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(54) Tube filling machine with automatic adjustment for processing tubes of different lengths

(57) A tube filling machine with automatic adjustment for processing tubes of different sizes, comprising a frame (100) which forms a supporting surface (200) which is suitable to support a lower section for processing the stopper end of the tubes and an upper section for processing the open bottom end of the tubes (5), whose particularity is constituted by the fact that the lower section is rigidly coupled to the supporting surface and the upper section is arranged coaxially to the lower section and can move along a vertical axis with respect to the upper sections, the movement of the upper section being adjusted automatically by adjustment and control means in order to adapt the tube filling machine to treatments on tubes of different lengths.

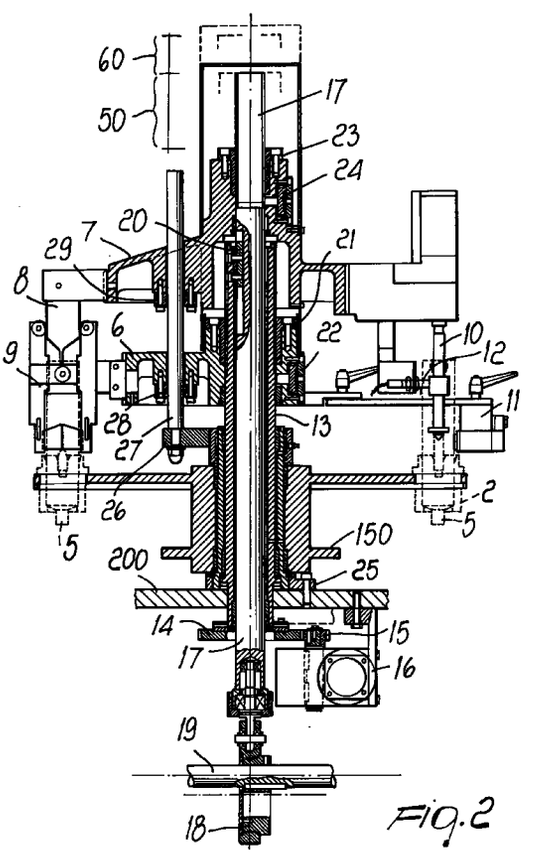

Fig.2

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Description

The present invention relates to a tube filling machine with automatic adjustment for automatically adapting the parts of the machine to the processing of tubes of different lengths.

Tube filling machines are used to fill and close cylindrical tubes made of aluminum, plastics, polyfoil, laminated materials and the like, which are used in the cosmetics and pharmaceutical industries and in similar fields.

Of course, there are tubes of different sizes in terms of both diameter and length, and conventional tube filling machines have the drawback that they require manual adjustments of their components in order to set the machine for processing different tubes when one wishes to change processing from one kind of tube to another.

These operations entail considerable downtimes for the machine and accordingly have an economic impact on the final cost of the processing of each individual tube.

Moreover, adjustment of the parts requires the presence of a skilled technician who is thoroughly familiar with the machine and has no uncertainties as to the operations to be performed.

The devices currently used to change the size of the tubes to be processed in a tube filling machine are currently mostly of three kinds.

A first device uses a fixed tube supporting plate, or "transfer". The tube closing clamps, the device for orientating the notch of the tube, the cleaning device, etcetera are installed outside the tube supporting plate or tube supporting chain and each one is manually vertically adjustable.

The drawback of this device is that in addition to requiring manual adjustment, a tube filling machine of this kind entails difficulties in cleaning the tube supporting plate, owing to the presence of external devices.

A second type of device uses a tube supporting plate (transfer) which is manually adjustable along a vertical axis. The tube closing clamps are fixed and are mounted outside the tube supporting plate. The device for orientating the notch of the tube, the cleaning device, etcetera are instead installed in a fixed position outside the tube supporting plate. In this case, too, one has the above-described drawbacks.

Finally, in a third type of device, the tube supporting plate (transfer) is manually adjustable along a vertical axis, the tube closure clamps are fixed and installed on a fixed support, centrally with respect to the tube supporting plate, and the device for orientating the notch of the tube is installed on a fixed support, centrally with respect to the tube supporting plate.

The drawbacks of this third type of device are the same as those of the previous implementations.

An aim of the present invention is to provide a tube filling machine in which it is possible to automatically adjust the parts of the machine in order to process tubes of different lengths without having to replace or manually adjust said parts.

An object of the present invention is to provide a tube filling machine which has a single adjustment for setting all the devices for processing the lower open part of the tubes.

A further object of the present invention is to provide a tube filling machine which allows to monitor the current processing at all times from outside the machine.

A further object of the present invention is to provide a tube filling machine which allows simplified cleaning of the surface of the machine, access being allowed from all sides.

A further object of the present invention is to provide a tube filling machine which has simplified maintenance with respect to conventional machines.

A further object of the present invention is to provide a tube filling machine which is highly reliable and relatively easy to produce at low costs.

This aim, these objects and others which will become apparent hereinafter are achieved by a tube filling machine with automatic adjustment for processing tubes of different sizes, which comprises a frame which forms a supporting surface which is suitable to support a lower section for processing the stopper end of the tubes and an upper section for processing the open bottom end of said tubes, characterized in that said lower section is rigidly coupled to said supporting surface and said upper section is arranged coaxially to said lower section and can move along a vertical axis with respect to said upper section, the movement of said upper section being adjusted automatically by adjustment and control means in order to adapt the tube filling machine to the processing of tubes of different lengths.

Further characteristics and advantages of the present invention will become apparent from the following detailed description of a preferred but not exclusive embodiment of the tube filling machine according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Fig. 1 is a partially cutout front elevation view of the tube filling machine according to the present invention;

Fig. 2 is a partially sectional view of the fixed part and of the moving part of the tube filling machine shown in Fig. 1;

Fig. 3 is a plan view of the tube filling machine according to the present invention.

With reference to the above figures, the tube filling machine according to the invention comprises a frame 100 which forms a supporting surface 200 for a fixed lower section, whose function is to perform all the treatments on a tube 5 at the stopper end.

The fixed section comprises a tube supporting plate

1, or transfer, which is suitable to support, in stations 2, the tubes 5 to be processed.

The tube supporting plate 1 is rotationally actuated by a conventional jogging unit or Maltese cross 150.

The tubes 5 arrive at the plate 1 from a container 3, inside which they are loaded and from which they exit to be placed vertically along the circumference of the tube supporting plate 1 at a plurality of stations 2.

A container, designated by the reference numeral 4, is filled with a liquid, creamy substance or other substance

The fixed section is rigidly coupled to the surface 200 of the tube filling machine.

An upper movable section, arranged coaxially to the fixed section, comprises a first head 6 and a second head 7. The second head 7 supports a plurality of actuation cams 8 for a matching number of clamps 9 which are suitable to close the open bottom end of a tube 5 and are supported by the first head 6.

Other devices are installed on the heads 6 and 7, such as a device 10 for orientating the notch of the tube 5 (the orientation device is installed on the head 7) and a photocell 11 (installed on the head 6), a device 12 for detecting the presence of a tube 5 on the tube supporting plate 1 (the detector 12 is installed on the head 7), a device for pushing tubes 5 onto the tube supporting plate 1 and a photocell for checking the exact positioning of the tube 5 on the tube supporting plate 1.

The heads 6 and 7 can move axially with respect to the fixed section of the tube filling machine (i.e., with respect to the tube supporting plate 1) and the head 7 can move axially with respect to the head 6.

Fig. 2 shows in detail the connection between the fixed section and the moving section of the tube filling machine.

As shown in Fig. 2, the fixed lower section and the movable upper section (which is movable with respect to the fixed section) are installed on a hollow shaft 13 which can rotate about its own axis and accommodates a moving shaft 17.

In particular, the first head 6 is fitted on the hollow shaft 13, whilst the second head 7 is fitted on the moving shaft 17.

The hollow shaft 13 is actuated by movement means which advantageously comprise a gear 14 and a sprocket 15.

The gear 14 is keyed on the hollow shaft 13, which is threaded in its upper portion, for example with a trapezoidal thread.

The gear 14 is actuated by a gearmotor 16 which is in turn control led by control means, for example of the programmable logic type, which are constituted by a PLC 16.

The PLC 16 is accommodated within a compartment designated by the reference numeral 300 in Fig. 1, which illustrates data entry and display means 301 which are suitable to set the adjustments of the moving parts of the tube filling machine according to the invention.

The moving shaft 17 is coaxial to the hollow shaft 13.

Said shaft 17 is capable of moving vertically along its own axis and is actuated by eccentric means 18 which are keyed on a driving shaft 19 of the tube filling machine.

Motion transmission means, conveniently constituted by a tab 20, transmit the rotary motion of the hollow shaft 13 to the moving shaft 17, which is also threaded at the upper end lying opposite with respect to the tube supporting plate 1. Conveniently, the thread of the moving shaft 17 is the same as the thread of the hollow shaft 13 and has the same pitch.

A ring 21, with a thread which is the same as the thread of the hollow shaft 13, is mounted on the first head 6 and allows to connect the head 6 to the hollow shaft 13. The ring 21 thus allows to adjust the position of the first head 6 along the hollow shaft 13 by screwing the ring on said shaft.

First locking means 22 are suitable to lock the first head 6 after each adjustment. Advantageously, the locking means are constituted by pneumatic means.

A second ring 23 with the same thread (and therefore with the same pitch) as the hollow shaft 13 is fitted on the second head 7, and its position can be adjusted along the moving shaft 17 by screwing. Second locking means 24, similar to the first locking means 22, are suitable to lock the second head 7 in position after adjustment.

The first and second heads 6 and 7 are adjusted manually by a handwheel and mechanical devices, or electrically by an electric motor which is assisted or not by a PLC or with a pneumatic device which is controlled or not by a PLC.

The hollow shaft 13 passes inside hollow supporting means 25 fitted on the surface 200 of the tube filling machine; said means are suitable to support rotation-preventing means 26, on which a rod guide member 27 is mounted which is suitable to connect the first head 6 and the second head 7 to each other.

The rod guide member 27 is inserted in guiding bearings 28 and 29 which are accommodated in the first and second heads 6 and 7 respectively.

With reference to the above figures, the operation of the tube filling machine according to the invention is as follows.

The positions of the first and second heads 6 and 7 are adjusted by acting on the threaded rings 21 and 23 respectively. These adjustments are performed either electrically or pneumatically, with or without the control of a PLC.

First of all, the position of the rings 21 and 23 is set according to the adjustment designated by the reference numeral 50 in figure 2, which corresponds to the maximum possible stroke of the rings on the hollow shaft 13.

The automatic adjustment of the rings 21 and 23

allows to process tubes of different lengths on the tube filling machine.

The locking means 22 and 24 allow to stably lock the set adjustment of the rings 21 and 23.

The tubes 5 arranged in the container 3 then descend, one at a time, from the container 3 towards the tube supporting plate 1, where they are accommodated in the stations 2.

The driving shaft 19 of the tube filling machine rotates under the actuation of a motor (not shown), and its rotation causes the eccentric element 18 keyed thereon to perform a cycle; this entails an ascending and descending motion of the second head 7 with respect to the first head 6 along the vertical axis of the hollow shaft 13. The tube supporting plate 1 instead remains fixed and so does the head 6.

The ascending and descending motion of the second head 7 with respect to the first head 6 is designated by the reference numeral 60.

The second head 7 supports a plurality of cams 8 for actuating a plurality of clamps 9 for closing the tubes 5. The clamps close the bottom end of the tubes 5.

The setting of the chosen rotation rate at the gearmotor 16 through the adjustment and control means (for example a PLC) allows to move the heads 6 and 7 monolithically by turning the hollow shaft 13 and the moving shaft 17 on which the heads 6 and 7 are respectively fitted.

The heads 6 and 7 can in fact move simultaneously, since they are interconnected by the rod guide member 27, which can slide freely in the guiding bearings 28 and 29 accommodated respectively in the heads 6 and 7.

The presence of the rotation-preventing element 26 causes the movement of the head 6 and of the head 7 to occur exclusively along the vertical axis of the hollow shaft 13.

The rotation of the hollow shaft 13 is transmitted to the moving shaft 17 by means of the tab 20.

The heads 6 and 7 therefore move upwards and downwards and are retained by the rotation-preventing means 26. The head 7 then moves vertically up and down with respect to the head 6.

In practice it has been observed that the tube filling machine according to the invention fully achieves the intended aim, since it allows to move the upper moving section of the machine with respect to the fixed lower section by means of a central control with a single automatic simultaneous adjustment of all the tube processing devices.

The tube filling machine thus conceived is susceptible of numerous modifications and variations, within the scope of the claims; all the details may also be replaced with other technically equivalent elements.

In practice, the materials used, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

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 tube filling machine with automatic adjustment for processing tubes of different sizes, comprising a frame (100) which forms a supporting surface (200) which is suitable to support a lower section for processing the stopper end of the tubes (5) and an upper section (6,7) for processing the open bottom end of said tubes, characterized in that said lower section is rigidly coupled to said supporting surface (200) and said upper section is arranged coaxially to said lower section and can move along a vertical axis with respect to said upper section, the movement of said upper section being adjusted automatically by adjustment and control means in order to adapt the tube filling machine to treatments performed on tubes of different lengths.

2. A tube filling machine according to claim 1, characterized in that said lower section comprises a tube supporting plate (1) which can rotate about its own axis and is fixed with respect to the upper section, said tube supporting plate being provided with a plurality of tube accommodating stations (2) arranged along its circumference.

3. A tube filling machine according to claim 2, characterized in that said upper section comprises a first (6) and a second (7) heads which are coaxial to said tube supporting plate (1) and can move along the same axis as said plate.

4. A tube filling machine according to claim 3, characterized in that said second head (7) can move with respect to said first head (6), said second head supporting a plurality of actuation cams (8) for a matching number of clamps (9) for closing the bottom end of the tubes, said clamps being arranged on said first head.

5. A tube filling machine according to claim 3, characterized in that said tube supporting plate (1) is fitted on a hollow shaft (13) which can rotate about its own axis and internally accommodates a movable shaft (17), said movable shaft being suitable to perform a translatory motion within said hollow shaft, along its axis, said first head being fitted on said hollow shaft, said second head being fitted on said moving shaft.

6. A tube filling machine according to claim 5, charac-

terized in that it comprises motor means which are suitable to drive actuation means (14,15) for moving said upper section.

7. A tube filling machine according to claim 6, characterized in that said motor means comprise a gearmotor which is driven by said adjustment and control means.

8. A tube filling machine according to one or more of the preceding claims, characterized in that said actuation means comprise a gear (14) and a sprocket (15), said gear being keyed to said hollow shaft (13), said hollow shaft being threaded at the upper end portion.

9. A tube filling machine according to one or more of the preceding claims, characterized in that said gearmotor actuates said gear (14) in order to rotate said hollow shaft (13).

10. A tube filling machine according to one or more of the preceding claims, characterized in that it comprises motion transmission means (20) which are suitable to transmit the rotary motion of said hollow shaft to said moving shaft for the movement of said second head with respect to said first head.

11. A tube filling machine according to one or more of the preceding claims, characterized in that said moving shaft (17) is actuated by eccentric means (18) which are keyed on a driving shaft (19) of said tube filling machine, each rotation of said driving shaft causing said eccentric means (18) to perform one cycle and consequently causing said second head to perform a vertical translatory motion with respect to said first head.

12. A tube filling machine according to one or more of the preceding claims, characterized in that said moving shaft (17) has, at its upper end, a thread which is similar to that of said hollow shaft (13).

13. A tube filling machine according to one or more of the preceding claims, characterized in that said motion transmission means comprise a tab (20) which is suitable to connect said moving shaft (17) to said hollow shaft (13).

14. A tube filling machine according to one or more of the preceding claims, characterized in that it comprises a first threaded ring (21) fitted on said first head (6) and a second threaded ring (23) fitted on said second head, said first and second rings being screwable respectively on said hollow shaft (13) and on said moving shaft (17) in order to adjust the position of said first and second heads on said hollow shaft and on said moving shaft, the threads of said rings being identical to the threads of said hollow shaft and of said moving shaft.

15. A tube filling machine according to one or more of the preceding claims, characterized in that it comprises first (22) and second (24) locking means which are suitable to respectively lock in position said first (6) and second (7) heads when the adjustment of said heads has been performed by means of said first (21) and second (23) rings.

16. A tube filling machine according to one or more of the preceding claims, characterized in that it comprises a hollow support (25) fitted on the plate of said machine, said support supporting rotation-preventing means (26) suitable to prevent the mutual rotation of said heads.

17. A tube filling machine according to one or more of the preceding claims, characterized in that said rotation-preventing means have a rod-shaped guiding element (28,29) which is installed thereon and is suitable to connect said first and second heads to each other.

18. A tube filling machine according to claim 17 characterized in that said rod-shaped guiding element is inserted in bearings which are accomodated within said first and second heads.

19. A tube filling machine according to one or more of the preceding claims, characterized in that it comprises a device (12) for orientating the notch of the tube and a respective photocell (11), a device for detecting the presence of the tube on said tube supporting plate, a tube pusher suitable to push the tubes onto the tube supporting plate, and a photocell for checking the exact positioning of the tube on the tube supporting plate, all said devices being installed on one head or the other.

20. A tube filling machine according to one or more of the preceding claims, characterized in that the position of said upper section can be adjusted manually by means of a handwheel and of mechanical devices.

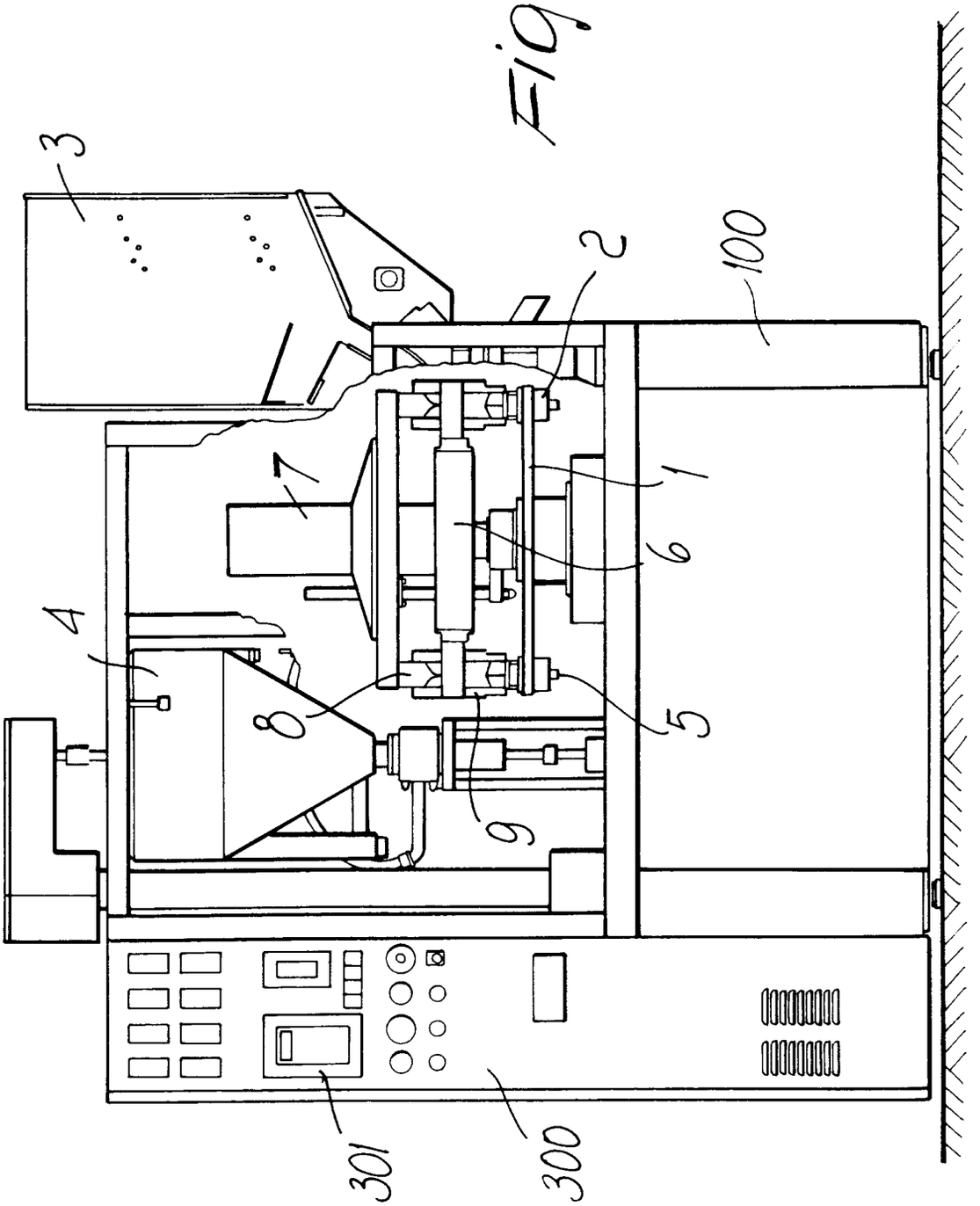
21. A tube filling machine according to one or more of the preceding claims, characterized in that said upper section can be adjusted electrically.

22. A tube filling machine according to one or more of the preceding claims, characterized in that said upper section can be adjusted pneumatically.

23. A tube filling machine according to one or more of the preceding claims, characterized in that said adjustment and control means comprise a pro-

grammable logic controller.

Fig. 1



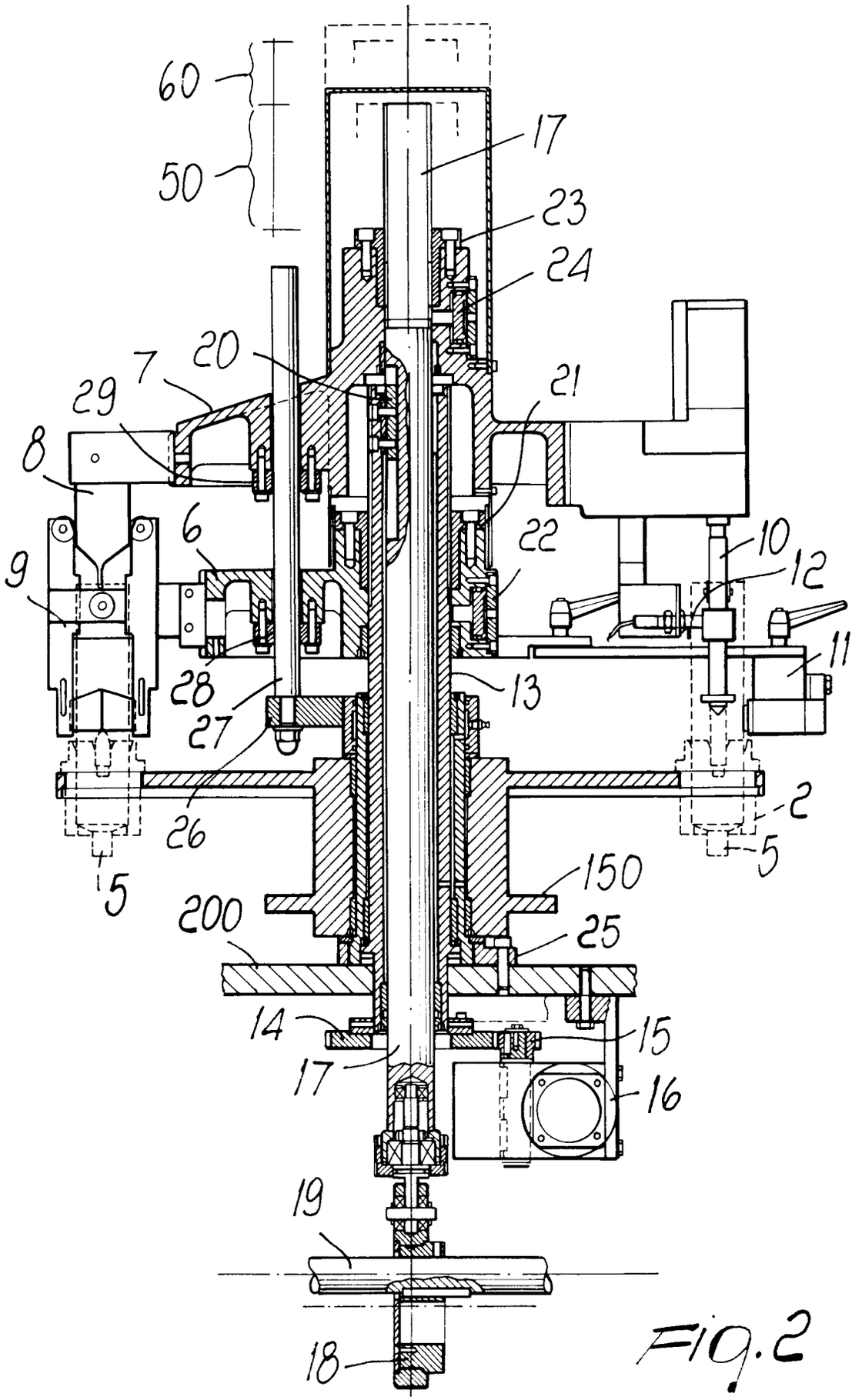

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Fig. 2

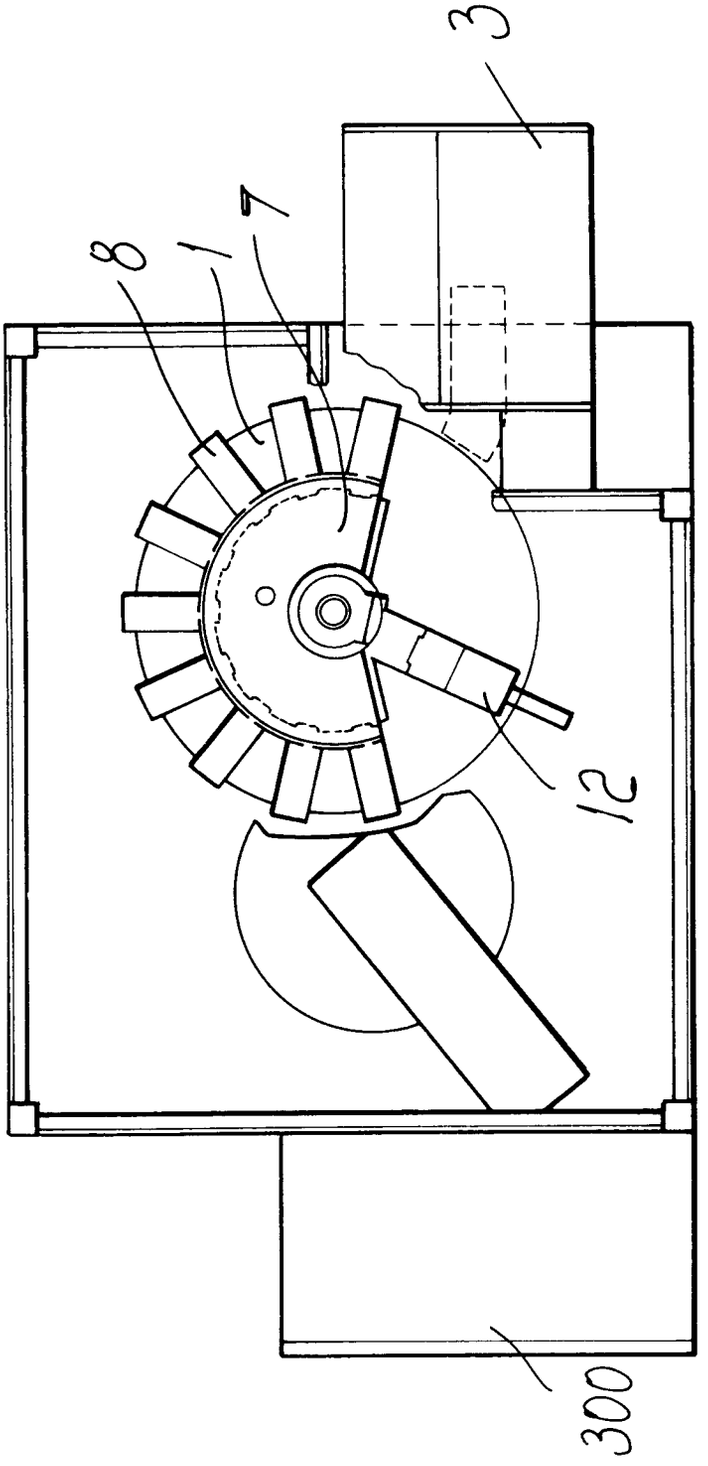

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 11 8344

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.6)
A	EP 0 479 010 A (HÖRAUF) * abstract * * column 5, paragraph 2 * * column 6, line 3; figure 1 *	1,2	B65B59/00
A	DE 25 45 760 A (KEPPLER) * the whole document *	1	
A	DE 29 31 571 A (SINDERMANN) * the whole document *	1	
A	US 5 195 565 A (ELOPAK)		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 February 1998	Claeys, H

CATEGORY OF CITED DOCUMENTS

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