



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
09.12.2020 Bulletin 2020/50

(51) Int Cl.:
D01H 15/00 (2006.01)

(21) Application number: **20177969.1**

(22) Date of filing: **03.06.2020**

(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
Designated Validation States:
KH MA MD TN

(30) Priority: **06.06.2019 IN 201941022424**

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(54) **LAPPET TILTING APPARATUS FOR AUTOMATIC YARN PIECING ASSEMBLY**

(57) The automatic yarn piecing assembly (8), according to the present invention comprises a yarn pickup module (9) mounted on a vertical column and being capable of sliding in vertical and horizontal direction. A suction bell unit is mounted on the yarn pickup module (9). The suction bell unit includes an elbow tubular arrangement (10) that has a first end and a second end, wherein the first end is connected to a vacuum source, and the second end has a suction bell (11). The automatic yarn piecing assembly (8) comprises a lappet tilting apparatus (12) provided on the second end of the elbow tubular arrangement (10) such that said lappet tilting apparatus (12) encircles the suction bell (11) and capable of sliding over the elbow tubular arrangement (10). The lappet tilting apparatus (12) makes impermanent slippery contact with a lappet hook (5) during tail yarn (3) pickup in a piecing operation.

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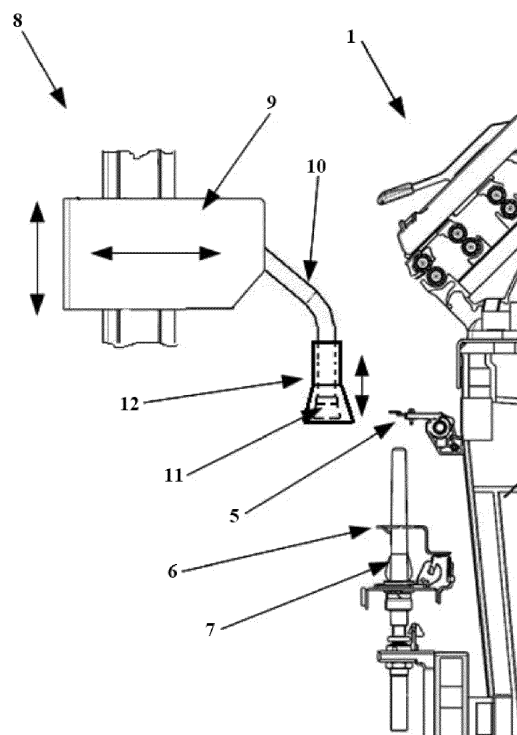


Figure 2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to textile spinning machines. Particularly, the present invention relates to an automatic yarn piecing arrangement for broken yarn ends in the textile ring spinning machine. More particularly, the present invention deals with a lappet tilting apparatus in the automatic piecing assembly of textile ring spinning machines.

BACKGROUND OF THE INVENTION

[0002] In textile industry, ring spinning machines are generally employed for spinning of fibres, such as cotton, flax or wool, to produce a yarn. Fiber material may be supplied to the ring spinning machines in the form of rovings. Further, the ring spinning machine draws the rovings to the desired degree of fineness and imparts sufficient twist, and finally forms a continuous yarn, which is then wound onto the bobbins for storage. Yarn breakage is an unavoidable plight in the ring spinning machines during the spinning operation. Hence, the piecing of the broken yarns is required for efficient and continuous operation of the ring spinning machine, and the process is called as yarn piecing. Yarn piecing is a manual process in which the broken yarns are joined/ assembled. Hence, this process aids in restarting the yarn spinning sequence at a swift rate. Yarn piecing process may be crucial in yarn spinning operation that determines the rate of productivity.

[0003] Conventionally, piecing of the broken yarns was performed manually, while the operator of the spinning machine moves around the spinning zones and identify the broken yarns to piece them together. In the manual piecing operation, the operator may have to periodically check through the length of the frame which may be normally of about 75 meters long and may include about 1600 spindles. In addition to periodic monitoring, the broken yarns have to be pieced and the corresponding yarn spinning sequence has to be restarted timely, in order to avoid wastage of yarn. Since, several ring spinning machines of this kind are installed in one spinning mill close to each other, it becomes tedious for the operator to access into the gangways for monitoring the ring spinning machine.

[0004] With the advent of modern technology, automatic piecing assembly have been employed in the spinning mills over the manual piecing operation. Generally, automatic piecing assemblies are mounted on guide rails provided in vicinity of frame of the ring spinning machines. The automatic piecing assemblies may employ automatic piecing equipment like robotic arms or may be configured to accommodate an operator for piecing. Said automatic piecing assemblies may traverse over the guide rails throughout the length of a frame of the ring spinning machine and carryout piecing operation at required spin-

ning stations. The piecing assemblies may be mounted on a platform, which traverse on the mill floor for carrying the piecing assembly throughout the length of the ring spinning machine for performing piecing operations. In general, automatic piecing assembly comprises plurality of modules for yarn pickup from bobbin, yarn insertion into the traveller and yarn piecing at drafting and the like.

[0005] Each spinning stations of a ring spinning machine comprises roving supply package, drafting unit, broken yarn collection tube, yarn breakage detection arrangement, yarn guide hook or lappet, balloon controller ring, ring-traveller assembly, yarn bobbin fitted on the rotating spindle, spindle driving assembly etc. The delivered yarn from the drafting unit travels through lappet hook, balloon controller ring and then through ring traveller before winding on to the rotating bobbin. During yarn spinning process, in case of any yarn breakage, the broken end of yarn from the bobbin has to be taken off up to the drafting unit for piecing it with delivery fibre federation.

[0006] Plurality of lappet hooks are serially mounted on a lappet rod of a spinning machine in such a way that one lappet hook for each spinning station. Said lappet hook is a small convolute shaped steel pin with an eyelet located at the center thereof. The yarn passes through said eyelet of the lappet hook and guided properly to maintain a fixed path. Before piecing operation takes place, inserting the yarn into the lappet hook eyelet is a tricky process for an Automatic piecing unit because of the convolute hook construction in the lappet.

[0007] Accordingly, there is a need of a lappet tilting apparatus in automatic yarn piecing assembly of textile ring spinning machines that overcomes the above shortcoming.

OBJECTIVE OF THE INVENTION

[0008] These objectives are provided to introduce a selection of concepts in a simplified form that are further described below in the detailed description. These objectives are not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0009] An object of the present invention is to provide a lappet tilting apparatus in the yarn pickup module of an automatic yarn piecing assembly of textile ring spinning machines.

[0010] Another object of the present invention is to provide a lappet tilting apparatus that offers hassle-free yarn insertion into the lappet hook eyelet after tail yarn pickup from the bobbin.

[0011] Object of the present invention is not limited to the above-mentioned problem. Other technical problems that are not mentioned will become apparent to those skilled in the art from the following description.

SUMMARY OF THE INVENTION

[0012] According to an aspect of the invention, an automatic yarn piecing assembly for a ring spinning machine comprises a yarn pickup module mounted on a vertical column such that said yarn pickup module is capable of sliding on the vertical column in both vertical and horizontal directions. A suction bell unit is mounted on the yarn pickup module that has an elbow tubular arrangement having a first end and a second end, wherein the first end is connected to a vacuum source, and the second end has a suction bell. The elbow tubular arrangement is flexible to move up and down in vertical direction. Further the piecing assembly comprises a lappet tilting apparatus provided on the second end of the elbow tubular arrangement such that said lappet tilting apparatus encircles the suction bell and capable of sliding over the elbow tubular arrangement and makes permanent slippery contact with a lappet hook of the ring spinning machine during tail yarn pickup in a piecing operation.

[0013] According to another aspect of the invention, a method of piecing a tail yarn by an automatic yarn piecing assembly in a textile ring spinning machine comprises an initial step of moving second end of an elbow tubular arrangement towards the yarn path by providing horizontal and vertical movement to a yarn pickup module and vertical movement to the elbow tubular arrangement, such that a lappet tilting apparatus hits a lappet hook and makes it to swivel away from a home position. In the next step, the tail yarn from a bobbin is picked by a suction pull into an open mouth of the suction bell in the elbow tubular arrangement, wherein the tail yarn is picked on the bobbin anywhere in the chase length from bottom to top. In the further step, said elbow tubular arrangement and the associated lappet tilting apparatus is moved vertically up in the yarn path such that the lappet hook falls back to the home position, thereby the yarn is inserted into the eyelet of the lappet hook loop. In final step, the elbow tubular arrangement carrying yarn is further moved upwards to enable automatic piecing operation in a textile ring spinning machine.

[0014] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawing, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] For a more detailed understanding of this invention, reference is made to the accompanying drawings in which:

Figure 1 illustrates the automatic piecing assembly in a ring spinning machine, according to the present invention;

Figure 2 illustrates the mounting arrangement for

yarn pickup module of automatic piecing assembly, according to an embodiment of the present invention; and

Figures 3 & 4 show working of lappet tilting apparatus in two different bobbin chase lengths according to the present invention.

[0016] Persons skilled in the art will appreciate that elements in the figures are illustrated for simplicity and clarity and may have not been drawn to scale. For example, the dimensions of some of the elements in the figure may be exaggerated relative to other elements to help to improve understanding of various exemplary embodiments of the present disclosure.

[0017] Throughout the drawings, it should be noted that like reference numbers are used to depict the same or similar elements, and features.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments of the invention as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

[0019] In a ring spinning frame (1), the supply fibre federation or roving (2) is spun into yarn (3) by way of linear stretching using a drafting unit (4). The produced yarn (3) is guided through a lappet hook (5), a balloon controller ring (6), a ring-traveller assembly (not shown) and subsequently wound on to a ring yarn bobbin (7) before further processing. In the ring spinning frame (1), during yarn breakage, there is a need for automatic yarn piecing to continue the ring spinning operation that is provided by an automatic yarn piecing assembly (8) for textile ring spinning machines to facilitate automatic piecing operation.

[0020] As shown in Figure 1, the automatic yarn piecing assembly (8) in a ring spinning frame (1) comprises a yarn pickup module (9) mounted on a vertical column. The yarn pickup module (9) is configured to slide in both horizontal and vertical directions. The yarn pickup module (9) has a suction bell unit mounted therein. The suction bell unit has an elbow tubular arrangement (10) that has a first end and a second end. The first end is connected to a vacuum source (not shown), whereas the second end hangs freely. This free end forms a suction bell (11). The suction bell (11) is an open mouth configuration defined at the second end of the elbow tubular arrangement (10). Accordingly, the first end and the sec-

ond end are also defined as fixed end and free end respectively. The elbow tubular arrangement (10) is flexible enough to move up and down in vertical direction. Further, said free end of elbow tubular arrangement (10) is provided with a lappet tilting apparatus (12) such that said lappet tilting apparatus (12) encircles the suction bell (11) and can slide over the elbow tubular arrangement (10) and makes impermanent slippery contact with a lappet hook (5) of ring spinning machine (1) during tail yarn pickup in a piecing operation. That is, lappet tilting apparatus (12) can be freely slidable in up and down direction over the suction bell (11) on the elbow tubular arrangement (10) as shown by arrow in the Figure 2 of the present invention.

[0021] The lappet tilting apparatus (12) has an upper portion and a lower portion that are connected and positioned along the common axis. The upper portion has a tubular structure. The lower portion has a configuration showing frustum of a hollow solid having a slant external surface. The hollow solid can be a hollow cone or a pyramid. Even though few configurations have been identified in the specification, the other configurations which are known to the person skilled in the art can be readily employed as per the requirement of the present invention.

[0022] The automatic yarn piecing assembly (8), further comprises a driving means coupled to the yarn pickup module (9) for moving the yarn pickup module (9) vertically up and down and horizontally far and away. The driving means can be a pneumatic driving unit, or a hydraulic driving unit having piston and cylinder arrangement with actuators. The drive means can also comprise of screw rod, cylinder and all types of actuating means. The yarn piecing assembly (8) includes a control apparatus functionally connected with driving means comprising a control unit coupled with a plurality of sensors and stoppers for precisely controlling the movement of moving yarn pickup module (9) so as to move the suction bell (11) vertically up and down.

[0023] For yarn pickup function, a negative pressure is created in elbow tubular arrangement (10) using vacuum source (not shown).

[0024] In the process of piecing operation, initially the automatic yarn piecing assembly (8) is positioned away from the lappet hook (5). Before piecing operation, the yarn pickup module (9) of the suction bell unit is moved towards the yarn path by providing horizontal and vertical movement to the yarn pickup module (9) and vertical movement to the elbow tubular arrangement (10) such that the lappet tilting apparatus (12) hits a lappet hook (5) and makes it to swivel away from its home position wherein the swivelling action is supported by the lappet rod (13) mounted in the ring spinning machine (1). Thus, the suction bell (11) accesses the yarn axis to suck the tail yarn (3) from bobbin (7). The tail yarn (3) is picked on the bobbin (7) anywhere in the chase length from bottom to top. Meanwhile the front end of the lifted lappet hook (5) is loosely supported by the tapered conical sur-

face of the lappet tilting apparatus (12). This impermanent slippery contact between lappet hook (5) and tilting apparatus (12) continues to exist till the yarn take off. After sucking the yarn (3), the suction bell (11) and the associated lappet tilting apparatus (12) is moved up by moving the elbow tubular arrangement (10) from the yarn bobbin (7), and thereby the lappet hook (5) falls back to home position in the yarn path, thereby the yarn (3) is inserted into the eyelet of the lappet hook loop (5). With the carried yarn (3), the elbow tubular arrangement (10) moves back from the yarn path and reaches upwards for subsequent piecing operation. Figure 3 illustrates the yarn pickup for bottom chase length position of the yarn bobbin (9), according to an embodiment of the present invention.

[0025] Figure 4 illustrates the yarn (3) pickup for another chase length position at the top of the yarn bobbin (7). While the yarn (3) breaks at top chase wound length of the bobbin (7), it is difficult for the suction bell (11) to enter near the bobbin (7) because of the size of the tilting apparatus (12) which cannot penetrate through the balloon controller ring (6). The bottom face of lappet tilting apparatus (12) seats over above the balloon controller ring (6) while the suction bell (11) moves down and penetrates further to reach the position above the yarn bobbin (7). The lappet tilting apparatus (12) freely slides over the suction bell (11) on the elbow tubular arrangement (10). Meanwhile the lifted lappet hook (5) swivels out of yarn path because of the support of tapered conical surface in tilting apparatus (12). The suction bell (11) moves up from the yarn bobbin (7) after sucking the yarn (3) and engages with the tilting apparatus (12) that is resting over the balloon controller ring (6) and then the yarn pickup module (9) along with the suction bell (11) and lappet tilting apparatus (12) moves up further as a whole and carry the yarn (3) upwards further for piecing operation. The lappet tilting apparatus (12) as described herein above provides a hassle-free yarn insertion into the lappet hook (5) eyelet and smooth functioning of automatic yarn piecing assembly (8) without any hindrance.

[0026] According to an embodiment of the present invention, the suction bell (11) can be positioned above the bobbin (7) at a distance normally in the range of 5mm to 15mm for picking the tail yarn (3). As shown in figure 4, the lappet tilting apparatus (12) according to the present invention is capable of sliding over the suction bell (11) on the tubular arrangement (10) for a distance of approximately 60mm for allowing the suction bell (11) to efficiently pick the tail yarn (3) from the top chase length position of the bobbin (7) irrespective of the hindrance caused by the balloon controller ring (6).

[0027] Thus, the above described automatic piecing assembly for ring spinning machine provides a reliable solution for picking the broken yarn end from the bobbin and enables automatic piecing operation. The elbow tubular arrangement with the suction bell and the lappet tilting apparatus is able to pick the broken yarn from the bobbin anywhere from bottom to top based on the broken

yarn position.

[0028] For exemplary the embodiment of this invention employs lappet tilting apparatus for an automatic yarn piecing assembly. Various modifications to these embodiments are apparent to those skilled in the art from the description and drawings herein. Therefore, the description is not intended to be limited to the embodiment shown along with the accompanying drawings but is to be provided broadest scope consistent with the principles and novel and inventive features describe/disclosed or suggested herein. Any modifications, equivalent substitutions, improvements etc. within the spirit and principle of the present invention shall all be included in the scope of protection of the present invention.

Claims

1. An automatic yarn piecing assembly (8) for a ring spinning machine comprising of:

a yarn pickup module (9) mounted on a vertical column, said yarn pickup module (9) being capable of sliding on the vertical column in a vertical direction and a horizontal direction;

a suction bell unit mounted on the yarn pickup module (9), said suction bell unit having an elbow tubular arrangement (10), the elbow tubular arrangement (10) having a first end and a second end, the first end connected to a vacuum source, the second end defining a suction bell (11), said elbow tubular arrangement (10) being flexible to move up and down in a vertical direction; and **characterized in that**,

a lappet tilting apparatus (12) provided on the second end of the elbow tubular arrangement (10), said lappet tilting apparatus (12) encircling the suction bell (11), said lappet tilting apparatus (12) capable of sliding over the elbow tubular arrangement (10) and making impermanent slippery contact with a lappet hook (5) of the ring spinning machine (1) during tail yarn (3) pickup in a piecing operation.

2. The automatic yarn piecing assembly as claimed in claim 1, wherein said lappet tilting apparatus (12) has an upper portion and a lower portion, the upper portion and the lower portion are connected and positioned along a common axis.

3. The automatic yarn piecing assembly as claimed in claim 2, wherein said upper portion has a tubular structure.

4. The automatic yarn piecing assembly as claimed in claim 2, wherein said lower portion has a configuration showing frustum of hollow solid having a slant external surface.

5. The automatic yarn piecing assembly as claimed in claim 1, further comprises a control unit coupled with a plurality of sensors and stoppers for precisely controlling the movement of yarn pickup module (9).

6. The automatic yarn piecing assembly as claimed in claim 1, wherein the suction bell (11) is positioned above the bobbin (7) at a distance in the range of 5mm to 15mm for picking the tail yarn (3).

7. The automatic yarn piecing assembly as claimed in claim 1, wherein said lappet tilting apparatus (12) is capable of sliding over the suction bell (11) on the tubular arrangement (10) up to 60mm for allowing the suction bell (11) to pick the tail yarn (3) from the top chase length position of the bobbin (7).

8. The automatic yarn piecing assembly as claimed in claim 1, wherein the suction bell (11) is configured to pick tail yarn (3) from the bobbin (7) at the bottom of the chase length.

9. The automatic yarn piecing assembly as claimed in claim 1, wherein the vacuum source creates negative pressure to suck the tail yarn (3) from the yarn bobbin (7).

10. A method of piecing a tail yarn (3) by an automatic yarn piecing assembly (8) in a textile ring spinning machine (1), the method comprising the steps of:

moving a suction bell end (11) of an elbow tubular arrangement (10) towards the yarn path by providing horizontal and vertical movement to a yarn pickup module (9) and vertical movement to the elbow tubular arrangement (10), such that a lappet tilting apparatus (12) hitting a lappet hook (5) thereby making said lappet hook (5) to swivel away from a home position;

picking the tail yarn (3) from a bobbin (7) by a suction pull into an open mouth of the suction bell (11) in the elbow tubular arrangement (10), wherein the tail yarn (3) is picked on the bobbin (7) anywhere in the chase length from bottom to top;

moving said elbow tubular arrangement (10) and the associated lappet tilting apparatus (12) vertically up in the yarn path such that the lappet hook (5) falls back to the home position thereby inserting the yarn (3) into the eyelet of the lappet hook (5) loop; and

moving the elbow tubular arrangement (10) carrying yarn (3) further upwards to enable automatic piecing operation in a textile ring spinning machine (1).

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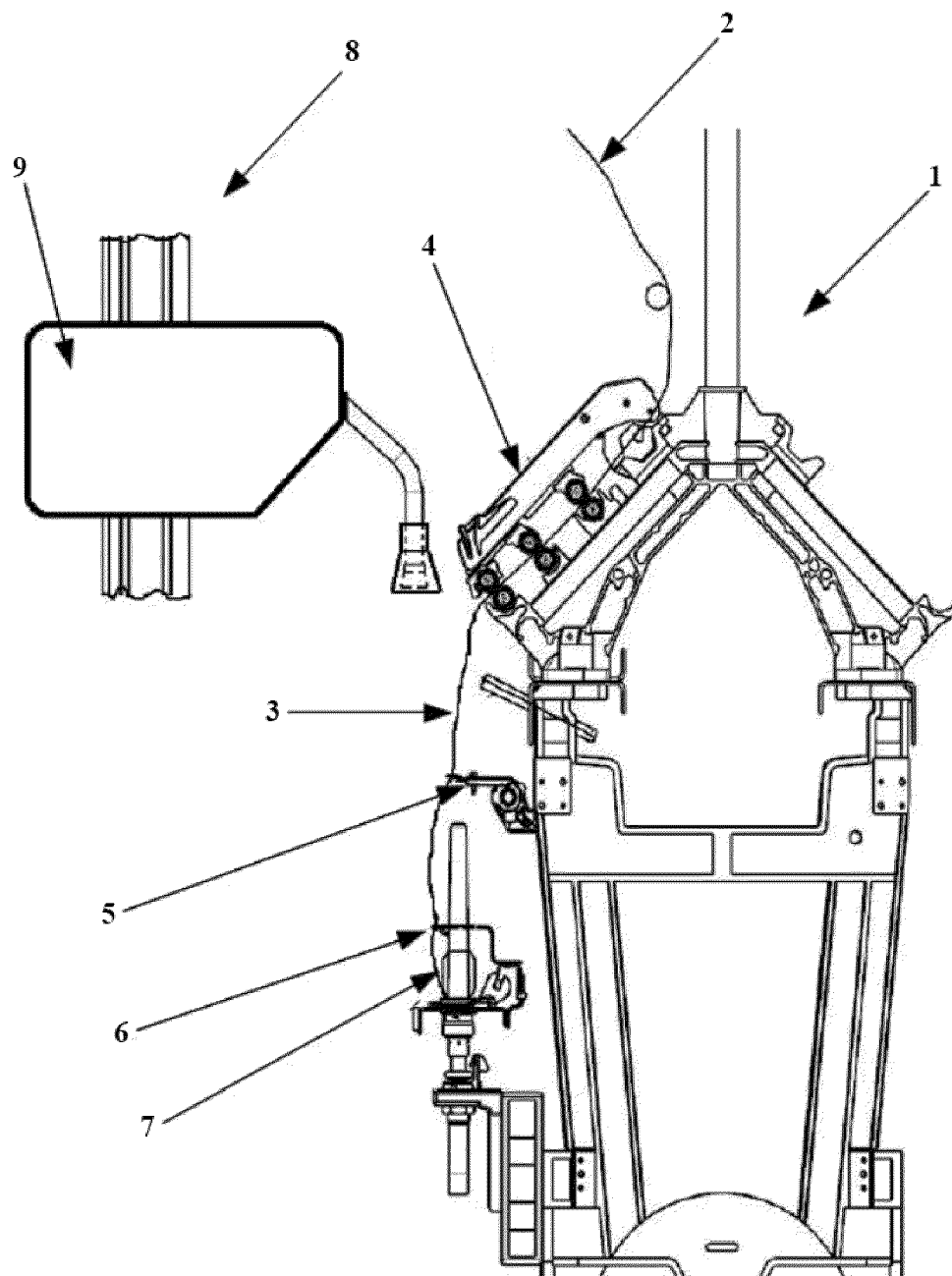


Figure 1

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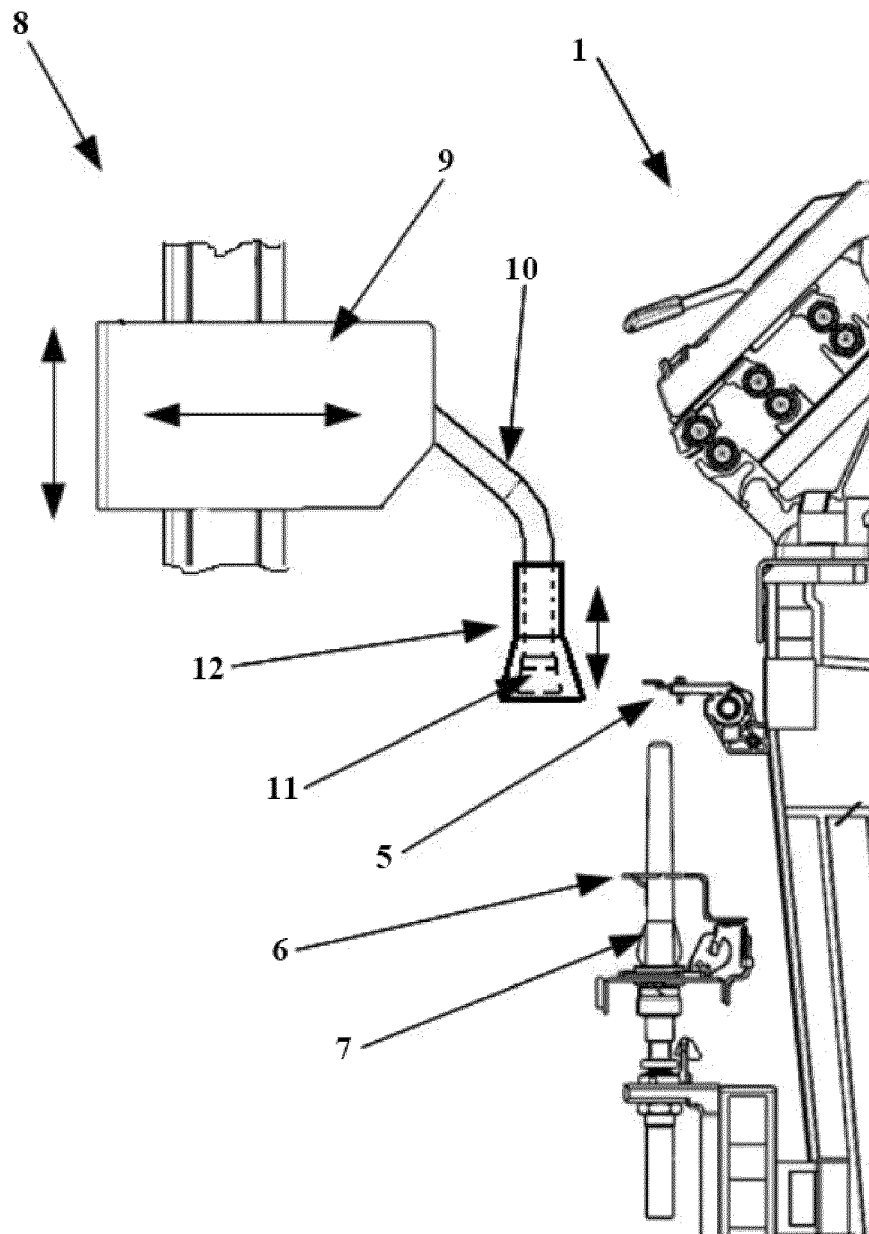


Figure 2

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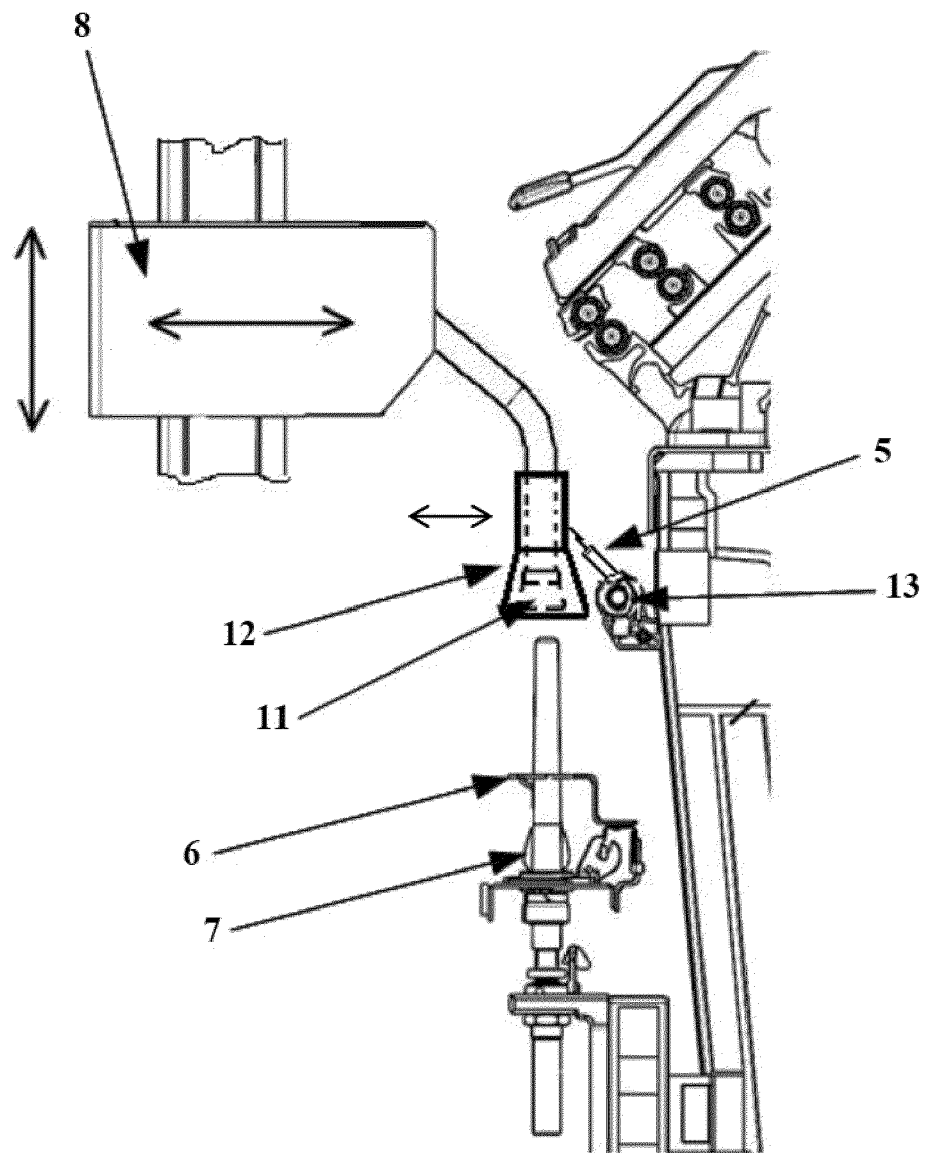


Figure 3

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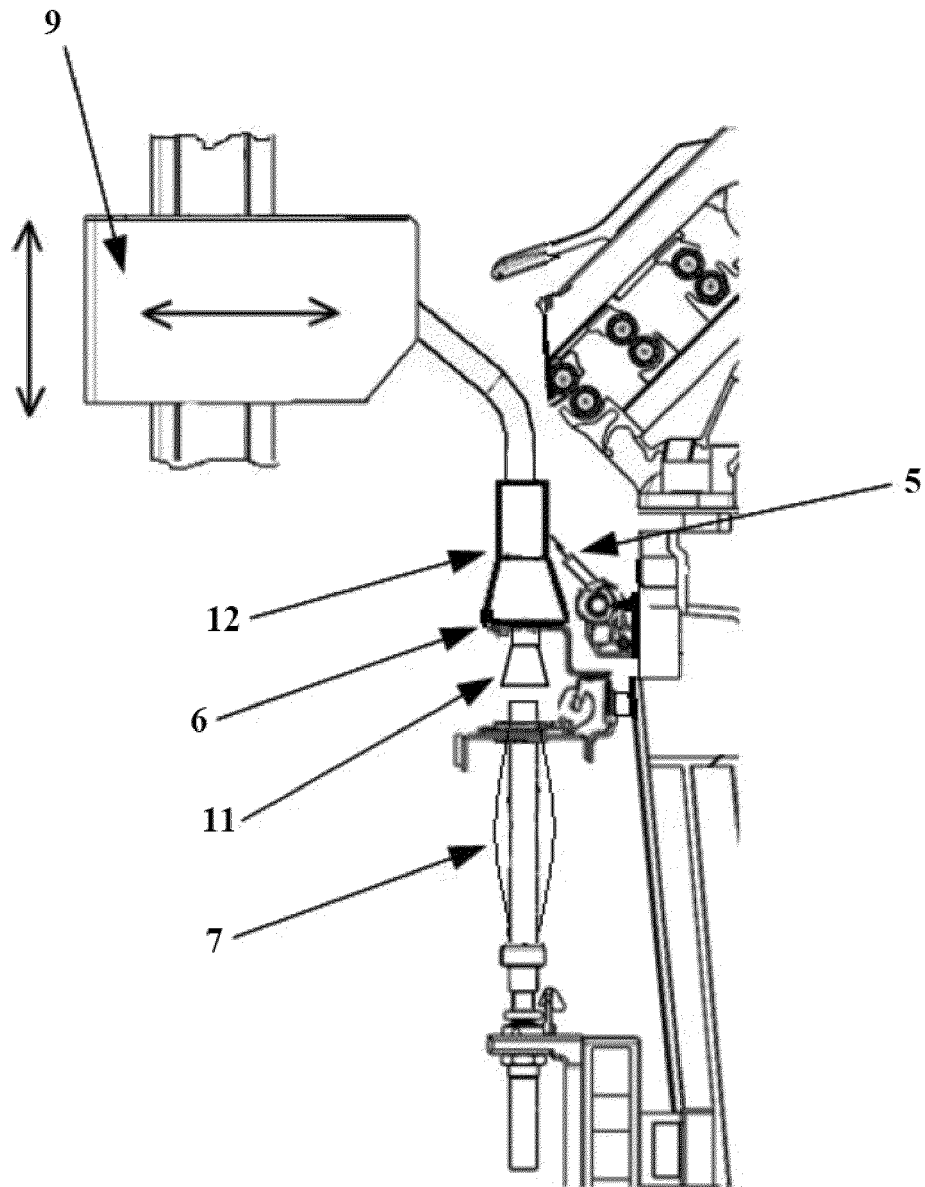


Figure 4



EUROPEAN SEARCH REPORT

Application Number
EP 20 17 7969

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 October 2020	Examiner Humbert, Thomas
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	

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

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