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(54) Title: LOCKING DEVICE AND METHOD FOR CATCH BASIN AND MANHOLE COVERS, AND THE LIKE

(57) 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 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.



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**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 18 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 70 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 70 provided in the bottom of the bore 42 the upper member 18. The bore 42
7 is formed with shallow grooves 65 to aid in aligning the protrusions 66 and a shallow
8 counterbore 61 to accommodate a cap flange 63'. The protrusions 66 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.

1 I Claim:

2
3 1. A locking device for a cover overlying a space defined in part by a
4 sidewall, a perimeter frame extending around said opening and said cover having a through
5 opening adjacent a side thereof, said device comprising:

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

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

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

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

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

16 at least one spring connected at one end to said upper member and at another
17 end to said lower member, said at least one spring located to urge said members together in
18 an end to end direction and also to urge relative rotation of said members about said trunnion
19 to articulate the same; a detent mechanism comprising a first detent feature on the bottom end
20 of said upper member and a second detent feature on said lower member engaging said first
21 detent feature with said members in end to end abutment so as to prevent relative rotation
22 about said trunnion; said bolt able to push said lower member away from said upper member
23 against said spring force to cause disengagement of said detent features allowing said

1 members to articulate by relative rotation other about said trunnion.

2
3 2. The locking device according to claim 1 wherein said lower member is
4 formed with at least one notched contour on an upper end rotated to engage an edge of said
5 cover opening upon disengagement of said detent features and rotation of said lower member
6 by said at least one spring.

7
8 3. The locking device according to claim 2 wherein a bottom end of said
9 lower member is formed with teeth engaging said sidewall upon articulation of said upper and
10 lower members to establish a wedging action between said lower member, said sidewall, and
11 said opening edge.

12
13 4. The locking device according to claim 3 wherein advance of said bolt
14 in said threaded hole of said trunnion causes raising of said lower member to increase said
15 wedging action by the reaction of said head on said bolt engaging said bottom wall of said
16 recess in said upper member to increase the pressure of said teeth on said lower end of said
17 lower member against said sidewall and said notched contour against said opening edge.

18
19 5. The locking device according to claim 1 wherein said bolt head is
20 formed with an irregular contour engageable only with a special tool to be tamper resistant
21 after said bolt is tightened.

22
23 6. The locking device according to claim 5 wherein said bolt head is

1 substantially enclosed in said recess after said bolt is tightened.

2
3 7. The locking device according to claim 6 further including a molded
4 plastic cap received over said bolt head in said recess.

5
6 8. The locking device according to claim 7 wherein said cap has at least
7 one protrusion contoured in a pocket in said recess upon being installed, said at least one
8 protrusion deformed upon removal of said cap to provide a tamper indicator.

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

14
15 10. The locking device according to claim 9 wherein each wall of said
16 lower member is formed with a bore aligned with the bore in the other wall, said trunnion
17 slidably received in said bores.

18
19 11. The locking device according to claim 10 wherein said trunnion is
20 located at an intermediate location along the length of said lower member.

21
22 12. The locking device according to claim 1 wherein two springs are
23 provided each connected at either end to said upper and lower members respectively, said

1 springs connected at one end to one side of one member and at the other ends to an opposite
2 side of the other member to create said rotational force resisted by said detent mechanism.

3
4 13. The locking device according to claim 12 wherein both of said springs
5 are partially wrapped around said trunnion in extending from said upper member to said
6 lower member.

7
8 14. The locking device according to claim 1 wherein said detent features
9 comprise a flat tab projecting from one member and recess in the other member, said flat tab
10 overlying said recess with said members in said end to end aligned position.

11
12 15. The locking device according to claim 7 further including a radio
13 transmitter located beneath said cap and activating a transmitted signal upon removal of said
14 cap.

15
16 16. The locking device according to claim 1 wherein said cover is a
17 manhole cover and further including an adaptor sleeve fixed in said manhole cover having
18 said cover opening formed thereon.

19
20 17. The locking device according to claim 16 further including an
21 extension arm fixed to the lower end of said lower member to be engageable with a manhole
22 sidewall.

1 18. The locking device according to claim 17 wherein said extension arm
2 is connected to said lower member by a shear pin which will be severed by a predetermined
3 force to allow release of said locking device in the event of an explosion.
4

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

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

10 establishing a force tending to cause said members to articulate by angling said
11 lower member with respect to said upper member about said pivotal connection;

12 aligning said members end to end and holding said members in said alignment
13 against said force while inserting the same through said cover opening;

14 suspending said connected members on said cover extending through said
15 cover opening;

16 releasing said members to allow articulation thereof; and

17 engaging said sidewall with a bottom end of said lower member and
18 simultaneously engaging an upper surface of said lower member with an edge of said cover
19 opening so as to wedge the same therebetween to secure said cover in place.
20

21 20. The method according to claim 19 further including drawing said lower
22 member up towards said upper member after engagement thereof with said sidewall and
23 cover opening edge to increase said wedging force to join said cover against said frame.

1 21. The method according to claim 20 wherein said step of establishing
2 said force comprises the step of connecting at least one tension spring to said upper and lower
3 members in location tending to articulate said members about said pivotal connection.
4

5 22. The method according to claim 20 wherein said step of pivotally
6 connecting said upper and lower members together comprises the step of installing a rotatable
7 trunnion in said lower member and threadably engaging said trunnion with a threaded bolt
8 extending through a hole in a wall in said upper member and a threaded cross hole in said
9 trunnion said bolt having a head seatable on said bottom wall.
10

11 23. The method according to claim 22 wherein said step of drawing said
12 lower member towards said upper member comprises the step of rotating said bolt in said
13 threaded hole in said trunnion with said bolt head abutting said bottom wall.
14

15 24. The method according to claim 19 wherein said step of suspending said
16 members includes the step of forming a flange on said upper member configured to rest on
17 surfaces adjacent said cover opening.
18

19 25. The method according to claim 22 further including the step of forming
20 engagement surfaces on said bolt engageable only with a special tool and advancing said bolt
21 with said special tool to be tamper resistant.
22

23 26. The method according to claim 25 further including the step of

1 recessing said bolt head within a flange formed on said upper member.

2
3 27. The method according to claim 26 further including the step of
4 installing a tamper indicator plastic cap over said bolt head.

5
6 28. The method according to claim 27 further including forming a contour
7 on said lower member to securely be captured by said cover opening edge.

8
9 29. The method according to claim 19 wherein said step of holding said
10 members in an aligned position includes the step of forming detent features on said upper and
11 lower members and engaging the same while inserting said upper and lower members through
12 said cover opening and thereafter releasing said engagement thereof to allow said articulation
13 to proceed.

14
15 30. The method according to claim 19 wherein said method is applied to a
16 manhole cover by first installing an adaptor sleeve in the undersurface, having a portion
17 formed with a rectangular opening receiving said locking device comprising said cover
18 opening.

19
20 31. The method according to claim 30 further including the step of
21 installing an extension arm engageable with a sidewall of said manhole to said lower member
22 bottom end by a shear pin able to release said locking device in the event of an explosion.

1 32. The method according to claim 19 further including the step of
2 installing a plurality of said locking devices on opposite sides of said cover.

3
4 33. The method according to claim 31 further including the step of
5 installing a bolt on the underside of said manhole cover adjacent a manhole cover flange to
6 prevent lifting of both sides of said manhole cover.

7
8 34. A system for locking down an enclosure comprising:
9 a cover for said enclosure;
10 a locking device received in a cover opening comprised of a pair of members
11 articulated together;
12 a bolt passing through one of said members and threadedly engaged with the
13 other to cause said members to be articulated when said bolt is rotated;
14 said bolt having a special head shape;
15 a socket tool adopted to mate with said special shaped bolt head;
16 a seal covering said bolt head and having a tamper indicator when removed;
17 and
18 an extractor tool for extracting said seal.

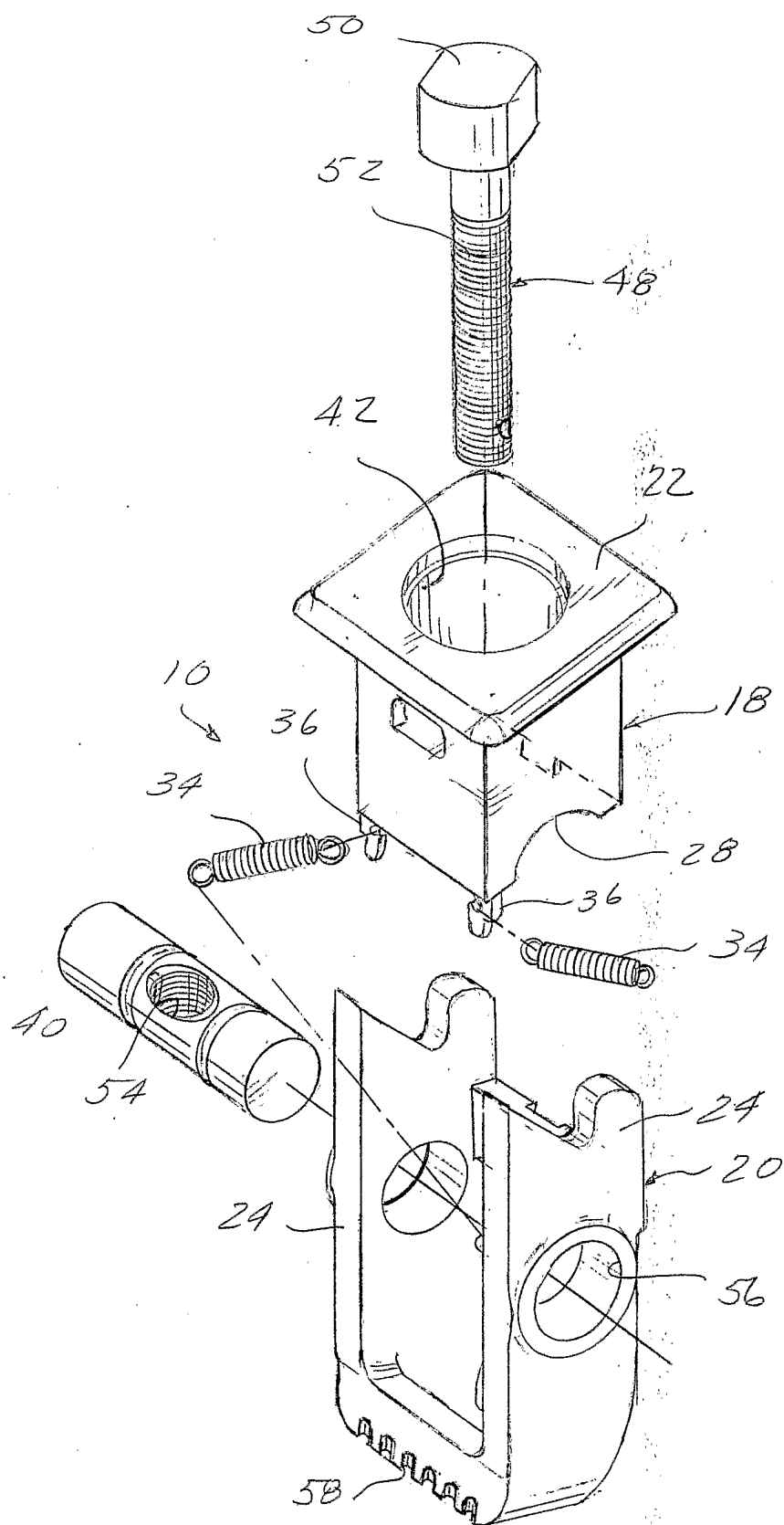


FIG 1

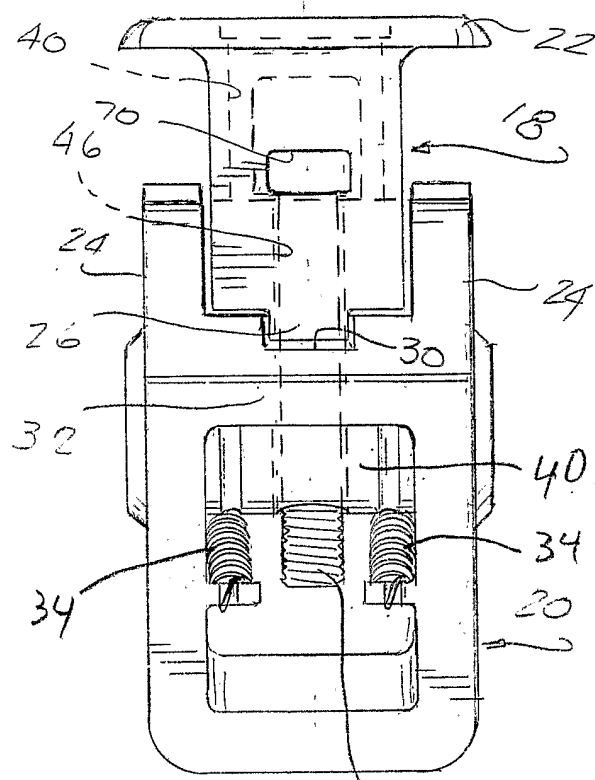


FIG. 2

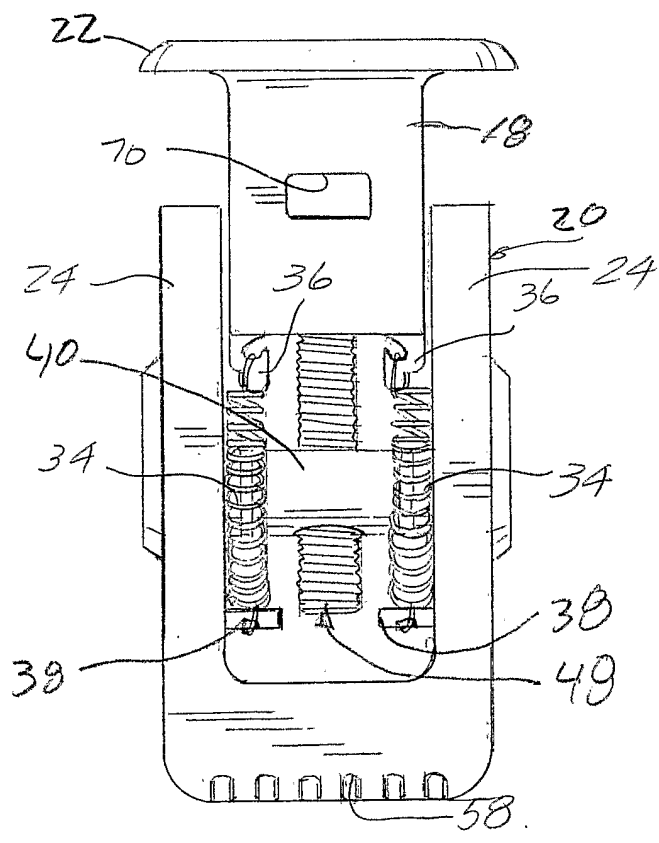
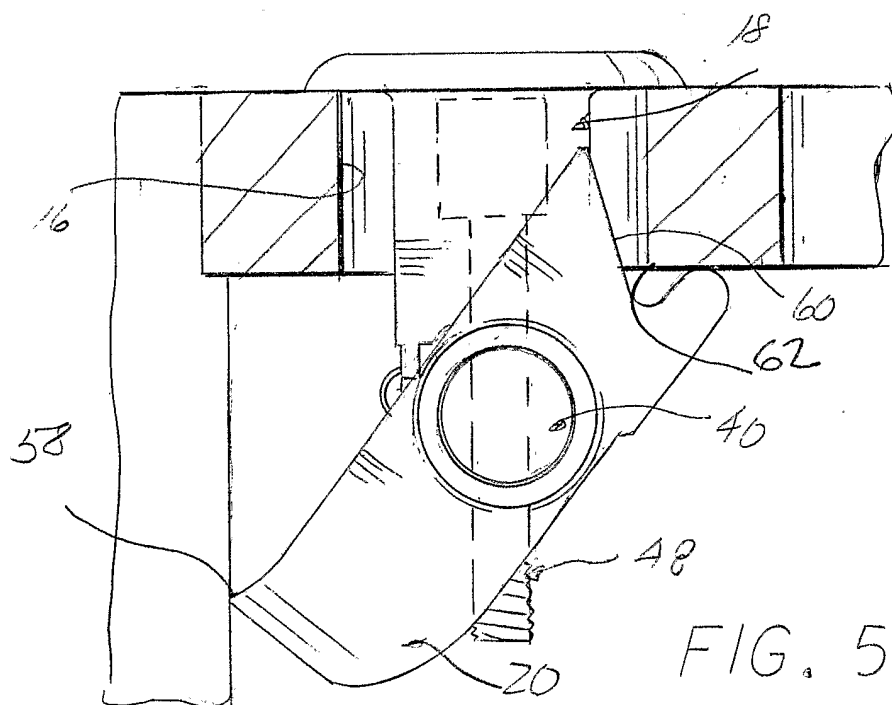
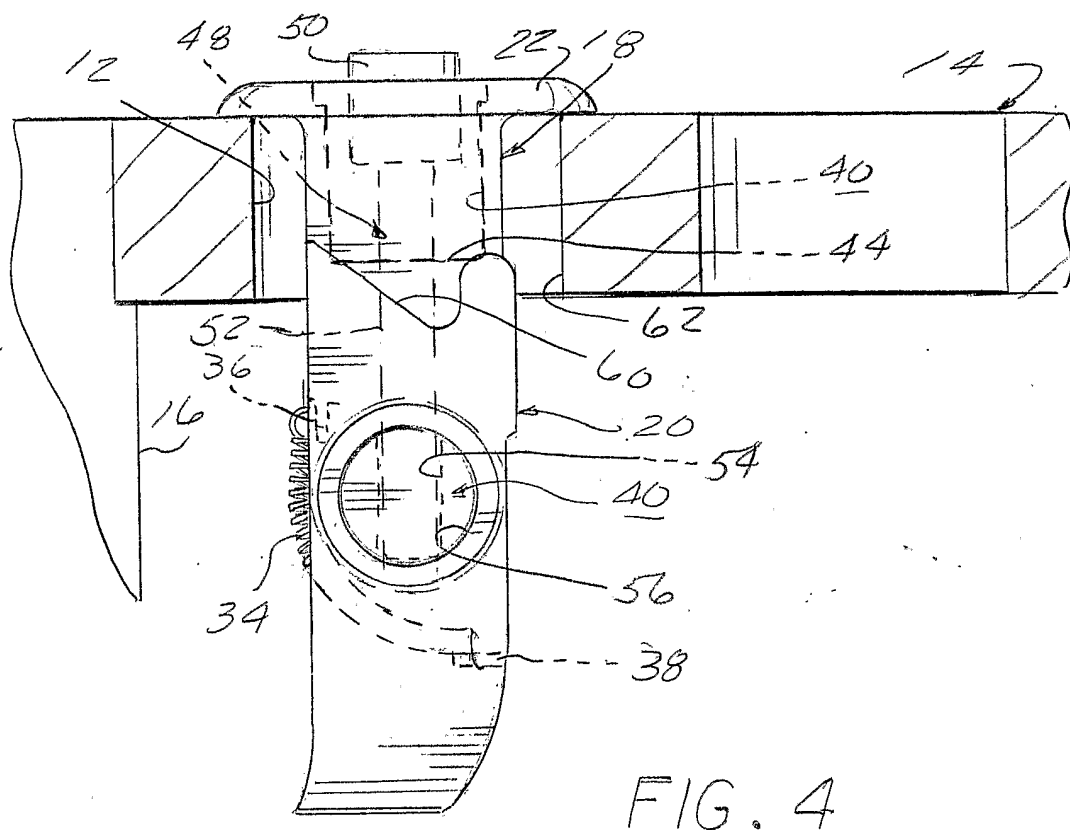


FIG. 3



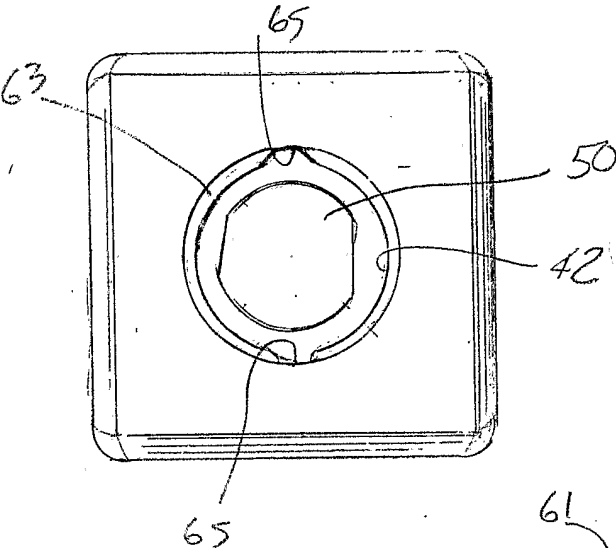


FIG 6

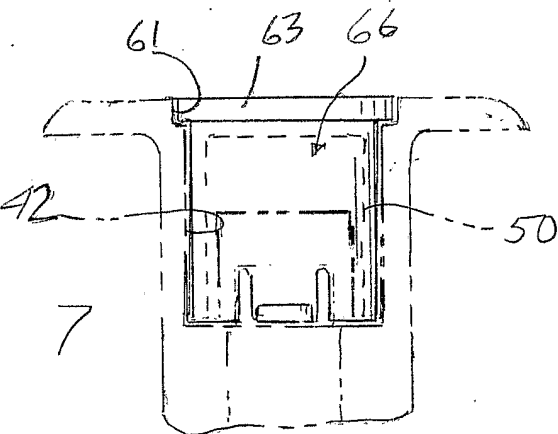


FIG 7

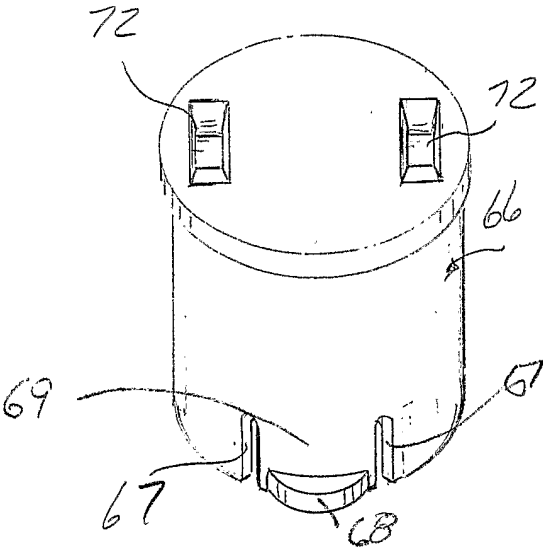


FIG 8

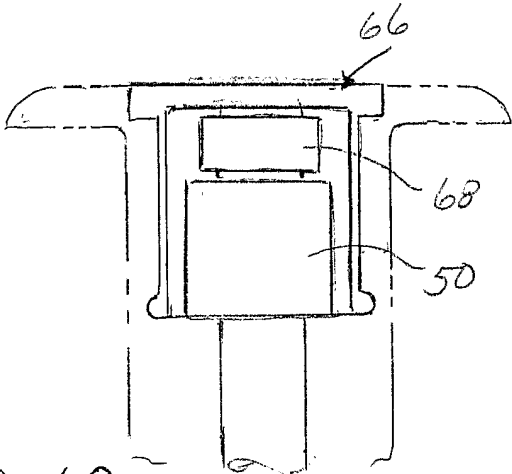
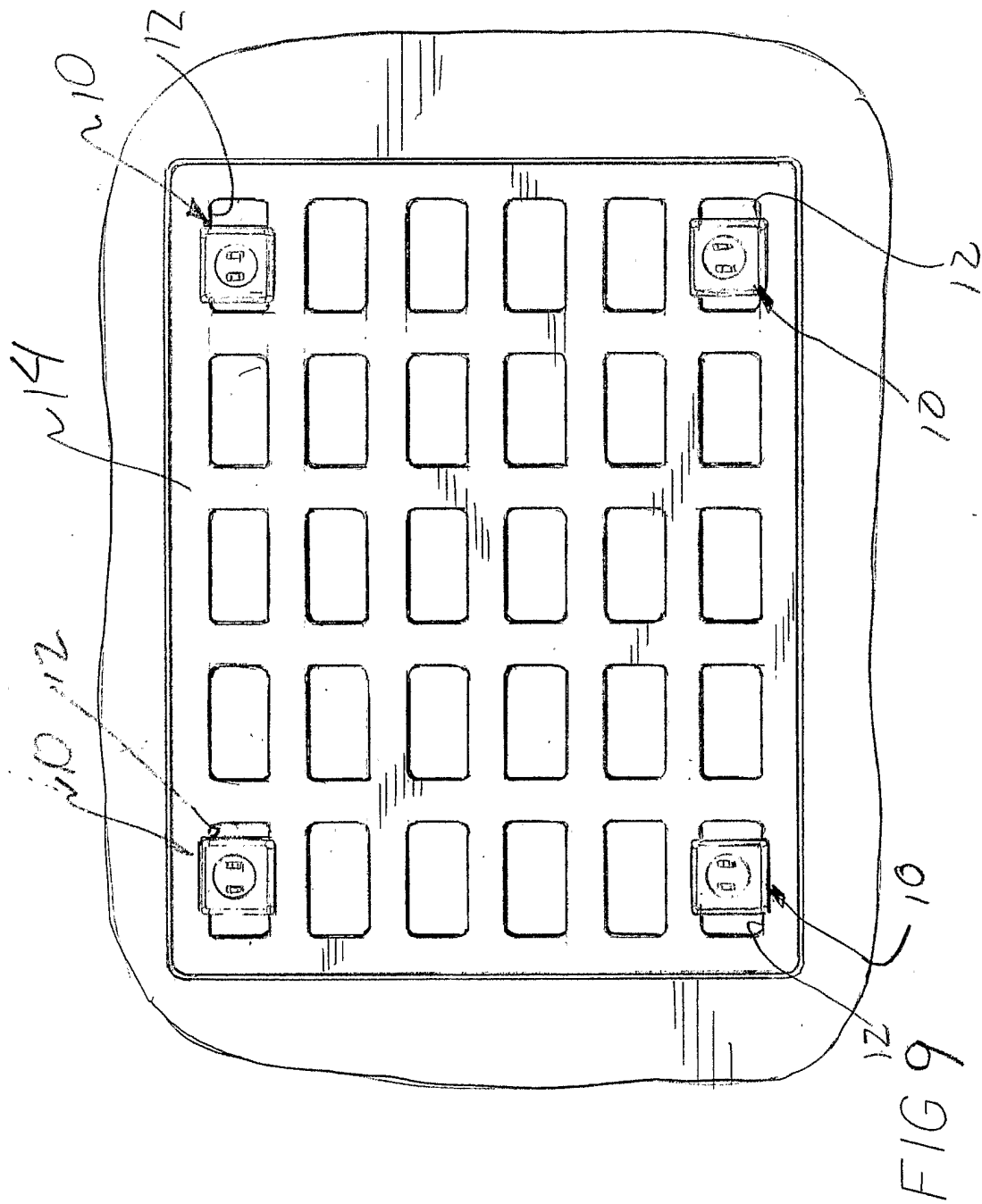


FIG. 10



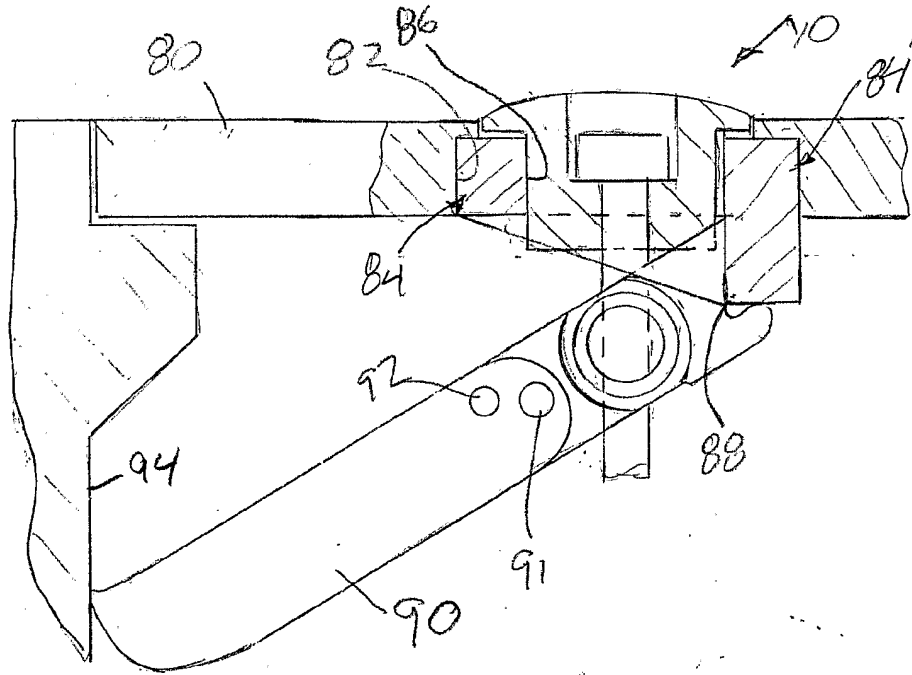


FIG 11

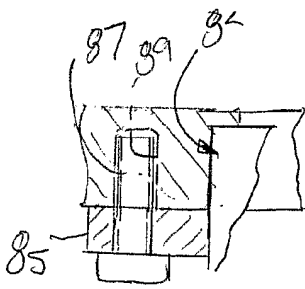


FIG 14

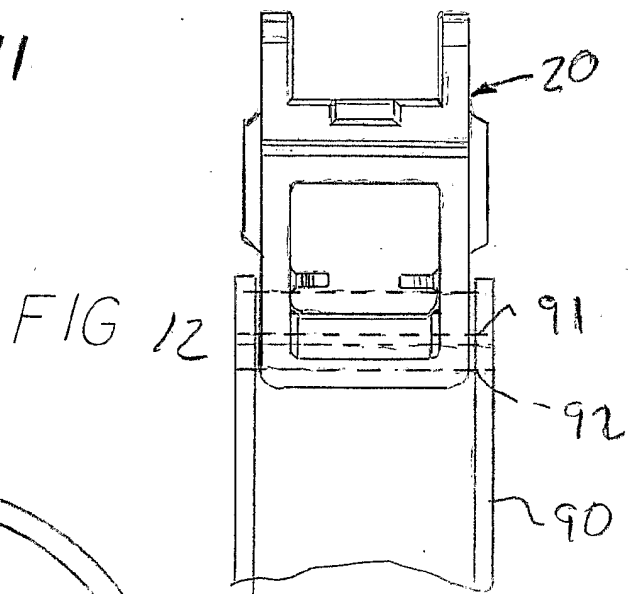


FIG 12

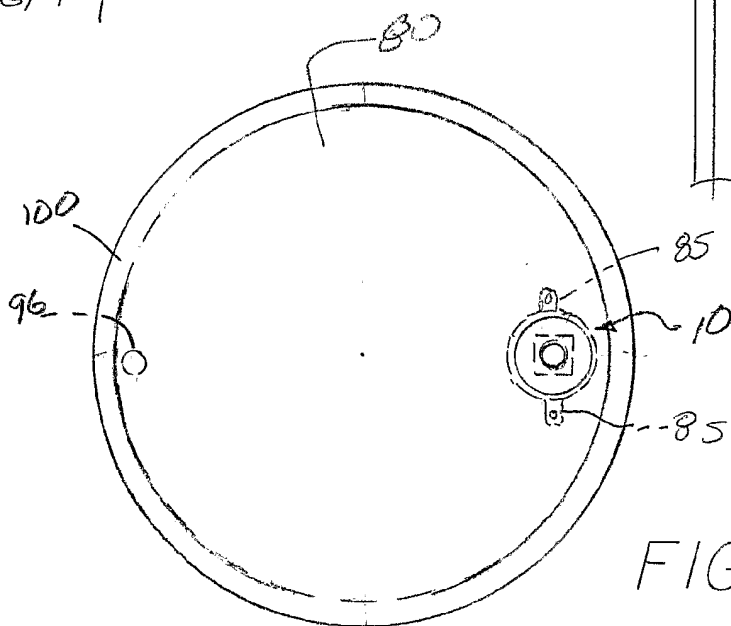


FIG 13