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Palmer

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[54] **CONVEYING APPARATUS FOR A MATERIAL HANDLING VEHICLE**

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[52] **U.S. Cl.** **214/83.2,** 198/171, 198/193, 198/230, 222/371, 214/520

[51] **Int. Cl.** **B60p 1/38**

[58] **Field of Search** 214/83.18, 83.2, 83.34, 214/83.36, 519, 520, 521, 522; 222/371; 198/230, 163, 164, 165, 171, 172, 193, 194

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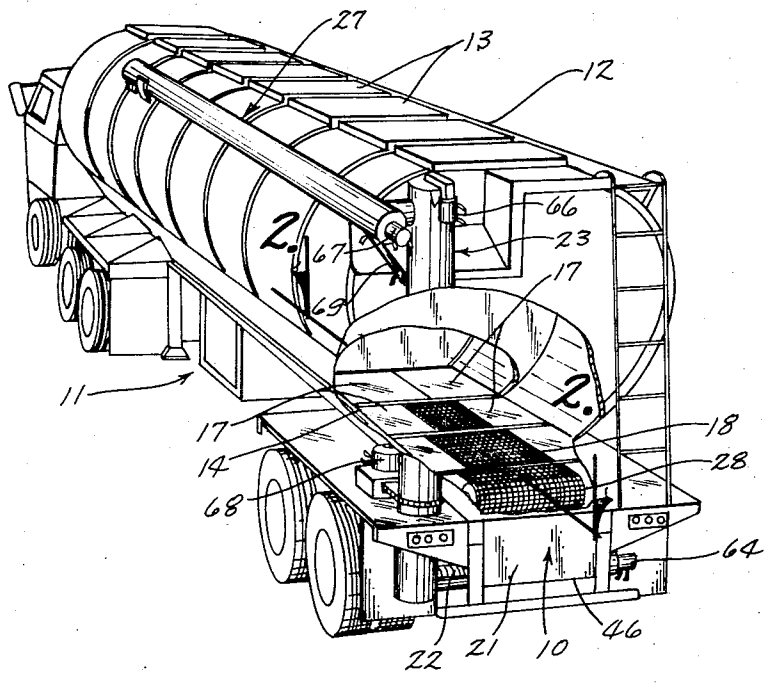
[57] **ABSTRACT**

The conveying apparatus includes an endless metal conveyor of a mesh construction having an upper length extended longitudinally of the vehicle at a position immediately below the bottom discharge outlets of a row of material bins for transfer of material from the bins to a common discharge hopper. A feed pan and return pan for upper and lower runs of the conveyor, respectively, are relatively arranged and constructed to substantially eliminate any accumulation of material adjacent the paths of longitudinal travel of the conveyor. A toothed drive roller located downstream from the delivery end of the conveyor is in driving engagement over the axial length thereof with the conveyor.

7 Claims, 8 Drawing Figures



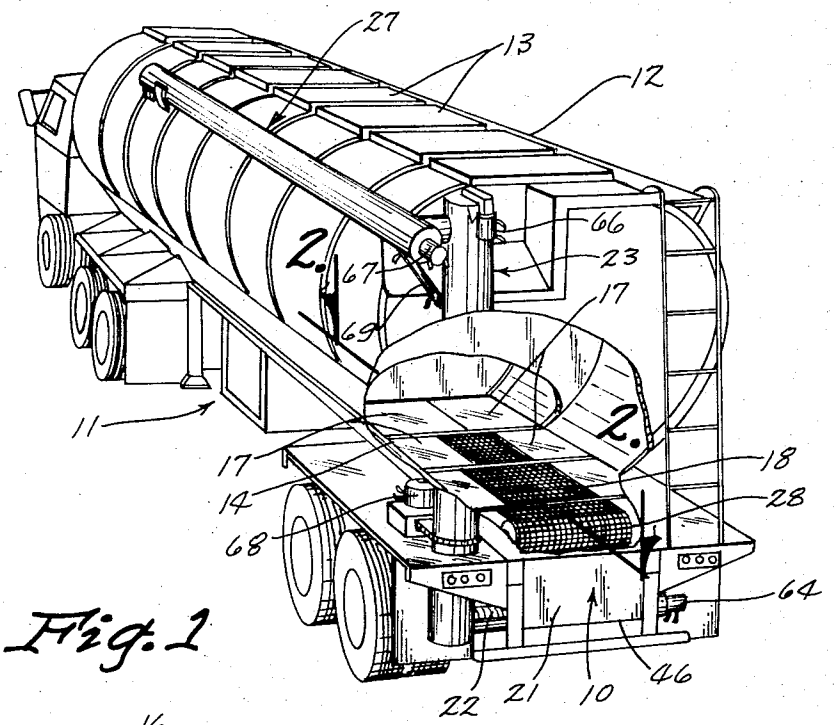


Fig. 1

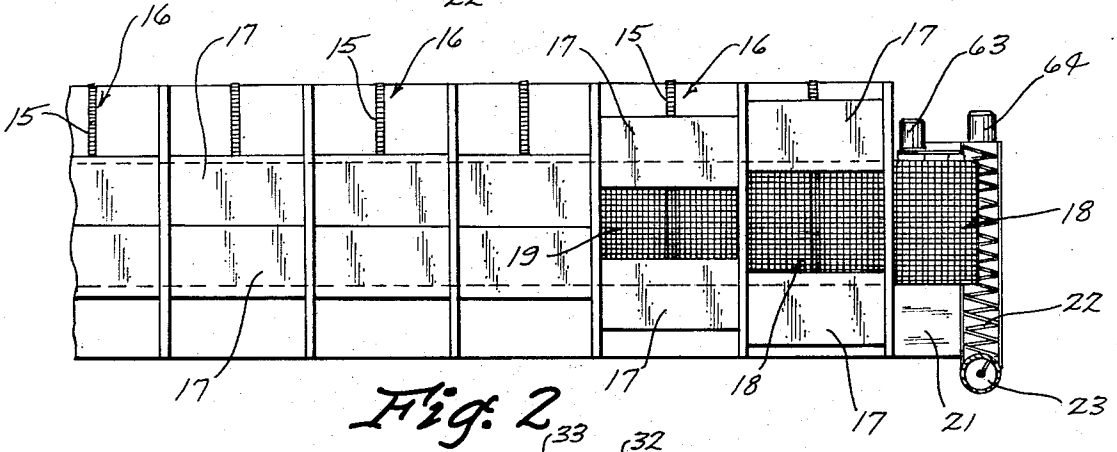


Fig. 2

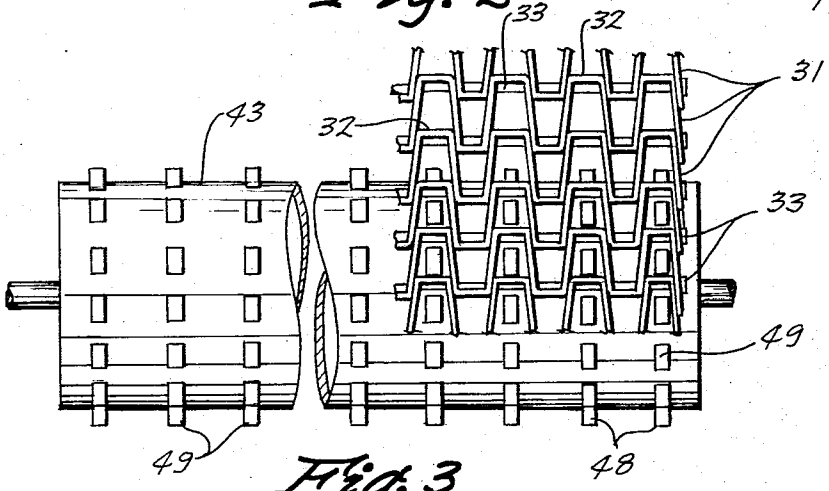


Fig. 3

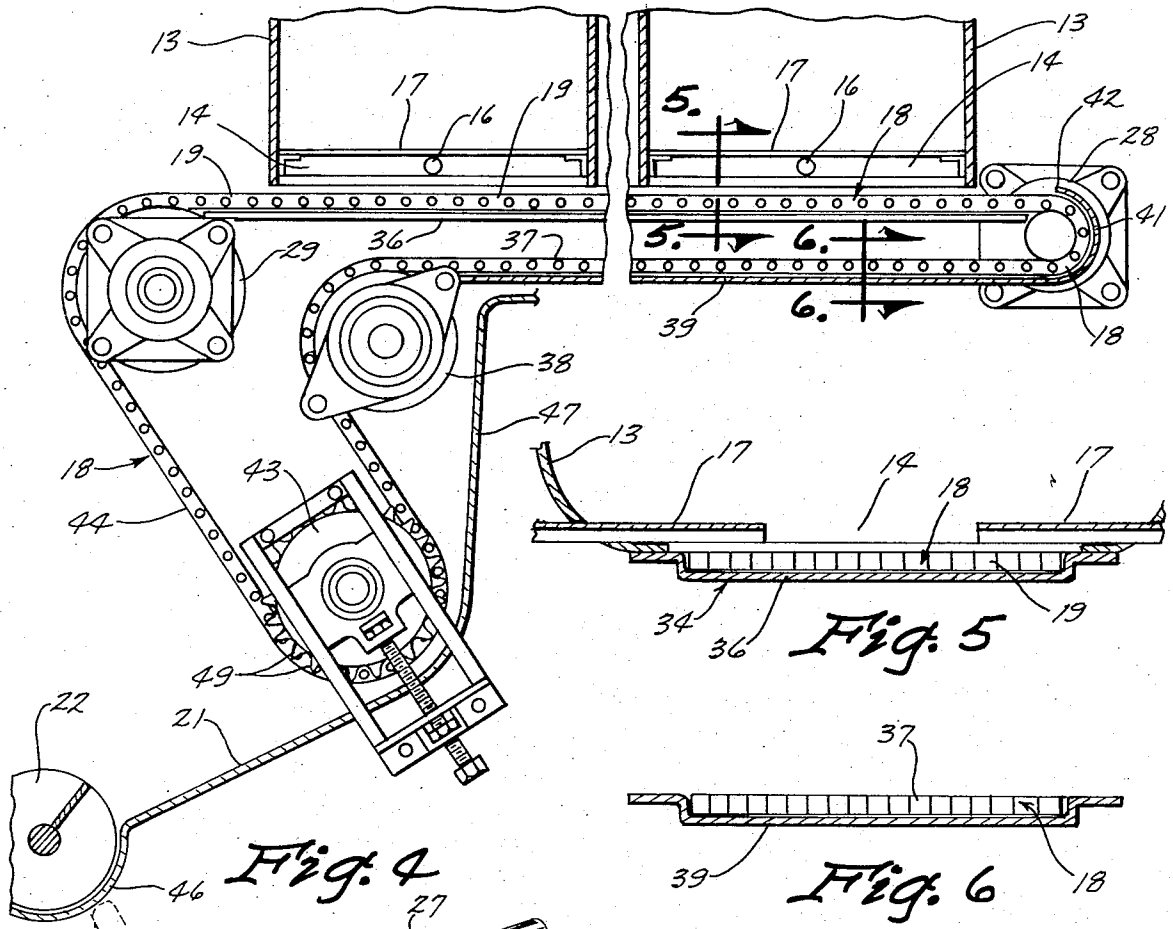


Fig. 4

Fig. 5

Fig. 6

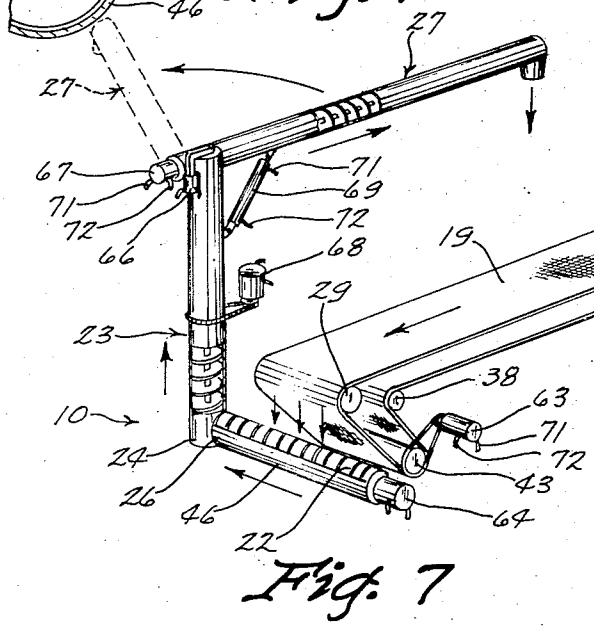


Fig. 7

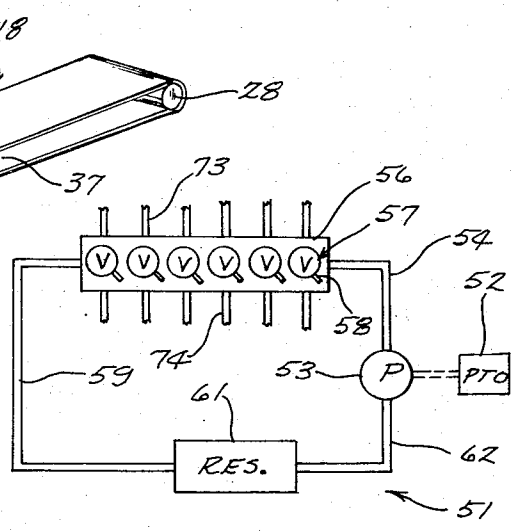


Fig. 8

CONVEYING APPARATUS FOR A MATERIAL HANDLING VEHICLE

SUMMARY OF THE INVENTION

The conveying apparatus is of a simple and compact construction and operable to efficiently convey material selectively supplied from one or more of a plurality of aligned containers to a common discharge hopper. The conveyor of the apparatus travels in a substantially closed path except at the delivery section thereof, so as to substantially eliminate material accumulations adjacent such path. Since the apparatus is thus practically self-cleaning, incompatible materials may be successively and separately conveyed from their respective containers and delivered to the discharge hopper without danger of material contamination.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a rear perspective view of a vehicle having a material handling system which includes the material conveying apparatus of this invention; with parts broken away to more clearly show such apparatus;

FIG. **2** is a sectional view taken substantially on the line **2—2** of FIG. **1**;

FIG. **3** is an enlarged foreshortened perspective view showing the operative association of a drive roller with a mesh type conveyor which form part of the conveying apparatus;

FIG. **4** is an enlarged foreshortened side elevational view of the conveying apparatus shown in assembly relation with the vehicle material containers and vehicle discharge hopper;

FIGS. **5** and **6** are sectional detail views as seen on the lines **5—5** and **6—6,** respectively, of FIG. **4**;

FIG. **7** is a diagrammatic perspective view of the power transmission system for the vehicle material handling system shown in FIG. **1**; and

FIG. **8** is a diagrammatic illustration of the control system for the transmission system of FIG. **7.**

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1** of the drawings, the conveying apparatus of this invention, indicated generally as **10,** forms part of a material handling system for a vehicle **11** which includes a vehicle body **12** of a tank shape divided into a plurality of upright material containers **13** arranged in a row longitudinally of the vehicle. A container **13** has a corresponding bottom discharge opening **14** equipped with an associated closure unit **16** (FIG. **2**) each of which is comprised of a pair of flat horizontally slidable doors **17** that are movable toward and away from each other to closed and opened positions, respectively, relative to a corresponding outlet **14.** The closure units **16** are operable independently of each other, as by adjustable screens **15,** to selectively feed material from the containers discharge openings **14** on to a common endless conveyor **18.** The conveyor has an upper run **19** extended longitudinally of the vehicle **11** at a position below and adjacent to the container discharge openings **14** (FIG. **4**) so as to receive directly thereon material from the containers **13.**

The materials discharged onto the upper run **19** of the conveyor **18** are carried to a common receiving hopper **21** which extends transversely across the rear end of the vehicle **11.** The hopper **21** is of a generally trough shape (FIGS. **2** and **4**) and is provided adjacent the bottom wall thereof with an unloading auger **22** which also extends transversely of the vehicle **11.** An upright auger unit **23** has its lower end **24** in communication with the discharge end **26** of the unloading auger **22.** Material from the unloading auger **22** is moved upwardly through the upright auger **23** for discharge into a swingable auger **27** for unloading of the material from the vehicle into a storage bin or the like (not shown).

The vehicle material handling system may be operated to remove predetermined quantities of selected materials from two or more of the containers **13** into a single bin concurrently with a mixing together of such materials; or to unload material from only a single container **13** into a storage bin. It is not uncommon in this type of material handling system that the containers **13** carry medicated feeds along with livestock and poultry additives and supplements. As a result the materials separately carried in the containers **13** may be relatively incompatible, namely, on being mixed together the resultant product may have injurious feeding effects. It is necessary, therefore, that if material from only one container is to be unloaded that the conveying apparatus **10** be clean of such material before any further material from another container is to be unloaded. It is also to be noted that the accumulation of any material falling from the conveyor belt into inaccessible collection zones along the path of travel of the endless conveyor **18** may result in undesirable odors and possible contamination to new materials being handled by the conveyor apparatus.

These objections are substantially eliminated by the conveying apparatus **10** of this invention which includes the endless conveyor **18** and front and rear supporting rollers **28** and **29** therefor. The conveyor **18** is of an open construction comprised of a plurality of pivoted transversely extended links **31** (FIG. **3**). Each link **31** is formed from a single piece of a strap material into a series of alternately inverted U-shape sections **32** with adjacent ones of the links **31** arranged such that the base of the U-sections **32** of one link are positioned between corresponding adjacent legs of the U-sections **32** of an adjacent link **31.** A pivot pin **33** extended through the apices of the U-sections **32** connects adjacent links **31** together for relative pivotal movement.

The upper run **19** of the conveyor **18** (FIGS. **4** and **5**) extended between the rollers **28** and **29** is operatively associated with a feed pan **34** of a generally trough shape and of a size to slidably receive the conveyor between the side walls thereof in a supported position on the trough bottom wall **36.** The feed pan **34** is substantially co-extensive in length with the upper run **19** of the conveyor **18.** It is to be also noted that the conveyor U-sections **32** form with the bottom wall **36** of the feed pan **34** a plurality of material holding pockets of a height equal to the lateral dimension or thickness of the conveyor **18.**

The lower run **37** of the conveyor **18,** which extends between the axes of the front roller **28** and an idler roller **38** is operatively associated with a return pan **39** (FIG. **6**) in a manner similar to the assembly of the conveyor upper run **19** with the feed pan **34.** The return pan **39** and lower run are substantially equal in length. As shown in FIG. **4,** the return pan **39** is integrally formed at its forward end with an upright section **41** of a semi-circular shape which is arranged in a concentric relation with the front half section of the front roller **28.** The terminal end **42** of the curved upright front section **41** is located substantially in a vertical plane

that extends through the axis of the front roller **28.** As a result, the conveyor **18** is in substantial continuous contact engagement with the feed pan **34** and return pan **39** over the complete length of its upper and lower runs **19** and **37**, respectively, and that portion of the conveyor which is trained about the front rollers **28.**

The idler rollers **38** (FIGS. **4** and **7**) is located forwardly of the rear roller **29** and at a position above a drive roller **43.** That section **44** of the conveyor **18** between the rear ends of the conveyor upper and lower runs thus extends downwardly and forwardly from the rear roller **29,** about the drive roller **43** and then upwardly and rearwardly for travel about the idler roller **38.** In this respect it is to be noted that the drive roller **43** is in a substantially one hundred and eighty degree engagement with the conveyor.

The rollers **29, 38** and **43** are arranged within the discharge hopper **21** which has a bottom section **46** of an arcuate shape that constitutes a partial casing or housing for the transversely extended unloading auger **22.** The lower side of the bottom section **46** (FIG. **1**) is arranged above the lower end of the upright auger **23** so that material is moved by the unloading auger **22** along the bottom section **46** directly into the lower end of the upright auger **23** for lifting into the swingable auger **27.**

The front wall **47** of the discharge hopper **21** (FIG. **4**) projects upwardly and forwardly from the bottom hopper section **46** and about the drive roller **43** for termination at a position forwardly of and adjacent to the idler roller **38.** It is seen, therefore, that any material falling from the conveyor in its travel from the rear roller **29** and about the drive roller **43** to the idler roller **38** drops into the discharge hopper for pickup by the unloading auger **22.**

The drive roller **43** (FIG. **3**) is integrally formed with a plurality of axially spaced circumferentially extended rows **48** of radially projected teeth or projections **49.** The teeth **49,** in a row thereof, are circumferentially spaced a distance apart corresponding to the spacing of the U-sections **32** longitudinally of the conveyor **18** for reception into certain of such sections for meshing engagement with the conveyor. In turn, the tooth rows **48** are axially spaced a distance apart corresponding to the spacing of alternate U-sections **32** transversely of the conveyor **18.** It is seen, therefore, that as the conveyor travels about the drive roller **43** certain of the U-sections **32** are entered by the teeth **49** to completely remove any material therefrom. The drive roller thus functions both to drive the conveyor **18** by the section of the tooth rows **48** as sprocket gears relative to the U-sections **32** and to empty the major portion of the U-sections **32** by the material punch out action of the teeth **49** relative to such sections.

In the operation of the conveying apparatus **10,** containers may be emptied separately for separate delivery of material therefrom into separate bins for storage purposes. Assuming that a single container **13** has the outlet **14** thereof open to the conveyor **18,** the conveyor operates to move the material from the single container into the discharge hopper **21.** As the conveyor travels over the rear roller **29** the material is dislodged therefrom by the relative pivotal movement of the relative pivotal movement of the conveyor links **31** and the action of gravity thereon resulting from the downward and forward inclination of the conveyor between the rollers **29** and **43.** This falling of material from the conveyor **18** is complemented by the clearing action of the teeth **49** relative to certain of the U-sections **32.** By virtue of the rollers **29, 38** and **43** being contained within the discharge hopper **21** all of the material thus falling from the conveyor **18** drops into the hopper for pickup by the unloading auger **22.**

Should any material continue with the conveyor for travel about the idler roller **38,** such material is moved along the return pan **39** and then along the feed pan **34** for return to the rear roller **29.** During this travel with the conveyor some of the material adhering thereto is shaken loose so that on passing over the rear roller **29** such loosened material drops into the discharge hopper **21.** Operation of the conveying apparatus is continued until the conveyor and the discharge hopper **21** are clear of the material to be unloaded. In this connection, it is to be understood that concurrently with the operation of the conveyor **18,** the unloading auger **22** and augers **23** and **27** are also in operation. When the conveying apparatus **10** is clear of a first material that has been unloaded for separate delivery to a storage bin, a second and succeeding containers may be separately emptied of the material therefrom onto the conveyor **18.** For each material to be separately delivered, the above operation is repeated.

Importantly, when the conveyor **18** is clear of a material it is known that the conveyor apparatus **10** is also clean of such material by virtue of the travel of the conveyor in a substantially closed passageway in operative association with the feed pan **34** and return pan **39.** As previously mentioned, this operative association is maintained over that length of the conveyor which is not within the discharge hopper **21.** Since the clearance relation of the conveyor **18** with the pans **34** and **39** is less than about one-quarter of an inch, the path of conveyor travel is substantially void of any material collecting zones or pockets. Material spoilage in inaccessible collecting zones and contamination resulting therefrom or from the mixing of incompatible materials is thus eliminated.

When material from the containers **13** are to be mixed together for use in a mixed form, such mixing can be done concurrently with the unloading of the materials from the vehicle **11.** In this instance the closures **16** of the selected containers **13** are actuated to relatively predetermined positions by adjustment of their corresponding adjustment screws **15.** This adjustment is determined by the relative amounts of the various materials that are to be mixed together. On completion of such adjustment, the conveyor apparatus **10** is operated in all respects similar to its operation for the unloading of material from a single container **13.** The materials discharged into the hopper **21** are acted upon and mixed by the unloading auger **22** and, in turn, by the upright auger and swingable auger **23** and **27,** respectively, prior to the delivery of the materials in a mixed condition into a storage bin. Operation is continued until the conveying apparatus **10** and auger **22** are clean of the materials to be unloaded.

As shown in FIGS. **7** and **8,** the conveying apparatus **10** is hydraulically operated. Oil under pressure is supplied from a pump and reservoir unit **51** driven from the vehicle engine (not shown) through a power take-off device **52.** The pump **53** of the unit **51** has the outlet **54** thereof connected to the oil supply manifold **56** of a suitable valve unit **57** provided with control handles **58** corresponding in number to the motor units to be controlled. The valve unit **57** also includes an oil ex-

haust manifold **59** connected to the reservoir **61** of the unit **51.** The inlet of the pump and outlet of the reservoir are connected by a fluid line **62.**

The drive roller **43,** and unloading auger **22** are driven by hydraulic motors **63** and **64,** respectively; and the augers **23** and **27** by hydraulic motors **66** and **67,** respectively. Rotation of the upright auger **23** to swing the auger **27** is provided by the hydraulic motor **68,** and pivotal up and down movement of the swingable auger **27** is provided by the cylinder assembly **69.** Each of the hydraulic motors has a pair of fluid connections **71** and **72** for assembly with corresponding connections **73** and **74** on the control valve unit **57.**

Although the invention has been described with respect to a preferred embodiment thereof it is to be understood that it is not to be so limited since changes and modifications can be made therein which are within the full intended scope of this invention as defined by the appended claims.

I claim:

1. In a material handling system for a vehicle including a body unit having a longitudinal row of upright material containers having corresponding selectively operable bottom discharge outlets and a common discharge hopper for receiving material from said discharge outlets, a conveying apparatus for delivering material from said discharge outlets to said common discharge hopper comprising:

a. a longitudinally extended endless conveyor of a mesh construction having an upper run movable below and adjacent said outlets,

b. front and rear longitudinally spaced rollers for said endless conveyor, said upper run extended between said two rollers,

c. a drive roller for said endless conveyor located in said discharge hopper at a position downwardly and forwardly of said rear roller,

d. an idler roller located forwardly of said rear roller,

e. said endless conveyor having a portion which from said rear roller is trained about the lower portion of said drive roller and the upper portion of said idler roller and a lower run extended from said idler roller to said front roller in a parallel relation with the upper run thereof,

f. a feed pan corresponding to said upper length extended substantially between said front and rear rollers having an upper surface in contact engagement with the bottom surface of said upper length, and

g. a return pan corresponding to the lower run of said endless conveyor having an upper surface in contact engagement with the bottom surface of said lower run, said return pan having an upright curved front section arranged in a concentric relation with the front half section of said front roller.

2. In a material handling system according to claim **1,** wherein:

a. the section of said conveyor between the rear roller and the drive roller, and the section thereof between the idler roller and the drive roller are in a substantially parallel relation.

3. In a material handling system according to claim **1** wherein:

a. said endless conveyor has longitudinally extended rows of interstices, and

b. said drive roller has a plurality of radially projected teeth on the outer peripheral surface thereof for reception within the interstices of certain ones of said rows of interstices.

4. In a material handling system according to claim **3** wherein:

a. said certain ones of interstices include alternate interstices arranged transversely of the conveyor.

5. In a material handling system according to claim **1** wherein:

a. the terminal end of the upright curved front section of said return pan lies in a vertical plane located adjacent a vertical plane extended through the axis of said front roller.

6. In a material handling system according to claim **1** wherein:

a. said rear roller, drive roller and idler roller are positioned within said discharge hopper.

7. In a material handling system according to claim **1** wherein:

a. each of said pans is of a trough shape having side walls and said conveyor is of a width to be received within a pan between and in contact engagement with the side walls thereof.

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