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(54) Automatic loader of ferrules for brushes and relative method to feed ferrules

(57) Automatic loader (10) of ferrules (11) and relative method to feed ferrules (11) to be fed one at a time to a station (27) to assemble brushes (12), said ferrules (11) consisting of a ring including means able to define a correct assembly position, said loader (10) including a feed assembly (19) equipped with a basket (20) comprising at least a guide channel (23) associated with a first conveyor belt (30), said loader comprising optical detection means (29) to detect the orientation of the ferrules (11) connected to a control unit (31), and means (24) to pick up the ferrules (11) governed by said control unit (31), said pick-up means (24) being able to pick up at least incorrectly oriented ferrules (11b) from said first belt (30) to deposit them on a discharge belt (25) after having rotated them into the correct position.

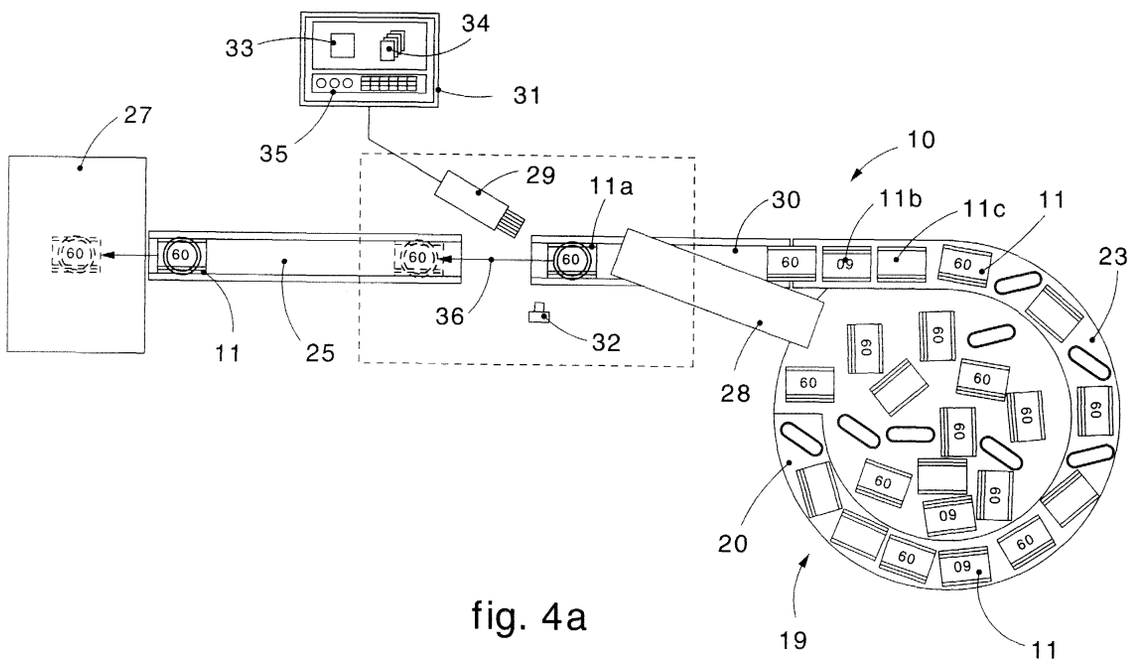

fig. 4a

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Description

FIELD OF THE INVENTION

[0001] The invention concerns an automatic loader of ferrules for brushes, used in the brush production industry to feed correctly oriented ferrules to a ferrule-assembly machine wherein a bundle of bristles and possibly a handle is associated with the ferrules.

[0002] The invention also concerns the relative method to feed ferrules to a ferrule-assembly machine for brushes.

[0003] The invention is applied to brushes of a substantially flat type wherein the ferrule consists of a metal or plastic strip, closed in a ring substantially of any shape: rectangular, round, polygonal, etc.

BACKGROUND OF THE INVENTION

[0004] In the brush production industry, the state of the art includes ferrule-assembly machines which are fed separately with bundles of bristles, which constitute the end part of the brush, and with ferrules onto which the bundles of bristles are attached, normally glued.

[0005] The ferrules normally consist of metal or plastic strips closed in a ring, the edges overlapping in correspondence with one of the narrow sides so as to constitute a closing ridge.

[0006] The ferrules generally have perimeter ribs and writings or markings to identify the brush, such as the size, brand, type of bristle or other information, which define a univocal assembly position for the bundle of bristles and the handle with respect to the ferrule itself.

[0007] The function of the ribs is both to stiffen the ferrule and as an anchor for the glue used to attach the bristles to the ferrule. The ribs determine univocally the side of the ferrule into which the bundle of bristles is inserted and the side into which the handle is inserted.

[0008] At present, the ferrules are usually fed into the loader of the ferrule-assembly machine manually by a worker who positions them, one at a time, in the loader; this operation takes a long time and entails high production costs.

[0009] One conventional solution provides to use a vibrating feeder which feeds the ferrules, aligned on a belt, one by one; there are means which detect the orientation of the ferrule on the belt and expulsion means which intervene in the event that the ferrule is not correctly oriented, returning it to the feeder.

[0010] Although this solution is very valid in that it makes it much faster to feed the ferrules, compared with the manual method, it is not completely satisfactory since it entails limited productivity in the event that there is a high percentage of incorrectly oriented ferrules among the total of those fed. Moreover, the system is not able to adapt to every type and every size of ferrule, which means it is necessary to make corrections and modifications every time the model is changed; this makes production times longer and increases the costs.

[0011] The present Applicant has devised and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0012] The invention is set forth and characterized in the respective main claims, while the dependent claims describe other characteristics of the main embodiment.

[0013] The purpose of the invention is to provide a completely automatic loader of ferrules for brushes, able to guarantee that the ferrules, correctly positioned and oriented, are fed at high speed to a ferrule-assembly machine.

[0014] Another purpose is to achieve a universal loader suitable to feed ferrules of any type, material, shape and size, varying in width at least from 20 to 100 mm and in height at least from 30 to 50 mm.

[0015] The invention allows to feed both metal ferrules made of brass, copper, stainless steel or other, made from sheet metal closed in a ring, and also ferrules made of plastic material. The invention allows to considerably increase the productivity of the ferrule-assembly machine and there is substantially no need for workers to be present; this consequently reduces the overall costs of making up the brushes.

[0016] Moreover, the loader is simple to make, economical and is very limited in bulk and energy consumption.

[0017] The invention is applied in cooperation with usual feeder assemblies, whether they be of the vibration type or not; only simple, quick and inexpensive modifications are required.

[0018] The automatic loader according to the invention has a guide channel associated with a conveyor belt, which is connected to a container/feeder from which the ferrules are fed, separate and one by one, with one wide face resting on the plane of the belt.

[0019] Upstream of the entrance to the feeder of the ferrule-assembly machine, the loader according to the invention comprises optical detection means able to recognize the orientation of the ferrules and to identify the ferrules which are not correctly oriented.

[0020] The detection means are associated with pick-up means which are activated in the event that an incorrectly oriented ferrule is identified.

[0021] In a preferential embodiment, the pick-up means consist of suction cup means able to pick up the incorrectly oriented ferrules from the conveyor belt and to rotate them through 180° to allow them to be fed correctly to the ferrule-assembly machine. In another preferential embodiment, the pick-up means are activated for every ferrule, in order to pick up the ferrules from a first feeder belt and to deposit them on a second discharge belt associated with the loader of the ferrule-assembly machine.

[0022] If the ferrule is already correctly oriented, it is simply transferred onto the discharge belt; otherwise, it is first rotated by 180° and then deposited on the discharge belt.

[0023] In this embodiment, every time a ferrule reaches a set position with respect to the optical detection means, the conveyor belt stops, until the cycle to pick up and discharge the ferrule is complete.

[0024] This embodiment allows to make the loading times of the ferrules independent of the working times of the ferrule-assembly machine, preventing problems in the event that blockages or downtimes of the machine occur during the steps of inserting the bristles or the handle into the ferrules.

[0025] In the event that the conveyor belt is full of ferrules, sensor means intervene to stop the vibrating feeder.

[0026] In the event that the ferrule is positioned upside down on the conveyor belt, for example with the markings not visible, the optical detection means recognize this condition and activate discharge means able to pick up the ferrule and return it to the feeder.

[0027] The functioning of the loader according to the invention is governed by the commands of a control unit equipped with memory means which contain sample images related to a plurality of types of ferrule which can be used with the loader.

[0028] At the start of the cycle, an operator selects the type of ferrule being worked, so that the optical detection means are able to compare the ferrules advancing on the conveyor belt with the sample image selected, and to recognize conditions of correct or incorrect orientation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The attached Figures are given as a non-restrictive example, and show some preferential embodiments of the invention wherein:

Fig. 1	is a schematic view of an assembled brush, complete with handle, bundle of bristles and ferrule;
Fig. 2	is a schematic view of a ferrule of the brush in Fig. 1, with an enlarged detail;
Fig. 3	is a part and schematic view from above of an automatic loader according to the invention;
Figs. 4a, 4b and 4c	show a view from above of the automatic loader according to the invention in three different working conditions;
Fig. 5	is a side view of the automatic loader in Fig. 4a.

DETAILED DESCRIPTION OF PREFERENTIAL EMBODIMENT

[0030] The reference number 10 denotes generally an automatic loader of ferrules 11 which is applied in making brushes 12 of a substantially flat type comprising a ferrule 11 to which a bundle of brushes 13 is solidly associated on one side and a handle 14 on the other.

[0031] The ferrule 11, in the case shown here, is of the type made from a strip of metal sheet closed in a ring with the edges overlapping along one of the narrow sides so as to constitute a closing ridge 15, which, in this case, has a rounded side 16 and a protruding fold 17 (Fig. 2).

[0032] The ferrule 11 has a perimeter rib 18a associated with the edge cooperating with the handle 14, and two perimeter ribs 18b associated with the edge cooperating with the bundle of bristles 13.

[0033] The ferrules (Figs. 3 and 4a-4c) also have identification markings, in this case a number (75 in Fig. 3 and 60 in Figs. 4a-4c) which indicates the measurement of the brush 12; in cooperation with the ribs 18a, 18b, the markings define a univocal assembly position of the bristles 13 and handle 14 with respect to the ferrule 11.

[0034] The automatic loader 10 comprises a feeder-vibrator assembly 19 equipped with a basket 20 to the lateral wall 21 of which a guide channel 23 is associated; the ferrules 11 aligned one by one pass on the guide channel 23 to be fed to a first conveyor belt 30.

[0035] The first conveyor belt 30 is equipped with lateral guides 130 (Fig. 3) adjustable at least in width according to the width of the ferrules 11 to be loaded; the function of the guides 130 is to align the ferrules 11 with one wide face resting on the belt 30. The ferrules 11 are loaded pell-mell into the basket 20 and, due to the vibration, are separated and aligned on the plane of the conveyor belt 30.

[0036] In cooperation with the terminal zone of the first conveyor belt 30, the loader 10 according to the invention has optical detection means 29 to detect the orientation of the ferrules 11; the optical detection means 29 are functionally associated with a control unit 31, shown for the sake of simplicity in Fig. 4a only.

[0037] The function of the optical detection means, in this case a video camera 29, is to verify that the ferrule 11 which is about to be sent to the discharge zone is correctly oriented for coupling with bristles 13 and handle 14.

[0038] The detection operation is based on the numerical marking located on one side of the ferrule 11.

[0039] To perform the detection operation, the invention provides that sensor means 32 interrupt the advance of the first belt 30 in correspondence with an end-of-travel position, aligning the first ferrule 11 to the lens of the video camera 29.

[0040] The image taken by the video camera 29 is sent to the control unit 31 which, by means of a processing unit 33, compares it with a sample image memorized in an appropriate memory cell 34 and selected by an operator, who makes the setting at the beginning of the cycle, by means of a keyboard 35 or similar means.

[0041] The control unit 31 can detect three possible cases. In a first case (Fig. 4a) the ferrule 11a is correctly oriented.

[0042] In this case, the control unit 31 commands a first suction cup means 24 (Fig. 5) to be activated, which is able to be lowered to pick up the ferrule 11a from the terminal end of the first conveyor belt 30 (position 24a), and to move forwards in a direction 36 to deposit the ferrule 11a on the initial end of a second discharge belt 25 (position 24b).

[0043] In correspondence with the terminal end of the second discharge belt 25 there is a second suction cup means 26 able to pick up the correctly oriented ferrule 11a and deposit it in an assembly zone 27, where the ferrule 11 is coupled, in a substantially conventional manner, with bristles 13 and handle 14.

[0044] In a second case, wherein a ferrule 11b is not correctly oriented (Fig. 4b), the video camera 29 recognizes the numerical marking but identifies that it is incorrectly oriented.

[0045] In this case, the first suction cup means 24 is able to rotate through 180°, in a direction indicated by the reference number 37, around its substantially vertical axis in order to restore the correct orientation of the ferrule 11b. To be more exact, the first suction cup means 24 is lowered to pick up the ferrule 11b from the first conveyor belt 30, then is raised, rotates on itself by 180° and then moves forwards; it then discharges the correctly oriented ferrule 11b onto the second discharge belt 25, which provides to carry it to the assembly station 27.

[0046] In the third case, shown in Fig. 4c, the video camera 29 recognizes a situation in which the numerical marking is not visible and where therefore the orientation of the ferrule 11c cannot be corrected simply with the help of the first suction cup means 24.

[0047] In this case, the invention provides to activate a third suction cup means 22 able to pick up the ferrule 11c from the first conveyor belt 30 and to deposit it on a third recovery belt 28, which has a direction of feed opposite to that of the belts 30 and 25, and the terminal end of which is arranged above the vibrating basket 20.

[0048] In this way, with the method according to the invention, only the ferrules 11c, which are in a position which cannot be corrected by means of the first suction cup means 24, are returned to the vibrating feeder 19, whereas all the other ferrules are fed forwards substantially continuously and discharged by means of the second discharge belt 25.

[0049] By using suction cup means 24, 26 and 22, the position of which can be adjusted both longitudinally, transversely and vertically with respect to the relative conveyor belts, it is possible to adapt the loader 10 to any size, shape and type of ferrule without needing important modifications and adaptations.

[0050] Modifications and variants may be made to the invention without departing from the spirit and scope thereof. For example, an alternative embodiment provides that the suction cup means itself transfers both the correctly oriented ferrules, or after the rotation, to the discharge belt 25, and also the upside down ferrules to the recovery belt 28. In another embodiment, the suction cup means can be replaced by magnet means, in the case of metal ferrules, or by gripper means. In another embodiment, the conveyor belt 30 can have a continuous feed, instead of a discontinuous one as described.

Claims

1. Automatic loader of ferrules (11) to be fed one at a time to a station (27) to assemble brushes (12), said ferrules (11) consisting of a ring including means able to define a correct assembly position, said loader including a feed assembly (19) equipped with a basket (20) comprising at least a guide channel (23) associated with a first conveyor belt (30), the loader being **characterized in that** it comprises optical detection means (29) to detect the orientation of the ferrules (11) connected to a control unit (31), and means (24) to pick up the ferrules (11) governed by said control unit (31), said pick-up means (24) being able to pick up at least incorrectly oriented ferrules (11b) from said first belt (30) to deposit them on a discharge belt (25) after having rotated them into the correct position.

2. Loader as in claim 1, **characterized in that** said pick-up means (24) are able to pick up correctly oriented ferrules (11a) to deposit them on said discharge belt (25).

3. Loader as in claim 1 or 2, **characterized in that** it comprises discharge means (22) able to pick up ferrules (11c) whose position cannot be corrected by rotation, and to deposit them on a recovery belt (28) to return them to the basket (20).

4. Loader as in any claim hereinbefore, **characterized in that** it comprises sensor means (32) able to stop the feed of said first belt (30) according to the activation of said pick-up means (24) and/or said discharge means (22).

5. Loader as in claim 4, **characterized in that** said sensor means (32) are able to stop the feed of said first belt (30) in a position such that the first ferrule (11) located on said belt (30) is substantially aligned with said optical detection means (29).

6. Loader as in any claim hereinbefore, **characterized in that** the position of said pick-up means (24) and/or said discharge means (22) is adjustable at least longitudinally and transversely with respect to said first belt (30) according to the size and/or type of ferrule (11).

7. Loader as in claim 6, **characterized in that** the position of said pick-up means (24) and/or said discharge means (22) with respect to said belt (30) is adjustable at least vertically.

8. Loader as in any claim hereinbefore, **characterized in that** said first belt (30) includes lateral guides (130) adjustable at least in width according to the width of said ferrules (11).

9. Loader as in claim 1, **characterized in that** said control unit (31) has memory means (34) able to memorize a plurality of sample images of said ferrules (11) which can be selected by the user at start of cycle, to allow to compare with the image detected by the optical detection means (29).

10. Loader as in claim 1, **characterized in that** it comprises second pick-up means (26) associated with said discharge belt (25) and able to pick up the ferrules (11) advancing thereon and to discharge them in said assembly zone (27).

11. Loader as in any claim hereinbefore, **characterized in that** at least some of said pick-up means and/or discharge means (24, 22, 26) consist of suction cup means with a substantially vertical axis.

12. Method to feed ferrules (11) to a station (27) to assemble brushes (12), said ferrules (11) consisting of a ring including means able to define a correct assembly position, wherein the ferrules (11) are made to advance, aligned on a first belt (30), from a feeder/vibrator assembly (19), the method being **characterized in that** it provides a first step to detect the correct orientation of said ferrules (11) performed by optical detection means (29), and a second step to pick up the incorrectly oriented ferrules (11b) from the first belt (30) performed by first pick-up means (24), and to discharge said ferrules (11) onto a discharge belt (25) after they have been rotated into the correct position.

13. Method as in claim 12, **characterized in that** in the case that said optical detection means (29) verify that the ferrule (11a) is correctly oriented on the first belt (30), it provides that said first pick-up means (24) pick up said ferrule (11a) and discharge it onto said discharge belt (25).

14. Method as in claim 12 or 13, **characterized in that** in the case that the orientation of the ferrule (11c) cannot be corrected by rotation, it provides that said ferrule (11c) is picked up by discharge means (22) and located on a recovery belt (28) able to return the ferrule (11c) to the basket (20).

15. Method as in any claim from 12 to 14 inclusive, **characterized in that** it provides that the first belt (30) is stopped in a position of alignment of said optical detection means (29) with the first ferrule (11) located thereon before said pick-up means (24) are activated.

16. Method as in any claim from 12 to 15 inclusive, **characterized in that** it provides that a control unit (31) makes a comparison between the image of the ferrule (11) detected by the optical detection means and a sample image memorized in memory means (34) inside said control unit (31) and selected by an operator before the loading cycle is started.

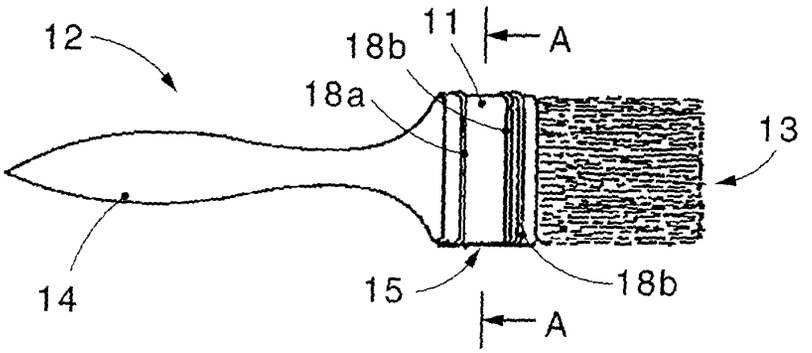

fig. 1

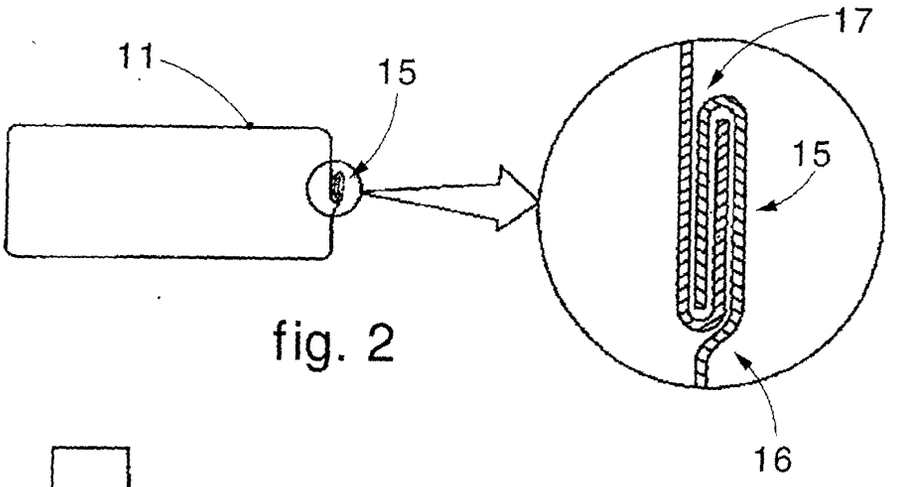

fig. 2

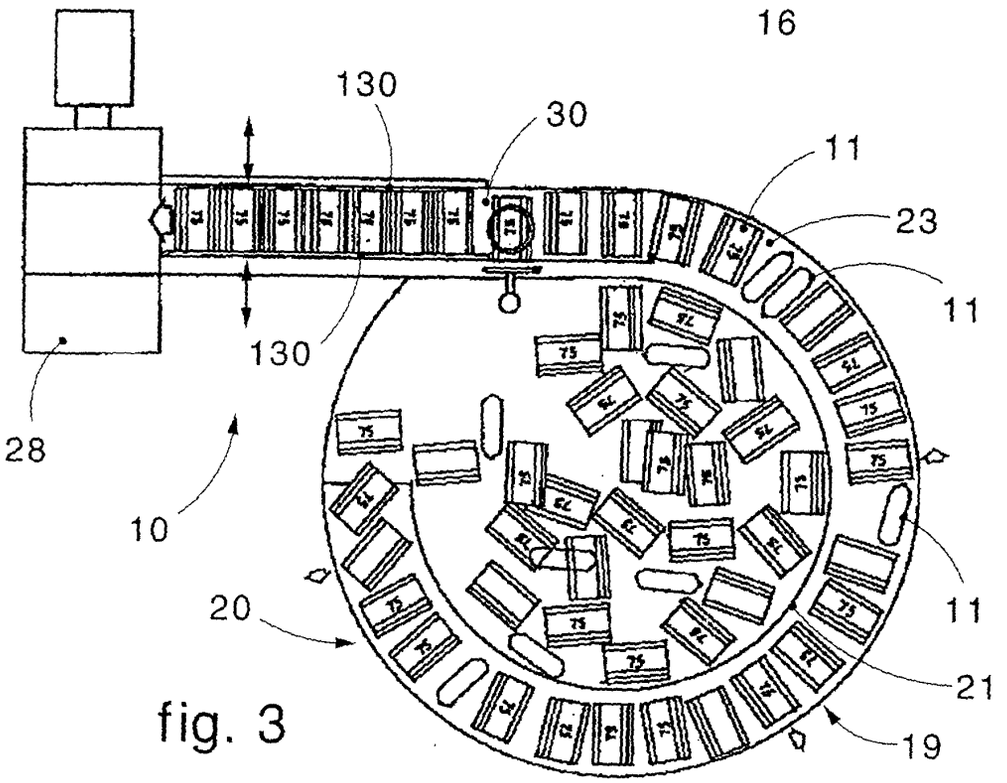

fig. 3

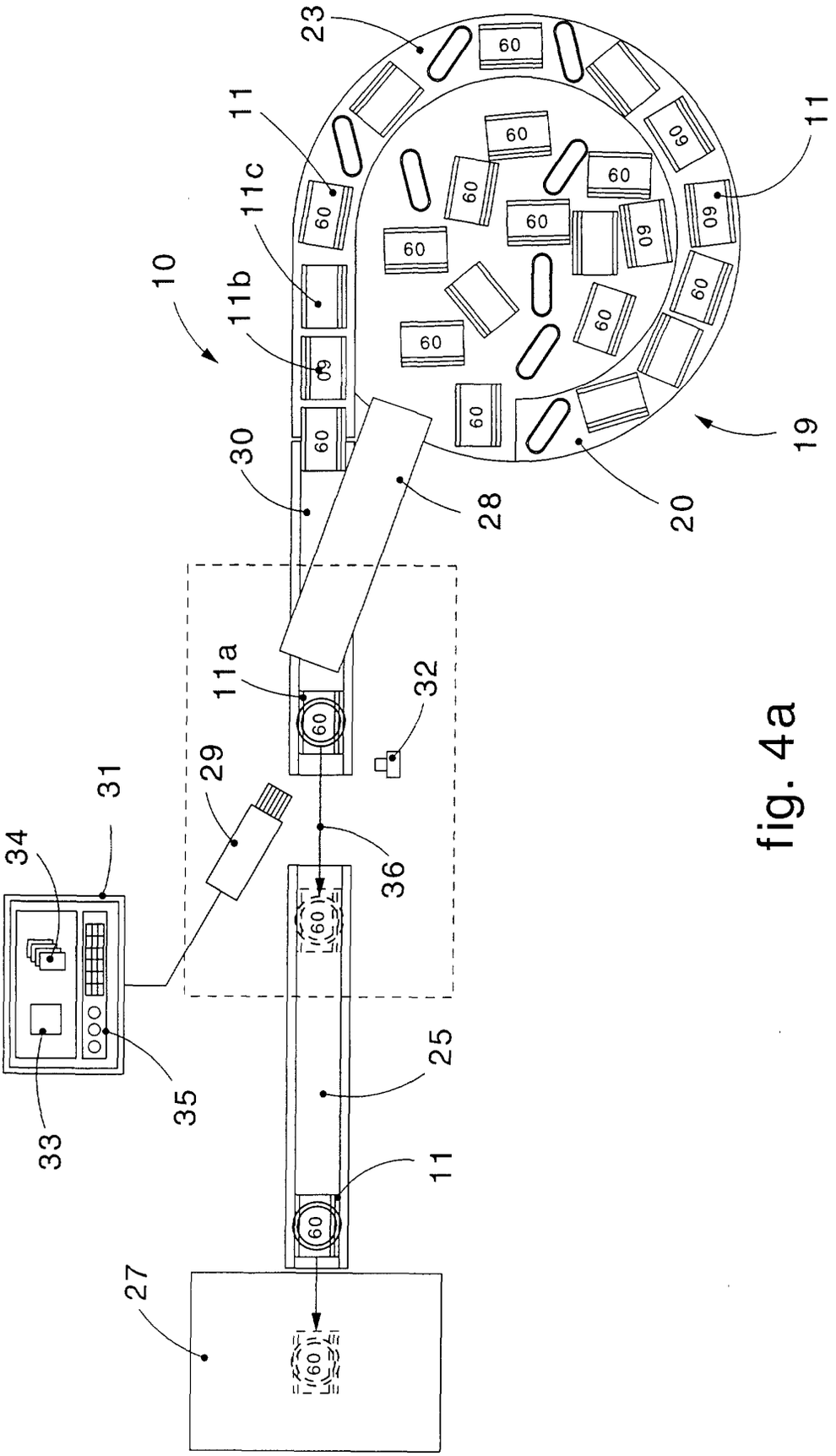

fig. 4a

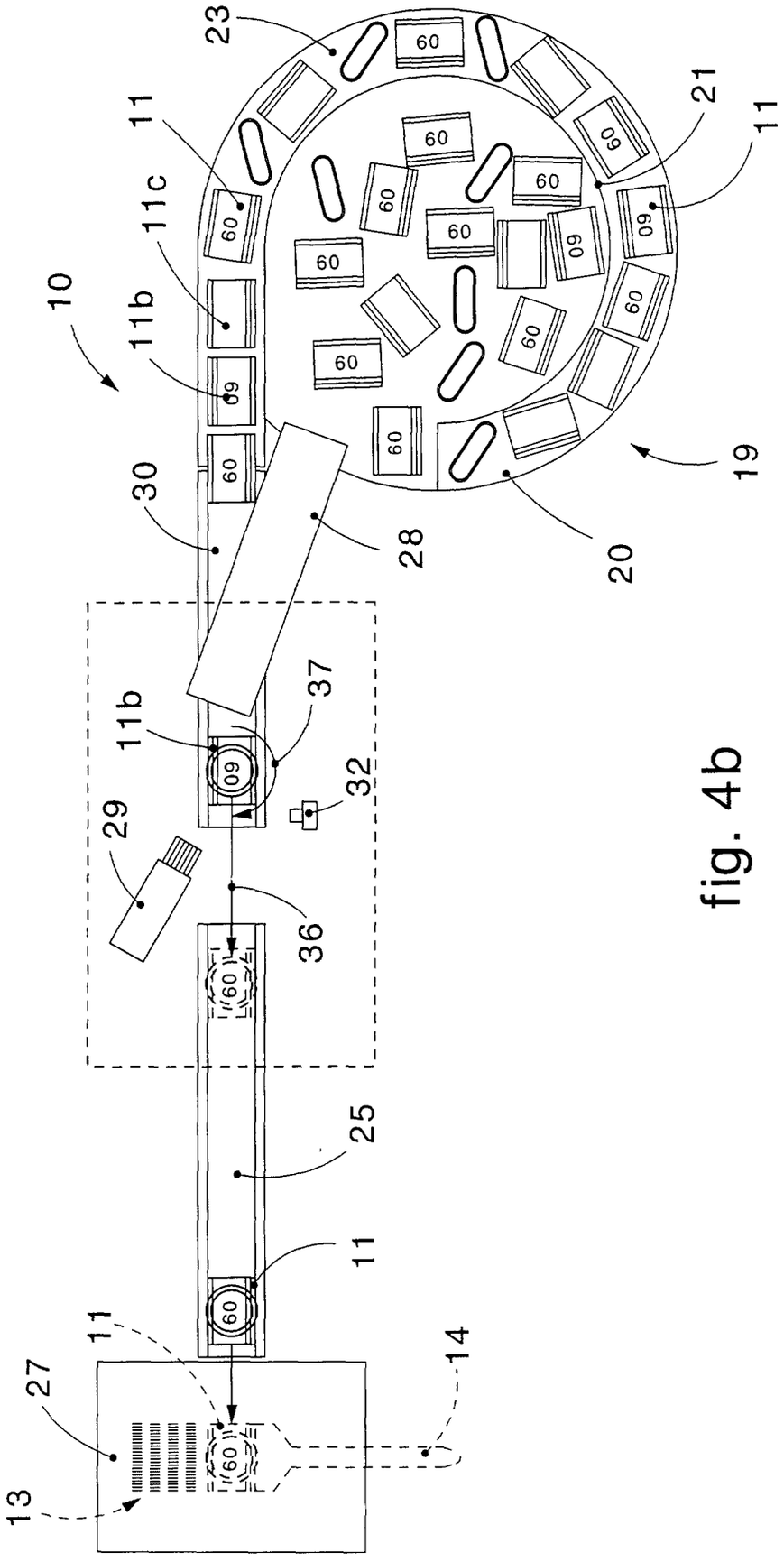

fig. 4b

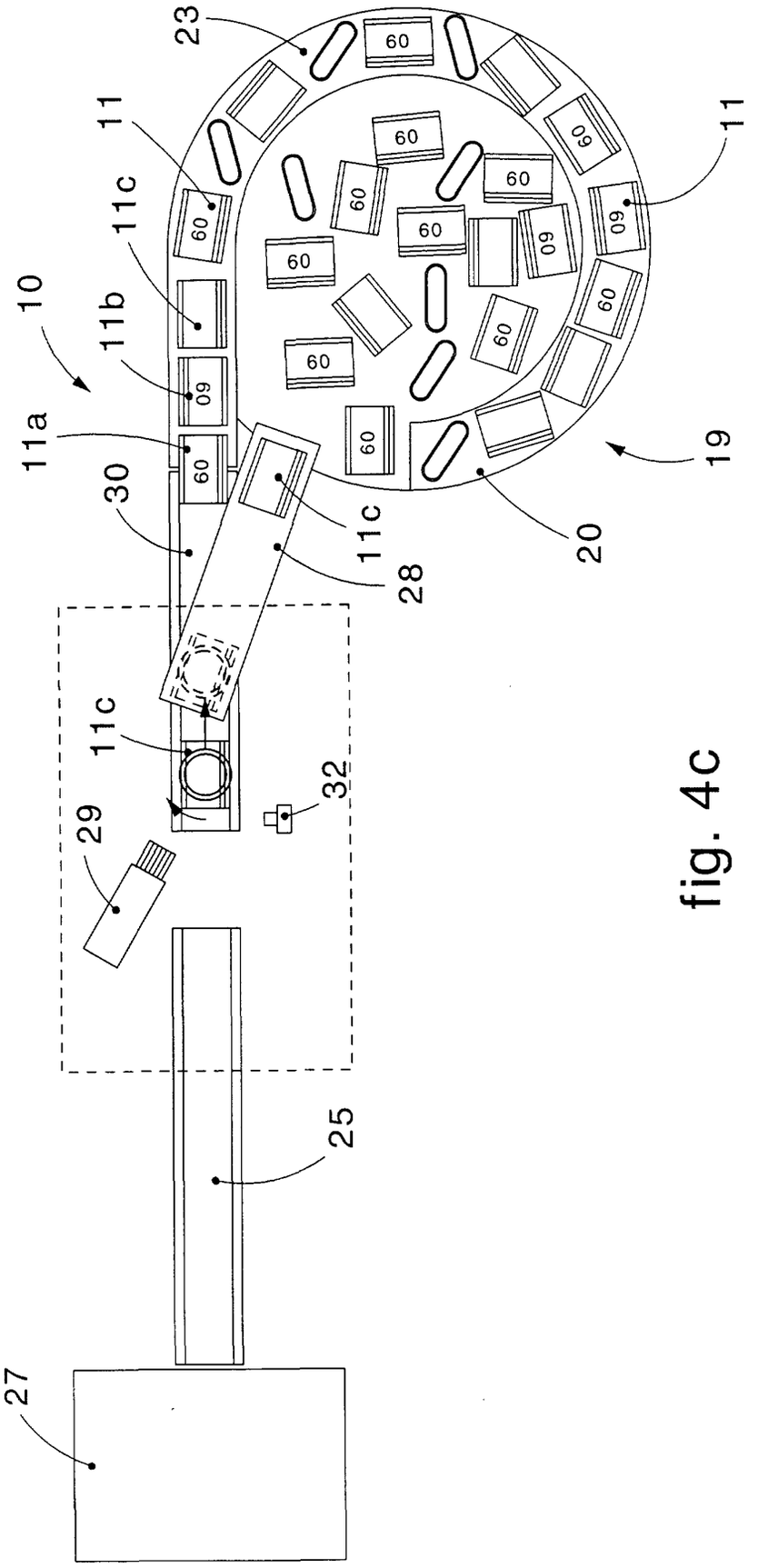

fig. 4c

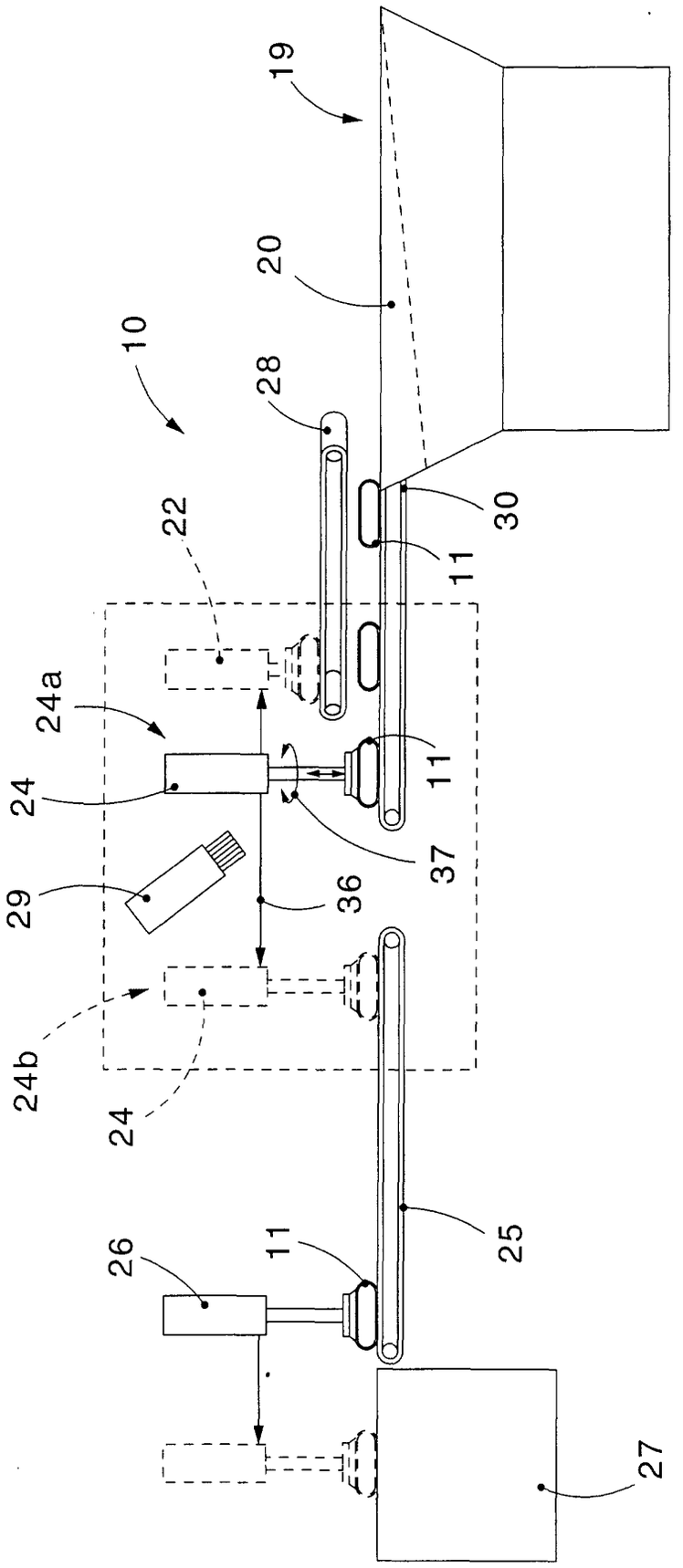

fig. 5