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(71) Applicant: **Gai Macchine Imbottigliatrici S.p.A.**
12040 Ceresole d'Alba (Cuneo) (IT)

(72) Inventors:
- **ASTEGGIANO, Andrea**
  I-12040 MONTALDO ROERO (Cuneo) (IT)
- **GAI, Carlo**
  I-12040 CERESOLE D'ALBA (Cuneo) (IT)

(74) Representative: **Savoca, Agatino et al**
Jacobacci & Partners S.p.A.
Corso Emilia, 8
10152 Torino (IT)

(54) CLEANING A BOTTLE WASHING MACHINE WITH A WASHING AND SANITIZING SYSTEM WHICH USES DUMMY TYPE BOTTLES

(57) The machine (10) comprises: a turret (12) rotatably supported for rotation about a vertical axis of rotation (z), and a plurality of washing devices (14) held by the turret (12), each of which arranged to wash a corresponding bottle (B) with each revolution of the turret (12) about said vertical axis of rotation (z). Each washing device (14) comprises: a supporting body (32) mounted on the turret (12) so as to rotate with respect to the turret (12) about a horizontal axis of rotation (y) lying tangentially; a gripping member (36) mounted on the supporting body (32) which may be controlled to switch, alternatingly, between a closed position for gripping the neck of the bottle (B) and an open position for releasing the bottle (B); a nozzle (38) for injecting a fluid into the bottle (B); and a dummy bottle (50) used to contain a spray of disinfecting liquid sprayed by said injection means (38) during the rinsing and sanitizing process of the machine (10), the dummy bottle (50) being secured to the supporting body (32) so as to rotate together therewith about the horizontal axis of rotation (y) between a work position, in which the dummy bottle (50) is above and aligned with the nozzle (38), and a rest position, in which the dummy bottle (50) is laterally away from the nozzle (38).

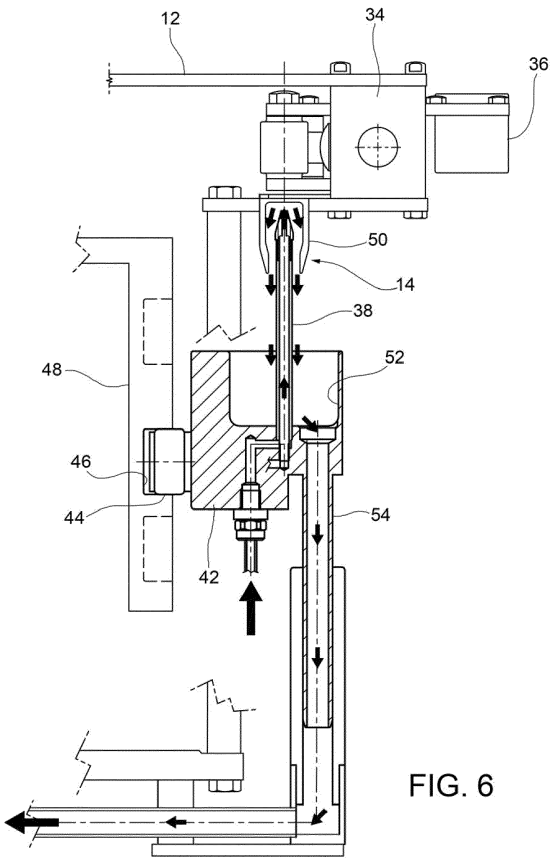

FIG. 6

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Description

[0001] The present invention relates in general to a bottle washing machine, particularly bottles for liquid foods, provided with a washing and sanitizing system, and more specifically a rotary washing machine in which the washing and sanitizing system is of the so-called dummy bottle type.

[0002] It is known that a washing machine is a machine intended to perform a washing operation inside new bottles, i.e. bottles that have yet to be filled with a liquid food, such as wine. This operation is necessary to ensure that the inside of the new bottle is free of impurities, such as residues from glass molding or external agents accidentally introduced into the bottle. Regulations governing the bottling of liquid foods are very strict and consequently the washing machine must be capable of performing the wash operation very effectively and under strict control.

[0003] The washing operation normally consists in injecting a water or air flow into the bottle in a quantity and at a pressure so as to ensure that the entire inside surface of the bottle is covered by said flow. In the case of washing with water, after water has been injected it is possible to inject compressed air into the bottle to at least partially remove any water still remaining on the inside surface of the bottle and thus minimize residual water inside the bottle. The water and air introduced into the bottle must first be filtered to ensure microbiological sterility.

[0004] In the case of a rotary washing machine, the machine comprises a rotating turret making each of a plurality of washing devices capable of washing a corresponding bottle, as well as an actuation system for rotating the turret about a vertical axis of rotation. The bottles to be washed, placed on a linear input conveyor belt, are spaced apart by a feed auger or endless screw and taken from a rotating loading component, commonly called a "loading carousel," and from there are introduced one by one into the gripping members of each washing device of the turret. As the turret rotates, each bottle is turned 180° so as to be brought into an upside-down position for the washing process, and then the bottle is washed by water injection (and possibly also air injection in a subsequent phase, as explained above), and lastly is again turned 180° so as to be returned to its initial vertical position. At this point, each bottle is removed by a rotating unloading component, commonly called an "unloading carousel," and deposited onto a linear output conveyor belt.

[0005] Each washing device essentially comprises:

a supporting body mounted on the turret so as to rotate about said vertical axis of rotation together with the turret, and to rotate with respect to the turret about a horizontal axis of rotation oriented tangentially with respect to a circumference having its center on the vertical axis of rotation,

a gripping member mounted on the supporting body and arranged to grip a corresponding bottle by the neck with each cycle,

a drive mechanism arranged to rotate the supporting body and, therewith, the gripping member and the bottle gripped by the gripping member, about the aforementioned horizontal axis of rotation,

a nozzle arranged to inject water or air into the bottle held by the gripping member, and

an actuation system, which may be mechanical or electropneumatic, to carry out the process of injecting water and/or air into the bottle through the nozzle.

[0006] The nozzle may have a single outlet, in which case the machine is designed to wash in a single step (water or air injection), or two outlets, one for water and one for air, in which case the machine is designed to inject water in a first step and air in a second step.

[0007] The nozzle may be vertically fixed or movable. In the case of a vertically fixed nozzle, the bottle is turned upside-down immediately above the nozzle and subjected to washing.

[0008] In the case of a vertically movable nozzle, the bottle is turned upside-down and, before injection, the nozzle is raised so as to penetrate into the bottle by a few centimeters, preferably past the neck of the bottle, so that the falling water does not interfere with the sterile water during the injection step.

[0009] Since the water and/or air used to wash the bottles must first be filtered, it is indispensable for the internal lines of the machine to be washed and sanitized using special liquids to rule out any possibility of contamination. The washing and sanitizing process of the machine can be performed in two different ways, that is, either by the so-called free method without a dummy bottle, or by the so-called dummy bottle method.

[0010] In the dummy bottle method, a so-called dummy bottle, that is a container simulating the shape of a bottle, is placed above the nozzle of each washing device in the upside-down position in such a way that the disinfectant liquid injected by the nozzle is contained in the dummy bottle so as to subsequently fall by gravity and be conveyed to a common drain and ultimately be recovered. In known washing machines, in which a washing and sanitizing system of the dummy bottle type is provided, a corresponding dummy bottle is manually placed on each washing device by the operator using the gripping member of the device, with said dummy bottle obviously having to be subsequently removed from the washing device once the washing and sanitizing process is complete. While the operations of manually installing and removing the dummy bottles are rather easy and quick, they may require a considerable amount of time, especially in the case of large washing machines, given the large number of washing devices. In addition, manual use of the dummy bottles may involve drawbacks, such as incorrect positioning of the dummy bottle or a failure to mount the dummy bottle on one or more washing devices. In addition, space needs to be provided for storing the dummy bottles when they are not being used.

[0011] The purpose of this invention is to overcome the drawbacks of the prior art described above by providing a rotary washing machine with a washing and sanitizing system of the dummy bottle type that does not require any action by an operator to install and remove the dummy bottles, that is simple and inexpensive to make, and that reduces the overall size.

[0012] This and other objectives are achieved in full according to the present invention thanks to a rotary washing machine having the features defined in the enclosed independent claim 1.

[0013] Advantageous embodiments of the invention are specified in the dependent claims, the content of which is to be considered an integral part of the description that follows.

[0014] In summary, the invention is based on the idea of providing each washing device of the machine with a dummy bottle installed on board the device, in particular secured to the supporting body of the device, so as not to require the installation and removal of the dummy bottle each time by the operator. Thanks to such a solution, operator action is no longer necessary to install and remove the dummy bottles, and so the washing and sanitizing operation can be completely automated. In addition, since the dummy bottles are installed on board the machine, each one on its corresponding washing device, a special space does not need to be set aside for storing the dummy bottles when they are not being used.

[0015] Each dummy bottle is mounted so as to be integral to the supporting body, and therefore to the gripping member, of the corresponding washing device so as to rotate together with said device about the aforementioned horizontal axis of rotation. In this way, the same drive mechanism that rotates the gripping member to turn the bottles upside-down may also be used to rotate the dummy bottle between a work position, in which the dummy bottle is above and aligned with the nozzle, and a rest position, in which the dummy bottle is laterally away from the nozzle.

[0016] In particular, the dummy bottle is placed on the opposite side of the gripping member with respect to the aforementioned horizontal axis of rotation, in such a way that the supporting body of the washing device is capable of assuming a first operating position, in which the gripping member is vertically aligned with the nozzle to allow the bottle, held by the gripping member, to be washed, while the dummy bottle is in the aforementioned rest position, and a second operating position, rotated 180° with respect to the first, in which the gripping member is laterally away from the nozzle, while the dummy bottle is in the aforementioned work position.

[0017] Further features and advantages of this invention will become clear from the following detailed description, given solely as a non-limiting example in reference to the appended drawings, in which:

figure 1 is a plan view of a washing machine according to one embodiment of this invention;

figure 2 is a partial cross-sectional view of one of the washing devices of the washing machine in figure 1, in a first operating condition;

figure 3 is a perspective view of a portion of the washing device in figure 2;

figure 4 is a view similar to that of figure 2, in which the washing device is in a second operating condition;

figure 5 is a view similar to that of figure 2, in which the washing device is in a third operating condition;

figure 6 is a view similar to that of figure 2, in which the washing device is in a fourth operating condition;

figure 7 is a view similar to that of figure 1, in which the angular distances corresponding to the various phases of the work cycle of the washing machine in figure 1 are identified; and

figure 8 is a graph showing the vertical position of the nozzle of one of the washing devices of the washing machine in figure 1 during the various phases of the machine's work cycle.

[0018] In reference first to figure 1, a washing machine according to one embodiment of this invention is referred to with the number 10 as a whole.

[0019] Washing machine 10 is made as a rotary machine and essentially comprises a rotating turret 12, a plurality of washing devices 14 held on turret 12, and an actuation system (not shown in detail but of a type known *per se*) for rotating turret 12, and therewith washing devices 14, about a vertical axis of rotation z.

[0020] Washing machine 10 further comprises, in a way known *per se*, a loading unit 16 for transferring bottles B to be washed, one-by-one from an input conveyor belt 18 to a corresponding washing device 14 and an unloading unit 20 for taking each bottle B from the corresponding washing device 14 and placing it on an output conveyor belt 22. The loading unit 16 comprises a feed auger 24 for spacing bottles B apart by a set pitch, which are then fed to washing machine 10 via input conveyor belt 18 and a rotating loading member 26 (rotating about a vertical axis of rotation z') for taking bottles B from the input conveyor belt 18 and transferring them to the washing devices 14 as the latter move along a circular path, carried by turret 12, about the vertical axis of rotation z. Similarly, the unloading unit 20 comprises a rotating unloading member 28 (rotating about a vertical axis of rotation z") for taking bottles B from washing devices 14 and transferring them to output conveyor belt 22, as well as a feed auger 30 for spacing bottles B apart by a set amount as they leave washing machine 10.

[0021] In a way known *per se*, the washing machine 10 is configured so that each washing device 14, while making a revolution about the vertical axis of rotation z, grips a corresponding bottle B by the neck from the rotating loading member 26, turns the bottle upside-down, and, with the bottle in the upside-down position, performs the washing operation by injecting water and, possibly in a subsequent step, also air, into the bottle, returns the

bottle to the initial vertical position and lastly releases it so that the bottle may be taken from the rotating unloading member 28 of the unloading unit 20.

[0022] In particular reference to figures 2 and 3, each washing device 14 comprises above all a supporting body 32 that is mounted on the turret 12, particularly on the outer circumferential perimeter thereof, so as to rotate, together with the turret 12, about vertical axis of rotation z. The supporting body 32 is supported by the turret 12, in particular by means of a pair of support plates 34 of the turret 12 rotatably about a horizontal axis of rotation y oriented tangentially with respect to a circumference having its center on the vertical axis of rotation z.

[0023] Each washing device 14 further comprises a drive mechanism (not shown in detail, but of a type known *per se*) arranged to rotate the supporting body 32 with respect to support plates 34 of turret 12 about the horizontal axis of rotation y. The drive mechanism may, for example, comprise a pinion that rotates as integral to supporting body 32, and a rack that meshes with the pinion and is driven by a flat cam to move forward and backward and in this way cause the pinion, and therewith supporting body 32, to rotate. A rack-and-pinion drive mechanism for moving the supporting body of a washing device is described, for example, in Italian patent No. IT1309550 in the name of the Applicant. Naturally, the drive mechanism may also be of a different type, and so the present invention is not limited to using a rack-and-pinion drive mechanism.

[0024] Supporting body 32 of each washing device 14 carries a gripping member 36, designed like a clamp, for example, which is provided to grip a bottle B by the neck in each cycle. Gripping member 36 is controlled in a way known per se (and therefore not described here in detail) to switch from an open position for insertion of the neck of bottle B and a closed position for gripping the neck of bottle B.

[0025] Each washing device 14 further comprises a nozzle 38 for injecting a wash fluid (water and/or air) into bottle B while the bottle is being held by gripping member 36. Nozzle 38 may have a single outlet, in which case the machine is designed to wash in a single step (water or air injection), or two outlets, one for water and one for air, in which case the machine is designed to inject water in a first step and air in a second step. Nozzle 38 is oriented vertically and has at the upper end thereof an outlet hole 40 (or a pair of outlet holes, each associated with a corresponding passageway) through which the water and/or air is injected upward into bottle B, which in this step is positioned upside-down, that is, with the neck pointing downward.

[0026] An actuation system (of a type known *per se* and not described or shown in detail here) is associated with nozzle 38 of each washing device 14 to control the operations of injecting water or air into bottle B through the nozzle. The actuation system may either be mechanical or electropneumatic.

[0027] Preferably, nozzle 38 of each washing device 14 is vertically movable between a lowered rest position (shown in figures 2 and 4), in which nozzle 38 is at a certain distance from bottle B, and a raised work position (shown in figure 5), in which nozzle 38 partially penetrates into the neck of bottle B to inject water or air into the bottle. To that end, nozzle 38 is mounted on supporting body 42, which is in turn mounted on turret 12 so as to rotate together therewith about the vertical axis of rotation z, but to be vertically movable with respect thereto, and supporting body 42 carries a wheel 44 that engages with a circumferential groove 46 on the external side of a cylindrical wall 48 integral to a fixed part (not shown) of washing machine 10. Groove 46 is suitably designed so that, as a result of the rotation of turret 12-and together therewith the assembly consisting of nozzle 38, supporting body 42, and wheel 44-wheel 44, following the profile of groove 46, moves vertically and then causes a corresponding vertical movement of supporting body 42 and together therewith nozzle 38.

[0028] A washing machine 10 is also provided with a washing and sanitizing system of the type using a dummy bottle. For each washing device 14, the system comprises a corresponding dummy bottle 50 suitable for working with nozzle 38 to contain the disinfectant liquid that is sprayed upward from nozzle 38 and allowing it to then fall back down by gravity to supporting body 42, which, for this purpose, has at the top a collection cup 52 in which the disinfectant liquid falling down from dummy bottle 50 is collected (just like the water that falls down from bottle B during the washing operation). A corresponding pipe 54 is connected to collection cup 52 of each washing device 14 to allow the liquid to flow from collection cup 54 for the purpose of recirculation.

[0029] According to the invention, each dummy bottle 50 is installed on board the corresponding washing device 14 so as not to have to be installed and removed manually by the operator every time that machine washing and sanitizing has to be performed. More specifically, each dummy bottle 50 is secured to supporting body 32 of the corresponding washing device 14 so as to rotate together with supporting body 32, and therefore together with gripping member 36, about the horizontal axis of rotation y, between a work position (figure 6), in which dummy bottle 50 is above and aligned with nozzle 38, and a rest position (figure 5), in which dummy bottle 50 is laterally away from nozzle 38. In particular, dummy bottle 50 is placed on the opposite side of gripping member 36 with respect to the horizontal axis of rotation y. In this way, supporting body 32 of the supporting washing device 14 is capable of assuming a first operating position (figures 2 and 5), in which gripping member 36 is vertically aligned with nozzle 38 to allow bottle B, held by gripping member 36, to be washed, while dummy bottle 50 is in the rest position defined earlier, and a second operating position (figure 6), turned 180° with respect to the first, in which gripping member 36 is laterally away from nozzle 38, while dummy bottle 50 is in the work position defined earlier.

[0030] As shown in figure 6, disinfectant liquid is injected by nozzle 38 to wash and sanitize the machine by means of washing device 14 in the aforementioned second operating position, that is, with dummy bottle 50 in the work position and preferably with nozzle 38 in a vertical position between the raised work position and the lowered rest position defined earlier.

[0031] The operation of each washing device 14 of washing machine 10 will now be described briefly.

[0032] In an initial step, as shown in figure 2, bottle B is transferred from rotating loading member 26 to one of washing devices 14, while the latter are rotated by turret 12 about the vertical axis of rotation z, and gripped by the neck by gripping member 36 of said device. In this first step, supporting body 32 of washing device 14 is in the aforementioned second operating position, in which gripping member 36, and also bottle B held thereby, is laterally away from nozzle 38, in particular moved radially outward with respect to nozzle 38. In addition, in this first step nozzle 38 is in the lowered rest position.

[0033] In a second step, as shown in figure 4, supporting body 32 of washing device 14 is rotated 180° about the horizontal axis of rotation y with respect to the second operating position so as to reach the first operating position, in which gripping member 36, and therefore also bottle B held thereby, is aligned with nozzle 38. This step takes place during the angular distance of rotation of turret 12 about the vertical axis of rotation z indicated with the letter A in figure 7. As mentioned earlier, the movement of supporting body 32 from one operating position to the other may be controlled, for example, by a cam acting on a rack meshing with a pinion rotatably integral to supporting body 32.

[0034] In a third step, as shown in figure 5, with supporting body 32 again in the first operating position, nozzle 38 is moved upward from the lowered rest position to the raised work position so as to penetrate at least partially into the neck of bottle B, and then water or air (or, possibly, first water and then air) is injected into the bottle.

[0035] The water injected into bottle B falls into collection cup 52 by gravity and from there flows through pipe 54 so as to be recirculated. After bottle B has been washed, nozzle 38 is returned to the lowered rest position. This step takes place during the angular distance of rotation of turret 12 about the vertical axis of rotation z indicated with the letter B in figure 7.

[0036] In a fourth step, which takes place within an angular distance of rotation of turret 12 about the vertical axis of rotation z, indicated with the letter C in figure 7, supporting body 32 is rotated from the first to the second operating position to allow bottle B to be transferred from gripping member 36 of washing device 14 to rotating unloading member 28.

[0037] Naturally, the movements and operations called for in the various steps of the wash cycle described above will be synchronized to the rotational movement of turret 12 so as to occur within the angular distances A, B, and C indicated above.

[0038] The washing and sanitizing operation, however, is carried out within the angular range, indicated with the letter D in figure 7, in which each washing device 14 moves from rotating unloading member 28 to rotating loading member 26; consequently, within a step of the work cycle of the machine in which the bottles are not washed. Indeed, during this angular distance supporting body 32 of each washing device 14 is in the second operating position, in which dummy bottle 50 is aligned with nozzle 38, whereas gripping member 36 is laterally away from nozzle 38 and is furthermore in the open position to allow another bottle to be loaded.

[0039] Lastly, figure 8 shows the change in the vertical position of nozzle 38 of each washing devices 14 during one complete revolution of turret 12 about the vertical axis of rotation z. Within angular distance A nozzle 38 is in the lowered rest position, then it is moved, during the transition from angular distance A to angular distance B, to the raised work position where it remains during angular distance B (during which the washing operation is performed), then returns to the lowered rest position during angular distance C, then is subsequently moved to the intermediate position during angular distance D (in which the washing and sanitizing operation is performed), and lastly is returned to the lowered rest position.

[0040] As is obvious from the above description, a washing machine according to the present invention is capable of working completely automatically, even during the washing and sanitizing step, since no operator action is required to install and remove the dummy bottles each time. This obviously increases the productivity of the machine. In addition, since the dummy bottles are permanently installed on the machine, no space needs to be provided to store the dummy bottles when they are not being used, resulting in a space savings and reduced cost of managing the bottling facility for which the machine is intended.

[0041] Naturally, without prejudice to the principle of the invention, the embodiments and construction details may be varied widely with respect to what has been described and illustrated solely as a non-limiting example, without exceeding the scope of the invention as defined in the enclosed claims.

Claims

1. A bottle washing machine (10) for washing bottles (B), in particular bottles for liquid foods, the machine (10) comprising a turret (12) rotatably supported about a vertical axis of rotation (z), and a plurality of washing devices (14) held by the turret (12), each of which arranged to wash a corresponding bottle (B) with each revolution of the turret (12) about said vertical axis of rotation (z),
   wherein each washing device (14) comprises:

a supporting body (32) mounted on the turret (12) so as to rotate about said vertical axis of rotation (z) together with the turret (12), and to rotate with respect to the turret (12) about a horizontal axis of rotation (y) oriented tangentially with respect to a circumference having its center on said vertical axis of rotation (z),
first drive means for causing the supporting body (32) to rotate with respect to the turret (12) about said horizontal axis of rotation (y) according to a given law of motion,
gripping means (36) which are carried by the supporting body (32) and may be controlled to switch alternatingly, between a closed position for gripping the neck of the bottle (B) and an open position for releasing the bottle (B),
injection means (38, 40) for injecting a fluid into the bottle (B) when the latter is clamped by said gripping means (36), and
a dummy bottle (50) usable to contain a spray of disinfecting liquid sprayed by said injection means (38) during a rinsing and sanitizing process of the machine (10),
the machine (10) being **characterized in that** each dummy bottle (50) is secured to the supporting body (32) of the corresponding washing device (14) so as to rotate therewith about said horizontal axis of rotation (y) between a working position, in which the dummy bottle (50) is above and aligned with said injection means (38), and a rest position, in which the dummy bottle (50) is laterally away from said injection means (38, 40).

2. A machine according to claim 1, wherein each dummy bottle (50) is arranged on a side opposite to said gripping means (36) of the corresponding washing device (14) with respect to said horizontal axis of rotation (y), whereby the supporting body (32) of each washing device (14) is able to assume a first operating position, in which said gripping means (36) are aligned with said injection means (38, 40) to allow the bottle (B) clamped by said gripping means (36) to be washed, while the dummy bottle (50) is in said rest position, and a second operating position, rotated 180°with respect to the first one, in which said gripping means (36) are laterally spaced apart from said injection means (38, 40), while the dummy bottle (50) is in said working position.

3. A machine according to claim 1 or claim 2, wherein said injection means (38, 40) include, for each washing device (14), a nozzle (38) which is oriented vertically and is mounted so as to be vertically movable, and wherein each washing device (14) further comprises second drive means (44, 46) arranged to control a vertical movement of the nozzle (38) between a lowered rest position and a raised work position in a coordinated way with the rotary movement of the supporting body (32) driven by said first drive means.

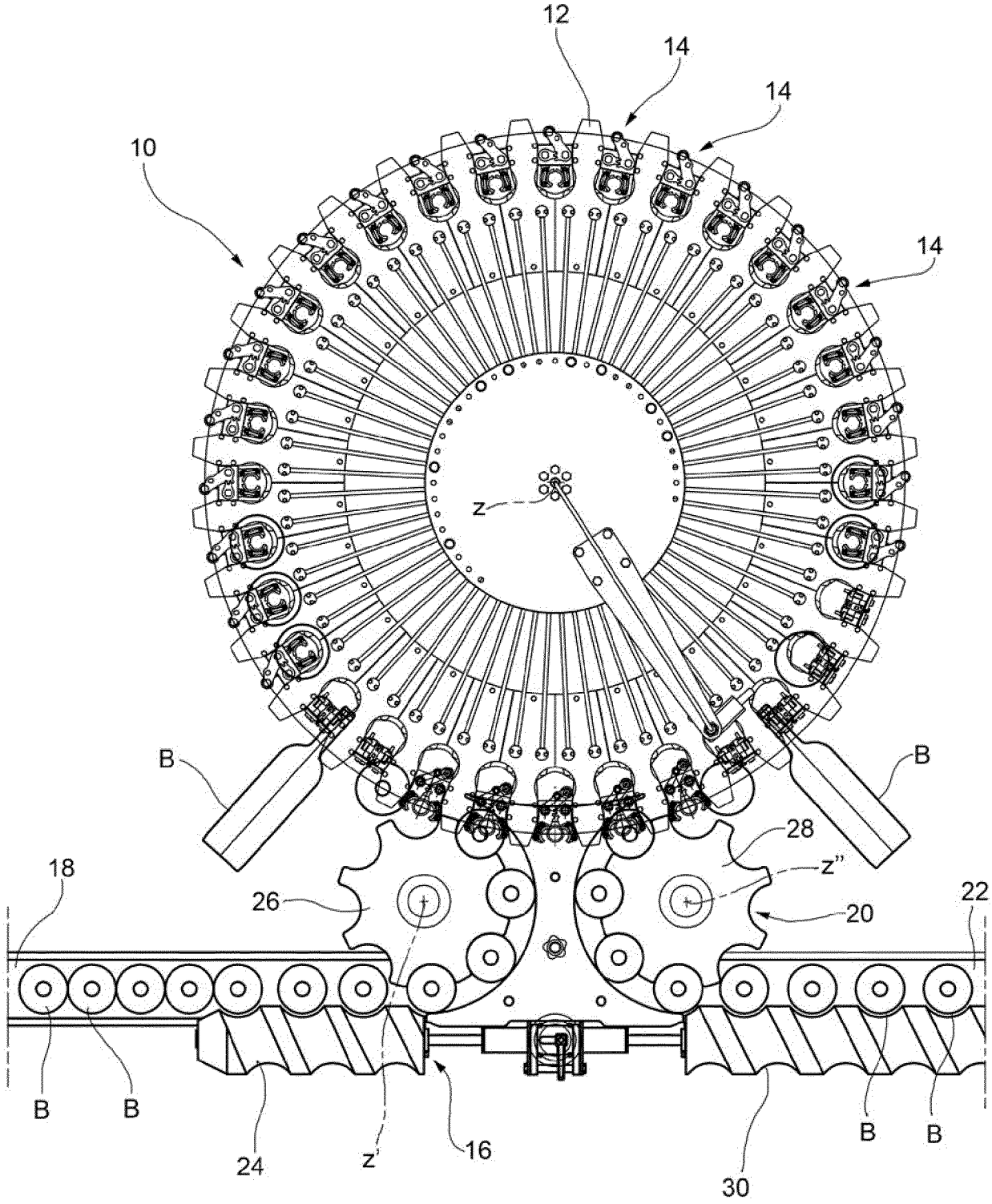

FIG. 1

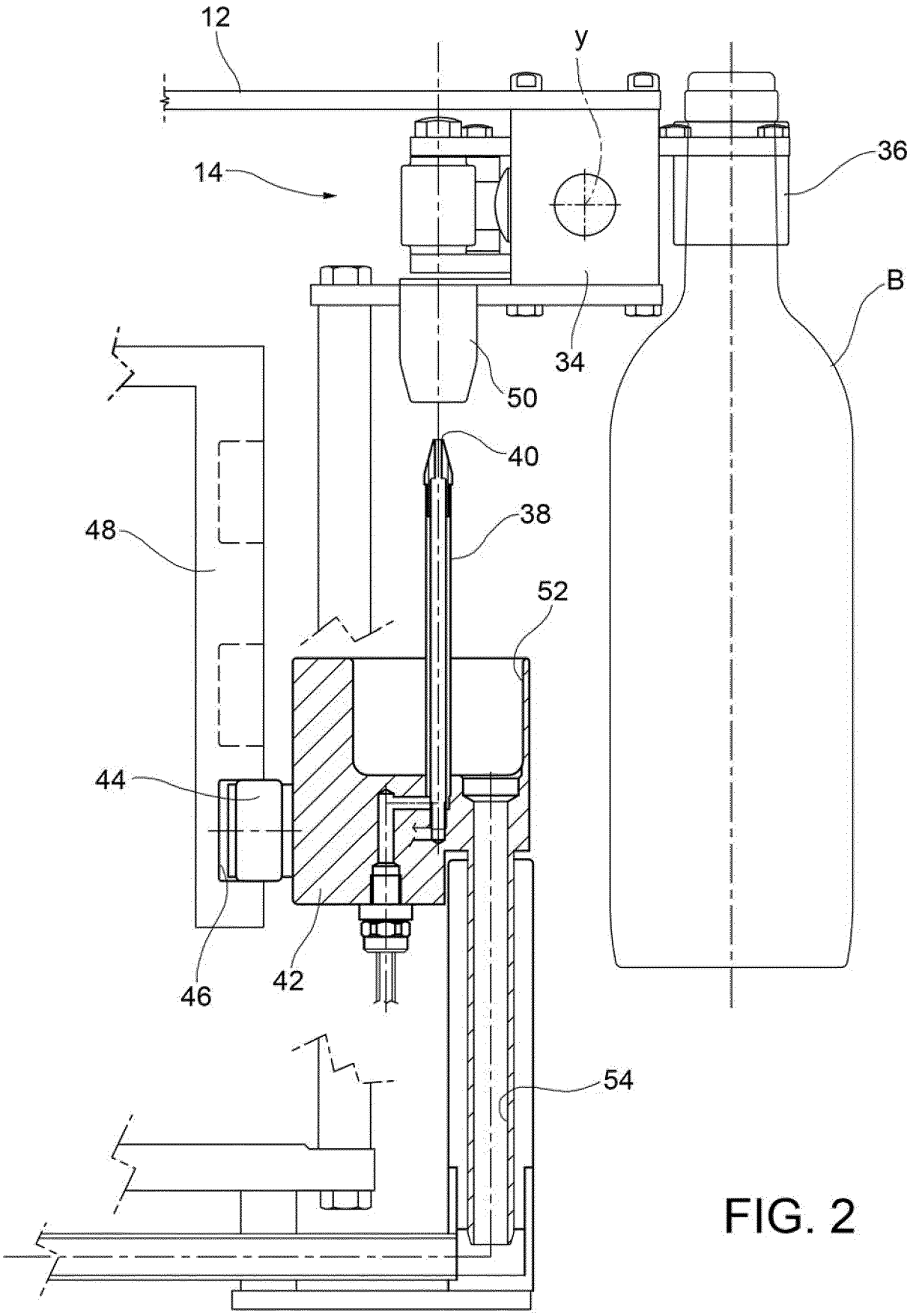

FIG. 2

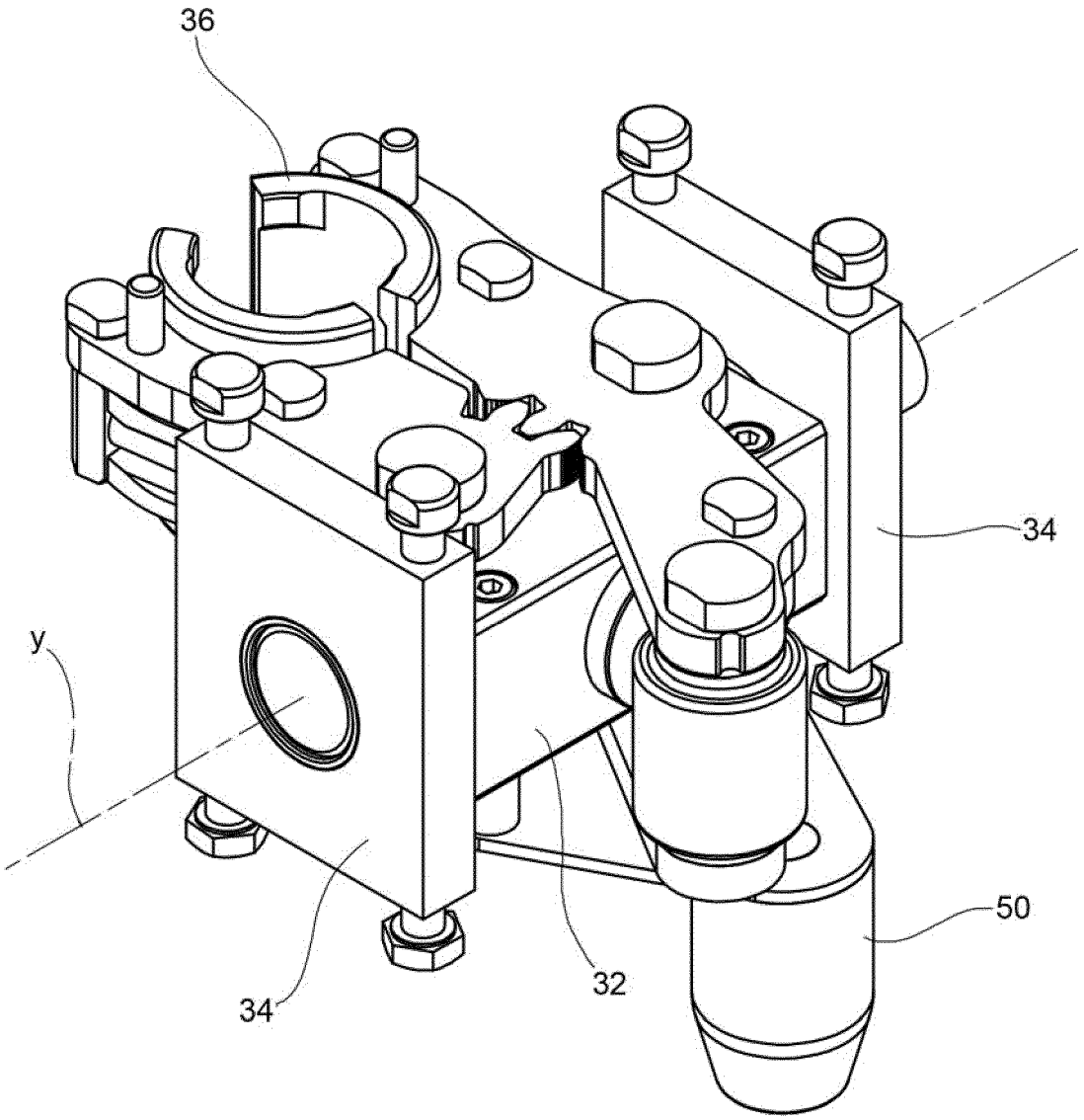

FIG. 3

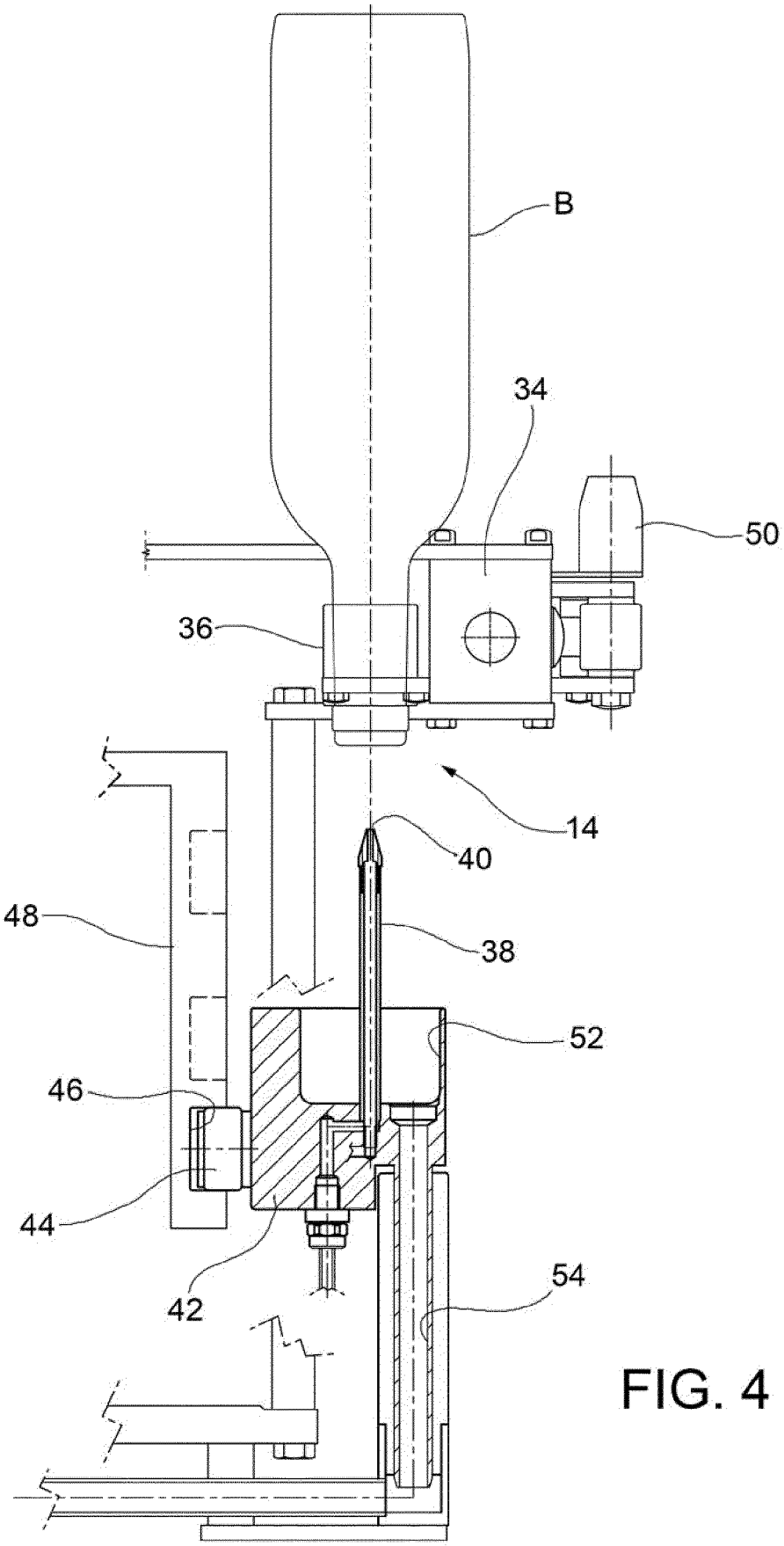

FIG. 4

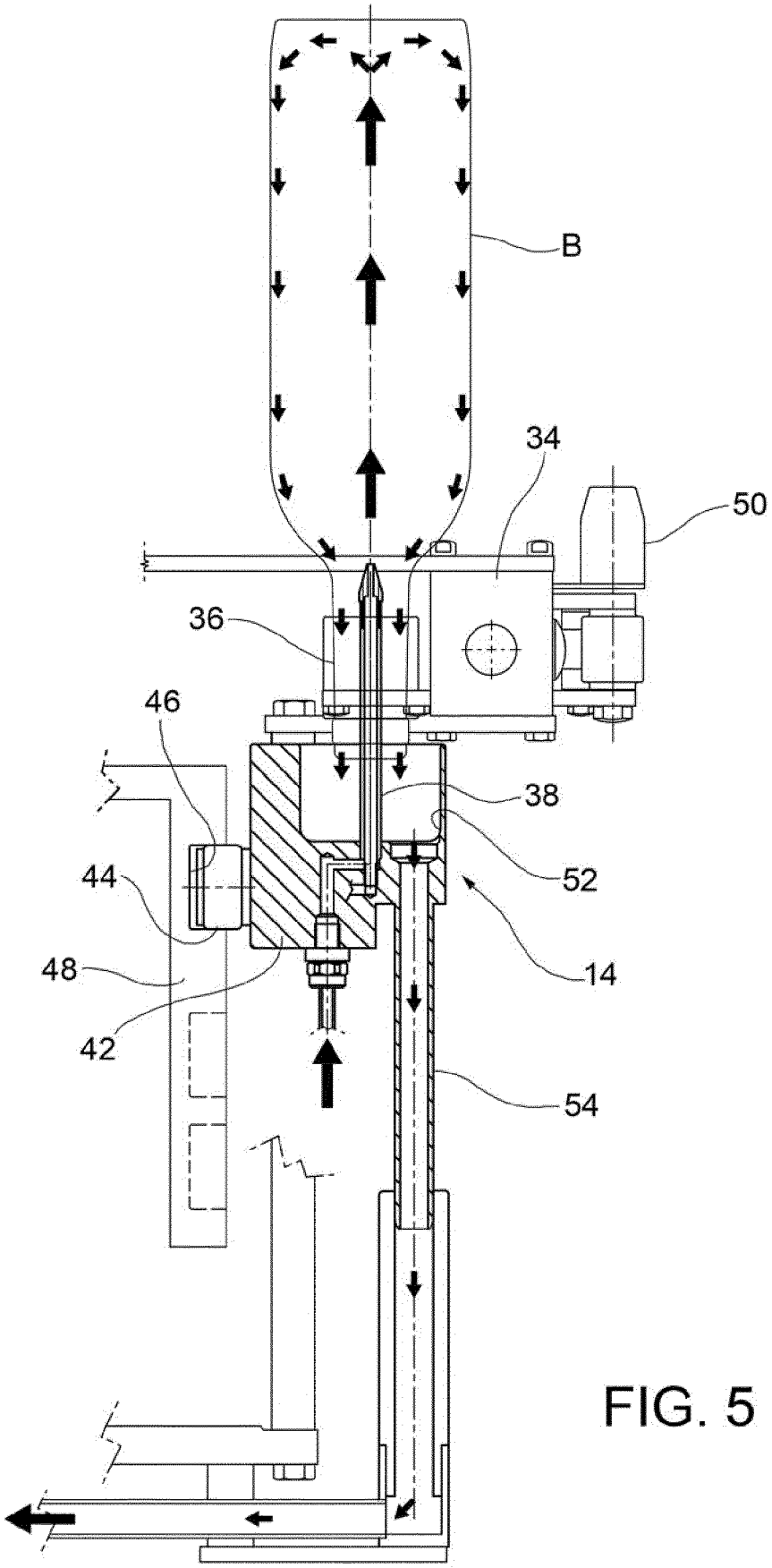

FIG. 5

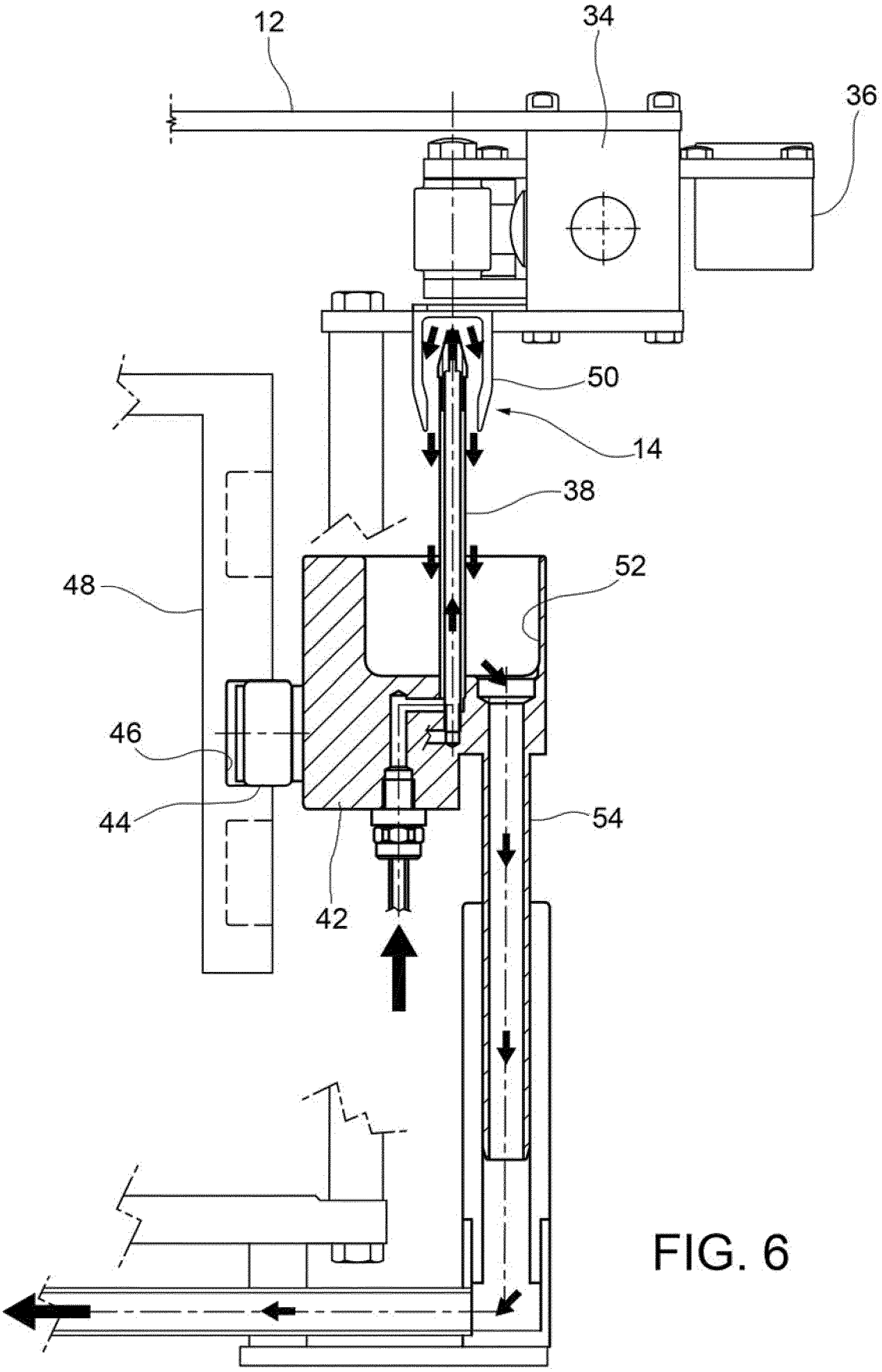

FIG. 6

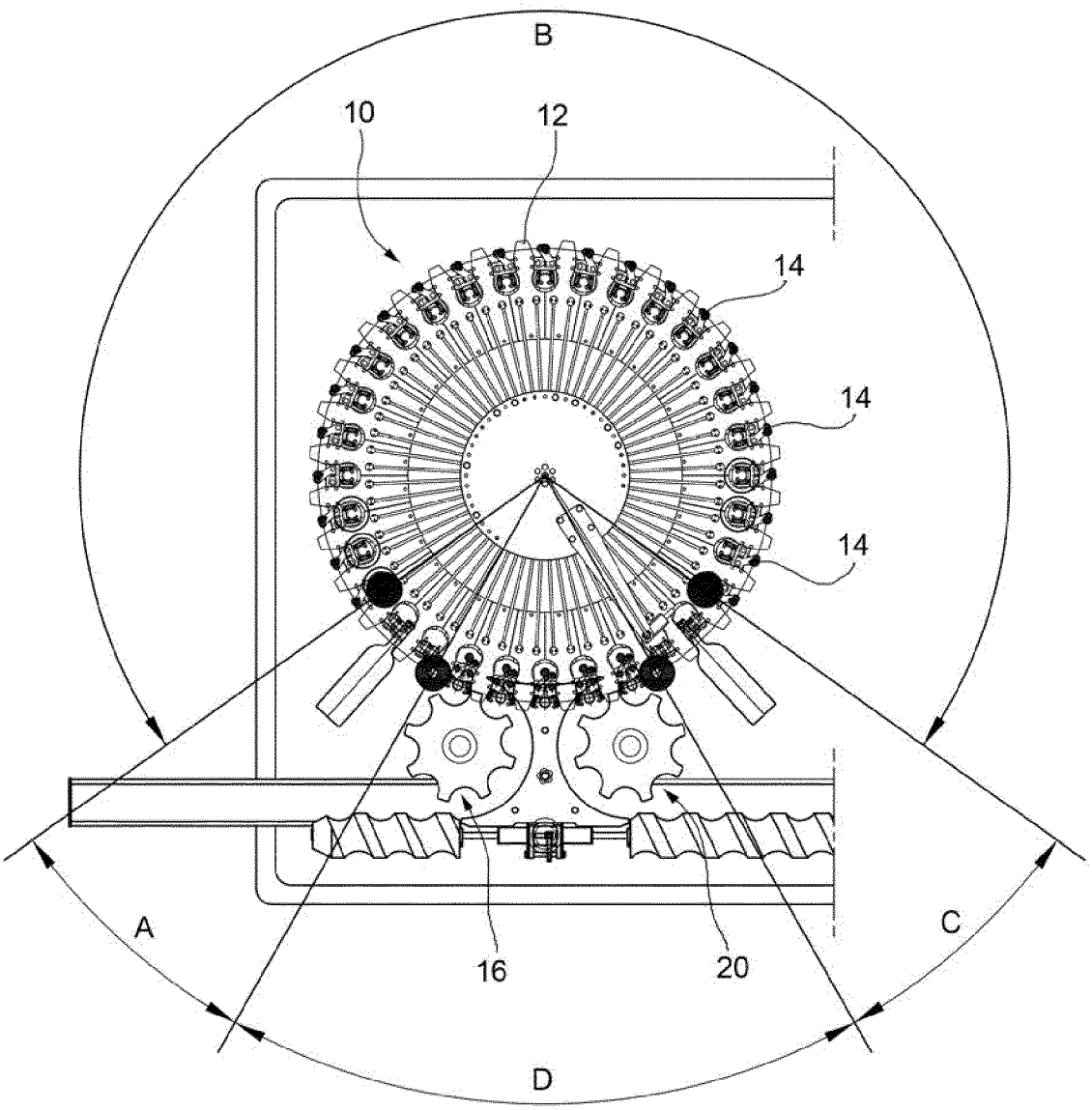

FIG. 7

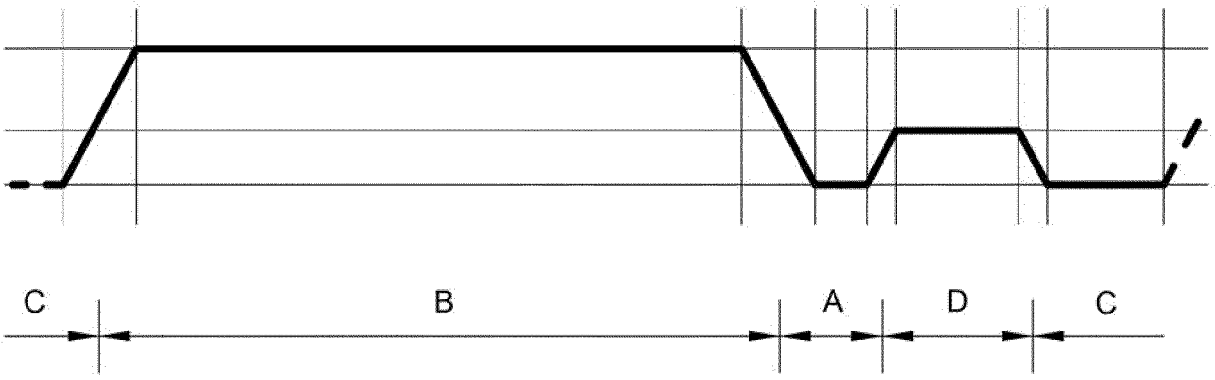

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 4576

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2010/037925 A1 (KAPPEL STEFFEN [DE] ET AL) 18 February 2010 (2010-02-18) * abstract; figures * * paragraph [0003] * * paragraph [0043] - paragraph [0058] *	1-3	INV. B08B9/32 B08B9/42 B08B9/027 B08B9/20 B08B3/02 B05B1/26 B05B15/55 B22F3/105
A	DE 44 25 219 A1 (KRONSEDER MASCHF KRONES [DE]) 18 January 1996 (1996-01-18) * abstract; claim 1; figures *	1-3	
A	EP 1 270 498 A1 (GALLARDO GONZALEZ ANTONIO [ES]) 2 January 2003 (2003-01-02) * figures *	1-3	

TECHNICAL FIELDS SEARCHED (IPC)

B08B
B05B
C22C
B22F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 October 2020	Kosicki, Tobias

CATEGORY OF CITED DOCUMENTS

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