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(54) Equipment and a method for the drawing of slivers of textile fibres with a continuous supply.

(57) The equipment includes at least one first drawing unit (4) and one second drawing unit (5) arranged in series and a rotary table (26) adjacent the input to the second drawing unit (5), the table carrying a plurality of containers (22) which have already been filled by the first drawing unit (4) and are intended to supply the second drawing unit (5). A waiting position (27) is operatively interposed between the position (23) in which the container (22) is filled at the output of the first drawing unit and the rotary table (26). There is an interchanging device (28) for replacing the container which has been filled with the sliver and is in the filling position (23) with an empty container which is in the waiting position (27). The equipment also includes a device for transferring a full container (22) which is in the waiting position (27) onto the rotary table (26) or for transferring an empty container (22) from the rotary table (26) to the waiting position (27).

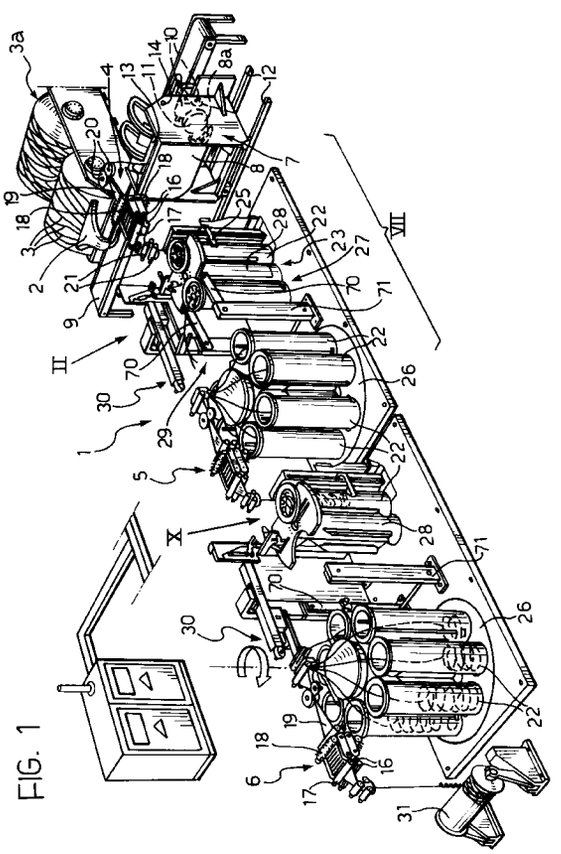

FIG. 1

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The present invention relates to equipment for the combination, making parallel, and drawing of textile fibres.

Slivers of textile fibres and, in particular, of wool have conventionally been processed by drawing frames with drawing heads which have the function of making parallel and homogenising the fibres of the sliver. In particular, the use of drawing heads of the type known as "intersecting heads" or "heads with two sets of needles" is now widespread. A drawing head of this type is described, for example, in the Applicant's U.S. patent 4,554,709 and in the corresponding German application 34 25 799.

In high-speed equipment for large-scale production, it would naturally be desirable for the machine to be able to operate continuously so that the input of the machine could be supplied with a continuous sliver and a continuous sliver could be delivered at its output. However, this requirement conflicts with the need to draw the sliver in both directions in order to achieve the desired parallelism and homogenisation of the fibres. For this reason, plants produced up to now generally include several drawing units in series. The sliver output from the first drawing unit is collected in containers. After each container has been filled with the sliver output from the first drawing unit, the sliver is broken and the tail end of the sliver in the container is used as the head end to be supplied to the next drawing unit. The second drawing operation thus draws the fibres of the sliver in the opposite direction from the first drawing operation. In the case, for example, of a conventional precombing line, the slivers output from the cards are supplied either into containers which then serve to supply the first drawing unit, or directly to the first drawing unit. The sliver output from the first drawing unit is collected in a container which is then transferred to a second drawing unit for supply thereto. A plurality of supply containers is generally disposed in correspondence with each drawing unit. The arrangement described above is usually repeated for a third drawing operation.

Naturally, conventional machines operate discontinuously and require constant supervision in operation, as well as having disadvantages from the point of view of reliability and productive efficiency.

The object of the present invention is to provide drawing equipment which can operate substantially continuously, solving all the problems mentioned above, and which has good characteristics of reliability and productive efficiency.

In order to achieve this object, the subject of the present invention is equipment for drawing slivers of textile fibres of the known type including:

at least one first drawing unit and one second drawing unit arranged in series,

means for supplying a sliver of textile fibres to the input of the first drawing unit and for advancing the sliver through the first drawing unit,

means for supplying the sliver output from the first drawing unit into a collecting container,

means for breaking the sliver once the collecting container is full,

means for supplying the tail end of the portion of the sliver which has been collected in the container to the input of the second drawing unit, and

means for advancing the sliver through the second drawing unit and supplying it towards the output of the equipment,

characterised in that the equipment also includes:

a rotary table adjacent the input of the second drawing unit and carrying a plurality of containers which have already been filled by the first drawing unit and are intended to supply the second drawing unit,

a waiting position operatively interposed between the position in which the container is filled at the output of the first drawing unit and the rotary table,

interchanging means for replacing the container which is filled with the sliver and is in the filling position with an empty container which is in the waiting position,

means for transferring a full container which is in the waiting position onto the rotary table or for transferring an empty container from the rotary table to the waiting position,

the means for breaking the sliver after a container has been filled being adapted to operate only after the full container has been exchanged with an empty container by the interchanging means, so that the full container can then be transferred to the rotary table whilst the empty container is already being filled by the first drawing unit.

A further subject of the present invention is the drawing method carried out by the equipment.

The invention will now be described with reference to the appended drawings, provided purely by way of non-limiting example, in which:

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

Figure 1A is a diagram illustrative of the equipment of Figure 1,

Figures 2 to 6 are perspective views of the detail indicated by the arrow II of Figure 1 in different operating conditions,

Figures 7 to 9 show the portion of the equipment indicated VII in Figure 1 in different operating conditions, and

Figure 10 shows the detail X of Figure 1 on an enlarged scale.

With reference to Figure 1, a drawing line, generally indicated 1, has an inlet mouth 2 which receives slivers of textile fibres 3, for example wool fibres, output from a carding device 3a, and combines them into a single sliver. The sliver undergoes three successive drawing operations by means of three drawing units 4, 5, 6 which form part of the equipment 1 and will be described in greater detail below. As will become

clear from the following, the head and tail of the sliver are reversed between each drawing unit and the next, so that the drawing unit 5 draws the sliver of fibres in the opposite direction from the drawing unit 4, the direction of drawing being reversed again in the drawing unit 6.

A device 7 for collecting the sliver output by the cards is interposed between the carding device (3a) and the first drawing unit 4 and is intended to ensure that there is a stock of the sliver so that the equipment can operate correctly during programmed slowing down or short stops during which empty and full containers are replaced or the drawing units automatically replace the pressure rollers and the brushes, as described in detail in two copending patent applications by the present applicant. The device 7 is the subject of an application filed simultaneously by the present applicant. It includes a casing 8 defining a chamber for collecting the sliver and having a lower inlet hole 8a. After the sliver has been transported, for example, by a conveyor belt 9, which receives it from the mouth 2, it reaches the inlet hole 8a by means of a pair of guide rollers 10. In correspondence with the hole 8a is a circular deposition device 11 in the form of a rotary disc with an eccentric outlet hole for the sliver. The device 11 supplies the sliver along a helical path whilst the device 7 moves to and fro on guide tracks 12 so as to enable the entire width of the casing 8 to be filled. The upper face of the chamber within the casing is defined by a cover 13 which is mounted on the two sides of the casing so as to be pivotable about an axis 14 and to produce a constant opposing force as the chamber in the casing 8 is gradually filled from the bottom up to a predetermined level.

The sliver then emerges from the hole at the top of the casing 8 and is supplied to the first drawing unit 4.

The drawing unit 4 is of the known type with two sets of needles (see, for example, the Applicant's U.S. patent 4,554,709). For this reason, the structure of the drawing unit 4 will not be described in detail herein. Immediately downstream of the two sets of needles are two drawing rollers 16 with helical ribs cooperating with a rubber pressure roller 17. The equipment according to the invention preferably has a device for automatically replacing the pressure roller 17, which is the subject of a copending patent application by the present Applicant. Above and below the two sets of needles respectively are two rotary needle-cleaning brushes 18 for which there is an automatic replacememt device which is the subject of a further patent application filed by the present Applicant. The portion of the sliver 19 which is disposed immediately upstream of the drawing unit 4 is guided through a closed duct (not visible in the drawing). At the inlet to the duct are two wheels 20 the larger of which has a circumferential groove in which the smaller is engaged. The two wheels 20 press the sliver of fibres between them and act as sensors forming part of an automatic regulation system of known type which is not therefore described in detail in the present description and which automatically causes the speed of advance of the drawing heads to vary in dependence on the thickness of the sliver detected by the sensor 20, so as to achieve the necessary uniformity of the sliver output by the drawing unit. The sliver is advanced through the drawing unit by rollers 16, 17 which are driven by a motor unit, of known type, which has not been shown in the drawings, in order to simplify the drawings and make them more easily understood. The web 15 output from the drawing unit is then collected into a sliver by rollers 21, also of known type, and supplied thereby into a collecting container 22 constituted by an elongate, open-topped, cylindrical container which is in a collecting position 23. The container 22 has a base wall 24 (Figure 10) which moves progressively downwardly as the container 22 is gradually filled. The device including the wall 24 which can be lowered, forms the subject of a further copending patent application filed by the present Applicant. The base wall 24 is connected, through two longitudinal slots in the container 22, to a pair of arms 25 which are moved vertically by a fluid cylinder (not shown).

Below the rollers 21, the support structure of the drawing unit (which, for reasons of clarity, is not visible in the drawings) also supports a deposition device of known type (Figure 10) which causes the sliver entering the container 22 to follow an epicyclic path. More precisely, the sliver is made to rotate within a horizontal plane around a circle the centre of which is spaced from the axis of the container 22 and which is moved along a circular path about that axis. The deposition device, indicated 60 in Figure 10, includes a disc 61 which rotates about the axis of the container 22 and in turn carries an eccentric rotary disc 62 with a hole 63 for supplying the sliver.

The drawing units 5 and 6 are identical to the drawing unit 4 and will not therefore be described further. Immediately upstream of the drawing unit 5 is a rotary table 26 which supports a plurality of collecting containers 22 which have previously been filled with slivers output from the first drawing unit 4. The slivers in the containers 22 on the rotary table 26 are used to supply the drawing unit 5. A waiting position 27 is operatively interposed between the rotary table 26 and the collecting position 23.

The equipment according to the invention includes an interchanging device 28 (which will be described in greater detail below) which serves to exchange a container 22 which has been filled in the filling position 23 with an empty container which is in the waiting position 27. Moreover, the plant according to the invention includes a transfer device 29 (which will also be described in greater detail below) for transferring a container 22 from the rotary table 26 to the waiting position 27 after the entire contents of the

container have been supplied to the drawing unit 5, or from the waiting position 27 to the rotary table 26, after a container 22 which has just been filled by the first drawing unit 4 has reached the waiting position.

In the embodiment illustrated, the rotary table 26 has seven positions. In Figure 1, one of the seven positions shown on the rotary table 26 upstream of the drawing unit 5 is empty, since the corresponding container 22 is in the waiting position 27.

Adjacent the interchanging device 28 there is also a device 30, which will be described in detail below, and which grips the sliver in the container 22 and tears it once the container 22 which is in the filling position 23 has been filled and moved to the waiting position 27.

There is a structure identical to that described above between the second drawing unit 5 and the third drawing unit 6. At the output of the drawing unit 6, the sliver is supplied, for example, to a collecting reel 31.

The preferred embodiment of the interchanging device 28 will be described below. With reference to Figure 10, the device 28 includes a vertical, rotary pillar 32 which is rotated by a motor unit (not shown). The pillar 32 has an upper flange 33 with two pairs of holes 34 for housing pins 35 which project downwardly from an annular top flange 22a of the container 22. A plate 36, also interposed between the flange 33 and the flange 22a, is fixed to the flange 33 and has opposed arcuate rims 37 for supporting the flange 22a, the rims having holes 38 which are aligned with the holes 35. The engagement of the pins 35 in the holes 35 and 38 enables the pillar 32 to support the container 22 and to move it between the filling position 23 and the waiting position 27 as a result of the rotation of the pillar. Naturally, when both sides of the plate 36 are engaged by containers 22, the rotation of the pillar 32 through 180° simultaneously exchanges the two containers between the filling position and the waiting position.

The device 30 for manipulating the end of the sliver will now be described with reference to Figures 2 and 10. The fixed structure of the equipment includes a fixed pillar 39 on which a slide 40 is slidable vertically. The slide 40 carries a gripper 41 with a first fork-shaped jaw 42 with two arms 43. The first jaw 42 is connected rigidly to the slide 40. The gripper 41 also includes a second jaw 44 which is also fork-shaped with arms 45, and is mounted on the slide 40 so as to be pivotable about a horizontal axis, and is movable about its articulation axis by means of a fluid cylinder 46 which is on the slide 40. The fixed frame of the machine also includes a cross member 47 which supports, in an articulated manner, the two jaws 48 and 49 of a further gripper 50. The jaw 48 is constituted simply by an elongate plate and the jaw 49 is constituted by a pair of plates, one of which is articulated to the cross member 47 and supports the other plate by means of a bridge element 51. The plate 36 has slots 52 which prevent it from interfering with the jaws of the gripper when they are in the lowered position. The actuator unit for the gripper 50 is schematically indicated 53 in Figure 10. Again with reference to Figure 2, the device 30 includes an arm 53 which is pivotable about a vertical axis 54 on a slide 55 which is movable horizontally relative to a supporting cross member 56. The distal end of the arm 53 carries a gripper 57, the jaws 58 of which are constituted by plates mounted on respective supports 59. The transfer device 29 simply comprises two transfer arms 70 which are pivotable about a horizontal axis on two support pillars 71, their free ends carrying two articulated heads each with two pins for engaging vertical holes 72 (see Figure 10) in the annular flange 22a of the container 22.

The equipment described above operates as follows:

With reference to Figure 1, the slivers 3 of fibres output from the cards are combined and supplied by the inlet mouth 2 to the conveyor belt 9 which in turn supplies the storage device 7 by means of the rollers 10 and the deposition device 11. The cover 13 moves upwardly until it is fully open, as the space inside the device 7 is gradually filled from the bottom. The sliver output from the casing 8 is supplied through the sensors 20 which automatically regulate the speed at which the sliver is supplied to the drawing unit 4, as already described above. At the output of the drawing unit 4, the sliver is deposited in the container 22 which is in the filling position 23 by the deposition device 60 (Figure 10). As the container (22) in the filling position 23 is gradually filled, its base wall 24 moves downwardly in the manner described in a copending patent application by the present Applicant. When the container is full, it is ready to be exchanged with an empty container which is in the waiting position 27. The exchange is effected by the rotation through 180° of the rotary pillar 2a, whose upper plate 36 supports the two containers 22. The empty container which was in the waiting position 27 thus reaches the filling position 23. It should be noted that the empty container had been brought to the waiting position 27 by the transfer device 29 which took it from the rotary table 26 after the container had been emptied because the sliver collected therein had been supplied to the drawing unit 5 or, at any rate, after a break in the sliver. Once the container 22 which was empty or in which the sliver was broken had been transferred from the device 29 to the waiting position 27, the arms 70 were disengaged to enable it to be interchanged by the device 28.

With reference again to the exchange of the full container which was in the filling position 23 with the empty container which was in the waiting position 27, it should be noted that the supply sliver is not broken until the exchange has been completed. When the full container 22 reaches the waiting position 27 (Figure

2), the sliver in the container therefore still constitutes a continuous extension of the sliver output from the drawing unit 4. In the meantime, the empty container which has been brought to the filling position 23 has already started to be filled. At this stage, the end portion of the sliver in the container 22 is situated in the gripper 50 which is in the open position (Figure 2). An auxiliary arm may be used to facilitate the insertion of the sliver into the gripper. At this point, the gripper 50 is closed (Figure 3) so as to grip the sliver, after which the slide 40 is lowered and the gripper 41 is closed (Figure 4) within the space defined by the bridge portion 51 of the jaw 49. At this point, the slide 40 is raised (Figure 5) so that the end portion of the sliver in the container 22 (which is gripped by the gripper 41) is separated from the immediately adjacent portion, which is gripped by the gripper 50 (Figure 5). Meanwhile, the container 22 in the position 23 continues to be filled. After the sliver has been torn, the end held by the gripper 41 is gripped by the gripper 57 after the arm 53 has pivoted (Figure 6). The arm 53 is then pivoted forwardly to bring it to the position shown in Figure 1 so that the gripper 57 presents the end of the sliver to the drawing unit 5 (see also Figure 7). At this point, the transfer device 29 comes into action to bring the container 22 which is filled with the sliver from the waiting position 27 to the empty position on the rotary table 26 (Figure 8). Simultaneously with this movement, the slide 55 is moved along the beam 56 so as to bring the end of the sliver to the input of the drawing unit 5. Supply is started automatically since, as a result of the operation described above, a portion of the sliver is left projecting in front of the gripper 57. Moreover, the gripper 58 preferably has a device for blowing air (which is the subject of a copending patent application by the present Applicant) the purpose of which is to keep horizontal the portion of the sliver which projects from the gripper. This portion of the sliver is thus gripped by the supply rollers of the drawing unit 5 so as to enable the supply to start automatically. When one of the containers 22 on the rotary table 26 is empty or, in any case, if the sliver is broken, the rotary table is rotated so as to bring said container to the position from which it can be picked up by the transfer device 29. This device moves the container 22 to the waiting position 27 in time to enable it to be interchanged with a container 22 which in the meantime has been filled in the filling position 23.

The operation of the portion of the equipment between the drawing units 5 and 6 and any subsequent drawing units is identical to that described above.

As is clear from the foregoing description, the equipment reverses the head and the tail of the sliver between its passage through one drawing unit and the next without interfering with the continuous supply of the sliver to the input of the equipment.

With reference to Figure 1a, the equipment as a whole is enclosed in a single housing 100 with an inlet 2 for the supply of the slivers coming from the cards and an outlet 101 for the combed sliver which is collected, for example, on reels. The equipment as a whole operates automatically and is preferably controlled by a microprocessor. The atmosphere within the housing is preferably conditioned so as to ensure the desired temperature and humidity for the operation, at the same time ensuring a total absence of pollution in the environment in which the equipment is used.

Claims

1. Equipment for combining, making parallel and drawing slivers of textile fibres, including:
at least one first drawing unit (4) and one second drawing unit (5) arranged in series,
means for supplying a sliver of textile fibres to the input of the first drawing unit (4) and for advancing the sliver through the first drawing unit,
means for supplying the sliver output from the first drawing unit into a collecting container (22),
means for breaking the sliver after the collecting container has been filled to the desired extent,
means for supplying the suitably broken tail end of the sliver collected in the container to the input of the second drawing unit (5), and
means for advancing the sliver through the second drawing unit and towards the output of the machine,
characterised in that the equipment also includes:
a rotary table (26) adjacent the input of the second drawing unit (5) and carrying a plurality of containers (22) which have already been filled by the first drawing unit (4) and are intended to supply the second drawing unit (5),
a waiting position (27) operatively interposed between the position (23) in which the container (22) is filled at the output of the first drawing unit and the rotary table (26),
interchanging means (28) for replacing the container which is filled with the sliver and is in the filling position (23) with an empty container which is in the waiting position (27),
means for transferring a full container (22) which is in the waiting position (27) onto the rotary table (26) or for transferring an empty container (22) from the rotary table (26) to the waiting position (27),
the means for breaking the sliver after a container (22) in the filling position (23) has been filled being adapted to operate only after the full container (22) has been exchanged with an empty container by the interchanging means (28), so that the full container (22) can then be transferred to the rotary table (26) whilst the empty container is already being filled by the first drawing unit (4).

2. Equipment according to Claim 1, characterised in that the interchanging means include a vertical, rotary pillar (32), with means (33, 34) for supporting two containers (22) in diametrally opposite positions relative to the axis of rotation of the vertical pillar.

3. Equipment according to Claim 2, characterised in that the rotary pillar (32) has at least one upper plate (33) with holes (34) for housing pins (35) which project downwardly from an annular top flange (22a) of the container (22).

4. Equipment according to Claim 1, characterised in that the transfer means include a pair of arms (70) which are pivotable about a horizontal axis relative to a fixed support structure (71) and the free ends of which have articulated heads with pins for engaging corresponding holes (72) in an annular top flange of each container (22).

5. Equipment according to Claim 1, characterised in that each container has a vertically-movable base wall which is adapted to be lowered progressively whilst the container in the filling position (23) is being filled.

6. Equipment according to Claim 1, characterised in that it has a first gripper (50) in correspondence with the waiting position (27) for gripping the end part of the portion of the sliver collected in a container (22) , a second gripper (41) which is movable between a waiting position and an operative position adjacent the first gripper (50), the second gripper (41) being adapted to grip the sliver near the point at which it has been gripped by the first gripper (50), means for moving the second gripper (41) between its waiting position and its operative position and vice versa so that the sliver is torn when the second gripper (41) is returned to its waiting position after having gripped the sliver, and a third gripper (57) for gripping the end of the sliver which has previously been torn by the second gripper (41) and bringing it near to the supply inlet of the second drawing unit (5).

7. Equipment according to Claim 1, characterised in that, upstream of the first drawing unit is a storage device (7) for forming a stock of material at the input of the equipment.

8. Equipment according to Claim 7, characterised in that the storage device includes a storage chamber with a lower inlet opening and an upper wall which is adapted to move progressively upwardly as the chamber is filled.

9. Equipment according to Claim 1, characterised in that it is enclosed within a housing in which the atmosphere is conditioned.

10. A method of drawing slivers of textile fibres in which the sliver is made to pass successively through a first drawing unit and at least one second drawing unit arranged in series, in which the sliver output from the first drawing unit is collected in a container, in which the sliver is broken once the container is filled, and in which the tail end of the portion of the sliver which has been collected in the container is supplied to the input of the second drawing unit, characterised in that a rotary table adjacent the inlet of the second drawing unit carries a plurality of containers which have been filled by the first drawing unit and are intended to supply the second drawing unit, in that the container which is in the filling position at the output of the first drawing unit is exchanged, after it has been filled, with an empty container which is in a waiting position, in that, after this exchange, the full container is placed on the rotary table so that it can supply the sliver it contains to the second drawing unit, and in that the sliver is broken after the full container has been brought to the waiting position and replaced by an empty container, so that the full container is transferred onto the rotary table whilst the empty container is already being filled by the first drawing unit, the method also including the step of transferring a container from the rotary table to the waiting position each time a container is emptied as a result of the supply of the sliver to the second drawing unit.

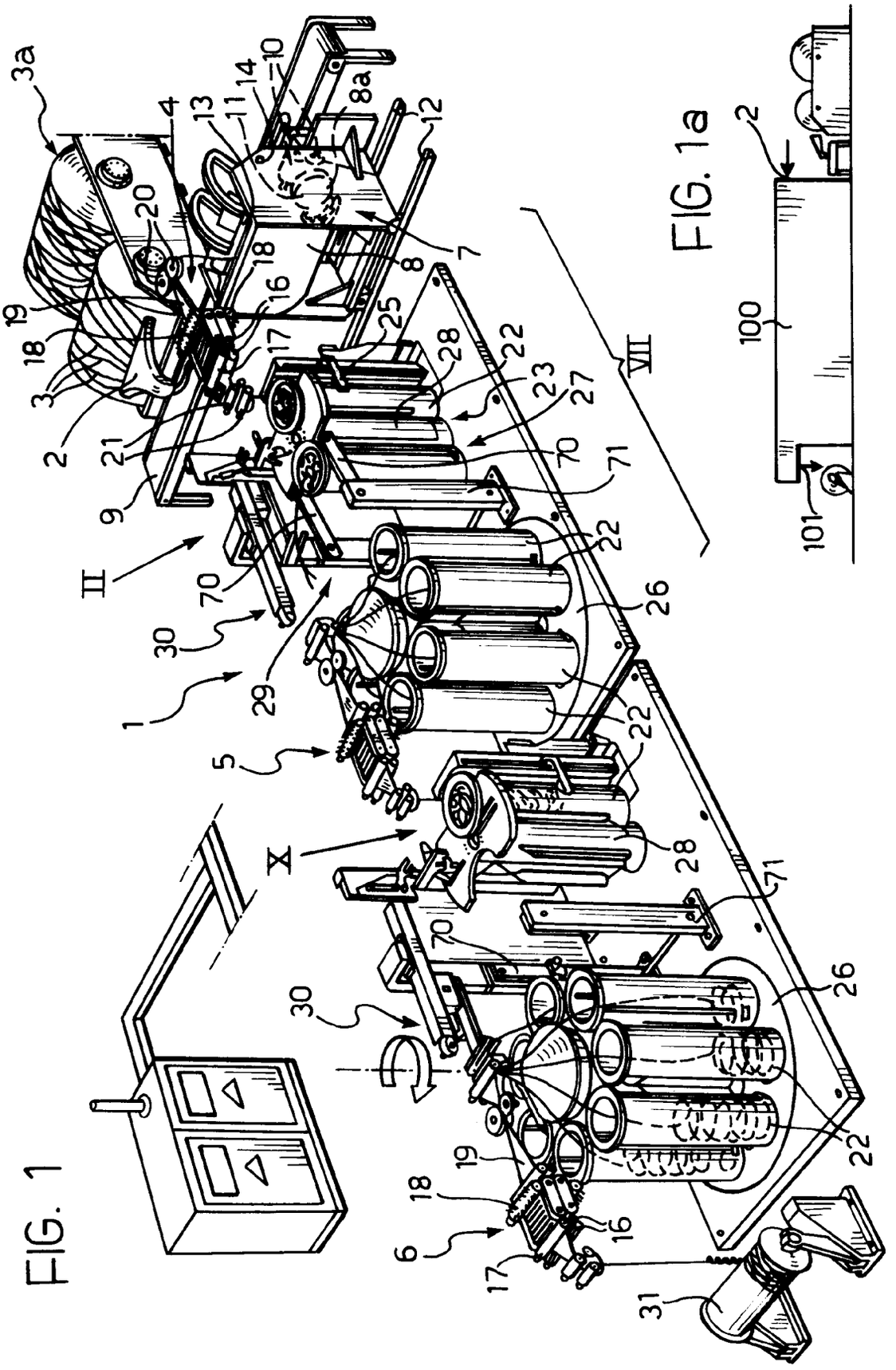
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FIG. 1

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FIG. 1a

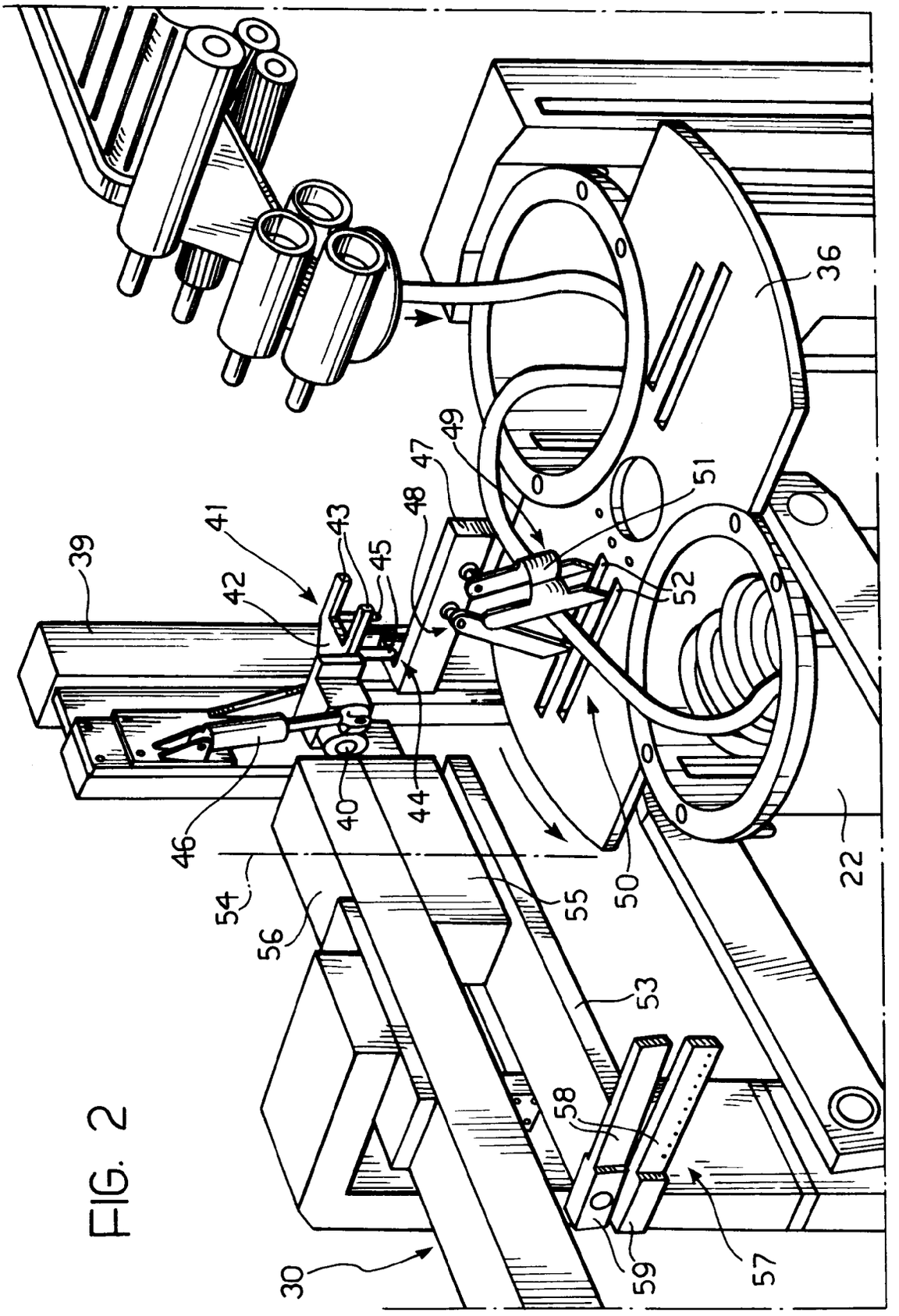

FIG. 2

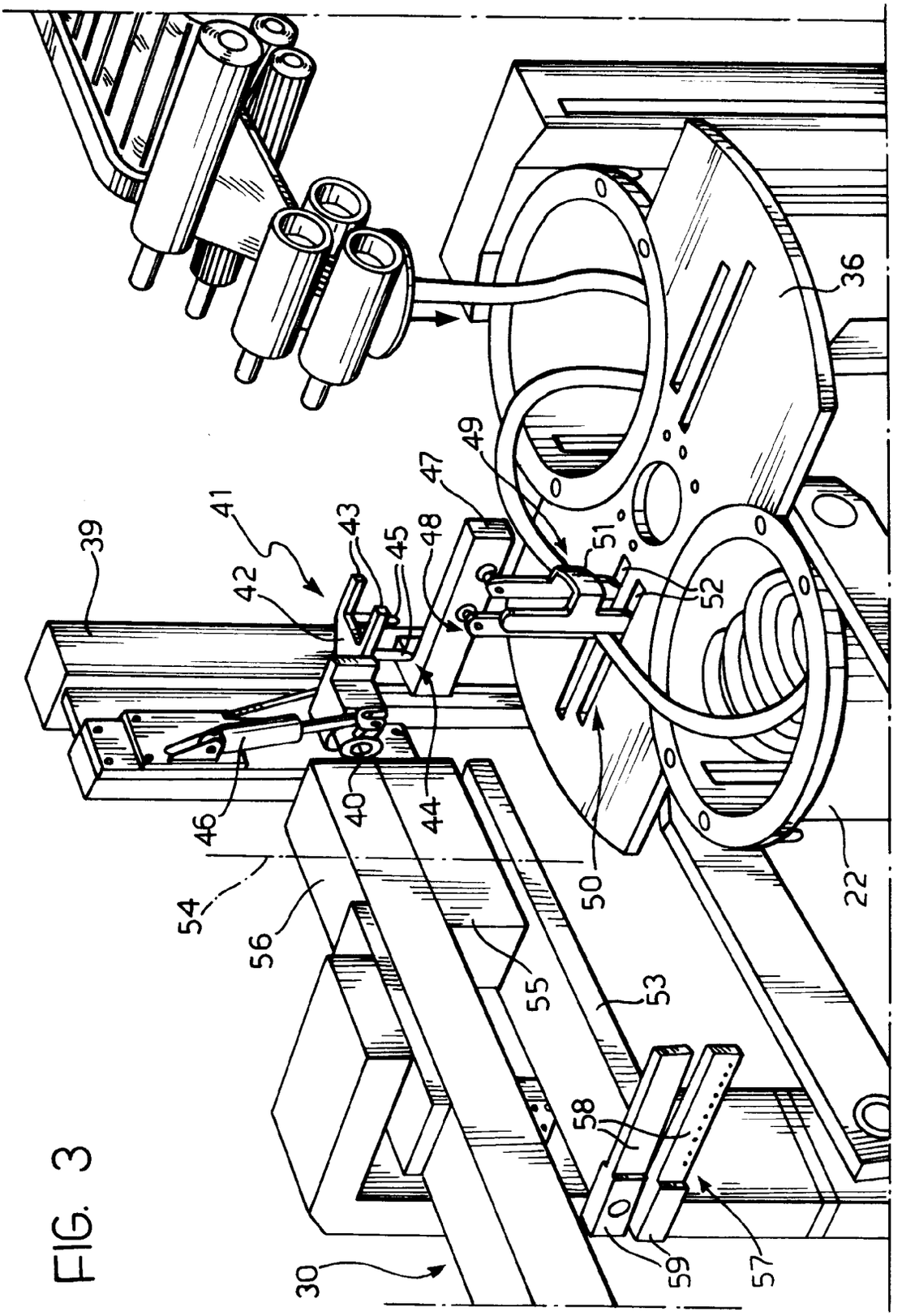

FIG. 3

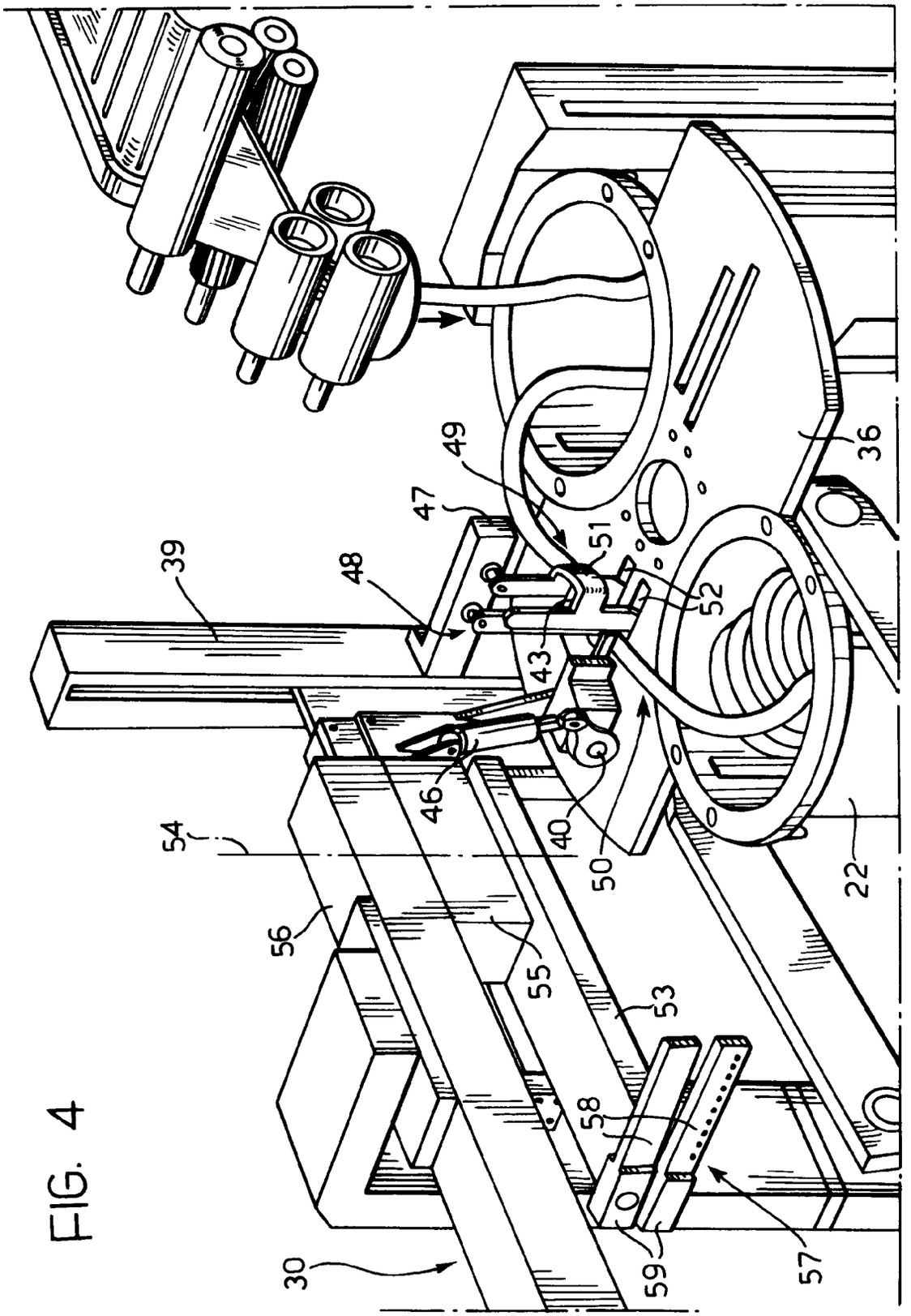

FIG. 4

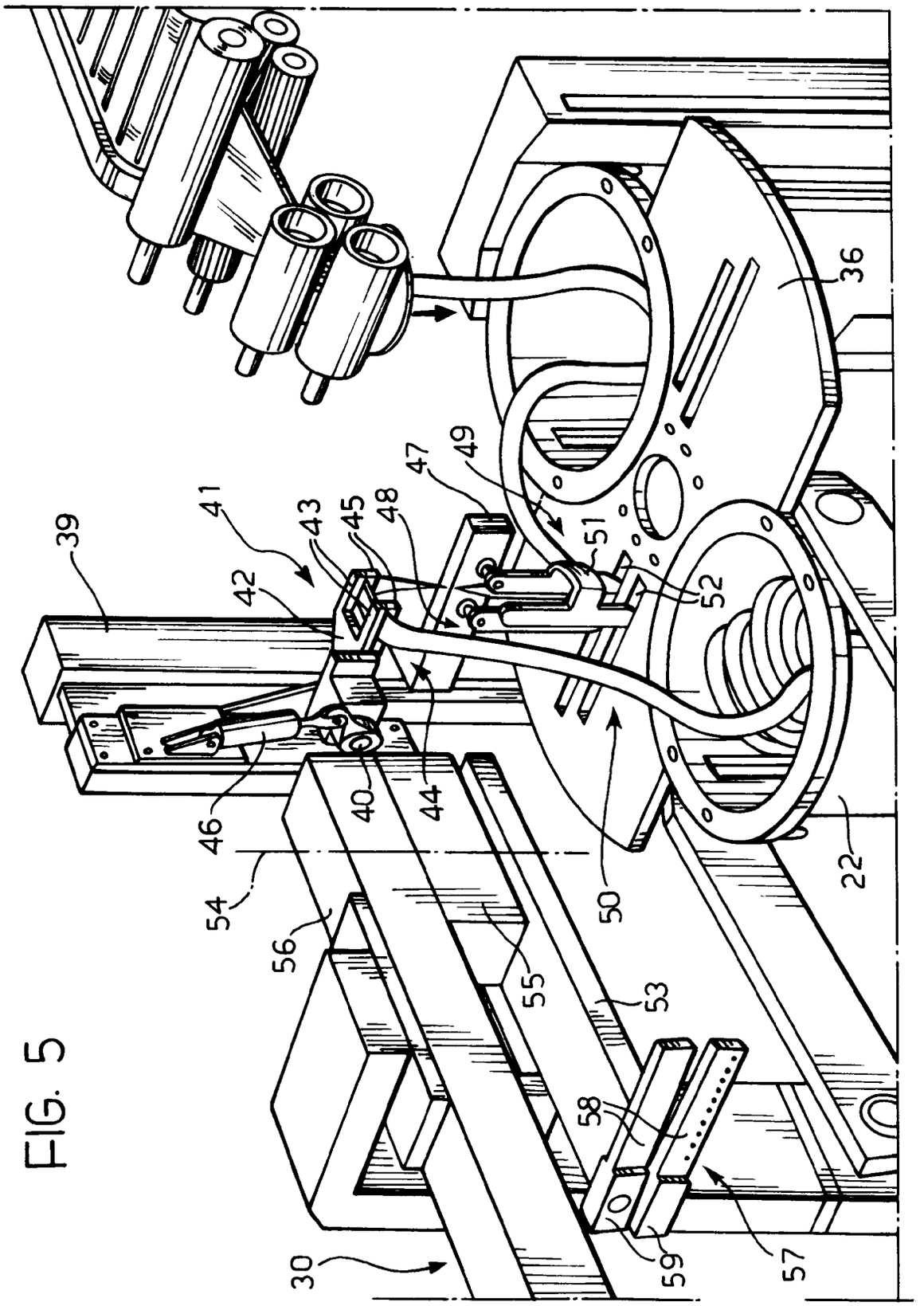

FIG. 5

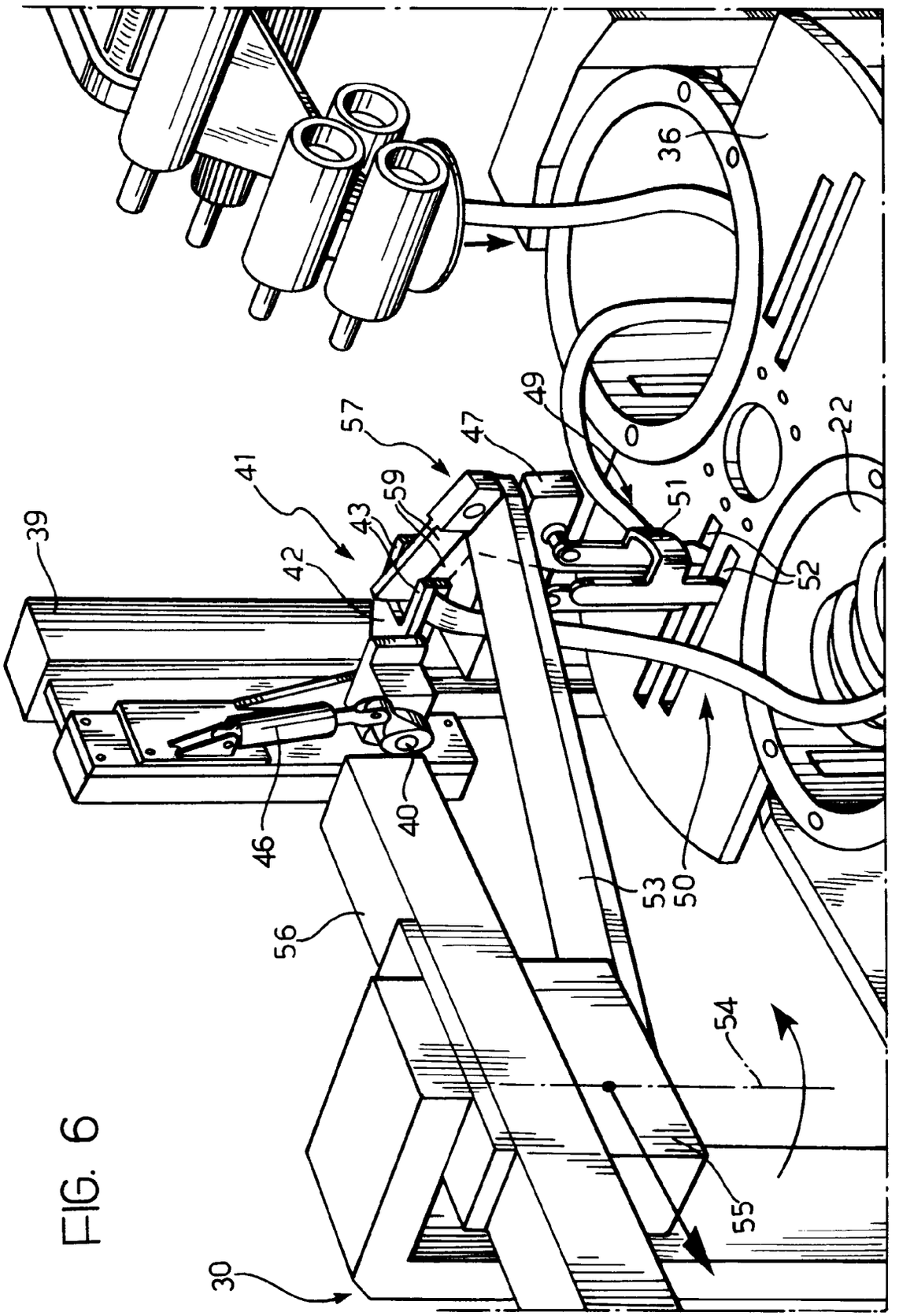

FIG. 6

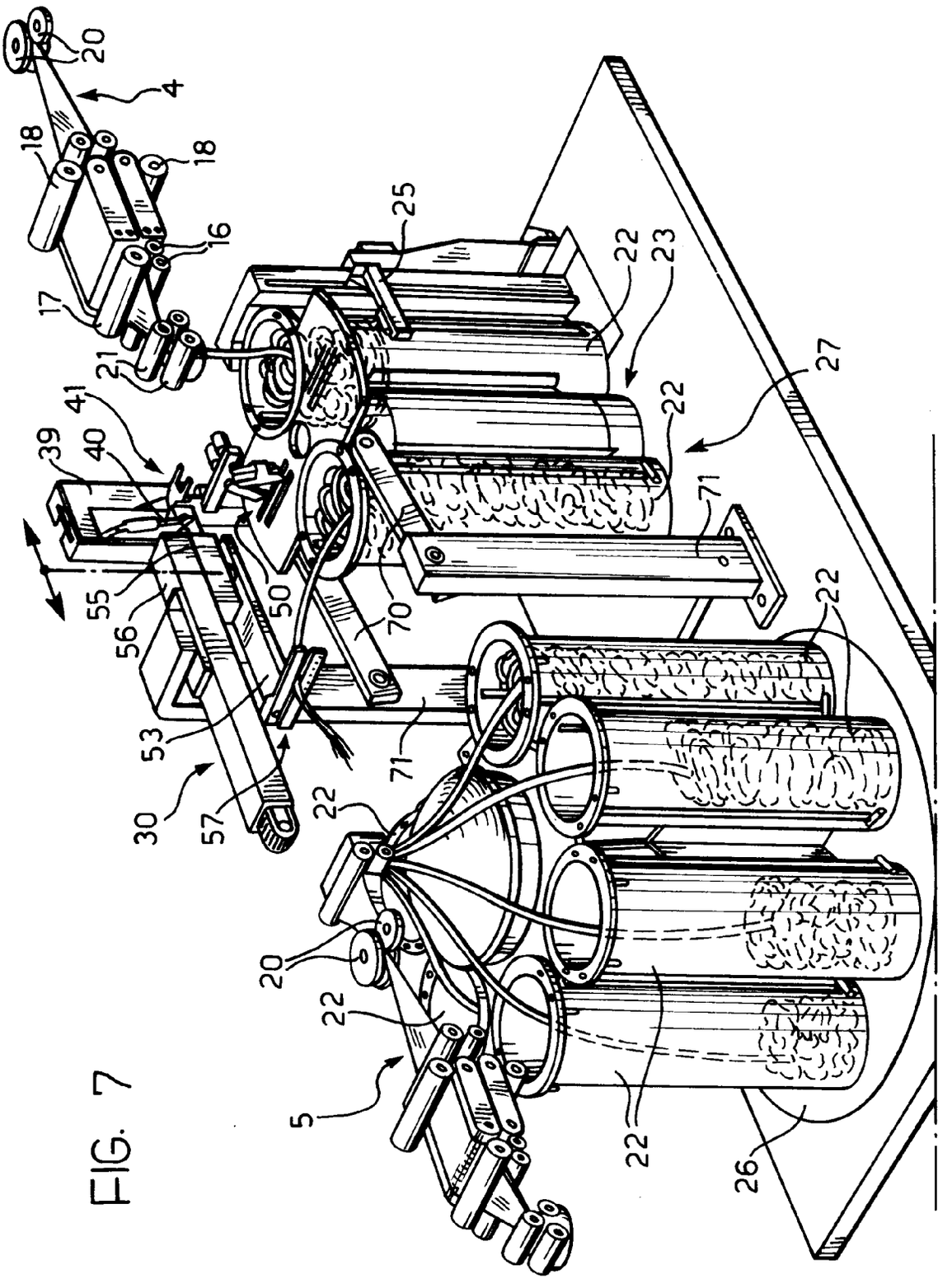
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FIG. 7

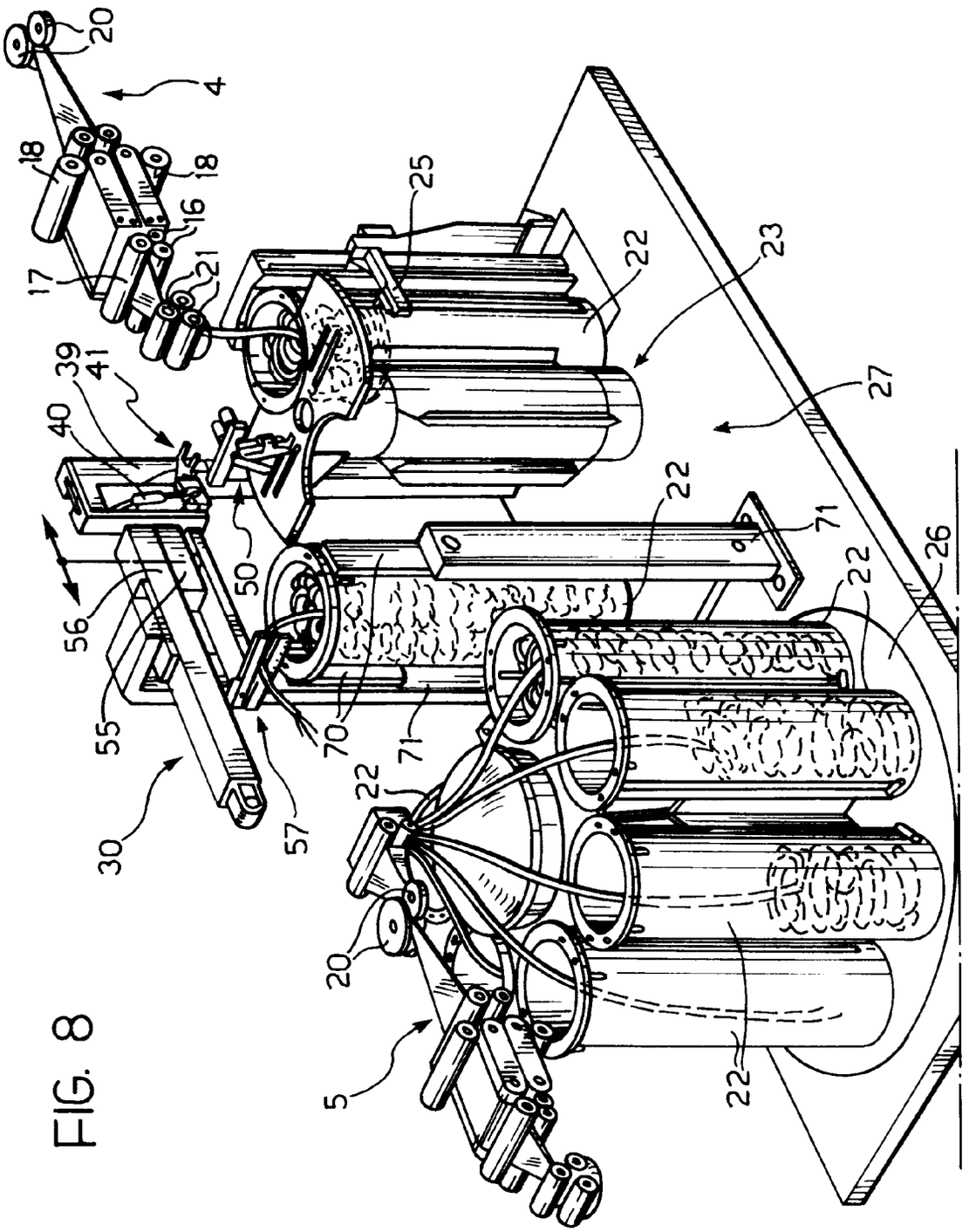
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FIG. 8

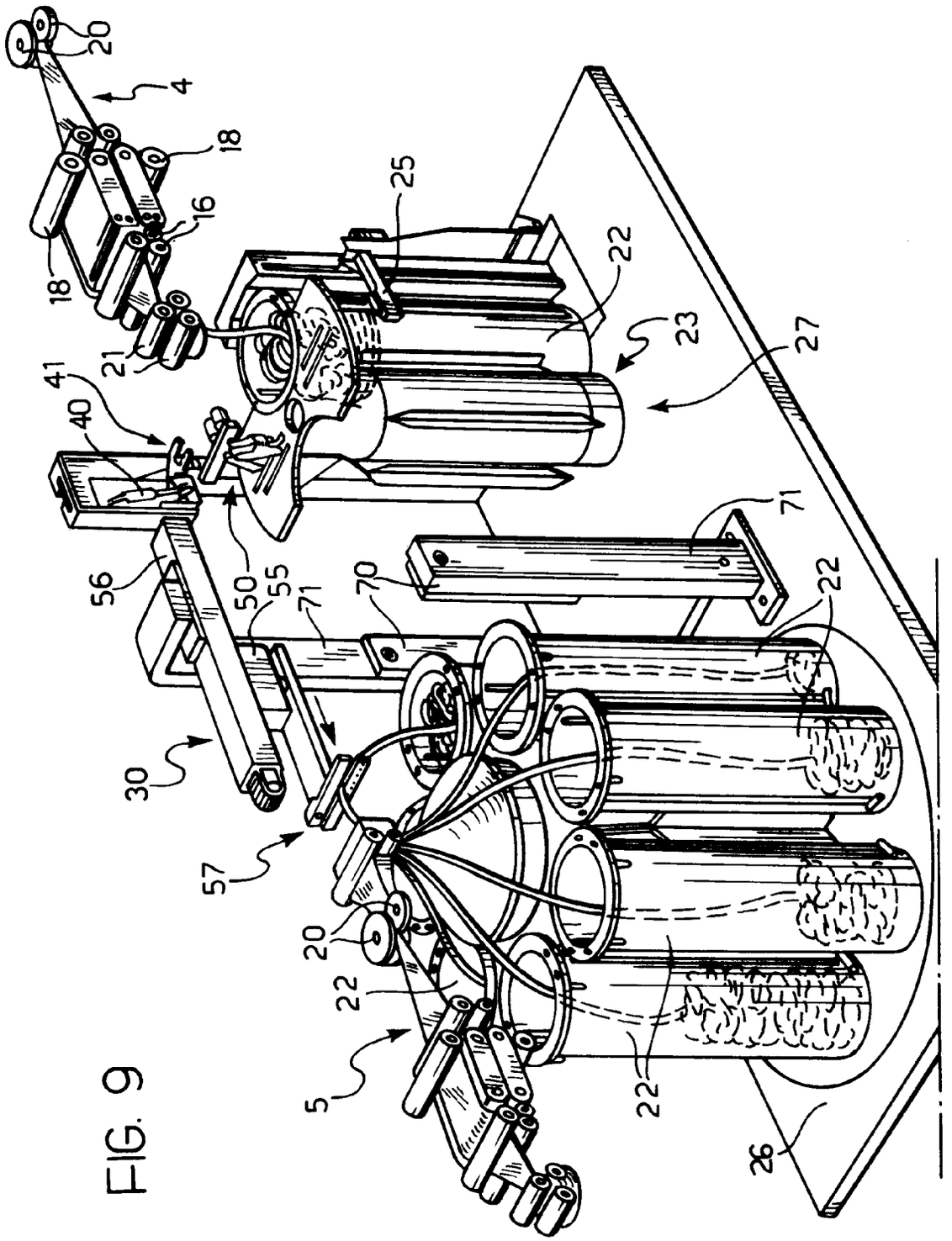
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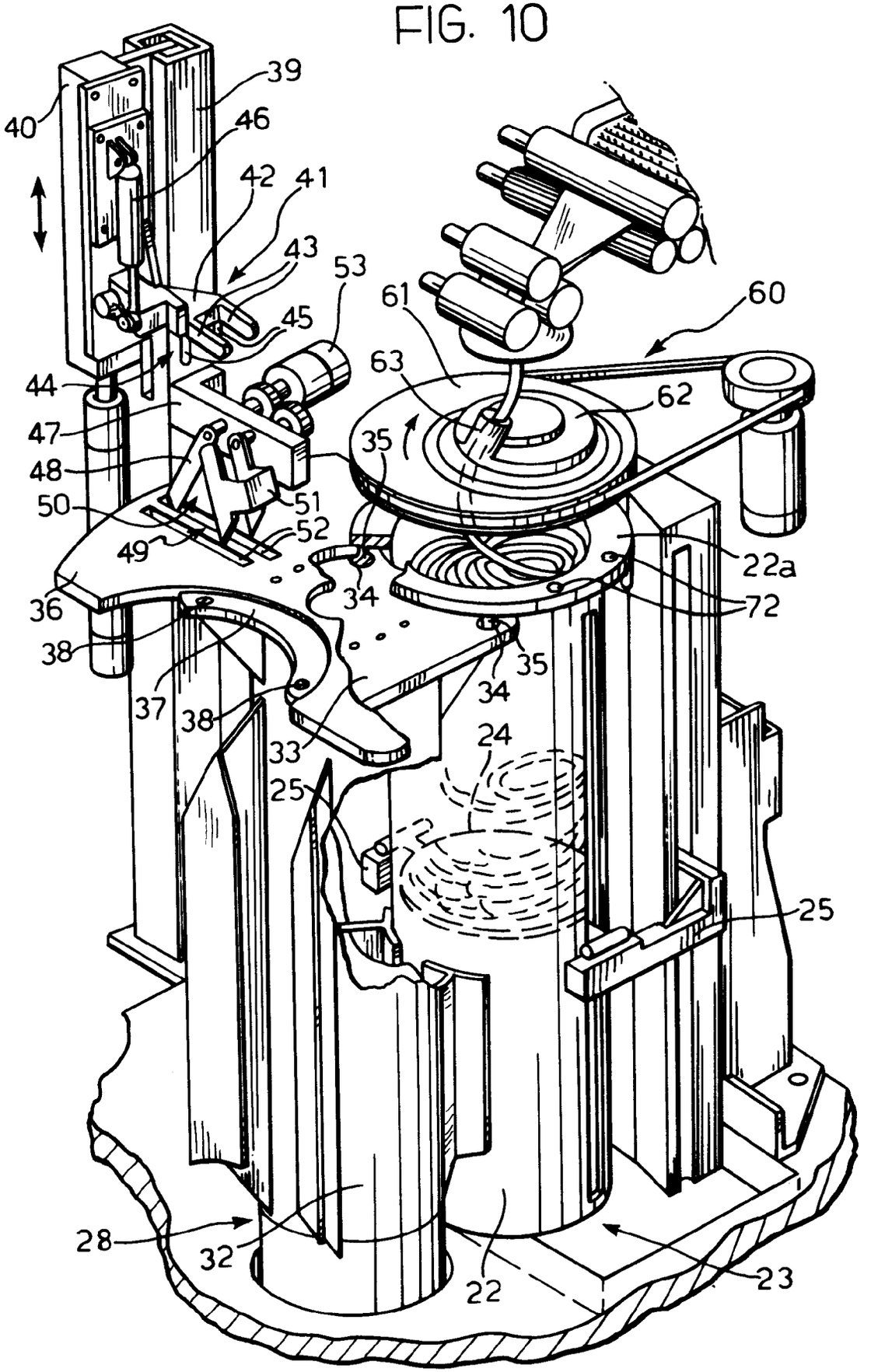
FIG. 9

FIG. 10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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0566

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	US-A-3 083 415 (IWAO OSAKI ET AL.) * figures * ---	1,10	D01H5/00 B65H67/04
A	EP-A-0 212 979 (HOWA MACHINERY) * figures * -----	1,10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

D01H
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 MARCH 1992	RAYBOULD B.D.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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