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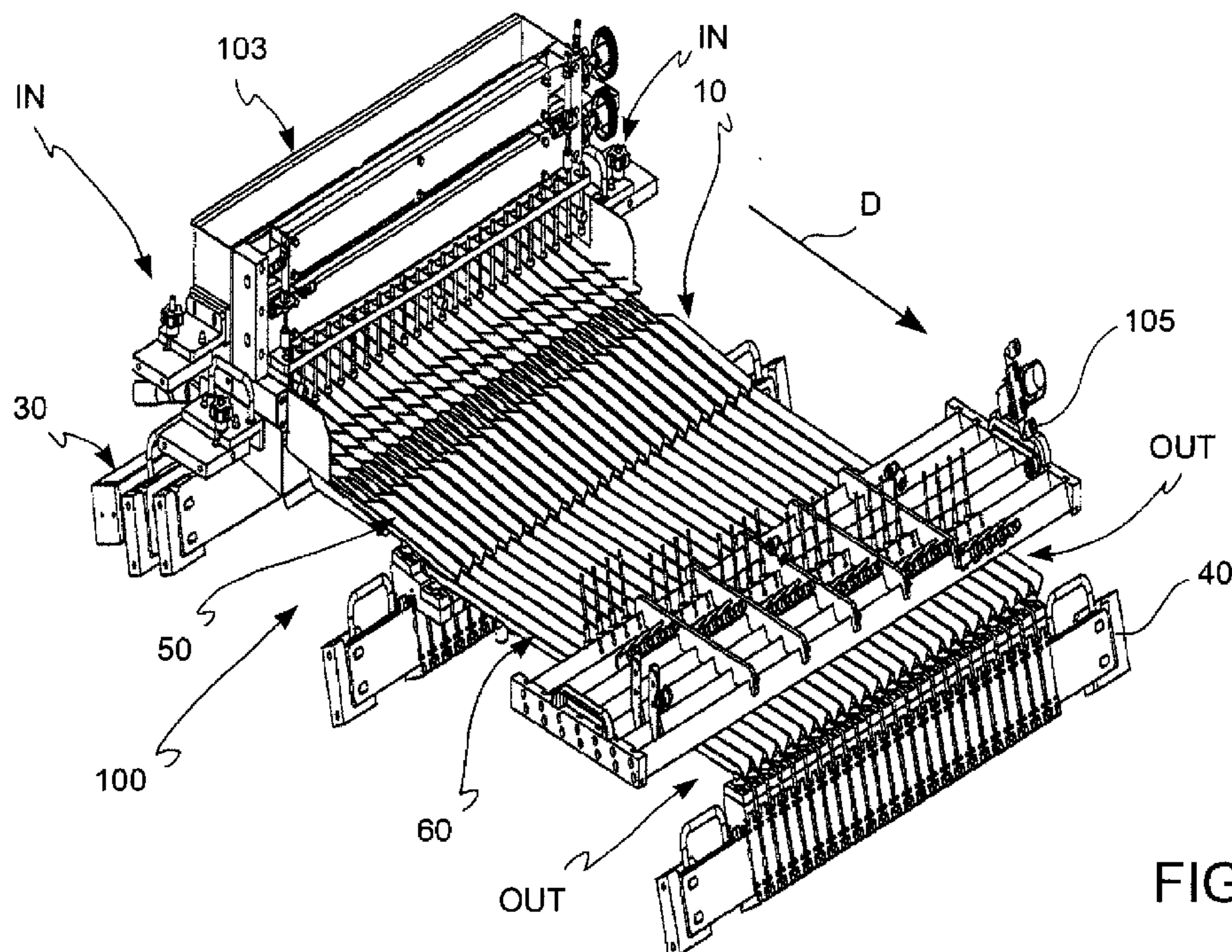


FIG. 2

(57) Abstract: The invention relates to an apparatus (1000) for conveying and dosing objects (1) on an automatic packaging line. The apparatus comprises: a vibrating conveyor unit (100) of the objects along an advancement direction (D) parallel to a supporting plane (P) of the apparatus; such a conveyor unit is interposed between an infeed portion (IN) of the device, configured for loading the objects (1), and an outfeed portion (OUT), configured for releasing the conveyed objects. The vibrating conveyor unit comprises: - at least one straight track (10), adapted to contain the objects to be conveyed and having a first end (11) and an opposite second end (12); first vibrating supporting and moving means (30) of the at least one track operatively associated with the infeed portion of the apparatus; the first end of at least one track is connected to the first vibrating supporting and moving means; second supporting means (40) of the track operatively associated with the outfeed portion of the apparatus; such a second end of the at least one track is connected to the

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second supporting means. The at least one track comprises: a first track (50), which extends between the first end of the track and a further second end (13); such a further second end is connected to third supporting means (70) of the track in an intermediate position between the first vibrating supporting and moving means and the second supporting means; a second track (60), aligned and separated from the first track, which extends between the second end of the track and a further first end (14); the further first end is connected to the third supporting means. Such third supporting means are configured to oscillate along the advancement direction of the objects in response to the movement of the first supporting means to transfer the vibration from the first track to the second track. The first track is at least partially superimposed on the second track.

DESCRIPTION**APPARATUS FOR CONVEYING AND DOSING OBJECTS ON AN
AUTOMATIC PACKAGING LINE**

TECHNOLOGICAL BACKGROUND OF THE INVENTION

Field of application

The present invention relates to an apparatus for conveying and dosing objects on an automatic packaging line.

In particular, the invention relates to a vibrating apparatus adapted to convey small objects, such as medicinal pills or tablets, hazelnuts, candies and similar food ingredients, to align them along a conveying direction and to promote releasing and dosing operations of the objects outwards, to devices for use in the packaging line of a finished product.

Prior art

In an automatic packaging line for foodstuff or pharmaceutical products, it is known to use vibrating machines adapted to convey small objects, such as for example hazelnuts, candies or medicinal tablets, to align them along a conveying direction and to promote the releasing operations of the objects towards devices provided for packaging a finished product.

Such vibrating machines of known type consist of a vibrating conveyor unit of the objects, e.g. pneumatically

driven, along an advancement direction of the objects themselves. Such a vibrating conveyor unit is interposed between an infeed portion of the machine, configured for loading the objects to be conveyed, e.g. through a hopper, and an outfeed portion, in which the objects are released towards external user devices on the packaging line. In such a step of releasing, in particular, the known machines use pistons adapted to push the objects to facilitate their release.

It is worth noting that the conveyor unit of the vibrating machine is further configured to align objects along the aforesaid conveying direction. Such a vibrating conveyor unit generally comprises a plurality of conveyor tracks, each of which is configured to contain a number of objects to be conveyed at the same time.

Each of such tracks has a first end proximal to the infeed portion of the objects to be conveyed into the machine and an opposite second end proximal to said outfeed and releasing portion of the objects.

In particular, the first end of the track is connected to a first support connected to a vibrating moving unit of the track itself, e.g. a pneumatic motor, to oscillate substantially along the conveying direction of the objects. The second end of the track is generally connected to a second support configured to oscillate

along the aforesaid conveying direction of the objects in response to the movement of the first support.

Such vibrating machines of the known type described above have some drawbacks.

Indeed, voids are often created between two moving objects aligned along the vibrating tracks of a known machine. The presence of these voids between the objects or groups of objects causes a reduction in the efficiency of the subsequent step of packaging.

Furthermore, during the step of releasing the objects, the use of mechanically operated pistons which strike the objects to be released may damage the objects themselves. This is a limit of the known vibrating machine such to make it unusable in applications in which maintaining the conveyed object substantially intact is required, as in the case of tablets for pharmaceutical use.

Furthermore, the vibrating machines of known type are not immune from localized jamming and accumulations of objects which decay both the alignment quality of the objects and the efficiency of the subsequent step of packaging.

SUMMARY OF THE INVENTION

It is the object of the present invention to devise and provide an apparatus for conveying and dosing objects

on an automatic packaging line, in particular, a vibrating conveyor apparatus of objects, which allows overcoming at least partially the drawbacks described above with reference to the solutions of known vibrating machines.

Such an object is achieved by a vibrating conveying and dosing apparatus of objects in accordance with independent claim 1.

Preferred embodiments of such apparatus are described in dependent claims 2-16.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the conveying and dosing apparatus of objects according to the invention will be apparent in the following description which illustrates preferred embodiments, given by way of indicative, non-limiting examples, with reference to the accompanying figures, in which:

- **figure 1** shows a perspective view of an apparatus for conveying and dosing objects which can be used on an automatic packaging line according to a preferred example of an embodiment of the invention;
- **figure 2** shows a perspective, enlarged view of a vibrating conveyor unit of objects comprised in the apparatus shown in figure 1, comprising a plurality of straight tracks for conveying objects;
- **figure 3** shows a side view of one of the straight

tracks of the conveyor unit in figure 2;

- **figure 4** shows an enlarged view of a portion of the straight track in figure 3;

- **figure 5** shows a perspective, enlarged view of one of the straight tracks of the conveyor unit in figure 2 connected to the supporting means provided in the apparatus;

- **figure 6** shows a cross-section, enlarged view of the straight track in figure 3, wherein such a section is made at a substantially median portion of the track.

It is worth noting that equal or similar elements in the aforesaid figures will be indicated by the same reference numerals.

DETAILED DESCRIPTION

With reference to the aforesaid figures 1-6, an apparatus for conveying and dosing objects 1 which can be used on an automatic packaging line, hereinafter referred to simply as conveying and dosing apparatus or simply apparatus or machine, according to an example of the invention as a whole, is indicated by reference numeral 1000.

For the purpose of the present description, it is worth noting that the term objects or objects 1 will be used hereafter to refer to small products for pharmaceutical uses, such as pills or tablets, or small

food products or ingredients, such as hazelnuts, candies and the like.

With reference to figure 1, the apparatus or machine 1000 for conveying and dosing objects 1 comprises a vibrating unit 100 for conveying objects along an advancement direction D parallel to a supporting plane P of the apparatus in a respective sense of advancement.

Such a vibrating conveyor unit 100 is interposed between an infeed portion IN of the apparatus 1000, configured for loading the objects 1 to be conveyed, and an outfeed portion OUT, configured to release the conveyed objects 1.

In particular, the vibrating conveyor unit 100 is fixed to a supporting base 101 of the machine 1000 resting on the supporting plane P and is laterally delimited by protection walls 102.

It is worth noting that the infeed portion IN of the apparatus 1000, adapted to delimit the head of the vibrating conveyor unit 100, comprises a block 103 for loading the objects 1 to be conveyed provided with a hopper 104.

The aforesaid outfeed portion OUT of the machine 1000, configured to either release or dose the conveyed objects 1, can be accessed from the outside of the machine and includes a block 105 for releasing or dosing

the objects 1 in controlled manner, as described in detail below.

With reference to figures 2-3 and 5, the aforesaid vibrating conveyor unit 100 of the objects 1 comprises at least one straight track 10 having a first end 11 and an opposite second end 12 and configured to contain the objects to be conveyed along the advancement direction D.

In a practical example of an embodiment of the invention, the machine 1000 comprises about twenty tracks. In other examples, the machine 1000 may be made so as to comprise from one to forty tracks 10, all mutually parallel. It is worth noting that each of the aforesaid tracks 10 can be moved by vibration independently from the others.

Furthermore, remaining within the scope of the present invention, it is possible to make a machine (not shown in the figures) which comprises two distinct groups of tracks 10 connected to the same infeed portion IN, i.e. using a single hopper 104.

If it is desired to feed such a hopper 104 with objects of mutually different type, the hopper is provided with respective compartments for loading such different objects. Each compartment of the hopper comprises a respective outlet adapted to feed one of the aforesaid two groups of tracks 10.

Furthermore, the aforesaid vibrating conveyor unit 100 comprises first supporting and vibrating moving means 30 of the at least one track 10 operatively associated with the infeed portion IN of the apparatus 1000. In particular, the first end 11 of the at least one track 10 is connected to the aforesaid first vibrating supporting and moving means 30.

For example, the supporting and moving means 30 of each track 10 are connected to a pneumatic drive (not shown in the figures) which can be selectively activated/deactivated to enable/disable the vibration of each track 10 independently from the others.

In other words, such first supporting means or first support 30 comprise a leaf-spring support or idle support configured to oscillate substantially along the advancement direction D of the objects in response to the vibrating action imparted by the pneumatic drive.

Furthermore, the aforesaid vibrating conveyor unit 100 comprises second supporting and vibrating moving means 40 of the at least one track 10 operatively associated with the outfeed portion OUT of the apparatus 1000. In particular, with reference to figure 5, such a second end 12 of at least one track 10 is connected to the second supporting means 40 configured to oscillate along the aforesaid advancement direction D of the

objects in response to the movement of the first supporting means 30. In general, the second end 12 of all tracks 10 of the vibrating conveyor unit 100 is connected to one of the second supporting means 40. For example, such second supporting means 40 comprise a leaf-spring support or idle support.

With reference to figures 3 and 5, each of tracks 10 of the vibrating conveyor unit 100 advantageously comprises a first track 50 and a second track 60, each representing a portion of the aforesaid track 10.

In particular, the first track 50 has a substantially straight development and extends between the first end 11 of the track 10 and a further second end 13. Such a further second end 13 is connected to third supporting means 70 of the track located in an intermediate position between the aforesaid first vibrating supporting and moving means 30 and the second supporting means 40. Such third supporting means 70 are configured to oscillate elastically along the aforesaid advancement direction D of the objects in response to the movement of the first supporting means 30.

The second track 60 is aligned with and separated from the first track 50. Such a second track 60 has a substantially straight development and extends between the second end 12 of the track 10 and a further first end

14. Such further first end 14 is connected to the aforesaid elastically oscillating third supporting means 70.

In a preferred exemplary embodiment, the third supporting means 70 of the track 10 comprise a leaf-spring support or idle support.

Such a leaf-spring 70 is thus configured to transmit the vibration imposed on the first track 50 by the first supporting and moving means 30 and to dampen said vibrations after the deactivation of the pneumatic drive.

In an example of an alternative embodiment, the second track 60 comprises a preparation element 61 for connecting an additional pneumatic drive to generate vibration, in addition to the main one connected to the first supporting means 30. Such an additional pneumatic drive is designed to provide a continuity of vibration or different vibration speed to the second track 60, thus compensating the damping.

In greater detail, the second track 60 is preferably parallel to the advancement direction D of the objects 1 or inclined at most by 2 degrees with respect to such a direction D. The first track 50 is parallel to a first advancement direction D' inclined by an angle of predetermined amplitude X with respect to the advancement

direction D of the objects 1. The first advancement direction D' lies on the same plane as the advancement direction D and such a plane is orthogonal to the supporting plane P. Furthermore, the first track 50 is at least partially superimposed on the second track 60.

Providing the use of two distinct tracks which are at least partially superimposed instead of a single track of the machines of the known solutions, allows minimizing the gaps between two moving objects 1 aligned along the second track 60 before releasing.

Furthermore, by means of functional tests of a prototype, the Applicant found that the machine 1000 in which the use of two distinct tracks is provided, in which the first track 50 is inclined with respect to the advancement direction D of the objects, instead of a single track of the machines of the known solutions, and in which it is possible to fix the amplitude X of the inclination angle of the first track 50 with respect to the advancement direction D, allows further minimizing the gaps between two objects 1 in motion and aligned along the second track 60 before releasing.

In an example of an embodiment of the apparatus 1000, the amplitude of the inclination angle X of the first track 50 with respect to the advancement direction D of the objects 1 is comprised in the range of 4-5

degrees.

In a preferred example of an embodiment, the aforesaid first track 50 and second track 60 are made of metal. More specifically, the first track 50 and second track 60 are made of steel (food-grade stainless steel 316), which was subjected to a polishing and electrolytic process to prevent the formation of fouling.

In a further example of embodiment of the apparatus 1000 of the invention, the first track 50 comprises means for detachably fixing the first end 11 of the track 10 and the further second end 13 to the first supporting and moving means 30 of the track and to the third supporting means 70 of the track which can oscillate, respectively.

Similarly, the second track 60 includes means for detachably fixing the second end 12 of the track and the further first end 14 to the second supporting means of the track 40 and the third supporting means 70 of the track, respectively.

In particular, such detachable fixing means comprise pairs of permanent magnets of opposite polarity which can be mutually coupled/uncoupled.

The use of such magnetic coupling/uncoupling means between the first track 50 and the second track 60 and the respective supports has the advantage of allowing rapid removal of the first track 50 and of the second

track 60 from the machine 1000 for maintenance and for washing the tracks themselves. Since each track 10 is independent of the others, removing even one or more tracks will not cause the stopping of the machine 1000.

A section view of the first track 50 and of the second track 60 of one of the tracks 10 of the machine 1000 is described with reference to figure 6. In particular, both the first track 50 and the second track 60 have a V-shaped section and comprise a first wall 51 and a second wall 52 which are inclined and mutually connected in one piece by means of a respective connecting portion 53 to delimit a seat SD for the housing and sliding of the objects 1 to be conveyed, in particular preventing the objects 1 from escaping from the track while they run.

In particular, such first 51 and second 52 inclined walls have free ends 51', 52' opposite to the aforesaid connecting portion 53.

Additionally, a distance d , d' between the free ends 51', 52' of said first 51 and second 52 wall of the first 50 and second 60 track can be modified to vary an amplitude of the housing seat SD of the objects. Such modifiability is obtained in the steel mold to create tracks with different seat widths.

With reference to the example of the figures:

the first track 50 has a distance d between the free ends 51', 52' of the first 51 and second 52 wall;

the second track 60 has a further distance d' between the free ends 51', 52' of the first 51 and second 52 wall.

The aforesaid distance d relative to the first track 50 is less than the further distance d' associated with the second track 60.

Advantageously, tracks 50, 60 may be provided having housing seats SD for objects 1 of different sizes in order to adapt such tracks 10 to convey categories of objects 1 of different sizes. The machine 1000 is therefore versatile and can be adapted to different machining operations by simply changing the dimensions of the tracks.

In a further example of an embodiment, with reference to figures 3 and 5, the first track 50 of each of the tracks 10 included in the machine 1000 comprises aligning means 20 of the objects 1 to be conveyed. Such aligning means 20 are obtained on the first 51 and second wall 52 in a middle position of the first track 50.

In greater detail, such alignment means of the objects 1 comprise shaped wings 20 comprising portions of the first wall 51 and of the second wall 52 folded towards the housing seat SD of the objects to be conveyed.

Such shaped wings 20 advantageously allow avoiding the accumulation of objects 1 in the first track 50, thus facilitating the alignment of the objects themselves.

In the example in figure 6, the first track 50 comprises a respective wing 20', also visible in figure 3, configured to facilitate the release of objects 1 from the first track 50 to the second track 60.

With reference to the example in figures 3-4, the second track 60 of each track 10 comprises a unit 80 for releasing or dosing the conveyed objects 1 in a controlled manner. It is worth noting that the aforesaid block 105 for releasing or dosing the objects 1 described with reference to figures 1 and 2 includes the releasing units 80 of all tracks 10 of the apparatus 1000.

For each track 10, the unit 80 for releasing or dosing the objects 1 is operatively associated with a releasing hole 85 of the object obtained in the second track 60, and electrically connected to an electronic control unit 200 of the apparatus.

In greater detail, each of the aforesaid units 80 for releasing or dosing the objects 1 in a controlled manner comprises:

- a photodetector device 81, e.g. a photocell, configured to detect the presence of an object 1 near the releasing hole 85 and to generate a detection signal S1 of the

object to be sent to the electronic control unit 200;

- a first compressed air blowing device or nozzle 82 configured to generate one or more compressed air blows after receiving a first activation signal S2 from the electronic control unit 200; such one or more air jets generated by the first blowing nozzle 82 are adapted to facilitate the falling of the object 1 into the releasing hole 85;
- a second compressed air blowing device or nozzle 83 configured to generate one or more compressed air jets after receiving a second activation signal S3 from the electronic control unit 200; such one or more jets generated by the second blowing nozzle 83 are adapted to slow down the approaching of a further object 1 to the releasing hole 85.

It is worth noting that the electronic control unit 200 of the device 1000 of the invention comprises a central processing unit including a programmable logic controller (or PLC) adapted to control the units described above and operatively connected to a main system memory (not shown in the figures).

In particular, such an electronic control unit 200 is electrically connected to the pneumatic drive of the machine 1000 to selectively activate/deactivate it and, consequently, to enable/disable the vibration of each

track 10 of the vibrating conveyor unit 100 independently of the others.

Furthermore, for releasing or dosing an object 1, the PLC of the electronic control unit 200 is configured to independently control each of the units 80 to either release or dose the objects 1 of the tracks 10.

In particular, the control by the PLC is carried out on the basis of the following sequence of steps, described, for the sake simplicity, with reference to any of the tracks 10 of the vibrating conveyor unit 100.

In a first step, the PLC receives the detection signal S1 generated by the photodetector device 81 and indicates the presence of object 1 close to the releasing hole 85.

In a later step, the PLC generates the first activation signal S2 to activate the generation of one or more compressed air jets by the first blower device or nozzle 82. In such a manner, the falling of the object 1 into the releasing hole 85 is facilitated.

At a later step, the PLC can selectively deactivate the pneumatic drive to disable the vibration of the concerned track 10. In such a case, the leaf-spring 70 is adapted to dampen the residual vibration after a few milliseconds.

Furthermore, with reference to figure 5, the first support 30 connected to the main pneumatic drive

comprises a vibration locking system or brake 31 which intervenes to substantially instantaneously interrupt the residual vibration.

In another next step, the PLC is adapted to generate a second activation signal S3 to activate the generation of one or more compressed air blows by the second compressed air blower device or nozzle 83.

In such a manner, the approaching of another object 1 to the releasing hole 85 is slowed down, thus optimizing the dosage along the packaging line.

It is worth noting that the central control unit 200 is designed to load program codes into the main system memory to be executed to implement the control procedure of the device 1000, such as the steps of releasing and controlled dosing of the object described above.

Furthermore, with reference to figure 1, the apparatus 1000 comprises an infeed/outfeed interface module 300 which is electrically connected to the central control unit 200 to enable the insertion (input) of machining parameters by an external operator and to view (output) data indicative of the machining. For example, such an interface module 300 takes the form of a keyboard and a display or a touchscreen display.

The PLC can, therefore, be programmed by the

operator in order to be able to dose the single piece. The machine 1000 can operate in counting mode, i.e. by counting the single objects 1 with the photocell sensor 81. Alternatively, the machine 1000 can operate in volumetric mode, i.e. by dosing the objects according to the moving time in the tracks 10. This allows dosing groups of objects, such as, for example: grain, sugar, chopped almonds and the like.

A person skilled in the art may make changes and adaptations to the embodiments of the apparatus for conveying and dosing objects described above or can replace elements with others which are functionally equivalent to satisfy contingent needs without departing from the scope of protection of the appended claims. All the features described above as belonging to one possible embodiment may be implemented independently from the other embodiments described.

CLAIMS

1. An apparatus (1000) for conveying and dosing objects (1) on an automatic packaging line, comprising:
- a unit (100) for vibrationally conveying the objects along an advancement direction (D) parallel to a supporting plane (P) of the apparatus in a respective advancement direction, said vibrating conveyor unit (100) being interposed between an infeed portion (IN) of the apparatus, configured for loading the objects (1) to be conveyed, and an outfeed portion (OUT), configured for releasing or dosing the conveyed objects (1),
said vibrating conveyor unit (100) comprising:
 - at least one straight track (10) having a first end (11) and an opposite second end (12) and configured to contain the objects to be conveyed along the advancement direction (D);
 - first vibrating supporting and moving means (30) of the at least one track operatively associated with the infeed portion (IN) of the apparatus, said first end (11) of at least one track (10) being connected to the first vibrating supporting and moving means (30);
 - second supporting means (40) of the track (10) operatively associated with the outfeed portion (OUT) of the apparatus, said second end (12) of the at least one track (10) being connected to the second supporting means

(40),

characterized in that said at least one track (10) comprises:

- a first track (50), which extends between said first end (11) of the track and a further second end (13), said further second end (13) being connected to third supporting means (70) of the track in intermediate position between said first vibrating supporting and moving means (30) and said second supporting means (40);
a second track (60), aligned with and separated from the first track (50), which extends between said second end (12) of the track and a further first end (14), said further first end (14) being connected to the third supporting means (70), said third supporting means (70) being configured to oscillate along the advancement direction (D) of the objects in response to the movement of the first supporting means (30) to transfer the vibration from the first track (50) to the second track (60),

said first track (50) being at least partially superimposed on the second track (60).

2. An apparatus (1000) according to claim 1, wherein said first track (50) is parallel to a first advancement direction (D') inclined by an angle of predetermined amplitude (X) with respect to the advancement direction

(D) of the objects.

3. An apparatus (1000) according to claim 1 or 2, wherein said second track (60) is parallel to the advancement direction (D) of the objects.

4. An apparatus (1000) according to claim 1, wherein:
the first track (50) includes means for detachably fixing said first end (11) of the track and said further second end (13) to the first supporting and moving means (30) of the track and to the third supporting means (70) of the track, respectively;

the second track (60) includes means for detachably fixing said second end (12) of the track and said further first end (14) to the second supporting means (40) of the track and to the third supporting means (70) of the track, respectively.

5. An apparatus (1000) according to claim 4, wherein said detachable fixing means comprise pairs of permanent magnets of opposite polarity which can be mutually coupled/uncoupled.

6. An apparatus (1000) according to claim 2, wherein the amplitude of the inclination angle (X) of the first track (50) with respect to the advancement direction (D) of the objects is comprised in the range of 4-5 degrees.

7. An apparatus (1000) according to claim 1, wherein both the first track (50) and the second track (60)

comprise a first wall (51) and a second wall (52) inclined and mutually connected in one piece by means of a respective connecting portion (53) to delimit a housing seat (SD) for the objects to be conveyed, said first (51) and second (52) inclined walls having free ends (51', 52') opposite to the aforesaid connecting portion (53).

8. An apparatus (1000) according to claim 7, wherein a distance (d, d') between the free ends (51', 52') of said first (51) and second (52) wall of said first (50) and second (60) track can be modified to vary an amplitude of the housing seat (SD) of the objects.

9. An apparatus (1000) according to claim 8, wherein the first track (50) has a distance (d) between the free ends (51', 52') of the first (51) and second (52) wall, the second track (60) has a further distance (d') between the free ends (51', 52') of the first (51) and second (52) wall, said distance (d) being less than the further distance (d').

10. An apparatus (1000) according to claim 7, wherein said first track (50) comprises aligning means (20) of the objects to be conveyed obtained on said first (51) and second (52) wall in a median position of the first track (50).

11. An apparatus (1000) according to claim 10, wherein

said aligning means (20) of the objects comprise shaped wings comprising portions of the first (51) and second (52) wall folded towards the housing seat (SD) of the objects to be conveyed.

12. An apparatus (1000) according to claim 1, wherein said second track (60) comprises a unit (80) for releasing or dosing the objects (1) conveyed in controlled manner, said unit (80) for releasing or dosing the objects (1) being operatively associated with a releasing hole (85) of the object obtained in the second track and electrically connected to an electronic control unit (200) of the apparatus.

13. An apparatus (1000) according to claim 12, wherein said unit (80) for releasing or dosing the objects (1) in controlled manner comprises:

- a photodetector device (81) configured to detect the presence of an object (1) near the releasing hole (85) and to generate a detection signal (S1) to be sent to the electronic control unit (200);
- a first compressed air blowing device (82) configured to generate one or more compressed air jets after receiving a first activation signal (S2) sent by the electronic control unit (200), said one or more jets generated by the first blowing device (82), facilitating the falling of the object (1) into the releasing hole

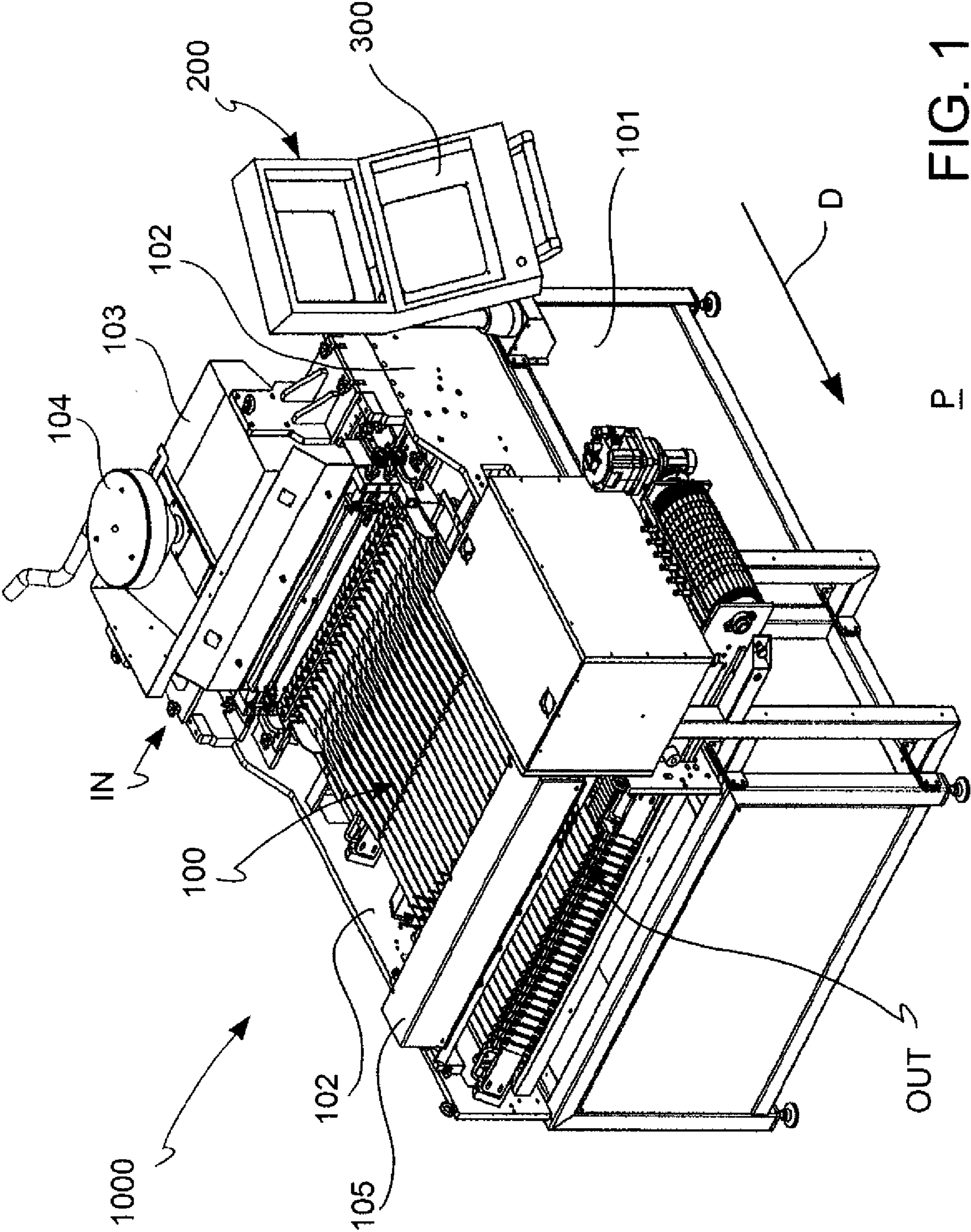
(85);

- a second compressed air blowing device (83) configured to generate one or more compressed air jets after receiving a second activation signal (S3) from the electronic control unit (200), said one or more jets, generated by the second blowing device (83), slowing down the approaching of a further object (1) to the releasing hole (85).

14. An apparatus (1000) according to claim 1, wherein said third supporting means (70) of the track (10) comprise a leaf-spring support.

15. An apparatus (1000) according to any one of the preceding claims, wherein said first (50) and second (60) tracks are made of metal material.

16. An apparatus (1000) according to any one of the preceding claims, wherein said first (50) and second (60) tracks are made of steel subjected to an electrolytic polishing process.



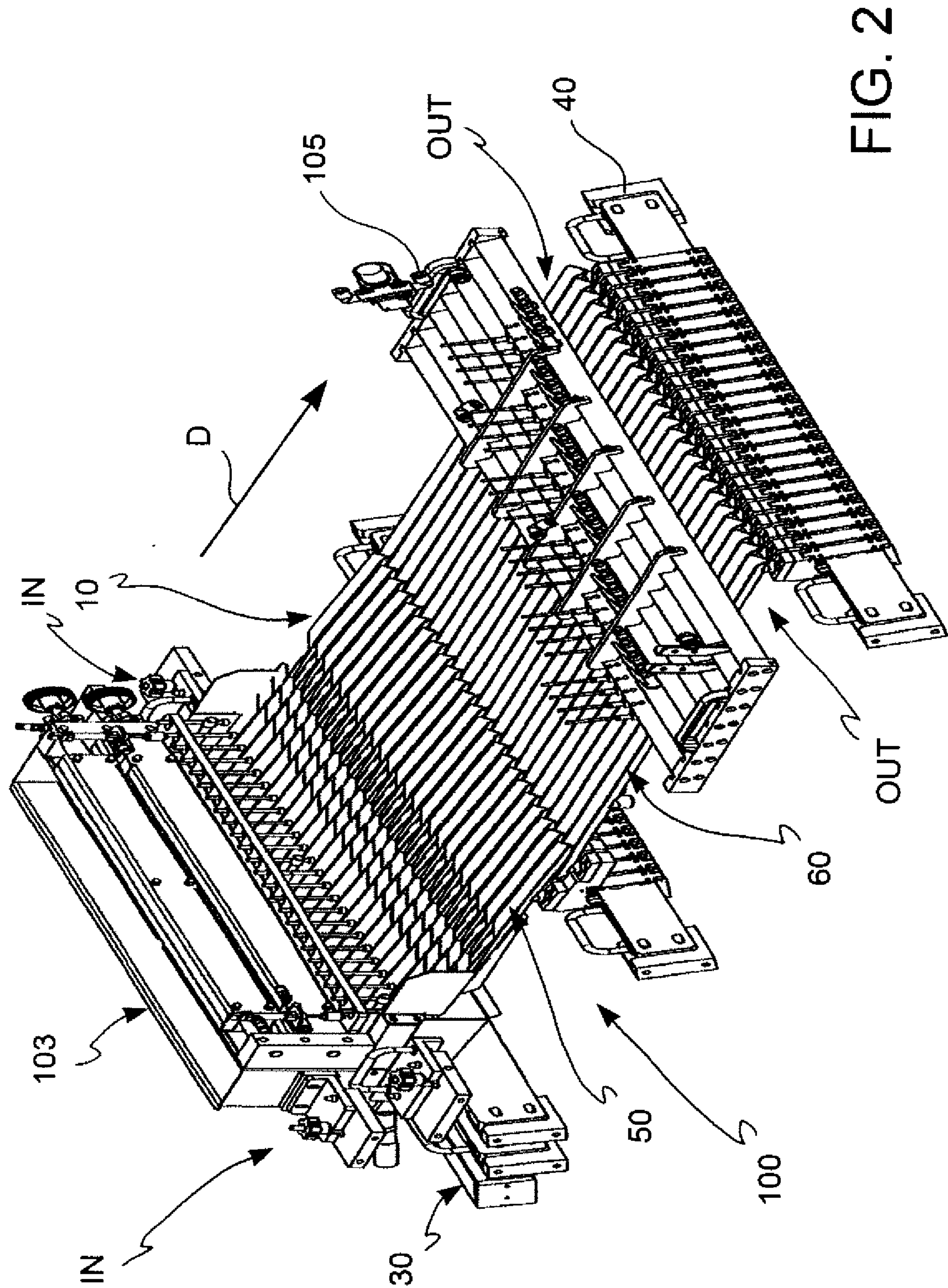


FIG. 2

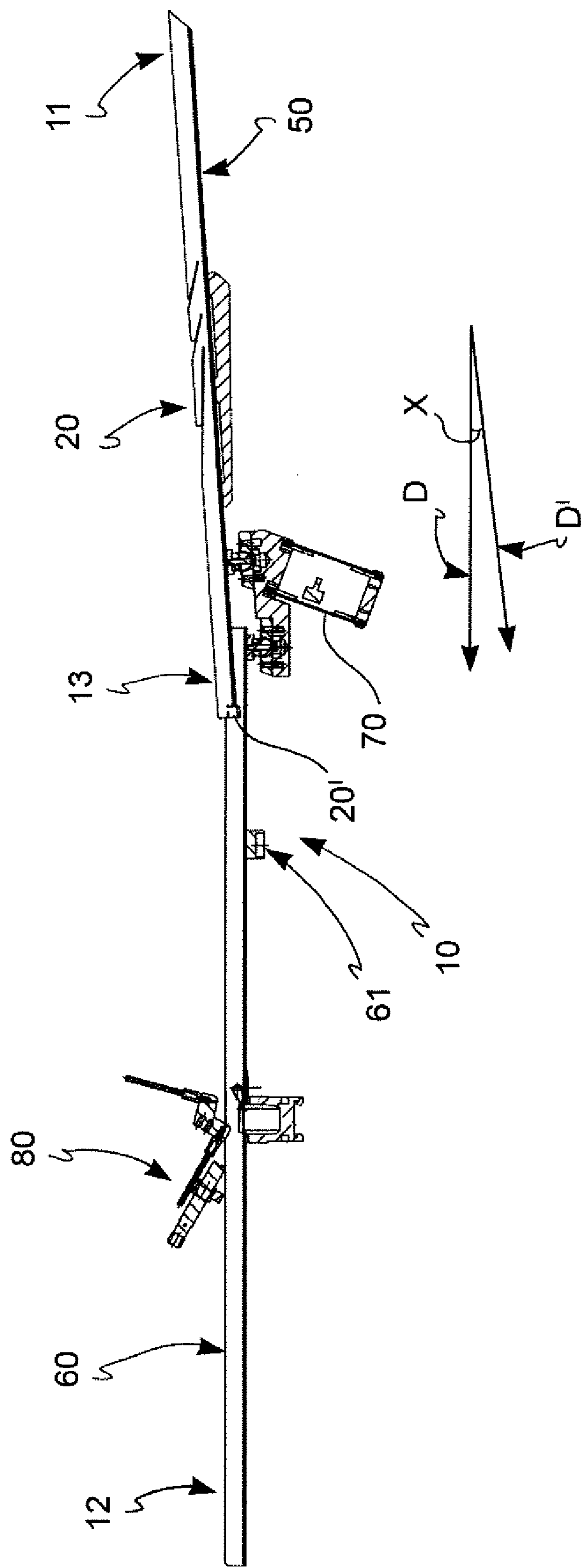


FIG. 3

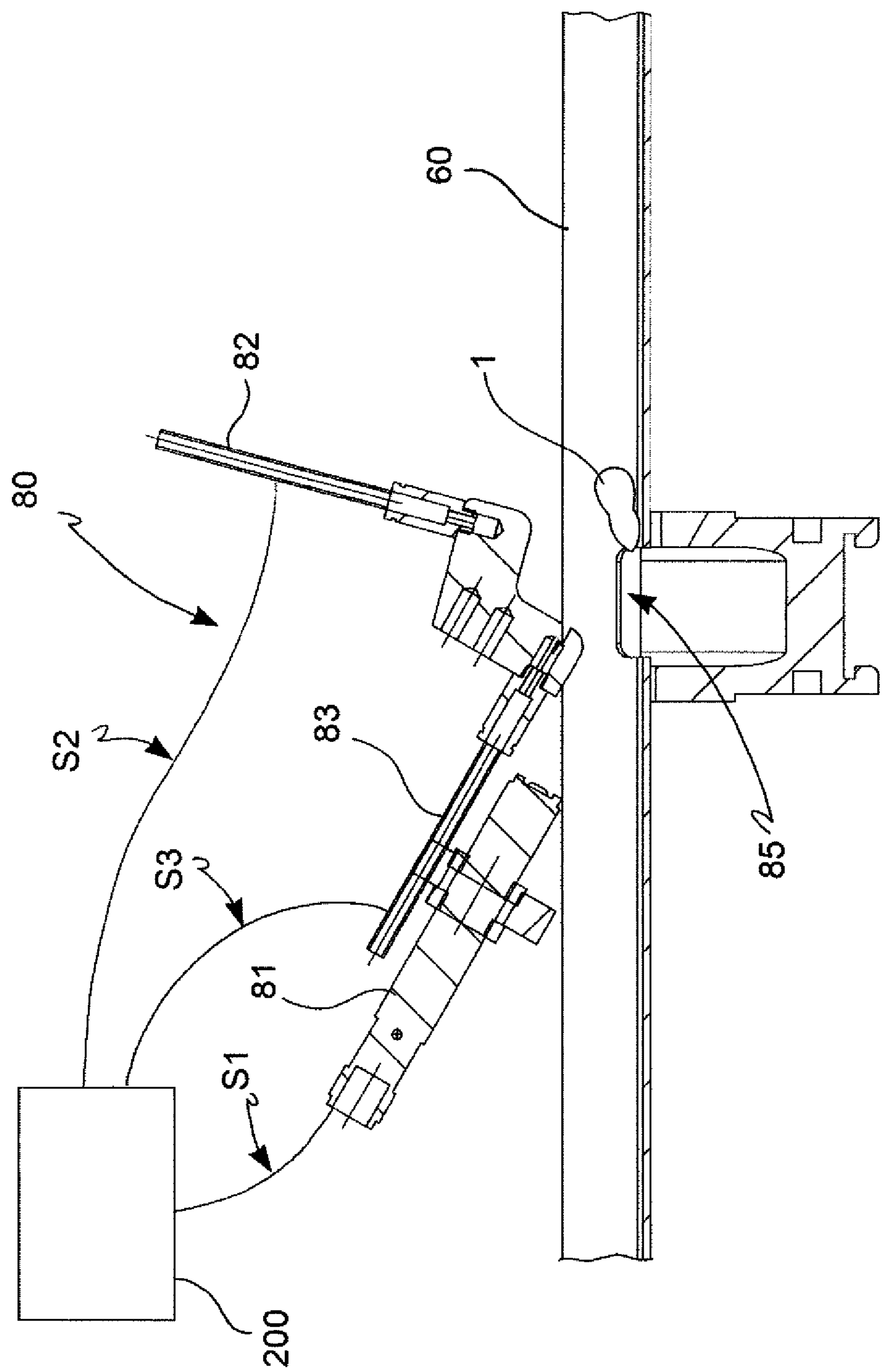


FIG. 4

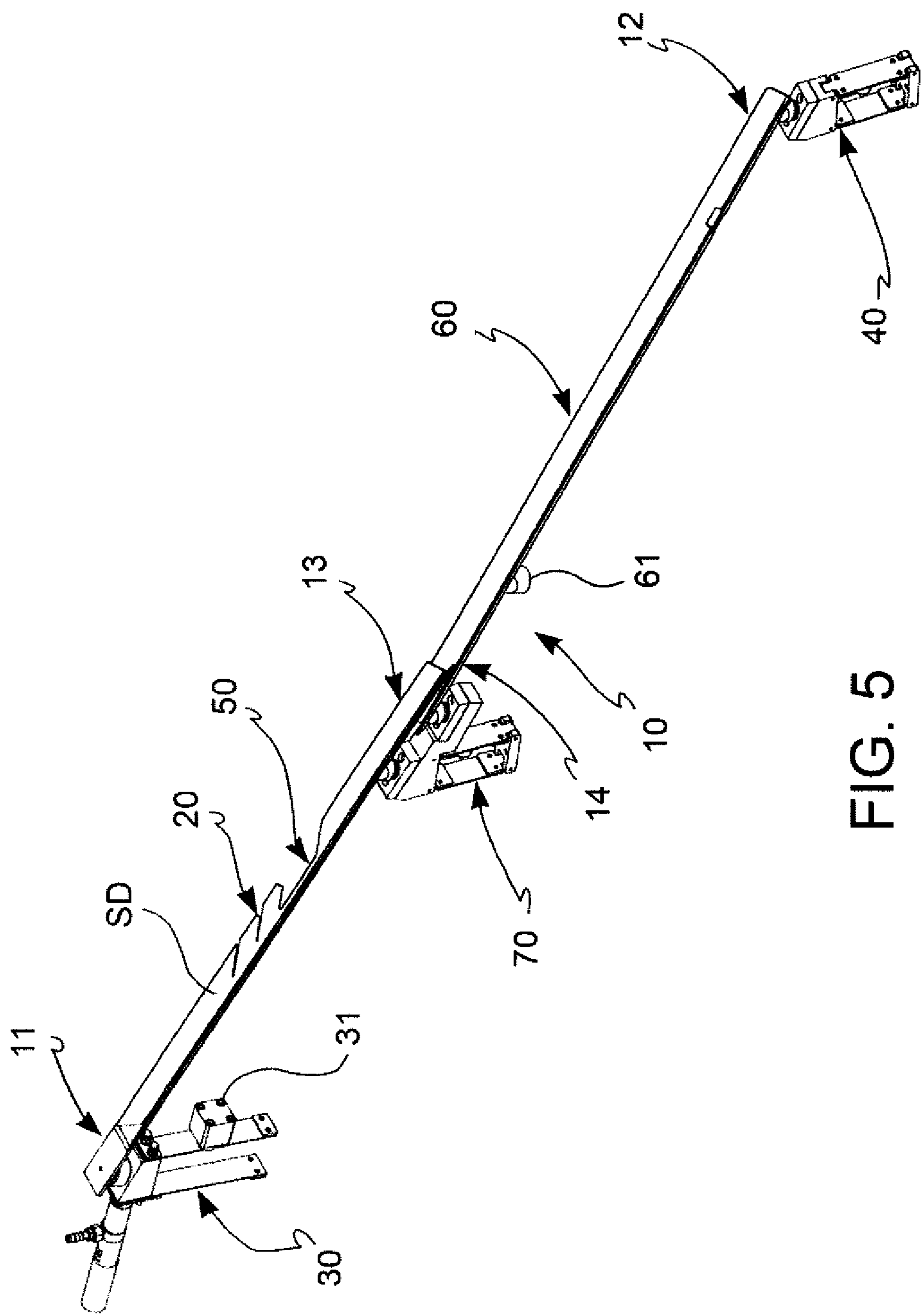


FIG. 5

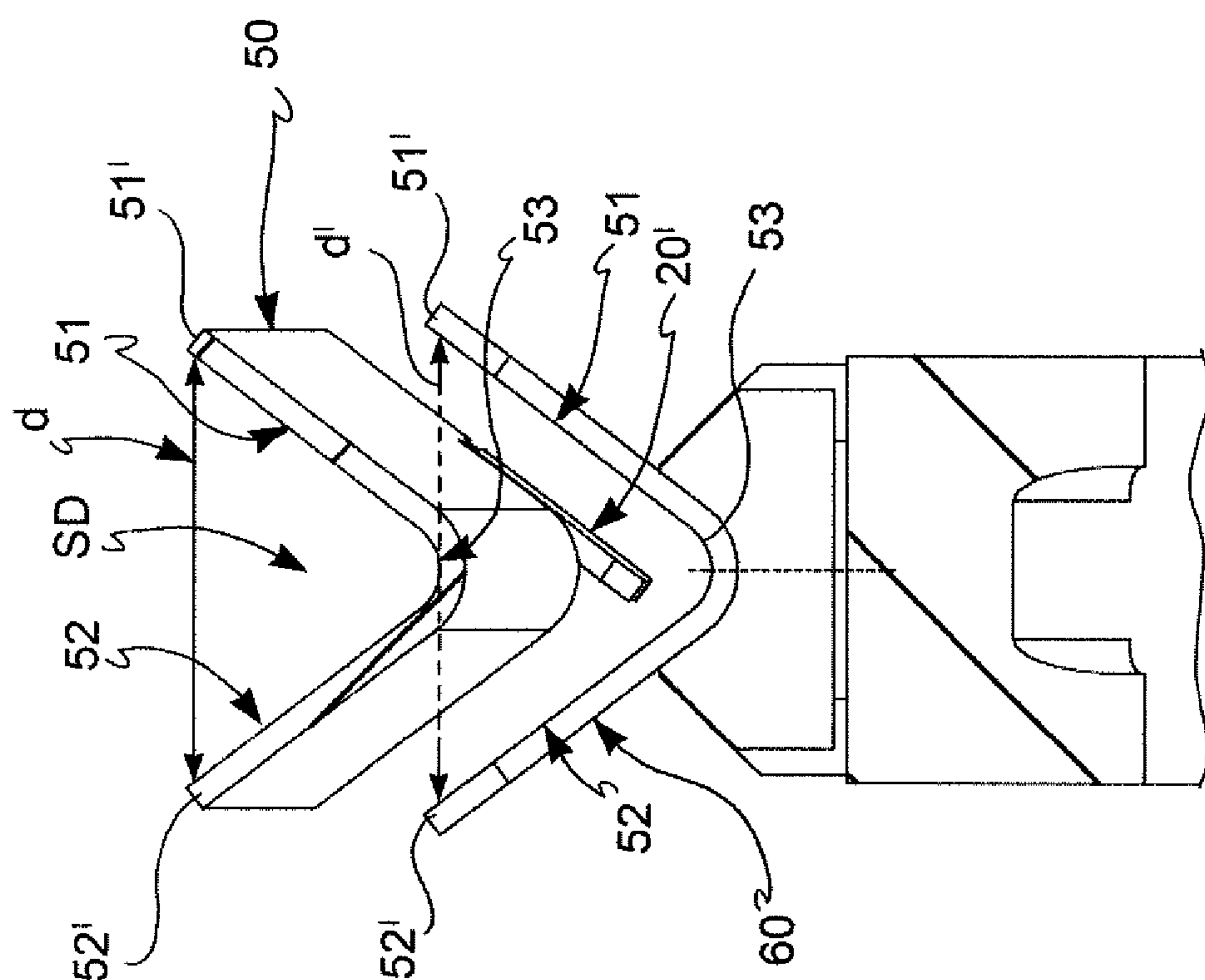


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/IT2019/000109

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65G27/04 B65G27/22 B65G27/34
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/061994 A1 (PANDRAUD JEAN-LUC [FR] ET AL) 17 March 2011 (2011-03-17) paragraphs [0005], [0025] - [0030]; figure 2A -----	1,3,15
A	KR 2014 0124503 A (COUNTEC CO LTD [KR]) 27 October 2014 (2014-10-27) figures 1,3,12 -----	1,2,6
A	US 9 463 935 B1 (KARPINSKY JAMES L [US] ET AL) 11 October 2016 (2016-10-11) figures 1,2 column 2, line 21 - column 3, line 37 ----- -/--	1,7,10



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

3 August 2020

Date of mailing of the international search report

17/09/2020

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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