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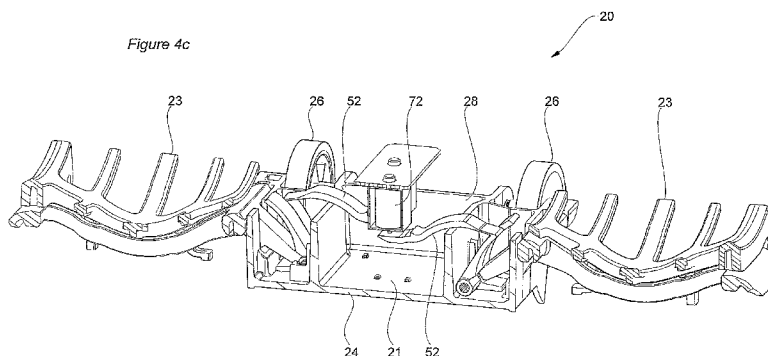
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(54) Title: FRUIT HANDLING EQUIPMENT



(57) Abstract: Fruit handling equipment comprising a conveyor having a plurality of linked carriages, each supporting at least one fruit carrying cup pivotally secured to the carriage, each cup having a latching mechanism operable to hold the cup in a fruit carrying mode and releasable to cause the cup to pivot to a detached position to eject the fruit, and remotely controllable means in each carriage to release the latching mechanism.

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FRUIT HANDLING EQUIPMENT**Introduction**

This invention relates to fruit handling equipment and, in particular, relates to a conveyor system which carries fruit that is rotated past a photographic zone, weighed at a weighing zone and then ejected into appropriately positioned bins in dependence on the characteristics of the fruit as determined by the images taken at the photographic zone and the weight recorded at the weighing zone.

The term fruit as used herein embraces part spherical fruit and vegetables such as citrus fruits, apples, potatoes, tomatoes, and like shaped articles.

Background of the Invention

Equipment of this kind usually utilises a series of carriages which are clipped onto a chain driven by sprockets. The carriages carry cups which support the fruit. A series of rotating rollers are arranged to rotate the fruit clear of the cups through a photographic zone. The fruit is then carried by the cups over a weighing zone in which the weight of each fruit is monitored. The cups are usually designed to pivot outwardly to cause the fruit to be ejected at appropriate positions along the conveyor determined by a computer that stores the data from the photographic and weighing zones. Equipment of this kind is very complex and thus expensive. The timing of the operation of components of the equipment is critical and thus setting up the equipment is a lengthy operation for a skilled individual. Furthermore, the power consumption of the motors which drive the sprockets is significant.

It is these issues that have brought about the present invention.

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Summary of the Invention

According to one aspect of the present invention there is provided a fruit handling equipment comprising a first conveyor adapted to transport a line of single pieces of fruit past a camera, over a load cell and through an ejection zone to eject the fruit at predetermined positions along the conveyor, and a second conveyor adapted to mesh with the first conveyor to lift the fruit off the first conveyor and rotate the fruit as it moves past the camera, characterised in that the first conveyor is a chain of fruit carrying carriages pivotally secured end-to-end to define a closed loop, and the second conveyor comprises a plurality of roller supports pivotally secured end-to-end to define a shorter closed loop, whereby each carriage pulls the adjacent meshing roller support.

Preferably, the fruit carrying carriages interlink with the roller carriages and the first conveyor drives the second conveyor.

Preferably, the respective carriages have interfitting formations which accurately line up the carriages and roller supports as the conveyor integrates.

In a preferred embodiment, the fruit carrying carriages and roller supports are manufactured in plastics.

According to another aspect of the invention there is provided a fruit handling equipment comprising a conveyor having a plurality of linked carriages, each supporting a fruit carrying cup supported in a cantilever fashion from each side of the carriage, each cup having a latching mechanism operable to hold the cup in a fruit carrying mode and releasable to cause the cup to pivot to a delatched position to eject the fruit, and remotely

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controllable means in each carriage to release the latching mechanism.

Preferably each carriage carries a radio controlled solenoid to trigger release of the latching mechanism.

5 The solenoid may be powered by induction.

Description of the Drawings

An embodiment of the present invention will now be described by way of example only with reference to the
10 accompanying drawings in which:

Figure 1 is a side elevational view schematically showing a two lanes of fruit handling equipment;

15 Figure 2 is a perspective view of the pair of lanes illustrating the inter-engagement of two conveyors forming part of the fruit handling equipment;

Figure 3a is a perspective view of a roller assembly;

20

Figure 3b is a side elevational view of the roller assembly;

Figure 3c is a plan view of the roller assembly;

25

Figure 3d is an end elevational view of the roller assembly;

30 Figure 4a is a perspective view of a cup carriage assembly with the cups in a latched position;

Figure 4b is a perspective view of the cup carriage assembly with one cup unlatched;

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Figure 4c is a sectioned perspective view of the cup carriage assembly with components removed to illustrate the latching assembly;

5 Figure 5a is a plan view of one side of the cup carriage assembly;

Figures 5b is a sectional view taken along the lines A-A of Figure 5a;

10

Figure 5c is the same section view but showing a cup in a delatched positioned;

15 Figure 6 is a section view taken along the lines A-A of Figure 5a showing the cup in a weighing position;

Figure 7a is a plan view of the cup carriage conveyor superimposed with the roller conveyor;

20 Figure 7b is a cross sectional view taken through the lines A-A of Figure 7a;

Figure 7c is a side elevational view of the assembly shown in Figure 7a;

25

Figure 8 is a plan view showing part of a sprocket driving the cup carriage assemblies;

30 Figure 9 is a cross sectional view taken along the lines A-A of Figure 8 and a partial section view taken along the lines BB of Figure 8;

Figure 10 is a perspective view of a cup carriage running on a rail of the conveyor;

35

Figure 11 is a sectional view of the carriage running on the rail;

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Figure 12 is a schematic circuit diagram illustrating the association of a radio transceiver and power supply with the fruit handling equipment; and

5

Figure 13 illustrates the electrical circuitry carried by each carriage.

Description of the Preferred Embodiment

10 ***General Layout***

The fruit handling equipment of the preferred embodiment essentially comprises a series of parallel lanes each comprising a main conveyor 10 of interlinked fruit carrying carriage assemblies 20 that integrates with a second roller conveyor 11 at one end. A pair of lanes is
15 illustrated in Figures 1 and 2.

The roller conveyor comprising a closed loop of pivotally interconnected roller assemblies 40. The roller conveyor
20 11 is arranged to freely rotate around semi-circular guide drums 12, 13 positioned at each end of the conveyor 11 whereby as the main conveyor 10 returns, the carriage assemblies 20 mesh with the roller assemblies 40 to pass together through a photographic zone A near the end
25 of the main conveyor 10. After the superimposed carriage and roller assemblies 20 and 40 pass the photographic zone A, the roller conveyor 11 descends a ramp 19 to disengage from the cup carriage assemblies 20 to return around the semi-circular guide drum 13. The fruit carrying carriage
30 assemblies 20 of the main conveyor 10 then continue to pass through a weighing zone B to an ejection zone C to return on the underside of the main conveyor 10 as shown in Figure 1. The portion of the conveyor between the carriage and drum assembly separation and end 16 of the
35 conveyor 10 is referred to as the active zone (AZ).

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In this manner, a much shorter secondary conveyor 11 drives the roller assemblies 40 only at the photographic zone A.

5 The main conveyor 10 is driven at one end 16 by a metal sprocket 17 with plastic tipped teeth 18 and runs at the other end 15 integrated with the roller conveyor 11 on the drum 12. The integration of the two conveyors 10 and 11 ensures that the main conveyor 10 drives the roller
10 conveyor 11 around the drums 12, 13.

Roller Assembly

As shown in Figures 3, each roller assembly 40 of the roller conveyor 11 comprises a roller support 41 having
15 two pairs of parallel flanges 42, 43 which extend in opposite directions parallel to the longitudinal axis of the conveyor 11. The flanges 42, 43 support each end of a spindle 44 which supports a roller 45. The roller 45 comprises two frusto-conical central members 46, 47 and
20 two larger tapered outer members 48, 49 defining gaps therebetween.

The spacing of the roller flanges 42, 43 on one side is slightly less than the spacing of the roller flanges of
25 the other side so that a series of roller carriage assemblies 40 can be joined together with the pins that support the rollers extending through the flanges 42, 43 of one roller assembly and the flanges of the adjacent roller assembly as shown in Figure 2. In this way, the
30 roller conveyor is made up of a series of interlinked roller assemblies 40 joined through the spindles 44 to provide a series of pivotal links forming the closed loop which constitutes the roller conveyor 11.

35 The roller support has an upstanding tooth 98 designed to fit in the slot 62 created between 2 adjacent carriages 20 thereby locating each roller assembly with respect to the

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carriage conveyor 10 when the two conveyors merge as shown in Figure 7b. In operation the leading vertical flange 96 of the carriage 20 acts against the upstanding tooth 98 of the roller support causing the roller conveyor 11 to be
5 driven by the main conveyor 10.

Carriage Assembly

In a similar manner, the main conveyor 10 is constituted by a series of links made up by interconnection of the
10 fruit carrying carriage assemblies 20. Each carriage assembly 20, as shown in Figures 4 to 6, comprises a central carriage 21 which pivotally supports a pair of laterally extending radius arms 22 on each side, each radius arm 22 in turn supporting a fruit carrying cup 23.
15 The carriage 21 is of rectangular profile with a substantially planar underside 24 and an open recess 28 covered by a removable cover 29 with a pair of outwardly extending flanges 25 at one end supporting a pair of wheels 26 on an axle 27. Two pairs of parallel outwardly
20 extending flanges 25 coaxially fit onto the flanges carrying the wheels at the other end so that carriages can be interlinked through the axle 27 that extends through the flanges of one carriage and the flanges on the end of the adjacent carriage. In this manner, the carriages are
25 pivotally interlinked to form a continuous loop to define the main conveyor 10 as shown in Figures 1 and 2.

The radius arm 22 comprises a curved beam with a T-shaped mounting flange 33 on one end which is pivotally secured
30 across the side of the carriage 21. The opposite end of the radius arm pivotally supports one end of the cup 23 through an elongate pivot 39. The underside of the cup has two spaced legs 34, 35 that are arranged to extend freely through a pair of spaced apertures 36, 37 in the
35 curved beam 22 of the radius arm. The pivotal connection of the radius arm 22 to the carriage 21 allows the cup to be supported in a fruit carrying position shown in Figure

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4a and an ejection position shown in Figure 4b in which the radius arm 22 pivots downwardly to eject fruit carried by the cup 23.

5 As shown in Figures 4, each cup 23 comprises a dished recess defined by five fingers 30 to define gaps 31 therebetween. The gaps 31 between the fingers 30 of the dish-shaped cup 23 are designed so that when the two conveyors are integrated and the roller assemblies 40 are
10 superimposed on the carriage assemblies 20 the upper surfaces of each roller 45 can extend through the gaps 31 to engage the underside of the fruit to lift the fruit clear of the cup 23 for rotation through the photographic zone A as shown in Figures 1 and 2. Once the fruit has
15 passed the photographic zone A, the conveyors 10 and 11 part, causing the rollers 45 to be lowered, as shown in Figures 8, so that a single piece of fruit then rests on the dish-shaped cup 23.

20 The radius arm 22 has a downwardly extending foot 38 that engages a latching mechanism 50 mounted in the recess 28 of the carriage 21 to control the position of the cup 23 relative to the carriage 21. As shown in Figures 5 and 6, the latching mechanism 50 is a long piece of plastic
25 moulding which includes an L-shaped latching arm 51 that is pivotally secured to the base of the carriage and a trailing detent 52 that is flexibly formed integrally with the rest of the moulding. The detent 52 has a trailing abutment 53 behind a shoulder 54 which is arranged to
30 engage the base 55 of a well 70 formed in the centre of the cover 29 of the carriage. The L-shaped arm 51 accommodates the base of the foot 38 of the radius arm 22 and, as shown in Figure 5b, there is a shoulder 56 on the interior of the L-shaped arm against which the foot 38
35 engages in the latched position. The weight of the radius arm 22 and cup 23 causes the assembly to pivot down about the pivot point P. This in turn causes the foot 38 to

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rest against the shoulder 56 in the L-shaped arm 51,
holding the assembly in the latched position, see Figure
5b. When the detent 52 is pushed down by operation of the
solenoid, it flexes relative to the arm 51 causing the
5 shoulder 54 to ride clear of the base 55 of the well 70.
The arm 51 then pivots backwards causing the foot 38 to
ride clear of the shoulder 56 allowing the radius arm 22
and cup 23 to pivot downwards into the unlatched position
shown in Figure 5c. The interior of the L-shaped arm 51
10 acts like a gear whereby the foot 38 meshes with its inner
surface as it travels from the latched position shown in
Figure 5b to the unlatched position shown in Figure 5c.

The cups 23 remain in the unlatched configuration as they
15 round the end 16 of the conveyor 10. As they invert,
gravity causes the cups 23 to return to the longitudinal
position and an inclined plastic ramp 75 on the return
consolidates the latching mechanism 50 of each cup 23.

20 When the main conveyor 10 is assembled, the carriage
assemblies 20 are pivotally interconnected through the
shaft 27 on the wheels 26 so that there is wheeled support
at each end of each carriage 21. These wheels 26 are
arranged to run on tracks 60, 61 that are formed by open
25 rectangular aluminium beams 60, 61 which are located on
the underside of the top of the main conveyor 10 and on
the underside of the return, as shown in Figures 1 and 2.
As shown in Figures 10 and 11, each beam 60, 61 has an
open top with inturned flanges 68, 69 that support the
30 wheels 26. The position of the wheels 26 in the carriage
is such that, as the carriage assemblies 20 invert on the
return, the wheels 26 engage the lower track 61.

The adjacent ends of the carriages 21 defines a
35 rectangular slot 62 having a vertical flange 96 which, as
shown in Figure 9, engages the teeth 18 of the drive

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sprocket 17 rotating in a clockwise direction to impart drive to the main carriage conveyor 10.

The vertical slot 62 also serves to engage with the
5 upstanding tooth 98 on the roller supports to align and integrate the carriages 21 with the roller assembly so that the axes of the carriage wheels 26 coincide with the axes of the roller spindles 44, thus aligning the axes of the pivot points of the links in both conveyors. In use
10 the action of the leading vertical flange 96 of the slot 62 on the upstanding tooth 98 of the meshed roller support forces the roller conveyor 11 to move in unison with the main carriage conveyor.

15 **Photographic Zone**

As the two conveyors 10 and 11 merge on the return, the inverted carriage assemblies 20 support the roller assemblies 40 on the track 61. As the integrated conveyors invert, the roller assemblies in turn support
20 the carriage assemblies 20. Between the drum 12 and ramp 19, a pair of driven belts 9 are positioned on each side of the conveyors 10 and 11 to engage the underside of the rollers 45 to cause them to rotate about their axes to in turn rotate the fruit as it is lifted clear of the
25 carrying cups 23 as the two inter-engaged conveyors move past the photographic zone A. The belts 9 provide the support for the assembly of the two conveyors 10 and 11. At least one CCD camera is located in the photographic zone A to view the rotating fruit as it passes that zone
30 and to forward a digital signal to a computer.

Weighing Zone

The spaced legs 34, 35 on the underside of each cup 23 are arranged to engage a load cell 67 arranged in the path of
35 the underside of the conveyor 11 at the weighing zone B. As shown in Figure 6, the load cell 67 lifts the cup 23 off the carriage 21 and ensures that there is no component

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of the horizontal movement distorting the actual weight measured by the load cell. The two-point weighing legs 34, 35 ensure that each piece of fruit is accurately weighed as it passes over the load cell 67. The data is
5 then fed to the computer.

Control of Ejection

The recess 28 which is formed in the carriage 21, has a base that supports a first circuit board 71 and the well
10 70 that is positioned internally of the cover 29 houses a solenoid 72 with an upper circuit board 73 positioned on the top of the solenoid 72. The solenoid has a plunger 74 that operates to push down against the abutment 53 of the detent 52 to release the latching mechanism as shown in
15 Figures 5c and 11. The power to drive the solenoid 72, the radio signal which activates the solenoid and the circuit associated with the release mechanism is illustrated in Figures 12 and 13. The well 70 is closed off by a lid 76 which sits flush with the cover 29 of the
20 carriage 21. The cover 29 and lid 76 and the associated well 70 ensure that the latching mechanism and solenoid release and associated circuit board 73 are housed in a clean discrete area where they will not be subjected to dust and debris which is often present in apparatus such
25 as this.

The release of the cups 23 to the unlatched position is triggered by a remote activation system that operates on the use of a radio frequency signal to activate the
30 solenoid. The section of the conveyor between the position where the rollers part from the carriages to the drive by the main sprocket is defined as the active zone (AZ) of the conveyor. It is in this zone that power is supplied to the carriages together with carefully
35 controlled radio waves to trigger release of the latching mechanisms. The electrical circuitry is illustrated in Figures 12 and 13.

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As shown in Figure 10, each rail 60 in the active zone AZ of the conveyor has transversely positioned spaced brackets 80 which have upstanding lugs 81 that support a wire coil 82 in the form a rectangular frame closed at one end. This coil 82 is positioned adjacent the flanges 68, 69 which support the wheels 26 of the carriage 21. The lugs 81 also supports a centrally positioned co-axial antenna cable 84 which is again positioned just under the carriage 21. As shown in Figure 11, the first lower circuit board 71 on the base of the carriage 21 is wired to the upper circuit board 73 positioned above the solenoid 72 in the well 70.

The power is supplied to the solenoids by magnetic resonance inductive coupling between a long static power source coil, that is the wire coil 82, and a small coil 85 mounted on the lower circuit board 71 in each carriage 21. The magnetic inductive coupling is particularly desirable because there are no wearing parts. The static coil 82 is coupled to a tuning capacitor 87 as shown in figure 12 to cause the coil to resonate at a frequency matched by a AC power source. The small coil carried in the base of the carriages 21 is tuned by capacitor 86 to resonate at the same frequency as the power supply so that, as the coil passes over the static coil, energy is transferred to the moving coil. Subsequently, the AC power from the small coil on the lower circuit board 71 is rectified and regulated to supply DC power to a super capacitor 88 on the upper circuit board 73, see circuit diagram in Figure 13.

Instead of supplying power by use of magnetic resonance, it is understood that each carriage could be powered by an electronic storage device such as capacitor or battery contained in each carriage. The preferred method of charging the storage device is an electromagnetic coil contained in the carriage passing over a magnetic field on

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the conveyor which causes an electrical current to be generated in the carriage coil. Other methods include microwaves, electromagnetic induction, or direct driven using the motion of the conveyor carriage. Alternatively
5 the power may be supplied via a direct electrical contact with a supply source i.e. using brushes, pins or through the wheels. The power may also be supplied via a replaceable battery or other storage device.

10 The radio frequency (RF) system comprises a base RF transceiver per row of carriages. Each transmitter serves two lanes and is controlled by the computer. Each carriage carries a transceiver. To minimise transmission distance from the base to the receivers, the co-axial
15 antenna 84 runs parallel to and immediately below the carriage bases. This configuration minimises RF power and reduces the likelihood of interference between adjacent pairs of lanes. It is also understood that the use of slightly different carrier frequencies on adjacent lanes
20 further reduces interference issues.

Since power consumption of the remote circuit board in the RF active mode is relatively high, the RF activity is restricted to the active section of the conveyor. On each
25 remote circuit board, at the point where the capacitor charging ceases, just prior to the main drive sprocket, the RF system is switched off and the processor enters a low power consumption sleep mode. At the recommencement of charging, the processor is woken and the RF system
30 reactivated at the start of the active zone (where the rollers separate from the carriages). As the length of the conveyor where the RF system is active corresponds with the charging zone, the super capacitor 88 remains fully charged. This capacitor is required as a buffer for
35 the electronics when in sleep mode and for a short, high powered burst to operate solenoids S1 and S2. The

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capacitor also maintains power to the circuit boards during short breaks in conveyor operation.

In this ejection system, the link (carriage assembly 20) houses an electronic circuit that can receive and process radio signals (or other type of electromagnetic signal) from the main conveyor controller which would be coupled to the computer. This signal tells the link when or where to delatch the cups. The conveyor controller tells the link when to drop by calculating or identifying its location and then sending the signal to delatch the cups when the link is in position at the drop point. Alternatively the conveyor controller may send the signal to the link to delatch at a predetermined location. The link then senses (by barcode and optical sensor, RFID tag, counting pulses to measure distance or time or other suitable means) when it has reached the correct location and delatches.

An advantage of this ejection system is that the delatching is triggered remotely from the conveyor controller. So long as the cup is in approximately the correct location with respect to the drop point (say 50mm) it can be triggered by the controller. This also means that the cup triggering position may be varied automatically by the controller depending upon the conveyor speed thereby allowing for the trajectory of the fruit and giving control over the where the fruit lands.

30 ***Jitter***

As shown in Figure 9, the drive system has been specifically designed to eliminate chordal action which usually results in significant oscillation in conveyor velocity due to the large pitch conveyor chain being positioned around a relatively small drive sprocket. The drive sprocket 17 which directly drives the carriages 21 has sixteen teeth, each of which is covered with a

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plastics tip 18 to reduce noise and wear. However, as the
carriages 21 move over the plastics coated tips 18, a
pulsing action is generated which can cause between 1% and
1.5% speed change. This is usually referred to as jitter.
5 Instead of directly driving the shaft of the main sprocket
17 through an electric motor, a separate smaller chain
drive 92 is provided in which the output sprocket 93 on an
electric motor (not shown) is coupled to a smaller drive
sprocket 94 mounted on a shaft 95 which is common to the
10 main driving sprocket 17. A conventional chain 92 effects
this drive. The smaller drive sprocket 94 is also
designed to have sixteen teeth but operates at a different
pitch. The drive to the smaller drive sprocket 94
introduces jitter in the same way that the main drive
15 introduces jitter. In this system, the jitter of the
smaller drive sprocket 94 is arranged to be timed to be
inverse to the jitter caused by the main sprocket 17 so
that the two jitters balance to provide a smooth drive.

20 **Features**

The majority of the components of this conveyor are
manufactured from plastics. The plastics components are
designed to be produced through a simple moulding process
and the use of plastic componentry to make up the links of
25 the two conveyors substantially reduces the overall weight
of the assembly by doing away with a conventional chain
to, in turn, substantially reduce the power required to
drive the assembly. The assembly is also designed to
reduce drag. The carriages run on wheels that engage a
30 track even in the return configuration, see Figure 2. It
is estimated that the assembly will operate on 25% of the
power used to drive similar such assemblies. The use of
plastics for the componentry of the assembly also
substantially reduces the noise of the equipment in
35 operation. The noise can be further reduced by coating
the portion of the track which engages the wheels of the

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carriages and, as described earlier, coating the tips of the drive sprockets.

Conveyors of this kind are usually 50-60m in length and thus providing a much smaller roller conveyor of about 8m in length substantially reduces the number of components and complexity of the arrangement. The inter-engagement of the two conveyors is shown with reference to Figures 7. The axes of the wheels 26 on the cup carriage assemblies 40 are arranged to align with the axes of the rollers 45 on the roller assemblies 40. The underside of each roller support 41 has a central portion which defines a centrally positioned, upstanding trapezoid tooth 98 that is arranged to be a sliding fit against a vertical flange 96 at either end of the carriage 21. The vertical flanges 96 of adjacent carriages 21 define leading and trailing walls of the slot 62 which accommodates the trapezoidal teeth 98 of the roller support 41 as shown in Figure 7b. In this way, as the two conveyors come together, the upturned roller conveyor 11 engages and supports the carriage 21 of the main conveyor 10, causing the axles 27, 44 of the wheels 26 and rollers 45 to align and bringing the two conveyors into a meshed configuration. Alignment of the axes of the pivot points of the roller carriages with axes of the roller assemblies when the two conveyors are meshed allows the meshed section of conveyors to flex and travel around the semicircular drive drums without any longitudinal movement between the two conveyors. The location of the tooth 98 against the flange 96 takes up any slack in the pivots between carriages 21 and roller supports 41 and ensures that the two conveyors 10, 11 are accurately aligned when they come together. The action of the leading vertical flange 96 of the slot 62 against the tooth 98 of the roller support 41 allows the main carriage conveyor 10 to impart the driving force to the roller conveyor 11 thereby allowing the single drive sprocket 17 to power both conveyors

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As the two conveyors 10 and 11 part after the photographic zone A, the roller conveyor 11 simply drops away from the underside of the cup conveyor 10, see Figures 7b and 7c.

5 The all plastics componentry reduces the running resistance and the reduction in the number of rollers reduces the load on the main conveyor thus substantially reducing the power needed to drive the assembly. It is envisaged that the equipment described above is cheaper to
10 build, simpler to assemble and maintain and uses substantially less energy. The assembly is quieter, more efficient and more reliable and, in consequence, easier to service. It is thought that the accuracy of the equipment will be also enhanced.

15

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as
20 "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

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CLAIMS :

1. Fruit handling equipment comprising a conveyor having
a plurality of linked carriages, each supporting at least
5 one fruit carrying cup pivotally secured to the carriage,
each cup having a latching mechanism operable to hold the
cup in a fruit carrying mode and releasable to cause the
cup to pivot to a delatched position to eject the fruit,
and remotely controllable means in each carriage to
10 release the latching mechanism.

2. Fruit handling equipment according to claim 1,
wherein each carriage carries a radio controlled solenoid
to trigger release of the latching mechanism.

3. Fruit handling equipment according to claim 2,
15 wherein the solenoid is powered by induction.

4. Fruit handling equipment according to either claim 2
or 3 wherein each cup has a leg that engages an abutment
in a latched position, displacement of the solenoid
causing displacement of the abutment to release the leg
20 causing the cup to pivot to the delatched position.

5. Fruit handling equipment according to any one of
claims 1 to 4, wherein a fruit carrying cup is pivotally
supported in a cantilever fashion from each side of the
carriage.

25 6. Fruit handling equipment comprising a first conveyor
adapted to transport a line of single pieces of fruit past
a camera, over a load cell and through an ejection zone to
eject the fruit at predetermined positions along the
conveyor, and a second conveyor adapted to mesh with the
30 first conveyor to lift the fruit off the first conveyor
and rotate the fruit as it moves past the camera,
characterised in that the first conveyor is a chain of

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fruit carrying carriages pivotally secured end-to-end to define a closed loop, and the second conveyor comprises a plurality of roller supports pivotally secured end-to-end to define a shorter closed loop, whereby each carriage
5 pulls the adjacent meshing roller support.

7. Fruit handling equipment according to claim 6, wherein a drive sprocket engages the carriages at one end of the first conveyor to drive the first conveyor.

8. Fruit handling equipment according to either claim 6
10 or 7, wherein the carriages and roller supports have interfitting formations which accurately line up the carriages and supports as the conveyors mesh.

9. Fruit handling equipment according to claim 8, wherein when the conveyors mesh, the pivot axes of the
15 roller supports and carriages align.

10. Fruit handling equipment according to any one of claims 6 to 9, wherein each carriage has a pair of axially rotatable wheels which engage a beam positioned underneath the top of the first conveyor and a beam positioned
20 underneath the return of the conveyor.

11. Fruit handling equipment according to any one of claims 6 to 10, wherein each roller support supports axially rotatable rollers that are linearly displaceable relative to the carriage to engage and rotate the fruit.

12. Fruit handling equipment according to either claim 10
25 or 11, wherein an arcuate surface is positioned at each end of the second conveyor whereby the rollers engage the surfaces as the second conveyor is driven by the first conveyor.

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13. Fruit handling equipment according to any one of claims 10 to 12, wherein a separate drive is positioned underneath the rollers to lift and rotate the rollers as the interlinked conveyors move past a photographic zone.
- 5 14. The fruit handling equipment according to claim 7, wherein the drive sprocket has tips coated in rubber or plastics that engage the underside of the carriages.
- 15 15. Fruit handling equipment according to either claim 7 or 14 wherein, the drive sprocket is driven by a shaft which is in turn driven by an auxiliary sprocket having the same number of teeth as the drive sprocket but arranged at a different pitch, whereby the timing of the drive is such that jitter caused by the auxiliary sprocket counter balances jitter caused by the drive sprocket.
- 15 16. Fruit handling equipment according to any one of claims 6 to 15, wherein the fruit carrying carriages and roller supports are manufactured in plastics.
- 20 17. The fruit handling equipment according to any one of the claims 6 to 16, wherein a fruit carrying cup is supported in a cantilever fashion from each side of the carriage, each cup having a latching mechanism operable to hold the cup in a fruit carrying mode and releasable to cause the cup to pivot to a delatched position to eject the fruit.
- 25 18. The fruit handling equipment according to claim 17, wherein each latching mechanism is releasable by remote control.
- 30 19. Fruit handling equipment according to claim 18, wherein each carriage carries a radio controlled solenoid to trigger release of the latching mechanism.

- 21 -

20. Fruit handling equipment according to claim 19,
wherein the solenoid is powered by induction.

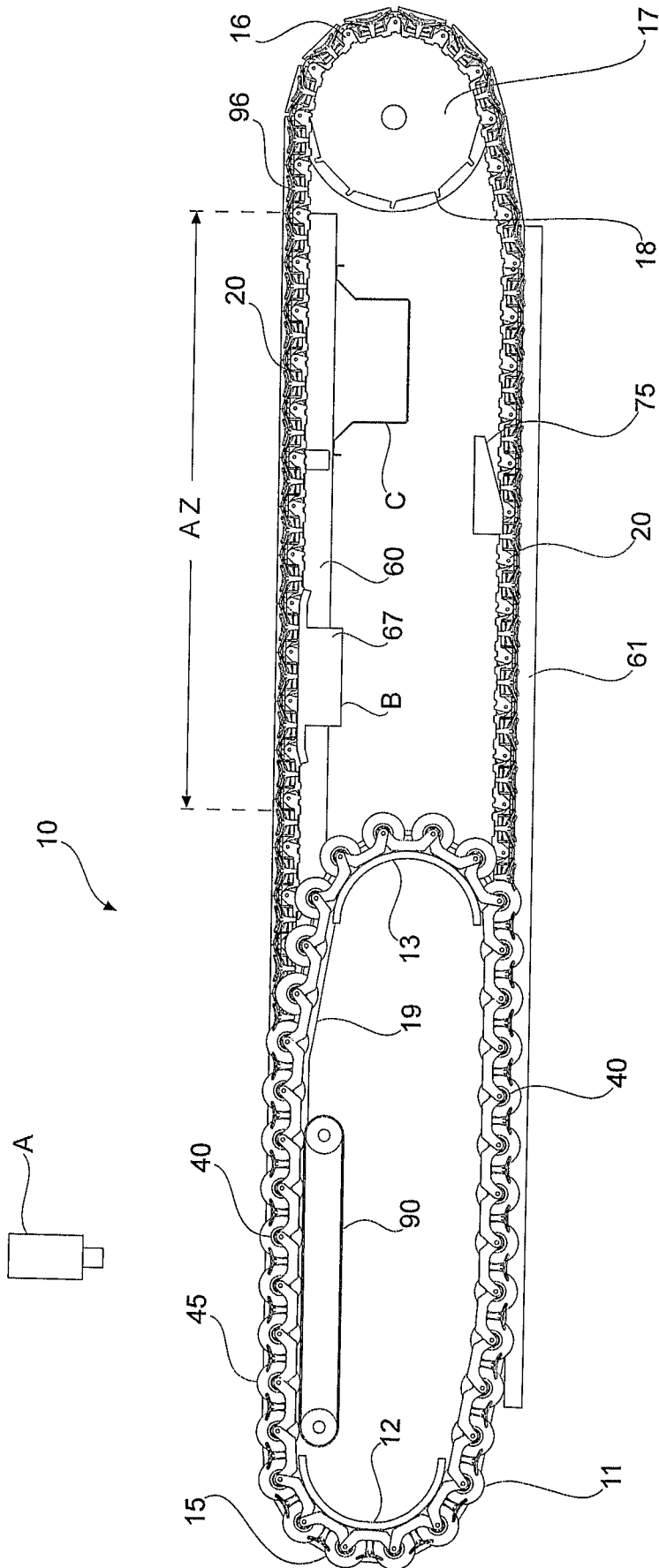


Figure 1

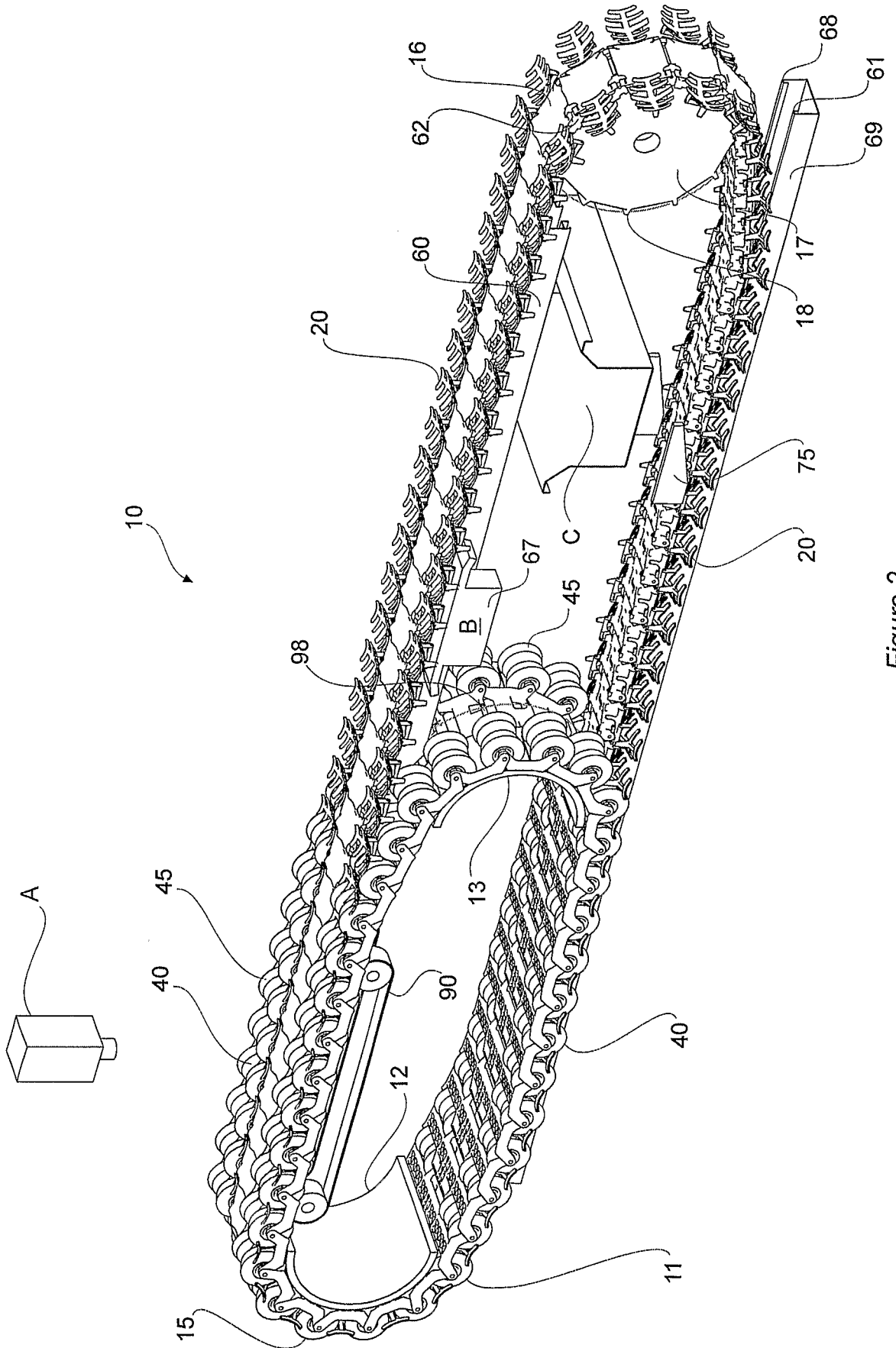


Figure 2

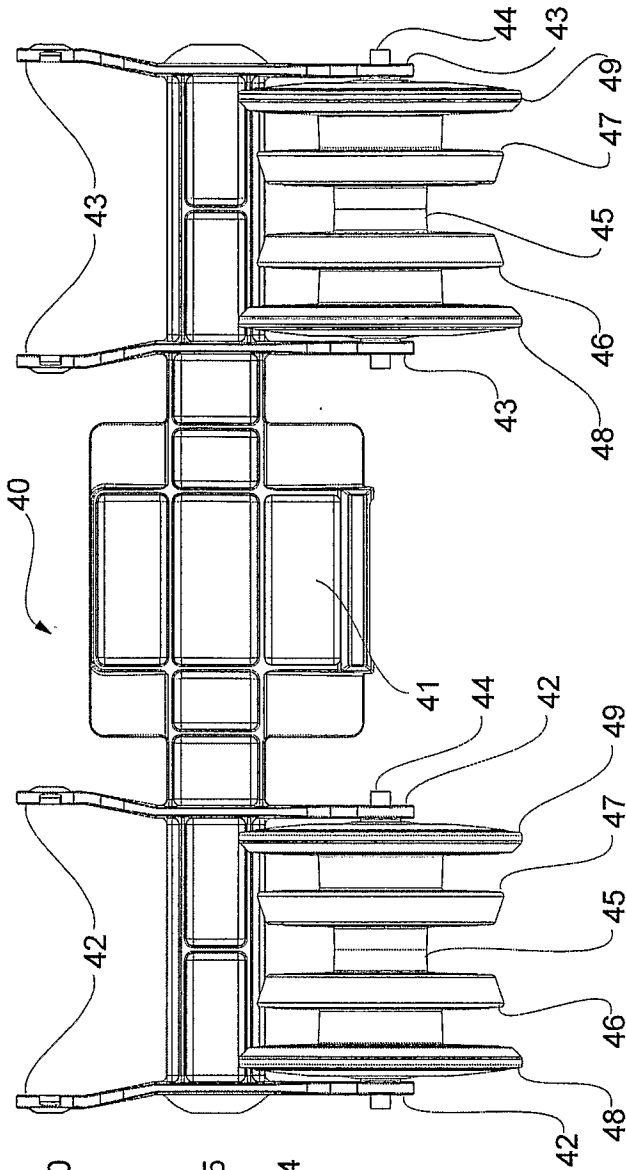


Figure 3c

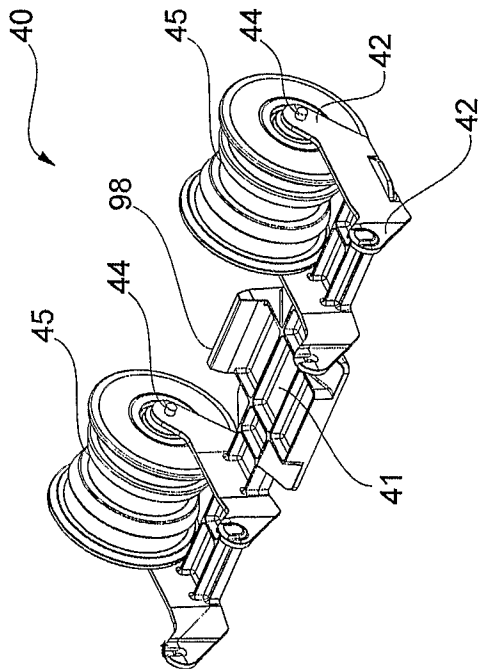


Figure 3a

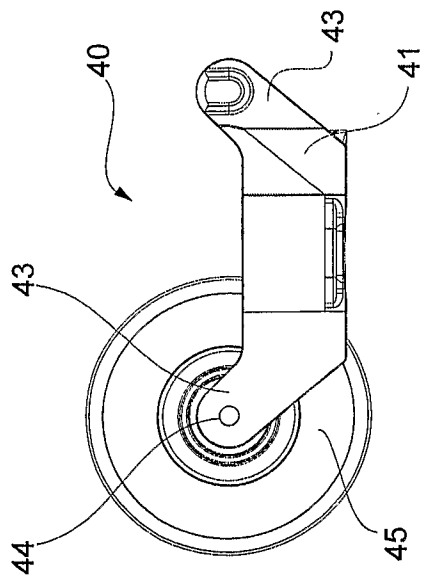


Figure 3b

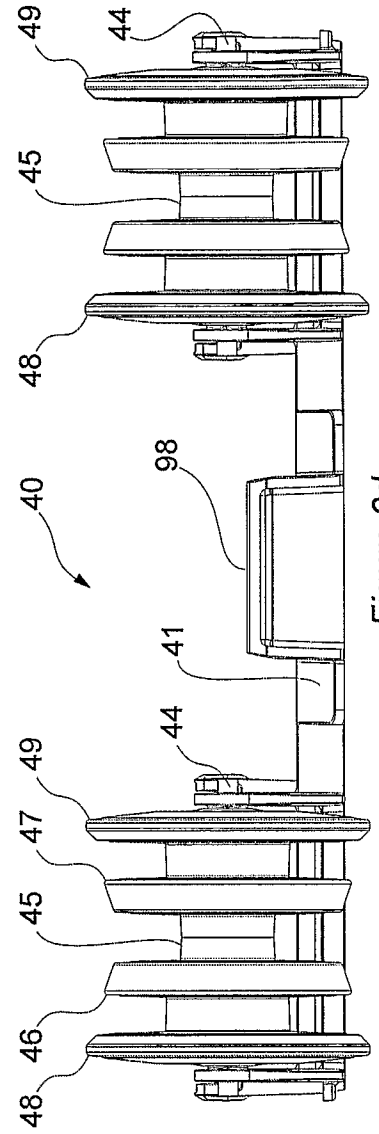


Figure 3d

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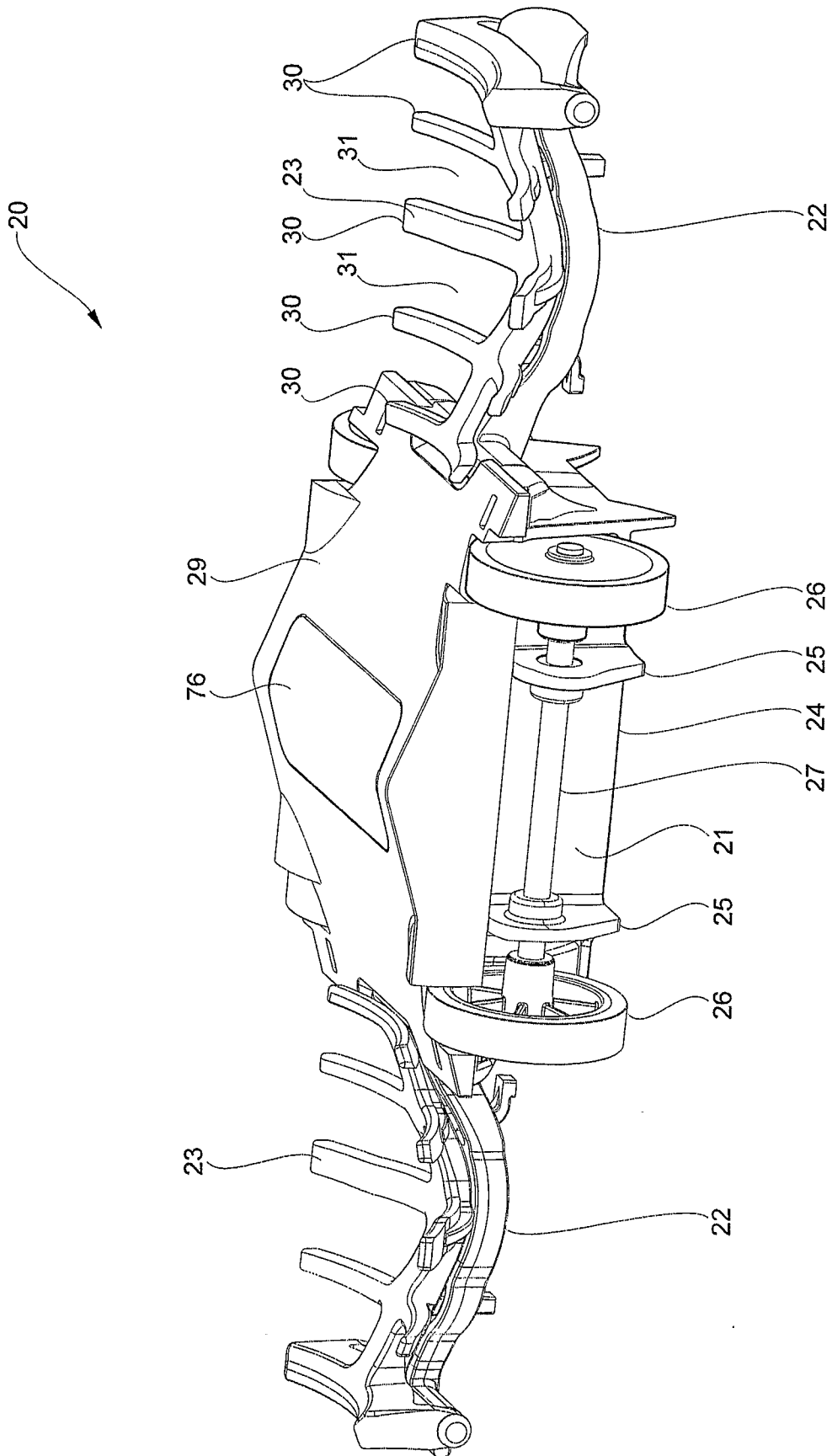


Figure 4a

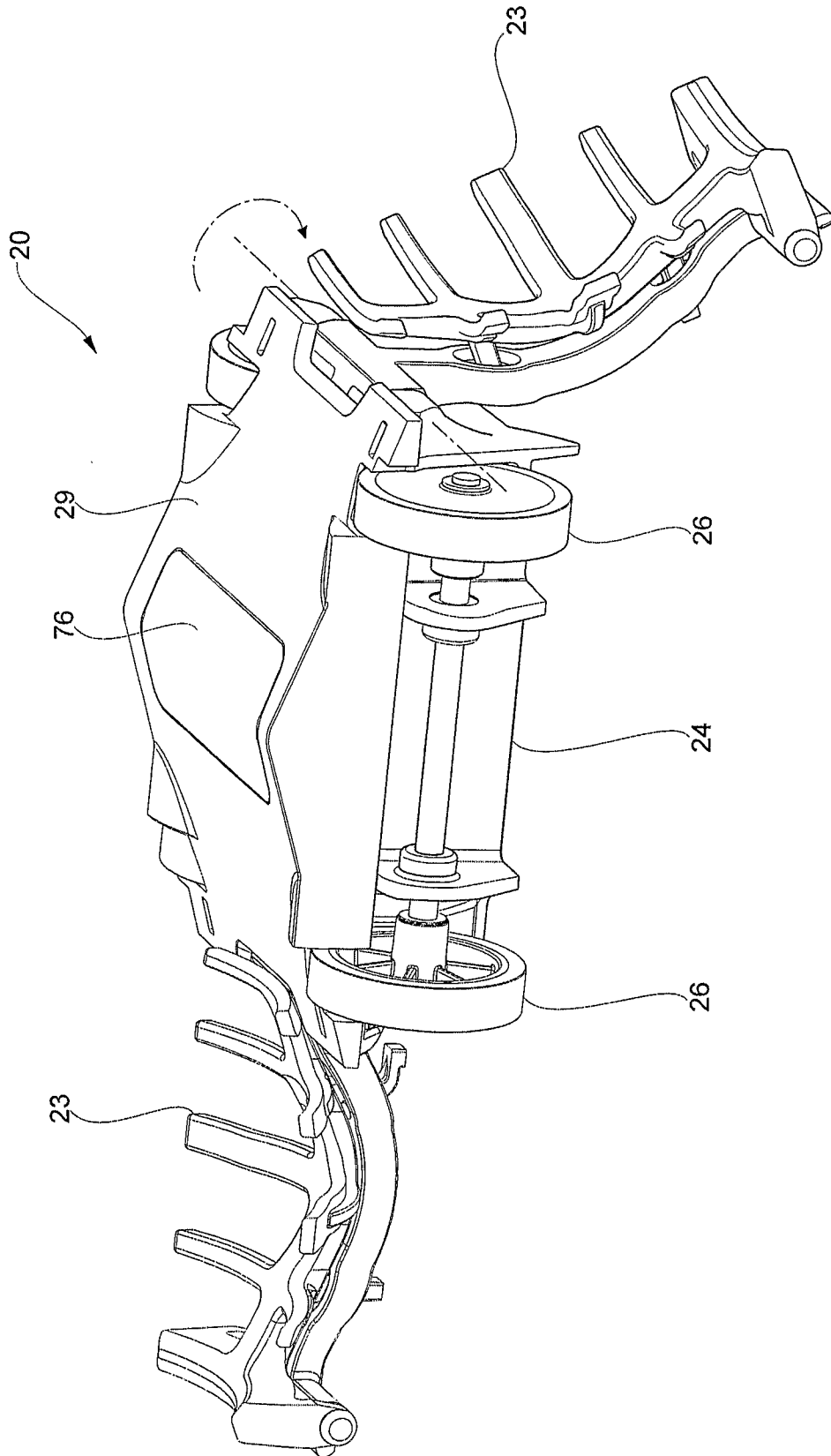


Figure 4b

6/14

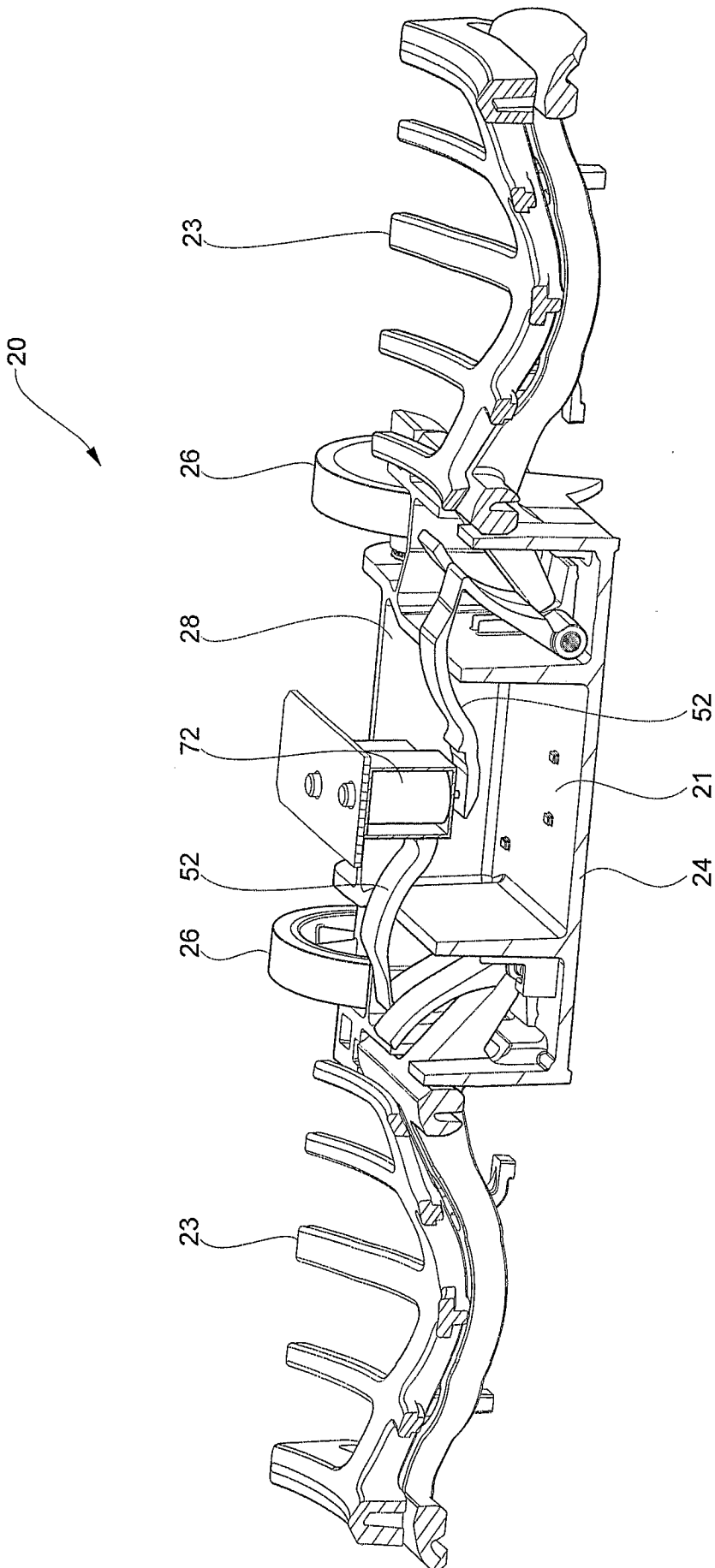


Figure 4c

7/14

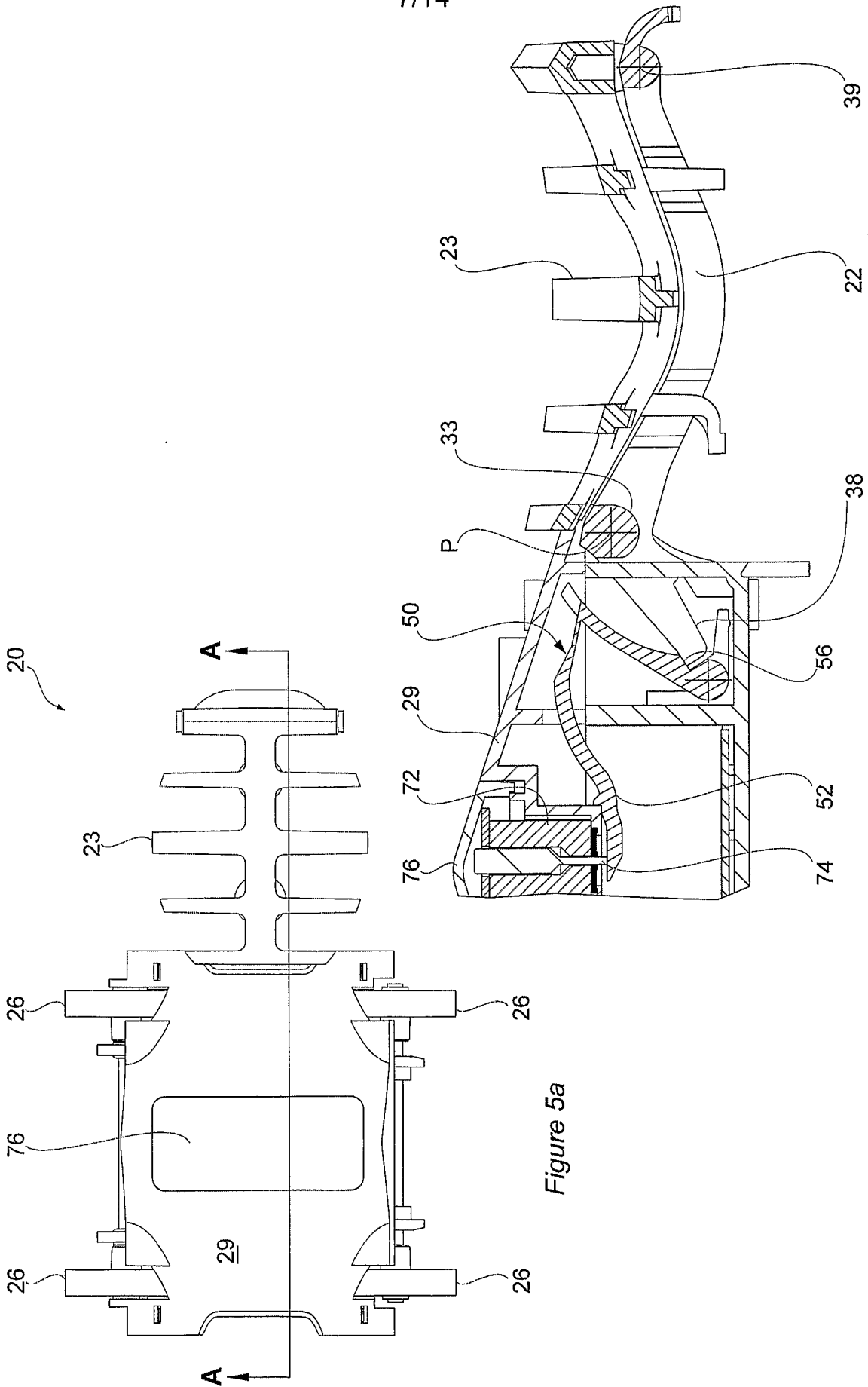


Figure 5a

Figure 5b

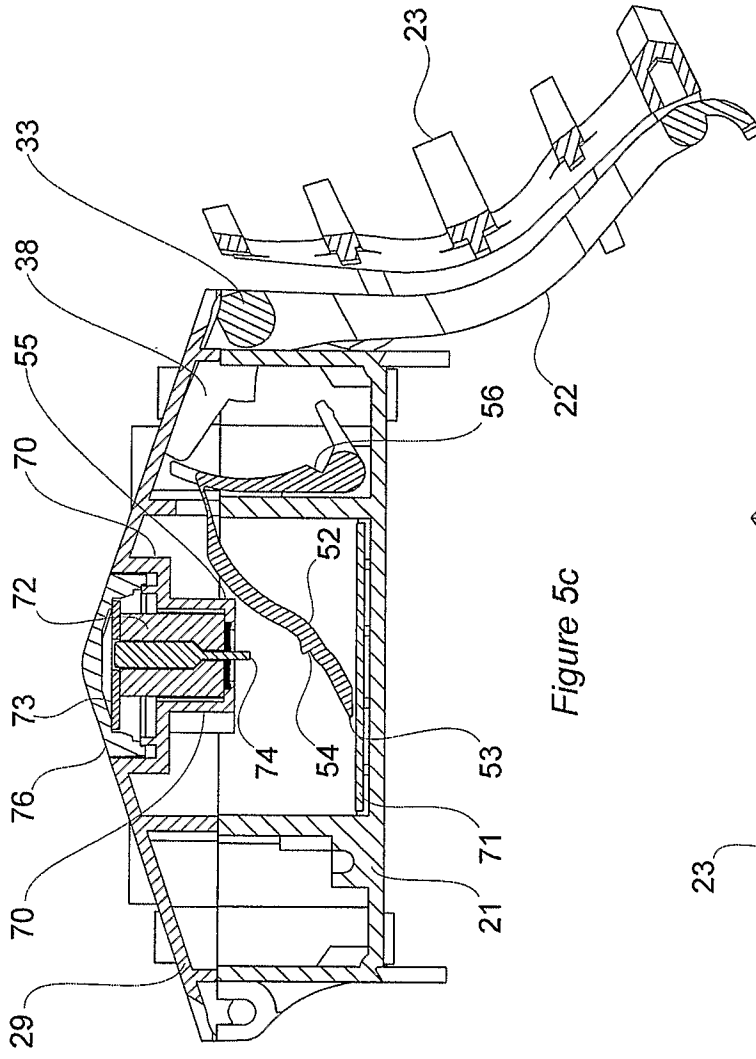


Figure 5c

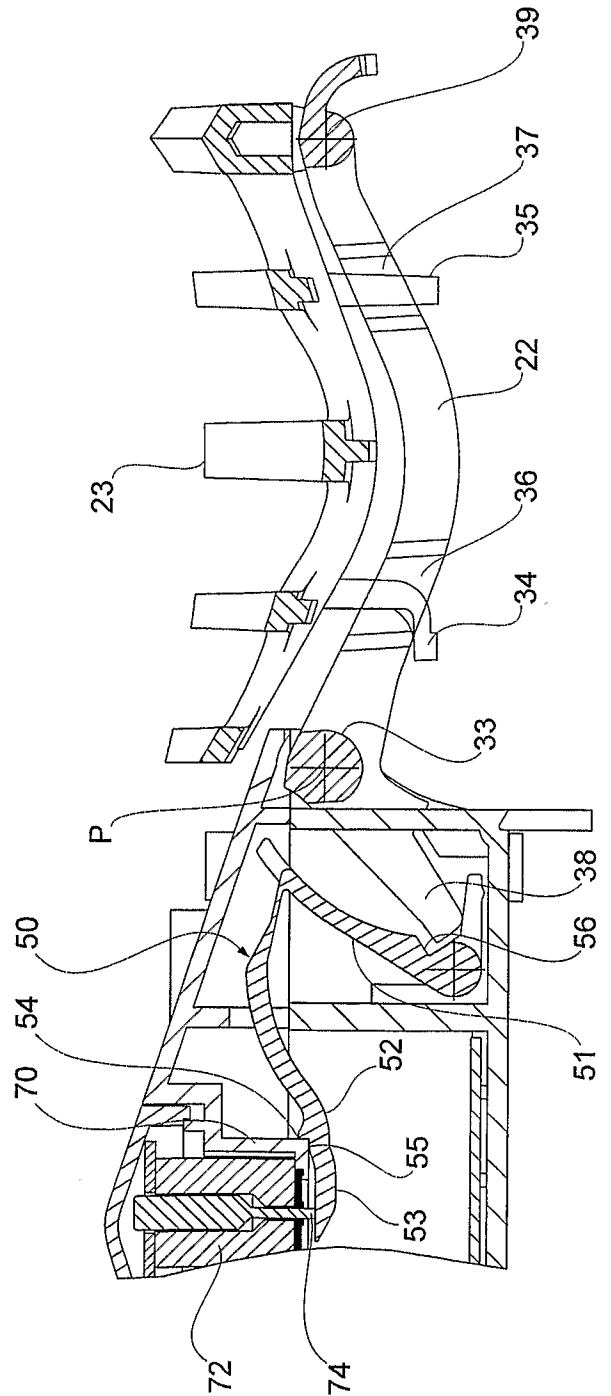


Figure 6

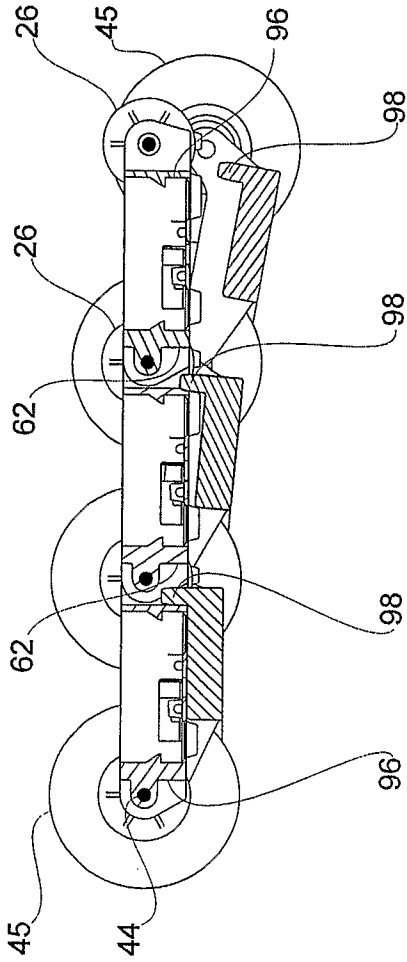


Figure 7b

9/14

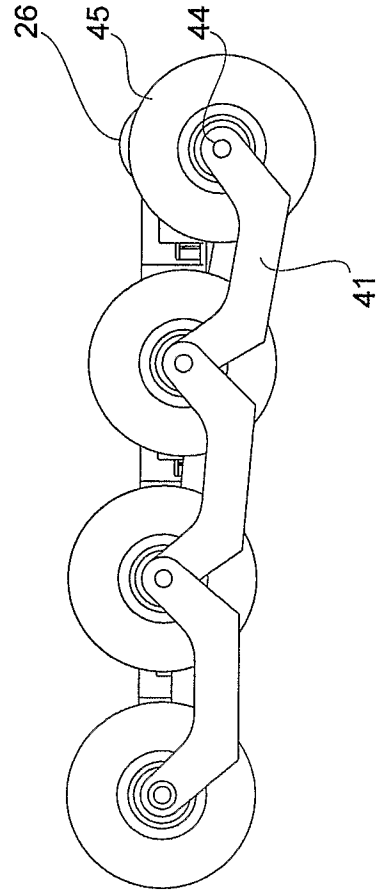


Figure 7c

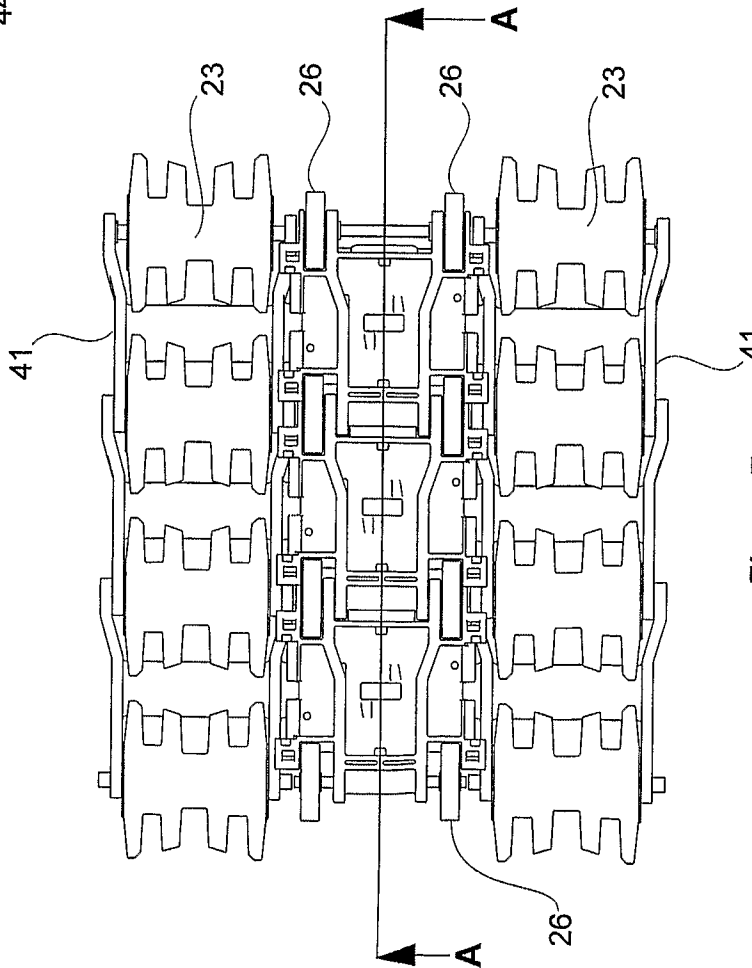


Figure 7a

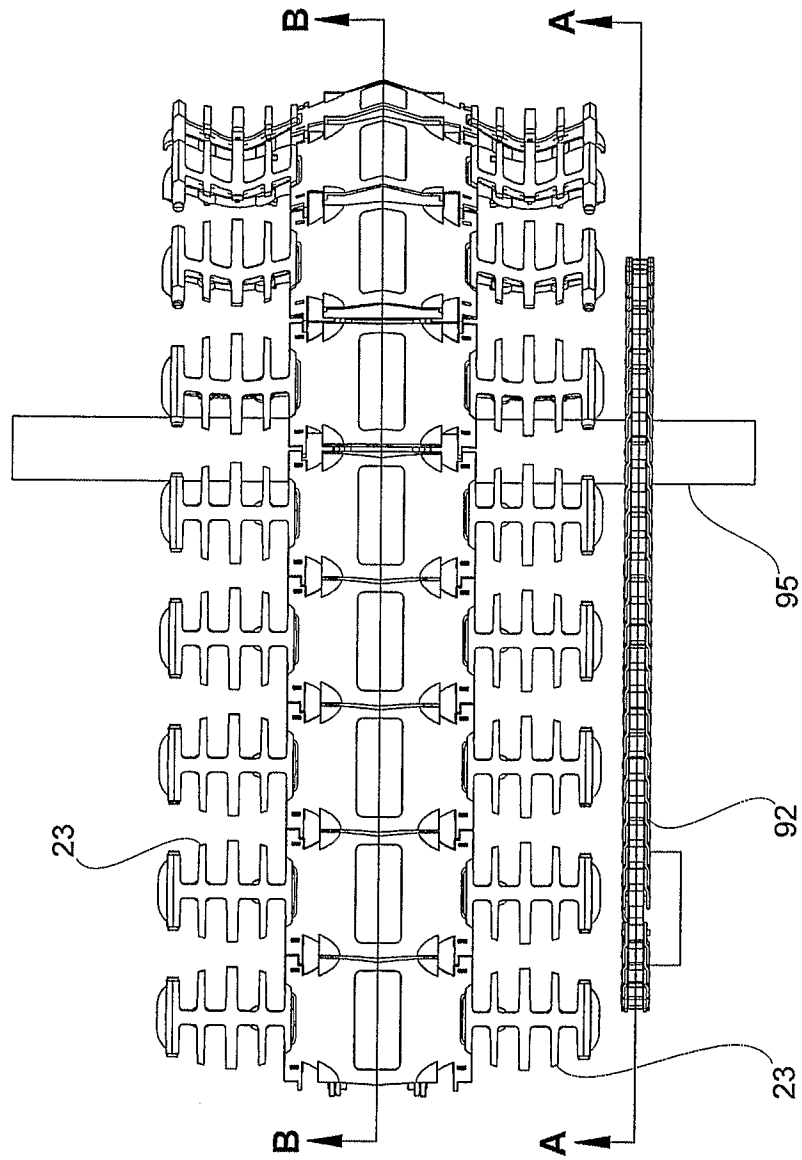


Figure 8

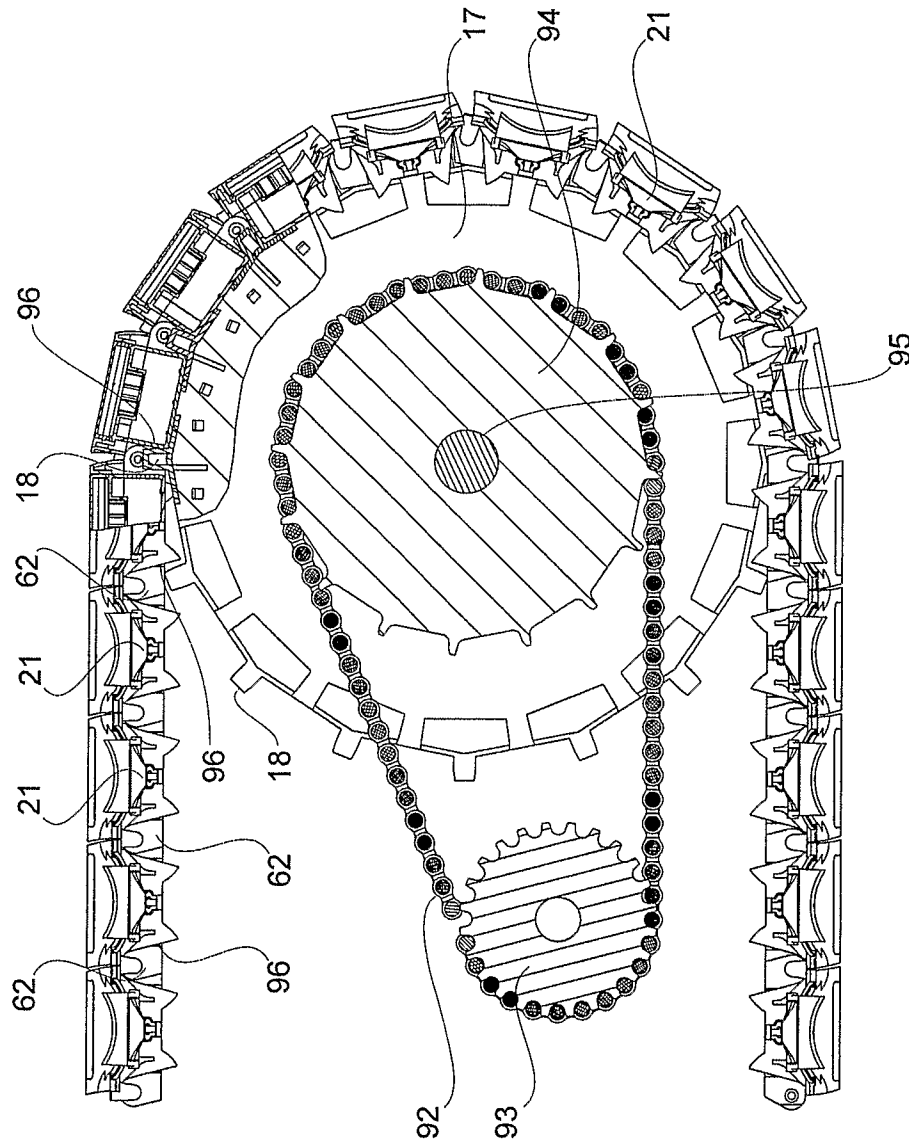


Figure 9

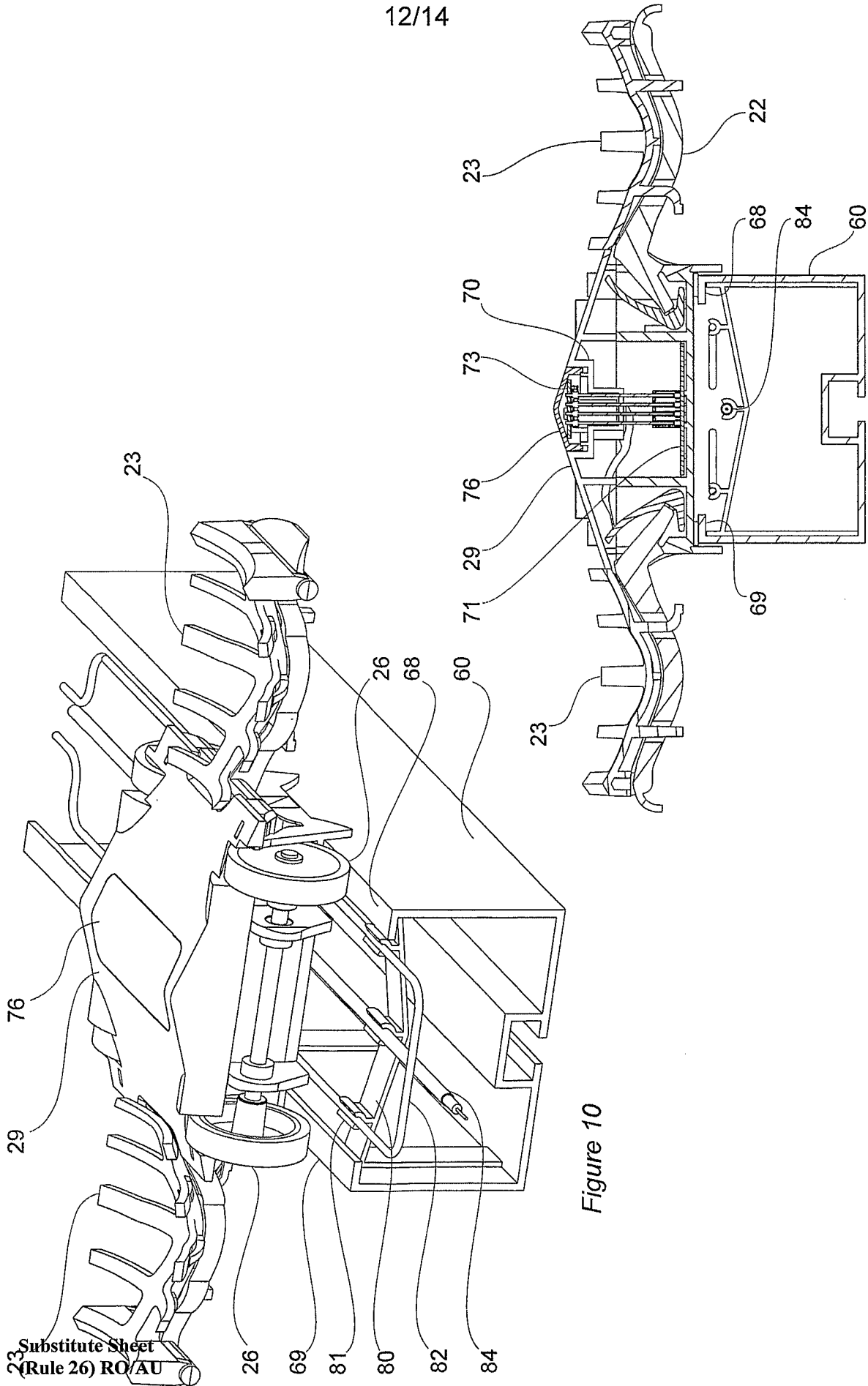


Figure 11

Figure 10

23 Substitute Sheet
(Rule 26) RO/AU

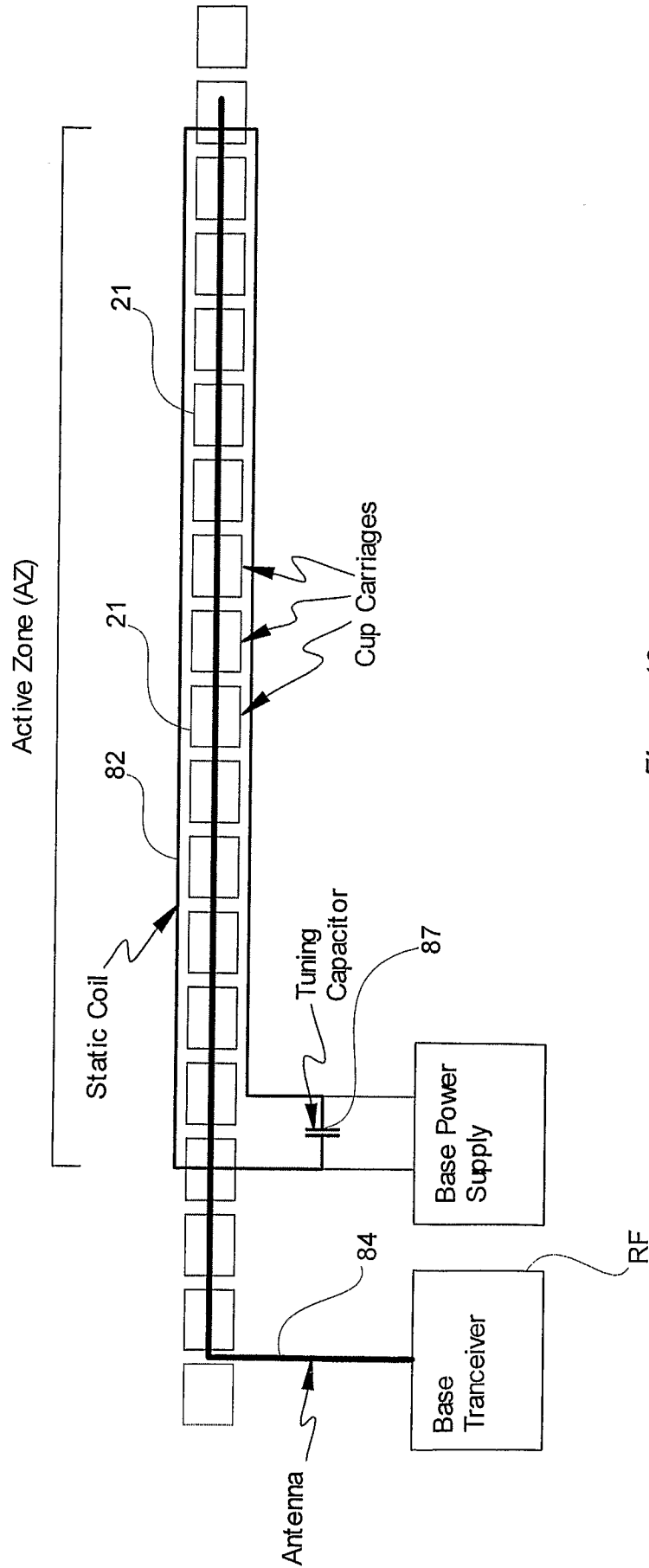


Figure 12

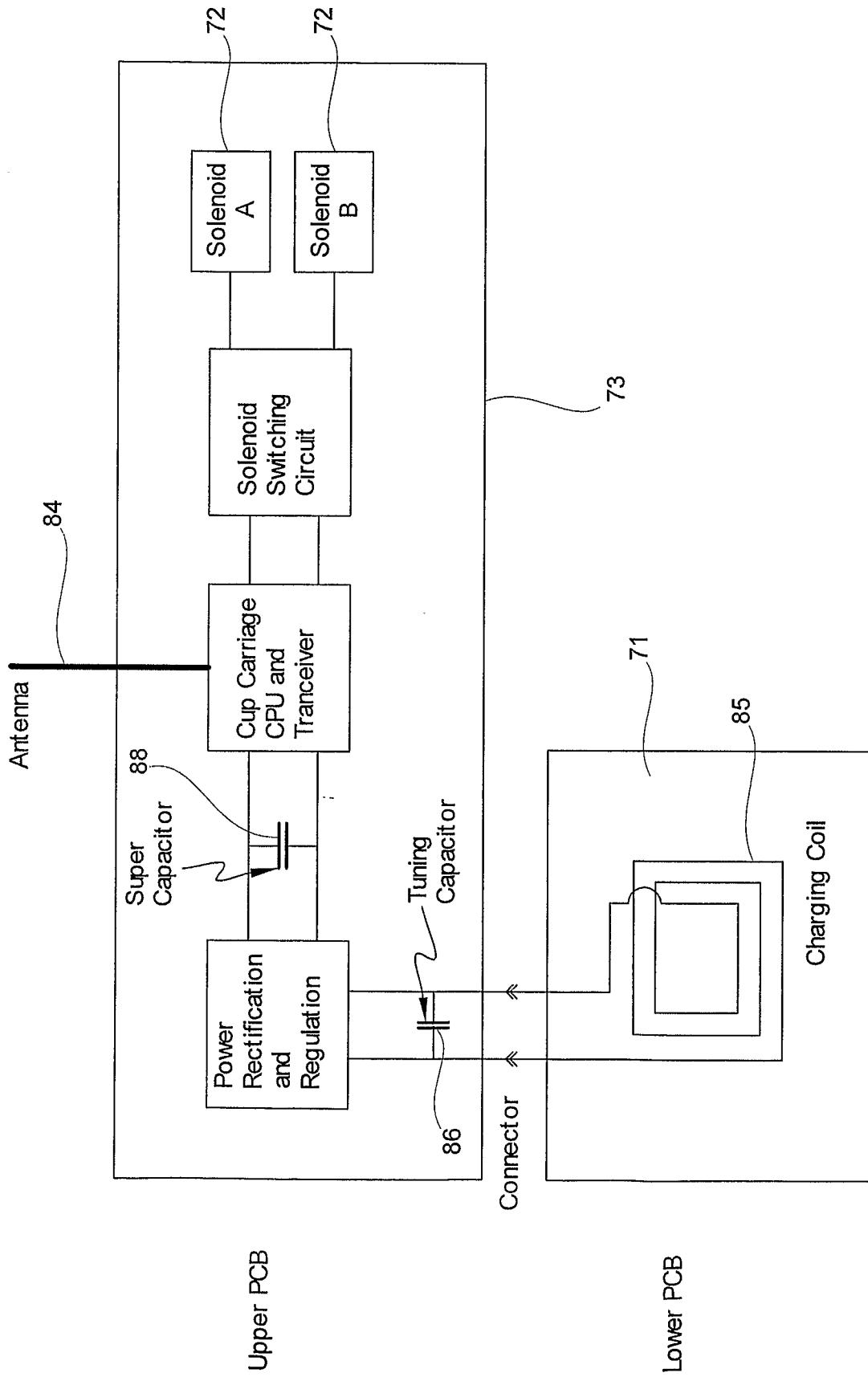


Figure 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2010/000063

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

B65G 47/40 (2006.01) **B65G 39/20** (2006.01)

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)

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)

Search 1: WPI, EPODOC: IPC, ECLA, B65G, B65G 47/00, B65G 47/96A, & keywords (cup, cradle, individual, fruit, egg, vegetable, solenoid, control, remote, sort, check, inspect) and the like.

Search 2: Esp@cenet: IPC, B65G, & keywords (chordal, drive) and the like

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6374983 B1 (MORIGI) 23 April 2002 Figure 1-7, column 1 line 5 to column 6 line 54	1, 5-9, 11-12, 17-18
Y	Figures 1-7, column 3 line 24 to column 6 line 16	2-4, 10, 13-16, 19-20
Y	US 5324143 A (SANDERS) 28 June 1994 Column 4 lines 20 to 23	2-4, 19
Y	US 6246023 B1 (KUGLE) 12 June 2001 Column 3 lines 56 to 58	3, 20
X	US 7222715 B2 (MADDEN et al) 29 May 2007 Figures 2 and 10, column 3 lines 16-17	1, 5
Y	Column 3 line 65 to column 4 line 17	10

Further documents are listed in the continuation of Box C

See patent family annex

<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search
15 March 2010

Date of mailing of the international search report
31 MAR 2010

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2010/000063

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6079542 A (BLOOD) 27 June 2000 Figure 3, column 3 lines 48-52	1, 5
Y	Column 5 lines 42 to 53, column 7 lines 27 to 30	13
Y	US 5611419 A (LA VARS) 18 March 1997 Column 6 line 63 to column 7 line 14	14
Y	US 4825999 A (HAMMER) 2 May 1989 Column 2 line 22 to column 6 line 62	15
X	US 5878863 A (MADDEN et al) 9 March 1999 Figure 12, column 7 lines 1-9	1
Y	Figures 1-9, column 4 lines 3-5, column 4 lines 64-67	16

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2010/000063

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

(Please see Supplemental Box 1)

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2010/000063

Supplemental Box 1

(To be used when the space in any of Boxes I to IV is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1 to 5 are directed to fruit handling equipment comprising a conveyor having a plurality of fruit carrying carriages, each supporting at least one fruit carrying cup pivotally secured to the carriage, each cup having a latching mechanism operable to hold the cup in the fruit carrying mode and releasable to cause the cup to pivot to a de-latched position to eject the fruit, and remote controlled means in each carriage to release the latching mechanism. It is considered that the fruit carrying cup pivotally secured to the carriage and that each carriage has a remotely controllable means to operate the latching mechanism comprises a first distinguishing feature.
- Claims 6 to 20 are directed to fruit handling equipment comprising a first conveyor adapted to transport a line of single pieces of fruit past a camera, over a load cell and through an ejection zone to eject the fruit the fruit at a predetermined position along the conveyor, and a second conveyor adapted to mesh with the first conveyor to lift the fruit off the first conveyor and rotate the fruit as it moves past the camera, characterised in that the first conveyor is a chain of fruit carrying carriages pivotally secured end to end to define a closed loop, and a second conveyor comprising a plurality of roller supports pivotally secured end to end to define a shorter closed loop, whereby each carriage pulls the adjacent meshing roller support. It is considered that first conveyor adapted to remove the fruit from the second conveyor and rotating the fruit as it passes a camera, and the second conveyor comprising a number of roller support adapted to mesh with the first conveyor and that each conveyor is pivotally secured to form two closed loop system comprises a second distinguishing feature.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

The only feature common to all of the claims is fruit handling equipment comprising a plurality of carriages and a fruit ejection system. However this concept is not novel in the light of:

D4: US 7222715 B2 (MADDEN et al) 29 May 2007.

Document D4 discloses, fruit handling equipment (figures 1, 2) comprising a plurality of carriages (figure 1, item 2) and a fruit ejection system (figure 2, items 2, 13, 16, 17) and (figure 1, item 7).

This means that the common feature can not constitute a special technical feature within the meaning of PCT Rule 13.2, second sentence, since it makes no contribution over the prior art.

Because the common feature does not satisfy the requirement for being a special technical feature it follows that it cannot provide the necessary technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a posteriori*.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2010/000063

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	6374983	BR	20010130 A	ES	19991201 U	ES	20000501 Y
		US	20020423 B1				
US	5324143	US	19940628 A				
US	6246023	EP	20011219 A1	EP	20040908 A4	US	20010612 B1
		US	20021001 B1	WO	20000824 A1		
US	7222715	AU	20020718 DO	AU	20040119 A1	AU	20090108 B2
		US	20070529 B2	US	20060302 A1	WO	20040108 A1
US	6079542	US	20000627 A				
US	5611419	AT	19990615 T	AU	19990506 B2	AU	19960814 A
		BR	19971111 A	DE	19990708 D1	DE	19991202 T2
		EP	19971112 A2	EP	19990602 B1	ES	19990816 T3
		GR	19991130 T3	IL	19960514 D0	IL	20020814 D0
		US	19970318 A	WO	19960801 A2	WO	19961003 A3
		ZA	19970108 A				
US	4825999	US	19890502 A				
US	5878863	AU	19980827 B2	AU	19960314 A	AU	19940915 D0
		DE	20010830 D1	EP	19970604 A1	EP	19980107 A4
		EP	20010725 B1	NZ	19990128 A	NZ	19991129 A
		US	19990309 A	WO	19960229 A1	ZA	19960326 A

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX