(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 801 785 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
12.11.2014 Bulletin 2014/46

(51) Int Cl.:
F42B 33/00 *(2006.01)* ***B30B 1/26*** *(2006.01)*
B30B 15/00 *(2006.01)*

(21) Application number: **14167195.8**

(22) Date of filing: **06.05.2014**

(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

(30) Priority: **08.05.2013 IT CR20130014**

(71) Applicant: **E.M.G. Srl**
26010 Pozzaglio ed Uniti (CR) (IT)

(72) Inventor: **Gatti, Giorgio**
26100 Cremona (IT)

(74) Representative: **Marcio', Paola et al**
Ing. Mari & C. SRL
Via Garibotti, 3
26100 Cremona (IT)

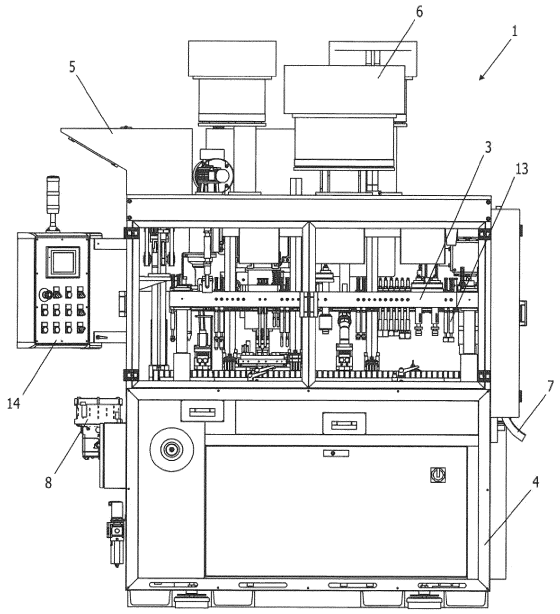
(54) Cartridge loading machine with balanced movement

(57) The invention relates to the field of production and loading lines for cartridges, in particular used in the sports, civil and military field.

More in detail, the invention relates to a cartridge loading machine with balanced movement (1) comprising:
- a support frame (4);
- means (5) for feeding said cartridges;
- means (6) for feeding components to be inserted in said cartridges;
- a working beam (3) adapted to load said cartridges, provided with an alternating movement of translation between two upper and lower end positions;
- means (7) for advancing and ejecting the loaded cartridges;
- motor means (8);
- motion transmission means (9, 19, 29).

Said loading machine (1) comprises a dynamic balancing device (2) connected to said working beam (3) by kinematic connection means, so that the inertia of said balancing device (2) is opposed to the inertia of said working beam (3) during its alternating movement of translation between the two upper and lower end positions.

Fig. 1



EP 2 801 785 A1

Description

[0001] The invention relates to the field of production and loading lines for cartridges, in particular used in the sports, civil and military field.

[0002] More in detail, the invention relates to a machine tool, in particular a loading machine equipped to receive the empty cartridges, fill them with the necessary internal components, seal and pack them.

[0003] According to the prior art, the cartridge loading machines substantially comprise a support frame; means for feeding said empty cartridges; a working beam supporting accessory means for the sequence loading and dosing of the component products of said cartridges; means for advancing and ejecting the cartridges already loaded.

[0004] The working beam is generally provided with a vertical translational motion and alternately moves between two end positions, corresponding to a working position, which occurs at the lowest height, and to a rest position located at a higher height.

[0005] Such machines also comprise motor means connected to motion transmission means for the movement of said working beam.

[0006] All the movement and synchronism operations between the various machine components are managed by a dedicated electronic control unit which controls and commands the electromechanical members.

[0007] In compliance with the regulations in force, such loading machines must be provided with appropriate safety devices adapted to intervene in cases of emergency or due to faults and anomalies, locking the movement of the working beam, especially to prevent its accidental falling down, which could cause serious harm to operators and to the machine itself.

[0008] In the machine tool industry, protecting the operator so that he can operate in close proximity to the machine and working bodies in total safety is of the utmost importance.

[0009] The traditional safety devices currently in use, in case of an abnormal machine stoppage, for example due to electrical failures with power interruption, provide for the intervention of a parking brake which tries to stop the movement of translation of the working beam in the shortest possible time.

[0010] Disadvantageously, such a parking brake is always subject to slippage and wear which make the safety device unreliable over time, and in any case it requires frequent check and maintenance operations, with additional costs.

[0011] Even more disadvantageously, the parking brake comes into operation only when activated by the operator or by means of sensors that detect anomalies, but it exerts no constant control on the machine, not providing any guarantee of timely and automatic intervention and providing reduced safety and efficacy.

[0012] Moreover, on all loading machines, the motion transmission means are directly connected between the motor means and the working beam: disadvantageously, the sudden and accidental breakage of the kinematic motion transmission chain causes the unavoidable falling, without control, of the working beam in its end position located at the lowest height.

[0013] In loading machines of known type there is no safety device that can intervene to stop the falling of the beam in such a case, creating a high potential danger, first of all for the operators who are working near the machine, and in the second place also for the machine itself that is subjected to significant shocks.

[0014] A further problem of such machines derives from the vibrations that the alternating movement of the working beam induces on the frame and which limits the working speed and the productive potential.

[0015] The invention aims at overcoming these limits by providing a cartridge loading machine provided with a device which:

- ensures maximum active safety for the operators and the machine itself;
- is effective and timely in locking the working beam, preventing its disastrous falling downwards;
- is not subject to wear and is independent of further activation devices;
- reduces vibration and increases productivity.

[0016] These aims are achieved with a cartridge loading machine with balanced movement comprising:

- a support frame;
- means for feeding said cartridges;
- means for feeding components to be inserted in said cartridges;
- a working beam adapted to load said cartridges, provided with an alternating movement of translation between two upper and lower end positions;
- means for advancing and ejecting the loaded cartridges;
- motor means;
- motion transmission means,

characterized in that it comprises a dynamic balancing device connected to said working beam by kinematic connection means, so that the inertia of said balancing device is opposed to the inertia of said working beam during its alternating movement of translation between the two upper and lower end positions.

[0017] According to a first embodiment of the invention, said dynamic balancing device comprises a shaft rotating about an axis, provided with a plurality of eccentric masses.

[0018] Additionally, said motion transmission means are interposed between said motor means and said rotating shaft and said kinematic connecting means are adapted to transfer the motion from said rotating shaft to said working beam, transforming it from rotating to alternating.

[0019] In a preferred embodiment of the invention, the inertial rotation of said eccentric masses causes the upward movement of said working beam, compensating for its weight force.

[0020] In particular, said upward movement of said working beam continues up to said upper end position.

[0021] According to a further embodiment of the invention, the rotation of said eccentric masses is in phase with the translation movement of said working beam.

[0022] Advantageously, the lower end position of the working beam corresponds with the arrangement of the eccentric masses with center of gravity above the axis of said rotating shaft, while the upper end position of the working beam corresponds to the arrangement of the eccentric masses with the center of gravity below the axis of said rotating shaft.

[0023] According to a further embodiment of the invention, said kinematic connection means comprise at least one connecting rod hinged between said rotating shaft and said working beam.

[0024] Additionally, said motion transmission means comprise at least one toothed pulley fitted onto said rotating shaft and at least one toothed pulley fitted onto a drive shaft driven by said motor means, wherein said toothed pulleys are connected to one another by means of a synchronous toothed belt.

[0025] The main advantage of the invention consists in being able to ensure, in any emergency situation that results from the disconnection of the working beam with the motor means or the stoppage of the latter, by the automatic activation of safety measures essentially consisting in the automatic inertial upward movement of the working beam, the safety of workers who need access to the working area of the machine, to carry out, whenever necessary, processing, loading of material, settings, etc.

[0026] The dynamic balancing device of the working beam according to the invention also has several advantages:

- it exerts a constant control of the mechanism inertia and is independent of the control circuits more or less implemented according to the regulations in force;
- it is self-adjusting and does not require pre-settings of the control parameters and frequent maintenance;
- it is not subject to wear and requires no routine or unscheduled maintenance, resulting in cost savings;
- it maintains its effectiveness over time being independent of any clearances that might occur due to the extended use of the machine itself;
- working in a continuous way, it is effective both in case of electrical failures, and in case of mechanical failure of the components, such as in case of breaking of the kinematic transmission chain.

[0027] A further advantage consists in the reduction of vibrations and therefore the possibility of increasing the machine productivity.

[0028] Accordingly, the noise of the machine itself is also reduced, with the possibility of increasing the working speed and thus productivity.

[0029] The advantages of the invention shall appear more clearly from the following description of a preferred embodiment, made by way of an indicative and non-limiting example with reference to the figures, wherein:

Figure 1 shows a front view of a cartridge loading machine provided with a dynamic balancing device of the working beam according to the invention;
Figures 2 and 3 respectively show a front view and a plan top view of the machine in Figure 1 with a particular detail of the balancing device;
Figs. 4-6 show a side view of the machine in Fig. 1 with the dynamic balancing device in three different working positions.

[0030] With reference to the Figures, there is shown a cartridge loading machine 1, said cartridges being generally used for hunting or in the sports field, for example, for clay pigeon shooting.

[0031] Said machine 1 essentially comprises a support frame 4 on which there are provided means 5 for feeding said empty cartridges, means 6 for feeding components to be inserted in said cartridges, a working beam 3, provided with accessory devices 13 adapted to load said cartridges, means 7 for feeding and ejecting the cartridges loaded.

[0032] Said working beam 3 has a linear development and is movable between two end positions, in particular, it is provided with an alternating movement of vertical translation between an upper rest position and a lower working position, where it allows the loading of the cartridges with the dedicated devices 13.

[0033] On said machine 1 there are also provided motor means 8 and motion transmission means 9, 19, 29, adapted to allow the vertical translation movement of the working beam 3, and a control unit 14 adapted to control and monitor all the functions of the machine itself.

[0034] Said machine 1 advantageously comprises a dynamic balancing device 2 of said working beam 3.

[0035] As particularly clear from Figures 2 and 3 and from the sections of Figures 4-6, said dynamic balancing device 2 comprises a shaft 10, rotating about its own axis x and arranged parallel to said working beam 3. Said dynamic balance device 2 is connected to said working beam 3 by kinematic connection means, in particular a pair of connecting rods 12, each hinged at one end of said working beam 3.

[0036] Said connecting rods 12 are adapted to transfer the motion from said rotating shaft 10, driven by motor means 8 of the machine, to said working beam 3, thus transforming it from rotating to alternating rectilinear motion.

[0037] Said motion transmission means comprise at least one toothed pulley 9 fitted onto said rotating shaft 10 and at least one toothed pulley 19 fitted onto a drive

shaft driven by said motor means 8.

[0038] Said toothed pulleys 9, 19 are connected to one another by means of a synchronous toothed belt 29.

[0039] On said rotating shaft 10 there is provided a plurality of eccentric masses 11, sized, arranged and spaced so as to balance the weight and inertia of the working beam 3.

[0040] Said eccentric masses 11 rotate integrally with said rotating shaft 10 by generating forces adapted to oppose the direction of the vertical movement of beam 3.

[0041] In particular, the inertia of the balancing device 2, and thus the inertial rotation of said eccentric masses 11, opposes the inertia of said working beam 3, canceling the forces resulting from its translation movement and from its weight. The latter would in fact tend to cause the descent thereof in event of sudden and accidental shutdown of the motor means.

[0042] The balance between the weights of the components and the forces involved is therefore essential to ensure the constant monitoring of the movement of the working beam 3.

[0043] The particular embodiment of the dynamic balancing device 2 shown in Figures 2-6 provides for the use of a linear working beam 3 weighing about 75 kg, whose vertical excursion, i.e. the distance between its end upper and lower positions, is approximately equal to 160 mm.

[0044] On the corresponding rotating shaft 10 there are provided four eccentric masses 11, shaped as a half-disc, with a diameter of about 135 mm.

[0045] Considering the forces involved, in order to ensure the balancing of the forces resulting from the translation movement of said working beam 3, each mass 11 must have a weight of about 22 kg.

[0046] The operation of the loading machine 1 and of the relative dynamic balancing device 2 of the working beam 3 is as follows.

[0047] Said working beam 3 moves synchronized with said rotating shaft 10.

[0048] The rotation of said eccentric masses 11 is in fact in phase with the translation movement of said working beam 3: the complete movement of ascent and descent of beam 3 corresponds to a 360° rotation of the eccentric masses 11 about axis x of the rotating shaft 10.

[0049] In particular, the lower end position of the working beam 3 corresponds with the arrangement of the eccentric masses 11 with center of gravity 11' above axis x of said rotating shaft 10, as shown in Figure 4, while the upper end position of the working beam 3 corresponds to the arrangement of the eccentric masses 11 with the center of gravity 11' below axis x of said rotating shaft 10, as shown in Figure 6.

[0050] Figure 5 instead refers to an intermediate position of beam 3, for example during the upward movement.

[0051] In case of accidental shutdown of machine 1, due to power failure or breakage of the motion transmission means, the eccentric masses 11 continue to rotate, because of their inertia, around axis x of the rotating shaft 10, opposing the inertia of said working beam 3 which, subject to the weight force, would of course tend to fall down.

[0052] In this way, however, the inertial rotation of said eccentric masses 11 causes the lock of beam 3, or even its upward movement, compensating its weight force, up to reaching its upper end position, in total safety for the machine and the operators.

Claims

1. A cartridge loading machine with balanced movement (1) comprising:

   - a support frame (4);
   - means (5) for feeding said cartridges;
   - means (6) for feeding components to be inserted in said cartridges;
   - a working beam (3) adapted to loading said cartridges, provided with an alternating movement of translation between two upper and lower end positions;
   - means (7) for advancing and ejecting the loaded cartridges;
   - motor means (8);
   - motion transmission means (9, 19, 29),

   characterized in that it comprises a dynamic balancing device (2) connected to said working beam (3) by kinematic connection means, so that the inertia of said balancing device (2) is opposed to the inertia of said working beam (3) during its alternating movement of translation between the two upper and lower end positions.

2. The cartridge loading machine (1) according to claim 1, **characterized in that** said dynamic balancing device (2) comprises a rotating shaft (10) rotating about an axis (x), provided with a plurality of eccentric masses (11).

3. The cartridge loading machine (1) according to claim 1 or 2, **characterized in that** said motion transmission means (9, 19, 29) are interposed between said motor means (8) and said rotating shaft (10) and said kinematic connecting means are adapted to transfer the motion from said rotating shaft (10) to said working beam (3), transforming it from rotating to alternating.

4. The cartridge loading machine (1) according to claim 2, **characterized in that** the inertial rotation of said eccentric masses (11) causes the upward movement of said working beam (3), compensating for its weight force.

5. The cartridge loading machine (1) according to claim 4, **characterized in that** said upward movement of

said working beam (3) continues up to said upper end position.

6. The cartridge loading machine (1) according to claim 2, **characterized in that** the rotation of said eccentric masses (11) is in phase with the translation movement of said working beam (3).

7. The cartridge loading machine (1) according to claim 6, **characterized in that** the lower end position of the working beam (3) corresponds with the arrangement of the eccentric masses (11) with center of gravity (11') above the axis (x) of said rotating shaft (10), while the upper end position of the working beam (3) corresponds to the arrangement of the eccentric masses (11) with the center of gravity (11') below the axis (x) of said rotating shaft (10).

8. The cartridge loading machine (1) according to claim 1, **characterized in that** said kinematic connection means comprise at least one connecting rod (12) hinged between said rotating shaft (10) and said working beam (3).

9. The cartridge loading machine (1) according to claim 3, **characterized in that** said motion transmission means comprise at least one toothed pulley (9) fitted onto said rotating shaft (10) and at least one toothed pulley (19) fitted onto a drive shaft driven by said motor means (8), wherein said toothed pulleys (9, 19) are connected to one another by means of a synchronous toothed belt (29).

Fig. 1

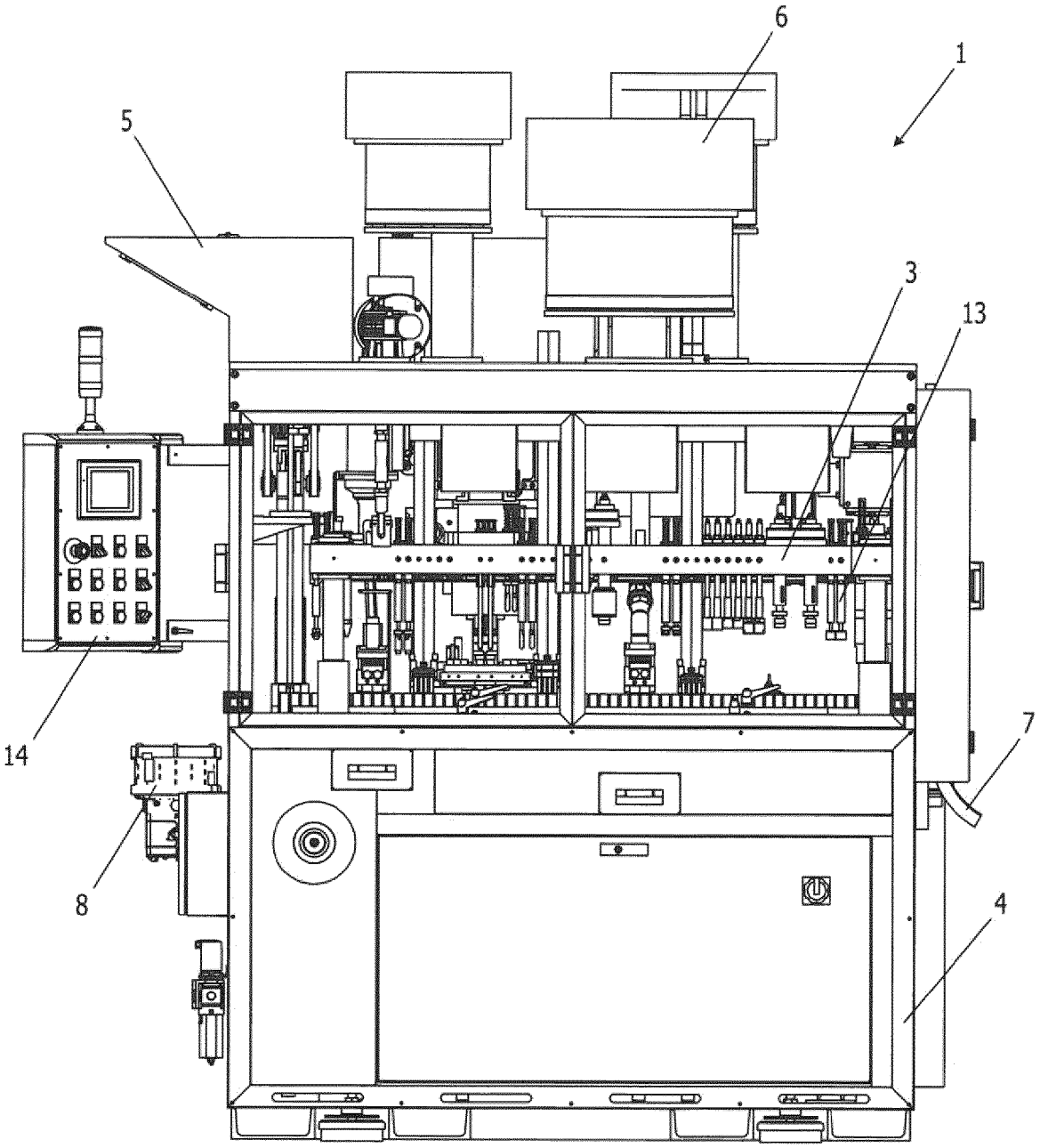


Fig. 2

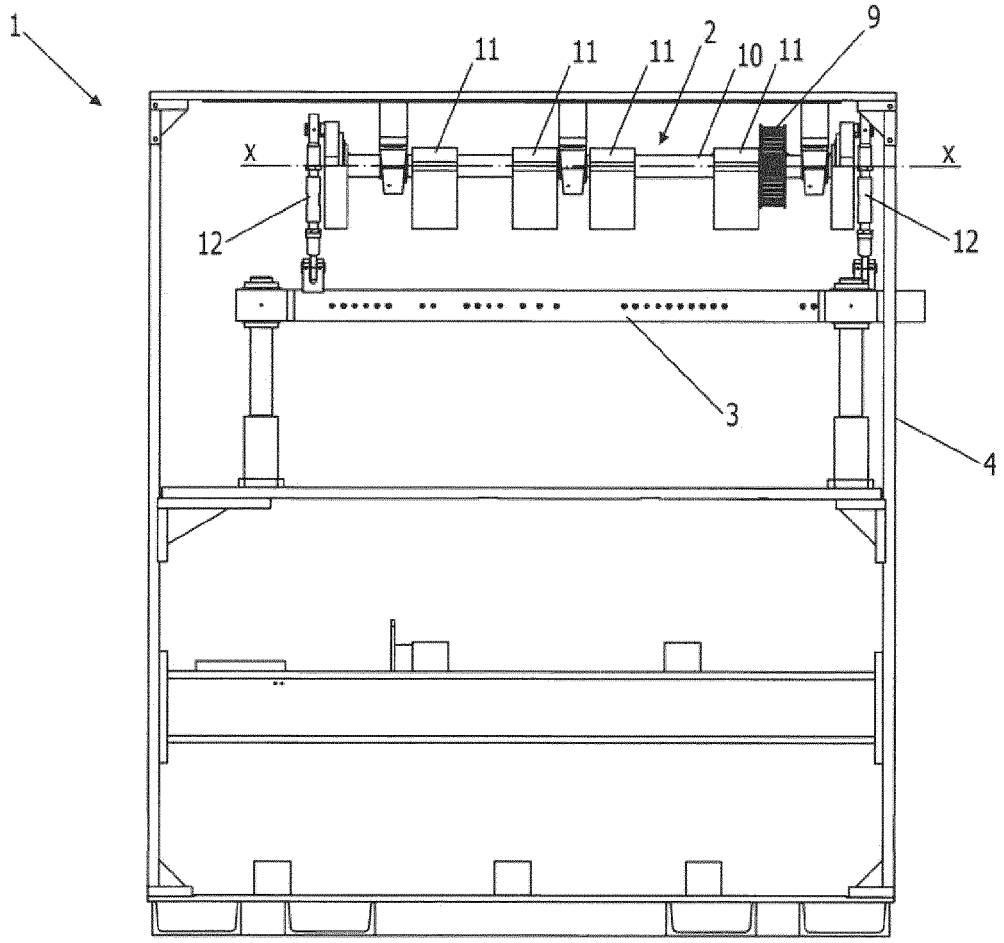


Fig. 3

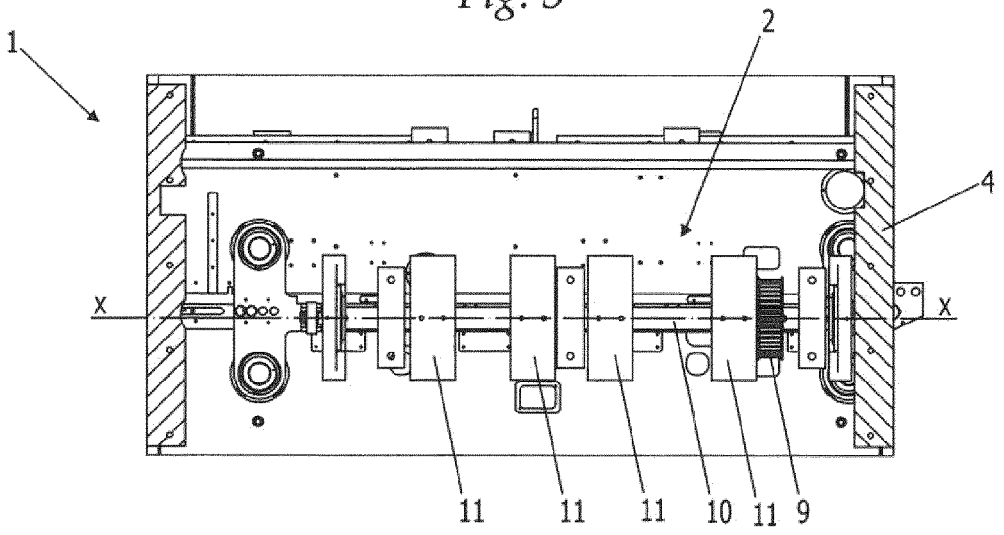


Fig. 4

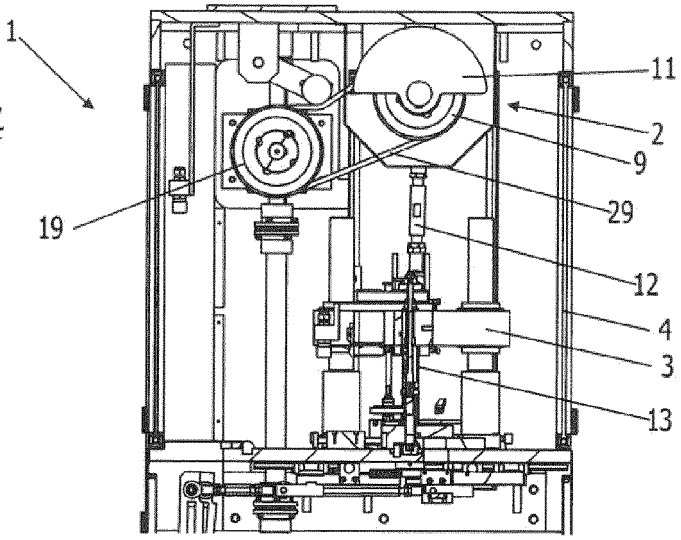


Fig. 5

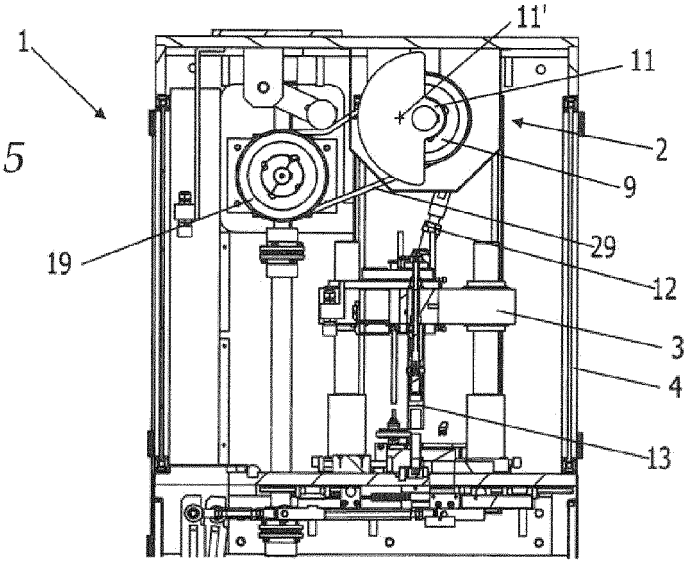
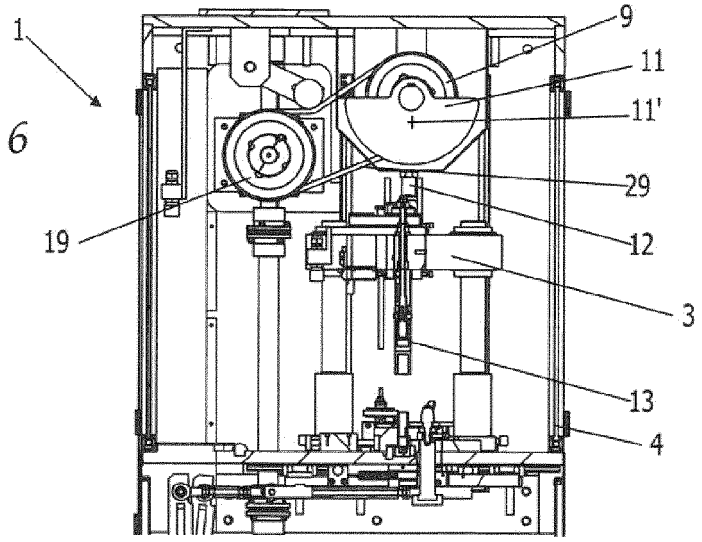


Fig. 6



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 16 7195

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2 325 642 A (TURNOCK JOSEPH E ET AL) 3 August 1943 (1943-08-03) * page 1, column 1, lines 5-14 * * page 1, column 2, lines 22-42 * * page 2, column 1, lines 7-16 * * page 2, column 2, lines 5-11 * * page 2, column 2, lines 33-51 * * page 2, column 2, lines 56-61 * * figure 1 *	1-8 9	INV. F42B33/00 B30B1/26 B30B15/00
A	US 6 067 886 A (IRWIN JERE F [US]) 30 May 2000 (2000-05-30) * the whole document *	1	
Y	US 3 150 558 A (WELCH ARTHUR L) 29 September 1964 (1964-09-29) * column 1, lines 8-17,44-65 * * figures 1,2 *	9	
A	FR 2 094 479 A5 (SAUVAGE JEAN CLAUDE) 4 February 1972 (1972-02-04) * the whole document *	1	TECHNICAL FIELDS SEARCHED (IPC) F42B B30B
A	US 1 602 334 A (CANDEE ZENAS P) 5 October 1926 (1926-10-05) * the whole document *	1	
A	US 3 483 792 A (WILLIAMS CHARLES F) 16 December 1969 (1969-12-16) * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 June 2014	Lahousse, Alexandre

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 16 7195

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-06-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2325642 A	03-08-1943	NONE	
US 6067886 A	30-05-2000	NONE	
US 3150558 A	29-09-1964	NONE	
FR 2094479 A5	04-02-1972	NONE	
US 1602334 A	05-10-1926	NONE	
US 3483792 A	16-12-1969	NONE	

EPO FORM P0459

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