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(54) **BRUSH DEVICE WITH QUICK COUPLINGS FOR CLEANING ELEMENTS**

(57) A brush device with quick couplings for cleaning elements (5) comprises: a rotation shaft that operatable by motor elements; support members (3) obtained fixed to the rotation shaft and each one assigned to connect respective cleaning elements (5) to said shaft; first connection elements (7), each one fixed to the respective support member (3) and provided with a housing (9) hosting a portion of at least one cleaning element (5) and with a respective second connection element (11) assigned to reversibly fix, i.e. to block and unblock, said at least one cleaning element (5).

First (15) and second (17) retaining elements of said device (1) are placed at, or obtained in, respective ends of the first connection element (7) and house, by reversibly blocking them, matching members first (21) and second (23) placed at the ends of the second connection element (11), or said first (15) and second (17) retaining elements are carried out in the respective ends of the second connection element (11) and reversibly block the first (21) and second (23) matching members obtained in the ends of the respective support member (3).

The first (15) and second (17) retaining elements define respective cavities shaped approximately complementary to the first (21) and second (23) matching members. The second the retaining element (17) has a tooth (27) delimiting the corresponding cavity, cantilevered onto a flexible arm (29) connecting it to the respective end of the first connection element (7) or of the second connection element (11).

Said flexible arm (29) has a driving extension (33) for the manual actuation thereof to free the matching member (21, 23) from the tooth (27) allowing for the detachment of at least the second connection element (11) and of the cleaning element (5).

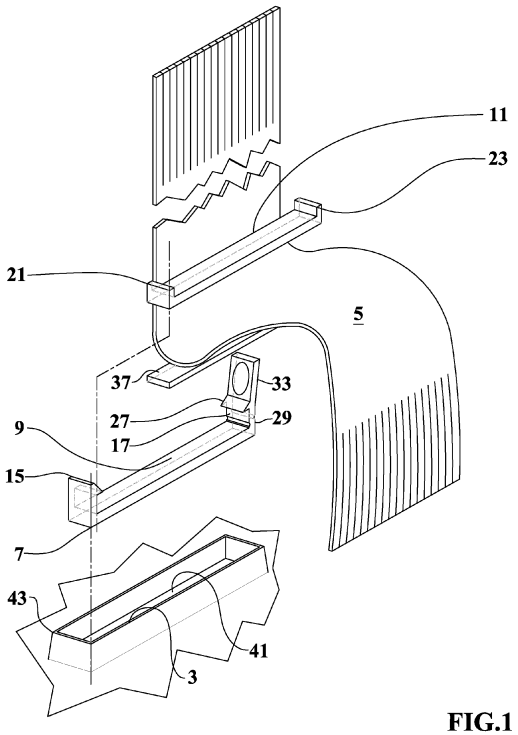

FIG.1

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Description

[0001] The present invention relates to the technical field concerning the washing and/or cleaning of objects, such as vehicles, and refers to a brush device with quick couplings for cleaning elements.

[0002] There are known brush devices of the type rotating around a rotation shaft thereof, for example in use in vehicle washes or in industrial washing. Each of such brush devices is provided with one or more flexible support members fixed to the cylindrical or prismatic outer surface of the respective rotation shaft. Each flexible support is equipped with a plurality of concave seats open in the direction opposite to the shaft.

[0003] Each seat is delimited by a respective perimeter wall protruding perpendicularly from the support member and is intended to house a median transverse portion of at least one cleaning element generally in the form of a flexible ribbon-like flap made, for example, of non-woven fabric, felt, or closed-cell synthetic material sheet.

[0004] A transverse portion of each cleaning element, housed in the respective concave seat, is fixed to the bottom of the seat constituted by the flexible support for the member of fastenings, seams, staples and other types of connections.

[0005] Some types of brushes, for example those for the final drying of vehicles or for cleaning delicate surfaces or surfaces to be preserved, require the cleaning elements to be periodically and thoroughly washed. These washings of the cleaning elements cannot be carried out on site and require that an employee, after separating the support members from the rotation shaft, detaches, one by one, each cleaning element from its respective seat by cutting or detaching the fastenings or seams or staples.

[0006] This operation is complex, not free from risks for the operator and takes a very long time. After washing the cleaning elements, each of them must be repositioned and fixed into its respective seat.

[0007] Drawbacks of such known devices consist in the fact that it's very expensive to clean such kind of brushes, it takes a lot of time, it can be dangerous for the operator, for example he could get injured while cutting or detaching the fasteners, and also can lead a damage to the delicate cleaning elements or to other parts of the brush that can be excessively stressed by the detachment and fixing operations.

[0008] An object of the present invention is to propose a brush device with quick couplings for cleaning elements which allows to carry out the operations of detaching and fixing the cleaning elements from the respective support member, in a fast and safe way.

[0009] Another object is to allow the detachment and repositioning of the cleaning elements even without the need to separate the support members from the rotation shaft.

[0010] The characteristics of the invention are highlighted below with particular reference to the accompanying drawings in which:

- Figure 1 shows a schematic, axonometric, exploded and partial view of a quick coupling for connecting a cleaning element to a support member of the brush device with quick couplings for cleaning elements object of the present invention;
- Figure 2 shows a partial and axonometric view of the support member of Figure 1 provided with a plurality of concave seats;
- Figure 3 shows a partial and cross-section view of a variant of the elements of Figure 1 mutually assembled;
- Figure 4 shows an enlarged detail of Figure 3;
- Figure 5 shows a side view of a second connection element of a second variant of the brush device with quick couplings for cleaning elements of Figure 1;
- Figure 6 shows a section view along the plane VI-VI of the second connection element of Figure 5;
- Figure 7 shows a section view along the plane VII-VII of the second connection element of Figure 5;
- Figures 8, 9, 10 and 11 show respectively bottom, top, front and rear views of the second connection element of Figure 5;
- Figures 12 and 13 show respective axonometric views of the second connection element of Figure 5;
- Figures 14, 15 and 16 show respectively bottom, side and top views of a first connection element of the second variant of the brush device with quick couplings for cleaning elements of Figure 1;
- Figure 17 shows a section view along the XVII-XVII plane of the first connection element of Figure 15;
- Figures 18 and 19 show respective axonometric views of the first connection element of Figure 14;
- Figures 20 and 22 show respective top and side views of a support member of the second variant of the brush device with quick couplings for cleaning elements of Figure 1;
- Figure 21 shows a section view along the plane XXI-XXI of the support member of Figure 20;
- Figures 23 and 24 show respective rear and front views of the support member of Figure 20;
- Figure 25 shows an axonometric view of two support members of Figure 20;
- figure 26 shows a schematic, axonometric, exploded and partial view of the second variant of the brush device with quick couplings for cleaning elements, the parts of which are illustrated in Figures 5 and subsequent ones.

[0011] With reference to Figures 1 to 4, 1 indicates the brush device with quick couplings for cleaning elements object of the present invention. Such device 1 comprises at least one rotation shaft, for example of the metal tubular type and made by extrusion of aluminum or similar.

[0012] The rotation shaft, being of a known type and not illustrated, can be operated by respective motor elements and has a set of support members 3 carried out

in the rotation shaft itself or fixed to it in an irremovable way or, preferably and as illustrated in the figures, in a removable way. The support members 3 are rigid and shaped like a portion of the external face of the shaft or, instead and preferably, they are rectangular and flexible. Once mounted onto the rotation shaft, the support members 3 reproduce the shape of the portion of the shaft to which they are removably fixed; for example, the rotation shaft can be cylindrical in shape and each support member 3 is fixed to it with two sides parallel to the longitudinal geometric axis of the rotation shaft assuming the shape of a cylinder portion.

[0013] Each support member 3 is assigned to connect a respective plurality of cleaning elements 5 to said shaft. Each cleaning element can consist of a sheet, patch, strip or flat of rectangular, ribbon-like or other elongated shape.

[0014] One or both ends of each cleaning element 5 can be frayed, as illustrated in Figure 1, or intact and this cleaning element 5 can be made of fabric, of a low density synthetic and/or closed-cell material, of non-woven fabric, of felt or of other flexible materials suitable for washing.

[0015] The device 1 comprises a plurality of first connection elements 7, each assigned to be fixed, for example by welding, gluing, rivets, by interference or by other fastening means, to the respective support member 3, and each provided with a housing 9, assigned to host a portion of at least one cleaning element 5, and with a respective second connection element 11, assigned to fix reversibly, or to lock and unlock, said portion of the at least one cleaning element 5 placed or clamped between said first 7 and second 11connection elements.

[0016] The portion of the cleaning element 5 intended to be blocked between the first 7 and second 11 connection elements has an elongated rectangular cross section consisting of a layer of the cleaning element material or of multiple folded layers; for example, the ratio between the thickness and the width of the cleaning element, that is the ratio between the dimensions of the cross section of this unfolded element, can be approximately between 1 to 10 and 1 to 300.

[0017] The main dimension of the housing 9 has length equal to or greater than the largest dimension of said section.

[0018] The ends of the housing 9 are delimited by retaining elements first 15 and second 17 placed at the respective end portions of the first connection element 7. The ends of the second connection element 11 bear matching members, respectively first 21 and second 23.

[0019] The first 15 and second 17 retaining elements can be rigidly fixed to the ends of the main body of the first connection element 7, or preferably they 15, 17 are made in a single body with the first connection element 7.

[0020] The first 15 and second 17 retaining elements are assigned to house, by reversibly locking them, the first 21 and second 23 matching members of the second connection element 11 blocking it together with the at least one respective cleaning element.

[0021] The first 7 and second 11 connection elements can have an overall shape as a very elongated "C" and as an "I", respectively, and can be made of synthetic material; preferably at least the first connection element 7 is made of plastic material and has a sufficient degree of flexibility and elasticity as better specified below. The first 15 and second 17 retaining elements define respective cavities with a shape approximately complementary to that of the first 21 and second 23 matching members.

[0022] At least the second retaining element 17 has a tooth 27 for delimiting the corresponding cavity and intended to reversibly lock the corresponding matching member 21, 23.

[0023] The tooth 27 is cantilevered onto a flexible arm 29 which connects it to the respective end of the main body of the first connecting element 7.

[0024] The tooth or preferably the flexible arm is provided with a driving extension 33 which, in the fastening condition, moves away from the support member 3 protruding outwards.

[0025] The driving extension 33 is fit for the manual actuation of the flexible arm 29 to free the matching member 21, 23 from the tooth 27 allowing the detachment of the second connection element 11 and the cleaning element 5.

[0026] As seen, the material of the first connection element 7 has flexibility and elasticity such as to allow for the elastic deformation of the flexible arm 29 which can be provided with grooves or tapering for an easier bending or to obtain a hinged movement. Alternatively, the flexible arm 29 can be connected to the main body of the first connection element 7 by means of a hinge with a rotation pin; this hinge can be equipped with elastic elements or the arm 29 can be equipped with reversible joint interlocking retainers to keep the tooth 27 elastically and reversibly in its stop position of the matching member 21, 23.

[0027] A further alternative provides that the matching member 21, 23 and the tooth 23 can be shaped to ensure a certain force which tends to keep them removably coupled to each other until a sufficient detachment force is applied to the flexible arm 29.

[0028] The face of the tooth 27 opposite the corresponding cavity is provided with an inclined surface to facilitate the pressure insertion and the joint block of the connection element 11 and the cleaning element 5.

[0029] The first 21 and second 23 matching members of the second connection element 11 are approximately the same shape and size. Alternatively or additionally, the cavities of the first 15 and second retaining elements 17 of the first connecting element 7 are approximately the same shape and size. In the case of equal and corresponding shapes, the fixing of the cleaning element 5 can be carried out regardless of the mutual orientation of the first 7 and second 11 connection elements, in fact it will be sufficient to align them and press them towards each other.

[0030] Preferably, where the second connection element 11 can be fixed by removable joint to the first connection element 7, said second connection element 11 is irremovably fixed to the portion of the at least one cleaning element 5 hosted in the housing 9 of the first connection element 7, for example to the face of the latter 5 opposite the first connection element 7. This irremovable fixing of the second connection element 11 to the cleaning element 5 speeds up and facilitates the operations of reassembling the cleaning elements to the brush.

[0031] The irremovable fixing can be achieved by gluing, by melting pins protruding from the second connection element 11 and engaged in respective holes of said portion of the at least one cleaning element 5, by means of seams, fastenings, stitches, clips, expansion elements, screws or similar fixings.

[0032] A further alternative of the invention provides that said first 7 and second 11 connection elements are respectively fixed to the cleaning element 5 and to the support member 3.

[0033] The invention optionally provides the adoption of a reinforcement element 37 assigned to be fixed to the second connection element 11 to block between them the portion of the at least one cleaning element 5; in this case the housing 9 and the cavities of the first 15 and second 17 retaining elements of the first connection element 7 are dimensioned to house the reinforcement element 37 and the second connection element 11 with said interposed portion of the cleaning element 5.

[0034] One among the reinforcement element 37 and the second connecting element 11 can be equipped with a set of protruding pins assigned to engage into holes carried out in said portion of the cleaning element 5 to insert into seats made in the other one and in which said pins are blocked for example by thermal welding or with an ultrasonic welder or other.

[0035] The faces of the reinforcement element 37 and of the first connection element 7 which are mutually facing in the fastening condition may possibly bear respective complementary projections and protrusions fit for at least one of:

- preventing incorrect coupling of the cleaning elements 5 with support members 3 or shafts;
- preventing, in the fastening condition, the sliding of the reinforcement element 37 with respect to the first connection element 7 to avoid unwanted detachment of the at least one cleaning element 5.

[0036] Each first connection element 7 is fixed to the respective support member 3 by fusion, with an ultrasonic welder or other, of pins protruding from the first connection element 7 and engaged into respective holes of the support member 3 itself or by gluing, stitches, clips, expansion elements, screws, seams, bonds or similar fixings.

[0037] The support member 3 is provided with a plurality of concave seats 41, for example of rectangular or oval elongated shape, open in the direction opposite to the shaft, each being delimited by a respective perimeter wall 43 protruding perpendicularly from the support member 3. Each first connection element 7 is fixed, inside a respective concave seat 41, to the bottom of said seat which is constituted by the main sheet-like body of the support member 3; in the operating condition of the brush, the longitudinal axes of the concave seats are preferably mutually parallel and oriented parallel to the longitudinal axis of the rotation shaft or inclined.

[0038] As an alternative to the equality of the shapes of the retaining elements and of the matching members, and where the second retaining element 17 is assigned to house the second matching member 23, the complementary shapes of the first retaining element 15 and of the first matching member 21 can be different from those of the second retaining element 17 and of the second matching member 23; in fact, it is sufficient that the complementary shapes of the first retaining element 15 and of the first matching member 21 are such as to prevent mutual distancing in the radial direction with respect to the rotation shaft when they are mutually engaged; for example, the variant of Figures 3 and 4 provides that the first matching member 21 of the second connection element 11 and the cavity of the first retaining element 15 of the first connection element 7 are of approximately cylindrical shape. Alternatively, the first matching member 21 and the cavity of the first retaining element 15 have rectangular or prismatic shape.

[0039] The mouth of the cavity of the first retaining element 15 of the first connection element 7 has a dimension smaller than the diameter of the cylindrical shape and the cylindrical first matching member 21 of the second connection element 11 has a flattening positioned and dimensioned such as to allow for the exit of the first matching member 21 from the cylindrical cavity of the first retaining element 15 only if the second connection element 11 is rotated by a certain angle with respect to the first connection element 7.

[0040] The second matching member 23 of the second connection element 11 and the cavity of the second retaining element 17 of the first connection element 7 can be approximately rectangular or prismatic in shape. Also the second variant of the brush device with quick couplings for cleaning elements, illustrated in Figures 5 to 26, provides that at least a portion of one or more cleaning elements 5 be clamped between the first 7 and second 11 connection elements.

[0041] Differently from the previous embodiments, in the operating condition the first connection element 7 is housed in the respective concave seat 41 of the support member 3 and is removably locked there by the second connection member 11 releasably fixed, that is detachable and re-attachable, to the support member 3, where the first 7 and second 11 connection elements irremovably block the interposed portions of the respective cleaning elements or elements blocked therebetween. The first retaining element 15 and the second retaining element

17 are placed or carried out in a single body in the respective ends of the second connection element 11.

[0042] The first matching member 21 and the second matching member 23 are placed or carried out in a single body in the respective ends of the support member 3, and are assigned to be housed and reversibly locked in the first 15 and second 17 retaining elements, respectively, for the removable joint fixing of the second connection element 11 and of the first connection element 7 and of the at least one cleaning element 5 associated therewith.

[0043] Each end wall 44 of the perimeter wall 43 of the support member 3, as illustrated in Figures 20 to 25, has a passage delimited by the first 21 and second 23 matching members in proximity to the opening of the concave seat 41. Said matching members first 21 and second 23 extend transversely along the perimeter of said opening of the support member 3 and consist of transverse elements fit to be engaged in coupling and releasing by the first 15 and second 17 retaining elements. Obviously the first 21 and second matching members 23 and the first 15 and second 17 retaining elements can take other forms of reciprocal engagement and jointing, for example the matching members can be convex or one convex and the other concave and each retaining element can have a shape complementary to that of the respective matching member.

[0044] The first connection element 7 is rectangular and has two longitudinal walls forming the concave housing 9 assigned to host the portion of the cleaning element 5 assigned to be blocked between the same first connection element 7 and the second connection element 11. The ends of the housing 9 are open and flat or preferably delimited by a frame slightly raised with respect to the bottom of the housing itself, that is, less deep than said longitudinal walls, as shown for example in Figures 14 to 19. Said ends of the housing 9 are therefore partially or totally open to house respectively the first retaining element 15 and the second retaining element 17, abutting the edge of the housing 9.

[0045] The second connection element 11 has a prevalent longitudinal development and has a portion assigned to abut with the respective at least one cleaning element 5; said portion has length equal to or slightly greater than the length of the housing 9 and width lower than that of this housing 9.

[0046] The second connection element 11 has the first retaining element 15at one end, protruding longitudinally, and at its opposite end it has a flexible arm 29 which carries the second retaining element 17.

[0047] The second retaining element 17 comprises a tooth 27 cantilever fixed on the flexible arm 29 and assigned to reversibly lock the corresponding matching member 21, 23.

[0048] The flexible arm 29 ends in a driving extension 33 for the manual elastic operation of the flexible arm 29. The second connection element 11 has a longitudinal handle 34 which, in the fastening condition, is parallel to the support member 3 and to the first connection element 7.

[0049] The handle 34 ends in proximity to the driving extension 33 so as to allow an employee to grasp the handle of the connection element 11 with one hand and at the same time to exert, for example with the thumb of the hand, a force on the driving extension 33 to release the second connection element 11 from its fixed condition to the support member 3 to detach from the support member 3 the assembly of the first 7 and second connection elements 11 with the at least one cleaning element 5 blocked between of them.

[0050] Preferably, the first 15 and second 17 retaining elements, cooperating with respective projections or protrusions facing them, define respective cavities with a shape approximately complementary to that of the first 21 and second 23 matching members. The first 15 and second 17 retaining elements are dimensioned such as to be inserted into the respective passage of the end wall 44 of the support member 3, and are shaped to ensure a certain force which tends to keep them removably coupled to the respective first 21 and second 23 matching members as long as a sufficient release and detachment force is not applied to the flexible arm 29 and to the handle 34.

[0051] Preferably, the shape and/or position of each of the first 21 and second 23 matching members is compatible with the shape and size of only one among the first 15 and second 17 retaining elements and/or of the respective cavities to allow the connection of the second connection element 11 to the support member 3 in one direction only. In particular, the second matching member 23 is more distant from the bottom of the concave seat 41 than the first matching member 21, and the passage in the end wall 44 of the perimeter wall 43 of the support member 3 delimited by the second matching member 23 is wider than that delimited by the first matching member 21; the second matching member 23 is compatible with jointing only with the second retaining element 17, while the first matching member 21 is compatible only with the first retaining element 15.

[0052] The portion of the flexible arm 29 closest to the second connection element 11, i.e. the face of the tooth 27 opposite the respective cavity, is provided with an inclined surface which, in correspondence with the fastening of the second connection element 11 itself to the support member 3 , slides on the respective matching member 21, 23 to facilitate the pressure insertion and the joint block of the connection element 11, with the cleaning element 5 and the first connection element 7 associated therewith, to the support member 3.

[0053] Preferably, since the second connection element 11 can be fixed by removable interlocking joint to the respective support member 3, said second connection element 11 is irremovably fixed to the first connection element 7, and said at least one portion of the at least one cleaning element 5 is inserted therebetween. This fixing simplifies and speeds up the fixing and removal of

the cleaning elements 5 from the support member 3, for example in correspondence with the replacement of these cleaning elements 5. The irremovable fixing of the second connection element 11 to the first element connection 7 can be made by welding pins 12 protruding from the second connection element 11 and engaged, through suitable openings or perforations of the at least one cleaning element 5, in respective holes 14 of the first connection element 7, or this fixing can be obtained by means of seams, ties, stitches, clips, expansion elements, screws, rivets or similar fixings. The portion or portions of the cleaning element 5 or of the cleaning elements are thus irreversibly fixed in the housing 9 between the first 7 and second 11 connection elements.

Claims

1. Brush device with quick couplings for cleaning elements (5) comprising at least one rotation shaft that can be operated by respective motor elements, a set of support members (3) obtained in the rotation shaft or fixed to it and each one assigned to connect a respective plurality of cleaning elements (5) to said shaft; said device (1) comprises a plurality of first connection elements (7), each one assigned to be fixed to the respective support member (3) and provided with a housing (9) assigned to house a portion of at least one cleaning element (5) and with a respective second connection element (11) assigned to reversibly fix, i.e. to block and unblock, said at least one cleaning element (5); said device (1) also comprises first (15) and second (17) retaining elements which are placed at, or obtained in, respective ends of the first connection element (7) and assigned to house, by reversibly blocking them, matching members first (21) and second (23) placed at the ends of the second connection element (11), or said first (15) and second (17) retaining elements are placed or carried out in the respective ends of the second connection element (11) and are assigned to house, by reversibly blocking them, the first (21) and second (23) matching members which are placed or obtained in the ends of the respective support member (3); said device (1) is **characterized in that** the first (15) and second (17) retaining elements define respective cavities with a shape approximately complementary to that of the first (21) and second (23) matching members and **in that** at least the second the retaining element (17) has a tooth (27) delimiting the corresponding cavity, cantilever fixed onto a flexible arm (29) which connects it to the respective end of the first connection element (7) or of the second connection element (11); said flexible arm (29) is provided with a driving extension (33) fit for the manual actuation of the flexible arm (29) itself to free the matching member (21, 23) from the tooth (27) allowing for the detachment of at least the second connection element (11) and of the cleaning element (5).

2. Device according to claim 1 **characterized in that** one face of the tooth (27) opposite the corresponding cavity is provided with an inclined surface to facilitate the pressure insertion and the joint block of the connection element (11) and of the cleaning element (5) to the first connection element (7) or to the respective support member (3).

3. Device according to claim 1 or 2 **characterized in that** the portion of the cleaning element (5) assigned to be blocked between the first (7) and second (11) connection elements has an elongated rectangular cross section and **in that** the main dimension of the housing (9) has length equal to or greater than the largest dimension of said section.

4. Device according to any of the preceding claims **characterized in that** the first (21) and second (23) matching members are of approximately equal shape and size and/or **in that** the cavities of the first (15) and second (17) retaining elements of the first connection element (7) are of approximately equal shape and size or the shape of one of the first (21) and second (23) matching members of the second connection element (11) is compatible with the shape and size of only one of the cavities of the first (15) and second (17) retaining elements to allow for the connection in one direction only.

5. Device according to any of the preceding claims **characterized in that** the first matching member (21) and the cavity of the first retaining element (15) are approximately cylindrical in shape or are approximately rectangular or prismatic in shape and/or **in that** the second matching member (23) and the cavity of the second retaining element (17) have approximately rectangular or prismatic shape.

6. Device according to any of the preceding claims **characterized in that**, where the second connection element (11) can be fixed by removable joint to the first connection element (7), said second connection element (11) is irremovably fixed to the face of said portion of the at least one cleaning element (5) opposite to the first connection element (7) by gluing, by fusion of pins protruding from the second connection element (11) and engaged in respective holes of said portion of the at least one cleaning element (5), by means of seams, ties, stitches, clips, expansion elements, screws or similar fasteners.

7. Device according to claim 6 **characterized in that** it comprises a reinforcement element (37) assigned to be fixed to the second connection element (11) to block therebetween said portion of the at least one

cleaning element (5), where the housing (9) and the cavities of the first (15) and second (17) retaining elements of the first connection element (7) are dimensioned to house the reinforcement element (37) and the second connection element (11) with said interposed portion of the cleaning element (5).

8. Device according to claim 7 **characterized in that** the faces of the reinforcement element (37) and of the first connection element (7) which face each other in a fastening condition have respective complementary projections and protrusions fit for at least one of: preventing incorrect coupling of the cleaning elements (5) with support members (3) or shafts, and preventing, in the fastening condition, the sliding of the reinforcement element (37) with respect to the first connection element (7) to avoid unwanted detachment of the at least one cleaning element (5).

9. Device according to any of the preceding claims **characterized in that** each first connection element (7) is fixed to the respective support member (3) by fusion of pins protruding from the first connection element (7) and engaged in respective holes of the support member (3) itself or by means of gluing, stitches, clips, expansion elements, screws, seams, bonds or similar fastenings; where the support member (3) is equipped with a plurality of concave seats (41) open in the direction opposite to the shaft, each one being delimited by a respective perimeter wall (43) protruding perpendicularly from the support member (3), in which each first connection element (7) is fixed inside a respective concave seat (41).

10. Device according to any of claims 1 to 5 **characterized in that**, where the second connection element (11) can be fixed by removable joint to the respective support member (3), said second connection element (11) is irremovably fixed to the first connection element (7), with interposition and fixing of said portion of the at least one cleaning element (5), by fusion of pins (12) protruding from the second connection element (11) and engaged in respective holes (14) of the first connection element (7), or by means of seams, ties, stitches, clips, expansion elements, screws or similar fasteners.

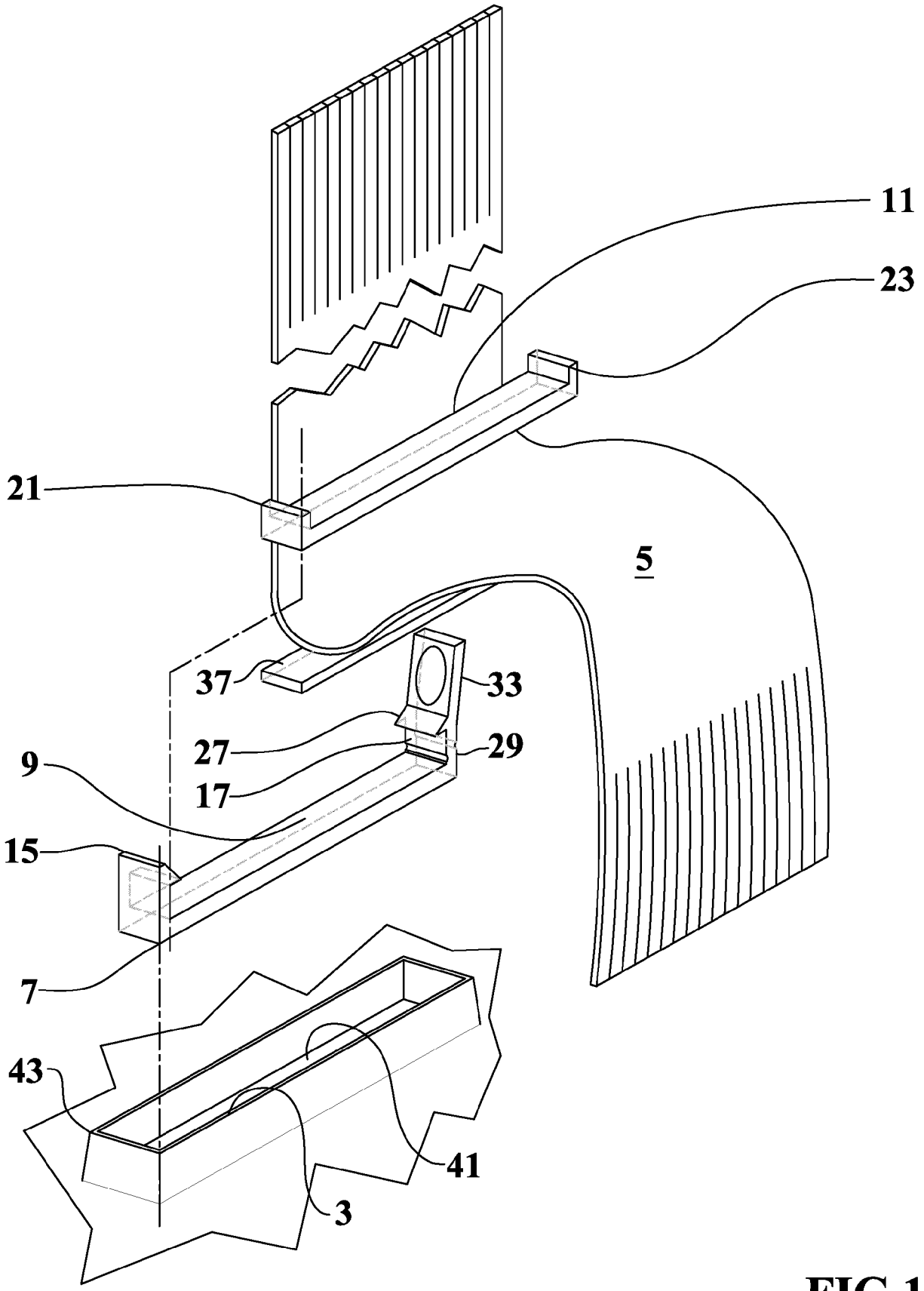

FIG.1

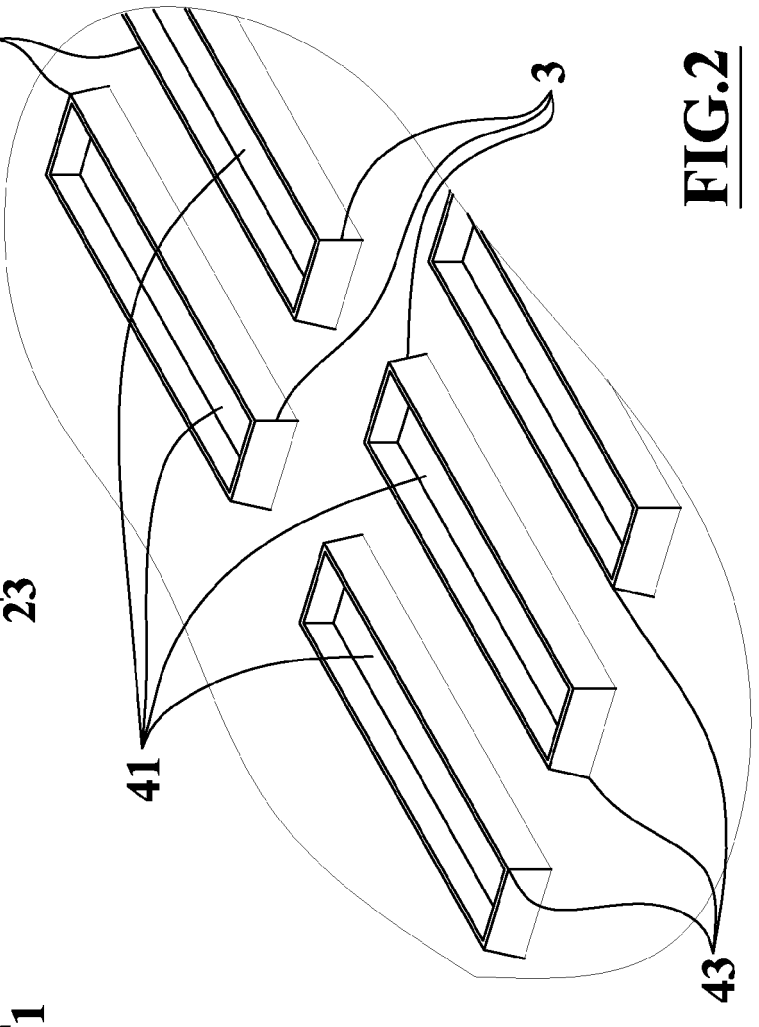

FIG.2

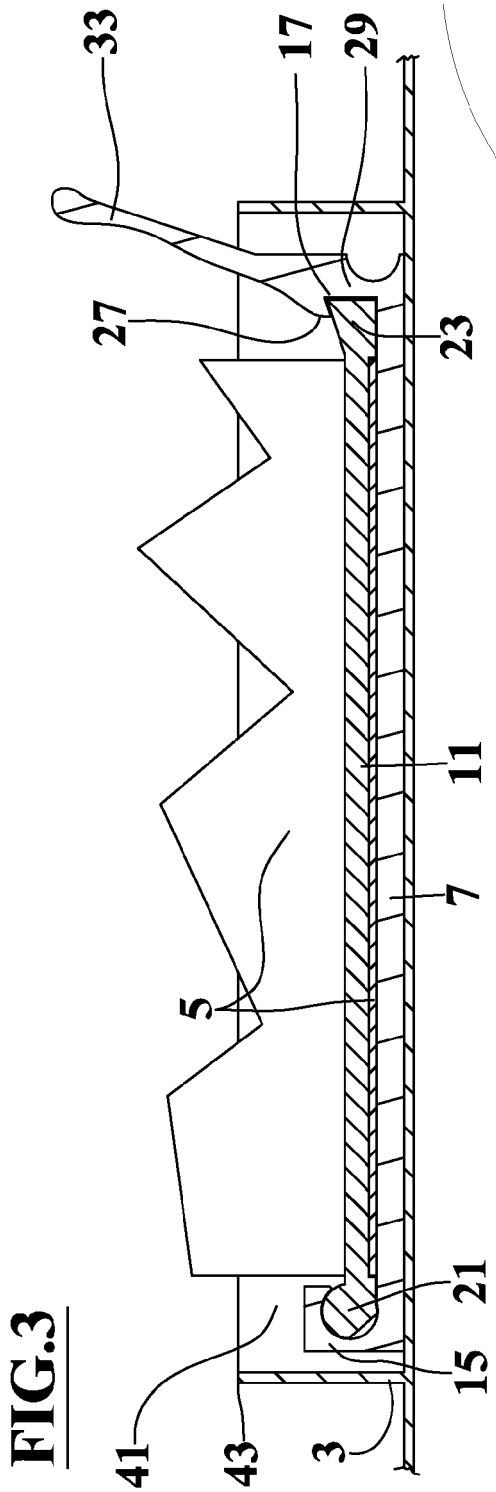

FIG.3

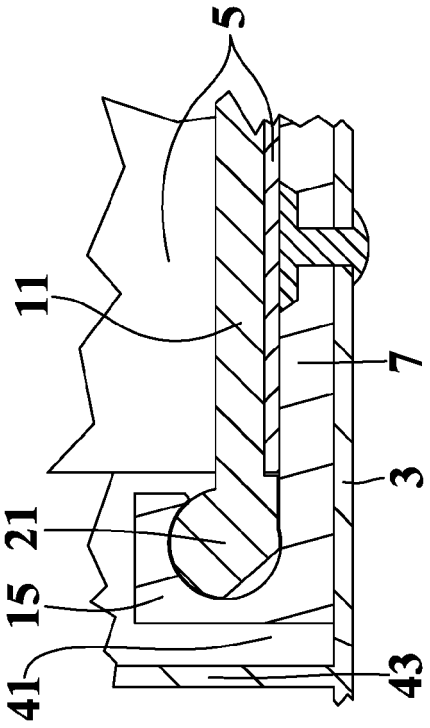

FIG.4

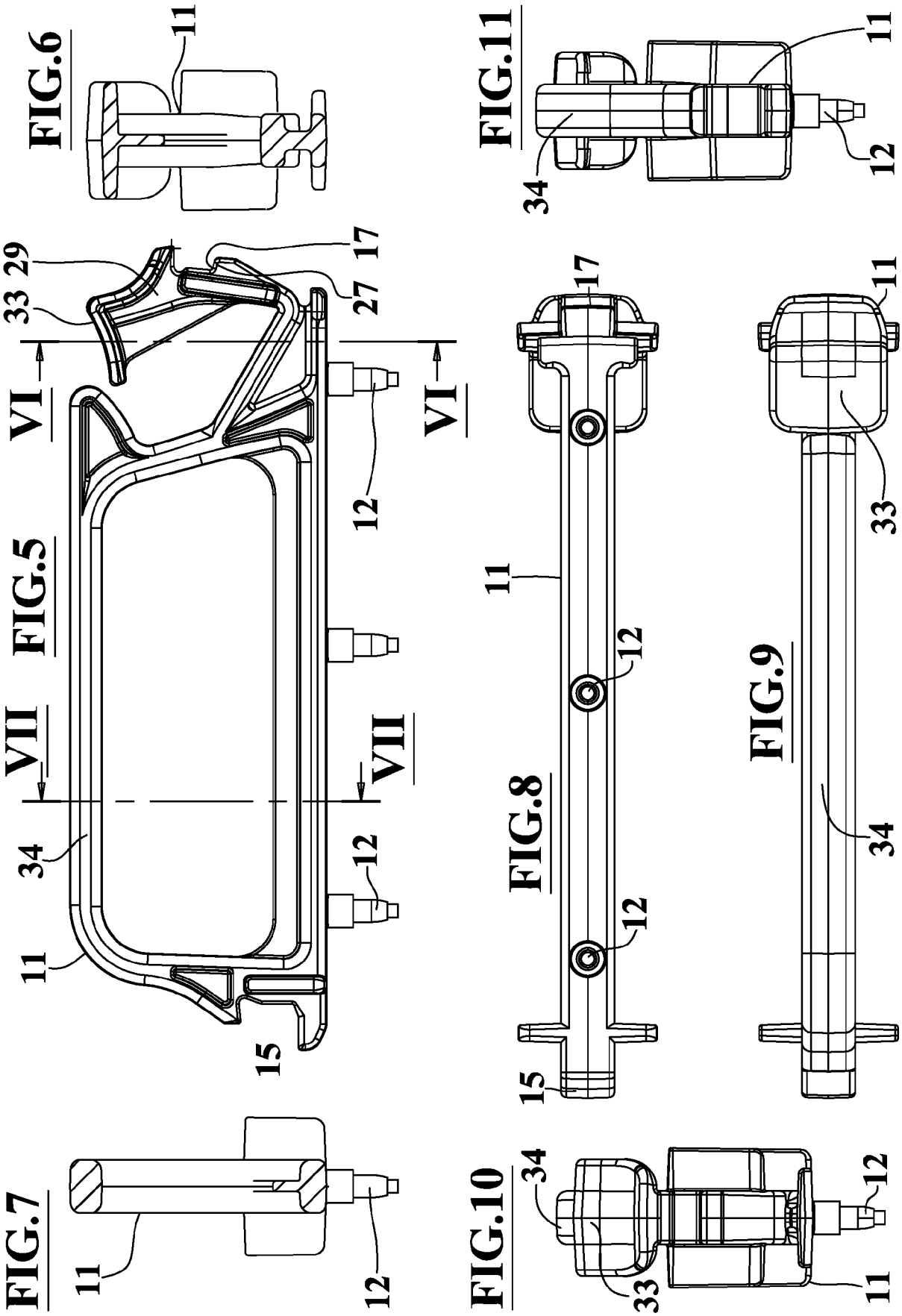
FIG.6
11
FIG.5
29
33
17
27
VI
VI
12
VII
VII
34
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11
15
FIG.7
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FIG.11
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34
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FIG.8
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11
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FIG.9
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33
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FIG.10
34
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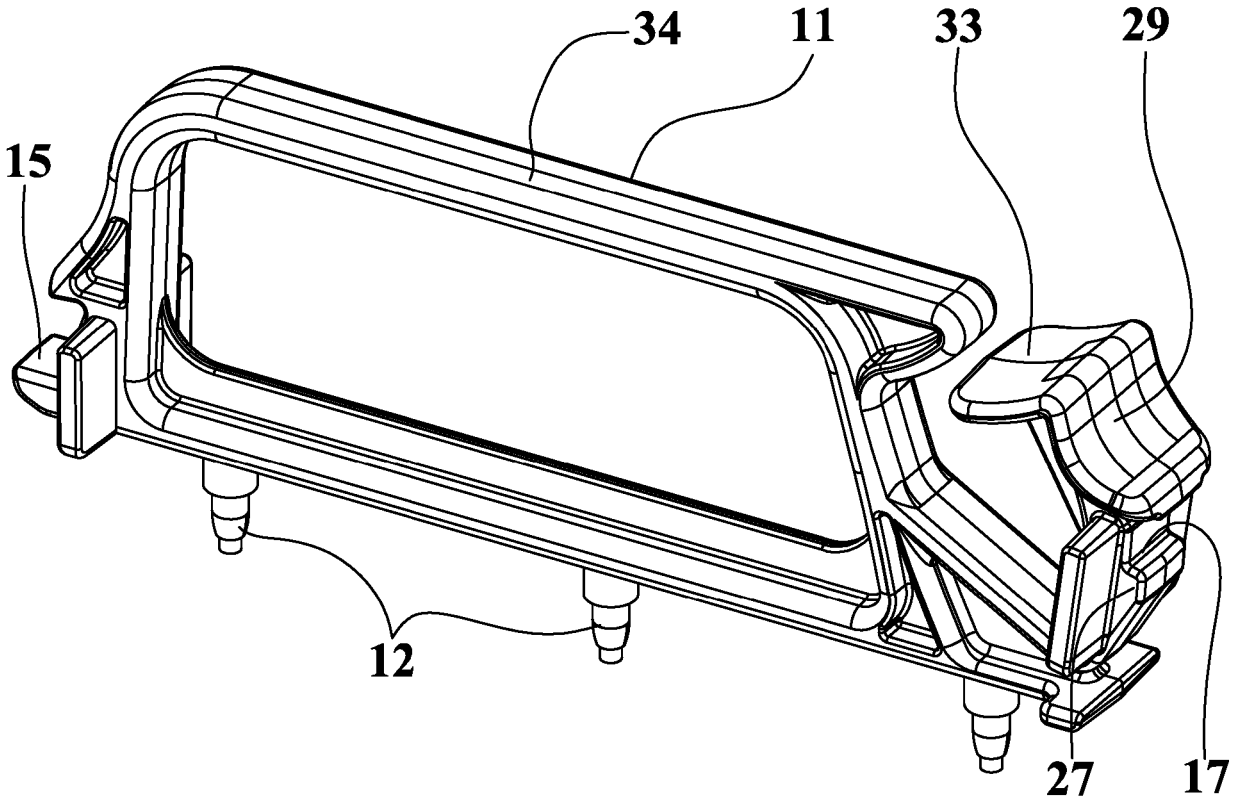
33
11

FIG.12



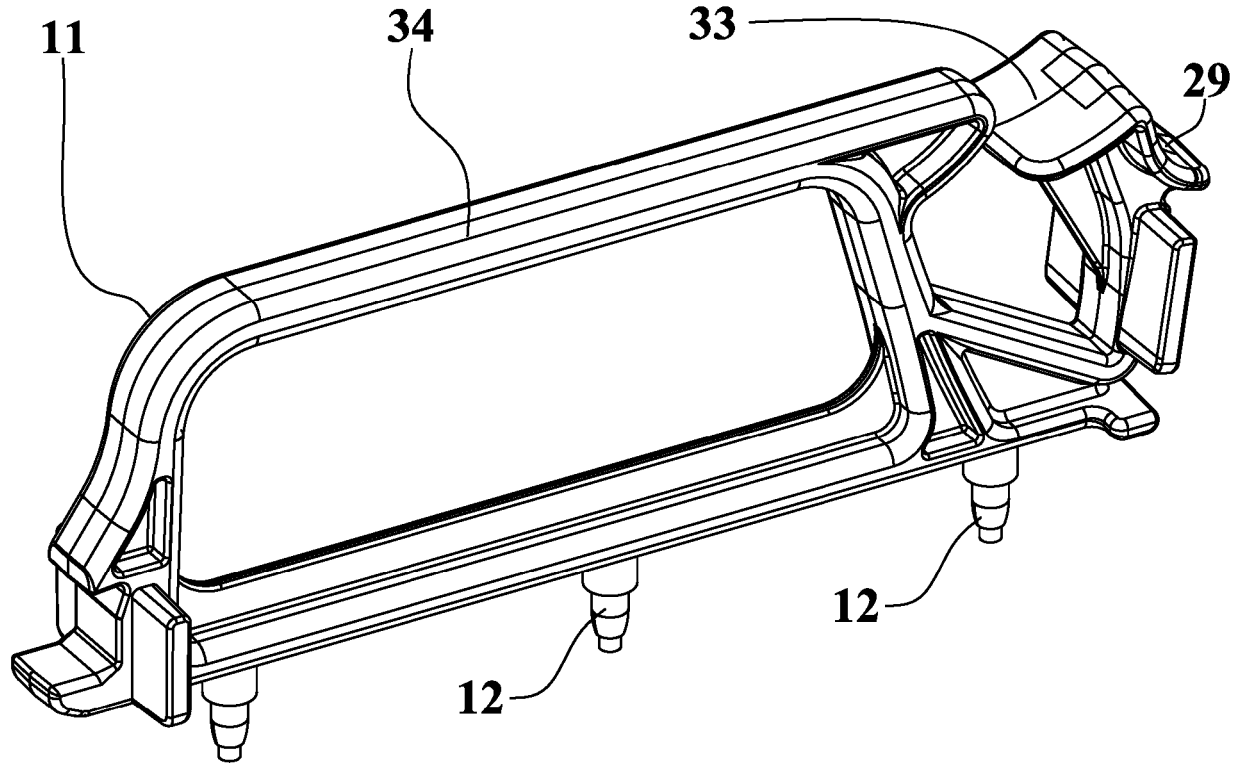


FIG.13

FIG.14

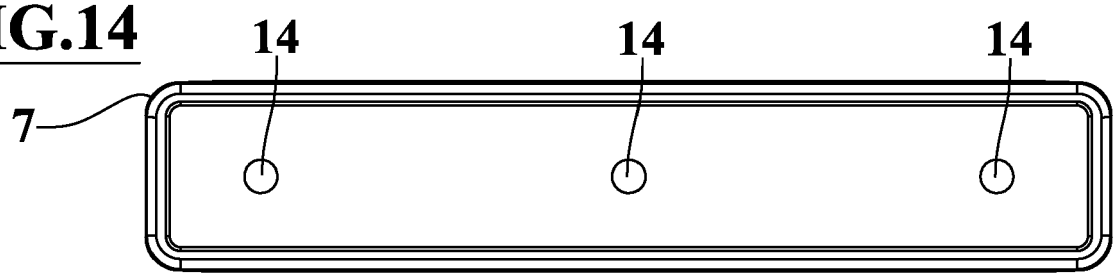
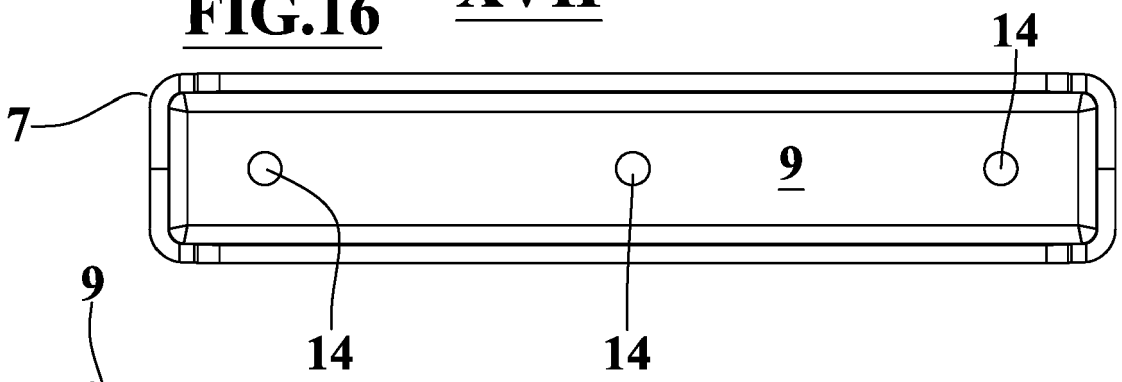


FIG.15

FIG.16



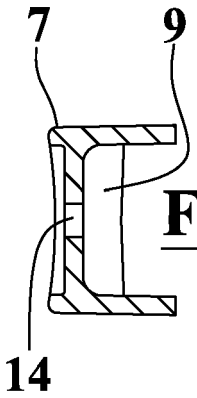


FIG.17

FIG.18

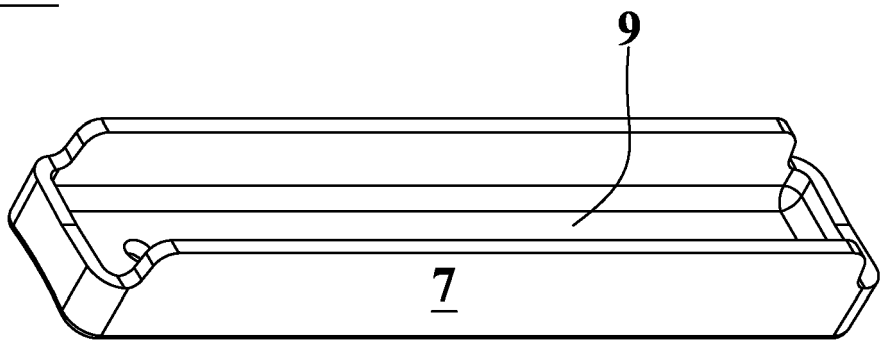


FIG.19

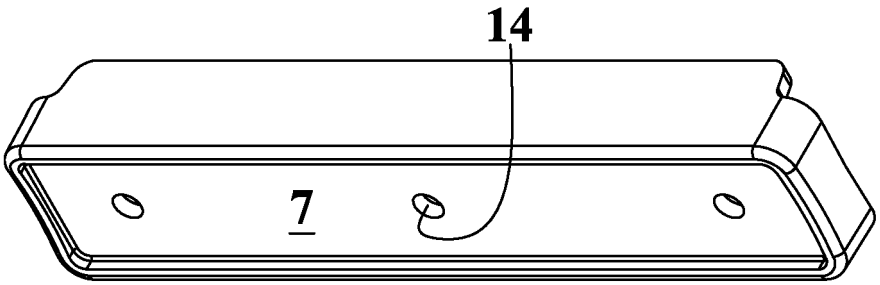


FIG.22

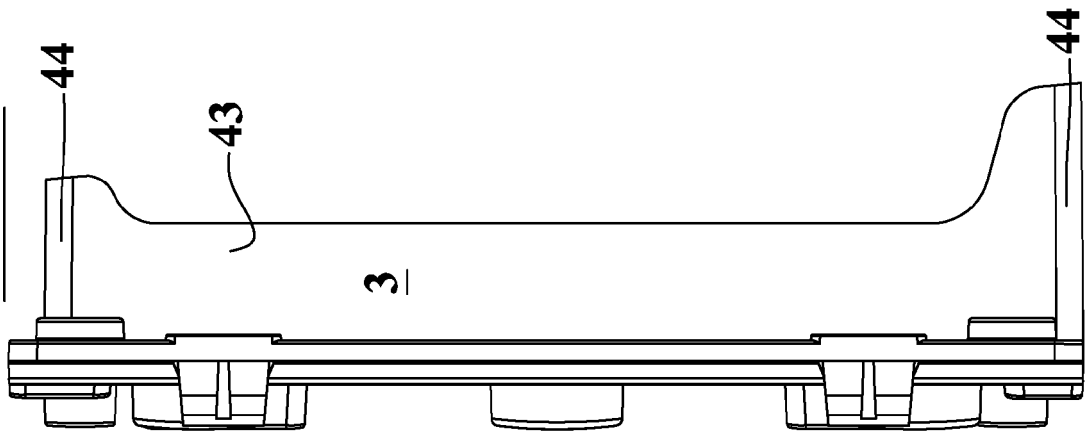


FIG.21

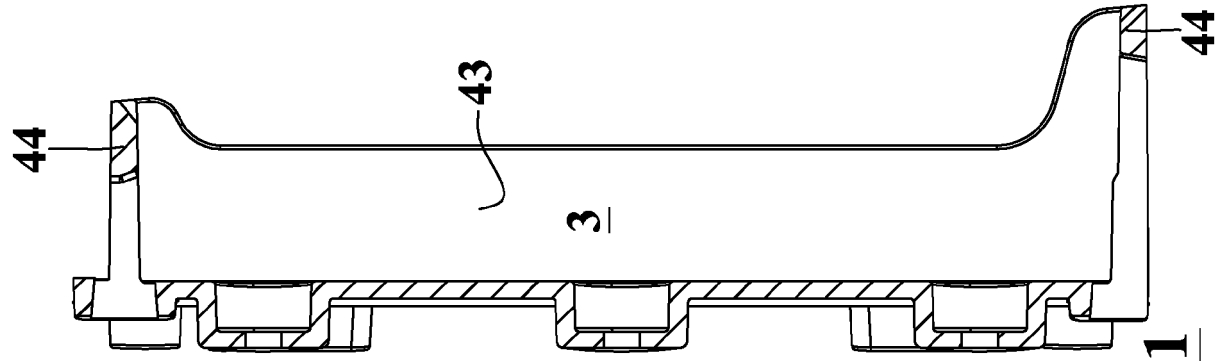


FIG.20

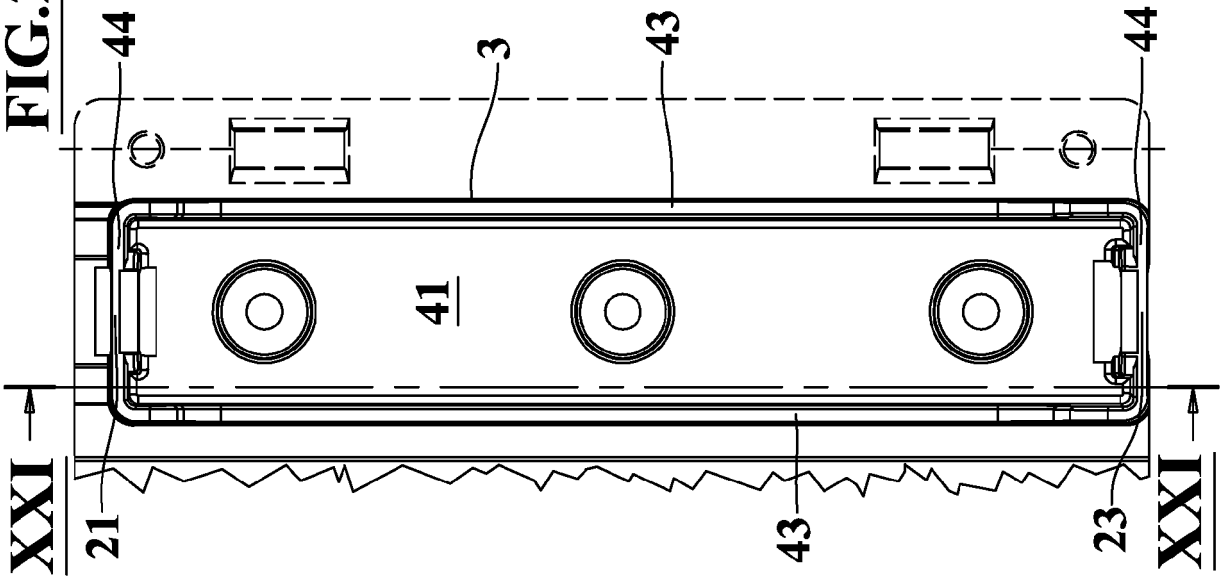
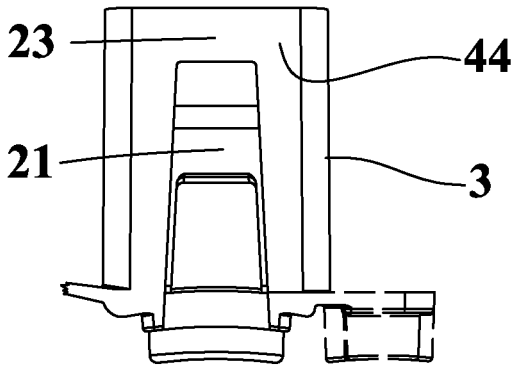


FIG.23



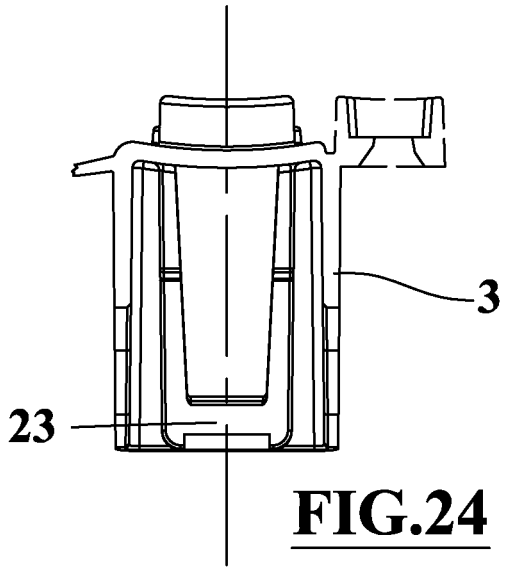


FIG.24

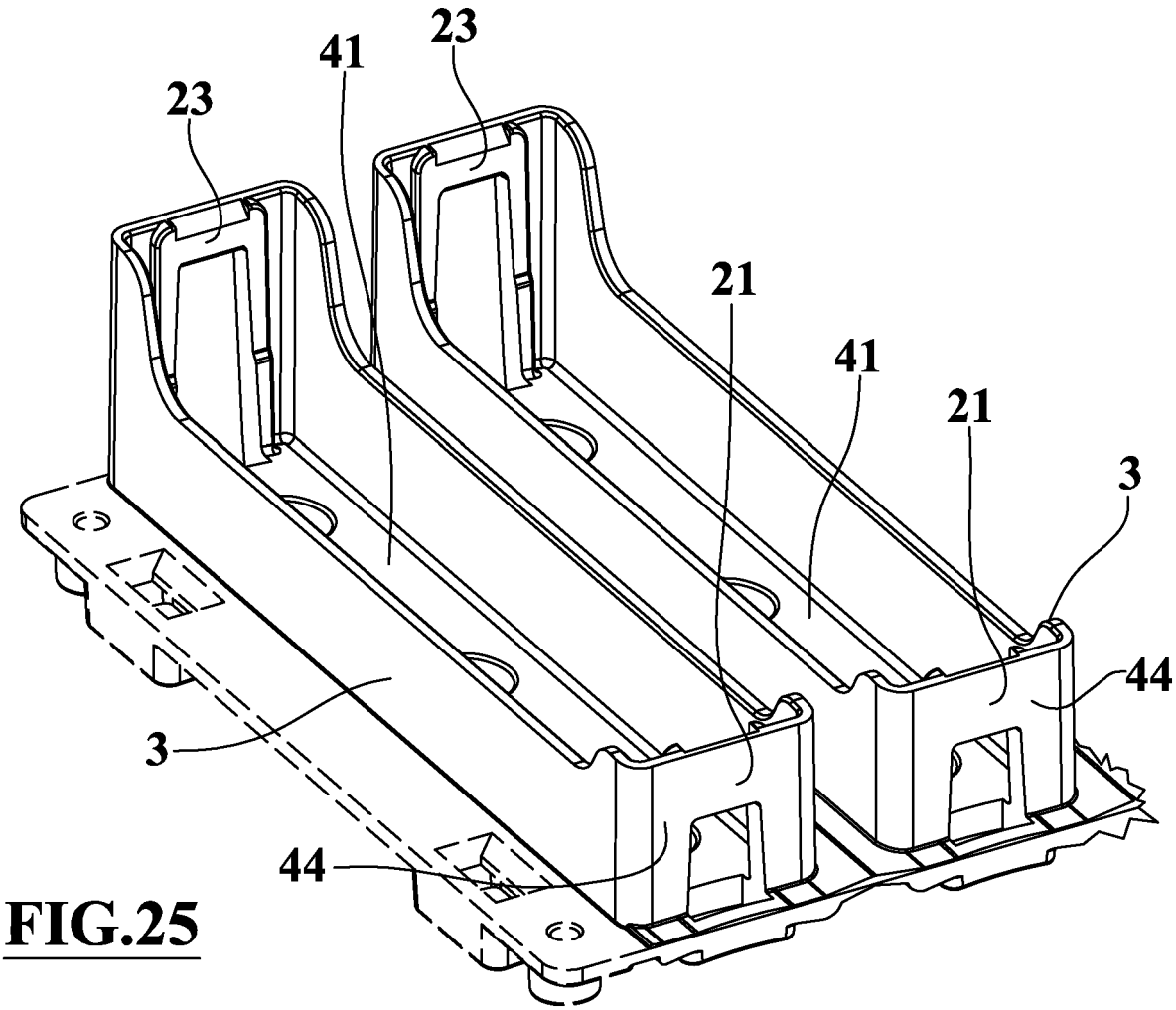
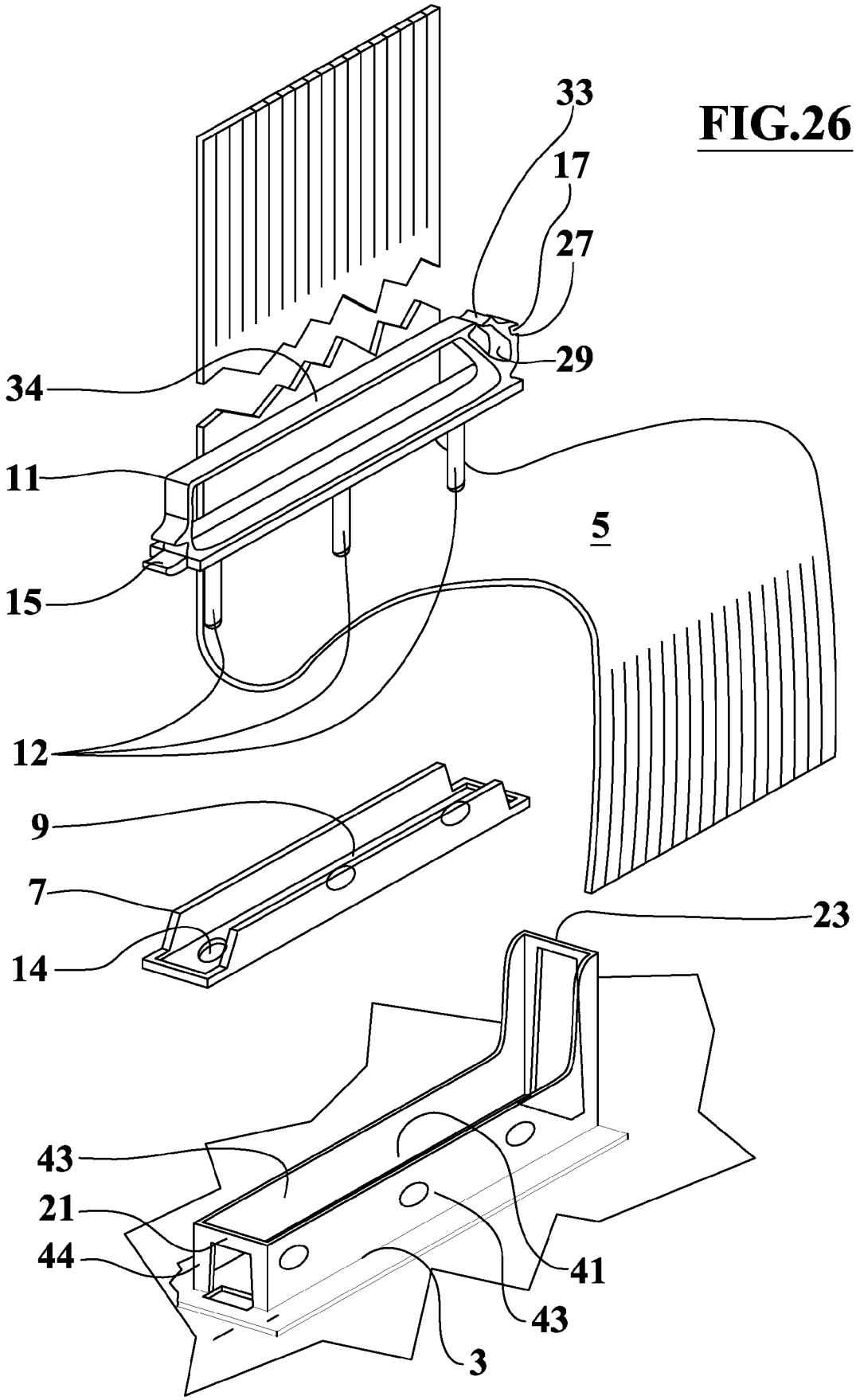


FIG.25

FIG.26



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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 8251

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 435 304 A (JAMES M. HENDERSHOT) 26 August 1890 (1890-08-26) * line 48 - page 1, line 61; figures 1-5 *	1-10	INV. A46B7/04 A46B13/00
A	EP 3 231 322 A1 (WEBER BÜRSTENSYSTEME GMBH [DE]) 18 October 2017 (2017-10-18) * paragraph [0057] - paragraph [0062]; figures 1-10 *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

A46B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 October 2022	Kun, Karla

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US 435304 A	26-08-1890	NONE	
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