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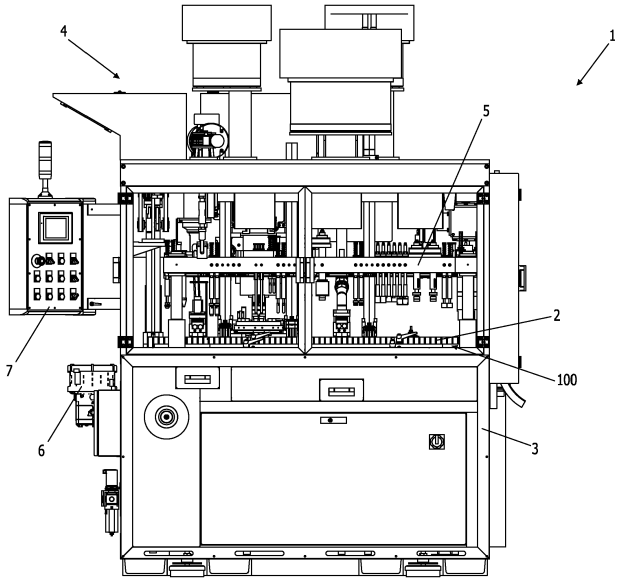
(54) **Cartridge loading machine with quick caliber change system**

(57) The invention concerns the field of cartridge production and loading lines, and relates to a loading machine (1) for cartridges (2) with quick caliber change system, where said machine (1) comprises: a frame structure (3); feed means (4) for a plurality of empty cartridges (2); an operating beam (5); feed and conveying means (100) of said cartridges (2); ejection means for the loaded cartridges; motor means (6) for activation of kinematic mechanisms; a control unit (7).

Said and conveying means (100) comprise:
- a race (8) adapted to support and allow feed of said cartridges (2) in a given direction;
- a conveyor guide (9), arranged parallel to said race (8), adapted to convey said cartridges (2) along said race (8);
- an abutment bar (10), arranged parallel to said race (8), symmetrical with respect to said conveyor guide (9), adapted to act as vertical support and stop surface for said cartridges (2) in production;
- shifting means (11) of said abutment bar (10) in transverse direction with respect to the direction of feed of said cartridges;
- interchangeable regulating means (12), adapted to cooperate resting against said abutment bar (10) to selectively define an appropriate distance between said bar (10) and said race (8) as a function of the caliber (c, c1, c2) of said cartridges (2).

Fig. 1



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Description

[0001] The invention concerns the field of cartridge production and loading lines, in particular for cartridges used in the sporting, civil and military sector.

[0002] More in detail, the invention relates to a cartridge loading machine with quick caliber change system, equipped to receive empty cartridges, fill them with the necessary inner components, seal them and manufacture them.

[0003] According to prior art, cartridge loading machines substantially comprise a frame structure, feed means for empty cartridges, an operating beam that supports ancillary means responsible for loading and in-line processing of said cartridges, feed and conveying means of the cartridges during loading thereof, ejection means for the loaded cartridges.

[0004] According to the prior art, cartridge feed and conveying means generally comprise:

- a race on which the casings of the empty cartridges are positioned and fed, resting on the base with the mouth facing upward, into which the ancillary loading means insert in sequence the various components that will fill and complete the whole cartridge;
- a comb-shaped conveyor guide, arranged parallel to said race along the side thereof facing the front of the machine and the operator, adapted to convey said empty cartridges along said race, to position them, according to the various filling steps, under the respective ancillary loading means;
- an abutment bar, arranged parallel to said race, symmetrical with respect to said guide, adapted to act as vertical support surface for said cartridges during the filling steps.

[0005] In particular, said abutment bar is stably and permanently fastened to said loading machine.

[0006] The main disadvantages of these cartridge loading machines concern the difficulty of preparing the machine during possible caliber changes of the cartridges being produced.

[0007] The geometry of the machine, and in particular the mutual distances between the race on which the cartridges travel, the conveyor guide and the abutment bar, are in fact defined with extreme precision and essentially depend on the caliber of the cartridges being produced.

[0008] A same machine can however be designed to produce cartridges of different calibers, for example cal. 12, cal. 16, cal. 20, and therefore, when changing from one caliber to another, it is necessary to vary the positions of the aforesaid components by millimeters, to maintain the axis of the cartridge unchanged with respect to the operating devices and allow correct operation of the machine and kinematic coordination of all the moving parts, thereby preventing undesirable misalignment, above all between empty cartridges and ancillary loading means.

[0009] In the conventional machines described above, to switch from the production of cartridges of a given caliber to cartridges of another caliber, the operator requires to perform the following operations manually:

- move the conveyor guide back, with respect to the race of the cartridges, loosening the respective fastening means;
- move the abutment bar away from the race, removing, one by one, all the respective fastening means;
- distribute the new empty cartridges along the race;
- reposition the abutment bar and the conveyor guide respectively using measurement and alignment instruments adapted to ensure perfect parallelism and correct distance between bar, race and guide;
- stably fasten the bar to the machine and the guide to the kinematic movement mechanisms, repositioning and clamping the respective fastening means.

[0010] However, all these operations require a substantial amount of time, even in the order of an hour, giving rise to long production stops of the machine, with consequent slow down and reduction in productivity, causing financial losses.

[0011] Operators also require using different instruments to measure and check alignment and compliance with the distance between components of the machine, with evident complications of setting up and adjustment before operations can be resumed.

[0012] These operations also require to be carried out in the event of problems and machine stops due to malfunction, each time it is necessary, for example, to take action to position the cartridges in proximity of the race, or to take action on the ancillary loading means.

[0013] Even more unfavorably, operating for long periods of time in proximity of the machine, although stopped, can be hazardous for operators having to work under the heavy operating beam.

[0014] The invention intends to overcome these limits by producing a loading machine provided with feed and conveying means of the cartridges that speed up and simplify operations to prepare the machine during caliber changes of the cartridges to be manufactured.

[0015] A further aim of the invention is to produce a loading machine that is safe for operators, efficient and productive.

[0016] These aims are achieved with a loading machine for cartridges with quick caliber change system, wherein said machine comprises:

- a frame structure;
- feed means for a plurality of empty cartridges having a given caliber;
- an operating beam provided with ancillary means adapted to load and manufacture said cartridges;
- feed and conveying means of said cartridges during loading thereof;
- ejection means for the loaded cartridges;
- motor means for activation of kinematic mecha-

nisms;

- a control unit;

wherein said feed and conveying means of said cartridges comprise:

- a race adapted to support and allow feed of said cartridges in a given direction according to a rectilinear trajectory;
- a conveyor guide, arranged parallel to said race along the side thereof facing the front of the machine, adapted to convey said cartridges along said race;
- an abutment bar, arranged parallel to said race, symmetrical with respect to said conveyor guide, adapted to act as a vertical support and stop surface for said cartridges in production,

characterized in that said feed and conveying means of said cartridges further comprise:

- shifting means of said abutment bar in transverse direction with respect to the direction of feed of said cartridges;
- interchangeable regulating means, adapted to cooperate resting against said abutment bar to selectively define an appropriate distance between said bar and said race as a function of the caliber of said cartridges.

[0017] According to a first embodiment of the invention, said shifting means of said abutment bar are automatic.

[0018] In a particular embodiment of the invention, said shifting means of said abutment bar comprise a pair of pneumatic cylinders.

[0019] According to a further embodiment of the invention, said interchangeable regulating means comprise a plurality of spacers, acting as abutment surface for said bar and having a thickness adequate for the distance to be maintained between said bar and said race.

[0020] In particular, said spacers are stably associable with said frame structure by means of reversible fastening means.

[0021] Moreover, said loading machine comprises housings adapted to receive and retain said spacers in stable position.

[0022] Advantageously, each spacer comprises a foot having dimensions corresponding to the dimensions of said housings, and a body adapted to act as support for said abutment bar, wherein said body has a different thickness with respect to the foot, and said thickness is selected as a function of the distance to be maintained between said bar and said race.

[0023] According to a possible embodiment of the invention, said conveyor guide comprises a first and a second element, wherein said first element moves with translational motion in transverse direction to the direction of movement of said cartridges and is adapted to act, in cooperation with said abutment bar, as stopping and contact element for said cartridges during loading, and said second element moves with translational and rotational motion and is adapted to shift said cartridges from one operating position to the other, at said ancillary means.

[0024] In particular, said first and second element are both provided with a comb-shaped edge facing the cartridges.

[0025] The main advantage of the invention consists in the fact that the shifting means of the conveyor bar and the interchangeable regulating means allow quick and accurate preparation of the machine at each caliber change of the cartridges in production and ensure maximum safety for operators working under the operating beam and for the machine itself and its components.

[0026] In particular, a further advantage consists in the possibility of easy access to the inside of the loading machine, in particular in proximity of the feed and conveying means of the cartridges.

[0027] Moreover, by optimizing the preparation times of the machine, which are drastically reduced, there is a considerable increase in production, resulting in financial benefits.

[0028] Automation of the shifting means of the abutment bar further simplifies the step to replace the regulating means.

[0029] The structure of the spacers, in cooperation with the specific housings provided on the frame and into which they can be inserted, makes them self-centering, stable and acting as perfect support and stop surface for the abutment bar, which thus always remains perfectly aligned with the race of the cartridges and at the correct distance therefrom to take account of the caliber of the cartridges being filled.

[0030] The use of a pair of spacers also ensures maximum precision and maximum parallelism between abutment bar and race, for the entire length thereof.

[0031] The possibility of choosing spacers that, due to their different thickness, have a regulating function makes the machine very flexible and adaptable to any market demand, for cartridges with very different calibers.

[0032] The conveyor guide provided with two superimposed elements with differentiated movement is very advantageous. In particular, the first element provided with translational motion allows the cartridges to remain even more stable during the loading steps, coming into contact against the abutment bar while the cartridges are stopped, and retracting while the second element translates along the race.

[0033] The advantages of the invention will be made clearer below with the description of a preferred embodiment, provided by way of non-limiting example, and with the aid of the drawings wherein:

Fig. 1 represents, in a front view, a cartridge loading machine provided with a quick caliber change system according to the invention;

Figs. 2 and 4 represent, in a transverse cross section along a vertical plane, the machine of Fig. 1, respectively in two operating conditions of the quick caliber change system, with some mechanical components omitted for clarity;

Figs. 3 and 5 represent, in a transverse cross section along a horizontal plane, the loading machine respectively of Fig. 2 and Fig. 4, with some mechanical components omitted for clarity;

Fig. 6 represents, in a top plan view, a detail of the machine of Fig. 1 in operating condition;

Fig. 7 represents, in a transverse cross section along a vertical plane, the main components forming the quick caliber change system according to the invention;

Figs. 8 and 9 represent, in a schematic cross section with proportions intentionally deformed for clarity, the main components that form the quick caliber change system, during processing of cartridges with two different calibers.

[0034] With reference to the figures, there is shown a loading machine 1 for cartridges 2, generally used for hunting or in the sporting sector, for example for clay pigeon shooting.

[0035] Said machine 1 essentially comprises a frame structure 3 on which there are provided feed means 4 for said empty cartridges 2 having a given caliber c, an operating beam 5 provided with ancillary devices adapted to load said cartridges 2, feed and conveying means 100 of said cartridges 2 during loading thereof, ejection means for the loaded cartridges, motor means 6 for activation of all the kinematic mechanisms and a control unit 7 adapted to monitor all the functions of the machine 1.

[0036] In particular, said feed and conveying means 100 of said cartridges 2 comprise:

- a race 8 adapted to support and allow feed of said cartridges 2 in a given direction according to a rectilinear trajectory;
- a conveyor guide 9, shown in Figs. 6 and 7, arranged parallel to said race 8 along the side thereof facing the front of the machine 1 and the operator, adapted to convey said cartridges 2 along said race 8;
- an abutment bar 10, arranged parallel to said race 8, symmetrical with respect to said conveyor guide 9, adapted to act as vertical support and stop surface for said cartridges 2 in production.

[0037] In all the variants shown, said conveyor guide 9 comprises a first 19 and a second 29 element, both having a comb-shaped edge facing the cartridges and at least partly superimposed on one another.

[0038] Said first element 19, arranged at a lower height, moves with translational motion in transverse direction to the direction of movement of said cartridges 2 and is adapted to act, in cooperation with said abutment bar 10, as stopping and contact element for said cartridges 2 during loading thereof.

[0039] Said second element 29, instead, moves with translational and rotational motion and is adapted to shift said cartridges 2 on the race from one operating position to the other at the ancillary devices of the operating beam 5, when passing from one filling step to the other of these cartridges, making use of the concave housings arranged along the comb-shaped edge thereof.

[0040] Besides the automated movements described above, said first 19 and said second 29 element are reversibly associated with the kinematic mechanisms of said loading machine 1, so that, simply by loosening the respective fastening means 16, 17 thereof, it is possible to move said elements 19, 29 away from said race 8, during ordinary maintenance and each caliber change of the cartridges 2 in production.

[0041] In alternative embodiments with lower performance, said conveyor guide 9 can comprise only the rotating and translating element 29, without the use of the element 19 for stopping the cartridges during the loading steps.

[0042] With reference to Figs. 2-5 and 7, in order to facilitate the operations to prepare the machine 1 during each caliber change of the cartridges 2 in production, said feed and conveying means 100 of said cartridges 2 also comprise:

- selectively activatable shifting means 11 of said abutment bar 10 in transverse direction with respect to the direction of feed of said cartridges 2;
- interchangeable regulating means 12, adapted to cooperate resting against said abutment bar 10 to selectively define an appropriate distance between said bar 10 and said race 8 as a function of the caliber c of said cartridges 2.

[0043] In particular, said shifting means 11 of said abutment bar 10 are automated and can comprise, as for example in the variant shown, a pair of pneumatic cylinders 13, distributed along said bar 10 and operable by means of the control unit 7 provided on the machine 1.

[0044] Said interchangeable regulating means 12 comprise a plurality of pairs of spacers 14 adapted to be inserted between said abutment bar 10 and said race 8, to maintain an appropriate distance therebetween, defined on the basis of the caliber c of the cartridges 2 in production.

[0045] The spacers 14 of each pair, in fact, have a suitable thickness s to define the distance to be imposed between said bar 10 and said race 8: at each caliber change of the cartridges 2, this distance must be changed and consequently a further pair of spacers 14 with appropriate thicknesses s is selected.

[0046] Said loading machine 1 comprises housings 15 adapted to retain said spacers 14 in a stable position and, to increase the stability and safety of the feed and conveying means 100 of said cartridges 2, said spacers 14 are also associated with the frame structure 3 of said machine 1 by means of reversible fastening means, for example screws.

[0047] As shown in the sections of Figs. 7, 8 and 9, each spacer 14 comprises a foot 14' having dimensions

corresponding to the dimensions of said housings 15, and a body 14", against which said abutment bar 10 rests and abuts, having a different thickness s with respect to the foot 14', and said thickness s is selected adequately as a function of the distance to be maintained between said bar 10 and said race 8.

[0048] Figs. 8 and 9 shows, with intentionally deformed proportions, some components of the quick caliber change system, in two possible operating conditions, in particular for cartridges 2 of two different calibers c1, c2.

[0049] In the Fig. 8, the cartridge 2 in production has a smaller caliber c1, for example cal. 12, and consequently, in order for the abutment bar 10 to rest against the cartridge 2, the space between this bar and the race 8 of the cartridges 2 must be minimized and therefore a spacer 14 having a body 14" of limited thickness s1 is used.

[0050] Instead, in Fig. 9 the cartridge 2 in production has a larger caliber c2, for example cal. 20, and therefore the abutment bar 10 must be positioned slightly retracted with respect to the front of the machine 1 and in the condition shown in Fig. 8: in this case a spacer 14 having a body 14" with increased thickness s2 must be used in order to move the abutment bar 10 slightly farther from the race 8 of the cartridges 2 and offset the increase in caliber c2 of the new cartridge 2 to be manufactured.

[0051] Operation of the loading machine 1 and, in particular, the method of preparing the machine 1 during each caliber change of the cartridges 2 is as follows.

[0052] Firstly, after stopping the machine, the operator must move the conveyor guide 9 away from the race 8 of the cartridges: standing in front of the machine 1 and loosening the respective fastening means 16, 17, with a simple movement the operator slides the conveyor guide 9 towards him/her, releasing the race 8 from any obstructions.

[0053] Operating the pneumatic cylinders 13 directly through the control unit 7, the former retract, drawing with them the abutment bar 10 associated therewith, while maintaining it perfectly parallel to the sliding guide 8 of the cartridges at all times.

[0054] Subsequently, the operator selects a pair of spacers 14, evaluating the thicknesses s, s1, s2 of the respective bodies 14" based on the caliber c, c1, c2 of the cartridges 2 to be processed subsequently, and positions them in the housings 15 produced in the frame 3 of the loading machine 1 parallel to the race 8 of the cartridges.

[0055] After fastening the feet 14' of the spacers 14 stably by means of screws, the operator once again operates the pneumatic cylinders 13 so that they push the abutment bar 10 forward, until it rests and abuts against the body 14" of the spacers.

[0056] Finally, without requiring to check and measure perfect alignment between abutment bar 10 and race 8 using instruments, the operator only requires to move the conveyor guide 9 back towards the race 8, after having positioned some casings of the new caliber, to be used as gauge block, and to clamp the respective fastening means 16, 17 once again.

[0057] As a result of the caliber change system according to the invention, these operations to prepare the loading machine 1 can be carried out in very short times, in the order of a few minutes, without the requiring verification and alignment instruments, speeding up and considerably simplifying operations that with conventional technologies require hours, as well as skilled personnel and appropriate instruments.

Claims

1. A loading machine (1) for cartridges (2) with quick caliber change system, where said machine (1) comprises:

   - a frame structure (3);
   - feed means (4) for a plurality of empty cartridges (2) having a given caliber (c, c1, c2);
   - an operating beam (5) provided with ancillary means adapted to load and manufacture said cartridges (2);
   - feed and conveying means (100) of said cartridges (2) during loading thereof;
   - ejection means for the loaded cartridges;
   - motor means (6) for activation of kinematic mechanisms;
   - a control unit (7);

   wherein said feed and conveying means (100) of said cartridges (2) comprise:

   - a race (8) adapted to support and allow feed of said cartridges (2) in a given direction according to a rectilinear trajectory;
   - a conveyor guide (9), arranged parallel to said race (8) along the side thereof facing the front of the machine (1), adapted to convey said cartridges (2) along said race (8);
   - an abutment bar (10), arranged parallel to said race (8), symmetrical with respect to said conveyor guide (9), adapted to act as vertical support and stop surface for said cartridges (2) in production, **characterized in that** said feed and conveying means (100) of said cartridges (2) also comprise:
   - shifting means (11) of said abutment bar (10) in transverse direction with respect to the direction of feed of said cartridges (2);
   - interchangeable regulating means (12), adapted to cooperate resting against said abutment bar (10) to selectively define an appropriate distance between said bar (10) and said race (8) as a function of the caliber (c, c1, c2) of said cartridges (2).

2. The loading machine (1) for cartridges (2) according to claim 1, **characterized in that** said shifting means

(11) of said abutment bar (10) are automatic.

3. The loading machine (1) for cartridges (2) according to claim 2, **characterized in that** said shifting means (11) of said abutment bar (10) comprise a pair of pneumatic cylinders (13).

4. The loading machine (1) for cartridges (2) according to claim 1, **characterized in that** said interchangeable regulating means (12) comprise a plurality of spacers (14), acting as abutment surface for said bar (10) and having a thickness (s, s1, s2) adequate for the distance to ne maintained between said bar (10) and said race (8).

5. The loading machine (1) for cartridges (2) according to claim 4, **characterized in that** said spacers (14) are stably associable with said frame structure (3) by means of reversible fastening means.

6. The loading machine (1) for cartridges (2) according to claims 4 or 5, **characterized in that** it comprises housings (15) adapted to receive and to retain said spacers (14) in a stable position.

7. The loading machine (1) for cartridges (2) according to claim 6, **characterized in that** each spacer (14) comprises a foot (14') having dimensions corresponding to the dimensions of said housings (15), and a body (14"), adapted to act as support for said abutment bar (10), wherein said body (14") has a different thickness (s, s1, s2) with respect to the foot (14'), and said thickness (s, s1, s2) is selected as a function of the distance to be maintained between said bar (10) and said race (8).

8. The loading machine (1) for cartridges (2) according to claim 1, **characterized in that** said conveyor guide (9) comprises a first (19) and a second (29) element, wherein said first element (19) moves with translational motion in transverse direction to the direction of movement of said cartridges (2) and is adapted to act, in cooperation with said abutment bar (10), as stopping and contact element for said cartridges (2) during loading, and said second element (29) moves with translational and rotational motion and is adapted to shift said cartridges (2) from one operating position to the other, at said ancillary means.

9. The loading machine (1) for cartridges (2) according to claim 8, **characterized in that** said first (19) and second (29) element are provided with a comb-shaped edge facing the cartridges.

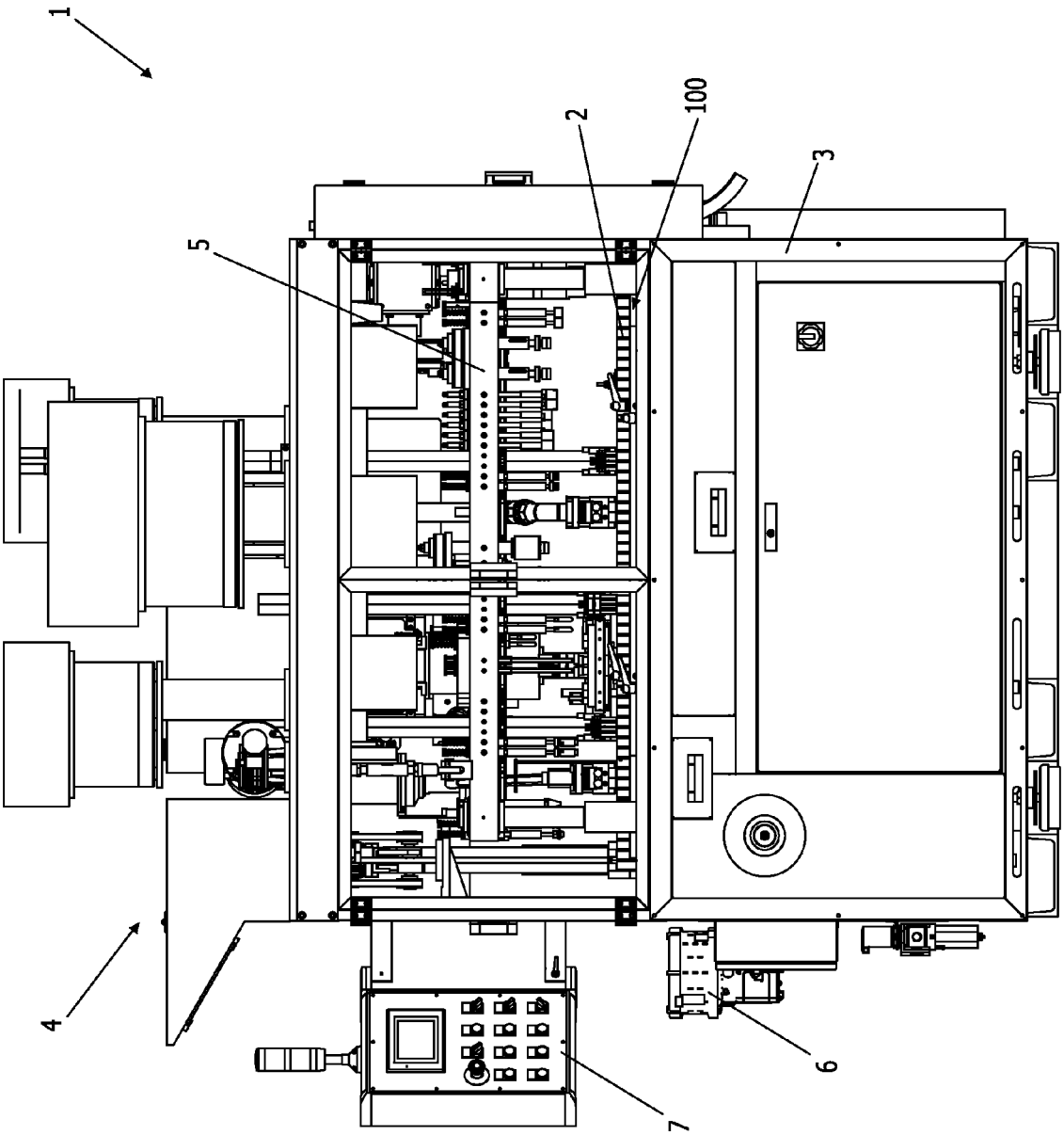

Fig. 1

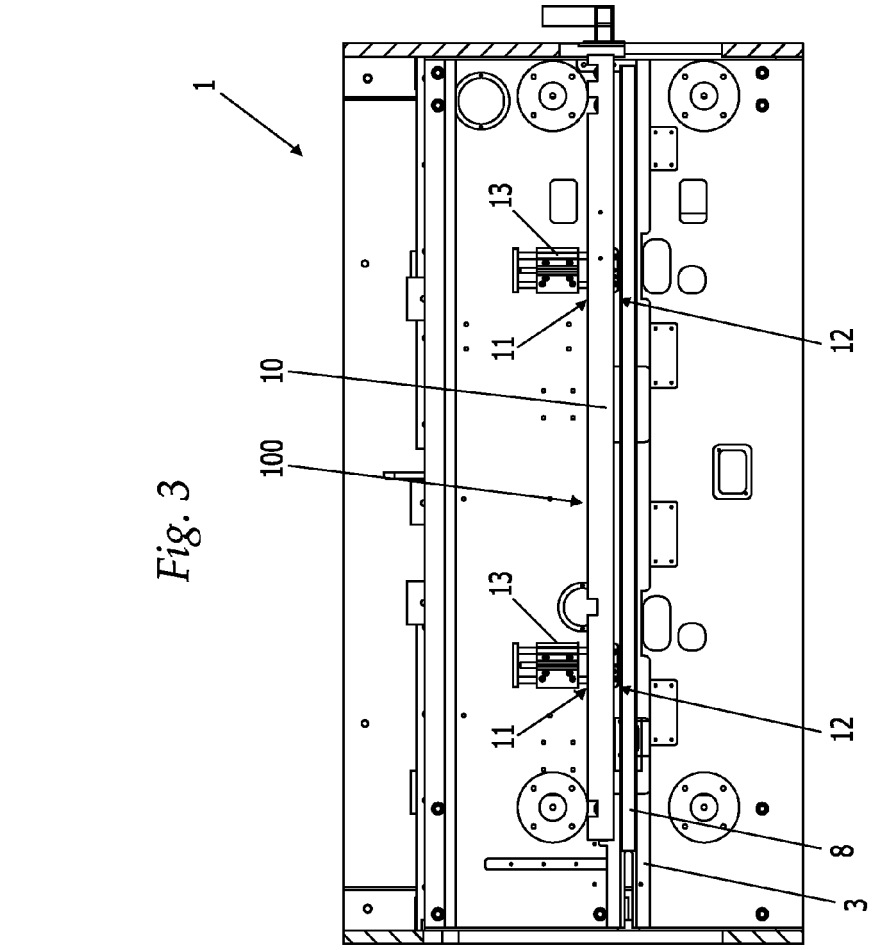

Fig. 3

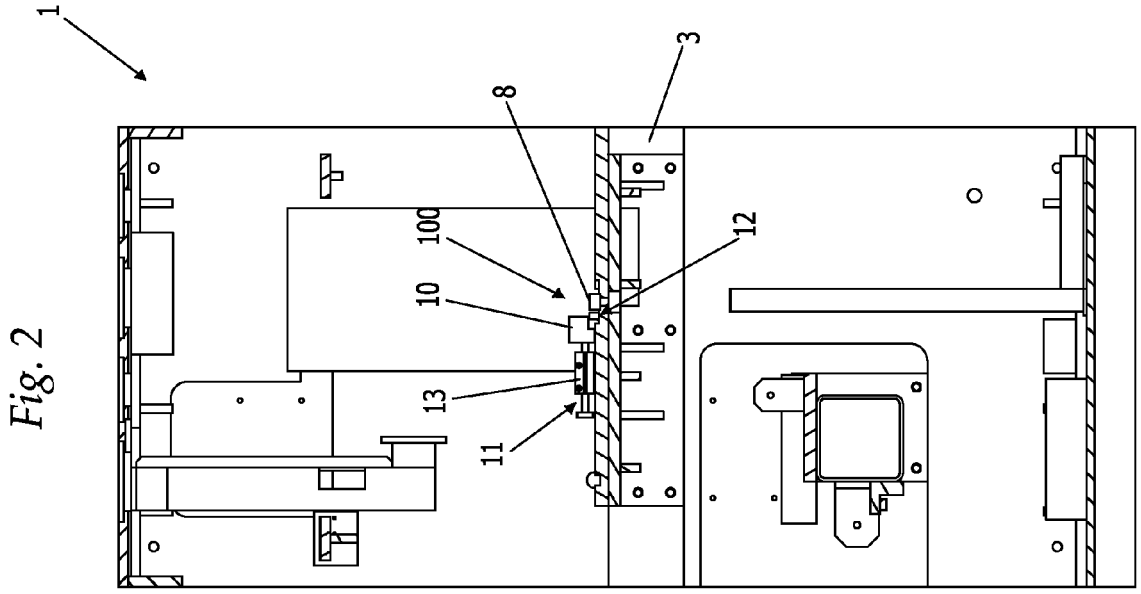

Fig. 2

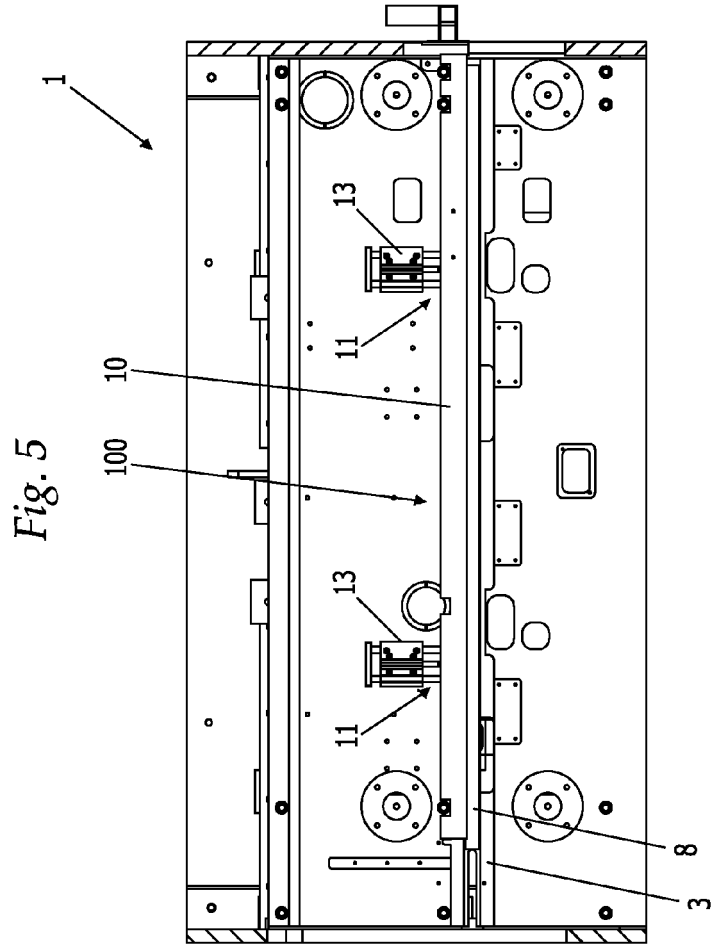

Fig. 5

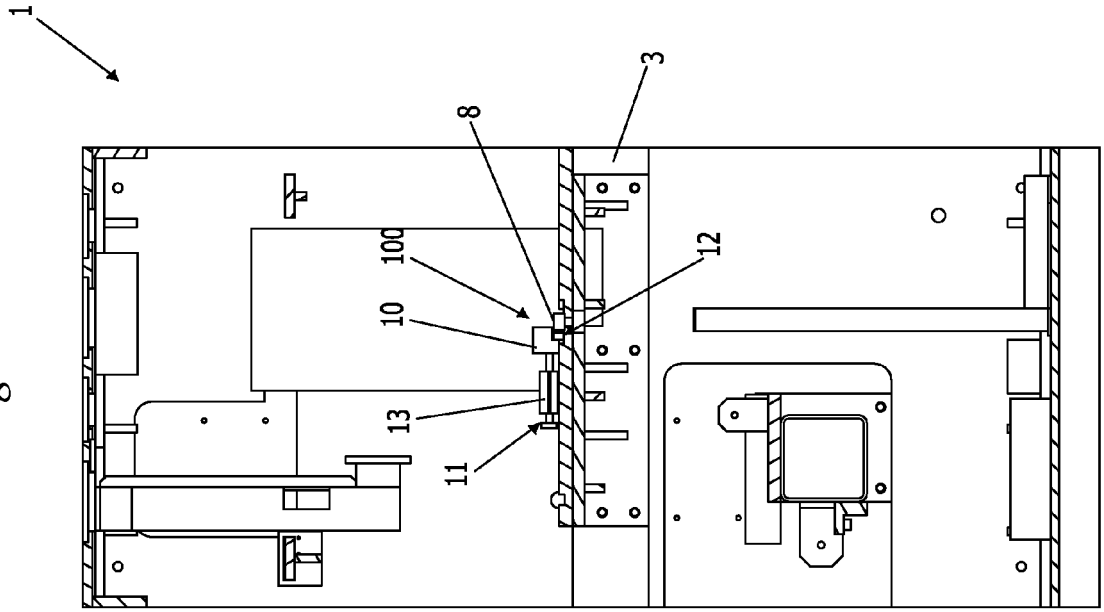

Fig. 4

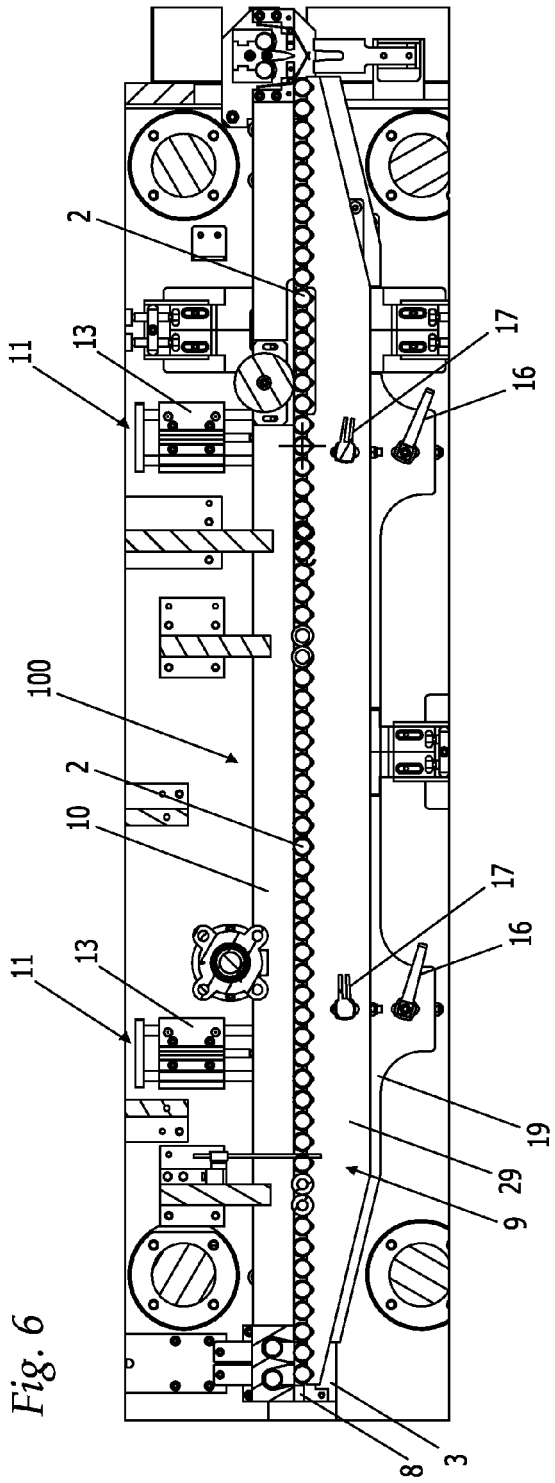

Fig. 6

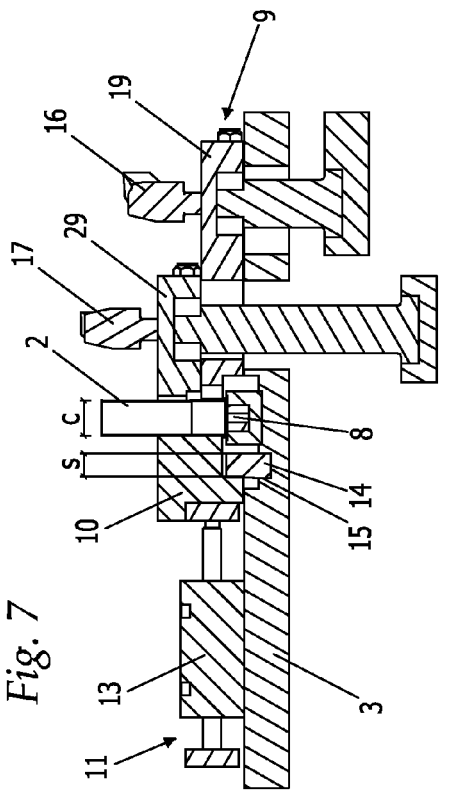

Fig. 7

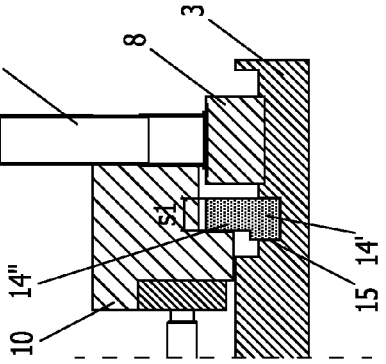

Fig. 8

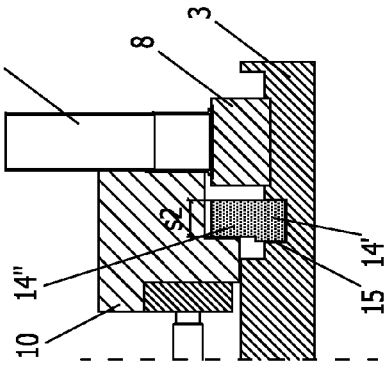

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 7140

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2013/139675 A1 (BAXTER TIMOTHY R [US] ET AL) 6 June 2013 (2013-06-06) * abstract * * paragraph [0064] - paragraph [0066] * * paragraph [0071] - paragraph [0072] * * figures *	1-9	INV. F42B33/00 F42B33/02
A	US 4 020 737 A (RANSON CHARLES R) 3 May 1977 (1977-05-03) * column 5, line 55 - column 6, line 24 * * figures *	1-9	
A	FR 950 182 A (M. GEORGES-HENRI EUVELINE) 20 September 1949 (1949-09-20) * the whole document *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)
F42B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 September 2014	Vermander, Wim

CATEGORY OF CITED DOCUMENTS

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82