(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 249 652 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.09.2023 Bulletin 2023/39

(21) Application number: **23158035.8**

(22) Date of filing: **22.02.2023**

(51) International Patent Classification (IPC):
D01D 5/16 *(2006.01)* ***D01H 5/72*** *(2006.01)*
D01D 4/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
D01D 5/16; D01D 4/00; D01H 5/72

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **10.03.2022 IT 202200004619**

(71) Applicant: **Savio Macchine Tessili S.p.A.**
33170 Pordenone (IT)

(72) Inventors:
- **DEOTTO, Luca**
33170 PORDENONE (IT)
- **DE VECCHI, Luca**
33170 PORDENONE (IT)

(74) Representative: **Busana, Omar**
Jacobacci & Partners S.p.A.
Piazza Mario Saggin, 2
35131 Padova (IT)

(54) **CONDENSER DEVICE FOR FIBRE RIBBON, SPINNING HEAD COMPRISING SUCH DEVICE, AND SPINNING MACHINE COMPRISING SUCH SPINNING HEAD**

(57) A condenser device (12) for fibre ribbon (14) for spinning head (16), comprises at least one passage groove (18, 19) arranged with a mouth (20), an outlet (22), and a sliding surface (24) comprised between said mouth (20) and said outlet (22). The sliding surface (24) converges from the mouth (20) towards the outlet (22). The sliding surface (24) is arranged with a sliding bottom (26) and sliding side walls (28, 30), wherein the sliding side walls (28, 30) diverges from each other in the opposite direction with respect to said sliding bottom (26).

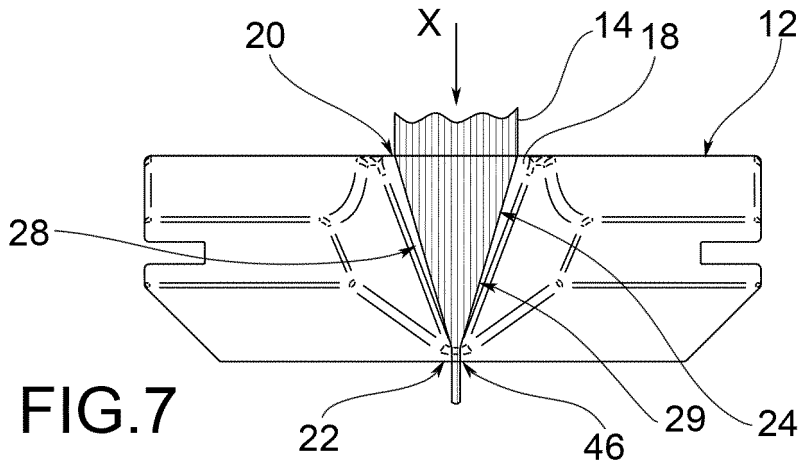

FIG.7

EP 4 249 652 A1

Description

FIELD OF APPLICATION

[0001] The present invention relates to a condenser device for fibre ribbon, a spinning head comprising such a device, and a spinning machine comprising such a spinning head.

BACKGROUND ART

[0002] As is known, in a spinning head the fibres forming the ribbon, which are parallelised and regularised by the stretching device, must be suitably conveyed and directed within a predefined linear path that coincides with the main spinning direction. Furthermore, to prevent the ribbon from being excessively thinned due to the crushing caused by the stretching rollers, with the consequent risk of separation, bending, curling and/or overlapping of the lateral fibres with respect to the central ones, it is essential that the fibres are collected and condensed in an orderly manner on one side, compressed in width in an area as narrow as possible on the other side, to limit the twisting defects in the subsequent spinning step. These operations are carried out by special devices, called condensers, which for the reasons already mentioned play a fundamental role in preserving the regularity and uniformity of the ribbon.

[0003] The condensers belonging to the prior art, an example of which is shown in figures 1-3, have a closed section of tapered shape and converging in the advancement direction of the ribbon, so as to favour a gradual collection of the fibres. However, as will be explained more clearly in the following, they are affected by multiple technical drawbacks of different nature, firstly all the poor ability to control the ribbon in the stopping and restarting steps of the spinning.

[0004] If a portion of the ribbon is considered between two contiguous pairs of stretching cylinders (hereinafter generally referred to as "axes"), under normal spinning conditions it is pulled from the front axis, which drags it at a higher peripheral speed than that imposed by the rear axis, so as to achieve the stretching and parallelisation of the fibres. When stopping the spinning, the two axes should theoretically stop at the same time so as not to induce over-strain or under-strain in the ribbon, but in fact this is practically impossible, because the axes are generally driven by electric stepper motors without angular position transducers, without there being any concrete possibility of carrying out a feedback check.

[0005] Forcibly, the stretching axes come to a stop at different times and consequently the ribbon undergoes a significant swelling at the inlet to the condenser, in particular on the sides (see figure 1) and towards the outside of the machine (see figure 2). Such a phenomenon is further accentuated by the fact that the closed section of the condenser prevents the ribbon from any possibility of accommodation and self-adjustment of the transverse area thereof.

[0006] It should be noted that the swelling of the ribbon can also occur when the spinning starts, in the particular case in which the spinning head produces fine thread counts. In such a case, to facilitate restarting, it is customary to initially reduce the stretching ratio to increase the amount of fibres introduced into the spinning unit. Also in this condition, if the condenser is not suitably sized, ribbon clogging occurs.

[0007] When the spinning starts again, the swelling of the ribbon immediately results in clogging and blocking inside the condenser, and the spinning head must be stopped to allow the operator to remove the excess accumulated fibre and restore the correct path of the ribbon. As can be easily understood, this undesired edge effect, if neglected, can induce defects and irregularities in the ribbon (and thus in the yarn) and can seriously compromise the functionality of the spinning head itself.

[0008] Still the closed section of the condenser generates further process disadvantages: in fact, the ribbon is pushed and pressed forcefully against the walls of the condenser, giving rise to localised wear phenomena. For this reason, the traditional condensers are typically provided with a pair of steel plugs at the outlet section (shown in figure 1 and figure 3), designed to intercept the ribbon and at the same time prevent the abrasion of the plastic body. This additional equipment increases the complexity of the construction of the condenser, especially due to the need to create the component in two separate pieces to be joined later, or to have to embed the pins in the plastic body.

[0009] Furthermore, the closure of the outlet section forces the operator, when preparing the ribbon upon starting the machine, to physically insert the ribbon inside each condenser, with a consequent increase in labour times. This condition also occurs if the section is opened by virtue of a slot passing in a direction transverse to the ribbon, as illustrated in patent US2272787.

[0010] However, the closed section does not allow the operator to monitor the evolution of the ribbon in that point, such as the occurrence of irregularities, clogging, tangles, etc.

[0011] A further drawback of the traditional condensers is the lack of flexibility thereof in varying the type of fibre and the thread count of the ribbon. In fact, to properly dispose of the ribbon, the inlet and outlet sections of the condenser must be compatible with the respective thread counts (and therefore with the corresponding volumetric material flow rates) of the ribbon which enters and exits the condenser.

[0012] Consequently, if the machine is required to process a new production batch (for example the same yarn with a different thread count), it is necessary to first replace all the condensers head by head, and this obviously translates into a series of operational disadvantages, such as the increase in the number of components to be fitted to the machine, the increase in production costs, the greater assembly, maintenance and storage

costs borne by the operators, and the general decrease in productivity of the machine due to the downtime necessary to replace the condensers themselves.

[0013] In the prior art there are systems, such as those illustrated in patents US2774995 and US2813307, which carry out the condensation process by means of a joint mechanical and pneumatic action, so as to centralise and compact the fibres by making them adhere to each other and preventing the undesirable expansion thereof on the sides.

[0014] However, these devices are disadvantageous because they require a vacuum-generating device in order to operate successfully, as well as leading to a certain absorption of electrical energy.

[0015] Furthermore, in such devices, the transverse passage section of the ribbon is in fact always closed, because the condenser is applied in direct proximity to the stretching belt, with the consequent risks already mentioned in terms of clogging and blocking the ribbon in stopping and restarting.

[0016] Patent GB705039 describes a condenser which performs a crushing and rolling action of the ribbon by means of a ball which is rolled by the advancement motion of the ribbon itself. The main disadvantage of this device is the mechanical stress to which the ribbon is subjected, which can affect the regularity and quality thereof.

[0017] Also known are active control systems of the transverse section of the ribbon, such as those described in patent GB1131069, in
which the stretching ratio is varied in proportion to the displacement suffered by the condenser due to the force exerted by the ribbon thereon. However, these apparatuses are also particularly limiting, because they must be provided with a mechanical system for the resilient assembly of the condenser, as well as an electronic apparatus for measuring and controlling the deflection; moreover, these condensers also use a preferably closed type transverse section, in particular in the form of a funnel.

[0018] Finally, there are other active ribbon width control systems, such as those described in patent JP2009030180A, consisting of a pair of arms which are moved farther away or closer symmetrically with respect to the nominal position of the ribbon. This system is rather complex, being formed by a variety of mechanical components provided with pins and slots, which in textile environments are easily subject to dirt, impingement and blocking. The illustrated device also presupposes the use of a motor, and therefore also of a controller adapted to drive it according to specific parameters which the user must enter into the machine, with the consequent greater complexity of the mechanical and electronic architecture of the machine.

PRESENTATION OF THE INVENTION

[0019] The need is therefore felt to resolve the drawbacks and limitations mentioned with reference to the prior art.

[0020] In particular, in light of the aforementioned limitations, there is a need to provide a condenser for spinning machines which is simple, economical, small in size, without active control systems, self-adaptive and independent with respect to the features of the ribbon to be processed.

[0021] Such needs are at least partially met by a condensing device for fibre ribbon according to claim 1, by a spinning head according to claim 18, and by a spinning machine according to claim 19.

DESCRIPTION OF THE DRAWINGS

[0022] Further features and advantages of the present invention will be more clearly comprehensible from the description given below of preferred and non-limiting embodiments thereof, in which:

- figures 1-3 show in schematic form respectively a front view, a side view and a top plan view of a condensing device according to the prior art, in which figures 1 and 2 show it in operating conditions with fibre ribbon inserted;
- figure 4 shows in schematic and simplified form a section portion of a condenser device according to a possible embodiment of the present invention;
- figure 5 shows in schematic and simplified form a section portion of a condenser device according to a possible embodiment of the present invention;
- figure 6 shows in schematic and simplified form a section portion of a condenser device according to a possible embodiment of the present invention;
- figure 7 shows in schematic form a front view of a condenser device according to a possible embodiment of the present invention;
- figure 8 shows in schematic form a side view partially in section of a condenser device according to a possible embodiment of the present invention;
- figure 9 shows in schematic form a top plan view of a condenser device according to a possible embodiment of the present invention;
- figure 10 shows in schematic form a front view of the condenser device of figure 4 in a different condition of use;
- figure 11 shows in schematic form a perspective view of a condenser device according to a possible embodiment of the present invention;
- figure 12 shows in schematic form a top plan view of a condenser device according to a possible embodiment of the present invention;
- figure 13 shows in schematic form a perspective view of a condenser device according to a possible embodiment of the present invention; and
- figure 14 shows in schematic form a possible embodiment of a spinning machine according to the present invention.

[0023] The elements or parts of elements common to the embodiments described below will be indicated using the same reference numerals.

DETAILED DESCRIPTION

[0024] In figure 11, reference numeral 12 shows a condenser device for at least one fibre ribbon 14 for spinning head 16 according to a possible embodiment of the present invention.

[0025] The condenser device 12 comprises at least one passage groove 18, 19 for the fibre ribbon 14, arranged with a mouth 20 and an outlet 22 for the fibre ribbon 14, and a sliding surface 24 comprised between the mouth 20 and the outlet 22.

[0026] The sliding surface 24 converges from the mouth 20 towards the outlet 22.

[0027] Furthermore, the sliding surface 24 is arranged with a sliding bottom 26 and sliding side walls 28, 30 diverging from each other in the opposite direction with respect to the sliding bottom 26.

[0028] In accordance with a possible embodiment, the condenser device 12 can comprise a radial opening 31 substantially opposite with respect to the sliding bottom 26.

[0029] As seen in figures 4-6, the section trace 26 of the at least one passage groove 18, 19 in a section plane 28 substantially perpendicular to the sliding direction X at the inlet to the mouth 20 is open.

[0030] In this discussion, sliding direction X at the inlet to the mouth 20 of the condenser device 12 means the theoretical direction along which the ribbon 14 is guided near the mouth 20. In particular, such a sliding direction X does not necessarily coincide with the direction of each fibre of the ribbon 14, being an overall sliding direction of the ribbon 14.

[0031] The section trace 26 of the sliding surface 24 comprising the sliding bottom 27 and the sliding side walls 28, 29 comprises diverging arms 30, 32.

[0032] Advantageously, the section trace 26 of the at least one passage groove 18, 19 according to each section plane perpendicular 28 to the sliding direction X are open and have diverging arms 30, 32. In other words, the entire passage groove 18, 19 is open, which is why the fibre ribbon 14 can be inserted into the passage groove 18, 19, for example according to a direction substantially perpendicular to the sliding direction X.

[0033] In accordance with a possible embodiment, the condenser device can comprise two side-by-side passage grooves 18, 19, as seen in the example of figure 13. In accordance with specific needs, the condenser device 12 can comprise more than two passage grooves.

[0034] In accordance with a possible embodiment, the section trace 26 of the at least one passage groove 18, 19 in a section plane perpendicular 28 to the sliding direction X can be substantially V-shaped, or U-shaped with diverging arms 30, 32.

[0035] As seen in figure 6, the diverging arms 30, 32 can define an angle α comprised between 40° and 70°, and preferably around 57°.

[0036] In accordance with a possible embodiment, the section trace of the at least one passage groove 18, 19 according to a plane containing the sliding direction X and perpendicular to a centreline plane 38 containing the direction X can be substantially V-shaped, or U-shaped with converging arms 34, 36 according to the sliding direction itself. Advantageously, the converging arms 34, 36 define an angle β comprised between 20° and 60°, and preferably around 40°.

[0037] An embodiment of this type is visible in the example of figure 10.

[0038] In particular, the passage groove 18, 19 can be V-shaped (or U-shaped with diverging arms) in both a vertical and a horizontal plane.

[0039] As seen for example in figures 4, 5 and 6, the passage groove 18, 19 can be a side surface portion of a pyramid.

[0040] Such a pyramidal surface can comprise for example at least two faces 40, 42, 44, and preferably, the side surface portion of a pyramid can comprise three faces 40, 42, 44.

[0041] According to a possible embodiment, the passage groove 18, 19 can comprise an apical surface portion 46 close to or comprising the vertex of the side surface portion of the pyramid. In other words, the passage groove 18, 19 can comprise an apex portion or a portion very close to the apex of the pyramid with which the passage groove 18, 19 is geometrically constructed.

[0042] In accordance with a possible embodiment seen for example in figure 11, the passage groove 18, 19 can be a conical surface portion.

[0043] In accordance with a possible embodiment, the passage groove 18, 19 can comprise an apical surface portion 46 close to or comprising the vertex of the conical surface. In other words, the passage groove 18, 19 can comprise an apex portion or a portion very close to the apex of the cone with which the passage groove 18, 19 is geometrically constructed.

[0044] In accordance with a possible embodiment, the sliding bottom 27 of the passage groove 18, 19 can be inclined by an angle γ comprised between 0° and 10°, and preferably around 5°, with respect to the sliding direction X. As seen in the example of figure 8, the sliding bottom 27 can be inclined to achieve the convergence of the passage groove 18, 19 from the inlet section 20 to the outlet section 22.

[0045] According to a possible embodiment, the passage groove 18, 19 can be symmetrical with respect to a centreline plane 38 containing the sliding direction X. However, in accordance with specific needs, the passage groove 18, 19 can be asymmetrical with respect to a centreline plane 38 containing the sliding direction X.

[0046] The length 52 of the passage groove 18, 19 in the sliding direction X can be comprised between 10 mm and 20 mm, and preferably around 15 mm.

[0047] The depth 54 of the passage groove 18, 19 in

a plane perpendicular to the sliding direction X, at the outlet section 22 can be comprised between 8 mm and 18 mm, and preferably around 13 mm.

[0048] Advantageously, the edges and/or the vertex of the sliding groove are provided with fittings of radius r comprised between 0 mm and 1.5 mm, and preferably around 0.5 mm.

[0049] The present invention further relates to a spinning head 16 comprising a condenser device 12 as just described, and a spinning machine 48 comprising at least one spinning head 16.

[0050] The advantages achievable with the condenser device 12 according to the present invention are now evident.

[0051] For example, by virtue of the double V or double U configuration with diverging arms, the condenser device is capable of condensing the fibre ribbon along two directions, giving the fibre ribbon the possibility to freely expand the transverse section thereof on the sides and frontally as a function of the operating conditions of the spinning head, without creating clogging and/or fibre blocks at the inlet of the condenser itself.

[0052] This ability to self-adjust ensured by the degree of freedom in the transverse and frontal direction compensates for any excess fibre volume during restarting and/or during normal operation, making the flow more smooth and homogeneous.

[0053] The tapered double V or double U shape, together with the fact that the ribbon converges progressively towards the vertex and therefore towards gradually decreasing passage sections, allows the fibre ribbon to condense when needed and to disperse when it is not necessary, as well as to accompany it firmly even in the presence of defects and/or anomalies.

[0054] Furthermore, such a shape allows the fibres to be condensed at the vertex, therefore in an extremely narrow, theoretically point-like area, and this translates into the minimisation of twisting defects during the spinning step.

[0055] In general, it is a passive device, which therefore does not require any active electronic control apparatus.

[0056] Furthermore, it is universal, i.e., it can be used for any type and for a wide range of fibre ribbon thread coats by virtue of the open and convergent shape, which gives the ribbon the possibility to expand and retract on the sides and/or frontally without creating unwanted clogging or any need to mechanically vary the transverse passage section. Consequently, the flow of the ribbon is more regular and uniform.

[0057] The pyramidal or conical shape allows a better collection and condensation of the fibres, in a theoretically point-like area at the outlet, with consequent limiting of the twisting defects during the spinning step.

[0058] Again, the converging V or U shape with diverging arms better guides the fibres, preventing the peripheral ones on the sides from undesirably winding around the idle cylinders; this helps to improve the reliability, performance and cleanliness of the spinning head.

[0059] Advantageously, the condenser can be applied to multiple-feed spinning machines.

[0060] Furthermore, the open and convex section completely eliminates the manual threading operation of the ribbon during the initial preparation step of the machine.

[0061] Furthermore, the open section allows the operator to monitor the state of the fibre ribbon inside the condenser, so as to visually detect any tangling or unwanted accumulations, etc.

[0062] Again, the open section permanently eliminates the problem of wear caused by the fibre ribbon.

[0063] To the embodiments described above, the person skilled in the art may, in order to meet specific needs, make changes and/or replacements of elements described with equivalent elements, without departing from the scope of the attached claims.

Claims

1. Condenser device (12) for fibre ribbon (14) for spinning head (16), comprising at least one passage groove (18, 19) arranged with a mouth (20), an outlet (22), and a sliding surface (24) comprised between said mouth (20) and said outlet (22),
   characterised in that said sliding surface (24) converges from the mouth (20) towards the outlet (22); and **in that** said sliding surface (24) is arranged with a sliding bottom (26) and sliding side walls (28, 30), said sliding side walls (28, 30) diverging from each other in the opposite direction with respect to said sliding bottom (26) .

2. Condenser device (12) according to the preceding claim, **characterised in that** it comprises a radial opening (31) substantially opposite to said sliding bottom (26).

3. Condenser device (12) according to any one of the preceding claims, **characterised in that** it comprises at least two side-by-side passage grooves (18, 19).

4. Condenser device (12) according to any one of the preceding claims, **characterised in that** the section trace (26) of said at least one passage groove (18, 19) in a section plane perpendicular (28) to the sliding direction (X) at the inlet to the mouth (20) is substantially V-shaped, or U-shaped with diverging arms (30, 32).

5. Condenser device (12) according to the preceding claim, **characterised in that** said diverging arms (30, 32) define an angle (α) comprised between 40° and 70°, and preferably around 57°.

6. Condenser device (12) according to any one of the preceding claims, **characterised in that** the section trace of said at least one passage groove (18, 19) according to a plane containing the sliding direction (X) and perpendicular to a centreline plane (38) containing the direction (X) is substantially V-shaped, or U-shaped with converging arms (34, 36).

7. Condenser device (12) according to the preceding claim, **characterised in that** said converging arms (34, 36) define an angle β comprised between 20° and 60°, and preferably around 40°.

8. Condenser device (12) according to any one of the preceding claims, **characterised in that** said at least one passage groove (18, 19) is a side surface portion of a pyramid.

9. Condenser device (12) according to the preceding claim, **characterised in that** said side surface portion of a pyramid comprises at least two faces (40, 42, 44).

10. Condenser device (12) according to the preceding claim, **characterised in that** said pyramidal surface portion comprises three faces (40, 42, 44).

11. Condenser device (12) according to any one of claims 1- 7, **characterised in that** said at least one passage groove (18, 19) is a conical surface portion.

12. Condenser device (12) according to any one of claims 8-11, **characterised in that** said at least one passage groove (18, 19) comprises an apical surface portion (46) close to or comprising the vertex of said pyramidal or conical surface.

13. Condenser device (12) according to any one of the preceding claims, **characterised in that** said sliding bottom (27) of said at least one passage groove (18, 19) is inclined by an angle γ comprised between 0° and 10°, and preferably around 5°, with respect to the sliding direction (X) at the inlet to the mouth (20).

14. Condenser device (12) according to any one of the preceding claims, **characterised in that** said at least one passage groove (18, 19) is symmetrical with respect to a centreline plane (38) containing the sliding direction (X) at the inlet to the mouth (20).

15. Condenser device (12) according to any one of the preceding claims, **characterised in that** the length (52) of said at least one passage groove (18, 19) in the sliding direction (X) at the inlet to the mouth (20) is comprised between 10 mm and 20 mm, and preferably around 15 mm.

16. Condenser device (12) according to any one of the preceding claims, **characterised in that** the depth (54) of said at least one passage groove (18, 19) in a plane perpendicular to the sliding direction (X) at the inlet to the mouth (20), at the outlet section (22) is comprised between 8 mm and 18 mm, and preferably around 13 mm.

17. Condenser device (12) according to any one of the preceding claims, **characterised in that** the edges and/or the vertex of said at least one passage groove are provided with fittings with radius r comprised between 0 mm and 1.5 mm, and preferably around 0.5 mm.

18. Spinning head (16) comprising a condenser device (12) according to any one of the preceding claims.

19. Spinning machine (48) comprising at least one spinning head (16) according to the preceding claim.

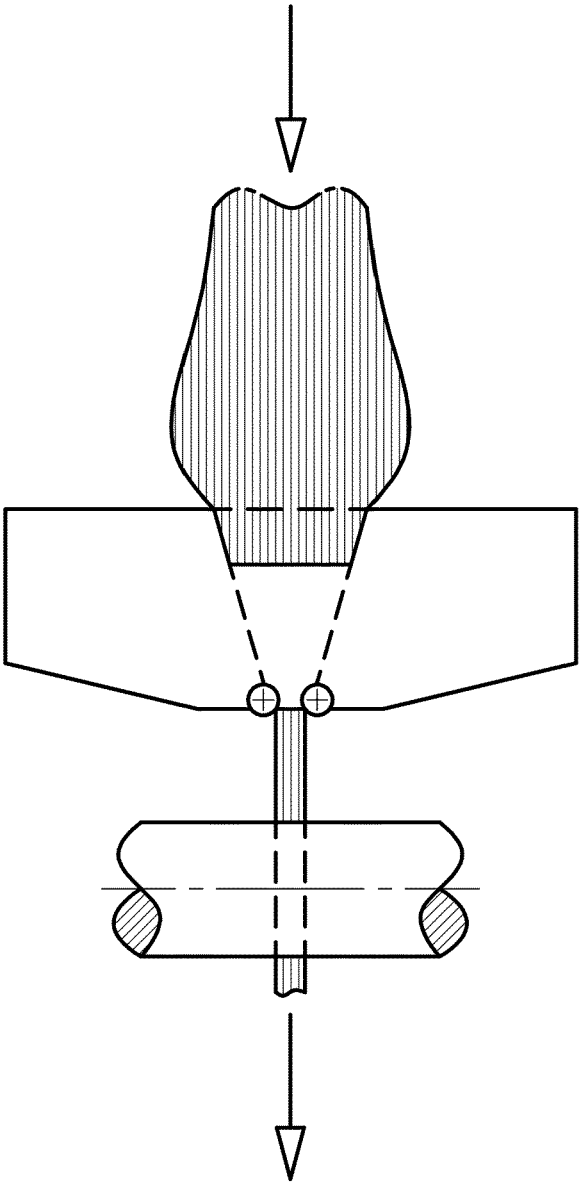

FIG.1 - Prior art

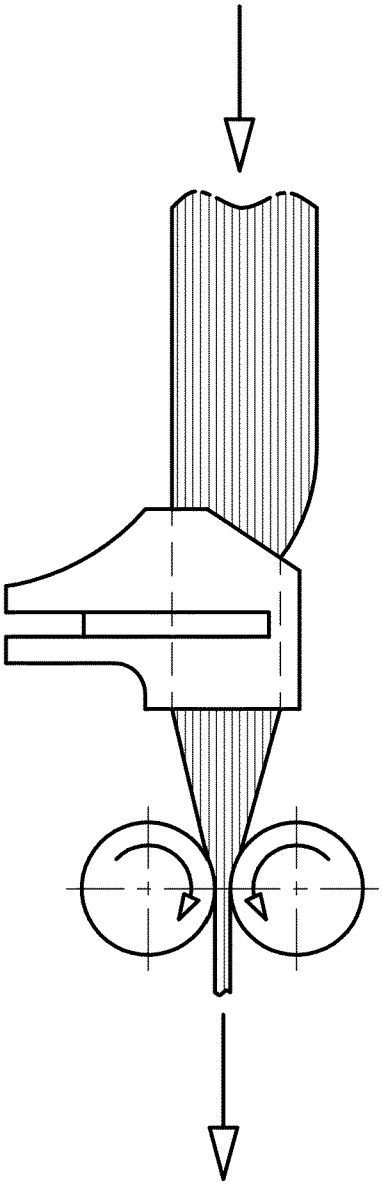

FIG.2 - Prior art

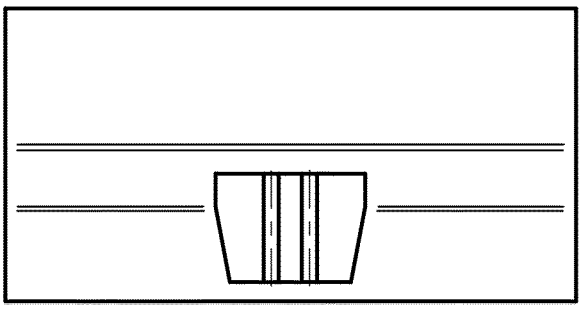

FIG.3 - Prior art

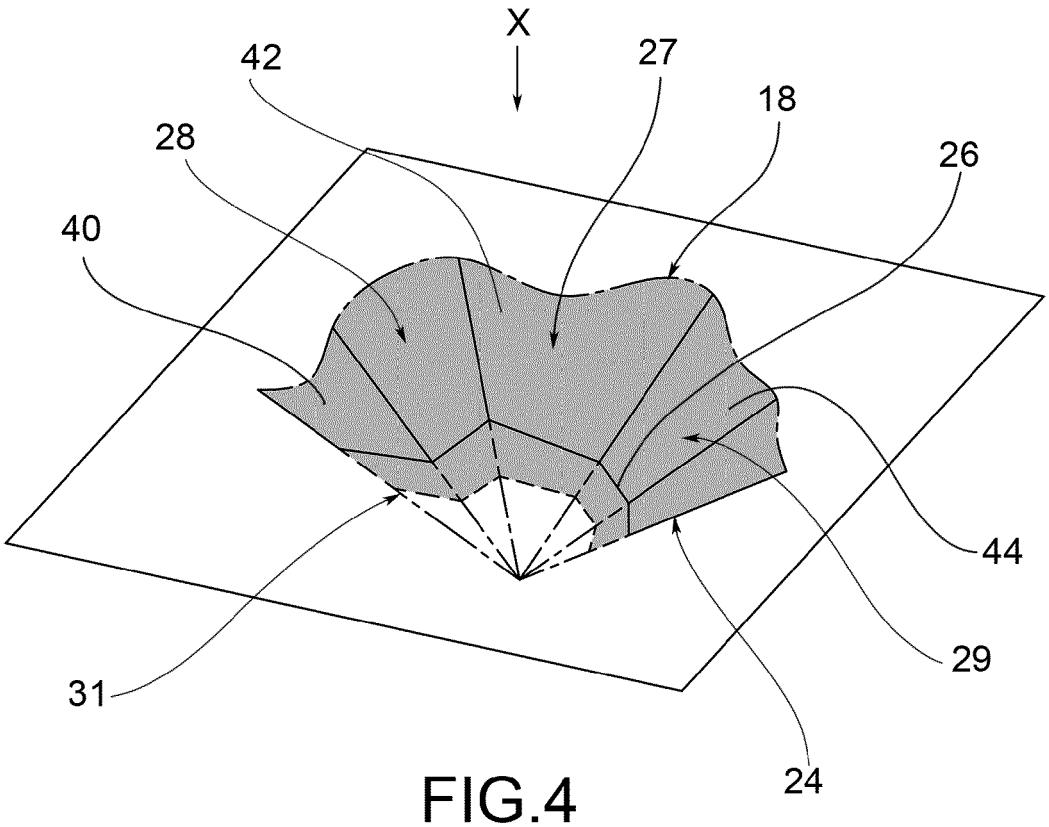

FIG.4

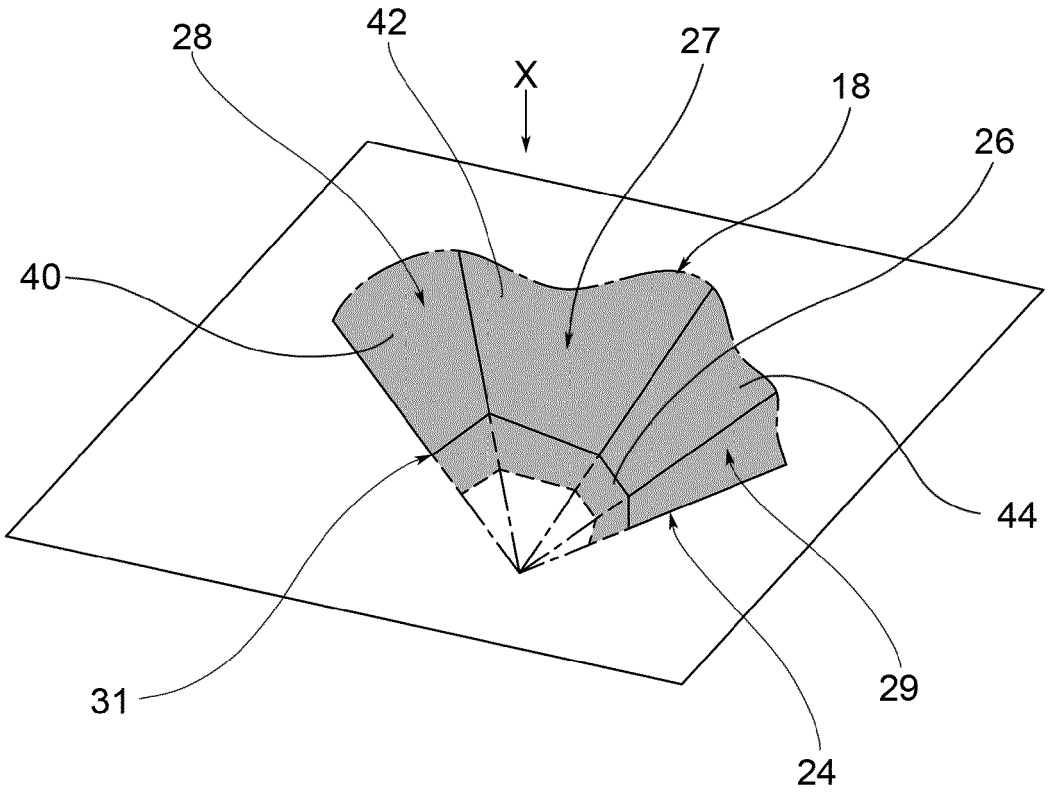

FIG.5

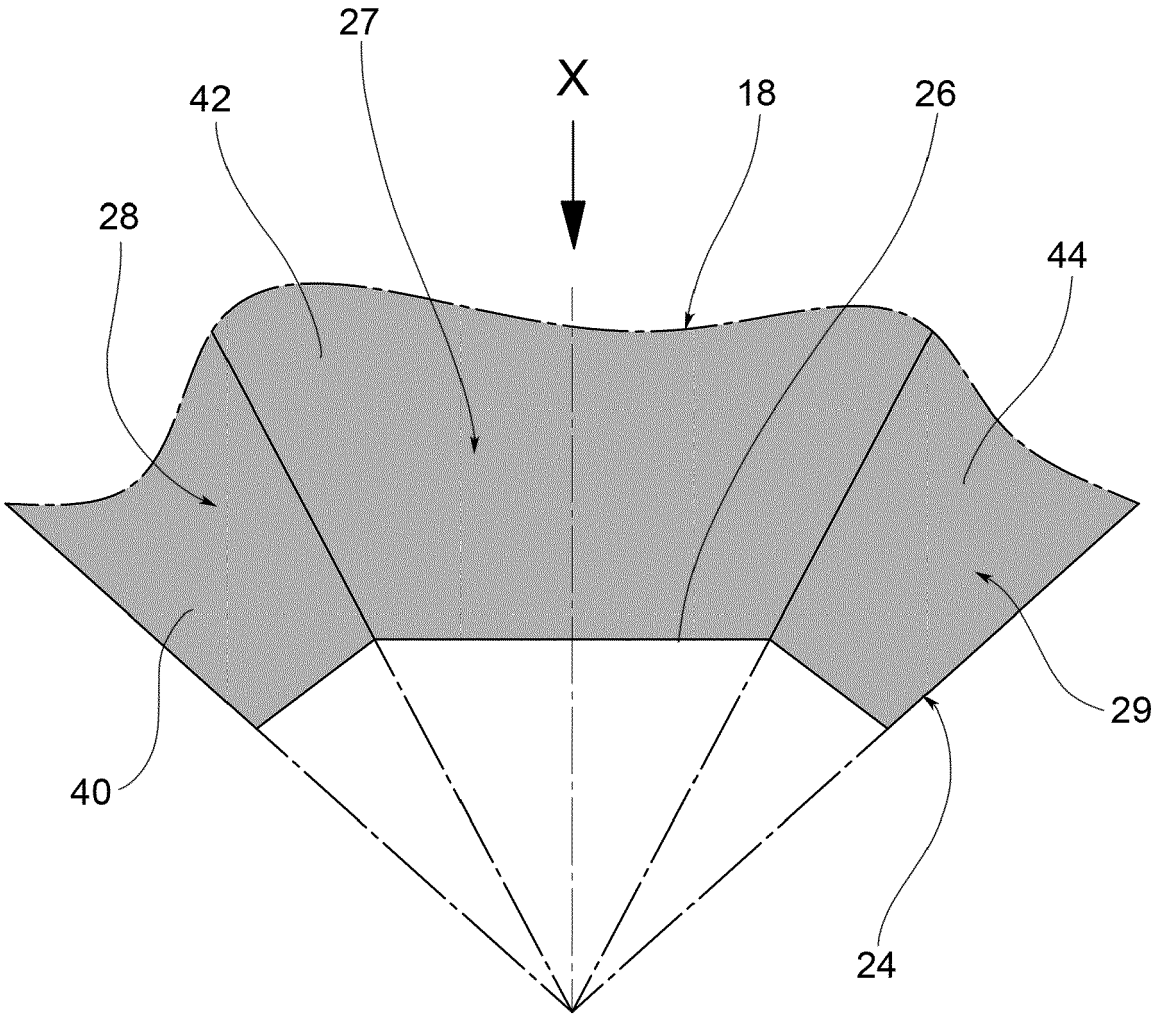

FIG.6

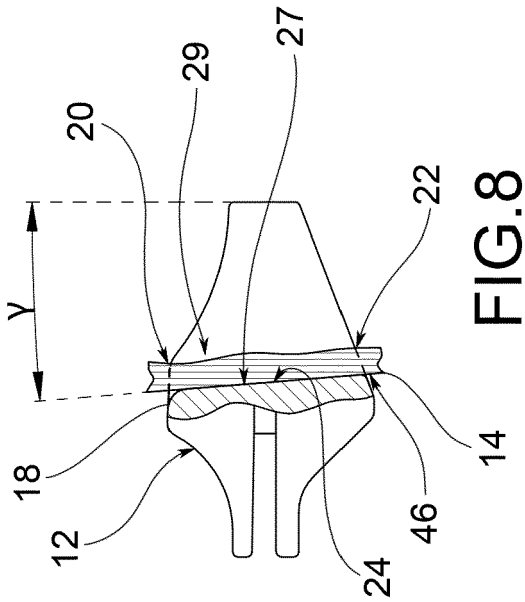

FIG.8

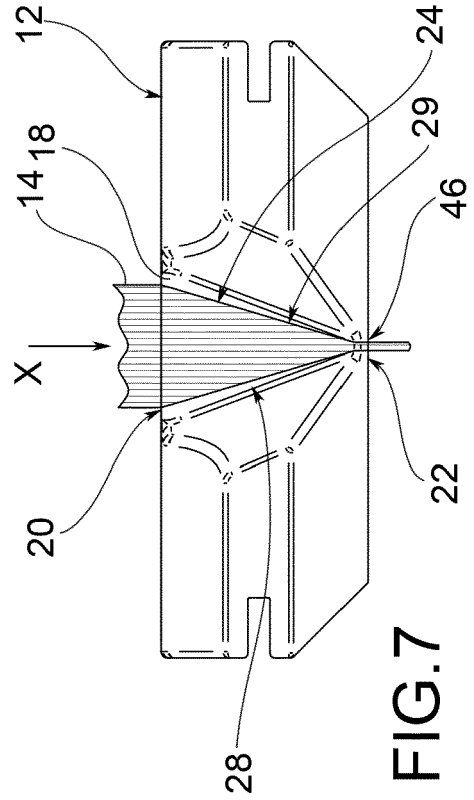

FIG.7

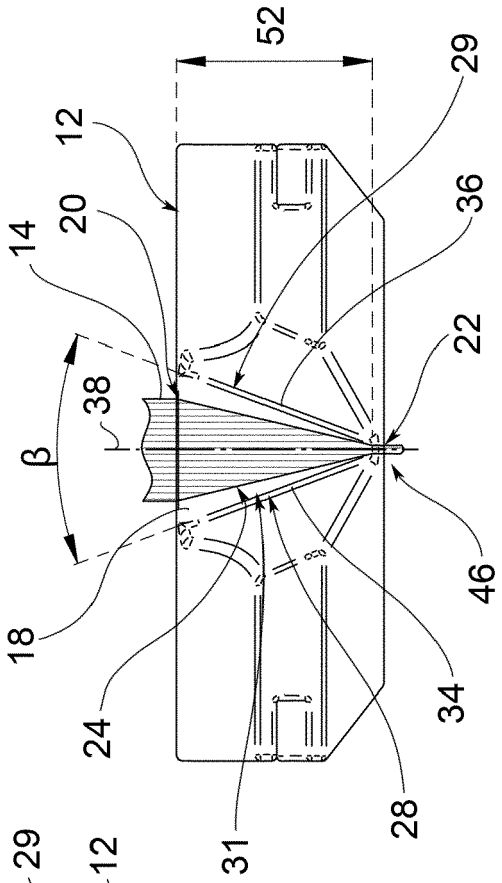

FIG.10

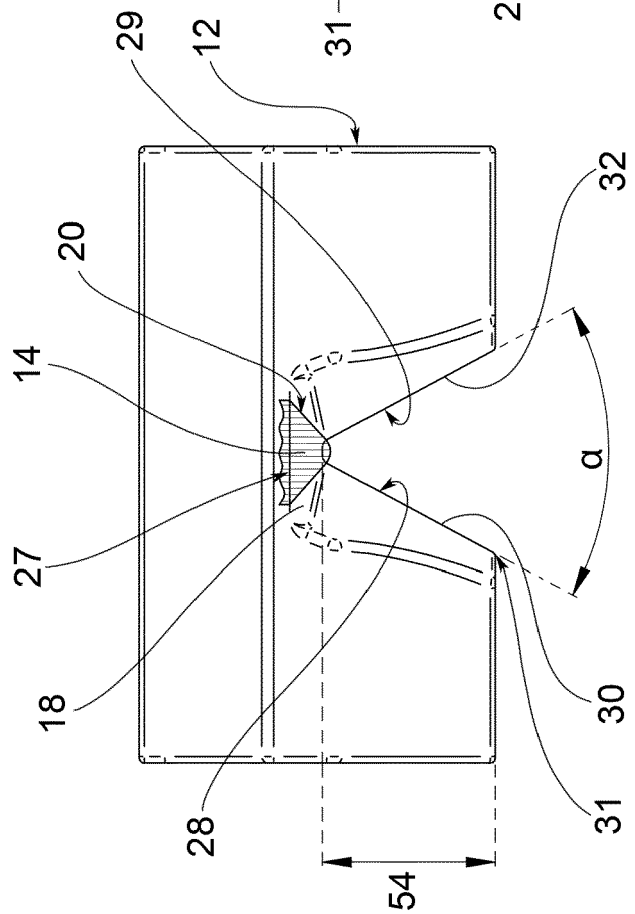

FIG.9

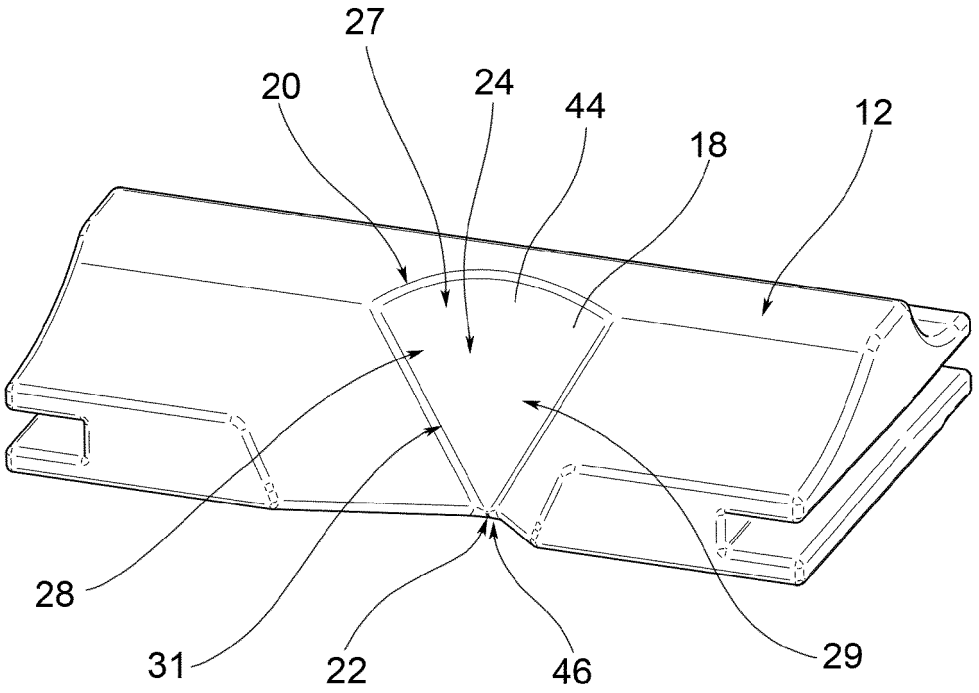

FIG.11

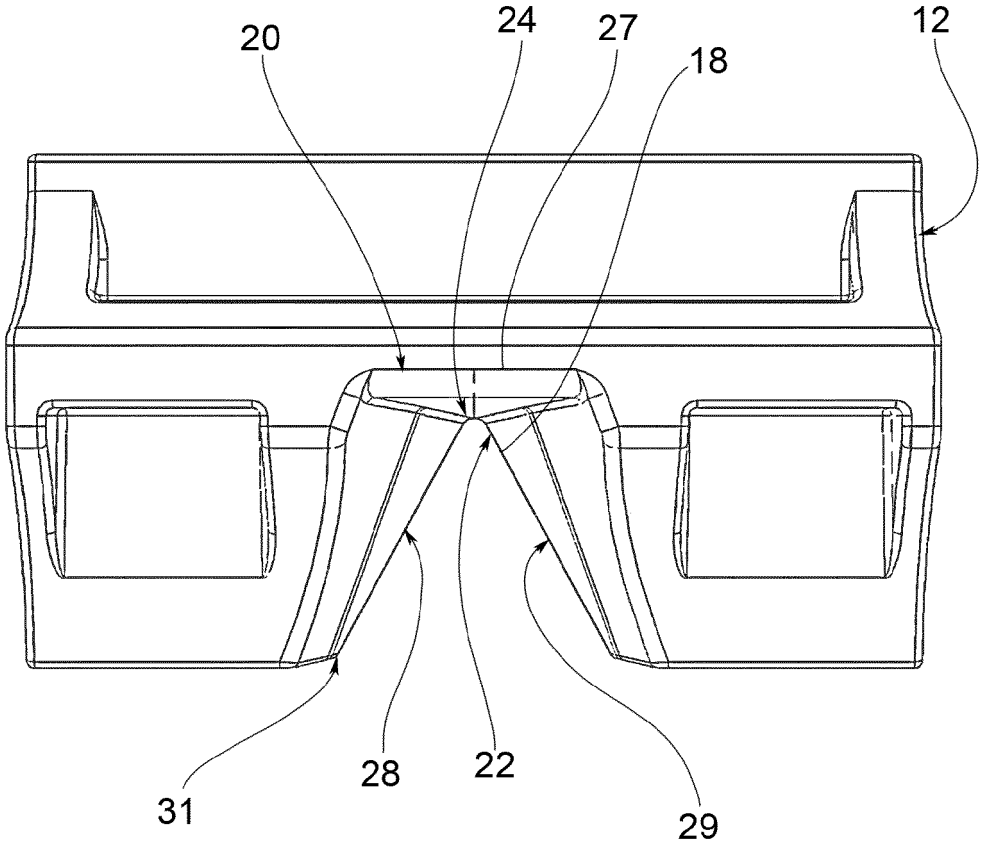

FIG.12

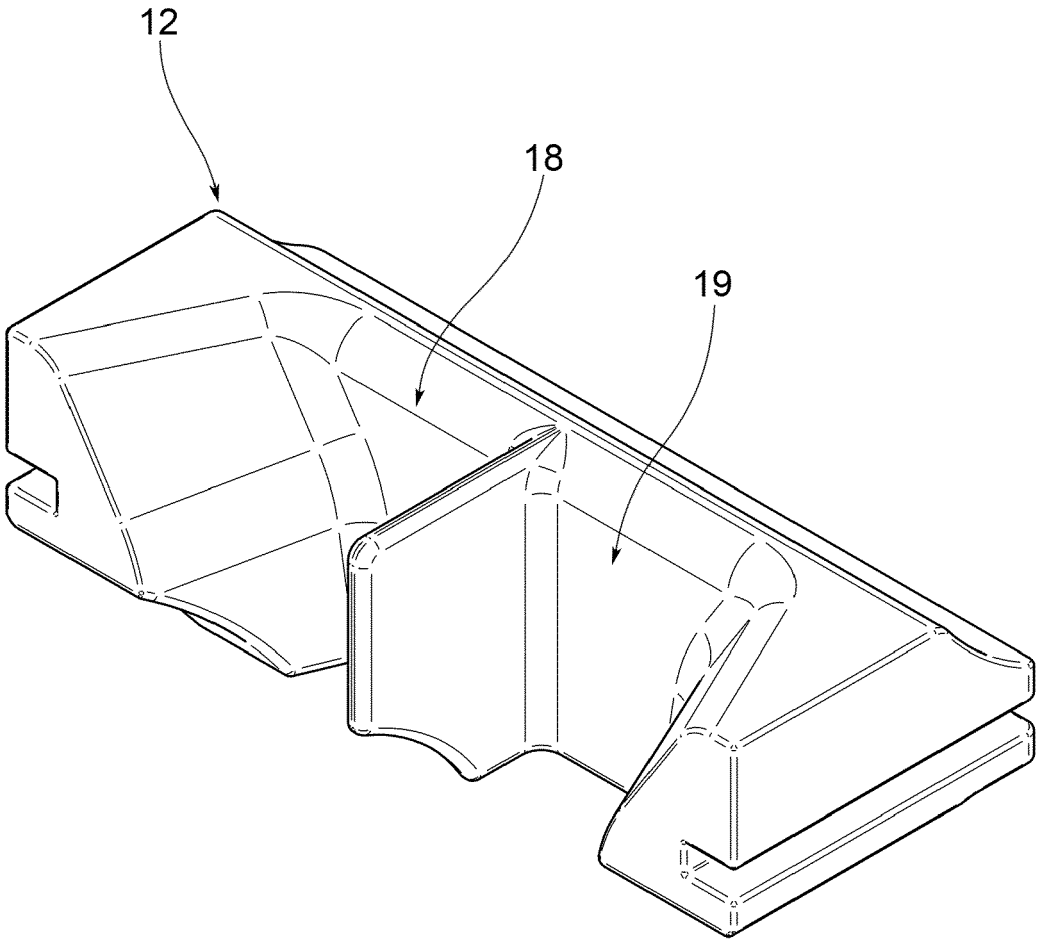

FIG.13

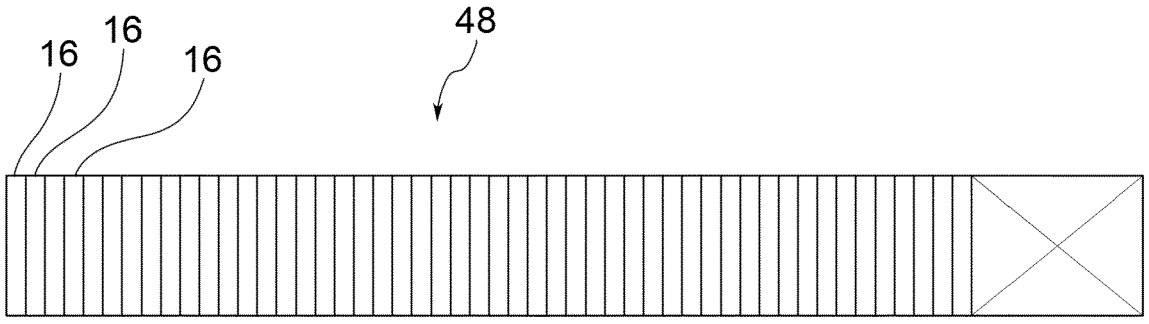

FIG.14

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 15 8035

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,D	US 2 774 995 A (EVALD SANDELIN OLLE) 25 December 1956 (1956-12-25) * the whole document *	1-19	INV. D01D5/16 D01H5/72 D01D4/00
A	US 2 202 755 A (F.CASABLANCAS) 28 May 1940 (1940-05-28) * the whole document *	1-19	
A,D	GB 705 039 A (ST JOHN S TEXTILE MILLS LTD; WATSON JOHN WOOD) 3 March 1954 (1954-03-03) * the whole document *	1-19	
			TECHNICAL FIELDS SEARCHED (IPC)
			D01D D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 August 2023	Van Beurden-Hopkins

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 8035

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-08-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2774995 A	25-12-1956	NONE	
US 2202755 A	28-05-1940	FR 832972 A	07-10-1938
		GB 508644 A	04-07-1939
		US 2202755 A	28-05-1940
GB 705039 A	03-03-1954	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2272787 A **[0009]**
- US 2774995 A **[0013]**
- US 2813307 A **[0013]**
- GB 705039 A **[0016]**
- GB 1131069 A **[0017]**
- JP 2009030180 A **[0018]**