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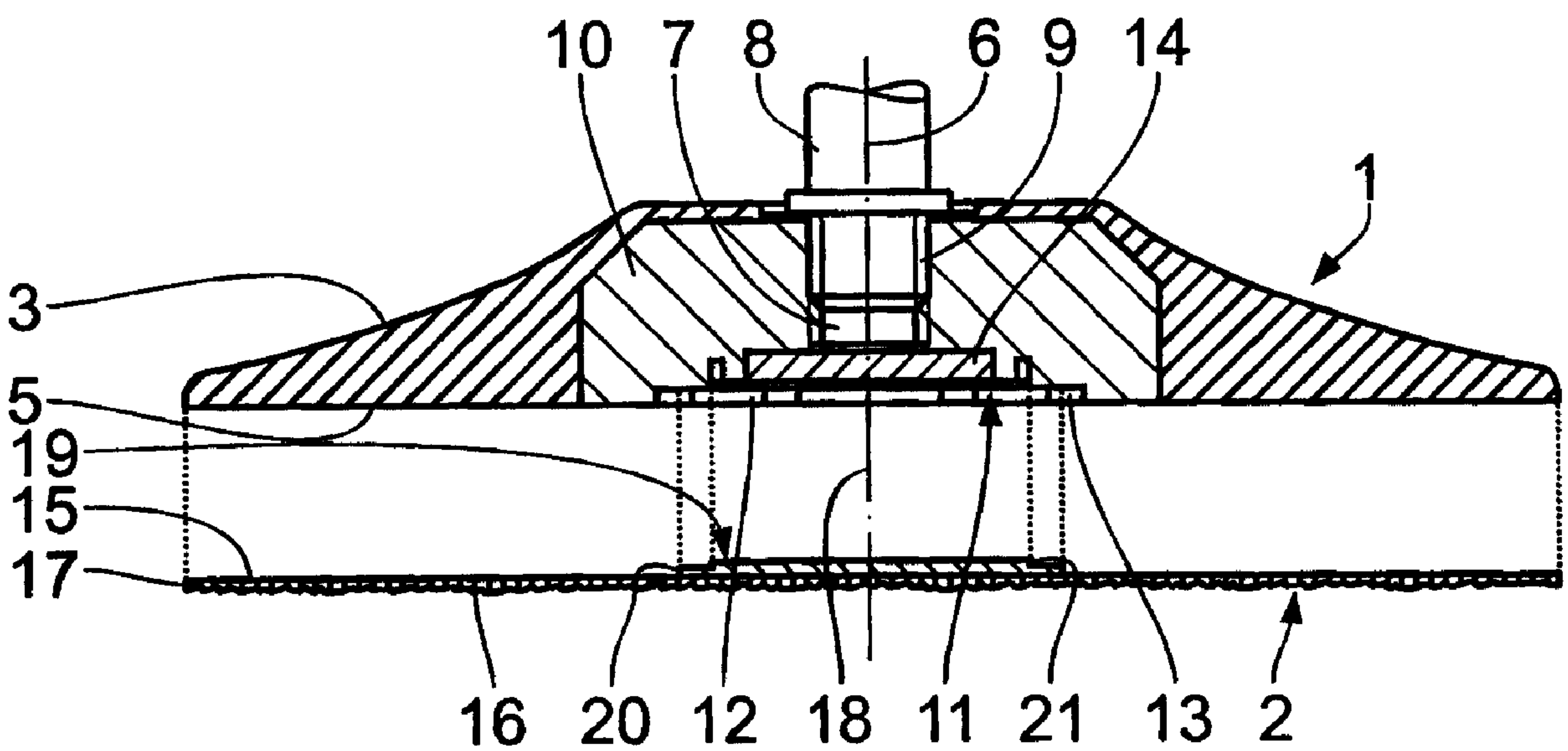

(57) Abrégé/Abstract:
In a tool comprising a supporting part (1) and a disk-shaped working part (2) for machining operation, the supporting part (1) comprises a supporting face (5) for the working part (2) and a permanent magnet (14) within the supporting face (5). The working part (2) comprises a coupling member (19) of ferromagnetic material which is movable into magnetically clinging connection with the permanent magnet (14) upon application of a counter-part supporting face (15) to the supporting face (5).

Abstract

In a tool comprising a supporting part (1) and a disk-shaped working part (2) for machining operation, the supporting part (1) comprises a supporting face (5) for the working part (2) and a permanent magnet (14) within the supporting face (5). The working part (2) comprises a coupling member (19) of ferromagnetic material which is movable into magnetically clinging connection with the permanent magnet (14) upon application of a counter-part supporting face (15) to the supporting face (5).

- Fig. 2 –

Tool

The invention relates to a tool comprising a supporting part and a disk-shaped working part for machining operation.

Tools of the generic type come in the most various designs, having a supporting part or base member that is joined to a working part which is a wearing part. These working parts are for instance abrasives on a backing, polishing wheels, cleaning wheels which consist of abrasive embedded in needled nonwoven or felt wheels. The supporting part and the working part are regularly driven in rotation. In known designs, a coupling member is mounted on the side that faces away from the working side, having a female thread that is screwed on a thread of the supporting part. Attaching the working part to, and detaching it from, the supporting part is regularly rather difficult or needs very accurate implementation, which is in particular stressed by the fact that these working parts must be replaced frequently after a very short time of use. Especially in these cases, great stacking heights of the working parts are occasioned by the considerable height of the coupling member and female thread.

EP 1 007 282 B1 teaches to attach abrasive sheet material to a magnetizable support. To this end, the abrasive material includes a ferromagnetic metal film. This is not suitable for tools of the above type.

It is an object of the invention to embody a tool of the generic type in such a way that producing and releasing the connection between the supporting part and the working part can be implemented easily and very rapidly.

According to the invention, this object is attained by the features wherein the supporting part has a supporting face for the working part and, within the supporting face, at least one permanent magnet; wherein the working part has a counterpart supporting face for the supporting face; and wherein the working part has a coupling member of ferromagnetic material which is movable into magnetically clinging connection with the at least one permanent magnet upon contact of the counterpart supporting face with the supporting face. The gist of the invention resides in that the working part includes a coupling member that clings to the supporting member by magnetic forces. The development of claim 2 and in particular the further embodiments according to claims 3 to 6 and 15 to 17 help create an additional possibility of positive-fit torque transmission and centering. According to claims 12 to 14, large-surface, tensile-strength connection is produced between the coupling member and permanent magnet without however the working-part stacking height being substantially affected by the coupling member.

The other sub-claims reflect advantageous embodiments.

Further features, advantages and details of the invention will become apparent from the ensuing description of exemplary embodiments, taken in conjunction with the drawing, in which

Fig. 1 is a plan view of the supporting face of a supporting part of a tool according to the invention;

Fig. 2 is an explosive cross-sectional view of a tool according to the invention;

Fig. 3 is a plan view of the counterpart supporting face of the working part of the tool;

Fig. 4 is a sectional explosive view of a coupling member including a permanent magnet.

Fig. 5 is a plan view of the supporting face of a supporting part of another embodiment;

Fig. 6 is a cross-sectional exploded view of the tool according to the further embodiment; and

Fig. 7 is a plan view of the counterpart supporting face of the working part of the further embodiment.

As seen in the drawing, the tool in its fundamental structure comprises a supporting part 1 in the form of a supporting plate, and a working part 2. The supporting part 1 has a supporting casing 3 of flexible plastics which includes an annular supporting face 5. On the side turned away from the supporting face 5, the supporting part 1 comprises a threaded hole 7 which is concentric of the center line 6 and into which to insert a drive shaft 8 of a tool-actuating unit (not shown) by a corresponding external thread 9. These kinds of tool drive units can be so-called right angle grinders or spur wheel grinders.

In the supporting casing 3 on the side of the supporting face 5, provision is made for a retainer 10 which includes the threaded hole 7 and, concentrically of the center line 6, a flat recess 11 of polygonal cross-sectional shape. In the present case, the recess 11 is formed by flanks 12 of an equilateral and equiangular polygon, for example a hexagon. A cutout 13 is provided at each intersection of two adjacent flanks 12.

A permanent magnet 14 in the form of a flat circular disk is disposed in the recess 11; it is countersunk as compared to the supporting face 5 and fixed to the retainer 10 for example by gluing. Suitably the retainer 10 consists of non-magnetizable material, but it may also consist of ferromagnetic material or partially ferromagnetic material, for example in the form of composite material.

The real working part 2 also has the shape of a circular disk, including a counterpart supporting face 15 which comes to bear against the supporting face 5 upon attachment of the working part 2 to the supporting part 1. The working part 2 possesses approximately the diameter or the circumference of the supporting part 1. In the present case, the working part 2 is comprised of abrasive material 16 on a backing 17, with the counterpart supporting face 15 being on the side of the backing 17 that faces away from the abrasive material 16. Those abrasive materials 16 on a backing 17 are customarily pliable i.e., flexibly resilient.

A coupling member 19 of ferromagnetic material is mounted on the counterpart supporting face 15 concentrically of the center line 18 of the working part 2. It has the shape of a polygon, corresponding substantially to that of the recess 11 i.e., in the present case, it is an equilateral and equiangular hexagon, the flanks 20 of which, upon placement into the recess 11, bear against the flanks 12 of the recess 11, this producing a non-rotary connection between the working part 2 and the supporting part 1. The coupling member 19 consisting of ferromagnetic material, it is retained tightly in the recess 11 through magnetic attraction by the permanent magnet 14. The magnetic forces act in the direction of the center lines 6, 18. With working parts 2 of the species, such as abrasive material 16 on a backing 17 or polishing wheels or cleaning wheels, being set at an angle to the surface that is worked, the center lines 6, 18 not being perpendicular to the surface worked, the working parts 2, inclusive of the flexible supporting casing 3, are bent upon machining operation, which produces forces that act between the coupling member 19 and the magnet 14, tending to lift the coupling member 19 off the magnet 14. The magnet 14 must be sufficiently strong to muster these forces. So it does not only serve to prevent the working part 2 from coming off the supporting part 1.

On its side turned away from the counterpart supporting face 15, the coupling member 19 comprises a flat, projecting, circular centering shoulder 21 which is tangent to the six flanks 20 of the coupling member 19. Upon attachment of the working part 2 to the supporting part 1, this centering shoulder 21 is inserted first into the recess 11, thereby producing the centering. Then the working part 2, together with the coupling member 19, can be rotated to such an extent that the flanks 20 and the flanks 12 coincide so that the coupling member 19 then bears against the permanent magnet 14 or is close thereto with only a small air gap remaining, and the counterpart supporting face 15 bears against the supporting face 5. The quick-fixing system that acts between the supporting part 1 and the working part 2 has three jobs, namely: axial mounting of the working part 2 and attachment thereof to the supporting part 1 by magnetic forces during a machining operation; positive-fit torque transmission between the flanks 12 and 20; and centering upon assembly by the centering shoulder 21 being insertable between the flanks 12.

As for the ratio that the diameter D_2 of the working part 2 bears to the greatest diameter D_{19} of the coupling member 19, the following applies: $1 < D_2/D_{19} \leq 10$, the small value of this ratio applying to particularly small diameters D_2 of the working part 2 of for instance approximately 20 mm, whereas the great ratio applies to great values of D_2, for example in the range of 200 mm or more. As regards the diameter D_2 found in practice, $20\ \text{mm} \leq D_2 \leq 250\ \text{mm}$ applies.

Although the described quick-action assembly of the working part 2 and supporting part 1 is primarily used in rotarily drivable working parts, it may just as well be used in primarily linearly drivable working parts, for example in vibrating grinders. With only a coupling available in this case, the described design serves as a safeguard against undesired rotation of the working part in relation to the supporting part.

As further seen in Fig. 4, the following applies to the ratio that the greatest diameter D_{19} of the coupling member 19 bears to the axial thickness d_{19} of the coupling member 19: $5 \leq D_{19}/d_{19} \leq 100$ and preferably $10 \leq D_{19}/d_{19} \leq 30$. As regards the ratio that the greatest diameter D_{19} of the coupling member 19 bears to the diameter D_{14} of the permanent magnet, $1 < D_{19}/D_{14} \leq 2$ applies.

The details specified above show that the coupling member 19 is extraordinarily flat as regards its diameter D_{19} and its thickness d_{19} on the one hand, and the diameter D_2 of the working part 2 on the other. Consequently, the stacking height of the working parts 2 as wearing parts and replacements is affected by the coupling member 19 only to some minor extent.

The embodiment according to Figs. 5 to 7 differs from the foregoing embodiment only in some details. Therefore, the same reference numerals are used for identical parts without any renewed explanation. As far as functionally identical parts are involved that differ constructionally, the same reference numerals are used, however provided with a prime.

Several permanent magnets 14' are provided – six in the actual case – which are disposed at equal angular distances around the threaded hole 7 in the retainer 10'. The threaded hole 7 is open towards the supporting face 5. The recess 11' is defined by flanks 12' that form an approximately equilateral polygon, with the individual flanks 12' being bent in a direction towards the center line 6 and the meeting points or intersections where the flanks 12' meet being shaped into rounded corners 22.

By adaptation to the modified supporting part 1', the working part 2' comprises a coupling member 19', the all-round flanks 20' of which correspond in shape and size to the flanks 12' of the recess 11' so that, upon snap-engagement of the coupling member 19' with the recess 11', the flanks 20' rest on the flanks 12'. The flanks 20' too join each other by rounded corners 23 that match the rounded corners 22. The flanks 12' of the recess 11' incline towards each other away from the supporting face 5 into the retainer 10'. The flanks 20' of the coupling member 19' incline towards each other in the same way so that, upon insertion of the coupling member 19' into the recess 11', there is not only non-rotary engagement by positive fit, but also a centering effect towards the center line 6. A hole 24 is provided in the coupling member 19', corresponding in size and position to the threaded hole 7, so that the drive shaft 8 of the first exemplary embodiment may possibly project through the tool – given corresponding conditions on the side of the tool-actuation unit. As regards the ratios of diameter and thickness, the explanations of the first embodiment apply.

Of course, a number of for instance four permanent magnets can be provided instead of six permanent magnets 14'. The supporting face 5 may be a continuous flat surface, however it may just as well be defined by a plurality of ribs which, not being of decisive importance, are not shown in detail.

Claims

1. A tool, comprising
a supporting part;
a disk-shaped working part for machining operation; and
a common center line;
wherein the supporting part has a supporting face for the working part and, within the supporting face, at least one permanent magnet;
wherein the working part has a counterpart supporting face for the supporting face; and
wherein the working part has a coupling member of ferromagnetic material which is movable into magnetically clinging connection with the at least one permanent magnet upon contact of the counterpart supporting face with the supporting face.

2. A tool according to claim 1, wherein the at least one permanent magnet is disposed in a recess of the supporting part; and wherein the coupling member enters into the recess.

3. A tool according to claim 2, wherein the recess has a non-circular cross-sectional shape; and wherein the coupling member has a non-circular cross-sectional shape that conforms to the cross-sectional shape of the recess.

4. A tool according to claim 3, wherein the recess and the coupling member have a polygonal cross-sectional shape.

5. A tool according to claim 4, wherein the recess and the coupling member have a cross-sectional shape of an equilateral and equiangular polygon.

6. A tool according to one of claims 2 to 5, wherein the coupling member has a circular centering shoulder that conforms to the recess.

7. A tool according to one of claims 1 to 6, wherein the supporting part comprises a supporting casing and a retainer which is at least sectionally encased by the supporting casing.

8. A tool according to claim 7, wherein the supporting casing consists of plastics.

9. A tool according to claim 7 or 8, wherein the retainer consists of metal.

10. A tool according to one of claims 1 to 9, wherein the supporting part comprises a connection to a rotary drive unit.

11. A tool according to one of claims 1 to 10, wherein the working part is comprised of abrasive material on a backing.

12. A tool according to one of claims 1 to 11, in particular according to claim 8, wherein the supporting casing consists of flexibly resilient material.

13. A tool according to one of claims 1 to 12, wherein $5 \leq D_{19}/d_{19} \leq 100$ applies to the ratio that the greatest diameter D_{19} of the coupling member bears to the thickness d_{19} thereof.

14. A tool according to one of claims 1 to 13, wherein $1 < D_2/D_{19} \leq 10$ applies to the ratio that the greatest diameter D_2 of the working part bears to the greatest diameter D_{19} of the coupling member.

15. A tool according to claim 4, wherein the recess and the coupling member have flanks that are bent inwards.

16. A tool according to claim 15, wherein respectively adjacent flanks of the recess and respectively adjacent flanks of the coupling member are joined to each other by rounded corners.

17. A tool according to claim 15, wherein the flanks of the recess incline towards each other from the supporting face into the supporting part.

18. A tool according to one of claims 1 to 17, wherein several permanent magnets are disposed in the supporting part.

19. A tool according to claim 18, wherein the permanent magnets are disposed at equal angular distances and at a distance from the center line.

20. A tool according to claim 11, wherein the working part is pliable.

21. A tool, substantially as described hereinbefore with reference to, and as illustrated in, the accompanying drawings.

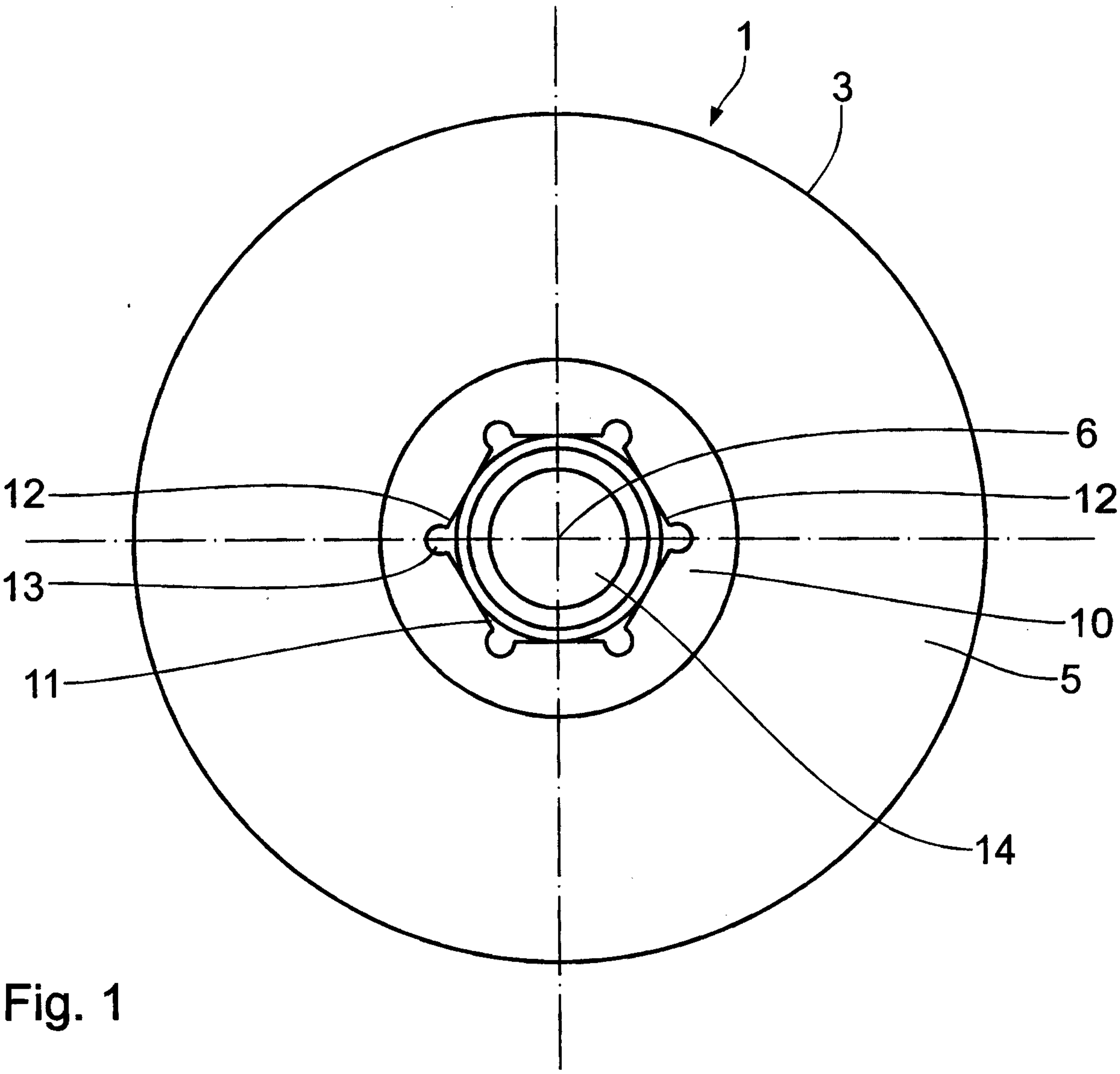

Fig. 1

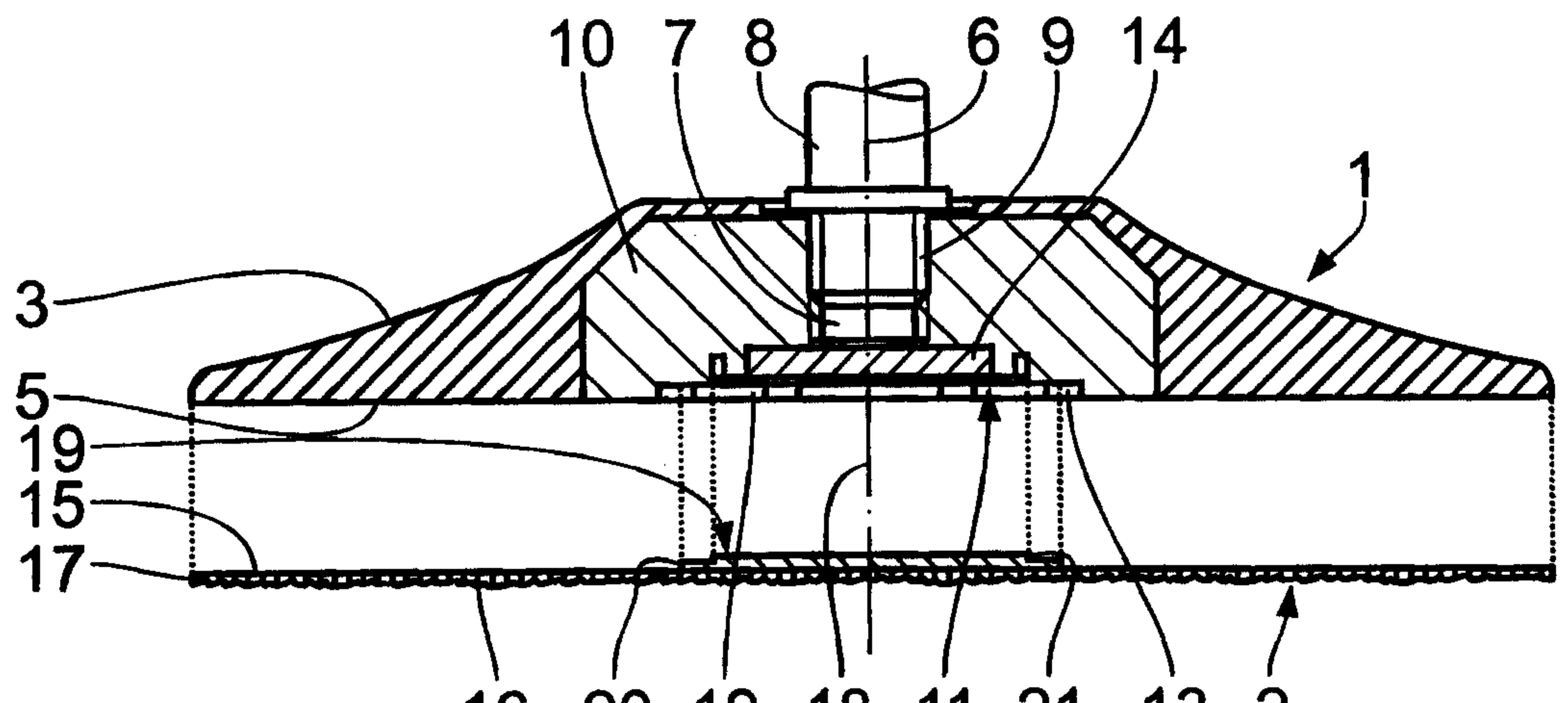

Fig. 2

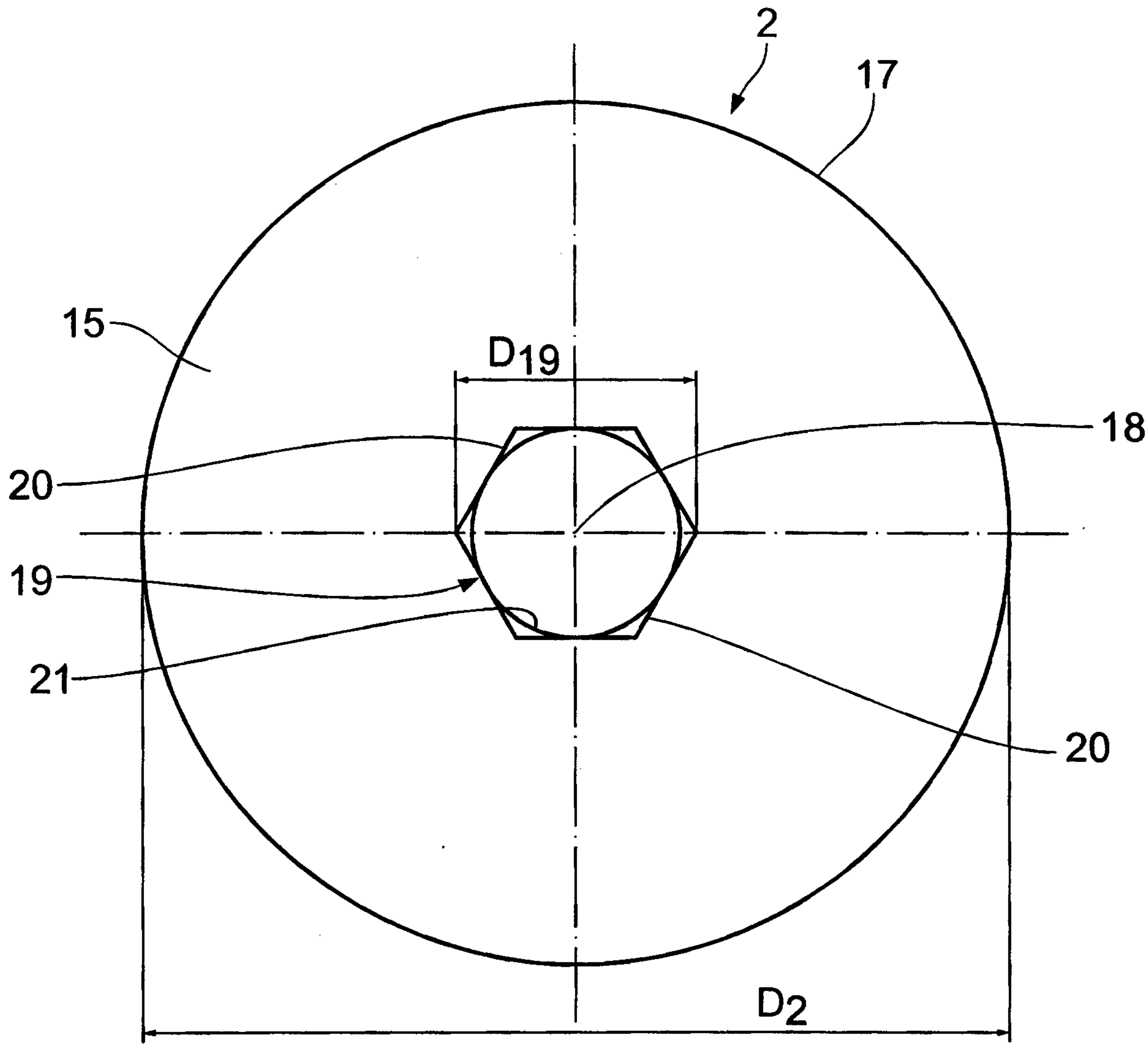

Fig. 3

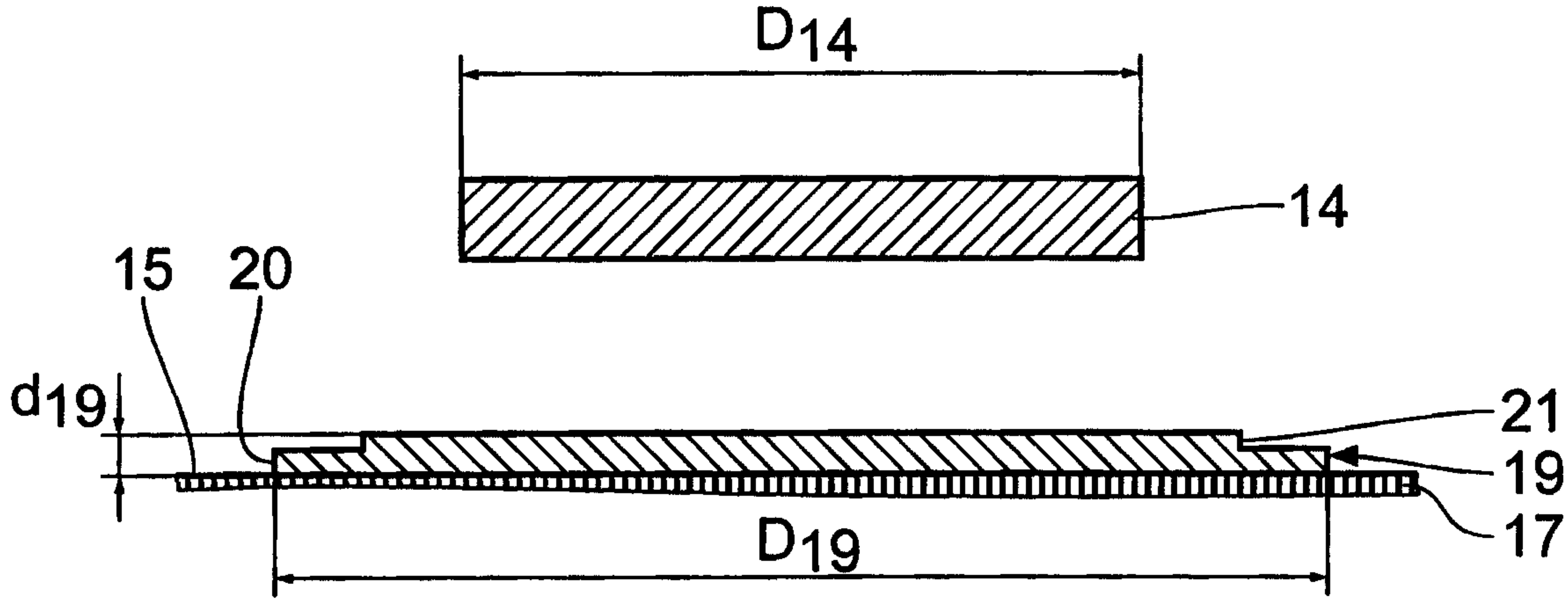

Fig. 4

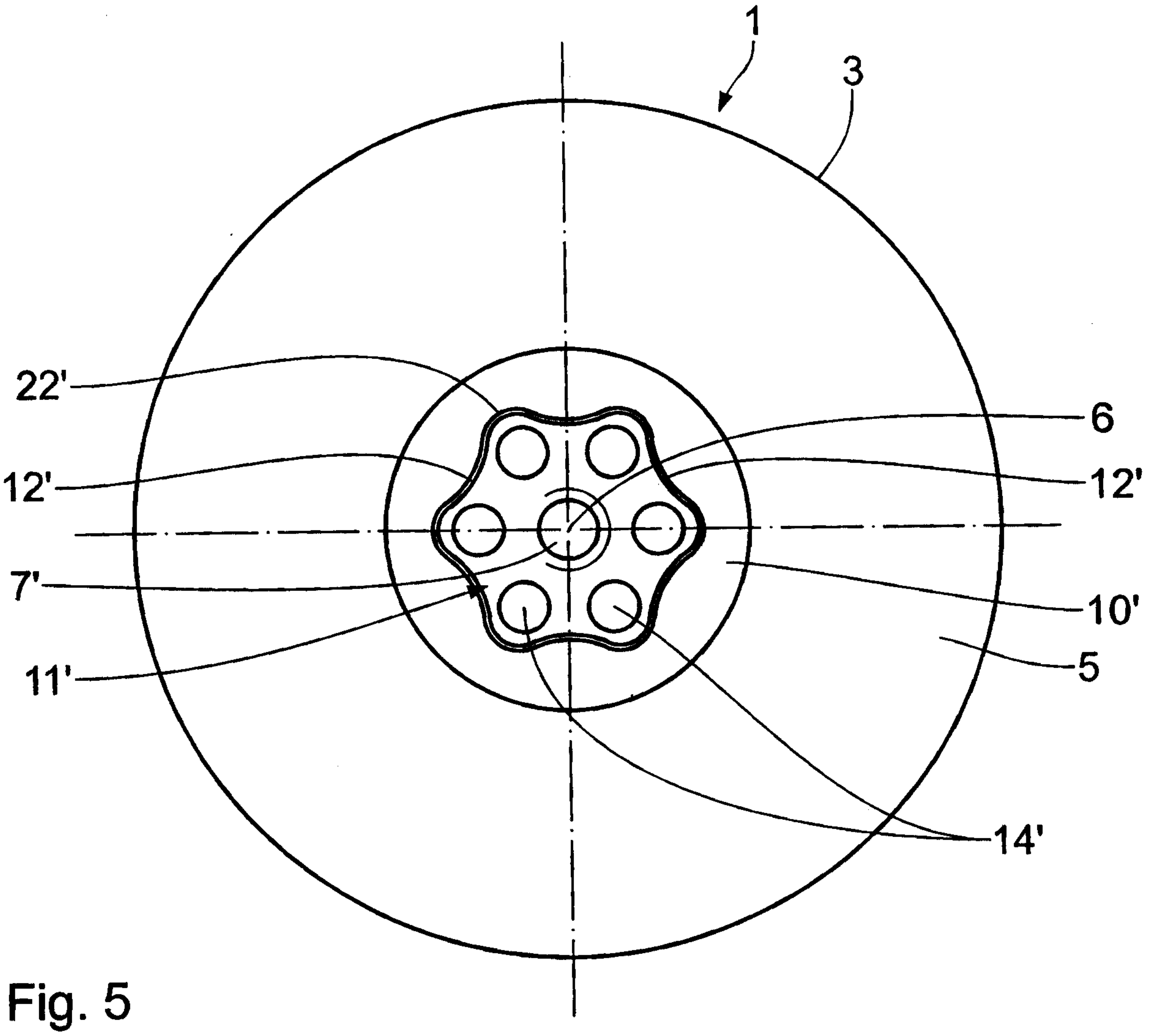

Fig. 5

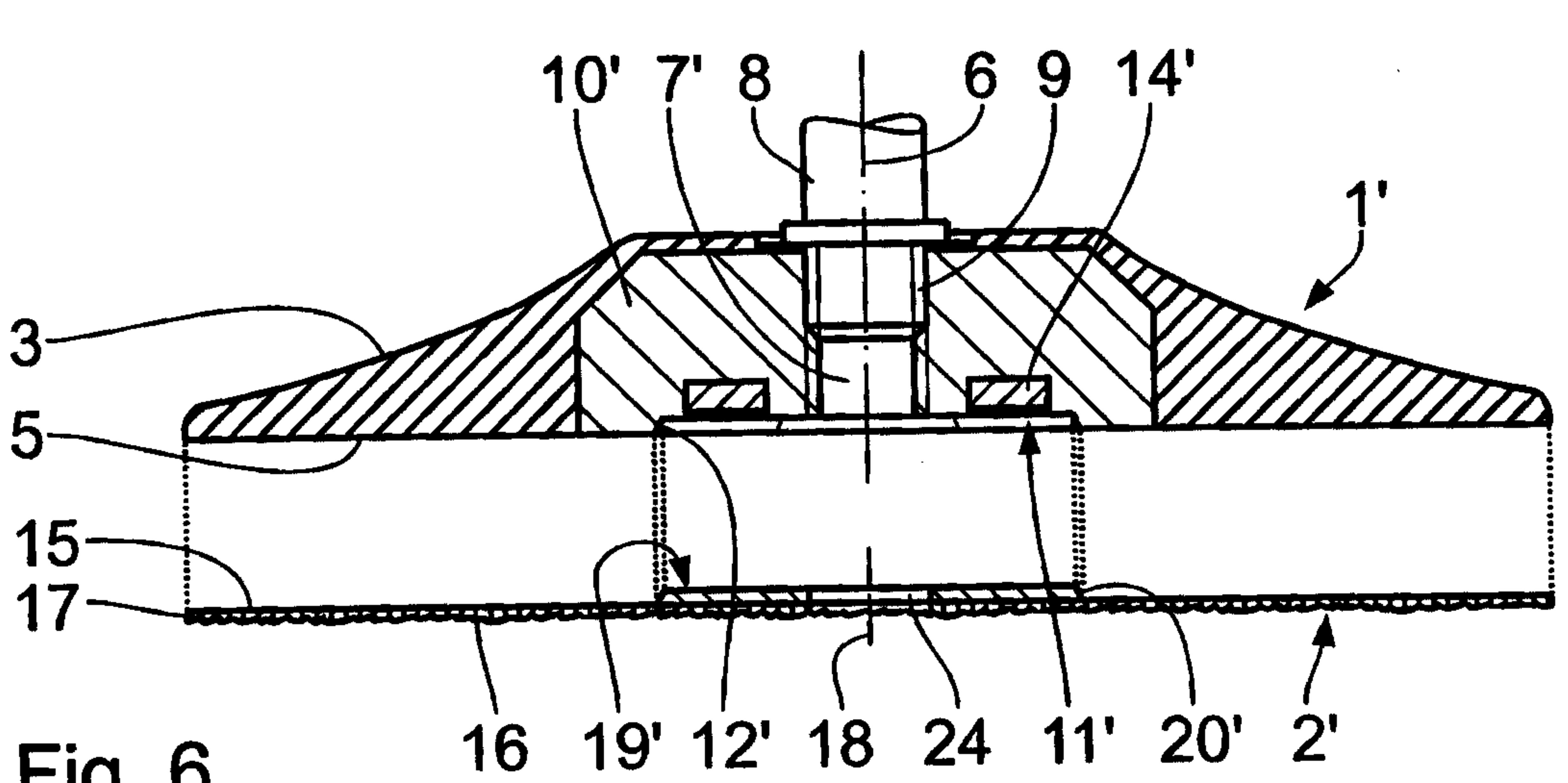

Fig. 6

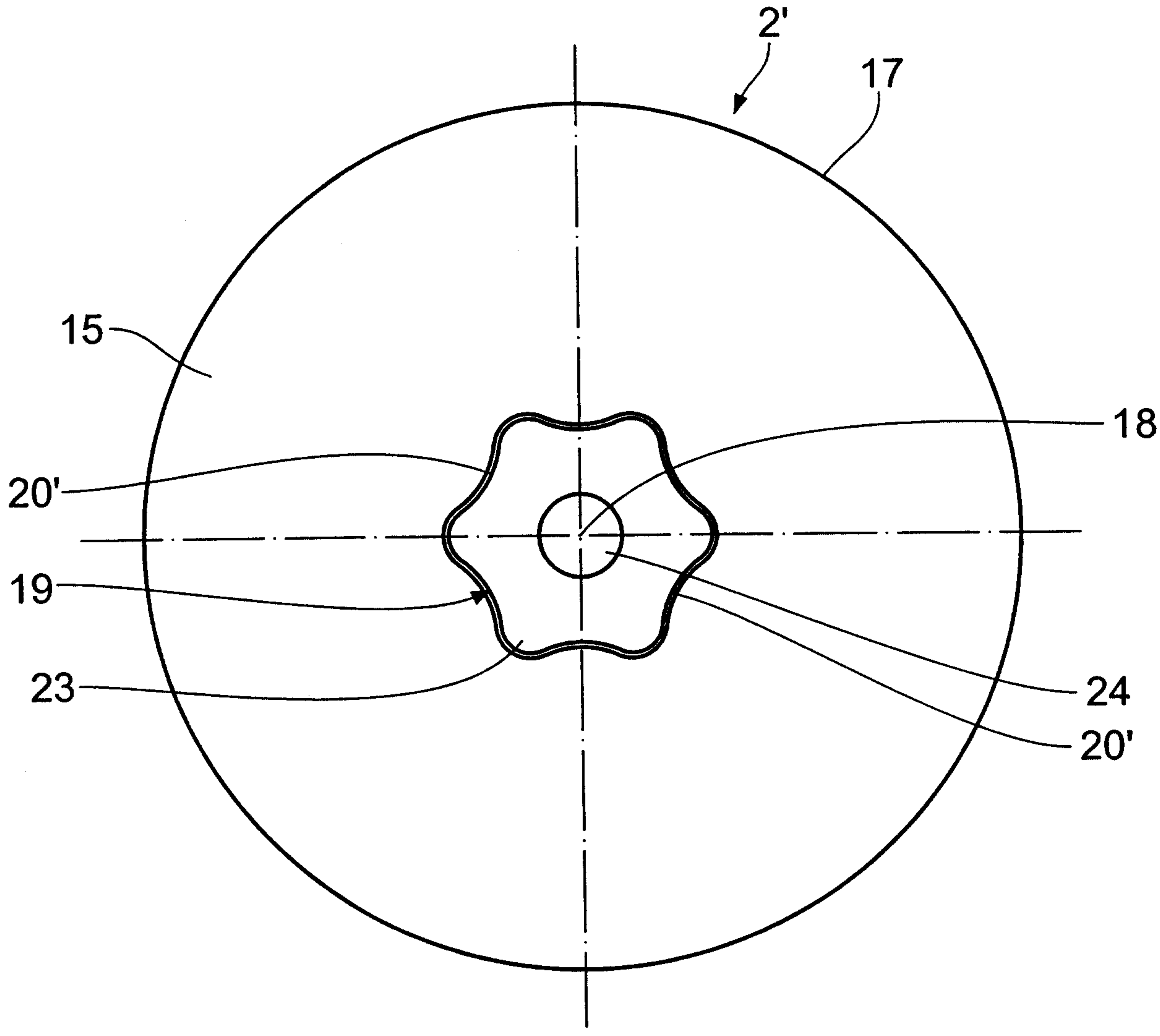

Fig. 7


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