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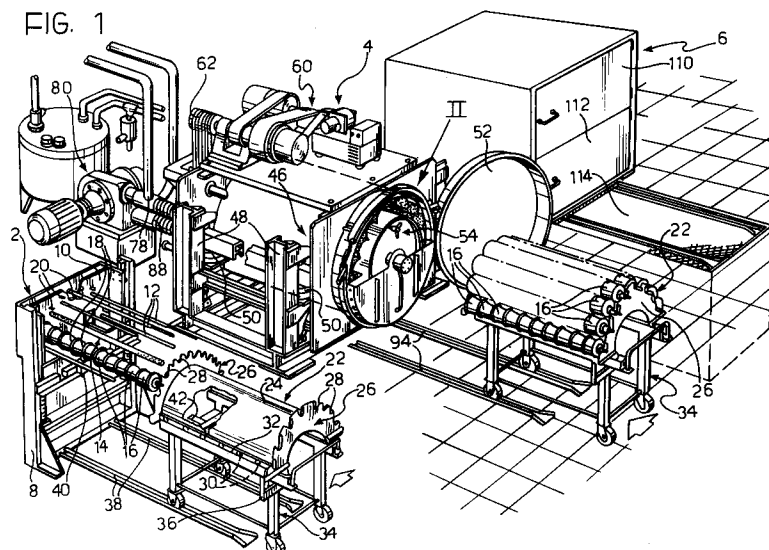
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I-10121 Torino(IT)(54) **Equipment for dyeing yarn wound on reels and the like.**

(57) Equipment for dyeing yarn wound on reels and the like includes a cylindrical container (46) with a horizontal axis containing a rotary drum (54) with an outer, perforated, cylindrical wall (64) and an inner, non-perforated, cylindrical wall (66) between which an annular chamber is defined. The equipment includes two identical material-holders (22) each of which has an elongate, arcuate structure with a substantially semicircular cross-section. Each material-

holder is intended to support a plurality of perforated tubes (14) each carrying a row of reels (16) with their axes parallel to generatrices of the arcuate structure. In order to load the material-holders (22) into the drum (54), one material-holder is inserted in the upper half of the annular chamber of the drum (64), the drum (54) is rotated through 180° and the other material-holder (22) is then inserted in the upper half of the annular chamber (67).

FIG. 1

**EP 0 470 562 A1**

The present invention relates to equipment for dyeing yarn wound on reels and the like, of the type including a cylindrical dye container with a horizontal axis and an open end which can be closed by a door, and a material-holder which supports a plurality of parallel, perforated tubes on each of which a row of reels is fitted, the material-holder and its reels being intended to be inserted in the cylindrical container for the dyeing operation, the bath passing through the material alternately outwards from the inside and inwards from the outside, and being removed from the container upon completion of the operation.

The object of the present invention is to provide equipment of the type specified above which simplifies the handling of the material during the dyeing cycle; in particular, the invention proposes equipment in which the same material-holder can carry the reels throughout all the stages of the dyeing cycle (the dyeing itself, the centrifuging, and the drying) and can be transported without the need for a bridge crane.

According to the present invention, this object is achieved by equipment of the type defined above, characterised in that:

- a) the cylindrical container has an internal rotary drum including an outer, perforated, cylindrical wall and an inner, non-perforated cylindrical wall, the two walls defining an annular chamber which is open at its front end facing the open end of the container and communicates at its rear end with a collecting chamber which is connected in turn to one pipe of a reversible pump used to circulate the bath, the other pipe of the pump communicating with the space between the container and the drum,
- b) means are provided for rotating the rotary drum,
- c) the material-holder is constituted by two identical material-holders each comprising an elongate, arcuate structure with a substantially semi-circular cross-section for supporting the tubes with their axes parallel to generatrices of the structure,
- d) guide and support means are disposed respectively in the annular chamber of the rotary drum and on each of the material-holders for cooperating with each other to enable a material-holder to be inserted in the upper portion of the annular chamber of the rotary drum and supporting it in that portion of the chamber,
- e) there is at least one trolley for supporting each of the material-holders with the convex part of its arcuate structure facing upwardly on guide means which enable the material-holder to be moved longitudinally relative to the trolley,
 - the two material-holders thus being loaded into the annular chamber by bringing the

trolley carrying one of the two material-holders up to the open end of the cylindrical dye container, moving the material-holder axially relative to the trolley so as to insert the material-holder into the upper half of the annular chamber of the drum, rotating the drum through 180° to move the material-holder into the lower half of the annular chamber, and inserting the other material-holder in the upper half of the annular chamber in the same manner.

In a first embodiment, the means for rotating the rotary drum are of a size such that they can rotate the drum at a slow speed suitable for effecting the rotation through 180° necessary for the loading and unloading of the material-holders. In this case, the machine only carries out the dyeing of the reels and must therefore be associated with a centrifuging machine which is arranged for housing the same material-holders. This solution is convenient in a plant with a large production capacity in which a single centrifuging machine can serve a plurality of dyeing machines.

According to another embodiment, the means for rotating the rotary drum are of a size such that they can also rotate the drum at a fast speed in order to expel the bath from the reels by centrifuging upon completion of the dyeing operation. In this case the same machine can thus dye and centrifuge the material, and intermediate handling between the dyeing stage and the centrifuging stage is unnecessary. The equipment according to this latter embodiment preferably includes means connected to the collecting chamber and to the space inside the cylindrical casing by means of a pair of pipes for generating a flow of hot air to dry the reels. The same machine thus dyes, centrifuges, and dries the material.

Further characteristics and advantages of the present invention will become clear in the course of the detailed description which follows with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a perspective view of equipment according to the present invention,

Figure 2 is a perspective view of the portion indicated by the arrow II of Figure 1,

Figure 3 is a section taken on the line III-III of Figure 2,

Figure 4 is a section taken on the line IV-IV of Figure 3,

Figure 5 is a section taken on the line V-V of Figure 2,

Figure 6 is a schematic view of an alternative version of the equipment according to the present invention,

Figure 7 is a perspective view of a centrifuging machine, and

Figure 8 is a front elevational view of a machine arranged solely for dyeing.

Figure 1 shows equipment for dyeing yarn including a loading device 2, a dyeing and centrifuging machine 4 and a drying device 6.

The loading device 2 is constituted substantially by a fixed framework 8 carrying a vertically-movable slide 10 driven by a pair of hydraulic cylinders, not shown. A plurality of parallel rods 12 projecting from the slide 10 are arranged on generatrices of a half-cylinder. Respective perforated tubes 14, onto each of which a plurality of reels 16 separated by spacer discs 18 is fitted, are intended to be slipped onto the rods 12. The tubes 14 are retained on the rods 12 by respective pressure catches 20 carried by the slide 10. The reels 16 and the spacer discs 18 are locked axially on the respective tubes 14 by conventional locking members not visible in the drawings.

A material-holder, indicated 22, is intended to receive and support the tubes 14 and their reels 16 which have been prepared on the loading device 2. The material-holder 22 is constituted by a semi-cylindrical wall 24 each end of which has a flange 26 with a semicircular profile. A series of profiled notches 28 is formed in the periphery of each flange 26 for supporting the ends of the perforated tubes 14. The lower edges of the material-holder 22 have a plurality of wheels 30 which bear on guides 32 on a trolley 34. The trolley 34 has a catch lever 36 for anchoring the material-holder 22 on the trolley 34.

In front of the loading device 2 are a pair of guides 38 for aligning the trolley 34 with the device 2. In order to load the tubes 14 carrying the reels 16 onto the material-holder 22, the slide 10 is raised and the trolley 34 with the empty material-holder 22 is brought up to the framework 8 of the device 2. A proximity switch (not shown) detects the presence of the trolley 34 and operates a hydraulic cylinder 40 the rod of which is inserted in a hole 42 in the structure of the trolley 34 to anchor the latter to the framework 8. The switch which detects the presence of the trolley 34 also causes the slide 10 to descend until the ends of the tubes 14 bear on the bases of the profiled notches 28 in the material-holder 22. The trolley 34 is then released by the cylinder 40 and is moved away from the loading device 2 slipping the tubes 14 off the rods 12.

The dyeing and centrifuging machine 4 includes a cylindrical container 46 with a horizontal axis supported on a base structure 48 by means of a series of air-cushions 50. The suspension system of the container 46 is described in detail in the present Applicant's Italian patent application No. 19131-A/89.

The front end of the container 46 has a semi-

circular opening. A closing cover 52 is disposed in correspondence with the open end. As can be seen in greater detail in Figures 2 and 3, inside the cylindrical container 46 is a drum 54 with a shaft 56 which is supported by the container 46 by means of a pair of bearings 58 each protected by a mechanical seal for rotary shafts. The shaft 56 of the drum 54 is connected to a drive unit 60 (visible in Figure 1) by transmission belts 62.

The drum 54 includes an outer, perforated, cylindrical wall 64 and an inner, non-perforated, cylindrical wall 66 between which an annular chamber 67 is defined. The inner, cylindrical wall 66 is closed at the front by an end wall 68 and at the rear by a pair of spaced-apart walls 70, 72. The walls 68, 70 and 72 seal the space surrounded by the inner cylindrical wall 66 and are fixed to the shaft 56.

The space described forms a liquid-tight chamber which contains the bath, that is, a quantity of liquid used in the process, the quantity being proportional to the number of kilograms of material to be dyed.

A collecting chamber 74 defined between the walls 70 and 72 is connected to the annular chamber 67 by a plurality of holes 76. The collecting chamber 74 is connected to a reversible pump 80 (visible in Figure 1) by means of a pipe 78. As can be seen in Figures 2 and 5, the pipe 78 extends through the rear wall of the container 46 and its end carries a telescopic member 82 which can be made to slide by a pair of pneumatic cylinders 84. The telescopic member 82 is intended to establish a connection between the pipe 78 and a hole 86 in the wall 72 (see Figure 5). The reversible pump 80 is also connected to a second pipe 88 (Figure 2) which communicates with the space between the drum 54 and the container 46.

As can be seen in Figure 2, a plurality of channel-shaped elements 90 of perforated sheet metal is fixed to the cylindrical outer wall 64 of the drum 54 and defines a series of seats which, as will be explained further below, are intended to house respective tubes 14 with their reels 16. As can be seen in Figures 2 and 4, the annular chamber 67 between the cylindrical walls 64 and 66 is divided into two semi-annular chambers by two diametrically-opposed radial partitions 92 fixed to the inner wall 66 and to the outer wall 64. The two semi-annular chambers are open in correspondence with the open end of the container 46 and are intended to house respective material-holders 22. The radial partitions 92 constitute the guides on which the wheels 30 of the material-holder 22 are intended to roll when it is inserted in the chamber 67.

In order to load the material-holders 22 into the drum 54, the drum is stopped in a position in which

the radial partitions 92 extend horizontally. This position is detected by a conventional position sensor (not shown). The end of the trolley 34 with the material-holders 22 and the reels 16 is brought up to the open end of the container 46. A pair of guides 94 is also provided in front of the dyeing machine 4 for aligning the trolley 34 with the container 46. The radial partitions 92 are aligned with the guides 32 on the trolley 34. The material-holder 22 is then inserted in the upper half of the annular chamber 27 simply by moving the material-holder 22 into the drum 54 axially. After the first material-holder 22 has been inserted, the drum 54 is rotated through 180° moving the material-holder 22 which has just been loaded into the lower half of the annular chamber 67 and bringing the empty half of the annular chamber 67 to the top. A second trolley 34 is then brought up to the machine 4 and a second material-holder 22 is inserted in the second semi-annular chamber.

Figures 3 and 4 show the drum 54 loaded with the two material-holders 22. The wall 68 of the drum 54 carries two threaded rods 96 which are inserted in respective holes in the material-holder 22. A handwheel 98 is screwed onto each rod 96 to fix the material-holders 22 axially to the drum 54. As can be seen in Figure 3, the ends of the tubes 14 which face the rear end of the container 46 are arranged in correspondence with respective holes 76 in the end wall 70. The dye bath which is sent into the collecting chamber 74 through the pipe 78 thus flows into the cavities in the tubes 14 and passes through the reels 16 outwardly from the inside. The bath collects in the space between the drum 54 and the container 46 and returns through the pipe 88 to the pump 80 for recirculation. Since the pump 80 is reversible, the dye bath can also flow in the opposite direction, that is, the bath is sent into the container 46 through the pipe 88 and passes through the reels 66 inwardly from the outside and then through the tubes 14, the collecting chamber 74, and the pipe 78 back to the pump 80. As can be seen in Figure 3, a coiled tube 100, through which a cooling or heating fluid flows, is disposed in the bottom of the cylindrical containers 46 so that the temperature of the dye bath can be varied according to a predetermined programme.

Upon completion of the dyeing, the bath is removed from the container 46 through a lower outlet valve, not shown in the drawings. The telescopic member 82 is then retracted so that the drum 54 is free to rotate. The drive unit 60 is then operated and rotates the drum 54 at a high speed. When the acceleration to which the tubes 14 and the reels 16 are subjected exceeds the acceleration due to gravity, the spacer discs 18, which have larger diameters than the reels 16, are brought into contact with the inner surfaces of the respective

channel-shaped elements 90. The bath which is removed from the reels 16 collects in the bottom of the container 46 and is then discharged from the equipment gradually through the outlet valves, not shown.

The dyeing and centrifuging machine 4 can also dry the material upon completion of the centrifuging stage. In order also to carry out this latter function, the machine 4 is connected to a circuit for the forced supply of hot air as shown in Figure 6. With reference to Figure 6, a valve in the pipe 78 is indicated 101. Two hot-air supply pipes, indicated 102 and 104, are connected to the pipes 78 and 88 and to a fan unit, not shown. Respective valves 106 and 108 in the pipes 102 and 104 are closed during the dyeing stage. Upon completion of the centrifuging stage, the valve 101 is closed, the valves 106 and 108 are opened and the hot-air supply unit is activated in order to dry the material.

Alternatively, the dyeing and centrifuging machine 4 may be associated with an independent drying device 6 as shown in Figure 1. In this case, upon completion of the centrifuging stage, the material-holders 22 are removed from the drum 54 by reversing the process described above and are loaded on respective trolleys 34. The material-holders 22 are transported by the trolleys 34 to the drying device 6 which, in the embodiment illustrated in Figure 1, includes two superposed drying chambers 110 and 112. The platform 114 of a hoist which is sunk into the floor in front of the drying device 6 can be lowered below the floor level in order to bring the guides 32 of the trolley 34 to the same level as the base wall of the lower drying chamber 112. The base wall of the upper drying chamber 110, however, is aligned with the guides 32 of the trolley 34 when it is at floor level.

A plant with a high production capacity may conveniently have a series of machines solely for dyeing, associated with a single machine solely for centrifuging the material. Figure 8 shows the rear end of a machine solely for dyeing. In this embodiment, the casing 46 is supported on the floor by supports 118 instead of being suspended on air cushions 50. The motor, indicated 120, which rotates the drum 54 is of a size such that it can rotate the drum 54 at a speed suitable for effecting the rotation through 180° necessary for the loading and unloading of the material-holders 22. The shaft 56 of the drum 54 is supported on the casing 46 by bearings protected by mechanical rotary-shaft seals.

Figure 7 shows a machine solely for centrifuging the material. This machine differs from the dyeing and centrifuging machine described above in that it has no pump for circulating the bath and in that the closure door 52 does not have to be of a size such as to withstand the pressure of the dye

bath.

The equipment according to the present invention may be used for bleaching treatments as well as dyeing treatments. The yarn may be made up into any kind of textile provided that it has the necessary degree of compactness. Instead of being wound on reels, the yarn may be wound on bobbins, cheeses, or beams, or may be in the form of tops or tufts.

Finally, it should be noted that, in the case of a series of dyeing machines, it is possible to use a single loader suitable for all the machines and one modular material-holder suitable for loading into each machine of the series. In this case any other movement of the material takes place with trolleys and material-holders of a single type.

Naturally, the principle of the invention remaining the same, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated, without thereby departing from the scope of the present invention.

Claims

1. Equipment for dyeing yarns wound on reels and the like of the type including a cylindrical dye container (46) with a horizontal axis and an open end which can be closed by a door (52) and a material-holder (22) which supports a plurality of parallel, perforated tubes (14) on each of which a row of reels (16) is fitted, the material-holder (22) and its reels (16) being intended to be inserted in the cylindrical container (46) for the dyeing operation, the bath passing through the material alternately outwards from the inside and inwards from the outside and being removed from the container (46) upon completion of the operation, characterised in that:

a) the cylindrical container (46) has an internal, rotary drum (54) including an outer, perforated cylindrical wall (64) and an inner, non-perforated cylindrical wall (66), the two walls (64, 66) defining an annular chamber (67) which is open at its front end facing the open end of the container (46) and communicates at its rear end with a collecting chamber (74) which is connected in turn to the pipe (78) of a reversible pump (80) used to circulate the bath, the other pipe (88) of the pump (80) communicating with the space between the container (46) and the drum (54),

b) means (60, 120) are provided for rotating the rotary drum (54),

c) the material-holder is constituted by two identical material-holders (22) each comprising an elongate, arcuate structure with a

substantially semi-circular cross-section for supporting the tubes (14) with their axes parallel to generatrices of the structure,

d) guide and support means (92, 30) are disposed respectively in the annular chamber (67) of the rotary drum (54) and on each of the material-holders (22) for cooperating with each other to enable a material-holder (22) to be inserted in the upper portion of the annular chamber (67) of the rotary drum (54) and supporting it in that portion of the chamber,

e) there is at least one trolley (34) for supporting each of the material-holders (22) with the convex part of its arcuate structure facing upwardly on guide means (32) which enable the material-holder (22) to be moved longitudinally relative to the trolley (34),

- the two material-holders (22) thus being loaded into the annular chamber (67) by bringing the trolley (34) carrying one of the two material-holders (22) up to the open end of the cylindrical dye container (46), moving the material-holder (22) axially relative to the trolley (34) so as to insert the material-holder into the upper half of the annular chamber (67) of the drum (54), rotating the drum (54) through 180° to move the material-holder (22) into the lower half of the annular chamber (67), and inserting the other material-holder (22) in the upper half of the annular chamber (67) in the same manner.

2. Equipment according to Claim 1, characterised in that the collecting chamber (74) is constituted by the space between first and second axially spaced-apart end walls (70, 72) fixed to the rear end of the non-perforated cylindrical wall (66) of the drum (54), the first end wall (70) having a plurality of holes (76) for connecting the collecting chamber (74) to the cavities of the tubes (14), the second wall (72) having a hole (86) for connecting the collecting chamber (74) to a pipe (78) through which the bath can pass, the pipe having a telescopic member (82) operated by a pressurised-fluid actuator (84) for connecting the pipe (78) to the hole (86) in the second end wall (72), the non-perforated cylindrical wall (66) being closed at the front by a front end wall (68) which has two threaded rods (96) for fixing the material-holders (22) axially, and the rear end walls (70, 72) and the front wall (68) being fixed to a shaft (56) for supporting the drum (54).

3. Equipment according to Claim 1, characterised in that a plurality of channel-shaped elements (90) of perforated sheet metal is fixed to the inner surface of the perforated cylindrical wall (64) of the drum (54), each element (90) being intended to house the reels (16) carried by a tube (14), the reels (16) being spaced from the inner surface of the channel-shaped element (90) by spacer discs (18) mounted on the tubes (14) between each reel (16) and the adjacent reel (16). 5 10
4. Equipment according to Claim 1, characterised in that each material-holder (22) includes a semicylindrical wall (24) each end of which has a flange (26) with a semicircular profile having a series of profiled notches (28) in its periphery for supporting the ends of the perforated tubes (14). 15 20
5. Equipment according to Claim 1, characterised in that the guide and support means in the annular chamber (67) of the drum (54) are constituted by two diametrically-opposed radial partitions (92) which divide the annular chamber (67) into two semi-annular chambers, the lower edges of the material-holder (22) having a plurality of wheels (30) for engaging the radial partitions (92) when the material-holder (22) is inserted in one of the two semi-annular chambers, the wheels (30) of the material-holder (22) also being intended to engage longitudinal guides (32) carried by the trolley (34). 25 30
6. Equipment according to Claim 3, characterised in that it also includes a loading device (2) with a fixed structure (8) carrying a vertically-movable slide (10) with a plurality of rods (12) which project from the slide (10) and are arranged on generatrices of a half-cylinder of corresponding shape to the material-holder (22), the rods (12) being intended to support respective tubes (14) during the preparatory operation in which the reels (16) and the spacer discs (18) are fitted onto the tubes (14). 35 40 45
7. Equipment according to Claim 1, characterised in that the means (120) for rotating the rotary drum (54) are of a size such that they can rotate the drum at a slow speed suitable for effecting the rotation through 180° necessary for the loading and unloading of the material-holders (22). 50
8. Equipment according to Claim 7, characterised in that the means (60) for rotating the rotary drum (54) are of a size such that they can also rotate the drum (54) at a fast speed in order to 55
9. Equipment according to Claim 8, characterised in that it includes means for generating a flow of hot air for drying the reels (16), the means being connected to the collecting chamber (74) and to the space inside the cylindrical casing (46) by a pair of pipes (102, 104). 60
10. Equipment according to Claim 1, characterised in that it also includes a drying device (6) with an upper drying chamber (110) and a lower drying chamber (112) for housing the two material-holders (22), the base wall of the upper chamber (110) being at the same level as the guide means (30) on the trolley (34) and a sunken hoist being provided for lowering the trolley (34) to bring its guide means (32) to the level of the base wall of the lower chamber (112). 65

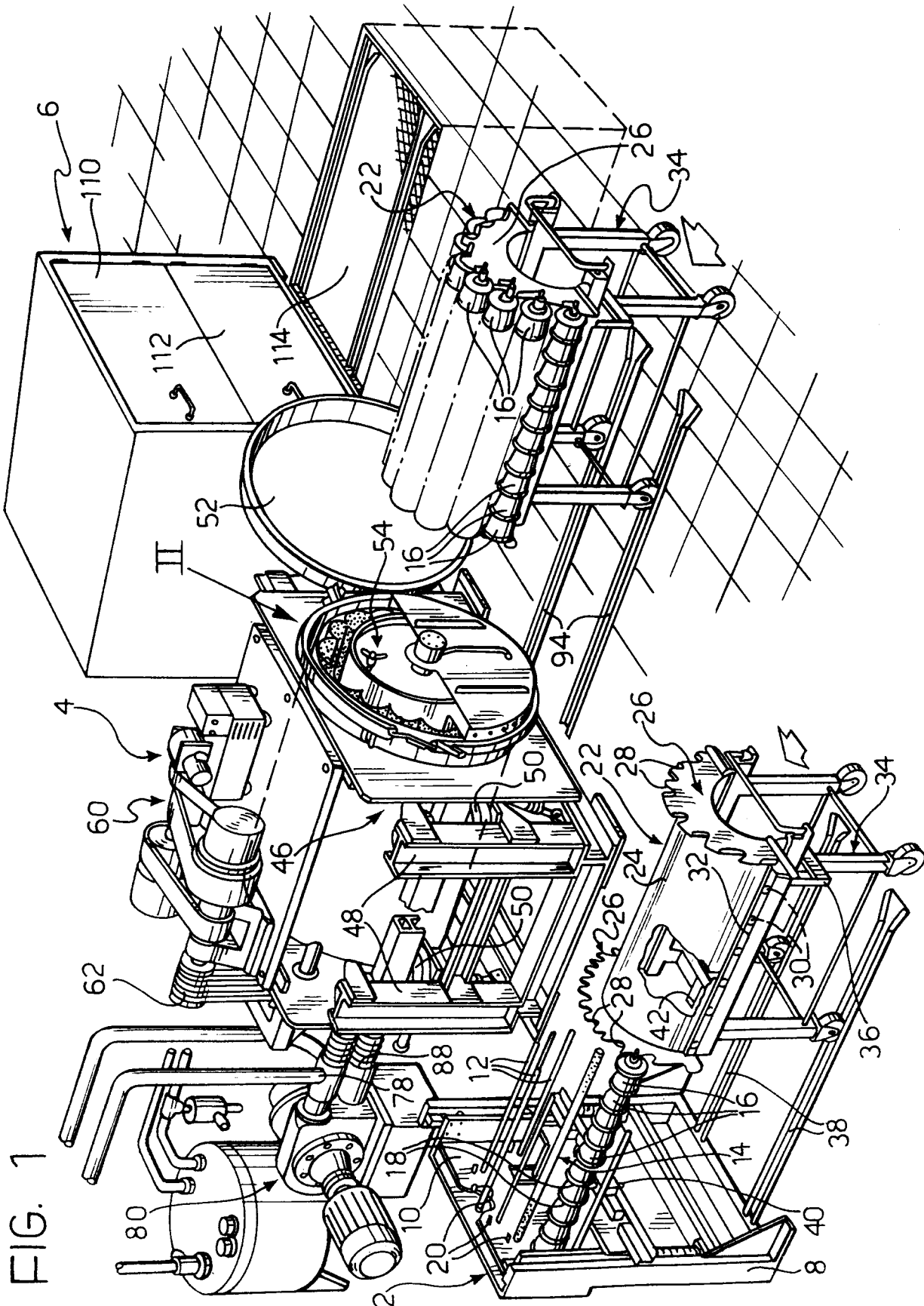
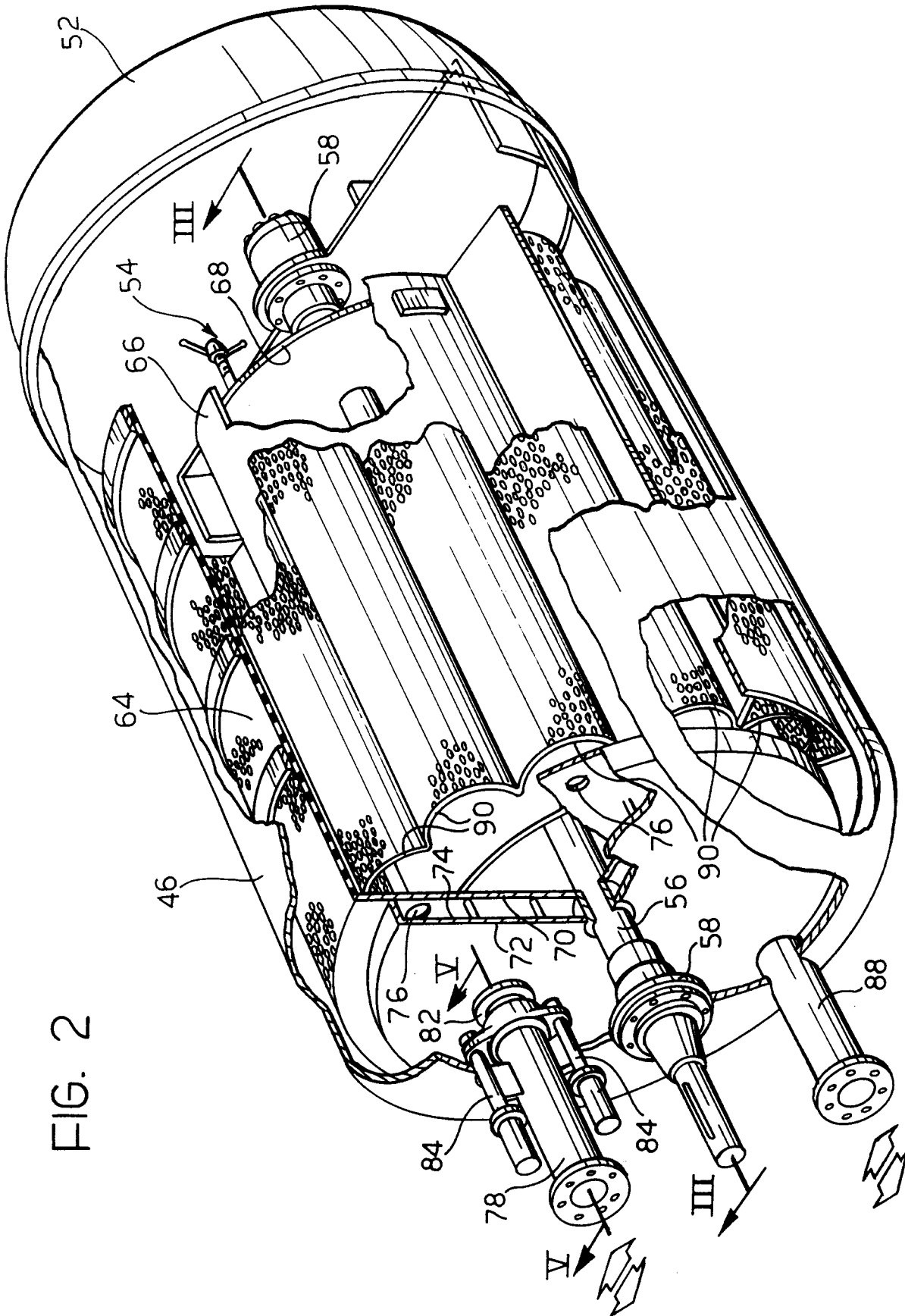


FIG. 2



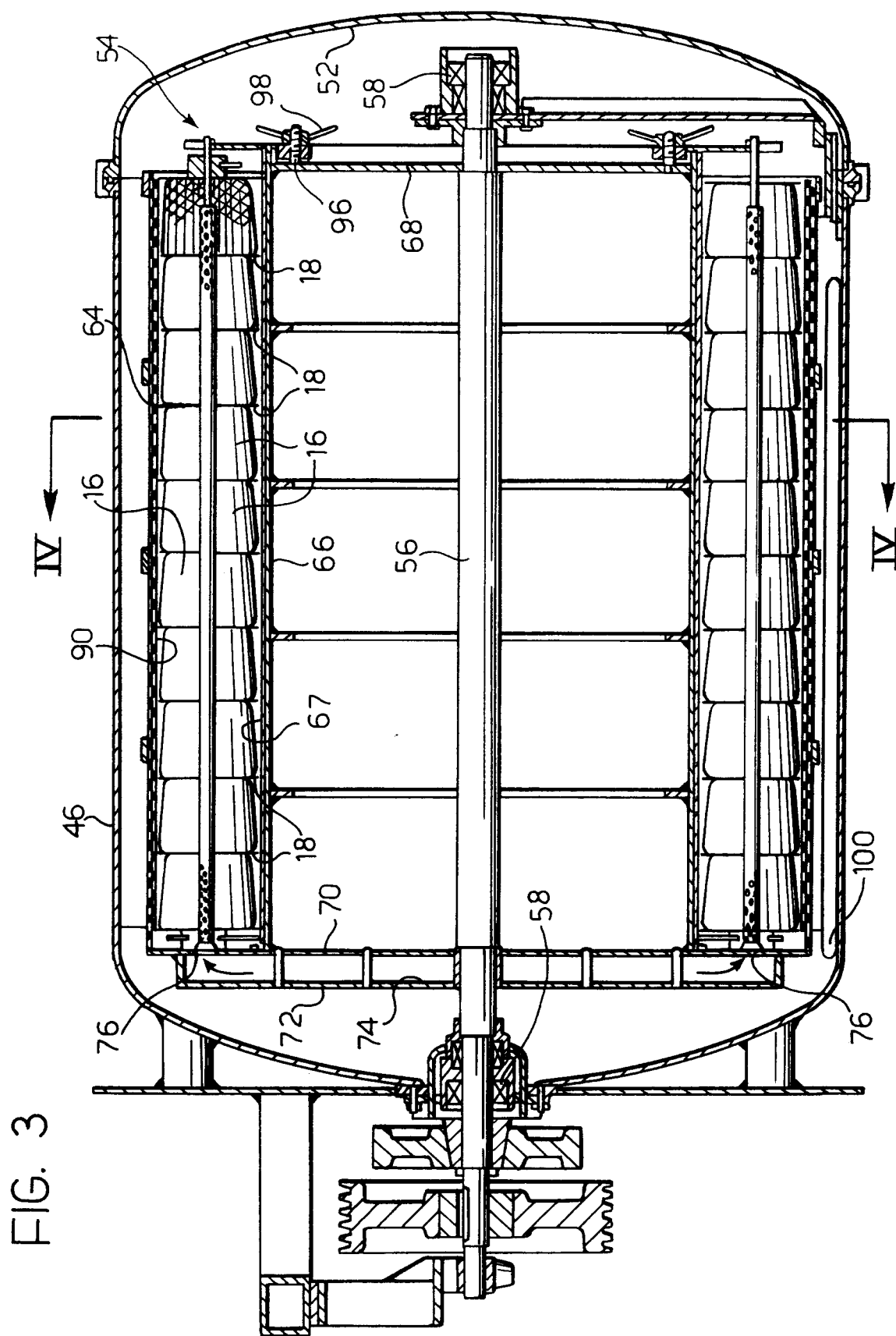


FIG. 4

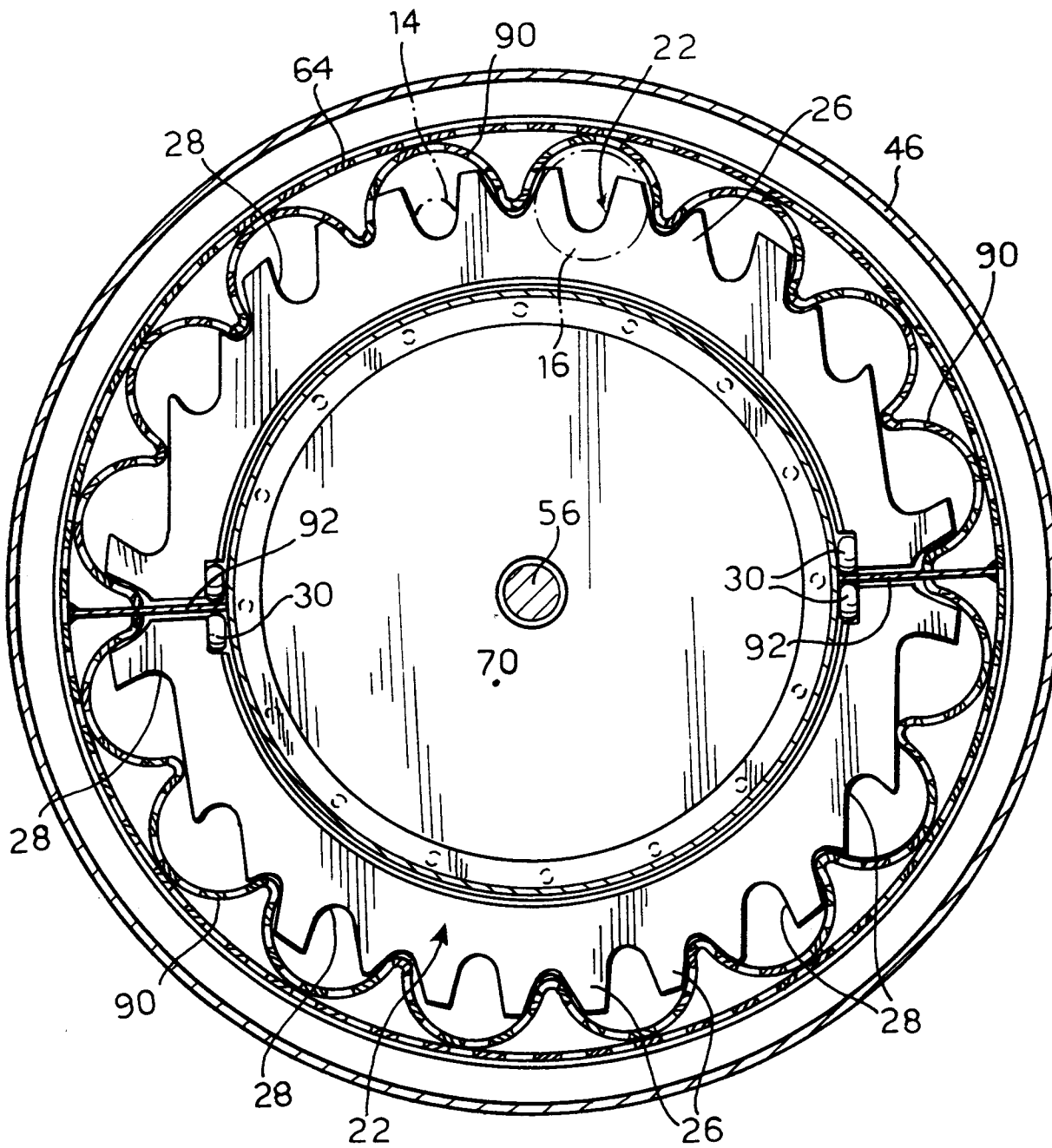


FIG. 5

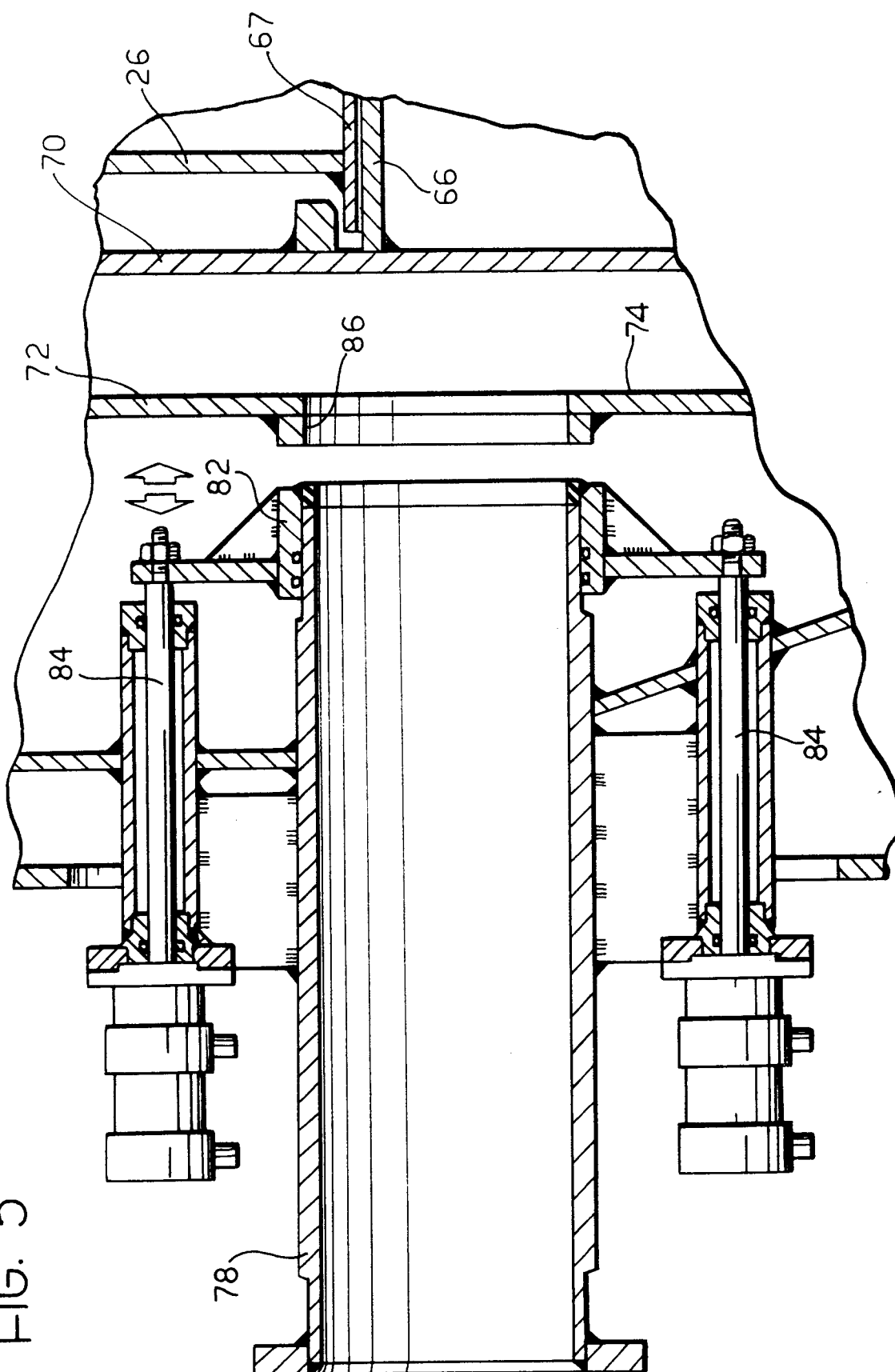


FIG. 6

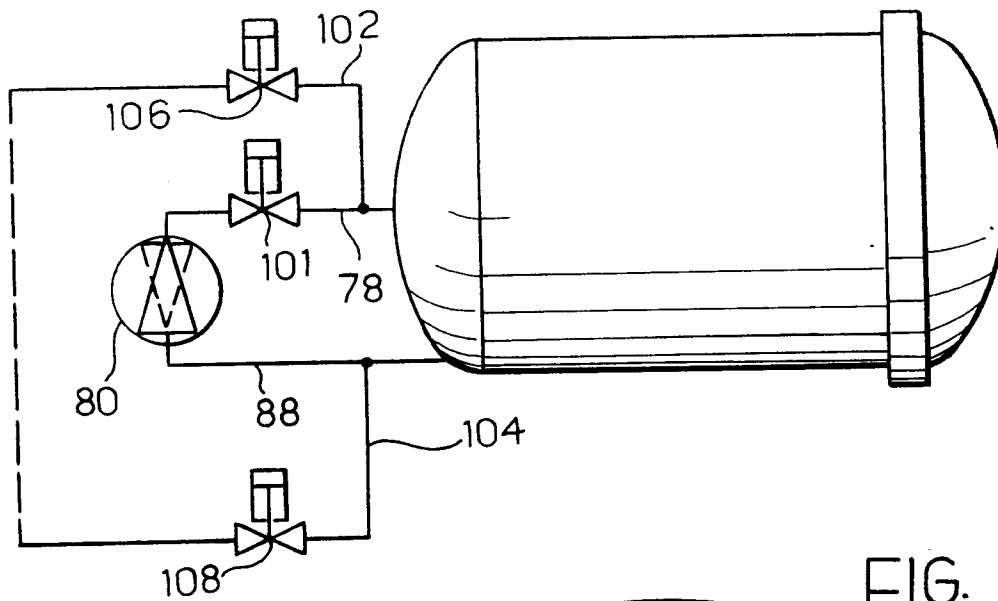


FIG. 8

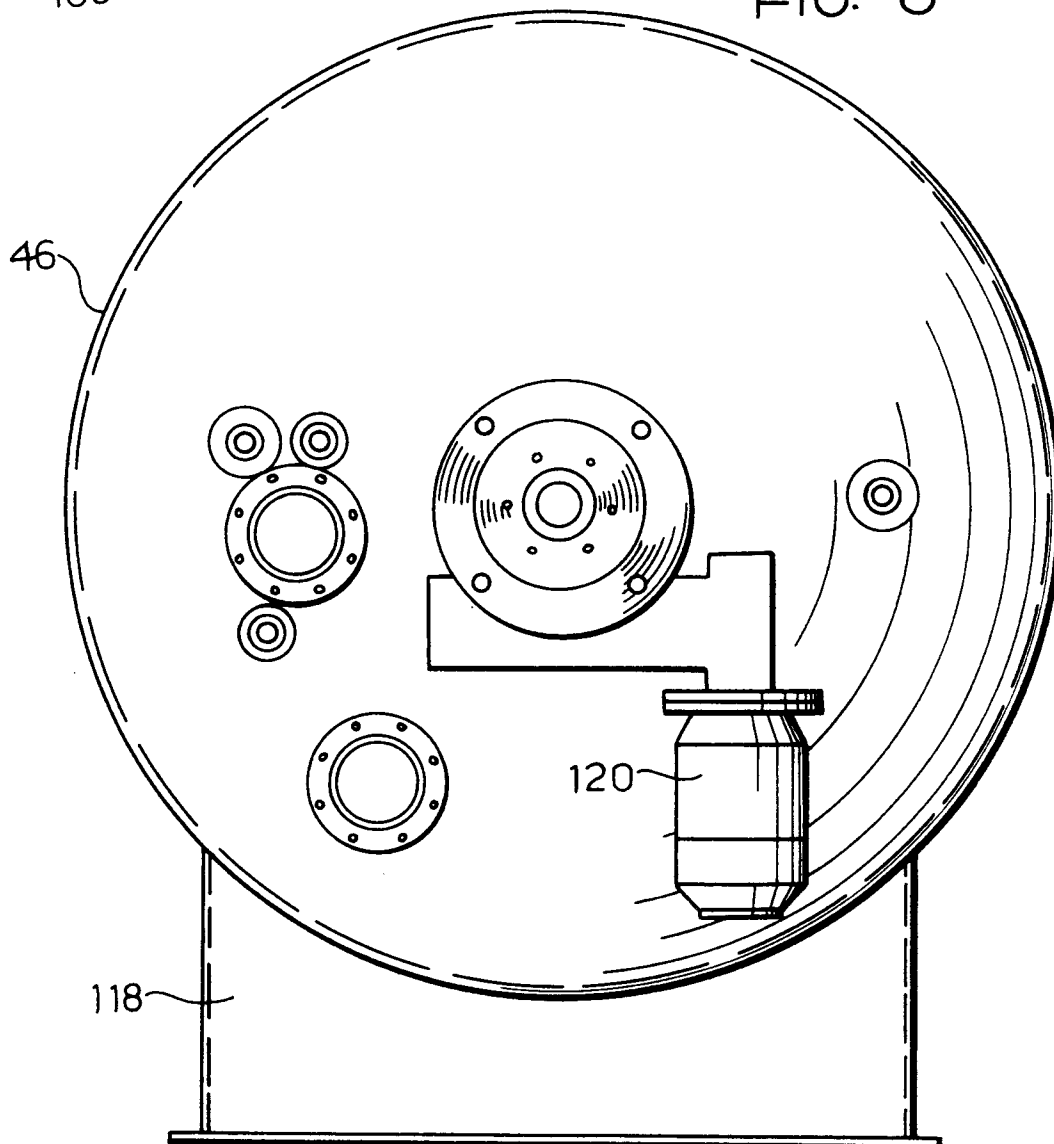
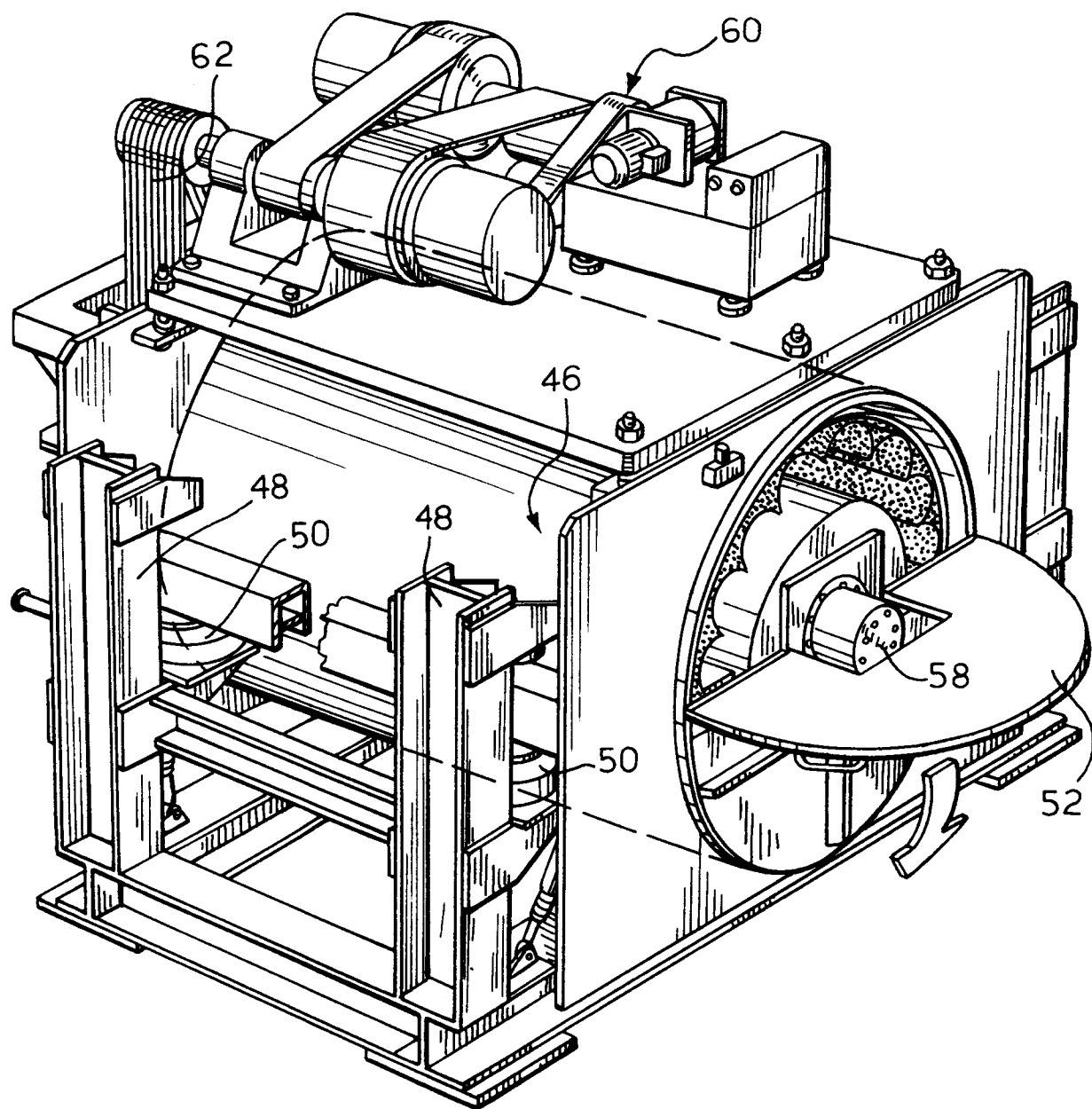


FIG. 7





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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 3156

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)	
A	FR-A-2 268 104 (LEOPOLDO POZZI) - - -		D 06 B 5/16	
A	DE-A-1 964 593 (BRÜCKNER) - - -			
A	US-A-3 638 458 (TEINTURERIE DES FRANCS) - - - - -			
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)	
			D 06 B	
Place of search		Date of completion of search	Examiner	
The Hague		11 November 91	PETIT J.P.	
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