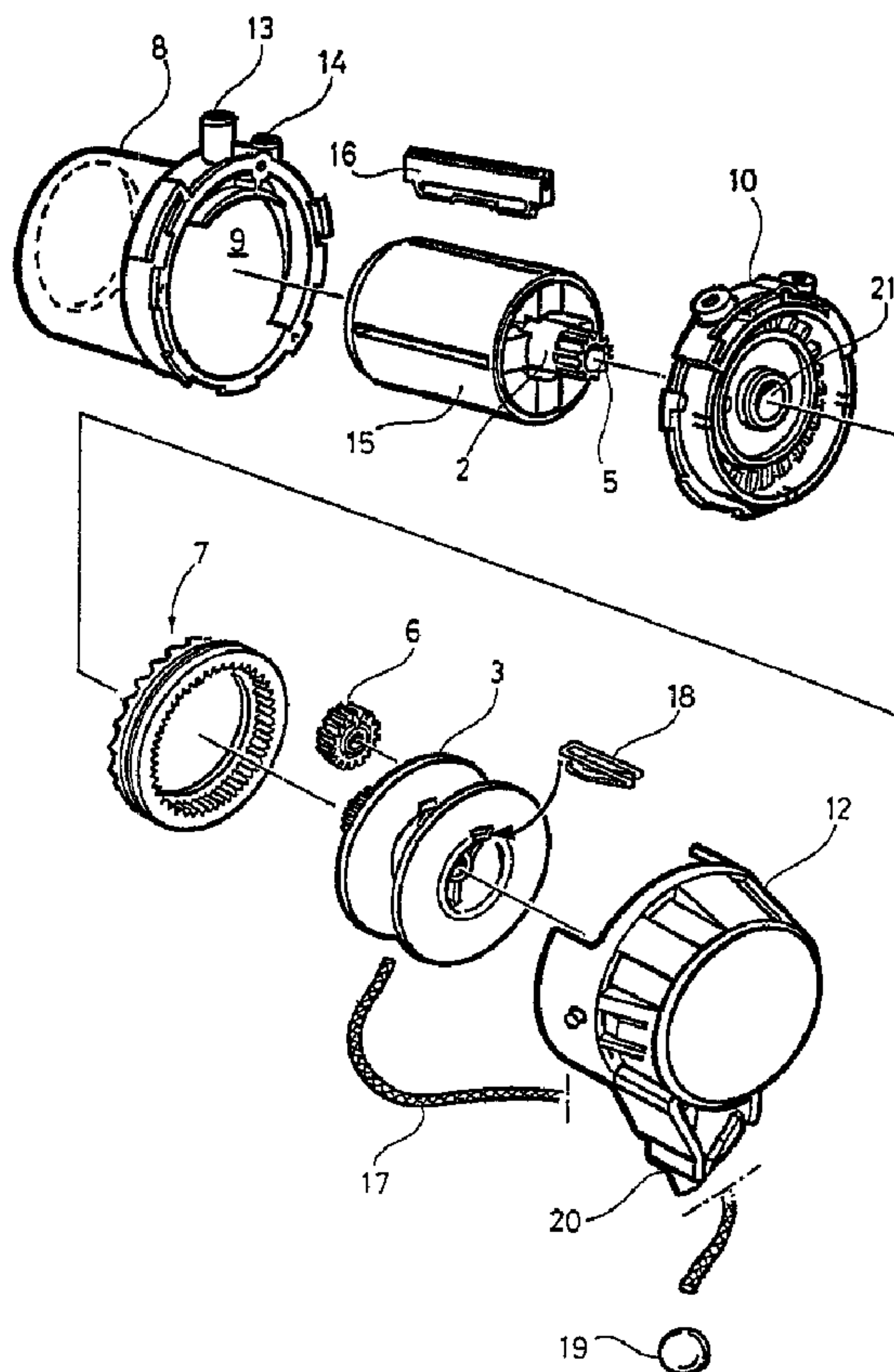




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(54) Titre : DISPOSITIF POUR L'ENLEVEMENT AUTOMATIQUE D'UNE TRAYEUSE  
 (54) Title: AUTOMATIC MILKING MEANS REMOVAL DEVICE



(57) **Abrégé/Abstract:**

A device for automatic removal of a milking means from an animal's udder, comprising a motor (1) and a removal means (3) rotatable by the motor. According to the invention a coupling device (K) is adapted to keep the removal means (3) operably connected to the motor and to keep the removal means disconnected from the motor, respectively.



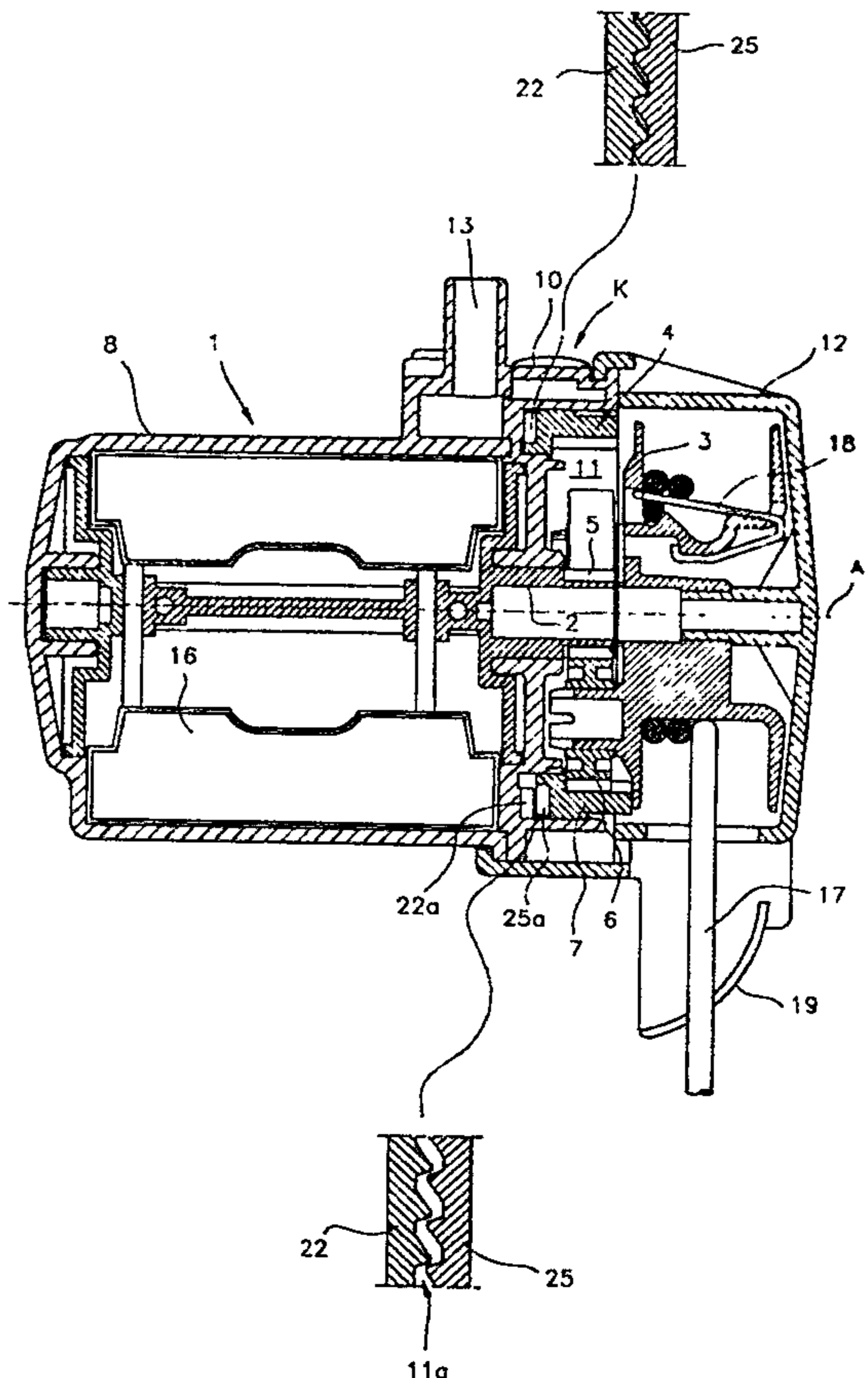
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(54) Title: AUTOMATIC MILKING MEANS REMOVAL DEVICE

(57) Abstract

A device for automatic removal of a milking means from an animal's udder, comprising a motor (1) and a removal means (3) rotatable by the motor. According to the invention a coupling device (K) is adapted to keep the removal means (3) operably connected to the motor and to keep the removal means disconnected from the motor, respectively.



Automatic milking means removal device5     **FIELD OF THE INVENTION**

The present invention relates to automatic milking machines and, in particular, to automatic milking machines equipped with an automatic mechanism for removing the milking  
10 machine from an animal's udder.

**THE TECHNOLOGICAL STATE OF THE ART**

A device for automatic removal of a milking means from an  
15 animal's udder, comprising a motor and a removal means rotatable by the motor in a first direction, the removal means being adapted to pull the milking means off the udder when the milking means is rotated by the motor in said first direction, and to admit movement of the milking means  
20 for its attachment to the udder when the removal means is rotated in an opposite, second direction is known.

Such a removal device, which is described in WO 93/00002, has great advantages, since it may be designed very  
25 compactly and low in weight. In the known removal device, the removal means comprises a cord drum with a cord adapted to be connected to the milking means. However, the known removal device has a drawback, since a mechanical resistance must be overcome each time the cord is to be  
30 pulled out from the cord drum to attach the milking means onto the teats of an animal. The reason for this resistance is the motor, which is connected to the cord drum during the operation thereof. When pulling out the cord from the cord drum, the resistance of the removal  
35 device is not particularly strong, but the operation must be repeated over and over, it may become strenuous for the milker.

**OBJECT OF THE INVENTION**

The object of the present invention is to achieve an  
5 automatic removal device of the above described kind, which  
overcomes the above described disadvantage of the said known  
removal device.

**SUMMARY OF THE INVENTION**

10

This object is achieved by a device, which is characterized  
by a coupling device adapted to keep the removal means  
operably connected to the motor when the removal means is  
rotated by the motor in said first direction and to release  
15 the removal means from the motor when the removal means is  
rotated in said second direction. Thus, the removal means  
can be rotated in said second direction without resistance  
from the motor when the motor is not in operation, whereby  
the milker can easily move the milking means for its  
20 attachment to the udder.

According to one aspect of the present invention there is  
provided a device for automatic removal of a milking means  
from an animal's udder, comprising: a motor; a removal means  
25 rotatable by the motor in a first direction, the removal  
means being adapted to pull the milking means off the udder  
when the removal means is rotated by the motor in said first  
direction, and to admit movement of the milking means for  
its attachment onto the udder when the removal means is  
30 rotated in an opposite, second direction; a coupling device  
adapted to keep the removal means operably connected to the  
motor when the removal means by means of the motor in said  
first direction and to keep the removal means disconnected  
from the motor when the removal means is rotated in said  
35 second direction; and means for influencing the coupling  
device such that the removal means is automatically  
connected to the motor when the latter is driven for

2a

rotating the removal means in said first direction, said  
influencing means comprising a source of positive or  
negative pressure adapted for pneumatic influence on the  
coupling device, wherein the motor is pneumatically operable  
5 for rotation of the removal means in said first direction  
and is connectible to said source, and in that the coupling  
device is adapted to operably connect the removal means to  
the motor, substantially simultaneously with the connection  
of the motor to said source.

10

According to a further aspect of the present invention there  
is provided a device for automatic removal of a milking  
means from an animal's udder, comprising: a motor;  
a removal means rotatable by the motor in a first direction,  
15 the removal means being adapted to pull the milking means  
off the udder when the removal means is rotated by the motor  
in said first direction, and to admit movement of the  
milking means for its attachment onto the udder when the  
removal means is rotated in an opposite, second direction; a  
20 coupling device adapted to keep the removal means operably  
connected to the motor when the removal means is rotated by  
means of the motor in said first direction and to keep the  
removal means disconnected from the motor when the removal  
means is rotated in said second direction; and means for  
25 influencing the coupling device such that the removal means  
is automatically connected to the motor when the latter is  
driven for rotating the removal means in said first  
direction, said influencing means comprising a source of  
positive or negative pressure adapted for pneumatic  
30 influence on the coupling device, wherein the motor is a  
rotary motor, and that said coupling device is  
interconnected between the motor and the removal means, said  
coupling device comprising a gear change device adapted to  
give the removal means a rotational speed which is lower  
35 than that of the motor.

2b

According to another aspect of the present invention there is provided a device for automatic removal of a milking means from an animal's udder, comprising: a motor; a removal means rotatable by a motor in a first direction, the removal means being adapted to pull the milking means off the udder when the removal means is rotated by the motor in said first direction, and to admit movement of the milking means for its attachment onto the udder when the removal means is rotated in an opposite, second direction, said device including a coupling device adapted to keep the removal means operably connected to the motor when the removal means is rotated by means of the motor in said first direction and to keep the removal means disconnected from the motor when the removal means is rotated in said second direction by means other than the motor.

Advantageously, there is a means provided for engaging the coupling device such that the removal means is automatically connected to the motor when the motor is driven for rotation of the removal means in said first direction, said means comprising a source of positive or negative pneumatic pressure.

Preferably, the motor is pneumatically operable for rotation of the removal means in said first direction and is connectible to said pneumatic source. The coupling device is preferably adapted to operably connect the removal means to the motor substantially simultaneously with the connection of the motor to said pneumatic source. This can suitably be achieved by pneumatically interconnecting the coupling device and the motor.

The motor may be a rotary motor, wherein the coupling device is interconnected between the motor and the removal means. In this case the coupling device suitably comprises a gear change device adapted to drive the removal means at a speed of rotation which is lower than that of the motor, whereby the motor can be compact and yet a desired torque can be achieved.

Advantageously, said source is a vacuum source, which enables use of existing vacuum system in the milking stall.

#### **DRAWING SUMMARY**

The invention will now be described in detail with reference to the accompanying drawings, in which

Figure 1A is a view of a longitudinal section through a removal device according to a preferred embodiment of the invention;

Figure 1B is an enlarged detail of a coupling portion of the removal device shown in Figure 1A in an engaged state;

Figure 1C shows the same detail as shown in Figure 1B, but with the coupling device in an unengaged state;

Figure 2 is an exploded view illustrating details of a motor, a gear change device, a housing for the gear change device, and a removal means of the removal device shown in Figure 1A;

Figure 3A shows a cross-sectional view of the interior of the housing illustrated in Figure 2;

Figure 3B shows an enlarged section taken along the line IIIB-IIIB of Figure 3A;

Figures 4A and 4B show views of the opposite sides of a gear change means of the gear change device illustrated in Figure 2;

5 Figure 4C shows an enlarged section taken along the line IVC-IVC in Figure 4B; and

10 Figure 5 shows an end view of a further gear change means of the gear change device mounted on the removal means shown in Figure 2.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION**

15 The removal device according to the invention shown in Figures 1A and 2 comprises a motor 1 with a drive shaft 2, which is connected to a removal means in the form of a cord drum 3 via a gear change device 4, for achieving required torque. This preferred embodiment of the gear change  
20 device 4 has planetary gearing enclosed in a housing, even though other gear change devices could be used.

The planetary gearing 4 comprises a first gear change means in the form of a sun wheel 5 connected to the drive shaft 2  
25 of the motor, a second gear change means in the form of three planet wheels 6 connected to the cord drum 3 and a third gear change means in the form of a crown wheel 7 adapted to be releasably engaged with the housing of the planetary gearing.

30 The motor 1 is equipped with a housing 8, which forms a cylindrical chamber 9. One end of the housing 8 of the motor is provided with a wall, which also forms one of the walls for the housing of the planetary gearing and, hence,  
35 constitutes an intermediate wall 10 between the chamber 9 of the motor and the chamber 11 of the planetary gearing 4.

The housing of the planetary gearing is formed by the intermediate wall 10 and a casing 12. The chamber 11 of the planetary gearing also houses the cord drum 3. The intermediate wall 10 and the crown wheel 7 delimit a sub-chamber 11a of the chamber 11 (see Figure 1C). The housing 8 of the motor 1 is provided with an inlet 13 and an outlet 14 for connection to a source of vacuum (not shown) for operation of the motor.

In the motor's chamber 9 is arranged a rotor 15 provided with vanes 16 radially movable in relation to an axis A through the rotor 15, which axis is coaxial with the motor's 1 driving shaft 2. The rotor is arranged eccentrically in the motor's chamber 9, so that the vanes 16 are forced to move in a radial direction during the rotor's 15 rotation. When connected to the vacuum source, there is a pressure difference in the motor's chamber 9. The pressure difference acts upon the vanes 16, which in turn force the rotor 15 to rotate.

A cord 17 is releasably connected at one end to the cord drum 3 by means of a connection means 18. The connection means 18 is arranged such that the cord 17 releases from the cord drum 3 if the cord is subjected to external pulling force that exceeds a preset limit after the cord is completely unwound from the cord drum 3, and is held in place only by the connection means 18. The cord 17 is connected at its other end to the milking means (not shown), as described in WO 93/00002.

The cord 17 is provided with a stop member in the form of a ball 19. The ball 19 prevents the milking means from hitting the removal means when the cord 17 is rewound. The casing 12 is provided with a catch means 20, through which the cord 17 freely runs, but which does not let the ball 19 through. In the motor's 1 rest position, which will be described in more detail below, the catch means 20 catches

the ball 19 and prevents the cord 17 from being unwound from the cord drum 3. In this way, the whole weight of the milking means can be taken up by the removal device via the catch means 20, when the motor 1 is in said rest position.

5

Figure 3A is a front view of the part of the intermediate wall 10, which forms an inner, axially directed wall of the housing 10, 12 of the planetary gearing 4. Centrally in the intermediate wall 10 an opening 21 is formed for reception of the motor's drive shaft 2 with the sun wheel 5 arranged thereon. The intermediate wall 10 is provided at its periphery with a ring 22 of an axially directed friction enhancing means, which ring 22 is coaxial with the opening 21 (see Figure 3B). The intermediate wall 10 is furthermore provided with two passages 23 for pneumatically connecting the sub-chamber 11a to the motor's 1 chamber 9. Alternatively, more or less than two passages can be provided in the intermediate wall 10.

20

Figure 4A shows the planetary gearing's 4 crown wheel 7 seen from a direction which faces away from the intermediate wall 10 and towards the cord drum 3. The crown wheel 7 is provided with a ring 24 with teeth directed radially inwards. Figure 4B shows the side of the planetary gearing's crown wheel 7, which faces the intermediate wall 10. On this side the crown wheel 7 is provided at its periphery with a ring 25 of an axially directed friction enhancing means, which ring is coaxial with the axis of the crown wheel 7 (see Figure 4C).

25

30

The friction enhancing means on the intermediate wall 10 and the crown wheel 7, respectively, are shown in the Figures 3A, 3B, 4B and 4C as teeth 22a, 25a having a form substantially similar to a saw tooth, i.e. with non uniformly inclined back rakes, 22b, 25b and 22c, 25c, respectively. The back rakes of each tooth form angles  $\alpha$  and  $\beta$ , respectively, with the base of the tooth,  $\alpha$  being

35

about  $20^\circ$  and  $\beta$  being about  $55^\circ$ . For reasons explained below these friction enhancing means do not need to consist of teeth 21a, 25a, but could be plain, substantially planar, friction surfaces or a mechanical coupling in the form of a pin or the like.

Figure 5 illustrates one end wall 26 of the cord drum 3, provided with three axes 27, each being provided with a planet wheel 6 with teeth. The planet wheels 6 fit between the crown wheel 7 and the sun wheel 5. Of course the teeth of the crown wheel 7 and the sun wheel 5 fit the teeth of the planet wheels 6.

#### FUNCTION

When milking is completed, which is sensed by a milk flow meter known, but not illustrated, the removal device receives a signal to start the motor 1 for winding the cord 17 onto the cord drum 3. The milking means, which is connected to the cord 17, is thereby pulled away from the teats of the animal.

When the signal is given that the motor 1 should start, the motor 1 is connected to a vacuum source, which is suitably the same as the one that operates the milking means. The negative pressure which is thereby created in the chamber 9 of the motor drives the motor 1 so that the motor shaft 5 rotates. The passages 23 in the intermediate wall 10 pneumatically connect the chamber 11 of the planetary gearing 4 to the motor's chamber 9, so that the planetary gearing's 4 chamber 11 and its sub-chamber 11a, is exposed to the vacuum. Consequently, the crown wheel 7, which is close to the intermediate wall 10 and in front of the passages 23, is sucked against the intermediate wall 10 and is retained there.

Accordingly, the crown wheel 7 of the planetary gearing 4 cooperates with the intermediate wall 10 as parts of a coupling device K (see Figure 1) between the motor 1 and the cord drum 3. It should be noted, though, that the crown wheel 7 need not necessarily be retained pneumatically. It could also be retained in a plain mechanical way by locking by means of pins or by a clamping means of any known kind. Alternatively, it could also be retained in an electromechanical way, for example by means of a magnet or a solenoid, which pushes or pulls the crown wheel 7 against the intermediate wall (see Figure B).

The engagement of the crown wheel 7 with the intermediate wall 10 is achieved by means of two different forces, namely a force acting axially relative to the crown wheel 7, which is achieved by means of the vacuum in the sub-chamber 11a, and a force acting in the circumferential direction of the crown wheel 7, which is achieved by means of the friction enhancing means. It is to be understood that the said engagement can be achieved by means of a friction engagement between plane friction surfaces. In such a case, the friction enhancing means may consist of plane friction coatings. However, it is desirable that different properties of engagement in different directions of rotation of the crown wheel 7 be achieved and for this reason the differently back raked teeth 22a, 25a are preferred. The reason for this is that the substantially axially directed back rakes 22b, 25b of the teeth on the crown wheel 7 and the intermediate wall 10 provide a relatively stable engagement of the teeth 22a, 25a in the winding direction, whereas the more sloping back rakes 22c, 25c provide extra protection against overload for the removal device, since they will without difficulty disconnect under a load opposite to the winding direction.

With the crown wheel 7 anchored on the intermediate wall 10, the sun wheel's 5 rotation of the planet wheels 6

results in rotation of the planet wheels along the crown wheel 7 and about the sun wheel 5, such that the cord drum 3 is turned. The cord drum 3 thus winds the upcord 17 so that the milking means is pulled off the animal's udder.

5 Before the cord is pulled in too far on the cord drum 3, it is stopped by the catch means 20, which catches the ball 19 arranged on the cord 17.

10 When the milker is to move the milking means and the removal device to the next animal to be milked, the milker releases the connection means from the vacuum source. This motor 1 therefore returns to the rest position described above and is no longer driven because there is no longer a negative pressure in the chamber 9 of the motor.

15 Furthermore, a vacuum is no longer transmitted through the passages 23 in the intermediate wall 10, which means that the crown wheel 7 is disengaged from the intermediate wall 10 (see Figure 1C).

20 When the crown wheel 7 is freely movable it can move with less friction than the motor 1 on which the sun wheel 5 is arranged, the planet wheels 6 engage the sun wheel 5 which only moves insignificantly or not at all. Accordingly, the cord drum 3 is now disengaged from the motor 1. The ball  
25 19 is still in the catch means 20, which prevents rotation of the disengaged cord drum 3.

30 When the next animal is to be milked, the milker first disengages the ball 19 from the catch means 20. Owing to the freely movable crown wheel 7 the milker can thereafter pull out the cord from the removal means without resistance from the motor 1 and the planetary gearing 4. The milking means which is now connected to the source of vacuum, will be attached to the animal's teats, where it remains until a  
35 signal is given that milking is finished.

The invention is not limited to the embodiment shown here. Hence, the crown wheel 7 may be arranged to be affected by a positive pressure instead of by vacuum. Nor is it necessary to use a pneumatic sliding vane motor. A  
5 pneumatic cylinder, an electrical motor or a spiral spring could also be used to achieve rotation of the cord drum for the winding of the cord.

10 Similarly anyone of the three said gear change means may comprise anyone of the said wheels, i.e. the sun wheel, the planet wheel or the crown wheel, may be permutably connected to the motor, the cord drum or the housing of the gear change device.

## Claims:

1. A device for automatic removal of a milking means from an animal's udder, comprising:

a motor;

a removal means rotatable by the motor in a first direction, the removal means being adapted to pull the milking means off the udder when the removal means is rotated by the motor in said first direction, and to admit movement of the milking means for its attachment onto the udder when the removal means is rotated in an opposite, second direction;

a coupling device adapted to keep the removal means operably connected to the motor when the removal means is rotated by means of the motor in said first direction and to keep the removal means disconnected from the motor when the removal means is rotated in said second direction; and

means for influencing the coupling device such that the removal means is automatically connected to the motor when the latter is driven for rotating the removal means in said first direction, said influencing means comprising a source of positive or negative pressure adapted for pneumatic influence on the coupling device,

wherein the motor is pneumatically operable for rotation of the removal means in said first direction and is connectible to said source, and in that the coupling device is adapted to operably connect the removal means to the motor, substantially simultaneously with the connection of the motor to said source.

2. A device according to claim 1, characterized in that the motor is a rotary motor, and that said coupling device is interconnected between the motor and the removal means, said coupling device comprising a gear change device adapted to give the removal means a rotational speed which is lower than that of the motor.

3. A device according to claim 1, characterized in that the coupling device and the motor are pneumatically connected to each other.

4. A device according to claim 3, characterized in that the motor is a rotary motor, and that said coupling device is interconnected between the motor and the removal means, said coupling device comprising a gear change device adapted to give the removal means a rotational speed which is lower than that of the motor.

5. A device for automatic removal of a milking means from an animal's udder, comprising:

a motor;

a removal means rotatable by the motor in a first direction, the removal means being adapted to pull the milking means off the udder when the removal means is rotated by the motor in said first direction, and to admit movement of the milking means for its attachment onto the udder when the removal means is rotated in an opposite, second direction;

a coupling device adapted to keep the removal means operably connected to the motor when the removal means is rotated by means of the motor in said first direction and to keep the removal means disconnected from the motor when the removal means is rotated in said second direction; and

means for influencing the coupling device such that the removal means is automatically connected to the motor when the latter is driven for rotating the removal means in said first direction, said influencing means comprising a source of positive or negative pressure adapted for pneumatic influence on the coupling device,

wherein the motor is a rotary motor, and that said coupling device is interconnected between the motor and the removal means, said coupling device comprising a gear change

device adapted to give the removal means a rotational speed which is lower than that of the motor.

6. A device according to claim 5, characterized in that the gear change device is a planetary gearing, which comprises a first, a second and a third gear change means.

7. A device according to claim 6, characterized in that the first gear change means is connected to the motor, that the second gear change means is connected to the removal means and that the third gear change means is movable between a first position, in which it is adapted to be kept non-rotatable, such that the motor is operably connected to the removal means, and in a second position, in which it is adapted to be entrained into rotation by one of the other gear change means, such that the motor is disconnected from the removal means.

8. A device according to claim 7, characterized in that the gear change means comprise a sun wheel, at least one planet wheel and a crown wheel, said sun wheel, planet wheel and crown wheel having parallel axes of rotation, and that the planetary gearing is arranged in a housing, the crown wheel constituting said third gear change means and is axially movable to and from engagement with the housing.

9. A device according to claim 8, characterized in that the housing of the planetary gearing has at least one passage for connection to said source of positive or negative pressure.

10. A device according to claim 9, characterized in that said source is a source of negative pressure and that the housing of the planetary gearing has a wall designed for cooperation with the crown wheel, the crown wheel being adapted to be moved by a negative pressure generated by the

source of negative pressure to an engagement with said wall such that the crown wheel is prevented from rotating relative to said housing.

11. A device according to claim 10, characterized in that the motor is a pneumatically operable sliding vane motor comprising a housing forming a cylindrical chamber, a rotor eccentrically arranged in the chamber, and at least a pair of vanes arranged radially movable in the rotor.

12. A device for automatic removal of a milking means from an animal's udder, comprising:

a motor;

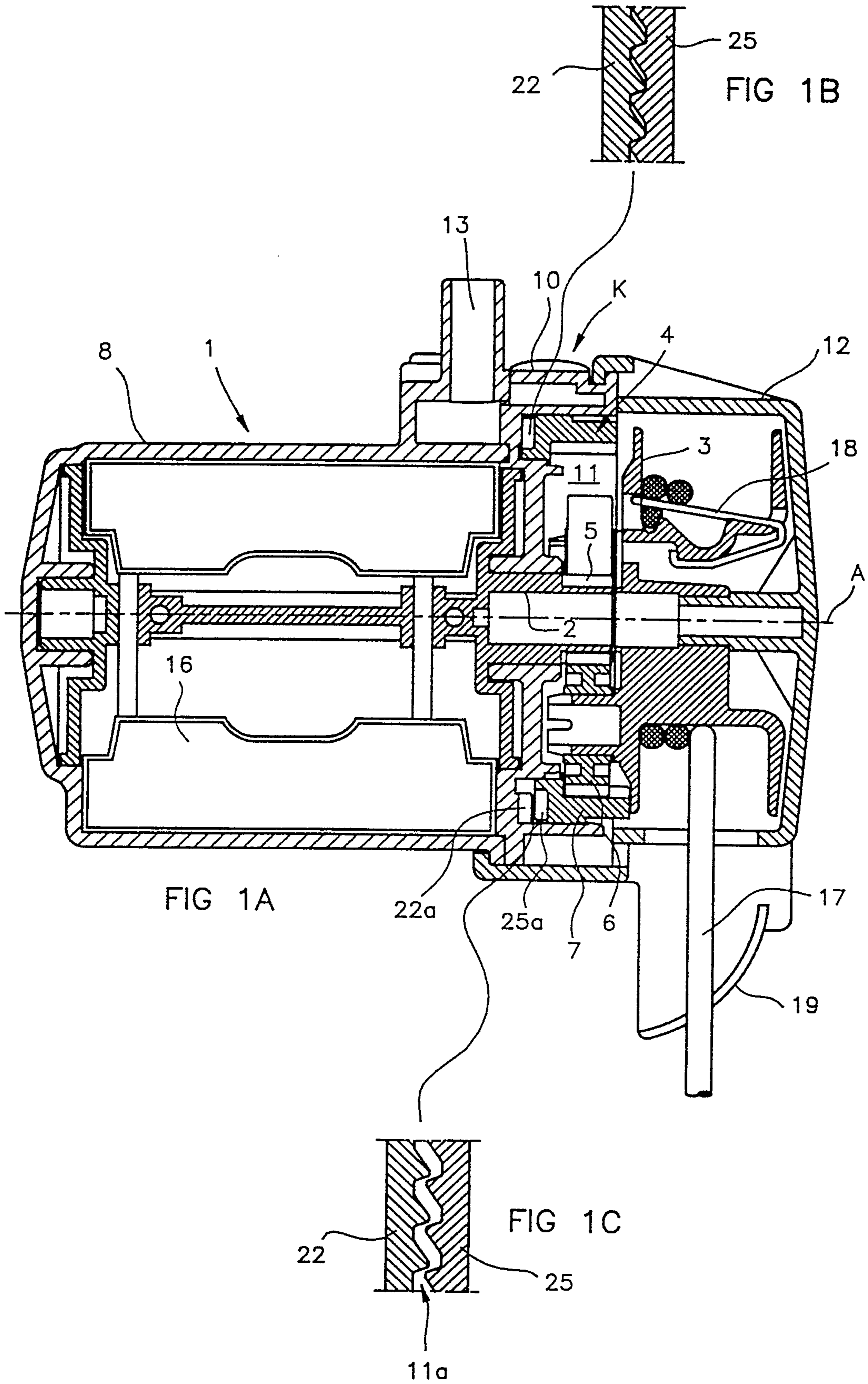
a removal means rotatable by a motor in a first direction, the removal means being adapted to pull the milking means off the udder when the removal means is rotated by the motor in said first direction, and to admit movement of the milking means for its attachment onto the udder when the removal means is rotated in an opposite, second direction,

said device including a coupling device adapted to keep the removal means operably connected to the motor when the removal means is rotated by means of the motor in said first direction and to keep the removal means disconnected from the motor when the removal means is rotated in said second direction by means other than the motor.

13. A device according to claim 12, including means for influencing the coupling device such that the removal means is automatically connected to the motor when the latter is driven for rotating the removal means in said first direction.

14. A device according to claim 13, wherein said influencing means comprises a source of positive or negative pressure adapted for pneumatic influence on the coupling device.

15. A device according to claim 12, wherein the motor is a pneumatically operable sliding vane motor comprising a housing forming a cylindrical chamber, a rotor eccentrically arranged in the chamber, and at least a pair of vanes arranged radially movable in the rotor.



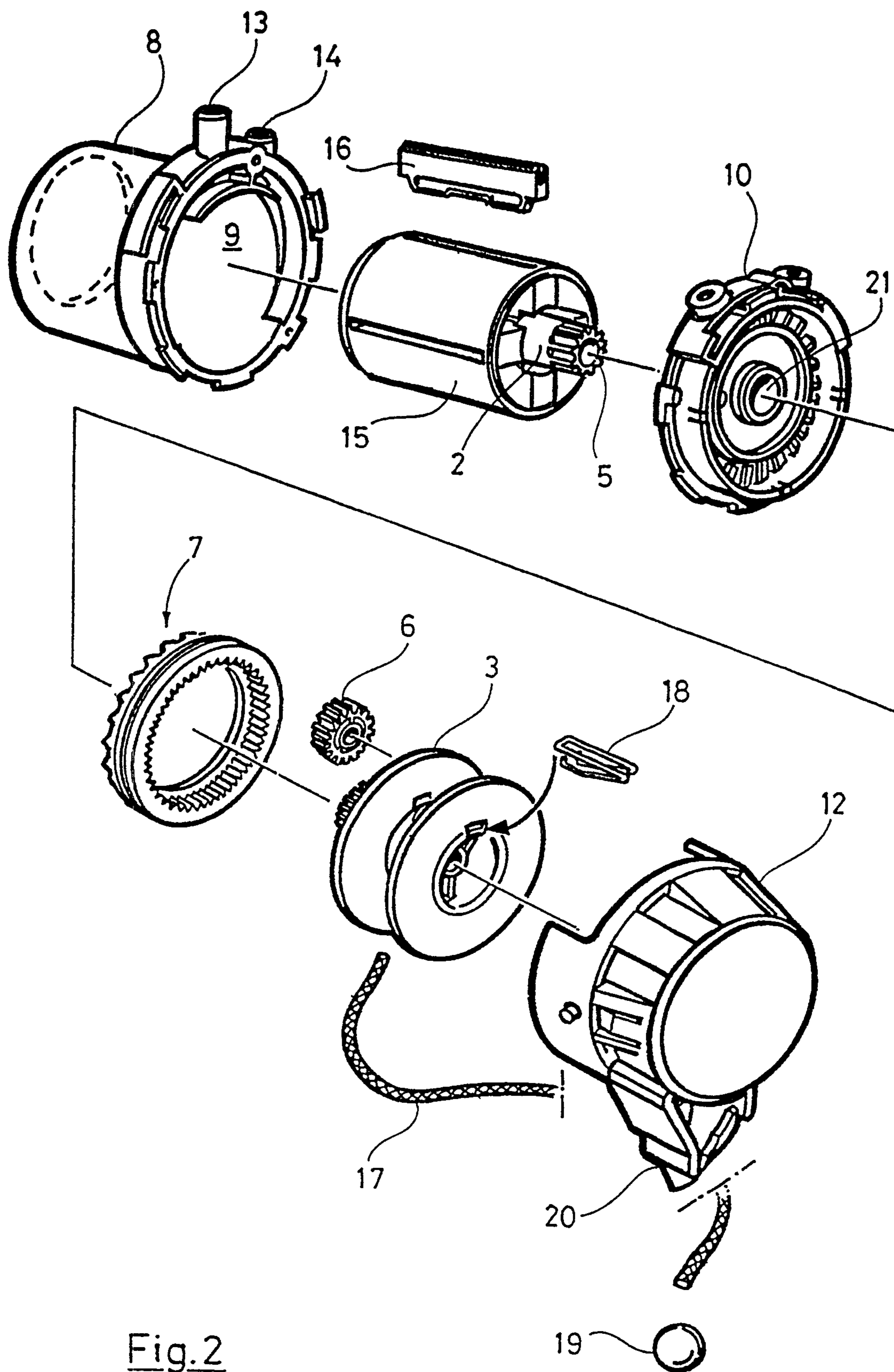


Fig.2

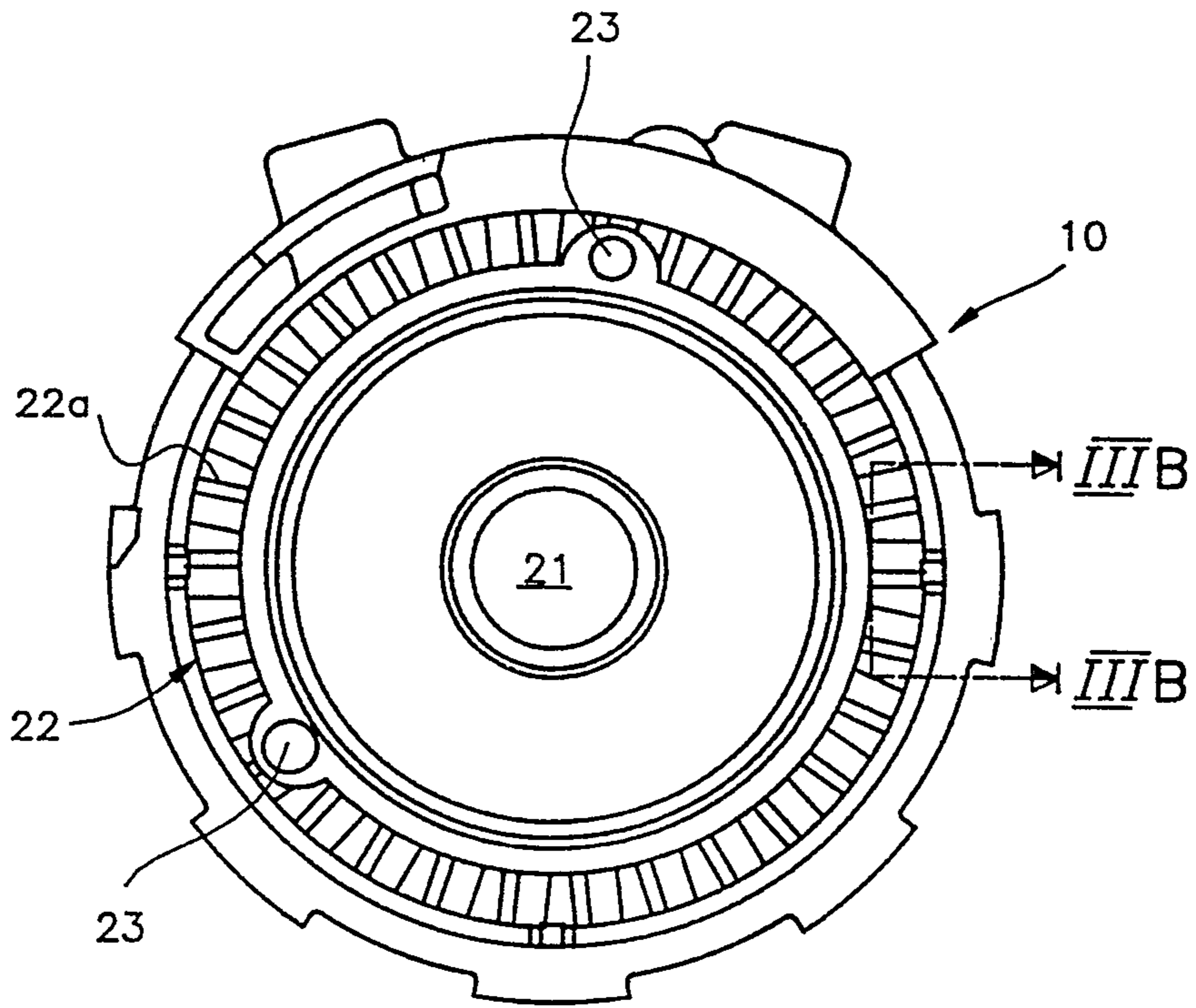


FIG 3A

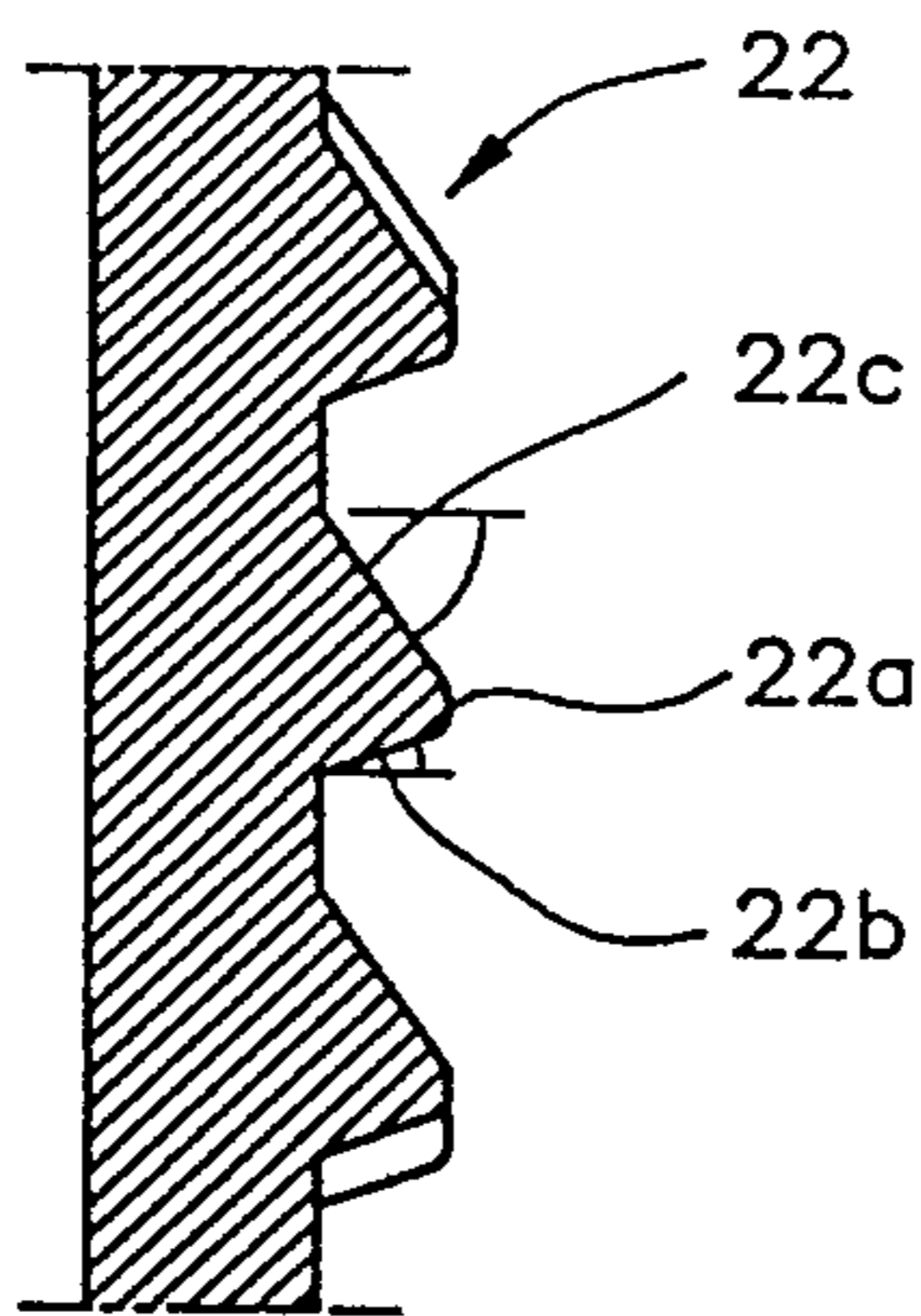


FIG 3B

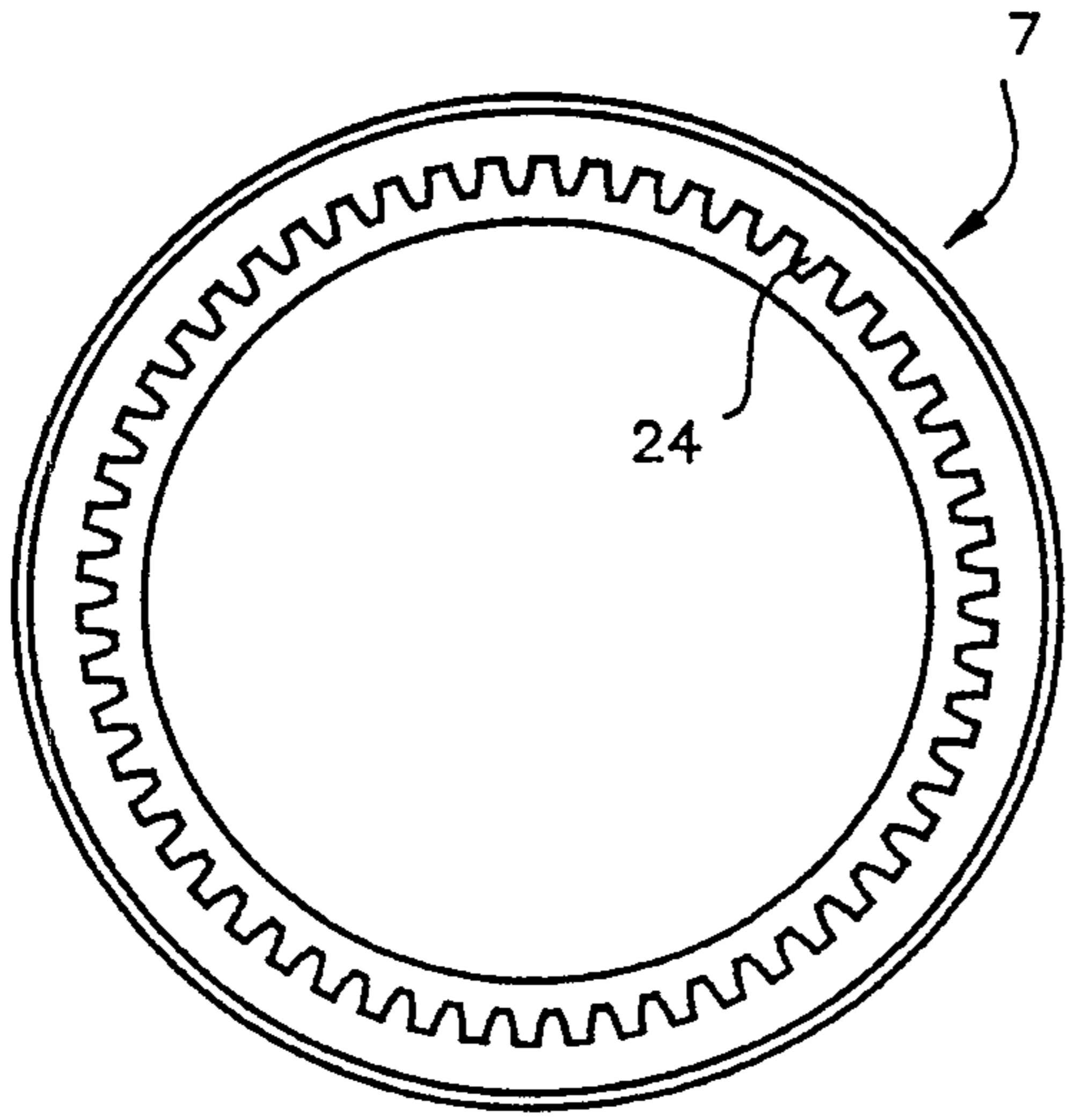


FIG 4A

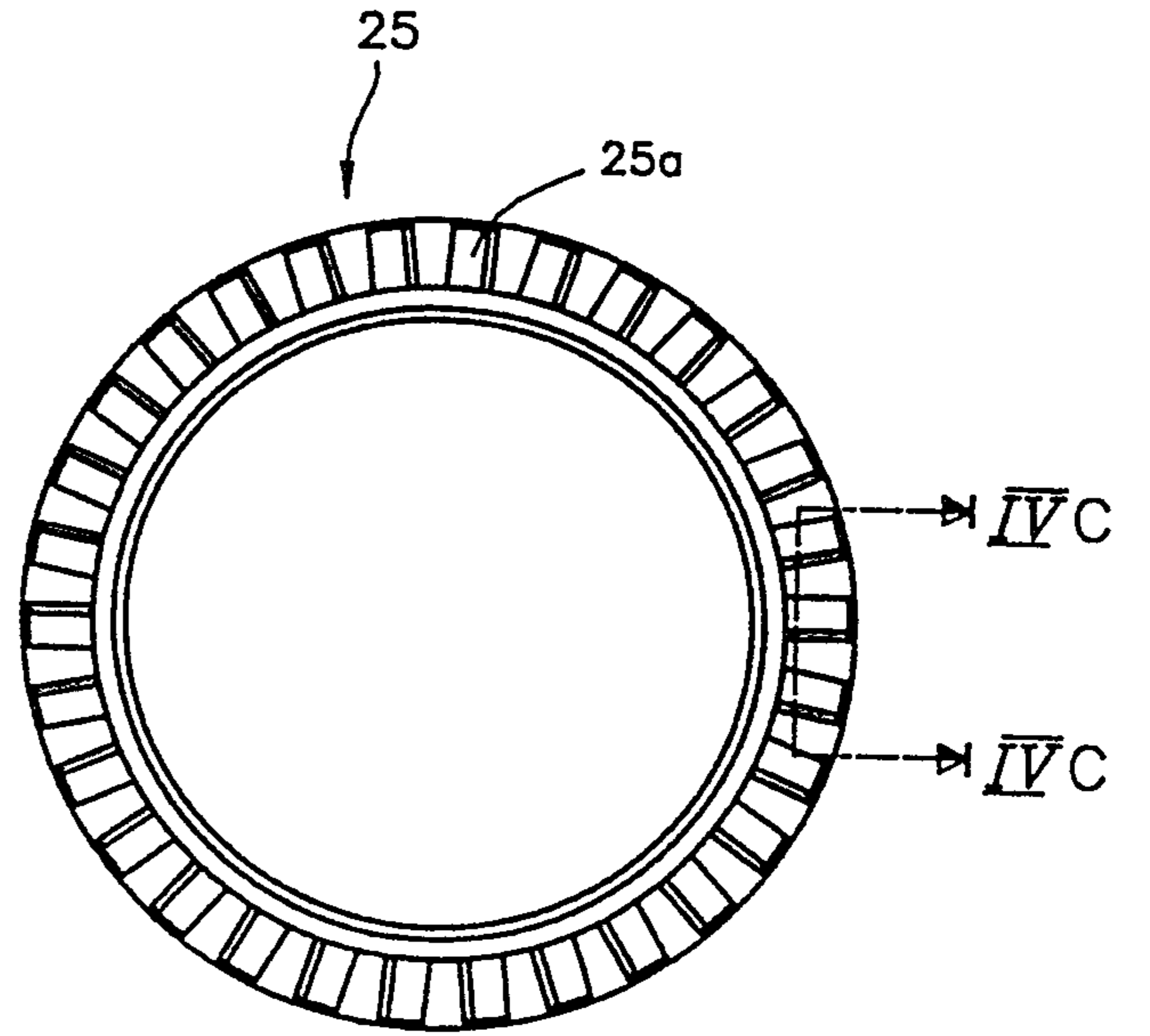


FIG 4B

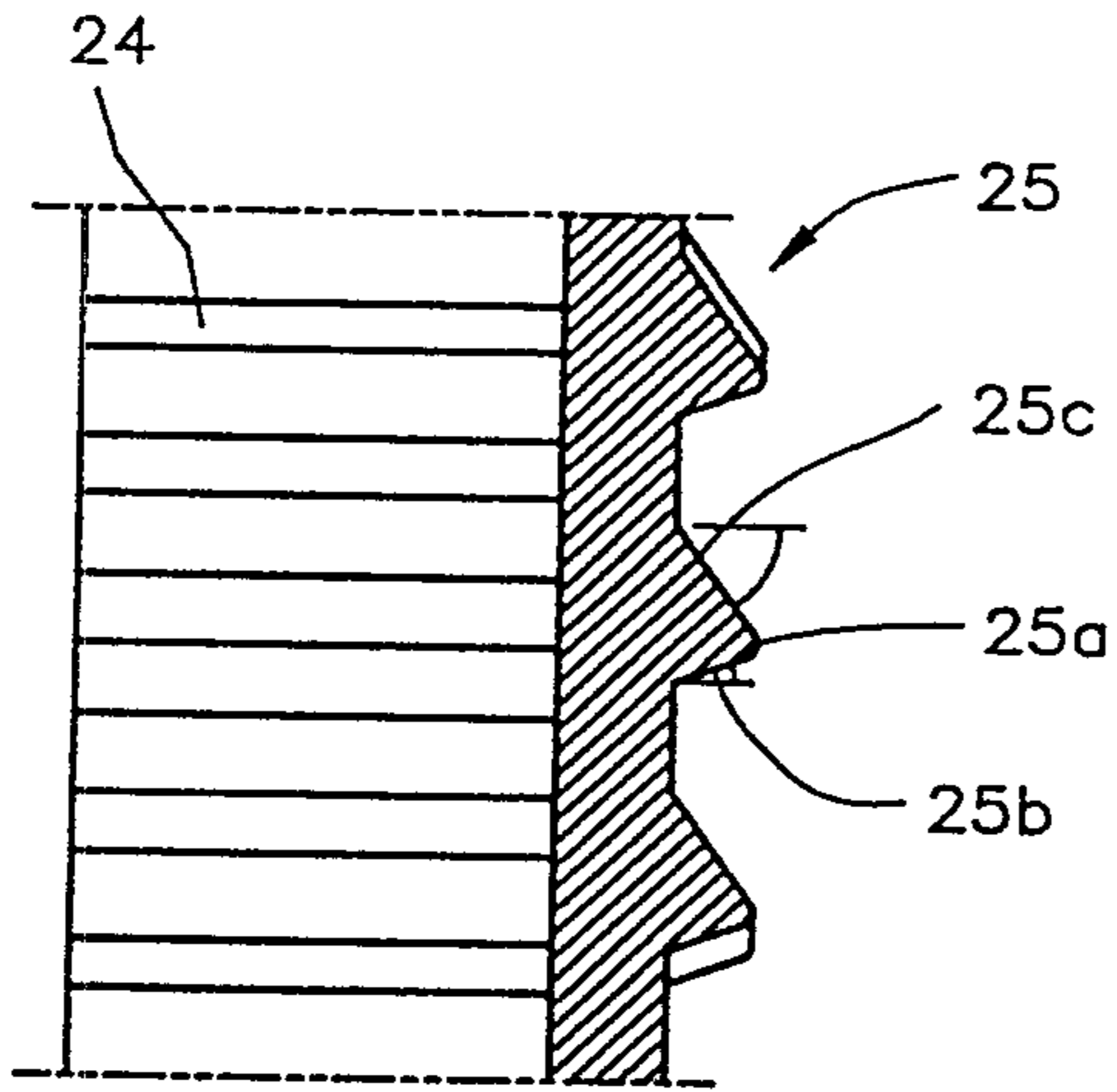


FIG 4C

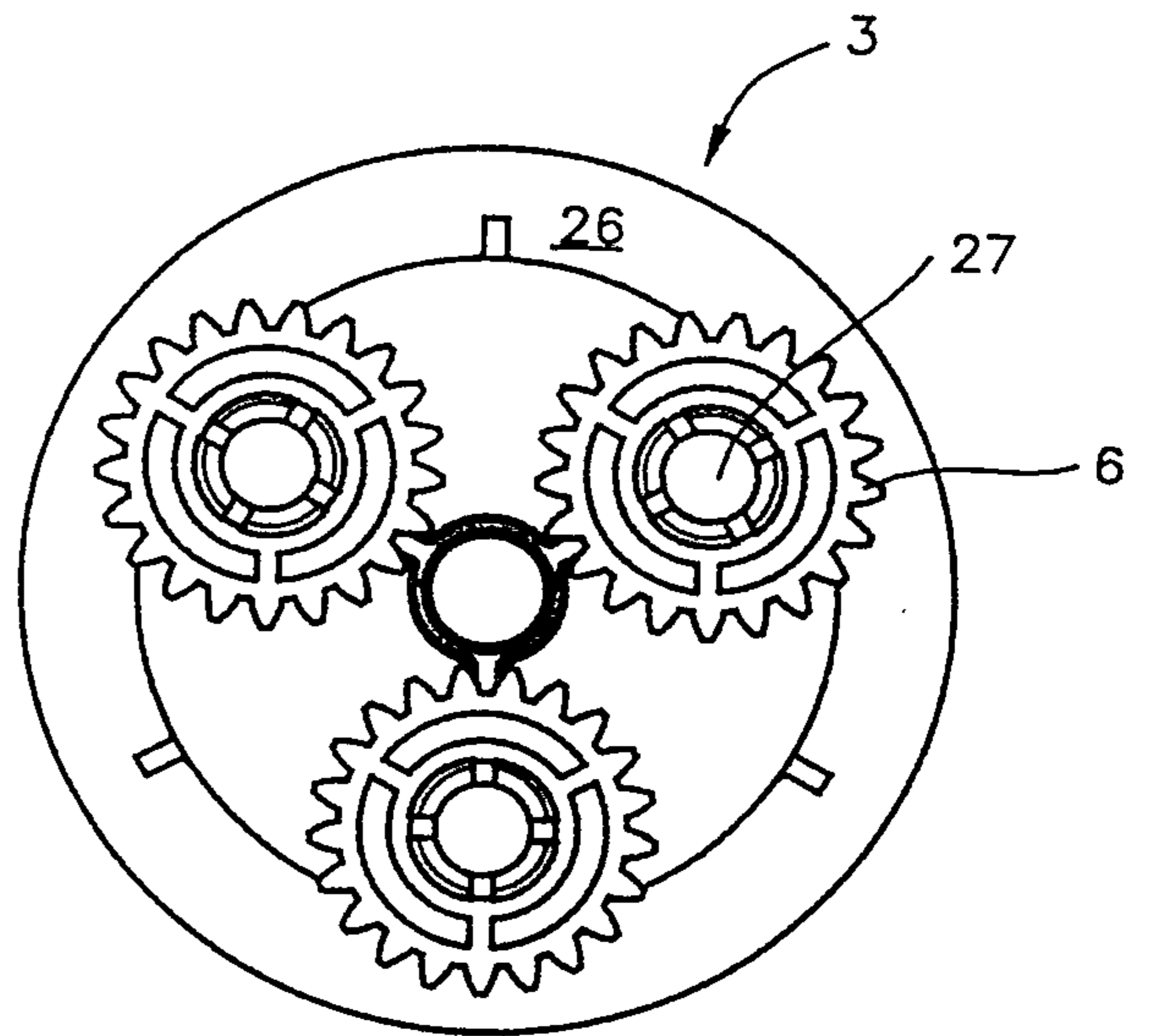


FIG 5

