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**US-A1- 2002 170 476**



## SINGULATOR, SEED METER AND SINGLE GRAIN SEEDER

**Description**

5 The invention relates to a sowing heart, a wiping device and a single-grain sowing machine according to the co-ordinated claims. Known sowing hearts for pneumatic single-grain sowing assemblies consist as a rule of two halves, namely a rear part, in which the bearings for the sowing disc and the negative pressure area are housed, and a front part into which the lower outlet of the seed container opens  
10 and which itself has a seed store.

The printed specification FR A 29 71 391 discloses a sowing heart for a single-grain sowing machine.

15 Individual seed grains from a seed store are received in sowing holes of the sowing disc which are adapted to the size of the seeds and are arranged at specific intervals as a series of sowing holes around a circular ring, and the individual seed grains are dispensed in a dispensing area through a break in the negative pressure. If the break in the negative pressure is not sufficient for dispensing then an  
20 automatic wiper is provided at a short distance behind the ideal dispensing site. Several sowing hole series can be arranged per sowing disc on mutually spaced circular rings of the sowing disc.

In order where possible to dispense only one seed grain per each discharge, singulating devices are provided for each row of sowing holes. These operate relatively  
25 reliably in the case of simple seeds, but are stretched to the limit in the case of difficult seed material, by way of example carrot seeds.

The object of the present invention is therefore to provide a wiping device and a  
30 sowing heart with a wiping device as well as a corresponding single-grain sowing machine, with which a reliable singulating of the seed material is possible, even with complicated seed material.

This is achieved with a sowing heart, a wiping device and also a single-grain sowing machine according to the subjects of the co-ordinated claims. Advantageous  
35 further developments of the invention are provided in the dependent claims.

The core idea of the present invention is to provide a wiping device having at least two wiping elements for wiping off excess seeds at the sowing holes, these wiping elements being adjustable relative to one another and fixable against one another. During operation of the sowing heart through rotation of the sowing disc the wiping elements wipe along the sowing holes arranged on the sowing hole series. The wiping elements are thus to be arranged so that only excess seed material is removed from each sowing hole whilst one seed grain remains per sowing hole. Since the wiping elements are displaceable relative to one another but at the same time can be fixed against one another or relative to one another, an optimum adjustment of the two wiping elements opposite the sowing hole series of the sowing disc is possible.

By the term seed material what is meant within the scope of the present disclosure by way of example is fertilizers and seed grains, whether pelleted or uncoated.

According to an advantageous embodiment of the invention it is proposed that the wiping elements are designed to be adjustable with respect to one another, in particular exclusively in the radial direction of the sowing discs parallel to the sowing disc. Adjusting the wiping elements is hereby considerably simplified since the degrees of freedom for the displacement of the wiping elements are restricted to the radial direction relative to the sowing disc. The adjustment or displacement within the radial direction is decisive for the optimum singulating of the seeds at the sowing holes.

The function of the wiping elements is furthermore improved when they are spring-loaded, in particular together, in an orthogonal direction relative to the sowing disc. This prevents flat seeds from getting underneath the wiping elements or prevents the function of the wiping elements from no longer being guaranteed if the wiping elements wear down. A long-term operation of the wiping elements and thus the sowing heart is possible with greater maintenance intervals.

In a further development of the sowing heart according to the invention it is proposed that the wiping elements are designed to be displaceable with respect to one another by a conversion of a rotational motion of an adjustment device into a translational motion of the wiping elements in the radial direction. The displacement can be automated in this way, in particular by an electric motor.

According to the invention it is advantageous in this context if a control circuit is provided for the displacement of the wiping elements, in particular in the radial direction and/or with regard to the contact pressure against the sowing disc. As a control parameter, the signal of an evaluation/detection of the sowing holes, preferably a video monitoring is used in particular. The video monitoring is in particular carried out by a monitoring unit integrated in the sowing heart so that the monitoring of the seed discharge can be carried out directly at the member responsible for the singulating, namely the sowing heart. A further aspect of the present invention is to provide commercially viable, rapid-response space-saving monitoring through a line-scan camera, in particular through a purely contrast measurement. It is particularly advantageous with the present invention that the monitoring can take place only from one side of the sowing disc, namely in particular by reflection measurement. In other words: electromagnetic waves directed from a radiation source to the sowing disc are reflected by the sowing disc and are detected after reflection by the line-scan camera, namely in the region in which the seeds are supplied on the sowing disc. The line-scan camera is focussed correspondingly to the reflection surface of the sowing disc and the impulses generated by the line-scan camera are evaluated by an evaluating unit wherein clearly different impulses are obtained at the sowing holes, depending on whether there is no grain, or there are one or two grains adhering to the sowing hole. Thus the occupancy of each sowing hole can be evaluated immediately after detection, thus in-line, and serve as a control parameter for the control circuit for displacing the wiping elements.

According to a further advantageous embodiment of the invention it is proposed that

- the first wiping element has a first holding plate and a first wiper attached, more particularly removably, to the first holding plate, and
- the second wiping element has a second holding plate and a second wiper attached, more particularly removably, to the second holding plate.

Thus the wiping elements can be integrated in an optimum space-saving manner in a work chamber of the sowing heart, despite the expanded functionality of the wiping elements.

It is then particularly advantageous if the second holding plate is designed to pass through the first holding plate.

The wiping elements are further designed according to the invention whereby the second holding plate, in particular with an outside contour of the second holding plate at an inside contour of the first holding plate, is guided to slide along the first holding plate in the radial direction of the sowing disc. Thus it is possible to dispense with expensive mechanics so that the manufacture of the wiping device is simple and a long-term operation can be guaranteed without the need for maintenance of the wiping device.

Since the first holding plate and/or the second holding plate have on the reverse sides facing away from the wipers spring elements for spring-loading the first wiping element and/or the second wiping element, the advantages of the spring tension described above can be incorporated in the sowing heart in a simple space-saving manner.

In a further advantageous embodiment of the invention it is proposed that the first holding plate has a first actuator intake for receiving a first actuator of the adjustment device and the second holding plate has a second actuator intake for receiving a second actuator of the adjustment device. The actuators can preferably be designed as pins which engage in corresponding recesses in the holding plates, in particular designed as an elongated hole.

It is then particularly advantageous if the first actuator and/or the second actuator are arranged, in particular controlled separately, eccentrically rotatable on the adjustment device. The adjustment is thus carried out by simple mechanical means, which are maintenance-free and can be controlled with precision.

In a further development of the wiping elements it is proposed that the first wiper has a first runner and is connected to the first holding plate by at least two arms which are separated from one another and/or the second wiper has a second runner and is connected to the second holding plate by at least two arms which are separated from one another. According to the invention it is also conceivable that one of the two wipers is connected to only one arm, more particularly the wiper which is attached to the second holding plate, where the latter is formed to pass through the first holding plate.

It is particularly advantageous here for the function of the wiping device if the first runner and/or the second runner, in particular in the opposite direction, are prestressed relative to a plane defined by the sowing disc and/or each have a, in par-

5 ticular running in the opposite direction, curvature. The contact pressure of the wipers, generated by the curvature or pretension, particularly at a front edge arranged opposite the direction of rotation of the sowing disc, minimizes the problem that the seed material passes underneath and jams beneath the wipers which can lead to a faulty operation.

It is particularly advantageous if the curvature is uniform along the runners.

10 A wiping device as well as a single-grain sowing machine are disclosed as independent inventions wherein the features of the sowing heart and/or features of the wiping device and/or features of the single-grain sowing machine are each to be regarded as transferrable to the other invention.

15 Further advantages, features and individual details of the invention are apparent from the following description of preferred exemplary embodiments and from the drawings. In the drawings:

20 Figures 1a and 1b show perspective views of a single-grain sowing assembly of a single-grain sowing machine according to the invention, inclined from the rear (Figure 1a) and inclined from the front (Figure 1b);

25 Figures 2a and 2b show perspective views of one half of a sowing heart according to the invention;

Figures 3a and 3b show perspective views of a wiping device according to the invention, inclined from the front (Figure 3a) and inclined from the rear (Figure 3b);

30 Figures 4a and 4b show perspective views of the wiping device according to Figures 3a and 3b; and

35 Figures 5a and 5b show perspective views of the function of the wiping element according to the invention.

In the figures the same components and components having the same function are marked by the same reference numerals.

Figures 1a and 1b show a sowing assembly 1 of a single-grain sowing machine according to the invention which is fixed by an arm 2 to the frame of the single-grain sowing machine. The driving direction during operation of the single-grain sowing machine is correspondingly in the direction indicated by the arrow F.

5

A sowing heart 3, a tank 4 arranged above the sowing heart 3, a sowing coulter 5 arranged underneath the sowing heart 3, as well as two wheels 6 arranged in front of and behind the sowing heart 3 in the driving direction F and capable of pivoting relative to the sowing heart 3, are attached on the arm 2 which permits a pivotal movement, preferably as a vertical movement, through the formation of the arm 2 as a parallelogram arm.

10

The tank 4 can be closed by a cover 4d and can be filled with seed material which in turn is guided sideways into the sowing heart 3 via a channel 4k.

15

The seed material is singulated in the sowing heart 3 and is deposited via the sowing coulter 5 into a furrow in the ground opened up by a share tip 7 of the sowing coulter 5.

20

Figures 2a and 2b show the interior of a half 3h of the sowing heart 3 to be seen in Figure 1a, whilst the interior of the corresponding half 3v (see Figure 1b) is not shown. A work chamber 8 enclosed by the two halves 3h and 3v is divided by a sowing disc 40 into a pressure chamber and a seed chamber.

25

The pressure chamber is divided by a sealing ring into a negative pressure area and a normal pressure area. It is essential here that in the negative pressure area a pressure difference is formed at the sowing holes 41 of the sowing disc 40 which serve to receive and dispense the seeds, and in the normal pressure area this pressure difference is released whereby the seed is dispensed during transition of the sowing holes 41 from the negative pressure area into the normal pressure area and through the rotational movement of the sowing disc 40 in a rotational direction R of the sowing disc 40.

30

The negative pressure area is charged with negative pressure by a pump (not shown) or a negative pressure blower.

35

The sowing holes 41 are arranged spread out at defined intervals around the periphery of the sowing disc 40 on two, in particular parallel running, sowing hole series 42, 43 in concentric circles of the sowing disc 40.

5 The component which is decisive for the present invention, namely a wiping device 10, is arranged in the work chamber 8 in the rotational direction R behind an inlet 9 of the channel 4k. At this point the sowing holes 41 are already provided with seeds through the negative pressure adjoining the sowing disc 40. The wiping device 10 serves to singulate the sowing holes 41 which are provided with seed  
10 grains, so that in the ideal case just one seed grain adheres to each sowing hole 41.

The wiping device 10 has two mutually displaceable wiping elements 11, 12. The first wiping element 11 consists of a first holding plate 13 which is fixed by way of  
15 fixing means 24 on the half 3h of the sowing heart 3 with two degrees of freedom. One degree of freedom is in the radial direction of the sowing disc 40 and the second is in the axial direction of the sowing disc 40, thus orthogonally to the sowing disc 40. The degree of freedom in the axial direction is preferably restricted by spring means.

20 The first holding plate 13 and thus the first wiping element 11 have no degree of freedom in the rotational direction of the sowing disc 40. The degree of freedom in the radial direction is in particular restricted in that the fixing means are formed as screws along the shaft of which the first wiping element 11 is guided in elongated  
25 holes 25 corresponding to the fixing means 24. The elongated holes 25 are arranged in alignment with one another, in particular on an upper and lower end of the first holding plate 13.

The first wiping element 11 has on its side facing the sowing disc 40, an, in particular  
30 runner-shaped, first wiper 15. This is preferably formed from a first runner 17 which can be clipped on the first holding plate 13 via two arms 19, 20 (see Figures 5a and 5b).

The arms 19, 20 are arranged on the two opposite ends of the first runner 17, in  
35 the direction of rotation R, wherein the first runner 17 preferably has a pretension through the convex curvature of the first runner 17, relative to the sowing disc 40. The pretension and curvature can be provided by the arrangement of the arms 19,

20, which more particularly can be clipped on the holding plate 13, and/or by corresponding shaping of the first runner 17.

5 The first wiper element 11 furthermore has a receiving opening 27, in particular arranged between the elongated holes 25, for receiving, guiding and fixing the second wiper element 12. The receiving opening 27 is formed as a substantially rectangular inner contour with two opposing guide faces 28 parallel to the radial direction of the sowing disc 40.

10 The second wiping element 12 consists of a second holding plate 14 on which a second wiper 16 is attached, in particular clipped on. The second wiper 16 has in particular a second runner 18 which is attached to the second holding plate 14 by arms 21, 22. The second runner 18 runs substantially parallel to the first runner 17. As opposed to the first wiper 15, the second wiper 16 is arranged in particular  
15 in a centre third of the second runner 18, thus at a distance from the two opposite ends in the rotational direction of the sowing disc 40. In particular the second wiper 16 has a pretension and/or curvature, preferably convex in the direction of the sowing disc 40.

20 The second wiping element 12 has two elongated holes 26, corresponding in particular to the elongated holes 25 of the first wiping element 11 and preferably arranged on the fixing means 24 for fixing on the half 3h of the sowing heart 3, and interacting therewith.

25 The second holding plate 14 has between the elongated holes 26 a shaping 29 with parallel side walls 30 corresponding to the receiving opening 27. The side walls 30 act as slide faces for guiding the second wiping element 12 along the guide faces 28 of the first wiping element 11.

30 The second wiping element 12 also has correspondingly two degrees of freedom analogous with the degrees of freedom of the first wiping element 11.

The first wiper 15 is attachable or attached, in particular can be or is clipped, removably by first fixing means to the first holding plate 13 and the second wiper 16  
35 is attachable or attached, in particular can be or is clipped, removably by second fixing means to the second holding plate 14.

The fixing means each consist on the wiper side of mutually parallel opposing arms 44, 45 and each on the holding plate side of in particular rounded, preferably circular cylindrical shaped, fixing profiles 46 which can be engaged by the arms 44, 45. More particularly the fixing means have on the holding plate side a recess 47  
5 which receives the fixing profiles 46 and restricts the arms 44, 45 parallel to the holding plate 13,14. This recess 47 serves to restrict the degrees of freedom of the connection between the wipers 15, 16 and the holding plates 13, 14 to a degree of freedom orthogonal in respect of each holding plate 13, 14 and the sowing disc 40. The fixing profiles 46 are in particular formed rotationally symmetrical,  
10 preferably with an axis of rotation which is or can be aligned radially relative to the sowing disc 40. Figure 4b shows that the first wiping element 11 and the second wiping element 12 are spring-tensioned on their sides facing away from the sowing disc 40 towards the sowing disc. As spring means, cylindrical pins 31 can be used in particular protruding orthogonally on the first holding plate 13 and the  
15 second holding plate 14, with coil springs 32 which can be fitted thereon. The coil springs 32 are supported in the installed position preferably on an inner wall of the half 3h of the sowing heart 3.

For adjusting the first wiping element 11 and second wiping element 12 by means  
20 of the adjustment device 23 the first wiping element 11 has an, in particular arcuate, elongated hole 33 in which a first actuator, formed in particular as a rotatable actuating pin 36, can engage eccentrically about an actuating axis 35 of the adjustment device 23.

25 Likewise, the second wiping element has an, in particular bent, elongated hole 34 for receiving a second actuator of the adjustment device 23 formed in particular as a rotatable actuating pin 37, rotating about the actuating axis 35.

Through the rotation of the actuating pins 36, 37 arranged eccentrically about the  
30 actuating axis 35, the wiping elements 11, 12 are movable and thus adjustable relative to one another through the restriction of their degrees of freedom in the radial direction, insofar as the actuating pins 36, 37 can be controlled separately from the actuating device 26. The adjustment can also take place manually and can be fixed in the desired position.

35 The positioning of the wiping elements 11, 12 takes place here so that wiping edges 38, 39, in particular having an undulating form, of the runners 17, 18 dur-

ing rotation of the sowing disc 40 pass the sowing holes 41 so that seeds adhering to the sowing holes 41 are singulated.

## SINGULATOR, SEED METER AND SINGLE GRAIN SEEDER

## Reference numeral list

5	1	Sowing assembly
	2	Arm
	3	Sowing heart
	3v	Half
	3h	Half
10	4	Tank
	4d	Cover
	4k	Channel
	5	Sowing coulter
	6	Wheels
15	7	Coulter tip
	8	Work chamber
	9	Intake
	10	Wiping device
	11	First wiping element
20	12	Second wiping element
	13	First holding plate
	14	Second holding plate
	15	First wiper
	16	Second wiper
25	17	First runner
	18	Second runner
	19,20	Arms
	21,22	Arms
	23	Adjustment device
30	24	Fixing means
	25	Elongated holes
	26	Elongated holes
	27	Receiving opening
	28	Guide faces
35	29	Shaping
	30	Side walls
	31	Pins
	32	Coil springs

	33	Elongated hole
	34	Elongated hole
	35	Actuating axis
	36	Actuating pin
5	37	Actuating pin
	38	Wiping edge
	39	Wiping edge
	40	Sowing disc
	41	Sowing holes
10	42	First sowing hole series
	43	Second sowing hole series
	44	Arms
	45	Arms
	46	Fixing profiles
15	47	Recess
	R	Direction of rotation

## PATENTKRAV

5 1. Såhjerte (3) for en enkeltkorn-såmaskine med de følgende karakteristiske træk:

- En såskive (40), som kan rotere i en rotationsretning R,
- at såskiven (40) har i det mindste to såhulrækker (42, 43) med såhuller (41), og som er placeret koncentrisk i forhold til såskiven (40),
- 10 - et optageområde til optagelse af såmateriale på såhullerne (41) og et afgivningsområde til afgivning af såmaterialet,
- at der foran afgivningsområdet er tilvejebragt en afstrygerindretning (10) med henblik på singularisering af såmaterialet på såhullerne (41) under driften af såhjertet (3), hvilken afstrygerindretning omfatter et
- 15 første afstrygerelement (11) for den første såhulrække og et andet afstrygerelement (12) for den anden såhulrække (43), hvorved afstrygerelementerne (11, 12) er sammenkoblede og udformet, så de kan justeres i forhold til hinanden,

20 **k e n d e t e g n e t v e d**, at

- det første afstrygerelement (11) omfatter en første holdeplade (13) og en første afstryger (15), der er anbragt på den første holdeplade, og
- det andet afstrygerelement (12) omfatter en anden holdeplade (14) og
- 25 en anden afstryger (16), som er anbragt på den anden holdeplade (14),

hvorved den anden holdeplade (14) er udformet som gående gennem den første holdeplade (13).

30

2. Såhjerte ifølge krav 1,

**k e n d e t e g n e t v e d**, at afstrygerelementerne (11, 12) er udformet til at kunne justeres i forhold til hinanden, navnlig udelukkende i radial retning for såskiven (40), parallelt med såskiven (40).

35

3. Såhjerte ifølge krav 1 eller krav 2,

**k e n d e t e g n e t v e d**, at afstrygerelementerne (11, 12) er fjederbelastede, navnlig sammen, i såskivens (40) retning.

4. Såhjerte ifølge et hvilket som helst af de foregående krav,  
**k e n d e t e g n e t v e d** , at afstrygerelementerne (11, 12) ved hjælp  
af omsætningen af en justeringsindretnings (23) rotationsbevægelse til en  
5 translationsbevægelse for afstrygerelementerne (11, 12) er udformet, så  
de i radial retning kan justeres i forhold til hinanden.
5. Såhjerte ifølge krav 1,  
**k e n d e t e g n e t v e d** , at den anden holdeplade (14), navnlig med  
10 en yderkontur på den anden holdeplade (14), er udformet, så den glidende  
føres på en inderkontur på den første holdeplade (13), langs den første  
holdeplade (13) i radial retning for såskiven (40).
6. Såhjerte ifølge krav 1,  
15 **k e n d e t e g n e t v e d** , at den første holdeplade (13) og/eller den  
anden holdeplade (14) på bagsiden, som vender bort fra afstrygerne (15,  
16), omfatter fjederelementer med henblik på fjederpåvirkning af det før-  
ste afstrygerelement (11) og/eller det andet afstrygerelement (12).
7. Såhjerte ifølge krav 1 og krav 4,  
20 **k e n d e t e g n e t v e d** , at den første holdeplade (13) omfatter en  
første aktuator-indgang til modtagelse af en første aktuator i justeringsind-  
retningen (23), og den anden holdeplade (14) omfatter en anden aktuator-  
indgang til modtagelse af en anden aktuator i justeringsindretningen.  
25
8. Såhjerte ifølge krav 7,  
**k e n d e t e g n e t v e d** , at det første styreelement og/eller det andet  
styreelement er udformet, så de navnlig kan styres separat og excentrisk  
rottere på justeringsindretningen.  
30
9. Såhjerte ifølge krav 1,  
**k e n d e t e g n e t v e d** , at den første afstryger (15) omfatter en før-  
ste løber (17) og ved hjælp af i det mindste to arme (19, 20), som har en  
afstand fra hinanden, er forbundet med den første holdeplade (13),  
35 og/eller at den anden afstryger (16) omfatter en anden løber (18) og er  
forbundet til den anden holdeplade (14) ved hjælp af i det mindste to arme  
(21, 22), som har en indbyrdes afstand.

10. Såhjerte ifølge krav 9,

**k e n d e t e g n e t v e d**, at den første løber (17) og/eller den anden løber (18) navnlig i modsat retning er forspændt i forhold til et plan, som defineres af såskiven (40), og/eller at hver omfatter en (konkav/konveks) krumning, der navnlig strækker sig i modsat retning.

5

11. Såhjerte ifølge krav 10,

**k e n d e t e g n e t v e d**, at krumningen er ens langs løberne.

10

12. Afstryjerindretning til singularisering af frø på såhullerne i en såskive (40) i et såhjerte under driften af såhjertet (3) med følgende karakteristiske træk:

- Et første afstrygerelement (11) for en første såhulrække (42) i såskiven (40), og
- et andet afstrygerelement (12) for en anden såhulrække (43) i såskiven (40), hvorved afstrygerelementerne (11, 12) er udformet, så de kan sammenkobles og justeres i forhold til hinanden,

15

20

**k e n d e t e g n e t v e d**, at

- det første afstrygerelement (11) omfatter en første holdeplade (13) og en første afstryger (15), der er anbragt på den første holdeplade (13), og
  - det andet afstrygerelement (12) omfatter en anden holdeplade (14) og en anden afstryger (16), som er anbragt på den anden holdeplade (14),
- hvorved den anden holdeplade (14) er udformet, så den strækker sig gennem den første holdeplade (13).

25

30

13. Enkeltkorn-såmaskine med i det mindste én afstrygerindretning (10) ifølge krav 12.

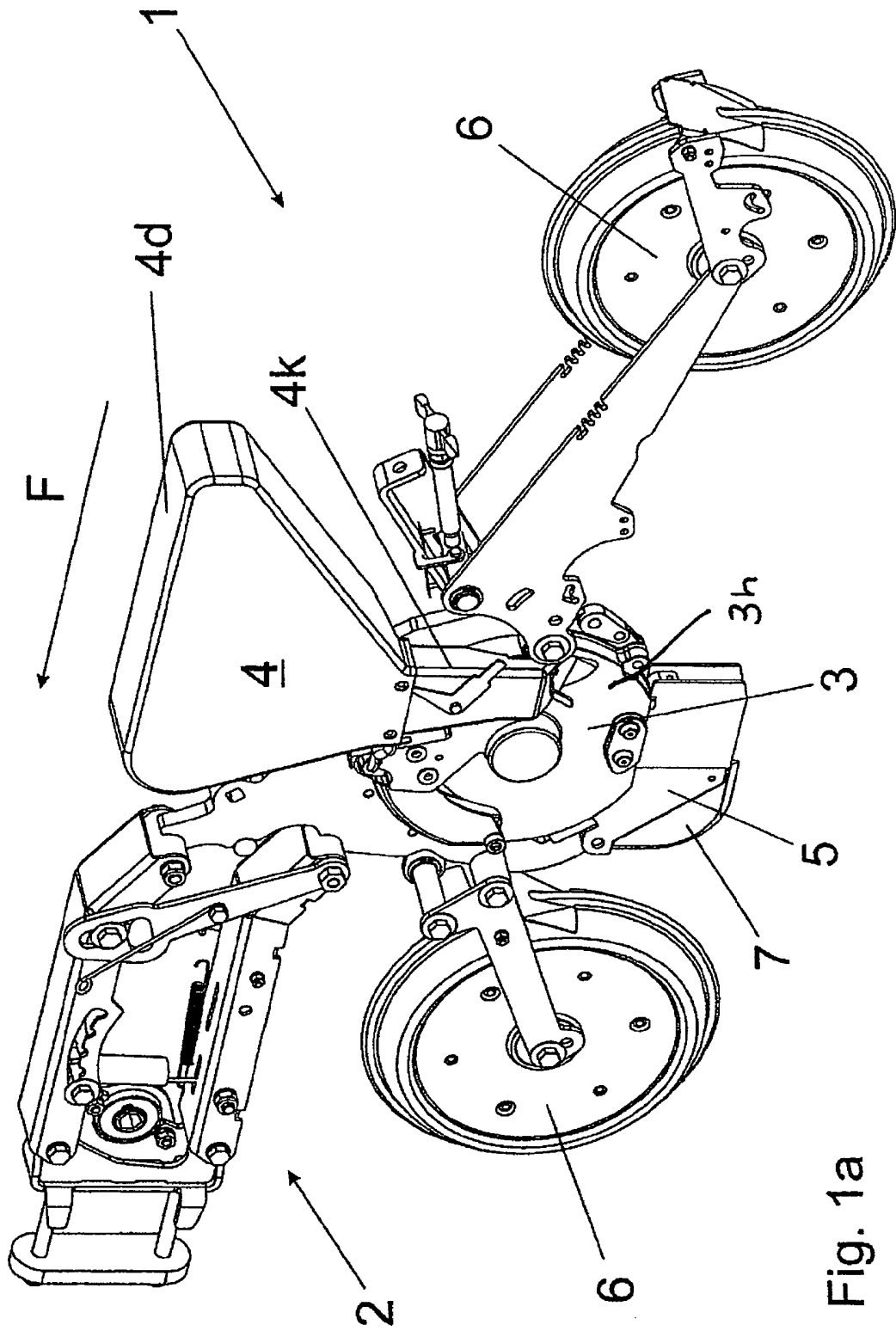


Fig. 1a

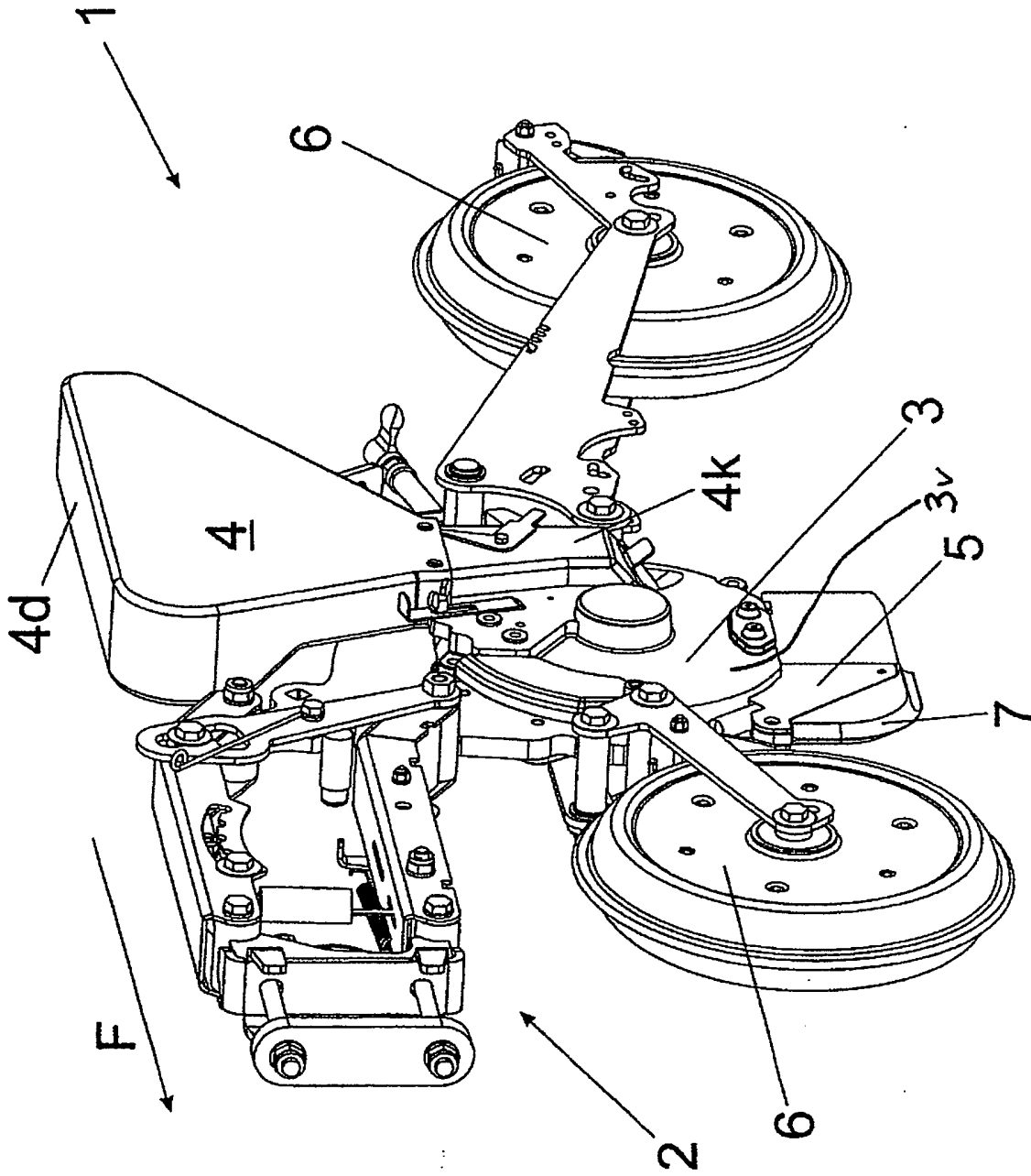
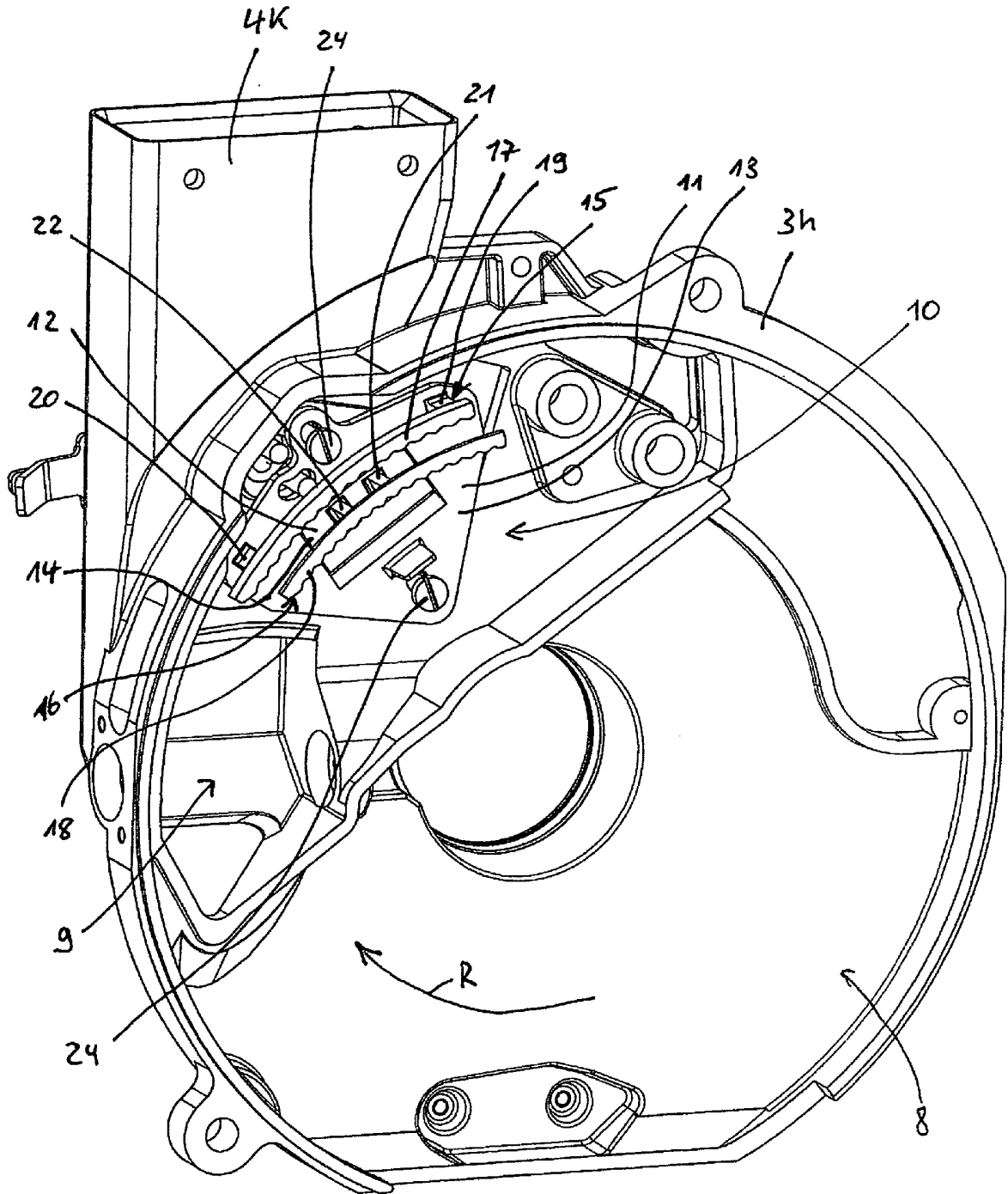


Fig. 1b



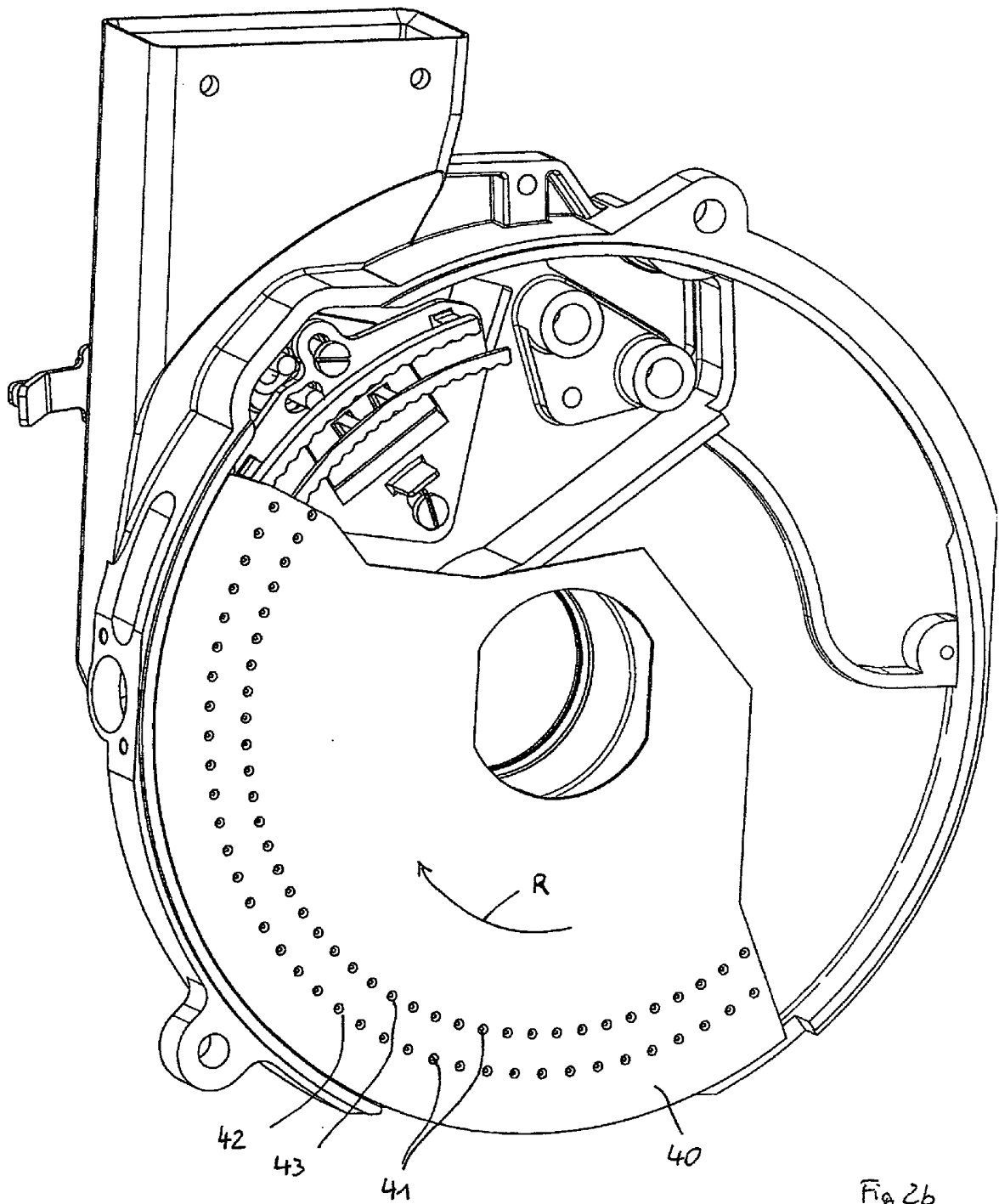


Fig 26

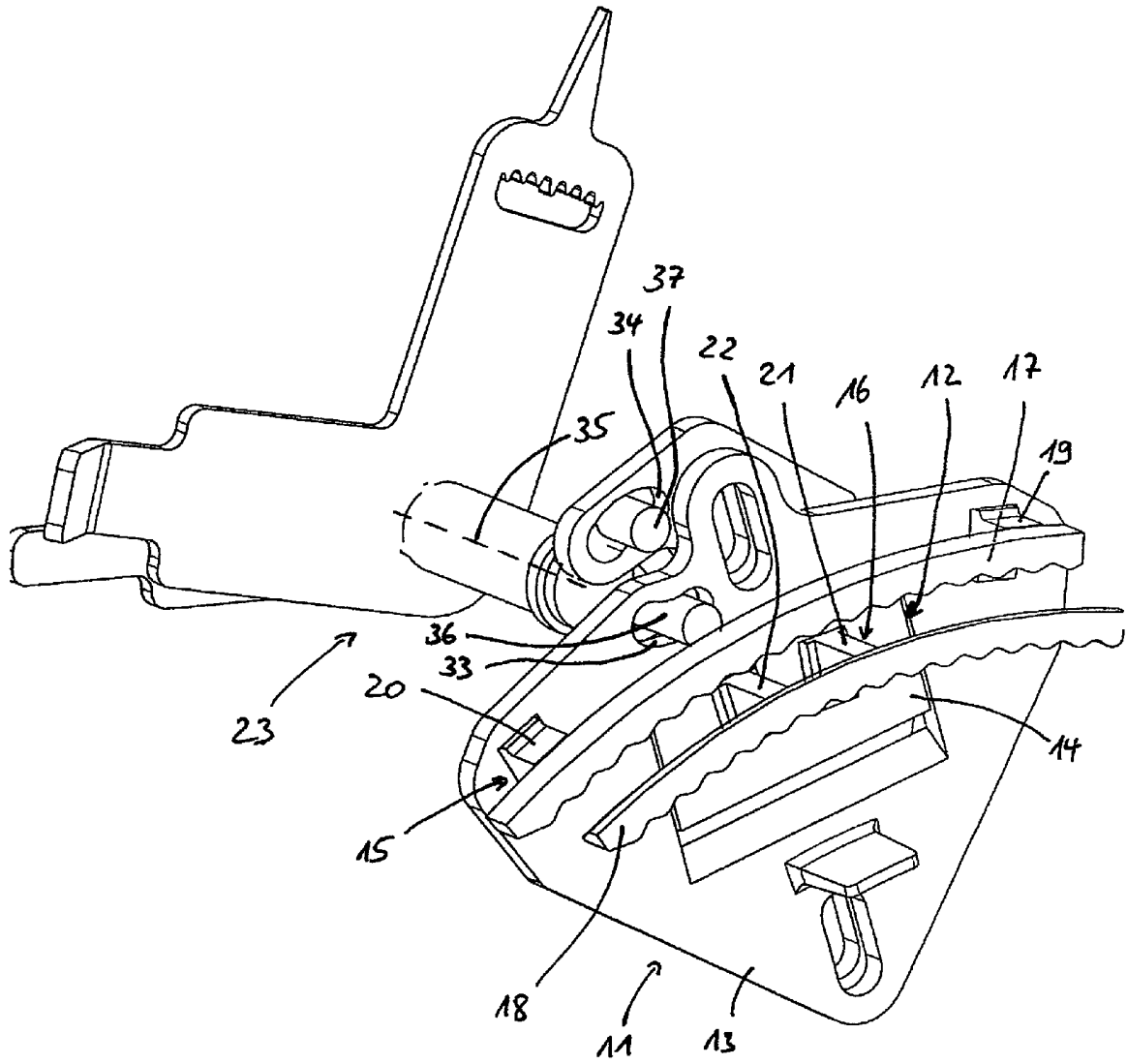


Fig. 3a

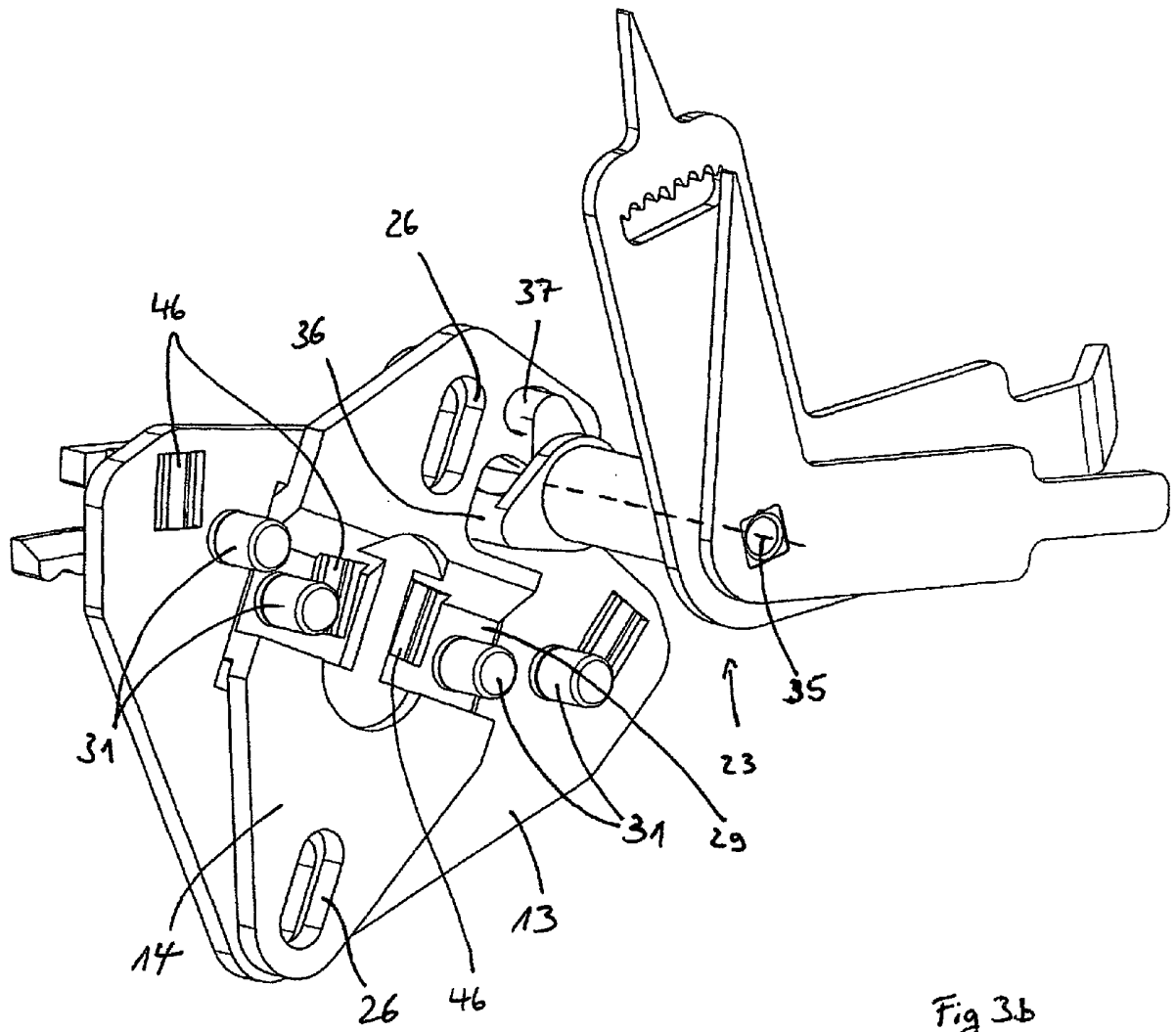


Fig 3b

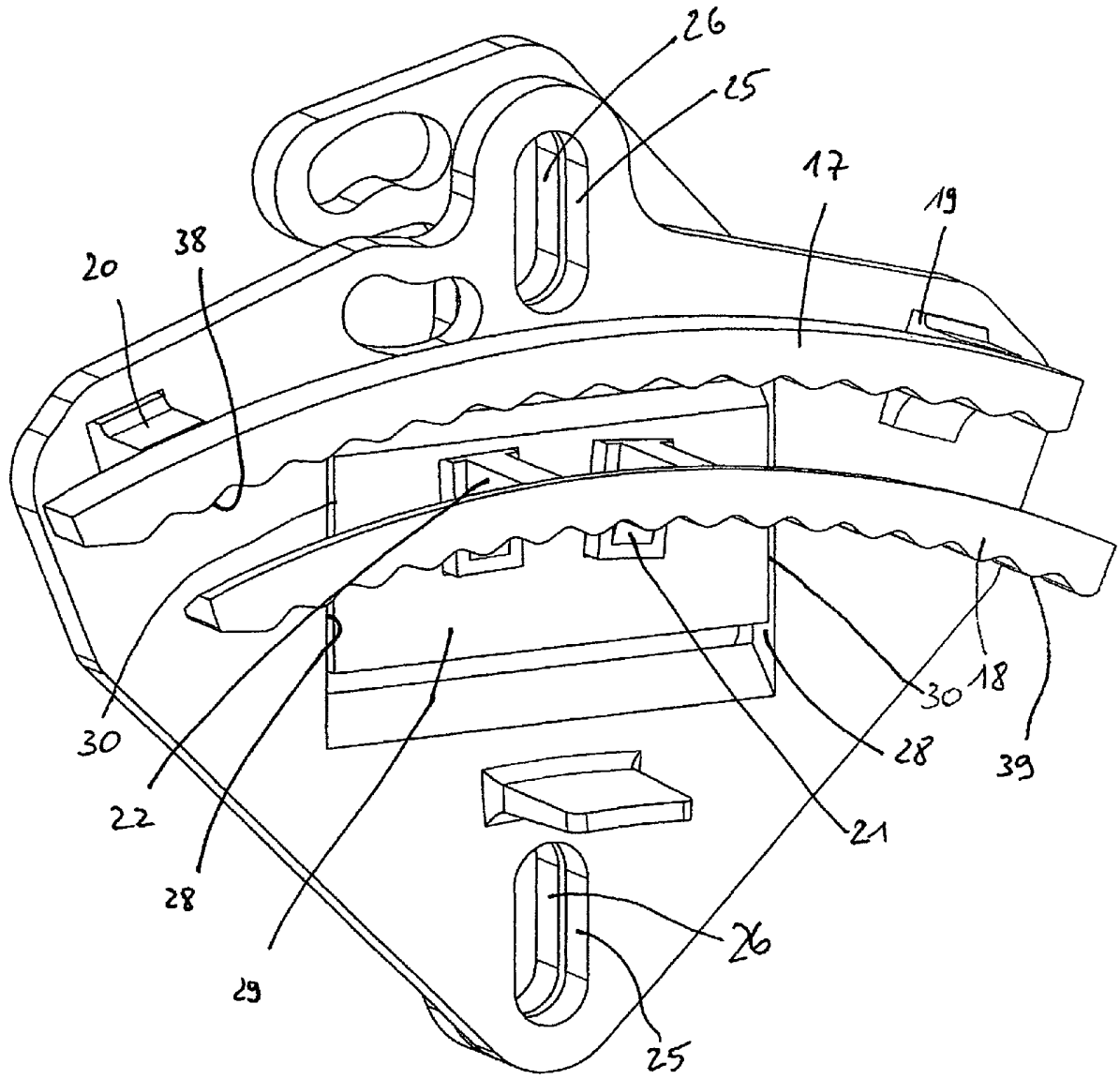


Fig 4a

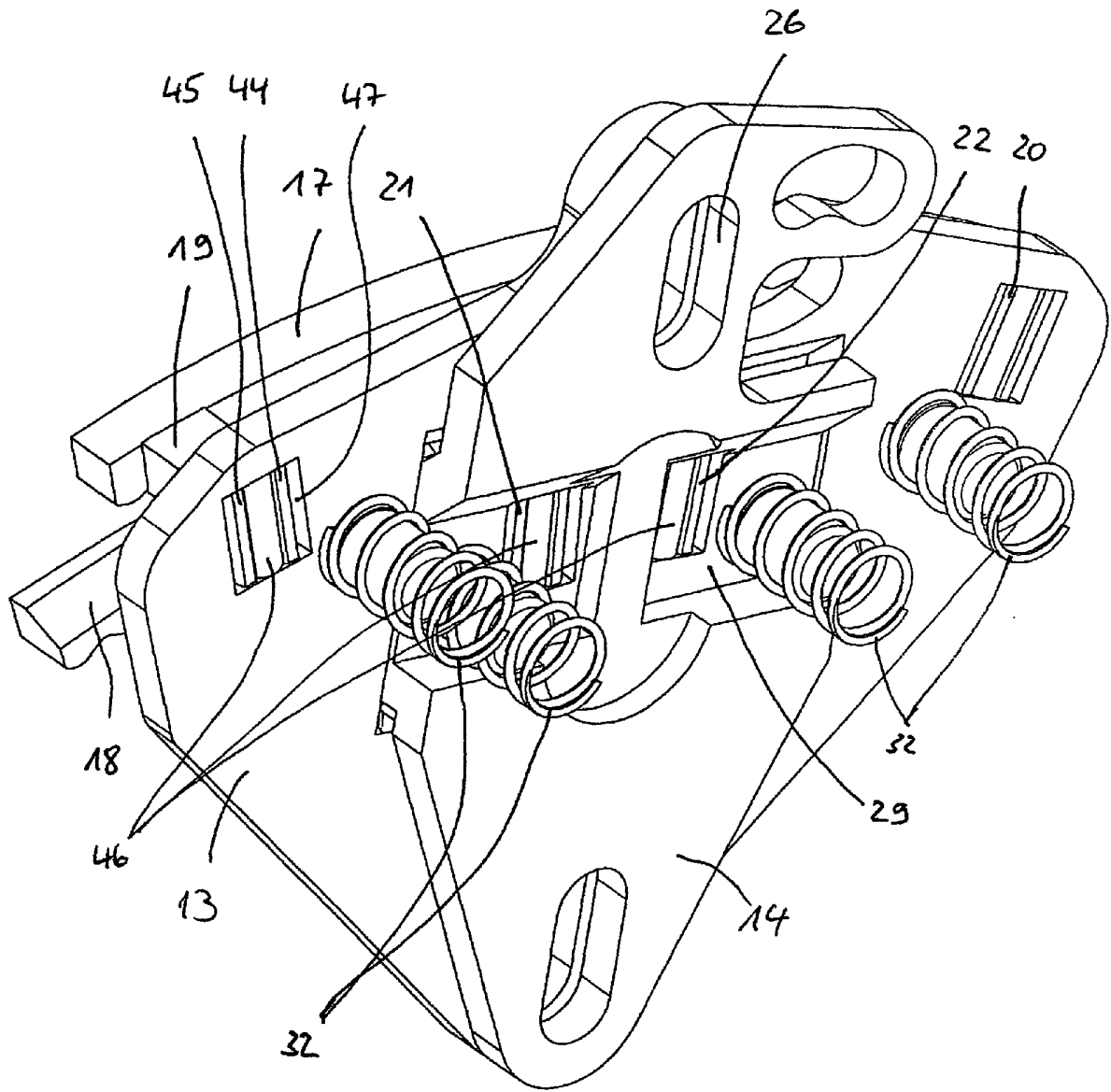


Fig 4b

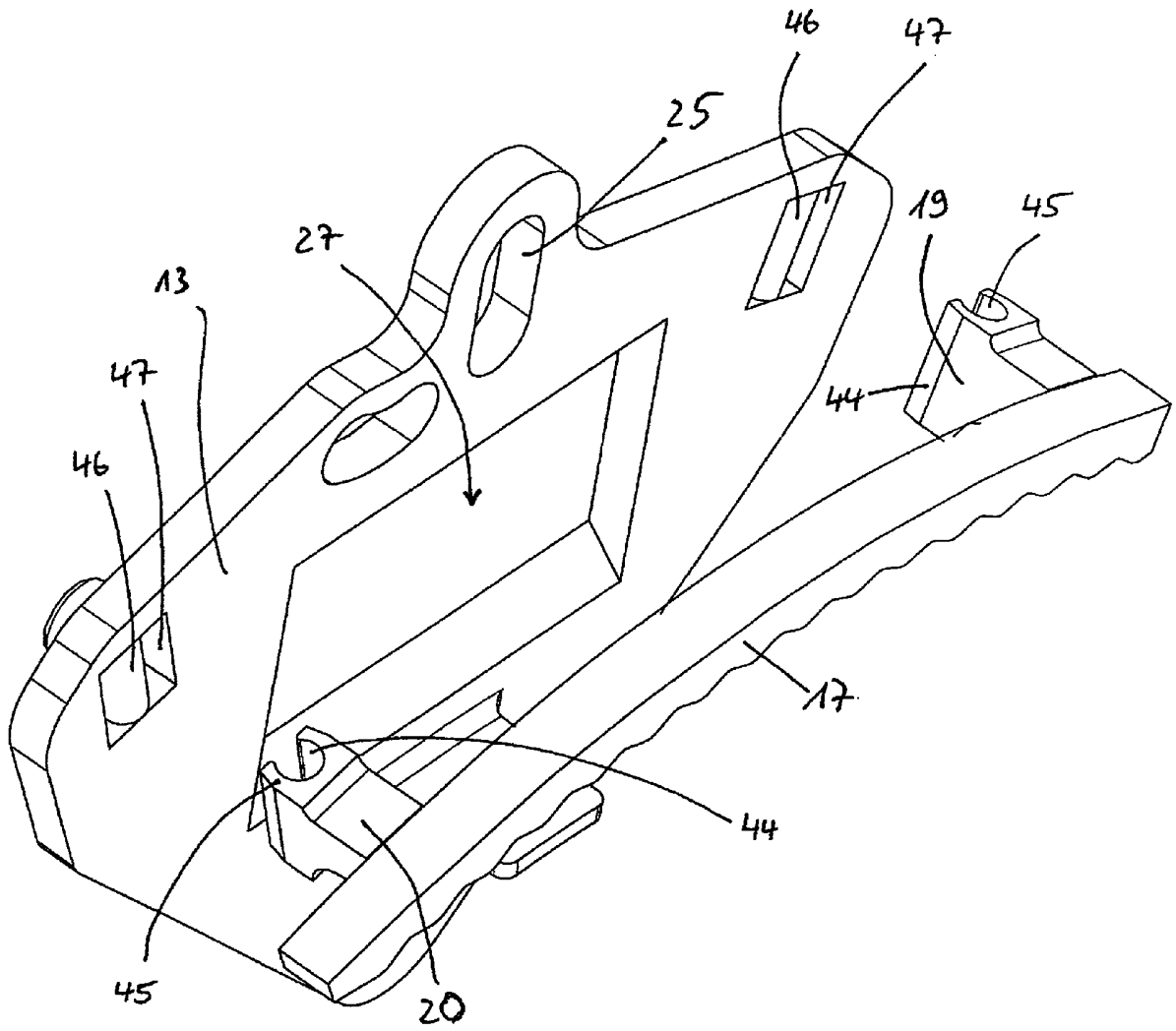


Fig. 5a

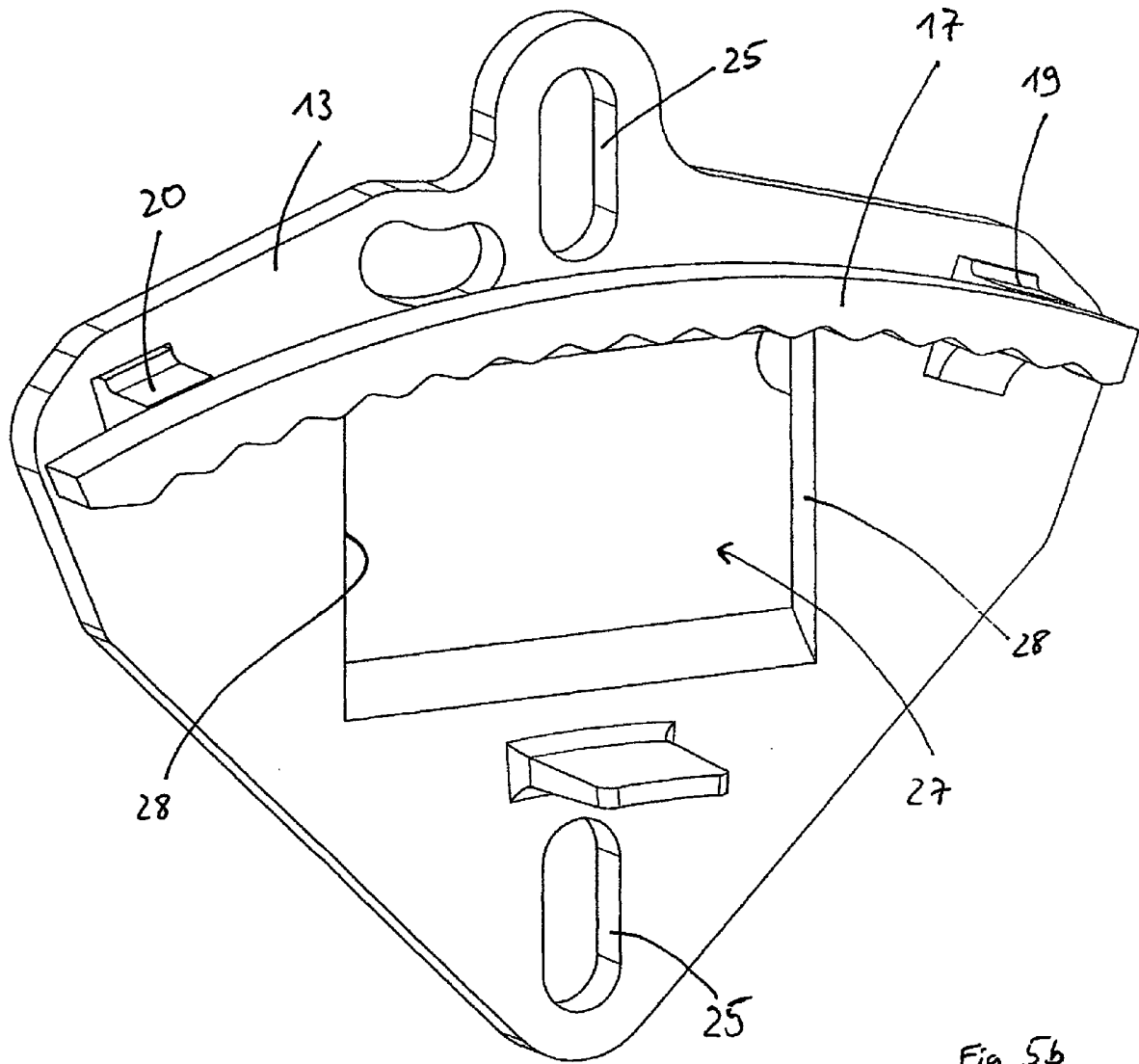


Fig. 5b