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(54) Dyeing or bleaching apparatus for yarn packages

(57) Dyeing or bleaching apparatus of yarns wound on reels or similar packages, comprising a plurality of small vertical dyeing boilers (15) arranged on a single circumference each suitable for receiving a mobile reel-holding shaft (13) able to be removed at the same time as the others for the subsequent centrifugal water-removal and drying operations, functioning in a reduced bath able to be impregnated even at fractional capacities with a constant bath ratio and productivity.

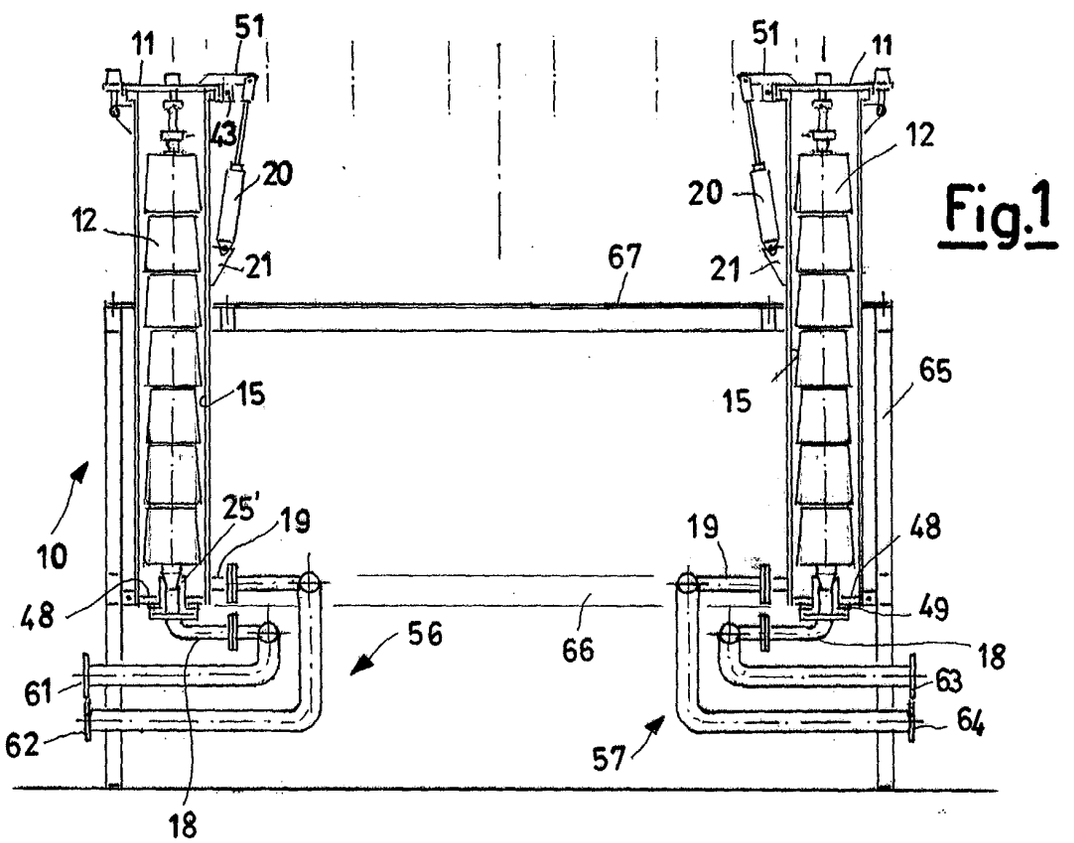

Fig.1

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Description

[0001] The present invention refers to a dyeing or bleaching apparatus of yarns wound on reels or similar packages.

[0002] Conventional apparatuses for dyeing or bleaching yarns consist of a vertical or horizontal treatment boiler that is cylindrical in shape with a curved base and lid, equipped with a pump and with devices for the reversible circulation of a treatment bath. Such apparatuses have universal use since they are suitable for receiving material-holders for the different possible packages of yarn. These apparatuses work with a relatively high bath ratio, in other words they use a large amount of water for every kg of material to be treated, for every dyeing cycle and, moreover, the number of water changes varies according to the type of material to be treated and the class of colorants used.

[0003] Therefore, it is clear how known dyeing processes are characterised by high water, steam and auxiliary chemical product consumption and, consequently, by high environmental and atmospheric pollution.

[0004] To try to reduce the bath ratio, apparatuses equipped with a treatment boiler able to eliminate all of the dead spaces have been proposed by the Applicant of the present application.

[0005] In particular, patent application WO 02/095113 describes an externally cylindrical treatment boiler with an annular section, in other words without upper and lower rounded portions, whereas application WO 02/095114 describes a plurality of distinct small treatment boilers arranged on a single circumference each suitable for receiving a mobile reel-holding shaft that can be withdrawn at the same time as the others for the subsequent centrifugal water-removal and drying operations.

[0006] These apparatuses, eliminating all of the dead spaces inside the boiler and reducing its volume, have the advantage, with respect to conventional ones, of being able to operate with an extremely reduced bath ratio, thus cutting down environmental and atmospheric pollution and consequently production and energy costs. Moreover, thanks to the particular configuration of the treatment boilers the intermediate manipulations of the yarn and thus the labour costs can be minimised as much as possible.

[0007] Although efficient, such machines, however, cannot operate with amounts of yarn below the nominal amount of the machine without substantially reducing its productivity and consequently its profitability.

[0008] It is thus clear that, removing the advantage of the reduction in bath ratio, these apparatuses certainly do not represent what the dyeing industry expects nowadays from a dyeing or bleaching apparatus of yarns wound on reels or similar packages. If, in fact, the economic, ecological and energy goals are reached thanks to the low bath ratio with which the aforementioned apparatuses operate, the goals relative to the flexibility and versatility of the apparatus are, however, lacking.

[0009] In other terms, it is necessary for such apparatuses to be able to work even at fractional capacities independent from each other and therefore also with different yarns by type, count or colour without reducing the productivity of the apparatus.

[0010] It is thus clear how the modern dyeing industry requires apparatuses that allow operation not only at full load for the dyeing of the entire load of yarn in a single colour, but also at full load for the dyeing of different types of yarn in different colours and this, of course, at a constant bath ratio.

[0011] The purpose of the present invention is that of realising a dyeing or bleaching apparatus that allows good fractionability of use, maintaining a constant bath ratio at the type and load of material to be treated varies, without reducing the productivity of the apparatus.

[0012] Another purpose of the present invention is that of realising a dyeing or bleaching apparatus that uses a very low bath ratio, consequently reducing the environmental and atmospheric pollution and the production and energy costs.

[0013] Yet another purpose of the present invention is that of realising a dyeing or bleaching apparatus of yarns wound on reels or similar packages that allows the manipulations to be carried out to be minimised as much as possible.

[0014] A further purpose of the present invention is that of realising a dyeing or bleaching apparatus that is particularly simple and functional, with low costs.

[0015] These purposes according to the present invention are accomplished by realising a dyeing or bleaching apparatus of yarns wound on reels or similar packages, as outlined in claim 1.

[0016] Further characteristics are foreseen in the dependent claims.

[0017] The characteristics and advantages of a dyeing or bleaching apparatus of yarns wound on reels or similar packages according to the present invention shall become clearer from the following description, given as an example and not for limiting purposes, referring to the attached schematic drawings, in which:

- figure 1 is a top side section view of a dyeing or bleaching apparatus of yarns wound on reels, according to the present invention, consisting of a plurality of small vertical treatment boilers, arranged on a single circumference and each containing a reel-holding shaft;
- figure 2 shows an enlarged top side section view of a moving device of all of the reel-holding shafts, carrying just two shafts for the sake of simplicity;
- figures 3a and 3b show an enlarged top side section view of a detail of a lid of a small boiler of the apparatus of figure 1, in a step before closing and in closed position, respectively;
- figures 4a, 4b and 4c show the circulation plan of the treatment bath of three different embodiments

of the apparatus of figure 1, alternatively one equipped with two treatment sectors, one equipped with four treatment sectors and one equipped with a plurality of treatment sectors;

- figure 5 shows a front view of the dyeing apparatus of figure 1, inserted in a productive embodiment of a dyeing line, upstream of a centrifugal water-removal apparatus with baskets with an alveolar section and of a drier with a chamber having a circular section;
- figures 6a, 6b and 6c show three different plan views from above of as many productive embodiments of a dyeing line, with respective trolleys, and precisely in figure 6a the line of figure 5 is schematised, in figure 6b a line with a conventional drier with a chamber having a rectangular section can be seen, and finally in figure 6c a line with a conventional water-removal apparatus and a conventional drier is shown;
- figure 7 shows a plan view from above of the apparatus of figure 1 without a cover, where the plurality of small boilers can be seen, the axes of which are arranged on a single circumference;
- figure 8 shows a top side section view of an alternative embodiment of the dyeing or bleaching apparatus of yarns wound on reels according to the present invention, consisting of a plurality of vertical small treatment boilers with a section in the shape of a circular crown sector; and
- figure 9 shows a plan view from above of the apparatus of figure 8 without a cover, where the plurality of small boilers with a section in the shape of a circular crown sector can be seen.

[0018] Before anything else, it must be stated that in the drawings only those parts of a dyeing apparatus that are essential for a complete understanding of the invention are illustrated and hereafter shall be described, whereas all of the accessories, such as command and control apparatuses, that can be realised in a conventional way that is well known in the art, have been omitted.

[0019] Moreover, we shall always talk of a dyeing apparatus, but it should be understood that it could also be apparatuses for bleaching or other treatments.

[0020] With reference to figures 1 to 7, a dyeing apparatus is shown, with a low bath ratio, equipped with a plurality of vertical small boilers 15, wholly indicated with 10.

[0021] Such an apparatus 10 comprises a cylindrical structure 65 with a vertical axis. A lower ring 66 and an upper ring 67 are internally welded, suitably spaced apart, onto such a structure 65, which support a plurality of small cylindrical treatment boilers 15 with a vertical axis, the axes of which are arranged on a single circumference inside the structure 65, concentric with its axis, as shall be seen in figure 7.

[0022] The small cylindrical boilers 15 are equipped with a flat base 48 and are open at the top. They are closed through a series of circular lids 11, each fitted to its own small boiler, and arranged with the centres on a single circumference. Such a circumference is the same as the one on which the axes of the small boilers 15 are arranged.

[0023] Each lid 11 is supported at an end thereof by a lever 51, pivoted with a pin 43 to the small boiler 15. Each lever 51 is actuated by a reversal cylinder 20, arranged between an end of the lever 51 and a bracket 21 foreseen on the outside of the small boiler 15.

[0024] The small boilers 15, with reference to figure 4a, are placed in communication by two fluid connectors 56, 57 so as to form two independent treatment sectors 2, 2'.

[0025] In other words, each sector 2, 2' consists of a predetermined number of small boilers 15, for example ten in figure 4a, fluidly connected so as to be able to treat the reels of yarn 12 contained in the sector, thus formed, independently of the reels of yarn 12 contained in the remaining sector. It is thus possible, for example, to treat the reels of sector 2 with one type of colour and the reels of sector 2' with another type of colour, without reducing the productivity of the apparatus. For such a purpose, each small boiler 15 is equipped with two entry and/or exit tubes 18, 19 of the treatment bath connected to the two fluid connectors 56, 57. These connectors 56, 57, advantageously in the example of figure 4a, are represented by the four connection ducts 61, 62, 63, 64.

[0026] Each sector 2, 2' is connected to a dedicated circulation group of the treatment bath 90, 91.

[0027] Each circulation group 90, 91 of the bath, as shown in figure 4a, comprises an external pump 16, a heat exchanger 17 for cooling and heating the bath and a flow-inverter 60.

[0028] Interconnection means, such as interconnection ducts 66, 67, are also foreseen, suitable for putting two or more distinct sectors in communication.

[0029] For such a purpose, the interconnection ducts 66, 67 are equipped with selection means, such as intercept valves 68, 69, 70, 71, 72, 73, to open or close the circulation of the bath.

[0030] It is thus possible to place two or more sectors in fluid communication to allow the same treatment bath to circulate in them or, alternatively, it is possible to disconnect them to make them work independently.

[0031] The base 48 of each small boiler 15 is equipped centrally with a catch basin 49. The catch basin, at a lower end, is connected to the piping 18. On the other end, however, it terminates with an upturned reel-shaped seat 25'.

[0032] Such seats host a conical lower end 25, visible in figure 2, of reel-holding shafts 13, on which the reels 12 to be treated are slotted. In the case of figure 2 the reels 12 are, in a known way, wound on conical perforated supports and are separated by spacer discs 26. In the case of reels 12 wound on particular cylindrical perforated supports the discs 26 can also be omitted.

[0033] In figure 2 a circular moving device 14 for all of the shafts 13 arranged circumferentially is shown, comprising a structure 32 that carries, arranged along the circumference, a plurality of chain portions 33, in particular one for each reel-holding shaft 13, provided at one end with hooks 28 or other known reversible connection means able to be impregnated in suitable slots 27 to connect or release the shafts 13.

[0034] In figures 3a and 3b a detail of a closing mechanism for a lid 11 on an upper edge of a small boiler 15 is shown.

[0035] On each lid 11 locking and centring devices of the shafts 13 are foreseen.

[0036] Such devices consist of a pin 30, equipped with a spring 31, able to slide inside a seat 29 formed in the lid 11.

[0037] The pin 30 terminates with a head 32 equipped, on the outside, in other words on the side next to the inside of the boiler 15, with a concave profile, suitable for receiving the shaft 13 that terminates at the top with a chamfer 24.

[0038] In figure 4a a circulation plan of the treatment bath is shown, with the small boilers 15 grouped together by the fluid connection ducts 61-64 to form two distinct treatment sectors 2, 2' .

[0039] In detail, the connection ducts 61, 62 connect ten small boilers 15 to the circulation group of the treatment bath 90, forming the treatment sector 2, whereas the connection ducts 63, 64 connect the remaining ten small boilers to the circulation group of the bath 91, forming the treatment sector 2'.

[0040] The interconnection ducts 66, 67 connect the two sectors 2, 2' together allowing the exchange of the treatment bath and the valves 68, 69, 70, 71, 72, 73 regulate the opening or closing of the interconnection ducts 66, 67.

[0041] Therefore, it is possible to close the valves 68, 69, 72, 73 and open the valves 70, 71 to make the two sectors 2, 2' work independently or vice-versa, to open the valves 68, 69, 72, 73 and close the valves 70, 71 to make the two sectors 2, 2' work in an integrated manner, thus making the same treatment bath circulate in both of the sectors, according to the direction indicated, for example, by the arrows F in figure 4a.

[0042] In figure 4b an alternative circulation plan of the treatment bath of the apparatus according to the invention is shown, in which the small boilers 15 are divided by the fluid connector ducts 74-81, so as to form four distinct treatment sectors 2, 3, 4, 5.

[0043] Also in this case, the intercept valves 100-116 regulate the various operating possibilities of the sectors.

[0044] In other words, it is possible to make all of the sectors 2, 3, 4, 5 work in a distinct or integrated manner in sets of two, for example 2, 3 and 4, 5 or else, finally, three sectors can work in an integrated manner 2, 3, 4 and one 5 in a distinct manner. In figure 4c a further alternative circulation plan of the treatment bath is shown, in which the small boilers 15 are grouped together by the fluid connectors to form a plurality of distinct treatment sectors 2, 3, n. The structure and operation of this embodiment are totally analogous to that of figures 4a and 4b apart from for the number of treatment sectors, for that of the groups, of the valves and of the ducts and therefore they shall not be described in further detail.

[0045] In figure 5 a dyeing line is shown, under a bridge crane 35, consisting of a trolley 36 that carries a series of shafts 13, arranged on a circumference, the dyeing apparatus 10, a centrifugal water-removal apparatus with baskets having pits or perforated tubes 37 and a drier with a chamber having a circular section 38.

[0046] In figures 6a, 6b and 6c other embodiments of the dyeing line are shown, in which there are, in addition with respect to figure 5, a conventional drier with a chamber having a rectangular section 40, a conventional water-removal apparatus 41, and a rectangular trolley 42 that carries a series of fixed shafts.

[0047] The reels 12 to be dyed, wound on the conical perforated supports, are slotted into the shafts 13, separated by discs 26. These shafts 13 are positioned on the trolley 36 to then, all together, through the device 14, be loaded into the dying apparatus 10.

[0048] In particular, said shafts 13 are positioned in the small boilers 15, which, as can be seen in figure 1, have an internal diameter slightly greater than the maximum diameter of the reels 12.

[0049] The seats 25', arranged circumferentially, are sized to receive the conical lower ends 25 of the shafts 13.

[0050] Advantageously, the shafts 13, in the example of the figure there are twenty, can be positioned simultaneously, to fill all of the small boilers 15, using the moving device 14.

[0051] As can be seen in figure 5, the device 14 connects all of the shafts 13 arranged circumferentially for example on the trolley 36, on the same circumference as that which passes through the centre of the small boilers 15, and lowers them from above into the dyeing apparatus through the bridge crane 35.

[0052] Once the shafts 13 are inserted in the seats 25', the lids 11 are closed, under the action of the cylinders 20, on the small boilers.

[0053] In detail, the cylinder 20 actuates a flipping of the lever 51 about the pin 43, in a position indicated in figure 3a.

[0054] In this step the locking of the shafts 13 into position also takes place. This is actuated through the devices formed from the pins 30, which terminate with heads 32 equipped with a conically concave profile. In the closing mechanism, visible in figure 3b, said heads 32 are forced by the compressed springs 31 towards the upper chamfers 24 of the shafts 13, thus obtaining its locking and also, thanks to their conically concave profile, its centring.

[0055] The mechanical and hermetic closing of the small boilers 15 is carried out by locking the single lids

11 to the upper edges 44 through locking devices 42 or other known systems.

[0056] As an example, threaded stay rods, pivoted at an end of the small boilers 15 and provided with nuts that can be impregnated in suitable grooves in the lid 11 are used as locking means 42.

[0057] After the quoted closing of the lids 11, it is possible to treat the reels 12 according to the production requirements.

[0058] In particular, referring for example to figure 4a, it is possible to separate the two treatment sectors 2, 2' or make them work in an integrated manner. In the first case, the valves 68, 69, 72, 73 are closed preventing access to the interconnection ducts 66, 67, and the valves 70, 71 are opened.

[0059] The small boilers 15 are then filled with two distinct treatment baths.

[0060] On the other hand, in the second case, should one wish to work in an integrated manner, in other words so that the same bath circulates in all of the small boilers, the valves 70, 71 are closed and the valves 68, 69, 72, 73 are opened, freeing the access of the treatment bath to the interconnection ducts 66, 67.

[0061] In both cases, the circulation of the bath is created through the external pumps 16, also with the possibility of inverting the direction of the flow in the tubes 18, 19 through the inverters 60.

[0062] The dyeing bath is heated or cooled through the heat exchangers 17.

[0063] Figures 8 and 9 illustrate an alternative embodiment of the apparatus according to the present invention totally similar to the one illustrated in figure 1 apart from the fact that the small treatment boilers 15 are obtained by dividing a boiler formed from two concentric cylinders, like the one illustrated in patent application WO 02/095113, into different treatment sectors 2, 3, 4, 5, through watertight bulkheads 117.

[0064] Each treatment sector is thus formed from a small boiler 15 that has a circular arc of crown section.

[0065] Each sector or small boiler 15 has two entry/exit treatment tubes 18, 19 connected to a dedicated circulation group of the treatment fluid.

[0066] All of the small boilers are connected together by interconnection ducts (not shown) provided with intercept valves (not shown) to allow the various sectors 2, 3, 4, 5, thus realised, to each work independently with its own treatment bath or in an integrated manner, in other words all with the same bath.

[0067] At the bases 48, each small boiler or sector has an inner fluid connector 58 shaped to support more reel-holding shafts 13.

[0068] With the dyeing apparatus 10, it is also possible to rationalise production. Regarding this, figure 5 and figure 6a represent a dyeing line that foresees a trolley 36 where the shafts 13 are arranged circumferentially with the reels 12 to be treated. These shafts 13 are picked up by the bridge crane 35 which lowers them, through the moving device 14, into the dyeing apparatus 10. After the cycle into the apparatus 10, the series of shafts 13 is picked up by the moving device 14 and lowered into the centrifugal water-removal apparatus 37, which can be with baskets having pits or with perforated tubes, of a suitable size to host the circumferential series of shafts 13. At the end of this step, the moving device 14 picks up the series of shafts 13 and lowers them into the drier 38, which has a chamber having a circular section of a size suitable for hosting the circumferential series of shafts 13, where the process is completed.

[0069] Alternatively, in figure 6b the productive line includes, with respect to figure 6a, replacing the drier with a chamber having a circular section 38, a conventional drier 40 with a chamber having a rectangular section, for which reason, at the exit from the centrifugal water-removal apparatus 37, the circumferential series of shafts 13 is picked up by the moving device 14 and rested upon a trolley 36, which is then taken into the drier 40.

[0070] In another alternative, in figure 6c the productive line includes, with respect to figure 6a, a conventional water-removal apparatus 41 and a conventional drier 40 with a chamber having a rectangular section, for which reason, at the exit from the dyeing apparatus 10, the circumferential series of shafts 13 is picked up by the moving device 14 and rested upon a trolley 36. From the trolley 36, the single reels 12 are unslotted from the shafts 13 and positioned, manually or mechanically, in the conventional water-removal apparatus 41. At the end of the water-removal step, the single reels 12 are picked up and arranged, manually or mechanically, on a trolley 42, which is then taken into the conventional drier 40 with a chamber having a rectangular section, to conclude the working process.

[0071] It should be noted that the plant solution realised in figure 6a is, of course, the optimal one, because it reduces the manipulations of the reels 12 in the production cycle to a minimum.

[0072] The advantage that characterises this particular embodiment of the dyeing apparatus with a plurality of vertical small boilers is that of receiving the reels to be dyed on single removable reel-holding shafts, arranged on a single circumference. Such shafts can all be removed simultaneously through a circular device with hooked means, or another known means, and which can thus be positioned, without intermediate manipulations, firstly in the centrifugal water-removal apparatus with baskets having pits or perforated tubes and then in the drier with a circular chamber.

[0073] A further advantage is the rationalisation of production, since the manual transfer operations of the reels from the dyeing apparatus to the water-removal apparatus, and from here to the drier are eliminated. In practice, therefore, the entire batch is dyed, centrifuged and dried without intermediate manipulations of the reels.

[0074] Regarding this, the arrangement of the reel-holding shafts on a single circumference enormously simplifies the possible automation with robots of the in-

itial loading and end unloading operations of the single reels from the shafts.

[0075] The apparatus according to the present invention, as illustrated previously, is fractionable into various sectors each of which is equipped with its own circulation group of the dyeing bath. Each sector being able to be used independently with a specific dyeing bath totally different with respect to those used in the remaining sectors, or alternatively, being able to be used connected, through the interconnection ducts and the intercept valves, to the remaining sectors for individual dyeing. In both cases, the productivity of the apparatus 10 remains constant at the maximum value, thus allowing the costs to be optimised.

[0076] It is also possible to use the apparatus also with the use of one or more partially empty sectors, or rather with the replacement of some reel-holding shafts with bath reducer chambers, in such a way allowing the maximum production capacity to be further fractioned, to the slight detriment to productivity: the operative flexibility is thus maximum.

[0077] Finally, to treat large batches, apparatuses can be realised with a modular structure, combining or twinning many dyeing apparatuses according to the present invention.

[0078] The reduction in bath ratio permitted by the particular configuration of the small boilers of the apparatus according to the invention leads to the simultaneous decrease in water, energy, steam and chemical product consumption and in environmental and atmospheric polluting discharges.

[0079] Moreover, the treatment time is reduced since, with the same flow rate of the pump and heat exchange surface with respect to conventional apparatuses, due to the substantial reduction in volume of the bath, increasing its recycles per minute as well as the upward temperature gradient, and thus in theory, and compatibly with the characteristic colorant depletion curves, the treatment time is reduced. Moreover, the increase in cycles per minute also involves an improvement of the dyeing capacity.

[0080] The dyeing apparatus thus conceived is susceptible to modifications and variants, all of which are covered by the invention; moreover, all of the details can be replaced with technically equivalent elements. In practice, the materials used, as well as the sizes, can be whatever according to the technical requirements.

[0081] It should also be specified that for the sake of simplicity of illustration the apparatus (10) in figures 6a, 6b, 6c is represented in the embodiment with two circulation groups (90, 91), but it could, however, consist of 3, 4, n circulation groups without departing from the scope of protection of the present invention.

Claims

1. Dyeing or bleaching apparatus of yarns wound on reels or similar packages, with a low bath ratio, comprising a plurality of small treatment boilers (15) with a vertical axis closed on the bases (48) and equipped with removable closing lids (11), said small boilers (15) being equipped with entry and/or exit tubes (18, 19) of a treatment bath, in each of said small boilers (15) being arranged at least one removable support shaft (13), on which reels of yarn or similar packages (12) are slotted one on top of the other, **characterised in that** it comprises at least two distinct treatment sectors (2, 2', 3, 4, 5, n) each equipped with at least one circulation group of the treatment bath (90, 91, 92, 93), with interconnection means between said sectors, and with selection means for opening or closing said interconnection means.

2. Apparatus according to claim 1, **characterised in that** each circulation group (90-93) of the treatment liquid comprises at least one circulation pump (16), at least one heat exchanger (17) for heating and cooling the bath and at least one flow-inverter (60) to invert the circulation of the treatment bath inside the small boilers (15).

3. Apparatus according to claim 2, **characterised in that** said treatment sectors (2, 2', 3, 4, 5, n) each comprise a plurality of small boilers (15) connected through said entry and/or exit tubes (18, 19) to two fluid connectors (56, 57, 56', 57') each in turn connected to a circulation group of the bath (90-93) to allow the circulation of the treatment bath.

4. Apparatus according to claim 3, **characterised in that** said fluid connectors (56, 57, 56', 57') each comprise two ducts (61, 62, 63, 64, 74-81) joined to said entry and/or exit tubes (18, 19) to divide said small boilers (15) into distinct treatment sectors (2, 2', 3, 4, 5, n).

5. Apparatus according to claim 2, **characterised in that** said treatment sectors (2, 2', 3, 4, 5, n) comprise a single small boiler (15) equipped with at least one fluid connector (58) connected to the circulation group of the treatment bath to allow the circulation of the treatment bath; each connector (58) being configured to support many reel-holding shafts (13).

6. Apparatus according to any one of the previous claims, **characterised in that** said interconnection means comprise interconnection ducts (66, 67) suitable for placing said at least two treatment sectors (2, 2', 3, 4, 5, n) in fluid connection.

7. Apparatus according to claim 6, **characterised in that** said selection means comprise valves (68, 69, 70-73, 100-116) to exclude said interconnection ducts (66, 67) from the circulation of the treatment

baths.

8. Apparatus according to any one of the previous claims, **characterised in that** each lid (11) is attached to a small boiler (15) and is moved by an opening and closing device (51, 20, 21, 43).

9. Apparatus according to any one of the previous claims, **characterised in that** said lids (11) mechanically and hermetically close upper edges (44) of the small boilers (15) with locking devices (42).

10. Apparatus according to claim 8, **characterised in that** said opening and closing device comprises a lever (51), which, supports at one end a lid (11), said lever (51) being pivoted with a pin (43) and actuated by a reversal cylinder (20) fixed, with a bracket (21), to said small boiler.

11. Apparatus according to any one of the previous claims, **characterised in that** said support shafts (13) are removable each arranged circumferentially between housings (25', 29) formed near to said bases (48) and said lids (11), respectively.

12. Apparatus according to claim 11, **characterised in that** said housings (25', 29) consist of a series of conical seats (25'), formed on the inner bases (48) of the small boilers (15), and arranged on a single circumference that passes through the centre of them, and a corresponding series of seats (29), formed on the lids (11), which, in the closing of the lids (11) on the small boilers (15), are coaxial with the centre of the conical seats (25') formed on the bases of the small boilers (15), and which are on a surface that faces towards the inside of the small boilers (15).

13. Apparatus according to claim 11, **characterised in that** said support shafts (13) are equipped at the bottom with conical seats (25), suitable for a removable housing in said conical seats (25').

14. Apparatus according to claim 11 or 12, **characterised in that** said seats (29) present on the lids (11) are provided with pins (30) with a head (32) equipped with compensation springs (31), such as to lock, at the act of closing the lids (11) on the small boilers (15), the support shafts (13) in the conical seats (25'). formed on the bases (48) of the small boilers (15), through chamfers (24) realised at the upper ends of the shafts (13).

15. Apparatus according to claim 1, **characterised in that** said support shafts (13) have a slot (27) at the top suitable for being attached through reversible attachment means (28) to moving devices (14).

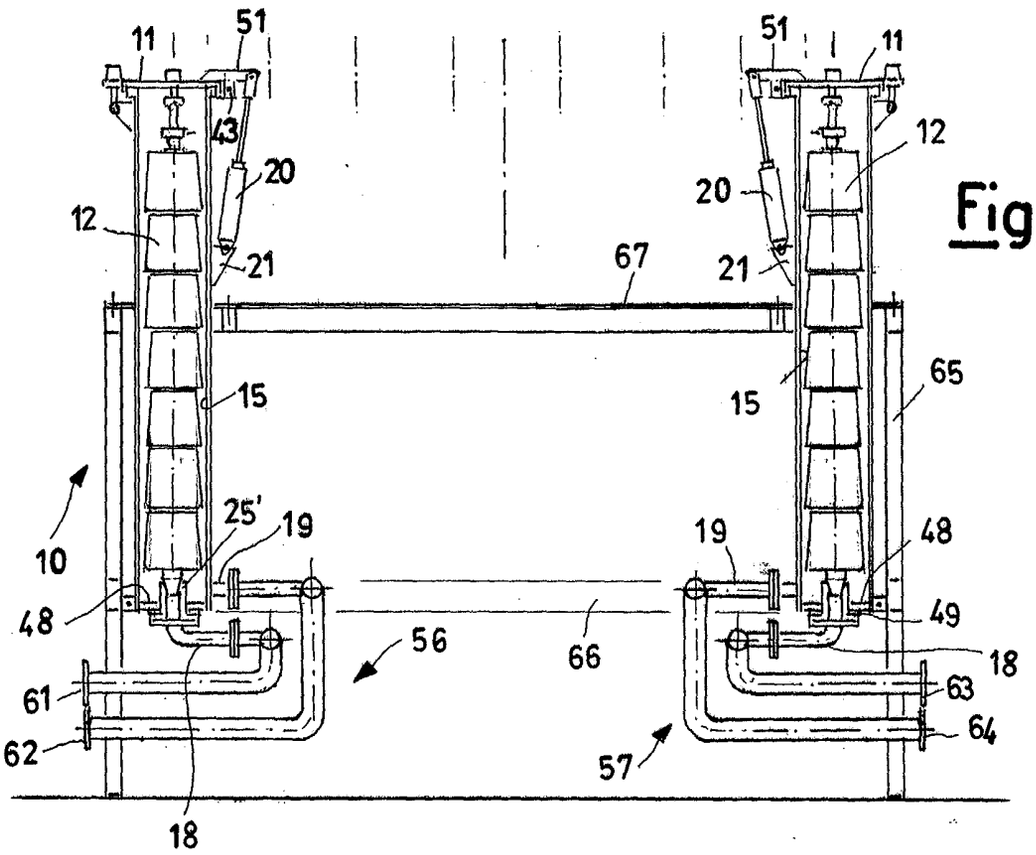
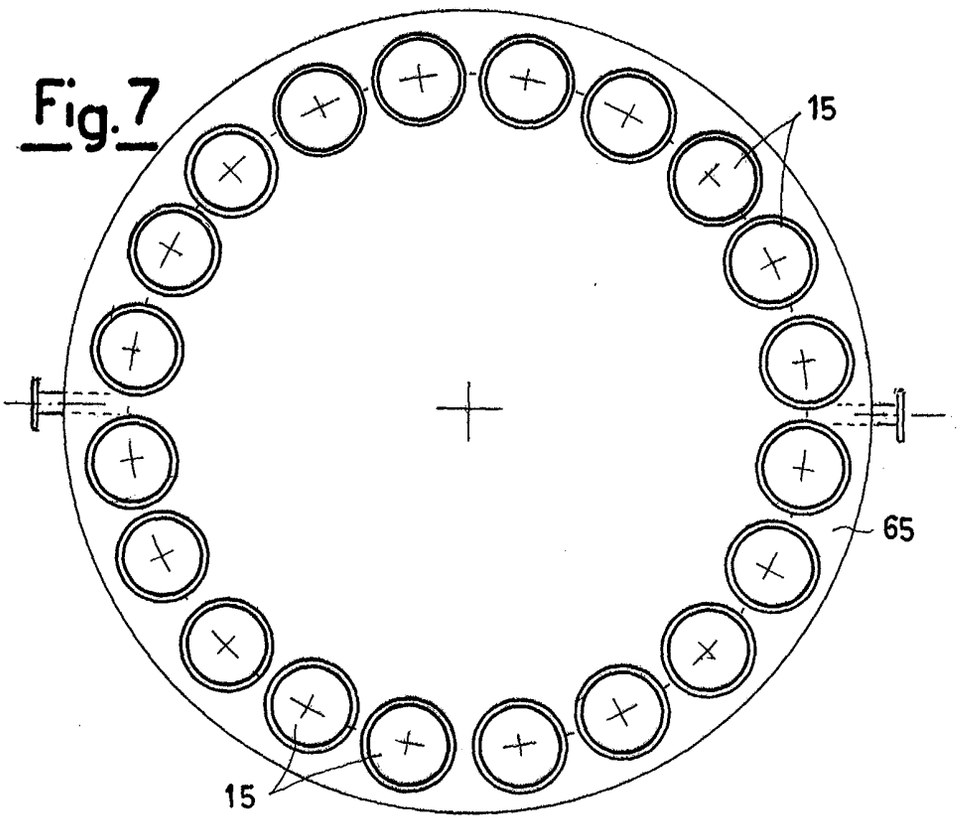


Fig.1

Fig.7



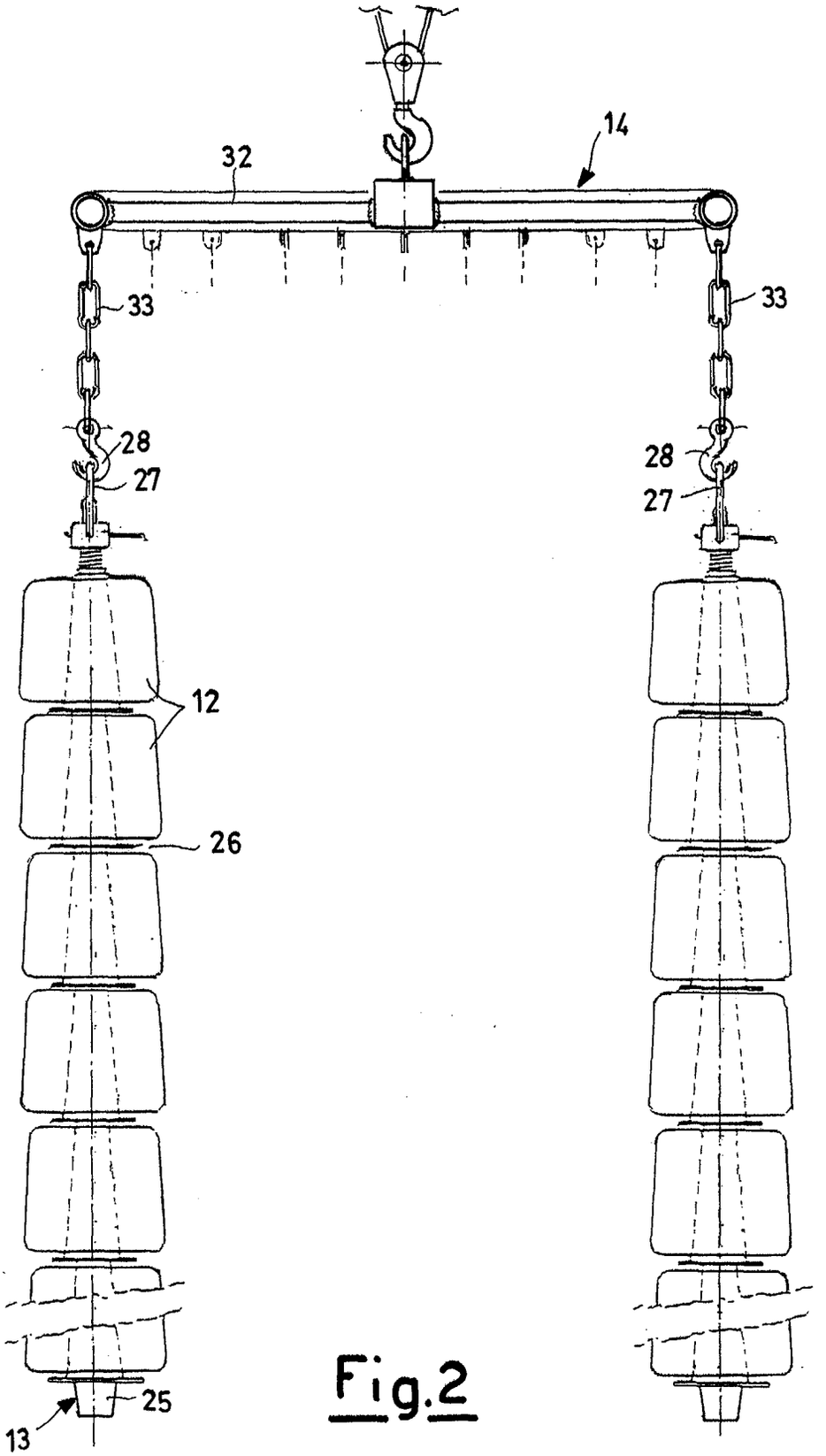
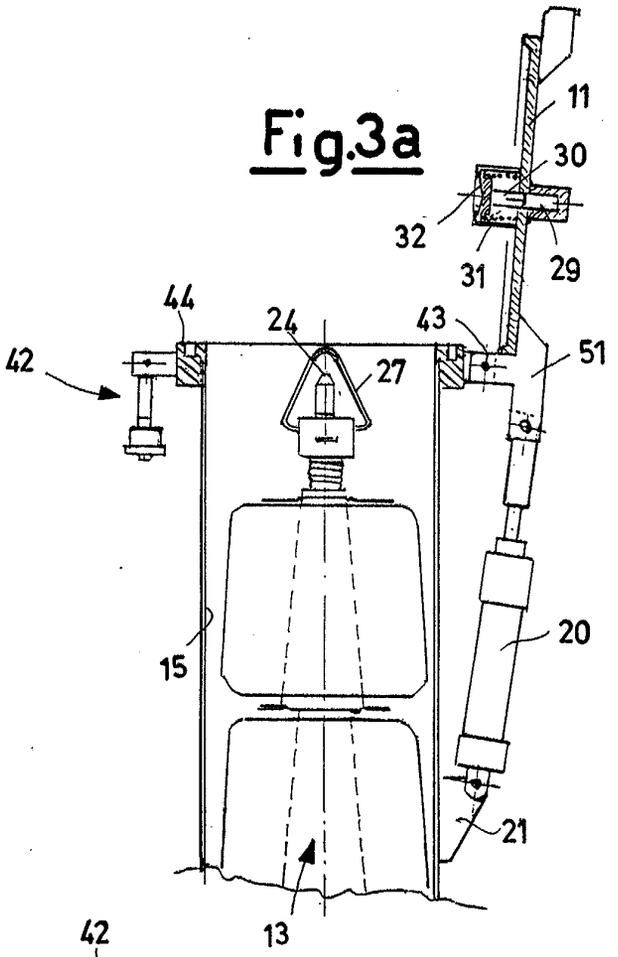


Fig.2

Fig.3a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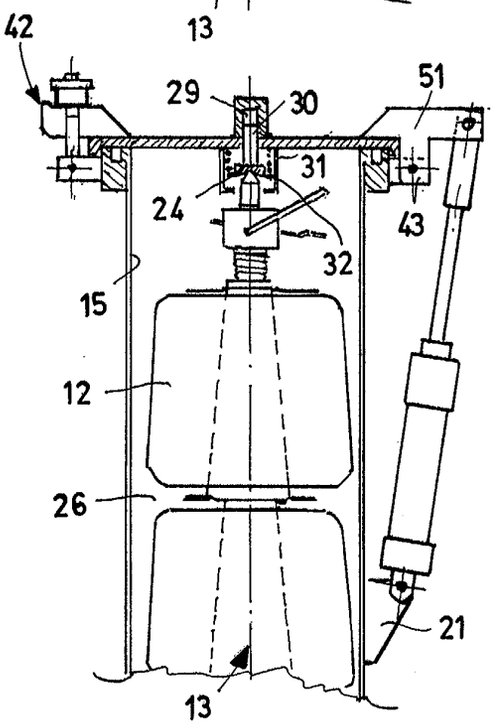
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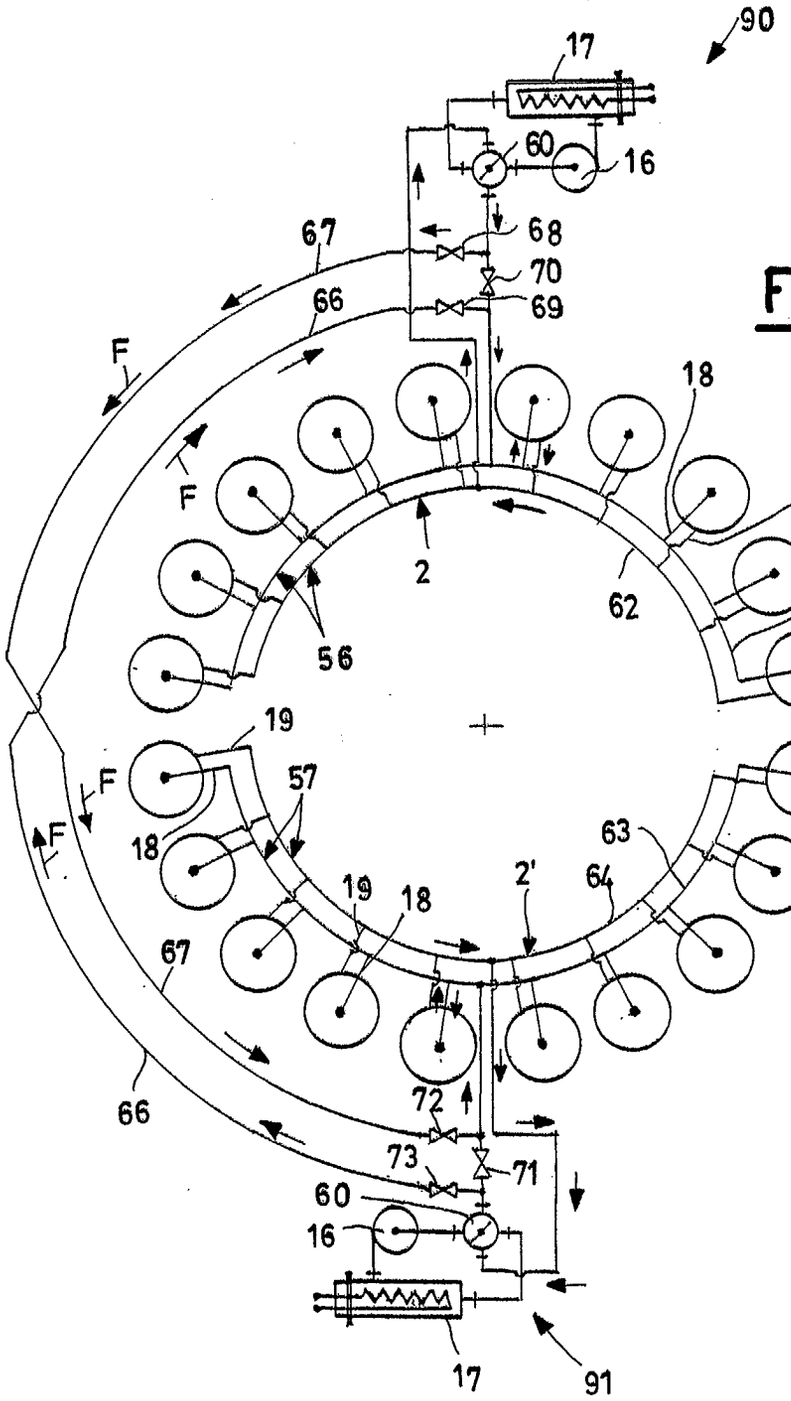
Fig.3b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F
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63
2'
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19
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66
72
73
71
60
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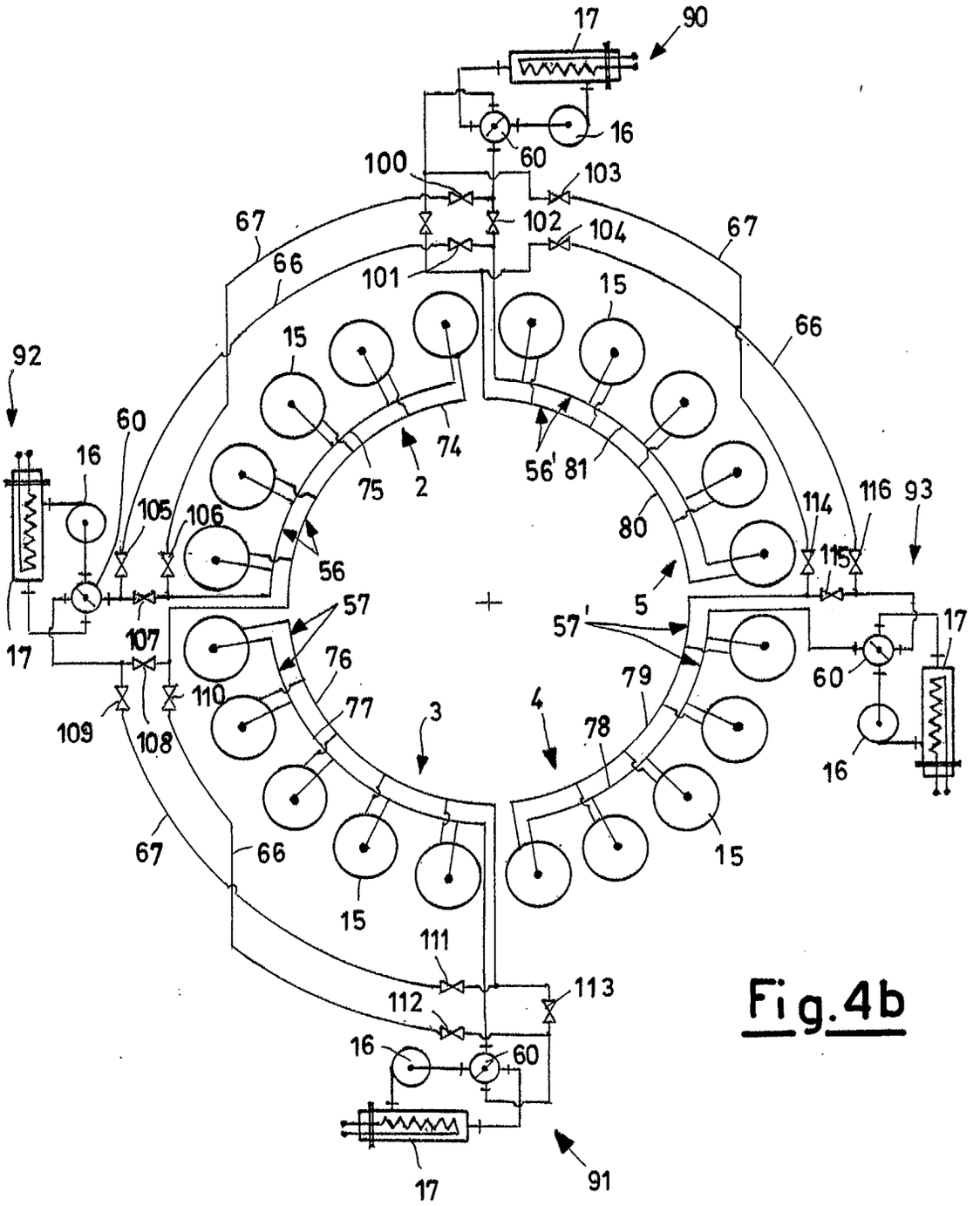
17
91

Fig.4a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108
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112
113
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Fig.4b

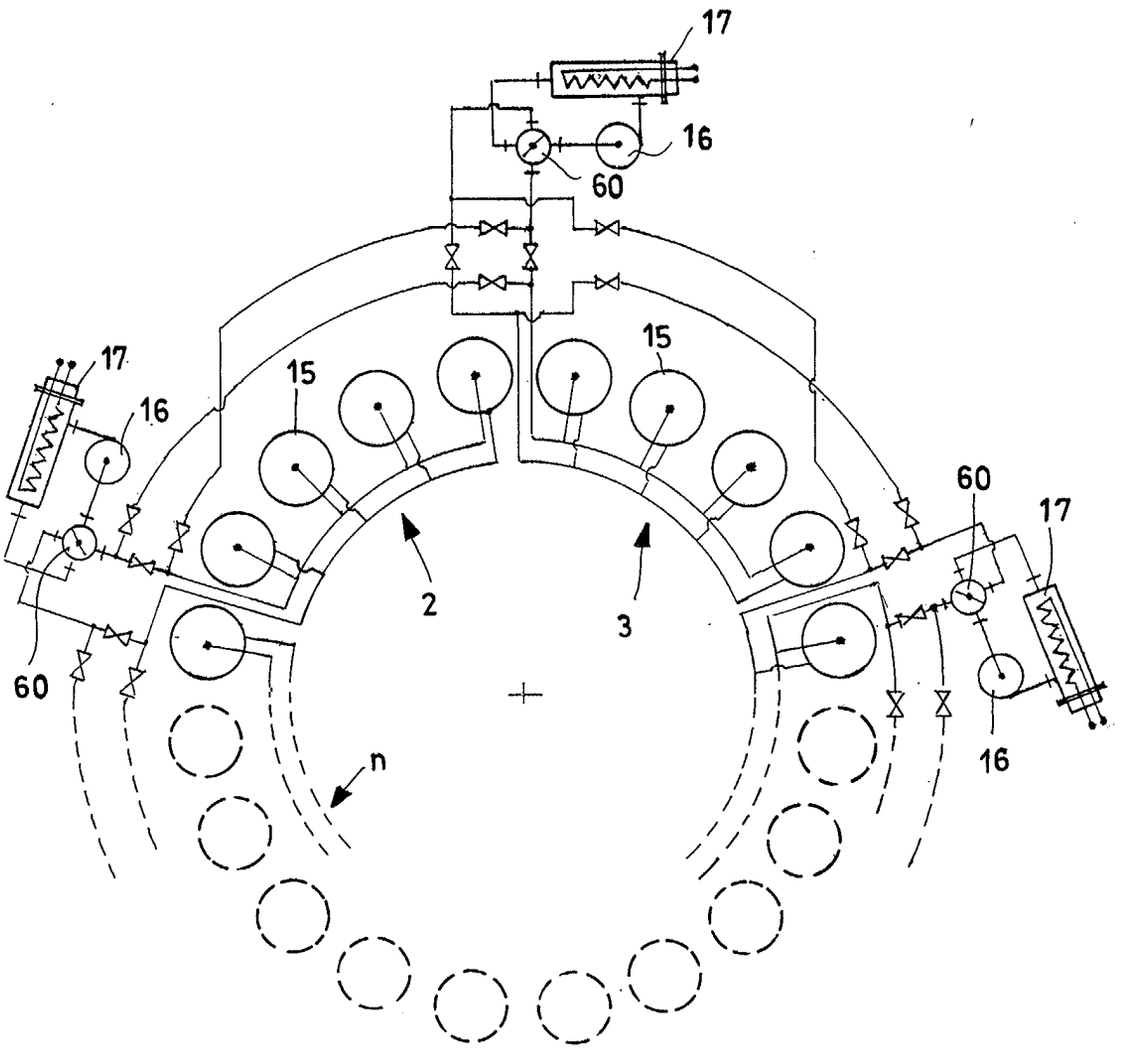


Fig.4c

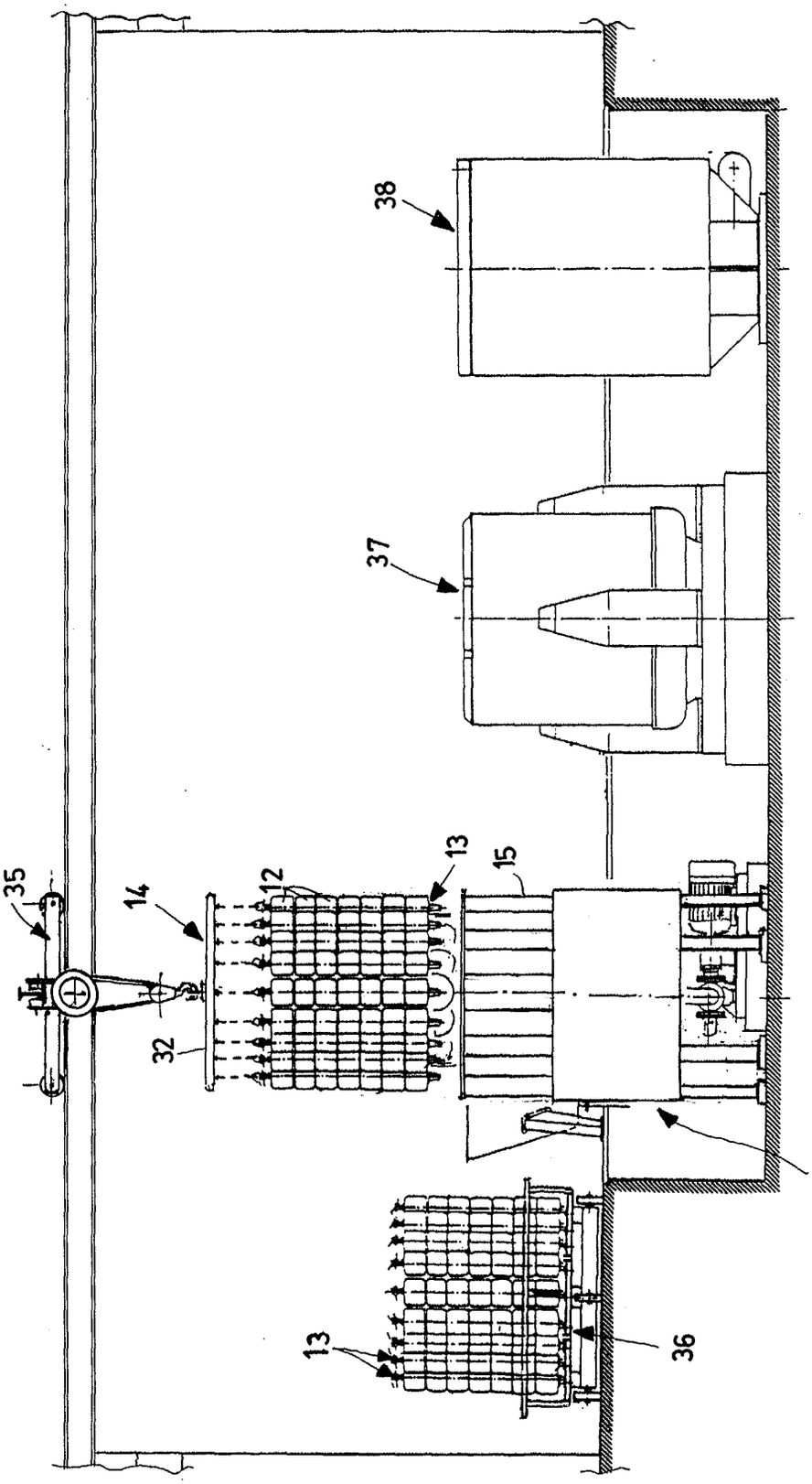


Fig.5

Fig.6a

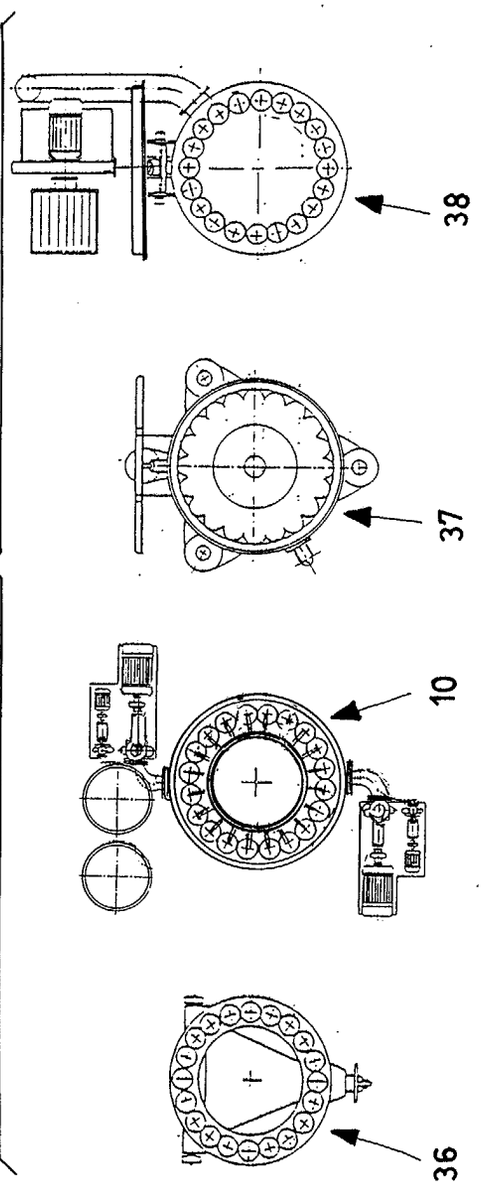


Fig.6b

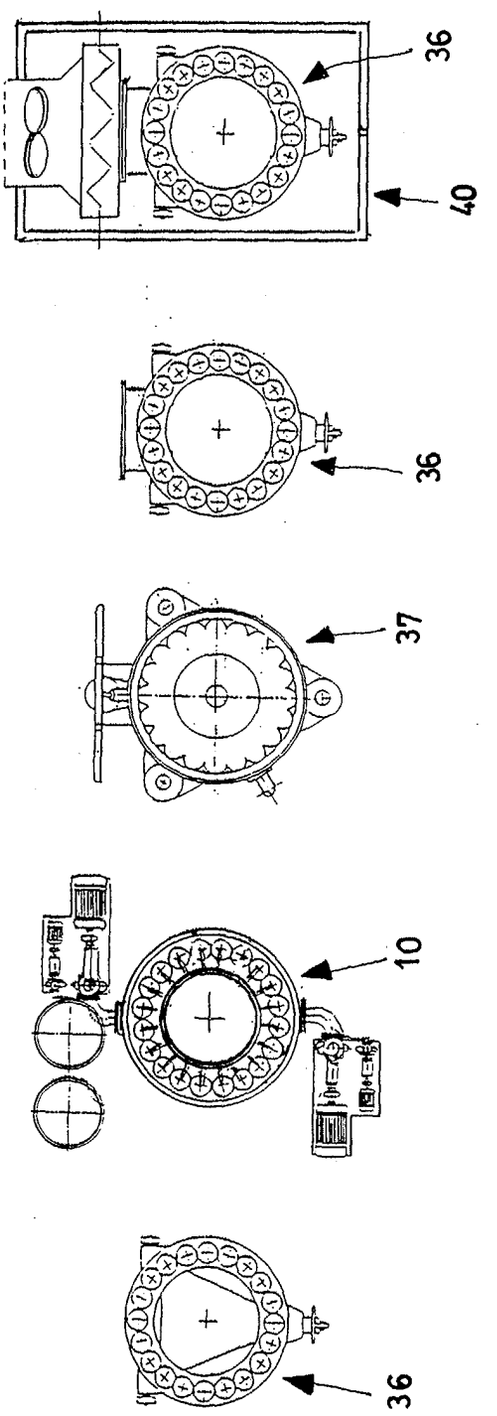
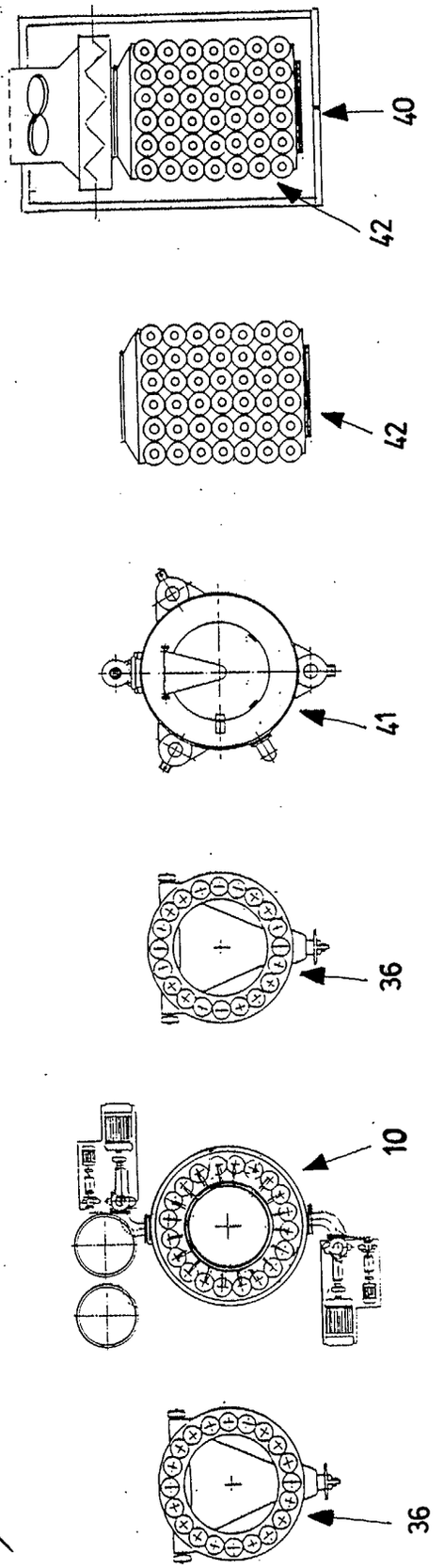


Fig.6c



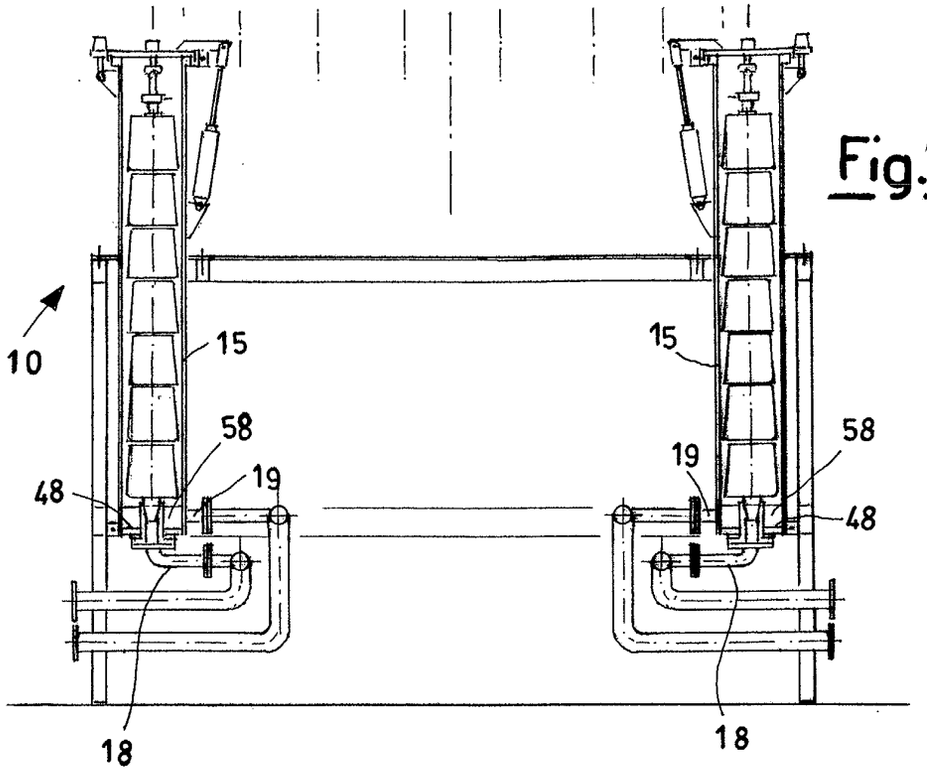


Fig.8

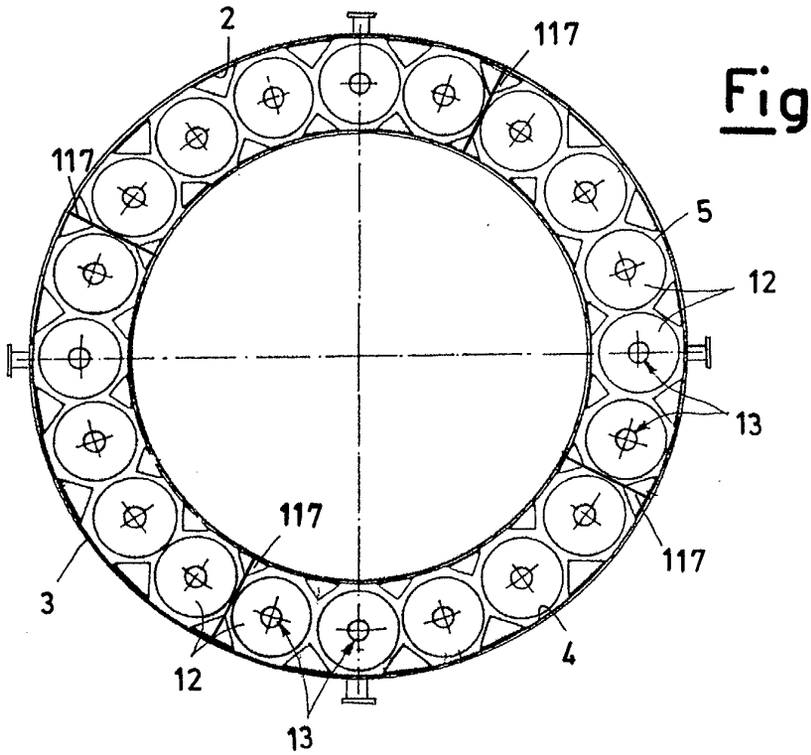


Fig.9