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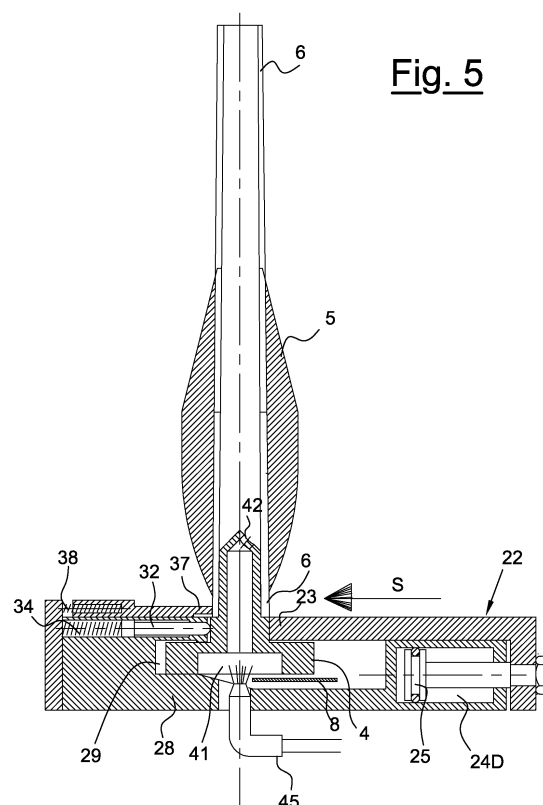
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(54) **Automatic spooling station**

(57) Automatic spooler served by a transportation system using spool carriers (4) with full spools (5) and with spent spools, in which a plurality of transversal paths (1) corresponding to the individual spooling units is inserted, served by conveyor belts (8) and comprising a reserve position (R) and a processing position (L) of the spool that is unwound, in which the processing position (L) of the spool is provided with elements (22,29) for locking the spool (5) being unwound, which lock said spool in misaligned position with respect to the transversal conveyor (8).



Description

[0001] The present invention refers to a device and process for moving and controlling spools fed to the individual spooling units or stations of an automatic spooler.

[0002] In industry, the technique of producing yarns in a first spinning stage - typically ring-spinning that produces yarns in a spool - followed by a second spooling stage in which the yarn is unwound from the spool, purified of its defects and rewound in a reel, is widely used. The spooling process is carried out in spoolers arranged downstream of the spinners.

[0003] The most recent automatic spoolers most often use the technique of moving the spools and the cops, using spool carrier supports to be arranged on conveyor belts or similar moving members for serving the machine to individually take said spools and cops to and from the spooling units, supporting them in upright position on their spool carrier during the entire moving and processing cycle of the spool and the cop.

[0004] In general, said spool carriers consist of a disc-shaped base that carries a vertical central pin, on which the cop of the spool is slotted, transferring and then working the spools practically without touching them, manipulating just the spool carriers, without the spools having to touch and rub, getting dirty or deteriorating in contact with the members of the machine.

[0005] The automatic spooler generally consists of a plurality of spooling units or stations aligned and served by common service and control members. On the front of the machine there is a main discharge path for the spent cops and on the back of the machine there is a main feeding path for the spools to be subjected to spooling. Such paths are defined with directional guides for the spool carriers and are moved with conveyors, generally belt or band conveyors, which serve all of the aligned spooling stations. Between the two main paths transversal paths are made corresponding to the individual spooling units, in which the processing of the spools takes place. Such movement set-ups are, for example, described in European patents 374.403, 374.404, 402.630 and in US patents 4,953,798 and 5,484,115.

[0006] The relative transversal paths can be moved with various transportation systems, with a conveyor belt, with bands, with rotary discs, thrusters with rotary levers and so on. The transversal paths are also defined with directional guides for the spool carriers that cross them. Said paths foresee one or more positions of new reserve spools, an unwinding position and a discharge position of spent spools: the movement between such positions, and the relative control, are often complex and delicate, because spooling is a process with high spool change frequency and substantial unwinding speeds of the yarn from the spools, of the order of 30 m/sec.

[0007] The present invention is intended for moving and processing a spool inside the individual spooling unit, keeping it upright on its spool carrier. Before being fed

to one of said spooling units or stations that make up the automatic spooler, the spool to be unwound is prepared, with processing that makes its end available, in general at the top of the cop, to pick it up and begin its spooling.

[0008] The invention is described here with reference to a typical embodiment thereof in an automatic spooler.

[0009] The present invention, in its most general embodiment of device for moving and processing a spool inside an individual spooling unit, is defined in the first claim. Its variants or preferred embodiments are defined in the dependent claims from 2 to 8.

[0010] The characteristics and advantages of the device for moving and processing a spool inside an individual spooling unit according to the present invention shall become clearer from the description, given as a nonlimiting example, of a typical embodiment thereof, illustrated in figures 1 to 6.

Figure 1 illustrates the plan view of the transversal path inside the spooling station, when the spool is being changed.

Figure 2 illustrates the side vertical section view of the transversal path inside the spooling station, when the spool is being changed.

Figure 3 illustrates the front section view of the transversal path inside the spooling station, when the spool is being changed.

Figure 4 illustrates the plan view of the transversal path inside the spooling station, with the spool changed and being unwound.

Figure 5 illustrates the front section view of the transversal path inside the spooling station, with the spool already started to be unwound.

Figure 6 illustrates the transversal view of the path according to figures 4 and 5 with the spool during the unwinding.

[0011] The movement and processing of the spool take place, for example, as follows. The system is foreseen - for example - to keep the reserve position always occupied with two spools ready to be unwound and the processing position always occupied by a spool being worked. The performance of the cycle is controlled by a control unit - and not indicated in the figures for the sake of simplicity - dedicated to the spooling unit that receives the signals from the sensors present in the various parts that make up the unit and processes and sends the commands to perform the various operations of the work cycle in succession.

[0012] In figures 1 and 2 the spooling unit has ended the spooling of the spool being worked and carries out a spool change. The transversal path 1 of the spooling unit is defined by the guides 2 that are a distance apart corresponding to the diameter of the neck 3 of the spool carrier 4 that transports the spool 5. Said spool 5 is wound on a cop 6 that has an inner diameter such as to allow the pin 7 of the spool carrier 4 to be introduced with a good fit inside its bottom end. The transversal path is

served by a conveyor belt 8 that transports the spool carriers in the direction of the arrow T and that circulates between two relay rollers 9 with motorised actuation, not shown in the figures for the sake of simplicity. On the two faces of the spooler there are the paths for the arrival of new spools and for the evacuation of the cops of the spent spools. In the top part of figure 1, which corresponds to the right part of figure 2, the path 11 for the arrival of the new spools on their spool carriers 4 is shown. It consists of two side guides 12, a distance apart that allows the neck 3 of the spool carrier 4 to pass, transported by the conveyor 13 that carries the spool carriers with the new spools in the direction of arrow A. In the bottom part of figure 1, which corresponds to the left part of figure 2, the path 15 for discharging the cops 6 of the spent spools again on their spool carriers 4 is shown.

[0013] It consists of two lateral guides 16, again a distance apart that allows the neck 3 of the spool carrier 4 to pass, transported by the conveyor 17 that moves with the spool carriers in the direction of arrow B.

[0014] At the reserve position R of path 1 a stop 18 is arranged for the spool carriers that carry the reserve spools and at the position L for processing the spool that is unwound a stop 19 is arranged for the spool carriers that carry the spools being worked. Such stops open to allow one spool carrier to pass at a time and close automatically when the spool carrier has passed. At the position L the distance between the guides 12 widens, having a transversal cavity that allows the sideways movement and the locking of the spool carrier 4 with its spool, which is illustrated hereafter in greater detail in figure 3.

[0015] As stated, in figures 1 and 2 the spooling station is in spool change configuration. The stop 19 has opened and closed: the spool carrier with the cop 6 of the spent spool is sent towards the discharge, to be deposited in the conveyor 17. The stop 18 has similarly opened and closed: the first spool carrier with the new spool 5 of the reserve is delivered by the conveyor belt 8 into the position L. In reserve position R there is a single spool carrier: the control unit of the spooling unit commands that a further reserve spool be picked up from the feed circuit 11. This picking up involves the commanding of the actuation of the L-shaped deviator lever 21 by the control unit. Such a deviator lever 21, placed at the entry of the transversal path 1, is hinged with a pin 50 and is equipped with two ends 51 and 52. In the position shown in figure 1, the deviator lever 21 intercepts the neck of the arriving spool carrier and deviates it from the conveyor belt 13 to the conveyor 8 with its end 51 that intercepts the path 11 as shown in figure 1. The same deviated spool carrier rests, with its neck 3 on the end 52 of the deviator lever 21 and causes the access to the spooling station to be closed, after the spool carrier with the new spool that goes to constitute the second reserve spool has passed, as shown later on in figure 4. The rotation stroke that the deviator lever L is able to make is defined by two limit switches, not indicated in the figures for the sake of simplicity, at the interception position of the spool carrier ar-

iving on the path 11 and at the closed position of the transversal path 1 inside the spooling unit. The path 1 stays closed by the deviator lever 21 until a new spool is needed again by the spooling unit.

[0016] Figure 3 shows a front view of the section of the transversal path inside the spooling station, when the spool is being changed as illustrated with reference to figures 1 and 2, and in greater detail on the blocking system of the spool carrier and of the spool being worked. At the work position L, the new spool 5 with its end 20 slotted in the top of the cop 6 rests upon its conveyor belt 8 and is ready to be blocked. The locking members comprise: a slider 22, with a concave end 23 placed at the level of the neck 3 of the spool carrier 4 and configured to rest coherently on it, actuated by a pneumatic cylinder 24, which can be single or double-acting, in which a piston 25 slides, connected to the slider 22 with a stem 26 and a nut 27;

- a receiving block 28, opposite the slider 22, comprising a cavity 29 that is able to precisely house the base disc of the spool carrier 4 between its bottom surface 30 and the nib 31. On the top face of the block 28 a rod 32 is arranged that rests on the other side of the neck 3 of the spool carrier 4, and that slides and retracts - in the same direction as the slider 22 - in a hollow cylinder guide 33 in which an elastic counteraction element is arranged, for example a contrast spring 34, against the action of the slider 22;
- again above the piston 32, on the receiving block 28, a slider 36 is arranged for receiving the spool with an end 27 at a suitable level and shaped to rest on the bottom base of the cop 6. Such a slider 36 slides in the transversal direction in the same direction as the slider 22, between guides (not shown in the figures for the sake of simplicity) and is counteracted in its motion towards the left by an elastic counteraction element, for example a contrast spring 38.

[0017] As stated, figures 4, 5 and 6 illustrate the configuration of the transversal path inside the spooling station, with the spool changed, locked and unwinding. In figure 4 it is possible to see the spool carrier with the cop 6 of the spent spool now sent onto the conveyor 17. The stop 18 has closed and in the reserve position R in which there are now two spool carriers with the reserve spools. The deviator lever 21 is closed to prevent access to the spooling station, after the spool carrier with the new spool that has gone to make up the reserve has passed. The spool in work position L is unwinding and locked, as better illustrated with reference to figure 5, in which the spool 5 is shown with unwinding already having begun, so as illustrated in figure 6.

[0018] When the spool carrier 4 with the new spool 5 has arrived in the work position, the control unit of the spooling station has commanded the locking operations before unwinding again with the new spool 5. The locking operations are, for example, the following. With reference

to figure 5, the slider 22 has been pushed towards the left by pushing its end 23 to rest on the neck 3 of the spool carrier, through actuation of the pneumatic cylinder 24 by injecting pressurised fluid into its right chamber 24D and making the piston 25 and the slider 22 slide according to the arrow S. Through the effect of the pushing towards the left of the slider 22, the new spool 5, which was resting on the conveyor belt 8 and ready for locking, is moved sideways, with respect to the path 1, and detached from the conveyor belt 8. The base disc of the spool carrier 4 between its bottom surface 30 and the nib 31 is thus pushed into the cavity 29. The neck 3 of the spool carrier itself rests against the rod 32 and pushes it in a guide 33 and compression loading the contrast spring 34, thus locking the spool carrier 4 between the slider 22 and the rod 32. Together with the spool carrier, the spool 5 is also pushed towards the left. The slider 36 receives the spool with its end 27 on which the cop 6 rests, sliding towards the left counteracted by the contrast spring 38, which is also compression-loaded. The spool is then locked by resting it elastically against the pin 7 of the spool carrier 4, in turn locked.

[0019] Such a locking system, by sideways movement of the spool carrier 4 with the spool 5, allows the base of the spool carrier and, in particular, its central opening 41 that opens out into the bottom face of its base disc and that communicates with the orifice 42 arranged on the top of the pin 7 to be freed.

[0020] Under the work position L a compressed air injector nozzle 45 is arranged aiming upwards, placed in a position misaligned with respect to the conveyor belt 8 and centred from the bottom with respect to the blocked position of the spool carrier 4. The central opening 41 can thus be engaged by the nozzle 45 below that can inject a jet of compressed air inside the cop 6 to withdraw the end 20 of the spool 6 and use it to start the unwinding of the spool itself.

[0021] At the end of the unwinding of the spool 5, the unblocking operations are, for example, the previous ones in reverse. With reference to the configuration of figure 3 - in which, however, instead of the spool 5 there is now a cop 6 without its winding - the thrusting of the slider 22 is stopped, through release of the fluid injected into the right chamber 24D of the pneumatic cylinder 24, allowing the piston 25 and the slider 22 to slide according to the arrow D, through the effect of the pushing of the spring 34, previously loaded by the action of the slider 22 itself.

[0022] Through the effect of the return towards the right of the slider 22 and of the rod 32, the spool carrier 4, which carries the cop 6 of the spent spool, is moved towards the right and is thus taken back onto the conveyor belt 8, and is ready to be discharged.

[0023] Compared to the systems for moving and processing spools inside the individual spooling unit available in the prior art, the device for processing spools according to the present invention offers substantial advantages, of which the following deserve to at least be

pointed out.

[0024] The spool being worked is unwound at high speeds, of the order of 30 m/sec, and with a balloon that rotates like a vortex: it is thus subjected to discontinuous actions that tend to pull out its cop 6 from the pin 7 of the spool carrier 4, if the spool is not locked well. Already due to the balloon rotating at speeds of the order of 40,000 revolutions/min., the yarn being unwound is subjected to a centrifugal effect from which a substantial tension derives: the rigid lockings can cause the yarn to pull away. The locking requirements are particularly needed with hairy yarns, fantasy yarns and with irregularly wound yarns.

[0025] The technical solution foreseen with the present invention foresees to firstly lock the spool carrier, so as to ensure that its pin 7 and its neck 3 are in a constant and predetermined position. The spool is then locked by pushing its cop 6 against the pin 7. The two lockings are carried out in series with the interposition of elastic elements that are able to ensure the damping of possible vibration stresses. The direction of the axis of the pin 7 is in any case rigidly fixed by the interlocking action of the edge of the base disc of the spool carrier in the cavity 29 so as to keep the rotary trajectories of the yarn constant during the unwinding of the spool.

[0026] The locking action of the spool 5 being unwound is associated with the sideways movement of the spool carrier freeing the bottom face of its base and the opening 41 by the air jet to pull away the end 20.

Claims

1. Automatic spooler consisting of a plurality of spooling units aligned and served by a transportation system to carry spool carriers (4) with full spools (5) and spool carriers (4) with the cop (6) of the spent spools, the spool carrier transportation system comprising a path (11) for the arrival of new spools, a path (15) for discharging the cops (6) of the spent spools as well as a plurality of transversal paths (1) corresponding to the individual spooling units, in which the processing of the spools takes place, served by conveyor belts (8) that transport the spool carriers (4) in the direction of the arrow (T), in which each transversal path (1) comprises a reserve position (R) for one or more new waiting spools and a processing position (L) of the spool that is unwound, said position (L) being provided with elements for locking the spool being unwound, **characterised in that** said locking means of the spool being unwound comprise means (22, 29) for locking the spool carrier (4) and means (36) for locking the cop (6) of the spool that operate in opposition to one another, and **in that** said locking means move the spool (5) sideways on its spool carrier (4), with respect to the path (1), and detach it from the conveyor belt (8), locking the spool to be unwound in misaligned position with respect to the

conveyor (8).

end (52) of the deviator lever (21) and causes the access to the spooling station to be closed.

2. Automatic spooler according to claim 1, **characterised in that** the locking means of the spool carrier (4) in the work position (L) comprise a slider (22) that slides at the level of the neck (3) of the spool carrier to rest on said neck to push the spool carrier against an opposite receiving block (28) comprising, in turn, a cavity (29) able to precisely house the base disc of the spool carrier (4), as well as a sliding element (32) equipped with an elastic counteraction element (34) to the action of the slider (22). 5 10
3. Automatic spooler according to claim 2, **characterised in that** the sliding element (32) is arranged on the top face of the block (28) and consists of a rod (32) that rests on the other side of the neck (3) of the spool carrier (4), and that slides and withdraws, in the same direction as the slider (22), in a hollow cylinder guide (33) in which a contrast spring (34) is arranged against the action of the slider (22). 15 20
4. Automatic spooler according to claim 1, **characterised in that** the locking means of the cop (6) of the spool in the work position (L) comprise a slider (36) arranged at the side of the receiving block (28) with an end (27) at a suitable level and configured to rest on the bottom base of the cop (6) able to slide in the same direction as the slider (22), counteracting it with an elastic contrast element (38). 25 30
5. Automatic spooler according to claim 1, **characterised in that** below the work position (L) there is a nozzle (45) for injecting compressed air, arranged in misaligned position with respect to the conveyor belt (8) and centred with respect to the locking position of the spool carrier (4). 35
6. Automatic spooler according to claim 1, **characterised in that** at the entry of the transversal path (1) there is an L-shaped deviator lever (21), alternatively to intercept the spool carrier arriving with the new spool and deviate it onto the transversal path (1) and to cause the access to the path (1) to be closed. 40 45
7. Automatic spooler according to claim 6, **characterised in that** the deviator lever (21) is hinged with a pin (50) and is equipped with two ends (51) and (52) and is able to make a stroke in rotation defined at two positions corresponding to the interception of the spool carrier arriving on the path (11) and the closing of the transversal path (1) inside the spooling unit. 50
8. Automatic spooler according to claim 7, **characterised in that** the closed position of the transversal path (1) is determined by the passing of the deviated spool carrier towards the path (1), which rests on the 55

Fig. 1

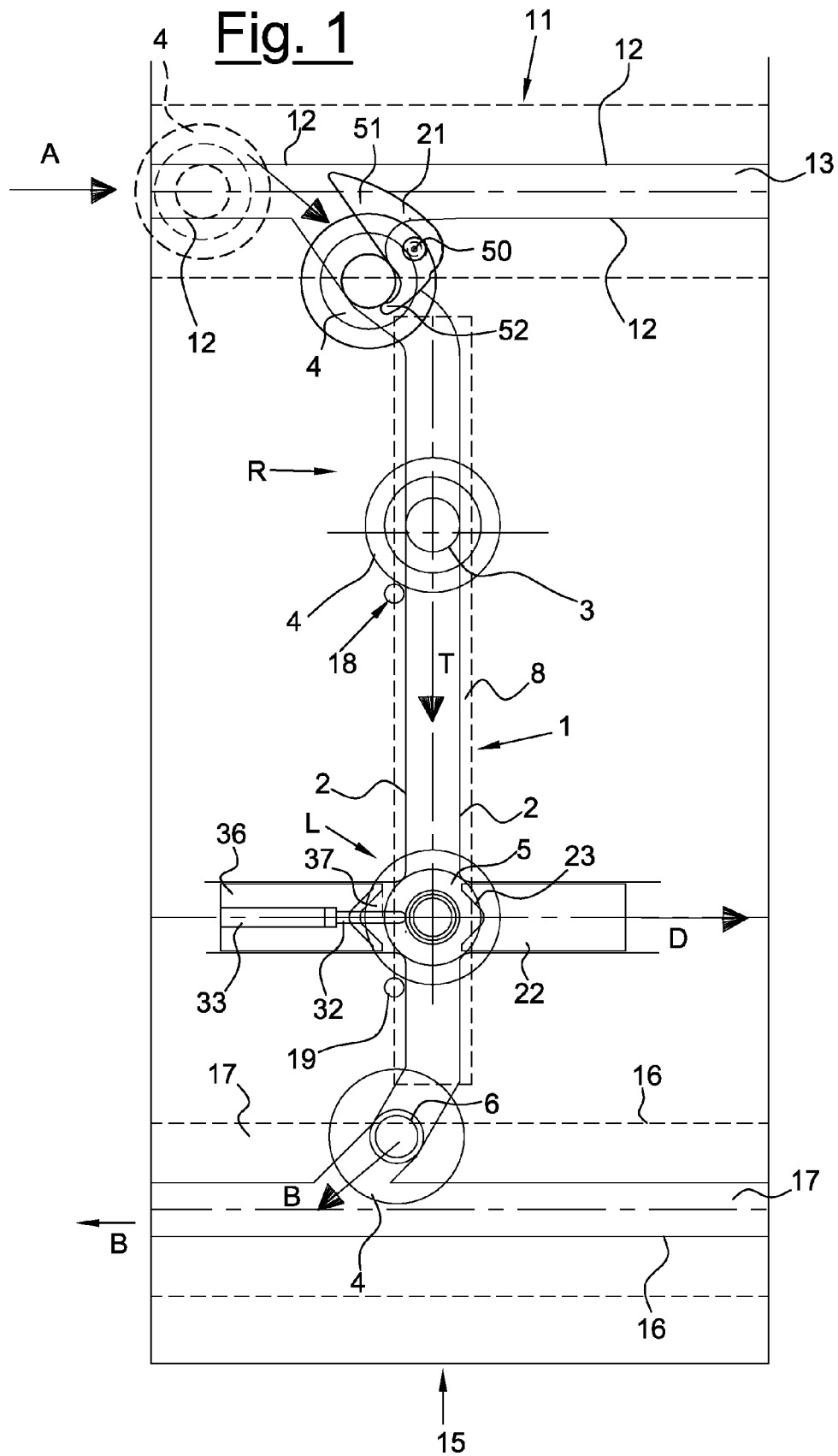


Fig. 2

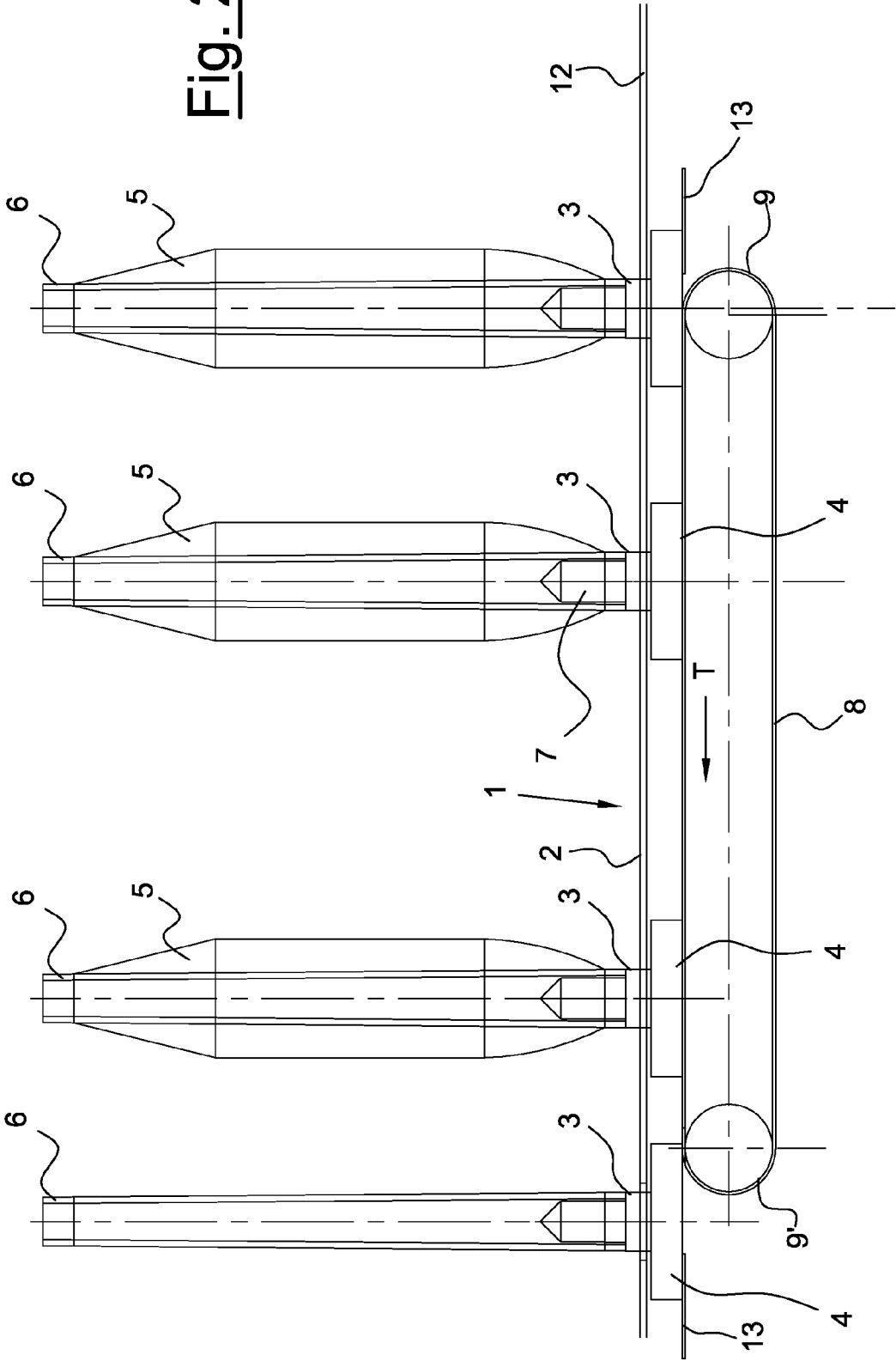


Fig. 3

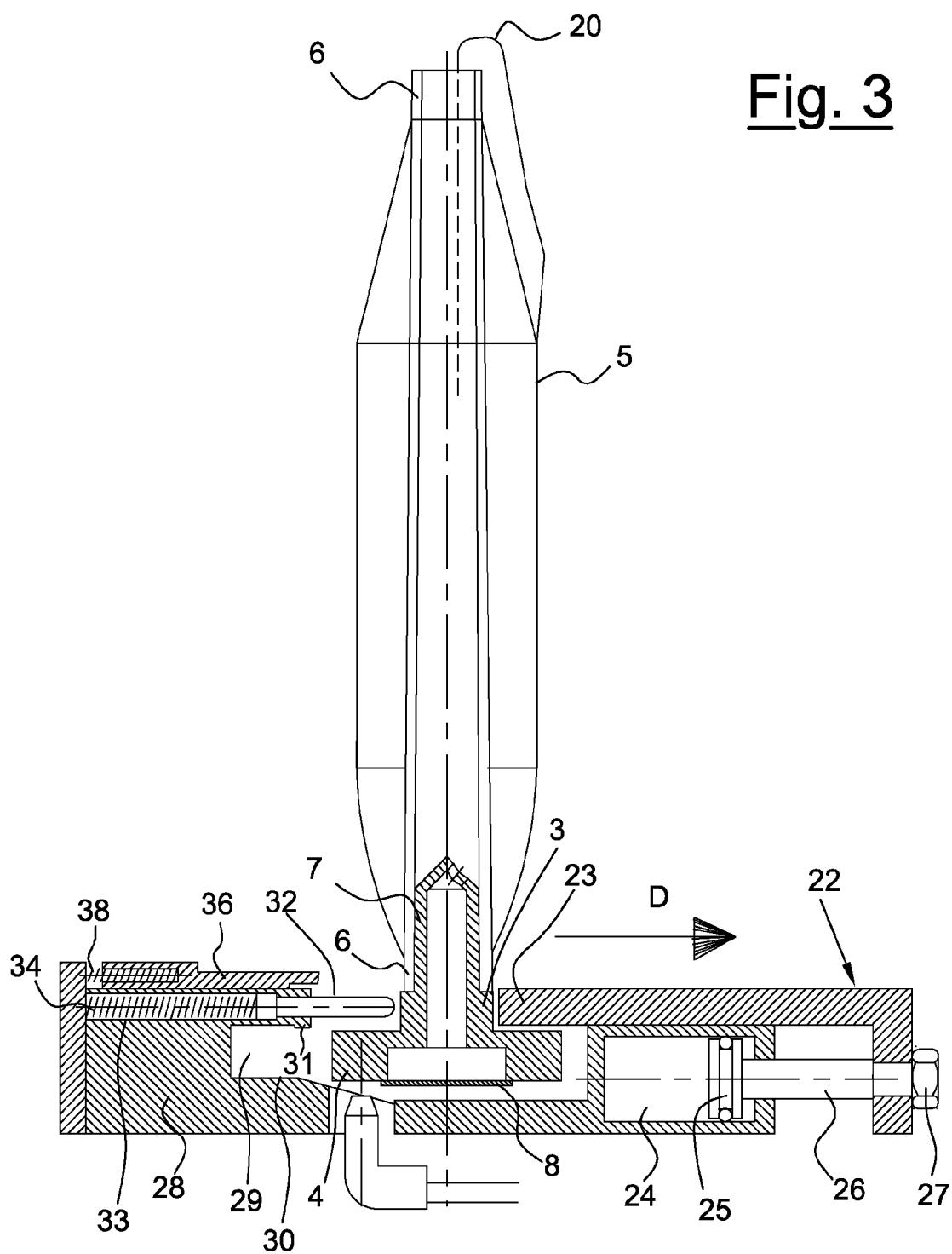


Fig. 4

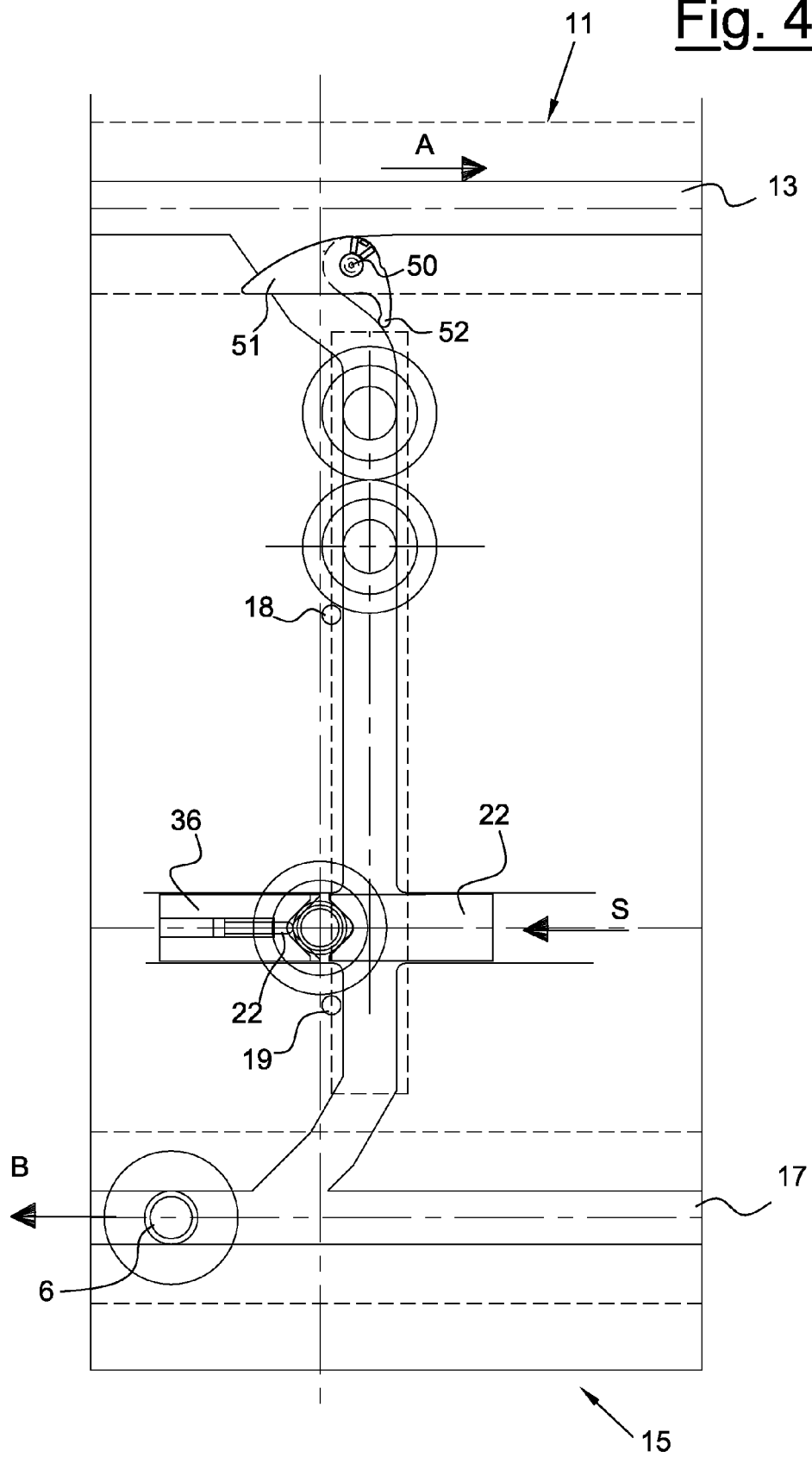
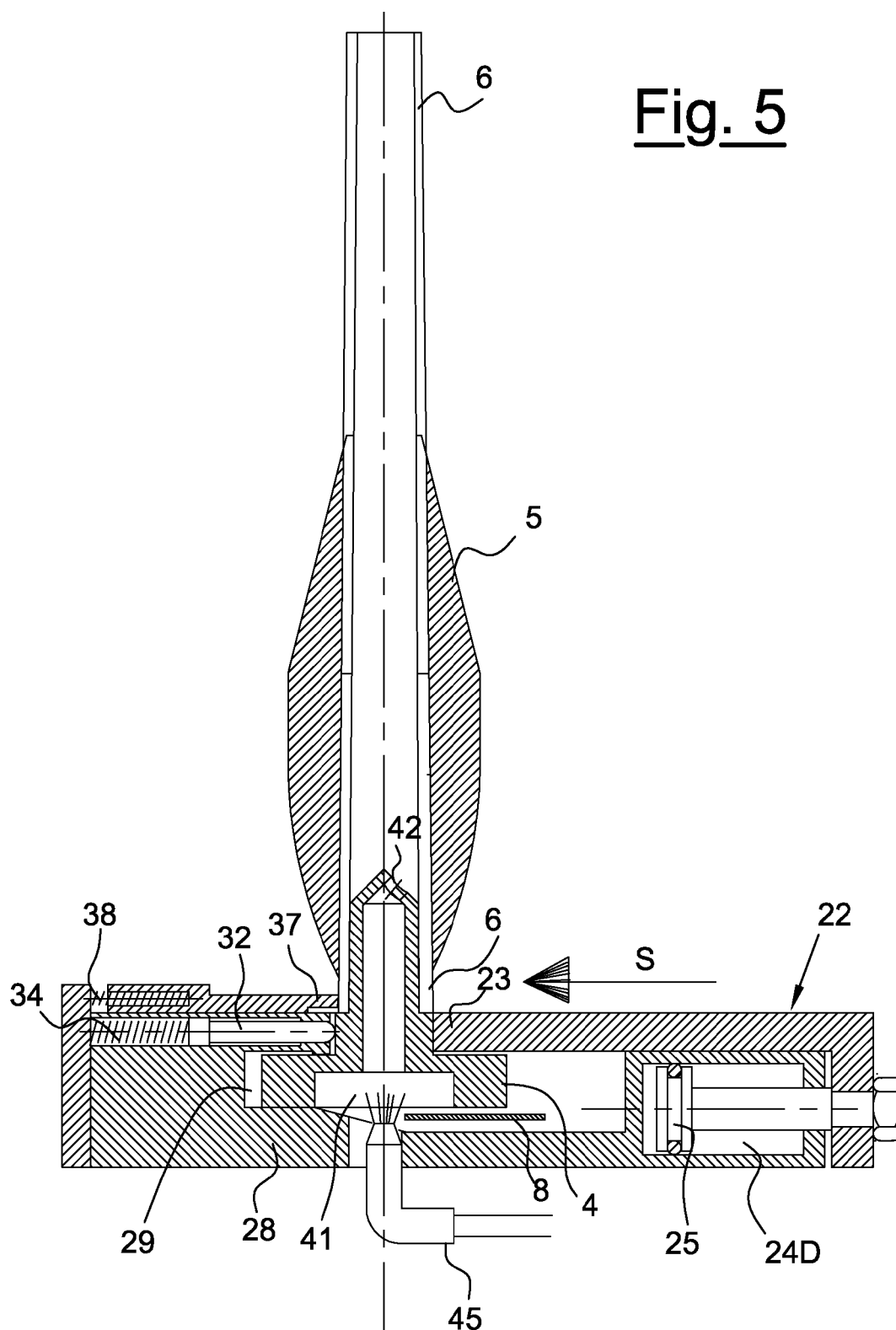
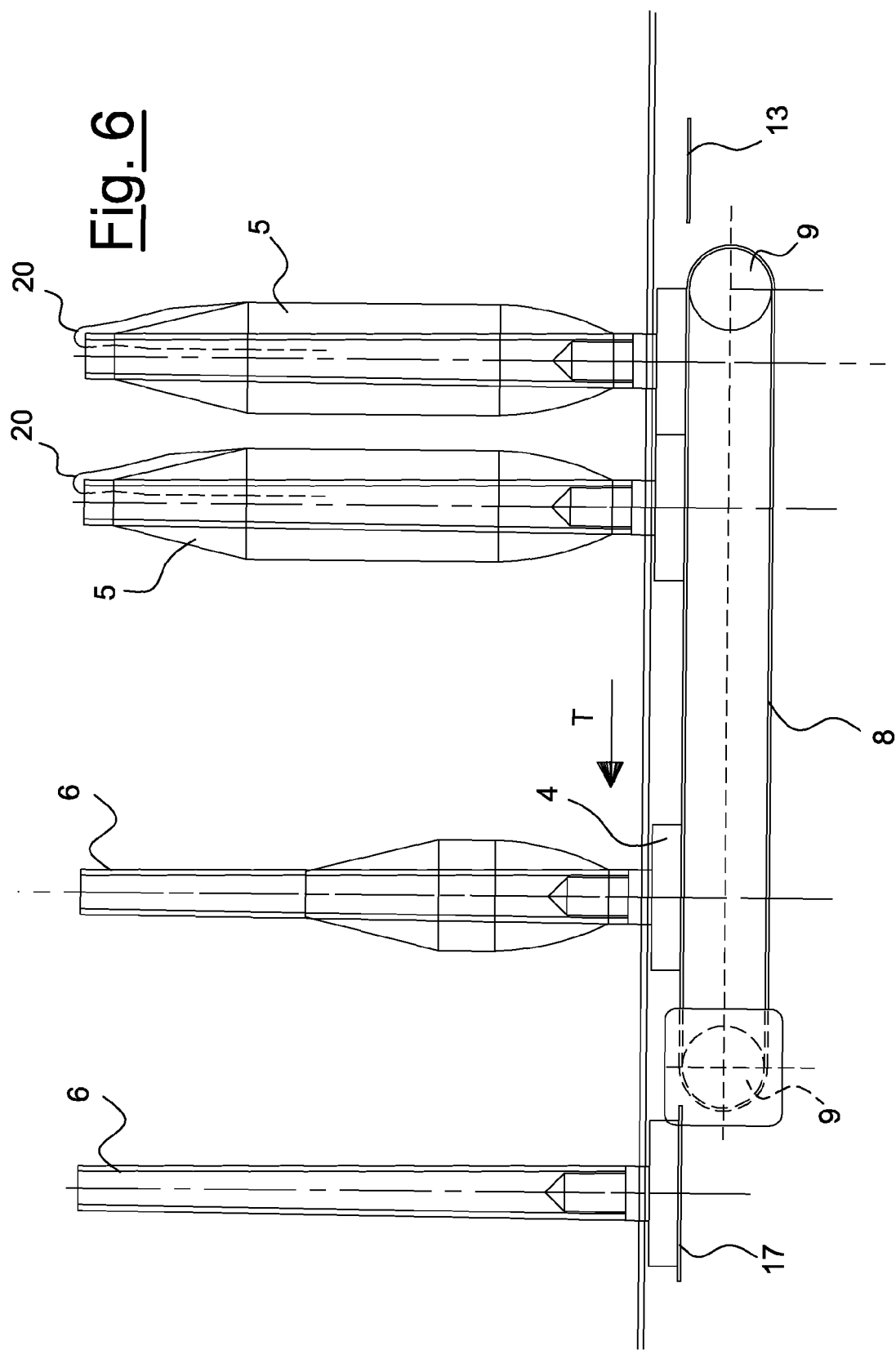


Fig. 5





REFERENCES CITED IN THE DESCRIPTION

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