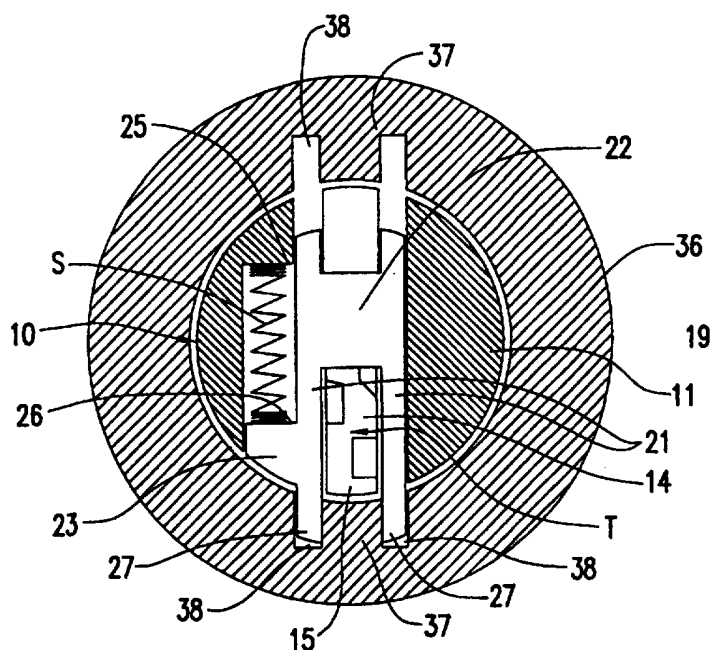




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(54) Title: A LOCK CYLINDER WITH PLATE OR WAFER TUMBLERS



(57) Abstract

A lock cylinder of a plate or wafer tumbler type. The cylinder (10) has a plurality of locking wafers (19) and a key slot (14). Th locking wafer (19) includes a pair of legs (21) which define therebetween an open ended key receiving slot in the wafer. This open-ended key receiving slot aligns with a key receiving channel (15), being an extension of the key slot (14), which extends into or through the wall of the body (11) of the cylinder. As a result a key of greater depth than normally required to operate the wafer lock can be accommodated in the aligned key slots and key receiving channel. This permits common keying between wafer and pin tumbler locks to be achieved.

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A LOCK CYLINDER WITH PLATE OR WAFER TUMBLERS

5

BACKGROUND OF THE INVENTION

This invention relates to improvements in locks.

It is generally the case that for security purposes the locks
10 used externally in buildings (eg domestic dwellings) are of a
pin tumbler type. However, inside a building it is often the
case that the high degree of security provided by a pin
tumbler cylinder is not required thus a wafer tumbler
cylinder (also known as a plate tumbler cylinder) is
15 employed. As a consequence, different types of keys are
required to operate the pin tumbler external locks and the
wafer cylinder internal locks.

It would be desirable to allow one key to operate all locks
20 in a building whether they be of a pin tumbler type or a
wafer type. This has not hitherto been achievable as a
consequence of the difficulty associated with achieving
enough lift of the wafers in a wafer cylinder to accommodate
a key designed for the comparatively long vertical movement
25 of the pins in a pin tumbler cylinder.

SUMMARY OF THE INVENTION

The object of the present invention is thus to provide a
5 cylinder for a lock of the wafer type able to be operable by
a key intended for operation of a pin tumbler cylinder lock.

Broadly in one aspect of the invention there is provided a
lock cylinder for a wafer lock, the cylinder being
10 characterised in that the locking wafers include an open
ended key receiving slot.

According to a second broad aspect the lock cylinder of the
first broad aspect includes a key receiving channel with
15 which the key receiving slots of the wafers are aligned, the
key receiving channel opening into the side wall of the
cylinder. Preferably that part of the locking wafers through
which the open ended key receiving slots extend project from
the side wall of the cylinder adjacent where the key
20 receiving channel opens into said side wall.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Figure 1 is a cross-sectional illustration of a pin
tumbler cylinder with an associated service key inserted
therein,

Figure 2 is an end elevation of a cylinder according to the present invention of a wafer cylinder lock,

Figure 3 is a side elevation view of the cylinder shown in Figure 2,

5 Figure 4 is a further side elevation view but from the opposite side of the cylinder to that shown in Figure 3,

Figure 5 is a section on line A-A of Figure 3,

Figure 6 is a section on line B-B of Figure 4,

10 Figure 7 is an elevation view of a wafer for installing in the cylinder of Figures 2-5,

Figure 8 is a section on line C-C of Figure 7,

Figure 9 is an elevation view of a further wafer for use in the cylinder of Figures 2-6,

Figure 10 is a section on line D-D of Figure 9,

15 Figure 11 is an elevation view of a retaining wafer for use in the cylinder of Figures 2-6,

Figure 12 is a section on line E-E of Figure 11, and

Figure 13 is a section through a wafer cylinder lock incorporating the lock cylinder according to the present invention,

20 Figures 14 to 16 are part views in cross section of the cylinder lock according to the invention modified by the incorporation of anti-pick grooves,

Figure 17 is a side elevation view of a modified form of the cylinder,

25

Figure 18 is a cross-sectional view on line F-F of Figure 17 but illustrating the cylinder within the bore of a lock body,

Figures 19 to 21 show in perspective view further examples of the wafers,

Figure 22 is an elevation view of a further form of the cylinder as shown in Figure 17, and

Figures 23 and 24 are exploded perspective views of one form of the lock cylinder and an encasement sleeve.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings there is shown a cylinder 10 for a wafer or plate tumbler type lock. The cylinder 10 is designed to fit within a cylinder housing (as shown in Figure 13) in a conventional manner. The cylinder 10 comprises a body 11 with a conventional peripherally extending end flange 12. This flange 12 forms a shoulder 13. A key slot 14 extends longitudinally through the flange 12 and body 11.

Extending transversely through the body 11 are a plurality of wafer slots for locking wafers, these wafer slots intersecting with the key slot 14. In a preferred form of the invention as shown in Figures 3 and 4 there are three such wafer slots 16. However, as shown in Figures 17 and 22 the cylinder can be configured (as described herein) to

accommodate more than three locking wafers, eg nine in the case of Figure 17 and seven in the case of Figure 22. Also provided is a wafer slot 17 for a retaining wafer which once again extends transverse to the key slot 14.

5

This basic construction shown in Figures 3 and 4 is in accordance with conventional construction of a wafer lock cylinder.

10 According to the present invention and unlike conventional wafer cylinders the key slot 14 has an extension 15 which opens into and preferably through the side of lock flange 12 and the side wall of body 11 as shown, for example, in Figures 2 and 3. The key receiving slot 14/15 is thus deeper
15 than is conventional with wafer cylinders. It can thereby accommodate the full depth of a key useable with a standard pin tumbler, eg a key K of the type shown in Figure 1.

Of course, the extent by which the key slot 14/15 extends
20 into the thickness of the wall of body 11 will depend on the overall diameter of body 11 relative to the depth of the pin tumbler lock key intended to be used with the wafer lock. Thus, for example, when the diameter of the cylinder body 11 is greater than the greatest depth of the key to be used
25 therein the slot 14/15 would not need to extend through the entire wall thickness of the body, ie would not open entirely

through the side wall of the body 11 as shown in the drawings.

Into each of wafer slots 16 there is slidably inserted a
5 locking wafer 18 or 19 (see Figures 7-10). In retaining
wafer slot 17 there is inserted a retaining wafer 20 as shown
in Figures 11 and 12.

Each of wafers 18 and 19 can be of generally "H" shape formed
10 by a pair of parallel legs 21 joined by a cross piece 22 (see
Figures 7 and 9). This cross piece 22 is located more toward
one of the pair of ends of legs 21 as shown in Figures 7 and
9. The legs 21 define or form a key receiving slot T. As
also shown in these Figures the cross piece 22 of wafer 19 is
15 of greater depth than that of wafer 18.

As can be seen from Figures 8 and 10 the legs 21 have edges
21a which are outwardly inclined so that in overall cross
section through the joining piece 22 (eg see Figure 10) the
20 wafer is of substantially "dumbbell" shape.

Projecting from the side edge of one of legs 21 is a
projection 23. This forms a land or shoulder 26.

25 Wafer slots 16 extending through body 11 are each of a cross
sectional shape commensurate with the cross sectional shape
of the locking wafers 18 and 19. Thus the width of the slot

16 is slightly greater than the width of cross piece 22 while the ends 16a of the slots are shaped with outwardly tapering sides so as to be of a substantially corresponding shape to the cross sectional shape of legs 21.

5

Extending from one end of each of slot 16 is an extension 24 which is of substantially circular cross section. The extension only extends part way through the thickness of the body 11 and thereby forms a step 25 (see Figure 5). A small
10 spring 5 (as shown in Figure 13) resides within bore 24 and locates between step 25 and shoulder 26 of projection 23 when the wafer 18 or 19 is located in wafer slot 16. This spring thus provides a biasing effect so that normally the ends 27 of legs 21 project from cylinder 10 beyond the peripheral
15 external surface of body 11, that is when the lock is in the locking position as shown in Figure 13.

The retaining wafer 20 (see Figures 11 and 12) is of generally U-shape with legs 28 extending from a cross piece
20 29. Extending transversely of the side edges of legs 28 are wings 30. As shown wings 30 are formed integrally with legs 27.

Slot 17 is formed such that it is stepped as at 31 (see
25 Figure 6). Once again a bore 34 is formed at one side of slot 17 for the reception of a spring which engages between step 31 and the shoulder 32 of one of wings 30. This ensures

that retaining wafer 20 projects proud of the part of the peripheral surface of body 11 from which wafers 18 and 19 also project as is conventional with a lock cylinder of this type.

5

The distance between legs 21 of wafers 18 and 19 and legs 21 of wafer 20 is substantially the same as the greatest width (ie dimension D) of slot 14. Thus a key K of the type shown in Figure 1 can be inserted into key slot 14/15 and the
10 aligned key receiving slots T of wafers 18, 19 and 20 with edge E being located substantially in line with the peripheral surface of body 11 either side of the open end of slot 15.

15 The contoured surface E', however, slides over and engages with the cross pieces 22 of wafers 18 and 19 so as to force the wafers against their spring biases such that the distal ends 27 of legs 21 are moved to lie substantially flush with the aforementioned peripheral surface of body 11 adjacent the
20 open end 15 of the key slot 14/15. Profiled edge E' of key K, however, does not so engage with wafer 20 so that the projecting ends 33 of wafer 20 still remain proud of the peripheral surface of body 11.

25 The retaining wafer 20 or more particularly ends 33 of legs 27 in accordance with normal wafer lock construction slidably engages in a slot in the housing in which the

cylinder is located whereby the cylinder can be rotated once wafers 18 and 19 have been retracted into the cylinder 10.

As opposed to the closed end wafers of conventional wafer
5 locks the substantially "H" shaped wafers 18 and 19 of the present invention provide an open end which align with the open side portion 15 of key slot 14/15. This provides for reception of a key of greater depth than normal wafer lock keys such that a conventional pin tumbler lock key can be
10 inserted. Thus, in situations where both standard pin tumbler key locks and wafer locks are fitted inside, say, a domestic dwelling the two types of locks can be arranged so that one key can operate all locks. This provides a substantial advantage as the house owner does not need to
15 have a plurality of keys to operate all of the locks in the dwelling.

To enable the "H" configuration wafers of the present invention to resist side loadings it is preferred that the
20 cylinder housing 36 in which the cylinder 10 is located will have an upstand 37 (see Figure 13) which extends the length of the tumbler engagement groove 38 on both sides. The upstand will thus be straddled by legs 21 in the vicinity of ends 27 where they extend from the open side 15 of key slot
25 14/15 of the cylinder 10 as shown in Figure 13. This straddling of the upstand 37 will occur when the key has been

withdrawn (as shown in Figure 13) and thus will reinforce the lock to provide it with suitable resistance to side load.

In addition, the dumbbell shape of the wafers will also
5 spread side load along the cylinder body 11 instead of
concentrating in just one position at the ends 27 of the legs
21.

The aforementioned side load is something which occurs when
10 someone tries to unlock the lock by inserting a flat bladed
screwdriver in the cylinder in an attempt to turn it to the
unlocked position. It is thus important that the wafers 18
and 19 resist such a side load to prevent unauthorised
operation of the lock. It is believed that the dumbbell
15 shape of the wafers together with the interaction of the ends
27 straddling the upstands will provide the required
resistance to a side load.

It is envisaged that the body of the cylinder 10 may be
20 shorter than a typical pin tumbler cylinder so that when the
pin tumbler key is inserted it will project from the inner
end (ie the end of body 11 opposite to that having flange
12). Accordingly, an installer may need to drill a hole in
the structure in which the lock is installed to accommodate
25 the tip of the key.

A further problem associated with wafer lock cylinders is "picking" by experts and amateurs. To counter this, points or serrations 39 formed by a series of transverse grooves can be incorporated in the sides of the wafers 18 and 19. In
5 Figure 14 the lock is shown in the locked position with key removed. The grooves or serrations 39 will tend to hang up on the inside of the cylinder body 11 as a "pick" lifts up the wafer and attempts to rake the wafers out of the engaged mode. This is shown in Figures 15 and 16. In Figure 15 the
10 wafer is shown as being lifted in direction "A" by a rake or pick tool. Any attempt to turn the cylinder in direction "B" by the tool will result in the wafer being held at "C" (see Figure 16) up by the anti-pick grooves 39.

15 Referring now to Figures 17 and 18 a modified form of the invention is shown. Those parts of the modified form which are common to the forms of the invention previously described bear the same reference numerals.

20 Unlike the form of the invention illustrated in Figures 3 and 4 separate wafer slots 16 are not provided. As shown in Figure 17 a single chamber 40 is formed in the body 11 with extensions 24 being located alternately at opposite sides of the chamber 40.

25

A pair of longitudinally extending ribs 41 are provided on each face of the locking wafer 18 and 19 (see Figures 19 and

20). The wafers at each end of the chamber 40 engage in a sliding manner with the respective end wall 42 of the chamber 40 while intermediate wafers slidingly engage against each other via the longitudinal ribs 41. These longitudinal ribs
5 41 thus keep the wafers apart and reduce friction. The ribs do not need to extend for the full length of the wafer. For example, pips or projections on one face only of the wafer could be sufficient.

10 The retaining wafer 20 for retaining slot 17 can be as shown in Figure 21.

As with the previously described form of the lock cylinder the wafers are open ended but with this arrangement the
15 wafers can be wider (ie thicker) and therefore stronger.

According to this form of the invention the replacement of individual slots for the wafers by a single chamber leads not only to simplified manufacturing processes but also enables
20 the wafers to be of a stronger construction.

Yet a further embodiment is shown in Figure 22. According to this embodiment the cavity or chamber 40 is formed by two cavities 43 and 44 which are joined by a bridge 45. This
25 provides a better support and guide for the key when being inserted into the lock cylinder.

The present invention also provides a means of simplifying the manner in which wafers of a wafer lock barrel or cylinder can be cut to suit individual keys.

5 According to the method a key is inserted into a complete lock cylinder, ie with the wafers in place. This results in the legs of the wafers standing proud of the cylinder as a result of the wafers lining up internally with the key cuts. The cylinder and the key is then inserted into a pencil
10 sharpener-type grinder and slowly rotated. This removes the legs of the wafers so that effectively the cylinder now suits the key that has been inserted into it. The main benefit of this procedure is the ease with which the cylinder assembly can be keyed to suit a cut key rather than individually
15 placing individual wafers in the cylinder.

In an alternative arrangement the projecting ends of the legs of the wafers could be removed by an end nipper (precision type).

20

An additional benefit is that only two sizes of wafers are required as opposed to having four or five different wafers which provides for more complicated production of a cylinder assembly. Thus, contrary to the traditional manner in which
25 wafers are selected to suit key cuts the method of the present invention allows the key to be inserted, the tops of

the wafers removed and just two individual configurations of wafer to accommodate any cut key.

The invention is open to modification within the scope of the following claims. For example, other biasing means can be used in place of the spring elements disclosed herein. In one form of the invention a strip spring having a plurality of fingers can form the biasing means. The strip spring locates in a recess or other locating means near the periphery of the cylinder with each of the fingers engaging with the end of a respective one of the wafers.

According to a further modification the diameter of the cylinder can be reduced and a sleeve (with appropriate cut-outs for the legs of the wafers and the key groove 15) can be fitted over the cylinder. Such an arrangement will provide additional support for the wafers.

Furthermore, as shown in Figures 23 and 24 the cylinder 10 could be made in two halves 10' and 10". When using the sleeve arrangement described in the preceding paragraph the sleeve 46 can be used to join the two parts 10' and 10" together. The sleeve 46 includes parallel slots 47 to accommodate the ends of the legs of the locking wafers 18 and 19 and a cut-out 48 to facilitate installation of the locking wafers. A further cut-out 49 is provided to align with the recessed area 50 found on the side of the lock cylinder 10.

This will lead to easier casting, assembly and keying up of the lock.

CLAIMS

1. A wafer lock cylinder for a lock, the cylinder being characterised in that the locking wafers (18, 19) include an open ended key receiving slot (T).
5
2. A lock cylinder as claimed in claim 1 wherein the cylinder (10) includes a receiving means (15) for receiving a part of a key when said key is inserted into the lock cylinder (10) and is located in aligned open ended key receiving slots (T) of the locking wafers (18, 19).
10
3. A lock cylinder as claimed in claim 2 wherein the receiving means is a slot or channel (15) formed in the wall of the cylinder body (11).
15
4. A lock cylinder as claimed in claim 2 wherein the receiving means is a slot (15) which extends through the wall of the cylinder body (11).
20
5. A lock cylinder as claimed in claim 1 further including a key receiving channel (15) with which the key receiving slots (T) of the locking wafers (18, 19) are aligned, the key receiving channel (15) opening into the side wall of the body (11) of the cylinder (10).
25

6. A lock cylinder as claimed in claim 5 wherein that part of the locking wafers (18, 19) through which the open ended key receiving slots (T) extend project from the side wall of the cylinder body (11) adjacent where the key receiving channel (15) opens into said side wall.

5

7. A lock cylinder as claimed in claim 5 or 6 wherein the key receiving channel (15) extends through the side wall.

10

8. A lock cylinder as claimed in any one of the preceding claims wherein each locking wafer (18, 19) is slidingly located in a wafer slot (16) and biased by biasing means (S).

15

9. A lock cylinder as claimed in any one of claims 1 to 7 wherein a plurality of locking wafers (18, 19) are located in a single cavity (40) in the body (11) of cylinder (10).

20

10. A lock cylinder as claimed in any one of claims 1 to 7 wherein a plurality of locking wafers (18, 19) are located in two or more cavities (43, 44) in the body (11) of cylinder (10).

25

11. A lock cylinder as claimed in claim 9 or 10 wherein the locking wafers (18, 19) include separating ribs (41) via

which each wafer is in sliding contact with another wafer or a wall surface (42) of the cavity (40) or cavities (43, 44).

- 5 12. A lock cylinder as claimed in claim 8 wherein each locking wafer (18, 19) is of a cross-sectional shape which is substantially of dumbbell shape and the wafer slot (16) is of commensurate shape.
- 10 13. A lock cylinder as claimed in claim 8 wherein the biasing means is a spring (S) which is located in a bore (34) formed at one end of the wafer slot (16) and engages with a shoulder of the locking wafer (18, 19).
- 15 14. A lock cylinder as claimed in claim 12 wherein the bores (34) of adjacent wafer slots (16) are located at opposite ends of the wafer slots (16).
- 20 15. A lock cylinder as claimed in claim 9 or 10 wherein each locking wafer (18, 19) is biased by biasing means (S).
- 25 16. A lock cylinder as claimed in claim 14 wherein the biasing means (S) of alternate locking wafers (18, 19) are located at an opposite side of the cavity to the biasing means (S) of intermediate locking wafers (18, 19).

17. A lock cylinder as claimed in any one of the preceding claims wherein the cylinder body (11) is formed in two parts joined together by a sleeve.
- 5 18. A lock cylinder in combination with a lock housing (36) wherein the lock cylinder (10) is as claimed in any one of the preceding claims 2 to 17.
- 10 19. The combination according to claim 18 wherein end portions (27) of the locking wafers (18, 19) engage separate receiving means (38) in an inner wall of the housing (36) when the lock cylinder (10) is of the housing (36) when the lock cylinder (10) is in a locking position.
- 15 20. The combination of claim 19 wherein the end portions (27) of each locking wafer (18, 19) are separated by a longitudinal upstand (37).
- 20 21. A method of keying a wafer lock cylinder of a lock comprising the step of inserting a key into a lock cylinder incorporating locking wafers which have not been selected specifically to suit the contours of the key, the insertion of the key thereby resulting in legs
25 of one or more of the locking wafer continuing to project from the cylinder followed by the step of removing the projecting portions of the legs.

22. The method of claim 21 wherein the removal of the projecting portions of the legs is carried out by placing the cylinder in a pencil sharpener-type grinder.

5

23. The method of claim 21 wherein the projecting portions of the legs are removed by a precision end nipper tool.

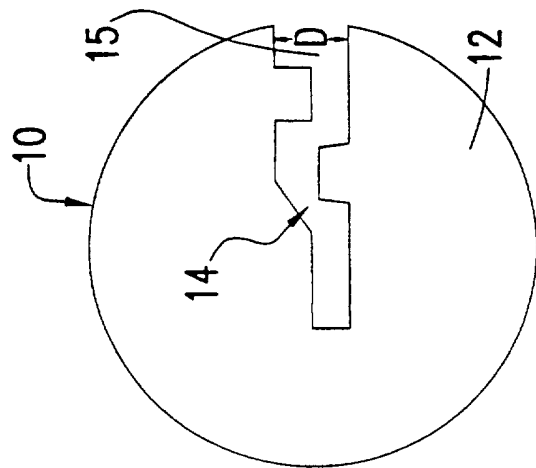


FIG. 2

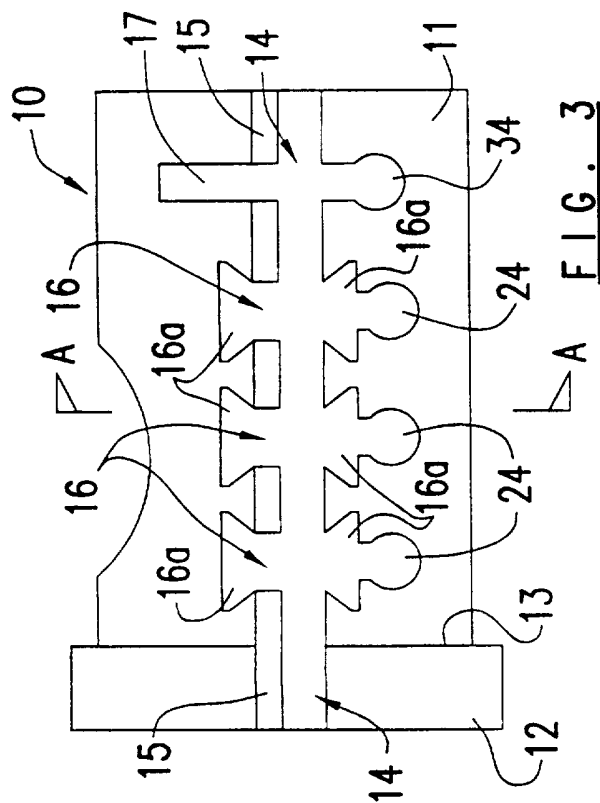


FIG. 3

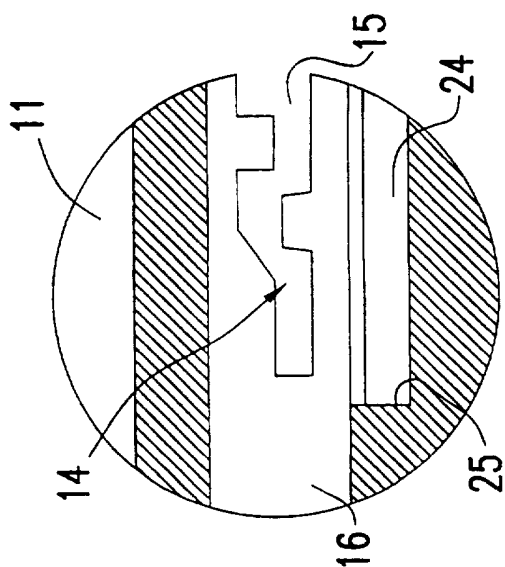


FIG. 5

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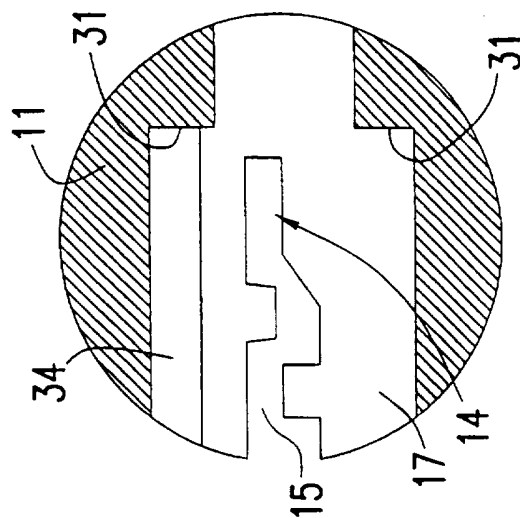


FIG. 6

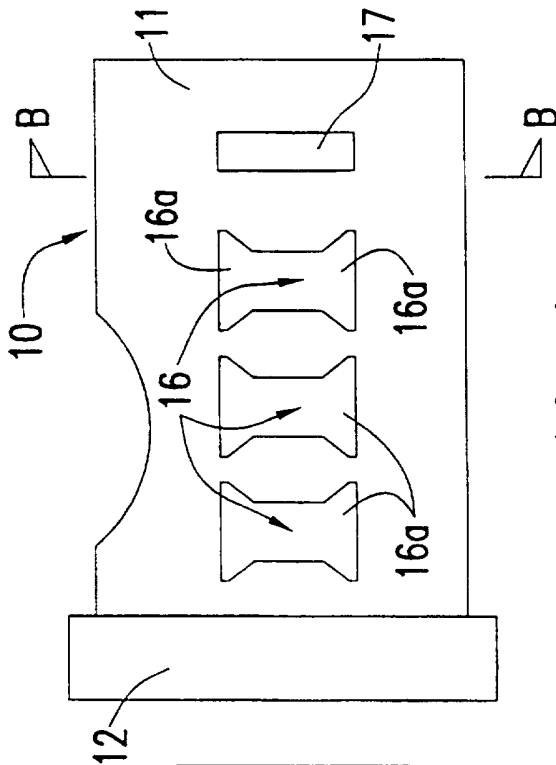


FIG. 4

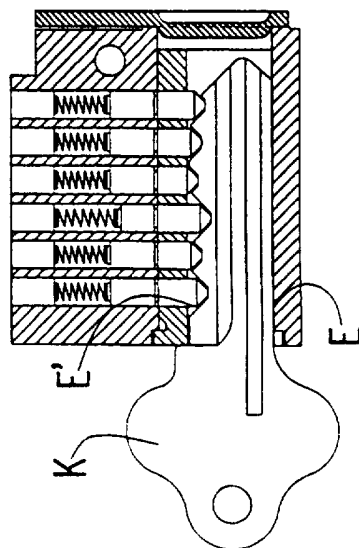
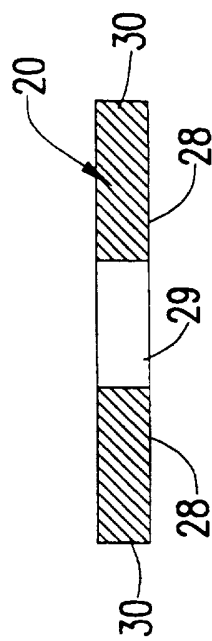
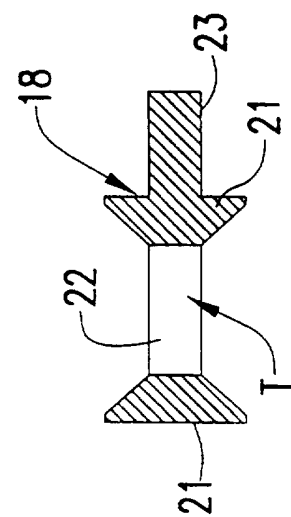
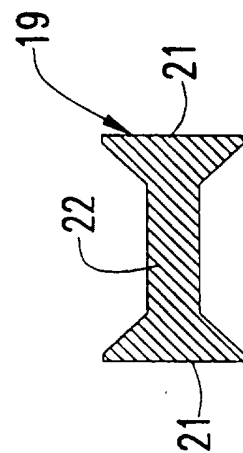
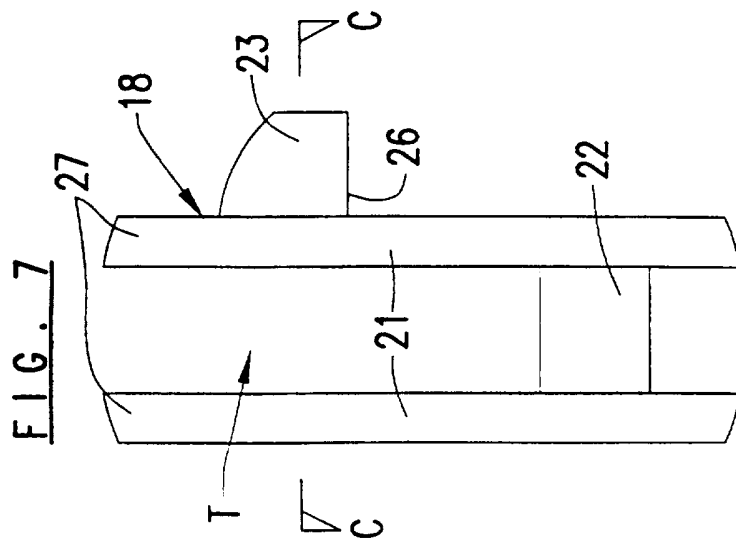
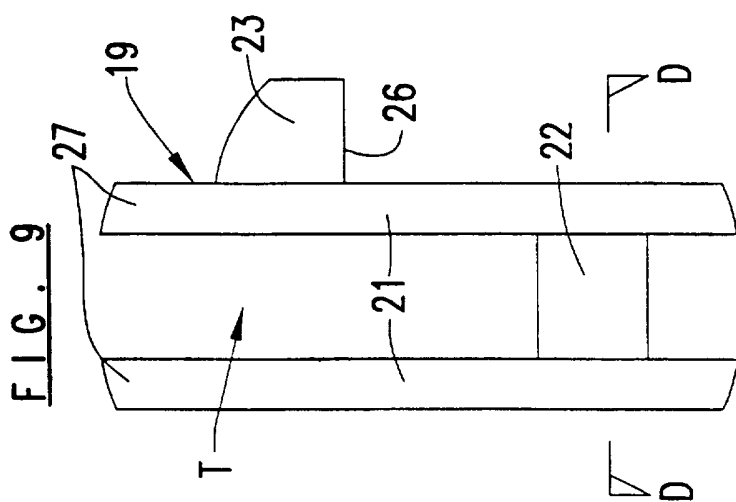
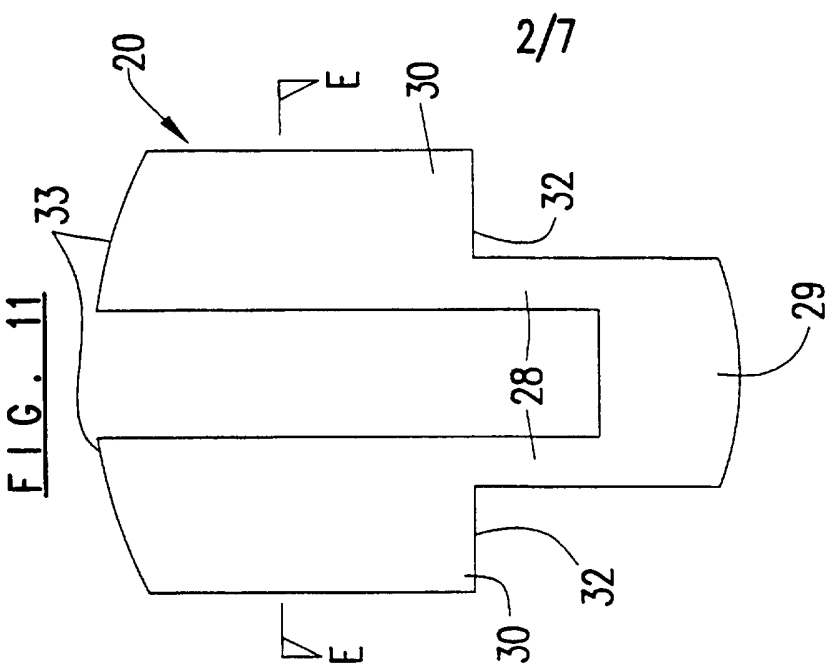
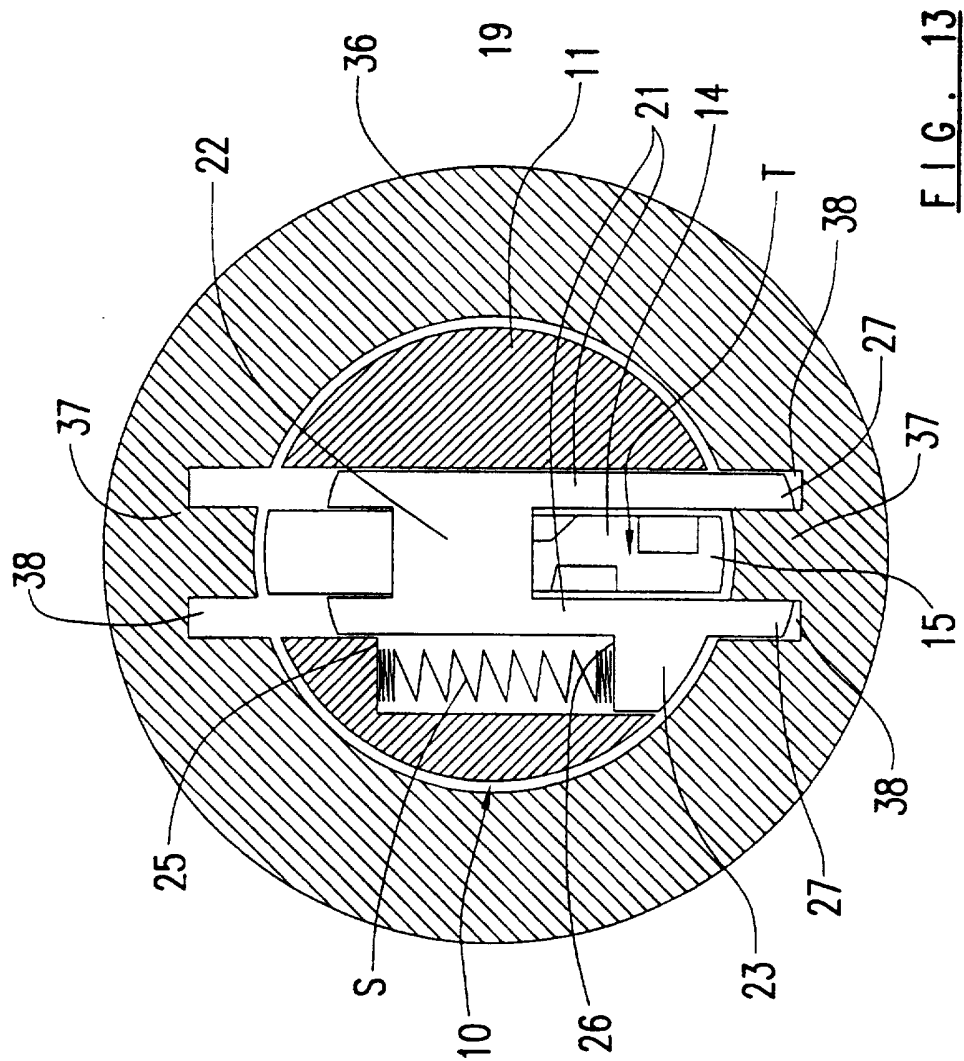


FIG. 1



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4/7

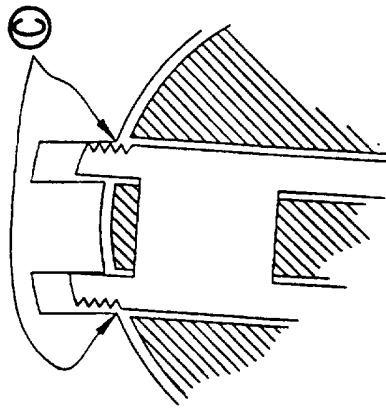


FIG. 16

FIG. 15

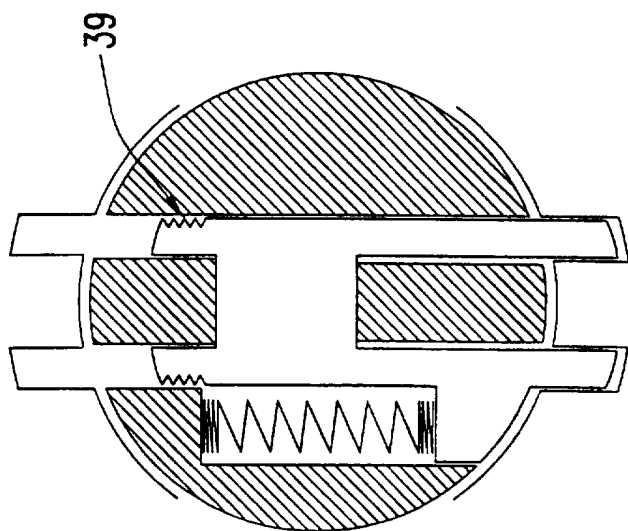
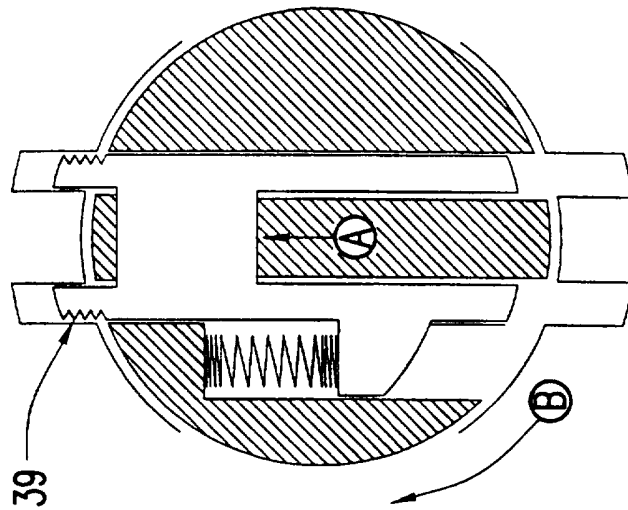
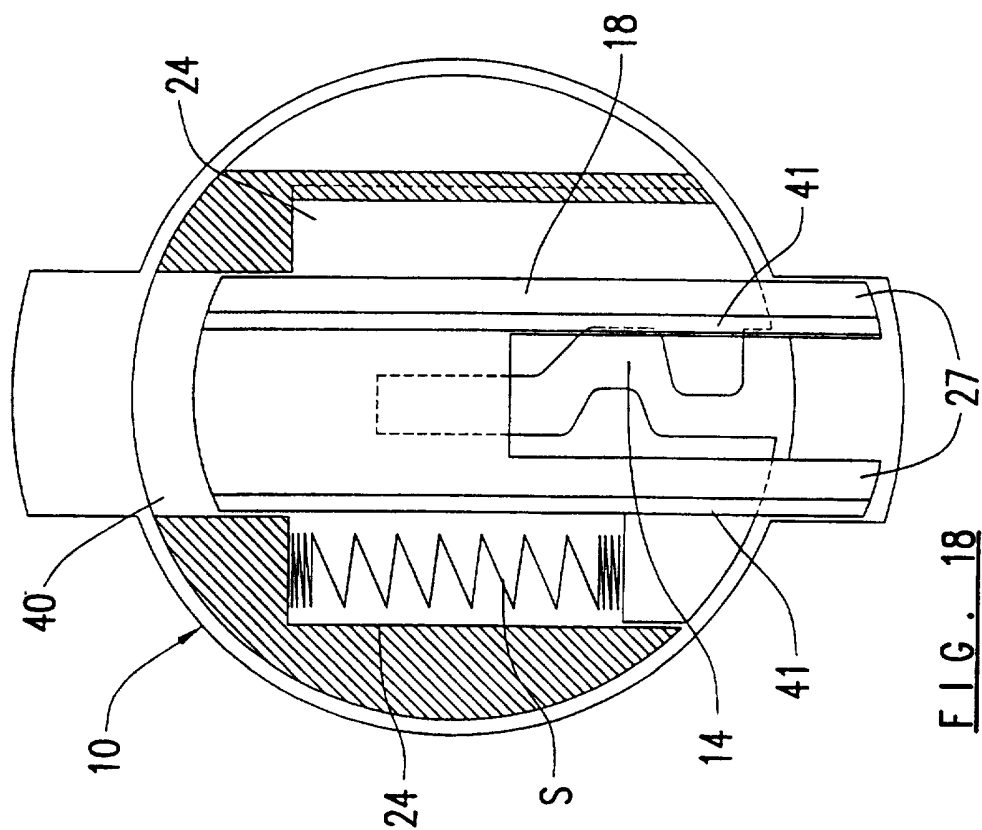
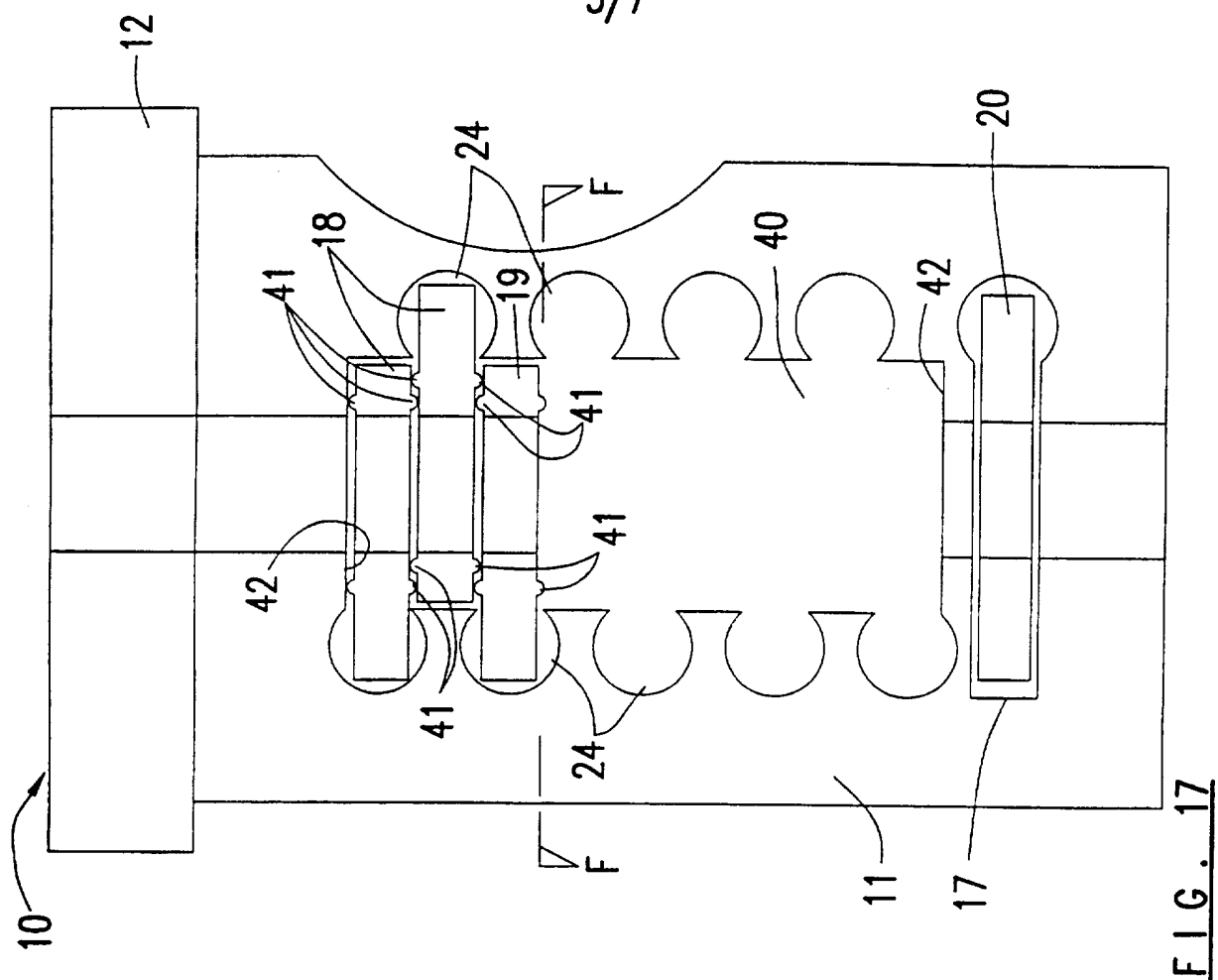


FIG. 14

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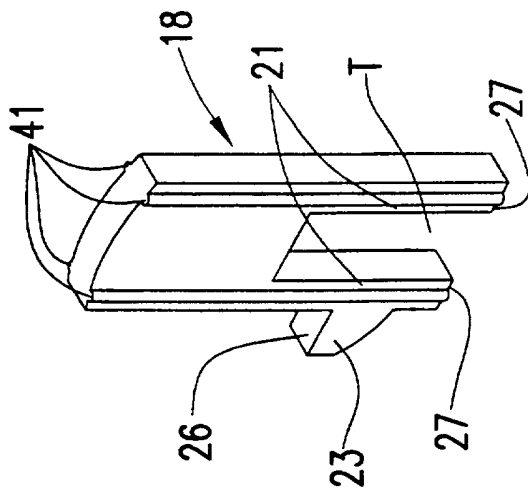


FIG. 19

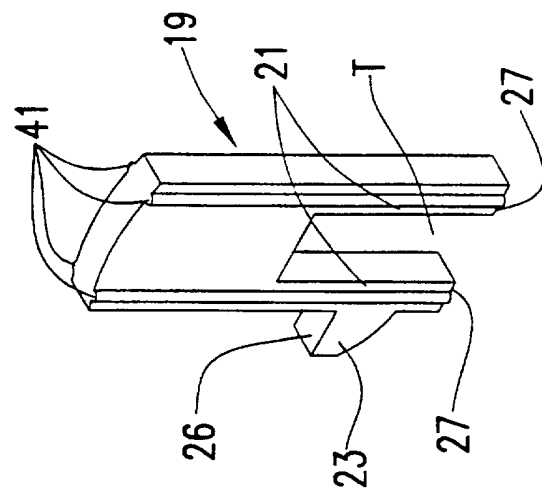


FIG. 20

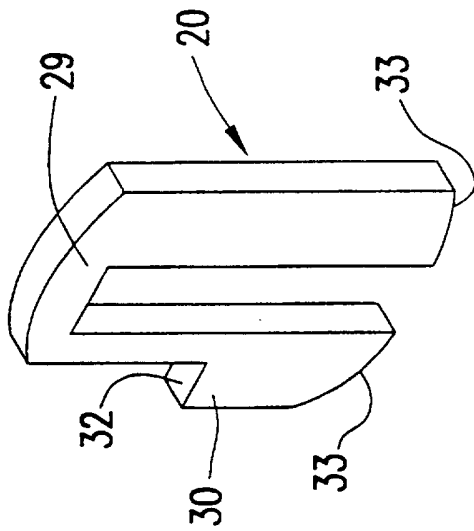


FIG. 21

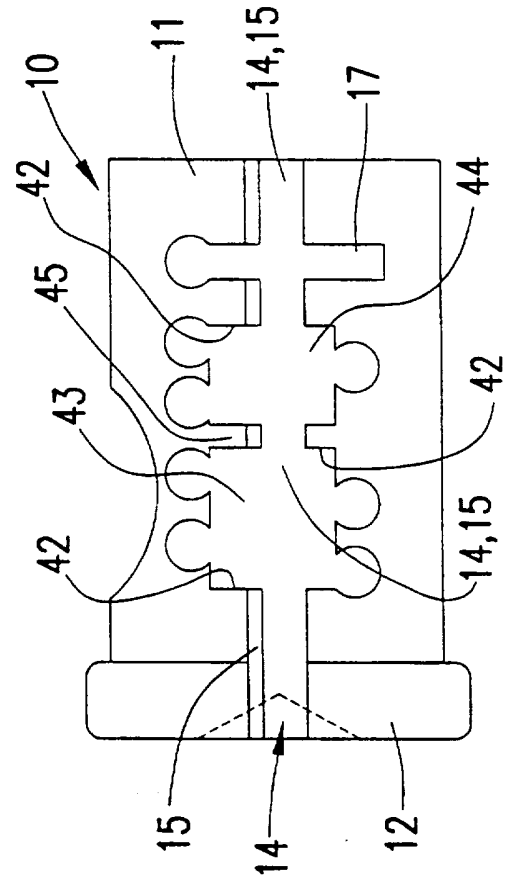


FIG. 22

