(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 553 022 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.10.2019 Bulletin 2019/42

(51) Int Cl.:
B67C 3/28 *(2006.01)*

(21) Application number: **19167124.7**

(22) Date of filing: **03.04.2019**

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

(30) Priority: **13.04.2018 IT 201800004468**

(71) Applicant: **Sacmi Beverage S.p.A.**
40026 Imola (IT)

(72) Inventors:
- **MASSARI, Mirco**
  43126 PARMA (IT)
- **MARCHESI, Luigi**
  43044 COLLECCHIO PR (IT)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Via Meravigli, 16
20123 Milano (IT)

(54) FILLING MACHINE

(57) A filling machine (1) comprising a containment tank which is connected, by way of supply ducts, to a plurality of dosing valves (3) which are functionally connected to a device (10) for managing and controlling the opening and the closure of the dosing valves (3); the dosing valves (3) comprise at least one reference valve (3a) which is associated with a flowrate measurement device (3b) which is functionally connected to the managing and controlling device (10) in order to determine the open time of the reference valve (3a) that corresponds to the dispensing of a predetermined quantity of liquid, and at least one valve to be calibrated (3c). The filling machine (1) has a calibration station which comprises at least one tray (20), into which the liquid dispensed by each valve to be calibrated (3c) can be discharged, the tray (20) being associated with a device for weighing the liquid discharged in a time that corresponds to the open time of the reference valve (3a) determined by the managing and controlling device (10), the managing and controlling means (10) being adapted to detect the difference between the quantity of liquid contained in the tray and the predetermined quantity of liquid, and being adapted to generate a correction coefficient for the time that the valve to be calibrated (3c) is to remain open as a function of such difference in order to allow the dispensing, by the valve to be calibrated (3c), of the predetermined quantity of liquid.

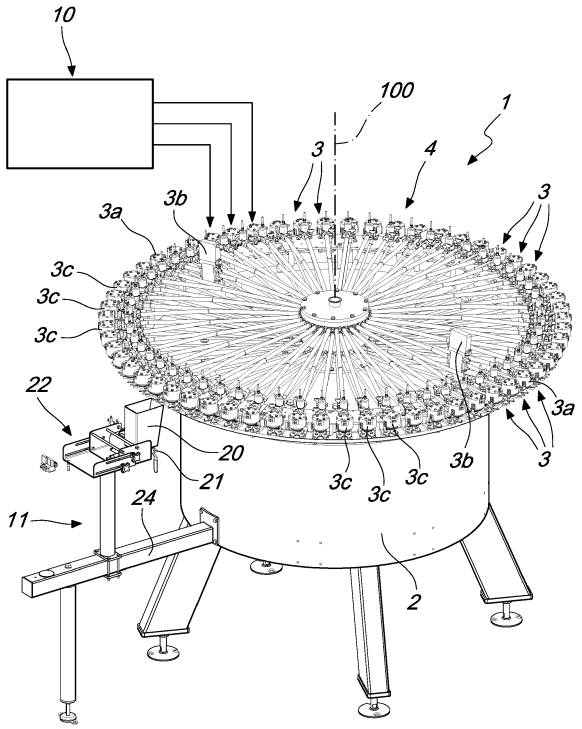

Fig. 1

EP 3 553 022 A1

Description

[0001] The present invention relates to a filling machine and, in particular, a filling machine for liquids using time-controlled dosing valves.

[0002] Filling machines for liquids are known and widely used, which use time-controlled dosing valves in order to produce the quantity of liquid to be introduced into each container.

[0003] Typically, the time necessary to fill each container is found experimentally by way of calibration operations and initial fine-tuning.

[0004] During use however, some fluid dynamic factors or wear factors can lead to a variation of the flow-rate in output from the dosing valves, and this results in the necessity to proceed with a recalibration.

[0005] It is known in fact that the flow-rate of a valve, once the open time is fixed, depends on the outflow speed, and the value of the outflow speed is affected by flow resistances in the circuit.

[0006] The value of the flow resistances is affected by multiple factors such as viscosity, density, temperature, centrifugal force in rotary filling machines, the geometry of the conduits, the level of the liquid, and the pressure in the supply tank.

[0007] In order to solve such problem, the same Applicant filed Patent no. EP1713692 on 1 February 2005.

[0008] The aim of the above invention was to ensure that the variations of the thermal/fluid dynamic parameters would not affect the initial calibration of the filling apparatus.

[0009] In particular, the solution in question discloses a filling machine with time-controlled dosing valves and having at least one master valve provided with an electronic flow meter which is connected to a computer unit, which manages the timing of the operations of dosed filling of at least one master bottle.

[0010] In this manner the time necessary to measure the actual quantity of liquid dispensed from the tank under pressure to each valve and introduced into all the bottles in transit is determined in advance.

[0011] In particular, a throttling diaphragm is applied upstream of each valve which is calibrated with very high flow resistances in order to ensure that the relative variations of all the other parameters that could affect the repeatability of the operating conditions of the dosed flow will not affect such repeatability.

[0012] The solution described above, although being particularly widespread and capable of solving the problems of calibration and of repeatability as the thermal/fluid dynamic parameters vary, results in some factors that are complex from the point of view of construction, given that both a master valve and a plurality of throttling diaphragms need to be provided.

[0013] The aim of the present invention is to provide a filling machine that is capable of improving the known art in one or more of the above mentioned aspects.

[0014] Within this aim, an object of the invention is to provide a filling machine by which it is possible to manage the steps of calibration in a very practical manner.

[0015] Another object of the invention is to provide a filling machine that is highly reliable, easy to implement and at low cost.

[0016] This aim and these and other objects which will become better apparent hereinafter are achieved by a filling machine according to claim 1, optionally provided with one or more of the characteristics of the dependent claims.

[0017] Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not exclusive, embodiment of the filling machine according to the invention, which is illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a perspective view of a filling machine according to the invention;

Figure 2 is an enlarged-scale perspective view of the calibration station of the filling machine according to the invention.

[0018] With reference to the above figures, the filling machine according to the invention, generally designated by the reference numeral 1, comprises a containment tank which is connected, by way of supply ducts, to a plurality of dosing valves 3, which are functionally connected to a device 10 for managing and controlling the opening and the closure of the above mentioned dosing valves 3.

[0019] According to the present invention, the dosing valves 3 comprise at least one reference valve 3a, which is associated with a flow-rate measurement device 3b.

[0020] If the filling machine 1 has a particularly high number of dosing valves 3, it is possible to have two or more reference valves 3a so as to be able to compensate for any malfunctions of one of such reference valves 3a.

[0021] The flow-rate measurement device 3b is functionally connected to the managing and controlling device 10 in order to determine the open time of the reference valve 3a that corresponds to the dispensing of a predetermined quantity of liquid.

[0022] Specifically, the dosing valves 3 comprise a plurality of valves to be calibrated 3c.

[0023] The filling machine 1 is provided with a calibration station 11, which comprises at least one tray 20 into which the liquid dispensed by the at least one valve to be calibrated 3b can be discharged.

[0024] The tray 20 is associated, in particular, with a device for weighing the liquid discharged into the aforementioned tray 20 by the valve to be calibrated 3c in a time that corresponds to the open time of the reference valve 3a determined by the managing and controlling device 10.

[0025] In detail, the managing and controlling means 10 are adapted to detect the difference between the quantity of liquid discharged into the tray 20 by the valve

to be calibrated 3c in a time that corresponds to the open time of the reference valve 3a determined by the managing and controlling device 10, and the aforementioned predetermined quantity of liquid.

[0026] Specifically, the managing and controlling means 10 are functionally connected to the weighing device so that such means can automatically detect the difference between the quantity of liquid discharged into the tray 20 by the valve to be calibrated 3c in a time that corresponds to the open time of the reference valve 3a determined by the device for managing and controlling 10, and the aforementioned predetermined quantity of liquid.

[0027] In particular, the managing and controlling device 10 is adapted to generate a correction coefficient for the time that the respective valve to be calibrated 3c is to remain open as a function of such difference in order to allow the dispensing by the valve to be calibrated 3c, during use of the filling machine 1, of the aforementioned predetermined quantity of liquid.

[0028] Preferably, the filling machine 1 comprises a plurality of valves to be calibrated 3c.

[0029] In particular, the filling machine 1 is provided with means for positioning, on command, each valve to be calibrated 3c in a calibration position in which the liquid that exits from the valve to be calibrated 3c is discharged into the at least one tray.

[0030] Advantageously, the tray 20 comprises a liquid discharge valve 21.

[0031] Conveniently, the filling machine 1 comprises a supporting structure 2 for a carousel 4 which can rotatingly move about a vertical axis 100.

[0032] The carousel 4 is provided, at its peripheral region, with the plurality of dosing valves 3.

[0033] The tray 10, and more generally the calibration station 11, is arranged along the movement trajectory of the dosing valves 3 and, more specifically, at a lower level with respect to that of the dosing valves 3.

[0034] Preferably, the weighing device comprises a load cell.

[0035] The tray 20 can move on command between an operative position, in which it is arranged below the trajectory of the dosing valves 3 during the calibration operations, and an inoperative position in which it is arranged laterally with respect to the carousel 4 so as not to interfere with the bottles during filling during the normal use of the filling machine 1.

[0036] According to a possible variation of embodiment, the filling machine 1 comprises a containment tank 2 which is connected, by way of supply ducts 2a, to a plurality of dosing valves 3 which are functionally connected to a device 10 for managing and controlling the opening and the closure of the dosing valves 3.

[0037] The filling machine 1 comprises a plurality of valves to be calibrated 3c.

[0038] The filling machine further has a calibration station 11, which comprises at least one tray 20 into which the liquid dispensed by the at least one valve to be calibrated 3c can be discharged.

[0039] The tray 20 is associated with a device for weighing the liquid discharged into the aforementioned tray 20 by the valve to be calibrated 3c in a time determined by the managing and controlling device 10.

[0040] In this manner, it is possible to execute the calibration of the valves to be calibrated even without having a reference valve 3a.

[0041] The filling machine 1 of the type described above is also advantageously provided with means for positioning, on command, each valve to be calibrated 3c in a calibration position in which the liquid that exits from the valve to be calibrated 3c is discharged into the at least one tray 20.

[0042] According to a further aspect, the present invention relates to a method for calibrating dosing valves 3 of a filling machine 1, which comprises:

- a step of setting a reference valve 3a which is associated with a flow-rate measurement device 3b which is functionally connected to the managing and controlling device 10 in order to determine the open time of the reference valve 3a that corresponds to the dispensing of a predetermined quantity of liquid;
- a step of positioning a valve to be calibrated 3c at a calibration station 11 which comprises at least one tray 20 associated with a device for weighing the liquid discharged into the tray 20, into which the liquid dispensed by the valve to be calibrated 3c can be discharged;
- a step of opening the valve to be calibrated 3c for a time that corresponds to the open time of the reference valve 3a determined by the managing and controlling device 10 during the step of setting;
- a step of detecting, by the managing and controlling device 10, the difference between the quantity of liquid discharged into the tray during the step of opening and the predetermined quantity of liquid;
- a step of generating, by the managing and controlling device 10, a correction coefficient for the time that the at least one valve to be calibrated 3c is to remain open as a function of the difference detected during the step of detecting.

[0043] Advantageously, after the step of generating, the method according to the invention entails a step of actuating the valve to be calibrated 3c for a time that corresponds to the open time of the reference valve 3a multiplied by the time correction coefficient and, optionally, a step of discharging the liquid dispensed during the step of actuating into the tray 10.

[0044] In particular, after the step of actuating, there is a step of weighing to control the quantity of the liquid discharged into the tray during the step of actuating and a step of verifying the correspondence between the quantity of liquid discharged into the tray during the step of weighing to control the quantity of the liquid discharged into the tray and the predetermined quantity of liquid.

[0045] Preferably, the method comprises, in succession, a plurality of single steps of opening the valve to be calibrated for a time that corresponds to the open time of the reference valve 3a, and a plurality of respective steps of detecting, by the managing and controlling device, the difference between the quantity of liquid discharged into the tray and the predetermined quantity of liquid.

[0046] The managing and controlling device is adapted to determine the time correction coefficient, if the single quantities of liquid detected in the respective steps of detecting show a percentage deviation with respect to each other that is within the limit that can be preset.

[0047] During the above mentioned step of generating, there is also the step of calculating the average value of the single quantities of liquid detected.

[0048] The step of generating, by the managing and controlling device 10, the open-time correction coefficient uses, in particular, such average value.

[0049] If the quantity of liquid discharged into the tray 20 during the control weighing step deviates from the predetermined quantity of liquid within a percentage that is lower than an acceptable deviation percentage, for example equal to 0.2% or more preferably equal to 0.1%, a step is envisaged of validating the time correction coefficient.

[0050] Conveniently, the method entails a step of emptying the tray 20 when a limit level is exceeded.

[0051] According to a further aspect, the present invention relates to a method for calibrating dosing valves 3 of a filling machine 1, which comprises:

- a step of positioning a valve to be calibrated 3c at a calibration station 11 which comprises at least one tray 20 associated with a device for weighing the liquid discharged into the tray 20, into which the liquid dispensed by the above mentioned valve to be calibrated 3c can be discharged;
- a step of opening the valve to be calibrated 3c;
- a step of detecting the open time of the valve to be calibrated that corresponds to a predetermined quantity of liquid discharged into the tray:
- a step of storing, by a managing and controlling device 10, the respective open time of the valve to be calibrated 3c.

[0052] In practice it has been found that the invention fully achieves the intended aim and objects by providing a filling machine and a method for calibrating dosing valves that are particularly practical and reliable.

[0053] The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

[0054] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements and to the state of the art.

[0055] The disclosures in Italian Patent Application No. 102018000004468 from which this application claims priority are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A filling machine (1) comprising a containment tank which is connected, by way of supply ducts (2a), to a plurality of dosing valves (3), which are functionally connected to a device (10) for managing and controlling the opening and the closure of said dosing valves (3), **characterized in that** said dosage valves (3) comprise at least one reference valve (3a) which is associated with a flow-rate measurement device (3b) which is functionally connected to said managing and controlling device (10) in order to determine the open time of said reference valve (3a) that corresponds to the dispensing of a predetermined quantity of liquid, said dosing valves (3) comprising at least one valve to be calibrated (3c), a calibration station (11) being provided which comprises at least one tray (20), into which the liquid dispensed by said at least one valve to be calibrated (3c) can be discharged, said tray (20) being associated with a device for weighing the liquid discharged into said at least one tray (20) by said at least one valve to be calibrated (3c) in a time that corresponds to the open time of said reference valve (3a) determined by said managing and controlling device (10), said managing and controlling device (10) being adapted to detect the difference between the quantity of liquid discharged into said tray (20) by the valve to be calibrated (3c) in a time that corresponds to the open time of the reference valve (3a) determined by the managing and controlling device (10) and said predetermined quantity of liquid, and being adapted to generate a correction coefficient for the time that said at least one valve to be calibrated (3c) is to remain open as a function of said difference in order to allow the dispensing, by said valve to be calibrated (3c), of said predetermined quantity of liquid.

2. The filling machine (1) according to claim 1, **characterized in that** it comprises a plurality of valves to be calibrated (3c), means being provided for positioning on command each valve to be calibrated (3c) in a calibration position in which the liquid that exits from said valve to be calibrated (3c) is discharged into said at least one tray (20).

3. The filling machine (1) according to claim 1, **characterized in that** said tray (20) comprises a liquid discharge valve (21).

4. The filling machine (1) according to claim 1, **characterized in that** it comprises a supporting structure (2) for a carousel (4) which can move about a vertical axis (100) and has, at its peripheral region, said plurality of dosing valves (3), said tray (20) being arranged along the movement trajectory of said dosing valves (3) and at a lower level with respect to said dosing valves (3).

5. A filling machine (1) comprising a containment tank which is connected, by way of supply ducts (2a), to a plurality of dosing valves (3), which are functionally connected to a device (10) for managing and controlling the opening and the closure of said dosing valves (3), **characterized in that** it comprises a plurality of valves to be calibrated (3c), a calibration station (11) being provided which comprises at least one tray (20), into which the liquid dispensed by said at least one valve to be calibrated (3c) can be discharged, said tray (20) being associated with a device for weighing the liquid discharged into said at least one tray (20) by said at least one valve to be calibrated (3c) in a time determined by said device for managing and controlling (10).

6. The filling machine (1) according to claim 5, **characterized in that** it comprises means for positioning on command each valve to be calibrated (3c) in a calibration position in which the liquid that exits from said valve to be calibrated (3c) is discharged into said at least one tray (20).

7. A method for calibrating dosing valves (3) of a filling machine (1), which comprises:

- a step of setting a reference valve (3a) associated with a flow-rate measurement device (3b) which is functionally connected to said managing and controlling device (10) in order to determine the open time of said reference valve (3a) that corresponds to the dispensing of a predetermined quantity of liquid;
- a step of positioning a valve to be calibrated (3c) at a calibration station (11) which comprises at least one tray (20) associated with a device for weighing the liquid discharged into said at least one tray (20), into which the liquid dispensed by said at least one valve to be calibrated (3c) can be discharged;
- a step of opening said valve to be calibrated (3c) for a time that corresponds to the open time of said reference valve (3a) which is determined by said managing and controlling device (10) during said step of setting;
- a step of detecting, by said device (10) for managing and controlling the difference between the quantity of liquid discharged into said tray (20) and said predetermined quantity of liquid;
- a step of generating, by said managing and controlling device (10), a correction coefficient for the time that said at least one valve to be calibrated (3c) is to remain open as a function of said difference detected during said step of detecting.

8. The method according to claim 7, **characterized in that** it comprises, after said step of generating, a step of actuating said valve to be calibrated (3c) for a time that corresponds to the open time of said reference valve (3a) multiplied by said time correction coefficient, a step of weighing being provided for controlling the quantity of said liquid discharged into said tray during said step of actuating and a step being provided of verifying the correspondence between the quantity of liquid discharged into said tray during said step of weighing and said predetermined quantity of liquid.

9. The method according to claim 7, **characterized in that** it comprises, in succession, a plurality of single steps of opening said valve to be calibrated (3c) for a time that corresponds to the open time of said reference valve (3a), and a plurality of respective steps of detecting, by said managing and controlling device (10), the difference between the quantity of liquid discharged into said tray (20) and said predetermined quantity of liquid, said managing and controlling device (10) being adapted to determine said time correction coefficient by calculating the average value of the individual quantities of liquid detected, said step of generating, said managing and controlling device (10), said open-time correction coefficient using said average value.

10. The method according to claim 7, **characterized in that** it comprises, if the quantity of liquid discharged into said tray (20) during said step of weighing for controlling deviates from said predetermined quantity of liquid within a percentage that is lower than an acceptable deviation percentage, a step of validating said time correction coefficient.

11. The method according to claim 7, **characterized in that** it comprises a step of emptying said tray (20) when a limit level is exceeded.

12. A method for calibrating dosing valves (3) of a filling machine (1), which comprises:

- a step of positioning a valve to be calibrated (3c) at a calibration station (11) which comprises at least one tray (20) associated with a device

for weighing the liquid discharged into said at least one tray (20), into which the liquid dispensed by said at least one valve to be calibrated (3c) can be discharged;

- a step of opening said valve to be calibrated (3c);
- a step of detecting the open time of said valve to be calibrated that corresponds to a predetermined quantity of liquid discharged into said at least one tray;
- a step of storing, by a device for managing and controlling (10), said respective open time of said at least one valve to be calibrated (3c).

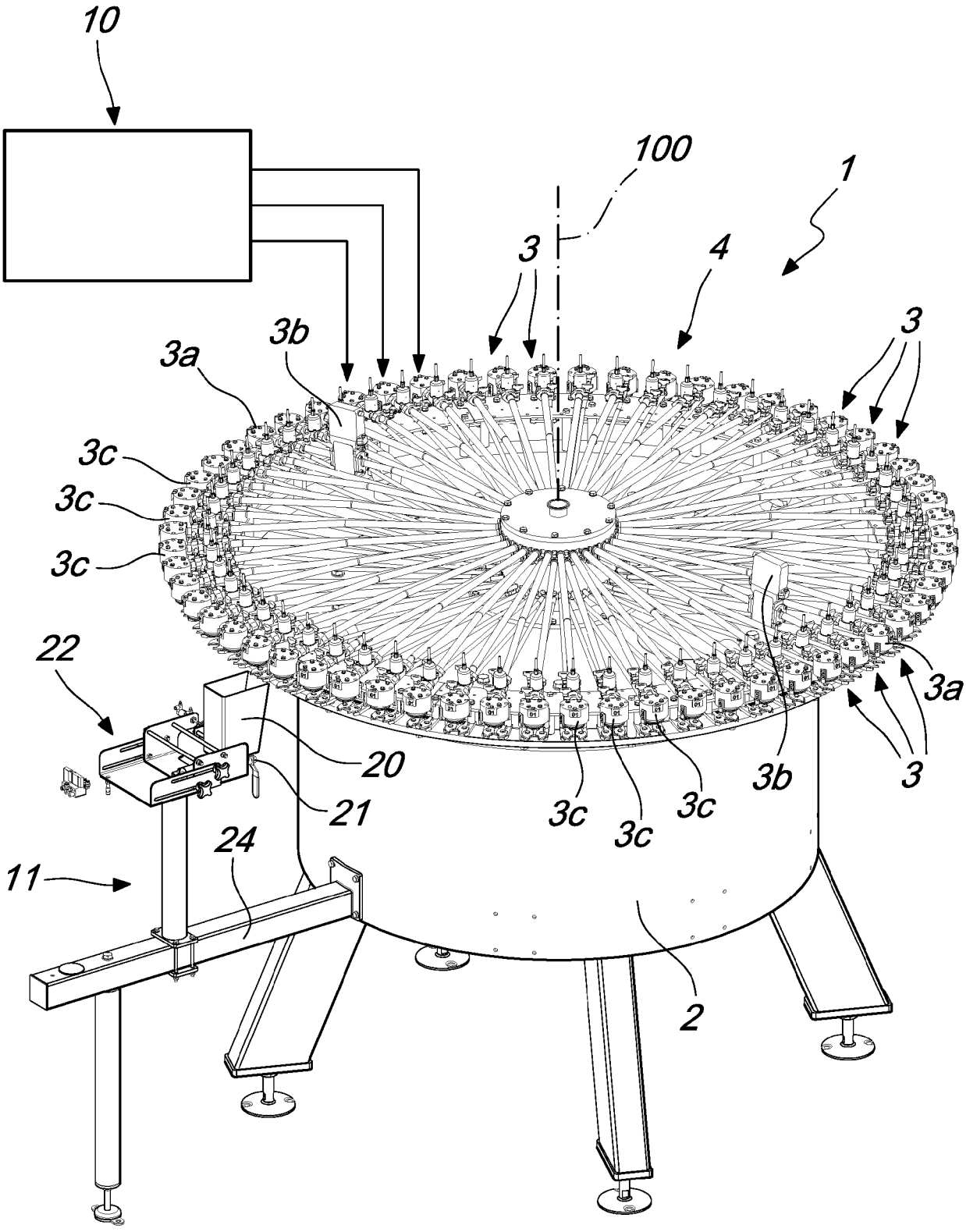

Fig. 1

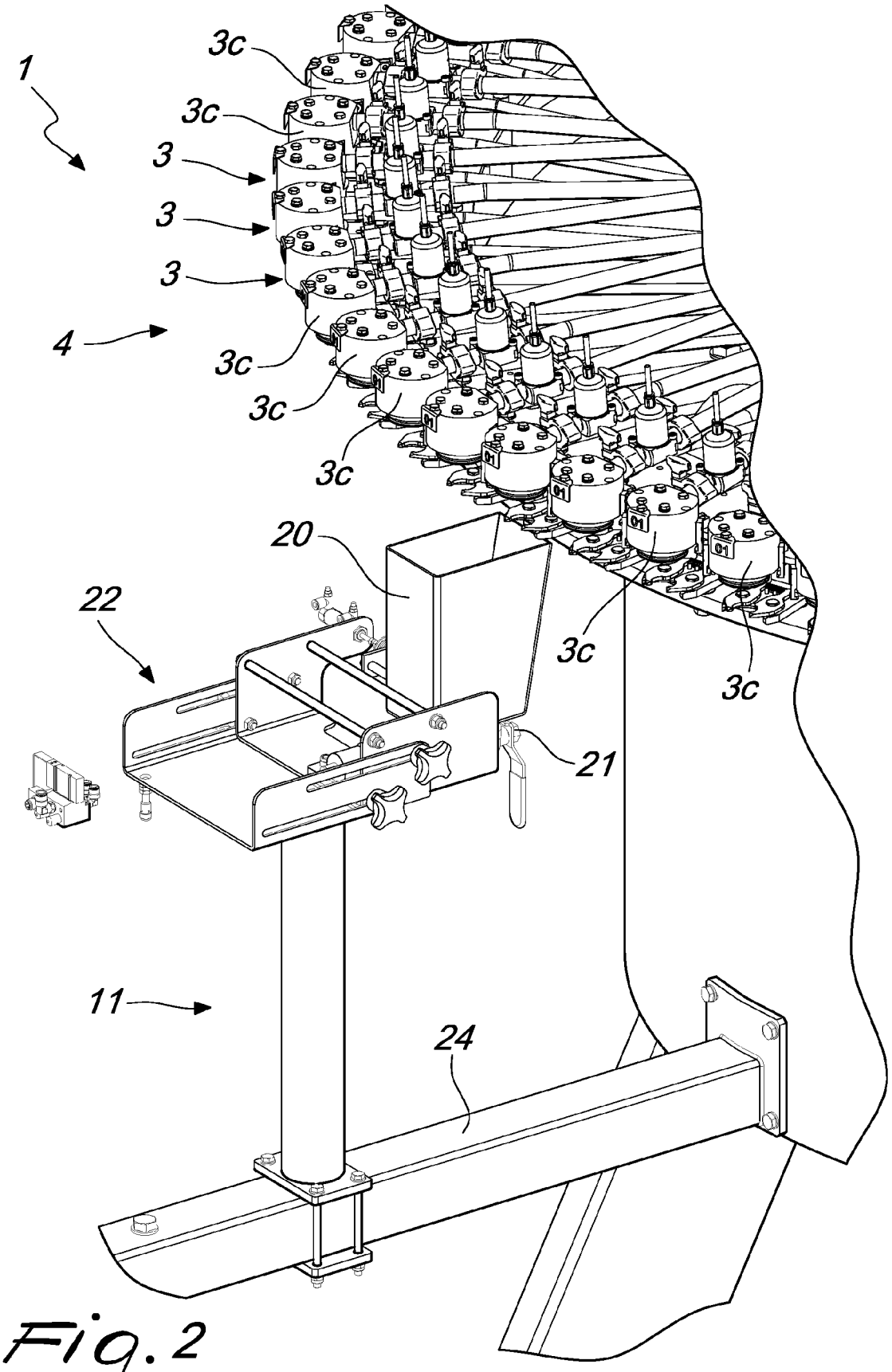

Fig. 2

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 16 7124

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 515 960 A1 (SEITZ ENZINGER NOLL MASCH [DE]) 2 December 1992 (1992-12-02) * column 7, line 11 - line 46 * * column 9, line 9 - line 39; figures 1-3 * -----	1,5, 7-10,12	INV. B67C3/28
A	GB 2 288 168 A (BWI DAWSON [GB]) 11 October 1995 (1995-10-11) * page 4, line 20 - line 33; figure * -----	1-12	
A	WO 2011/030211 A1 (FT SYSTEM SRL [IT]; AROL SPA [IT]; FORESTELLI FABIO [IT]; CIRIO ALBERT) 17 March 2011 (2011-03-17) * page 13, line 25 - page 14, line 8 * * page 15, line 10 - line 16; figure 1 * -----	1-12	
			TECHNICAL FIELDS SEARCHED (IPC) B67C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 September 2019	Wartenhorst, Frank

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
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 16 7124

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0515960 A1	02-12-1992	DE 4117287 A1	03-12-1992
		EP 0515960 A1	02-12-1992
		ES 2064135 T3	16-01-1995
		JP H06144489 A	24-05-1994
		US 5273082 A	28-12-1993
GB 2288168 A	11-10-1995	NONE	
WO 2011030211 A1	17-03-2011	BR 112012005628 A2	25-07-2017
		CA 2773635 A1	17-03-2011
		CN 102630213 A	08-08-2012
		EP 2477936 A1	25-07-2012
		ES 2677350 T3	01-08-2018
		IT 1395607 B1	16-10-2012
		US 2012222387 A1	06-09-2012
		WO 2011030211 A1	17-03-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1713692 A **[0007]**
- IT 102018000004468 **[0055]**