



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.07.2009 Bulletin 2009/30

(51) Int Cl.:
D01H 1/28 (2006.01) **D01H 1/32** (2006.01)
D01H 9/04 (2006.01)

(21) Application number: **08171104.6**

(22) Date of filing: **09.12.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(30) Priority: **17.12.2007 IT MI20072353**

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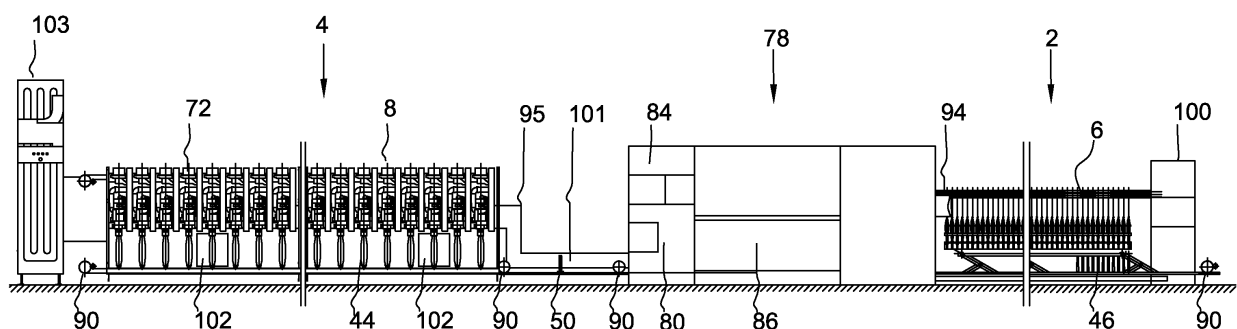
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(54) **Integrated yarn-winder machine**

(57) An integrated yarn-winder machine comprising a spinning unit (2), provided with a plurality of spinning stations (6) each capable of achieving the winding of a yarn (34), obtained starting from a sliver (10), on a bobbin (44), a winding unit (4), provided with a plurality of winding stations (8) each capable of unwinding the yarn (34) from the bobbin (44) and to rewind it on a package (72), and means for the transport of the bobbins (44) replete with yarn (34) from the spinning stations (6) towards the winding stations (8) and for the transport of the empty tubes (46) from the winding stations (8) towards the spinning

stations (6). The yarn-winder machine comprises a single management and control group (78) containing all the control equipment and the service devices adapted to simultaneously ensure the functioning of the spinning unit (2), of the winding unit (4), of one or more service modules (100) dedicated to the spinning stations (6), situated along the sides of the spinning unit (2), and one or more service modules (101, 102, 103) dedicated to the winding stations (8), situated along the sides of the winding unit (4). The yarn-winder also comprises a centralised suction unit (86) with two reduced pressure stages connected in series with each other.

Fig. 3



Description

[0001] The present invention refers to an integrated yarn-winder machine.

[0002] In industrial practice, the yarn production technique is widely prevalent that includes a first stage of ring spinning which produces bobbin yarn, followed by a second winding stage in which the yarn is unwound from its bobbin, cleaned of its defects and rewound in a package, which contains a much greater yarn quantity and which corresponds to a considerable number of processed bobbins.

[0003] As is known, a spinning unit or spinning frame is composed of a plurality of spinning stations aligned along its faces. Every spinning frame face is composed of hundreds of such stations which commonly derive their driving from motors which actuate longitudinal axes, and their functions from dispenser units which distribute them along the machine. In turn, also the winders are composed of a plurality of winding units aligned along the face of the machine, also provided with their own common control and service equipment.

[0004] The transfer between the two processing stages, i.e. the bobbins replete with yarn from the spinning frame to the winder, and the transfer of their empty tubes from the winder to the spinning frame, generally occurs by means of a system which provides for the movement of the bobbins and the tubes along a continuous path which extends around the spinning unit and the winding unit, employing peg supports to be placed on conveyor belts or similar movement members, so to individually bear each bobbin or each tube.

[0005] The winding processing is much faster than the spinning, and thus a small quantity of winding stations or units, on the order of several dozen, is capable of completing the production of a great number of ring spinning units, on the order of several thousand. Generally, in order to complete, within a certain margin, the entire production without dead times, a spinning frame is coupled to a winder having hourly winding capacity that considerably exceeds the spinning capacity of the spinning frame.

[0006] Overall, the two machines, i.e. the spinning frame and the winder, are generally made by different manufacturers, and are achieved with highly standardised configurations. Their mechanical production type thus results dissimilar, along with the various optimised management, logic and functioning programs (work and production cycles).

[0007] These differences in particular regard, in most cases, both the program architecture (software), and the electronics instrumentation (hardware) composed of electronics processors, programmable logic controllers (PLC), and/or process transducers.

[0008] In order to achieve their presetting for the connection, the two machines thus require various modifications, including:

- mechanical and structural modifications of the respective ends, so to be able to allow the most rational and simplest possible connection, always keeping in mind market logic, i.e. that every spinning frame can be connected with any winder and vice versa;
- electrical and electronic modifications of communications and signal exchange, comprising the interfacing logics and the related management programs (for example at the start and end of the run, machine shutdown, troubleshooting, etc.);
- pneumatic modifications, with related interfacing logics.

[0009] In this manner, every machine affected by the connection, in addition to maintaining its essential structural characteristics, is further complicated by one or more additional components in order to allow such connection.

[0010] The object of the present invention is therefore that of making an integrated yarn-winder capable of overcoming all the problems related to the mechanical and functional connection of a spinning frame and a winder according to the prior art.

[0011] This object according to the present invention is achieved by making an integrated yarn-winder machine as set forth in claim 1.

[0012] Further characteristics of the invention are shown in the subsequent claims.

[0013] The characteristics and advantages of an integrated yarn-winder machine according to the present invention will be more evident from the following exemplifying and non-limiting description, referred to the attached schematic drawings in which:

Figure 1 illustrates, in its essential components, a single spinning station belonging to an integrated yarn-winder machine according to the present invention;

Figure 2 illustrates, in its essential components, a single winder station belonging to an integrated yarn-winder machine according to the present invention; Figure 3 illustrates, in side elevation and partial section view, a preferred embodiment of an integrated yarn-winder machine according to the present invention;

Figure 4 is another partial cross section view of the integrated yarn-winder machine shown in figure 3; Figure 5 illustrates, in side elevation and partial section view, an electro-suction unit which equips an integrated yarn-winder machine according to the present invention; and

Figure 6 is another partial section view of the electro-suction unit of figure 5.

[0014] With reference in particular to figure 1, the conventional functioning scheme is shown overall of a generic spinning station 6 belonging to the spinning unit 2 of an integrated yarn-winder machine according to the

present invention.

[0015] The sliver 10 comes from a package hung above the spinning station 6, not indicated in the figure for the sake of simplicity, and is first brought forward to a drafting unit 12. It generally consists of a plurality of members for driving the sliver 10 at increasing linear speeds; the driving members gradually refine the sliver by making the sliver fibres slide between them. In figure 1, the drafting group 12 is depicted as an example with an initial pair of strips 14 and 16, of which the lower strip 14 is driven in movement by a knurled segment 18 of a longitudinal bar 20, shared with the adjacent spinning stations 6 and rotating in accordance with the arrow A.

[0016] The path of the lower strips 14 is approximately triangular and is determined by a common terminal bar 22 which is longitudinally extended. The upper strip 16 is idle and is driven in motion in accordance with the arrow B by the underlying strip 14, on which it is pressed by an upper support, not indicated in figure 1 for the sake of simplicity. Also the path of the upper strip 16 is approximately triangular and is determined by a roller 24 and by a fixed terminal bar 26.

[0017] Downstream of the strips 14 and 16, there is a pair of drafting rollers 28 and 30 which impart the final drafting to the sliver 10, since they are provided with a linear speed greater than the preceding pair of strips 14 and 16. More precisely, the lower roller is composed of a grooved segment 28 of a longitudinal bar 32, shared with the adjacent spinning stations 6 and rotating in accordance with the arrow C. The upper counter-roller 30 is idle and is also pressed by an upper support, not indicated in figure 1, against the roller segment 28 which drives it in rotation in accordance with the arrow D, with the refined sliver 10 interposed between them, giving rise to the yarn 34.

[0018] The yarn 34 first passes into a fixed thread guide 36, typically in spiral form, and from here into a small rotating ring 38 which rotates on a fixed ring 40 borne by a ring-rail 42 shared with the adjacent spinning stations 6, continuously moved in accordance with the arrow E in two directions, to continuously lift and lower all the fixed rings 40 of the single spinning stations 6 and to distribute the yarn 34 winding onto a bobbin 44 wound on a related tube 46. The tube 46 is fit on an underlying rotating spindle (not shown) driven in rotation at high speeds, which currently are in the range of 10,000 ÷ 20,000 rpm. In general, such driving is carried out with longitudinal drive belts which slidably engage the lower part of the bobbin carrier spindle.

[0019] With every rotation of the spindle, i.e. of the bobbin 44, the yarn 34 released by the drafting group 12 is drawn so to be wound on such bobbin 44. Substantially, a twisting turn of the yarn 34 is generated, which drives in rotation the rotating small ring 38, although with a slight delay due to its friction with the guide ring 40. If the spindle rotates at N revolutions per minute and the cylinders 28 and 30 release L meters per minute of drafted sliver (yarn) 34, except for shortening due to twisting, the twists T

applied to a meter of produced yarn 34 result equal to N/L.

[0020] The yarn 34 rotates in a whirling manner around the bobbin 44, forming the so-called "balloon" due to the centrifugal force. The balloon is due to significant stress on the yarn 34 and can be limited with a containment ring 48, in general with slightly greater diameter than the transverse size of the bobbin 44. The balloon containment ring 48 is firmly mounted on a platform or rail thereof, capable of vertical travel movements which in any case keep it above the level of the ring-rail 42.

[0021] The yarn 34 twisting is caused by the rotation of the bobbin 44 and extends, together with the relative stresses, up to the point at which the sliver 10 of the yarn 34 is released by the final drafting cylinders 28 and 30.

[0022] In order to wind the yarn 34 thus twisted on the bobbin 44 in a regular manner, as the bobbin progressively forms, it is necessary to distribute it on the bobbin 44 at different heights, continuously changing the level of the rotating small ring 38 borne by the ring-rail 42, continuously moved in accordance with the arrow E in two directions, and modulating the deposition so to continuously lift the average travel point of the arrow E itself. The deposit of the yarn 34 on the bobbin 44 generally starts in the lower part of the bobbin 44 and rises upward in overlapped layers with conical progression, layers obtained with a series of slow, ascending movements of the ring-rail 42 following by sudden and slightly shorter descending movements. The object of such bobbin 44 winding mode is essentially that of giving a tapered shape to the bobbin 44 itself, such that it results compact, so that it does not break up during its unwinding, and so that the yarn 34 is unwound, substantially unwinding layer-by-layer from its upper conical part.

[0023] Once the winding of the yarn 34 on the bobbin 44 has completed, it is doffed from the relative bobbin carrier spindle and is then deposited on one of the pins 50 of a suitable peg/plate support 52 (figure 2), belonging to a transport system which acts as a carrier of the full bobbins 44 and empty tubes 46 from and towards the single winding stations 8 belonging to the winding unit 4 of the integrated yarn-winder machine according to the present invention.

[0024] Each winder station 8, schematically shown in figure 2, is therefore capable of drawing a single bobbin 44 replete with yarn 34, for unwinding such yarn 34, and sending it to an unwinder group which comprises thread guide members 54, a yarn presence detector or sensor 56 and a yarn tensioner 58, generally composed of a pair of facing plates which press the unwinding yarn 34 between them with regulated and controlled pressure. Along the ascending path of the yarn 34, a yarn tail junction device 60 is present, currently called "splicer", to which the yarn tails of the yarn 34 are brought when they may have been cut by an accidental breaking or by the intervention of the so-called clearer 62 which is situated immediately downstream of the splicer 60; such yarn tails are spliced by means of an air suction system 64 and 66 movable between an operative position and a rest posi-

tion.

[0025] The clearer 62 is a device of mechanical, electronic or optical type, capable of detecting size defects (both transverse and length) of the yarn 34. The clearer 62 then commands the cutting of the yarn 34 every time that its detected size does not come within the range of the acceptable sizes of the yarn 34 itself, on the basis of its calibration. The member which cuts the yarn 34 can be incorporated in the same clearer 62, or as shown for example in figure 2 it can be separated and made in the form of scissors 68 placed between the sensor 56 of the yarn 34 and the yarn tensioner 58.

[0026] Following a breakage, or a cutting of the yarn 34 commanded by the clearer 62, the sensor 56 of the yarn 34 signals the absence of the yarn 34 to the governing unit 70 of the winding station 8. The governing unit 70 in fact comprises, among other functions, a drive and control program for the re-attachment process by means of the splicer device 60, with the connections shown as an example with dashed lines in figure 2.

[0027] The yarn 34 is then collected in a package 72, which is driven into rotation at predetermined and substantially constant speed by a roller 74, on which a package carrier arm 76 is supported in an abutting manner. The rotating package 72 draws the yarn 34, unwinding it at high speed from the bobbin 44 kept stopped on the positioning pin 50 of the relative peg/plate support 52.

[0028] According to the invention, with particular reference to figure 3, the integrated yarn-winder machine comprises a single master management and control group 78 containing all the command equipment and service devices adapted to simultaneously ensure the functioning of the spinning unit 2 and the winding unit 4 present on the machine itself, of the service modules 100 dedicated to the spinning stations 6, situated along the sides of the spinning unit 2, of one or more service modules 101, 102, 103 dedicated to the winding stations 8, situated along the sides of the winding unit 4.

[0029] The service module 100, for example, is dedicated to the motion transmission to the command of the drafting units 12, for the interlock of the spinning stations 6, respectively in the case of short or long spinning unit 2. The service module 101 is dedicated to the physical connection between the spinning unit 2 and the winding unit 4. The service module 102 is dedicated to the station for the search of the bobbin 44 yarns. The service module 103 is dedicated to storing and sending the cones on which the packages 72 are wound to the winding stations 8. Other modules can also be provided, dedicated to different objects for interlocking the spinning unit 2 and the winding unit 4.

[0030] More precisely, the management and control master group 78 or control head, which can be arranged at one of the two heads or free ends of the integrated yarn-winder machine, or preferably in intermediate position between the spinning unit 2 and the winding unit 4, as shown in figure 3, is provided with a single electrical drive and control panel 80, operatively connected to the

different control and service motors of the spinning unit 2 and to the different control and service motors of the winding unit 4.

[0031] The management and control group 78 moreover comprises a single electronic processor 84, provided with an electrical and electronic logic interface unit for the setting and sending of functioning data to the command and control devices of the spinning unit 2, of the winding unit 4 and of the service modules 100, 101, 102 and 103, and of a single software packet, with consequent improved management and programming simplicity with respect to the separate control heads of the spinning frames and winders according to the

prior art.

[0032] Also present on the management and control group 78 is a centralised suction unit 86 with two reduced pressure stages connected in series with each other, composed of a first stage with high flow rate and average reduced pressure, set to collect and capture the fibres, yarns and dust coming from the spinning unit 2 by means of a suction and capture channel 94, and by a second stage with low flow rate and strongly reduced pressure for the suction of the yarn tails of the bobbins 44 and the packages 72 in the individual winding stations 8 and for the search of the yarns of the bobbins 44 in the service module 102, by means of a suction and capture channel 95.

[0033] The two reduced pressure stages of the centralised suction unit 86 (figure 5) are respectively constituted by two electro-suction devices 91 and 92 connected together in series. In detail, the first stage is constituted by an electro-suction device 92 with high flow rate and mildly reduced pressure, connected upstream of an attenuation chamber 93, or air inflow plenum chamber, in turn connected upstream with the channel 94 coming from the spinning unit 2. The second stage is constituted by an electro-suction device 91 with low flow rate and average reduced pressure, connected with suction to the channel 95, and with discharge to the aforesaid reduced pressure plenum chamber 93 of the first stage. Such connection in series allows the second stage to advantageously exploit the existing reduced pressure at its discharge, due to the plenum chamber 93 of the first stage, in order to further reduce the suction pressure at its inlet.

[0034] Such solution thus allows making a first stage with low flow rate and strongly reduced pressure without having to use an electro-suction device of larger size and power. However, by exploiting the reduced pressure at the discharge, as said, it allows using an electro-suction device 92 of smaller diameter, therefore with smaller losses and energy dissipations, obtaining advantages in terms of space reduction and lower energy absorption.

[0035] The centralised suction unit 86 is provided with a single technological air discharge point, by means of air or underground channelling, in such a manner simplifying the general plan of the factory where the integrat-

ed yarn-winder machine is installed.

[0036] As shown in figure 4, the integrated yarn-winder machine according to the present invention is provided with a single travelling cleaning device 88, placed above the spinning 2 and winding 4 units and the management and control group 78, for the cleaning and collection of dust and yarns from all the components of the machine itself.

[0037] A single drawing and collection point is provided for the waste and lint coming from the reduced pressure filtration tank connected with the centralised electro-suction unit 86, while the discharge of the lint and dust coming from the travelling cleaning device 88 is cyclically carried out in the dust and yarn collection tank of the strongly reduced pressure suction device.

[0038] The integrated yarn-winder machine according to the present invention is also provided with a single common transport system, provided with a plurality of motorised control units 90, capable both of transferring the bobbins 44 replete with yarn 34 from the spinning unit 2 to the winding unit 4, and to bring back the empty tubes 46 from the winding unit 4 to the spinning unit 2, by means of moving the relative peg/plate supports 52 along a single continuous path (not shown) which extends around the spinning unit 2 and the winding unit 4.

[0039] The management and control group 78 is finally provided with a single interface for the possible insertion or interposition, between the spinning unit 2 and the winding unit 4, of a continuous vapour treatment system (not shown) of the bobbins 44.

[0040] In order to facilitate the control of the integrated yarn-winder machine by the operators, the service modules 100, 101, 102 and 103, situated along the sides of the spinning unit 2 and/or winding unit 4, may be provided with control interfaces and/or command interfaces operatively connected with the management and control group 78.

[0041] It is thus seen that the integrated yarn-winder machine according to the present invention achieves the above-mentioned object, obtaining a series of advantages including the following:

- cost savings on the electrical control parts, on the suction and mechanical structure parts (which are integrally formed) of the machine;
- reduction of the electrical consumptions due to the centralised suction unit with two reduced pressure stages placed in series;
- reduction of the energy consumptions of the electrical and electronic parts due to the single electrical control and command panel, and to a single electronic processor;
- reduction of the overall machine bulk, with the possibility of increasing the number of spinning spindles and/or winding heads given the same occupied land space;
- machine management ergonomics, which encloses the components to be managed by the operators in

a single allocation.

[0042] The integrated yarn-winder machine of the present invention thus conceived is in any case susceptible to numerous modifications and variants, all falling within the same inventive concept; moreover, all details can be substituted by technically equivalent elements while the shapes and sizes can be of any type according to technical needs.

[0043] The protective scope of the invention is therefore defined by the attached claims.

Claims

1. Yarn-winder machine comprising a spinning unit (2), provided with a plurality of spinning stations (6) each capable of achieving the winding of a yarn (34), obtained starting from a sliver (10), on a bobbin (44), a winding unit (4), provided with a plurality of winding stations (8) each capable of unwinding said yarn (34) from said bobbin (44) and re-winding it on a package (72), and means for the transport of said bobbins (44) replete with yarn (34) from said spinning stations (6) towards said winding stations (8) and for the transport of the empty tubes (46) from said winding stations (8) towards said spinning stations (6), **characterised in that** it comprises a management and control master group (78) containing all the control equipment and service devices adapted to simultaneously ensure the functioning of said spinning unit (2), of said winding unit (4) and of one or more service modules (100, 101, 102, 103) operatively connected with said spinning unit (2) and/or said winding unit (4).
2. Yarn-winder machine according to claim 1, **characterised in that** said management and control group (78) is provided with a single electrical drive and control panel (80), operatively connected with the different command and service motors of the spinning unit (2) and to the different command and service motors of the winding unit (4).
3. Yarn-winder machine according to claim 2, **characterised in that** said management and control group (78) comprise a single electronic processor (84), provided with a single software packet and a single electrical and electronic interlocking logic unit for setting and sending the functioning data to the command and control devices of the spinning unit (2), of the winding unit (4) and of said service modules (100, 101, 102, 103).
4. Yarn-winder machine according to claim 1, **characterised in that**, on said management and control group (78), a single centralised suction unit (86) is present.

5. Yarn-winder machine according to claim 4, **characterised in that** said centralised suction unit (86) is of the type with two reduced-pressure stages connected in series with each other, wherein the first stage is with high flow rate and average reduced pressure, set for collecting and capturing the fibres, yarns and dust coming from the spinning unit (2) by means of a first suction and capture channel (94), and the second stage is with low flow rate and strongly reduced pressure, for the suction of the yarn tails of said bobbins (44) and of said packages (72) in the single winding stations (8) and for the search of the yarns of said bobbins (44) in one of said service modules (102) by means of a second suction and capture channel (95). 5
6. Yarn-winder machine according to claim 5, **characterised in that** said first stage is composed of an electro-suction device (92) with high flow rate and mildly reduced pressure, connected upstream of an attenuation chamber (93) in turn connected upstream with said first suction and capture channel (94). 10
7. Yarn-winder machine according to claim 6, **characterised in that** said second stage is composed of an electro-suction device (91) with low flow rate and average reduced pressure, connected with suction to said second suction and capture channel (95) and with discharge to said attenuation chamber (93) of said first stage, said electro-suction device (91) generating at its inlet, into said second suction and capture channel (95), strongly reduced pressure due to the direct discharge of the air directly into said reduced pressure attenuation chamber (93). 15
8. Yarn-winder machine according to claim 1, **characterised in that** it is provided with a single travelling cleaning device (88), placed above the spinning units (2) and winding units (4) and said management and control group (78), for the cleaning and collection of dust and yarns from all the components of said yarn-winder machine. 20
9. Yarn-winder machine according to claim 1, **characterised in that** said means for the transport of said bobbins (44) replete with yarn (34) from the spinning stations (6) towards the winding stations (8) and for the transport of said empty tubes (46) from the winding stations (8) towards the spinning stations (6) are provided with a single motorised command unit (90) for moving peg/plate supports (52) of said bobbins (44) and said tubes (46) along a continuous path which is extended around the spinning unit (2) and the winding unit (4). 25
10. Yarn-winder machine according to claim 1, **characterised in that** said management and control group (78) is provided with a single interfacing for the insertion, between the spinning unit (2) and the winding unit (4), of a continuous vapour treatment system of said bobbins (44). 30
11. Yarn-winder machine according to any one of the claims 1 - 10, **characterised in that** said management and control group (78) is arranged in intermediate position between the spinning unit (2) and the winding unit (4). 35
12. Yarn-winder machine according to claim 11, **characterised in that** said one or more service modules (100) dedicated to the spinning stations (6), situated along the sides of the spinning unit (2), and said one or more service modules (101, 102, 103) dedicated to the winding stations (8), situated along the sides of the winding unit (4), are provided with control and/or command interfaces that are operatively connected with said management and control group (78) for facilitating the control of said yarn-winder machine by the operators. 40

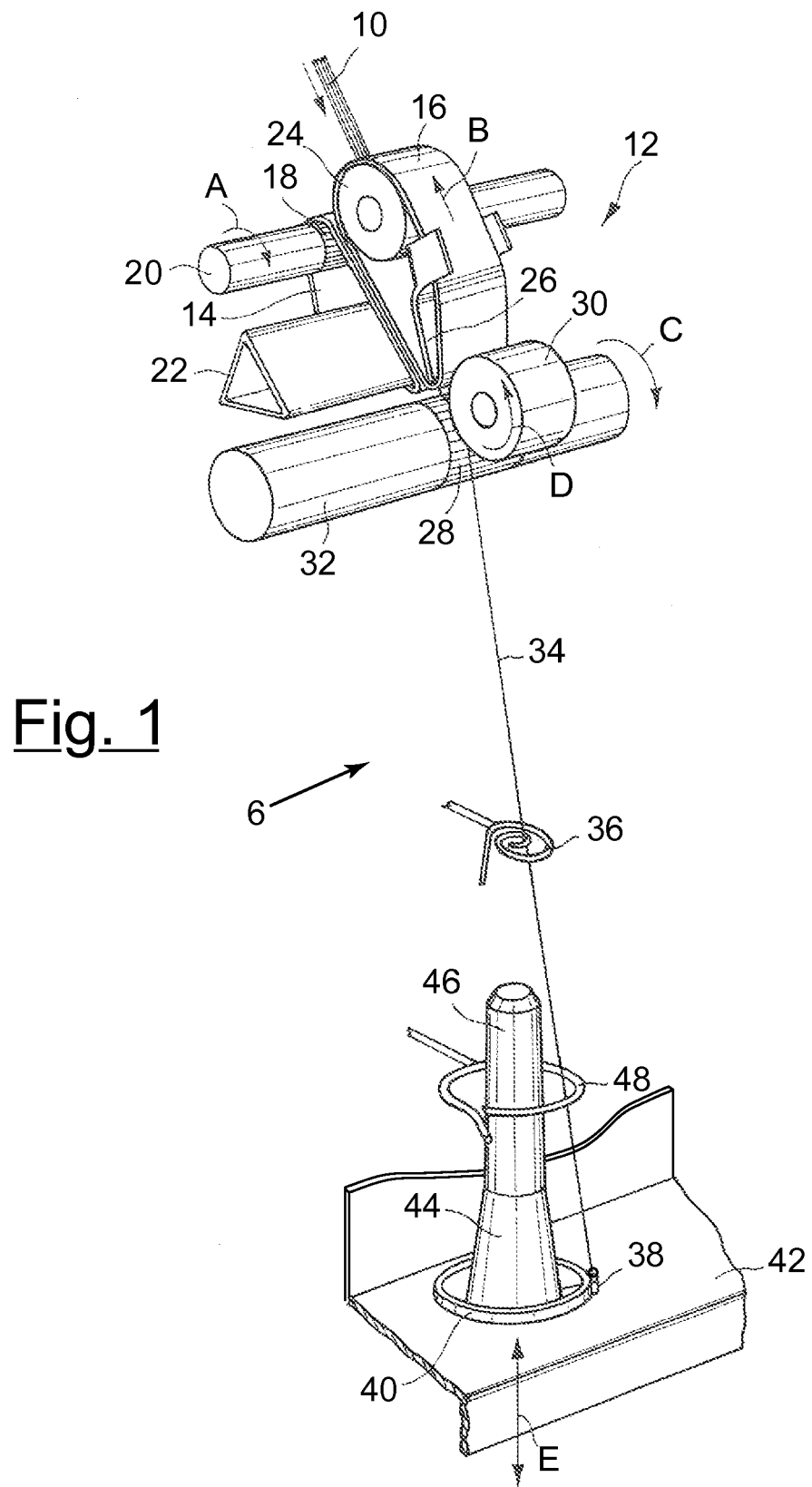


Fig. 2

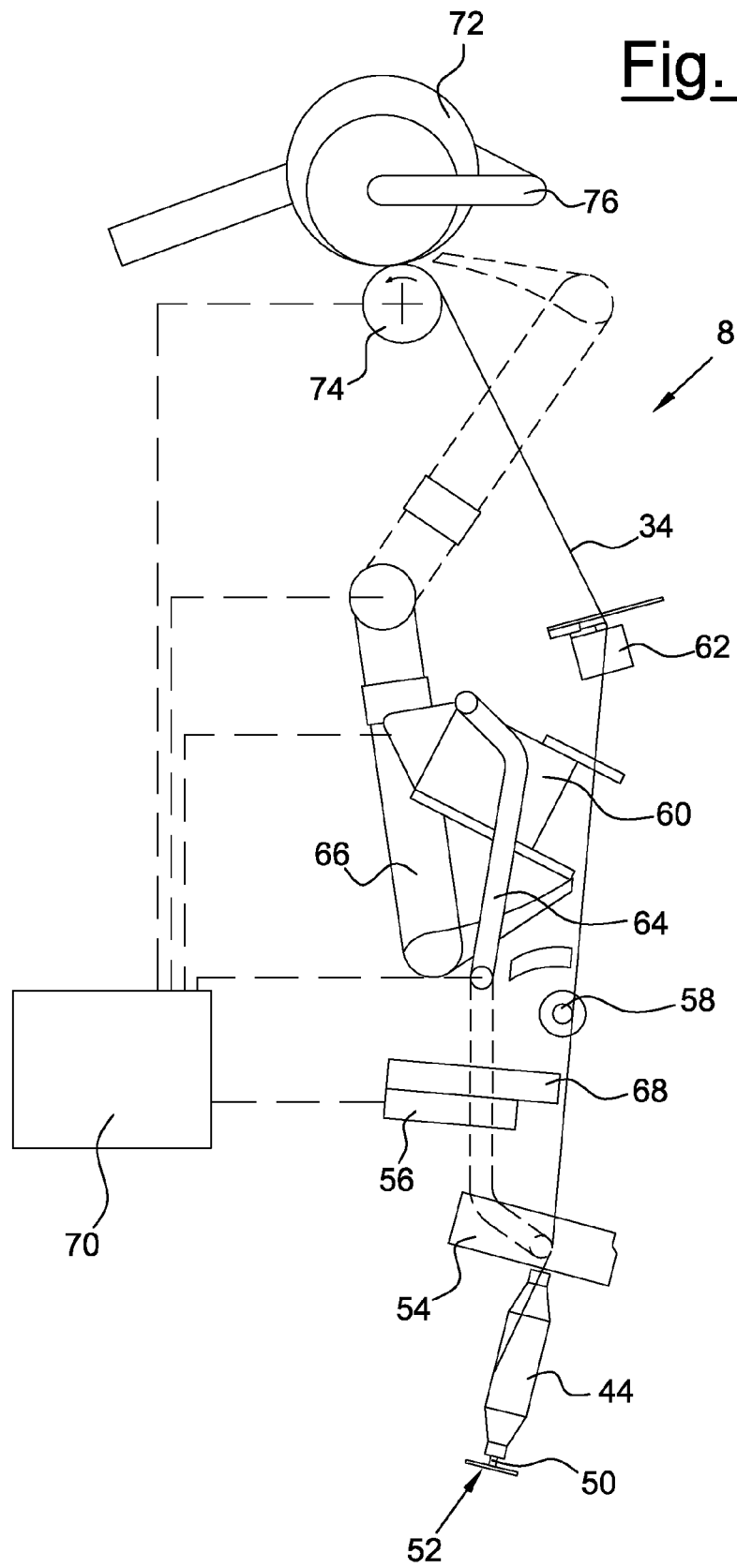
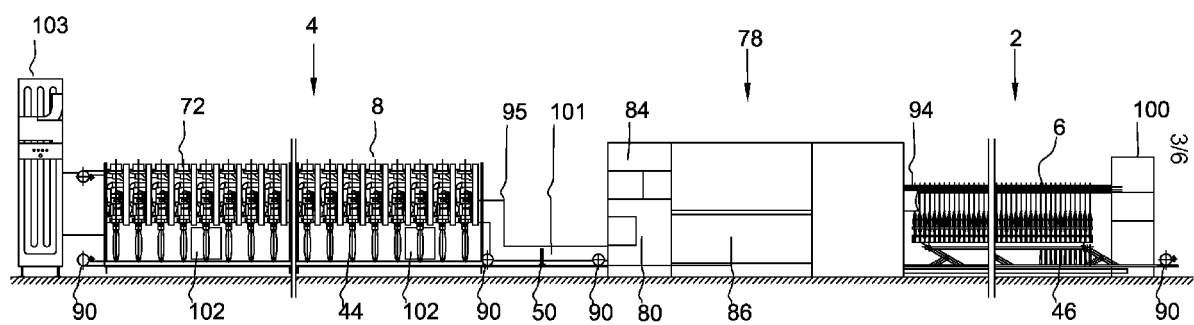


Fig. 3



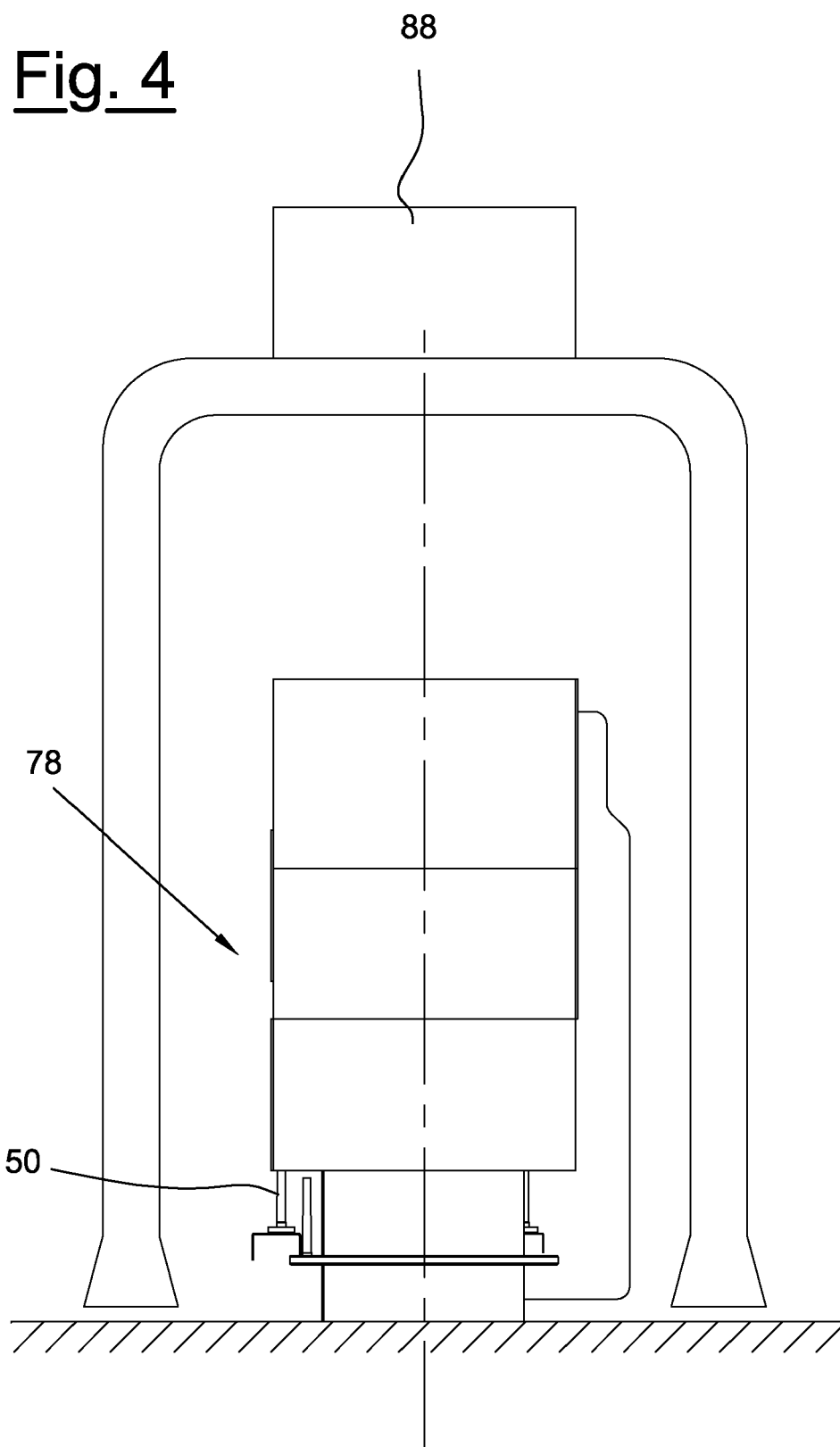


Fig. 5

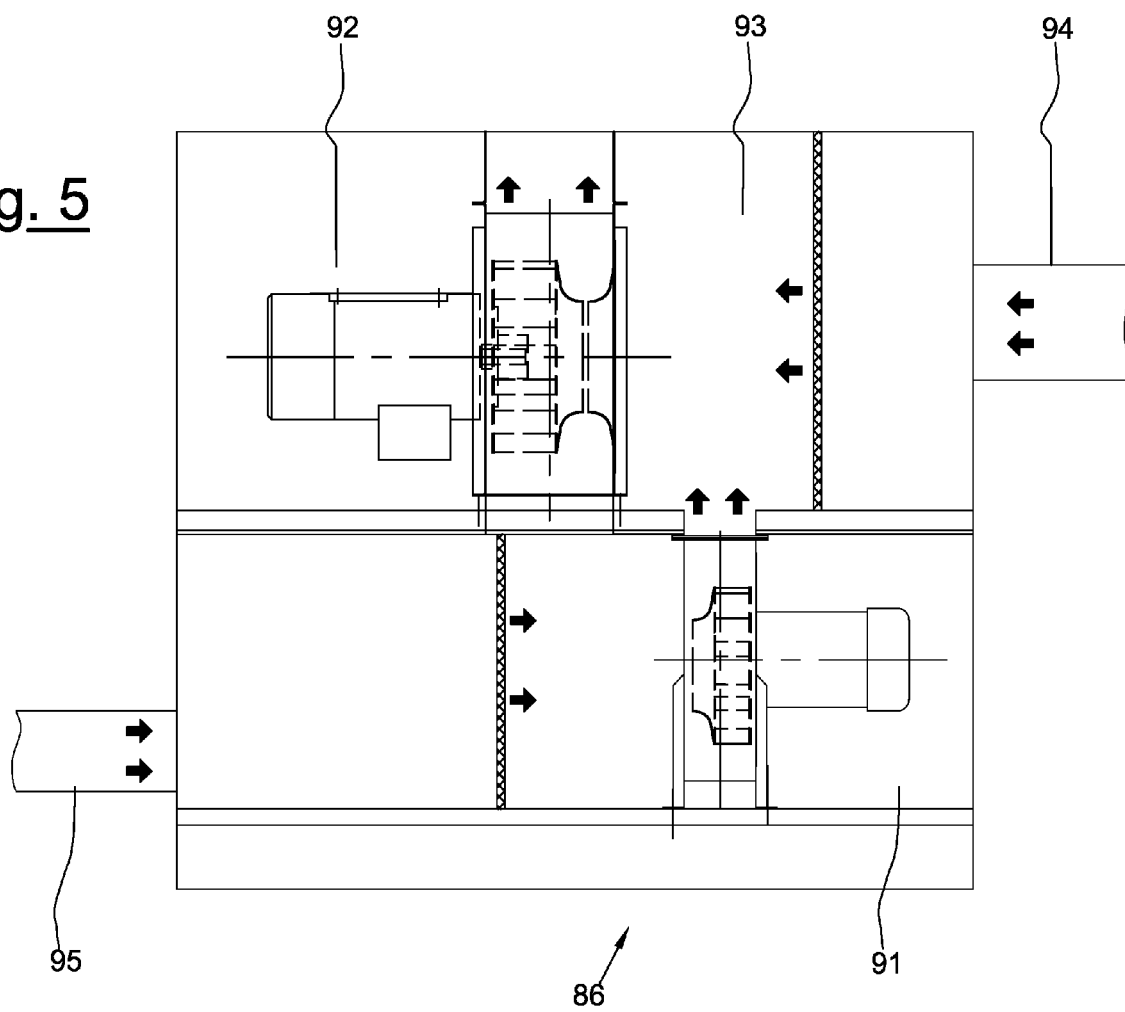


Fig. 6

