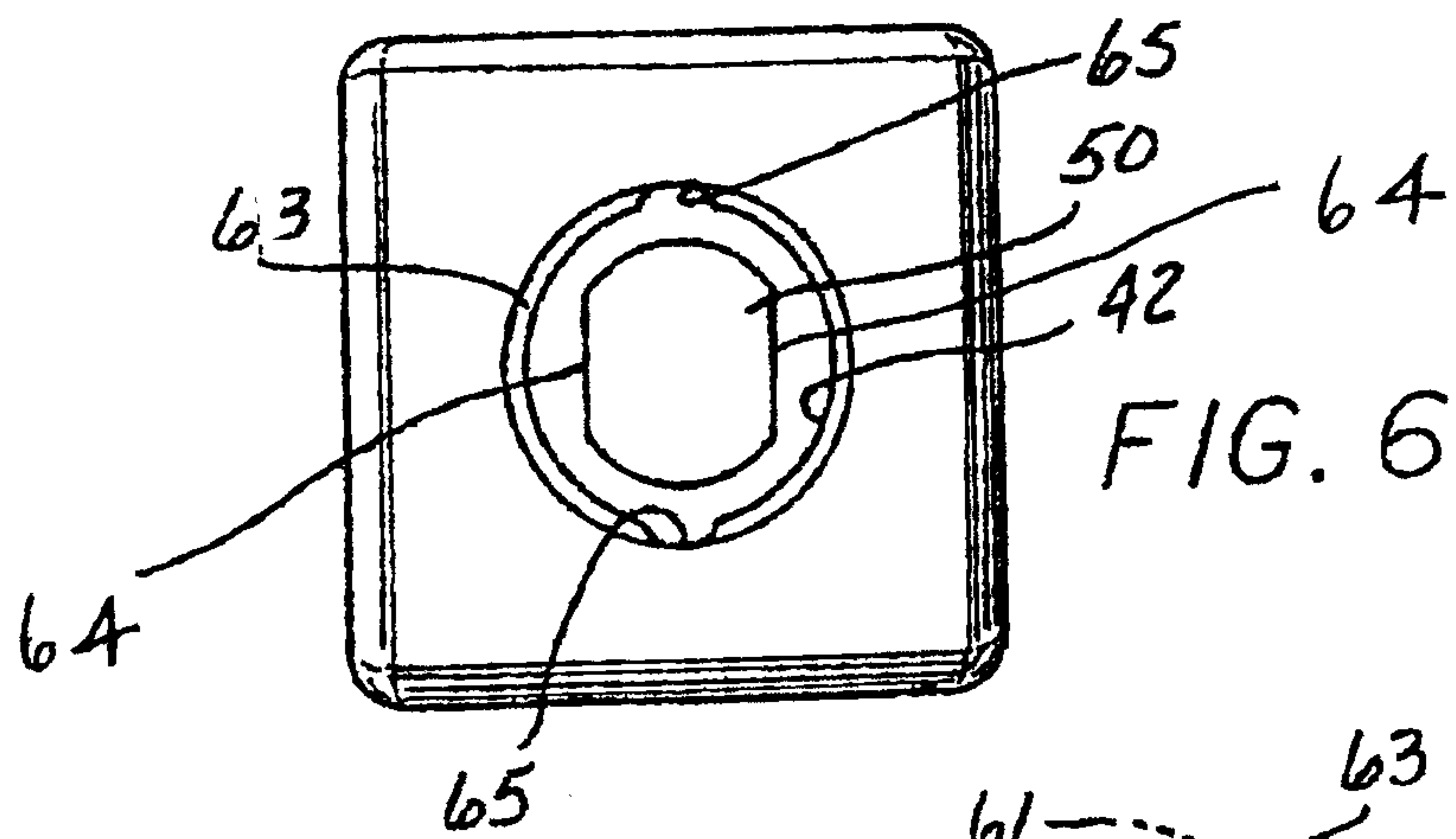
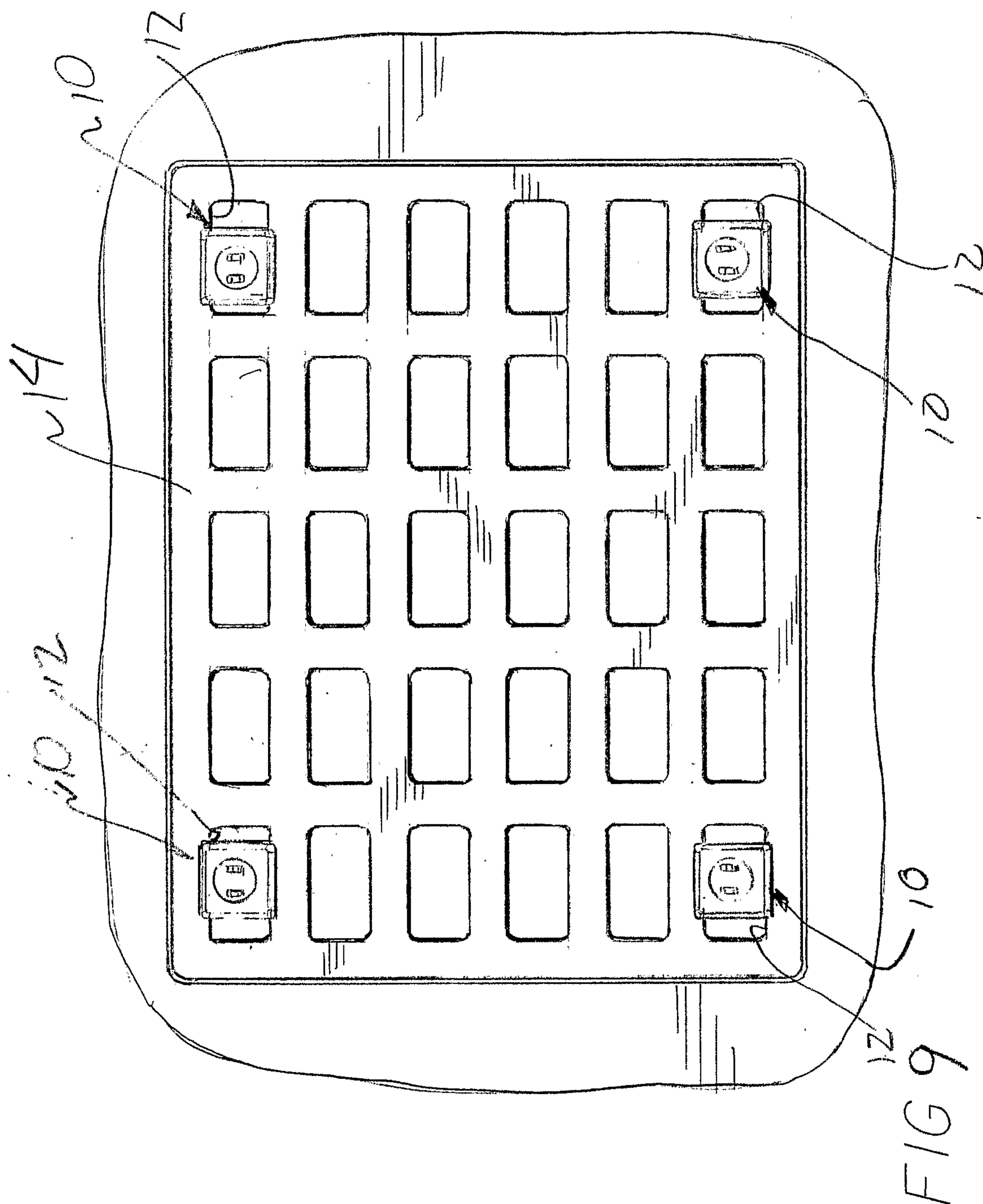


FIG 1









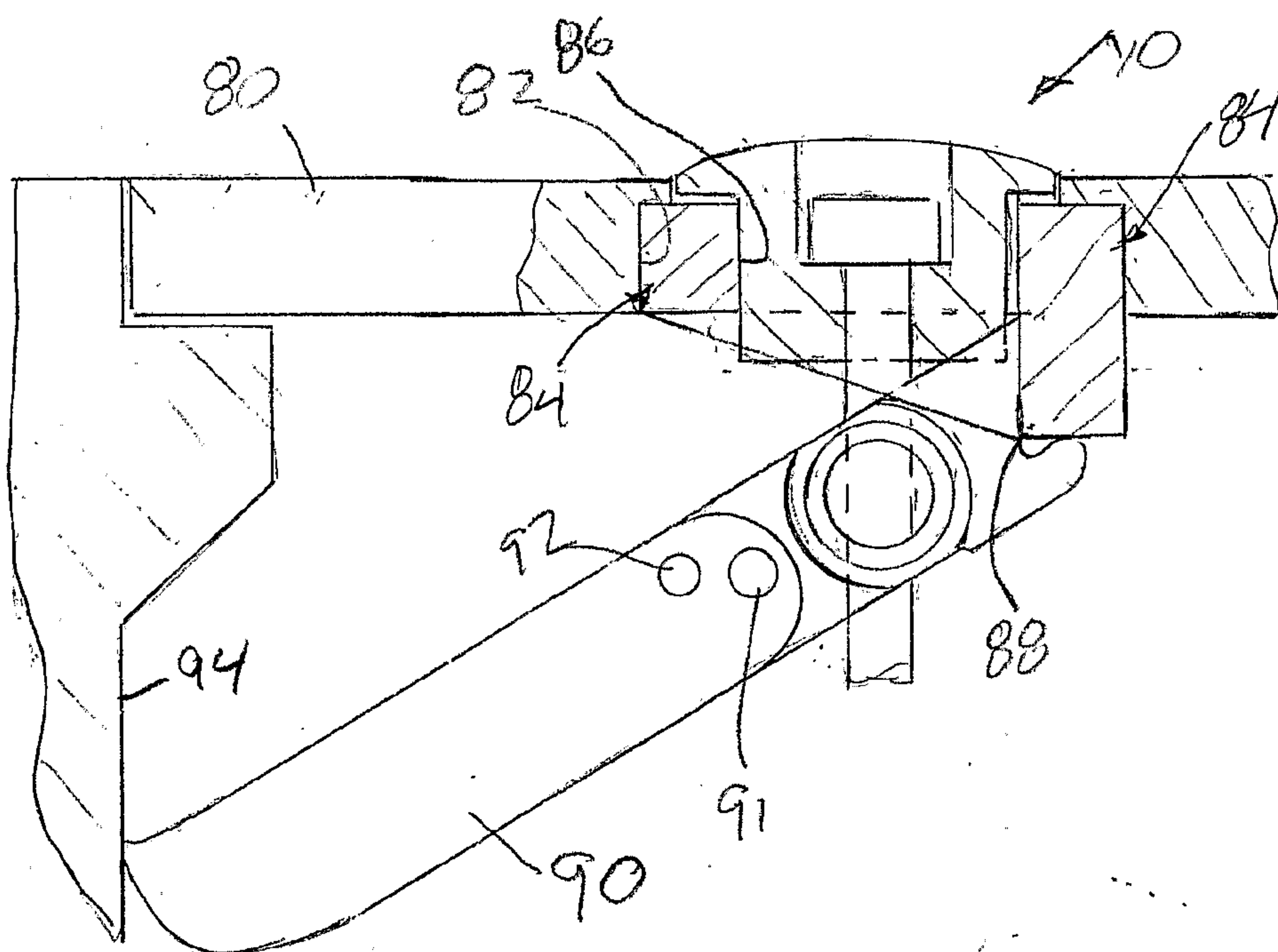


FIG 11

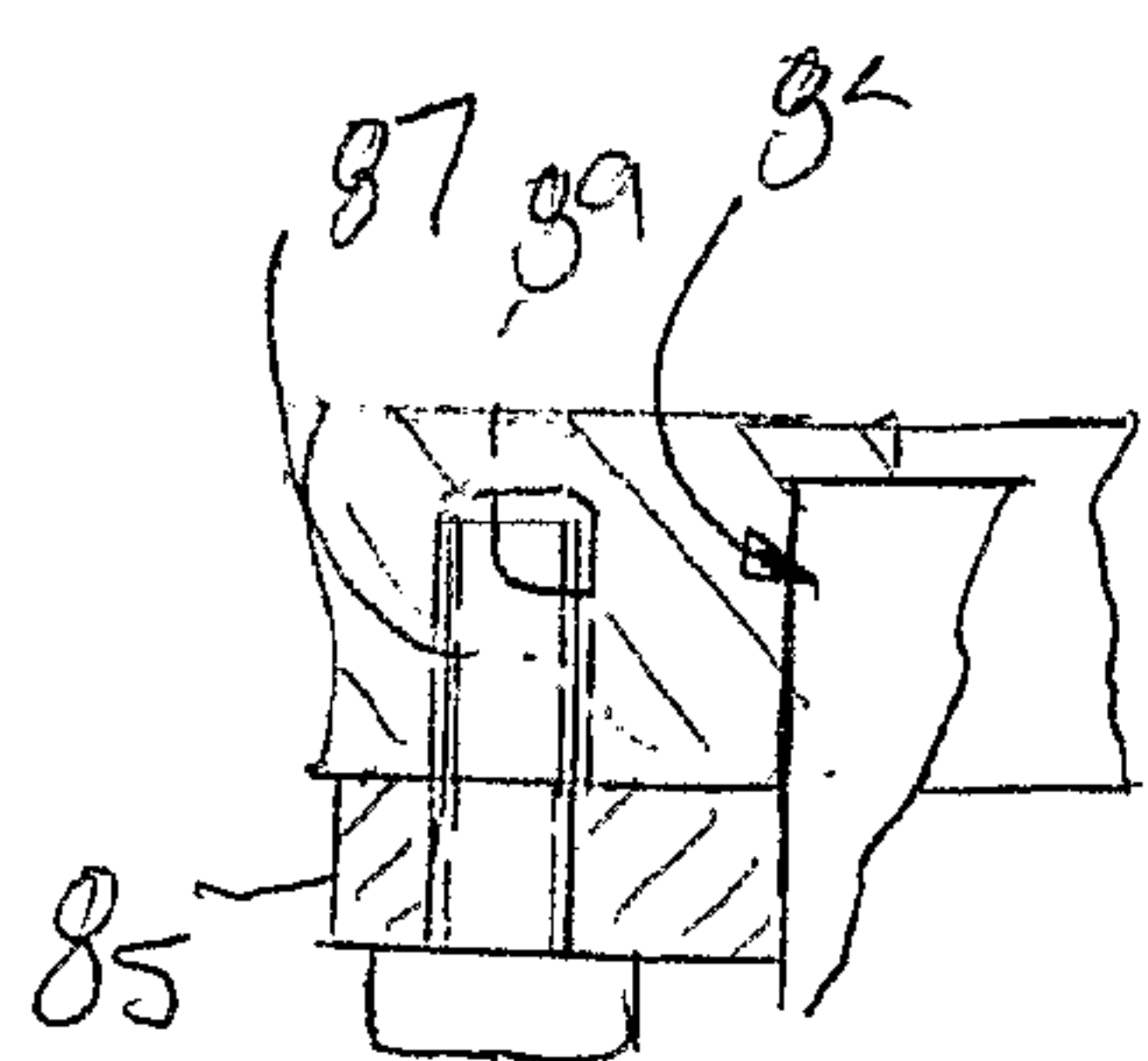


FIG 14

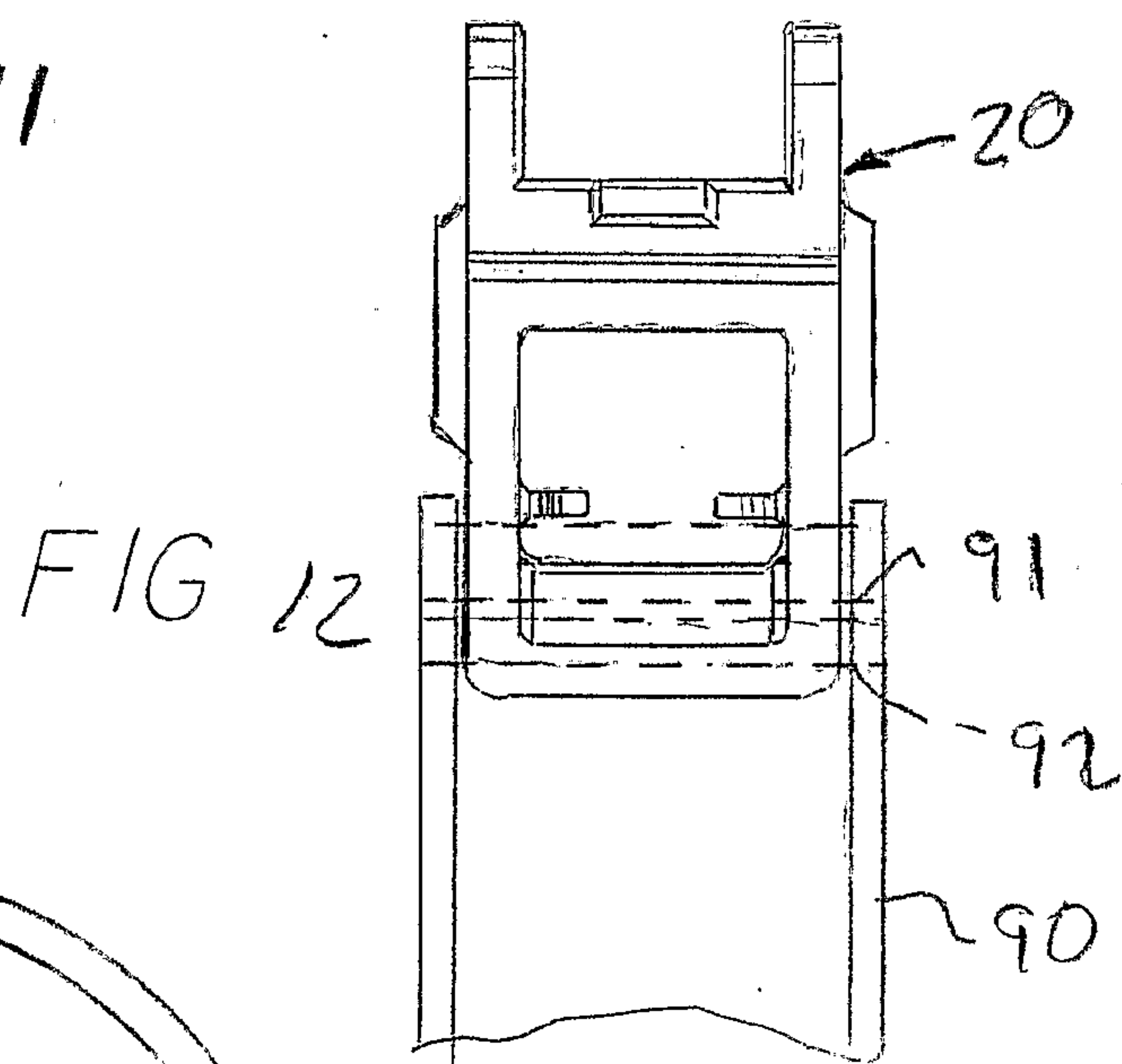


FIG 12

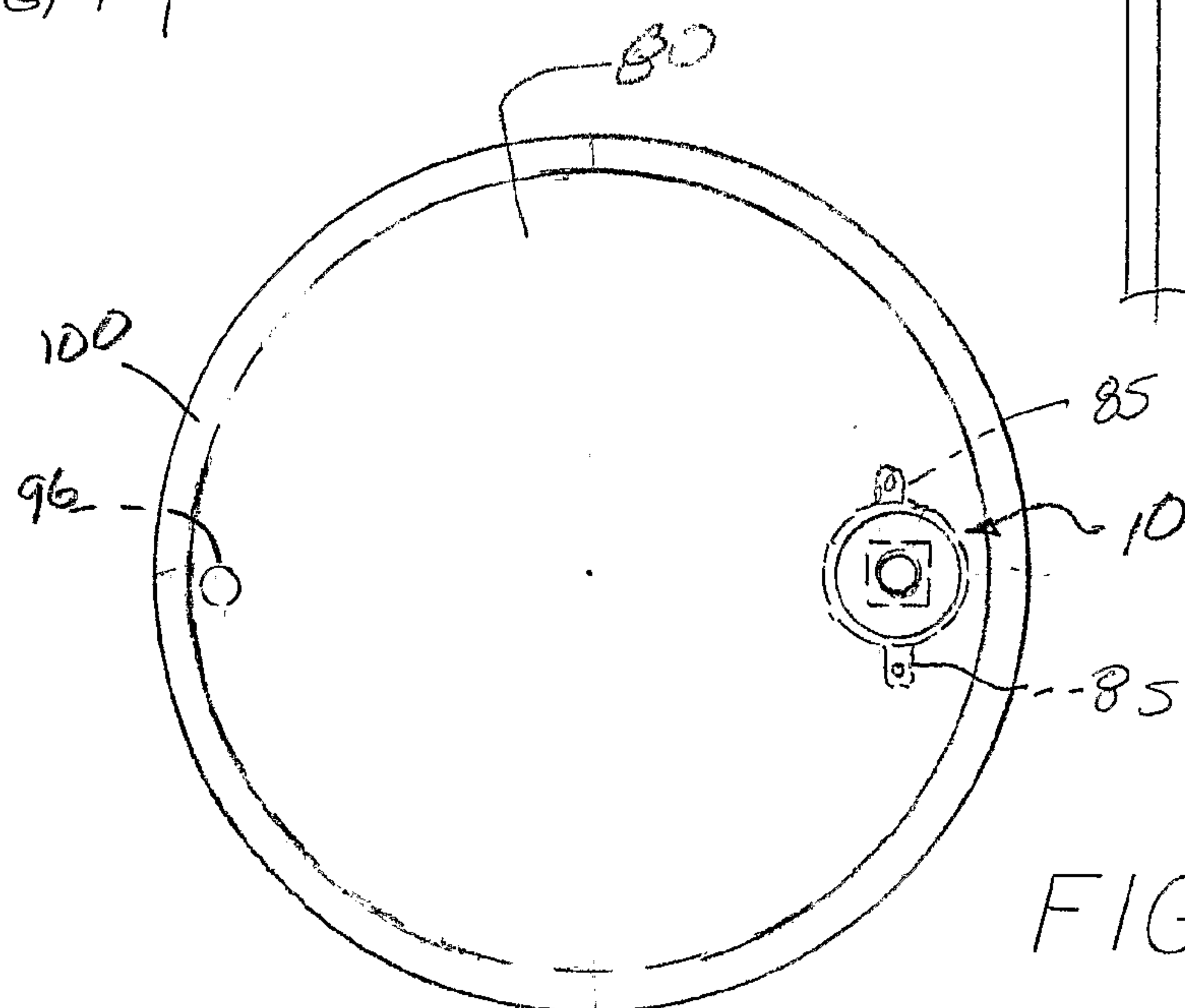


FIG 13