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[Continued on next page]

(54) **Title**: COMPONENT FEEDING SYSTEM OF AT LEAST AN ASSEMBLY LINE

(57) **Abstract**: A component feeding system of at least an assembly line is described wherein the containers containing the components are moved by the force of gravity. The system comprises at least a loading station (3) at least a sorting trolley (5) to move the components and at least an assembly station (7). Both empty (91) and full (90) containers are retained up to the passage of the sorting trolley (5), thanks to check means cooperating with release means enabled by the weight of the empty (91) or full (90) containers themselves.

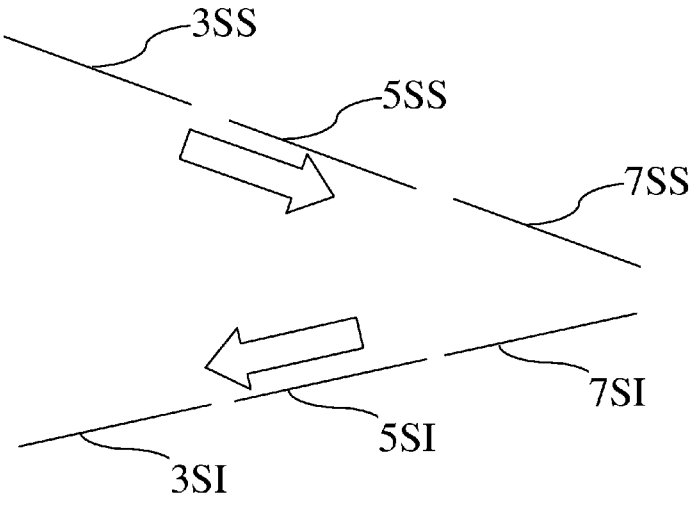

Fig. 10

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COMPONENT FEEDING SYSTEM OF AT LEAST AN ASSEMBLY LINE

Application field of the invention

The present invention relates to the field of the component feeding systems of at least an assembly line and, in particular, of assembly lines of motor vehicle components, specifically of industrial vehicles. In particular the invention relates to a system for sorting components, delivered by means of appropriate containers.

Description of the prior art

Motor vehicle components are stored in a warehouse.

The assembly line comprises one or more assembly stations aligned along the assembly line itself.

Depending on the distribution of the assembly stations of an assembly line, an electric tractor tows one or more trolleys where the components that have to be distributed to said assembly stations are placed.

According to the current feeding system, each trolley is preferably intended to feed a station of a line. Thus, the operator driving the tractor couples the tractor to the trolleys in the warehouse, which were previously loaded by other operators, drives them in the vicinity on an assembly line, releases a full trolley and couples an empty one in order to drive it in the warehouse, where it will be exchanged with a full trolley to start again the feeding tour

of the assembly line.

Each trolley may be dimensioned in order to contain exactly the number of components that are necessary to complete an operation schedule.

According to what is provided by the current handling systems, most of the operations are done by persons.

On the other hand, the automation of the feeding systems is particularly expensive for different reasons.

Firstly it should be considered that the length of the assembly lines depends on the type of vehicle, which may vary over time. Thus the space can be divided and exploited in a different way. This conditions remarkably the constructions relating to the space allocation and in particular to the electricity supply for automating all the operations performed both in the warehouse and at the assembly line.

Furthermore, also the warehouse may be modified over time, in order to be adapted to variations of the production needs. Thus here also, the electricity supply and the automation of the feeding of the components that fill the trolleys are expensive, above all if the operations of the warehouse automation are intended to be put in relation with the loading of the trolleys.

On the other hand, even in presence of automation systems both in the warehouse and at the assembly line, a human contribution is still necessary to exchange the full trolleys

with the empty ones and vice versa.

The problems mentioned above are even more serious considering that the dimensions of the motor vehicle components may vary greatly: from a few centimetres of a caliper, to about two metres of a bumper.

Moreover, further constraints must be added to the constraints mentioned above, to ensure the safety of the operators.

The areas crossed by the tractors with their respective trolleys are forbidden to anyone except the drivers of the tractors.

Thus, a further problem arises, which is the need for non-restricted areas, where the trolleys can be loaded or manually led by other people than the tractor's operators, and then coupled to the tractor.

For example, US2010/300841 shows a feeding system which partially solves the aforementioned problems. Such document shows a loading station, a trolley, and an assembly station of the components. The stations and the trolley comprise component sliding planes inclined in order to exploit the gravity force for the reciprocal transfer of material. Figures 15 and 16 clearly show that the wheels of the trolley are oriented towards the assembly station. This implies that only a single trolley at a time can be moved until it matches frontally with the assembly station.

Summary of the invention

Therefore the aim of the present invention is to overcome all the aforementioned drawbacks and to provide a component feeding system of at least an assembly line.

The object of the present invention is a component feeding system of at least an assembly line, according to claim 1.

Advantageously, according to the present invention, the approach of the sorting trolley to the stations is grazing, namely it is tangent and thus it is not frontal. Primarily this means that it is not necessary to disconnect the trolley from its tractor. This implies that the approach operation does not need a manual displacement of the trolley and thus it is not necessary for a human operator to occupy zones that are not suitable for human operators moving on foot.

Moreover, the fact that it is no longer necessary to disconnect the trolley from the tractor implies that the tractor can pull more trolleys at the same time and that, organizing the position of the trolleys according to the position of the stations, two or more stations, both loading and unloading, can be served at the same time by means of a single grazing approach of the train at the stations in the warehouse or along the assembly line. The term train refers to the arrangement of the tractor followed by the trolleys.

According to a preferred alternative embodiment of the present invention, the components are sorted by containers. Consequently the stations and the trolley may be further equipped with inclined planes, also for the transfer of empty containers.

In particular, by arranging the transfer planes of the empty containers below the inclined planes used for transferring the full containers, at each approach it is possible not only to serve two or more stations at the same time, but it is also possible to transfer empty and full containers at the same time.

Thus also the loading stations are preferably aligned, in order to have a bijective correspondence between loading and unloading stations.

The system comprises at least a first station arranged within or at the side of a warehouse area, at least a second station arranged along or at the side of an assembly line, at least a sorting trolley moving between said first station and said second station, wherein said at least a first station comprises a first upper inclined plane; said at least a sorting trolley comprises a second upper inclined plane, said at least a second station comprising a third upper inclined plane, said upper inclined planes defining ideally a single continuous inclined path, during a grazing approach of the sorting trolley to the stations, for the transfer of said

containers full of components addressed to the assembly line. The functioning of the system depends primarily on the fact that the upper inclined plane of the trolley is inclined transversally in relation to the travelling direction of the train.

From this it is evident that the train approaches the warehouse line or the assembly line in a grazing way, thus both the loading and the unloading stations are arranged so that it is possible to transfer components and/or containers at the grazing passage of the sorting trolleys.

Preferably the system is arranged so that said at least a first station comprises a first lower inclined plane, said at least a sorting trolley comprises a second lower inclined plane, said at least a second station comprises a third lower inclined plane, said lower inclined planes defining ideally a single continuous inclined path, during a grazing approach of the sorting trolley to the stations, for the transfer of said empty containers which will be filled again in the warehouse.

According to another aspect of the present invention, both the stations and the sorting trolley comprise check means of the components or containers of components, suitable to avoid an inappropriate sliding of the components themselves.

Such check means are configured in order to be released during the grazing approach of the sorting trolley when the trolley comes into contact with the stations.

Advantageously the fact that the transfer is enabled by the reciprocal contact between stations and trolleys and by the effect of the weight force, as it will be explained in the following, solves the further problem of avoiding any electrification of the check and release means.

More in particular, this means that the lines, both the assembly line and correspondingly the warehouse line, may be modified without making important structural changes.

Such system is particularly suitable for the production plants where the components are delivered by means of containers. Preferably the containers are suitable to keep the components they contain in a position of grasp already oriented for their assembly on the vehicle.

As it will be explained later, from the loading station, warehouse side, to the unloading station, assembly line side, through the sorting trolley, an ideally continuous inclined path is defined, wherein containers full of components travel. On the contrary, between the assembly and the loading station, through the sorting trolley, an ideally continuous inclined path is defined, wherein empty containers travel.

Thus both the stations and the trolley comprise one upper chute and one lower chute. In fact, according to the needs, the inclinations of the chutes may be varied reciprocally.

A sorting trolley is also object of the present invention, according to claim 11.

The loading and unloading stations for components and/or containers are also object of the present invention.

In particular, the unloading station, according to a preferred alternative embodiment, comprises a frame supporting an upper inclined plane having a first inclination with respect to a horizontal plane; a lower inclined plane having a second inclination opposite to the direction of said first inclination, said first and second inclination being suitable to move a full container towards an operator and to move an empty container away from the operator.

The second station comprises also an exchange chute, in the vicinity of the assembly line, hinged to the frame so that it takes two positions:

a first position wherein it is the ideal extension of the third upper plane and a second position wherein it is the ideal extension of the third lower plane; and further comprises means for operating the exchange chute suitable to put an emptied container on the third lower inclined plane.

Methods for the functioning of the system are also object of the present invention, as defined in the claims 30-34.

In the following the station indicated as the first station is at the side or within the warehouse where the components or the full containers are loaded. Thus it will be called first station, loading station or warehouse station. Correspondingly, the second station may be called second

station, assembly line station or unloading station.

According to another aspect of the present invention, an electric tractor is appropriately adapted to perform in an efficient way said grazing approach between said at least a sorting trolley and said loading or unloading stations.

A system for aiding the grazing alignment between a train, comprising a tractor and at least a sorting trolley, and a loading or unloading station is also an object of the present invention.

Another object of the present invention is a container for sorting the components.

The claims are an integral part of the present invention.

Brief description of the Figures

Further purposes and advantages of the present invention will become clear from the following detailed description of a preferred embodiment (and its alternative embodiments) and the drawings that are attached hereto, which are merely illustrative and non-limitative, in which:

- figure 1 shows a feeding step of a loading station,
- figures 2 and 3 show respectively a sorting trolley approaching a loading station and a feeding trolley approaching an assembly station,
- figure 4 shows an instant following the approaching of the sorting trolley to the assembly station, determining an exchange of containers,

- figure 5 shows an integration of a loading station within a warehouse,
- figures 6 and 8 show detailed views, perpendicular between each other, of a sorting trolley,
- figure 9 shows a detailed side view of an assembly station,
- figure 10 shows schematically the back and forth travel of the containers, being respectively empty and full,
- figure 11 schematically shows a system for aiding the alignment of a tractor of a convoy of sorting trolleys;
- figure 12 shows a perspective view of an example of sorting container of components;
- figure 13 shows a perspective view of an example of a part of the container of figure 12.

In the figures the same reference numbers and letters identify the same elements or components.

Detailed description of preferred embodiments of the invention

With reference to the figures, the system that is object of the present invention comprises essentially

- one or more sorting trolleys 5, in the following called trolley, preferably in cascade connection with a tractor, e.g. per se known in the art,
- a first exchange station 3 for exchanging full containers with empty ones, placed in the warehouse or at the side of the area of the warehouse, in the following called loading

station,

- a second exchange station 7 for exchanging empty containers with full ones, placed along or at the side of the area of the warehouse, in the following called assembly station.

For the sake of simplicity, full containers are marked by two crossing diagonals, while empty ones are marked by one single diagonal.

As it will be clearer later, both the exchange stations and the trolleys contain an upper chute SS for the full containers and a lower chute SI for the empty containers.

From figure 2 to figure 4 the sequence is shown of the various approach instants of a trolley 5 to the two aforementioned types of stations 3, 7.

Figure 1 shows the loading with full containers 90 of the upper chute 3SS of the first station 3, from the side of the warehouse.

Figure 2 shows the approach of a trolley 5 to the first station 3. It is evident that if the station is loaded from the left side, wherein the operators may circulate, the trolley 5 approaches the first station from the right side.

Figure 2 shows the instant preceding the exchange of containers. The trolley 5 carries the empty containers 91 on its lower chute 5SI. As soon as the exchange starts, the full containers move from the chute 3SS to the chute 5SS, while the empty containers move from the chute 5SI to the chute

3SI.

As it can be seen in the figures, at least when they are loaded, the chutes are inclined so that they exchange containers by means of the sliding of the containers themselves, namely without the help of any manual or motorized handling means.

Thus both the trolley and the stations comprise upper inclined planes for full containers and lower inclined planes for empty containers which ideally are continuous between the stations, passing from the trolley. Such inclined planes define some chutes, since they comprise surfaces or rollers or bearings suitable for facilitating the sliding of the containers.

As it will be clear in the following, it is preferable that some chutes are horizontally pivoted.

Figure 3 shows a trolley 5 approaching a station 7 from the left side. This implies that operators may approach the station 7 from the right side.

Figure 3 shows, as in figure 2, an instant preceding the exchange of containers 90, 91.

On the contrary, figure 4 shows that an instant after the exchange, the full containers lie on the upper chute 7SS of the second station 7, while the lower chute 7SI is devoid of any container.

With particular reference to figures 3 and 4 it can be noted

that the number of containers in the upper chute of the line station 7 is one unit more than the unloaded containers. This is preferable in order to ensure a continuous feeding of material to the assembly operator. As the containers are emptied, they pass to the lower chute 7SI of the assembly station 7. When the last full container 90 is left, a trolley 5 collects the empty containers and unloads the same number of full containers.

A first fundamental concept of the invention is that the handling of the containers, both full and empty, is performed between the stations and the trolley, just thanks to the force of gravity.

The exchange of the containers is performed by means of release means cooperating with check means of the trolleys. Such cooperation is realized by the passage of the trolley in correspondence of the stations. Such release/check means are preferably mechanical, so that, also in this case, it is not necessary to provide switches, motors and automation means in general that will need electric energy.

According to the alternative embodiment shown in the figures, said release means are also realized/connected in order to allow the release of the check means and thus the unloading of full containers only when the empty containers are ready to be collected.

Firstly, it is worth noting that the upper chute of the

loading station 3 is horizontally pivoted, while the lower chute is fixed. Symmetrically, the upper chute of the assembly station 7 is fixed while its lower chute is horizontally pivoted. When the full containers 90 are positioned correctly on the upper chute of the first station, the latter pivots, for example thanks to the action of a load spring, determining a positioning of the release means 31 such that it cooperates with a respective check means 51 of the trolley 5 suitable for retaining the empty containers 91 in the lower chute 5SI.

As it will be explained below, the check means are substantially fixed to the respective structure, both of the stations and of the trolley, while the release means are moved by the weight of the containers.

Also the lower chute 5SI of the trolley is horizontally pivoted. The lowering of the lower chute 5SI of the trolley 5 determines also the positioning of the release means 52 integral with the trolley 5 in order to cooperate with the check means 32 of the upper chute 3SS of the loading station 3.

Considering now figure 4 it can be seen that the trolley 5 has already unloaded the full containers and collected the empty ones, thus the release means are no longer in a position wherein they can cooperate with the check means.

With reference to figure 3, an instant before the exchange,

the lower chute 7SI of the line station 7 is empty, its respective release means 73 are lowered due to the pivoting of the chute itself and can cooperate with the check means 53 of the trolley to release the sliding of the full containers from the upper chute 5SS. In the same way, the upper chute 5SS of the trolley is lowered, which determines that the release means 54 associated with the upper chute 5SS, are in position to cooperate with the check means 74 of the lower chute 7SI of the assembly station in order to release the sliding of the empty containers 91. It is evident that when the upper chute 5SS of the trolley and the lower chute 7SI of the second station 7 are both full, then the respective release means 54 and 73, may cooperate with the check means, respectively 74 and 53, in order to enable the exchange of full containers with empty containers. Thus this happens symmetrically between the trolley and the assembly station and the trolley and the loading station.

In particular, it can be noted that the lowering of an upper horizontally pivoted chute, for example 3SS or 5SS, opens the check means of a lower chute 5SI or 7SI of the system at its right, being it a trolley or a station, namely according to the sliding direction of the full containers. In the same way, it can be noted that the lowering of a lower horizontally pivoted chute opens the check means of an upper chute 5SS or 7SS of the system at its left, being it a

trolley or a station, namely according to the sliding direction of the empty containers 91.

The last chutes, both towards the line and towards the warehouse, namely respectively 7SS and 3SI, are fixed.

A second fundamental concept of the present invention is that the release means are suitable to cooperate with the respective check means thanks to the weight force which makes the chute pivot horizontally. On the contrary, their reciprocal cooperation is determined by the reciprocal movement between the trolley and the stations, resulting from the traction of the trolley towed by the tractor.

The figure shows only one trolley approaching a loading or assembly station. Actually there is a convoy of trolleys that, as they move, meet a series of loading stations 3, namely on the warehouse side, and perform the exchange of the containers of the first trolley, then of the second trolley, and so on. This happens in the same way on the assembly line side.

It is the interaction mechanism of the release/check means itself that ensures that the containers are loaded on the right trolleys.

Thus, advantageously, it is not the driver of the convoy of trolleys who determines which trolley should be filled, but everything is predetermined from the position in sequence of the stations both on the warehouse and on the line side. This

makes first of all impossible to make mistakes. Moreover, the driver must no longer exchange the trolleys coupling or uncoupling the convoy of trolley, since the trolleys are not exchanged or uncoupled, but only the full/empty containers are. Thus a lot of time is saved, since the driver has just to follow a path and to stop in the vicinity of each station in order to allow the transit of the containers 90 and 91 and after that to drive off again.

Consider that the system shown here would work also with a manually driven sorting trolley 5.

In order to simplify the driver's task, aid systems may be provided, for example remote controlled assistance systems, or constrained and/or checking systems. Such aspect will be described later.

The empty containers may be collected from the first station 3 in different ways, for example by arranging an appropriate platform that, once it is filled again, it may be lifted in order to load the upper chute 3SS of the loading station 3, preferably in a following cycle.

The loading/unloading of the containers must not be necessarily synchronous, thus a movable plane 11, for example of a lift truck 1, lifts and, once it reaches a predetermined level, releases the full containers in the upper chute 3SS, after that it lowers waiting for an exchange with a trolley 5. After that, the empty containers 91, passing through the

lower chute 3SI, settle on said movable plane 11 in order to be filled and lifted back again to the upper chute 3SS.

Preferably the loading station 3 on the warehouse side is integrated directly in the shelving 100 of a warehouse. See for example figure 5. This advantageously allows to respect immediately the concept of separation between the areas used for the transit of the trolleys and the areas used by the operators.

Consider that, said separation is advantageous anyway, also in those cases where the containers are automatically filled by robots and the like, because it protects the driver of the convoy of trolleys 5.

With particular reference to figure 4, the container being worked on 93 is inclined towards the assembly operator 9, with an inclination that is preferably higher than the one of the upper chute 7SS of the station 7. The station 7, as it will be showed in the following, comprises a system to move forward one container 90 at a time in order to bring it in position of withdrawal of the component/s it contains. Once it is empty, said system allows to drive the containers on the lower chute 7SI in order to receive an empty container coming from the upper chute 7SS.

With reference to the figures 6, 7 and 8, an example of trolley 5 is shown according to different views.

Figure 6 shows a front view from the left of the trolley 5

according to any of the previous figures or according to the side figure 7. Figure 8, instead, shows a front right view of the same trolley.

Check means 51, similarly to check means 53 or 32 or 74, comprise preferably

- a plate 61 rotatably associated to the structure of the trolley or station to which the chute whose containers it checks is fixed, the plate rotating according to a vertical plane tangent to the moving direction of the convoy of trolley,
- at least a hooked rod 63 hinged in a middle position, acting as a fulcrum, to the same structure and at one end to the plate 61 by means of a transmission 62.

A rotation of the plate makes such rod 63 move with respect to the fulcrum, between an interference position with respect to the sliding of the containers and a non interference position with respect to it.

The retain means, for example 31, which cooperate with said check means, comprise a tapered object, said hammer, in the direction of forward movement of the trolley, see figure 6, which collides with a knob or a crest, projecting from the surface of said plate 61, and makes it rotate.

With particular reference to figure 7, the hammer 52 or 54 may be connected in various ways to a respective horizontally pivoted chute, for example in a rigid way by means of an arm

64 or by means of an overturn L-shaped arm 66, having a first end hinged to the horizontally pivoted chute 5SI and a second end connected with said hammer, while in a central position it is hinged to a first end of a connecting rod whose second end is hinged in the structure of the trolley. Figure 9 shows the possible movements of the hammer 73. More sophisticated handling systems may be provided, for example by means of double hinges, in order to guarantee a perfectly vertical lifting and lowering of the hammer, or a lateral projecting or retraction movement with respect to the trolley. Such alternative embodiments can be realized by the person skilled in the art.

With reference to figure 7, load springs 68 e 69 are illustrated, which, when there are no containers on the respective upper and lower chute, bring the chutes in raised position, consequently making the hammers move away from the position wherein they can hit the plates 61.

With reference to figure 9 a second station 7, side assembly line, is shown in detail.

Such station comprises, as said above, an upper fixed chute and a lower horizontally pivoted chute.

More in detail, it can be seen that the upper opening of container being worked on 93 is turned towards the right, namely towards the withdrawal direction of the components contained in the container.

This is realized by means of an exchange chute 80.

Such chute is hinged at its end 81, thus it cannot pivot under certain conditions. The exchange chute is supported by a rod in two pieces 84, the so-called toggle. The latter is hinged at an upper end 88 to a lower part of the exchange chute and at a lower end to the frame of the station. The rod in two pieces 84 has a middle articulation 85 such that the upper part may rotate only counter clockwise with respect to the lower part.

A traction spring 86 is placed between said articulation 85 and the frame, in order to avoid such rotation of the two parts of the rod 84, keeping the rod pointing against the lower part of the exchange chute.

A projecting pedal 83 is connected to the lower part of the two-piece rod 84 from the side that induces the breaking of the rod. A pressure on the pedal 83 that overcomes the traction of the spring 86 determines a clockwise rotation of the lower part of the rod and a counter clockwise rotation of the upper part of the rod. Thus the exchange chute lowers in order to allow the container 93 (presumably empty) to be placed on the lower chute 7SI. Any other container 90 cannot move forward on the exchange chute until the container 93 is on the exchange chute. During the exchange rotation of the chute, there is a condition wherein the bulk of the container 93 is no longer able to hinder the forward movement of a

following full container 90. The arm 82 is connected to the exchange chute so that it can continue blocking the following container 90 when the container 93 is on the lower chute. Once the exchange chute is free, its lifting frees said arm 82, thus next full container 90 may be put on the exchange chute 80.

As it can be noted, also in this case, the containers move substantially thanks to the force of gravity and to low-effort manual operations.

Advantageously, the exchange chute is placed so that it is within an interval of heights from the ground which facilitates the assembly operator.

It is also clear that, a simple pressure on the pedal allows the operator to move away an empty container, without having to seize, lift and move it.

A preferred operating method of a system that is object of the present invention comprises at least the following steps in a cyclical sequence:

- filling of containers and placing of said first upper chute 3SS, when a sorting trolley 5 approaches said at least a first station 3 and contains empty containers 91 in a respective second lower plan 5SI,
- simultaneous exchange of empty 91 and full 90 containers between said at least a first station and said sorting trolley,

- directing the approach of the sorting trolley 5 to at least a second station 7, when the trolley approaches said at least a second station 7, if the latter contains empty containers 91 in a respective third lower chute 7SI,
- simultaneous exchange of empty 91 and full 90 containers between said sorting trolley and said second station,
- directing the approach of the sorting trolley 5 to at least a first station 3.

From the description above it is clear that the trolley approaches the stations 3 and 7 tangentially.
Furthermore, in order to allow a perfect alignment between the convoy and the stations, rubber wheels 99 are provided rotating in a horizontal plane and placed along the sides of the trolley, or, as an alternative, along the sides of the stations 3 and 7, see figures 7 and 8, between the trolley and the stations suitable to deaden blows and bushes 98 cooperating with guides 97 are also provided, see respectively figure 8 and 9. During the approach, the return bushes engage into the guides 97 which perform a sort of returning action aligning the trolley with respect to the station. It is clear that this is valid for both station types.

Figure 10 shows schematically both the upper and the lower chute, in order to show better the concept of ideally continuous path between first station, trolley, second

station and back.

In the interconnection points between the chutes tips may be provided.

As regards the aids to the alignment of the train or of the convoy with said stations 3 and 7, further systems per se known may be used, based for example on a magnetic strip drowned in the floor.

A preferred aid for the alignment of the convoy or train comprises the arrangement of coloured strips on the floor and the presence of a laser pointer 111 mounted on the tractor 110 which lights up a point on the floor. As long as the light projected on the floor falls within such colored bands on the floor, the tractor, and thus the whole convoy, is aligned with said stations. Moreover, in the vicinity of the stations, on the coloured strip, for example white coloured, there is a differently coloured circle, which indicates the point where the light point should be projected so that the release means may correctly cooperate with the check means.

According to further alternative embodiments, in correspondence of the exchange station, slight depressions on the floor can be provided, so that one wheel of the tractor is automatically pulled there, due to the weight force. Such slight depressions serve as check to determine the correct stop point of the tractor 110.

According to a preferred alternative embodiment of the invention, the use of colored strips on the floor with a laser pointer is combined with magnetic sensor and respective

check magnets.

With particular reference to figure 11, the tractor 110 is equipped with

- laser pointer 111 which project a light spot on the floor,
- a first sensor 112 checking the stop,
- a second sensor 113 of the beginning of the speed reduction.

The first and the second sensor may also be integrated in a single sensor.

A first magnet 123 is arranged on the floor which interacts with the second sensor 113 to control the speed reduction of the tractor 110 at a predefined reduced travelling speed within the loading or unloading zones. This advantageously helps the driver to drive the light spot on the colored strip with a higher precision, at least in the most critical points when the train approaches the warehouse or the assembly line.

A second magnet 122 is positioned where the tractor is expected to stop, determining the automatic stop of the tractor by the interaction with said first sensor 112.

The correct stopping of the tractor determines the correct facing of the sorting trolley with the loading or unloading stations. In other words, this avoids that the train stops before or after the correct lateral alignment of the sliding planes 3SS, 5SS, 7SS e 3SI, 5SI, 7SI.

An appropriate button, not shown, is arranged on the trailer

in order to enable its restarting after being stopped.

A third magnet 124 is placed at the end of the area where the tractor should keep going at said predetermined reduced speed.

Such magnets may be, for example, set in the floor of the warehouse and in the floor of the rooms accommodating the assembly line.

Such magnets may also be fixed to the stations 3, 7 themselves and/or to appropriate supports lying on the floor or hanging from the ceiling.

According to a further aspect of the present invention, a preferred alternative embodiment of containers for sorting the components is shown in figure 12. Such containers 150, instead of being filled with a carved sponge in order to define a stable support seat for one or more components, as known in the prior art, have walls equipped with a plurality of hollow seats 151 wherein one or more locking elements 152 can be firmly inserted.

One or more locking elements, preferably long and narrow, may be removed in order to take the components. Advantageously, when the shape of the component varies, it is not necessary to dispose of any sponge, since the position of such long and narrow elements 152 can be varied as the components change.

Another enormous advantage lies in that the sponge according to the prior art, in order to be stable, is processed so that

the single components can be taken independently of one another without any superimposition of the components. A superimposition of the components is intolerable, due to the use of a sponge partitioned into separate parts without any stability within the containers, which means that they should be attached to the walls of the containers.

On the contrary, it is sufficient that the locking elements block the components within the containers, without occupying further space. This frees some space that allows at least a partial superimposition or interpenetration between the shapes of the components, allowing time after time to fix the components so that they can be taken from the container for example according to a predetermined sequence.

With particular reference to figure 13, each locking element 152 has a long and narrow shape, preferably cylindrical, which develops along an axis Y. An end of the locking element comprises a coupling part 153 which develops parallel to the axis Y, but offset with respect to it, so that a rotation of the locking element 152 with respect to the coupling element engaging in a respective seat 151 allows to obtain a slight movement of the locking element 152, substantially like a cam, thus adapting easily to the shape of the component to be carried in the container.

It will be apparent to the person skilled in the art that other alternative and equivalent embodiments of the invention

can be conceived and reduced to practice without departing from the scope of the invention.

From the description set forth above it will be possible for the person skilled in the art to embody the invention with no need of describing further construction details. The elements and the characteristics described in the different preferred embodiments may be combined without departing from the scope of the present application.

CLAIMS

1. Component feeding system of at least an assembly line, in particular of motor vehicle, comprising

- at least a first station (3) placed within or at the side of a warehouse area, and comprising at least a first upper inclined plane (3SS),

- at least a second station (7) placed within or at the side of an assembly line, and comprising at least a third upper inclined plane (7SS),

- at least a sorting trolley (5) movable between said first station (3) and said second station (7) and comprising at least a second upper inclined plane (5SS);

said first, second and third inclined planes (3SS,5SS,7SS), defining ideally a single continuous inclined path, when the sorting trolley (5) approaches the stations (3,7), in order to transfer said components addressed to the assembly line, so that said transfer of components is caused by the weight force;

and characterized in that

said second plane (5SS) is inclined in a transversal way with respect to a travelling direction of the sorting trolley (5) so that said approach of the sorting trolley (5) to said first and second station is grazing, in order to transfer the components laterally with respect to said travelling direction.

2. System according to claim 1, wherein said at least a first station (3) comprises first check means (32) suitable to avoid an inconvenient sliding of full containers (90) from the upper first plane/chute (3SS) and wherein said at least a sorting trolley (5) comprises first release means (52) suitable to release said check means (32) by the reciprocal contact when at least a trolley (5) approaches in a grazing way said at least a first station (3).

3. System according to claim 1 or 2, wherein said at least a sorting trolley (5) comprises second check means (53) suitable to avoid an inconvenient sliding of full containers (90) from the upper second plane/chute (5SS) and wherein said at least a second station (7) comprises second release means (73) suitable to release said check means (53) by reciprocal contact when the at least a trolley (5) approaches in a grazing way said at least a second station (7).

4. Sorting system according to one of the preceding claims from 1 to 3, wherein said components are sorted by means of full containers (90) and wherein

- said at least a first station (3) further comprises a first lower inclined plane (3SI),
- said at least a sorting trolley (5) comprises a second lower inclined plane (5SI)
- said at least a second station (7) comprises a third lower inclined plane (7SI)

said lower inclined planes (3SI,5SI,7SI), defining ideally a single continuous inclined path, when the sorting trolley (5) approaches the stations (3,7) in a grazing way, in order to transfer empty containers (91) intended to be filled again in the warehouse, so that said transfer of empty containers is caused by the weight force.

5. System according to claim 4, wherein said at least a second station (7) comprises third check means (74) suitable to avoid an inconvenient sliding of empty containers (91) from the third lower plane/chute (7SI) and wherein said at least a sorting trolley (5) comprises third release means (54) suitable to release said check means (74) by reciprocal contact when at least a trolley (5) approaches in a grazing said at least a second station (7).

6. System according to claim 4 or 5, wherein said at least a sorting trolley (5) comprises fourth check means (51) suitable to avoid an inconvenient sliding of empty containers (91) from the second lower plane/chute (5SI) and wherein said at least a first station (3) comprises fourth release means (31) suitable to release said check means (51) by reciprocal contact when the at least a trolley (5) approaches in a grazing way said at least a first station (3).

7. System according to any of the claims from 2 to 6, wherein said release means (52, 31, 73, 54) comprise gravitational means for positioning the release means in position of

cooperation with said check means (32, 51, 53, 74) when both, said at least a first or second station (3, 7) and said at least a sorting trolley (6), have containers (90, 91) to exchange.

8. System according to claim 7, wherein said first and third release means (52, 54) of said at least a sorting trolley (5) are connected mechanically with said second lower inclined plane (5SI) and said second upper inclined plane (5SS) respectively and wherein said second lower (5SI) and upper (5SS) inclined plane are horizontally pivoting due to the effect of the weight of the respectively empty (91) and full (90) containers placed on them; the first and third release means (52, 54) being in position of cooperation with the respective first and fourth check means (32, 74) when the respective inclined plane (5SI, 5SS) are loaded with containers (91,90).

9. System according to claim 7, wherein said fourth and second release means (31, 73) respectively of said at least a first station (3) and of said at least a second station (7) are connected mechanically with said first upper inclined plane (3SS) and with said third lower inclined plane (7SI) respectively and wherein first upper inclined plane (3SS) and said third lower inclined plane (7SI) are horizontally pivoting due to the effect of the weight of the respectively full (90) and empty (91) containers placed on them; the

second and third release means (31, 73) being in position of cooperation with the respective second and third check means (51, 53) when the respective inclined plane (3SS, 7SI) are loaded with containers (90,91).

10. System according to claim 8 or 9, wherein said first and second horizontally pivoting planes (3SS, 5SS) pivot along a clockwise direction when the full containers (90) move from left to right and wherein said second and third horizontally pivoting planes (5SI, 7SI) pivot along a counter clockwise direction when the empty containers (91) move from right to left.

11. Sorting trolley (5) of a component feeding system of an assembly line, in particular of motor vehicles, comprising a supporting frame and at least

- an upper inclined plane (5SS) having a first inclination with respect to a support horizontal plane of the trolley and/or
- a lower inclined plane (5SI) having a second inclination with respect to a support horizontal plane of the trolley,
- sliding wheels defining a direction of movement,

wherein said first and/or second inclination are transversal to said travelling direction and wherein the trolley is configured in order to transfer the components laterally with respect to said travelling direction.

12. Trolley according to claim 11, wherein when it comprises

both the upper inclined plane (5SS) and the lower inclined plane (5SI), said respective first and second inclination are one opposite the other.

13. Trolley according to one of the claims 11 or 12, comprising first check means (53) suitable to avoid the inappropriate sliding of full containers (90) from the upper plane/chute (5SS) and/or

when it is equipped with a lower plane/chute (5SI) it comprises second check means (51) suitable to avoid the inappropriate sliding of empty containers (91) from the lower chute (5SI).

14. Trolley according to claim 13 and to one of claims from 1 to 10, wherein said first check means (51) and/or second check means (53) are suitable to cooperate with appropriate release means (31,73) arranged respectively on said loading station (3) in the warehouse and on said unloading station (7) in the assembly line by a grazing approach of the trolley to the stations (3, 7).

15. Trolley according to one of the claims 13 or 14, comprising respective release means (52,54) of check means (32,74) suitable to cooperate by means of a grazing approach with respective check means (32, 74) of said loading station (3) and/or said unloading station (7) respectively, the check means being suitable to avoid an inappropriate sliding of components or of full containers (90) and of empty containers

(91) respectively.

16. Trolley according to claim 15, wherein said release means (52, 54) comprise means for enabling the cooperation with said check means (32, 74), wherein said enabling means exploit the weight force of the full containers (90) and/or of the empty containers (91) respectively.

17. Trolley according to claim 16, wherein said enabling means are defined by said inclined planes (5SS, 5SI) horizontally pivoted in order to increase their inclination and wherein each plane is kept in its minimum inclination position by means of respective load springs (68, 69).

18. Trolley according to one of the claims from 11 to 17, further comprising means for facilitating the grazing approach of the trolley to one of said stations (3, 7), in particular

- tired wheels (99) lying in a horizontal plane disposed along the sides of the trolley and/or
- return bushes (98) suitable to cooperate with respective return guides (97) of one of said first or second station (3,7) and/or return guides suitable to cooperate with the respective return bushes,

in order to guarantee the perfect grazing alignment of the trolley with respect to said stations.

19. Loading station (3) suitable to be arranged within or at the side of a warehouse area and comprising at least a first

upper inclined plane (3SS) for aiding the transfer of components and/or containers (90) full of components by means of the weight force on a sorting trolley (5) and comprising check means (32) for preventing an inappropriate sliding of said components or full containers (90) suitable to cooperate with respective release means (51) of a sorting trolley (5) when said sorting trolley approaches in a grazing way to the loading station (3).

20. Loading station (3) according to claim 19, wherein said check means (32) are complementary to said release means (51) and wherein the release means of the sorting trolley (5) are in accordance with one of the claims from 15 to 17.

21. Loading station (3) according to one of the claims 19 or 20 further comprising means for facilitating the grazing approach for a sorting trolley (5), in particular:

- tired wheels (99) lying in a horizontal plane disposed along the sides of the trolley and/or
- return bushes (98) suitable to cooperate with respective return guides (97) and/or return guides suitable to cooperate with the respective return bushes,

- in a complementary way with respect to the facilitation means of the sorting trolley (5) according to the claim 18;

in order to guarantee the perfect grazing alignment of the trolley (5) with respect to the loading station (3).

22. Loading station (3) according to one of the claims from

19 to 21, further comprising a lower inclined plane (7SI) in order to receive empty containers (91) from said sorting trolley (5) and release means (31) complementary with the check means (51) of the sorting trolley, as defined in one of the claims from 13 to 18, so that the release means cooperate with said check means when the at least a trolley (5) is approaching in a grazing way with said at least a loading station (3).

23. Loading station (3) according to claim 22, wherein said release means (31, 54) comprise means for enabling the cooperation with said check means (51, 74), wherein said enabling means exploit the weight force of the components or full containers (90), when placed on said upper inclined plane (3SS).

24. Loading station (3) according to claim 23, wherein said enabling means are defined by said upper inclined plane (3SS) horizontally pivoted in order to increase their inclination and wherein each plane is kept in its minimum inclination position by means of respective load springs.

25. Assembly station (7) suitable to be arranged within or at the side of a warehouse area and comprising at least a first upper inclined plane (7SS) suitable to receive the components and/or containers (90) full of components by means of the weight force on a sorting trolley (5) comprising check means (53) suitable to prevent an inappropriate sliding of said

components or full containers (90); the station (7) comprising release means (73) suitable to cooperate with said check means (53) when the sorting trolley approaches in a grazing way to the loading station (7).

26. Assembly station (7) according to claim 25, wherein said release means (73) are complementary to said check means (53) and wherein the release means of the sorting trolley (5) are in accordance with one of the claims from 13 or 14.

27. Assembly station (7) according to one of the claims 25 or 26 further comprising means for facilitating the grazing approach for a sorting trolley (5), in particular:

- tired wheels (99) lying in a horizontal plane disposed along the sides of the trolley and/or
- return bushes (98) suitable to cooperate with respective return guides (97) and/or return guides suitable to cooperate with the respective return bushes,

- in a complementary way with respect to the facilitation means of the sorting trolley according to the claim 18;

in order to guarantee the perfect grazing alignment of the trolley (5) with respect to the loading station (3).

28. Assembly station (7) according to one of the claims from 25 to 27, further comprising an inclined plane (7SI) placed below a support horizontal plane having an inclination opposite to said inclination of the upper plane (7SS), in order to transfer empty containers (91) on a sorting trolley

(5).

29. Assembly station (7) according to claim 28, further comprising

- a frame and
- an exchange chute (80), in the vicinity of the assembly line, hinged to the frame in order to take two positions:
  . a first position wherein the exchange chute (80) is the ideal continuation of the upper inclined plane (7SS)
  . a second position wherein it is the ideal continuation of the lower plane (7SI),
  - activation means (84, 86, 83) of the exchange chute (80) suitable to place an emptied container (93) on the lower inclined plane (7SI).

30. Second station (7) according to claim 29, wherein said activation means (84, 86, 83) of the exchange chute (80) are driven by a pedal (83).

31. Second station (7) according to claim 29 or 30, further comprising stop means (93,82) of the forward movement of a following full container (90) until the exchange chute is free (80).

32. Operating method of a system according to claims from 1 to 10, comprising at least the following steps in a sequence:

- positioning of containers full of components (90) or of components on the upper inclined plane (3SS) of the loading station (3),

- when a sorting trolley (5) approaches in a grazing way at least a loading station (3) transfer of said components or full containers (90) due to the weight force.

33. Method according to claim 32, wherein when the components are sorted by means of containers,

- when a sorting trolley (5) approaches in a grazing way at least a loading station (3) and contains, on a respective lower plane (5SI), empty containers (91),
- simultaneous exchange of empty (91) and full (90) containers between said at least a first station (3) and said sorting trolley (5) due to the weight force.

34. Operating method of a system according to the claims from 1 to 10, comprising at least the step according to which, when a sorting trolley (5) approaches in a grazing way at least an assembly station (7) transfer of said components or full containers (90) due to the weight force.

35. Method according to claim 34, wherein when the components are sorted by means of containers it further comprising the following steps in a sequence:

- when the sorting trolley (5) has containers full of components (90) on the respective upper inclined plane (5SS) and approaches in a grazing way the at least an assembly station (7), if the latter contains empty containers (91), in a respective third lower plane (7SI),
- simultaneous exchange of empty (91) and full (90)

containers between said sorting trolley and said second station due to the gravity force.

36. Operating method of a system according to claims from 1 to 10, the method being in accordance with claims 33 or 35, comprising the step of directing the sorting trolley (5) between said first and second station (3,7) in order to sort components or full containers (90) and/or empty containers (91).

37. System for aiding a grazing alignment between a train, comprising a tractor (110) and at least a sorting trolley (5), and a loading or unloading station (3,7), wherein said loading or unloading stations are arranged in at least a room defining a loading area and an unloading area and wherein a floor of said room is equipped with at least a coloured strip in the vicinity of said stations (3,7) within said loading or unloading areas and said tractor comprises means for visual check in order to light up said at least a coloured strip when the tractor has a grazing approach with said stations (3,7) in order to ensure the correct alignment of the train with the stations (3,7).

38. Aiding system according to claim 37, wherein a first magnet (123) is arranged at the entrance of at least one of said loading or unloading areas and wherein said tractor comprises means for automatically limiting its speed when it passes over, below or sideways to said first magnet.

39. Aiding system according to one of the claims 37 or 38, a second magnet (122) is arranged within at least one of said loading or unloading areas and said tractor comprises means for controlling its automatic stopping when it passes over, below or next to said second magnet; said second magnet being positioned so that the stopping of the tractor corresponds to the correct facing of the at least a sorting trolley (5) with the at least a loading or unloading station (3,7).

40. Aiding system according to one of the claims 38 or 39, further comprising a third magnet (124) placed at the exit of one of said loading or unloading areas, in order to remove said speed limitation of the tractor.

41. Aiding system, according to one of the claims 37 or 38, wherein said tractor further comprises means for manual restoring the movement after said automatic stopping.

42. Sorting container (150) made of walls, wherein at least a wall is equipped with a plurality of seats (151), the container comprising at least a locking element (152) suitable to be engaged within one of said seats (151) in order to stop, at least partially, a component within the container.

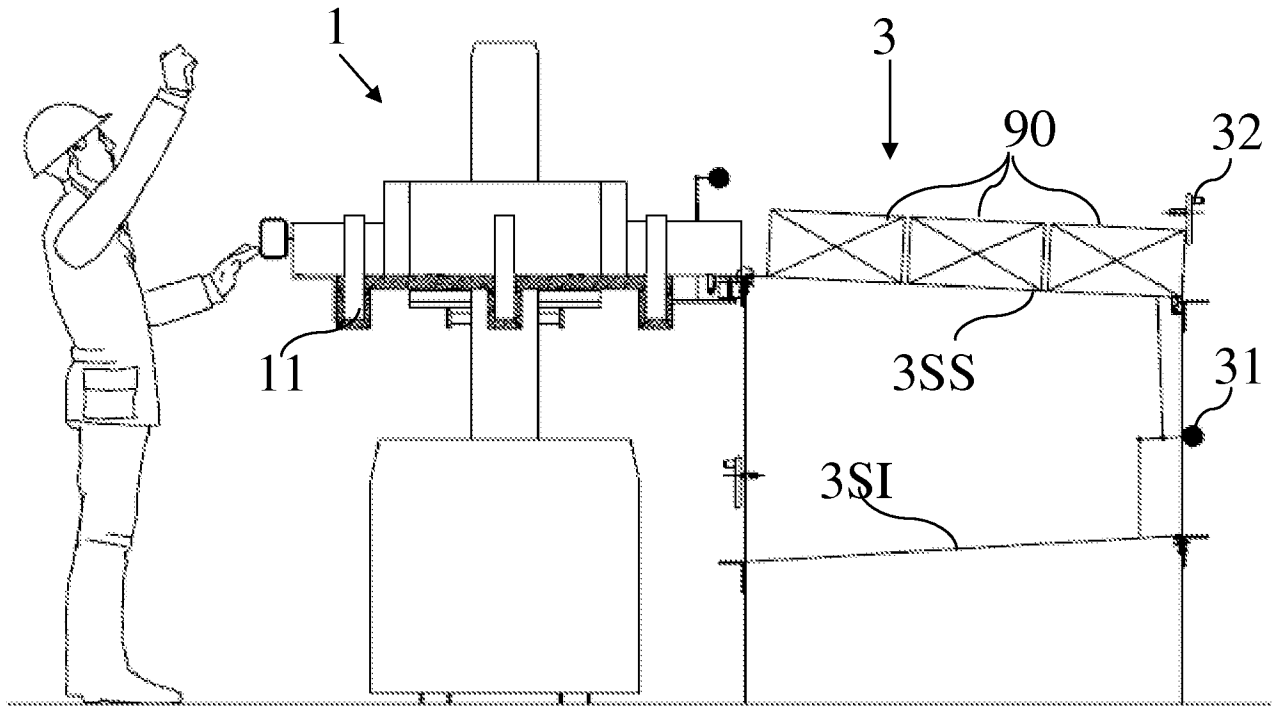

Fig. 1

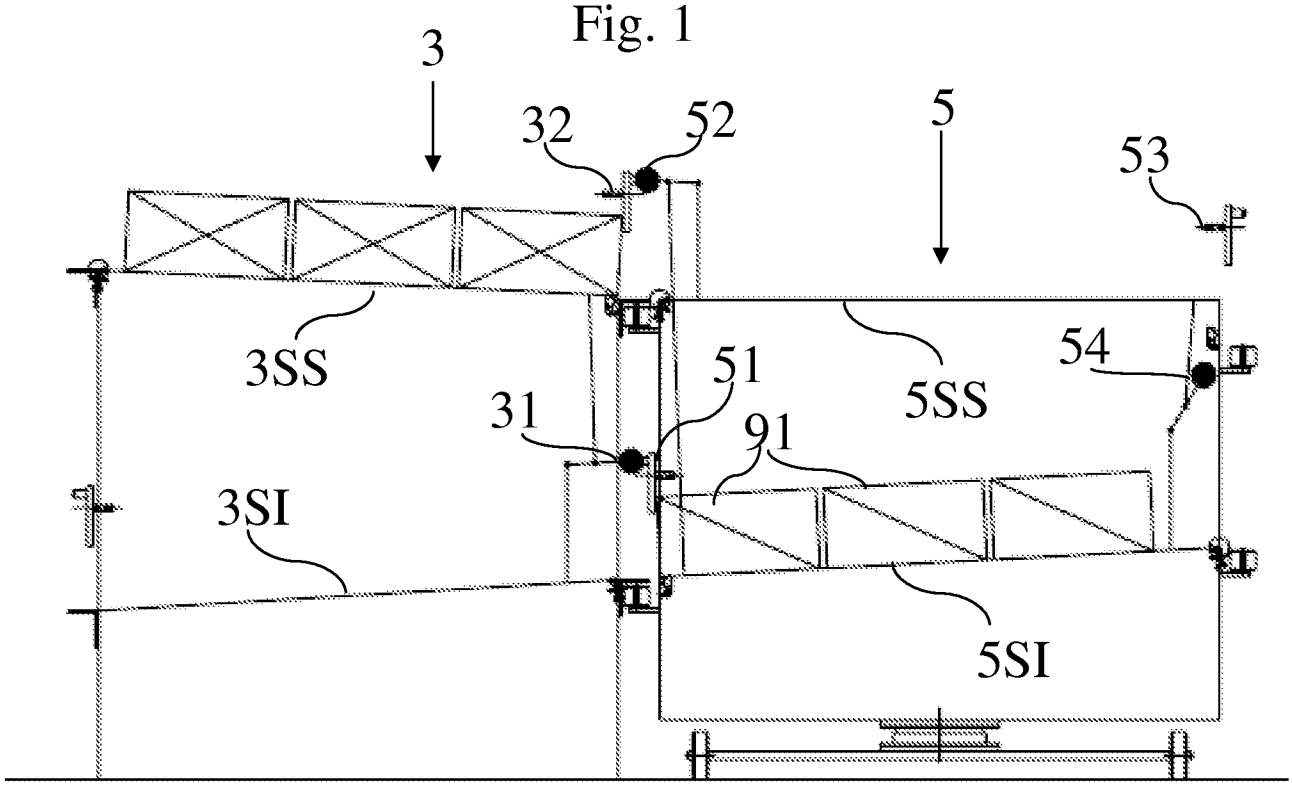

Fig. 2

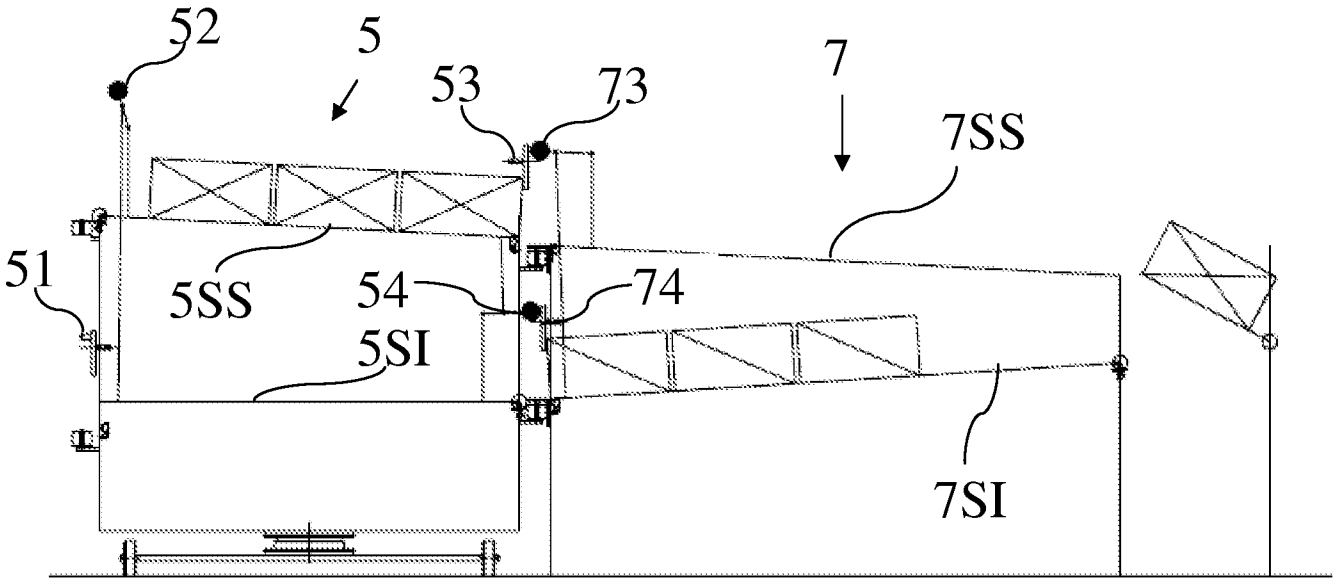
52
5
53
73
7
7SS
51
5SS
54
74
5SI
7SI

Fig. 3

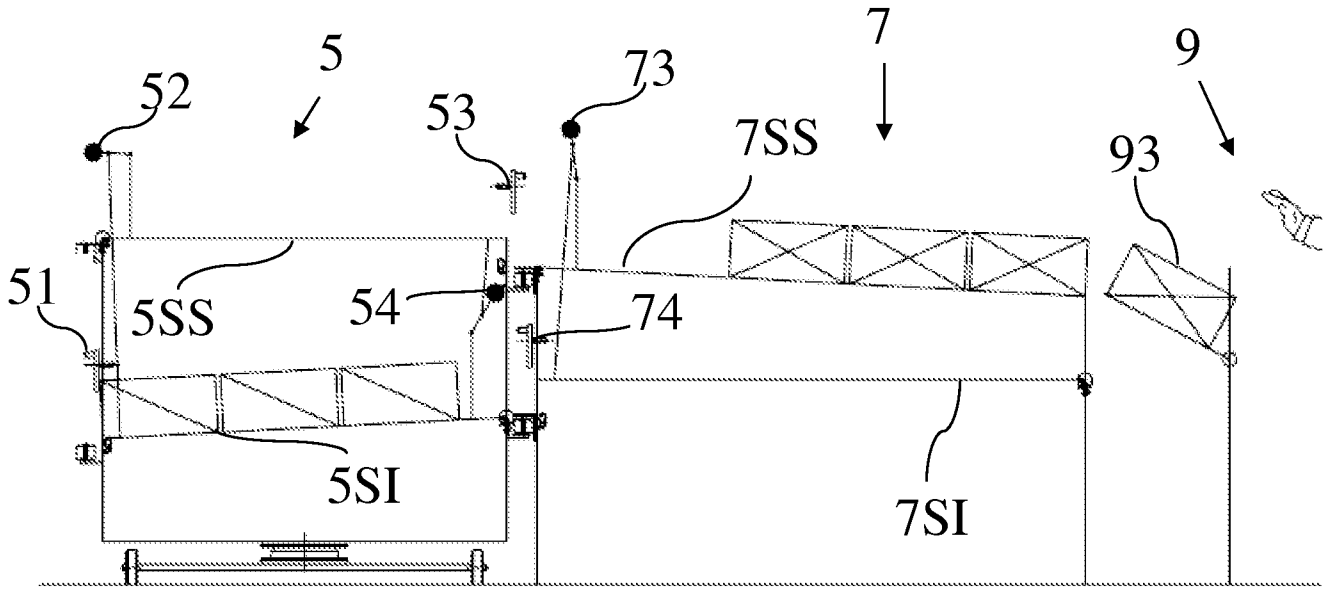
5
52
53
73
7
7SS
9
93
51
5SS
54
74
5SI
7SI

Fig. 4

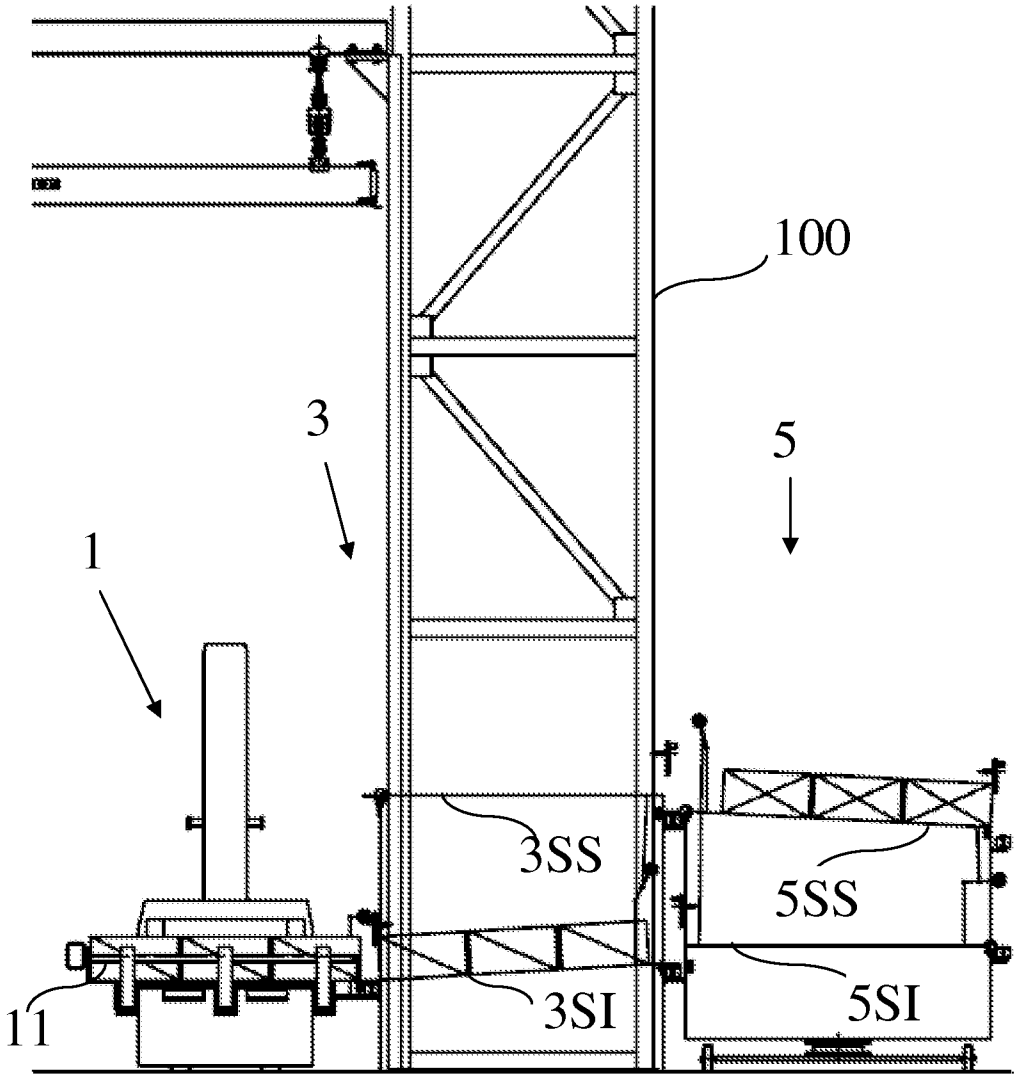

Fig. 5

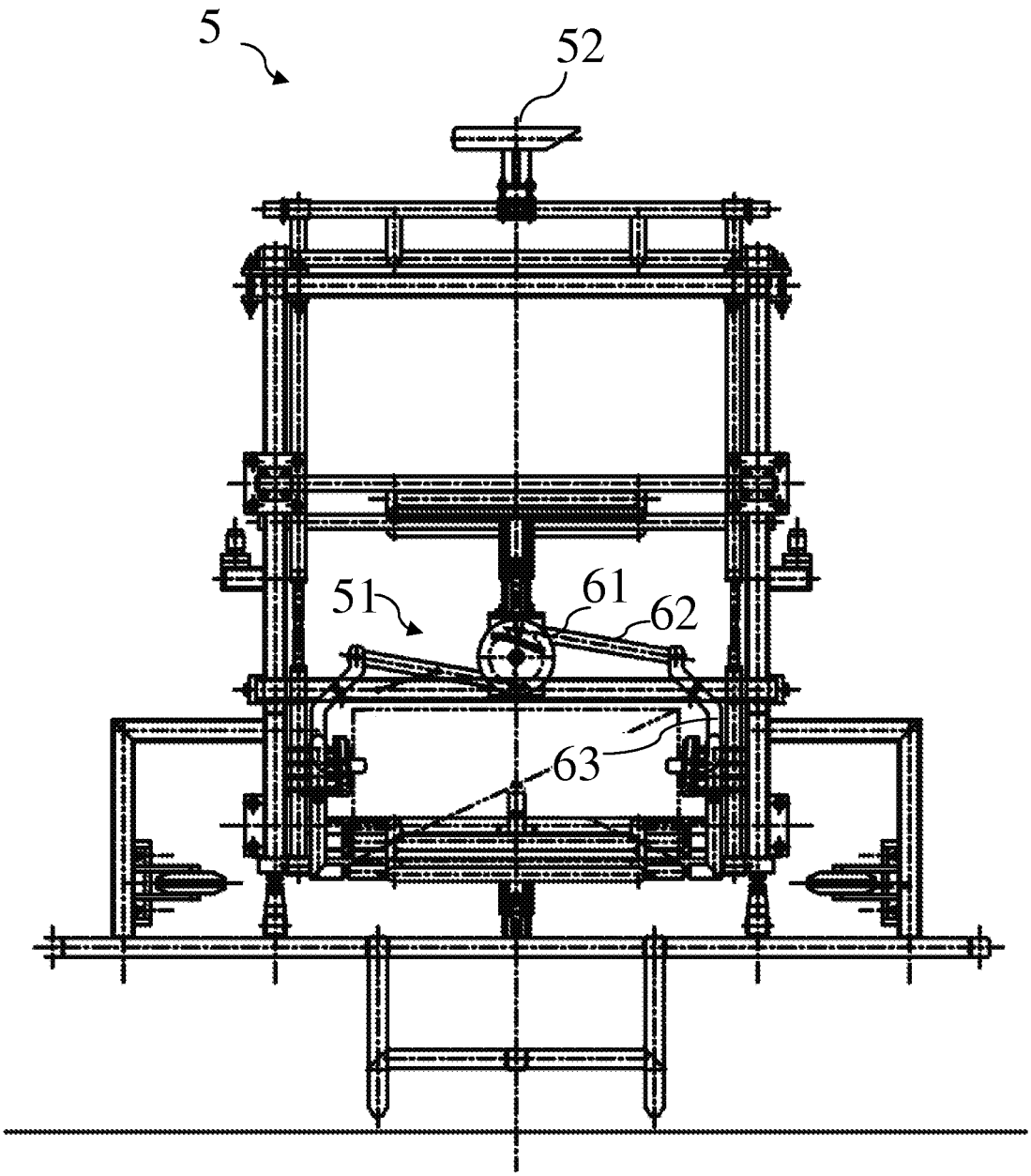

Fig. 6

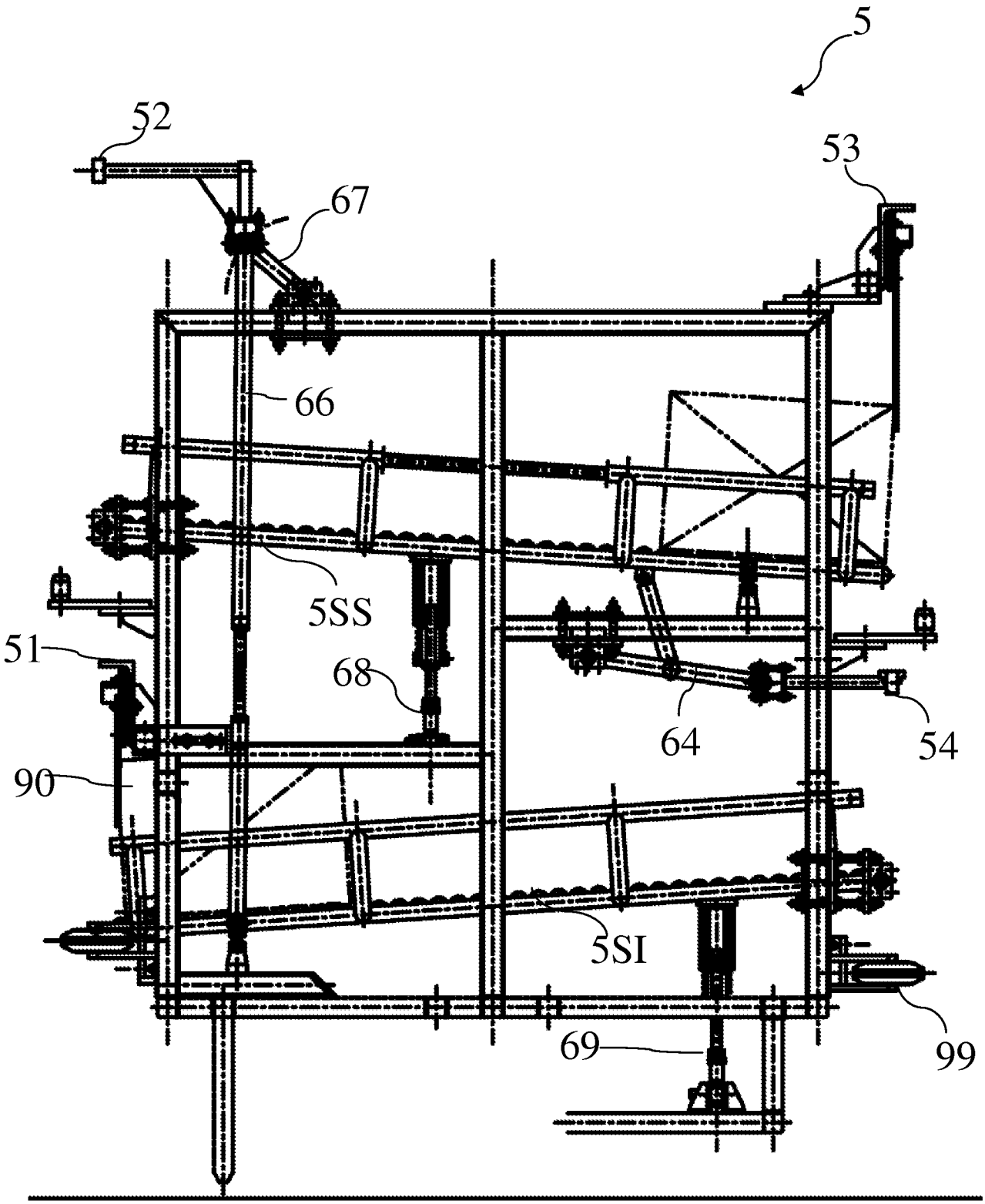

Fig. 7

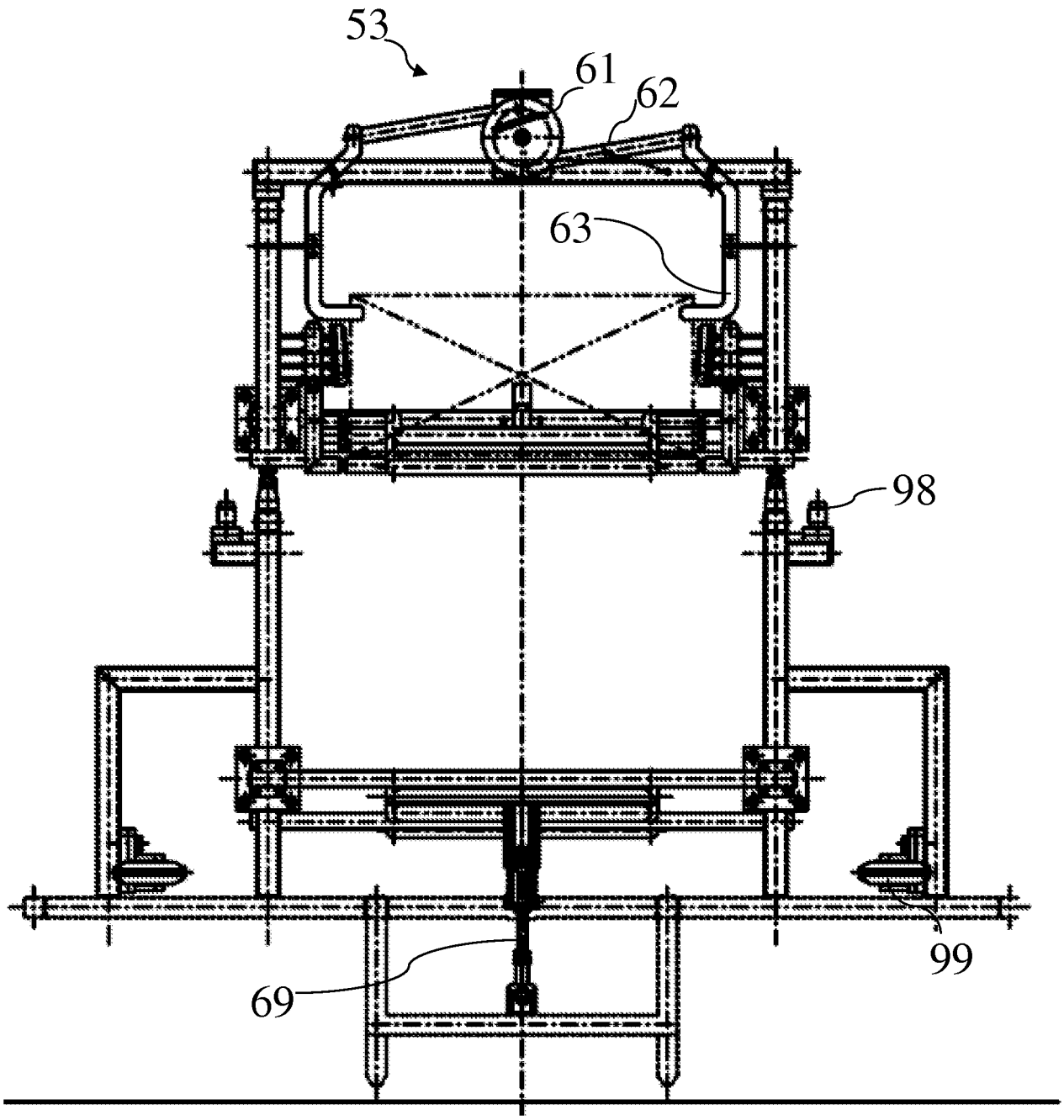

Fig. 8

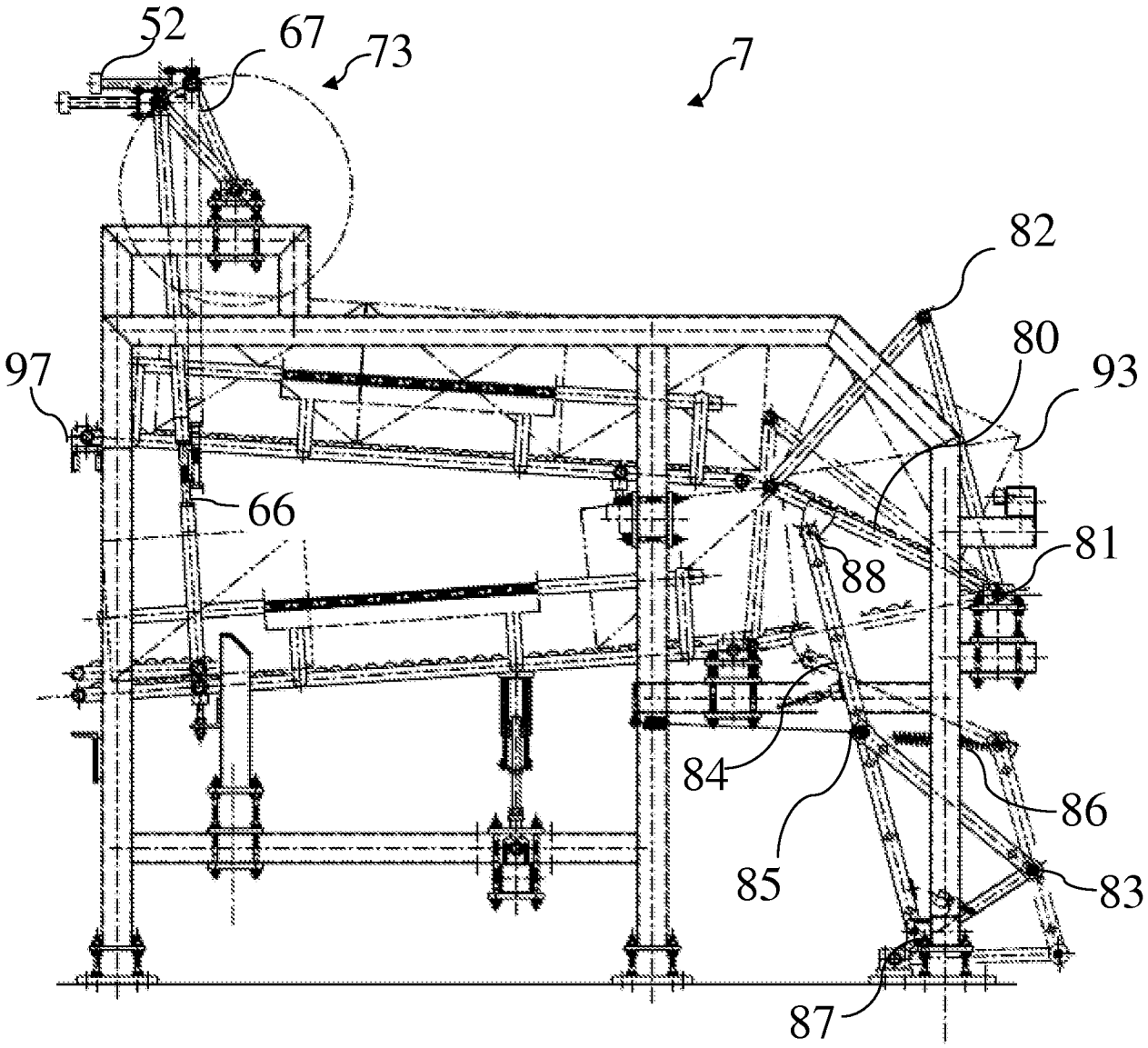

Fig. 9

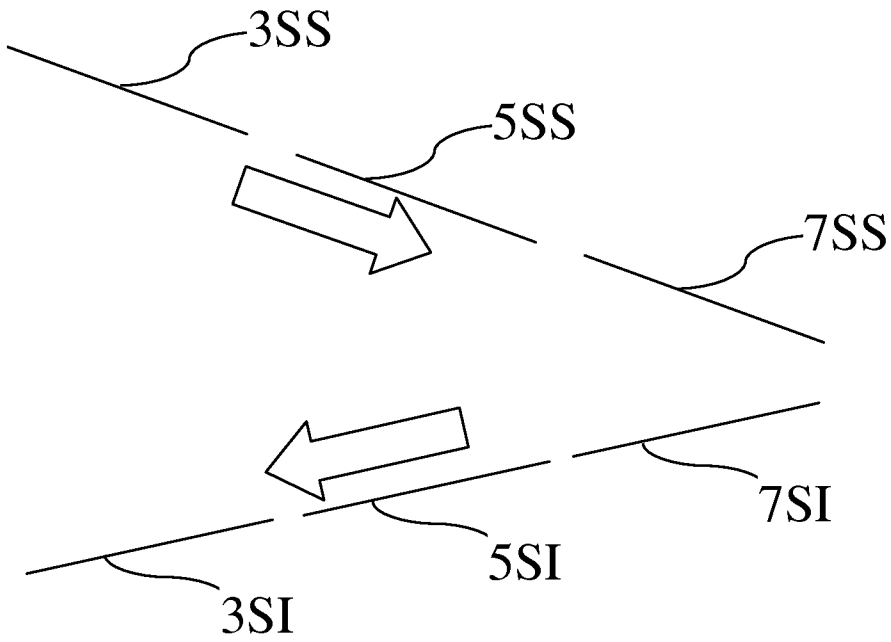

Fig. 10

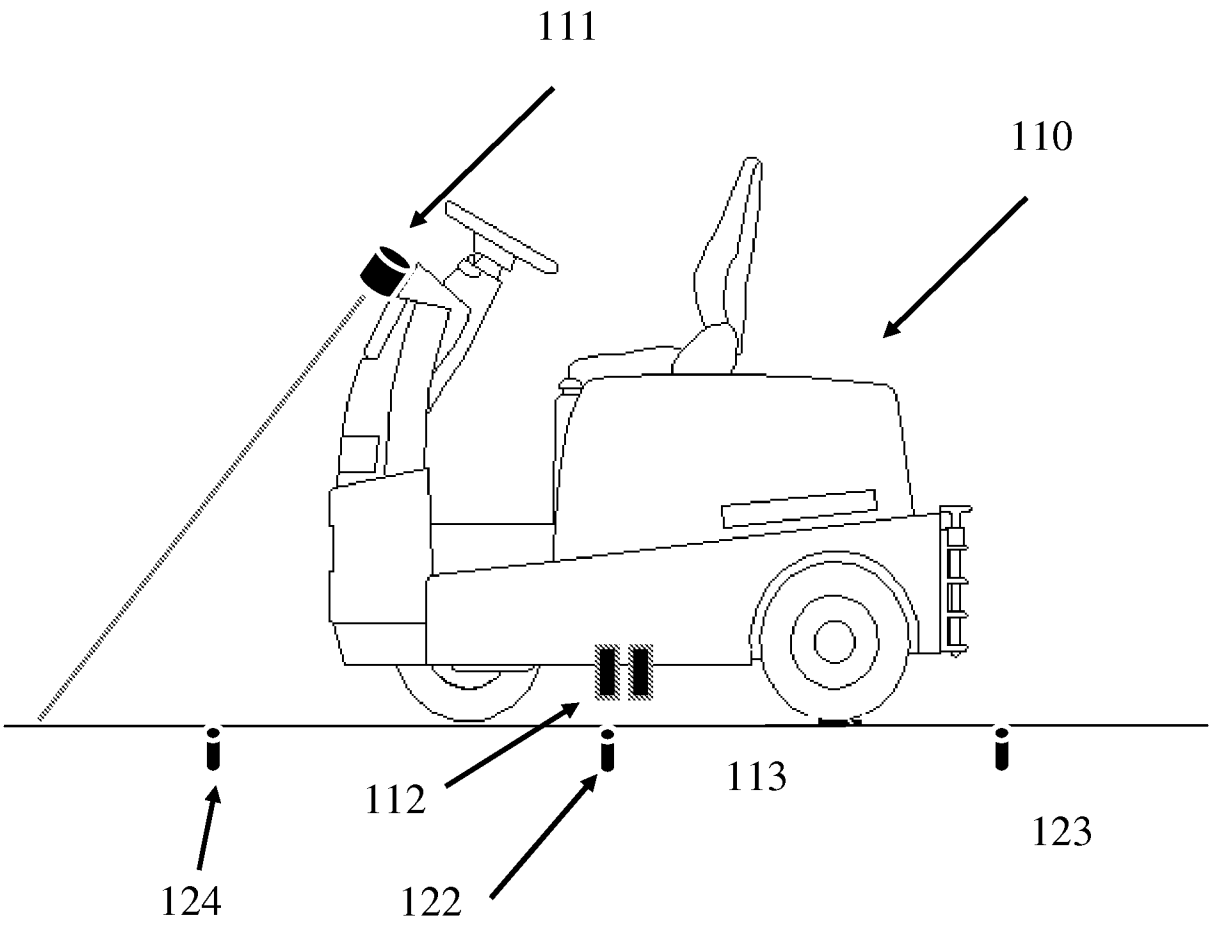

Fig. 11

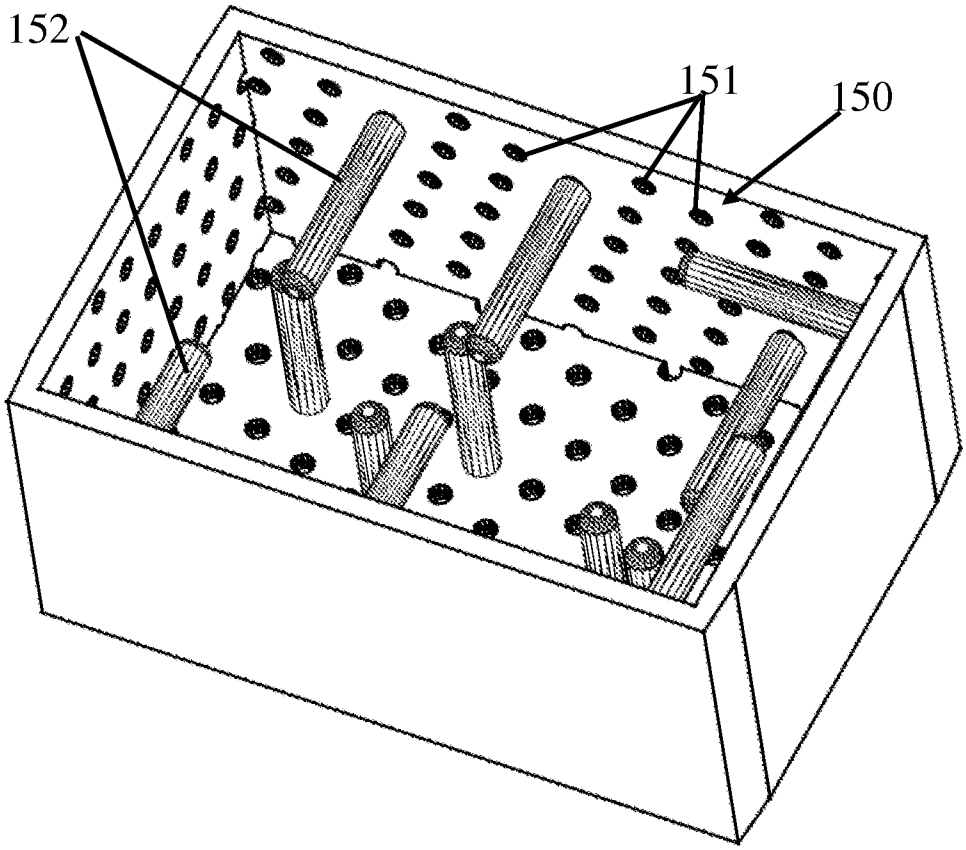

Fig. 12

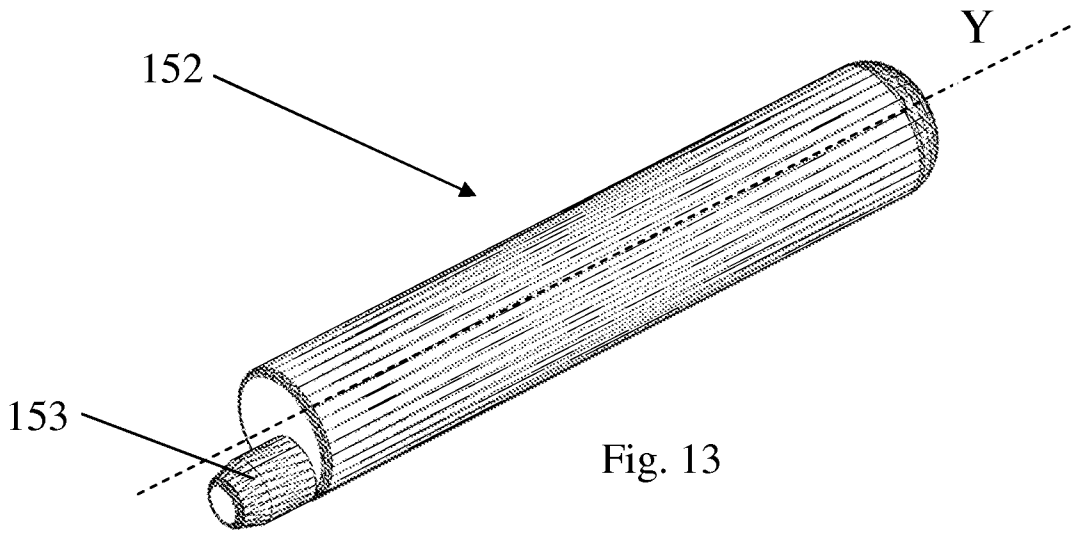

Fig. 13