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(54) Position setting device.

(57) Position setting device (30) activated by key means comprising a housing (1), rotor means (2,3) rotatable within the housing and position setting means (20) which in a setting disposition sets the rotor means at a preselected rotational disposition relative to the housing and which in a release disposition allows rotation of the rotor means relative to the housing. On activation by the key means at least a part (3) of the rotor means becomes axially displaceable relative to the housing and axial displacement of the at least a part of the rotor means by a preselected amount (d) relative to the housing causes or enables the position setting means to be displaced from the setting disposition to the release disposition thereby allowing rotation of the rotor means relative to the housing.

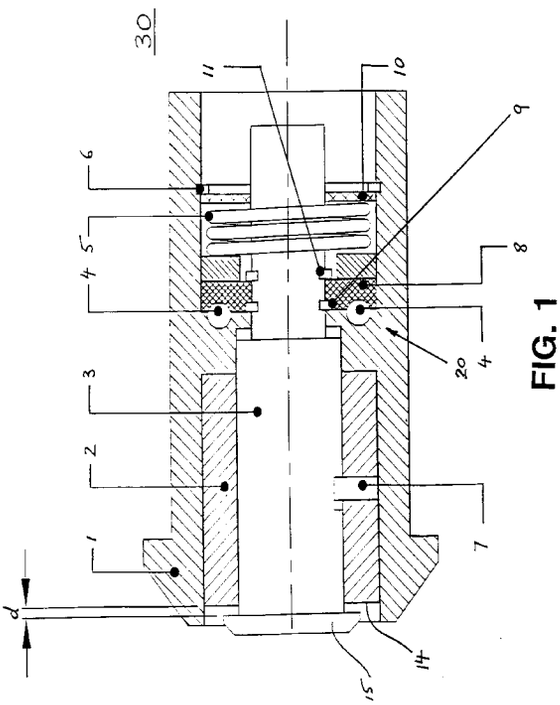

FIG. 1

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The present invention relates to a position setting device which is activated by key means and is particularly, although not exclusively, concerned with locking or security devices having key operated rotor means adapted to be rotated to and set at different angular positions with the key being removable at the different angular dispositions; for example key actuated switches, cam locking devices and the like.

According to the present invention there is provided a position setting device which is activated by key means and which comprises a housing, rotor means rotatable within the housing and position setting means which in a setting disposition sets the rotor means at a preselected rotational disposition relative to the housing and which in a release disposition allows rotation of the rotor means relative to the housing, wherein on activation by the key means at least a part of the rotor means becomes axially displaceable relative to the housing and axial displacement of the at least a part of the rotor means by a preselected amount relative to the housing causes or enables the position setting means to be displaced from the setting disposition to the release disposition thereby allowing rotation of the rotor means relative to the housing.

In an embodiment of the invention hereinafter to be described the at least a part of the rotor means is a core element, the rotor means further comprises a sleeve element within which the core element is rotatably coupled and the core element is axially displaceable relative to the sleeve element and housing on activation by the key means.

In an embodiment of the invention hereinafter to be described a first part of the position setting means is coupled to or forms part of the core element, an inner surface of the housing is provided with or presents a second part of the position setting means and the first and second parts of the position setting means are cooperable and register with one another at the setting disposition of the position setting means and become axially spaced apart at the release disposition of the position setting means.

In an embodiment of the invention hereinafter to be described the first and second parts of the position setting means present complementary surface profiles which are such that application of a turning moment to the rotor means causes the first part to ride up the complementary surface profile presented by the second part so as to axially displace the core element by the preselected relative amount to displace the position setting means from the setting disposition to the release disposition.

In an embodiment of the invention hereinafter to be described the first and second parts of the position setting means present a plurality of angularly spaced apart complementary surface profiles whereby the rotor means can be set at one of a plurality of preselected rotational dispositions relative to the housing.

In an embodiment of the invention hereinafter to be described one or other of the first and second parts of the position setting means comprises a plurality of angularly spaced apart balls and the other part of the position setting means presents at least a corresponding number of surface profiles which complement the outer surface profile of the balls.

In an embodiment of the invention hereinafter to be described the key means is a key which is insertable in the core element.

In an embodiment of the invention hereinafter to be described insertion of the key into the core element disengages a pin tumbler locking mechanism which locks the core element and sleeve element together to prevent relative axial displacement therebetween.

In an embodiment of the invention hereinafter to be described biasing means bias the core element of the rotor means to a first disposition relative to the sleeve element and housing in which first disposition the position setting means adopts the setting disposition.

In an embodiment of the invention hereinafter to be described displacement of the core element to the first disposition aligns the passages of the pin tumbler locking mechanism in the core element with the passages of the pin tumbler locking mechanism in the sleeve element.

In an embodiment of the invention hereinafter to be described setting of the rotor means in one of the plurality of preselected rotational dispositions relative to the housing allows removal of the key from the rotor means.

In an embodiment of the invention hereinafter to be described the axial displacement of the core element which causes or enables the position setting means to be displaced from the setting disposition to the release disposition is in a direction into the housing. In an alternative embodiment of the invention hereinafter to be described the axial displacement of the core element which causes or enables the position setting means to be displaced from the setting disposition to the release disposition is in a direction out of the housing.

In an embodiment of the invention hereinafter to be described the housing forms or is provided with a bezel which prevents axial displacement of the sleeve element in a direction out of the housing.

According to a second aspect of the invention there is provided a rotor which is activated by key means and adapted in use to rotate in a housing, the rotor having a first part axially displaceable relative to a second part, locking means which in a locking disposition prevents axial displacement of the first part relative to the second part and which in an unlocking disposition allows axial displacement of the first part relative to the second part and position setting means which in a setting disposition sets the rotor at a preselected rotational disposition in the housing and

which in a release disposition allows rotation of the rotor in the housing, wherein on activation by the key means the locking means moves from the locking disposition to the unlocking disposition thereby enabling axial displacement of the first part relative to the second part whereby axial displacement of the first part relative to the second part by a preselected amount causes or enables the position setting means to be displaced from the setting disposition to the release disposition thereby enabling rotation of the rotor in the housing.

In an embodiment of the invention according to the second aspect the first part of the rotor is a core element and the second part is a sleeve element within which the core element is rotatably coupled.

In an embodiment of the invention according to the second aspect the position setting means is coupled to or forms a part of the core element and cooperates and registers with an inner surface of the housing when in the setting disposition to set the rotor at the preselected rotational disposition.

In an embodiment of the invention according to the second aspect the position setting means presents a surface profile complementary to that of the inner surface of the housing whereby application of a turning moment to the rotor causes the position setting means to ride up the surface profile presented by the inner surface so as to axially displace the core element by the preselected amount relative to the sleeve element to displace the position setting means from the setting disposition to the release disposition.

In an embodiment of the invention according to the second aspect the position setting means presents a plurality of angularly spaced apart complementary surface profiles whereby the rotor can be set at any one of a plurality of preselected rotational dispositions relative to the housing.

In an embodiment of the invention according to the second aspect the key means is a key which is insertable in the core element.

In an embodiment of the invention according to the second aspect the locking means takes the form of a pin tumbler locking mechanism movable from the locking disposition to the unlocking disposition on insertion of the key into the core element.

In an embodiment of the invention according to the second aspect biasing means are provided which bias the core element to a first disposition relative to the sleeve element in which first position the position setting means adopts the setting disposition.

In an embodiment of the invention according to the second aspect displacement of the core element to the first disposition aligns the passages of the pin tumbler locking mechanism in the core element with the passages of the pin tumbler locking mechanism in the sleeve element.

In an embodiment of the invention according to the second aspect setting of the rotor at one of the preselected rotational dispositions allows removal of the key from the core element.

According to a third aspect of the invention there is provided a housing adapted to receive a rotor according to the second aspect of the invention having a position setting means which cooperates and registers with an inner surface of the housing when in the setting disposition to set the rotor at the preselected rotational disposition.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a side sectional view of a position setting device in accordance with the invention with the position setting means in the setting disposition,

Figure 2 shows the position setting device of Figure 1 with the position setting means in the release disposition,

Figures 3A to 3D are transverse sectional views of indexing patterns for the moving part of the position setting means of Figures 1 and 2,

Figure 4A is a transverse sectional view of a moving part for the position setting means of Figures 1 and 2 having an alternative surface profile,

Figure 4B is a partial side sectional view of the moving part of Figure 4A in juxtaposition with a complementary fixed part of the position setting means,

Figure 5A is a transverse sectional view of a further moving part for the position setting means of Figures 1 and 2 having an alternative surface profile,

Figure 5B is a partial side sectional view of the moving part of Figure 5A in juxtaposition with a complementary fixed part of the position setting means,

Figure 6 is a side sectional view of a modified position setting device in accordance with the invention with the position setting means in the setting disposition,

Figure 7 is a side sectional view of an alternative position setting device in accordance with the invention with the position setting means in the setting disposition, and

Figure 8 is a transverse sectional view of the alternative position setting device of Figure 7.

In Figure 1 there is shown a position setting device 30 in accordance with the invention comprising a housing 1 having a stepped cylindrical bore within which is rotatably mounted rotor means comprising a core 3 within a sleeve 2. The core 3 and sleeve 2 are locked together such that no relative movement between the two can take place unless the core 3 and sleeve 2 are unlocked by key means.

In this embodiment, the key means take the form of a key (not shown) which is insertable in the core 3 and the locking and unlocking of the core 3 and sleeve

2 can be achieved using well established principles; for example a pin tumbler locking mechanism used with saw tooth keys or keys containing borings and formed shapes and keys which align sliding plates. These will hereinafter be referred to as the locking means.

The position setting device 30 further comprises position setting means 20 comprising a fixed part in the form of a plurality of balls 4 received in an inner surface of the housing 1 and a moving part in the form of a clutch plate 8 carried by the inner end of the core 3 and provided with surface profiles to complement the outer surface profile of the balls 4.

In Figure 1, the position setting means 20 is shown in a setting disposition. That is to say, the clutch plate 8 bears against the balls 4 so that rotation of the rotor means 2, 3 in the housing 1 is prevented. The rotor means 2, 3 is further prevented from moving longitudinally relative to the housing 1 by the inner surface profiling of the housing 1 and a first circlip 9.

When a key with the correct code is inserted in the core 3 the locking means are moved to a position in which they allow longitudinal inward displacement of the core 3 relative to the sleeve 2 and housing 1, the sleeve 2 still being prevented from being longitudinally displaced. Rotation of the core 3 relative to the sleeve 2, though, is prevented by a pin 7. The pin 7 does not prevent the longitudinal inward displacement of the core 3, however, since a slot is provided to allow such displacement.

If an incorrectly coded key is inserted in the core 3 and a turning moment or longitudinal force is applied to the rotor means 2, 3, no longitudinal inward movement of the core 3 occurs due to the inner surface profiling of the housing 1 and the locking means.

Longitudinal inward displacement of the core 3 relative to the sleeve 2 and the housing 1 after insertion of the correctly coded key results in the clutch plate 8 being displaced longitudinally inwardly by the first circlip 9 and the clutch plate 8 compressing a spring 5 concentrically arranged about the inner end of the core 3 against a spring retainer 10 which is prevented from movement in the housing 1 by a second circlip 6. The longitudinal inward displacement of the core 3 is restricted to the distance d highlighted in the top left hand corner of Figure 1, the restriction being limited by the distance between the head 15 of the core 3 and the outer face 14 of the sleeve 2.

As is more clearly apparent by reference to Figure 2, longitudinal inward displacement of the core 3 by the restricted distance d disengages the clutch plate 8 from the balls 4. This will herein be referred to as the release disposition of the position setting means 20.

The clutch plate 8 is secured to the core 3 so that no relative rotational movement takes place between the two. Accordingly, when the position setting means 20 is brought to the release disposition application of a turning moment to the rotor means 2, 3 through turning of the correct key results in the rotor means 2, 3 and the clutch plate 8 revolving inside the housing 1.

As can be seen from Figures 3A to 3D, the clutch plate 8 is provided with a plurality of angularly spaced apart recesses 25 to complement the outer surface profile of the balls 4. It will therefore be appreciated that when the position setting means 20 is in its release disposition the rotor means 2, 3 can be set at one of a variety of preselected rotational dispositions by firstly rotating the rotor means 2, 3 relative to the housing 1 to a different preselected rotational disposition and then releasing the applied longitudinal force so that the spring 5 biases the position setting means 20 back into a setting disposition with each ball 4 registering with a different recess 25 on the clutch plate 8. The key can then be withdrawn at this new angular disposition causing the locking means to lock the sleeve 2 and core 3 together again.

It will be understood that the number of recesses 25 in the clutch plate 8 may correspond to the number of balls 4 or be greater than the number of balls 4 for operation of the invention.

Such an arrangement as described above provides the position setting device 30 with an indexing feature because a user of the device is aware because of the change in the force of the spring 5 and the action of the clutch plate 8 engaging with the balls 4 that the indexing movement is completed. By changing the pattern of the recesses 25 presented by the clutch plate 8 the key withdrawal positions can be selected as required through a complete revolution, as illustrated in Figures 3A to 3D. In order to restrict the angular movement over which indexing can take place, the clutch plate 8 can be designed to engage with the housing 1.

A particular feature of the present invention is the provision of means which can translate a turning moment applied to the rotor means when the position setting means is in its setting disposition into the longitudinal displacement which brings the position setting means to its release disposition. For example, in the position setting device 30 of Figures 1, 2 and 3A to 3D application of a turning moment to the rotor means 2, 3 results in the recesses 25 of the clutch plate 8 riding up the outer surface of the balls 4 and the core 3 being longitudinally inwardly displaced relative to the sleeve 2 and housing 1. Continued application of the turning moment brings the recesses 25 in the clutch plate 8 out of contact with the balls 4 and thus the position setting means 20 to its release disposition. One can therefore see that it is not always essential for an initial longitudinal force to be applied to bring the position setting means to the release disposition to allow rotation of the rotor means relative to the housing, although it will be appreciated that this eventuality falls within the scope of the invention.

While balls 4 are used in the embodiment of the invention described with reference to Figures 1, 2 and 3A to 3D, other complementary geometric shapes such as those illustrated in Figures 4A and 4B and Figures 5A and 5B can be equally applied where the criteria is to translate a turning moment on the rotor means into the longitudinal inward displacement required to bring the position setting means to its release disposition. In Figures 4A, 4B and 5A, 5B the clutch plates 8 present a plurality of angularly spaced apart truncated projections 43 having divergent side walls with an inner surface 45 of the housing presenting complementary recesses 47 for the projections 43.

Provided the fixed and moving parts of the position setting means present complementary surface profiles which enable the moving part to be longitudinally displaced relative to the fixed part on application of a turning moment then the position setting means will be brought to its release disposition.

In Figure 6 there is shown a modified position setting device 50 in accordance with the invention. The modified position setting device 50 is similar to that hereinabove described with reference to Figures 1 to 3 and accordingly like numerals indicate corresponding parts.

The modified position setting device 50 differs from that described with reference to Figures 1 to 3 in that a bezel 70 is included as shown to restrict longitudinal displacement of the sleeve 2' thus ensuring that the sleeve 2' does not move towards the head 15' of the core 3' and prevent withdrawal of the key.

In Figures 7 and 8 there is shown an alternative position setting device 100 in accordance with the invention with those parts thereof common with the position setting device 30 hereinabove described with reference to Figures 1 to 3 assigned like numerals.

As can be seen, the position setting means 20" of the alternative position setting device 100 is shown in the setting disposition and no relative movement between the core 3" and sleeve 2" can take place unless a correctly coded key is inserted in the core 3" to disengage a pin tumbler locking mechanism which locks the core 3" and sleeve 2" together.

As will be known by the skilled reader, the normal method of manufacturing a pin tumbler locking mechanism would be to have the borings for the pin tumblers in alignment when the head 15" of the core 3" and the outer face 14" of the sleeve 2" are in contact. The alternative position setting device 100 has been designed so that the parts can be made using this standard method of manufacture.

Until a correctly coded key is inserted in the core 3" it remains locked to the sleeve 2" by the pin tumblers which bridge the shear line 35 between the core 3" and the sleeve 2" and longitudinal movement of the rotor means 2", 3" is prevented by the inner surface profiling of the bore in the housing 1" and a clamping bezel 75. When a correctly coded key is inserted into the core 3", the pin tumblers of the locking mechanism are brought to the neutral position by becoming aligned on the shear line 35. The core 3" is then free to move axially in the sleeve 2" although rotation of the core 3" within the sleeve 2" is prevented by a locking pin 16, as can be seen by reference to Figure 8.

In the setting disposition of the position setting means 20" the action of the spring 5", which is of the compression type, holds the clutch plate 8" against the balls 4" which are located in the inner surface of the housing 1". The core 3" is pinned to the clutch plate 8" by a shear pin 19 and thus rotation of the rotor means 2", 3" in the bore of the housing 1" is prevented.

The spring 5" exerts a force between the sleeve 2" and the clutch plate 8" with the clutch plate 8" transmitting the force to the core 3" via the pin 19. The spring 5" therefore further serves to pull the head 15" of the core 3" into the housing 1" and thus into contact with the outer face 14" of the sleeve 2", the normal position for pin tumbler alignment.

Application of a rotational force to the rotor means 2", 3" with the correctly coded key inserted in the core 3" results in the balls 4" acting on the clutch plate 8" to move the clutch plate 8" longitudinally outwardly. This causes a pressure to be exerted on the spring 5" and the core 3" moving axially relative to the sleeve 2" under the force transmitted by the shear pin 19. A displacement of 0.4mm is suitable for bringing the position setting means 20" to the release disposition. When this longitudinal displacement has taken place the rotor means 2", 3" can then be rotated within the housing 1".

To achieve a good balance to the design it is advantageous for four balls 4" to be used, although it will be appreciated by the skilled reader that it would function acceptably with a different number of balls 4", for example with two balls 4". As before, a range of clutch plates 8" could be utilised to give a variety of different angular rotational positions at which the key can be withdrawn.

The shear pin 19 is designed such that in the event of the rotor means 2", 3" being subject to a torsional force without the correct key inserted the shear pin 19 shears off before the clutch plate 8" can be rotated.

For assembly of the alternative device 100 into a panel the bezel 75 has first to be removed. To prevent movement of the balls 4" a retention rig 18 is fitted so that in the event of the bezel 75 being removed the rotor means 2", 3" is retained within the housing 1".

Claims

1. A position setting device (30;50;100) which is activated by key means and which comprises a housing (1;1';1"), rotor means (2,3;2',3';2",3") rotatable within the housing and position setting means (20;20';20") which in a setting disposition sets the rotor means at a preselected rotational disposition relative to the housing and which in a release disposition allows rotation of the rotor means relative to the housing, wherein on activation by the key means at least a part of the rotor means becomes axially displaceable relative to the housing and axial displacement of the at least a part of the rotor means by a preselected amount (d;d') relative to the housing causes or enables the position setting means to be displaced from the setting disposition to the release disposition thereby allowing rotation of the rotor means relative to the housing.

2. A device according to claim 1, wherein the at least a part of the rotor means is a core element (3;3';3"), the rotor means further comprises a sleeve element (2;2';2") within which the core element is rotatably coupled and the core element is axially displaceable relative to the sleeve element and housing on activation by the key means.

3. A device according to claim 2, wherein a first part (8;8';8") of the position setting means is coupled to or forms part of the core element, an inner surface (45) of the housing is provided with or presents a second part (4;4';4";47) of the position setting means and the first and second parts of the position setting means are cooperable and register with one another at the setting disposition of the position setting means and become axially spaced apart at the release disposition of the position setting means.

4. A device according to claim 3, wherein the first and second parts of the position setting means present complementary surface profiles (4,25;47,43) which are such that application of a turning moment to the rotor means causes the first part to ride up the complementary surface profile presented by the second part so as to axially displace the core element by the preselected relative amount to displace the position setting means from the setting disposition to the release disposition.

5. A device according to claim 3 or 4, wherein the first and second parts of the position setting means present a plurality of angularly spaced apart complementary surface profiles whereby the rotor means can be set at one of a plurality of preselected rotational dispositions relative to the housing.

6. A device according to claim 5, wherein one or other of the first and second parts of the position setting means comprises a plurality of angularly spaced apart balls (4) and the other part of the position setting means presents at least a corresponding number of surface profiles (25) which complement the outer surface profile of the balls.

7. A device according to any of claims 2 to 6, wherein the key means is a key which is insertable in the core element.

8. A device according to claim 7, wherein insertion of the key into the core element disengages a pin tumbler locking mechanism which locks the core element and sleeve element together to prevent relative axial displacement therebetween.

9. A device according to any of claims 2 to 8, wherein biasing means (5;5';5") bias the core element of the rotor means to a first disposition relative to the sleeve element and housing in which first disposition the position setting means adopts the setting disposition.

10. A device according to claim 9 when appendant to claim 8, wherein displacement of the core element to the first disposition aligns the passages of the pin tumbler locking mechanism in the core element with the passages of the pin tumbler locking mechanism in the sleeve element.

11. A device according to claim 7 when appendant to claim 5 or 6, wherein setting of the rotor means in one of the plurality of preselected rotational dispositions relative to the housing allows removal of the key from the rotor means.

12. A device according to any of claims 2 to 11, wherein the axial displacement of the core element which causes or enables the position setting means to be displaced from the setting disposition to the release disposition is in a direction into the housing.

13. A device according to any of claims 2 to 11, wherein the axial displacement of the core element which causes or enables the position setting means to be displaced from the setting disposition to the release disposition is in a direction out of the housing.

14. A device according to any of claims 2 to 13, wherein the housing forms or is provided with a

bezel (70;75) which prevents axial displacement of the sleeve element in a direction out of the housing.

15. A rotor which is activated by key means and adapted in use to rotate in a housing (1;1';1"), the rotor having a first part (3;3';3") axially displaceable relative to a second part (2;2';2"), locking means which in a locking disposition prevents axial displacement of the first part relative to the second part and which in an unlocking disposition allows axial displacement of the first part relative to the second part and position setting means (8;8';8") which in a setting disposition sets the rotor at a preselected rotational disposition in the housing and which in a release disposition allows rotation of the rotor in the housing, wherein on activation by the key means the locking means moves from the locking disposition to the unlocking disposition thereby enabling axial displacement of the first part relative to the second part whereby axial displacement of the first part relative to the second part by a preselected amount (d;d') causes or enables the position setting means to be displaced from the setting disposition to the release disposition thereby enabling rotation of the rotor in the housing.

16. A rotor according to claim 15, wherein the first part of the rotor is a core element and the second part is a sleeve element within which the core element is rotatably coupled.

17. A rotor according to claim 16, wherein the position setting means is coupled to or forms a part of the core element.

18. A rotor according to any of claims 15 to 17, wherein the position setting means cooperates and registers with an inner surface (45) of the housing when in the setting disposition to set the rotor at the preselected rotational disposition.

19. A rotor according to claim 18, wherein the position setting means presents a surface profile (25;43) complementary to that (47) of the inner surface of the housing whereby application of a turning moment to the rotor causes the position setting means to ride up the surface profile presented by the inner surface so as to axially displace the core element by the preselected amount relative to the sleeve element to displace the position setting means from the setting disposition to the release disposition.

20. A rotor according to claim 18 or 19, wherein the position setting means presents a plurality of angularly spaced apart complementary surface profiles whereby the rotor can be set at any one of a plurality of preselected rotational dispositions relative to the housing.

21. A rotor according to any of claims 16 to 20, wherein the key means is a key which is insertable in the core element.

22. A rotor according to claim 21, wherein the locking means takes the form of a pin tumbler locking mechanism which moves from the locking disposition to the unlocking disposition on insertion of the key into the core element.

23. A rotor according to any of claims 16 to 22, wherein biasing means (5;5';5") are provided which bias the core element to a first disposition relative to the sleeve element in which first position the position setting means adopts the setting disposition.

24. A rotor according to claim 23 when appendant to claim 22, wherein displacement of the core element to the first disposition aligns the passages of the pin tumbler locking mechanism in the core element with the passages of the pin tumbler locking mechanism in the sleeve element.

25. A rotor according to claim 21 when appendant to claim 20, wherein setting of the rotor at one of the preselected rotational dispositions allows removal of the key from the core element.

26. A housing (1;1';1") adapted to receive a rotor according to any of claims 18 to 24.

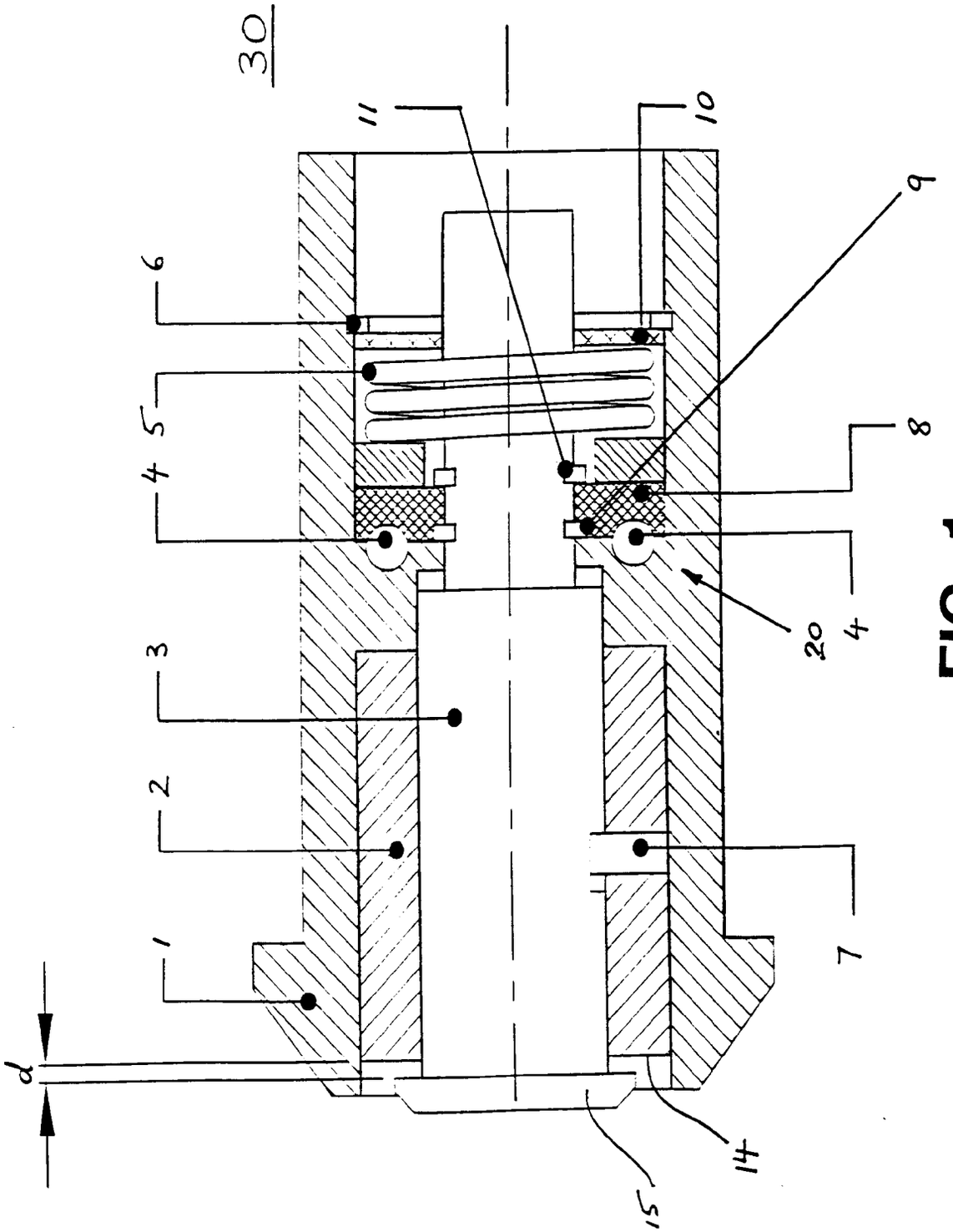

FIG. 1

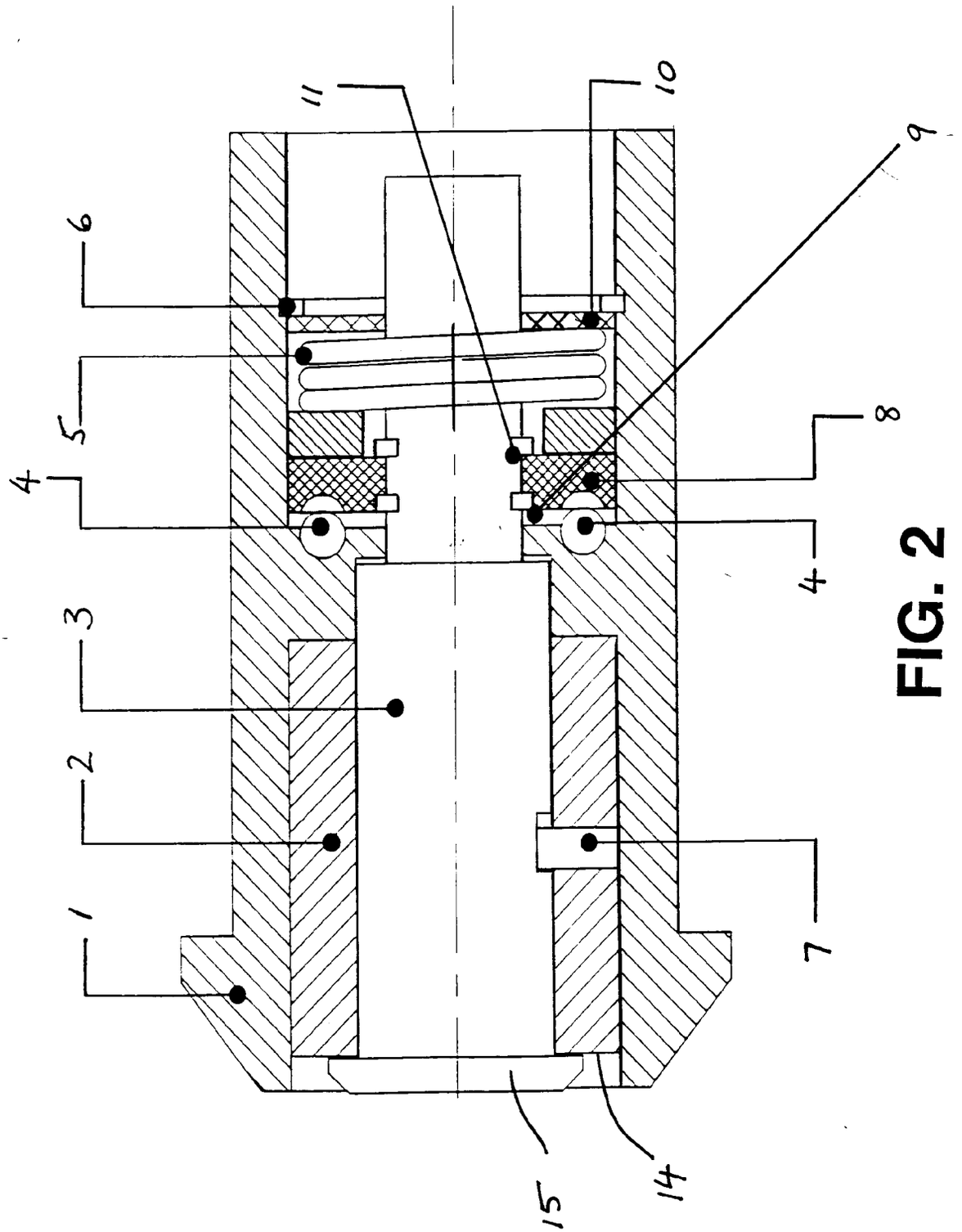

FIG. 2

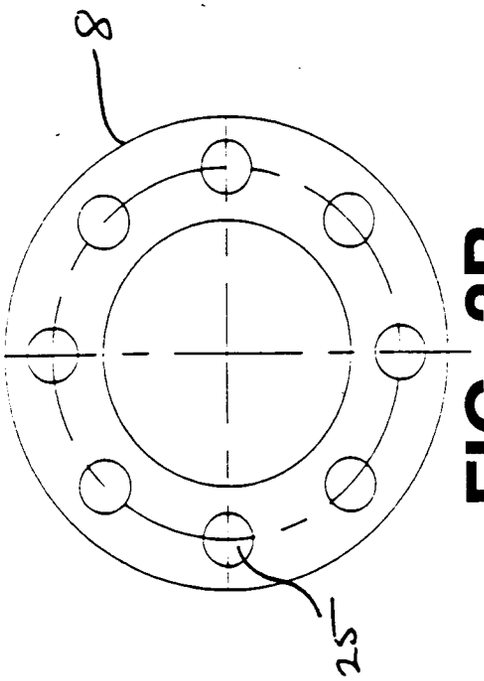

FIG. 3B

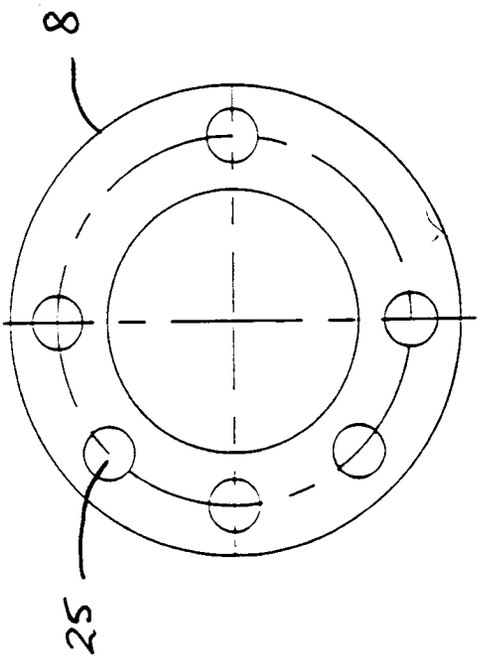

FIG. 3D

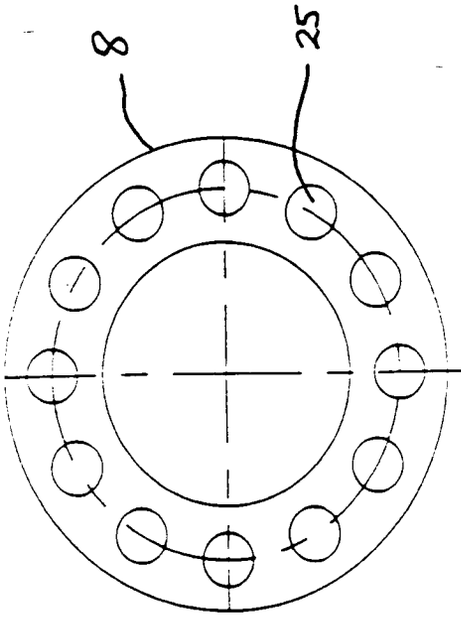

FIG. 3A

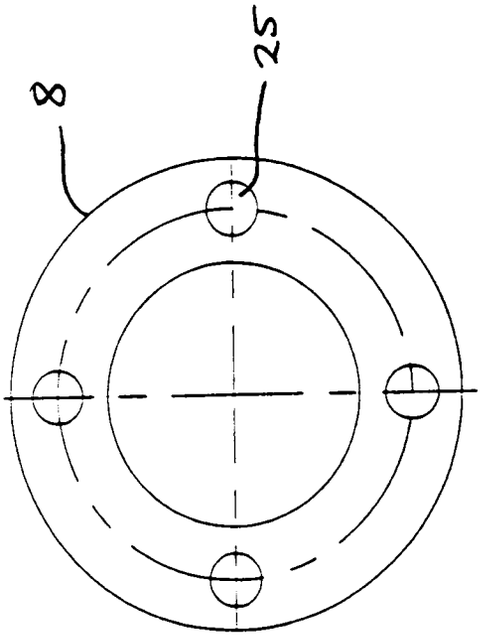

FIG. 3C

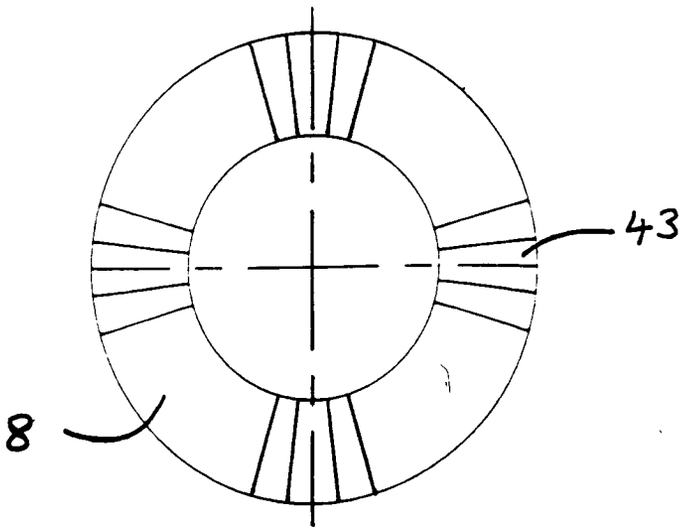

FIG. 4A

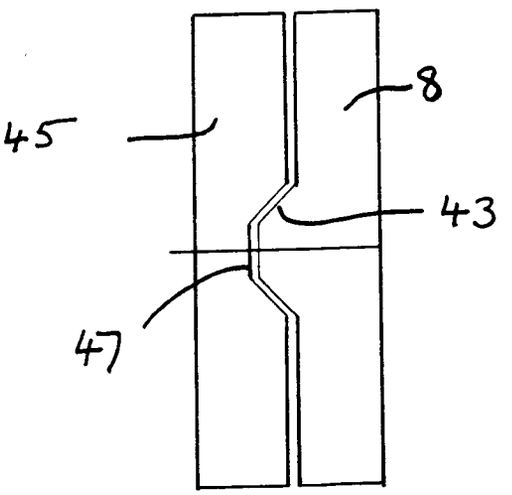

FIG. 4B

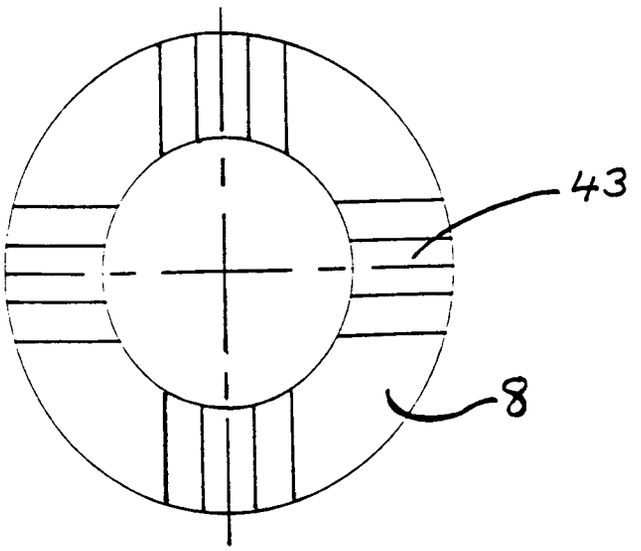

FIG. 5A

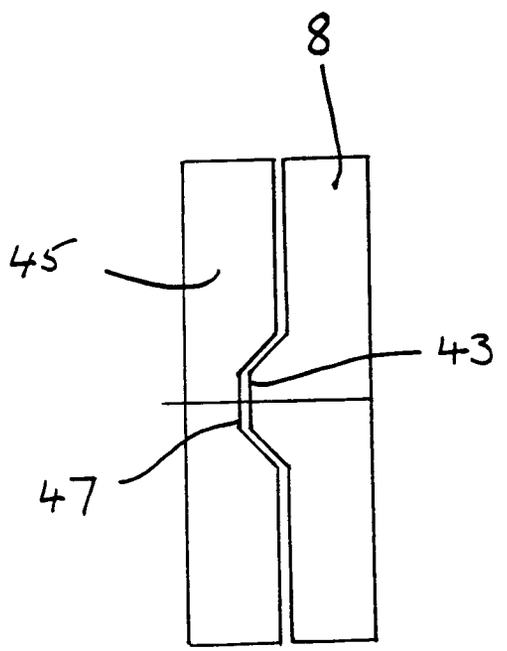

FIG. 5B

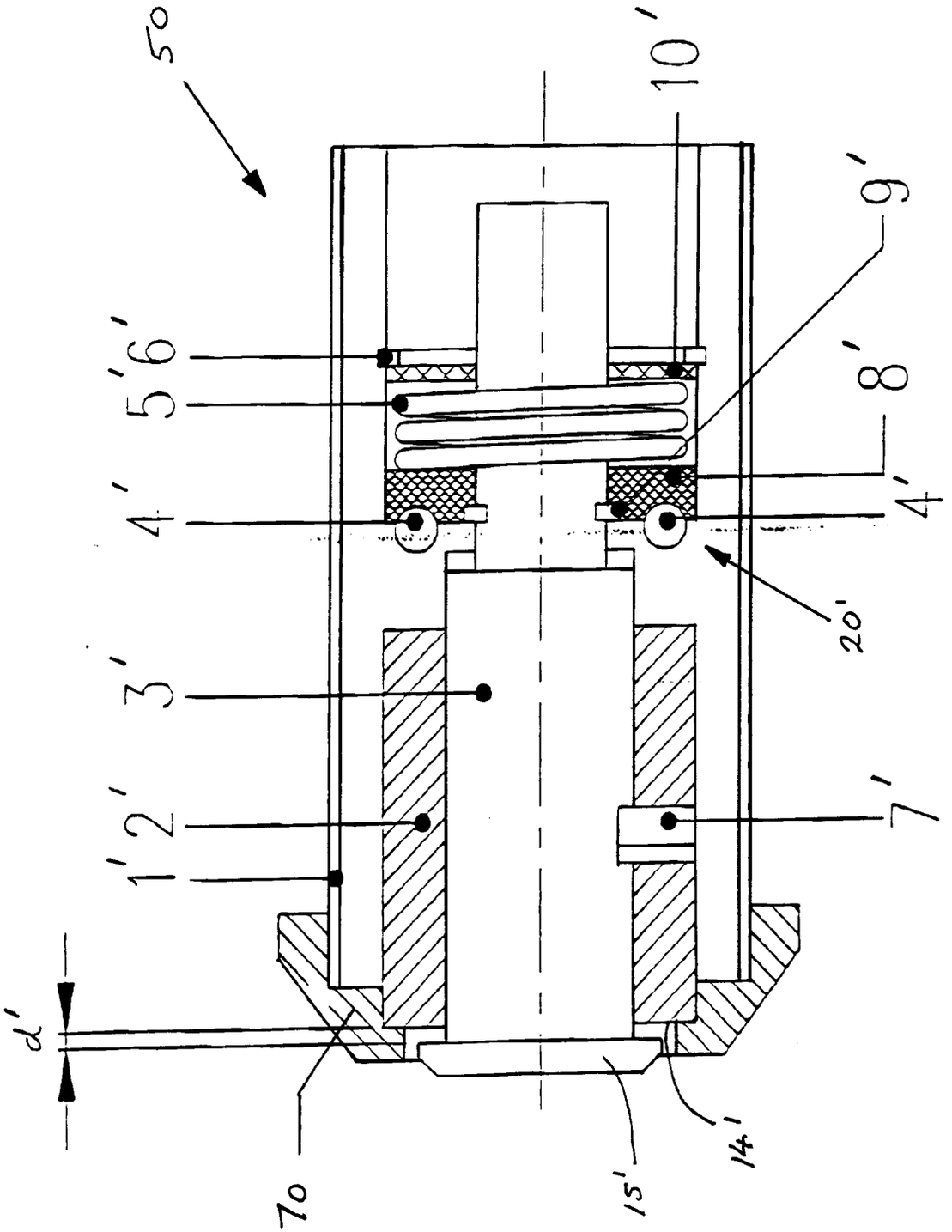

FIG. 6

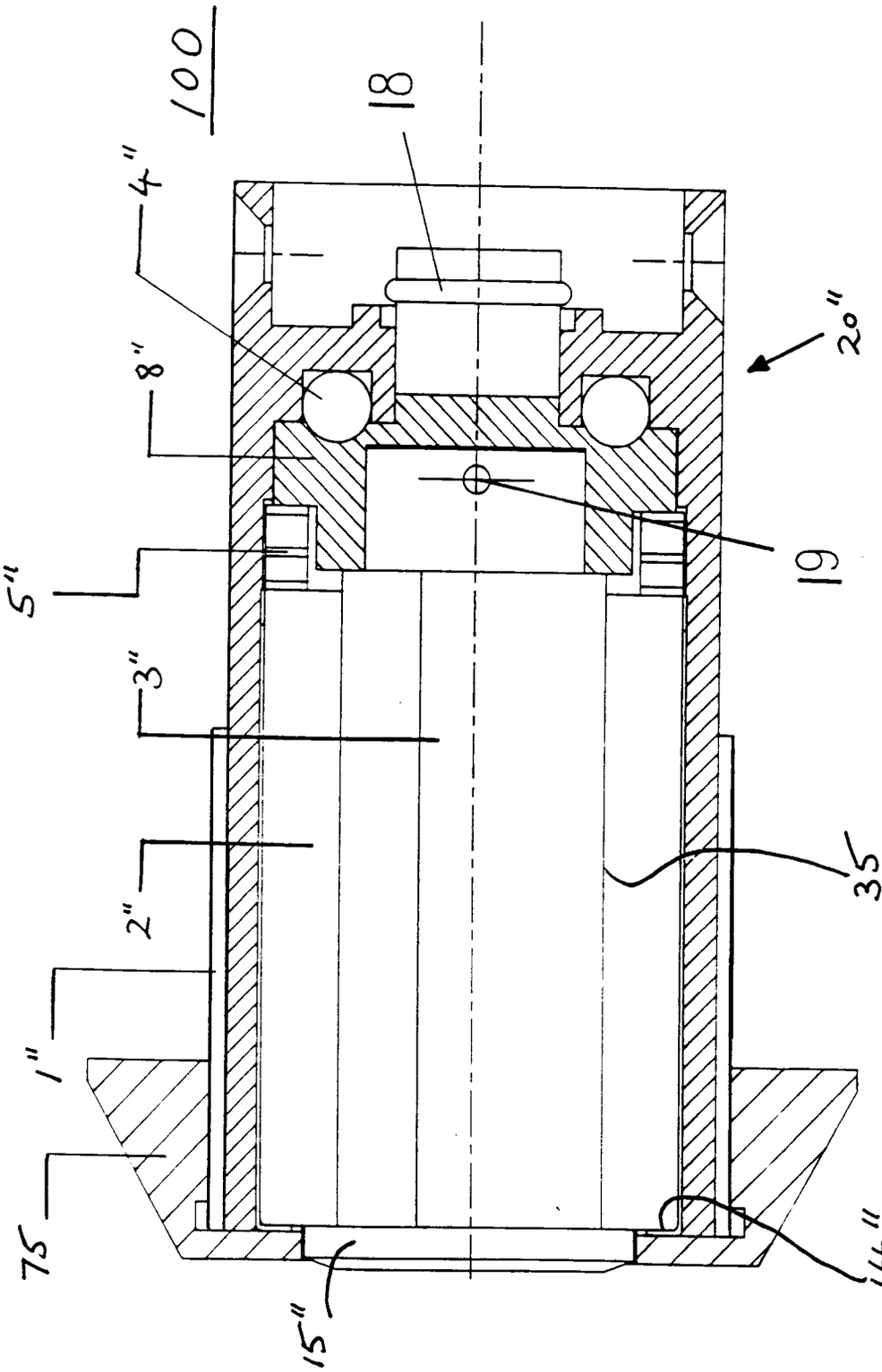

FIG. 7

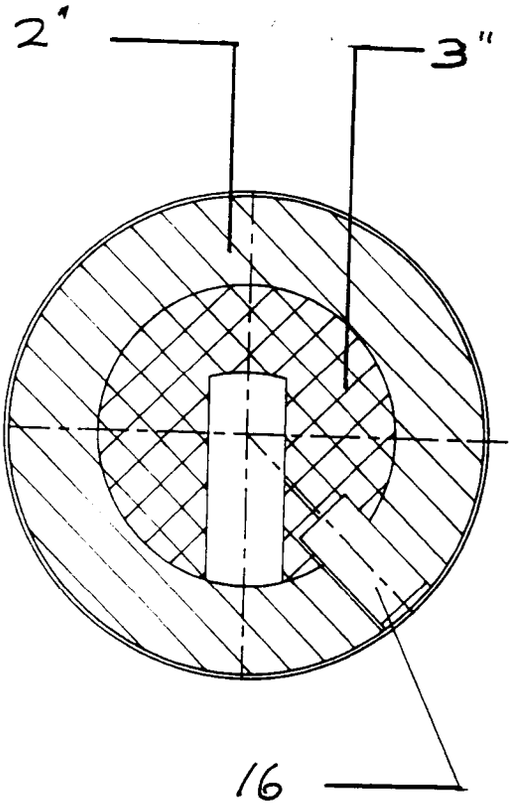

FIG. 8