



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.06.2014 Bulletin 2014/25

(51) Int Cl.:
B26D 7/18 (2006.01) **B26D 1/24** (2006.01)

(21) Application number: **12197431.5**

(22) Date of filing: **17.12.2012**

(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 MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME

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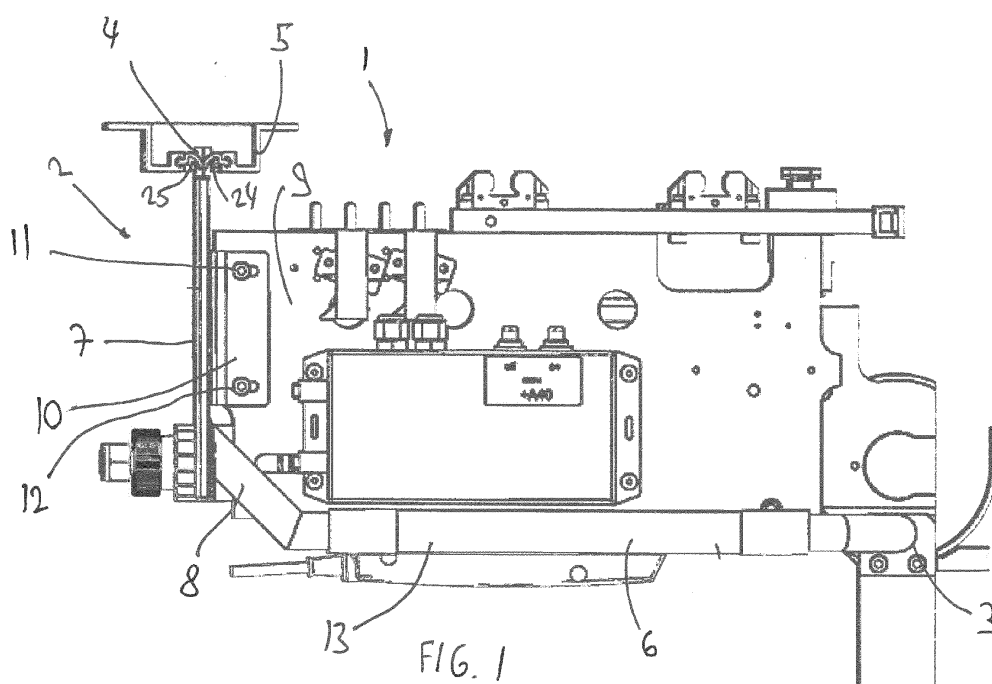
Remarks:
Amended claims in accordance with Rule 137(2)
EPC.

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(54) **Dust extraction system and web slitters equipped therewith**

(57) A dust extraction system for a web slitter incorporating one or more slitting blades; said system comprises an extractor conduit (6) which at its proximal extremity (3) is in an area adjacent the slitting operation and which at its distal extremity incorporates a head (4) which engages with an extraction manifold (5); and an

extractor fan for causing the flow of extracted dust from said proximal to said distal extremity; characterised in that said manifold incorporates an elongate channel with means (24,25) for sealing said head to said extraction manifold; whereby said head may be positioned anywhere along said channel.



Description

Field of the Invention

[0001] The invention relates to dust extraction systems and web slitters equipped therewith.

Background to the Invention and Prior Art Known to the Applicant

[0002] The traditional dust extraction systems as used on the Applicant's slitter/rewinding machines include dust extraction hoses attached at one end to the male knife and at the other end to a fixed dust extraction manifold. A vacuum pump is provided to suck the dust away from the blade along the dust extraction hoses into the dust extraction manifold from where it is delivered to the dust collection vessel. The male knife may be positioned anywhere along the male knife beam within the limits imposed by the length of the dust extraction hose. Current dust extraction systems restrict the lateral movement of a knife blade during automatic knife positioning and manual knife positioning. The extraction hose of the prior art is secured in close proximity to the blade of the male knife and to the extraction manifold by respective hose clamps. These hose clamps are usually of the Chenny or Jubilee type. The extraction manifold is normally secured to the male knife beam.

[0003] Whilst the prior art dust extraction systems have proved successful for a number of years, the number of knives fitted to the machine typically match the number of distinct extraction manifold fittings provided. Consequently, when the customer wishes to add another knife he has to allow several hours downtime in order to modify the extraction manifold and then purchase the spare parts to attach a new knife to the manifold. Furthermore, when the customer wishes to remove a male knife, the revealed unused manifold connection must be blocked to maintain the vacuum created in the extraction manifold.

[0004] Furthermore, due to their inherent structure, the prior art dust extraction systems require relatively unwieldy external hoses and clips. It is therefore a relatively complex operation even to replace a knife blade with another kind of knife blade. Furthermore, since a flexible hose is used to connect the male knife blade guard to the extraction manifold, the flexible hose is extended every time the male knife is engaged with the female knife or grooved roll and compressed every time the male knife is disengaged with the female knife or grooved roll. The constant deflection of the flexible hose makes hose failure a real possibility.

[0005] Within the current design, the hose used to link the knife holder to the manifold restricts the movement of the knife thereby limiting the set-ups that can be achieved with standard hoses. Extended hoses can be used to overcome this restriction but the cost and complexity of handling the additional hose length safely is

prohibitive.

[0006] Finally, relatively noisy, heavy and complex vacuum pumps are required to create the suction in the manifold.

Summary of the Invention

[0007] In a first broad independent aspect, the invention provides a dust extraction system for a web slitter incorporating one or more slitting blades; said system comprising an extractor conduit which at its proximal extremity is in an area adjacent the slitting operation and which at its distal extremity incorporates a head which engages with an extraction manifold; and an extractor fan for causing the flow of extracted dust from said proximal to said distal extremity; **characterised in that** said manifold incorporates an elongate channel with means for sealing said head to said extraction manifold; whereby said head may be positioned anywhere alongside said channel.

[0008] This configuration is particularly advantageous because it avoids the traditional requirement of one hole in the manifold for a particular hose end. Instead of discrete positioning of the end of an extractor conduit, unlimited male knife positioning may be achieved in the elongate channel. The requirements for potentially fiddly and complex clips are avoided. The male knives may be added or removed quickly and simply without the need for extensive technical assistance or spare parts other than the extra male knife.

[0009] In a subsidiary aspect, the seal is formed from two oppositely positioned sealing strips; whereby, in use, the relatively low pressure in the extraction manifold combines with the relatively high ambient air pressure to push said portions against said head. This configuration is particularly advantageous since it allows the strips to be relatively straightforwardly parted for the removal of the head whilst at the same time allowing a tight fit on the extraction head. Furthermore, it allows the knife blade to be positioned in any appropriate position of the elongate channel. Consequently, downtime if any, for the replacement of a knife blade is kept to the minimum with little or no requirement for modification of the manifold.

[0010] In a further subsidiary aspect, the sealing strip portions are bowed. This increases the surface area of contact between the inner portion of the sealing strips and the head of the extraction system.

[0011] In a further subsidiary aspect, the head incorporates an upper aperture and laterally extending fins. This configuration is particularly advantageous in terms of allowing the parting of the sealing strips for the insertion or the removal of the head.

[0012] In a further subsidiary aspect, the fins are tapered. This further improves the ability of the fins to be used in parting the sealing strips.

[0013] In a further subsidiary aspect, the fins are tapered in varying width from an upper portion of the fins to a lower portion of the fins. This further improves the

ability of the fins being used to part the sealing strips.

[0014] In a further subsidiary aspect, the fins decrease in thickness in the lateral direction. This provides a relatively pointed lateral extremity for the fins further facilitating the parting of the sealing strips.

[0015] In a further subsidiary aspect, the fins are rounded. This configuration is particularly advantageous in terms of removing the sharp edges which may otherwise damage the air tightness of the extraction manifold.

[0016] In a further subsidiary aspect, the extractor conduit incorporates a rigid telescopic portion. This configuration is particularly advantageous as it limits the degree of motion other than in the telescopic direction. In preferred embodiments, the internal surfaces of the rigid telescopic portion are relatively smooth which reduces the level of turbulence and consequently noise during the suction process.

[0017] In a further subsidiary aspect, the extraction manifold is directly mounted onto a male knife blade beam.

[0018] In a further subsidiary aspect, the system further comprises Venturi holes through said extraction manifold which are aligned with holes provided through the male knife blade beam. This further improves the flow of air between the extraction manifold and the male knife blade beam.

[0019] In a further subsidiary aspect, both the extraction manifold and the fan are mounted onto the male knife blade beam. This further improves the suction properties of the dust extraction system.

[0020] In a further independent aspect, the invention provides a web splitter comprising a dust extraction system according to any of the preceding aspects.

Brief Description of the Figures

[0021]

Figure 1 shows a side view of a male knife equipped with a first embodiment of the invention.

Figure 2 shows a perspective view of a first embodiment of a dust extraction system.

Figure 3 shows a cross-sectional view of a dust extraction manifold according to the first embodiment of the invention.

Figure 4 shows a side view of a second embodiment of a dust extraction system.

Figure 5 shows a front view of a male knife beam equipped with a plurality of extractor conduits at various locations along the length of the dust extraction manifold.

Figure 6 shows a perspective view of the dust extraction manifold of the second embodiment of the

invention.

Figure 7 shows a cross-sectional view of the dust extraction manifold and male knife beam in accordance with a further embodiment of the invention.

Figure 8 shows three separate configurations of the head of an extractor conduit in accordance with any of the embodiments of the invention.

Detailed Description of the Figures

[0022] Figure 1 shows a knife blade assembly 1 equipped with a dust extraction system generally referenced 2. The dust extraction system incorporates an extractor conduit which at its proximal extremity 3 is in an area adjacent the slitting operation and which at its distal extremity incorporates a head 4 which engages with extraction manifold 5. The extractor conduit 2 incorporates a telescoping extraction tube 6 and a manifold seal deflector 7. The telescoping extraction tube 6 extends laterally whilst the manifold seal deflector 7 extends upwards. The telescoping extraction tube 6 and the deflector 7 are joined together by a tube section 8 provided at an angle. The deflector is secured onto the mounting plate 9 by the mounting plate 10. Releasable attachment means such as fasteners 11 and 12 immobilise the deflector relative to the plate 9.

[0023] The telescoping extraction tube 6 incorporates a number of concentric tubular portions which slide relative to one another in order to achieve a lengthening or a shortening of the tube. The central portion 13 of the telescoping extraction tube provides a relatively smooth internal surface.

[0024] The manifold seal deflector 7 provides a substantially oblong internal cavity through which a mixture of air and dust travel upwards. The upper extremity of the deflector incorporates a head 4 which has at least one but preferably two laterally extending fins 14 and 15. These fins are wedge shaped and reduce in thickness towards their distal extremities 16 and 17. Alternative head configurations are presented in Figure 8 where distal extremities 18 and 19 are rounded, distal extremities 20 and 21 progressively increase in width and, extremities 22 and 23 where a reduction in width is provided from an upper portion to a lower portion. The head of the manifold seal deflector has tapered ends machined perpendicular to maximise the sealing efficiency when traversing the manifold seals 24 and 25.

[0025] As can be best seen in Figure 3, the seal is formed of two sealing strips 24 and 25 which are upwardly bowed and abut each other at their distal extremities. The sealing strips will be of inherently flexible material in order to accommodate the insertion of the fins of the head. The sealing strips fit tightly in an elongate channel generally referenced 26. The dust extraction manifold 5 may be mounted onto the male knife beam 27 through releasable attachment means 28 and 29. The extraction

manifold may be substantially U-shaped. An aperture 30 may be provided between the extraction manifold and the male knife beam 27. Extractor fans may be provided on at least one side of the male knife beam as shown for example in Figure 5 where pumps 31 and 32 can draw air from the internal cavity of the male knife beam 27.

[0026] When the male knife is positioned, the tapered ends of the head part the seal gradually, preventing loss of air from the dust extraction manifold. Sealing is increased by flowing air (low pressure) in the dust extraction manifold exerting an upward "pull" on the seals forcing them against the head of the extraction system whilst the ambient air (high pressure) push the seal onto the head. The length of the taper offers least resistance and best sealing efficiency.

[0027] The dust extraction manifold 5 may be formed of two parts 33 and 34. These parts may be light alloy extrusions. Each light alloy extrusion may have the facility to accommodate sealing strips as shown in the previous figures. The ends of the dust extraction manifold may be closed by a closure plate or other appropriate closure means. As shown in Figure 3, the dust extraction manifold 5 is mounted directly onto the male knife beam 27. The holes machined through the dust extraction manifold align with the holes machined through the male knife beam.

[0028] A control mechanism may be provided so that when the slitting operation starts, the extractor fans start. The air being expelled from the plenum chamber is replaced in equal volume by air being sucked into the telescoping extraction tube.

[0029] The volume of air being sucked into the telescoping extraction tube takes with it the dust created by the slitting action of the knives. The air passes through the telescoping extraction tube into the manifold seal deflector and into the dust extraction manifold. The smooth internal surfaces of the telescoping extraction tube produce a fast, laminar air flow that maximises dust extraction. The extractor fans draw the air out of the dust extraction manifold into the plenum chamber. From the plenum chamber, the air/dust mixture is expelled from the extractor fans into a dust collection vessel (not shown). The dust extraction is illustrated by arrows 35 and 36.

[0030] As can be best seen in Figure 5, a number of deflectors may be positioned along a part of a dust extraction manifold.

[0031] A further embodiment of the invention is illustrated in Figures 4, 6 and 7. Identical numerical references to the first embodiment are employed throughout for simplicity other than for parts which differ from the corresponding parts in the first embodiment. In Figures 4 and 6, the telescoping extraction tube of the first embodiment has been replaced by a flexible hose 37 which connects the male knife blade guard 38 to the manifold seal deflector 7.

[0032] As shown in Figure 7 dust extraction manifold 5 is mounted directly onto the male knife beam 39. Venturi holes 40 machined through the dust extraction manifold

5 align with holes machined through the male knife beam 39. The Venturi holes improve dust extraction by accelerating the airflow into the plenum chamber.

[0033] When the machine starts, the extractor fans start. The air being expelled from the plenum chamber is replaced in equal volume by air being sucked into the flexible hose. The volume of air being sucked into the flexible hose takes with it the dust created by the slitting action of the knives. Air passes through the flexible hose, into the manifold seal deflector, and into the dust extraction manifold. The extractor fans draw the air out of the dust extraction manifold into the plenum chamber. From the plenum chamber, the air/dust mixture is expelled from the extractor fans into the dust collection vessel.

[0034] In certain embodiments at least the following advantages are achieved:

- unlimited male knife positioning;
- simplified operation for changing the extraction hose attached to the male knife;
- male knives are added or removed quickly and simply without the need for technical assistance or spare parts other than the extra male knife;
- the number of male knives is only limited by the length of the male knife beam;
- a positive flow dust extraction manifold system;
- no external pipes or hoses connecting the male knives to the dust extraction manifold; and
- centrifugal blowers which are lighter and quieter.

Claims

1. A dust extraction system for a web slitter incorporating one or more slitting blades; said system comprising an extractor conduit which at its proximal extremity is in an area adjacent to the slitting operation and which at its distal extremity incorporates a head which engages with an extraction manifold; and an extractor fan for causing the flow of extracted dust from said proximal to said distal extremity; **characterised in that** said manifold incorporates an elongate channel with means for sealing said head to said extraction manifold; whereby said head may be positioned anywhere along said channel.
2. A system according to claim 1, wherein said seal is formed from two oppositely positioned sealing strip portions; whereby, in use, the relatively low pressure in the extraction manifold combines with the relatively high ambient air pressure to push said portions against said head.
3. A system according to claim 2, wherein said sealing strip portions are bowed.
4. A system according to any of the preceding claims, wherein said head incorporates an upper aperture

and laterally extending fins.

5. A system according to claim 4, wherein said fins are tapered. 5
6. A system according to claim 5, wherein said fins are tapered and vary in width from an upper portion of said fins to a lower portion of said fins. 10
7. A system according to either claim 5 or claim 6, wherein said fins decrease in thickness in the lateral direction. 15
8. A system according to any of claims 4 to 7, wherein said fins are rounded. 20
9. A system according to any of the preceding claims, wherein said extractor conduit incorporates a rigid telescopic portion. 25
10. A system according to any of the preceding claims, wherein said extraction manifold is directly mounted onto a male knife blade beam. 30
11. A system according to claim 10, further comprising Venturi holes through said extraction manifold which are aligned with holes provided through said male knife blade beam. 35
12. A system according to either claim 10 or claim 11, wherein both said extraction manifold and said fan are mounted onto said male knife blade beam. 40
13. A web slitter comprising a dust extraction system according to any of the preceding claims. 45

Amended claims in accordance with Rule 137(2) EPC.

1. A web slitter comprising a dust extraction system (2); said dust extraction system incorporating one or more slitting blades; said system comprising an extractor conduit (2) which at its proximal extremity (3) is in an area adjacent to the slitting operation and which at its distal extremity incorporates a head (4) which engages with an extraction manifold; an extractor fan for causing the flow of extracted dust from said proximal (3) to said distal extremity; and an elongate channel (26) with means for sealing said head (4) to said extraction manifold (5); whereby said head (4) may be positioned anywhere along said channel (26); **characterised in that** said manifold (5) is mounted onto a male knife beam (27); said manifold (5) incorporating Venturi holes (40) aligned with holes provided through said male knife blade beam (27). 50

2. A system according to claim 1, wherein said seal is formed from two oppositely positioned sealing strip portions (24,25); whereby, in use, the relatively low pressure in the extraction manifold (5) combines with the relatively high ambient air pressure to push said portions (24, 25) against said head (4).

3. A system according to claim 2, wherein said sealing strip portions (24,25) are bowed.

4. A system according to any of the preceding claims, wherein said head (4) incorporates an upper aperture (30) and laterally extending fins (14,15).

5. A system according to claim 4, wherein said fins (14,15) are tapered.

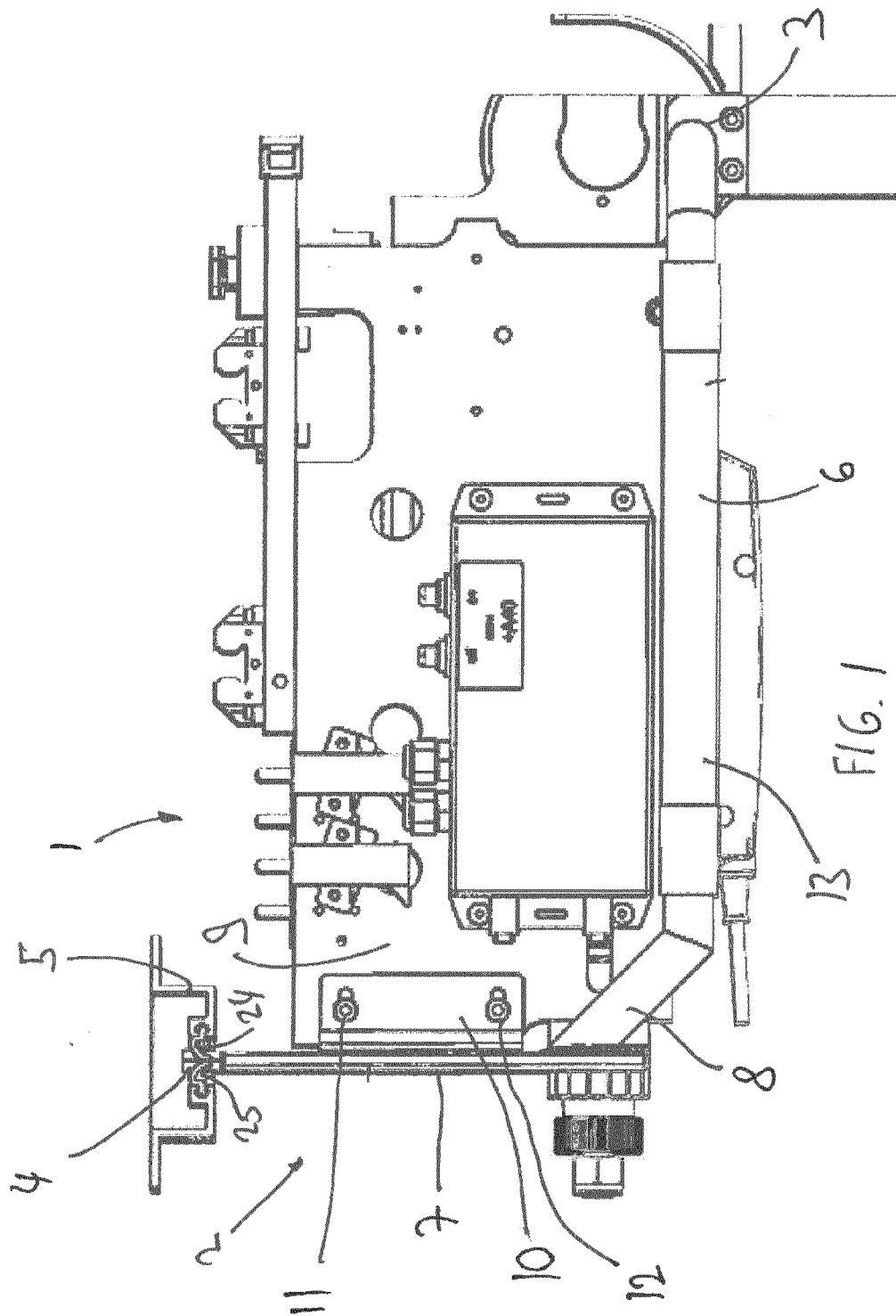
6. A system according to claim 5, wherein said fins (14,15) are tapered and vary in width from an upper portion of said fins to a lower portion of said fins.

7. A system according to either claim 5 or claim 6, wherein said fins (14,15) decrease in thickness in the lateral direction.

8. A system according to any of claims 4 to 7, wherein said fins (14,15) are rounded.

9. A system according to any of the preceding claims, wherein said extractor conduit (2) incorporates a rigid telescopic portion.

10. A system according to any of the preceding claims, wherein both said extraction manifold (5) and said fan are mounted onto said male knife blade beam (27).



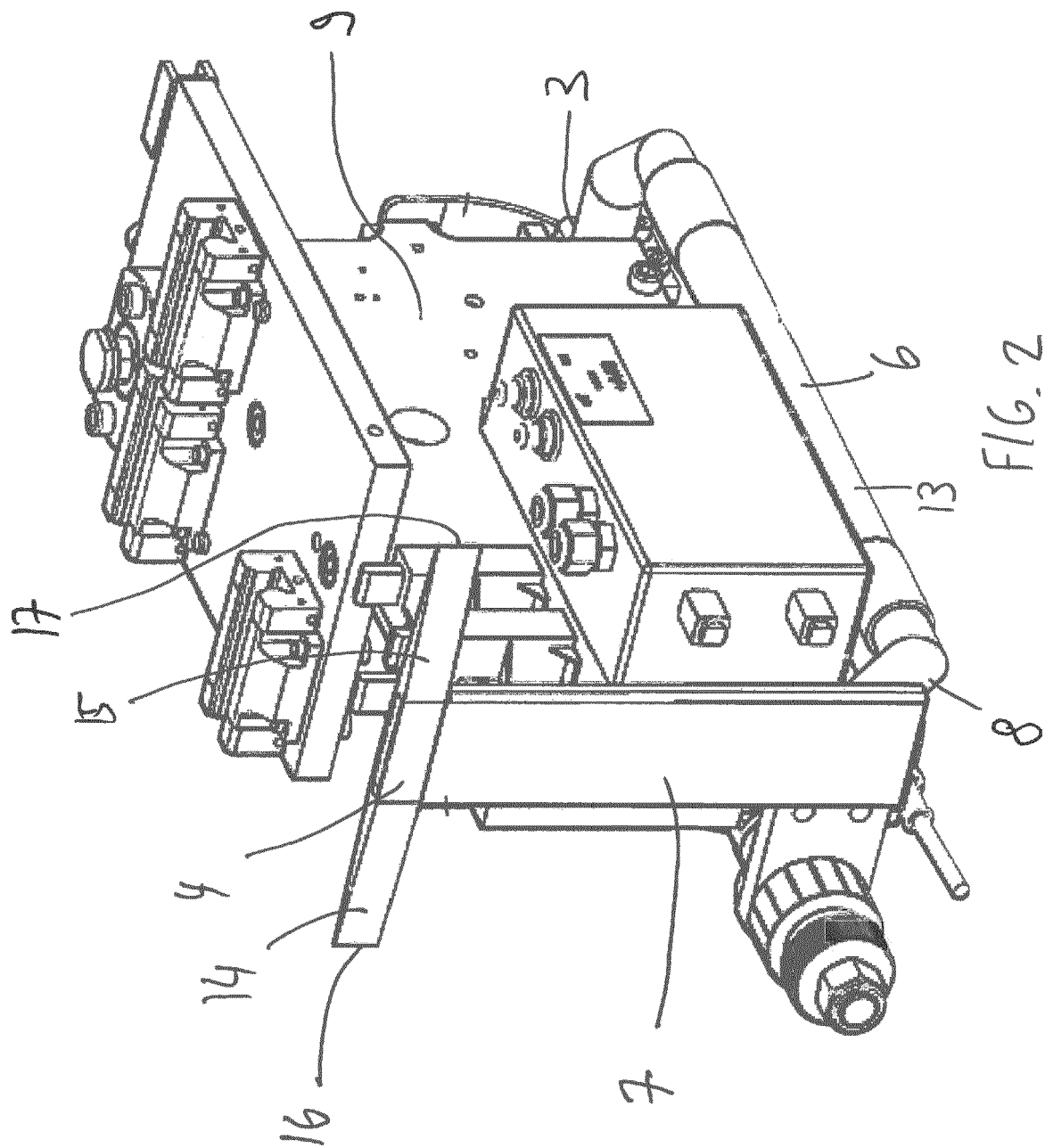
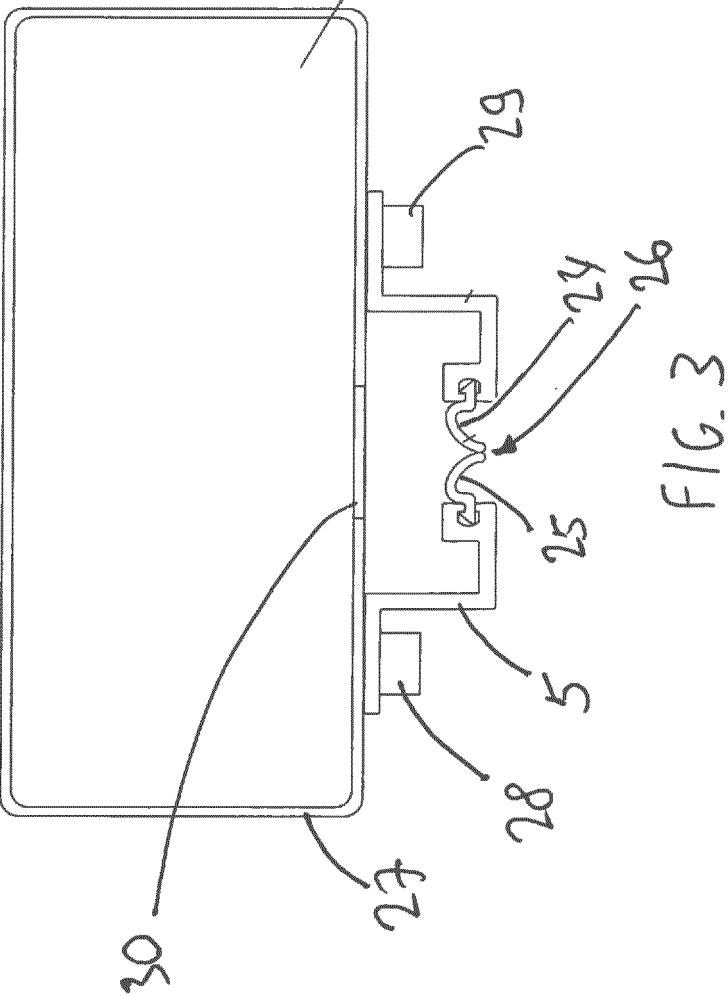
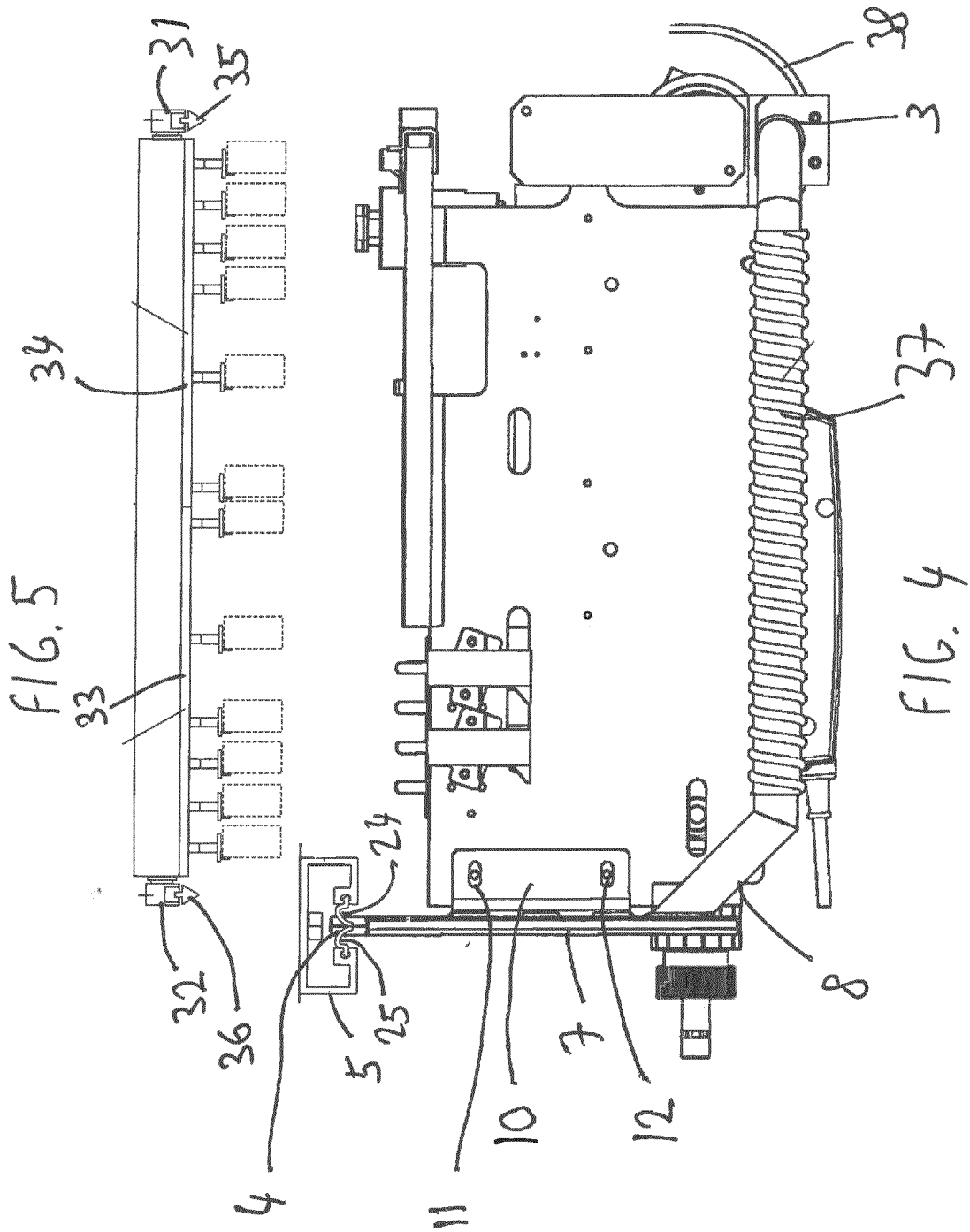
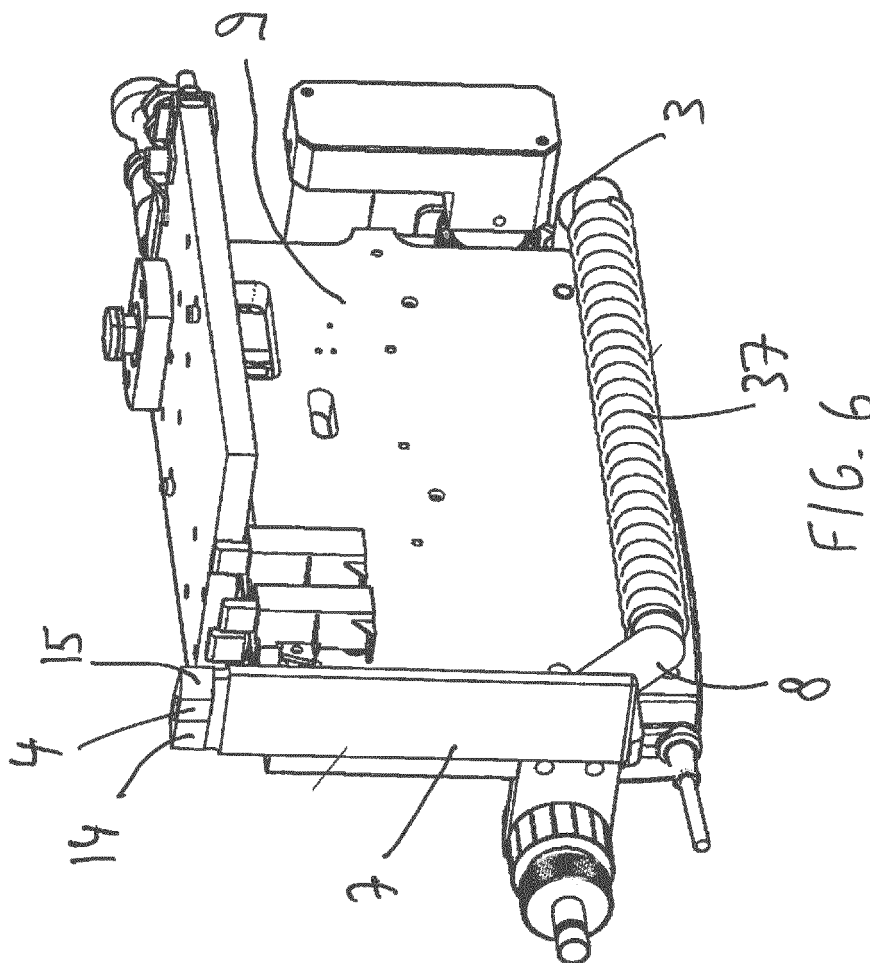
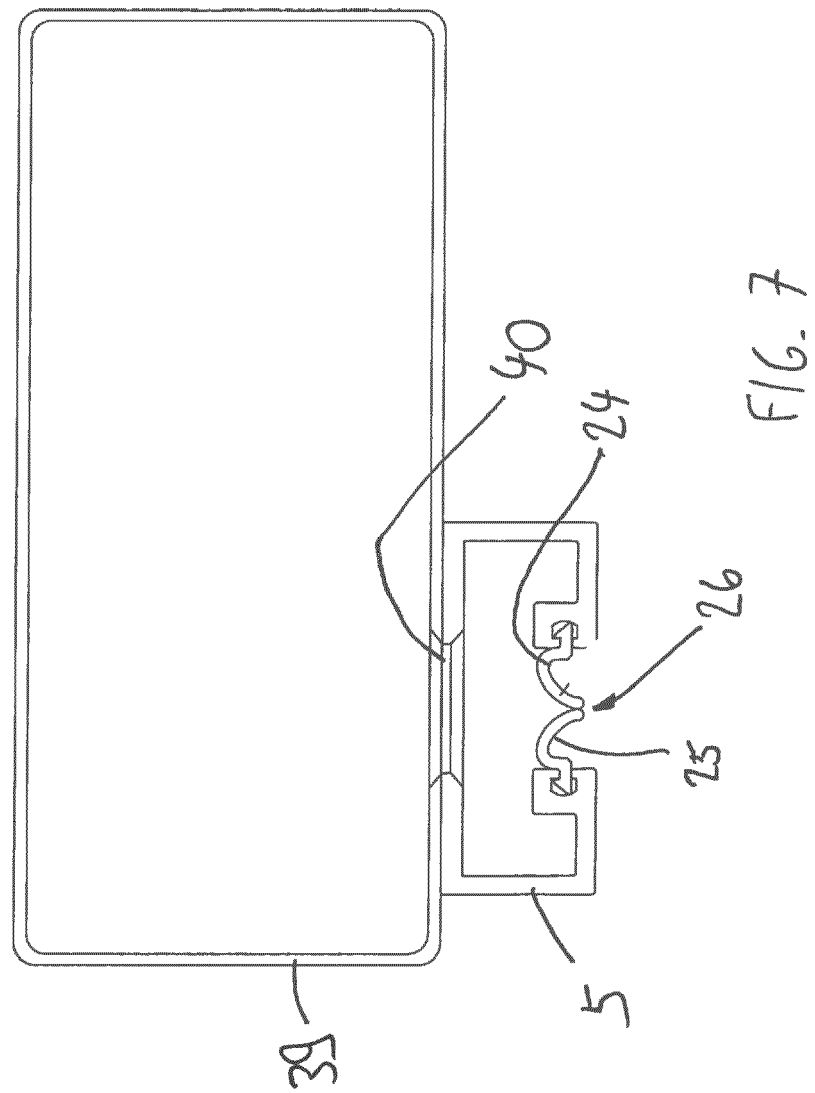


FIG. 2









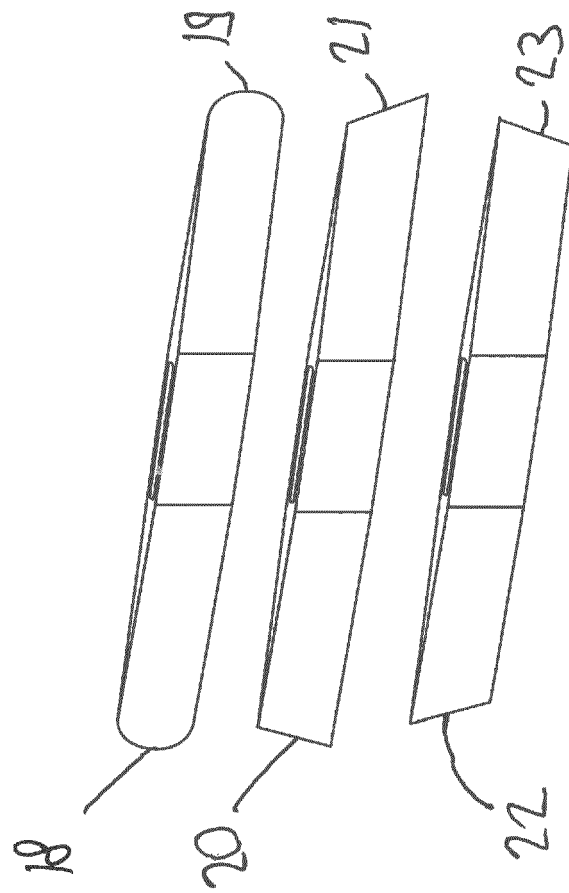


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
EP 12 19 7431

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 5 031 494 A (ASSELBORN PETER [DE] ET AL) 16 July 1991 (1991-07-16) * the whole document * -----	1-13	INV. B26D7/18 ADD. B26D1/24
			TECHNICAL FIELDS SEARCHED (IPC)
			B26D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 April 2013	Examiner Canelas, Rui
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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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 19 7431

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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09-04-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5031494	A	16-07-1991	NONE

EPO FORM P0459

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