(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 744 514 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.12.2020 Bulletin 2020/49

(51) Int Cl.:
B30B 11/10 *(2006.01)* ***B30B 15/30*** *(2006.01)*
B30B 11/04 *(2006.01)*

(21) Application number: **18460053.4**

(22) Date of filing: **07.09.2018**

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

(30) Priority: **22.09.2017 PL 42294417**

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(54) TABLET PRESS FOR PRODUCING MULTI-LAYER TABLETS

(57) The subject of this invention is a tablet press for producing multi-layer tablets from powder substances.

Tablet press for producing multi-layered tablets, characterized in that: on the working table (1), in a close vicinity of upper punch (2) it has at least two discharging hoppers (3) mounted on a device (4) feeding at least two powder substances, and the feeding device (4) along with the discharging hoppers (3) are mounted over the separator body (5), and in the separator (8) chamber (6) containing the tablet die (7) a revolving separator (8) is located with at least two discharging chambers (9).

The feeding device (4) comprises in its body at least two horizontal slides (10) each of which moves reciprocally between the upper hole (11) and lower hole (12) of the feeding device (4), ended with a bush (19), and each slide (10) has a passthrough vertical hole (13), and each slide (10) has a pneumatic valve (14) controlling the reciprocal motion of slide (10).

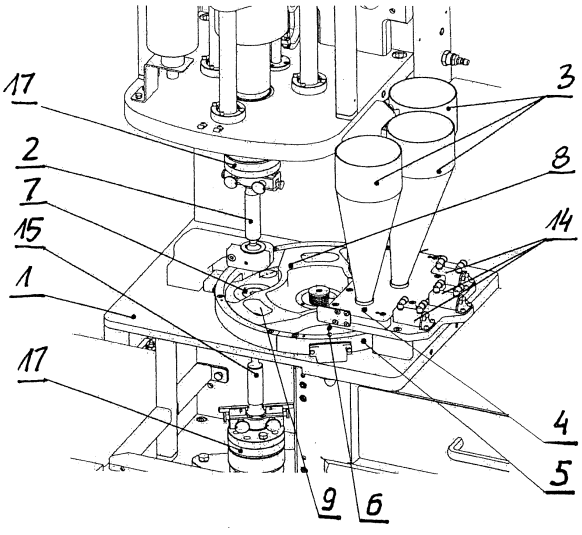

Fig. 2

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Description

[0001] The subject of this invention is tablet press for producing multi-layer tablets from powder substances.

[0002] The produced tablets may comprise of a single, or multiple layers of powder substances combined with the use of cohesive forces produced during the exerting of adequate value of pressure on the powder layers fed into the process.

[0003] From German patent description DE 102 56 654 B4 a tablet press is known that contains: a first device for filling the tablet die with powder substance forming the first tablet layer, and a second device for filling the tablet die with powder substance forming the second tablet layer; the tablet press also contains a device for pressing the powder substances placed in the tablet die. The tablet press also comprises an actuator ejecting the pressed and ready tablet from the die. The die is situated stationary in the press; the press is made as a hydraulic pressing device with hydraulic actuator situated in the die spatially, and - after starting the second filling device - is activated in order to produce the tablet. The ejecting actuator is also situated in the direct vicinity of the die. The tablet press is equipped with an electronic control system that controls at least one of the process parameters, such as pressing speed, pressing force, pressing force trend, pressing process time and/or pressing stroke. The pressing actuator features pneumatic and hydraulic drive.

[0004] From German patent description DE 102 62 091 B4 a tablet press is known for producing tablets from powder substances with a die for receiving the powder substance used for tablet production, the design of which characterizes in that the pressing actuator is made as pneumatic and hydraulic pressing actuator, that means were foreseen in order to preliminarily densify the powder substance located in the die after the filling process, and that the means for preliminary densification were effected in the form of a pneumatic and hydraulic pressing actuator driven within the operating range of the pneumatic drive. The tablet press features an ejecting device for ejecting the pressed tablet from the die, which is made as a hydraulic ejecting actuator located on the die side opposite to the pressing actuator, and contains a control or adjustment system for at least one of the tablet production process parameters.

The driving mechanisms in the designs of similar tablet presses existing presently, which are based on hydraulics and pneumatics, do not allow to accurately control the pressing process of the single tablet from the moment of commencing this single process until its completing. With this kind of drives, controlling the punches force and speed versus their displacement value is impossible. It is also not possible to report force and speed versus displacement. Moreover, such hydraulic and pneumatic drives hinder maintaining the level of cleanliness required for machinery operated in laboratory conditions. The currently existing solutions for feeding the pressed powder substance also constitute a significant limitation of the possibility of increasing the machine's operating speed due to the long stroke of the slides feeding the powder into the die hole. This, in turn, resulted in the laboratory-tested tabletting process to be too short for the results to be easily translatable into industrial processes, which the processes, due to their nature, are fast-paced.

The above limitation was the reason for starting works on the claimed invention.

[0005] The substance of the tablet press's design, according to the invention, characterizes in that it comprises at least two discharging hoppers located on the working table, in a close vicinity of the upper punch, mounted on a device feeding at least two powder substances, and the feeding device along with the discharging hoppers is mounted over the separator body; in the separator chamber which contains the tablet die a revolving separator is situated with at least two discharging chambers.

[0006] The feeding device contains in its body at least two horizontal sliders of which each moves reciprocally between the upper and lower hole of the feeding device which is ended with a bush, and each slide has a vertical pass-through hole, with each slide featuring a pneumatic valve for controlling the reciprocal motion of the slide.

[0007] The revolving separator, of shape resembling an openwork wheel, has, in the vicinity of its external edge, at least two discharging chambers.

[0008] The tablet die is located at the bottom of the separator chamber and situated in such way that the powder substance located in the discharging chamber of the revolving separator gravitationally fills the die volume. Each of the punches is connected with a pressing screw; the other end is connected with an electrical drive through a gear.

[0009] The device for monitoring the level of filling of the charging chamber with powder substance has a volumetric sensor.

[0010] The tablet press is equipped with a monitor with a system for automatic adjustment, monitoring and displaying of the parameters of the technological process of the produced multi-layer tablets, including pressing forces for each tablet layer versus displacement speed of the upper punch and/or lower punch, and displacement speed of the upper punch and lower punch.

[0011] The tablet press features an automatic adjustment system which can be communicated with via an USB port.

[0012] The tablet press features an automatic adjustment system which can be wireless communicated with.

[0013] The benefits of the invention in comparison with existing solutions are as follows:

- thanks to the application of electro-mechanical punch drive, the possibilities for accurate control of the process were extended, i.e. it is now possible to control the pressing force versus punch displacement, and control the punches movement speed versus their displacement.

- thanks to the application of electro-mechanical punch drive, cleanliness of the drive was increased compared to the hydraulic and pneumatic solution
- thanks to the use of electro-mechanical punch drive, such possibility of controlling the punches was obtained that a working mode was achieved similar to the ones existing in industrial-class tablet presses. Due to this, the results of tests carried out on the tablet press covered by this invention can be easily translated into a fast industrial process.
- thanks to the application of powder feeding solution employing short-stroke slides working together with a revolving separator, the maximum speed of the tablet press in its laboratory variant was increased, bringing it closer to the mode of operation of an industrial-class tablet press.

[0014] The subject of invention is presented on the example in figure 1, which presents the tablet press in its front view, fig. 2 - presents the front view of the tablet press part with the powder substance feeding device, fig. 3 - presents a view of the working table of the tablet press with the revolving powder substance separator, fig. 4 - presents a cross-section of the tablet press with the powder substance feeding device and revolving powder substance separator.

[0015] According to the invention, the tablet press for producing three-layered tablets comprises of a body 20 with working table 1 with upper punch 2, seated in a guide 21, and is equipped with an electrical drive 17 with transmission, and - inside the body 20 - the lower punch 15 is seated with electrical drive 17 and transmission. On the working table 1 a revolving separator 8 is seated on which a device for feeding the powder substances 4 is mounted; at the side opposite to the feeding device 4 a guide 21 is installed in which the upper punch 2 is mounted over the tablet die 7. On working table 1, three discharging hoppers 3 are placed in a close vicinity of upper punch 2, which are installed on the powder substances feeding device 4. The powder substance feeding device 4 along with the discharging hoppers 3 is mounted on the body 5 of the revolving separator 8. In the chamber 6 of the revolving separator 8 a tablet die 7 and revolving separator 8 are mounted, with three discharging chambers 9. The revolving separator 8 has a shape resembling an openwork wheel, and in the close vicinity of its external edges three discharging chambers 9 are located, with each discharging chamber 9 having the form of a pass-through hole visible from above, of shape resembling a rectangle. The tablet die 7, located at the bottom of separator chamber 6, is situated in such way that the powder substance located in the discharging chamber 9 of the revolving separator 8 fills the die volume gravitationally. At the bottom of chamber 6 of the revolving separator 8 a device is located for monitoring 16 the level of filling the charging chamber 9 with the powder substance.

The powder substance feeding device 4 has in its body three horizontal slides 10 of which each moves reciprocally between the upper hole 11 and lower hole 12 of the feeding device ended with a bush 19, and each slide has a pass-through vertical hole 13, with each slide 10 equipped with a pneumatic valve 14 for controlling the reciprocal movement of slide 10.

A monitor 18 is mounted over the working table 1 on an arm extending from the upper punch casing 2; it comprises a system for automatic adjustment, supervision and presentation of the parameters of the technological production process of three-layer tablets, including pressing forces for each tablet layer versus upper punch and/or lower punch displacement value and upper punch and lower punch displacement speed.

The upper punch 2 and lower punch 15 are connected with an appropriate pressure screw the other end of which is connected with electrical drive 17 through a transmission.

[0016] The automatic adjustment system may be communicated with through a USB port or wireless.

[0017] In the technological process performed by the tablet press it is assumed that the bulk substances to be pressed are situated in suitable discharging hoppers 3 in the order in which they are to be placed in the pressed tablet. The powder substances from discharging hoppers 3 are moved to the die hole 7 through the revolving separator 8.

[0018] The components used for forming and pressing the powder substances fed to the process, such as upper punch 2, die 7 and lower punch 15, are replaceable for the purpose of obtaining the desired tablet. Die 7 has specific position in the revolving separator 8 chamber 6. The upper punch 2 is mounted in the upper driving device 17 which ensures controlled reciprocating motion in vertical direction, and controlled value of the exerted pressure force. The tip of upper punch 2 which forms the tablet may be located over die 7 or in the hole of this die 7. Lower punch 15 is mounted in the driving device 17 that ensures controlled reciprocating motion and control of the force exerted during the pressing out of the ready tablet from the hole of die 7. The tip of lower punch 15 does not leave the die hole 7.

Claims

1. Tablet press for producing multi-layered tablets, comprising of a powdery substance feeding system and electro-mechanical punch drives, **characterized in that**: on the working table (1), in a close vicinity of upper punch (2) it has at least two discharging hoppers (3) mounted on a device (4) feeding at least two powder substances, and the feeding device (4) along with the discharging hoppers (3) are mounted over the separator body (5), and in the separator (8) chamber (6) containing the tablet die (7) a revolving separator (8) is located with at least two discharging chambers (9).

2. Tablet press, as per claim 1, **characterized in that** the feeding device (4) comprises in its body at least two horizontal slides (10) each of which moves reciprocally between the upper hole (11) and lower hole (12) of the feeding device (4), ended with a bush (19), and each slide (10) has a pass-through vertical hole (13), and each slide (10) has a pneumatic valve (14) controlling the reciprocal motion of slide (10).

3. Tablet press, as per claim 1 and 2, **characterized in that** the revolving separator (8) of shape resembling an openwork wheel has at least two discharging hoppers (9) in the vicinity of its external edge.

4. Tablet press, as per claims 1 to 3, **characterized in that** the tablet die (7) located at the bottom of the separator chamber (6) is situated in such way that the powder substance located in the discharging chamber (9) of the revolving separator (8) gravitationally fills the volume of the die (7).

5. Tablet press, as per claim 1 to 4, **characterized in that** each of the punches (2) and (15) is connected with a pressing screw the other end of which is connected with electrical drive (17) through a transmission.

6. Tablet press, as per claim 1 to 5, **characterized in that** the device (16) for monitoring the level of filling the discharging chamber (9) with powder substance contains a volumetric sensor.

7. Tablet press, as per claim 1 to 6, **characterized in that** it comprises a monitor (18) with a system for automatic adjustment, monitoring and displaying of the parameters of the technological process of the produced multi-layer tablets, including pressing forces for each tablet layer versus displacement speed of the upper punch (2) and/or lower punch (15), and displacement speed of the upper punch (2) and lower punch (15).

8. Tablet press, as per claims 1 and 7, **characterized in that** it comprises an automatic adjustment system which can be communicated with via an USB port.

9. Tablet press, as per claims 1 and 7, **characterized in that** it comprises an automatic adjustment system which can be wireless communicated with.

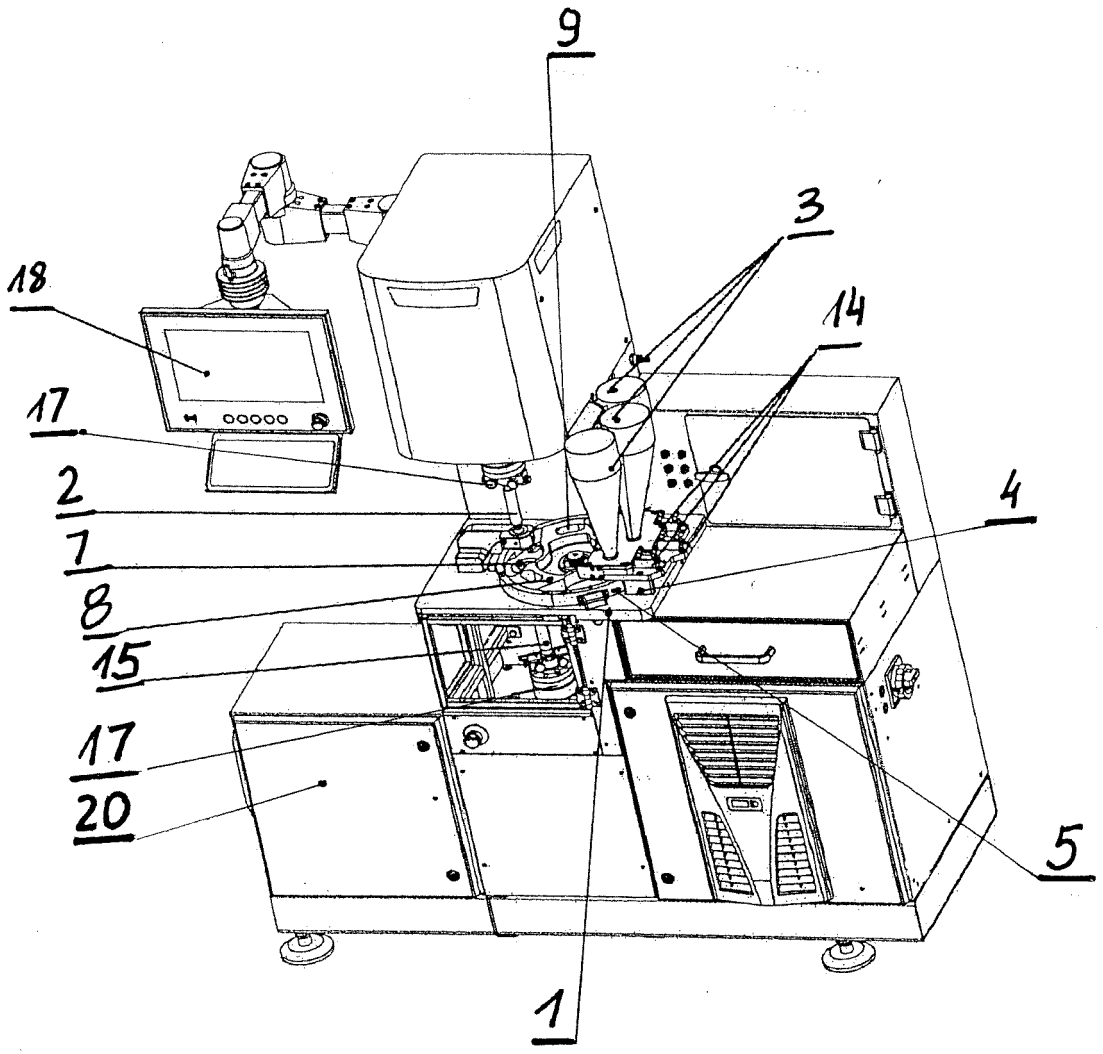

Fig. 1

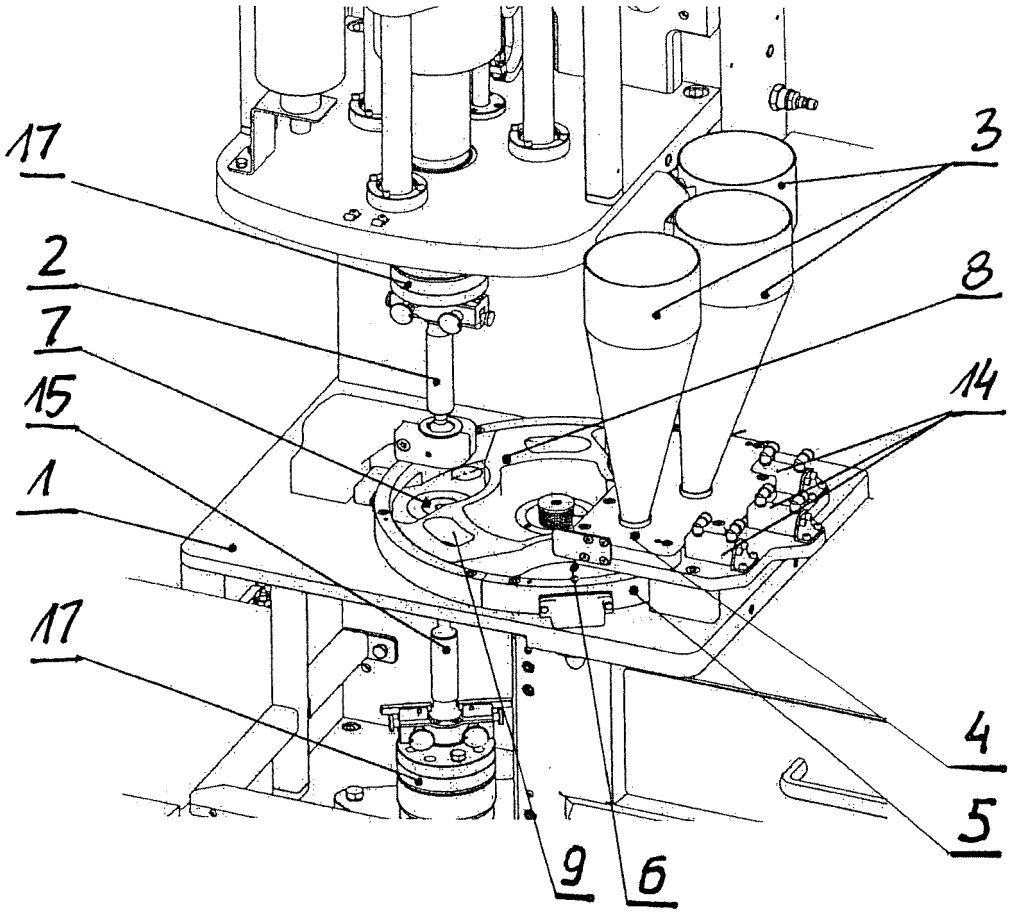

Fig. 2

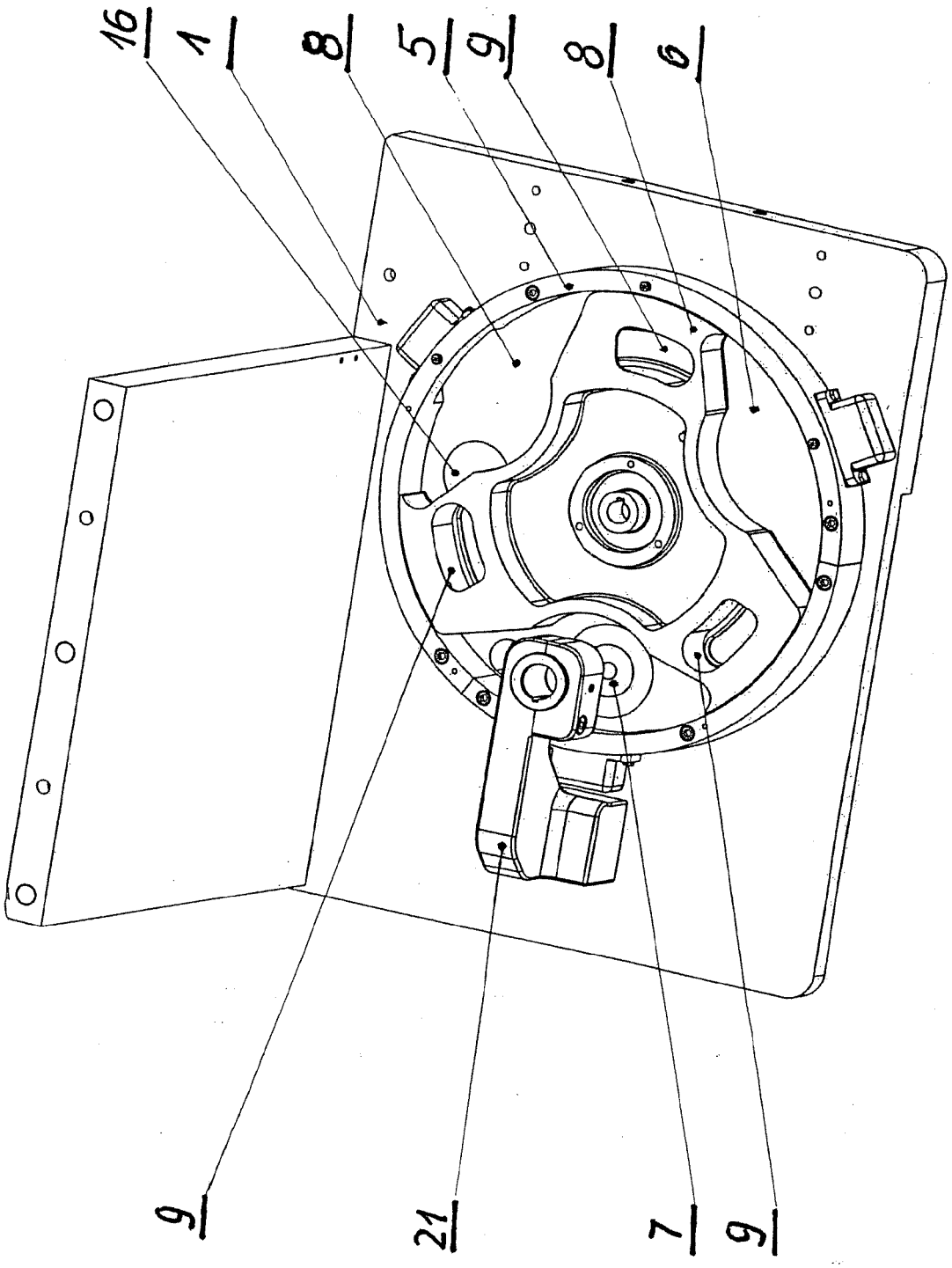

Fig. 3

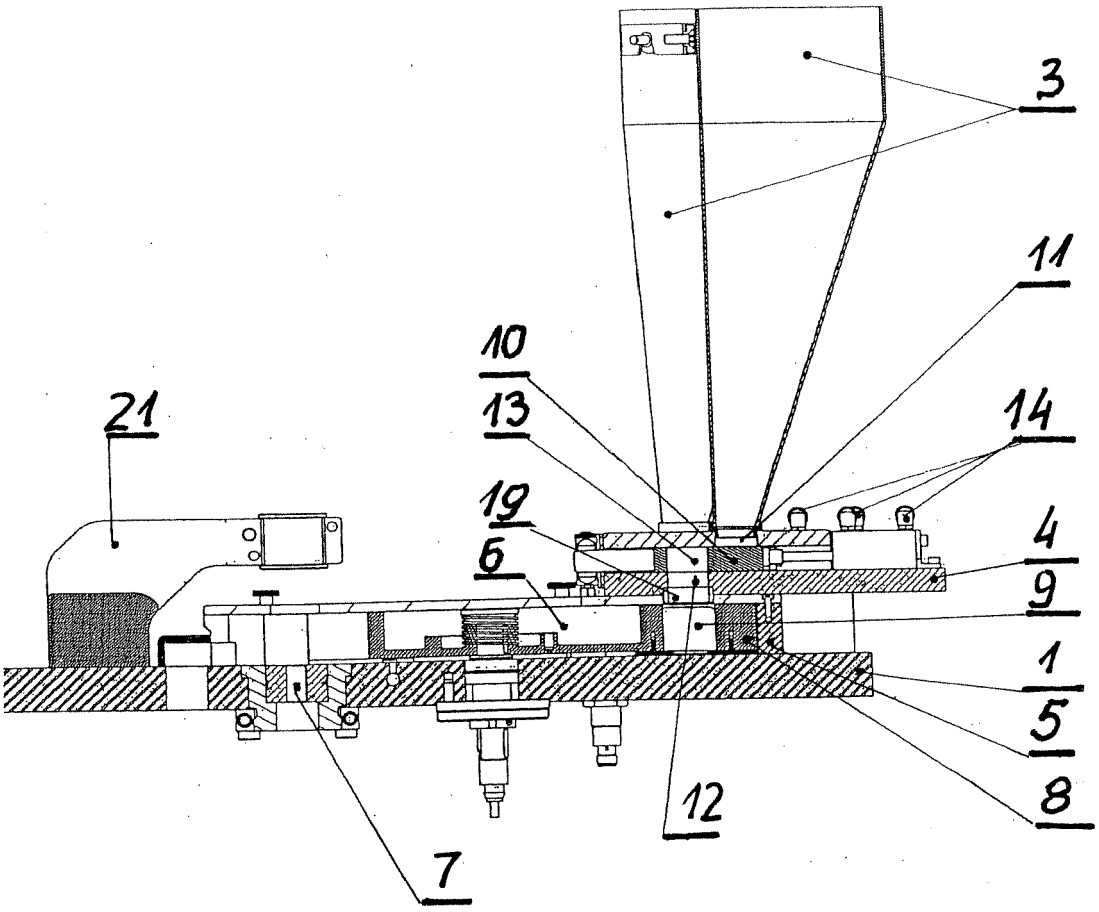

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 46 0053

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 October 2020	Labre, Arnaud

CATEGORY OF CITED DOCUMENTS

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

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