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(54) **APPARATUS AND A SET OF BRUSHES FOR A BRUSHING DEVICE, ARRANGEMENT FOR A BRUSHING DEVICE USING BRUSH RINGS, AND A METHOD FOR CHANGING THE BRUSHING MODE IN A BRUSHING DEVICE**

(57) The object of the invention is an apparatus (10') for a brushing device (33), which brushing device is intended for brush rings (31) and which includes a shaft (20) arranged for the said brush rings, and an axial (A) locking profile (22) fitted to the shaft to prevent the rotation of the brush rings. The apparatus (10') is an adapter (10) for arranging brush strips (50, 50') on a shaft intended for brush rings. The apparatus includes an annular base part (12), which is on its inner circumference (17)

arrangeable to lock in circumferential direction to the axial locking profile fitted to the shaft. The base part is on its outer circumference (18) equipped with fits (14) arranged in the shape of the base (54) of a brush strip to receive brush strips and arrange them using the adapter on a shaft intended for brush rings. In addition, the invention also relates to an arrangement, a set of brushes, and a method.

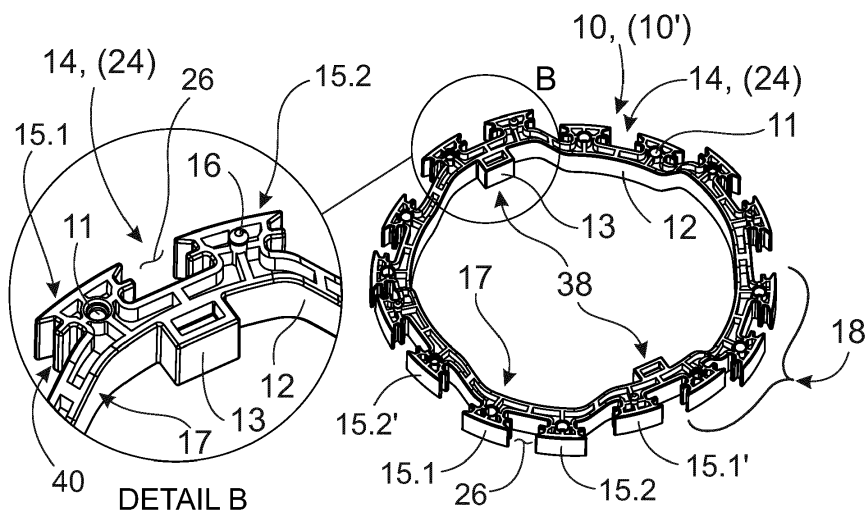


Fig. 1a

Description

[0001] The invention concerns to an apparatus for a brushing device, which brushing device is intended for brush rings and which includes a shaft arranged for the said brush rings, and an axial locking profile fitted to the shaft to prevent the rotation of the brush rings. In addition, the invention also concerns an arrangement in a brushing device using brush rings, a set of brushes for the brushing device, and a method for changing the brushing mode in a brushing device.

[0002] One example of a brush ring is disclosed in Finnish patent FI 102350 (EP 1009254 B1). The user of the brushing device has typically their own set of device for the brush rings. It includes a shaft adapted to the brush rings, on which the brush rings are set axially. The setting takes place in such a way that the locking members of each brush ring, such as, for example a radial pin arranged on the inner circumference of the base part of the ring, coincides with a locking groove or similar locking profile of the shaft. As a result, the brush ring is not able to rotate relative to the shaft.

[0003] The brushing device's user can also have a separate strip brush system, in addition to the brush ring. In it the brushing device's shaft is grooved, being often made as an aluminium profile, for example by extrusion. The strips are placed axially in the grooves formed in the shaft's circumference. Finally, end-locks are attached to both shaft ends. They hold the strips in place axially.

[0004] Equipping with both brush types has a considerable effect on cost. Each brush type must have its own shaft. In addition, strip-brush shafts do not even exist for all brushing machines. It can be difficult to change the brush strips on the strip-brush shaft. The grooves in it, into which the strips are placed, collect dirt and sand. However, a strip brush would suit some work better than a brush ring. One example is brushing snow. However, due to the above reasons, the threshold to equipment investment is often too great to allow strip-brush readiness to be arranged alongside a ring brush.

[0005] The present invention is intended to create an apparatus, arrangement, set of brushes, and method, by which it is simple to change from one type of brush to the other, and in addition to create cost-effective brushing readiness for both brush types. The characteristic features of the apparatus, arrangement, set of brushes, and method according to the invention are stated in the accompanying Claims 1, 11, 14, and 15.

[0006] The apparatus according to the invention is an adapter for arranging brush strips on a shaft intended for brush rings. The adapter includes an annular base part. The base part is arranged to be locked in circumferential direction from its inner circumference to the axial locking profile fitted to the shaft. In addition, the base part belonging to the adapter is equipped from its outer circumference with fits shaped like the base of the brush strip to receive the brush strips and to arrange them on a shaft intended for brush rings, using the adapter.

[0007] The adapter can also be called an adapter ring. Its inner circumference is arranged to lock in circumferential direction to the shaft and the outer circumference has a fit corresponding to the brush strip's base, in order to receive brush strips. Together with several similar adapters, the adapters form an elongated attachment arrangement on the shaft, for example in the form of a groove space. A brush strip is to be fitted into it by threading it axially by its base.

[0008] According to one embodiment, at least some of the adapters can alternate axially to extend in both directions, so that the effective length of the attachment points formed by them for strip brush element increases considerably when placing the adapters on the shaft opposite to the axially oriented protrusions. This lightens the construction. In addition, fewer adapters are needed.

[0009] According to one embodiment, the adapters include opposing axial locking members as circumferentially oriented catch, to prevent the adapters' mutual rotation on the shaft.

[0010] In addition to the apparatus, i.e. the adapter, the invention also relates to an arrangement, which includes several adapters, and also a set of brushes, which includes a shaft and a group of strip brushes in addition to several adapters. According to one embodiment, the arrangement includes ends arranged to be attached to the shaft, to prevent the adapters, and thus also the brush strips attached to them, from coming off the shaft axially. Other characteristic features of the invention will become apparent from the accompanying Claims and additional advantages obtained are itemized in the description portion.

[0011] In the following, the invention, which is not restricted to the embodiments presented, is described in greater detail with reference to the accompanying figures, in which

Figure 1a	shows an adapter ring in an axonometric projection and a detail of it in an insert,
Figures 1b and 1c	show projections of the adapter ring shown in Figure 1a, seen from the side and above,
Figure 2a	shows an axial assembly of several adapter rings on the brushing device's shaft,
Figure 2b	shows an adapter ring arranged on a shaft intended for brush rings, seen from the end,
Figure 2c	shows the brush-ring shaft, shown in Figures 2a and 2b, without the adapter ring, seen from the end,
Figure 3a	shows the assembly shown in Figures 2a and 2b, together with strip brushes,
Figure 3b	shows in detail the installation of a strip brush in the adapter and its end locking,
Figures 4a and 4b	show an axonometric view of an assembly like that of Figure 2a,
Figure 5a	shows a detail of a two-attitude adapter ring, concerning a radial locking profile fitted to it,
Figures 5b and 5c	show the two-attitude adapter ring shown in Figure 5a in different attitudes on the shaft,

Figures 6a and 6b show the positioning of the adapter ring in two attitudes corresponding to Figures 5b and 5c,
 Figure 7a shows the assembly of two-attitude adapter rings on the shaft,
 Figure 7b shows a strip brush when using two-attitude adapter rings,
 Figure 8a shows an example of a set of brushes according to the invention,
 5 Figure 8b shows a single embodiment of a brush, which can be formed from the set of brushes of Figure 8a,
 Figure 9 shows an example of a brushing device, in which the invention can be applied,
 Figure 10 shows an example of the packing of adapter rings in a small space, and
 Figure 12 shows an example of the positioning of adapter rings relative to each other when assembling an adapter element from them.

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[0012] Figures 1a - 1c show one example of the apparatus 10' according to the invention, for the brushing device 33, and even more particularly the brush 43 of the brushing device 33. Figure 9, in turn, shows an example of one brushing device 33. The brushing device 33 is intended for brush rings 31. It includes a shaft 20 arranged for the brush rings 31 (Figures 8a and 8b). For this purpose, an axial A locking profile 22 is fitted to the shaft 20 to prevent the brush rings 31
 15 from rotating on the shaft 20. In a brush ring 31 there is in turn one or more radial locking members 13'. It can be arranged to lock to the locking profile 22 formed for it on the shaft 20. These are shown, for example, in Figure 8a.

[0013] Figures 1a, 1b, and 1c show an example of an individual apparatus 10'. The apparatus 10' is more particularly an adapter 10 for arranging brush strips 50, 50' on the shaft 20 intended, i.e. adapted for brush rings 31. A schematic example of the brush strips 50, 50' is shown in Figures 3a, 3b, 7, 8a, and 8b. An annular base part 12 can be said to belong to the adapter 10. Its side profile forms a closed circular ring. The base part 12 can be said to have an inner circumference 17 and an outer circumference 18. The adapter 10 can be arranged to lock by the inner circumference 17 of its annular base part 12 in the circumferential direction to axial A locking profile 22 fitted to the shaft 20. For example, Figures 2b - 4a show an example of this locking and its creation. In addition, the adapter 10 is on the outer circumference 18 of its annular base part 12 equipped with fits 14 arranged in the shape of the base 54 of the brush strip 50, 50'. The fits 14 are arranged to receive the brush strips 50, 50' and in this way to be attached to the adapter 10, and even more particularly to its annular base part 12. Thus the fits 14 are also to arrange the brush strips 50, 50', using the adapter 10, on the shaft 20 intended for the brush rings 31. This diversifies considerably the possibilities of using the shaft 20 intended for the brush rings 31.

[0014] The adapter 10 includes a radial, i.e. radially oriented R locking profile 38 fitted to the base part 12 in its inner circumference 17. The radial locking profile 38 is fitted to the inner circumference 17 to lock the adapter 10 in the circumferential direction to the axial A locking profile 22 fitted to the shaft 20. The radial locking profile 38 can form one or more radial protrusions 13 fitted to the inner circumference 17 of the base part 12 shown for example in the case according to the embodiment. The protrusion 13 of the locking profile 38 can also be termed a retainer. In the embodiment shown, there are two protrusions 13, these being now on opposite sides of the inner circumference 17. The protrusion 13, more generally the radial locking profile 38, can be, for example, like BEELINE® brush rings (FI and EP patent referred to in the description of the prior art).

[0015] One example of the axial A locking profile 22 fitted to the shaft 20 is shown, for example, in Figures 2b - 4b and especially in Figure 2c, which shows the brush-ring 31 shaft 20 shown in Figures 2a and 2b without an adapter 10, seen from the end. In the embodiment shown as an example, the axial A locking profile 22 is formed of two elongated locking formations fitted to the shaft's 20 outer circumference 28. The locking formation is now formed of an axial A groove strip 23 in the longitudinal direction of the shaft 20. The groove strip 23 has a U-profile opening outwards from the shaft 20. In the embodiment shown, the protrusion 13 lies between the arms 29 forming the U-profile, being in the space 37 formed between them.

[0016] According to one embodiment, the fit 14 arranged in the shape of the base 54 of the brush strip 50, 50' is arranged to form a group of radial protrusions 15.1, 15.2 arranged in the circumferential direction of the outer circumference 18 of the base part 12. The annular base part 12 can thus also be lightened in this way. The protrusions 15.1, 15.2 are arranged consecutively on the outer circumference 18. Here a space 26 is now arranged between the protrusions 15.1, 15.2. The space 26 forms, with several similar adapters 10, a strip groove 24 acting as a groove space 19' arranged for the shaft 20, more generally, an attachment arrangement 19. The space 26 is arranged in the shape of the cross-sectional profile of the base 54 of the brush strip 50, 50'. There are several protrusions 15.1, 15.2 on the outer circumference 18. Thus, they form several spaces 26 on the circumference of the base part 12.

[0017] According to one embodiment, the radial protrusions 15.1, 15.2 forming the fits 14 are arranged in pairs in the circumferential direction of the outer circumference of the base part 12 in the adapter 10. Pair formations can be implemented in several different ways. One way to arranged the pairs is to form the base part 12 in such a way that the adapter 10 is of its base part 12 arranged to extend axially. In other words, the base part 12 then has a deformed structure. One example of this is an axially A angularly zig-zag shaped base part 12. Then, when the adapters 10 are set on the shaft 20, their circumferentially facing contacts surfaces 27 (Fig. 1c) are on both sides alternately in contact laterally with the adjacent adapters 10. On one side being contact with adjacent adapter the adapter 10 on the opposite side then is

without contact. Then in the case of the exemplary zig-zag-shaped adapter 10, the adapters 10 can together form honeycomb open places (the openings 42 in Fig. 4a) on the shaft 20.

[0018] More particularly, the adapter 10 can include axial A displacements arranged in its base part 12, oriented alternately on opposite sides of the adapter 10 in its axial direction A. Straight portions 39 then remain between the displacements. From the outer surfaces 27 of the straight portions 39 the adapters 10 can be arranged against each other when they are installed on the shaft 20.

[0019] Even more particularly, in the embodiment being described the base part 12 of the adapter 10 is formed regularly in a straight line into a laterally bent construction. Its base part 12 is then arranged to protrude laterally at an acute angle of, for example 45°, from its base level. Thanks to the aforementioned arrangement, it is first of all possible to assemble the adapters 10 on the shaft 20 by stacking the consecutive adapters 10 on the brushing device's 33 shaft 20 alternately the right way round and the wrong way round with a circumferential alignment. A honeycomb structure formed by consecutive base parts 12, for example according to Figures 4a and 4b is then created.

[0020] Particularly Figures 4a and 4b show clearly a construction arranged in the axial A displacement formed using the adapter 10 and the honeycomb construction arranged to be formed of the shaft 20 between two consecutive adapters 10. In it the displacements in the base part 12 and the following subsequent straight portions 39 alternating from one side to the other are arranged to form a hexagon on the shaft 20 between the base parts 12 of the consecutively arranged adapters 10.

[0021] According to one embodiment, radial protrusions 15.1, 15.2 are arranged opposite each other on the outer circumference 18 of the base part 12. The protrusions 15.1, 15.2 can then be in the circumferential direction of the base part 12 described above on each of its straight portions 39. The pairing of the protrusions 15.1, 15.2 is then implemented in such a way that each straight portion 39 has two protrusions. A space 26 is then formed between the paired protrusions 15.1, 15.2 arranged in the shape of the cross-sectional profile of the brush strip's 50, 50' base 54.

[0022] Due to the construction of the base part 12 now alternating axially A, the radial protrusions 15.1, 15.2 are arranged divergently also axially A in the circumferential direction of the base part's 12 outer circumference 18. This is caused by the lateral displacement in the base part 12. Then the protrusions 15.1, 15.2, which are in the base part 12 on consecutive straight portions 39, separate from each other circumferentially, are on slightly different lines relative to each other axially A. On the other hand, then too the protrusions 15.1, 15.2 can be said to be paired, but now also axially A. This is because then too a circumferential space 26 forms between the protrusions 15.1, 15.2 on the consecutive straight portions 39, arranged in the shape of the cross-sectional profile of the brush strip's 50, 50' base 54. Now, however, the protrusions 15.1, 15.2 delimiting the space are slightly displaced axially A due to the alternating shape of the base part 12. In other words, a circumferential semi-profile 40 of the base 54 is then arranged, relative to the space 26 arranged in the shape of the base 54 of the brush strip 50, 50' on the opposite side of the base part 12, in the radial protrusions 15.1, 15.2 to form the space 26 formed in the base 54 with the second protrusions 15.1', 15.2'. The second protrusions 15.1', 15.2' can thus be, for example, radially divergent.

[0023] In order to arrange the spaces 26 between the protrusions 15.1, 15.2 into the cross-sectional profile shape of the brush strip's 50, 50' base 54, there can be various formations 41 (Figure 5c) in them, which implement the shape-locking attachment principle. In the case of the embodiment described, the formations 41 are circumferential claws 41.1, 41.2 fitted to the protrusions 15.1, 15.2. They permit the brush strips 50, 50' to be threaded axially A into the spaces 26 formed between the protrusions 15.1, 15.2. One skilled in the art will understand that the formations 41 can vary greatly between different manufacturers of the brush strips 50, 50' and even between the same manufacturer's different brush-strip models.

[0024] According to one embodiment, the adapter 10 includes axial locking members 16, 11 fitted to opposite sides of the base part 12, now as a circumferential safety catch. According to one embodiment, this can be implemented with the aid of axial pins 16 arranged in the adapter 10 and corresponding holes 11 fitting to the pins 16, when the adapters 10 are assembled consecutively on the shaft 20, for example according to Figures 2a, 4a, and 4b. The adapters 10 axially in a cluster are firmly secured on each other against rotation. Thus, if the inner-circumferential 17 protrusion 13 breaks in one of the adapters 10, the other adapters continue to hold it in place. This feature also permits the adapters 10 to be handle in clusters of several adapters 10. The locations of the pins 16 and holes 11 in the flat surfaces 27 facing the sides of the adapter 10 provide a guide to the correct orientation and support of the adapters 10 when they are installed on the brushing device's 33 shaft 20.

[0025] In addition to the adapters 10, the invention also relates to an arrangement in a brushing device 33 using brush rings 31. In the following, the arrangement is described in greater detail with reference to Figures 2a - 4b. This will also clarify the arrangement of the adapter 10 and the shaft 20 relative to each other. The arrangement includes a shaft 20 for brush rings 31, which shaft 20 includes an axial A locking profile 22 to prevent the rotation of the brush rings 31. The arrangement includes several apparatuses 10', i.e. adapters 10 according to the invention. The adapters' 10 inner circumference 17 is arranged to lock onto the shaft 20 in the circumferential direction and on the outer circumference 18 there is in turn a fit 14 corresponding to the brush strip's 50, 50' base 54 for receiving the brush strips 50, 50' in an elongated attachment arrangement 19 formed of several adapter rings 10, which can be, for example, the described

elongated groove space 19'. Thus, when arranged on the shaft 20, the adapters 10 are arranged to form together an elongated groove space 19' to receive the brush strips 50, 50' by their base parts 54.

[0026] One skilled in the art will understand that, instead of the groove space 19', the attachment arrangement 19 can equally also be an elongated attachment rail (not shown) formed by a radial protrusion of the adapter 10. The axial A cross-sectional profile of the radial protrusion is then adapted to the shape of the brush strip's base. There can then be a groove space in the base, to the shape of which the protrusion is adapted. Thus a shape-locking male-female joint pair between the brush strips and the adapter's 10 outer circumference 18 can be formed both towards the base 54 and the adapter 10.

[0027] According to Figure 2a, by assembling adapters 10 consecutively on the shaft 20, an adapter element 30 is created that is arranged to receive and attach a brush strip 50, 50' in connection with the shaft 20. According to what is shown in Figure 2a, the adapter element 30 is preferably assembled by placing the axial extending, i.e. protruding base parts (34, 34 and correspondingly 32, 32) against each other. Using this light, but quite sturdy construction the entire axial A length required to attach the brush strip 50, 50' is created. In other words, the axial A length of a single adapter 10 is only a fraction (a few centimetres) of the axial A length (about one metre) of the entire brush strip 50. The adapter's 10 axial A effective or the width covered on the shaft 20 can be, for example, 2 - 15 %, more particularly 2 - 10 %, and even more particularly 2 - 5 % of the brush strip's 50 axial A length. This facilitates the handling of the adapters 10 and lightens the construction.

[0028] By assembling several adapters 10 on the shaft 20 consecutively alternating their axial protrusions set end-to-end, the necessary light-construction axial length is obtained to receive the brush strips 50, 50'. Figure 11 shows this arranging of the adapters 10 against each other when assembling them. The adapter elements 30 are quite light to handle even when equipped with brush strips 50. For example, their length can be 1 m. Several adapter elements 30 can be made ready for brushing operations. They then only need to be installed when required on the shaft 20. The assembled adapter element 30 together with the installed brush strips 50 is easily threaded onto the shaft 20.

[0029] The adapter 10 being fitted by its base part 12 to extend axially, its effective length also increases as a brush strip 50, 50' attaching element. This is realized if when installing the adapters 10 they are arranged axially A in such a way that the adapters' 10 protrusions 32, 34 are opposite each other.

[0030] The arrangement includes end stops 36. The end stops 36 are arranged to be attached to the shaft 20. In addition, the end stops 36 are arranged to prevent the adapters 10 and also the brush strips 50, 50' arranged on them from moving axially A, i.e. coming off the shaft 20. Figure 2a shows the end stop 36 at the left-hand end of the shaft 20. In this way, the brush strip 50, 50' and also the adapters 10 are made to remain in place axially A. The end stop 36 also presses the adapter clusters against each other.

[0031] In Figure 2b, the adapters 10 are installed on the shaft 20. In shaft 20 there is an external groove strip 23 on its outer circumference 28 on the opposite sides of the shaft 20 and also end plates 36, in which is a centre hole 35 for the brushing device's 33 shaft pin. Through it the brush 43 is rotated.

[0032] Figures 3a and 3b show the attachment of brush strips 50 to an adapter element 30 formed of adapter rings. In the brush strips 50 there are radial bristles 52 set in an as such known manner, which are attached to a base part 54. The base part 54 is a strip profile shaped in a chosen manner. It can equally also be a groove profile. The adapters 10 are always adapted to a specific strip profile or to a groove profile. Of course, in some cases there could also be a universal fit 14 in the adapter 10. Several strip profiles could then be used in it. It would even be possible to function without a radial protrusion in some cases. The base part 12 of the adapter 10, in which a fit 14 for the brush strip 50 is formed, can then be utilized directly.

[0033] Figure 3b shows especially clearly the setting of an end stop 36 into the bases 54 of the brush strips 50. Another feature is the positioning of the axial A element belonging to a U-rail 23 fitted to the outer circumference of the shaft 20, more generally to the locking profile 22, to the inner circumference 17 of the adapters 10 and to the protrusion 13 acting as a radial retainer fitted to it.

[0034] Figures 4a and 4b show the assembly of adapter rings 10 on the shaft 20. Figure 4b also shows the radial direction R. It can also be seen from Figures 4a and 4b that the formation of the groove space 19' in the circumferential direction of the shaft 20 can vary, for example, alternately. Every second groove space 19.1 is then arranged to be formed radial protrusions 15.1, 15.2 arranged opposite each other on their outer circumferences 18 axially A in the apparatuses 10'. Every second groove space 19.2 is arranged to be formed of radial protrusions 15.1, 15.2', 15.1', 15.2 arranged to differ axially A on the outer circumferences 18 of the apparatuses 10'. It is also possible to speak of overlapping protrusions formed in the groove space 19'. To this groove space 19.2 formed between the axially differing protrusions 15.1, 15.2', 15.1', 15.2 is then directed to the axial A displacement arranged in the base part 12. The groove space 19.2 then defines the opposing semi-profiles 40 arranged on the outer edge of the protrusions 15.1, 15.2, relative to the space 26 between them, which together, through not aligned axially A, form the relevant groove space 19.2. Correspondingly, the groove space 19.1 formed between the axially aligned protrusions 15.1, 15.2 is directed to their straight portions 39 in the base part 12. They are then also directed to the adapter element 30 at the openings 42 in the formed honeycomb structures. Thus the groove spaces 19' can be implemented using a very light structural solution, for example compared

to the groove space forming continuously a strip groove 24 on both sides in the axial direction A.

[0035] Figures 5a - 5c show a second embodiment of the adapter 10. Now the adapter 10 is a planar, i.e. straight circular ring in the axial A direction of the base 12. This can be clearly seen, especially in Figures 6a and 6b. Here the radial locking profile 38 fitted to the adapter's 10 base part 12 includes at least two radial protrusions 13.1, 13.2 arranged to act as locking members to be fitted to the shaft's 20 locking profile 22. The protrusions 13.1, 13.2 are now consecutively adjacent in the circumferential direction. They can said to be in pairs. Here they are mainly in the form of radial pins. The radial protrusions 13.1, 13.2 are thus used to arrange, an optional, i.e. changing, circumferential position to attach the adapter 10 to the shaft 20.

[0036] The protrusion arrangement is dimensioned in such a way that the U-rail 23 of the shaft 20 lies tightly against either protrusion 13.1, 13.2. The protrusions 13.1, 13.2 can be inside the U-rail 23 in turns. They can then lean on, for example, the inner edge of the edge 29 delimiting the space 37 of the rail 23. In addition, one of the protrusions 13.1, 13.2, for example the second, can also lean on the outer edge of the edge 29 of the U-rail 23. Both of the protrusions 13.1, 13.2 now also have counter-pairs 47. The counter-pairs 47 are in edges of the pairs formed by the protrusions 13.1, 13.2 in the circumferential direction. In the embodiment described the protrusions 13.1, 13.2 remain between them. The counter-pairs 47 ensure that the protrusions 13.1, 13.2 remain in the U-rail 23, more generally, in the locking profile 22. The distance between the protrusion 13.1, 13.2 and the counter-pair 47 arranged for it is arranged in such a way that a small groove, into which the edge 29 fits, remains between them. This further ensures the locking. The counter-pair 47, which is on the side of the protrusion, which is not locked to the groove, can for its part lean on the outer circumference 28 of the shaft 20, as shown in Figures 5b and 5c. This too reduces the strain acting on the adapter 10.

[0037] By means of this variable attachment of the adapter's 10 circumferential position the brush strips 50 are made to overlap on the shaft 20. Thanks to this, the brush 43 gains better load-bearing and bushiness. In addition, this embodiment diversifies the arrangement created, in that by using the same adapter 10 and brush strips 50, for example, from a strip brush 43 formed of six strips in the axial direction A, either six strips in the same axial line, or then overlapping are obtained. By overlapping, six different sectors are obtained. This increases the bushiness of the strip brush.

[0038] In this embodiment too the adapter 10 includes axial locking members 16' fitted on opposite sides of the base part 12. They can act, once again, for example, as a circumferential check, but now also in addition to, or instead of a gap being arranged between the adapters 10. In Figures 5a - 6b the base 12 of the adapter 10 is a straight ring. There are now pins 16' on its laterally oriented contact surfaces 27, by which not only the locking can be ensured, but now also the distance between the adapters 10. Here too the structure is thus lightened. The protrusions 15.1, 15.2 in the base 12 are now circumferentially consecutive. Spaces 26 are formed between them for the brush strip's 50 base 54. Thus, the spaces 26 are formed by the protrusions 15.1, 15.2 in pairs on both sides of the outer circumference of the base 12.

[0039] In the embodiment shown in Figures 7a and 7b, the adapters 10 form partial elements, unlike what is shown in Figures 4a and 4b. The partial elements are installed on the brush's 43 shaft 20 being formed axially A on a slightly different line to each other. Figure 7a shows the assembly of the partial elements on the shaft 20. One way to achieve this is to first of all arranged the adapter rings in partial assemblies 30.1 - 30.3, ..., 30.n. Then the partial assemblies formed 30.1 - 30.3, ..., 30.n are installed mutually so that the middle one is turned by 11.25° relative to the others. This describes how "bushiness" is created for the brush totality through the partial assemblies. One skilled in the art will understand that in some cases the number of strips in the circumferential direction of the shaft 20 can be other than described in this case (16). The mutual angle of the partial assemblies then also changes.

[0040] The adapter 10 is a complete integral piece. In other words, the fits 14 for the brush strips 50 and the locking profile 38 are both in the same annular base part 12. The adapter 10 is typically of a single material and is made, for example, from plastic, composite, or metal (e.g. aluminium). One example of a way of making the adapter 10 is moulding, such as, for example injection moulding. An aluminium adapter 10 can be made, for example by die-casting. The adapter 10 has the properties of a hard and also rigid piece. The adapter 10 is also a low structure in the radial direction R. In other words it does not significantly increase the shaft's 20 diameter. For example, the shaft's 20 diameter can be 7 - 10 inches. The adapter 10 only increases the diameter by a few tens of millimetres, such as, for example 50 mm.

[0041] Owing to the invention, the same brushing device's 33 shaft 20, in which brush rings 31 are used (e.g. the applicant's Beeline trademark), can, with the aid of adapters 10 be converted to use a brush strip 50, 50'. This is an economical solution to use, on the same shaft 20, either brush rings 31 or brush strips 50, or even simultaneously, as shown in Figure 8b, brush rings 31 and brush strips 50. It also does not demand changes to the brushing device 33 itself. Changing the brush elements 25 is also quick, so that it saves time and bother.

[0042] The invention also further relates to a set of brushes for a brushing device 33. Figure 8a shows an example of this. The set of brushes 21 includes brush elements 25 and a shaft 20 equipped with a locking profile 22 for brush rings 31. The brush elements 25 are exchangeably to be assembled on the shaft 20. As the brush elements 25, the set of brushes 21 includes several brush strips 50, 50'. In addition, the set of brushes 21 also includes several apparatuses 10' according to the invention for arranging brush strips 50, 50' on the shaft 20 of a brushing device 33 adapted for brush

rings 31. Figure 8a also shows an example of a radial locking member 13' fitted to the base part of a brush ring 31.

[0043] The adapter 10 and an element 30 assembled of them on a shaft 20 is product that can be used for a long time. When the brush strips 50 are worn out, they are detached from the element 30 formed of adapters 10 by opening the end flange 36. After this, the worn brush strips 50 are pulled off the element 30 and thus also the shaft 20, to which they are rotatably attached through the element 30 and new brush strips 50 are pushed in their place. The end flange 36 is reattached and brushing can continue with the strip brush thus formed.

[0044] Figure 9 shows an example of a brushing device 33, in which the invention can be applied. The brushing device 33 is attached, for example, to the lifting mechanism 44 of a work machine 45. The brushing device 33 can then be used to brush the surface 46 on which the work machine 45 moves, such as, for example, streets and areas.

[0045] The adapters 10 and the one or more elements 30 to be formed from them on the shaft 20 are used, for example, as follows:

- 1) the brushing device 33 is switched off,
- 2) the end flange 36 or flanges of the shaft 20 holding the brush rings 31 in place are removed,
- 3) the brush rings 31 are removed from the shaft 20 through its ends,
- 4) the adapters 10 or the elements 30 formed of them are placed on the shaft 20 in such a way that their claws 16, 16' lock,
- 5) if it is wished that the adapter elements 30 coming to the shaft 20 form several totalities attached to each other, one adapter 10 is placed between them in the same attitude as the previous. This prevents the claws 16, 16' from locking and at the same time the totalities formed of elements 30 formed of adapters 10 are light to handle, if it is wished to change back to brush rings 31,
- 6) once the shaft 20 is filled with adapters 10 or elements 30 formed of them, the brush strips 50 are set in the grooves 23 in them,
- 7) once the brush strips 50 are in place, they are locked onto the shaft 20 using an end flange 36,
- 8) the brushing device 33 is again ready for use.

[0046] In turn, moving from brush strips 50 back to brush rings 31 can take place owing to the invention as follows:

- 1) the end flange 36 is removed from the shaft 20,
- 2) the brush strips 50 are pulled out of the elements 30 formed of adapters 10,
- 3) the adapters 10 / elements 30 formed of them are removed,
- 4) the brush rings 31 are placed on the shaft 20,
- 5) the end flange 36 is secured to the shaft 20,
- 6) the brushing device 33 is ready for use.

[0047] The adapters 10 according to the invention can be implemented for all brushing devices 33 and even more particularly for all of their shafts 20. The sizes of the adapters 10 can cover all the shaft sizes and models. The number of brush strips 50 can vary of shafts 20 of different sizes. The model and shape of the brush strip 50 also affect the number of brush strips 50. There can naturally be adapters 10 with different kinds of brush-strip grooves. This permits the use of different kinds of brush-strip models in this embodiment, for example, independently of their base 54, more generally their attachment profile. One example of the base's 54 profile appears in Figure 8a. The invention need not of course be restricted to the base-profile example shown.

[0048] In the adapter elements 30 there are claws 16, 16', which attach them to each other. However, the elements 30 can be detached from each other if necessary. The claws 16, 16' also position them at the correct alignment to each other. The brush strips 50 can then be easily set in the grooves 24 in them. The locking claws 16, 16' also permit the adapter elements 30 to be handled as a totality / partial totality.

[0049] There are also planar surfaces 27 in the adapter elements 30. Thanks to the planar surfaces 27 the elements 30 lie parallel to each other on the shaft 20. The adapter's 10 inner circumference 17 has a locking profile 38, such as, for example a protrusion 13, which can also be called a rivet. The locking profile 38 can be used to set the adapters 10 in the same attitude on the shaft 20. The adapter elements 30 have various rivet alternatives. They then fit different shafts 20.

[0050] According to what is shown in Figure 10, the shape of the adapters 10 permits them to be packed in a small space for transportation. This reduces their transport costs and thus also their carbon footprint. The adapters' 10 shape also reduces the number of them on the brushing device's 33 shaft 20, which brings savings in many different ways.

[0051] The adapters 10 can be set on the shaft 20 at two or more different angles, when the brush strips 50 are "overlapping". This means that, for example, 0.5-m long brush strips 50 are in two different attitudes over the entire length of the shaft 20. In this way it is possible to imitate brush strips in a spiral shape, but it also permits softer operation during brushing.

[0052] In addition to the adapter 10 and arrangement, the invention also relates to a method for changing from one brushing mode to another using the brushing device 33. The brushing modes are brushing performed using a brush assembled from brush rings 31 on a shaft 20, i.e. ring brushing, and brushing performed using a brush 43 assembled from brush strips 50 on a shaft 20, i.e. strip brushing. The brush 43 can also be called a brush roll. A set of brushes 21 according to the invention is used in the method. In addition, both brushing modes are performed using the same shaft 20 intended for brush rings 31. The solution according to the invention, also creates a low threshold to seek experience of brushing using a strip brush, if it is compared, for example, to the acquisition cost of a separate special strip-brush shaft, which can be as much as € 1000 - 2000.

[0053] It should be understood that the above description and the related figures are only intended to illustrate the present invention. The invention is thus not restricted to only the embodiments described above or defined in the Claims, but instead many different variations and adaptations of the invention, which are possible within the scope of the inventive idea defined in the Claims, will be obvious to one skilled in the art.

Claims

1. An apparatus for a brushing device, which brushing device (33) is intended for brush rings (31) and which includes a shaft (20) arranged for the said brush rings (31), and an axial (A) locking profile (22) fitted to the shaft (20) to prevent the rotation of the brush rings (31), **characterized in that** the apparatus (10') is an adapter (10) for arranging brush strips (50, 50') on a shaft (20) intended for brush rings (31), which adapter (10) includes an annular base part (12), which is
 - on its inner circumference (17) arrangeable to lock in circumferential direction to the axial (A) locking profile (22) fitted to the shaft (20),
 - on its outer circumference (18) equipped with fits (14) arranged in the shape of the base (54) of a brush strip (50, 50') to receive brush strips (50, 50') to and arrange them by using the adapter (10) on a shaft (20) intended for brush rings (31).
2. The apparatus according to Claim 1, **characterized in that** a group of radial protrusions (15.1, 15.2) arranged consecutively in the circumferential direction of the outer circumference (18) of the base part (12) is arranged to form the fit (14),
 - between which is arranged to be formed a space (26) arranged in the shape of the brush strip's (50, 50') base (54) and/or
 - the axial (A) cross-sectional profile of the protrusions (15.1, 15.2) is arranged in the shape of the brush strip's (50, 50') base.
3. The apparatus according to Claim 2, **characterized in that** the radial protrusions (15.1, 15.2) are arranged in pairs in the circumferential direction of the outer circumference (18) of the base part (12).
4. The apparatus according to Claim 2 or 3, **characterized in that** the radial protrusions (15.1, 15.2) are arranged opposite each other in the circumferential direction of the outer circumference (18) of the base part (12).
5. The apparatus according to any of Claims 2 - 4, **characterized in that** the radial protrusions (15.1, 15.2) are arranged divergently in an axial (A) direction in the circumferential direction of the outer circumference (18) of the base part (12).
6. The apparatus according to any of Claims 2 - 5, **characterized in that** a semi-profile (40) in the circumferential direction of the base (54) is arranged in the radial protrusions (15.1, 15.2), relative to the space (26) arranged in the shape of the base (54) of the brush strip (50, 50') on the opposite side in the circumferential direction of the base part (12), to form the said space (26) formed for the base (54) with the second protrusion (15.1', 15.2').
7. The apparatus according to any of Claims 1 - 6, **characterized in that** the adapter (10) includes a radial locking profile (38) fitted to the inner circumference (17) of the base part (12) to lock the adapter (10) in the circumferential direction to the axial (A) locking profile (22) fitted to the shaft (20).
8. The apparatus according to Claim 7, **characterized in that** the radial locking profile (38) fitted to the base part (12) includes at least two radial protrusions (13.1, 13.2) to arrange an optional circumferential-position attachment on the shaft (20) for the adapter (10).

9. The apparatus according to any of Claims 1 - 8, **characterized in that** the adapter (10) includes axial locking members (16, 16', 11) fitted to the opposite sides of the base part (12), for example, as a check in circumferential direction and/or to arrange a gap between the adapters (10).

10. The apparatus according to any of Claims 1 - 9, **characterized in that** the adapter's (10) base part (12) is arranged to extend axially, to increase its effective length.

11. An arrangement in a brushing device using brush rings, which includes a shaft (20) for brush rings (31), which shaft (20) includes an axial (A) locking profile (22) to prevent the rotation of the brush rings (31), **characterized in that** the arrangement includes several apparatuses (10') according to any of Claims 1 - 10, which, arranged on the shaft (20), are arranged to form an elongated attachment arrangement (19) to receive brush strips (50, 50') by their base parts (54).

12. The arrangement according to Claim 11, **characterized in that** the arrangement includes end supports (36) arranged to be attached to the shaft (20) and to prevent the apparatuses (10') and brush strips (50, 50') from coming off the shaft (20).

13. The arrangement according to Claim 11 or 12, **characterized in that** the attachment arrangement (19) is arranged to be formed of an elongated groove space (19') and of the said groove spaces (19') in the circumferential direction of the shaft (20)

- every second groove space (19.1) of which being arranged to form radial protrusions (15.1, 15.2) arranged opposite each other axially (A) in the apparatuses (10'), on their outer circumference (18),

- every second groove space (19.2) is arranged to form radial protrusions (15.1, 15.2, 15.1', 15.2') arranged divergently axially (A) in the apparatuses (10'), on their outer circumference (18).

14. A set of brushes for a brushing device, which set of brushes (21) includes brush elements (25) and a shaft (20) equipped with a locking profile (22) for brush rings (31), and on which shaft (20) the said brush elements (25) can be exchangeably assembled, **characterized in that** the set of brushes (21) includes

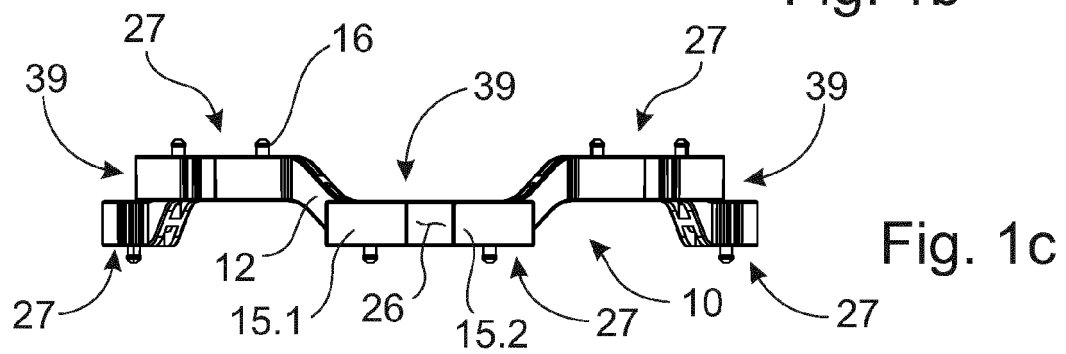
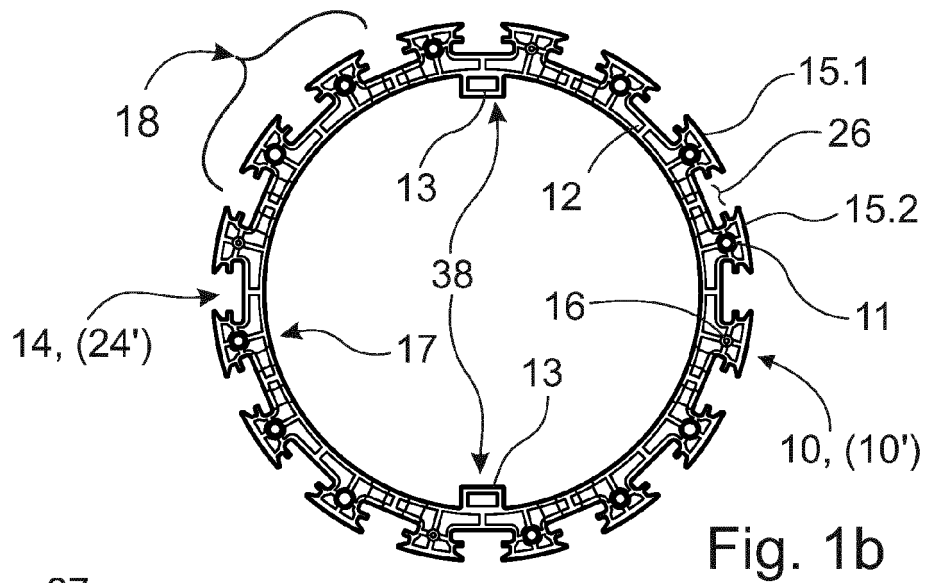
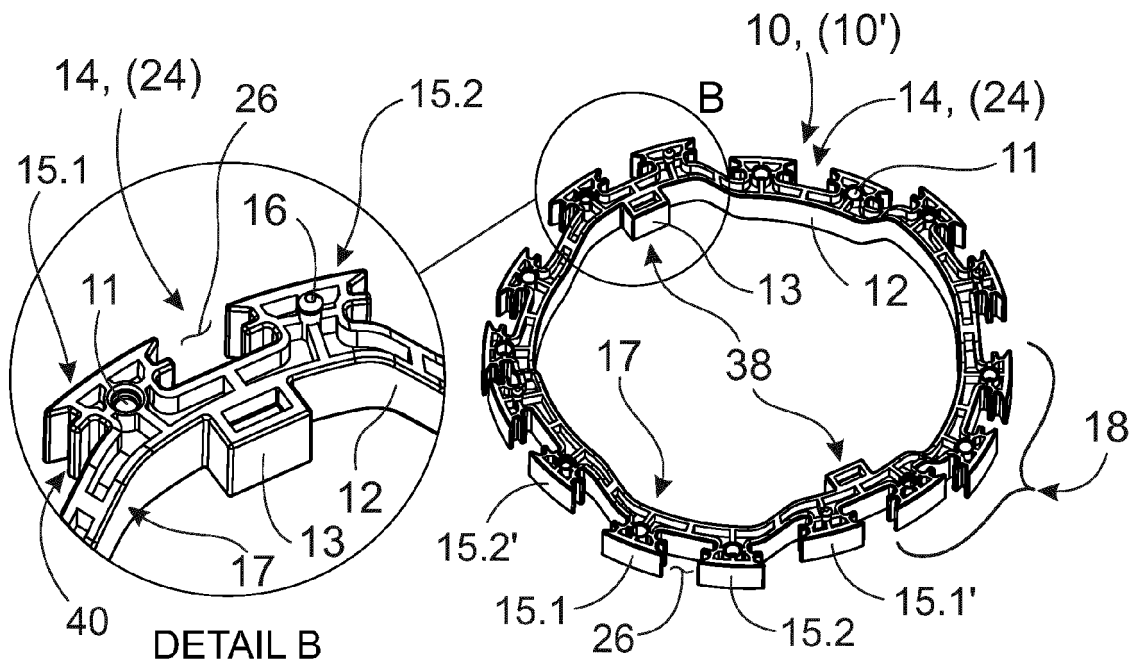
- several brush strips (50, 50') as the brush elements (25),

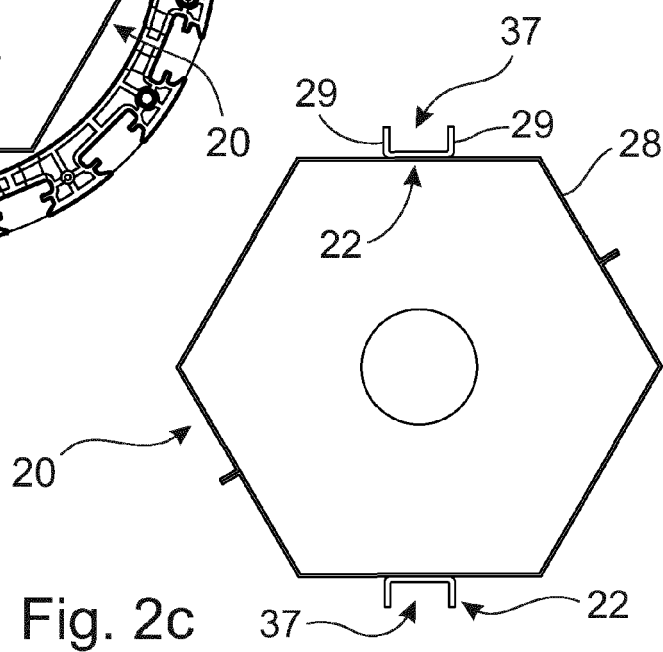
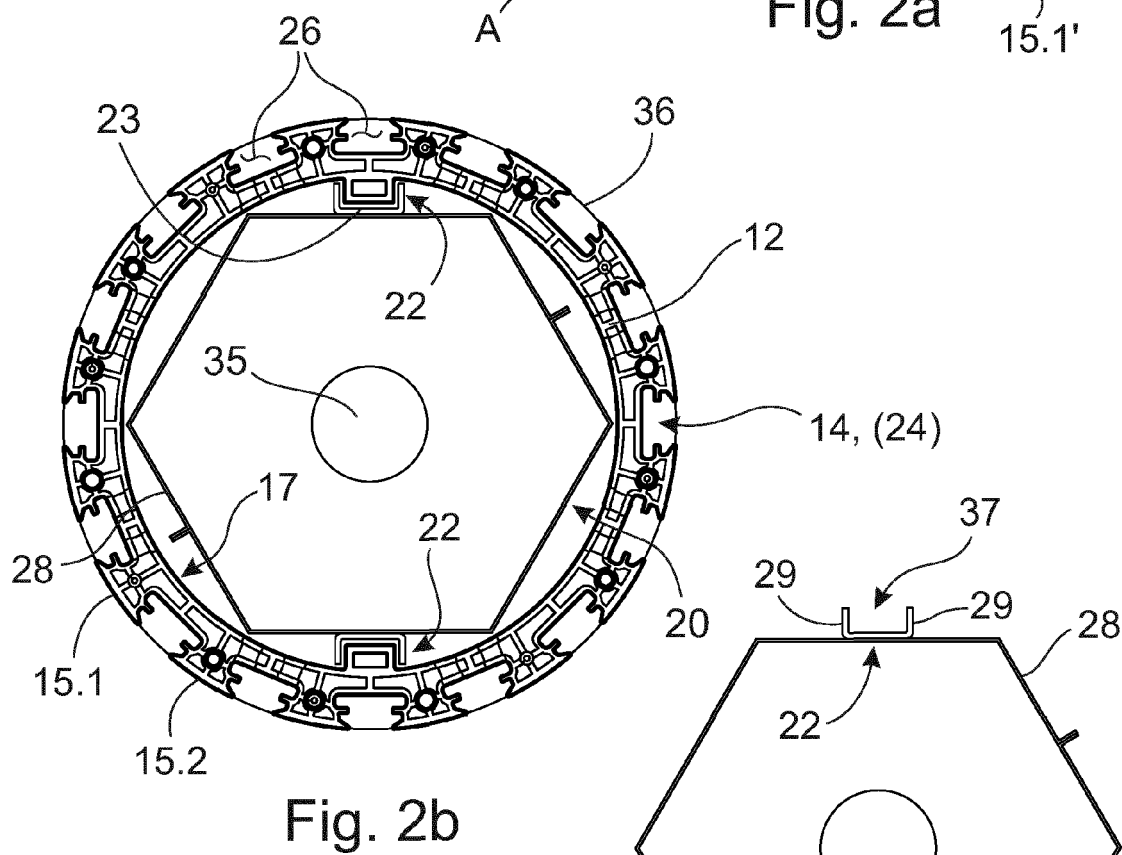
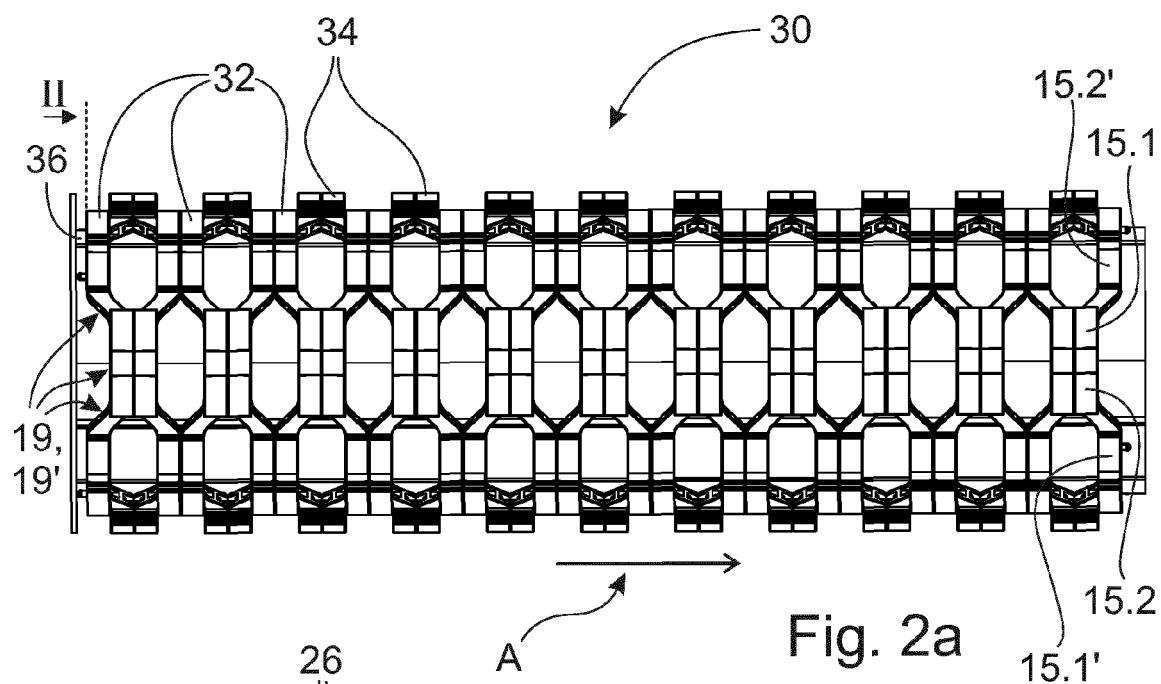
- several apparatuses (10') according to any of Claims 1 - 10 for arranging the brush strips (50, 50') on the brushing device's (33) shaft (20) adapted for brush rings (31).

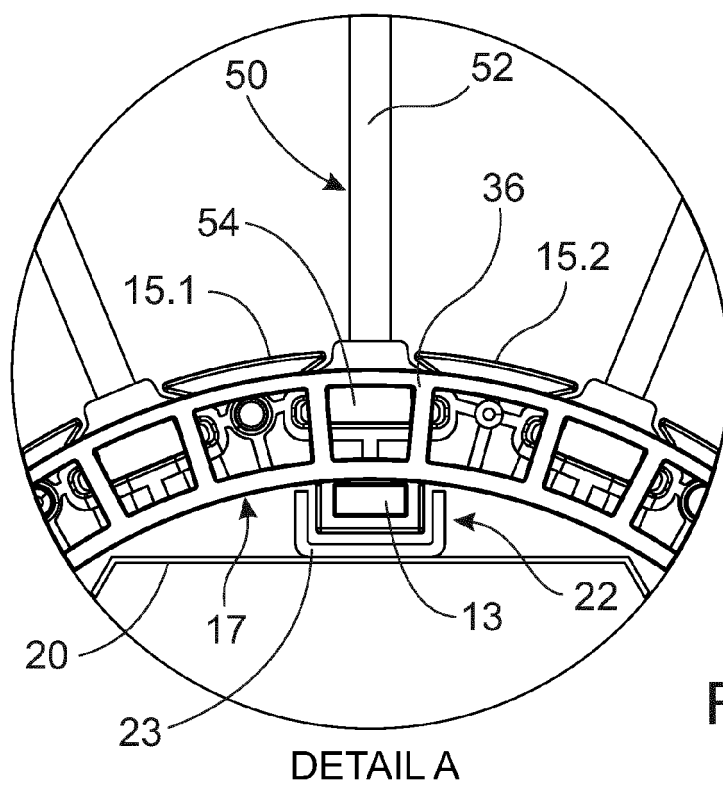
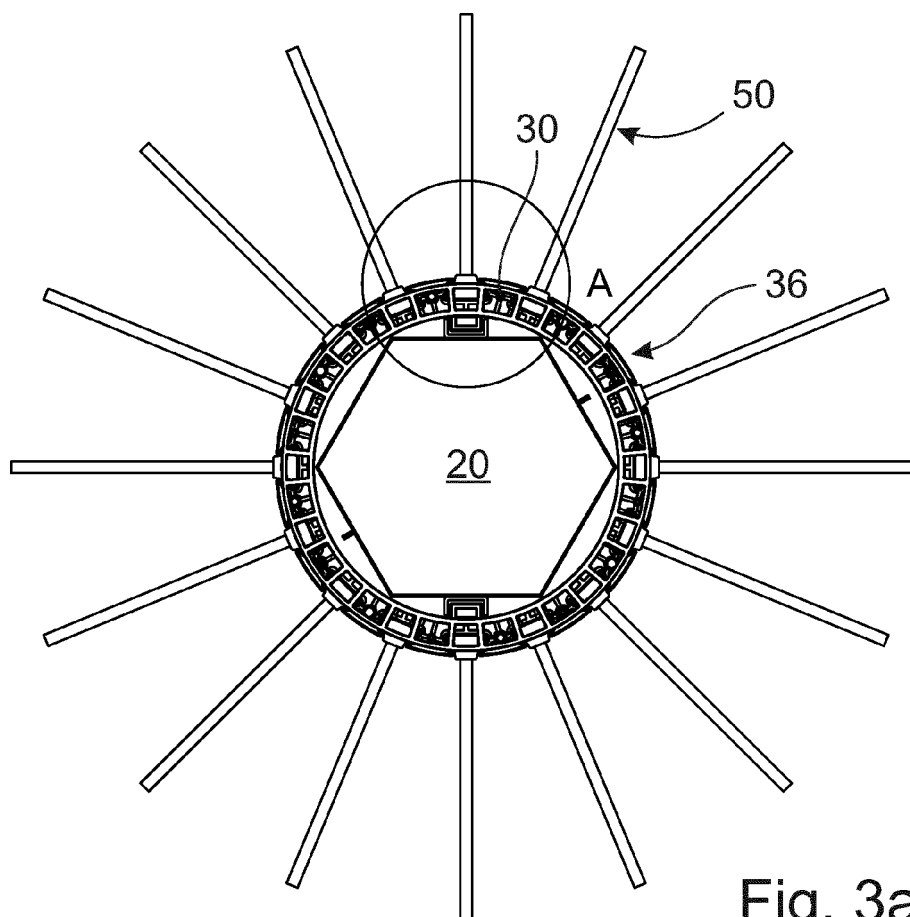
15. A method for changing brushing mode in a brushing device, in which the said brushing modes are brushing performed using a brush assembled from brush rings (31) on a shaft (20) and brushing performed using a brush (43) assembled from brush strips (50) on a shaft (20), **characterized in that**, in the method

- a set of brushes (21) according to Claim 14 is used,

- both brushing modes are performed using the same shaft (20) intended for brush rings (31).







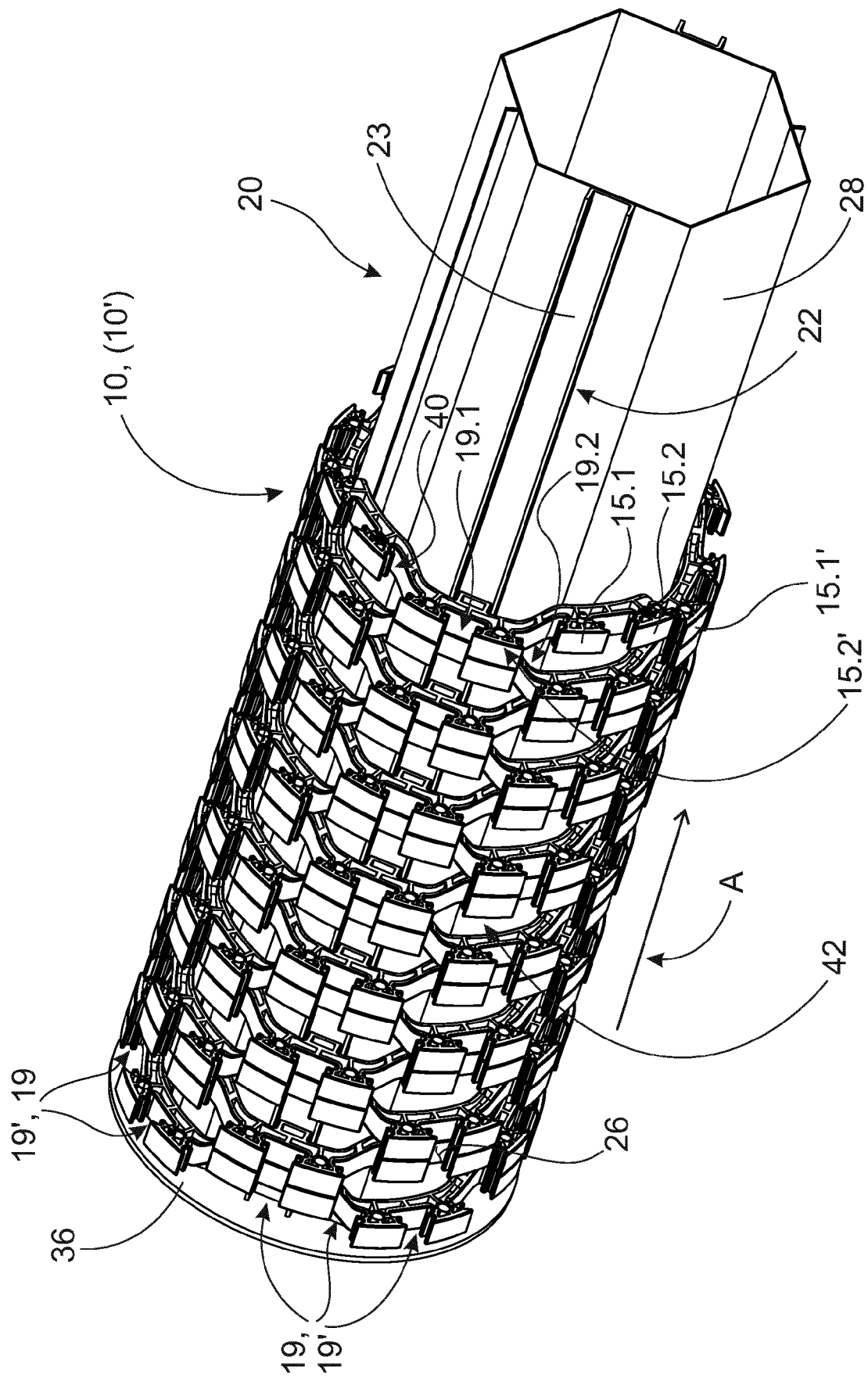
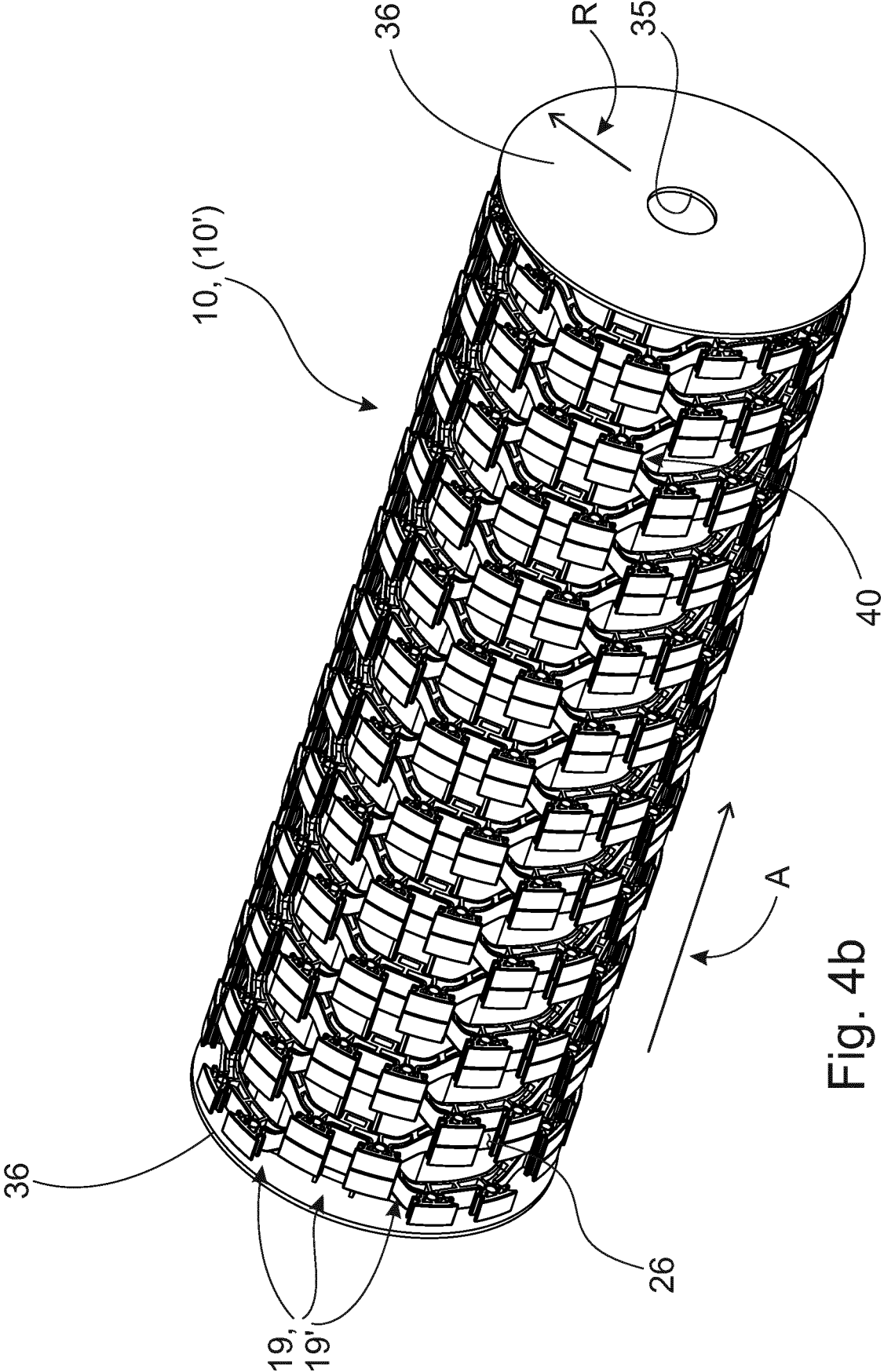
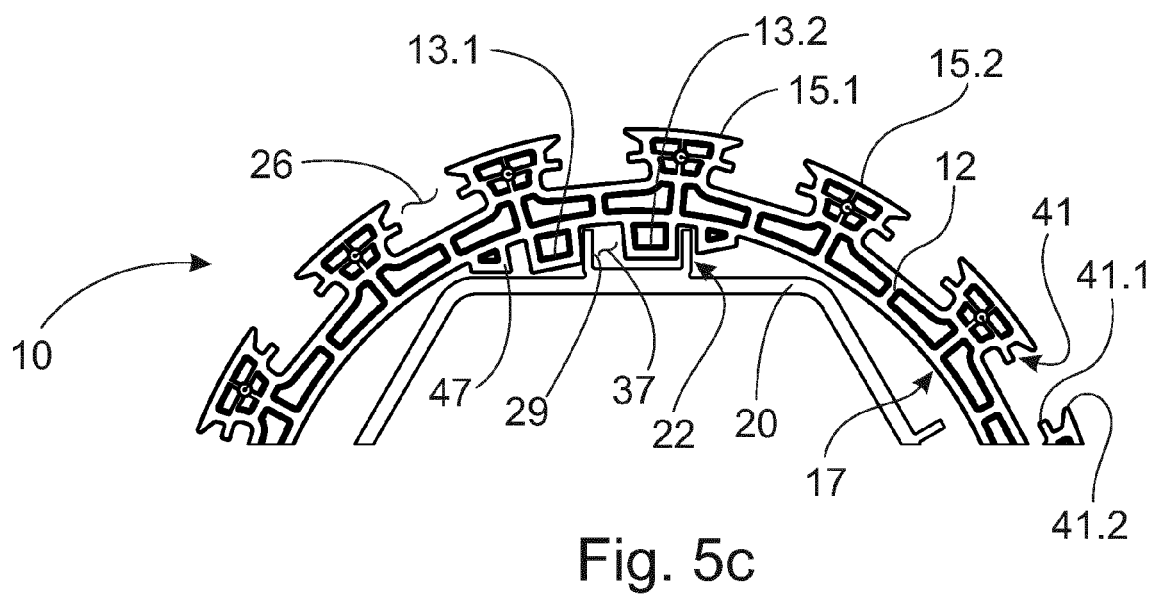
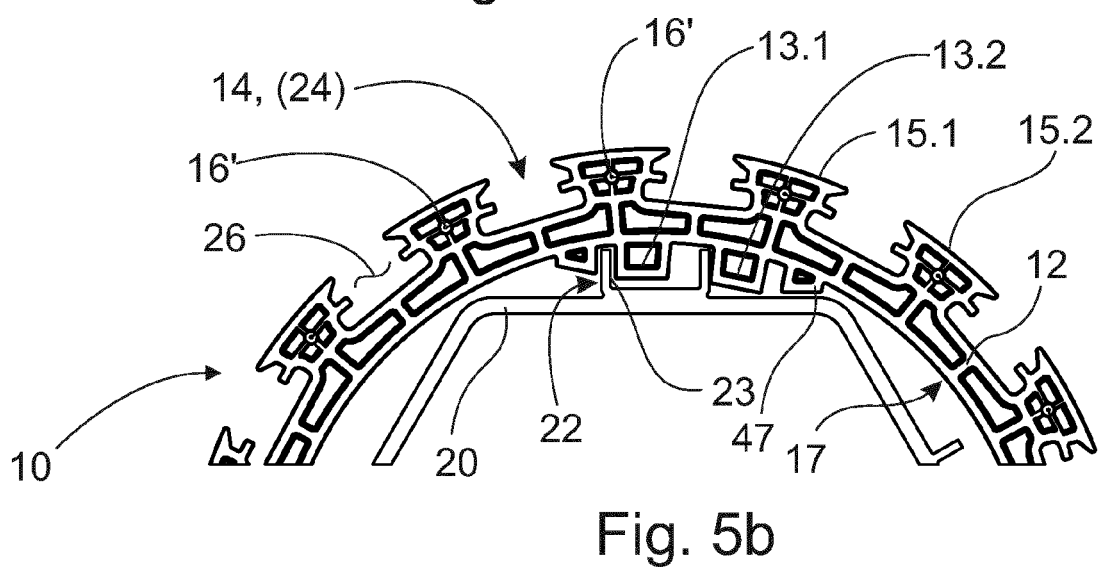
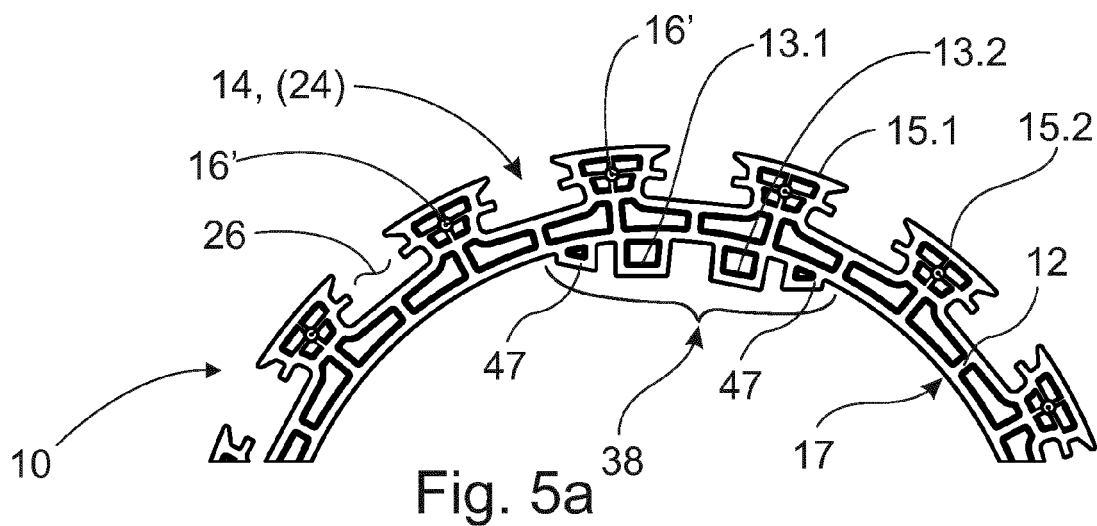


Fig. 4a





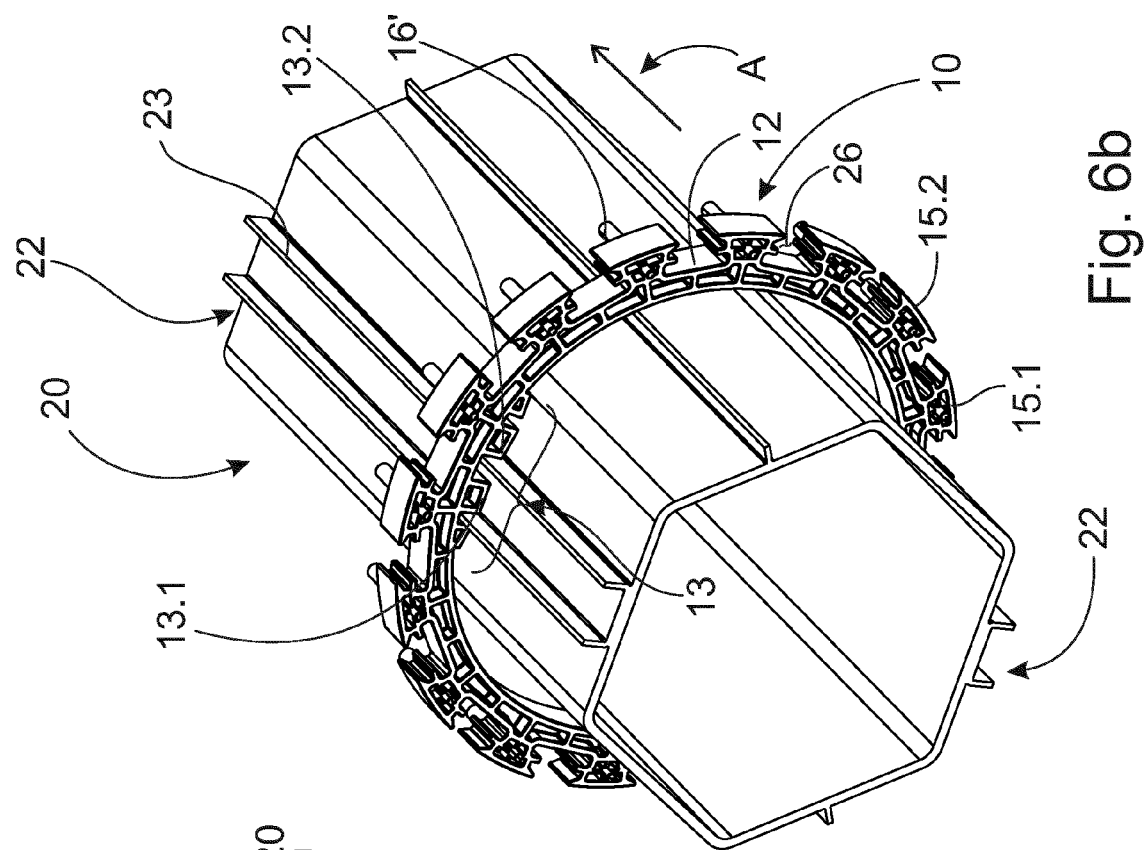


Fig. 6b

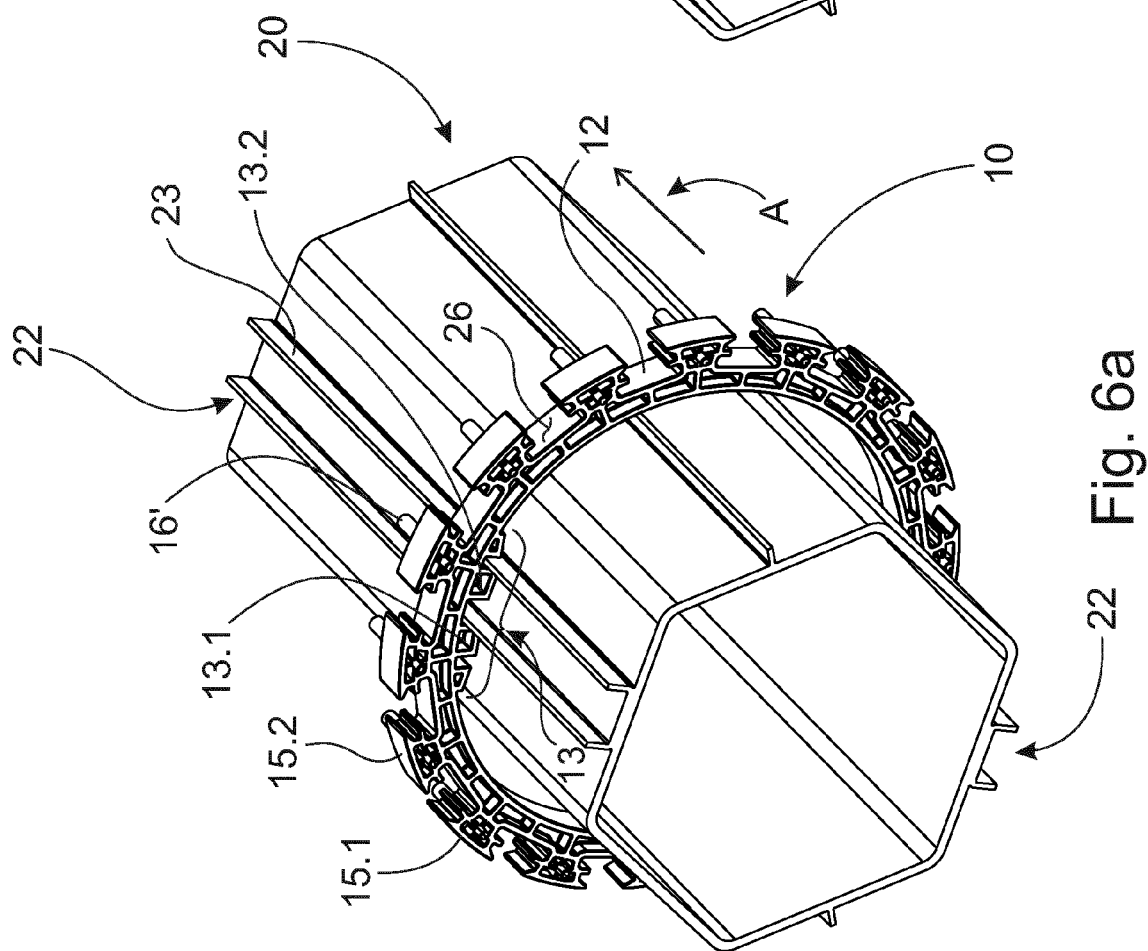
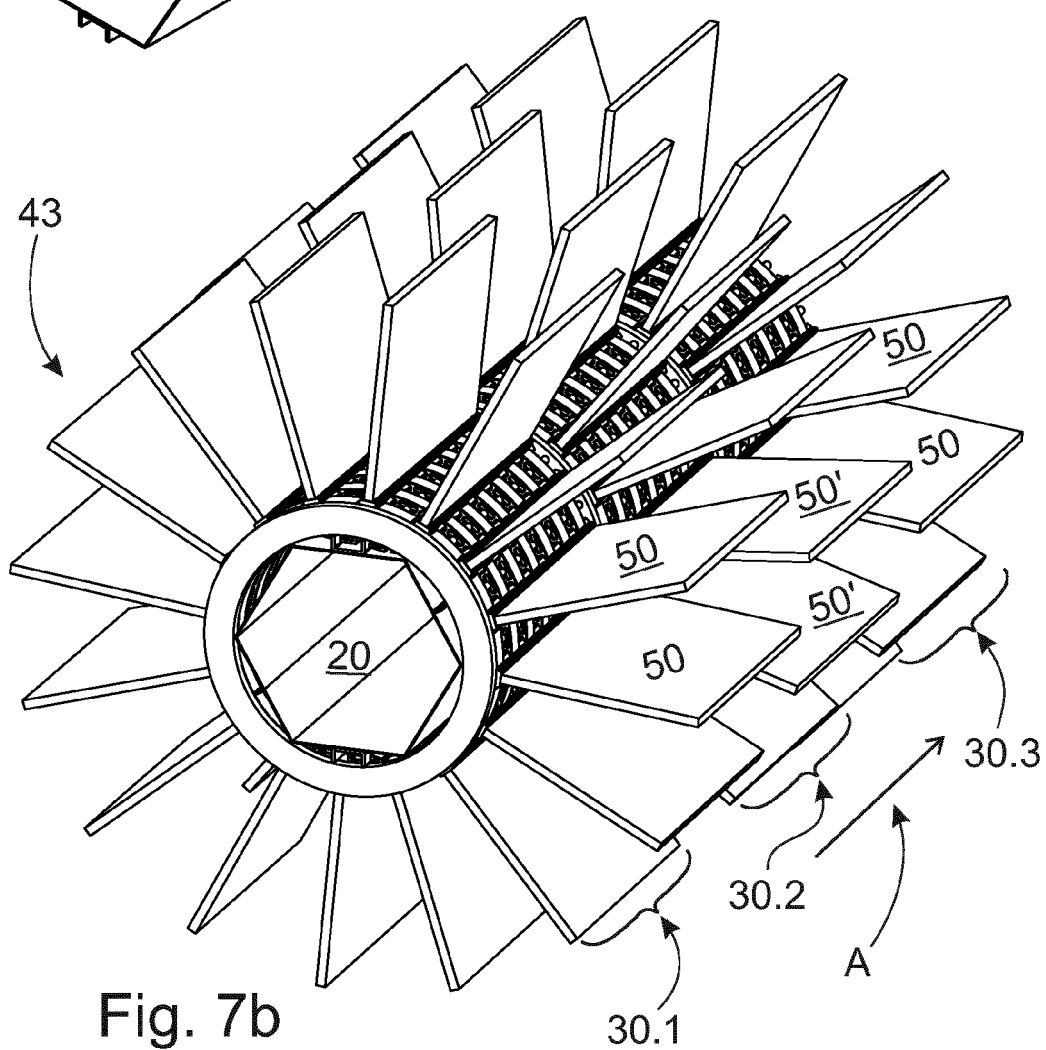
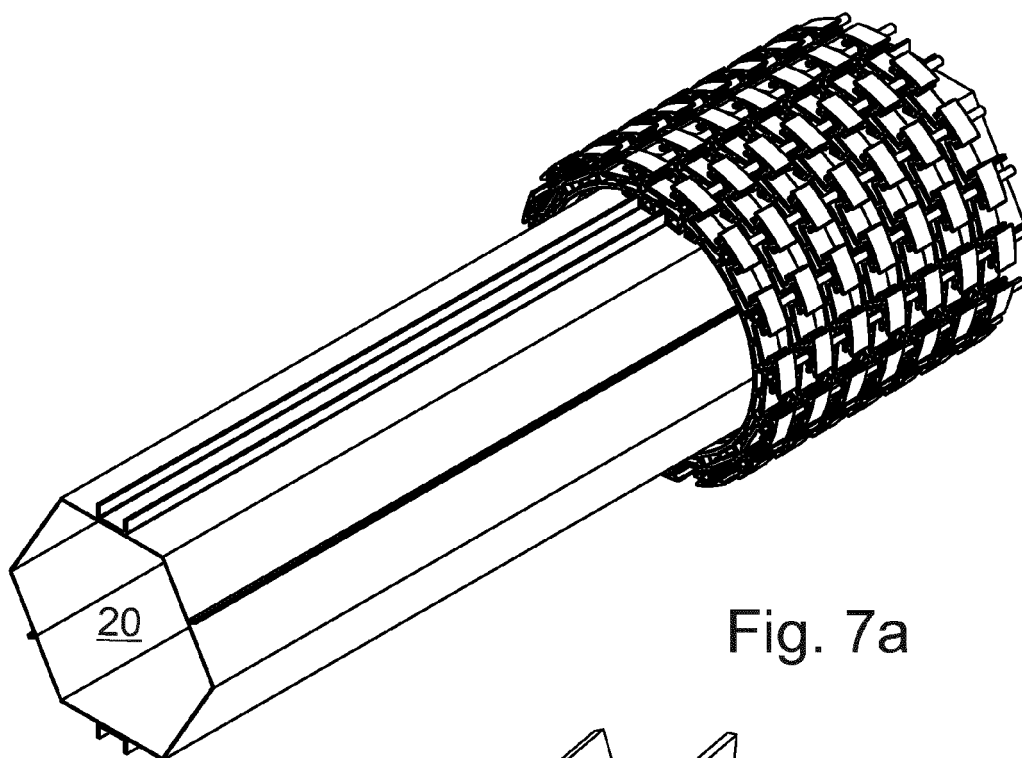


Fig. 6a



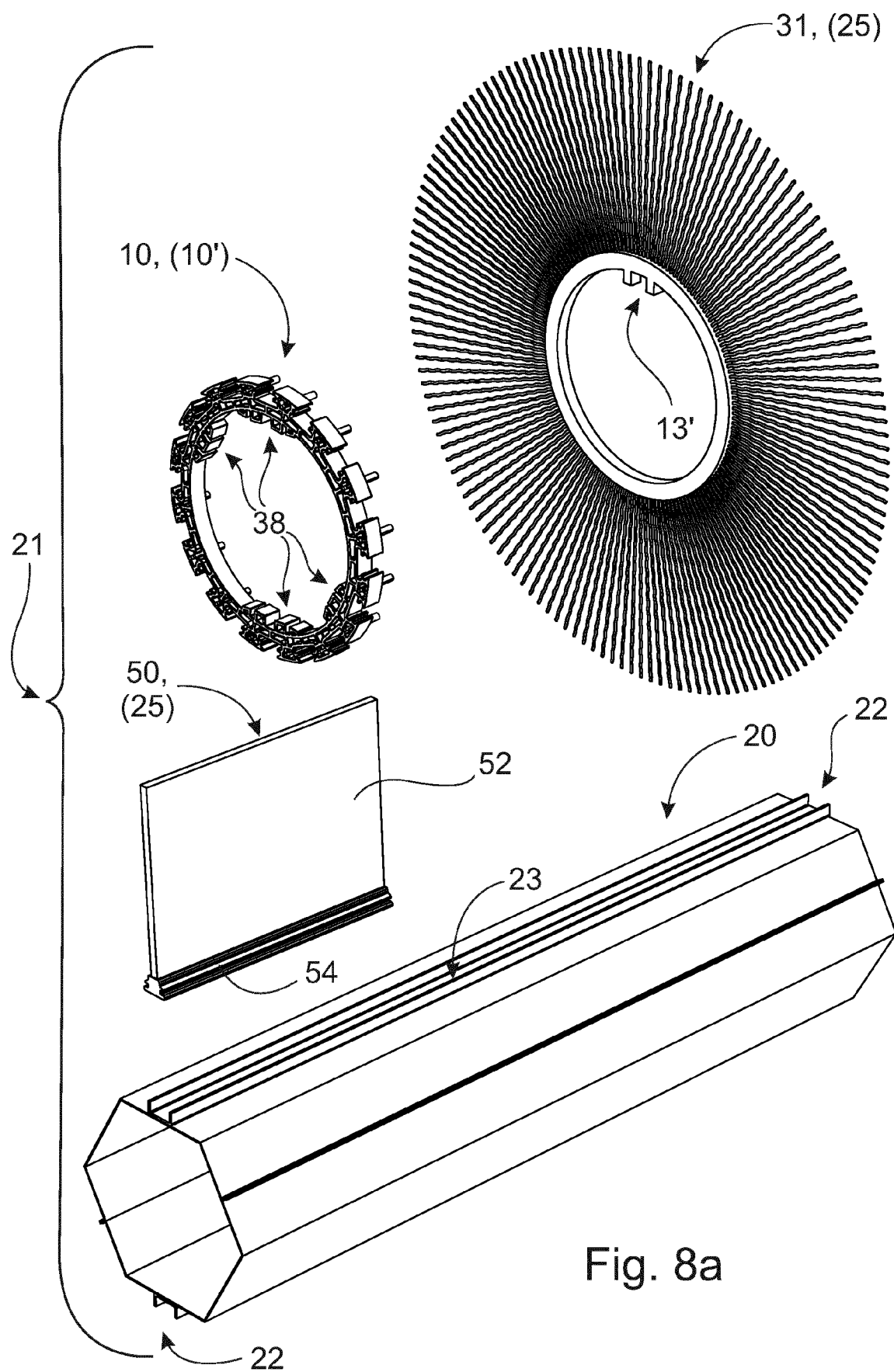


Fig. 8a

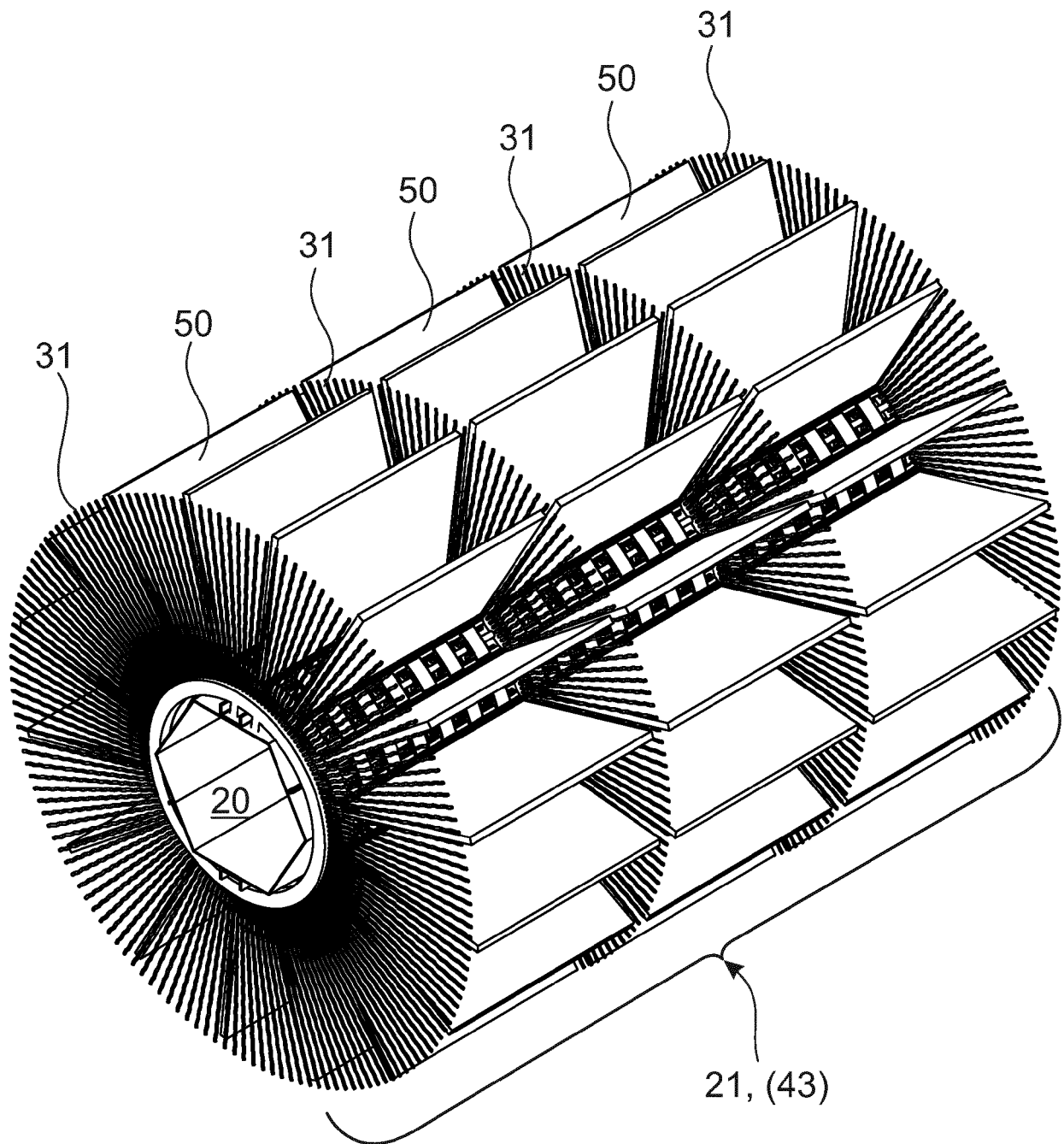
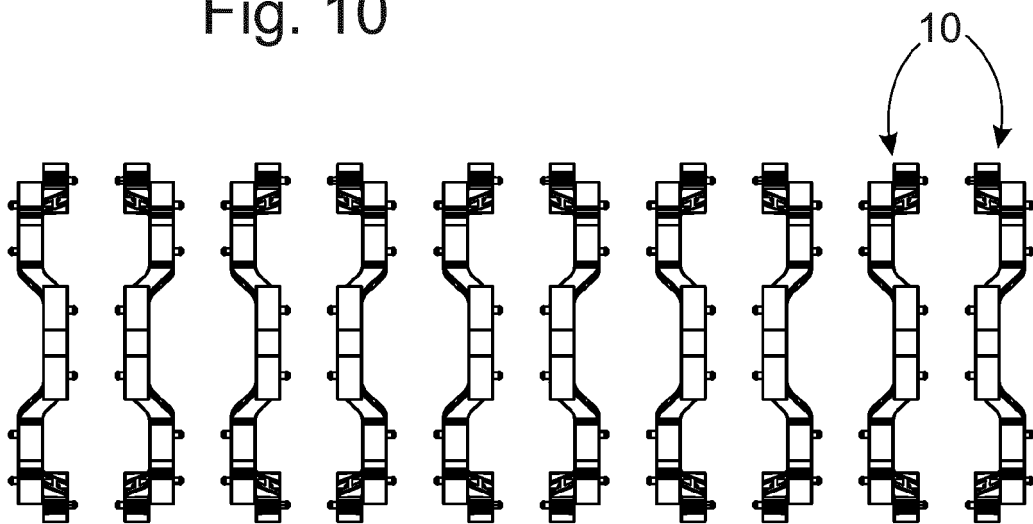
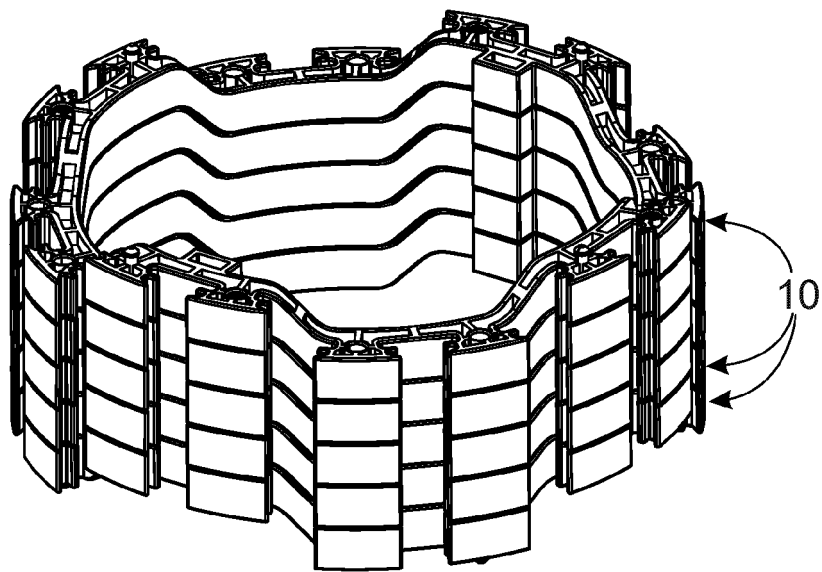
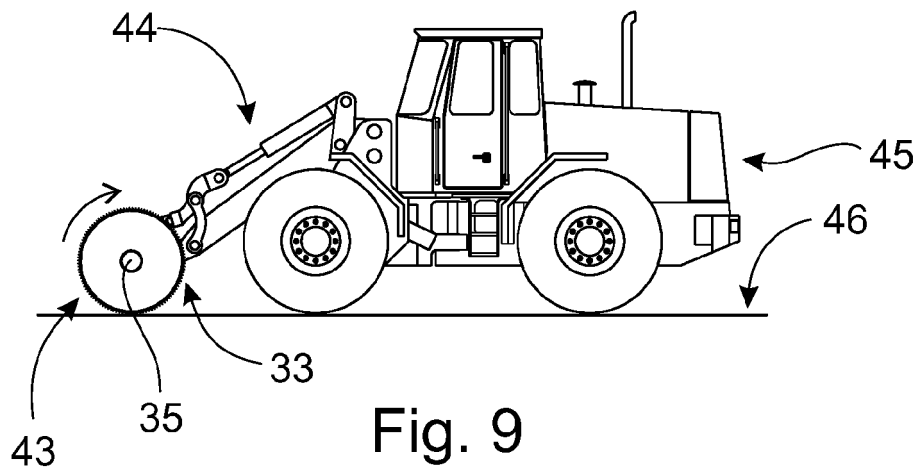


Fig. 8b





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Place of search The Hague		Date of completion of the search 19 February 2020	Examiner Kun, Karla
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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