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(54) **BRUSH COMPRISING A MECHANICAL FIXING SYSTEM OF TUFTS OF FIBERS WITHOUT THE USE OF METAL ELEMENTS AND RELATED METHOD FOR THE PRODUCTION OF BRUSHES, BROOMS OR THE LIKE**

(57) The present invention relates to a brush comprising a system for mechanically fixing tufts of fibers that does not require metal elements.

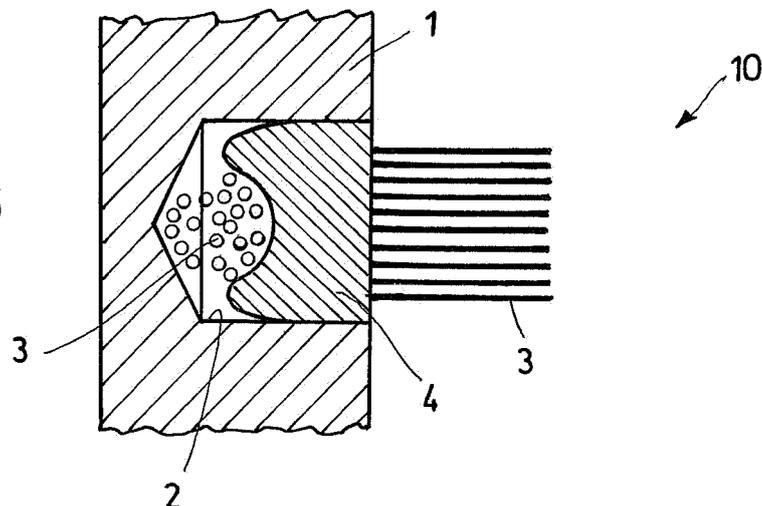
The present invention also refers to a method for the production of brushes by means of the fixing system. According to the inventions, the brush (10) comprises a support body (1) comprising a plurality of holes (2) or cavities, and a plurality of tufts of fibers (3), each tuft being constituted by a plurality of fibers substantially U-folded in their central portion, in which said tufts of fibers (3) are fixed to said support body (1) through a mechanical fixing system of tufts of fibers (3) according to which, in each of said holes (2) is inserted the U-folded

end of one of said tufts of fibers (3) and an insert (4), presenting a shape partially complementary to that of the hole (2), said insert (4) being coupled to the support body (1) by means of a forced coupling;

wherein said fixing system is implemented by a punching machine (15) to which said insert (4) is fed in the form of a continuous chain (6) or a continuous profile (7) which separates said inserts (4) from each other when they are inserted into said holes (2);

said insert (4), said support body (1) and said tufts of fibers (3) being made of equal or different materials but compatible with each other for being recycled together.

Fig.6



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Description

[0001] The present invention relates to a brush comprising a system for mechanically fixing tufts of fibers that does not require metal elements.

[0002] The present invention also refers to a method for the production of brushes by means of the fixing system.

[0003] In the present discussion, by brushes it is meant a brush body or support body comprising a plurality of holes in which tufts of fiber are associated, and which will form brushes of any type, such as for example hair-brushes or brushes for domestic use or even toothbrushes, but also brooms and so on.

[0004] Brooms, brushes or similar tools generally comprise a block or support with tufts of fibers attached therein in appropriate holes, and which will form the brush portion. The methods of attaching the tufts to the support's holes have changed over time depending on the technologies available.

[0005] The use of brushes and brooms has very ancient origins. Initially, they were produced manually, then with the development of industrial machinery, punching machines were devised that revolutionized and greatly facilitated the production of brooms and brushes on an industrial scale.

[0006] Nowadays, there are mainly two systems for the mechanical fixing of fiber tufts in the support structures, both involve the insertion of the fiber tufts folded in half in the appropriate holes in the support and their anchorage to it through the use of metal wires.

[0007] The first system, shown in figure 1, called "staple" involves a metal wire with a round cross-section that will be folded around the fibers and embedded in the supporting body at the bottom of the hole.

[0008] The second system, shown in figure 2, called "bar" involves a metal wire, preferably with a flat section, which holds the tufts of fiber in the hole by gripping the sides of the same through its ends.

[0009] Both systems are extremely efficient, durable and allow easy production of brooms or brushes or similar. However, in recent years, with the advent of plastic and its wide use, disposable tools and items have increased and the numbers of brooms or brushes consumed have multiplied enormously, as it is an extremely cheap and easy to handle material.

[0010] As a result, the need to recycle and dispose plastic items at the end of their life has also increased.

[0011] Plastic is in fact an extremely recyclable material, however brooms, brushes or similar as described are not easily recyclable as they also contain a plurality of metal bars which make the recycling process long and costly, as it would be necessary to separate the metal elements from the plastic ones.

[0012] One possible solution would be to replace the metal wire with a plastic wire compatible with the material of the rest of the tool components, which would make recycling easy, immediate and cost-effective.

[0013] This is not possible because in both staple and bar systems the wire is heavily stressed, in the first case to stick in the support and in the second to penetrate the sides of the hole, which makes it impossible to use a wire made of plastic material to perform this function as it would not be able to withstand such stresses.

[0014] Solutions in which the fibers are fixed to the substrate by fusion have existed for some time and these have the advantage of making recyclable products, however, the fusion process has many limitations and is not as applicable on a large scale as mechanical fixing.

[0015] It is the purpose of the present invention to overcome the above-mentioned drawbacks and in particular to devise a brush comprising a system for mechanically fixing tufts of fibers that does not use metal elements, in particular that is exclusively made of plastic.

[0016] A further purpose of the present invention is to devise a brush comprising a system for mechanically fixing tufts of fibers that enables the production of fully recyclable tools.

[0017] It is a further purpose of the present invention to provide a brush comprising a system for mechanically fixing tufts of fibers that is extremely durable, efficient and economical and that can also be accomplished with present punching machines suitably modified thereby making possible and inexpensive the desirable transition to the production of fully recyclable plastic brushes.

[0018] A further object of the present invention is to provide a particularly efficient method for production of brushes, in fact, thanks to some characteristics of the present invention, it is possible to condense in a single automated work unit various phases which are necessarily separated in current systems.

[0019] These and other purposes according to the present invention are achieved by realizing a brush comprising a system for mechanically fixing tufts of fibers as set forth in claim 1 and a method for the production of brushes as set forth in claim 12.

[0020] Further features of the brush and the method are the object of the dependent claims.

[0021] The features and advantages of a brush comprising a system for mechanically securing tufts of fibers and of the production method according to the present invention will be most apparent from the following description, which is illustrative and not limiting, referring to the accompanying schematic drawings in which:

- Figure 1 is a schematic side section view of the known "staple" type fixing system;
- figure 2 is a schematic side section view of the known "bar" type fixing system;
- figure 3 is a perspective view of a first embodiment of an insert of the mechanical fixing system of tufts of fiber in brushes, according to the present invention;
- figure 4 is a schematic top view of a detail of a brush according to the present invention, with the insert of figure 3 inserted in a support body;

- figure 5 is a sectional view along the V-V line of the support body of figure 4;
- figure 6 is a sectional view along the VI-VI line of the support body of figure 4;
- figure 7 is a perspective view of a second embodiment of an insert of the mechanical fixing system of tufts of fiber in brushes, according to the invention;
- figure 8 is a schematic top view of the insert of figure 7 inserted in a support body;
- figure 9 is a sectional view along line IX-IX of the support body of figure 8;
- figure 10 is a sectional view along line X-X of the support body of figure 8;
- figure 11 is a perspective view of a preferential execution of the inserts of the type illustrated in figure 3 made in the form of a continuous chain to facilitate their feeding to a punching machine;
- figure 12 is a perspective view of a further preferential execution of the inserts of the type illustrated in figure 3 in the form of continuous extruded profile;
- figure 13 is a perspective view of a preferential embodiment of the inserts of the type illustrated in figure 7 in the form of continuous chain;
- figure 14 is a perspective view of a third preferential embodiment of the inserts of the type illustrated in Figure 3 in the form of a continuous chain with the inserts linked in a longitudinal direction;
- Figure 15 is a perspective view of an embodiment of a plant for implementing the method for the production of brushes according to the present invention.

[0022] First of all, it is to be pointed out that for clarity reasons the same or similar elements in the various illustrated embodiments will be indicated with the same numerical references within the different embodiments. With reference to the figures, there is shown a detail of a brush comprising a system for mechanically fixing tufts of fibers, collectively referred to with reference 10. The brush 10 comprises a support body 1 comprising a plurality of holes 2, and a plurality of tufts of fibers 3, each tuft 3 being constituted by a plurality of fibers substantially U-folded in their central portion. According to the fixing system, into each hole 2 is inserted the U-folded end of a tuft of fibers 3 and an insert 4 presenting a shape partially complementary to that of the hole 2. In particular, the insert 4 is coupled to the hole 2 by a forced coupling. In particular, the insert 4, the support body 1 and the tufts of fibers 3 are made of equal or different materials but compatible with each other for being recycled together.

[0023] In particular, the fixing system is implemented by a punching machine 15 to which said insert 4 is fed in the form of a continuous chain 6 or a continuous profile 7 which separates the inserts 4 from each other when they are inserted into said holes 2.

[0024] Preferably, the insert 4 couples to the support body 1 by adherence to the hole 2.

[0025] Such holes 2 may be blind or even partially or

fully open on the side opposite the fibers.

[0026] In a first embodiment, illustrated in figures 3 to 6, the mechanical fixing system 10 includes an insert 4 that anchors into the hole 2 by friction through dimensional interference.

[0027] In the particular preferred embodiment illustrated, the hole 2 has a circular shape and the insert 4 has a lobed section. The surfaces of the hole 2 exert compression on each other while holding the insert 4 in place.

[0028] In a second embodiment, the insert 4 is coupled to the support body 1 in the hole 2 by interlocking. Preferably, said interlocking takes place by means of suitable locking elements 5 between the insert 4 itself and the support body 1 at the hole 2, suitable for blocking the insert 4 in the hole 2 once inserted.

[0029] For example, the embodiment illustrated in Figures 7 to 10 involves a hole 2 having a complex shape consisting of two semi-circles and two intermediate zones with protuberances 5 towards the inside of the hole 2. The insert 4, having a shape partially complementary to that of the hole, is inserted through elastic deformation into it until it overrides the protuberances 5 and compresses the tufts of fibers 3 at the bottom of the hole. In this case the interference of the coupling becomes secondary and the restraint is ensured by the upper protuberances 5 which allow, the insert 4 to be inserted by deformation, but prevent it from coming out. In another embodiment, the locking elements 5 may be one or more knurls, saw teeth or any other form suitable to allow the insertion of the insert 4 but not its release.

[0030] Preferably, the insert 4 has a shape that facilitates its insertion into the hole but prevents it from coming out, for example rounded or flared on the end that will be inserted inside the hole 2, also to follow the natural U-shaped curvature of the fibers.

[0031] The tightness of the insert 4 can be further improved by causing, upon insertion, a plastic deformation of said insert 4, of the hole 2 or of both, the effect of which is added to those of the friction and the interlocking.

[0032] The insert 4 of the mechanical fixing system has a larger size than other known fixing systems, which results in the fiber tufts 3 being divided into two halves separated from each other by the thickness of the insert 4, so as to form two tufts of the brush 10. Advantageously, such a feature suitably exploited allows to halve or anyway reduce the number of holes necessary for the realization of a brush 10 and therefore to speed up its production and reduce the necessary costs.

[0033] In order to realize the brushes 10 comprising the fixing system according to the present invention, it is extremely convenient to produce the inserts 4 attached to each other in the form of a chain 6 so as to facilitate their feeding at high speed to the punching machine or, in their simplest execution, to obtain them from an extruded profile 7 from which the punching machine cuts small segments, along the lines 8, creating the individual inserts at the time of use. Such a chain 6 of inserts 4 can be seen in figures 11, 13 e 14, while an example of ex-

truded profile 7 can be seen in figure 12.

[0034] Advantageously, this gives the possibility to use, with slight modifications, the traditional punching machines for the production of brushes 10 according to the present invention, and therefore to be able to produce them without having to resort to or create new machinery.

[0035] Furthermore, the use of the inserts 4 according to the present invention, allows to realize the support bodies 1, on which the tufts 3 are placed, of reduced thickness compared to those in which the fixing system of the standard type, with staples, is used. In fact, for the application of the staples, the support body needs a certain thickness as these must be solidly embedded in it.

[0036] Advantageously, this represents a reduction in the use of plastic and therefore an advantage from an economic and environmental point of view.

[0037] The reduction of the thickness advantageously allows to have faster injection molding cycles of the support, in particular thanks to the shorter cooling time necessary to bring the support body to a sufficiently low temperature in order to extract it from the mold.

[0038] This in itself is an improvement as production can be speeded up. Furthermore, it is possible to achieve the same production with smaller presses and molds. A further advantage is that the faster molding cycle of the support bodies 1 becomes of similar duration to the one of the punching machine 15 for the insertion of the inserts 4 and the tufts 3 into the holes 2 of the same, and therefore the two machines can be joined in a single working unit in which the injected support bodies are picked up from the mold by a mechanical arm and automatically placed on the punching machine 15 which inserts the tufts 3 and the inserts 4.

[0039] In particular, therefore, the method for the production of brushes 10 by means of the fixing system according to the present invention, comprises the steps of:

- injection molding a support body 1 having a plurality of holes 2;
- automatically transferring the support bodies 1 just printed to a punching machine 15 to which a continuous chain 6 or continuous profile 7 of inserts 4, preferably wound on reels, is also fed;
- by means of said punching machine 15 inserting a tuft of fibers 3 and an insert 4 in each of the holes 2 of said support body, separating a single insert 4. Advantageously, as previously explained in an optimal embodiment of the method, the step of inserting a tuft 3 and an insert 4 in each hole 2 takes place substantially without interruption after the injection molding step.

[0040] Advantageously, the continuous chain 6 or the continuous profile 7 are fed to a punching machine 15 of the known type, only by making a few small changes. For example, compared to punching machines used for the staple fixing systems, with wire, it is necessary to replace the wire with the continuous chain of inserts 6.

[0041] The punching machine 15 separates the inserts 4 forming the chain 6 or profile 7 on the breaking lines 8. Furthermore, between said injection molding step and said insert insertion step 4, parking and / or labeling steps of the support bodies 1 produced can be included. Finally, the method may include, following the insertion step, parking, finishing (for example scraping) and packaging steps.

[0042] The method is implemented by means of a plant for the production of brushes 10, illustrated according to a possible embodiment in figure 14, comprising:

- an injection press 11, comprising a multiple cavity mold station 12;
- a parking station 13;
- a labelling machine 14;
- a punching machine 15;
- a parking station 16;
- a scraping machine 17;
- a packaging machine 18.

[0043] The plant also includes a finished product exit station 19.

[0044] In particular, with reference to the illustrated system, the parking stations 13, 16, the labeling machine 14, the packaging machine 18 and the scraping machine 17 are optional and non-essential elements for the implementation of the method for the production of brushes 10 according to the present invention.

[0045] This method therefore allows to eliminate various production steps such as those of having to put the produced supports bodies in boxes or containers, storing the supports bodies waiting for the following phases and then taking them from the containers and feeding them to the punching machine. This method advantageously allows a saving of labor, storage space, time, and therefore allows to reduce the production costs of the brushes.

[0046] Finally, it is desired to highlight that by brush 10 any type of brush is intended, as for example brushes for the production of hairbrushes, brushes for domestic use, brooms and so on.

[0047] From the description given, the characteristics of the brush and the method which are the object of the present invention are clear, as are the relative advantages.

[0048] Finally, it is clear that the brush and the method thus conceived are susceptible to numerous modifications and variants, all of which fall within the scope of the invention; moreover, all details are replaceable by technically equivalent elements. In practice, the materials used, as well as the dimensions, may be any according to technical requirements.

Claims

1. Brush (10) comprising a support body (1) comprising a plurality of holes (2) or cavities, and a plurality of

- tufts of fibers (3), each tuft being constituted by a plurality of fibers substantially U-folded in their central portion, in which said tufts of fibers (3) are fixed to said support body (1) through a mechanical fixing system of tufts of fibers (3) according to which, in each of said holes (2) is inserted the U-folded end of one of said tufts of fibers (3) and an insert (4), presenting a shape partially complementary to that of the hole (2), said insert (4) being coupled to the support body (1) by means of a forced coupling; wherein said fixing system is implemented by a punching machine (15) to which said insert (4) is fed in the form of a continuous chain (6) or a continuous profile (7) which separates said inserts (4) from each other when they are inserted into said holes (2); said insert (4), said support body (1) and said tufts of fibers (3) being made of equal or different materials but compatible with each other for being recycled together.
2. Brush (10) according to claim 1, wherein said equal or different materials compatible with each other for being recycled together consist of plastic materials.
 3. Brush (10) according to one of the preceding claims, wherein said insert (4) is coupled to said hole (2) by friction through a dimensional interference.
 4. Brush (10) according to one of the preceding claims, wherein said insert (4) has a lobed section and said hole (2) has a circular section.
 5. Brush (10) according to claim 1 or 2, wherein said insert (4) is coupled to said hole (2) by interlocking.
 6. Brush (10) according to claim 5, wherein said support body (1) presents locking elements (5) in correspondence with said hole (2) suitable for blocking said insert (4) in said hole (2) once inserted.
 7. Brush (10) according to claim 6, wherein said locking elements (5) are protrusions, small teeth or other similar protruding elements bulging towards the inside of said hole (2) and said insert (4) has a flared or rounded shape towards its end to be inserted in said hole (2).
 8. Brush (10) according to one of the preceding claims wherein said insert (4) and/or said hole (2) are deformed plastically upon insertion of said insert (4) into said hole (2) to improve its tightness.
 9. Brush (10) according to one of the preceding claims wherein said holes (2) or cavities are blind or open, or partially open.
 10. Brush (10) according to one of the preceding claims, wherein a size of said insert (4) is increased so as to constitute two tufts of fibers (3) clearly separated, therefore effectively two tufts of the brush or broom, making them with a single stroke of the punching machine, thus doubling its productivity.
 11. Brush (10) according to one of the preceding claims suitable for the production of hairbrushes, brushes for domestic use, toothbrushes, brooms and so on.
 12. Method for the production of brushes (10) according to one or more of the preceding claims, said method comprising the steps of:
 - injection molding a support body (1) having a plurality of holes (2);
 - automatically transferring the support bodies (1) just printed to a punching machine (15) to which a continuous chain (6) or continuous profile (7) of inserts (4) is also fed;
 - by means of said punching machine inserting a tuft of fibers (3) and an insert (4) in each of said holes (2) of said support body (1), separating a single insert (4).
 13. Method according to claim 12 wherein said step of inserting a tuft (3) and an insert (4) in each of said holes (2) takes place substantially without interruption after the injection molding step.
 14. Method according to claim 12 or 13, **characterized by** the fact of comprising, between said molding step and said insert insertion step (4), parking and / or labeling steps of said support bodies (1).
 15. Method according to claim 12 or 13 or 14, **characterized by** the fact of comprising, following said insertion step, parking, finishing and packaging steps.

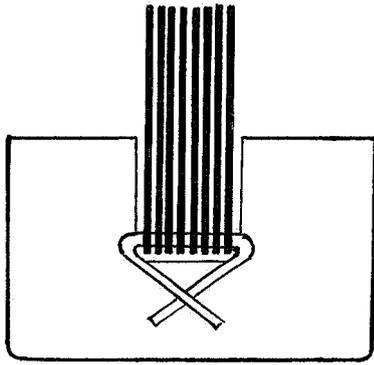


Fig. 1 (PRIOR ART)

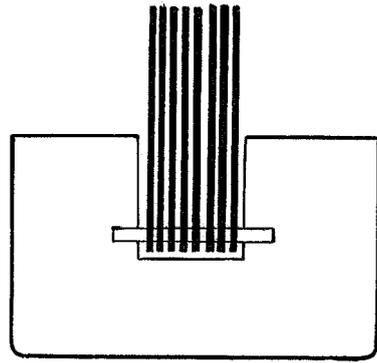


Fig. 2 (PRIOR ART)

Fig. 3

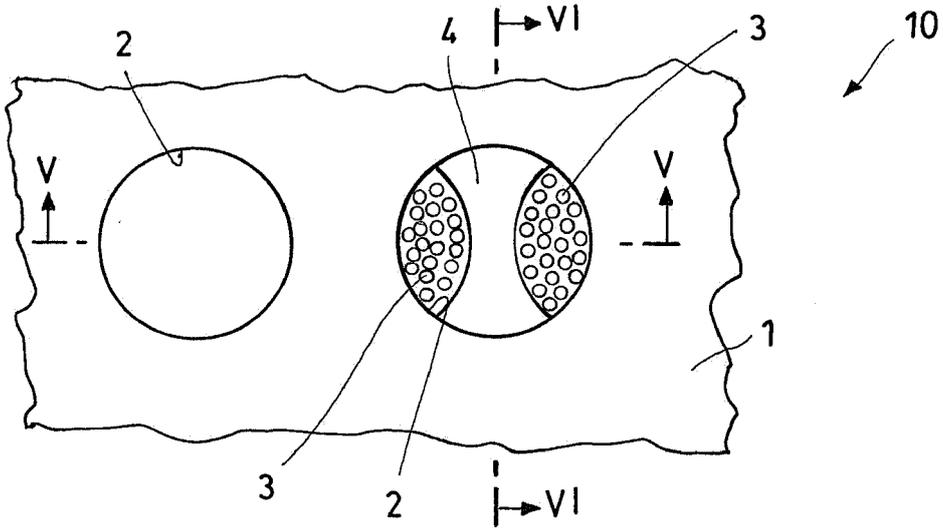
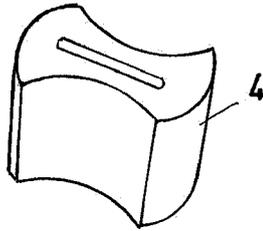


Fig. 4

Fig.5

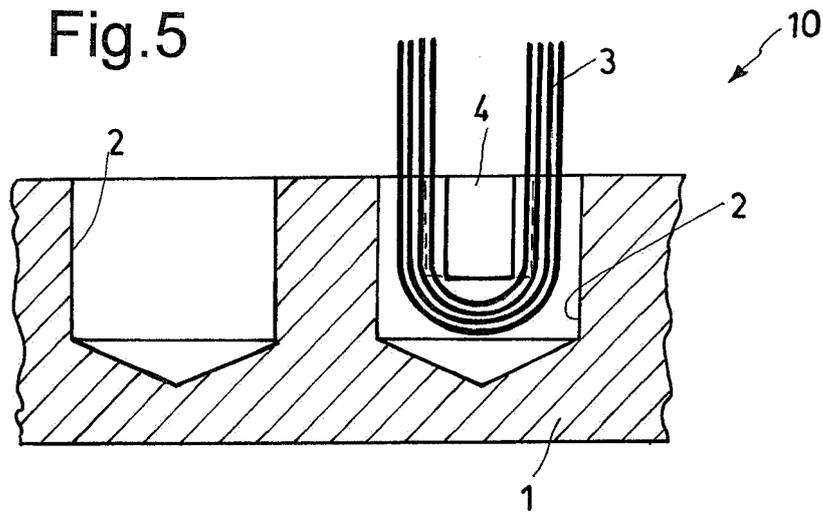


Fig.6

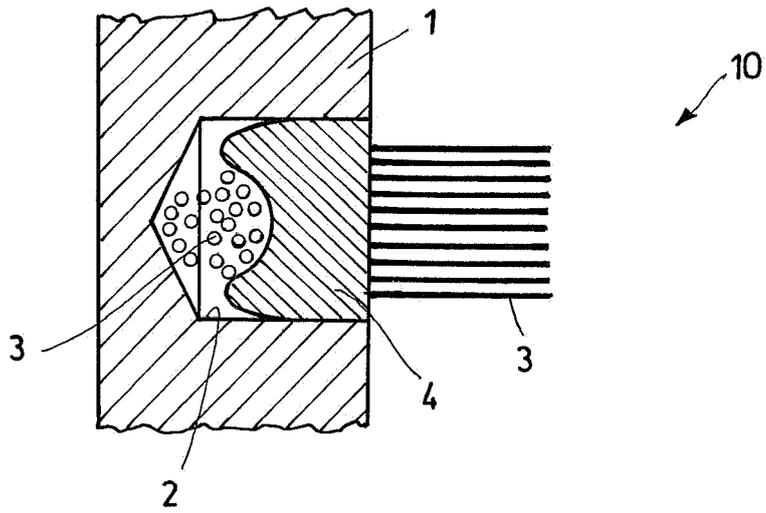


Fig.7

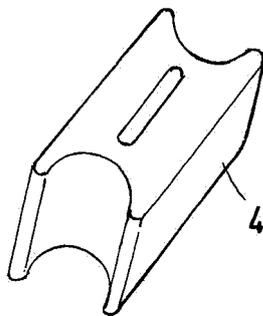


Fig.8

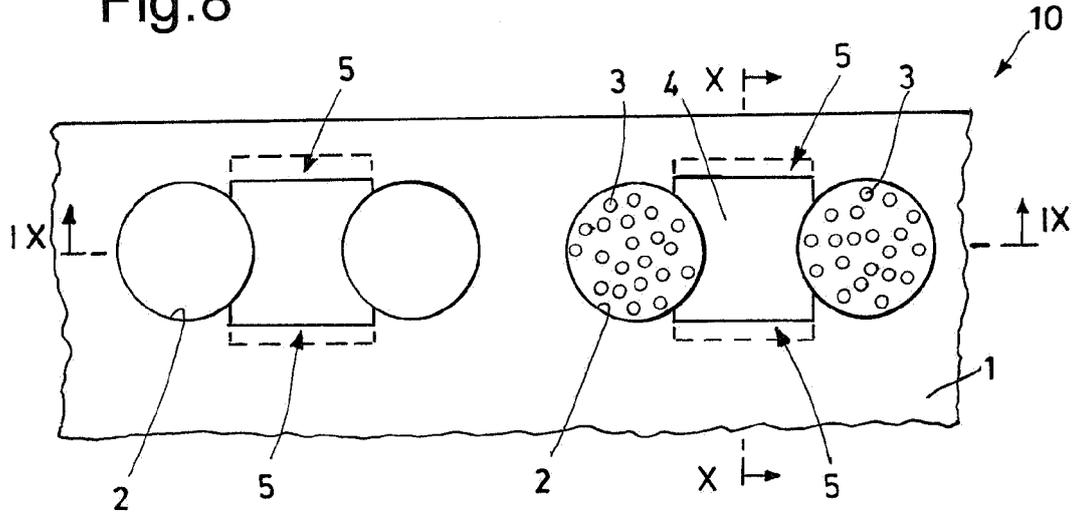


Fig.9

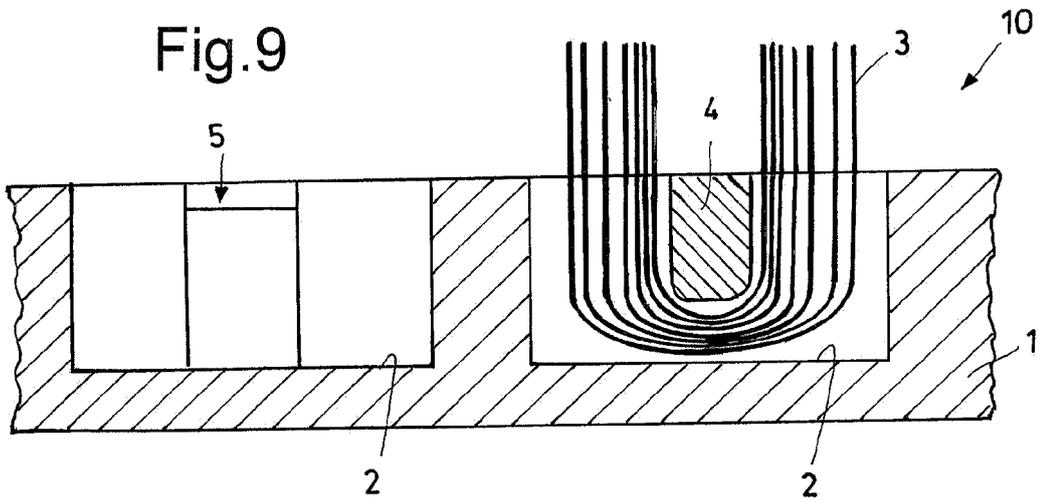


Fig.10

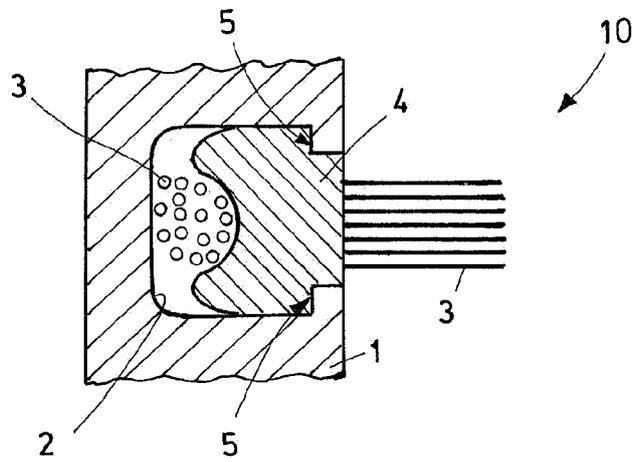


Fig.11

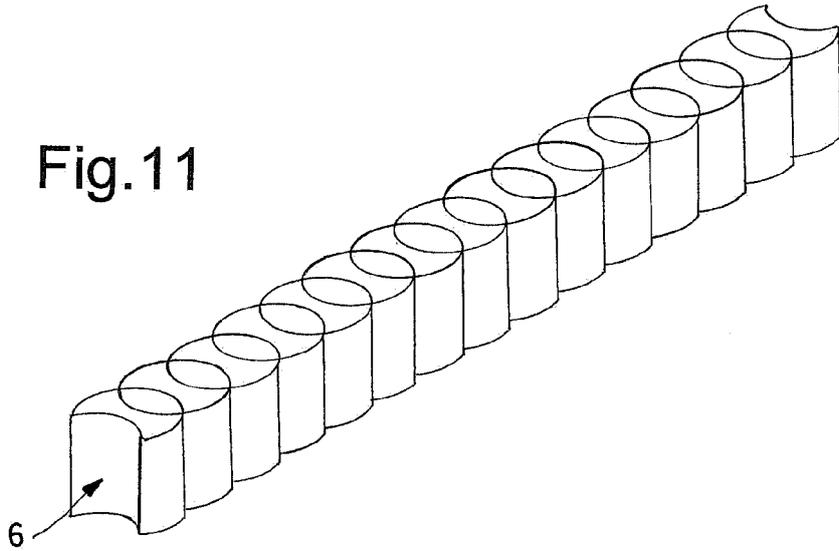


Fig.12

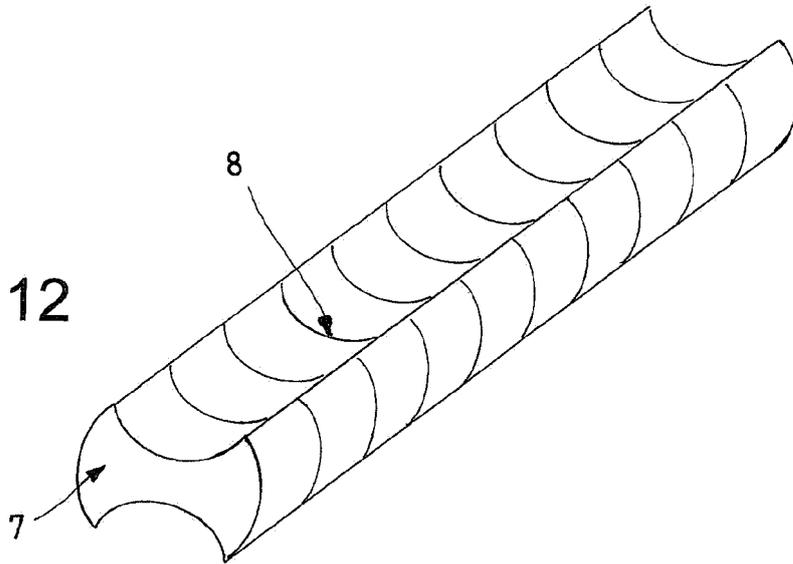
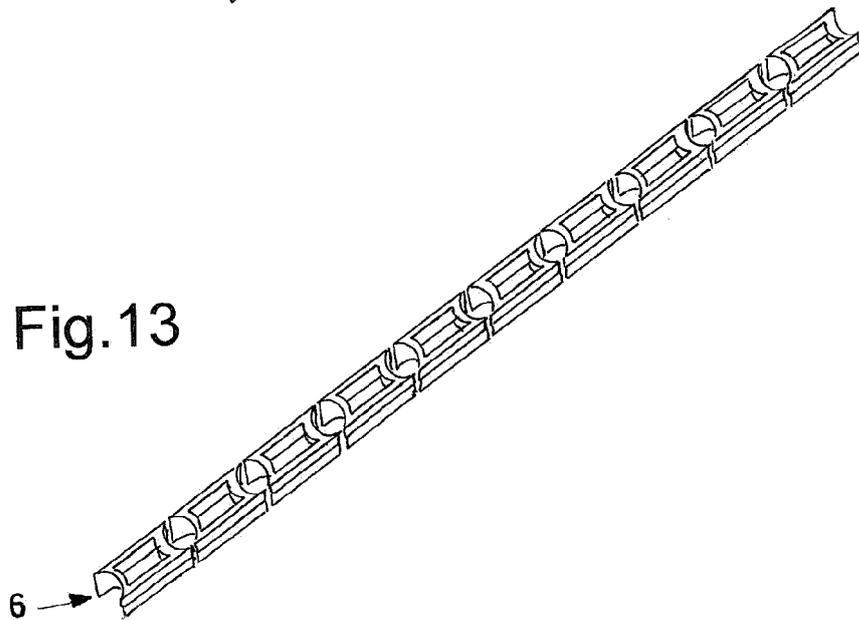


Fig.13



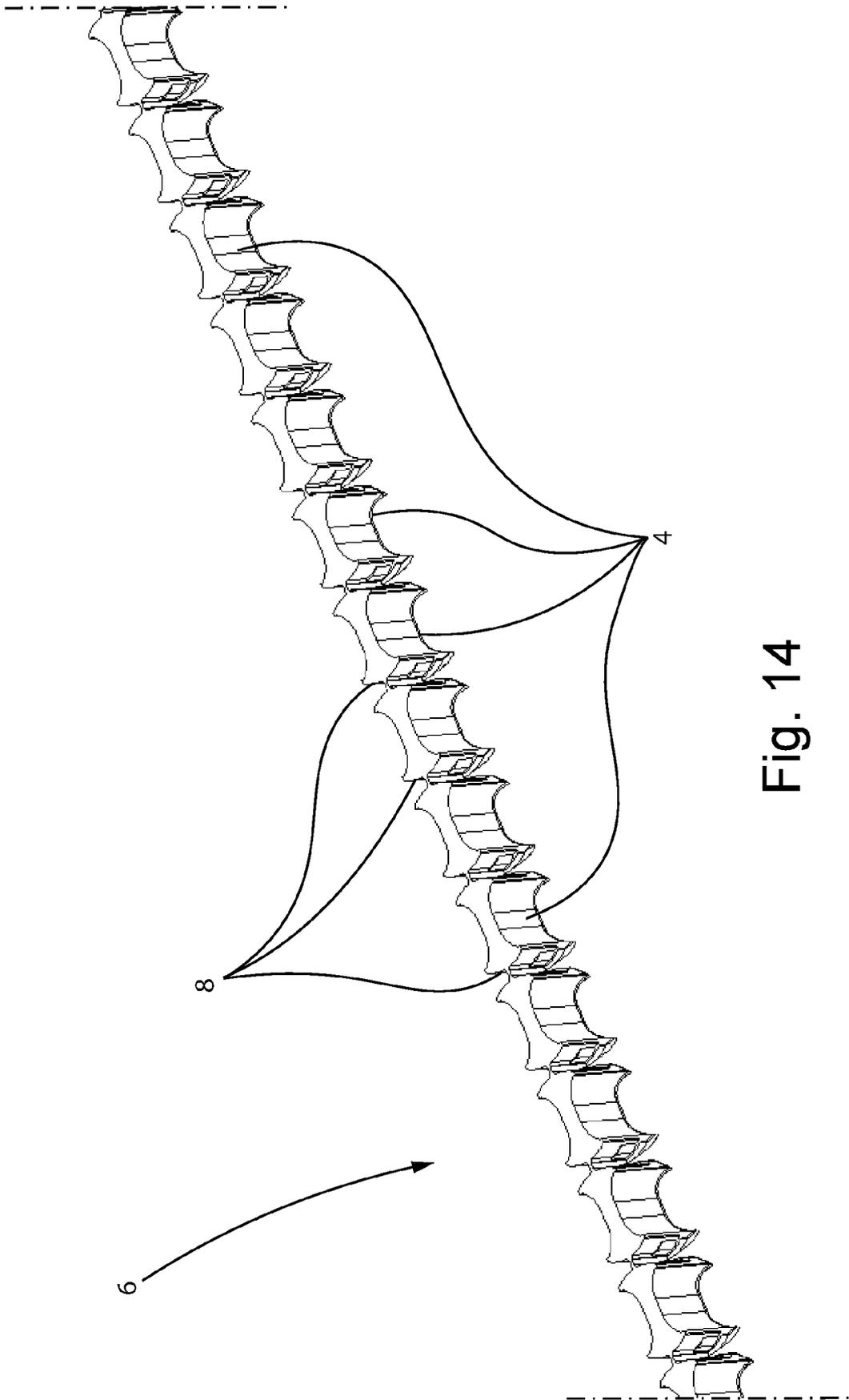


Fig. 14

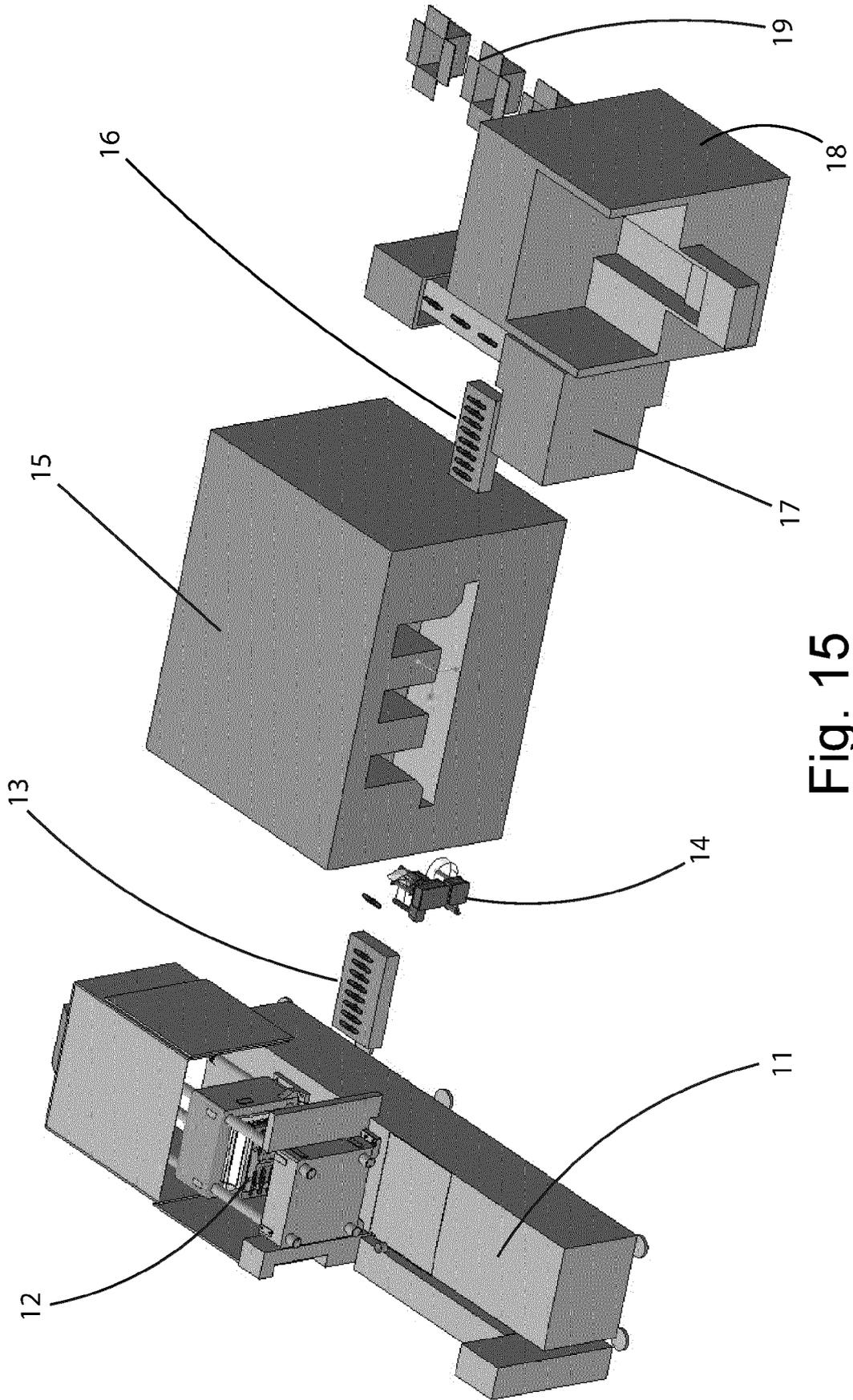


Fig. 15



EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2008/104785 A1 (ROBINSON) 8 May 2008 (2008-05-08) * figures 4-6,11-15 * * paragraph [0089] * -----	1,2,4-15	INV. A46B3/16 A46D3/04
X	DE 10 71 043 B (EUGEN GUTMANN KG) 17 December 1959 (1959-12-17) * claim 4; figure 1 * -----	1,3	
A		12	
X	FR 2 359 587 A1 (MACULAN) 24 February 1978 (1978-02-24) * figures 1,2,5 * -----	1,12	
X	US 2 648 083 A (CHESNEY ET AL) 11 August 1953 (1953-08-11) * claim 1; figures 4,6 * -----	1	
X	US 2 542 709 A (ROWLAND) 20 February 1951 (1951-02-20) * figures 3-6 * -----	1	
X	EP 3 167 747 A1 (WIM MUSKENS BEHEER) 17 May 2017 (2017-05-17) * figure 4 5 * -----	1	TECHNICAL FIELDS SEARCHED (IPC) A46B A46D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 June 2021	Examiner Raybould, Bruce
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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ON EUROPEAN PATENT APPLICATION NO.

EP 21 15 7209

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008104785 A1	08-05-2008	US 2008104785 A1 WO 2008057852 A2	08-05-2008 15-05-2008
DE 1071043 B	17-12-1959	NONE	
FR 2359587 A1	24-02-1978	AR 208612 A1 DE 2731943 A1 ES 239204 U FR 2359587 A1 IT 1077344 B	15-02-1977 02-02-1978 01-04-1979 24-02-1978 04-05-1985
US 2648083 A	11-08-1953	NONE	
US 2542709 A	20-02-1951	NONE	
EP 3167747 A1	17-05-2017	NONE	

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82