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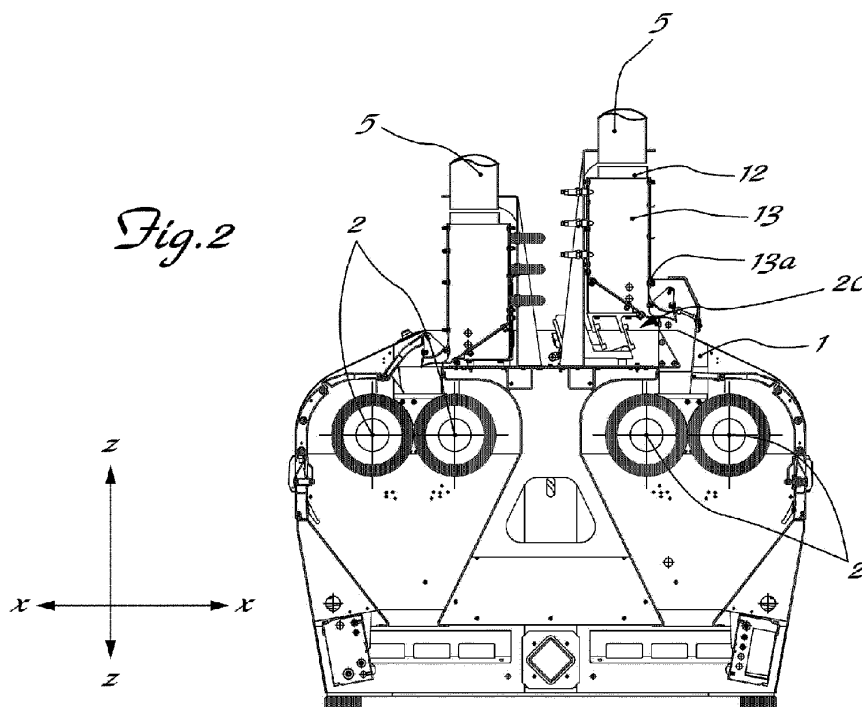
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(54) **Machine for grinding granular products with vibratory feeding of the product**

(57) Machine for grinding granular products, comprising at least one pair of rolling cylinders (2) extending and rotating about a longitudinal axis (X-X) and a vibrating apparatus for feeding the product to said cylinders, comprising at least one casing (11) provided with an opening (12) for entry of the product and a nozzle (14) extending along the longitudinal direction (X-X) for dispensing the product to the cylinders (2), said casing (11) being connected to at least one vibrating device (20;120)

arranged between a fixed frame (1) of the machine and the casing (11) itself and able to impart a vibratory movement to the feed apparatus, wherein the casing (11) has an approximately trapezoidal form with its bottom larger base (11a) directed towards the rolling cylinders (2) and top smaller base (11b) provided with an opening (12) for entry of the product into the casing (11) and the casing (11) is arranged in a top position substantially outside of the machine.



Description

[0001] The present invention relates to a machine for grinding granular products such as cereals and the like, comprising a vibrating apparatus for feeding the product to rolling cylinders.

[0002] In the technical sector relating to the grinding of products in the form of seeds or grains, such as cereals and the like, machines for grinding such products, able to convert the product from the granular form into a flour-like or powder-like form of predefined particle size, are known.

[0003] Said machines, which are by the name of rolling mills, are substantially based on the use of one or more pairs of rolling cylinders with a constant cross-section and adjustable interaxial distance, through which the product to be ground is passed, said product being fed for this purpose to the said cylinders by means of a feed apparatus in turn comprising one or more rollers associated with guiding baffles and deflectors for metering the product which falls by means of gravity from containing hoppers.

[0004] Although performing their function, the known apparatus for feeding the granular product to the rolling cylinders are subject to accumulation of the product and the powder and fat residues contained in it and therefore require periodic and frequent cleaning and maintenance operations in order to ensure that they remain functional and in particular hygienic since food products are involved.

[0005] Examples of embodiment of these machines are for example known from WO-01/32312 and GB-369 477 which describe vibrating devices arranged inside the machine and therefore requiring complicated machine disassembly operations in order to be able to clean the said accumulated powder and fat residues from the devices.

[0006] PCT/CH97/00362 also discloses rolling mills in which the apparatus for feeding the product to the rolling cylinders is fastened to a frame able to rotate about a fixed axis so as to move the entire assembly outside of the machine body and facilitate the necessary cleaning operations. Although performing its function, this machine nevertheless has the drawback consisting in the fact that the assembly remains closed at the bottom and therefore does not allow complete cleaning of the residues unless the entire assembly is removed.

[0007] The technical problem which is posed, therefore, is that of providing an apparatus for feeding granular products to the rolling cylinders of a grinding machine, which apparatus is such that it is able to reduce to a minimum the accumulation of product residues inside it and therefore reduce the necessary cleaning operations as well as the machine downtime. In connection with this problem a further need is that the apparatus should be able to be easily accessed and should be interchangeable so as to allow both easier cleaning operations and the installation of a new feed unit in the event of the prod-

uct being changed and/or wear of the existing unit.

[0008] These problems are solved according to the present invention by a grinding machine comprising a vibrating feed apparatus according to the characteristic features of Claim 1.

[0009] Therefore, the invention relates to a machine for grinding granular products, comprising at least one pair of rolling cylinders extending and rotating about a longitudinal axis X-X and a vibrating apparatus for feeding the product to said cylinders, the apparatus comprising at least one casing provided with an opening for entry of the product and a nozzle extending along the longitudinal direction for dispensing the product to the cylinders, said casing being connected to at least one vibrating device arranged between a fixed frame of the machine and the casing itself and able to impart a vibratory movement to the feed apparatus; advantageously the casing has an approximately trapezoidal form with its bottom larger base directed towards the rolling cylinders and its top smaller base provided with an opening for entry of the product into the casing and the casing is arranged in a top position substantially external to the machine.

[0010] According to preferred embodiments of the machine, whose characteristic features may also be combined: The casing has, arranged inside it, a blade extending along the length in the longitudinal direction and with a bottom end inclined from the top downwards and from the outside towards the inside of the rolling mill;

[0011] The vibration device may comprise a plate which can be fastened to the frame and which has, fixed thereon, a vibrating base acting on resilient arms carrying a flange fixed to the larger base of the casing; Optionally, rubber anti-vibration elements are arranged between the plate and the vibrating base;

[0012] The vibrating device may also comprise a vibration motor mounted on a plate attached to the casing; moreover, a further improvements foresees rubber anti-vibration elements arranged between the plate and the frame of the rolling mill;

[0013] In all cases it is preferred that the vibration movement acts along the longitudinal direction;

[0014] The machine according to the invention preferably comprises a control device for detecting, by means of sensors, the preset speed of rotation of the rolling cylinders and for correspondingly varying the degree of vibration of the casing.

[0015] Preferably, the control device is:

- connected to first sensors arranged at different heights of the casing and designed to signal the presence/absence of product inside it; and/or
- connected to a series of second sensors arranged along the bottom of the blade and in the vicinity of the mouth for discharging the product and designed to detect the uniform/non-uniform distribution of the product along the longitudinal direction X-X; and/or
- designed to start/stop and/or modulate the grinding operation depending on the presence/absence

and/or the uniform/non-uniform distribution of cereal detected by the sensors arranged along the bottom of the casing.

Preferably said sensors are of the capacitive type.

[0016] In all cases it is preferred that the vibrating devices associated with each casing are two in number and are arranged symmetrically in relation to the middle of the larger base of the casing. Further details may be obtained from the following description of a non-limiting example of embodiment of the present invention provided with reference to the accompanying sets of drawings in which:

Figure 1: shows a perspective view of the rolling mill with feed apparatus according to the present invention;

Figure 2: shows a schematic cross-sectional view along a transverse plane of the machine according to Fig. 1;

Figure 3: shows a perspective view of an embodiment of the vibrating apparatus according to the present invention;

Figure 4: shows a schematic cross-section along a vertical plane of the vibrating casing shown in Fig. 3;

Figure 5: shows a perspective view of a second embodiment of the vibrating apparatus according to the present invention

Figure 6: shows a perspective view of an alternative embodiment of the vibrating casing according to the present invention; and

Figure 7: shows a schematic cross-section along a vertical plane of an alternative embodiment of the vibrating casing according to the present invention;

[0017] As shown in Fig. 1 and assuming, solely for the sake of easier description and without a limiting meaning, a set of three reference axes, i.e. longitudinal axis X-X corresponding to the axis of rotation of the cylinders, transverse axis Y-Y perpendicular to the preceding axis and vertical axis Z-Z perpendicular to the other two axes and representing the direction in which the product falls through the rolling cylinders, the machine, which is known per se and therefore not described in greater detail, comprises a frame 1 supporting the rolling cylinders 2 and the apparatus 10 for feeding the product, arranged above the cylinders 2 in the vertical direction Z-Z and in turn comprising at least one casing 11 (Fig. 3) with an approximately trapezoidal form having a bottom larger base 11a directed towards the rolling cylinders 2 and a top smaller base 11b provided with an opening 12 for entry of the product into the casing 11.

[0018] The casing has, arranged inside it, a blade 13 which extends lengthwise in the longitudinal direction of the casing 11, with a bottom end 13a inclined from the top downwards and from the casing 11 towards the cylinders 2 of the rolling mill, and which is able to convey

the product towards a product dispensing nozzle 14 extending in the longitudinal direction X-X along the entire length of the casing 11.

[0019] The casing 11 is connected to at least one vibrating device 20 arranged between the casing itself and the fixed frame 1 of the rolling mill so as to impart a relative vibratory movement to the casing and the frame.

[0020] As shown in detail in Figs. 3,4 the vibrating device 20 comprises a plate 21 which can be fastened to the fixed frame 1 via screw means (not shown) and on which a vibrating base 22 is fixed by means of rubber anti-vibration elements 22a, said base acting on resilient arms 23 which support a flange 24 fixed to the larger base 11a of the casing 11.

[0021] With such a configuration the operating principle of the rolling mill is as follows:

- the product to be ground is fed through a fixed pipe 5 inserted inside a collar 5a mounted on a vertical arm 5b connected to the frame 1 which is fixed and coaxial with the opening 12 in the casing 11;
- the product fed through the pipe 5 enters into the casing 11 which is made to vibrate by means of the vibration motor 20 causing a movement of the product which is dispersed and distributed on the blade 13 along the entire length in the longitudinal direction X-X of the casing 11 so that, exiting from the nozzle 14, it feeds the cylinders 2 along their entire longitudinal length;
- the cycle involving rolling the product which, passing through the cylinders 2, is ground and then collected downstream of the rolling mill is of the conventional type.

[0022] As shown in Fig. 5, it is envisaged that the vibratory movement imparted to the casing may be generated by a device 120 which comprises at least one vibration motor 122 mounted on a plate 121; in this case rubber anti-vibration elements 122a are arranged between the larger base 11a of the casing 11 and the fixed frame 1 to which the casing is fixed via screw means or the like.

[0023] In both the constructional forms, the vibrating devices 20, 120 associated with each casing 11 are preferably two in number and are arranged symmetrically in relation to the middle of the larger base of the casing 11, advantageously reducing the overall volume and ensuring a suitable vibratory movement.

[0024] Although described with reference to a single vibrating casing 11, it is envisaged that - as shown in Figs. 1 and 2 - the rolling machine may be provided with two pairs of rolling cylinders 1, each pair being able to grind a product different from that fed to the other pair via a respective feed apparatus according to the invention. Correspondingly and depending on the different particle size and moisture characteristics of the products to be ground, it will be possible to equip the two casings 11 with one (vibrating base) or other (vibration motor) of the

vibration devices described above.

[0025] In both cases the vibration devices impart to the casing 11 a movement acting in the longitudinal direction X-X.

[0026] With such a configuration grinding of the granular product by means of the machine according to the invention comprises the following steps:

- feeding the product to be ground via a fixed pipe 5 to a feed apparatus 10;
- entry of the product fed through the pipe 5 into the feed apparatus 10;
- transmission of a vibratory movement acting in the longitudinal direction X-X to the casing 11;
- descent of the product along a blade 13 having its bottom end 13a inclined from the top downwards and from the outside towards the inside of the rolling mill;
- conveying and dispensing the product through a dispensing nozzle 14 extending lengthwise in the longitudinal direction of the casing 11;
- rolling the product by means of the cylinders 2 and collecting the ground product downstream of the rolling mill.

[0027] As shown in Figs. 6 and 7, it is also envisaged that in a preferred embodiment the machine according to the invention comprises a control device 300 for detecting by means of sensors (not shown) the preset speed of rotation of the rolling cylinders and for correspondingly varying the degree of vibration of the casing 11 so as to ensure a correct continuous flow of the product.

[0028] The control device 300 may also be connected to first sensors 320, for example of the capacitive type, which are arranged at different heights of the casing 11 and to a series of second sensors 330 situated along the bottom 13a of the blade 13 of the casing 11 and in the vicinity of the product discharging mouth 14; the first sensors 320 being designed to detect the presence/absence of cereal inside the casing, while the series of second sensors 330 are able to detect the uniform/nonuniform distribution of the product along the longitudinal direction X-X; once the presence of product inside the casing has been detected, the control unit 300 sends an enable signal for closing the cylinders, which are initially open when the machine is at a standstill, and for starting the production cycle with activation of the vibrating devices; if no product or irregular distribution thereof is detected, the control device 300 does not send the enable signal for closing the cylinders and starting vibration, if at the start of the cycle, or interrupts the cycle, stopping vibration, if processing is already in progress.

[0029] It is therefore clear how, with the vibrating apparatus for feeding granular products to grinding machines, such as a rolling mill, moving parts of the feed devices are eliminated, thereby increasing the safety for operators and maintenance staff; there is also a substantial reduction in the deposition of product in the feed device which therefore requires shorter cleaning cycles, al-

so reducing the machine downtime.

[0030] In particular, owing to the special form of the feed casing, it may be arranged in a position substantially outside the machine allowing easier access when it is required to perform maintenance and replace the casing in the event of a product change.

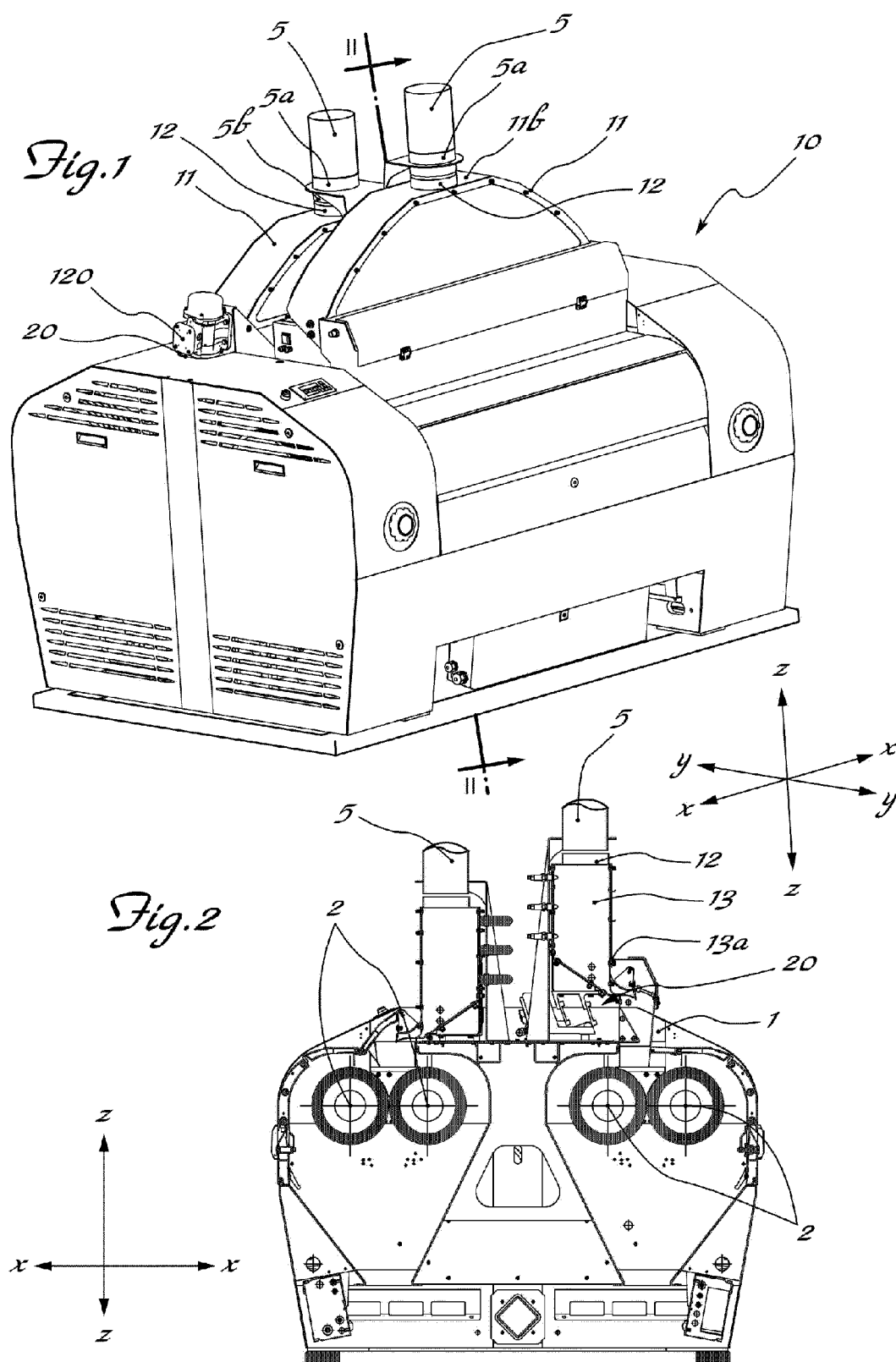
[0031] In addition it has also been established in tests that the improved distribution of the product to be ground resulting from the vibration imparted to the feed apparatus also results in improved distribution thereof to the cylinders with an evident reduction in wear thereof.

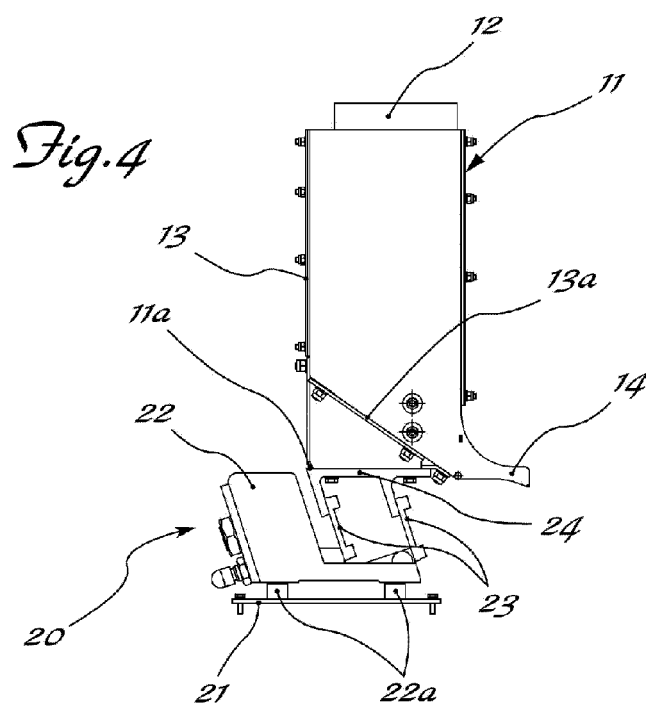
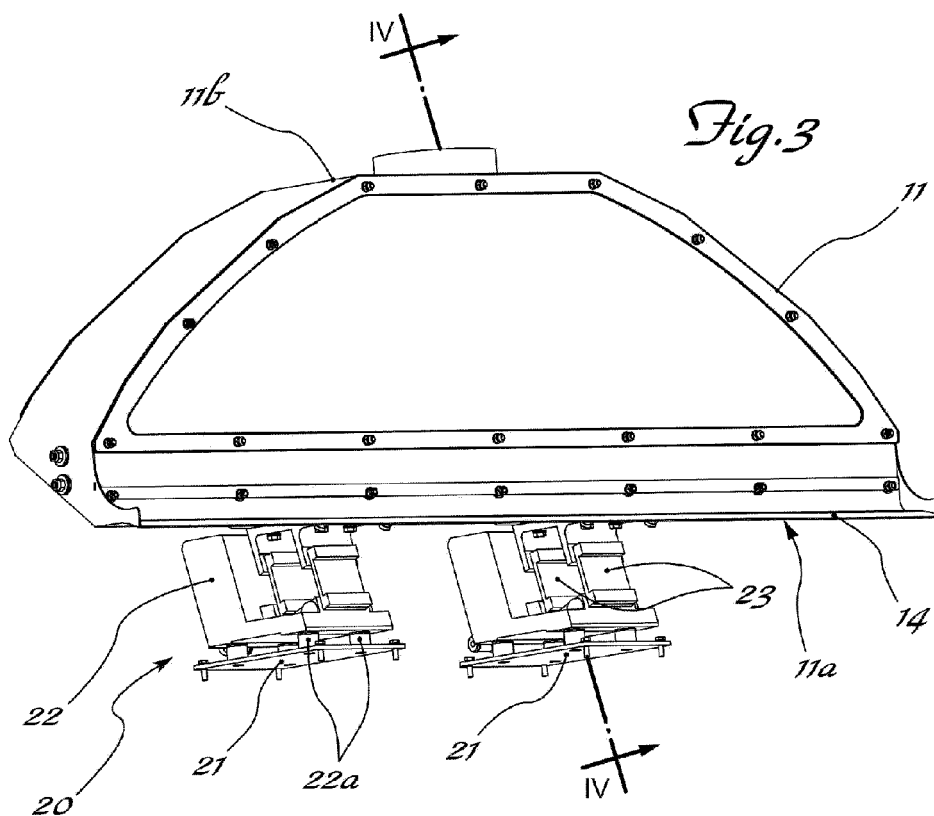
[0032] Although described in connection with certain constructional forms and certain preferred examples of embodiment of the invention, it is understood that the scope of protection of the present patent is defined solely by the following claims.

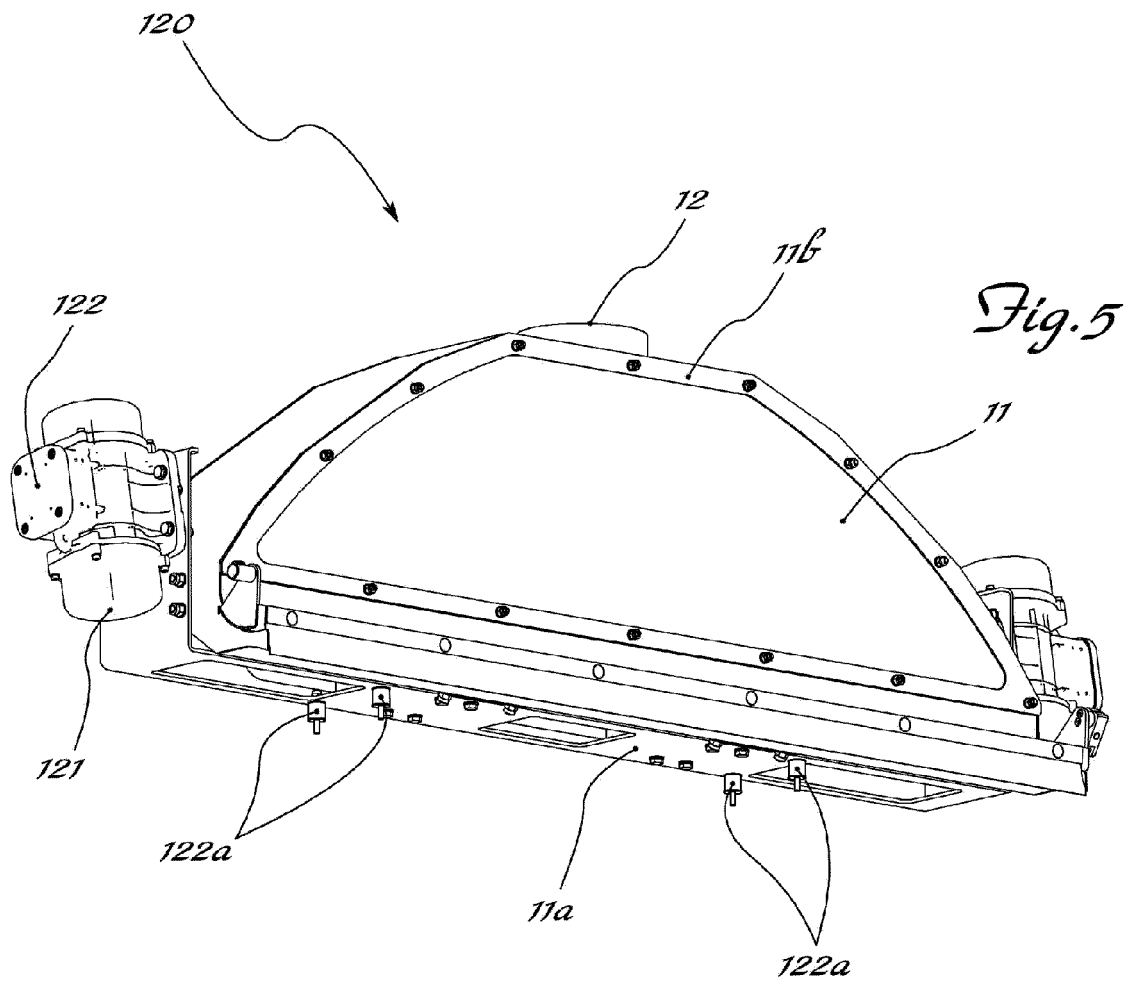
Claims

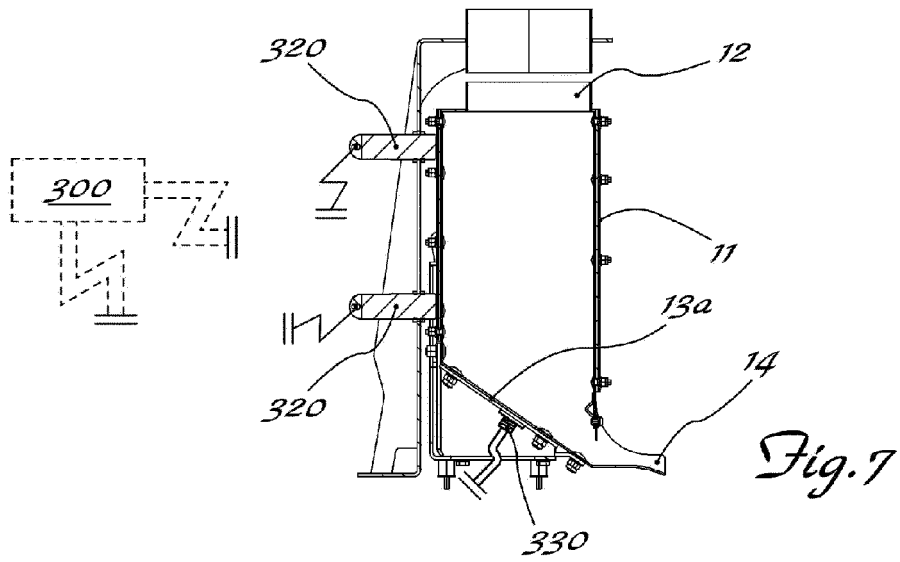
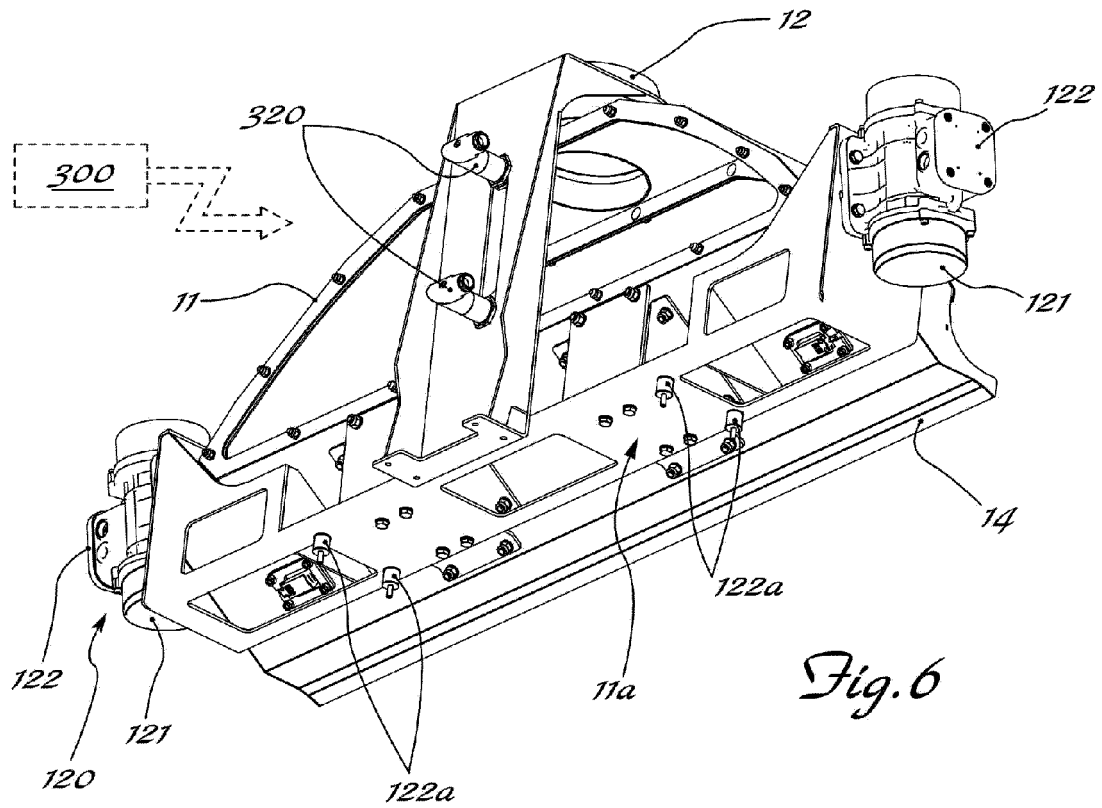
1. Machine for grinding granular products, comprising at least one pair of rolling cylinders (2) extending and rotating about a longitudinal axis (X-X) and a vibrating apparatus for feeding the product to said cylinders, comprising at least one casing (11) provided with an opening (12) for entry of the product and a nozzle (14) extending along the longitudinal direction (X-X) for dispensing the product to the cylinders (2), said casing (11) being connected to at least one vibrating device (20;120) arranged between a fixed frame (1) of the machine and the casing (11) itself and able to impart a vibratory movement to the feed apparatus, **characterized in that** the casing (11) has an approximately trapezoidal form with its bottom larger base (11a) directed towards the rolling cylinders (2) and top smaller base (11b) provided with an opening (12) for entry of the product into the casing 11 and **in that** the casing (11) is arranged in a top position substantially outside of the machine.
2. Machine according to Claim 1, **characterized in that** the casing has, arranged inside it, a blade (13) extending along the length in the longitudinal direction (X-X) of the casing (11) and with a bottom end (13a) inclined from the top downwards and from the outside towards the inside of the rolling mill.
3. Machine according to Claim 1, **characterized in that** the vibration device (20) comprises a plate (21) which can be fastened to the frame (1) and which has, fixed thereon, a vibrating base (22) acting on resilient arms (23) carrying a flange (24) fixed to the larger base (11a) of the casing (11).
4. Machine according to Claim 3, **characterized in that** rubber anti-vibration elements (22a) are arranged between the plate (21) and the vibrating base (22).

5. Machine according to Claim 1 or 2, **characterized in that** the vibrating device comprises a vibration motor (120) mounted on a plate (120) attached to the casing (121).
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6. Machine according to Claim 5, **characterized in that** rubber anti-vibration elements (122a) are arranged between the plate (121) and the frame (1) of the rolling mill.
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7. Machine according to any one of the preceding claims, **characterized in that** the vibration movement acts along a longitudinal direction (X-X).
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8. Machine according to any one of the preceding claims, **characterized in that** it comprises a control device (300) for detecting by means of sensors (310) the preset speed of rotation of the rolling cylinders and for correspondingly varying the degree of vibration of the casing 11.
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9. Machine according to Claim 8, **characterized in that** the control device (300) is connected to first sensors (320) arranged at different heights of the casing (11) and designed to signal the presence/absence of product inside it.
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10. Machine according to Claim 8, **characterized in that** the control device (300) is connected to a series of second sensors (330) arranged along the bottom (13a) of the blade (13) and in the vicinity of the mouth (14) for discharging the product and designed to detect the uniform/non-uniform distribution of the product along the longitudinal direction X-X.
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11. Machine according to Claim 9 or 10, **characterized in that** the control device (300) is designed to start/stop and/or modulate the grinding operation depending on the presence/absence and/or the uniform/non-uniform distribution of cereal detected by the sensors (320) arranged along the bottom of the casing (11).
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12. Machine according to Claim 9 or 10, **characterized in that** said sensors are of the capacitive type.
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13. Machine according to any one of the preceding claims, **characterized in that** the vibrating devices (20, 120) associated with each casing (11) are two in number and are arranged symmetrically in relation to the middle of the larger base of the casing (11).
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REFERENCES CITED IN THE DESCRIPTION

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