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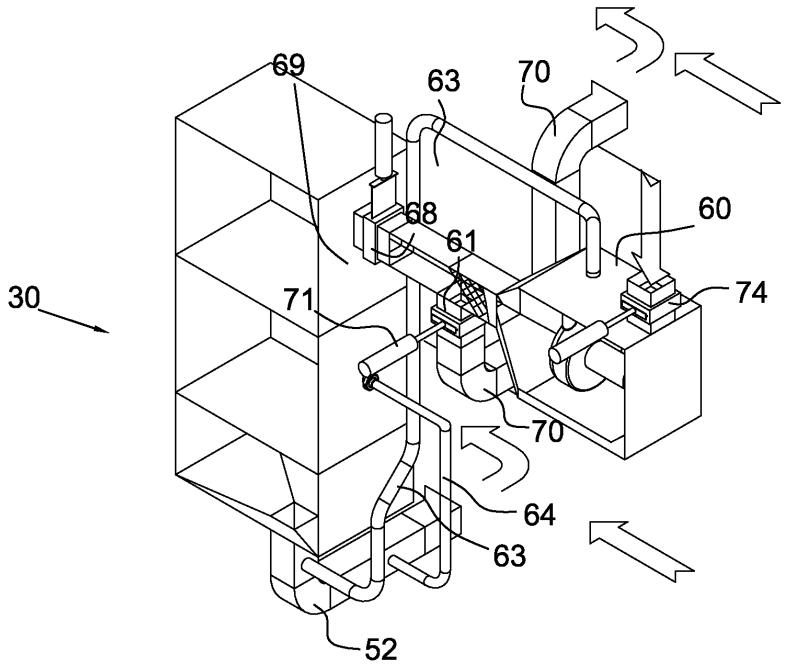
(54) Suction system for spoolers

(57) Spooler served by a suction system that provides both continuous low depression suction, for the dust removal service, and discontinuous high depression suction, for interventions for interruption and piecing of the thread and for starting a new spool, in which the discontinuous high depression suction is supplied by individual suction devices (60) with which each spooling unit (30) is equipped and only put into service for the time of the intervention cycle that is carried out by the unit itself.

Fig. 3C



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Description

[0001] The present invention refers to a suction device serving spooling stations of a 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 its 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] In order to clarify both the technical problems tackled and solved with the present invention and its characteristics and advantages with respect to the prior art, it is described with reference to the spooling process carried out in a spooler.

[0004] As known, spoolers consist of a plurality of spooling units aligned along the front of the machine and equipped with common control and service apparatuses.

[0005] The spooling unit is illustrated in its essential components in figure 1, omitting those not directly involved in the technical solution that constitutes the present invention. The feed spool 1 is unwound by picking up its thread 2. The thread 2 passes from the unwinding group that comprises thread guide members 3, the thread sensor or detector 4 and the thread tightener 5, generally consisting of a pair of interfacing spool carriers that press the unwinding yarn between them with regulated and controlled pressure. Along the path there is also the end joining device, known as thread piecing machine, to which the ends of interrupted thread needing to be pieced are taken by suction mouths 9 and 10, when the thread is interrupted by breaking or by intervention of the line clearer 11 that is located immediately downstream of the thread piecing machine. The spooled thread is collected in the reel 12, which is made to rotate by the roller 13, on which it rests supported with the reel-carrying arm 14, at a predetermined and substantially constant speed. The rotating reel 12 attracts the thread 2, unwinding it at high speed from the spool 1 kept still on a positioning pin 15.

[0006] The suction mouth 9 on the side of the spool can make the angular movement α that takes the suction nozzle of the mouth itself firstly to capture the end of the thread 2 from the unwinding group 3, to carry out, by lifting itself, the rotation α, taking the end to the thread piecing machine 6. The suction mouth 10 on the side of the mouth itself, before capturing the end of the thread 2 from the reel, on the other hand, is able to make the angular movement β that takes the suction nozzle of the mouth itself firstly to capture the end of the thread 2 from the reel 12, lowering with the rotation β, until the end of the reel side is taken to the thread piecing machine 6. Such a thread piecing machine, after having received and cut the two ends to size - eliminating the off-cuts and the pieces of thread, the so-called "lint", sucking them up at the mouths 9 and 10 - and having correctly aligned such prepared ends, then proceeds to piece them together. The thread piecing machine 6, with piecing complete, releases the thread and goes back into its spooling configuration from spool 1 to reel 12. The spooling process substantially consists of unwinding the feed yarn and of purifying it of its defective portions in terms of mechanical consistency or size. In its passage from the spool 1 to the reel 12, the yarn 2 is controlled from the line clearer 11 that detects its size defects, both the in the transversal direction and the in length. The line clearer 11 commands the cutting of the thread every time that the detected size of the thread 2 does not fall within the acceptable size range of the thread according to its calibration. The yarn cutting member can be incorporated into the line clearer 11 itself or, like in figure 1, it can be separate as scissors 7, shown arranged between the thread sensor 4 and the thread tightener 5.

[0007] After the thread 2 has broken or has been cut by the line clearer 11, the sensor 4 of the thread 2 indicates to the control unit 16 of the spooling station that there is no thread. The control unit 16, amongst its functions, includes the command and control programme for the reattachment procedure, with the connections indicated as an example with a broken line.

[0008] At the start of a new spool, it is necessary to pick up the end of the new spool that, in general, has already been positioned in a predetermined position: generally, it is slotted in the top of the cop of the spool. For this purpose the same mouth on the side of the spool 9 is used. Close to the thread tightener 5 a further small mouth 18, commonly known as "end delivery", is shown, which is in any case placed between the spool 1 and the cutting member, which can be included in the line clearer 11. Each time the thread is interrupted or cut, the end delivery mouth 18 captures the bottom end, i.e. of the thread on the side of the spool, and holds it taut between the thread tightener 5 and the unwinding group 3. From this position the mouth on the spool side 9 is able to take it and carry it to the thread piecing machine 6 to piece together the thread, after the elimination of the defective portion and to continue the spooling.

[0009] During spooling, unwinding the spools 1, which gradually lose their thread 2, a balloon rotating at a high speed is formed about the spool being worked and a substantial amount of dust, fibres and waste from the hairs of the thread is freed. A suction mouth 20 is placed in the vicinity of the spool 1 being unwound to take away and discharge such impurities.

[0010] As has been outlined up to now, the spooling units 30 that form the spooler require a significant suction service, the scheme of which according to a common technical solution in the state of the art is shown in an isometric view in figures 2A-C. Figure 2A illustrates the scheme of the structure of the individual spooling unit 30, the parallelepiped-shaped bulk of which is shown. On the one hand, it concerns a continuous service for sucking with the mouth 20, currently known as dust removal, which requires a low head suction, of the order of 5-10 mbar and with flow rates of the order of 50 mc/h. This

service involves an energy consumption of the order of 50-70 Wh per unit. This service can be ensured by a central unit that serves the entire front of the machine but, in general, it is carried out - as shown in figure 2B that shows a front view of a piece of many spooling units 30 - by fractioning such a service between a plurality of suction devices 31, in general 1 for every 8-12 spooling units, and as an example connected in figure 2 to eight of such spooling units 30 with connections 32 from the bottom to a short manifold 33, to ensure the uniformity between the eight units served, avoiding long pipes that would cause significantly less suction by the spooling units farthest away.

[0011] On the other hand, the suction services required to start the new spool 1 and for each piecing operation of the ends of the thread 2 due to the interruption of the thread by the line clearer, and that requires that they be sucked up with the mouths 9 and 10 as well as sucked up with the end delivery 18, are discontinuous and limited to the times of their intervention, lasting of the order of 1-4 seconds at a time. The frequency of the piecing of the thread during the course of the unwinding of a spool can vary within very wide limits, according to the quality of the thread and the calibration given to the line clearer 11.

[0012] Such discontinuous services with variable frequency require rather high suction heads, of the order of 60-90 mbar, to make the end capturing cycles and the waste discharge efficient and safe. In the most recent spoolers, this discontinuous service is centralised - as shown in figure 2C - into a single large suction device 35 with powers of the order of 7-20 kW according to the number of spooling units 30 that make up the spooler and connected with the pipe 36, providing the heads mentioned above and flow rates of the order of 4000-6000 mc/h: the flow rate and head of the suction device can be increased or decreased by modifying the number of revolutions given to the suction device itself, with the relative increase or decrease in power to be supplied to the actuation motor. Each spooling unit is connected to the general pipe of the high head suction device with the interposition of valves, for example electrovalves, which are opened just for the duration of the required suction when it makes its interventions on the ends of the thread, thus taking the suction that is needed for the time needed.

[0013] In the scheme of figure 2A and 2C, the suction device for serving the end delivery mouth 18 is connected to the pipe 36 of the high depression suction device with the piping 37 intercepted with the valve 38, whereas for the suction device for the mouths 9, 10 for serving the thread piecing machine 6, the connection is made with the piping 40 intercepted with the gate valve 41. Such valves 38 and 41 are therefore opened just when the spooling unit needs high depression suction and are kept closed at all other times. During spooling, the control of such suction, with the opening and closing of the electrovalves 38, 41, is always performed by the control unit 16 of the spooling unit. At the end of the suction pipes 33, 36 and before reaching the respective suction device 31, 35, a filter 43 for the dust that comes from the low depression dust removal and a filter 44 for the so-called "lint", produced in the intervention cycles of the line clearer and that are taken away by the high depression suction, are respectively arranged. These filters are arranged in low-speed areas of the pipes, known as calm areas, in which speeds are kept to 1-2.5 m/sec; they are periodically cleaned of the captured material so as to limit the load loss in their suction channel.

[0014] This scheme for carrying out the suction service is not without drawbacks. For example, long machines suffer from the lack of uniformity of suction for the various units of which they consist. The energy consumption for the high depression service, always kept running, is substantial. The efficiency of the discontinuous suction is negatively influenced when many spooling units require the service simultaneously: for example when a new batch is started, or when the spooler is started back up after a stop. It is not possible to modulate the suction values of the individual spooling unit, according to its operating parameters (count of the yarn, how far the reel has advanced, detection of low efficiency in capturing the ends and in piecing, and so on). There is not the flexibility that would be advantageous to work many batches of yarn simultaneously.

[0015] The present invention is aimed at a new suction scheme for serving the spooler that overcomes the drawbacks described up to now. The present invention, in its most general embodiment of a suction device serving the spooling units that make up the spooler is defined in the first claim. Its variants or preferred embodiments are defined in the dependent claims from 2 to 12.

[0016] The characteristics and advantages of the suction device for serving the spooler according to the present invention shall become clearer from the description, given as a non-limiting example, of a typical embodiment thereof, illustrated in figures 1 to 3.

[0017] Figure 1 illustrates the side view of the spooling unit and highlights the technical problem of the suction service to be supplied to it. Figures 2A-C show the scheme of a suction service illustrating the state of the art. Figure 3 illustrates the scheme of the suction device according to the present invention for serving a spooler. Figure 3A shows the two centralised suction devices for serving the spooler in an isometric view and figure 3B shows them in a front view. Similarly, figures 3C, 3D show respective isometric and front views of the scheme of the suction system of the individual spooling unit 30, the parallelepiped-shaped bulk of which is shown.

[0018] In the technical solution shown in figures 3A, B, C, D for continuously serving suction with the mouth 20 for dust removal, a central suction unit 50 is foreseen that serves all of the spooling units of the front of the machine with a large pipe 51 that runs for the entire length of the front of the spooler. Such a pipe 51 acts as a manifold of all of the mouths of the dust removal service that connect to it with pipe fittings 52. The power of such a low

head suction device is 2-3 kW and provides a head of 10-14 mbar, with a flow rate of 3000-5000 mc/h, depending upon the number of units of the spooler. Similarly to the scheme of figure 2, at the end of the suction pipe 51 for dust removal a filter 54 is arranged before the suction unit 50 for the fibres and dust that come from the low depression dust removal.

[0019] Unlike the scheme of figures 2A-C, in the suction system for spoolers according to the present invention the suction service for the end delivery mouth 18 is exerted continuously by connecting said mouth to the low depression suction device and sucking continuously, instead of just during interventions.

[0020] Figures 3C, D illustrate the scheme of the structure of the individual spooling unit 30, the parallelepiped-shaped bulk of which and the components of the suction service are shown. The discontinuous suction services, required for the mouths 9 and 10, on the other hand, are performed by a series of small suction devices 60 - one for each spooling unit - arranged to serve the individual spooling unit and always commanded by its control unit 16, which are only enabled for the time of the intervention cycle that is carried out by the unit itself.

[0021] The individual suction devices 60 have an indicative unitary power of the order of 1 kW, with a flow rate of 150 mc/h and a head of the order of 100 mbar. They are each equipped with a filter 61 for the "lint", taken away by the high depression suction by the suction device 60, which holds them upstream of the suction device itself. The individual suction device 60 may discharge its lot through the delivery pipe 63 directly to the atmosphere as the great part of the fibrous material suctioned remains in the filter 61. According to an improved embodiment of the present invention, illustrated in figures 3A-C, the delivery pipe 63 of the individual suction devices 60 opens out into the respective pipe fittings 52 that connect to the pipe 51, collector of the waste from the dust removal service, which thus also discharges the flows of the individual suction devices 60. The individual suction devices 60 serve their spooling unit 30 and are connected to its mouths 9, 10 with the piping 67 intercepted with the valve 68. The continuous service of the end delivery mouth 18, on the other hand, is connected with the piping 64 to the pipe fitting 52 with the low depression suction. Such a provision allows the dust and hair that is freed by friction in the thread tightener 5 to be sucked up and eliminated.

[0022] The valve 68 is therefore only opened when the single suction device 60 is placed in operation and remains closed during normal spooling.

[0023] The high head centralised suction service is reduced by a lot. A suction device 80 with a power of the order of 1-1.5 kW serves the spooling units that make up the spooler connected with the pipe 81, providing heads of the order of 100 mbar and flow rates of the order of 150 mc/h. Each spooling unit is connected to the general pipe of the high head suction 81 upstream of the respective filter 61, with a fitting 70 and with the interposition of valves 71, which are opened just for the cleaning of the filters 61 with which the individual units are equipped from the lint and from the dust that has accumulated in them. During cleaning the valves 65 and 68 for connection to the spooling unit are kept closed, avoiding the high depression centralised suction for cleaning the filters from affecting the spooling unit 30 in its normal operation. The suction time needed to clean the filters 61 with which the individual suction devices are equipped is of the order of 1-3 seconds.

[0024] Such cleaning is carried out on the individual suction devices 60 during the time when they are not operating, i.e. outside of the intervention cycles. It can be carried out at the end of the operation of the individual suction device 60, so as to take away the dirt deposited in the filter during the intervention that has just ended each time. In this case a pneumatically-controlled guillotine gate can be used, activated to open by the rotation of the same motor of the individual suction device, at the end of its actuation of the suction device. According to an alternative embodiment, cleaning can be carried out by the control unit of the spooler for one or more, and in any case not many, spooling units 30 at a time, preferably according to a programmed cycle independent of the interventions of their suction device 60, thus distributing the cleaning service in sequence between the spooling units 30.

[0025] On each individual suction device 60 with which the spooling units 30 are equipped an air intake valve 74 is mounted. It is normally kept closed both during the interventions of the line clearer and during normal spooling and is opened during cleaning of its filter 61, to allow the flow of air necessary to remove the lint from said filter through the connection to the high depression duct 81 opening the valve 71. The opening and closing command of the air intake valve 74 is thus associated with the same opening and closing command of the valve 71.

[0026] At the end of the suction pipe 81, before reaching the high depression centralised suction device 80, a filter 82 is arranged for the lint produced in the intervention cycles of the line clearers of the individual units 30, periodically taken away by the high depression centralised suction.

[0027] Similarly to the scheme of figure 2, the filters 54, 82 are arranged in calm areas and are periodically cleaned of the captured material so as to limit the load loss in the intake manifold.

[0028] According to an improved embodiment of the present invention, the control of the suction device 60 with which each individual spooling unit is equipped is actuated independently for each spooling unit 30; such control can thus be varied by its control unit 16 according to the state and the needs of the individual unit 30, modulating its operating suction parameters (preset or measured instantaneously): for example the frequency of red call lights for the operator due to the ends not being captured, defective spools, missing joins, and so on.

[0029] Compared to suction systems available in spoolers according to the prior art, the suction system

according to the present invention offers substantial advantages.

[0030] With the technical solution according to the present invention long machines do not suffer from the lack of uniformity of the suction for the various spooling units that make them up. The energy consumption for the high depression service to the individual spooling units is limited to the times of the intervention for the individual suction devices 60, whereas the centralised high depression suction service is used just to clean the individual filters 61 and requires limited consumption. The efficiency of discontinuous local suction is not at all influenced by the number of spooling units that simultaneously require service: the machine simply takes more energy from the main for the time needed.

[0031] The suction values of the individual spooling unit, according to its operating parameters, can easily be modulated according to the contingent need of the individual unit, or else with the required flexibility to simultaneously work many batches of yarn on the same machine.

[0032] The technical solution according to the present invention and illustrated with reference to figure 3 - in addition to the advantages of efficiency and quality outlined above - also allows a significant energy saving for the suction, which is of the order of 20-40% less than the scheme of figure 2, depending upon the number of spooling units that make up the machine. As for the manufacturing costs, referring to the suction unit, the saving allowed by the technical solution according to the present invention is of the order of 15-30% less compared to the scheme of figure 2.

Claims

1. Spooler consisting of a plurality of spooling units (30) aligned and served by a suction system that provides both continuous low depression suction, with mouths (20) arranged at the spool (1) for the dust removal service, and discontinuous high depression suction, with mouths (9, 10) for interventions for interruption and piecing of the thread (2) and for starting a new spool (1), **characterised in that** the discontinuous high depression suction is supplied by the individual suction devices (60), arranged to serve the individual spooling unit (30) and commanded by its control unit (16), which are only put into service for the time of the intervention cycle that is carried out by the unit itself, said individual suction devices (60).

2. Spooler according to claim 1, **characterized in that** the discharge of the lot of the individual suction devices (60) is carried out in the collector (51) of the waste of the dust removal service.

3. Spooler according to claim 1, **characterised in that** the continuous low depression suction is supplied with a central suction unit (50) that serves all of the spooling units with a pipe (51) that acts as a manifold both of the mouths (20) of the dust removal service as well as of the deliveries of the individual high depression suction devices (60).

4. Spooler according to claim 3, **characterised in that** the continuous low depression suction provided by the central suction unit (50) that serves all of the spooling units (30) with the pipe (51) and the fittings (52) also serves end delivery mouths (18) with which said spooling units are equipped to capture its bottom end, i.e. on the side of the spool (1), each time the thread is interrupted.

5. Spooler according to claim 1, **characterised in that** the individual suction devices (60) are each equipped with a filter (61) for the waste yarn, which holds it upstream of the suction device itself, and **in that** a high head centralised suction device (80) serves the spooling units that make up the spooler with a pipe (81), for cleaning the filters (61) with which the individual units are equipped, when their individual suction devices (60) are not operating.

6. Spooler according to claim 5, **characterised in that** the high head centralised suction device (80) is connected to the spooling units (30) with the interposition of valves (71), which are only opened for the cleaning of the filters (61) with which the individual suction devices (60) are equipped, whereas the valves (65) and (69) for connecting the mouths (9, 10, 18) of the spooling unit are kept closed.

7. Spooler according to claim 1, **characterised in that** the individual high depression suction devices (60) provide follow rates of 150 mc/h with a head of the order of 100 mbar.

8. Spooler according to claim 3, **characterised in that** the centralised low depression suction device (50) provides a head of 10-14 mbar, with flow rates of 3000-5000 mc/h.

9. Spooler according to claim 6, **characterised in that** the valves (71) for connection to the high head centralised suction device (80) for cleaning the filters (61) are made to open by the rotation of the same motor of the individual suction device (60), at the end of its actuation for said suction device.

10. Spooler according to claim 6, **characterised in that** the valves (71) for connection to the high head centralised suction device (80) for cleaning the filters (61) are opened upon the command of the control unit of the spooler for one or more spooling units (30) at a time, according to a programmed cycle independent of the interventions of their suction device

(60), distributing the cleaning service in sequence between the spooling units (30).

11. Spooler according to claim 6, **characterised in that** the individual suction device (60) is equipped with an air intake and **in that** the opening and closing command of the air intake valve (74) is thus associated with the same opening and closing command of the valve (71) to clean the filters (61).

12. Spooler according to claim 1, **characterised in that** the individual suction devices (60) are each commanded independently for each spooling unit (30) by its control unit (16) according to the state and the needs of the individual spooling unit (30).

Fig. 1

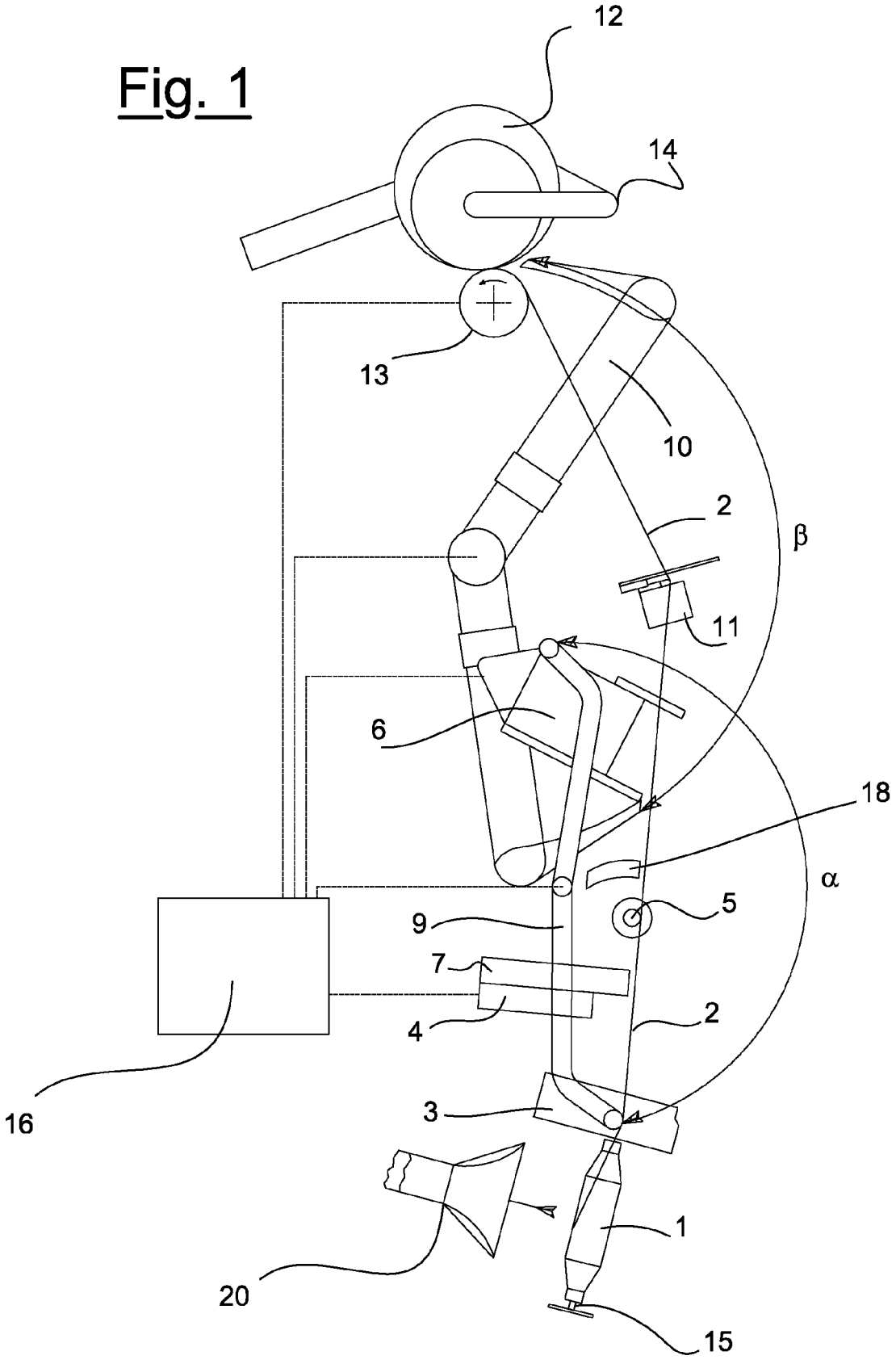
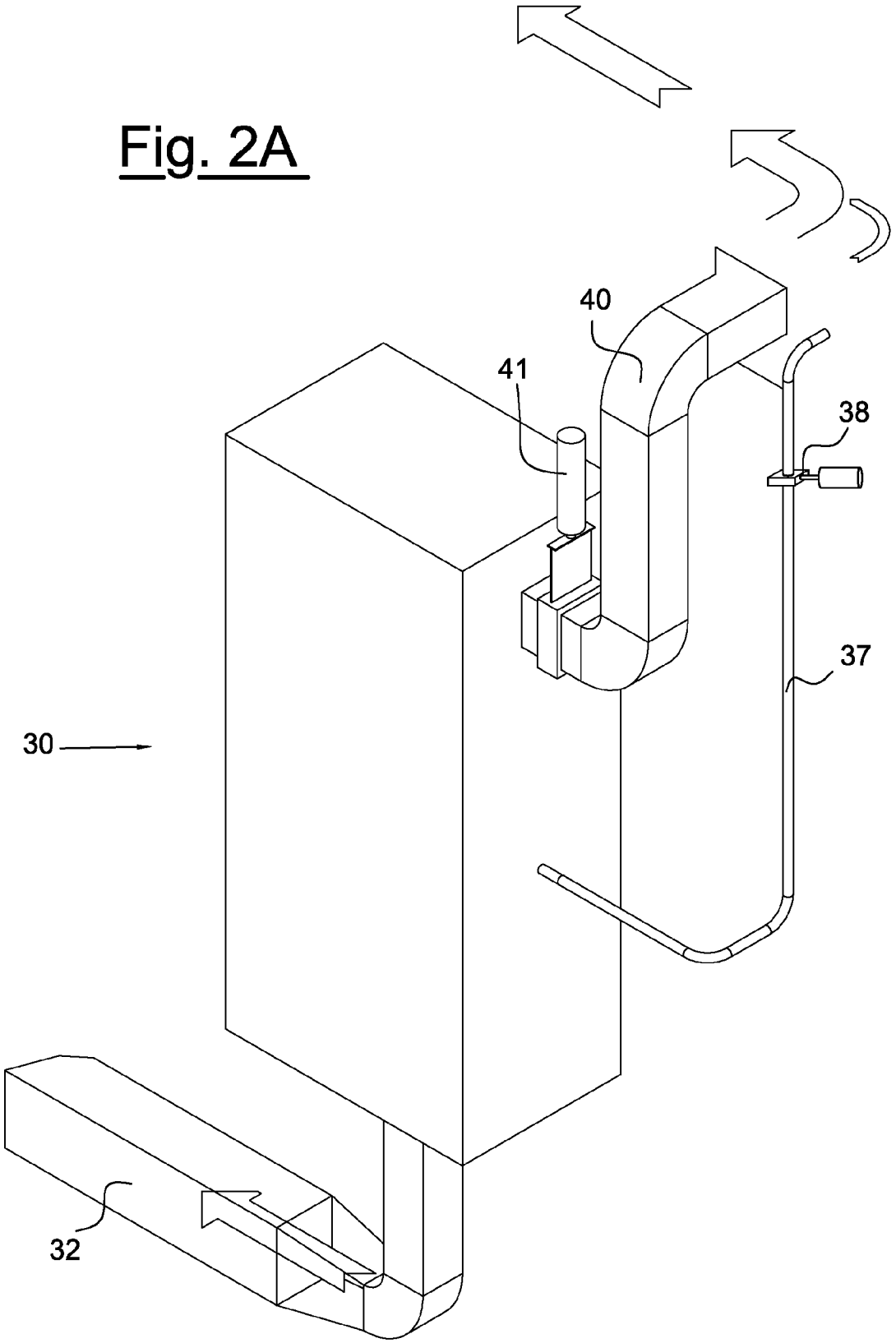


Fig. 2A



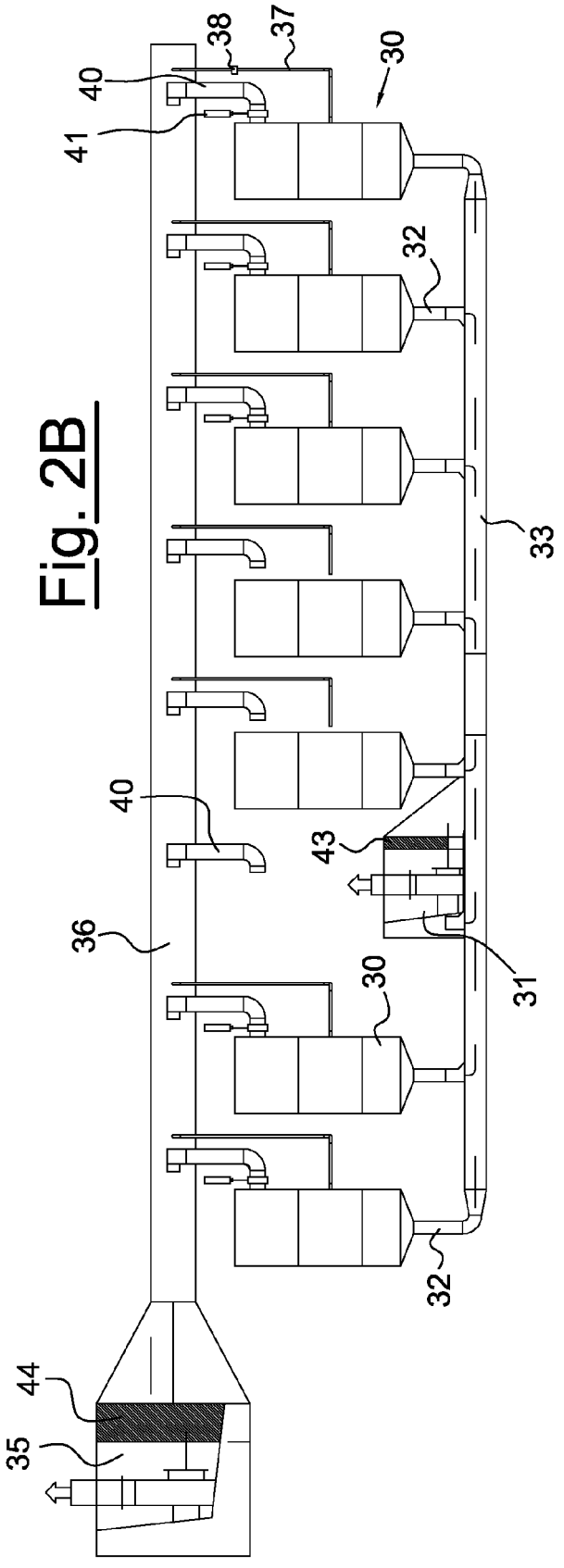
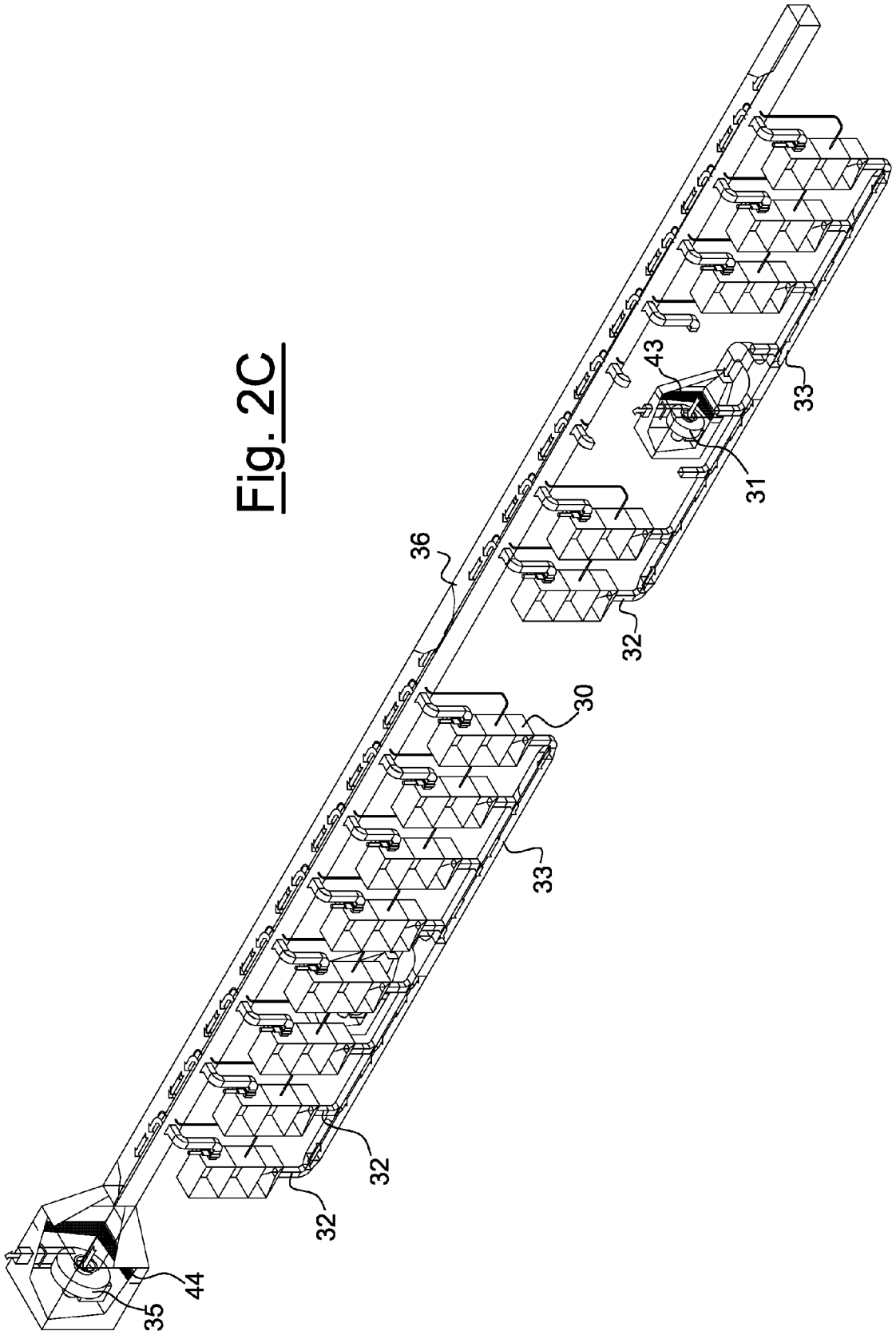


Fig. 2B

Fig. 2C



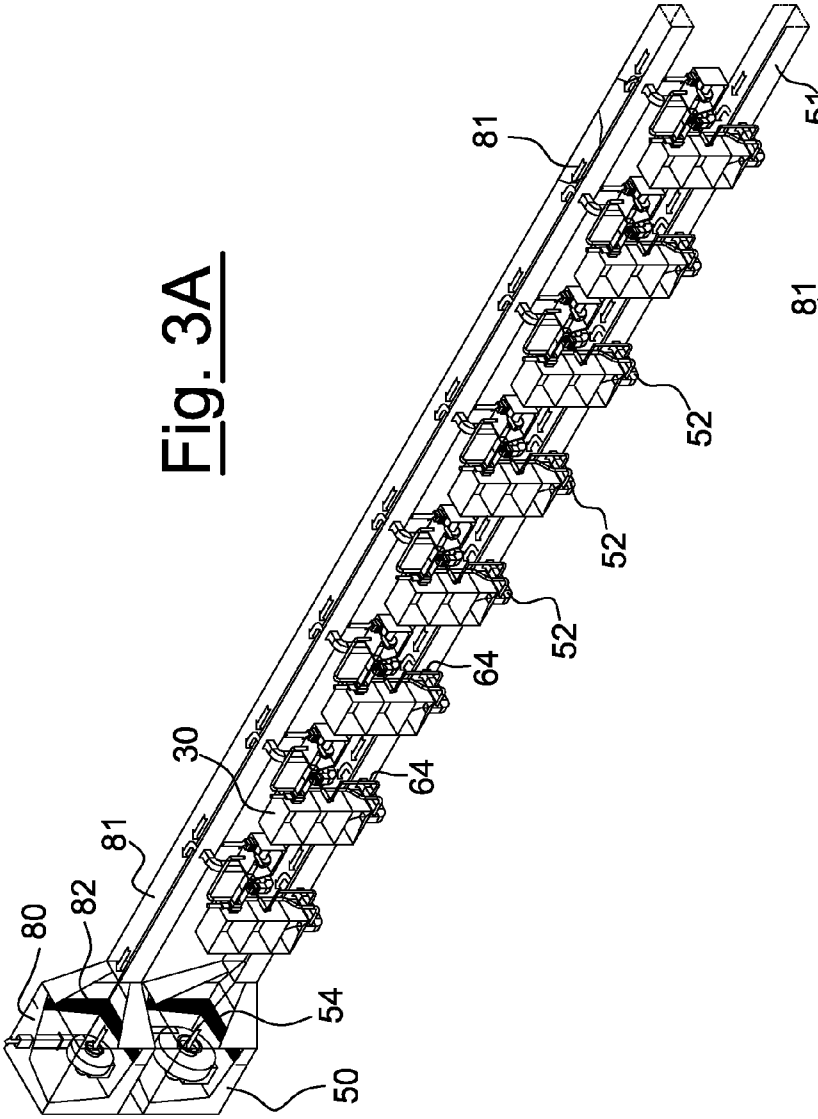

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Fig. 3A

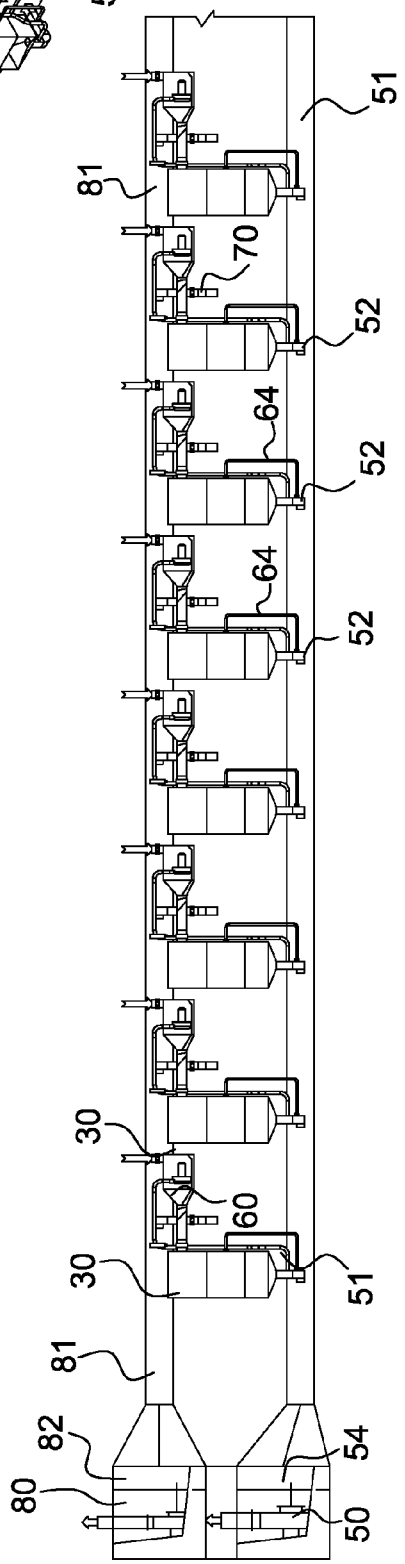
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Fig. 3B

Fig. 3D

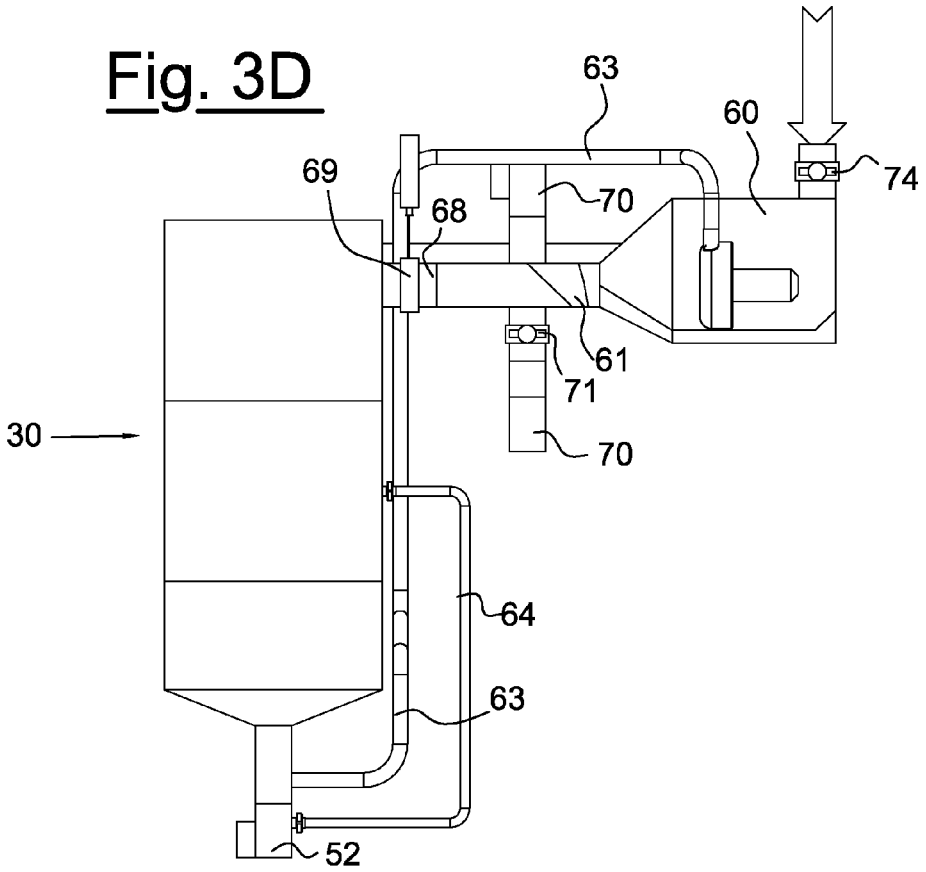
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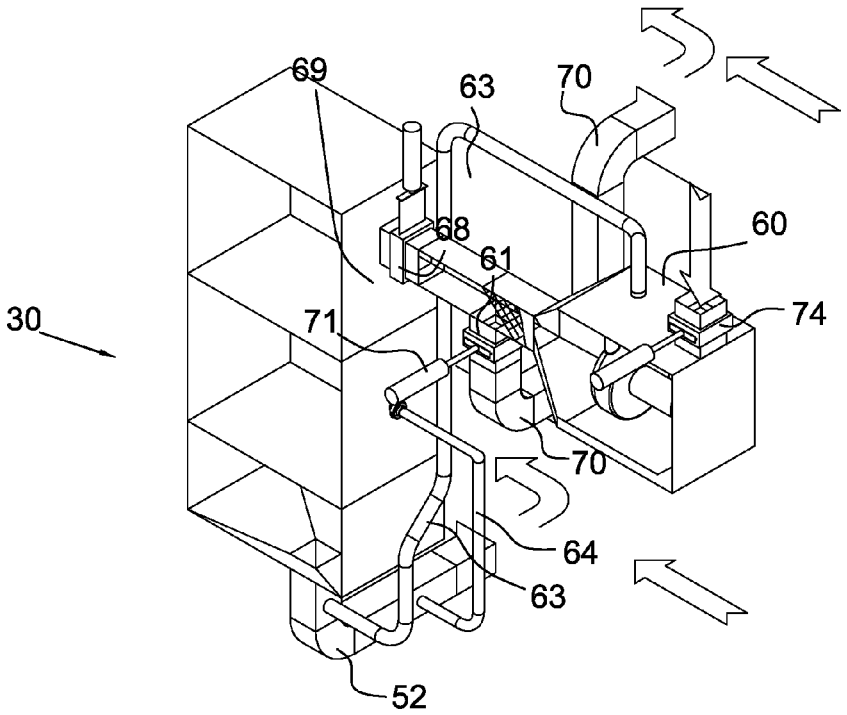
Fig. 3C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