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

Staubextraktionssystem und Bahnschneidvorrichtungen damit versehen.

Système d'extraction de poussière et dispositifs de coupe de toiles équipés de celui-ci

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(73) Proprietor: **Atlas Converting Equipment Limited**
Kempston,
Bedford,
Bedforshire MK42 7XT (GB)

(72) Inventor: **Phillips, Martin**
Bedford, Bedfordshire MK42 7XT (GB)

(74) Representative: **ip21 Ltd**
Central Formalities Department
Lakeside 300
Old Chapel Way
Broadland Business Park
Norwich
Norfolk NR7 0WG (GB)

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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.

[0007] US-5,031,494 discloses a device which defines the preamble of claim 1.

Summary of the Invention

[0008] The invention is defined in claim 1. 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 con-

duit 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, 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.

Brief Description of the Figures

[0018]

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

[0019] 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 upwardly. 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] As can be best seen in Figure 5, a number of deflectors may be positioned along a part of a dust extraction manifold.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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 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).

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).

Patentansprüche

1. Bahnschneidevorrichtung, umfassend ein Staubabsaugsystem (2); das Staubabsaugsystem enthaltend ein oder mehrere Schneidklingen; das System umfassend eine Absaugleitung (2), welche sich an ihrem äußersten proximalen Ende (3) in einem Bereich angrenzend an die Schneidoperation befindet und welche an ihrem äußersten distalen Ende einen Kopf (4) enthält, der in einen Absaugverteiler eingreift; ein Absauggebläse zum Bewirken des Flusses des abgesaugten Staubs von dem extremen proximalen Ende (3) zu dem extremen distalen Ende; und einen langen Kanal (26) mit Einrichtungen zum Abdichten des Kopfes (4) gegenüber dem Absaugverteiler (5); wodurch der Kopf (4) an einer beliebigen Stelle entlang dem Kanal (26) positioniert werden kann; **dadurch gekennzeichnet, dass** der Verteiler (5) auf einem positiven Messerbalken (27) befestigt ist; wobei der Verteiler (5) Venturi-Löcher (40) enthält, die an Löchern ausgerichtet sind, welche durch den positiven Messerbalken (27) bereitgestellt werden.

2. System gemäß Anspruch 1, wobei die Dichtung aus zwei gegenüberliegend positionierten Dichtungsstreifenabschnitten (24, 25) gebildet wird, wodurch - bei der Verwendung - der relativ geringe Druck in dem Absaugverteiler (5) mit dem relativ hohen Umgebungsluftdruck kombiniert wird, um die Abschnitte (24, 25) gegen den Kopf (4) zu drücken.

3. System gemäß Anspruch 2, wobei die Dichtungsstreifenabschnitte (24, 25) bogenförmig sind.

4. System gemäß einem der vorherigen Ansprüche, wobei der Kopf (4) eine obere Öffnung (30) und seitlich verlaufende Rippen (14, 15) enthält.

5. System gemäß Anspruch 4, wobei die Rippen (14, 15) konisch sind.

6. System gemäß Anspruch 4, wobei die Rippen (14, 15) konisch sind und eine von einem oberen Abschnitt der Rippen zu einem unteren Abschnitt der Rippen variierende Breite aufweisen.

7. System gemäß Anspruch 5 oder Anspruch 6, wobei die Rippen (14, 15) eine in seitlicher Richtung abnehmende Dicke aufweisen.

8. System gemäß einem der Ansprüche 4 bis 7, wobei die Rippen (14, 15) abgerundet sind.

9. System gemäß einem der vorherigen Ansprüche, wobei die Absaugleitung (2) einen steifen teleskopischen Abschnitt enthält.

10. System gemäß einem der vorherigen Ansprüche, wobei sowohl der Absaugverteiler (5) als auch das Gebläse auf dem positiven Messerbalken (27) befestigt sind.

Revendications

1. Un disque coupeur de bobine comprenant un système d'extraction de poussière (2) ; ledit système d'extraction de poussière incorporant une ou plusieurs lames de coupe ; ledit système comprenant un conduit d'extracteur (2) qui au niveau de son extrémité proximale (3) est dans une zone adjacente à l'opération de coupe et qui au niveau de son extrémité distale incorpore une tête (4) qui se met en prise avec un manifold d'extraction ; un ventilateur d'extracteur pour amener le flux de poussière extraite de ladite extrémité proximale (3) à ladite extrémité distale ; et un canal allongé (26) avec un moyen pour sceller ladite tête (4) sur ledit manifold d'extraction (5) ; grâce à quoi ladite tête (4) peut être positionnée n'importe où le long dudit canal (26) ; **caractérisé en ce que** ledit manifold (5) est monté sur une rampe de couteaux mâles (27) ; ledit manifold (5) incorporant des trous Venturi (40) alignés avec des trous fournis à travers ladite rampe de lames de couteaux mâles (27).

2. Un système selon la revendication 1, dans lequel ledit scellement est formé à partir de deux portions de bande de scellage positionnées de façon opposée (24, 25) ; grâce à quoi, lors de l'utilisation, la pression relativement basse dans le manifold d'extraction (5) se combine avec la pression de l'air ambiant relativement élevée pour pousser lesdites portions (24, 25) contre ladite tête (4).

3. Un système selon la revendication 2, dans lequel lesdites portions de bande de scellage (24, 25) sont courbées.

4. Un système selon n'importe lesquelles des revendications précédentes, dans lequel la tête (4) incorpore une ouverture supérieure (30) et des bords s'étendant latéralement (14, 15).

5. Un système selon la revendication 4, dans lequel lesdits bords (14, 15) sont effilés.

6. Un système selon la revendication 5, dans lequel lesdits bords (14, 15) sont effilés et varient en largeur à partir d'une portion supérieure desdits bords vers une portion inférieure desdits bords.

7. Un système selon n'importe lesquelles de la revendication 5 ou la revendication 6, dans lequel lesdits bords (14, 15) diminuent en épaisseur dans la direction latérale.

8. Un système selon n'importe lesquelles des revendications 4 à 7, dans lequel lesdits bords (14, 15) sont arrondis.

9. Un système selon n'importe lesquelles des revendications précédentes, dans lequel ledit conduit d'extracteur (2) incorpore une portion télescopique rigide.

10. Un système selon n'importe lesquelles des revendications précédentes, dans lequel ledit manifold d'extraction (5) et ledit ventilateur sont tous les deux montés sur ladite rampe de lames de couteaux mâles (27).

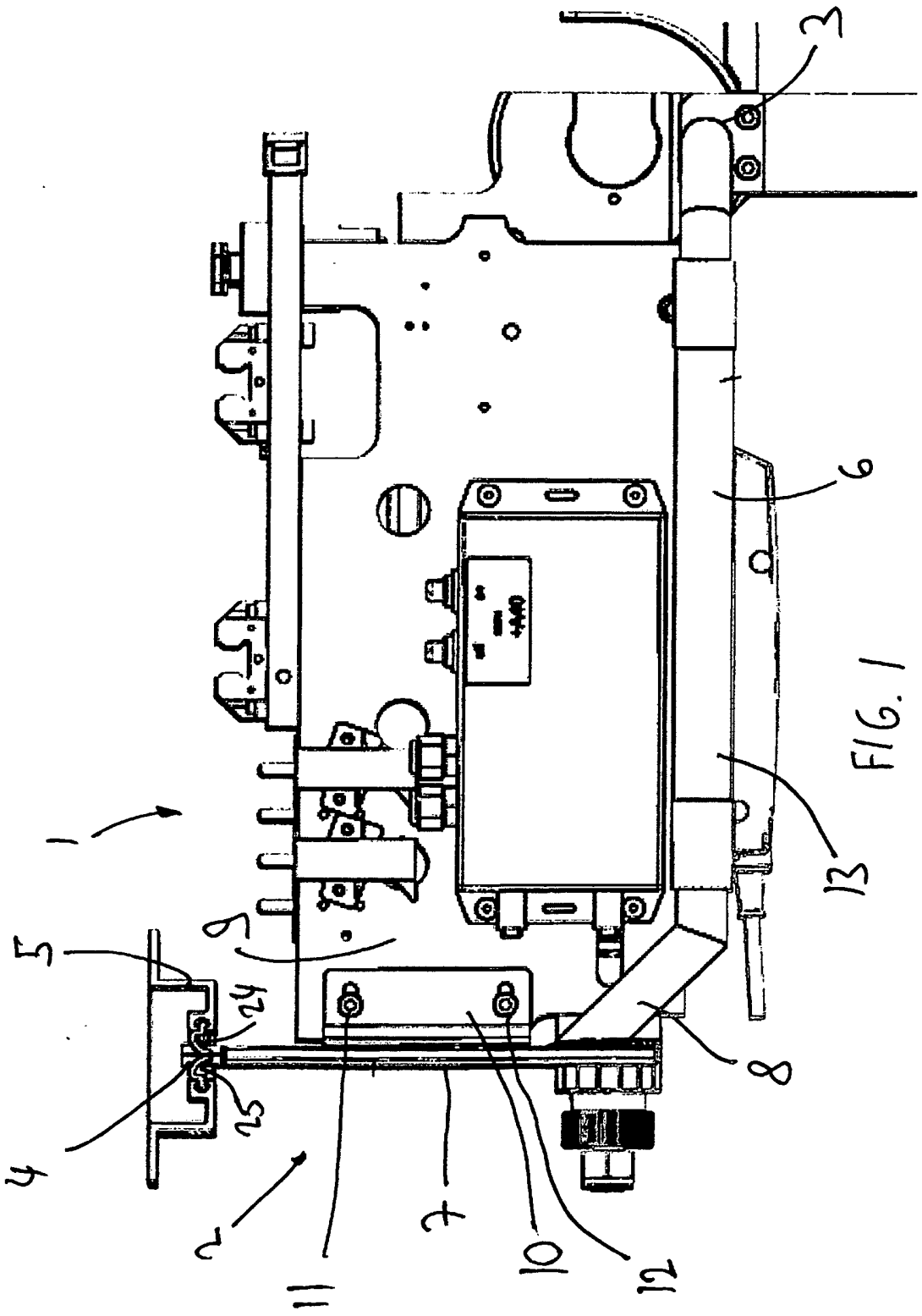

FIG. 1

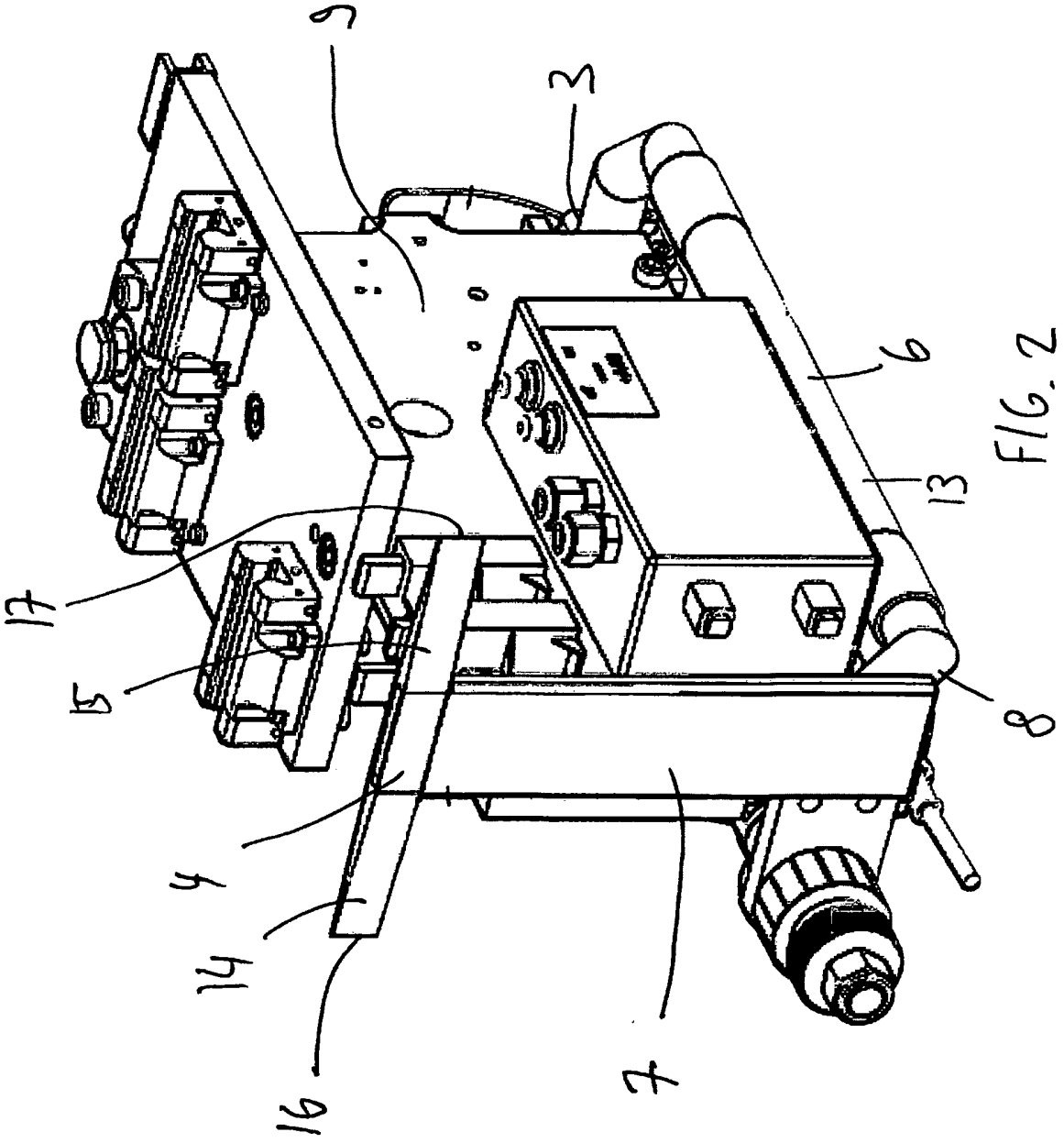

FIG. 2

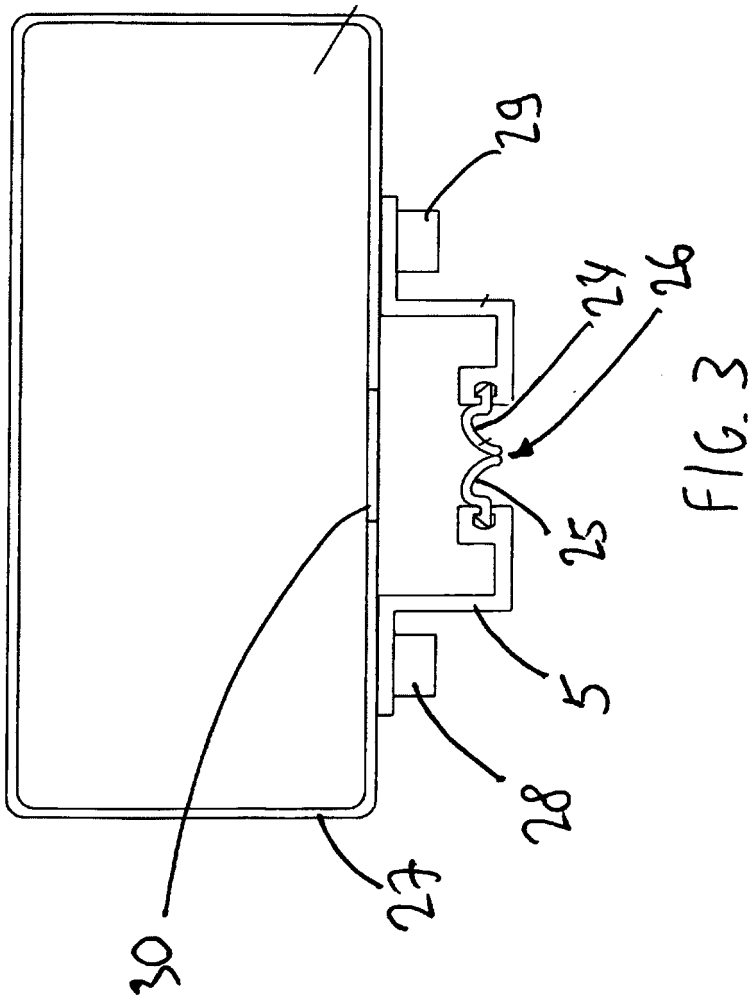

FIG. 3

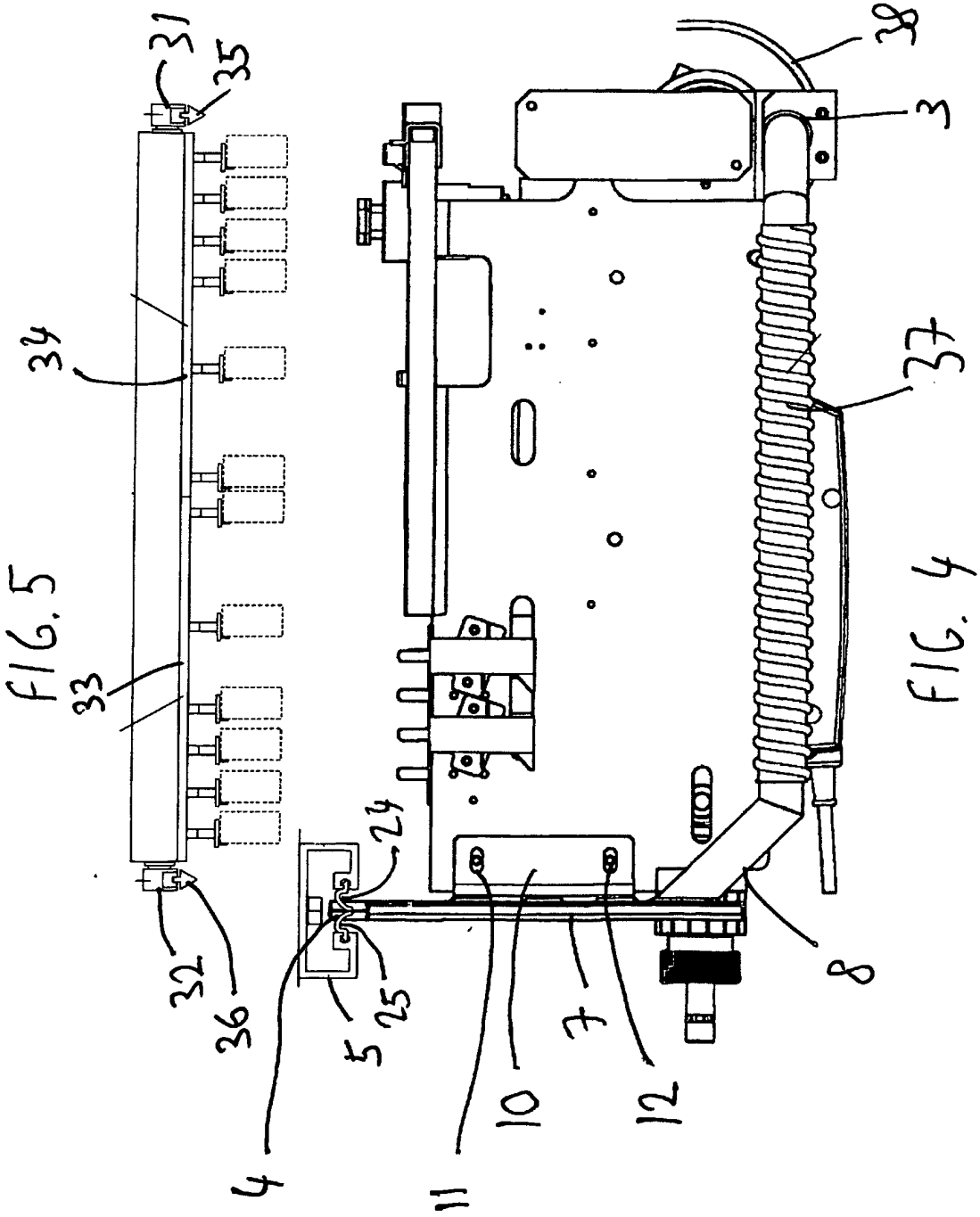

FIG. 5

FIG. 4

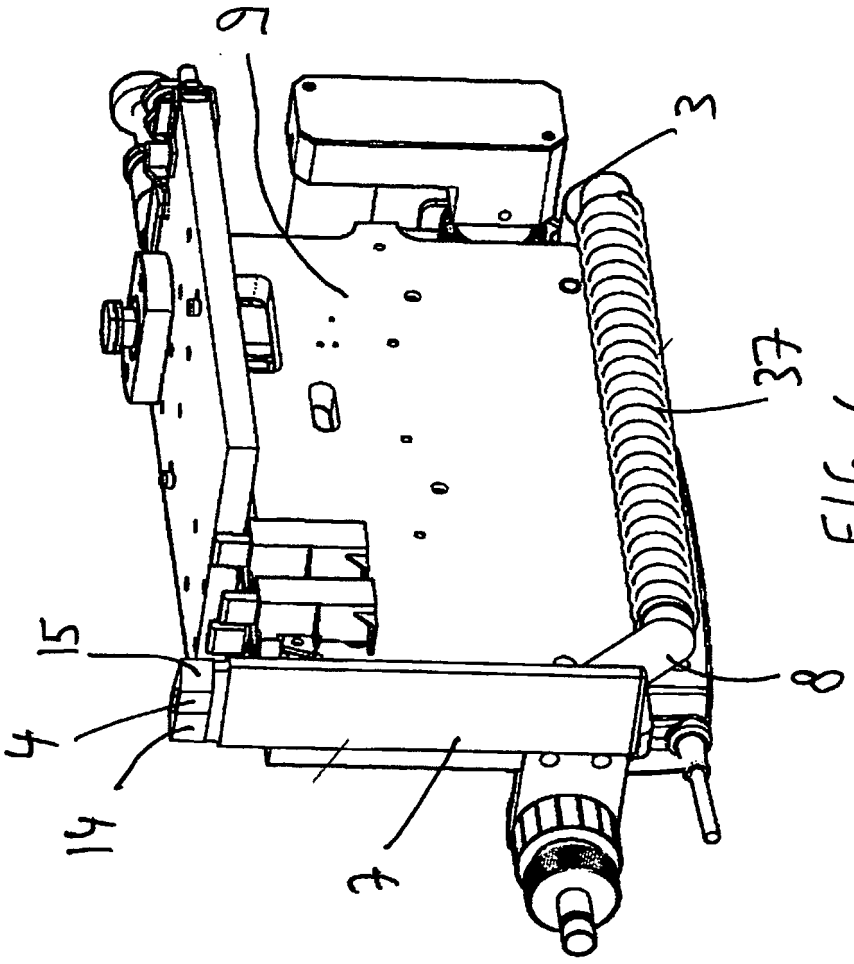

FIG. 6

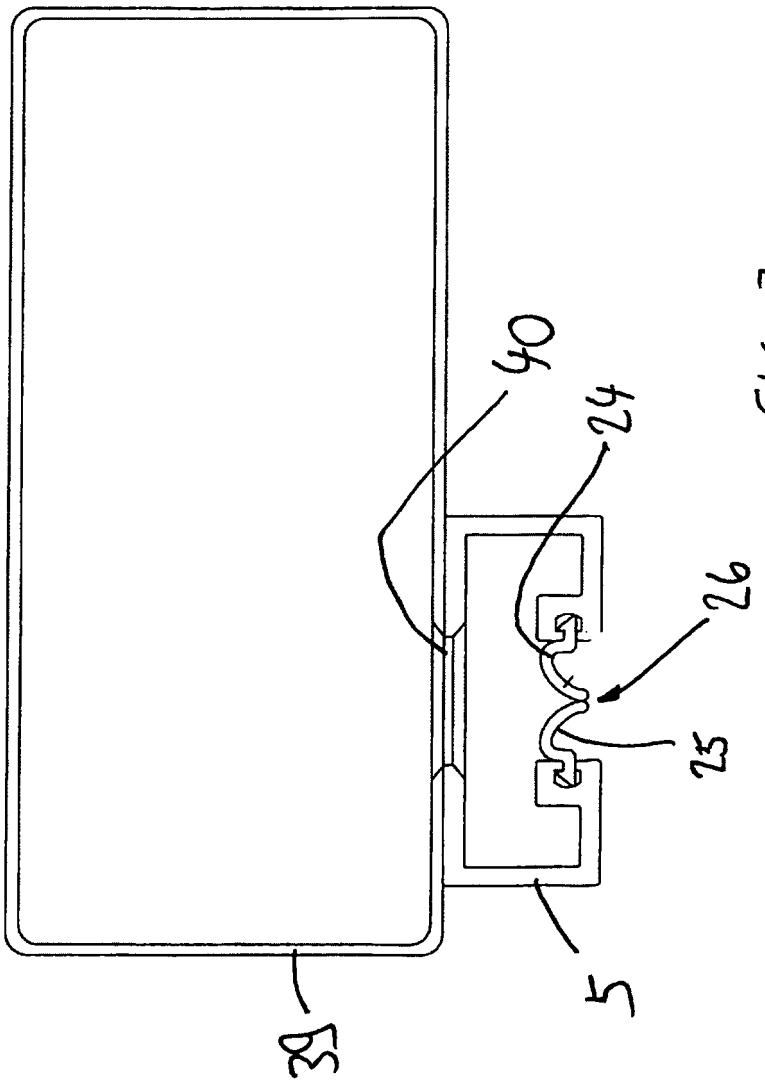

FIG. 7

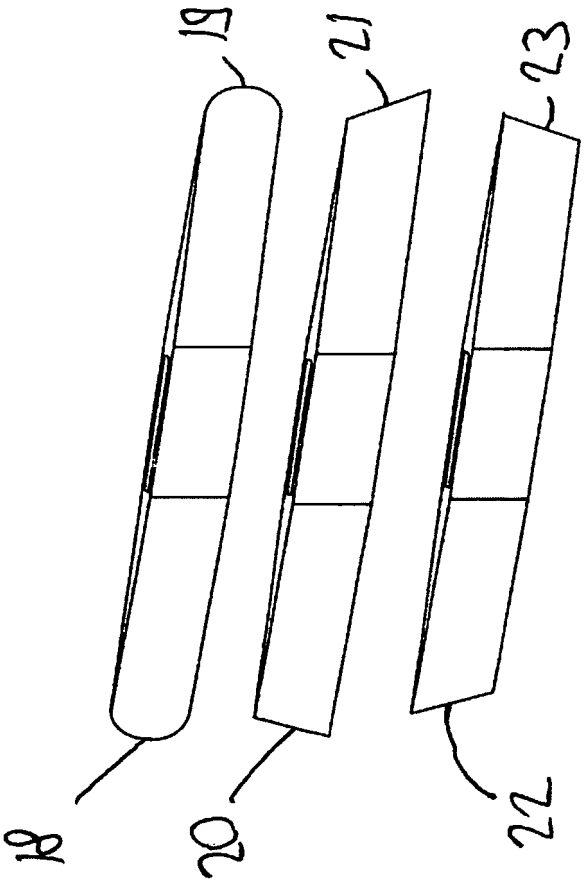

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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