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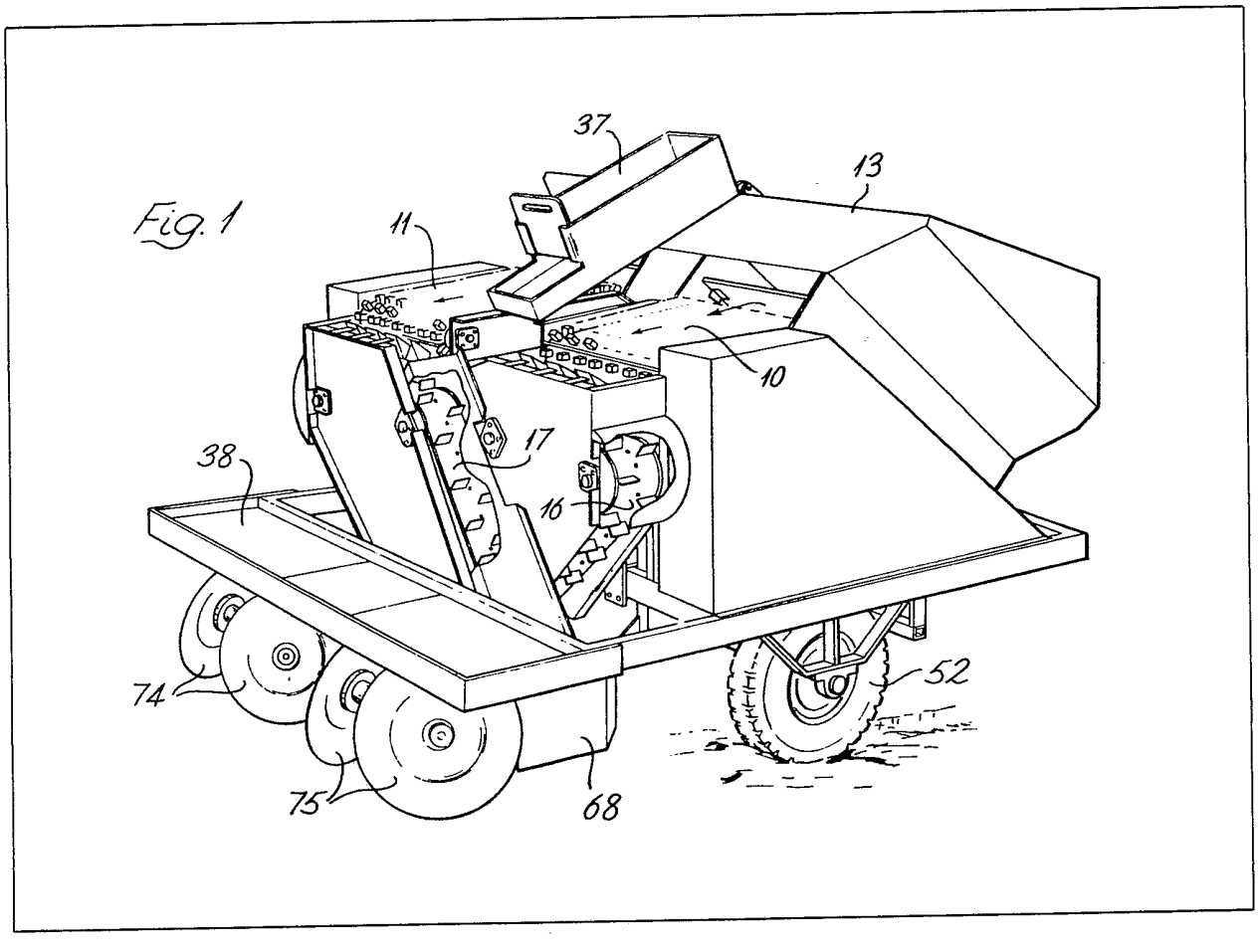
(54) Improvements in and relating to feed assemblies

(57) Existing potato planters are constrained to operate at relatively low planting rates in order to ensure adequate inspection and correction of the tuber distribution in the feed assembly of the machine prior to planting. By contrast, the present invention provides a relatively high-throughput feed assembly comprising two slow-moving feed belts 10, 11 (Fig. 1) which laterally convey rows of tubers from a supply hopper 13 and over an inspection/correction area to downwardly-inclined cross-transfer belts 16, 17. These latter discharge the tubers at planting locations 19, 20 (Fig. 2). Having the tubers closely packed on the two slowly moving feed belts maximises the available inspection and correction time whilst the row by row discharge on to the cross-transfer belts ensures a relatively high planting rate.



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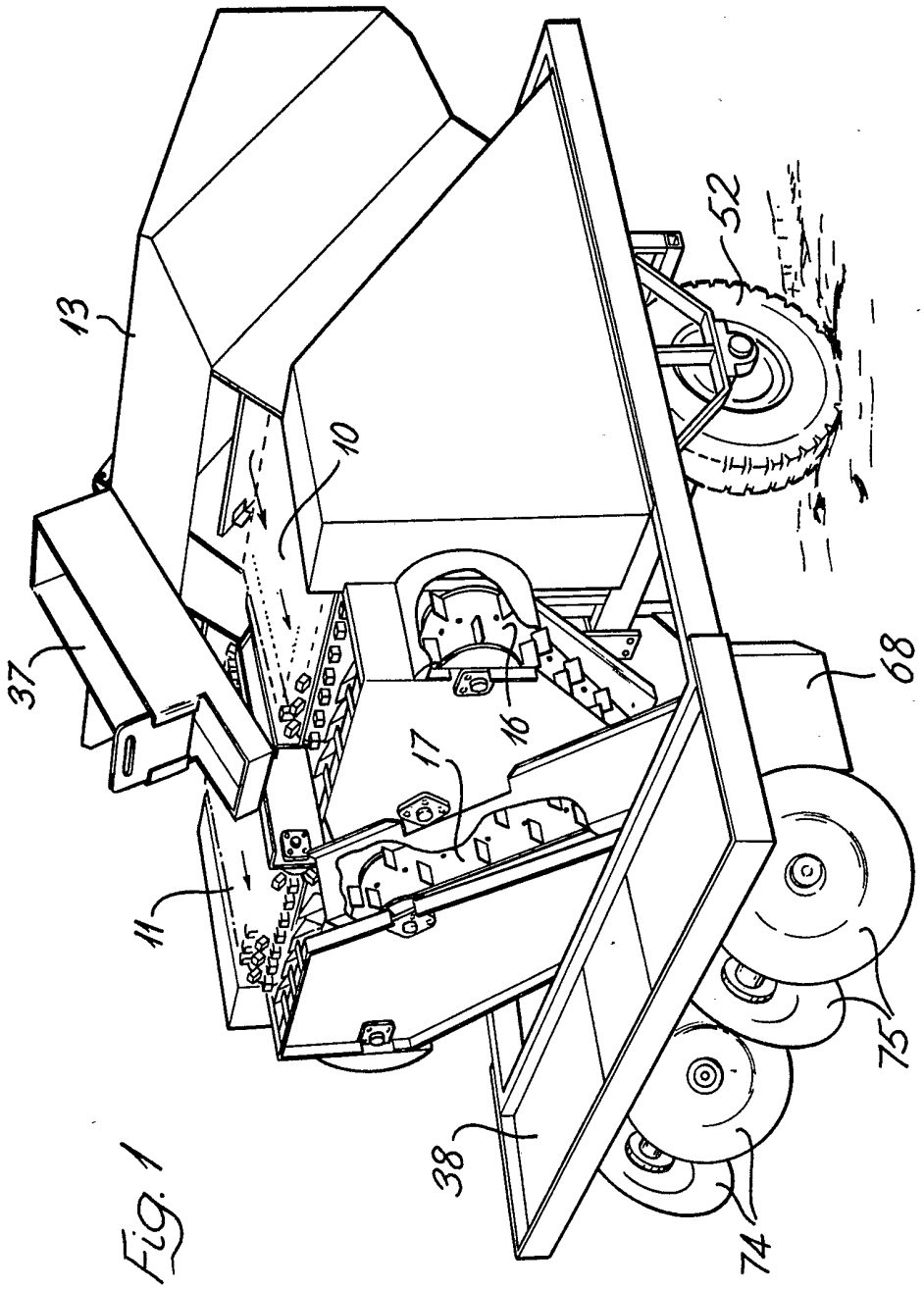

Fig. 1

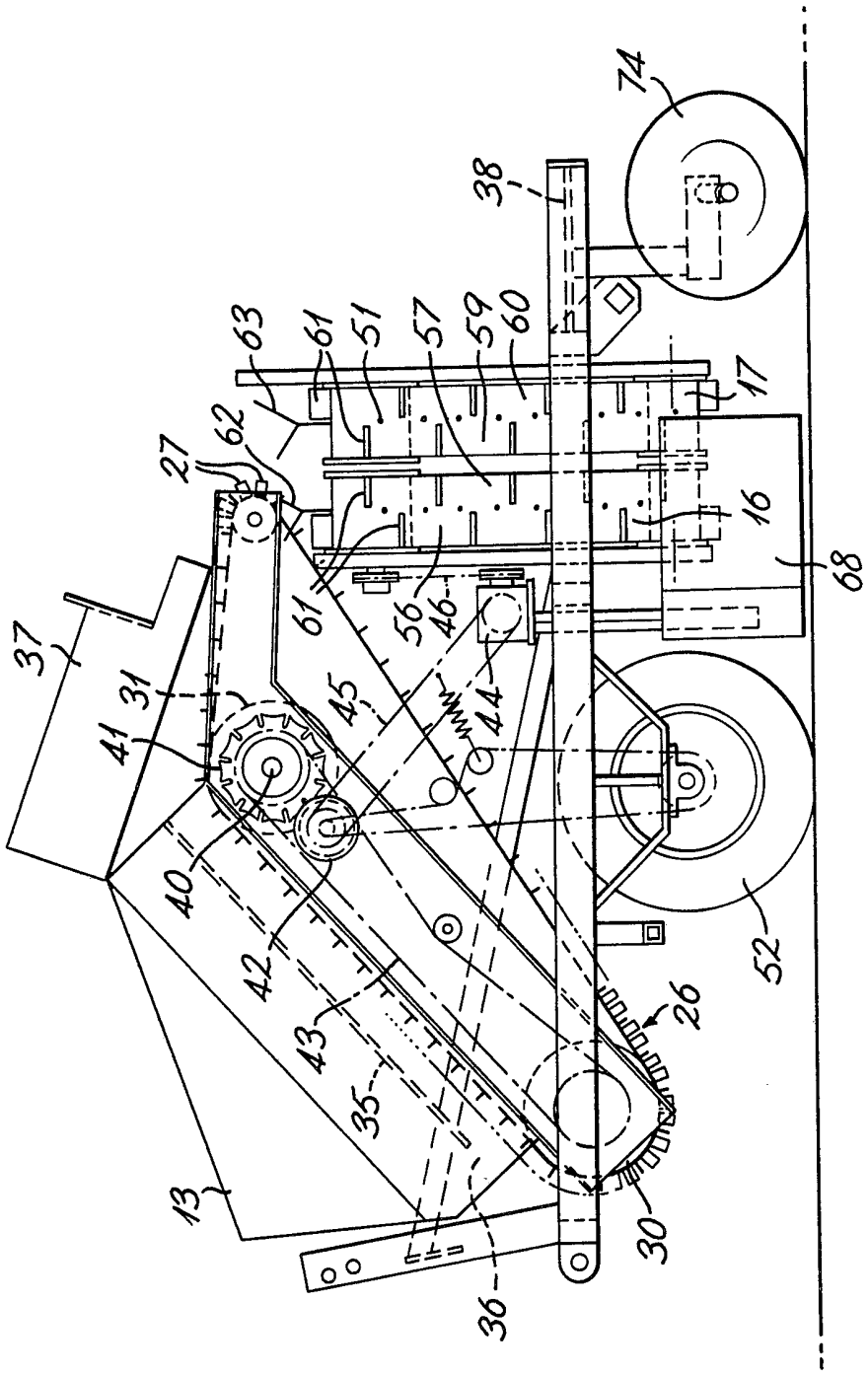
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Fig. 2

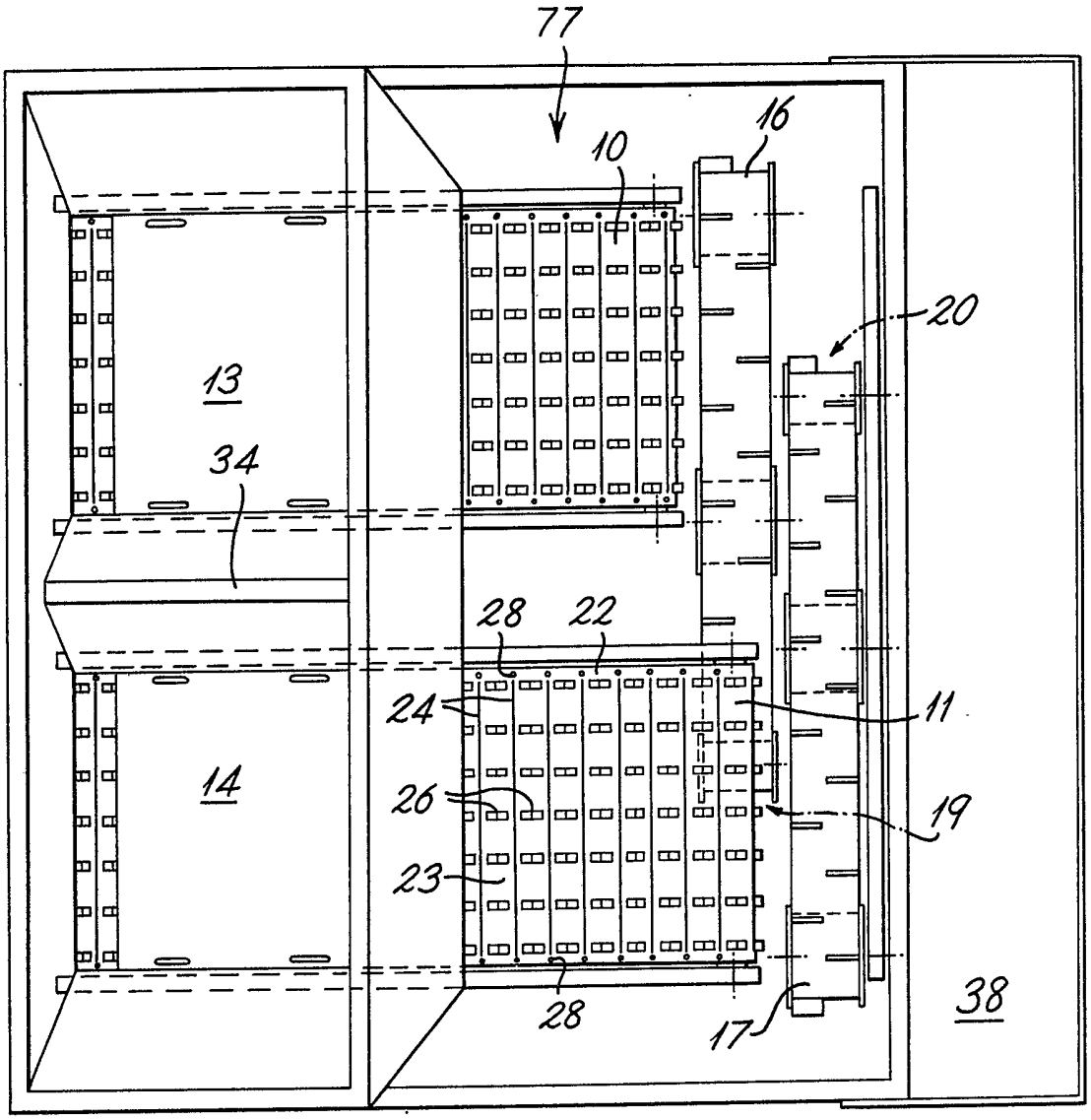
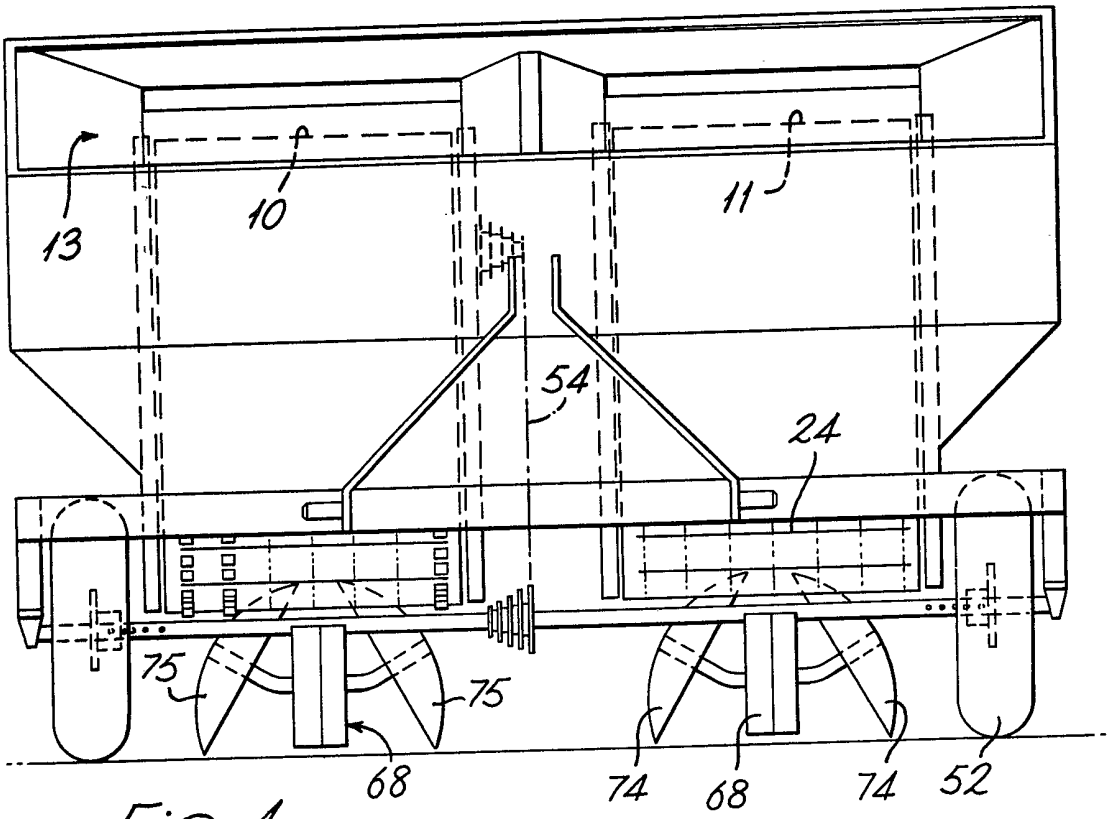


Fig. 3


13
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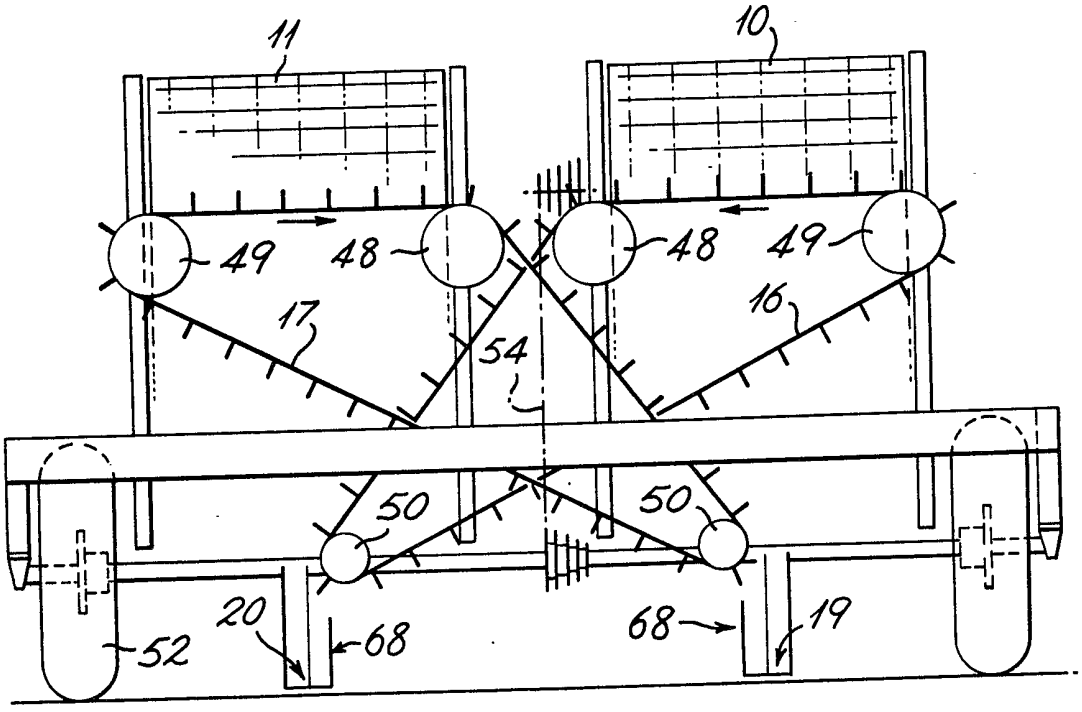
74
52

Fig. 4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17
16
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Fig. 5

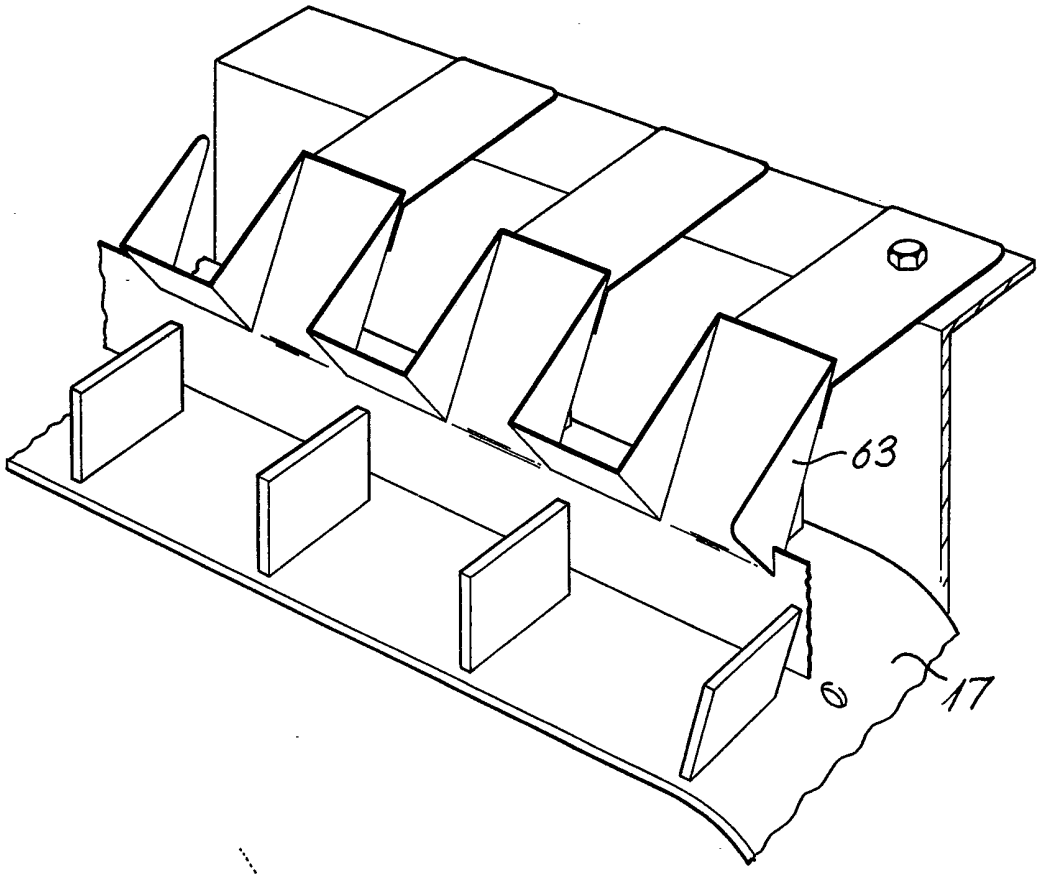

Fig. 6

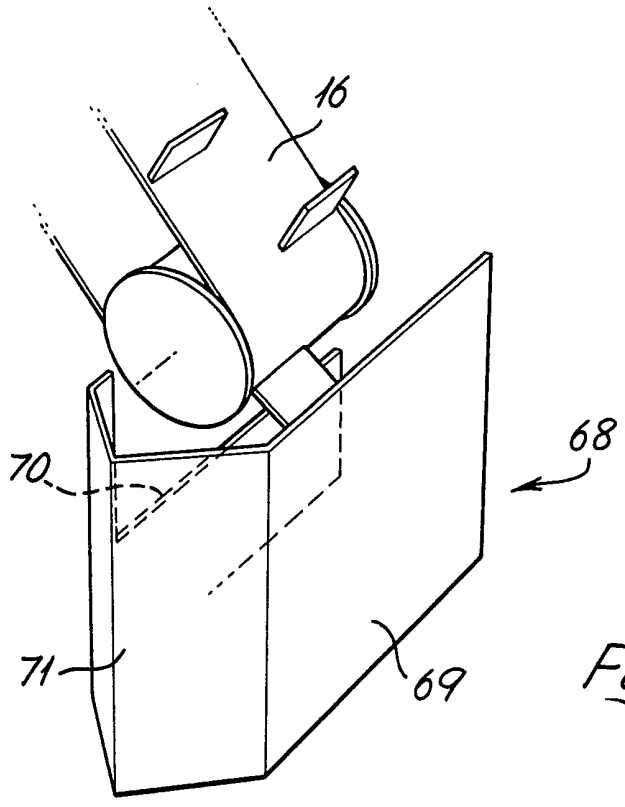

Fig. 7

SPECIFICATION

Improvements in and relating to feed assemblies

The present invention relates to a feed assembly and in particular, but not exclusively, to a feed assembly for tubers such as potatoes, bulbs and the like, and to a planting machine incorporating such an assembly.

Potato planters are already known in which a belt feed is used to collect potatoes from a hopper and place them in the ground. It is usual practice with such machines to have an operative keep an eye on the feed assembly of the planter to detect doubles and gaps in the stream of potatoes passing through the machine. This imposes a top limit on the planting speed of the machine in so far as it must at all times be operated slow enough to allow for this inspection and when necessary, intervention, to be carried out effectively.

According to the present invention a feed assembly for feeding objects from an input location towards an output location comprises first and second conveyors of which the first conveyor is arranged to transport the objects in receptacles in laterally-travelling rows from the input location for discharge on to the second conveyor, and the second conveyor is arranged to transport the objects of each said row, one object after the other, in receptacles towards the output location.

Where the assembly is to be used for feeding potatoes or other tubers in a planting machine, it is an advantage of the assembly that the first conveyor has only to move by one lateral row spacing to discharge a whole row of tubers on to the second conveyor, so that it is possible, by having the rows closely packed together on the first conveyor, for the first conveyor to move relatively slowly and yet provide a high discharge rate of tubers on to the second conveyor for planting. This relatively slow movement of the first conveyor facilitates the inspection and intervention referred to above without the corresponding loss in planting speed associated with the previously available machines. The same advantages would be present, however, if, for example, an assembly according to the present invention formed part of a fruit-packing plant since it would allow a relatively long inspection and intervention period for a relatively fast delivery rate of approved fruit from the second conveyor of the assembly. Equally an assembly according to the present invention might be used in a production line in a factory where individual components had to be approved at some stage of the manufacturing and/or packaging process.

According to a preferred feature of the invention, the first conveyor is arranged to expose several rows of objects simultaneously at any given moment for inspection and intervention purposes so as to give greater time for inspection and intervention than would be the case if say only one row at a time were so exposed.

The assembly preferably includes means for driving the first conveyor intermittently so as to prolong the time for which each row of receptacles is present at the input location.

Conveniently the second conveyor inclines downwardly towards the output location and includes object-locating members which are spaced apart from one another along the length of the second conveyor by an amount in excess of the predicted maximum dimension of the objects to be carried. In one such embodiment, the first conveyor comprises a belt having square-section compartments providing said receptacles for the objects and the second conveyor comprises a belt in which object-locating members adjacent one another in the direction of belt movement (i.e. movement of the second conveyor belt considered relative to the machine chassis) are separated by substantially twice the lengths of said compartments. As an alternative to compartments, the first conveyor belt might instead have cups providing the receptacles for the objects.

If the second conveyor comprises a belt, the object-locating members may take the form of flights extending across, or partially across, the belt width of the second conveyor. In one such embodiment, successive object-locating members are arranged on alternating sides of the second conveyor centre line with those on one side staggered in relation to those on the other side. In this case the assembly preferably includes a distributor arranged to divert successive objects, or groups of objects, of each row of objects discharged from the first conveyor to alternate sides of the second conveyor. Thus with a row of six objects, for example, the first, third and fifth objects in a row might be discharged on to the side of the second conveyor nearer one end of the machine, say, while the second, fourth and sixth objects might be discharged on to the side of the second conveyor nearer the other end of the machine.

The invention further includes a tuber-planting machine in which one or more of the feed assemblies according to the invention are incorporated to feed tubers from a supply hopper at the input location to an output location at the trailing side of a furrow-forming shape.

Conveniently, the machine includes two such assemblies with the first converyors of the assemblies arranged side by side and the second conveyors of the assemblies crossing one behind the other so that tubers from the first conveyor of each said assembly are discharged by the associated second conveyor at an output location positioned to the rear of the first conveyor of the other said assembly.

An embodiment of the invention will now

be described, by way of example only, with reference to the accompanying drawings in which:—

Figure 1 shows a perspective view of a potato-planting machine according to the invention with parts of the machine omitted or broken away for clarity;

Figure 2 shows a side view of the machine;

Figure 3 shows a plan view of the machine;

Figure 4 shows a front view of the machine;

Figure 5 shows a rear view of the machine;

Figure 6 shows, on an enlarged scale, a detail of the distributor appearing in earlier Figures of the drawings; and

Figure 7 shows a detail of the machine in the region of the planting location with parts of the machine omitted or broken away for clarity.

Thus referring especially to Figs. 1 to 5 of the drawings, a two-row landwheel-driven machine for planting chitted seed potatoes includes two feed belts 10, 11 arranged side by side at the top of the machine to convey the tubers from a supply hopper 13 to two cross-transfer belts 16, 17 at the rear of the machine. These latter belts incline downwardly in opposite directions from the discharge ends of feed belts 10, 11 to planting locations 19, 20 and it will be observed that because belts 16, 17 are arranged one behind the other, the associated feed belts 10, 11 have to extend rearwardly by different amounts as will most clearly be seen from Fig. 3. Moreover, because the cross-transfer belts are inclined in opposite directions to one another, the output or planting location 19 associated with the first pair of belts (10, 16) will be to the rear of the feed belt 11 of the second pair while the output or planting location 20 associated with the second pair of belts (11, 17) will be to the rear of the belt 10 of the first pair.

In more detail, the feed belts 10, 11 each comprise 3-ply rubber belting 22 divided up into 60 mm square-section compartments 23 for the tubers by L-section cross-bars 24 (mounted at 70 mm pitch) and seven longitudinal rows of attachments 26 each formed of two blocks 27 which can separate when the belt changes direction as may be seen from Fig. 2 for example. The edge regions of the two feed belts are punched with rows of 12 mm diameter holes 28 at 70 mm pitch longitudinally and these allow the belts to be positively driven by rollers 30, 31 fitted with drive pegs (not shown) at the same pitch.

The $\frac{1}{2}$-tonne capacity supply hopper 13 at the rear of the machine is partially divided into two equal sections by a ridged plate 34. Each section has a narrow-throated rounded-edged outlet located directly over one of the feed belts 10, 11 which provide a moving floor surface to that section. A sloping floor plate 35 is also fitted in the hopper to expose only a few rows of compartments 23 at a time to the associated hopper outlet (36) for loading purposes. The sloping floor plate of the hopper is slotted so that it can be moved to suit the width of the hopper outlet to different tuber sizes.

To allow the stream of tubers carried by the feed belts 10, 11 to be inspected and any corrections made, when an excess or deficiency of tubers is observed, an almost horizontal inspection section of each feed belt runs exposed before reaching the discharge roller 31. This secton is six rows long for belt 10 and eight for belt 11 allowing adequate time for inspection and correction of any one row before it passes out of the inspection area for discharge on to the cross-transfer belts 10, 11. Correction can be manual, semi-automatic or automatic as appropriate. In the manually-corrected version shown in the drawings, a small auxiliary hopper 37 is provided for convenience between conveyors 10, 11 for excess or replacement potatoes. This hopper is pivoted at its top edge so that its contents can be easily tipped into supply hopper 13 as and when necessary.

Reference numeral 38 indicates a support platform for operatives involved in the inspection/correction operation.

An alternative form of belt (not illustrated) is also envisaged for feed belts 10, 11. This would be made up of a large number of identical injection-moulded plastics units, each providing one tuber compartment, with six units making up one width of the belt. With such an arrangement the feed belt would typically be made up of 264 (conveyor 10) or 288 (conveyor 11) identical units. These units would be joined by 6 mm steel rods on which would be mounted small plastic rollers thus making a belt which should be relatively strong, accurate, easily indexed and, because of mass production of the components, cheap. A plastic inset cover would be used to reduce compartment size to discourage "doubles" occurring when small tubers were being planted.

Returning now to the embodiment illustrated in the drawings, the rollers 31 (at the upper ends of conveyors 10, 11) are mounted on a common axle 40 carrying at both ends Geneva wheels 41 provided with twelve radial slots and twelve concave peripheral surfaces as best seen from Fig. 2. This arrangement gives a positive anti-backlash intermittent drive to feed belts 10, 11 in response to a continuous rotation of driver 42. Feed belts 10, 11 will therefore move forward by just one row of compartments for every revolution of driver 42 and each such move will bring a new row of compartments to the associated hopper outlet 36 and will discharge the end-most row on to the cross-transfer belts 16, 17.

A chain and sprocket connection 43 transmits the intermittent drive of rollers 31 to the lower belt-supporting rollers 30.

The driver 42 also drives a gear box 44 through a chain and sprocket connection 45. A second chain and sprocket connection 46 connects the gear box with one drum (48) of each set of three drums (48, 49, 50) on which the cross-transfer belts 16, 17 are mounted (Fig. 5). As indicated by way of example at 51, these belts are centrally apertured to allow a positive drive by rollers 49 which carry drive pegs (not shown) at the same pitch. Typically, 12 mm diameter holes will be used at a 125 mm longitudinal pitch. Alternative methods of achieving this positive drive would be to use timing belts, chain drive or identical moulded plastics section.

The connection between the driver 42 and the machine's landwheels (52), is effected by a multi-sprocket chain drive arrangement 54 (Figs. 3 and 4) incorporating sprung chain tensioners. This enables the speed of the feed belts (10, 11) and the cross-transfer belts (16, 17) to be changed relative to the landwheel speed if it is desired to vary the planting distance between adjacent tubers in the direction of machine travel.

As can best be seen from Fig. 2, the cross-transfer belts 16, 17 are divided longitudinally into compartments 56, 57 and 59, 60 respectively by transverse flights 61. Distributors 62, 63 (see also Fig. 6) are arranged as shown in Fig. 2 so that alternate potatoes from each row on belt 10 are discharged into compartments 56, say, and the remainder into compartments 57 while alternate potatoes from each row on belt 11 are discharged into compartments 59, say, the remainder into compartments 60. In accordance with a preferred feature of the invention, each compartment 56–60 is arranged to be twice the length of the feed belt compartments 23 so that as the cross-transfer belts drop to the planting locations 19, 20 the tubers will roll or slide forward until they reach the dividing flights 61, thus ensuring accurate spacing of the tubers at release from belts 16, 17.

The timing of the machine is so arranged that each feed belt 10, 11 will discharge its row of potatoes only when the compartments of the corresponding transfer belts 16, 17 are directly in line with the feed belt compartments. This ensures the delivery of one tuber into each compartment 56–60. The relative compartment positions of the feed and cross-transfer belts can be accurately adjusted if necessary to obtain this result by removing and replacing the chain of connection 46 one link either way in relation to the gear box drive 44 until the necessary compartment-compartment alignment is achieved.

Row width can be changed by relocating the position of the cross-transfer belt lower rollers 50, the land wheels 52 and furrow openers 68.

These latter elements take the form of a share 69 (Fig. 7) having a cut-away 70 at its inner wall to allow the relevant cross-transfer belt to discharge tubers into the furrow formed by the V-form front-section 71 of the share.

Concave disc-ridgers 74, 75 (mouldboard ridgers may be used instead if desired), are fitted at the rear of the machine to cover the potatoes and allow the complete planting operation to be completed in one run.

The illustrated machine is intended to be semi-mounted for planting but for transporting and turning at the end of the rows, it can be fully mounted. In operation, the belts 10, 11 will transport potatoes out of the hopper outlet, and upwardly with the regular intermittent movement produced by drive arrangement 41, 42. The upward inclination of these initial positions of the feed belts will encourage any excess tubers on the belts to roll back into supply hopper 13.

At their upper regions, the feed belts 10, 11 assume a roughly horizontal disposition so that the tubers can travel almost horizontally over an inspection and correction area (77) as above described. After this, they are discharged six at a time from each feed belt on to one of the cross-transfer belts 16, 17 for downward transfer and eventual discharge into the furrow formed by the shares 69 at opposite sides of the machine.

Typically, the illustrated machine could reasonably be expected to reach a planting rate of up to nine potatoes per second for each row of the machine. (18 tubers per second on the 2 row machine). The speed, relative to platform 38 of belts 10, 11 over the inspection/intervention area 77 would typically be 70–100 mm per second giving a total exposure time of each row for inspection and correction purposes of about 6 seconds for belt 10 and 8 seconds for belt 11.

Envisaged advantages of the illustrated embodiment of the machine over the prior art designs include its high planting rate; its planting accuracy at high speed; the fact that examination and correction is possible well in advance of planting; the fact that the slow-moving feed belts are likely to achieve good compartment filling; the fact that the slow-moving feed belts can travel at less than 1/6th speed of the cross-transfer belt and hence they are unlikely to damage the chitted seed potatoes; the fact that relatively few potatoes are exposed to the feed belts at hopper outlet 36 should result in less damage to chitted seed; the fact that examination should allow the machine to be stopped when major trouble occurs e.g. tuber blockage, without leaving blanks in the rows being planted; and the fact that hopper and feed belt mechanisms are not moved when altering row width.

CLAIMS

1. A feed assembly for feeding objects

from an input location towards an output location comprises first and second conveyors of which the first conveyor is arranged to transport the objects in receptacles in laterally-travelling rows from the input location, for discharge on to the second conveyor, and the second conveyor is arranged to transport the objects of each said row, one object after the other, in receptacles towards the associated output location.

2. An assembly as claimed in Claim 1 in which several rows of objects are simultaneously exposed at any given moment for inspection and intervention purposes.

3. An assembly as claimed in Claim 1 or Claim 2 including means for driving the first conveyor intermittently so as to prolong the time for which each row of receptacles is presented at the input location.

4. An assembly as claimed in any preceding claim in which the second conveyor inclines downwardly towards the output location and includes object-locating members which are spaced apart from one another along the length of the second conveyor by an amount in excess of the predicted maximum dimension of the objects to be carried.

5. An assembly as claimed in Claim 4 in which the first conveyor comprises a belt having square section compartments providing said receptacles for the objects and the second conveyor comprises a belt in which object-locating members adjacent one another in the direction of belt movement are separated by substantially twice the lengths of said compartments.

6. An assembly as claimed in Claim 5 in which said members take the form of flights extending across, or partially across, the belt width of the second conveyor.

7. An assembly as claimed in Claim 6 in which successive object-locating members are arranged on alternating sides of the second conveyor centre line with those on one side staggered in relation to those on the other side.

8. An assembly as claimed in Claim 7 including a distributor arranged to divert successive objects, or groups of objects, of each row of objects discharged from the first conveyor to alternate sides of the second conveyor.

9. A tuber-planting machine including one or more feed assemblies according to any of Claims 1 to 8 to feed tubers from the supply hopper at the input location to an output location at the trailing side of a furrow-forming share.

10. A machine as claimed in Claim 9 including two said assemblies with the first conveyors of the assemblies arranged side by side and the second conveyors of the assemblies crossing one behind the other so that tubers from the first conveyor of each said assembly are discharged by the associated second conveyor at an output location position to the rear of the first conveyor of the other said assembly.

11. An assembly or machine substantially as hereinbefore described with reference to, and as illustrated in, Figs. 1 to 7 of the accompanying drawings.

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