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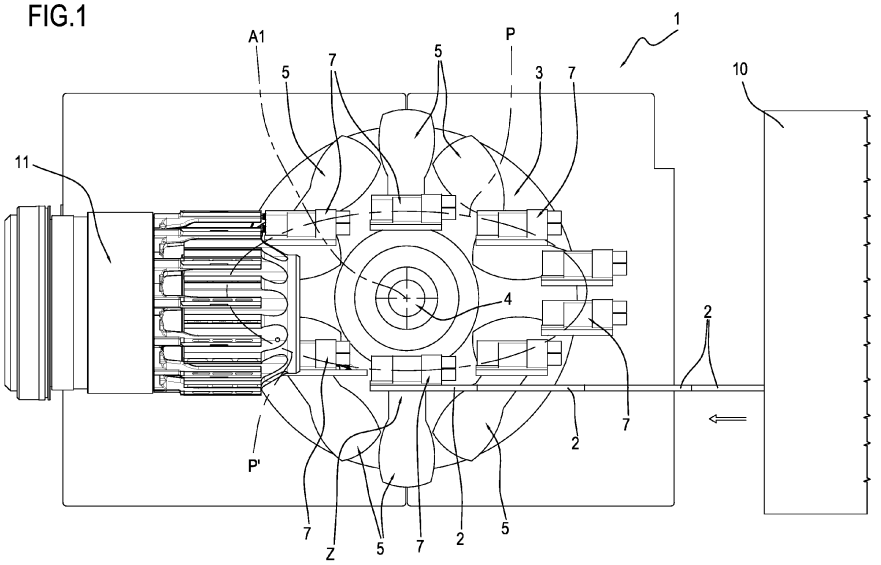
(54) **Device for transferring pieces of filter or cigarette rod**

(57) A device for transferring pieces of filter or cigarette rod comprises a supporting drum (3) mounted rotatably about a first rotation shaft (4) forming a first axis (A1), a plurality of satellite bodies (5), each of which rotatably mounted on the supporting drum (3) for rotating relative thereto about a second rotation shaft (6) with axis (A2) parallel to the first rotation axis (A1). Each satellite body (5) supports a pick up head (7) which is mounted on a third shaft (8) rotatable about a third axis (A3) parallel to the second axis (A2) and equipped with at least one seat (9) designed to engage and retain, by suction, at least one pieces (2) of filter or cigarette rod. The device (1) comprises a plurality of valves (15), each of which is connected to a respective pick up head (7) and designed to regulate, during and according to the relative movement of the head (7) relative to its satellite body (5), the opening and closing of a connection between the seat (9) of the head (7) and a source (12) of fluid.

FIG.1



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Description

[0001] This invention relates to a device for transferring pieces of filter or cigarette rod.

[0002] Prior art transfer devices of this kind are used in cigarette making machines to transfer, for example, pieces of filter rod feeding out of a first, cutoff station and into a second, assembly station where the pieces of filter rod are combined with pieces of cigarette rod to make finished cigarettes, or vice versa.

[0003] These devices have a supporting base body, called "satellite holder", which rotates about its axis, and a plurality of carrier elements, called "satellites", which are rotatably mounted on the satellite holder and which rotate about respective axes.

[0004] The satellites in turn mount "pick up heads", also known as "fingers" for holding the pieces of rod during their transfer from one station to the other. The pieces of rod are held by negative pressure which produces suction through a plurality of holes located on the ends of the pick up heads. The holes on the pick up heads are connected to a suction source through a series of conduits inside the pick up heads, the satellites and the satellite holders.

[0005] In particular, the suction by which these devices hold the pieces of rod is activated between the pick up zone at the outfeed of the first station and a release zone at the infeed of the second station.

[0006] Thus, during transfer of the pieces of rod, and in particular, during the rotation of the satellite holder in its entirety about its axis, the suction produced by these devices is turned on and off and regulated in accordance with the angular position of the pick up heads during the rotation of the drum.

[0007] This regulation occurs by way of a valve which is mounted upstream of the conduits inside the satellite holder and which has an arch-shaped opening which puts the conduits in fluid communication with the suction source each time the inlet of the conduits is aligned with the opening during the rotation of the satellite holder.

[0008] This solution, however, involves moving very large volumes of air and requires powerful equipment, for example a large air suction impeller.

[0009] A large impeller in turn means higher energy consumption and higher noise levels during operation.

[0010] Moreover, it should also be remembered that these devices are mounted on cigarette making machines which operate at very high speeds. A large air suction volume, besides creating greater load losses, also means that more time is needed to produce the negative pressure required to transport the piece of rod without letting it fall off during transfer.

[0011] This invention therefore has for an aim to provide a device for transferring the pieces of filter or cigarette rod and which overcomes the above mentioned disadvantages.

[0012] The invention accordingly provides a device for transferring pieces of filter or cigarette rod as claimed in the claims appended hereto.

[0013] These and other features of the invention will become more apparent from the following detailed description of a preferred, non-limiting embodiment of it, with reference to the accompanying drawings, in which:

- Figure 1 is a front view of a device for transferring pieces of filter or cigarette rod according to this invention;
- Figure 2 is a perspective view of a first detail from Figure 1;
- Figure 3 shows the detail of Figure 2 in cross section;
- Figure 4 shows the detail of Figure 3 in scaled-up cross section;
- Figure 5 is a perspective view of a detail from Figure 2;
- Figure 6 shows the detail of Figure 5 in cross section;
- Figure 7 shows a second embodiment of the detail of Figure 2 in a perspective view;
- Figure 8 is a perspective view of a detail from Figure 7;
- Figure 9 shows the detail of Figure 8 in a plan view;
- Figure 10 shows the detail of Figure 8 in cross section;
- Figure 11 is a perspective view of a second detail from Figure 7.

[0014] With reference to Figure 1, the numeral 1 denotes in its entirety a device for transferring pieces 2 of filter or cigarette rod.

[0015] The device 1 comprises a supporting drum, or "satellite holder" 3 mounted rotatably about a first rotation shaft 4, with axis A1, and a plurality of satellite bodies 5 each of which is rotatably mounted on the supporting drum 3 for rotating, relative thereto about a second rotation shaft 6, with axis A2 parallel to the first rotation axis A1.

[0016] Also, each of the satellite bodies 5 supports a respective pick up head 7 which picks up pieces 2 of filter or cigarette rod and which is mounted on a third rotation shaft 8, with axis A3 parallel to the second axis A2, and which is equipped with at least one seat 9 designed to engage and hold, by suction, at least one piece 2 of filter or cigarette rod.

[0017] The device 1 is preferably mounted on a cigarette making machine capable of operating simultaneously on two continuous filter or cigarette rod advancing in parallel with each other. As a result, each pick up head 7 is equipped with two seats 9 for simultaneously holding and transferring a pair of pieces 2.

[0018] Thus, the device 1 is capable of transferring a pair of separate pieces 2 obtained at a first cutoff station 10, where the continuous rods are cut, and a second, assembly station 11 where the pieces of filter (or cigarette) rod are combined with respective pieces of cigarette (or filter) rod.

[0019] As they feed out of the first, cutoff station 10, the cut pieces 2 run on a beam 14, drawn with dashed

lines in Figure 2, until they reach a pick up zone, labelled Z in the drawing, where they are delivered to the transfer device 1 of this invention.

[0020] At the pick up seats 9 which hold the pieces 2 of rod, the heads 7 have one or more suction holes, not illustrated, connected to a fluid source 12 of air by way of a series of conduits by which the pieces 2 of rod are held down during their transfer from the first station 10 to the second 11 (Figure 3).

[0021] Depending on the variant embodiments, described in more detail below, the fluid source 12 is a negative pressure source of fluid or a positive pressure source of fluid, in this case, preferably air.

[0022] As indicated by the letter P in Figure 1, each pick up head 7 follows a substantially elliptical transfer path during one complete rotation of the supporting drum 3.

[0023] Air is drawn in through the seats 9 only for a stretch P' of the total path P followed by the heads 7.

[0024] The stretch P' extends substantially between the first station 10 and the second 11, along the rotation direction of the supporting drum 3 and the feed direction of the pieces 2 of rod, as shown in Figure 1.

[0025] The steps of holding and releasing the pieces 2 of rod are controlled through the agency of a plurality of valves 15.

[0026] As shown in Figure 2, each of the valves 15 is connected to a respective pick up head 7 and is designed to regulate, during and according to the movement of the head 7 relative to its satellite body 5, the opening and closing of a connection between the seat 9 of each head 7 and a source of fluid 12.

[0027] In other words, each single head 7, separately from the others, mounts a single valve 15.

[0028] Further, with reference to Figures 2, 3 and 4, each valve 15 is integral with the respective pick up head 7.

[0029] To better understand the operation of the valves 15, it is necessary to explain the operation of the device 1 in its entirety.

[0030] More specifically, the device 1 produces two main relative movements.

[0031] A first relative movement occurs between the supporting drum 3 and each satellite body 5 in order to cause the pick up heads 7 to follow the transfer path P.

[0032] A second relative movement occurs between each pick up head 7 and the respective satellite body 5 in order to keep the orientation of the heads 7 fixed so that while the pieces 2 of rod are transferred from the first station 10 to the second 11 they remain parallel to the direction in which they feed out of the first station 10. Thus, to obtain the second relative movement, each pick up head 7 is rotatable relative to the respective satellite body 5 about the aforementioned third rotation axis A3.

[0033] The valve 15 is mounted between the satellite body 5 and the pick up head 7 on the third rotation shaft 8 of the respective head 7 (Figure 2). During the rotation of the supporting drum 3 as a whole, the valve 15 is integral with the pick up head 7 and its orientation remains fixed relative to the head.

[0034] Consequently, the valve 15 undergoes the same relative movement as that which occurs between the pick up head 7 and the satellite body 5.

[0035] The valve 15 regulates the fluid connection between a plurality of first conduits 16, connected to the seats 9 of the head 7 and integral with the pick up head 7, and a plurality of second conduits 17 connected to the source of fluid 12 and integral with the satellite body 5 which mounts the head 7.

[0036] In a first embodiment, illustrated in Figures 3 and 4, the first conduits 16 comprise a first conduit 18 inside the head 7, shown by the hatching in the drawings, which communicates with the seats 9 of the pick up head 7, and a second conduit 19, formed inside the third rotation shaft 8 of the head 7 and connecting the valve 15 to the first conduit 18 inside the head 7.

[0037] As better illustrated in Figure 3, the second conduits 17 comprise a fourth conduit 21, which communicates with the fluid source 12 and which is formed inside the second shaft 6 of the satellite body 5, and a fifth conduit 22 which is preferably formed outside the satellite body 5 and which connects the valve 15 to the fourth conduit 21.

[0038] In the first embodiment, the valve 15 comprises, as illustrated in Figures 5 and 6, a first tubular portion 23, having a first cylindrical outer surface 23a, and a second, substantially annular portion 24, on the outside of, and coaxial with, the first portion 23 and having a cylindrical inner surface 24a. A chamber 25 is defined between the cylindrical outer surface 23a of the first portion 23 and the cylindrical inner surface 24a of the second portion 24.

[0039] With reference to Figure 6, the chamber 25 is connected to the seats 9 of the pick up head 7, through the aforementioned first conduits 16 by way of a through hole 26 made in the first tubular portion 23. More in detail, the chamber 25 communicates directly with the second conduit 19 formed inside the third rotation shaft 8 of the head 7. In still more detail, the through hole 26 of the valve 15 is aligned with a further hole 27 made in the third shaft 8 of the head 7. During the rotation of the head 7 with the respective satellite body 5, the hole 26 and the hole 27 remain aligned with each other because the valve 15 and the pick up head 7 are mounted solidly to each other.

[0040] Furthermore, the valve 15 has an arch- shaped opening 28 (Figure 5) . The through opening 28 is made on the second tubular portion 24 and extends mainly along a substantially circumferential direction.

[0041] The opening 28 connects the chamber 25 with the aforementioned second conduits 17 and is such as to regulate the opening and the closing of the connection between the seats 9 of the head 7 and the fluid source 12 during and according to the relative movement of the head 7 relative to its satellite body 5.

[0042] More in detail, the opening 28 puts the chamber 25 in fluid communication with the fifth conduit 22, which

is outside of, and integral with, the satellite body 5 (Figure 4).

[0043] With reference to what is stated above regarding the relative movement between the pick up head 7 and its satellite body 5, the opening 28, during the rotation of the head 7 relative to the satellite body 5, comes into alignment with the fifth conduit 22 when the head 7 moves along the aforementioned stretch P' of its transfer path P and that is because the valve 15 is integral with the head 7 and because the fifth conduit 22, connected to the source of fluid 12, is integral with the satellite body 5. The arch-shaped opening 28 extends through an angle of at least 60°. More specifically, the arch-shaped opening 28 extends for an angle such as to define the connection between the seats 9 of the head 7 and the source of fluid 12, which in this case is a negative pressure source, at least for a stretch equal to the stretch P' of the transfer path P.

[0044] It should also be noted that the arch-shaped opening 28 might extend through an angle greater than 90°. In this case, su ction might be made to start before the pick up head 7 reaches the pick up zone Z where the pieces 2 of rod are picked up. This advantageously guarantees that the pieces 2 of rod are firmly picked up when the head 7 reaches the pick up zone Z.

[0045] Thus, the opening 28 causes suction to be applied to the pieces 2 of rod as long as the head 7 travels the stretch P' of its transfer path P from the first station 10, and in particular from the pick up zone Z, to the second station 11.

[0046] When, on the other hand, the head 7 travels the path P from the second station 11 to return to the first station 10, the opening 28 is no longer in alignment with the fifth conduit 22 and thus the fluid connection between the seats 9 of the head 7 and the source of fluid 12 is interrupted.

[0047] This solution is very advantageous because it requires movement of air volumes which are much smaller than those required to be moved in prior art solutions.

[0048] Indeed, the air volume needed to produce the necessary suction is the volume of air that flows between the fifth conduit 22, integral with the satellite body 5, and the suction seats 9 of the head 7.

[0049] Figure 7 illustrates a variant embodiment of the pick up head 7, where the connection between the valve 15 and the seats 9 of the head 7 is different from that described above and where the air suction through the seats 9 is also produced in a different way from the above. According to the Applicant, however, this embodiment, too, falls fully within the scope of the inventive concept and within the aims set out above.

[0050] According to this embodiment, the seats 9 are associated with an intake element 29. More specifically, as shown in Figure 7, the pick up head 7 is provided with two intake elements 29, one for each seat 9.

[0051] Each intake element 29 is enclosed within a respective elongate housing, made in the pick up head. The housing is made transversally to the third axis A3 and has open ends which communicate with respective sides of the head.

[0052] As shown in Figure 11, each intake element 29 comprises a Venturi-effect tubular element 30, that is to say, an element which is internally shaped in such a way as to create the Venturi effect. The tubular element 30 is open at its two opposite ends and is provided, on its cylindrical peripheral surface, with at least one hole 31. When compressed air is fed in at one end of the tubular element 30, the air pressure in at least one inner portion 32 drops below atmospheric pressure as a result of the tubular element 30 itself being made in a suitable size, which can be easily calculated by one skilled in the art.

[0053] The tubular element 29 has at least one portion 32 in which the Venturi effect occurs. More specifically, the drawing shows three portions 32 arranged in cascade. Each of the three portions 32 communicates with the outside through two holes 31.

[0054] The holes 31 of each intake element 29 are connected to a respective first conduit 18 inside the pick up head 7, in communication with the seats 9. Each seat 9 may have one or more holes 31 associated with it, as required.

[0055] In this embodiment, the first conduits 16 of the pick up head 7 are formed by at least one first conduit 18 inside the head 7, communicating with the seats 9, and by at least one third conduit 20 externally connecting the valve 15 with the first conduit 18.

[0056] As shown in Figure 7, the pick up head 7 mounts two intake elements 29 and these intake elements 29 operate preferably independently of each other.

[0057] For this reason, the aforementioned first conduits 16 are formed by a first conduit 18 and a third conduit 20 for each intake element 29. The third conduit 20 preferably consists of hoses, for example, rubber hoses.

[0058] In accordance with the above, the internal portions 32 of each tubular element 30 are, in use, occupied by air at a pressure below atmospheric pressure.

[0059] The pieces 2 of rod which reach the pick up zone Z are captured by the seats 9 of the heads 7 thanks to the suction produced by the delivery of compressed air from the source of fluid 12. The air flows into the tubular elements 30 and produces a negative pressure in the first conduit 18 associated with the seats 9.

[0060] The air leaving each tubular element 30 is made to flow out into the atmosphere by way of suitable silencers.

[0061] If one piece 2 of rod is detached from one of the two seats 9 during transfer, the resulting pressure variation does not cause the other piece 2 of rod to be detached because the intake elements 29 operate independently of each other.

[0062] As shown in Figures 8, 9 and 10, the valve 15 mounted on the pick up heads 7 equipped with the intake elements 29 just described differs from the valve of the embodiment described previously.

[0063] More specifically, as shown in these drawings, the valve 15 again has the arch-shaped opening 28 and

the chamber 25 but, in this case, the chamber 25 and the first conduits 16, in particular the first conduit 18 inside the head 7, are connected to each other by way of at least one through outlet hole 33.

[0064] In Figure 8, two outlet holes 33 are shown because the valve 15 communicates separately with each intake element 29 since the operation of one is independent of that of the other.

[0065] The outlet holes 33 are made in the second tubular portion 24 of the valve 15.

[0066] The air from the source of fluid 12, in this case a positive pressure source, flows through the fourth conduit 21 and the fifth conduit 22, which are integral with the satellite body 5, into the chamber 25 through the opening 28 and out of each of the outlet holes 33 in the direction of a respective intake element 29

[0067] As in the previous embodiment, applicable to this embodiment, too, is the principle whereby, when the arch-shaped opening 28 comes into alignment with the outlet of the fifth conduit 22, the source 12 and the intake elements 29 are put into communication with each other. The positive pressure air flow reaches the intake elements 29 which produce the negative pressure and suction by which the pieces 2 of rod are held. When the opening 28 is no longer aligned with the outlet of the fifth conduit 22, the positive air flow is interrupted causing the pieces 2 of rod to be released from the seats 9.

[0068] In this case, too, there is a considerable energy saving because the volume of air under positive pressure is minimal, owing to the proximity of the valve 15 to the suction seats 9. Moreover, the intake elements 29 are capable of generating a negative pressure sufficient to hold and transport the pieces 2 of rod, while requiring small volumes of air at low positive pressure. It is therefore possible to use small compressors characterized by low energy consumption and low noise.

[0069] This invention allows production of positive or negative pressure air flows using impellers which are smaller than those used in prior art devices. Advantageously, therefore, energy consumption and noise levels are reduced.

[0070] Furthermore, since the air volumes required are smaller, the time taken to reach the negative pressure needed to hold the pieces 2 of rod to be transferred is also reduced, allowing the machine to work safely at higher speeds, and reducing the risk of failing to pick up the piece 2 of rod feeding out of the first station 10 at the pick up zone Z and the risk of the piece 2 of rod being detached from the seat 9 during transfer.

[0071] The invention described above is susceptible of industrial application. It may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted for technically equivalent elements.

Claims

1. A device for transferring pieces of filter or cigarette rod comprising a supporting drum (3) mounted rotatably about a first rotation shaft (4) forming a first axis (A1); a plurality of satellite bodies (5), each of which rotatably mounted on the supporting drum (3) for rotating, relative to the supporting drum (3), about a second rotation shaft (6) with axis (A2) parallel to the first rotation axis (A1); each satellite body (5) supports a pick up head (7) mounted on a third shaft (8) rotatable about a third axis (A3) parallel to the second axis (A2) and equipped with at least one seat (9) designed to engage and retain, by suction, at least one piece (2) of filter or cigarette rod; the device (1) being **characterized in that** it comprises a plurality of valves (15), each of which is connected to a respective pick up head (7) and it is designed to regulate, during and according to the relative movement of the head (7) relative to its satellite body (5), the opening and closing of a connection between the seat (9) of the head (7) and a source (12) of fluid.

2. The device according to claim 1, **characterized in that** each valve (15) is integral with the respective pick up head (7).

3. The device according to any one of the preceding claims **characterized in that** the valve (15) is mounted on the third rotation shaft (8) of the respective head (7).

4. The device according to any one of the preceding claims **characterized in that** the valve (15) regulates the connection of fluid between a plurality of first conduits (16), connected to the seat (9) of the head (7) and integral with the head (7), and a plurality of second conduits (17), connected to the source of fluid (12) and integral with the respective satellite body (5) mounting the head (7).

5. The device according to any one of the preceding claims **characterized in that** the valve (15) is equipped with an arch-shaped opening (28); the opening (28) regulating the opening and the closing of the connection between the seat (9) of the head (7) and the source of fluid (12), during and according to the relative movement of the head (7) relative to its satellite body (5).

6. The device according to any one of the preceding claims **characterized in that** the valve (15) comprises:

   - a first tubular portion (23), having a cylindrical outer surface (23a),
   - a second tubular portion (24), coaxial with the first tubular portion (23) and having a cylindrical

inner surface (24a);
- a chamber (25) being formed between the cylindrical outer surface (23a) of the first tubular portion (23) and the cylindrical inner surface (24a) of the second tubular portion (24);
- the chamber (25) communicating with the seat (9) of the head (7), and
- the arch-shaped opening (28) being made through the second tubular portion (24) and putting in communication the chamber (25) with the source of fluid (12).

7. The device according to claim 6 **characterized in that** the through opening (28) is made on the second tubular portion (24) of the valve (15) and has a main extension along a substantially circumferential direction.

8. The device according to any one of the preceding claims **characterized in that** the arch-shaped opening (28) extends through an angle of at least 60°.

9. The device according to claim 9 **characterized in that** the arch-shaped opening (28) extends through an angle greater than 90°.

10. The device according to any one of the preceding claims **characterized in that** the first conduits (16) are formed by a first conduit (18) inside the head (7), communicating with the seat (9) of the head (7), and by a second conduit (19) made inside the third rotation shaft (8) of the head (7), connecting the chamber (25) of the valve (15) with the first conduit (18) inside the head (7).

11. The device according to claim 10 **characterized in that** the chamber (25) communicates with the second conduit (19) through a hole (26) made on the first tubular portion (23) and a corresponding hole (27) made on the third shaft (8) of the head (7).

12. The device according to any one of claims 1 to 11 **characterized in that** the source of fluid (12) is defined by a negative pressure source of air.

13. The device according to any one of claims 1 to 8 **characterized in that** the first conduits (16) are formed by a first conduit (18) inside the pick up head (7), communicating with the seat (9) of the head (7), and by at least a third conduit (20) connecting, externally, the chamber (25) of the valve (15) with the first conduit (18) inside the head (7).

14. The device according to claim 13 **characterized in that** the chamber (25) communicates with the third conduit (20) through an outfeed hole (33) made on the second tubular portion (24).

15. The device according to claim 13 or 14 **characterized in that** the pick up head (7) comprises a intake element (29) associated with the seat (9) comprising a Venturi-effect tubular body (30) having an end connected to the source of fluid (12); the tubular body (30) being equipped with at least one inner portion (32) which, in use, is occupied by air having a pressure less than atmospheric pressure, and the inner portion (32) communicating, through at least one hole (31), with the first conduit (18) inside the pick up head (7).

16. The device according to claim 15, **characterized in that** the intake element (29) is enclosed within a respective elongate housing, made in the pick up head (7).

17. The device according to claim 16 **characterized in that** the housing is made in the pick up head (7), transversally to the third axis (A3), and has its ends open and communicating with respective sides of the head (7).

18. The device according to any one of claims 15 to 17 **characterized in that** the tubular body (30) has at least one inner portion (32) in which the Venturi effect occurs.

19. The device according to claim 18 **characterized in that** the tubular body (30) has three inner portions (32) arranged in cascade in which the Venturi effect occurs.

20. The device according to any one of claims 13 to 19 **characterized in that** the source of fluid (12) is defined by a positive pressure source of air.

21. The device according to any one of the preceding claims **characterized in that** the second conduits (17) are formed by a fourth conduit (21), communicating with the source of fluid (12) and formed inside the second rotation shaft (6) of the satellite body (5), and by a fifth conduit (22) connecting the valve (15) with the fourth conduit (21).

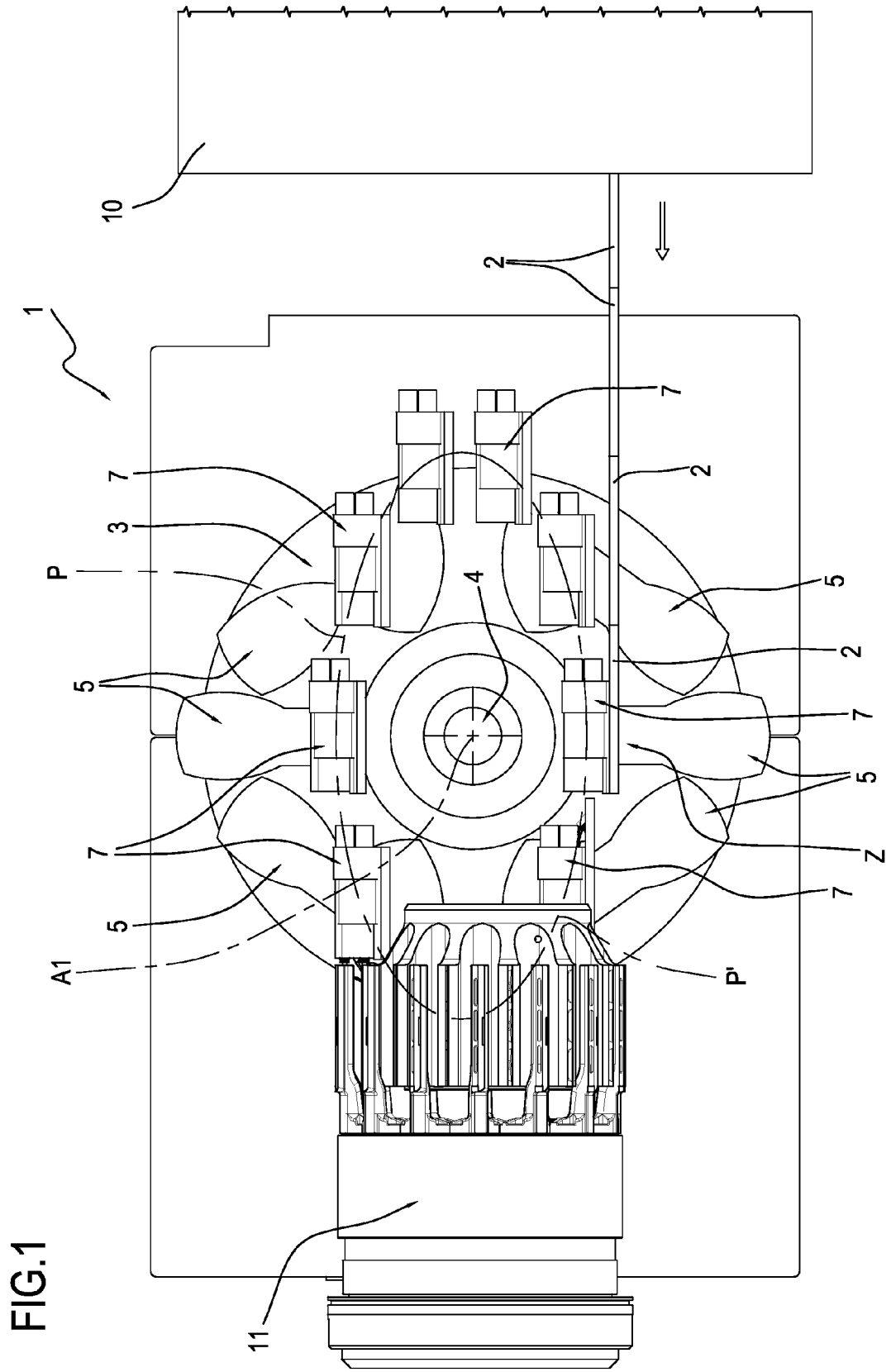


FIG.1

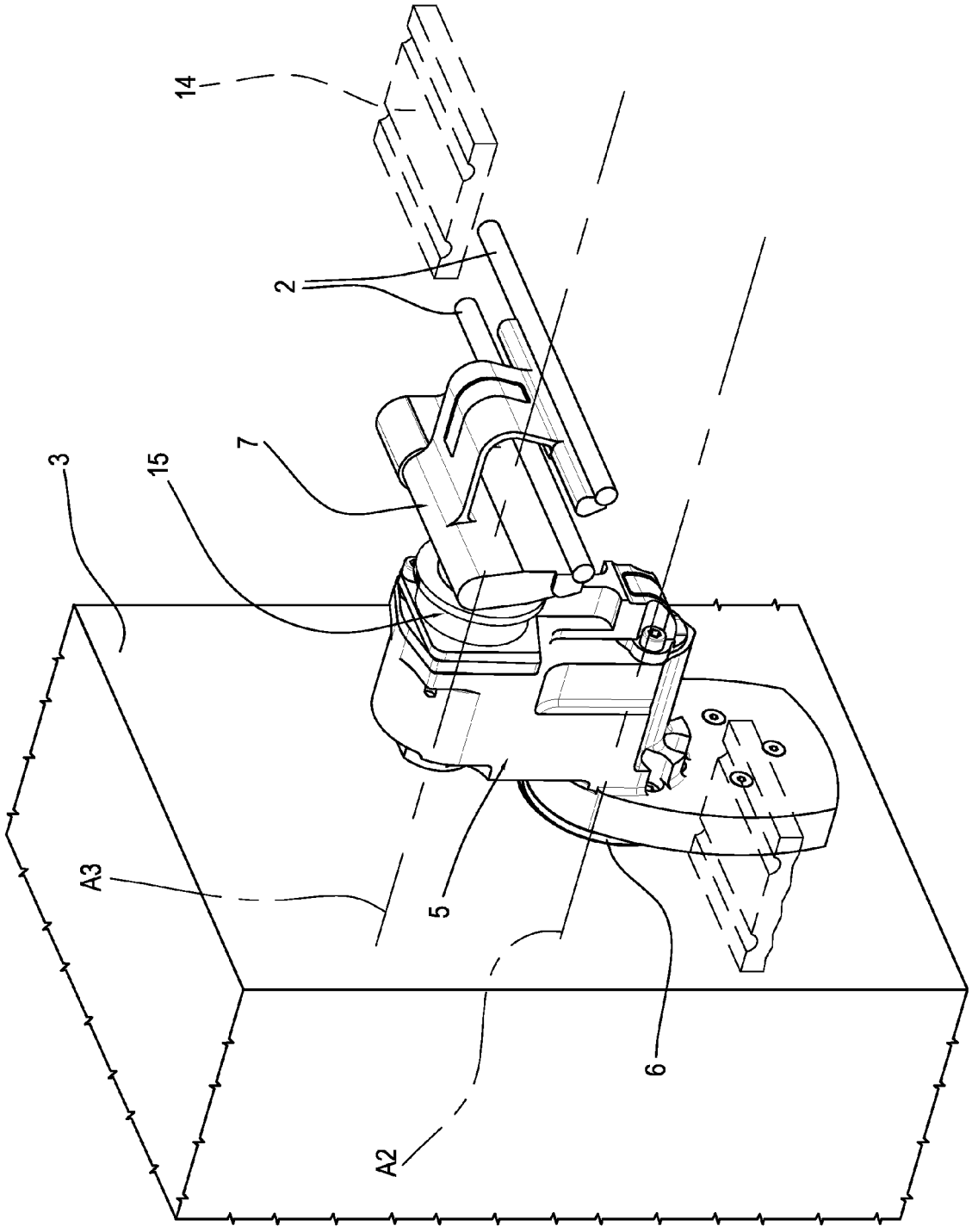


FIG.2

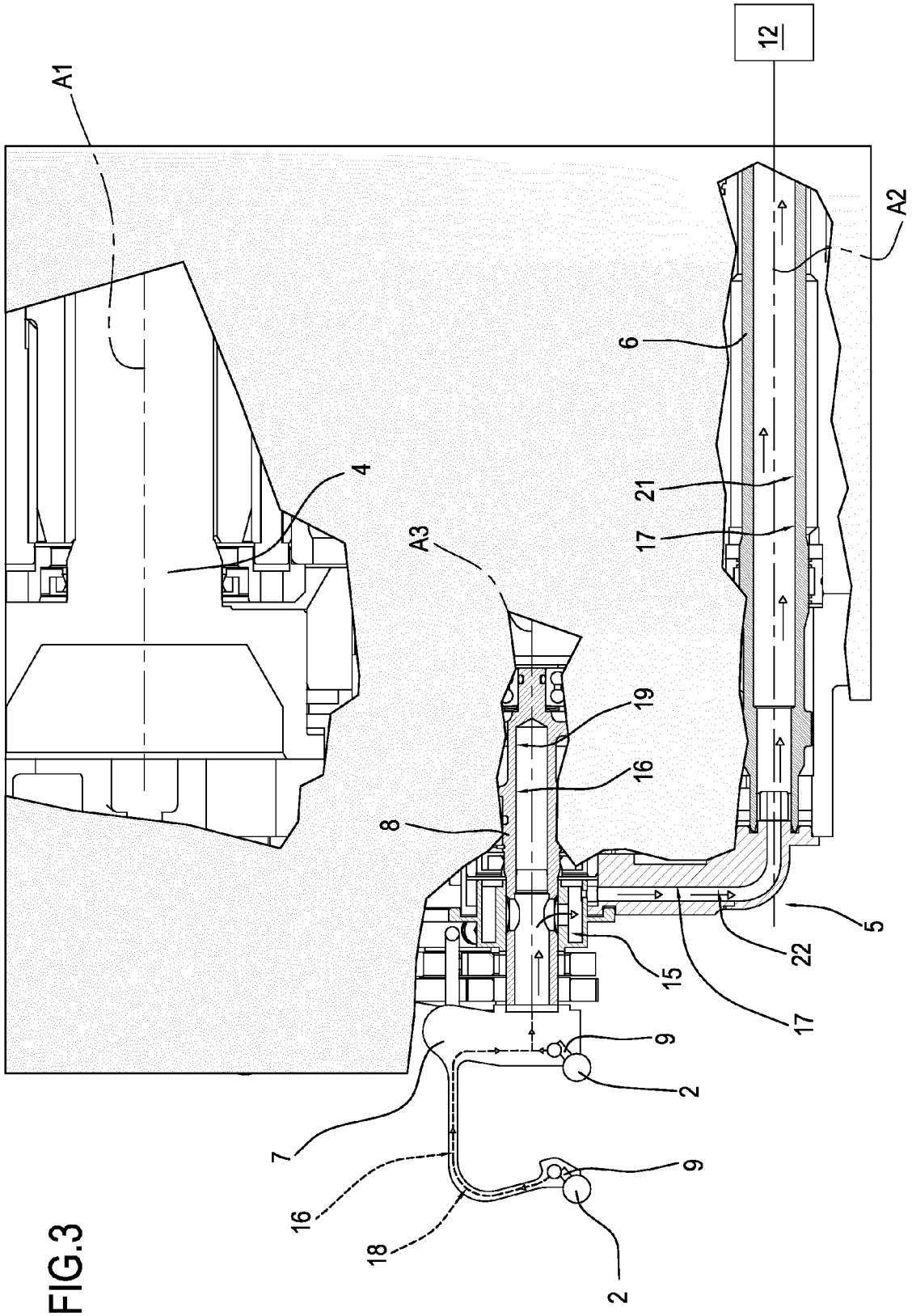


FIG.3

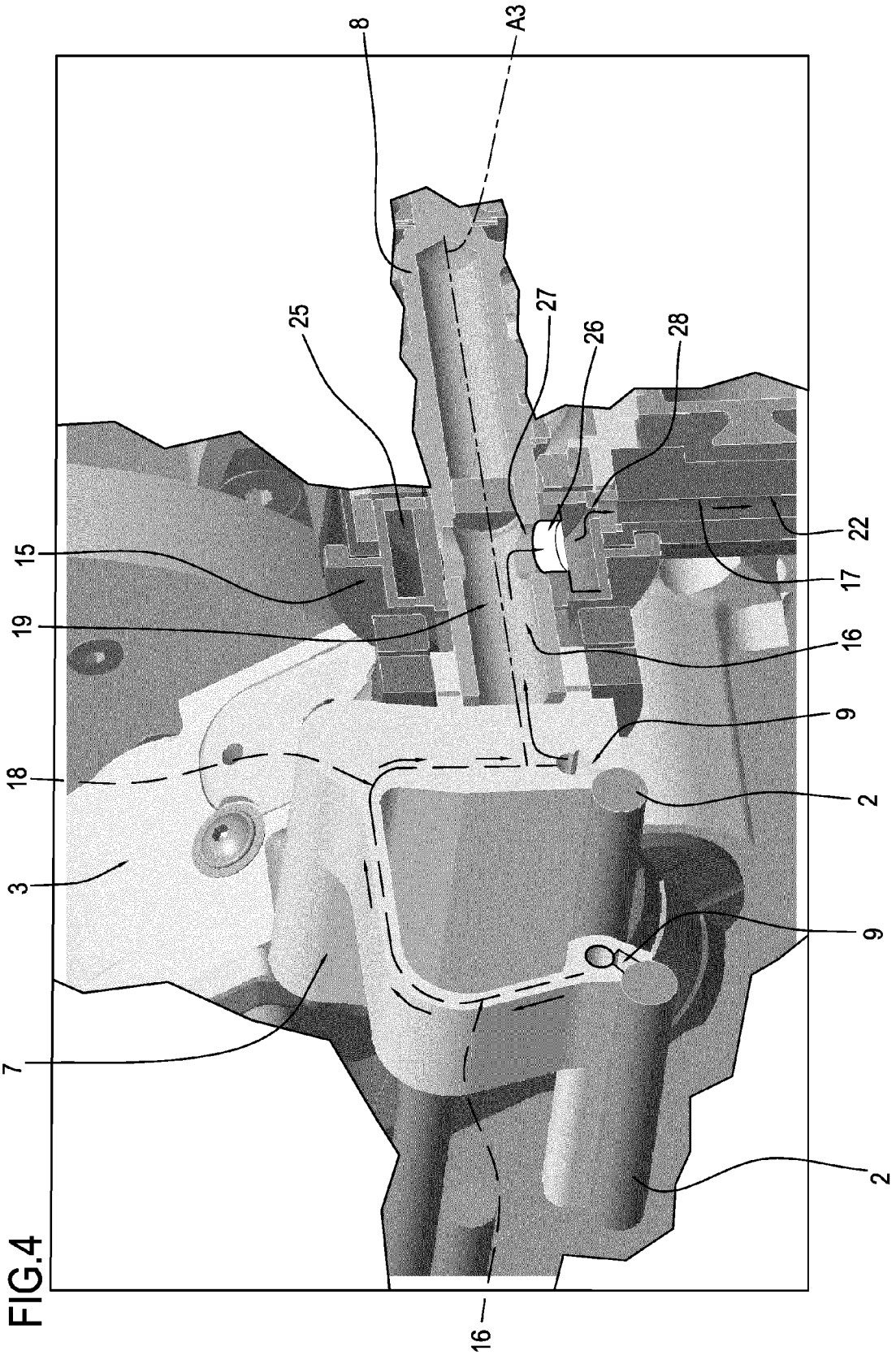


FIG.4

FIG.5

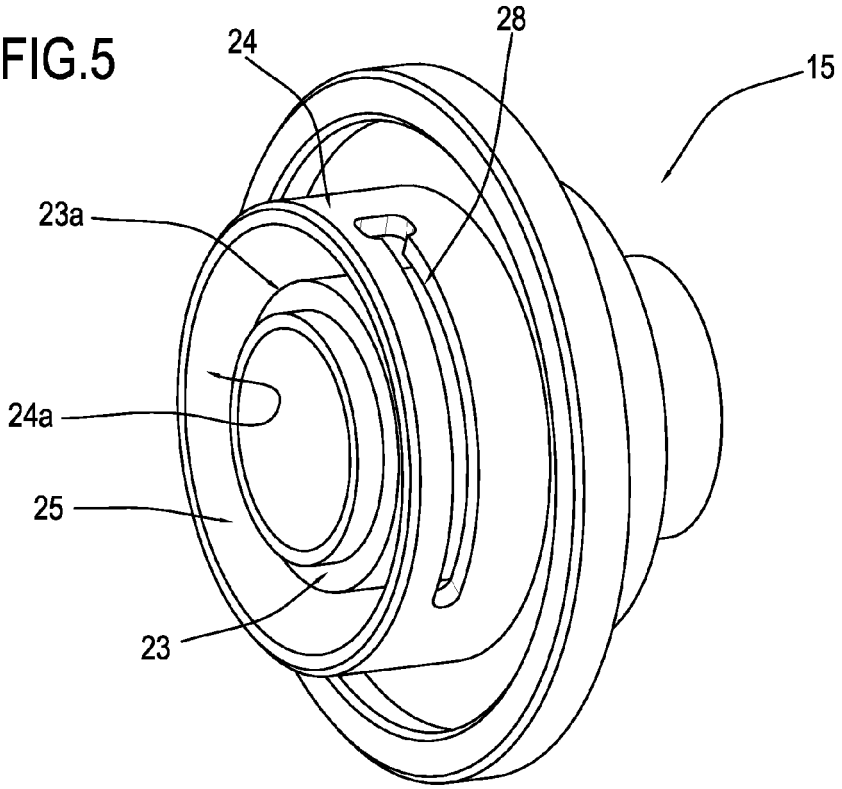


FIG.6

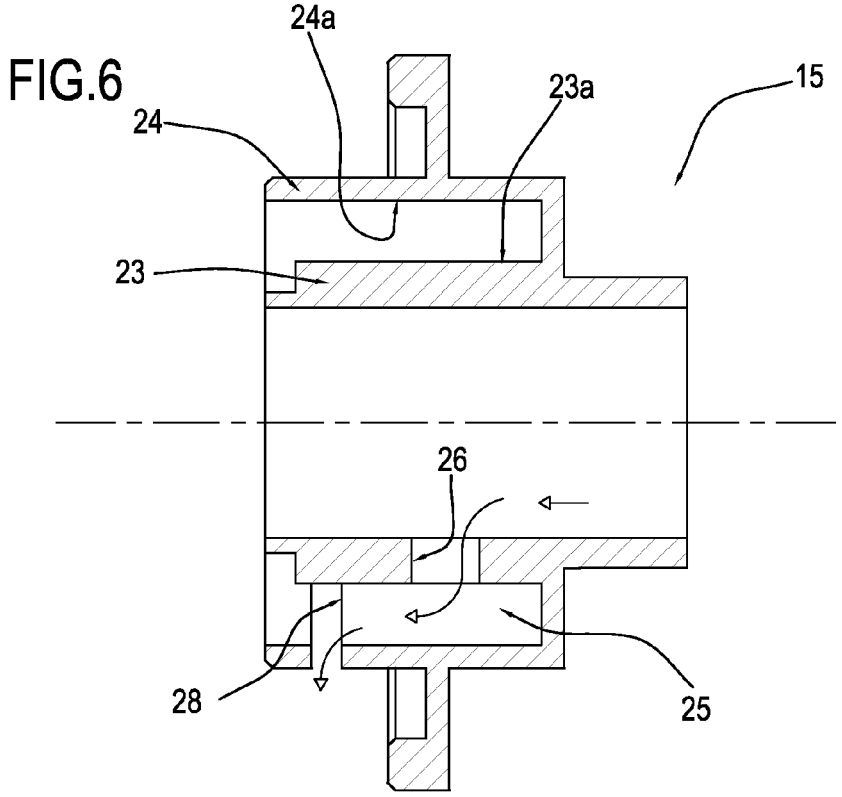


FIG.7

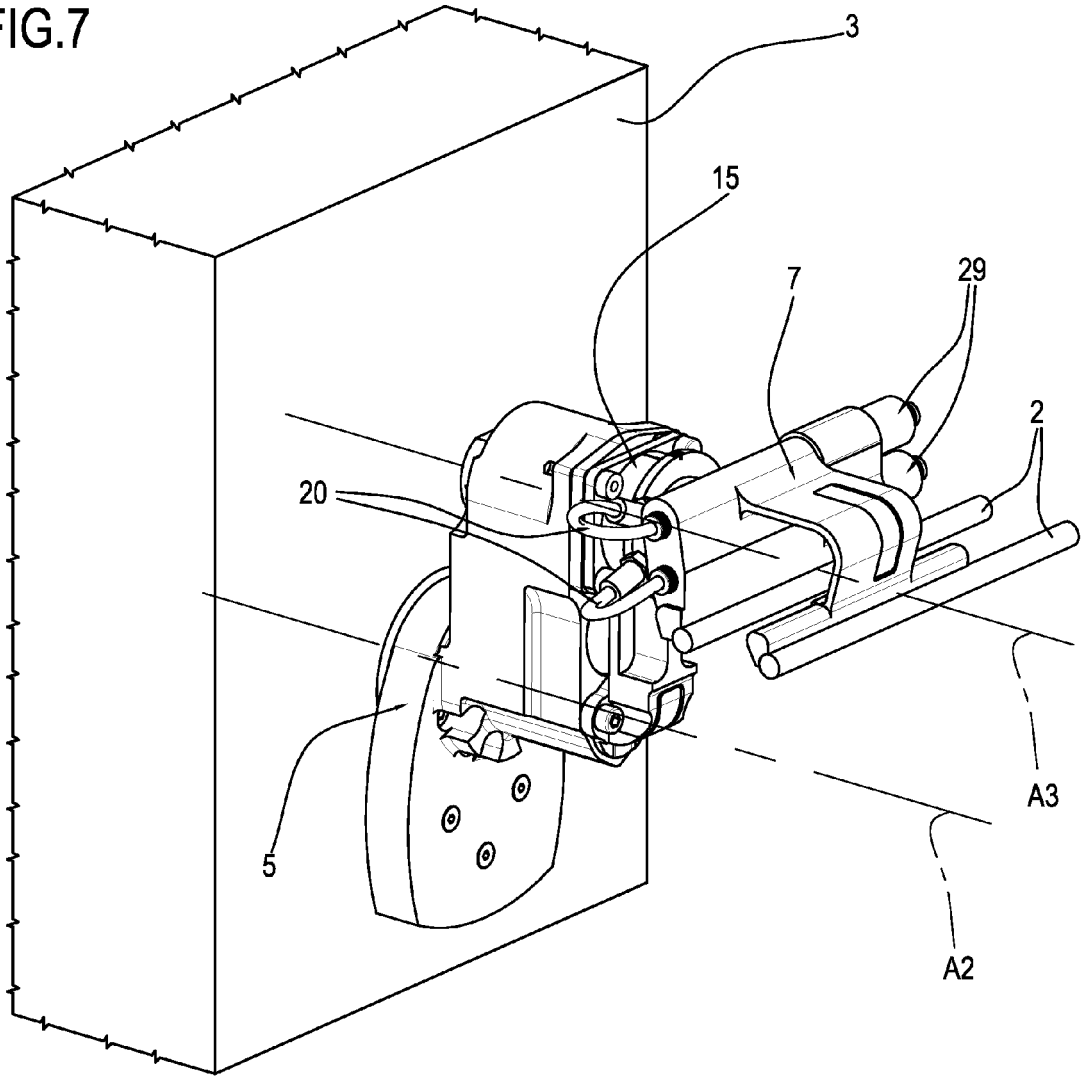


FIG.11

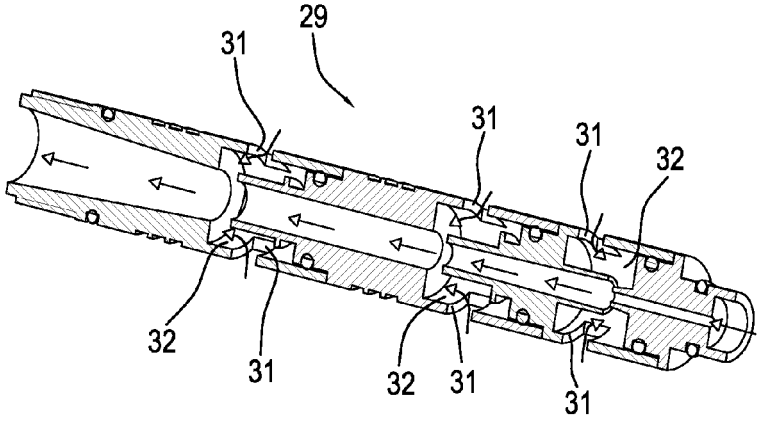


FIG.8

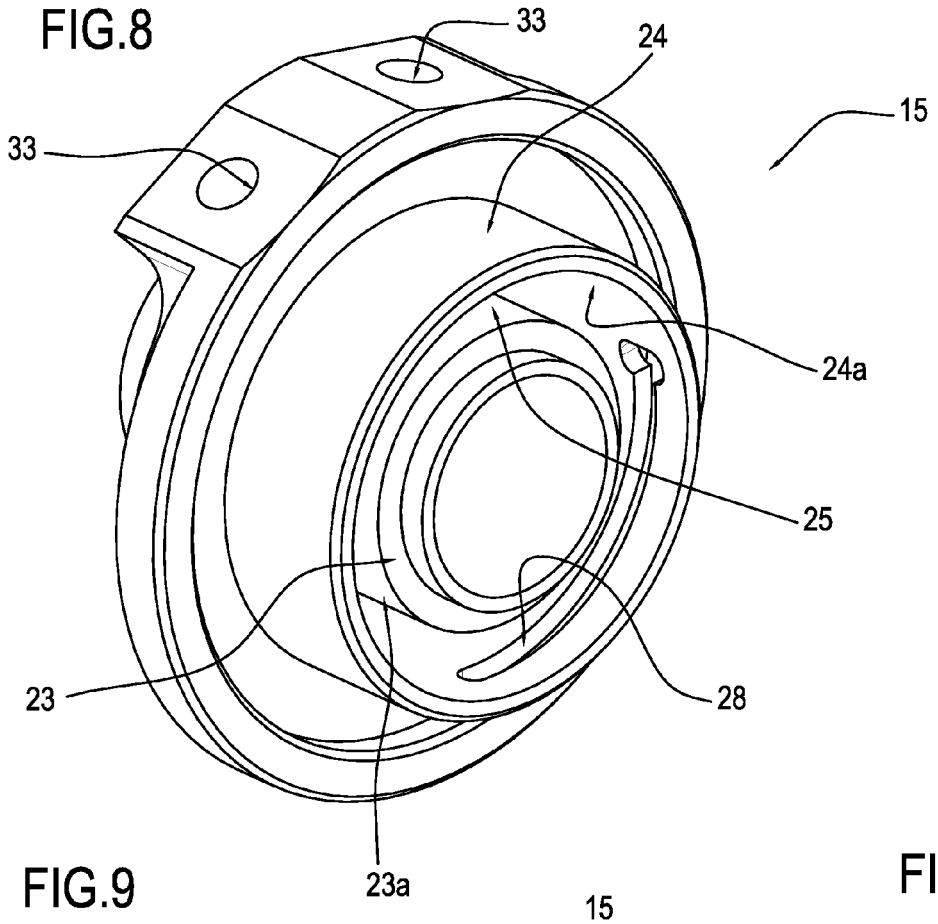


FIG.9

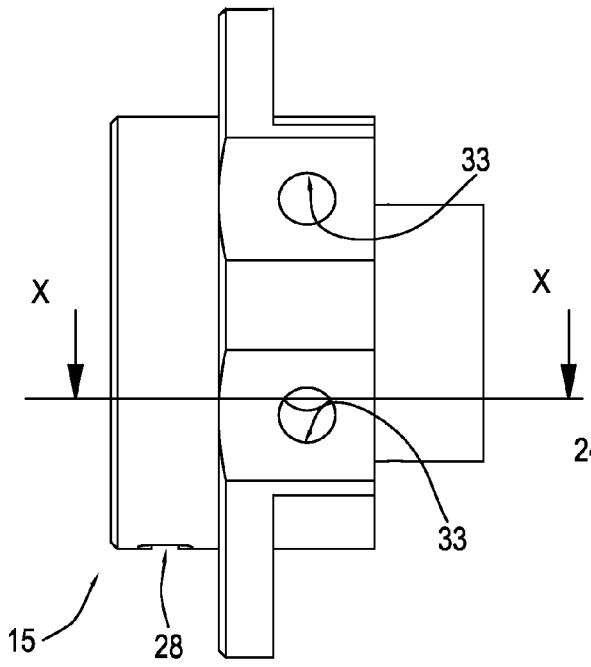
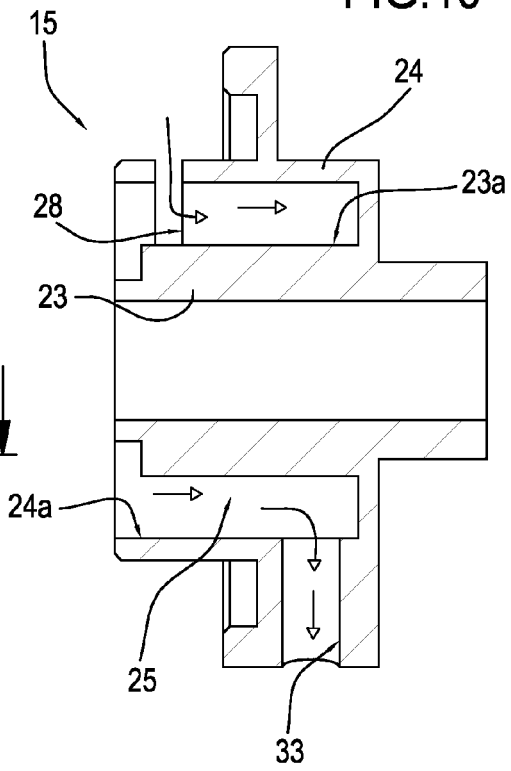


FIG.10



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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 9531

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Place of search	Date of completion of the search	Examiner
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