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(71) Applicant: **Mascheretti, Mariarosa**
Via Petrarca, 1
I-24036 Ponte San Pietro (Bergamo)(IT)

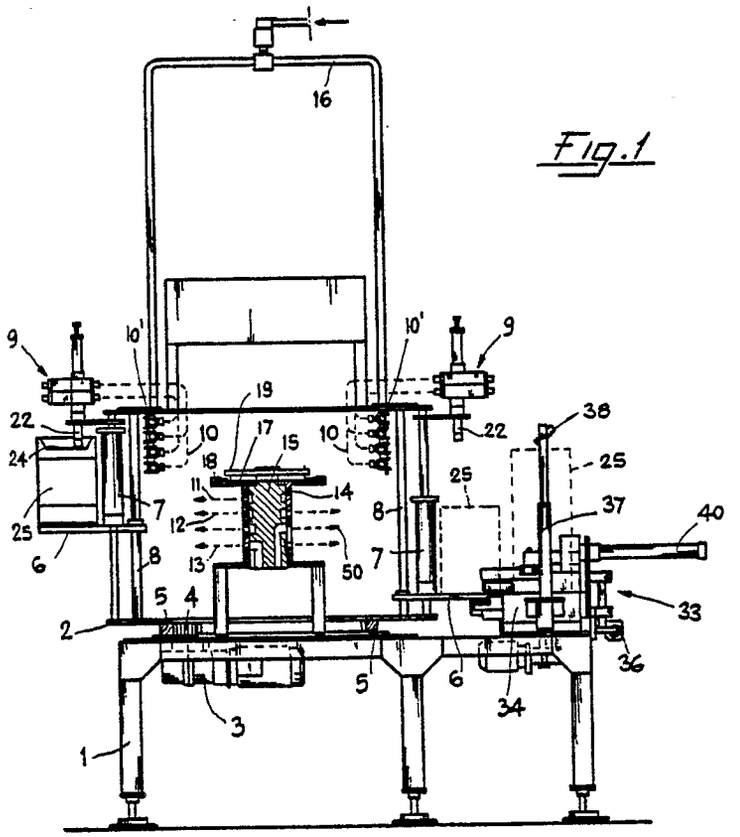
(72) Inventor: **Mascheretti, Mariarosa**
Via Petrarca, 1
I-24036 Ponte San Pietro (Bergamo)(IT)

(74) Representative: **Lecce, Giovanni**
STUDIO NORD BREVETTI Via Suardi, 4
I-24100 Bergamo(IT)

(54) Machine with continuous cycle for the sterilization and filling of drums, and the like.

(57) In a machine, preferably with turntable (2), with a plurality of sequential work heads, are carried out automatically and in successive phases the seal control, sterilization and filling of drums for liquid products in general, and, sin particular, for liquid food products, such as drinks and the like.

Fig.1



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MACHINE WITH CONTINUOUS CYCLE FOR THE STERILIZATION AND FILLING OF DRUMS, AND THE LIKE.

The invention concerns a machine with continuous cycle for the sterilization and filling of drums, and the like, in which the incoming drums, conveyed by a motorized belt positioned upstream, are first aligned and automatically arranged with respect to the position of their small filling and drain valves, then engaged in sequential heads in which said small valves are aligned and connected with distributors. The distributors are positioned, programmed and automatically driven to open and close in sequence in order to carry out, in each drum and at each head, a pressure-seal test, a steam sterilization treatment, a drying and discharge of condensations, a filling in pressure of carbon dioxide (CO_2), a filling in counterpressure with controlled discharge of CO_2 of the liquid product to be packed, a final recovery of the residual product comprised in the heads and a washing in CO_2 of said heads.

Everything takes place in sequential, automatic manner, with the drums in movement, up to their discharge on a conveyor belt positioned upstream of the machine.

It is known that many products in the liquid state, and in particular drinks in general, and the like, besides in the most well known packs, like bottles, small bottles, cans, cartons, are packed in drums for distribution and fast, rational use of the drinks in "draught" pouring systems, presently developed and used in many public places, e.g. beerhouses, bars, restaurants etc.

Said drums, equipped with main door and small filling and drain valves, are recycled, and, at each new filling, must first be washed and rinsed, then, with main door closed, are submitted to filling. These operations are at present carried out by devices controlled and manoeuvred by hand, so that the washed and rinsed drums pass to filling, where operators manually insert the feed mouths in the respective valves.

At the end of filling, the same operators carry out detachment of the manifolds and load and send the drums to the following phases of storage and palletization.

All this, as is evident, is very expensive, as a considerable amount of labour and high working times are involved.

Another particular problem consists in the fact that, at present, in the sequence of the above operations, no sterilization cycle of the washed drums is provided, and therefore, before filling and in closing phase of the upper cover, they are handled without special sanitary or hygienic conditions, with the serious risk that the liquid products subsequently inserted, especially the liquid food products, may suffer undesired pollution or even infective contamination.

The object of the present invention is to eliminate the the above problems.

The invention, as characterized by the claims, solves the problem by means of a machine with continuous cycle for the sterilization and filling of drums, and the like, with which the following results are obtained:

the washed drums are submitted in sequence to a pressure test, a sterilization and filling, in totally automatic and programmed manner, during a continuous cycle which receives the drums from conveyor belts, arriving from washing stations positioned downstream, and discharges them on conveyor belts positioned downstream, directed to storage or palletization stations.

Each drum is submitted to automatic controls and to separate seal check, and, on the basis of the results, the continuation or interruption of its cycle is established automatically, independently from the controls and from the characteristics of the other drums.

The advantages of the machine object of the present invention mainly consist in the fact that, before being filled, the drums are submitted to a pressure seal test to check their physical integrity, and to a sterilization treatment which eliminates all types of pollution and excludes the possibility of infective contamination, or the like.

Other advantages consist in the fact that the drums are aligned, controlled, treated and filled automatically and in continuous cycle, with a substantial saving of time with respect to the present work cycles; the automation of said cycle also allows to drastically reduce the use of labour.

The invention is described in more detail below, according to a preferred construction given only as example and unbinding, with reference to the enclosed drawings, in which:

fig. 1 is a lateral schematic view of the machine as a whole,

fig. 2 is a schematic view in plan of the same machine,

fig. 3 is a schematic cross-section of the central rotating distributor,

fig. 4 is a partial front view of a distributor of one head of the machine,

fig. 5 shows the longitudinal section of one of the distributors, and

fig. 6 shows, in detail, a lifting apparatus of the drums, equipped, according to a variant, with a "weighing" control device,

figs. 7 and 8 show respectively the upper and lower containing plates for the balances.

The figures illustrate a machine with continuous cycle for the sterilization and filling of drums, substantially composed of a fixed supporting structure (1) on which is positioned a rotating turntable (2) moved by a speed reducer (3) which drives a pinion (4) engaging in a round toothed crown (5).

On the periphery of the abovementioned rotating turntable (2) are aligned work heads, each composed of a supporting deck (6) supported by a vertical piston (7) and guided by a rear column (8). Each supporting deck (6) is aligned to an upper distributor (9), which in turn comprises the necessary connections (10), connected respectively to air inlets (11), CO_2 inlets (12), product inlets (13) and discharge inlets (50), present on the surface of a central distributor (14) which rotates, together with the rotating turntable (2), round the fixed central structure (15), in which are obtained the feed and/or discharge channels corresponding to the abovementioned inlets.

To each distributor (9) is also coupled another connection (10′) which is connected to a steam distribution manifold (16).

To the central rotating distributor (14) is coupled an upper plate (17) on which are radially applied, with possibility of regulation of position and of intervention, some means of contrast (18), e.g. limit microswitches or similar. During rotation, these contacts (18) enter or ,do not enter into engagement with some push rods (19), also adjustable on the basis of pre-established programs, modifiable to suit needs.

Each distributor (9) is divided into two blocks (20) and (21) of opposite valves, which are aligned and enter into joint communication, through joint central channels (45), with two adjustable lower hubs (22), whose center distance substantially corresponds to that of the two small valves (23) present on the head (24) of each drum (25).

The block (20) comprises a lower drain valve (26), an upper feed valve (27) of the product and a pressure switch (28).

The block (21) comprises a lower steam feed valve (29), an upper CO_2 feed valve and an overflow valve (31).

The structural concept, the composition of the valves, their preferably mushroom type, with drive by pneumatic piston, their orientation and position, although preferred as described and illustrated, must not be considered binding of the patent, but only given as example.

Various modifications to their structure, to their combination and to their position may be made without departing from the sphere and object of the invention.

During operation, the drums (25) are conveyed towards the machine by a conveyor belt with rollers (32), motorized.

On reaching the loading station (33), each drum (25) is loaded on a rotating plate (34) and held in position by pressing rollers (35), controlled by a piston (36). In alignment to said plate (34) is arranged an upper fixed structure (37) on which are applied two sensors (38), pre ferably composed of photo-electric cells. They are positioned with a distance between them equal to that corresponding to the center distance between the two small valves (23) present on the heads (24) of the drums (25) and are positioned in such a way as to detect their presence.

During its movement, the plate (34) makes the drum (25) rotate round its axis of vertical symmetry, so that the photo-electric cells (38), suitably orientated and positioned, can detect the exact position and orientation of said small valves. The moment both photo-electric cells simultaneously detect the presence of the two small valves, the plate (34) stops. The drum (25) is thus perfectly and automatically aligned in the desired position.

A device with suckers (39), driven by a piston (40), fixes in position the drum (25); the pressing rollers (35) move away and the drum is pushed on the supporting deck (6). which in that moment is aligned to the loading station (33). Subsequently, the corresponding vertical piston (7) lifts the drum (25) until the small valves (23) are engaged with the lower hubs (22) of the distributor (9) present in that work head.

The hubs (22) are equipped with elastic seal gasket (41), pressure spring (42) and conic mouth (43), so that they are capable of containing and engaging perfectly with the small valves (23), even if there are any small errors of orientation.

In the continuation of the slow, continuous rotation of the rotating turntable (2), the drum (25), as soon as loaded, starts its treatment cycle, while another drum presents itself on the loading station (33) for orientation operations.

Each drum (25) positioned on the supporting deck (6) drives the limit switch of drum presence; a second limit switch positioned on the central upper plate (17), with the consent of the presence of the drum, starts the various work cycles.

The treatment cycle starts with a first seal test to check the integrity of the structure of the drums, which consists in injecting inside them, through the opening of the valve (30), some CO_2 at the pressure of some bars and checking with a pressure switch that this pressure remains constant for a certain time.

If this takes place, it means that the drum in question is integral and the cycle may continue; if it does not take place, the station occupied by the faulty drum is excluded and, during rotation of the turntable (2), no operation is carried out, until discharge.

The same pressure test can be advantageously carried out with steam instead of CO_2; in this case the opening of the valve (29) instead of (30) is programmed and some dry satuated steam is injected inside the drums (25) at the pressure of some bars and at the temperature of 100° C and over.

If the seal test is positive, the drain valve (26) is opened, with consequent decompression, which starts at any rate with the natural condensation of the steam in contact with the cold surface of the drums, and the sterilization phase is carried out; this consists in continuing the injection of dry saturated steam inside the drums (25) and allowing it to drain through the valve (26).

Sterilization is carried out for a determinate time, while the turntable (2) continues its slow rotation.

Following the preestablished programming, the steam valve (29) is closed and the CO_2 valve (30) opened; the drain valve (26) remains open.

The flow of CO_2 causes the drainage of all residual condensation and the perfect internal drying of the drums; finally, the drain valve (26) closes and the drums are laoded with CO_2 at a slightly higher pressure than that to which the product to be transferred is submitted, then the CO_2 filling valve (30) also closes.

The filling phase then starts, with the opening of the product feed valve (27) and the start of opening of the overflow valve of the CO_2 (31), which is self-calibrated according to the pressure reached by the injected product.

In this way, a counterpressure is maintained inside the drums which makes it possible to carry out a regular, progressive filling, without the formation of foam, bubbles and the like.

It should be noted that the insertion of the product in the drums is carried out through the traditional small filling valve (23), which, as known, presents a long internal channel, with mouth facing the bottom, while the small drain valve (23) presents a shorter channel, facing the maximum filling level.

The control at end of filling may be carried out by means of a sensor (44) which detects the maximum level of liquid, or by means of a load cell (51), positioned above the supporting deck (6), which detects the effective weight of the full drum. In this second hypothesis, illustrated in figs. 6, 7 and 8, the shank of the cylinder and the guiding shank, indicated respectively with (52) and (53), are extended in upward direction and carry the balance (54) with upper containing plate (55); the prisms (56) are engaged in said shanks and obtain the "balanced" oscillation of the unit.

Below is parallelly provided the balance (57), with containing plate (58) and prism (60) inserted with the same system in the shanks. The electric and/or electronic connections of the device are of known type and are therefore not described.

In each case, after filling, the feed valve (27) is closed, after which, as a part of product remains in the feed channel of the heads, it is recovered by injecting it in the drum just loaded, by means of a momentary injection of CO_2 at higher pressure, with closure of the bleed valve (31) and temporary opening of the small valves (23) of the drum. This last phase, besides permitting the recovery of that part of product that would normally be lost at the start of the following cycle, makes it possible to carry out a perfect cleaning and drying of all the valves with CO_2.

The sequence of phases shown above is carried out in totally automatic manner, under the control of the photo-electric cells (38), of the means of contact (18), of the push rods (31), of the load cells or of the sensors (44), substantially regulated and programmed by means of a computer, external or on board machine, like a PLC.

The drain valves (26), the product feed valves (27), the steam feed valves (29) and the CO_2 feed valves (30) are preferably of type with pneumatic operation, as illustrated in figure (5), with the air inlets (11) derived and regulated by the inlet (50) present on the central distributor (14). Their operation, of known type, is not described in detail in the present report.

It is evident, however, that their mechanical structure is not binding but only relative to a preferred illustrative construction.

Said valves, or distributors, may therefore also be of other type, in the sphere of the innovative functional concept of the present invention.

At the end of the complete cycle, which substantially develops along the entire rotating route of the turntable (2), the vertical pistons (7) descend, freeing the small valves (23) of the drums from the corresponding distributors (9) and align the supporting decks (6) with a conveyor belt with motorized rollers (46). A second piston (47) with grip means with sucker (48), withdraws the filled drums from the decks (6) and deposits them on said conveyor belt. The arrangement on a rotating round turntable (2) and the number of work heads are unbinding, the same automatic functional concept may, in fact, also be applied on different constructions, for example with on-line arrangement or with any number of sequential heads. The round arrangement is, however, preferred for questions of easier, cheaper distribution, of general control of the machine, of maintenance and of bulk.

Claims

1) Machine with continuous cycle for the sterilization and filling of drums (25), and the like, characterized by the fact of comprising a sequential series of work heads equipped with groups of distributors (9), each formed by at least one product feed valve (27), a drain valve (26), a CO_2 feed valve (30), a steam feed valve (29) and an overflow valve (31), which are directly connected either to a central rotating distributor (14) or to a steam manifold (16), said distributors (9) being aligned and interconnected with adjustable hubs (22) which are engaged and coupled with the small valves (25) present on the heads (24) of the drums (25), which are engaged in the work loads through a loading and alignment station (33); said position being mairtainec up to the end of the work cycles.

2) Machine with continuous cycle according to claim 1, characterized by the fact that the loading station (33) is connected to a conveyor belt (32) and comprises a rotating plate (34), which carries drums (25), connected to: pressing rollers (35), a pushing device with suckers (39) and an upper fixed structure (37) on which are applied two sensors, e.g. photo-electric cells, which are positioned and orientated according to the center distance and to the pre-established orientation of the two small valves (23), present on the heads (24) of the drums (25); said sensors or photoelectric dells (38) being connected to the stopping system of the rotating plate (34), and being with intervention synchronized with the position of the small valves (23) in alignment to the detecting beam of said sensors.

3) Machine with continuous cycle according to claims 1 to 4, characterized by the fact that each supporting deck (6), on which the drums (25) are engaged under the action of the pusher with suckers (39), is equipped with a lifting piston (7) with rear guide (8), and is aligned to an upper distributor group (9).

4) Machine with continuous cycle according to claims 1 , 2 and 3 characterized by the fact that the sequential series of work heads is arranged in line, or is arranged on a rotating turntable (2), driven by a speed reducer (3) whose pinion (4) is engaged on a toothed crown (5), on which is fixed said turntable (2) complete with central rotating distributor (14).

5) machine with continuous cycle according to claims 1 to 7, characterized by the fact that the rotating distributor (14) is connected to an upper plate (17) on which are applied adjustable means of contact (18), alignable or not alignable to adjustable fixed push rods (19), and that said distributor (14) is engaged in rotation on a central, coaxial fixed structure (15) in which are obtained the feed channels corresponding to the air inlets (11), the CO_2 inlets (12), the product inlets (13), and the discharge inlets corre sponding to the aperture (50).

6) Machine with continuous cycle according to claims 1 to 9, characterized by the fact of having the filling control of the drums composed of weight-detecting load cells (51), the shanks (52) and (53) of the cylinder and of guide extended in upward direction, presenting at the top and bottom seats for the engagement of prisms (56) and (60) which produce the oscillation of the unit.

7) Machine with continuous cycle according to claims 1 to 6, characterized by the fact of having the filling control of the drums composed of level-detecting sensors (44).

8) Machine with continuous cycle according to claim 1, characterized by the fact that the drain valves (26), of the product (27), of the CO_2 (30), of the steam (29) and of overflow (31) are aligned according to common channels (45) and are preferably of pneumatic type.

9) Machine with continuous cycle according to claims 1 to 12, characterized by the fact that the continuous movement of the work heads, the valves, the control devices, the means of regulation, of intervention in closing and opening are directly connected to a programmable electronic elevator, like a PLC.

10) Machine with continuous cycle according to claims 1 to 13, characterized by the fact that, in the electronic programming of the control computer are provided, in sequence, a seal test phase with insertion of steam or CO_2 under pressure with possibility of suspension in case of presence of leaks, a sterilization phase with dry saturated steam in pressure with temperature over 100° C, a discharge phase of sthe residual condensations and of internal drying of the drums with CO_2, a pressurization phase of CO_2, a product filling phase in conditions of counterpressure of CO_2 overflowing, a recovery phase of the product remaining in the heads with momentary pressurization of CO_2 and a washing phase in CO_2 of the channels of the valves of the distributors (9).

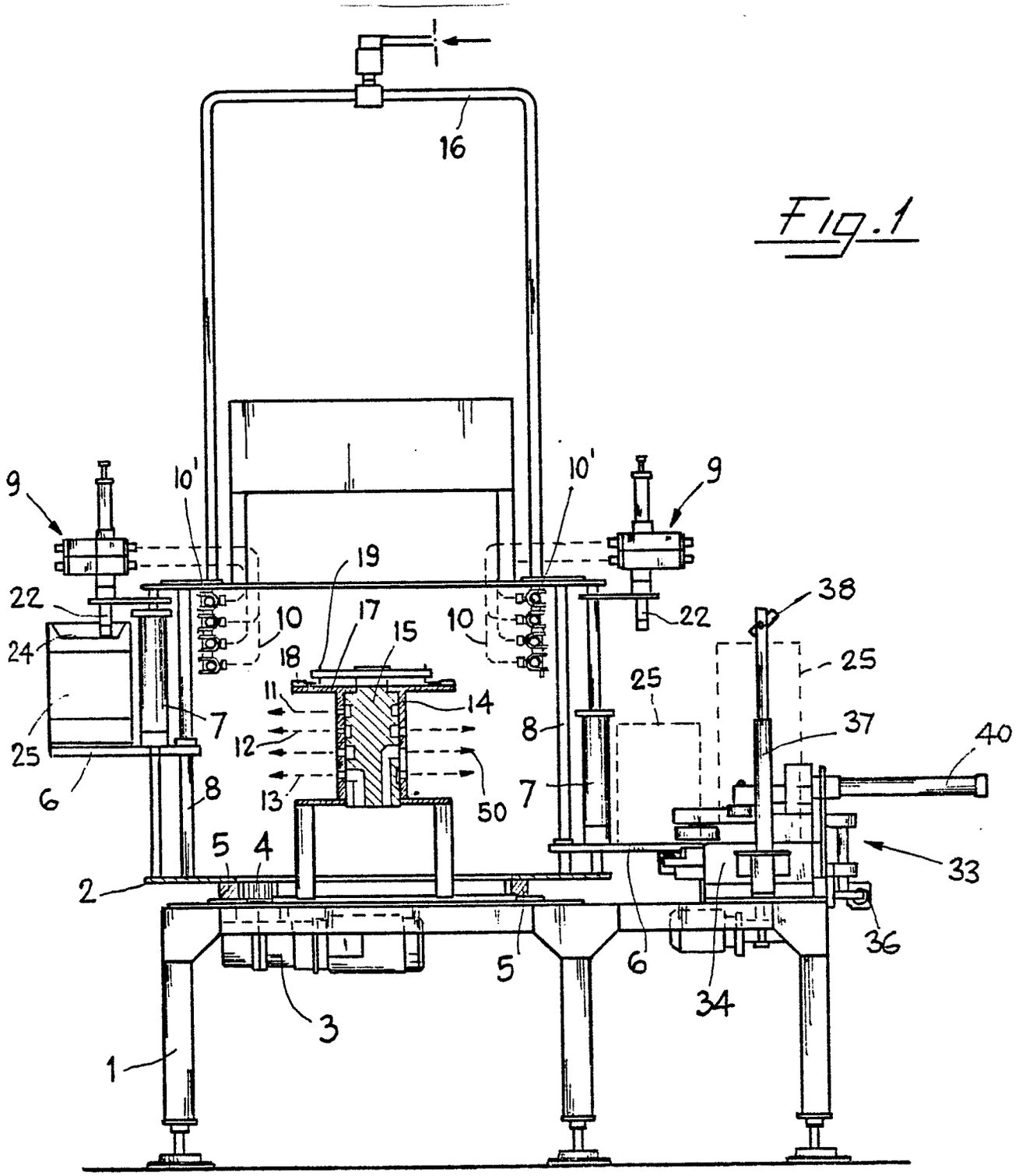
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Fig.1

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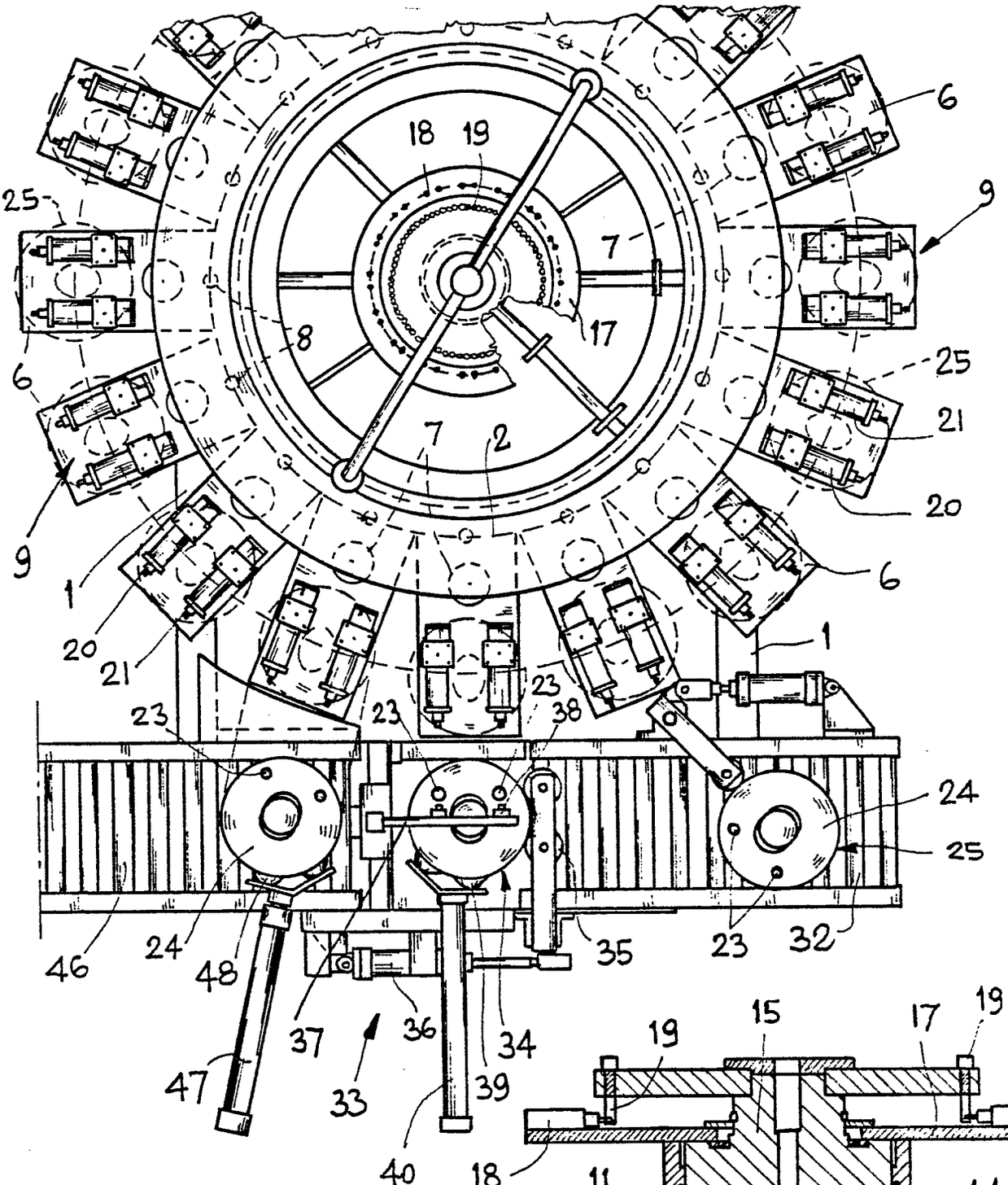

Fig. 2

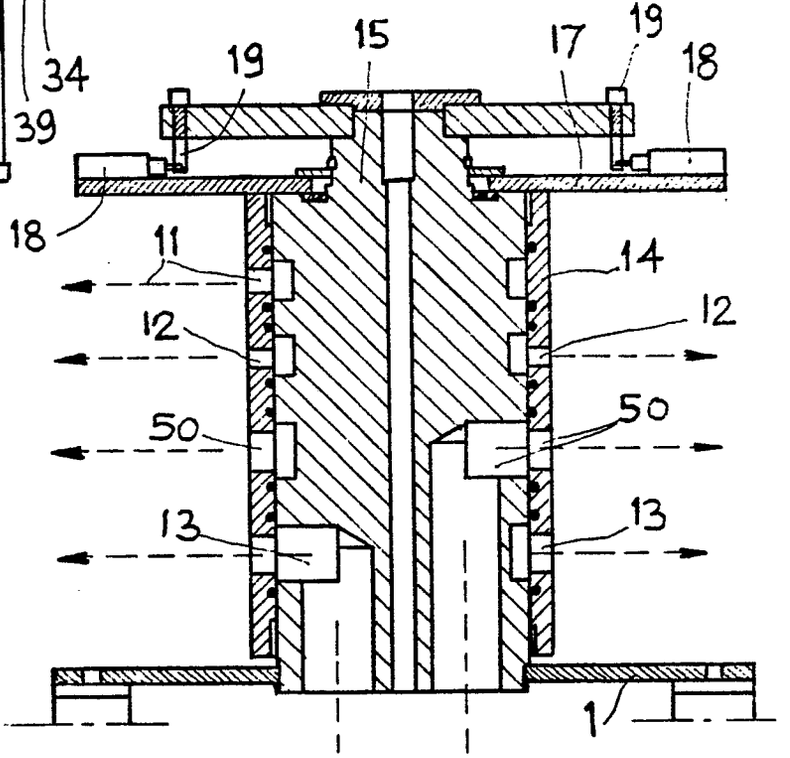

Fig. 3

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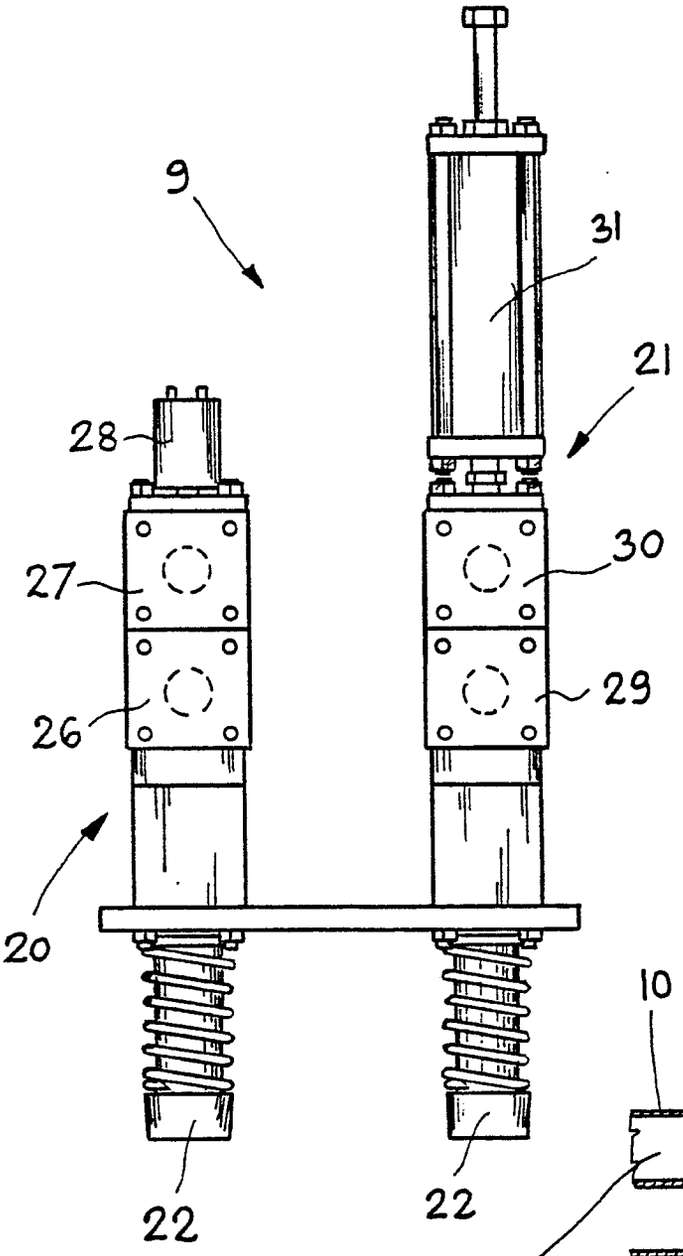
Fig.4



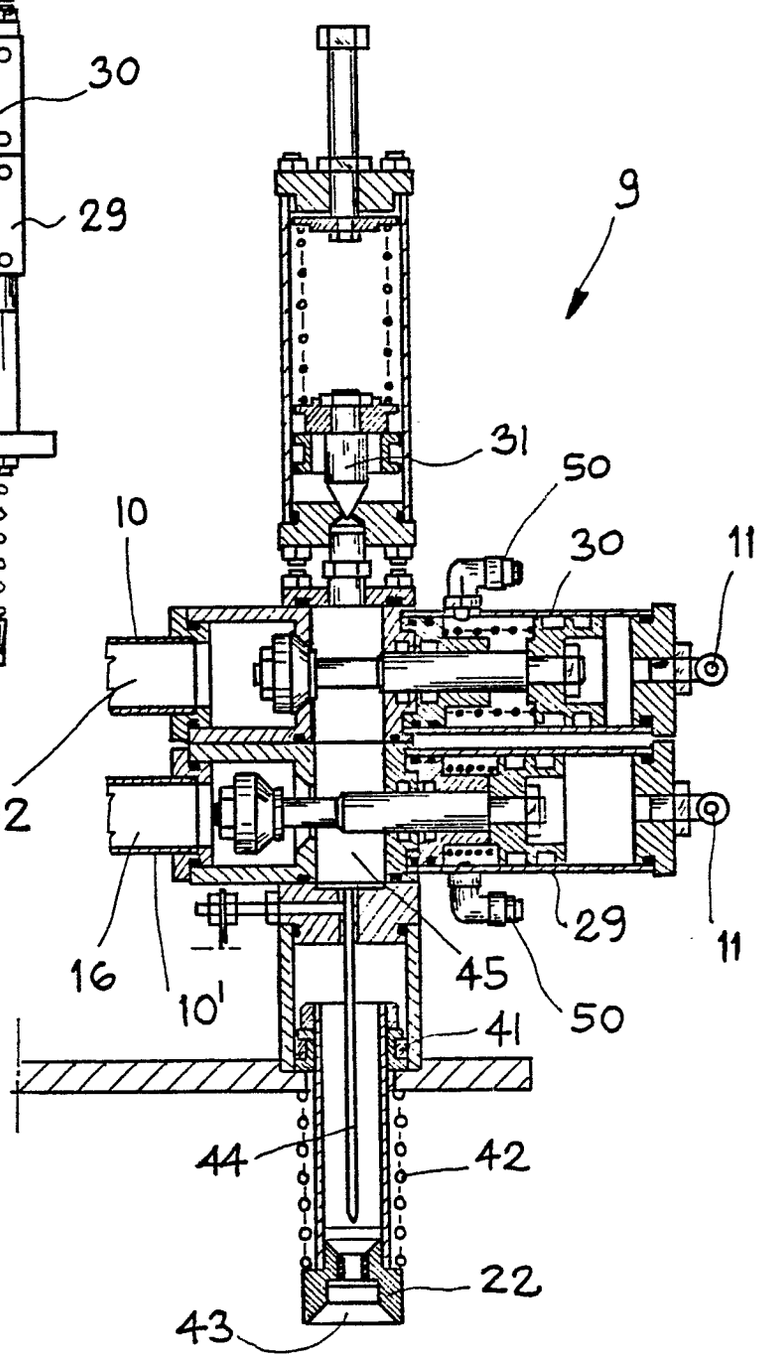


Fig.5

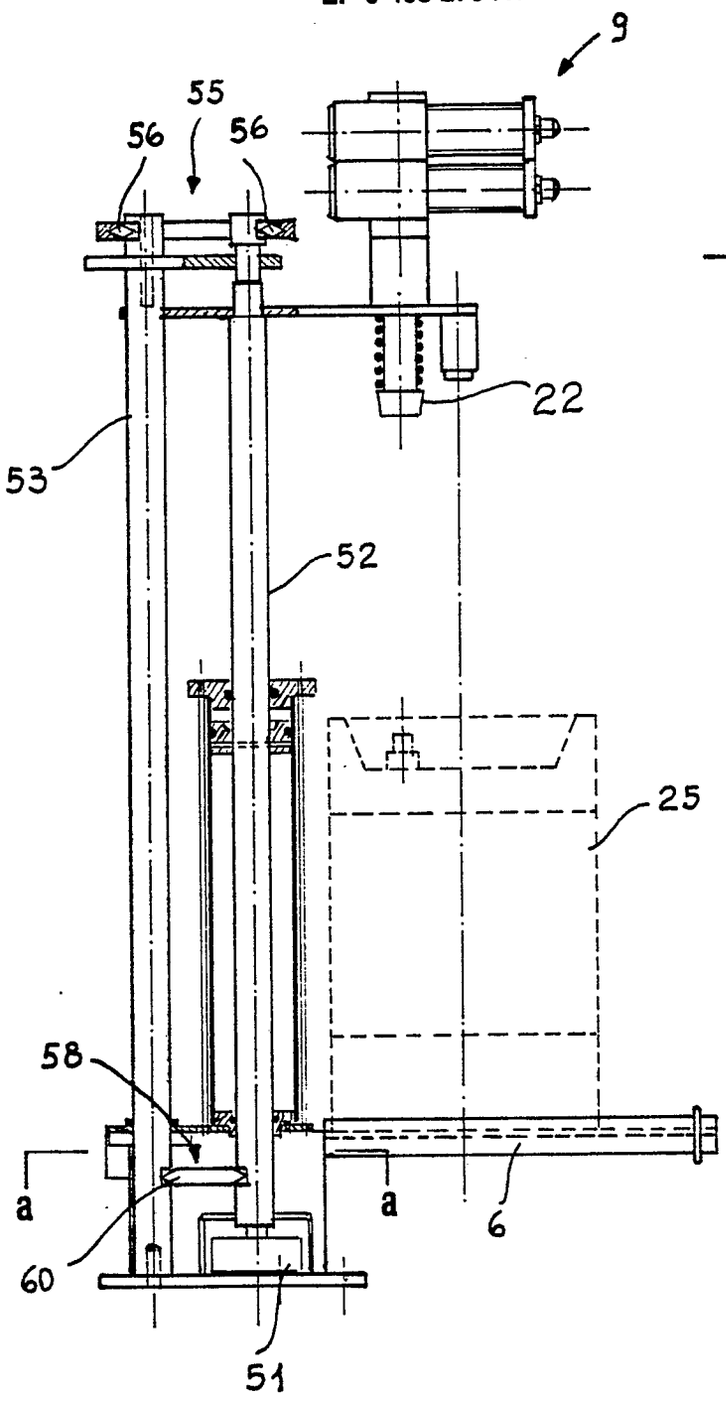


Fig. 6

Fig. 7

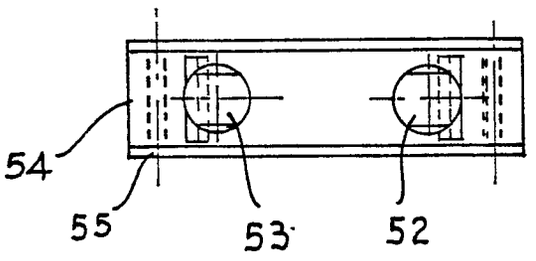
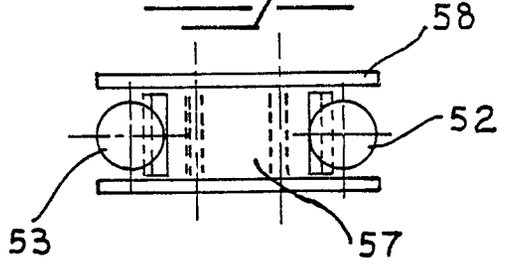


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 1444

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	DE-A-1 757 247 (DATZ) * The whole document * ---	1	B 67 C 7/00 B 08 B 9/20
A	CH-A- 101 585 (NIELSEN) * Page 2; figures 1-3 * ---	1	
A	GB-A-2 148 862 (CHAMBERLAIN) * Page 2, lines 53-90; figures 1-6 * ---	1	
A	US-A-4 275 980 (COOTS) * Column 4, line 29 - column 7, line 3; figures 1-9 * -----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 67 C
B 08 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-10-1990	VOLLERING J.P.G.

CATEGORY OF CITED DOCUMENTS

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