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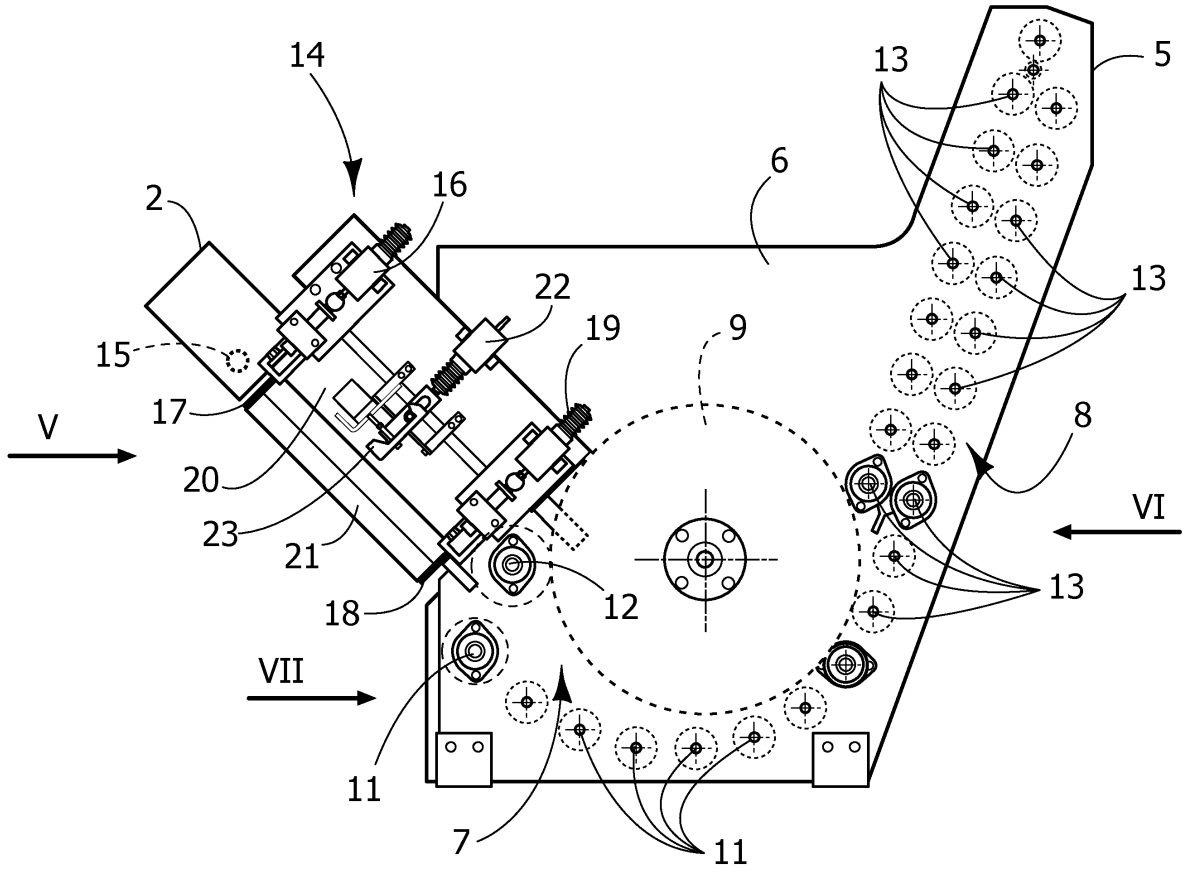
(54) **Machine for compacting collapsable containers, particulary bottles made of plastic material and the like**

(57) A machine (1) for compacting collapsable containers by means of a plurality of opposed counter-rotating rollers (7, 8) arranged in succession in contact with the container whilst this translates along a continuous path of advance between an inlet (2) and an outlet (5).

FIG. 3



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Description

Background of the invention

[0001] The present invention relates in general to collection and compacting of empty collapsable containers, particularly bottles made of plastic material (polyethylene), aluminium tins, flasks and the like, in order to reduce their volume with a view to disposal and possible recycling thereof.

[0002] More in particular, the invention relates to a machine for compacting containers of the sort described above using compacting means acting during translation of the container along a path of advance between an inlet and an outlet of the machine.

State of the prior art

[0003] A machine of the above type is known for example from the U.S. patent No. US-5,522,311, in which the compacting means are constituted by a pair of flexible endless belts convergent with respect to one another and provided with projections for gripping and perforating the containers each time introduced between them so as to grip and press them progressively.

[0004] Even though said belts are suitable for squeezing the container effectively, they are not able to guarantee a permanent deformation of the collapsed container, i.e., a deformation without a partial elastic return towards the undeformed condition, in the case where the container is made of a plastic material such as, for example, in the case of bottles for beverages.

Summary of the invention

[0005] The object of the present invention is to overcome the aforesaid drawback, and to provide a machine for compacting collapsable containers suitable for guaranteeing a complete permanent squeezing not only in the case of tins and similar metal containers, but also and in particular in the case of bottles, flasks, and the like, made of plastic material.

[0006] According to the invention, the above object is achieved principally thanks to the fact that the aforesaid compacting means of the machine include a plurality of opposed counter-rotating rollers, arranged in succession in contact with the container along said path of advance.

[0007] In particular, the aforesaid plurality of rollers includes a first set of rollers situated in the proximity of the inlet of the machine and defining a section for progressive squeezing of the container from an undeformed condition to a collapsed condition, and a second set of rollers set between said first set and the outlet of the machine and defining a section for maintenance of said collapsed condition of the container.

[0008] According to a preferred embodiment of the invention, the first set of rollers includes a cylinder of greater diameter and a series of rollers of smaller diameter facing the periphery of the cylinder and arranged at progressively decreasing distances therefrom. An eccentric conveying roller is advantageously provided in a position adjacent to the cylinder, between the latter and the inlet, with the purpose of conveying, i.e., guiding dynamically, the container against the surface of the cylinder.

[0009] According to a further characteristic of the invention, the inlet of the machine includes a mouth for introduction of the container associated to which are detector means for its identification and first means for temporary arrest of the container in a position corresponding to the detector means. Provided downstream of the first temporary-arrest means are second means for temporary arrest of the container in an area corresponding to a selection unit, which advantageously includes at least one mobile hatch for discharge of the container outside the machine, which is controlled by the aforesaid detector means. In addition, said mobile hatch is also advantageously controlled by a device for weighing the container.

Brief description of the drawings

[0010] Further characteristics and advantages of the invention will emerge clearly from the ensuing description with reference to the annexed drawings, which are provided purely by way of non-limiting example and in which:

Figure 1 is a rear perspective view of a compacting machine according to the invention;
Figure 2 is a front perspective view of the machine;
Figure 3 is a view in side elevation and at an enlarged scale that shows schematically and in a simplified form the operating assemblies of the machine;
Figure 4 is a top plan view of Figure 3;
Figure 5 is a view in elevation according to the arrow V of Figure 3;
Figure 6 is a partial perspective view according to the arrow VI of Figure 3; and
Figure 7 is a perspective view and at an enlarged scale of the detail indicated by the arrow VII in Figure 3.

Detailed description of the invention

[0011] With initial reference to Figures 1 and 2, the machine for compacting collapsable containers according to the invention includes a cabinet 1, contained within which are the functional components described in what follows and which has on its front side an inlet mouth 2, typically of a circular shape, for the introduction of the container that each time is to be compacted. The inlet mouth 2, which, for example, has a length of 380 mm and a diameter of 120 mm, is set at a height from the ground of approximately 1.40 m and is inclined downwards by approximately 45°. A "chip card" reader 3 for activation of the machine is set adjacent to the inlet mouth 2, and above it a display 4 of a conventional type may be provided, for example, pre-arranged for indicating the

instructions for introduction of the containers to be compacted, or else advertising or promotional messages.

[0012] On the side opposite to the inlet mouth 2, the dorsal side of the cabinet 1 has an opening 5 for outlet of the containers each time compacted.

[0013] The outlet opening 5, which is located in the vicinity of the top of the cabinet 1 and from which the containers that have each time been collapsed in a flattened configuration come out, can be connected to a device for supply of a hydraulic press, designed to reduce into compact blocks groups of containers which have been collapsed in succession.

[0014] With reference now in greater detail to Figures 3 to 5, according to the peculiar aspect of the invention, compacting of the containers is provided by the machine during their translation along a continuous path of advance between the inlet 2 and the outlet 5, via a plurality of counter-rotating and opposed motor-driven rollers, against which the container each time introduced into the machine sets itself in contact along its path of advance.

[0015] In detail, the machine includes a first set of rollers 7 situated in the proximity of the inlet mouth 2 and in a position underlying it, which defines a section for progressive squeezing of each container from an undeformed condition to a collapsed condition, and a second set of rollers 8 set between the first set of rollers 7 and the outlet 5 and defining a section for maintenance of the collapsed condition of the container.

[0016] The two sets of rollers 7 and 8 are supported in rotation around respective horizontal axes by two sturdy side plates 6 adjacent to the sides of the machine 1 and are driven in rotation via a single electric motor 29 (for example, with a power of 1.5 kW with 4 poles) and respective transmissions, in part with gears and in part with chains.

[0017] The first set of rollers 7 includes a cylinder of large diameter 9, from the periphery of which there project series of radial tips 10 (Figure 7), and a series of rollers of smaller diameter facing the periphery of the cylinder 9, in a bottom area of the latter and at distances progressively decreasing in the direction of the second set of rollers 8. Only some of the rollers of the first set 7 are represented in the drawings and designated by 11 in Figures 4 and 7: in Figure 3, for simplicity of illustration, only the traces of the corresponding axes thereof are illustrated, which are also designated by the reference 11.

[0018] The arrangement of the above rollers 11 is hence such that the space between said rollers and the cylinder 9 reduces progressively along the path of advance towards the second set of rollers 8 of the container each time introduced into the machine.

[0019] The first set of rollers 7 moreover includes an eccentric roller 12, visible in Figures 4 and 7, set above the first roller 11 in a position adjacent to the cylinder 9 and having the function of conveying the container each time arriving from the inlet mouth 2 between the cylinder 9 and the rollers 11. Also the eccentric roller 12 is driven in rotation by the same electric motor 29.

[0020] With reference to Figure 3, the cylinder 9 is driven in rotation in a counterclockwise direction, whilst the rollers 11 and the eccentric roller 12 rotate in a clockwise direction.

[0021] The rollers 11 can be smooth or else more conveniently be provided at least in part with radial projections shaped like tips, similar to the tips 10 of the cylinder 9, or else with radially projecting axial ribs.

[0022] The second set of rollers 8 includes a plurality of pairs of counter-rotating rollers 13, illustrated in Figure 6 and in Figures 4 and 5, whilst Figure 3 shows only the traces of the corresponding axes thereof, which are also designated by the reference number 13. The rollers 13 of each pair, which are all of a relatively small diameter, are arranged substantially at the same distance from one another and are driven in rotation via chains 14 (Figure 6). At least some of said rollers 11 are conveniently provided with radial projections in the form of tips similar to those of the cylinder 9, and in this case the opposed rollers may present circumferential grooves, or else may present axial ribs projecting radially.

[0023] Set between the inlet mouth 2 and the eccentric roller 12 of the first set of rollers 7 is an identification and selection assembly, designated as a whole by 14. For identification of the container each time introduced into the inlet mouth 2 a plurality of detector devices 15 is provided, typically bar-code readers, for example, arranged on the five sides of a pentagonal body mounted within the mouth 2, with the median reading axis set at approximately 130 mm from the plane of introduction of the containers. The detectors 15 are operatively connected to an actuator 16, either of an electric or hydraulic type, which controls opening and closing of a first mobile arrest gate 17. Downstream of the first mobile arrest gate 17 a second mobile arrest gate 18 is provided, opening/closing of which are controlled via a second actuator 19, which is also of the electric or hydraulic type. The gates 16 and 19 intercept the container each time introduced into the inlet mouth 2 through a duct 20, having a length in the region of 400 mm and inclined downwards in the direction of the first set of rollers 7. The bottom of the duct 20 is mobile and is, for example, constituted by a pair of mobile gates 21, represented in Figure 7 with a solid line in the closed condition and with a dashed line in the open condition.

[0024] The gates 21 of the mobile bottom of the duct 20 are normally kept in the closed position, and opening thereof is advantageously controlled using two different systems. A first system envisages a positive control performed by a third actuator 22, which is also of the electric or hydraulic type, controlled via the bar-code readers 15. The second system uses a counterweight, designated by 23 in Figure 7, which performs in practice the function of a weighing device. If the weight of the container positioned between the two mobile gates 17 and 18 is greater than the closing force exerted by the counterweight 23, the mobile hatches 21 is open.

[0025] The assembly 14 is then pre-arranged for se-

lecting the containers according to the characteristics of the corresponding bar codes conventionally applied on them, as well as on the basis of their weight in order to prevent containers that are full or in any case not completely empty from being subjected to compacting.

[0026] With the arrangement described above, it emerges clearly that the path of the container to be compacted each time fed into the machine 1 is made up of three successive sections: a first section, comprised between the inlet mouth 2 and the eccentric roller 12, in which the container translates by gravity, a second section corresponding to the first set of rollers 7, in which the container is made to advance whilst it collapses progressively between the cylinder 9 and the rollers 11; and a third section, in which the collapsed container is transferred upwards in direction of the outlet 5 whilst it is kept in the collapsed condition between the rollers 13.

[0027] Operation of the machine is described in what follows.

[0028] The container is introduced manually into the inlet mouth 2, and its recognition is performed via reading of the corresponding bar code by the readers 15. If the chip card has been correctly inserted by the user into the reader 3 and recognized, and if the bar code of the container has been detected properly, the actuator 16 causes opening of the first mobile hatch 17, enabling the container to proceed by gravity within the duct 20 until it rests against the second mobile hatch 18. Here it is decided whether the container introduced will have to proceed its path towards the squeezing rollers, or else whether it will instead have to be rejected. Rejection, performed by opening of the hatches 21 of the openable bottom of the duct 20, as has been said, can be performed by the actuator 22 in the case where the bar-code readers 15 have not identified the container as suitable, or else by the weighing system constituted by the counterweight 23 in the case where the weight of the container is higher than the weight set.

[0029] It should be noted that at least one of the mobile hatches 17 and 18 will in any case be closed before, during, and after introduction of the container so as to ensure the necessary safety against the possibility of the user inserting his hand beyond the selection assembly 14.

[0030] The containers that are not suitable are hence discharged from the machine, whilst the ones that are suitable proceed their advance through the first and second sets of rollers 7, 8 up to the outlet 5. As already explained, the eccentric roller 12 performs proper introduction of the container between the cylinder 9 and the rollers 11 of the first set of rollers 7, and the squeezing performed by the latter rollers occurs progressively so as to prevent any risk of jamming. The tips 10 of the cylinder 9, as well as the possible ones of the rollers 11, in addition to favouring advance of the container, enable holes to be made in it for outlet of the air contained therein, typically in the case of bottles made of plastic material, the top of which has not been previously removed.

[0031] At the end, the extraction of the chip card from the reader 3 causes arrest of the electric motor 29 and hence of operation of the machine 1.

[0032] The machine is typically controlled by an electronic card interfaced with the chip-card reader 3 as well as the bar-code readers 15, with the motor 29 and with the actuators 16, 19 and 22. The electronic card may moreover be interfaced with the display 4, as well as with a possible audio system and with a GSM modem, in order to supply to a remote control station data useful for statistical processing, etc.

[0033] Of course, the details of construction and the embodiments may vary widely with respect to what is described and illustrated herein, without thereby departing from the scope of the present invention, as defined by the ensuing claims.

Claims

1. A machine for compacting collapsable containers, particularly bottles made of plastic material and the like, using compacting means (7, 8) acting during translation of the container along a continuous path of advance between an inlet (2) and an outlet (5) of the machine (1), said machine being **characterized in that** said compacting means (7, 8) include a plurality of opposed counter-rotating rollers arranged in succession in contact with the container in said path of advance.

2. The machine according to Claim 1, **characterized in that** said plurality of rollers includes a first set of rollers (7) situated in the proximity of said inlet (2) and defining a section of progressive squeezing of the container from an undeformed condition to a collapsed condition, and a second set of rollers (8) set between said first set of rollers (7) and said outlet (5) and defining a section of maintenance of said collapsed condition of the container.

3. The machine according to Claim 2, **characterized in that** the first set of rollers (7) includes a cylinder of larger diameter (9) and a series of rollers of smaller diameter (11) facing the periphery of said cylinder (9) at progressively decreasing distances from the latter to said second set of rollers (8).

4. The machine according to Claim 3, **characterized in that** said first set of rollers (7) moreover includes an eccentric conveying roller (12) adjacent to said cylinder (10) and set between the latter and said inlet (5).

5. The machine according to Claim 3 or Claim 4, **characterized in that** said rollers of smaller diameter (11) are arranged in the bottom part of said cylinder (9).

6. The machine according to any one of Claims 3 to 5, **characterized in that** said cylinder (9) is provided with tips (10) projecting from its surface.

7. The machine according to one or more of Claims 3 to 6, **characterized in that** said rollers of smaller diameter (11) are provided at least in part with radial projections.

8. The machine according to Claim 2, **characterized in that** the second set of rollers (8) includes a plurality of pairs of contiguous rollers (13) substantially of equal diameter.

9. The machine according to Claim 8, **characterized in that** said pairs of rollers (13) are provided at least in part with radial projections.

10. The machine according to Claim 2, **characterized in that** said first and second sets of rollers (7, 8) are driven by a single motor (29).

11. The machine according to any one of Claims 1 to 3, **characterized in that** said inlet (2) communicates with a duct (20) for introduction of the container, operatively associated to which are means for temporary arrest (12, 18) of said container.

12. The machine according to Claim 10, **characterized in that** said duct (20) is provided with detector means (15) for identification of the container and with a first temporary arrest (12) for the container in a position corresponding to said detector means (15).

13. The machine according to Claim 11, **characterized in that** said detector means include a plurality of barcode readers (15).

14. The machine according to any one of Claims 11 to 13, **characterized in that** said duct (20) moreover includes, downstream of said first temporary arrest (12), a second temporary arrest (18) of the container in a position corresponding to a selection unit (14).

15. The machine according to Claim 14, **characterized in that** said selection unit (14) includes a duct (20) having an openable bottom including at least one normally closed mobile hatch (21), opening of which can be controlled via said detector means (15).

16. The machine according to Claim 15, **characterized in that** said mobile hatch (21) can moreover be controlled by a device for weighing the container.

17. The machine according to Claim 16, **characterized in that** said device for weighing the container uses a counterweight (23).

18. The machine according to one or more of the preceding claims, **characterized in that** said inlet (2) defines a path for feed by gravity of the container towards said plurality of rollers (7, 8).

19. The machine according to one or more of the preceding claims, **characterized in that** said outlet (5) is situated at the end of an upward path of the containers.

20. The machine according to one or more of the preceding claims, **characterized in that** operatively associated to said outlet (5) is a press for reducing the containers that have been collapsed one after another into blocks.

21. The machine according to one or more of the preceding claims, **characterized in that** it is equipped with an electronic control unit, which is also pre-arranged for remote data transmission.

FIG. 2

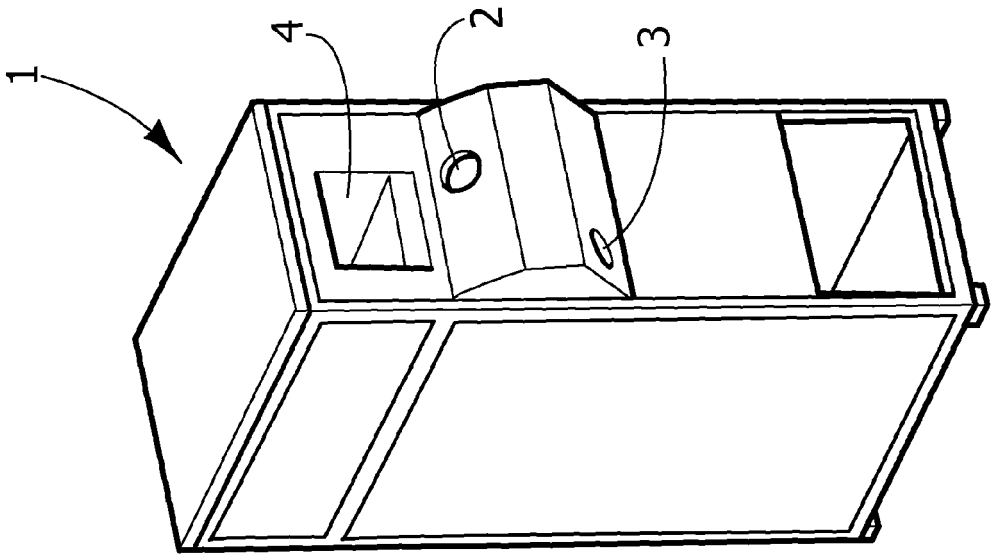


FIG. 1

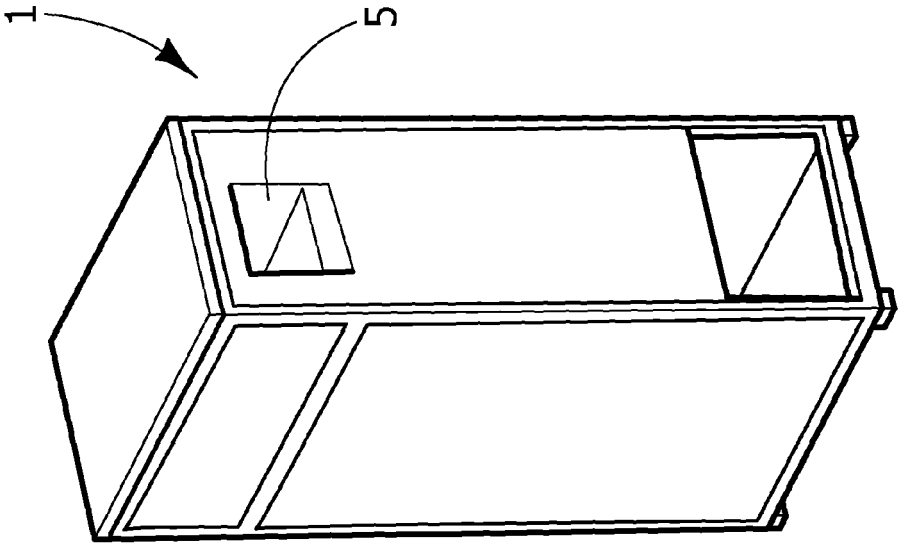


FIG. 3

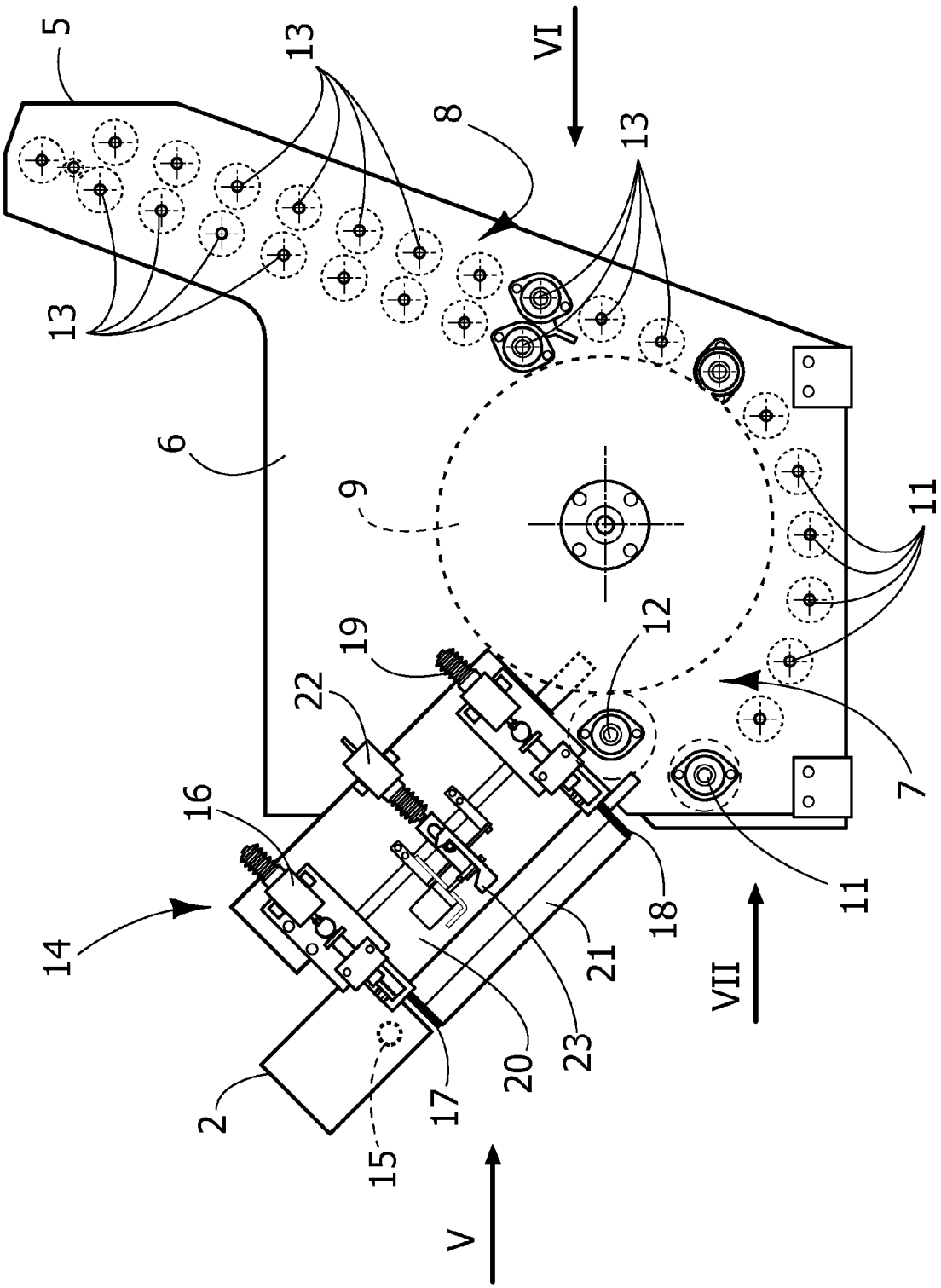


FIG. 4

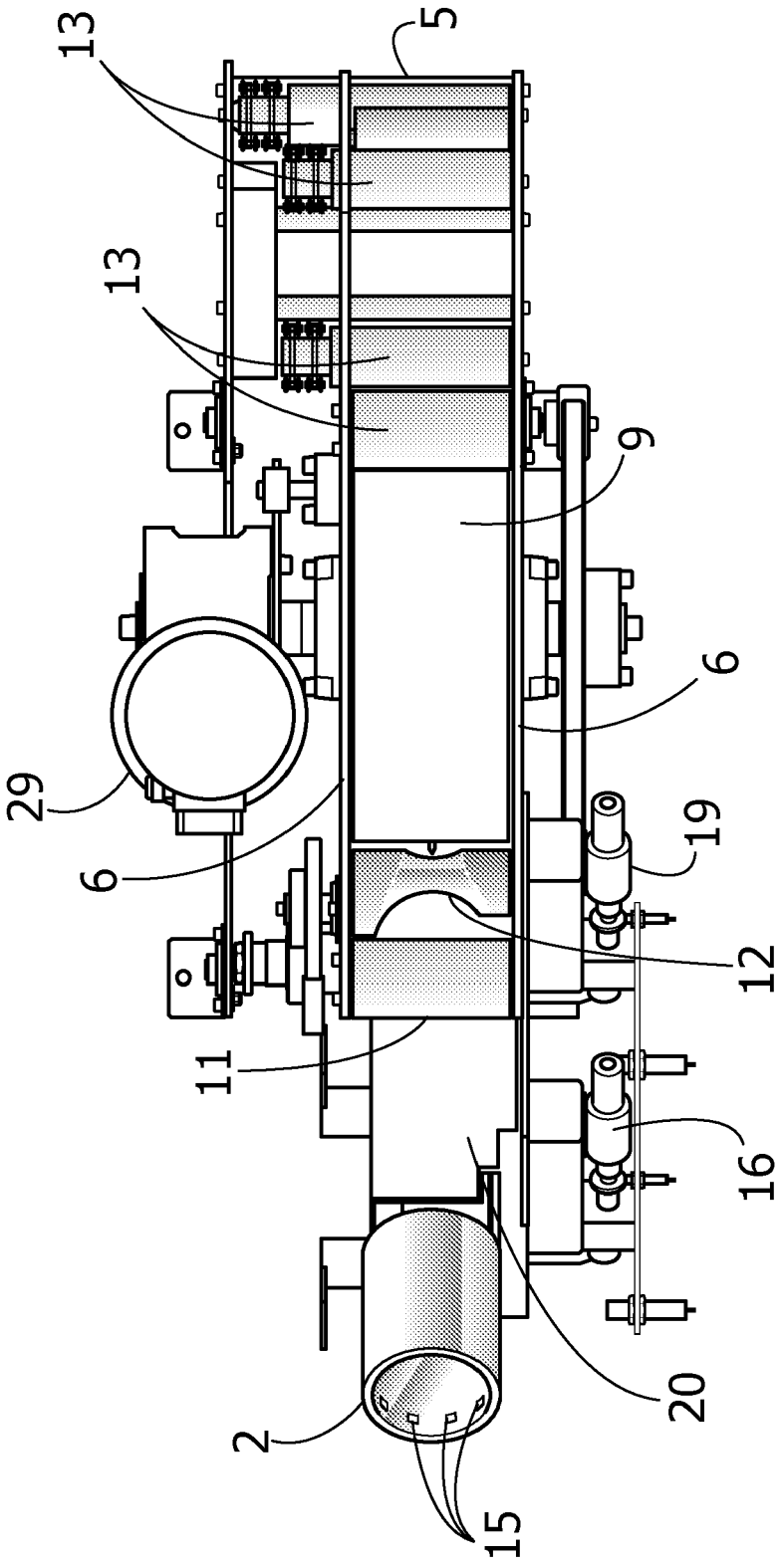


FIG. 5

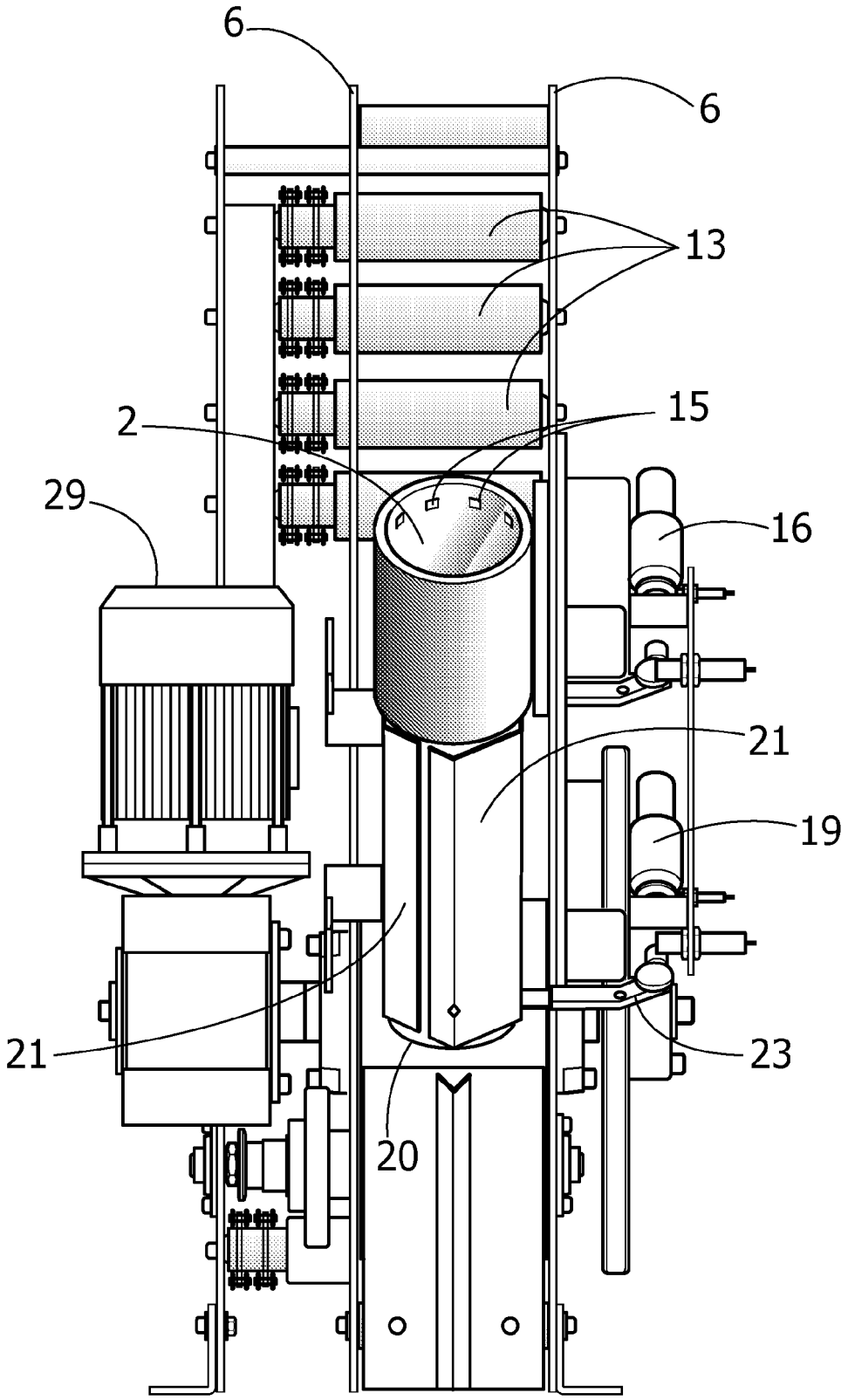


FIG. 6

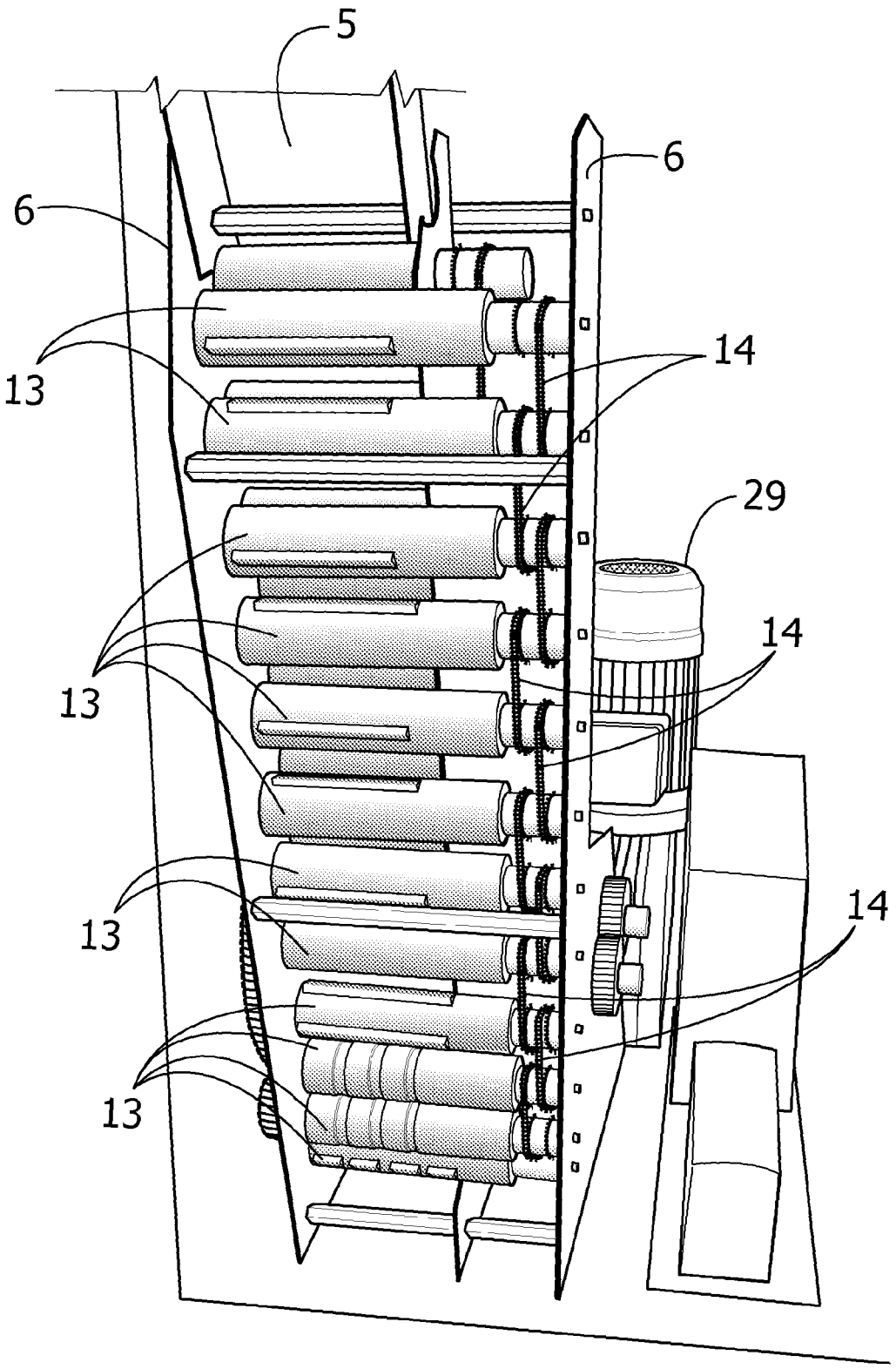
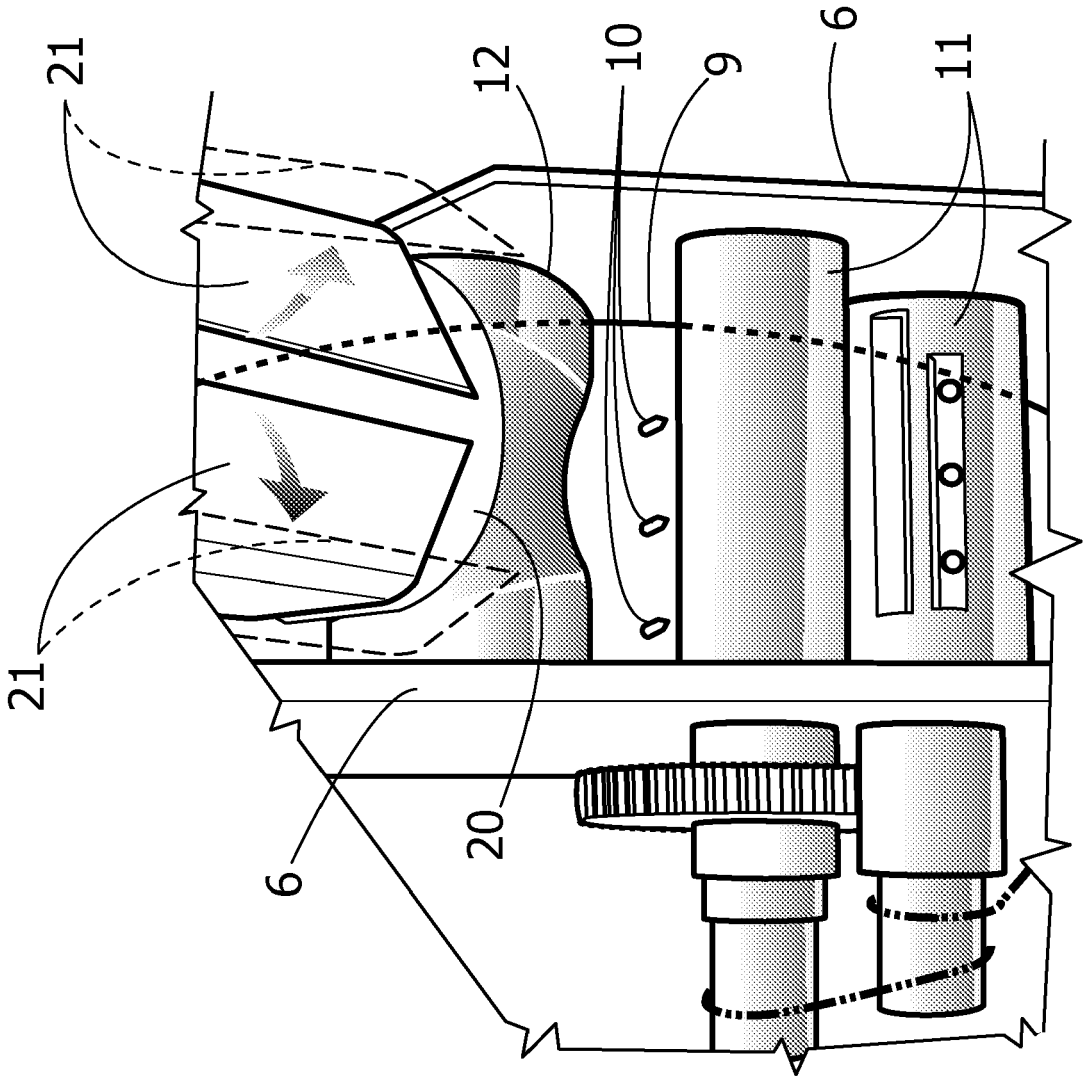


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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