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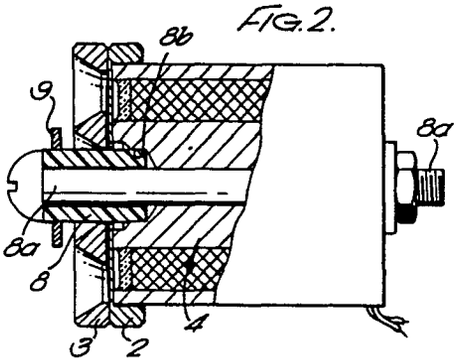
(54) Thread brake.

(57) A thread brake (1) is described which is particularly suitable for regulating the tension of sewing thread (5) during winding. In a preferred arrangement, the thread brake comprises two coaxial brake discs (2, 3) rotatably mounted on a wear-resistant sleeve (8) which is supported on a pin (8a) passing axially through the body of an electromagnet (4). The outermost disc (3) is made of ferromagnetic material and, when the electromagnet (4) is energised, it is urged towards the other disc (2) so as to apply a braking pressure to the thread (5). A series of countersunk and radial apertures (7) are provided in the outermost disc (3) and are disposed in a circle concentric to axis of rotation. This disc (3) also has a slight concave depression (13) on its braking side directly opposite the other disc (2). Both discs have central apertures and the central aperture (16) of the outermost disc (3) is also countersunk. Both discs can tilt through a predetermined angle on the sleeve (8). The apertures (7, 16) provide an exit for material abraded from the thread due to passage between the braking discs (2, 3).

FIG. 2.



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THREAD BRAKE

The invention relates to a thread brake, especially suitable for sewing thread and like threads, of the type comprising two brake discs which are located coaxially to one another and between which the thread is guided, in which the brake discs can be urged together, e.g. by an electromagnet, so as to regulate their braking effect on the thread.

Thread brakes of this type are already known for setting or regulating the thread tension during winding of the thread. As a result of the braking action, material becomes abraded from the thread, especially in the form of fibre dust or residues of dyes and finishing agents, and deposited on the braking faces of the brake discs. This of course adversely affects the operation of the brake. To prevent this, electromagnets used to urge the brake disc together have been subjected to alternating current, so that the brake disc or discs are caused to vibrate. As a result, the abraded material can be shaken off from the brake discs. The disadvantage of such an alternating current magnetic brake is that difficulties can arise when the alternating current is regulated to vary the braking force, or else that alternating current is not directly available. Moreover, only relatively narrow regulating limits for the braking force exist.

It is known, furthermore, to keep the brake discs clean by permanent or periodic blowing with compressed air. However, additional equipment is required for this purpose and, moreover, the use of compressed air can be disturbing for the surrounding area.

An object of the present invention is to provide a thread brake of the type mentioned, the construction of which is simple and inexpensive, but which can still be regulated easily and within wide ranges and yet is designed to be self-cleaning.

According to this invention, there is provided a thread brake, especially suitable for sewing thread and like threads,

with two brake discs which are located coaxially to one another and between which the thread is guided, in which the brake discs can urged together so as to regulate their braking effect on the thread, characterised in that at least one of the brake discs is rotatably mounted and at least one interruption is provided in the braking face of at least one of the brake discs.

The preferred form of interruption is a recess in the braking face of a brake disc, and it is preferred that this recess communicates with the opposite face of the disc so as to form an aperture from one face to the other. Although a plurality of interruptions will normally be used, it is possible to use a single interruption and, in this context, the singular includes the plural in the present description and claims.

It is not quite clear how these interruptions work, but it is believed that they have a cutting action on the deposits of abraded material and also, especially when they constitute an aperture as described above, serve to allow the escape of the cut-away deposits. It is surprisingly discovered that this is done without any cutting of the thread itself.

It is preferred that, in operation, there is a relative rotational movement between the brake discs. It is also preferred that at least part of the edge of the interruption lies at an angle to the circular direction of rotation of the rotatably mounted brake disc. Both these features provide a better cleaning action, presumably by promoting the aforesaid cutting action. The rotatably mounted brake disc is preferably freely mounted so that it will automatically be rotated by the thread running between the brake discs.

It is preferred that an electromagnet be used to urge the brake discs together, and this electromagnet can best be operated by means of direct current. Other urging means, such as springs, can however be used.

It is advantageous if essentially an outer annular region of the brake disc is provided as the braking face,

and if that region of the brake disc which is located radially further inwards is set back axially relative to the braking face. As a result, the removal of the abraded material to the interruptions or the like is made easier.

In this case. a preferred embodiment provides that the rotatable brake disc has, at a radial distance from the outer margin, a concave depression on its braking side, and that the approximately plane marginal annular region preferably has a radial width of approximately 1/4 of the radius of the brake disc. It has been shown, in practice, that the abraded material is removed especially effectively thereby.

Appropriately, the interruption is provided in the inner portion of the outer annular region of the braking face so as to merge with the axially set-back region, to allow the deposits to be conveyed away out of the region of the braking faces.

An advantageous development of the invention provides that the thread runs at an angle round a sleeve and that the resultant-force of the electromagnet or other urging device, which engages on the brake disc, lies within a triangle formed by the thread strands, with the deflecting point of the sleeve as the apex, this triangle being limited by a secant which passes through the points of intersection of the thread strands with the outer margin of the brake discs. This prevents the movable brake disc from tilting, under the influence of the magnetic force, round the thread as a tilt-bearing. In particular, a tilt-proof support is thus provided by means of the approximately V-shaped support of the brake disc, and a direct contact between the two brake discs is also prevented by this tilt-proof support.

A further especially advantageous development provides that the movable brake disc is mounted with a radial play on the sleeve, which also serves as a thread guide, and that, in its functional position, the thread has an angle, with the sleeve as apex, in the range from preferably approximately 110 degrees to approximately 160 degrees. Because of the radial play of the movable brake disc, this can also

tilt or rock to a certain extent, so that it can apply itself effectively to the thread.

Advantageously, the interruptions or the like in the brake discs have widened portions away from the braking face. This also assists the conveying away of the abraded material.

If appropriate, the rotatable brake disc or discs can be connected to a retarding device. This also makes it possible to influence the braking action on the thread running through. Furthermore, if appropriate, at least one of the brake discs could have a rotary drive, in which case the drive is effected, for example, via a magnetic rotating field of the brake magnet and in which case, if appropriate, the direction of the rotary drive is provided against the direction of rotation of the thread, and the speed of the rotary drive can preferably be varied. As a result of this, also, the braking action on the thread can be influenced, and it can be provided, if appropriate, that a braking action at a fixed presetting could be produced by means of an axial adjustment of the brake discs and that an additional precise adjustment of the braking force could be produced by influencing the rotation of the brake disc.

The invention is described in more detail below with reference to the drawings, in which:-

Figure 1 shows a side view of a thread brake,

Figure 2 shows the thread brake illustrated in Figure 1, partly cut away,

Figure 3 shows a plan view of a brake disc on its braking side,

Figure 4 shows a cross-section of the brake disc illustrated in Figure 3,

Figure 5 shows a modified embodiment of a brake disc in a plan view of the braking side, and

Figure 6 shows, in cross-section, the brake disc illustrated in Figure 5.

A thread brake, designated as a whole by 1, has as its essential components two brake discs 2 and 3, and an eletromagnet 4. By means of the electromagnet 4 the brake

disc 3 can be pulled towards the other brake disc 2 and pressed against the latter with a varying contact force via a regulating device (not shown). The thread 5 shown in Figure 3 is guided between the two brake discs 2 and 3.

In the exemplary embodiment, the brake disc 3 is freely mounted rotatably on a sleeve 8, made of wear-resistant material, the sleeve 8 being freely mounted on, but retained by a central pin 8a passing through the body of the electromagnet 4. The sleeve 8, is located in a recess 8b in the forward end of the body of the electromagnet 4. The sleeve 8 projects beyond the outer face of the disc 3 to allow the disc 3 to move away from, and or tilt with respect to the electromagnet 4. The axial movement of disc 3 away from the electromagnet 4 is limited by a retaining ring 9. Disc 3 is caused to rotate by the movement of the thread 5 between the two brake discs. Surprisingly, it has been found in practice, that in addition to other essential advantages, a higher braking action is exerted on the thread 5, in the case of a rotating brake disc 3, than in the case of a stationary brake disc. A further essential advantage is provided due to the fact that deposition of abraded material between the discs is reduced as a result of this rotation of the brake disc. Brake disc 2 can also be mounted rotatably, but is preferably arranged to rotate at a different speed than brake disc 3. A more uniform wear on a brake disc can be achieved if it rotates, since different parts are continuously being engaged because of the rotation.

While brake disc 2 is shown in Figure 1 as also being rotatably mounted on sleeve 8, it is under greater frictional restraint than brake disc 3 and hence, in operation, will either not rotate at all or will rotate slower than disc 3. Brake disc 2 is made of non-magnetic material, whereas the brake disc 3 consists of a ferromagnetic material.

Figures 3 and 5 make it clear that the interruptions 7 or the like are located at a radial distance from the outer margin of the brake disc 3. Here, the actual braking face 6 is formed essentially by an outer annular region 10, the interruptions 7 being provided in the inner portion of the outer annular region 10 so as to merge with an inner axially set-back region 11. This facilitates the conveying away of abraded material.

In the exemplary embodiment according to Figures 3 and 4, the brake disc 3 has, at a radial distance from the outer

margin 12, a concave depression 13 on its braking side, as the set-back region 11. By means of this depression 13, a continuous transition for the abraded material from the annular region 10 of the braking face to the removal points is provided, so that said abraded material can be removed, in particular, without being able to settle. It is advantageous, in this case, if the brake disc 3 is mounted with radial play on the sleeve 8, because a passage for the abraded material is also present, as a result, in the bearing region. The abovementioned depression 13 has a depth of less than 1 mm, for example 0.1 mm. The distance between the interruptions on the braking face and the outer margin of the braking face is suitably about 20% of the radius of the brake disc 3.

The interruptions 7 in the brake disc 3 have widened portions 15 which become larger towards the rear side 14, i.e. away from the braking face (6). In the exemplary embodiment, the interruptions 7 are formed by round holes, and these are arranged in a concentric circle. The number and size of the interruptions can be provided according to the respective requirements. Among other things, this can depend on the thread structure or also the thread material and also on the speed of transport of the thread 5. In the exemplary embodiment, eight round interruptions 7 are provided, the inside diameter of which is approximately 1/4 of the radius of the brake disc 3. The largest outlines of the widened portions 15 adjoining the interruptions 7 are provided so that their outer margins virtually touch one another. The central hole 16 for the sleeve 8 also has a conical widened portion 15a, the axial depth of which is approximately 2/3 of the wall thickness of the brake disc 3. The bearing face for the sleeve 8 is comparatively small, as a result, so that the brake disc 3 can also be tilted on the sleeve 8. It can thereby apply itself effectively to the thread 5. However, to prevent the brake disc 3 from tilting round the thread and coming in contact with the other brake disc 2, the thread is provided to run at an angle round the sleeve 8, as illustrated in Figure 3.

It is important, here, that the resultant of the magnetic forces acting on the brake disc 3 lie within the triangle limited, on the one hand, by the thread strands and, on the other hand, by a secant 20, the latter passing through the points of intersection of the thread strands with the outer margin 12 of the brake disc. The said angle of thread 5 can, for example, be 110 to 160 degrees, and the above-mentioned conditions regarding the resultant of the magnetic forces applied should be satisfied.

A modified embodiment of a brake disc 3a is shown in Figures 5 and 6. In this brake disc 3a, an approximately cylindrical central countersink 17 is provided as the set-back region 11, the shoulder of this countersink 17 being bevelled towards the braking face 6 in regions, thus forming the interruptions 7 or the like. A brake disc 3a of this type can, above all, be manufactured simply. Provided in the region of the countersink 17 are openings 18 in the wall of the brake disc, which are designed to run in an approximately slit-shaped manner in a peripheral direction. Abraded material, which passes from the braking face via the bevels 19 into the region of the countersink 17, can thereby be removed outwards from the gap between the two brake discs 2 and 3a. In the exemplary embodiment, the bevels 19 have an inner shape corresponding to approximately a quarter of a sphere. Here, again, abraded material can be removed additionally via the gap in the bearing region at the sleeve 8.

Altogether, the invention provides a thread brake 1 which can be operated by means of direct current, but is, nevertheless, self-cleaning, so that reliable functioning is ensured even over a relatively long period of operation. The possibility of using direct current to control the thread brake is advantageous particularly also in connection with the control of an entire system within which the thread brake is employed.

If appropriate, the rotatable brake disc 3 can also be connected to a retarding device. In the thread run envisaged (Figure 3), the brake disc 3 is rotated by means of the thread 5 at a lower angular speed than the thread speed, due mainly to the braking effect of the electromagnet. By means of an additional retarding device, the braking force acting on the thread 5 could be varied finely. Because of the distance between the two brake discs 2 and 3, a certain braking force could then be preset, and a precisely adjusted variation of the braking force, superimposed on the latter, could be effected by retarding the rotatable disc 3.

A further possible embodiment of the invention could provide that at least one of the brake discs 2, 3 should have a rotary drive which is effective, for example, via a magnetic rotating field of the brake magnet 4. The direction of the rotary drive could then be provided especially against the direction of rotation by the thread 5 and, in particular, its speed could also be variable, so that here, also, it would be possible to influence the actual braking force on the thread 5.

It is possible that the inner brake device 2 could be provided by a wall, e.g. an end wall of the housing of the electromagnet 4. The term disc used herein must be construed accordingly.

CLAIMS

1. Thread brake, especially suitable for sewing thread and like threads, with two brake discs which are located coaxially to one another and between which the thread is guided, in which the brake discs can be urged together so as to regulate their braking effect on the thread, characterised in that at least one of the brake discs (2,3) is rotatably mounted, and at least one interruption (7) is provided in the braking face (6) of at least one of the brake discs (3).

2. Thread brake according to claim 1 characterised in that the brake discs (2,3) are so arranged that in operation there is a relative rotational movement between them.

3. Thread brake according to claim 1 or 2, characterised in that one of the brake discs (3) is both rotatably mounted and provided with interruptions (7) in its braking face (6).

4. Thread brake according to any of claims 1 to 3 characterised in that at least part of the edge of the interruption (7) lies at an angle to the circular direction of rotation of the rotatably mounted brake disc (3).

5. Thread brake according to any of claims 1 to 4 characterised in that the interruption (7) is in the form of an aperture leading from one face of the brake disc (2,3) to the other.

6. Thread brake according to any of claims 1 to 5 characterised in that the brake discs (2,3) are urged together by means of an electromagnet (4).

7. Thread brake according to claim 6 characterised in that the electromagnet (4) is operated by means of direct current.

8. Thread brake according to claim 6 or 7 characterised in that the back face of an inner brake disc (2) is located against the electromagnet (4) and an outer brake disc (3) is located against the opposite and braking face of the inner brake disc (2), the inner disc (2) being of non-magnetic material and the outer disc (3) being of magnetic material.

9. Thread brake according to any of claims 1 to 8, characterised in that each interruption (7) is located at a radial distance from the outer margin of the brake disc (3).

10. Thread brake according to any of claims 1 to 9, characterised in that, in at least one brake disc, essentially an outer annular region (10) of the brake disc (3) is provided as the braking face (6), and that region of the brake disc (3) which is located radially further inwards is set back axially relative to the braking face (6).

11. Thread brake according to claim 10, characterised in that interruptions (7) are provided in the inner portion of the outer annular region (10) so as to merge with the axially set-back region (11).

12. Thread brake according to any of claims 1 to 11, characterised in that the thread is adapted to run at an angle round a sleeve (8), and in that the resultant-force of the electromagnet (4) or other urging device, which is applied to the brake disc (3), lies within a triangle which is formed by the thread strands, with the deflecting point of the sleeve(8) as the apex, and which is limited by a secant (20) passing through the points of intersection of the thread strands with the outer margin (12) of the brake disc.

13. Thread brake according to claim 5 and any other of the foregoing claims, characterised in that the aperture has a widened portion (15) which becomes larger away from the braking face (6).

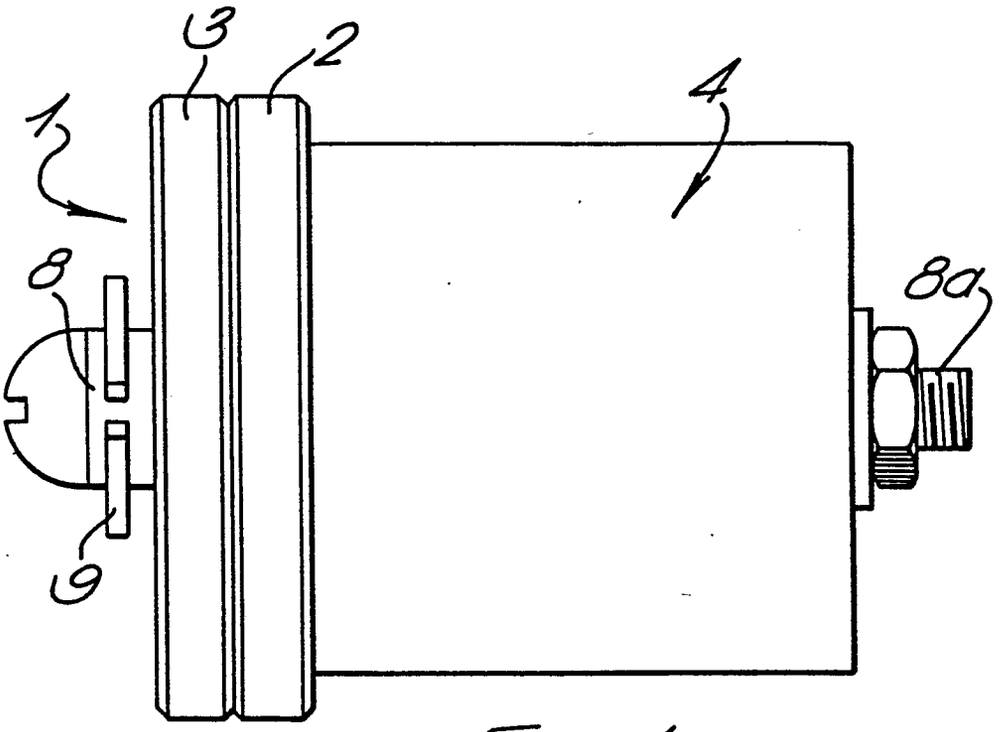

FIG. 1.

FIG. 2.

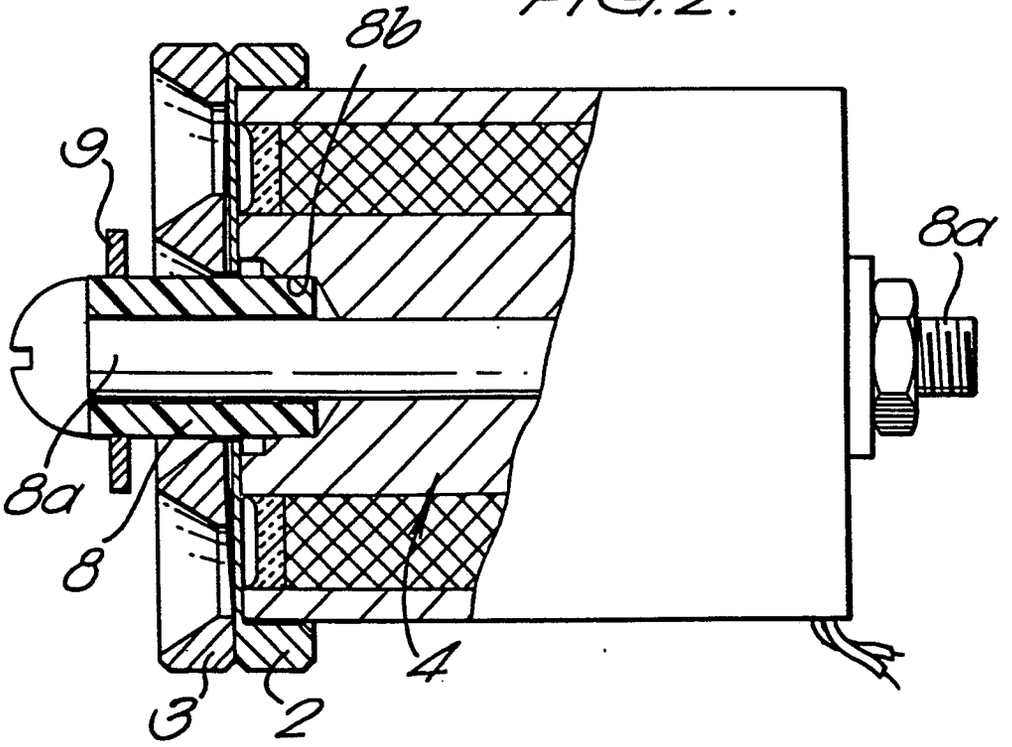

FIG.3.

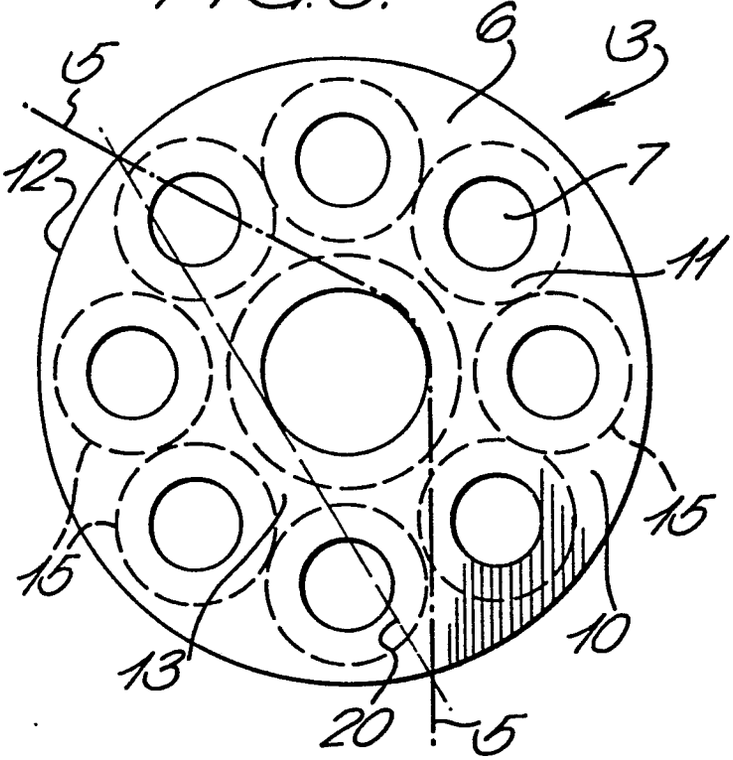

FIG.4.

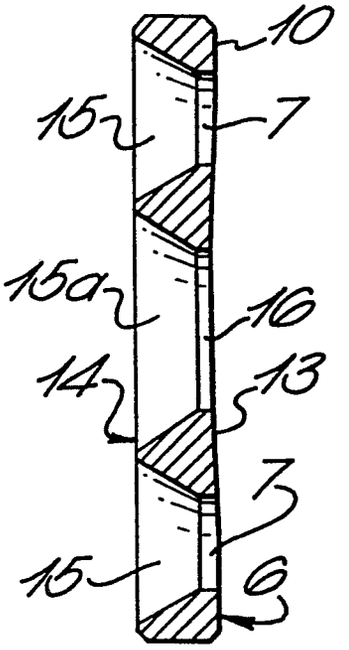

FIG.5.

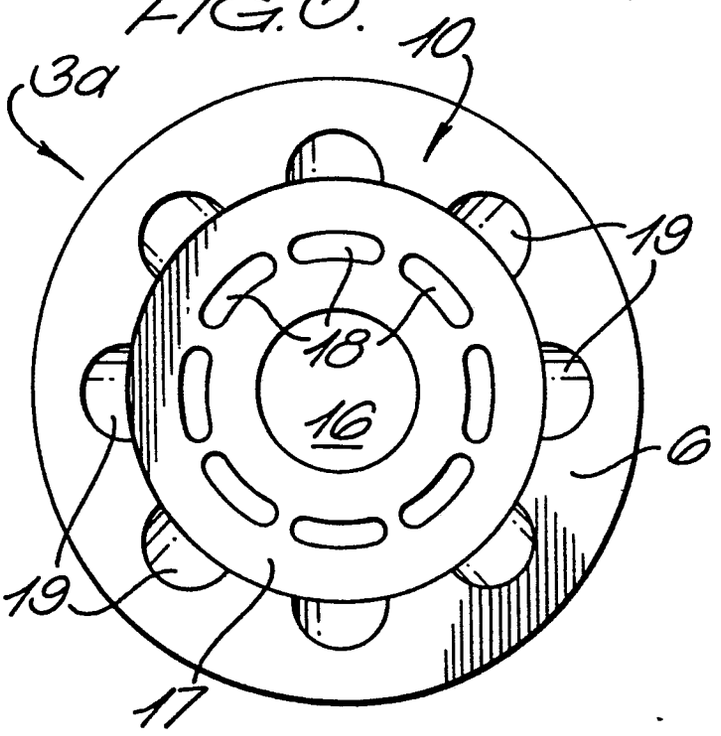

FIG.6.