



Michael D. Marston
mmarston@bhlawyers.net

October 25, 2013

Lisa N. Phillips, Esq.
ROTHWELL, FIGG, ERNST & MANBECK, P.C.
607 14TH Street, N.W., Suite 800
Washington, DC 20005

Re: *Unverferth Mfg. Co., Inc. v. Par-Kan Co.*
Case No. 13-cv-0097 (TLS) (N.D. Ind.)

Dear Ms. Phillips:

In accordance with Local Patent Rule 5-1(b), Par-Kan submits its Final Invalidity Contentions. Par-Kan Company ("Par-Kan") reserves the right to supplement this document production.

LIST OF EXHIBITS CITED:

1. Furrer U.S. Pat. No. 7,500,817 – prior art under 35 U.S.C. 102(e)
2. Baskerville U.S. Pat. No. 5,888,044 – prior art under 35 U.S.C. 102(a), (b)
3. ADC2220 (Great Plains 1997 Manual) – prior art under 35 U.S.C. 102(a), (b)
4. Convey-All – prior art under 35 U.S.C. 102(a), (b)
5. Declaration of Michael D. Marston
6. Declaration of Erick Flinn
7. Meyer U.S. Pat. No. 7,500,814 – prior art under 35 U.S.C. 102(e)

DEFINITIONS:

Claim terms are defined as below from agreement already reached between the parties.

Claim Term or Phrase	Agreed Claim Construction
"a frame"	a structure supporting the base and the main hopper
"a support arm"	a member that supports the conveyor

Unverferth Exhibit 2026
Par-Kan v. Unverferth
IPR2024-01426

UM-PK0000688

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Claim Term or Phrase	Agreed Claim Construction
“an unloading position wherein said conveyor hopper is disposed below said main hopper discharge to receive agricultural product from said main hopper”	an unloading position wherein the conveyor hopper is disposed lower than the main hopper discharge to receive agricultural product from the main hopper discharge
“a base”	a support for the first coupling and the support arm
“below said main hopper discharge”	lower than the main hopper discharge
“a first horizontal axis of rotation”	a first horizontal axis of rotation about which the first end of the support arm can rotate in relation to the first coupling

Claim term “a first coupling” remains in dispute and a ruling on the definition has not occurred.

Claim Term or Phrase	Unverferth’s Proposed Claim Constructions	Par-Kan’s Proposed Claim Constructions
“a first coupling”	a first connecting device Intrinsic Support: 2:63-3:20; 3:38-65; 4:40-57; Figs. 1, 4, 5 and 10; Claims 1, 15, 20 and 31.	a first connecting device providing a vertical pivot axis Intrinsic Support: 3:38-63; Fig. 4; Claim 1.

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INVALIDITY GROUNDS

Par-Kan asserts the following invalidity grounds:

1. ADC2220 in view of Baskerville and Furrer renders obvious Claims 1, 2, 5-14, 16, 19, 24 under 35 U.S.C. 103.
2. ADC2220 in view of Baskerville and Furrer and Convey-All renders obvious Claims 3, 4, 15, 20-23, 25-31, 34 under 35 U.S.C. 103.
3. All Claims of the '047 patent are invalid under 35 U.S.C. 112 as indefinite.

The claims chart below includes annotations that match the exhibits and describe the elements of the claims that appear to their immediate left box in the claim chart. References including a letter (such as F1, B1, A2, etc. refer to elements identified by Par-Kan in the corresponding Exhibit. For instance, F1 – refers to the frame in the Baskerville reference. For instance, other references refer to the numbering posted in the given reference. No. 23, 25 in Fig. 7 of Furrer refer to the numbers included in the patent drawing shown as Fig. 7 that indicate the frame. It should also be noted that in the ADC2220 reference, there are duplicate pages having the same number. For instance, Page 7-1 includes a first Page 7-1 that shows the exploded parts drawing, and the second Page 7-1 names the parts in the first Page 7-1 according to their corresponding label numbers.

<u>U.S. Patent 8,221,047</u>	Reference Column : Line
Claim 1. A seed or grain tender comprising:	Furrer – Abstract; Claim 1 Baskerville - Abstract

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a frame;	Baskerville – F1 Figs. 1-5 Furrer – No. 23, 25 Fig. 7 ADC2220 – F2 Page 0, 2-7, 4-1
a main hopper mounted on said frame	Baskerville – No. 11 Fig. 1, 5 ADC2220 – B1 Page 2-5, 2-7 Furrer – No. 13 Fig. 1A; 4:14-21; 4:54-65
and having a main hopper discharge;	Furrer – No. 50 Fig. 1A; 5:20-6:2 ADC2220 – D1, Page 2-5 Baskerville – No. 25 FIG. 8, 9; 4:3-5
a base	ADC2220 – B1 Page 0, 7-1 Baskerville – B2 Figs. 1, 3, 4, 5, 9 Furrer – No. 28 Figs. 3, 7; Abstract; 4:26-28
mounted on said frame below said main hopper discharge;	Furrer – No. 28 Fig. 7; 6:21-25
a support arm	ADC2220 – A1 Page 7-1 Furrer – A2 Figs. 1A, 2, 5, 7 Baskerville – No. 53 Figs. 1-5
having first [end]	ADC2220 – E1 Page 7-1 Furrer – E3 Figs. 5, 7 Baskerville – E5 Figs. 4, 5
and second ends;	ADC2220 – E2 Page 7-1 Furrer – E4 Figs. 5, 7 Baskerville – E6 Figs 4, 5
a first coupling connecting said first end of said support arm with said base,	Furrer – E3 Figs. 5, 7; 6:26-33 Baskerville – E5 Figs 4, 5 ADC2220 – E1 Page 7-1
said first coupling being rotatable in relation to said base about a first vertical axis of rotation,	Baskerville – AX1 Figs. 1-3; 4:53-56 ADC2220 – AX2 Page 7-1 Furrer – AX3 Figs. 1A, 2, 7; 2:26-27; 4:45-48; 4:26-29
and said first end of said support arm being rotatable in relation to said first coupling about a first horizontal axis of rotation;	Baskerville – Figs 4, 5; 4:53-63 Furrer – Figs 1A, 2, 7; 2:26-27; 4:45-48; 4:26-29 ADC2220 – Page 7-1
a conveyor having a longitudinal axis and first and second ends,	Baskerville – AX4 Figs. 1-5; Abstract Furrer – AX5 Figs 1, 1A, 2, 3, 7; 1:64 ADC2220 – Pages 0, 7-1, 8-1
a conveyor hopper at said first end,	ADC2220 – H1 Pages 7-1, 8-1 Furrer – No. 34 Fig. 2, 3, 4; 6:65-66 Baskerville – No. 34 Fig. 4; No. 73 Fig. 5; 4:17-25
a conveyor discharge at said second end	ADC2220 – H2 Pages 7-1, 8-1 Baskerville – No. 66 Figs. 1, 2; 4:67; 5:1 Furrer – No. 36 Fig. 3; 6:65-67

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and an internal elevator for moving seed or grain from said conveyor hopper to said conveyor discharge; and	Baskerville – Nos. 55, 56 Figs. 6, 8; 4:44-52 Furrer – 2:51-53; 2:60-61; 4:29-38; 6:65-67 ADC2220 – No. 8, 16, 28, 29, 41, 43 on Page 7-1 all refer to auger; No. 2 Page 7-2 “Auger Head Stub”
a second coupling connecting said second end of said support arm with said conveyor at an approximate center of gravity of said conveyor,	ADC2220 – No. 18 Page 7-1 “Auger Swivel Support” Baskerville – No. 42 Figs. 4, 5, 7, 8; 4:26-43; 4:43
said second coupling defining a second vertical axis of rotation that is not parallel to said conveyor longitudinal axis	ADC2220 – AX7 Page 7-1
and said conveyor being rotatable in relation to said second end of said support arm about said second vertical axis of rotation	ADC2220 – AX7 Page 7-1
between an unloading position wherein said conveyor hopper is disposed below said main hopper discharge to receive agricultural product from said main hopper and a loading position wherein said conveyor discharge is disposed above said main hopper to dispense agricultural product into said main hopper.	ADC2220 – Page 14 Baskerville – Figs. 4, 5; 2:27-43; 5:16-23; Abstract
Claim 2. The seed or grain tender of claim 1, wherein said support arm extends upwardly at an acute angle from said base.	Baskerville - Figs. 1, 3, 5 Convey-All – Fig. 1
Claim 3. The seed or grain tender of claim 2, wherein said conveyor is parallel to said support arm in said unloading position.	Convey-All - AX 16 Pages 1,4-6
Claim 4. The seed or grain tender of claim 3, wherein said conveyor is disposed above said support arm in said unloading position.	Convey-All – CV1 (conveyor) is above Arm A4 in CT1 (conveyor tube) on Page 5
Claim 5. The seed or grain tender of claim 1, wherein said conveyor is rotatable in relation to said second coupling about a second horizontal axis of rotation.	ADC2220 – Bolt No. 25 Page 7-1 forms a second horizontal axis of rotation.
Claim 6. The seed or grain tender of claim 5, wherein said second horizontal axis of rotation extends through said second coupling.	ADC2220 – Bolt No. 25 Page 7-1 extends through coupler part 18 (“Auger Swivel Support”)
Claim 7. The seed or grain tender of claim 1, further comprising a stand coupled with said first end of said conveyor and movable between a stowed position allowing said	ADC2220 – shows a stand on the conveyor hopper at Page 7-1 that is stowed and touches a ground surface when loading.

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conveyor hopper to be positioned below said main hopper discharge when said conveyor is in said unloading position and an extended position supporting said conveyor hopper above the ground when said conveyor is in said loading position.	
Claim 8. The seed or grain tender of claim 1, wherein said first vertical axis extends through said first end of said support arm.	ADC2220 –Page 7-1 coupler part 18 (“Auger Swivel Support”) extends through end of support arm.
Claim 9. The seed or grain tender of claim 1, wherein said first vertical axis extends through said base.	Furrer – AX 3 extends through the base in Figs. 1A, 2 Baskerville – AX1 extends through base B2 in Figs. 1, 2
Claim 10. The seed or grain tender of claim 1, wherein said second end of said support arm terminates at or near said approximate center of gravity of said conveyor.	Baskerville – Figs. 1-5, 9 ADC2220 – Page 7-1
Claim 11. The seed or grain tender of claim 1, wherein said first end of said support arm is fixed at a first height and said second end of said support arm is pivotable between a range of heights.	Furrer – 6:26-35 Baskerville – Figs. 4, 5
Claim 12. The seed or grain tender of claim 1, further comprising a lift device for adjusting a height of said second end of said support arm.	Furrer – 6:26-35 Baskerville – Figs. 4, 5; 5:5-24
Claim 13. The seed or grain tender of claim 12, wherein said lift device is a pressurized cylinder.	Furrer – 6:26-35 Baskerville – Figs. 4, 5; 5:5-24
Claim 14. The seed or grain tender of claim 12, wherein said lift device is a hydraulic cylinder.	Furrer – 6:26-35; A2 Fig. 1A Baskerville – Figs. 4, 5; 5:5-24
Claim 15. The seed or grain tender of claim 1, wherein said first coupling is a U-shaped member with a horizontal base portion and a pair of upright portions, and wherein said first horizontal axis extends through said upright portions of said first coupling.	Convey-All – Page 2 shows U1, U2 mating with coupler C1.
Claim 16. The seed or grain tender of claim 1, further comprising a locking mechanism for locking or unlocking said support arm in relation to said base.	ADC2220 – Page 7-1 shows L1 to lock the auger therefore the arm A1 Convey-All – Page 4 shows spring pin P1 to lock into holes H
Claim 19. The seed or grain tender of claim 17, wherein said internal elevator includes a	Baskerville – Nos. 55, 56 Figs. 6, 8; 4:44-52

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motor-driven belt.	
Claim 20. A seed or grain tender comprising:	Furrer – Abstract; Claim 1 Baskerville - Abstract
a frame;	Baskerville – F1 Figs. 1-5 Furrer – No. 23, 25 Fig. 7 ADC2220 – F2 Page 0, 2-7, 4-1
a main hopper mounted on said frame	Baskerville – No. 11 Fig. 1, 5 ADC2220 – B1 Page 2-5, 2-7 Furrer – No. 13 Fig. 1A; 4:14-21; 4:54-65
and having a main hopper discharge	Furrer - No. 50 Fig. 1A; 5:20-6:2 ADC2220 – D1, Page 2-5 Baskerville – No. 25 FIG. 8, 9; 4:3-5
a base	ADC2220 – B1 Page 0, 7-1 Baskerville – B2 Figs. 1, 3, 4, 5, 9 Furrer – No. 28 Figs. 3, 7; Abstract; 4:26-28 Convey-All – B4 Pages 2-4
mounted on said frame below said main hopper discharge	Furrer – No. 28 Fig. 7; 6:21-25 Convey-All – B4 Pages 2, 3, 4
a support arm	ADC2220 – A1 Page 7-1 Furrer – A2 Figs. 1A, 2, 5, 7 Baskerville – No. 53 Figs. 1-5 Convey-All – A4 Pages 1, 3, 4-6
having first [end]	ADC2220 – E1 Page 7-1 Furrer – E3 Figs. 5, 7 Baskerville – E5 Figs. 4, 5 Convey-All – E8 Pages 5, 6
and second ends	ADC2220 – E2 Page 7-1 Furrer – E4 Figs. 5, 7 Baskerville – E6 Figs 4, 5
a first coupling connecting said first end of said support arm with said base,	Furrer – E3 Figs. 5, 7; 6:26-33 Baskerville – E5 Figs 4, 5 ADC2220 – E1 Page 7-1 Convey-All – C1
said first coupling being rotatable in relation to said base about a first vertical axis of rotation,	Baskerville – AX1 Figs. 1-3; 4:53-56 ADC2220 – AX2 Page 7-1 Furrer – AX3 Figs. 1A, 2, 7; 2:26-27; 4:45-48;

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	4:26-29 Convey-All – AX14 Pages 1-4
and said first end of said support arm being rotatable in relation to said first coupling about a first horizontal axis of rotation;	Baskerville – Figs 4, 5; 4:53-63 Furrer – Figs 1A, 2, 7; 2:26-27; 4:45-48; 4:26-29 ADC2220 – Page 7-1 Convey-All – AX15 Pages 2, 3
a lift device extending from said base to a portion of said support arm between said first and second ends such that said support arm extends upwardly at an acute angle from said base;	Baskerville – No. 64 Fig. 4, 5; Abstract – mentions lifting cylinder Furrer – 6:26-35; A2 Fig. 2
a conveyor having a longitudinal axis and first and second ends,	Convey-All – AX16 Pages 1, 4, 6 Baskerville – AX4 Figs. 1-5; Abstract Furrer – AX5 Figs 1, 1A, 2, 3, 7; 1:64 ADC2220 – Pages 0, 7-1, 8-1
a conveyor hopper at said first end,	ADC2220 – H1 Pages 7-1, 8-1 Convey-All – H4 Pages 1, 5, 6 Furrer – No. 34 Fig. 2, 3, 4; 6:65-66 Baskerville – No. 34 Fig. 4; No. 73 Fig. 5; 4:17-25
a conveyor discharge at said second end, and	ADC2220 – H2 Pages 7-1, 8-1 Baskerville – No. 66 Figs. 1, 2; 4:67; 5:1 Furrer – No. 36 Fig. 3; 6:65-67
a motor-driven elevator for moving seed or grain from said conveyor hopper to said conveyor discharge; and	Baskerville – Nos. 55, 56 Figs. 6, 8; 4:44-52 Furrer – 2:51-53; 2:60-61; 4:29-38; 6:65-67 ADC2220 – No. 8, 16, 28, 29, 41, 43 on Page 7-1 all refer to auger; No. 2 Page 7-2 “Auger Head Stub”
a second coupling connecting said second end of said support arm with said conveyor at an approximate center of gravity of said conveyor,	ADC2220 – No. 18 Page 7-1 “Auger Swivel Support” Baskerville – No. 42 Figs. 4, 5, 7, 8; 4:26-43; 4:43
said second coupling defining a second vertical axis of rotation that is not parallel to said conveyor longitudinal axis,	ADC2220 – AX7 Page 7-1
and said conveyor being rotatable in relation to	ADC2220 – AX7 Page 7-1

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said second end of said support arm about said second vertical axis of rotation	
between an unloading position wherein said conveyor hopper is disposed below said main hopper discharge to receive agricultural product from said main hopper and a loading position wherein said conveyor discharge is disposed above said main hopper to dispense agricultural product into said main hopper,	ADC2220 – Page 14 Baskerville – Figs. 4, 5; 2:27-43; 5:16-23; Abstract
wherein said conveyor is disposed parallel to and above said support arm in said unloading position; and	Convey-All – CV1 (conveyor) is above Arm A4 in CT1 (conveyor tube) on Page 5 and parallel to arm A4
a locking mechanism for locking and unlocking said support arm in relation to said base.	ADC2220 – Page 7-1 shows L1 to lock the auger therefore the arm A1 Convey-All – Page 4 shows spring pin P1 to lock into holes H
Claim 21. The seed or grain tender of claim 20, wherein said conveyor is disposed above said support arm in said unloading position.	Convey-All – CV1 (conveyor) is above Arm A4 in CT1 (conveyor tube) on Page 5
Claim 22. The seed or grain tender of claim 20, wherein said conveyor is rotatable in relation to said second coupling about a second horizontal axis of rotation.	ADC2220 – Bolt No. 25 Page 7-1 forms a second horizontal axis of rotation.
Claim 23. The seed or grain tender of claim 22, wherein said second horizontal axis of rotation extends through said second coupling.	ADC2220 – Bolt No. 25 Page 7-1 extends through coupler part 18 (“Auger Swivel Support”)
Claim 24. The seed or grain tender of claim 20, further comprising a stand coupled with said first end of said conveyor and movable between a stowed position allowing said conveyor hopper to be positioned below said main hopper discharge when said conveyor is in said unloading position and an extended position supporting said conveyor hopper above the ground when said conveyor is in said loading position.	ADC2220 – shows a stand on the conveyor hopper at Page 7-1 that is stowed and touches a ground surface when loading.
Claim 25. The seed or grain tender of claim 20, wherein said first vertical axis extends through said first end of said support arm.	ADC2220 –Page 7-1 coupler part 18 (“Auger Swivel Support”) extends through end of support arm.
Claim 26. The seed or grain tender of claim	Furrer – AX 3 extends through the base in Figs.

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20, wherein said first vertical axis extends through said base.	1A, 2 Baskerville – AX1 extends through base B2 in Figs. 1, 2
Claim 27. The seed or grain tender of claim 20, wherein said second end of said support arm terminates at or near said approximate center of gravity of said conveyor	Baskerville – Figs. 1-5, 9 ADC2220 – Page 7-1
Claim 28. The seed or grain tender of claim 20, wherein said first end of said support arm is fixed at a first height and said second end of said support arm is pivotable between a range of heights.	Furrer – 6:26-35 Baskerville – Figs. 4, 5
Claim 29. The seed or grain tender of claim 20, wherein said lift device is a pressurized cylinder.	Furrer – 6:26-35 Baskerville – Figs. 4, 5; 5:5-24
Claim 30. The seed or grain tender of claim 20, wherein said lift device is a hydraulic cylinder.	Furrer – 6:26-35; A2 Fig. 1A Baskerville – Figs. 4, 5; 5:5-24
Claim 31. The seed or grain tender of claim 20, wherein said first coupling is a U-shaped member with a horizontal base portion and a pair of upright portions, and wherein said first horizontal axis extends through said upright portions of said first coupling.	Convey-All – Page 2 shows U1, U2 mating with coupler C1.
Claim 34. The seed or grain tender of claim 20, wherein said internal elevator includes a motor-driven belt.	Baskerville – Nos. 55, 56 Figs. 6, 8; 4:44-52

FOUNDATION FOR PRIOR ART

Convey-All shows a 2005 seed tender that was inspected and photographed by Erick Flinn of Par-Kan. In Paragraph 21 of his declaration Mr. Flinn refers to Appendix F, which was an appendix to a previously filed re-exam and contained photographs of the 2005 seed tender. Exhibit 4 of this page contains photographs of the same 2005 seed tender. The date of manufacture of this unit was verified by Mr. Flinn upon contacting the Convey-All Industries, Inc., the maker of the seed tender shown in Exhibit 4 of this paper. His declaration (Exhibit 6) confirms this.

ADC2220 is a 1997 seed tender that is shown in the manual that is the major portion of Exhibit 3. The date is listed in the footer of the pages of the manual itself. In addition to this evidence that Great Plains Manufacturing made such a seed tender in 1997, a listing of a 1997 ACD2220 seed tender was posted on the internet on www.tractorhouse.com. This listing is on

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pages 16 and 17 of Exhibit 3. The listing shows a picture of the same type of unit described in the 1997 ACD2220 manual. The Marston declaration which is Exhibit 5, states that the unit was verified by the manufacturer to have been made on June 18, 1997 and placed with a dealer that same year in Delaware.

The remaining prior art references are publicly available as issued patents having priority dates prior to the filing of the Unverferth patent.

MOTIVATION TO COMBINE REFERENCES

A common problem exists in the seed tender art. It is useful to have a self-loading seed tender in the field that can deliver seed or grain to a planting device. The prior art solves this problem and the '047 patent solves the same problem in a nearly identical way to the prior art using a combination of known parts.

One of ordinary skill in the art would be motivated to combine the aforementioned references cited in the claim chart. A showing of obviousness requires a motivation to combine prior art. The *KSR*¹ decision has yielded a list of rationales for a conclusion of obviousness:

- (A) Combining prior art elements according to known methods to yield predictable results
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of known technique to improve similar devices (methods, or products) in the same way;
- (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- (E) "Obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

Regarding the first Rationale (A), all of the prior art references in the claim chart could be predictably combined to arrive at the present invention. The lifting cylinder in Baskerville is mentioned for the purpose of raising and lowering the conveyor. Figs. 4 and 5 of Baskerville

¹ *KSR International Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 82 USPQ2d 1385 (2007).

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show how this works. Baskerville shows how using lifting cylinders supporting arm 53 provides the ability to load and unload the conveyor. The Abstract of Baskerville discusses that this is the purpose of the invention. The Myer reference (Exhibit 7) shows a self-load and unload conveyor. The abstract of Meyer discusses using hydraulic cylinders to position the conveyor. Fig. 4 of Meyer shows hydraulic cylinders 50, 51 that are used on coupling 42 to position the conveyor 34 vertically as well as horizontally about the vertical axis that extends through pin 52. Meyer describes at 3:59-3:13 a coupling that functions like the second coupling of the '047 patent. It provides vertical and horizontal pivoting. Furrer shows the conveyor hopper being below the discharge as is common in seed tenders due to the reliance on gravity to feed the conveyor hopper. Furrer also shows the base below the main hopper discharge and having a vertical pivot axis on the base. The prior art could be predictably combined to get the same result as the '047 patent; the '47 patent is not innovative, but instead is merely a predictable combination of known parts.

Rationale (B) discusses simple substitution of elements and simple substitutions can be made in the prior art to arrive at the '047 patent. Placing the base of Baskerville below the main hopper discharge essentially yields the '047 patent. Furrer teaches putting the vertically pivotal base below the main hopper discharge. One skilled in the art would be motivated to do this so that gravity would feed the conveyor hopper. Baskerville teaches a 180 degree pivotal conveyor as shown in Figs. 4 and 5. Simple substitution of the base location would be expected of someone having reasonable skill in the seed tender art.

Rationale (C) is shown in the prior art because of the inherent similarity of the devices. All of the prior art references are some type of seed tender. Improvements on Baskerville or Furrer using the teachings of them both would have yielded the device in the '047 patent. The references in combination with Baskerville and Furrer illustrate small nuances in addition to Furrer and Baskerville that illustrate the knowledge of those having ordinary skill in the art. The combination of the prior art is used in the same way as the device of the '04 patent.

In the case of Rationale (D), the techniques before the '047 patent were all known and the prior art devices were combined to improve an existing device into that of the '047 patent. One having ordinary skill in the art would have known about Baskerville and seen that it would be reasonable to have an arm that swings out like that of Baskerville so that a hopper being gravity fed could be moved outward from the main hopper to fill the main hopper.

Rational (E) is shown because throughout the prior art there are multiple variations on devices achieving the desirable task of having a seed tender that will load and unload itself. The main ways to accomplish the self-load and unload are to either use a swing arm, or to have a conveyor hopper that moves from beneath a gravity fed outlet. The '047 patent presents no variation that is not shown elsewhere in the prior art and one skilled in the art would have known

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about the prior art elements that were used to accomplish the task of providing a self-load and unload seed tender.

Rationale (F) is mentioned in the '047 patent application file history where the applicant mistakenly took credit for making the market based on novel features of the invention. In the seed distribution market there was a change in the way seed was distributed near the time the device of the '047 patent was first sold. That change was to sell seed in bulk containers rather than in bags or boxes as had been standard previously. As such if a single large container is delivered to a farmer he needs the convenience of being able to load a planter and unload the planter as is mentioned in the Meyer reference 2:46-47. The market incentives drove having large containers like that of Baskerville and ADC2220. Therefore it was reasonable for one of ordinary skill in the seed tender art to look for ways to process grain from containers by making obvious modifications to existing products which perform similar functions.

Rationale (G) requires that there be teaching or motivation to combine in the prior art. The motivation is as mentioned above, convenience in loading large seed containers. The prior art references speak of the desirability of having a self-load and unload seed tender. This is mentioned above in the Meyer reference and is discussed in the Baskerville abstract. ADC2220 mentions this at Pages 14, 15 and says the conveyor is balanced for easy handling. It is certainly reasonable as in the ADC2220 a reasonably skilled artisan would put the horizontal pivot for the conveyor near the center of gravity. As explained in the previous Rationales, the '047 patent is simply an obvious reorganization of known parts of implements which address the same problem, therefore there is substantial motivation to combine.

35 U.S.C. 112 INDEFINITENESS

Each of the independent Claims 1 and 20 include the limitation of the "support arm being rotatable in relation to said first coupling about a first horizontal axis." The specification makes no mention of the word "horizontal" or any synonym or analog. Nowhere in the drawings is this axis labeled, nor is any part which could form this axis labeled. There is no support in the written description for this claimed element, therefore the claims fail to meet both the written description and enablement requirements of 35 U.S.C. 112. Par-Kan has attempted to obtain documents in discovery to shed light on discussions Unverferth had with the patent examiner. The publicly available file history indicates that Unverferth submitted proposed amendments that are not in the file history. The examiner's interview summary near the end of prosecution indicates this is the case. Unverferth has resisted producing these submissions to the examiner that would not be disclosed in the publicly available file history. It is believed that these documents will shed light on how the limitation "horizontal axis" was argued before the

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examiner as a reason for allowance. In light of the fact that depositions have not been taken on this point at this time, Par-Kan is without information on this point. All of the dependent claims depend from Claims 1 and 20. Due to the fact that independent Claims 1 and 20 are invalid under 35 U.S.C. 112 for failing to contain a written description of the invention and enablement as it relates to the horizontal axis, the remaining claims are invalid as well.



Michael D. Marston
Botkin & Hall, LLP
105 E. Jefferson Blvd., Suite 400
South Bend, IN 46601
Telephone: (574) 234-3900
E-mail: mmarston@bhlawyers.net
Attorney for Defendant.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on October 25, 2013, a copy of the foregoing document was served by electronic mail upon:

Robert J. Palmer
May Oberfell Lorber
4100 Edison Lakes Parkway Suite 100
Mishawaka, IN 46545

Lisa N. Phillips
Rothwell Egg Ernst & Manbeck PC
607 14th Street NW, Suite 800
Washington, DC 20005

Joseph A. Hynds
Rothwell Figg Ernst & Manbeck PC
607 14th Street NW, Suite 800
Washington, DC 20005



Michael D. Marston

EXHIBIT 1



US007500817B2

(12) **United States Patent**
Furrer et al.

(10) **Patent No.:** **US 7,500,817 B2**
(45) **Date of Patent:** **Mar. 10, 2009**

(54) **AGRICULTURAL SEED TENDER WITH
MODULAR STORAGE CONTAINERS**

(75) Inventors: **G. Jason Furrer**, N. Remington, IN (US); **Todd W. Kaeb**, Loda, IL (US); **Steven R. Walder**, Hoopston, IL (US)

(73) Assignee: **KSI Conveyors, Inc.**, Cissna Park, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 305 days.

(21) Appl. No.: **11/348,659**

(22) Filed: **Feb. 7, 2006**

(65) **Prior Publication Data**
US 2006/0180062 A1 Aug. 17, 2006

Related U.S. Application Data

(60) Provisional application No. 60/653,876, filed on Feb. 16, 2005.

(51) **Int. Cl.**
B65F 1/00 (2006.01)
B65F 3/00 (2006.01)
B65G 41/00 (2006.01)
B60P 1/00 (2006.01)
G01F 11/10 (2006.01)

(52) **U.S. Cl.** **414/522; 414/523; 222/371; 198/311; 198/312**

(58) **Field of Classification Search** 222/371; 198/312, 311; 414/523, 522
See application file for complete search history.

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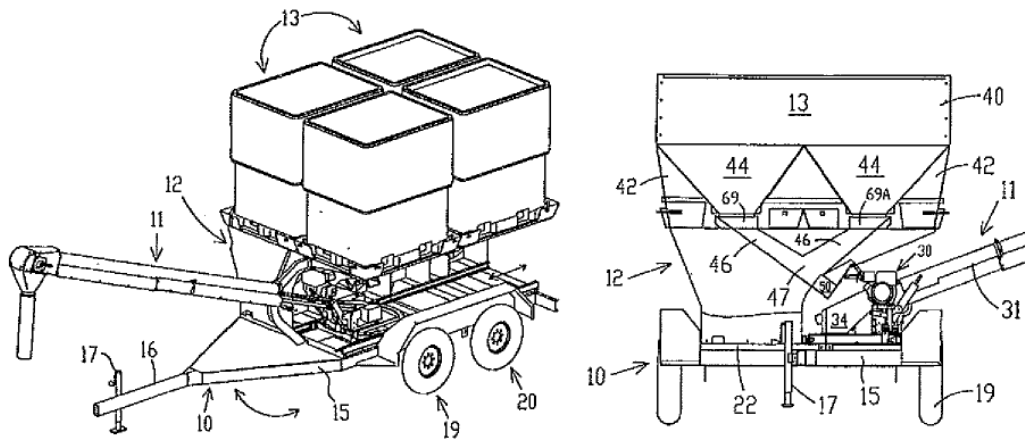
Primary Examiner—Christopher J. Novosad

(74) *Attorney, Agent, or Firm*—Wildman, Harrold, Allen & Dixon LLP

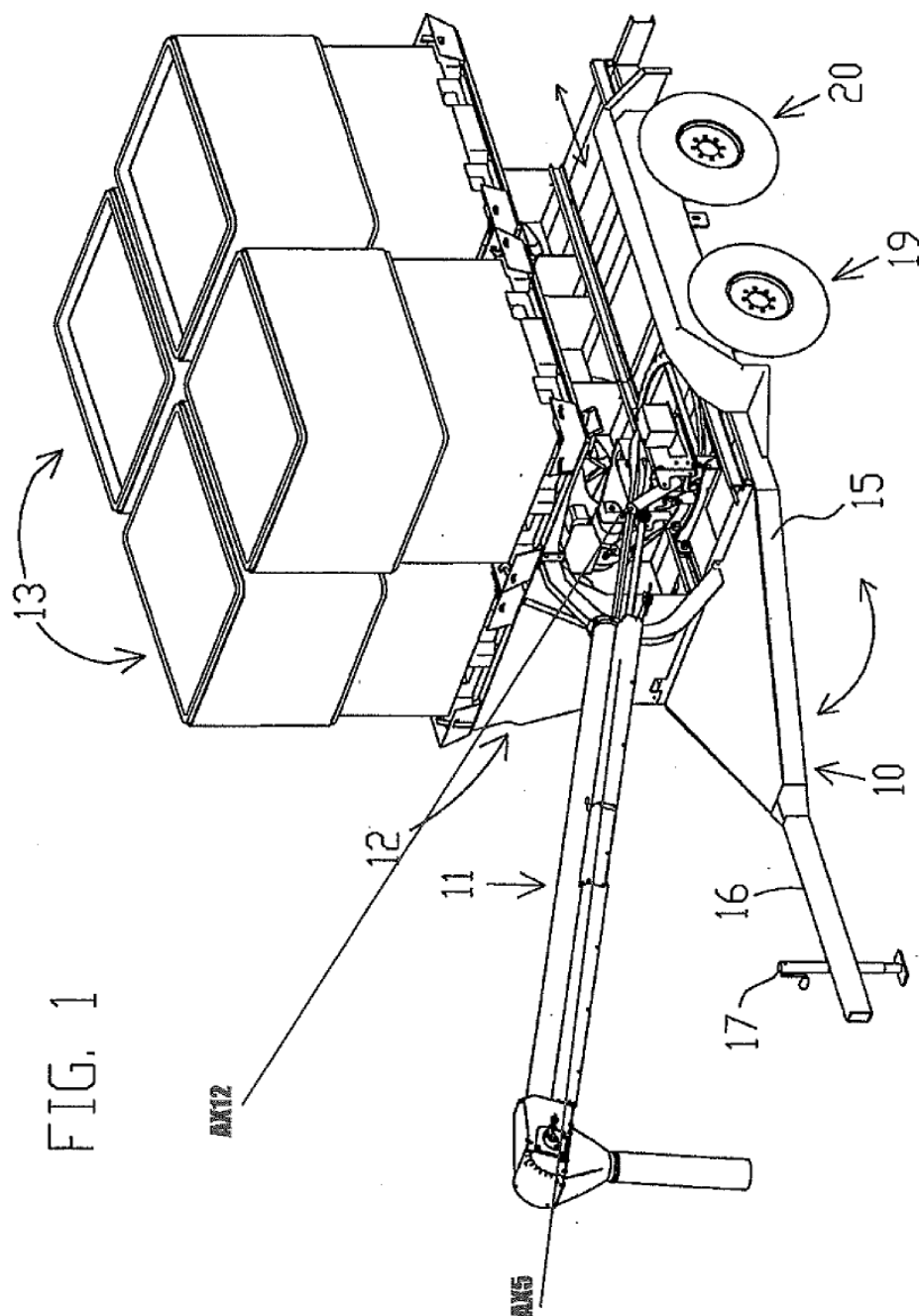
(57) **ABSTRACT**

A trailer having support wheels and a frame adapted to be hitched to a truck, includes a support track extending longitudinally for supporting an unload conveyor. The conveyor is mounted by a turret to the support track and, thus, to the trailer frame, permitting the turret to move in a fore-to-aft direction, as well as to rotate about the vertical for about 180°, providing flexibility in use as well as transport and storage. A support module, carrying at least one storage container is mounted on the trailer frame. The storage containers may be provided in a number of different sizes and they may be arranged in various configurations suiting the user's needs. The turret is positioned along the track beneath a desired seed container, which may then be unloaded by the conveyor to fill a planter seed box or grain drill, or for other seed handling applications.

9 Claims, 10 Drawing Sheets



UM-PK0000703



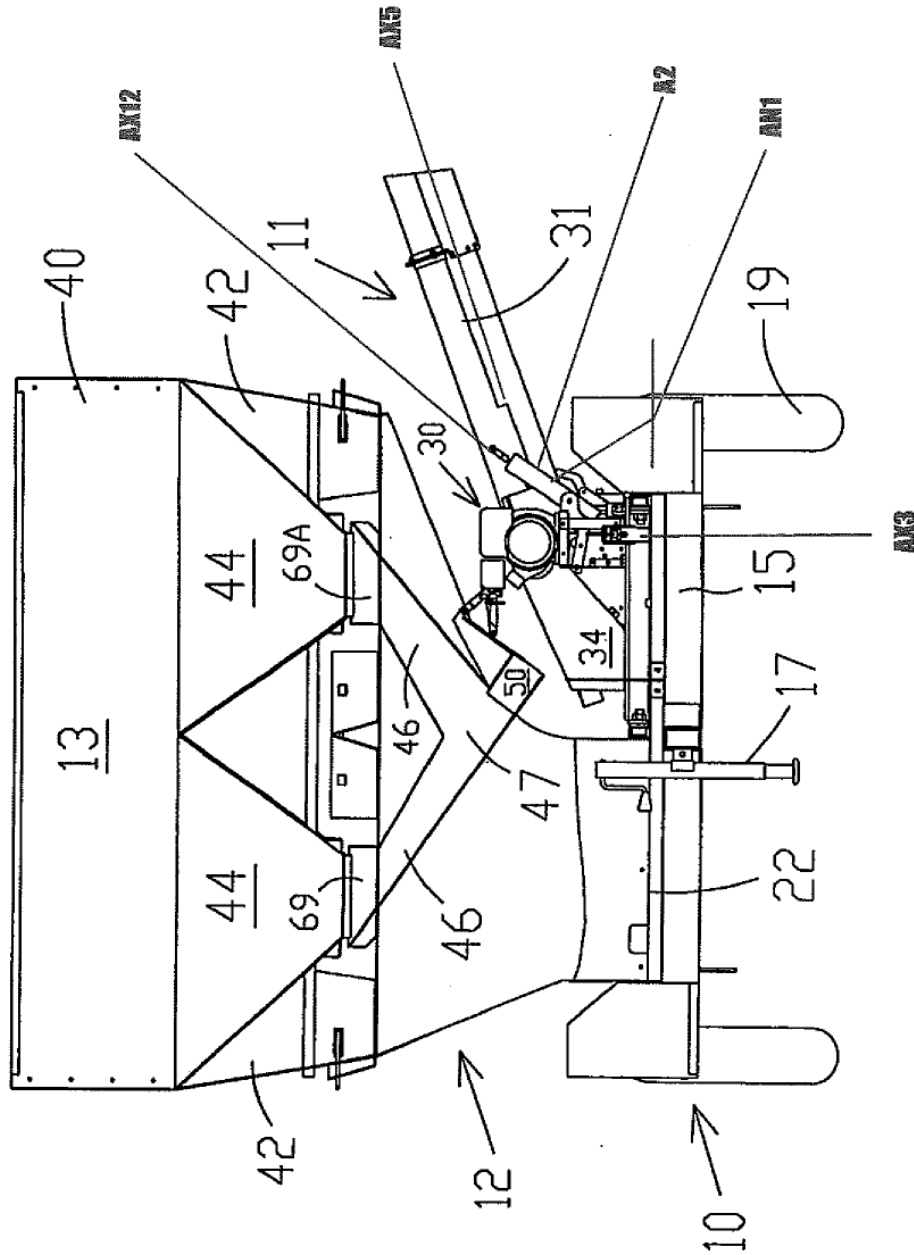
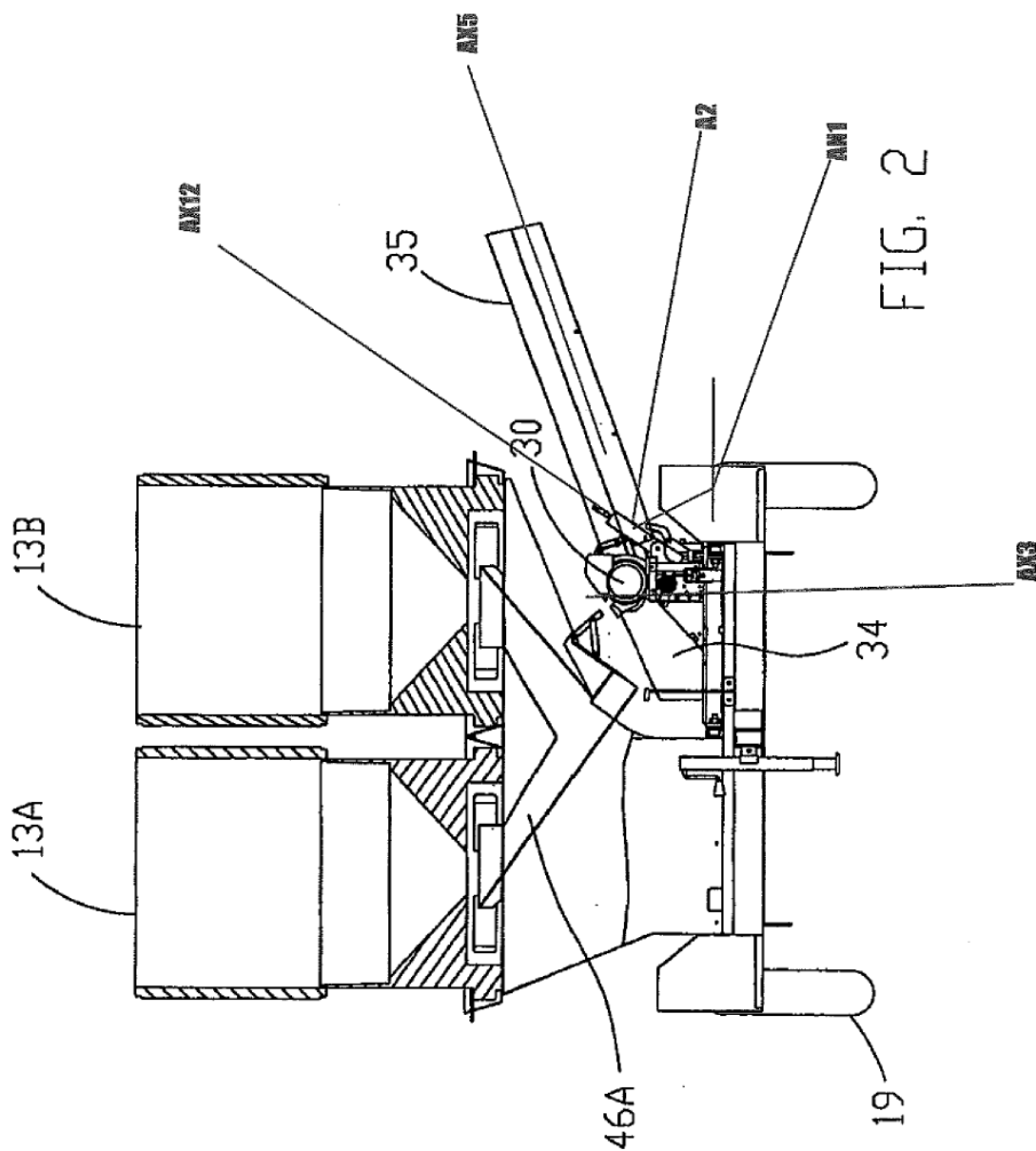
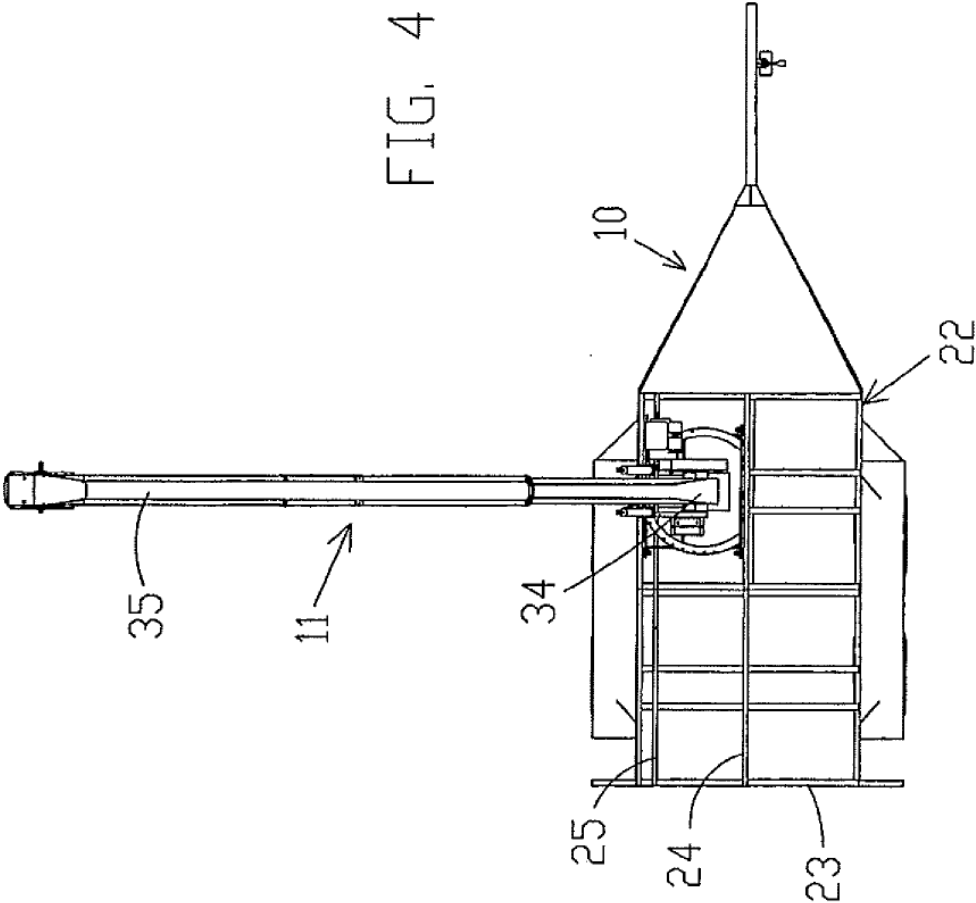
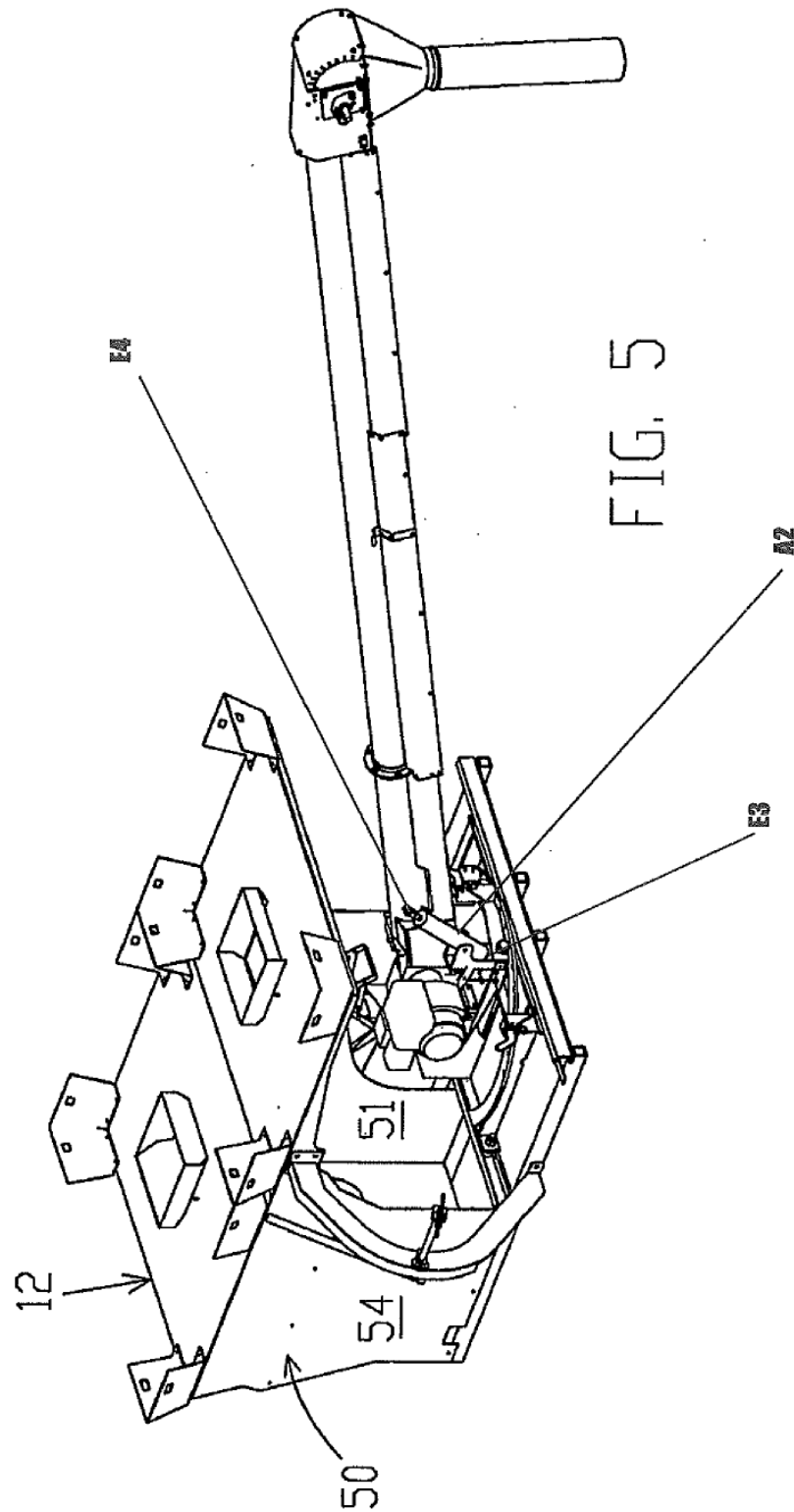


FIG. 1A







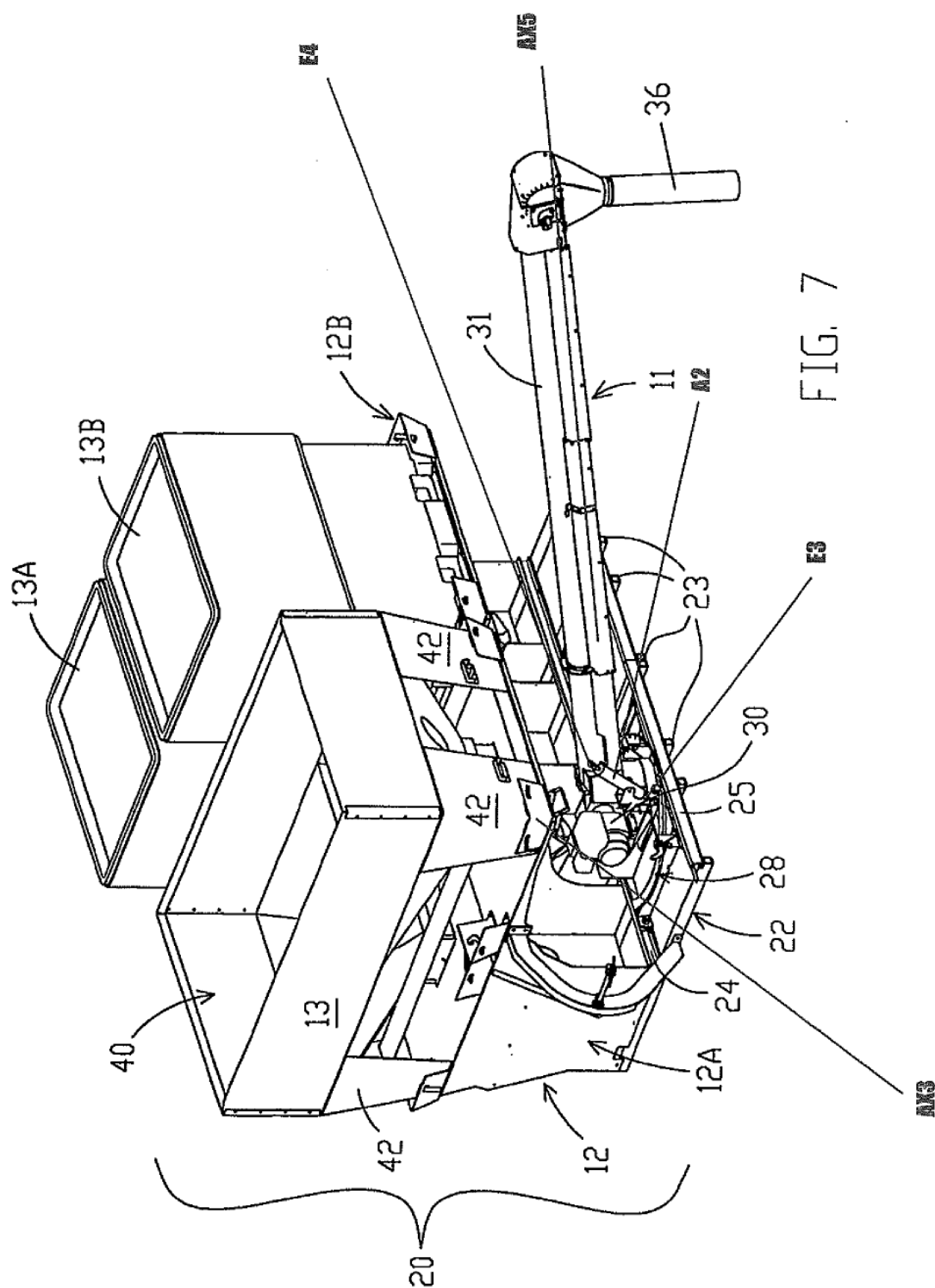


FIG. 7

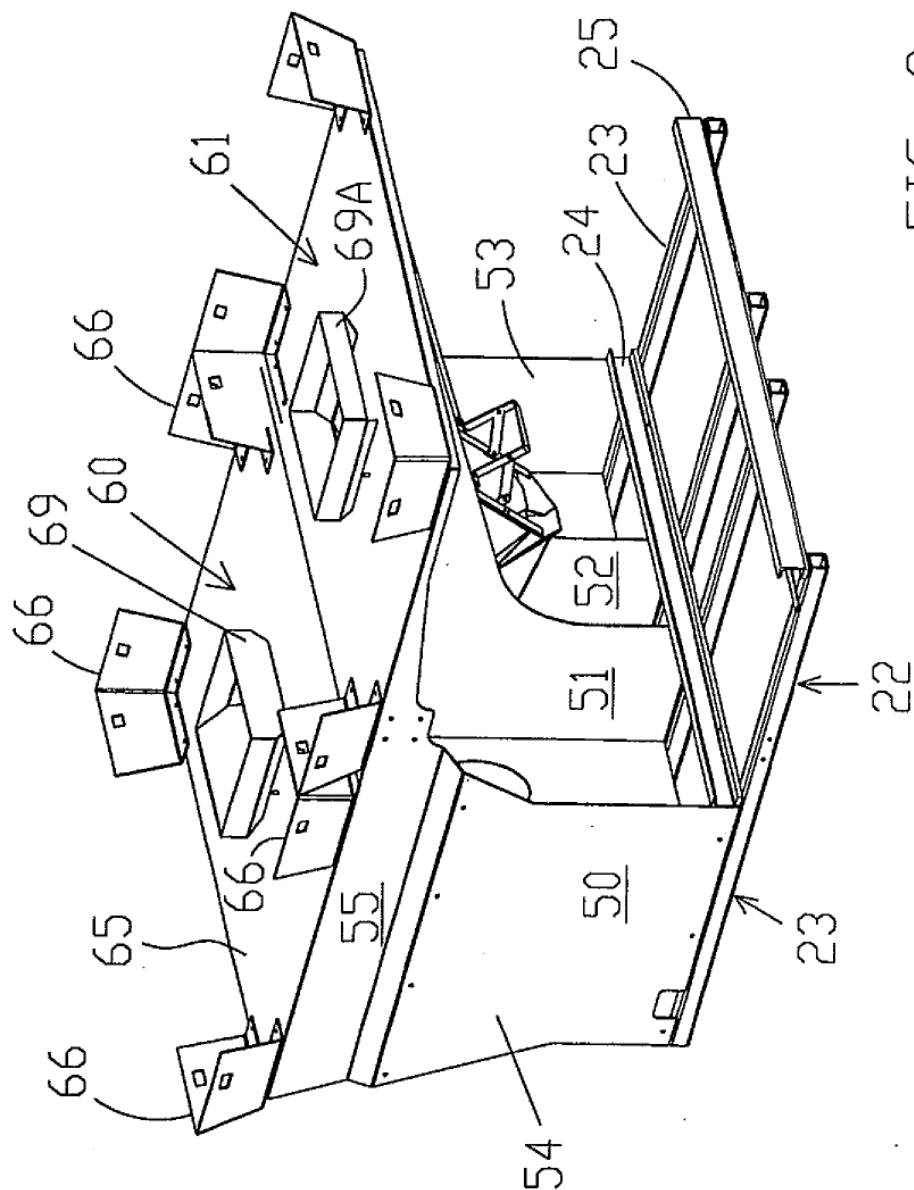


FIG. 8

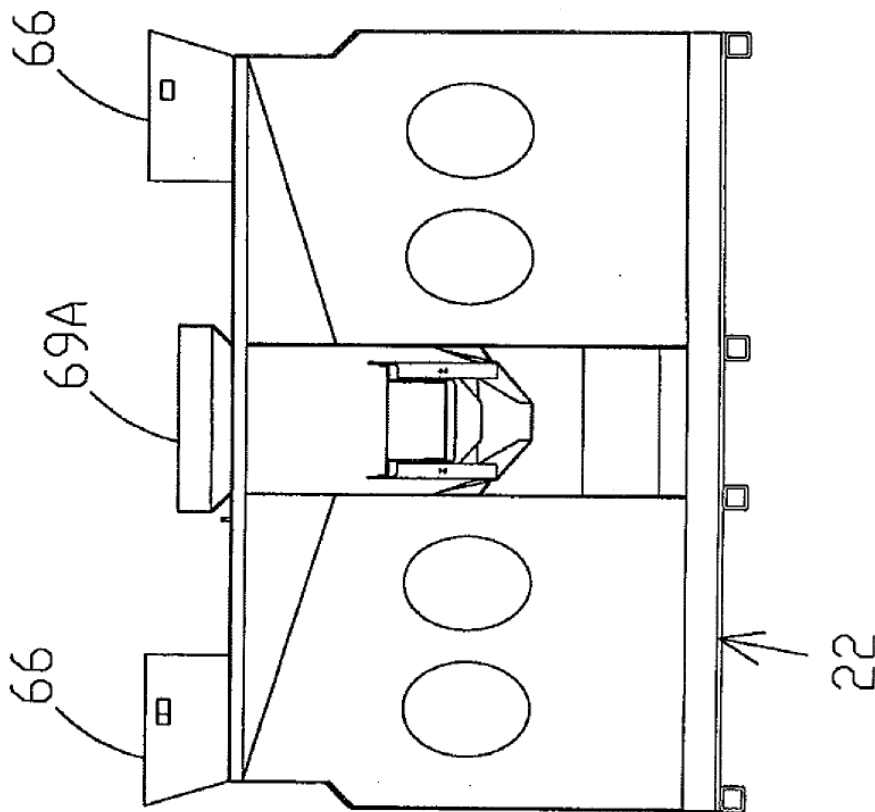


FIG. 9

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AGRICULTURAL SEED TENDER WITH MODULAR STORAGE CONTAINERS

RELATED APPLICATION

This application claims benefit under 35 U.S.C. '120 of U.S. application Ser. No. 60/653,876, filed Feb. 16, 2005, for "BULK SEED TENDER".

FIELD OF THE INVENTION

The present invention relates to apparatus for handling agricultural seed in bulk form. In particular, it relates to a trailer or wheeled tender adapted to be pulled by a vehicle such as a truck, and containing seed in bulk form or stored in large, heavy containers, primarily for supplying agricultural row crop planters or grain drills or the like, with seed, although it may be used for other seed handling applications as well.

BACKGROUND OF THE INVENTION

The term "planters" as used herein, it is intended to include all types of planting machines, such as row crop planters, grain drills and any other seed planting devices. As planters become larger and larger, the seed storage hoppers or containers on modern planters have also become larger in capacity such that currently, a large agricultural planter is capable of storing seed in quantities which are of considerable weight, and there have been many attempts to mechanize the filling and refilling of planter hoppers or seed bins with seed. Mechanized filling of seed hoppers or bins saves considerable time during the planting season, when time is at a premium.

Most prior attempts to provide a seed supply tender for a planter have been limited to a single type of seed at a given time, or to a single type of seed container. Such attempts are limited in that a farmer may use the same planter to plant different varieties of seed in the same field. Bulk seed for popular commercial crops such as corn and soy beans is now distributed in large boxes, tanks or seed bags, depending upon the producer of the seed and the quantity and volume of seed being transferred. The weight of the containers requires powered lifts for handling.

It is thus desirable to have a seed tender which is not only portable and adaptable to the various situations found in different farms and areas, but which is capable of handling large volumes and considerable weight of seed, and which is also capable of carrying seed containers of different volumes and/or configurations, for maximum flexibility. Further, by accommodating a larger number of seed containers on the seed tender, a problem arises in mechanizing the distribution of seed from the various containers, particularly as they are located in different places on a tender, as well as having the vehicle accommodate containers of different configurations.

SUMMARY OF THE INVENTION

The present invention includes a trailer having support wheels and a frame adapted to be hitched to a truck. The trailer frame includes a guide/support track extending longitudinally of the trailer. As used herein, "longitudinal" refers to the direction of travel of the trailer. "Transverse" refers to the side-to-side direction relative to the direction of travel.

A conveyor is mounted to the track by a turret rotatable about a vertical axis. Preferably the turret is located to one side of the trailer, and the turret and conveyor move beneath the seed storage bins. This arrangement permits the turret to

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move in a longitudinal direction so as to unload seed under gravity from containers located above the conveyor inlet and either in a forward or a rear position on the trailer. In this manner, the forward and rear seed containers need not be the same container size or configuration. For example, one could be a relatively large bin extending the full width of the trailer, whereas the others could be two smaller containers, located side-by-side, and having a combined width equal to the width of the larger container, depending upon the manner in which the distributor or seed manufacturer elects to ship and transport the seed.

Thus, the conveyor is capable of moving along the track to different unload positions in a longitudinal direction. The storage containers may be provided in a number of different sizes, types, and configurations so that they may be arranged and adapted for particular containers, which better suit the user's needs and convenience.

The turret and conveyor inlet hopper are positioned to move longitudinally along the track, to be positioned beneath a desired larger container or beside two containers located side-by-side, which may then be unloaded by the conveyor to fill a planter box or grain drill, or for other seed handling applications.

The conveyor may be turned by the turret about its vertical axis between: (i) a side position for unloading seed, (ii) a forward position and extending forwardly wherein the conveyor is located between the sides of the trailer and in front of it, for transport, or (iii) to the rear and extending rearwardly, for unloading or transport. In any longitudinal positioning of the conveyor, the conveyor delivery tube may be raised or lowered as desired. This feature is convenient as well as economical because some planters, particularly larger ones, have storage hoppers which typically have an inlet opening higher than the conventional seed hoppers of, smaller or intermediate size row crop planters, for example. Moreover, this arrangement (i.e., raising or lowering the elevation angle of the tubular conveyor) permits the conveyor to be raised in the storage position, but lowered during delivery or use applications.

The ability to raise and lower the unload auger also permits grain containers or bins carried on a trailer to be mounted at a lower elevation, thus, lowering the center of gravity of the trailer and providing greater stability in transport, as well as during unloading. Further, the ability to raise the unload auger during unloading permits unloading to be accomplished at greater heights than heretofore using conventional techniques, thus utilizing the full advantage of a cleated belt conveyor such as disclosed in U.S. Pat. No. 6,170,649, issued Jan. 9, 2001. Moreover, the use of a powered conveyor to fill the planter hopper or seed bin improves seed storage capacity, as well as the ability to place the conveyor and its mount on flatbed semi-trailers, or other trailers. Thus, the end user may already own one of these types of trailers and does not, therefore, have to purchase a new trailer or truck having a special height requirement. In other words, the present invention permits not only flexibility in positioning and elevating the unload auger, but also permits the user to mount the structure on a variety of vehicles, including trailers or trucks of different height.

Other features and advantages of the present invention will be apparent to persons skilled in the art from the following detailed description of a preferred embodiment, accompanied

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by the attached drawing, wherein identical reference numerals will refer to like parts in the various views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a right, front perspective view of a seed tender incorporating the present invention; taken from a front, left, upper view;

FIG. 1A is a front elevational view of a seed tender incorporating the present invention;

FIG. 2 is a view similar to FIG. 1, but with two rear grain storage bins shown in cross section taken along a vertical transverse plane;

FIG. 3 is an upper, right perspective view of the trailer, the conveyor in the unload position, and the track system mounting the conveyor to the trailer frame;

FIG. 4 is a plan view of the trailer and conveyor, without the seed bins;

FIG. 5 is a perspective view without the trailer, of the storage and unload module, taken from a forward and upper left side, showing the unload conveyor and its mount, and one modular support structure for the overhead seed storage bin or bins;

FIG. 6 is a front elevational view of the seed bin support module of FIG. 5;

FIG. 7 is a perspective view similar to FIG. 5, but with two modular seed bin supports, located fore and aft of each other, and with different configurations of seed storage bins fore and aft;

FIG. 8 is a close-up perspective view of a seed bin support structure for mounting two seed bins side-by-side on the trailer, taken from a forward, left and slightly elevated perspective; and

FIG. 9 is a right side view of the seed bin storage module of FIG. 6.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring first to FIGS. 1, 1A and 3, the seed tender of the present invention includes a wheeled trailer generally designated 9, an unload conveyor generally designated 11 and located toward the left side of the trailer in FIG. 1A (when looking in the direction of travel), one or more seed bin modules generally designated 12 (FIG. 1), and at least one seed storage bin 13. As used herein, "bin" is intended to be construed broadly to include all manner of container, regardless of size, shape, configuration or material (including even flexible bags). Broadly speaking, the invention includes a seed bin module 12 and a support vehicle. In the illustrated embodiment, the support vehicle is shown as a trailer simply because a trailer might be provided by a manufacturer of the entire system. However, the support vehicle could be a truck, as well, adapted for supporting and securing the seed bin module, because the seed bin module is self-contained and not dependent upon the type of vehicle which transports and positions it.

Still referring to FIGS. 1 and 3, the trailer 9 may be of conventional design, including a frame 15 fitted with a draft tongue 16 carrying, if desired, a support stand 17. Pairs of forward and rear wheels designated 19, 20 respectively in FIG. 3, support the frame 15 as well as the seed bin module 12, comprising an unload conveyor 11, bin support modules 12, which serve as mounts for individual storage bins 13, as well as the contents of the seed storage bins, while permitting the trailer and its load to be pulled by a vehicle or truck.

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The versatility and utility of the present invention may best be understood from FIGS. 1 and 7, to which reference is now made. A superstructure comprising one or more bin support modules, seen in FIG. 7, is mounted to the conventional frame 15 of the trailer 9. The superstructure, generally designated 20, includes a lower frame 22 including a series of transverse metal bars, which may be rectangular tubes, welded or otherwise affixed to the trailer frame 9. This provides a stable base for assembling and mounting the bin support modules. In FIG. 7, there are two bin support modules designated respectively 12A for the forward bin support module and 12B for the rear bin support module. These bin support modules may be identical even though the bins they support have different capacities. It will be appreciated that the forward hopper or storage bin module 13 is mounted to the forward bin support 12A whereas there are two bin modules 13A and 13B mounted to the rear bin support module 12B (compare FIGS. 1 and 2, for example). Both rear bins 13A, 13B are mounted to the rear bin support 12B, which in turn is mounted to the superstructure carrying frame 22 which, in turn, is secured to the main frame 9 of the trailer (or truck).

A pair of metal rails 24, 25 (in the form of C-shaped channels as seen in FIG. 8) are welded to the transverse frame members 23 of the lower frame 22 to form a track for moving the conveyor along the length of the wheeled support vehicle. The conveyor 11 includes a turret mount 28 carried by a conventional mobile carrier, including a circular track, and seen best in FIG. 3, for traveling longitudinally along the track defined by the rails 24, 25. The unload conveyor 11 also includes a drive motor 30 which drives the belt of a conventional tube conveyor. For example, the tube, conveyor 11 may be of the type described in U.S. Pat. No. 6,675,958 issued Jan. 13, 2004 entitled A Tube Conveyor. Although less desirable, the conveyor could be an auger. Briefly, the former preferred conveyor includes a tubular housing 31 in which the seed is moved by a cleated belt from an inlet hopper 34 (FIG. 3) through a conveyor tube 35 of closed cross section to a discharge tube 36. The turret mount 28, motor 30 and discharge tube 31 may be moved manually between a forward discharge position beneath the larger bin 13, as seen in FIG. 7, or rearwardly, along the rails 24, 25, to a rear discharge position beneath the rear bins 13A, 13B.

As best seen in FIG. 1, when the conveyor is in the forward position, it can be used either for transport or for unloading in a forward location. Alternatively, as seen in FIG. 7, the conveyor may be rotated to a wide range of angles, both vertical and horizontal, providing a flexible unload capability. See also FIG. 3. Finally, as will be appreciated, the turret can be moved to a rearward position, and the conveyor 11 may be rotated about a vertical axis to instill another wide range of unload, or rear-trailing positions. Thus, there is great flexibility and adaptability in the positioning of the conveyor, whether for unloading or for transport or storage.

Turning now to the bin support module 12 on which the forward storage bin 13 is mounted, with particular reference to FIGS. 1A and 7, it may be fabricated using conventional techniques from sheet metal. In the illustrated embodiment, the storage bin 13 includes a rectangular upper body hopper portion 40 (FIG. 7) having four upright walls arranged in a rectangular form, and four supporting legs 42, one located in each corner, also formed of sheet metal and bent into an angular form corresponding to the shape of the corners of the corresponding walls providing the upper hopper. In FIG. 7, the support legs are designated 42, and each may be of similar shape and structure.

At the bottom of the upper hopper wall 40, there are formed left and right funnel-shaped discharge areas 44, the bottom of

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which are open and rectangular, and lead into aligned, rectangular openings (69, 69A in FIG. 8) in a V-shaped conduit 46 having two upper conduit leg portions which converge at the bottom designated 47 in FIG. 1A. A manually operable gate 48 (FIGS. 6 and 8) is hinged above an outlet opening 49 of a discharge spout extending from the bottom 47 of the conduits 46 for controlling the flow of the seed under gravity into the inlet hopper 34 of the unload conveyor 11. Alternatively, the gate 48 may be operated electrically or hydraulically, if desired.

Turning now to FIGS. 5, 6 and 8-10, the bin support module 12 will now be described in detail. As mentioned, however, each bin support module may be the same as the other, so that only one need be described in detail for a full understanding of the invention. Making the bin support modules identical not only reduces the cost of the tender vehicle, but it also enhances its utility because it permits the type of modularity and various arrangements of different size seed bins as shown in FIGS. 1 and 7, and described above.

Turning then to the bin support module 12, it includes a forward wall 50, two intermediate walls 51, 52 and a rear wall 53. Each of the walls 50-53 may be similar in shape, which, as illustrated in FIG. 5, 6 and 8 for the forward wall 50 includes a lower section 54 having a width extending from the right side of the lower transverse superstructure frame 22 (i.e. the left side of FIG. 6) toward the center and immediately adjacent the inboard rail 24. The support wall 50 (and others as well) then extend upwardly and outwardly to brace and support the seed bins. Thus, the upright transverse support walls form openings which are aligned in the direction of travel to provide openings forming a passage or thruway above the rails or tracks 24, 25 to allow the conveyor to move between a forward position (FIG. 1) to a corresponding rear position as can be appreciated from FIGS. 1 and 6, and be located at any intermediate position as well. This leaves the track formed by the rails 24, 25 free for moving the conveyor assembly fore and aft. Above the lower portion 54 of the wall 50, there is an upper portion 55 which extends from the right side of the lower frame 22 over to the left side of the lower frame 22, and above the left rail 25. As seen in FIG. 8, the individual frame members 23 of the lower frame 22 extend from the right side to the left side of the bin support module 12. The lower edges of the walls 50-53 are secured, as by welding, to the right side of the individual frame members 23 of the transverse frame 22 (that is, toward the right side of the inner rail 24).

The upper section 55 of the wall 50 (as well as for the other support walls 51-53) extend toward the left (toward the right as FIG. 8 is viewed), to provide a thruway above the track for the passage of the inlet hopper, and base of the conveyor, including the drive motor and turret mount, as best seen in FIGS. 8 and 9. The cantilever upper portions such as that designated 55 in FIG. 8 of the walls 50-53 support the outboard, left side of the seed being stored and transported in the bins on the left side, as will be understood.

Above, and resting on the upper portions of the upright walls 50-53, for each bin support module are right and left base plates or mounting plates, designated respectively 60, 61 in FIG. 8, denoting the right and left base support plates respectively. Each of the base support plates is, in turn, fabricated from sheet metal, and to enhance the modularity of the system, each of the base support plates may be identical. Moreover, the same two base support plates may be used to support a single, larger storage bin such as that designated 13 in the front of the unit in FIG. 7, and the same structure, including two identical base support plates may be used to support the two separate seed storage bins 13A, 13B. Thus,

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only one base support plate need be described for further understanding 15 of the invention.

Turning then to FIG. 8, each base support plate includes a flat metal plate 65 including corner braces secured at each of the corners, and designated 66, for each corner brace. Depending on the desired configuration, the corner braces may have to be modified slightly. At the center of the plate 65 there is an aperture with a raised rectangular collar designated 69 which receives a shortened downspout from an associated discharge opening of a seed storage bin. The corresponding collar for the left side support brace 61 is designated 69A. As seen in FIG. 1, the two guide collars 69, 69A, are coupled respectively to the upper, input ends of the conduit sections 46 of the V-shaped conduit 47, leading to the input of the conveyor hopper 34.

Turning now to FIG. 2, briefly, it can be seen that each of the two rear storage bins 13A, 13B (seen in vertical cross section) may use the same routing conduit system for handling the seeds in those two bins when the conveyor is moved to the rear station beneath the two rear bins.

As has been mentioned, although two discharge stations are shown in the embodiment of FIG. 7, the invention, particularly due to its modularity, may have three, four or more discharge stations with different combinations of bin styles and shapes and capacities if desired.

It will thus be appreciated that the elevation of the unload conveyor 11 may be adjusted continuously over a wide range of unload heights, so that the system accommodates a number of different applications, from loading grain drills to loading individual hoppers for row crop planters to loading larger central seed storage hoppers on a planter or seed drill which have a higher reach, and can be moved from a forward position, to any side position to a rear position, providing over 180° of lateral flexibility, as well as the vertical adjustment flexibility described.

Having thus disclosed in detail, an illustrated embodiment of the invention, persons skilled in the art will be able to modify certain of the structure which has been illustrated, and to modify certain of the structure which has been disclosed; and it is, therefore, intended that all such modifications and substitutions be covered as they are embraced within the spirit and scope of the appended claims.

We claim:

1. A seed tender comprising:

a wheeled support vehicle;

a first support module mounted on said vehicle and defining an elongated first thruway, said first thruway opening to at least one side of said support vehicle;

a second support module mounted on said vehicle and defining a second elongated thruway extending longitudinally of said second support module, said first and second thruways forming an opening to a lateral side of said support vehicle and partially through a front side and a rear side of said support vehicle, whereby said conveyor may be positioned to extend in front of said support vehicle, to rear of said support vehicle, or adjusted along a lateral side of said support vehicle; and a second seed container mounted to said second seed support module;

at least one seed container mounted to said first support module for storing seed;

a track mounted to said support vehicle and extending longitudinally of said first thruway;

a powered conveyor having an input section adapted to receive seed from said seed container for delivering said seed through a discharge end to an outlet;

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a turret mounting said conveyor on said track for positioning said conveyor longitudinally of said track and for rotating said conveyor laterally for side adjustment and for adjusting said conveyor vertically for height adjustment of a discharge end.

2. The tender of claim 1 wherein one of said support modules is adapted to support first and second seed containers in side-by-side relation; and wherein

first and second seed containers are mounted to said first support module.

3. The tender of claim 1 wherein said support vehicle has a width, and one of said support modules is adapted to support one seed container having a generally rectangular upper inlet and extending laterally substantially the width of said support vehicle.

4. The tender of claim 3 wherein a second of said support modules is adapted to support two seed containers and further including

first and second seed containers mounted respectively on said first and second support modules, each container having a generally rectangular upper inlet and together extending laterally substantially the width of said one support module.

5. The tender of claim 4 wherein said first support module includes a lower discharge chute of a contentiously decreasing cross sectional area to funnel the seed contained therein through a discharge opening to an inlet of said conveyor; and further including

a door pivotally mounted to close said discharge opening and moveable to an open position to permit seed to flow from a container to an inlet of said conveyor.

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6. The tender of claim 1 wherein said first and second support modules each include first and second apertures for passing seed vertically from a seed container, and further comprising:

5 a conduit for receiving seed from said first and second apertures and delivering seed to said conveyor; and a gate mounted to selectively open and close said conduit for controlling the delivery of seed from said container.

7. The tender of claim 6 wherein said gate is manually controlled.

8. A support module for a seed container and adapted to be mounted to a frame of a vehicle, said module comprising:

at least first and second upright walls extending generally parallel to one another in a forward and a rear position, said first and second walls defining a thruway extending front to rear of said module and opening laterally to one side thereof;

a track extending longitudinally of said thruway;

a horizontal base support wall interconnecting said first and second upright walls and defining first and second laterally spaced discharge openings;

a plurality of connector members for receiving a seed container and removable mounting said seed container to said support vehicle;

25 a conduit for passing grain from said first and second discharge openings of a seed container to a conveyor carried on said track; and

a gate for controlling the flow of seed from said container to a conveyor on said track.

9. The module of claim 8 further comprising a module frame secured to a bottom of said upright walls; and wherein said track includes first and second rails mounted to said module frame.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,500,817 B2
APPLICATION NO. : 11/348659
DATED : March 10, 2009
INVENTOR(S) : G. Jason Furrer et al.

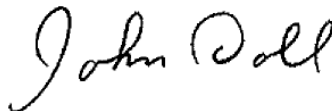
Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 6, line 2, "understanding 15 of the invention" should read --understanding of the invention--

Signed and Sealed this

Second Day of June, 2009



JOHN DOLL
Acting Director of the United States Patent and Trademark Office

EXHIBIT 2



US005888044A

United States Patent [19]

Baskerville

[11] Patent Number: 5,888,044
[45] Date of Patent: Mar. 30, 1999

- [54] **SEED CART WITH LOADING/UNLOADING CONVEYOR SYSTEM**
- [75] Inventor: Gregory Eugene Baskerville, Jolley, Iowa
- [73] Assignee: DewEze Manufacturing, Inc., Harper, Kans.
- [21] Appl. No.: 655,010
- [22] Filed: May 29, 1996
- [51] Int. Cl.⁶ B65G 67/02
- [52] U.S. Cl. 414/523; 198/311; 198/317; 198/318; 414/345; 414/528
- [58] Field of Search 414/523, 528, 414/327, 343, 345, 390, 391, 393, 398, 526; 198/311, 312, 317, 318

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(List continued on next page.)

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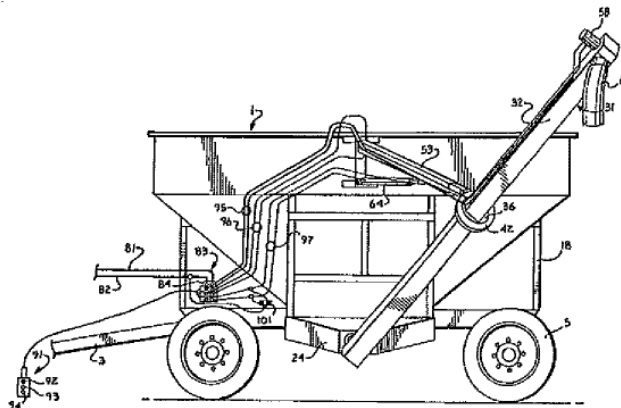
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Primary Examiner—David A. Bucci
Attorney, Agent, or Firm—Litman, McMahon, & Brown

[57] ABSTRACT

A bulk seed cart includes a seed bin with sloping sides converging at a bottom mounted discharge hopper to which a conveyor is removably connected for unloading seed from the cart. The conveyor is supported by a telescoping boom mounted on the side of the cart and the boom, and attached conveyor, can be raised or lowered via an attached hydraulic lifting cylinder. The boom can be pivoted from side to side and the conveyor is attached to the boom via a swivel assembly, which, once the conveyor is detached from the seed cart, allows the conveyor to be swiveled 180 degrees and attached to a nearby source of seed, such as another seed cart, a stationary bin, a truck or railroad car, etc., with the conveyor being directed toward the seed bin in the seed cart. Seed can thus be unloaded from the source and loaded into the seed cart via the conveyor. The lifting cylinder, the telescoping boom and the conveyor motor are all controllable via a single remote control module.

13 Claims, 4 Drawing Sheets



UM-PK0000720

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Sales literature of Parker Industries, Jefferson, Iowa for Bulk Seed Tender Model 2611S, publication date at least one year prior to the filing of the present invention.

Sales literature of Quality Plus Manufacturing, Oelwein, Iowa for The Bulk Seed Handling System, publication date unknown, not admitted prior art.

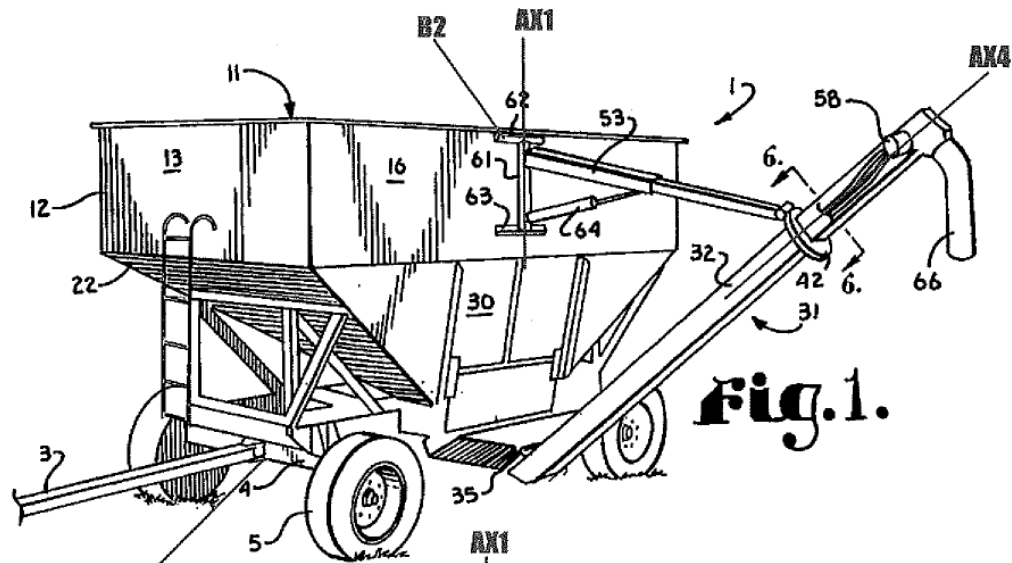


Fig. 1.

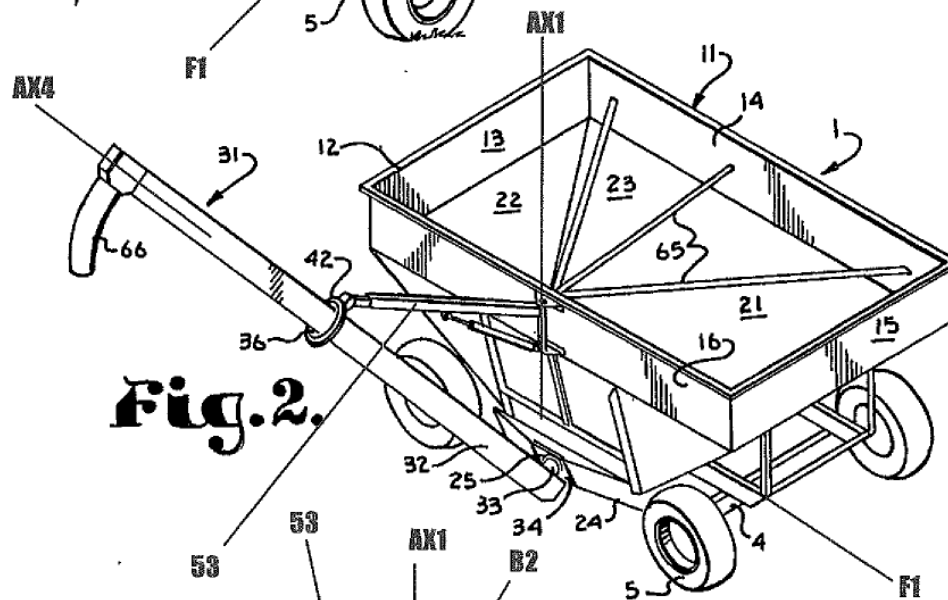


Fig. 2.

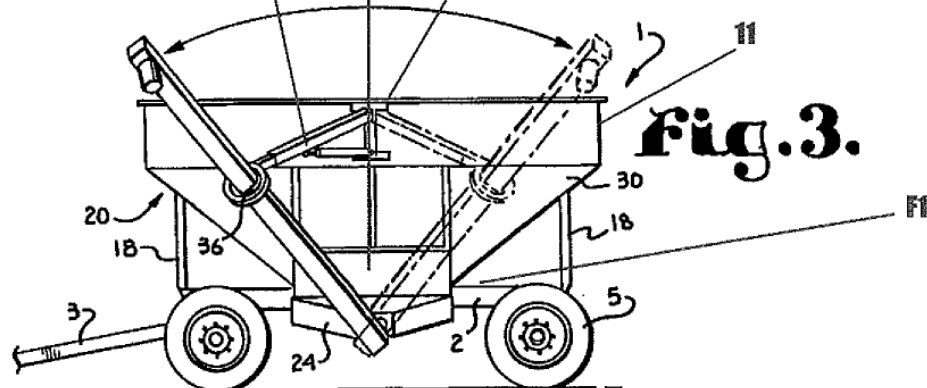
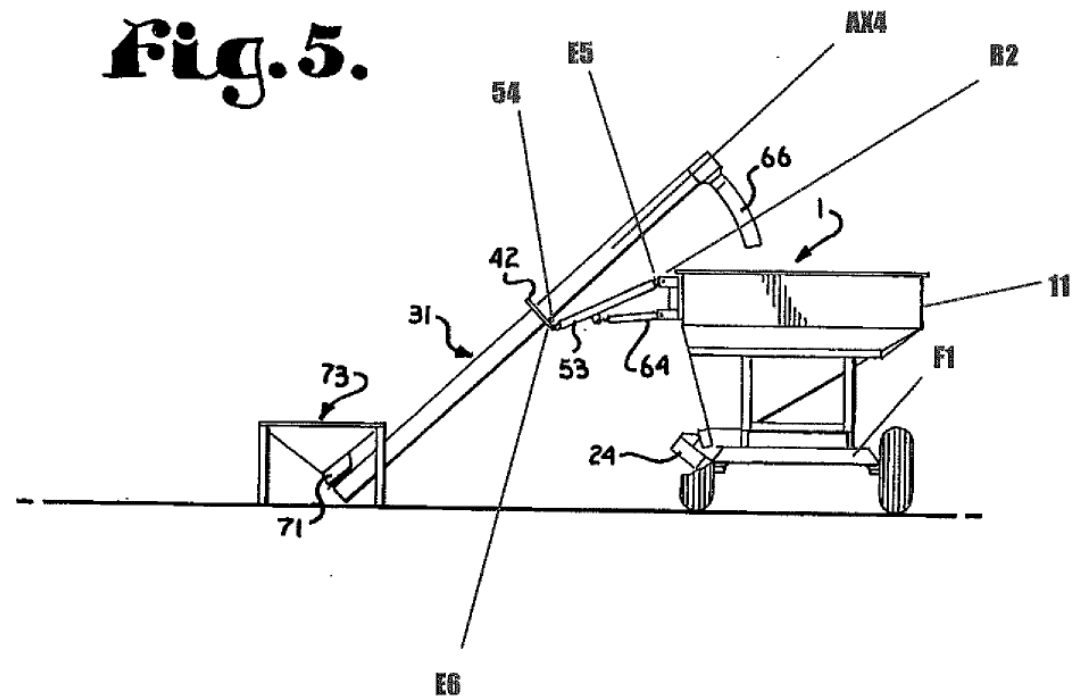
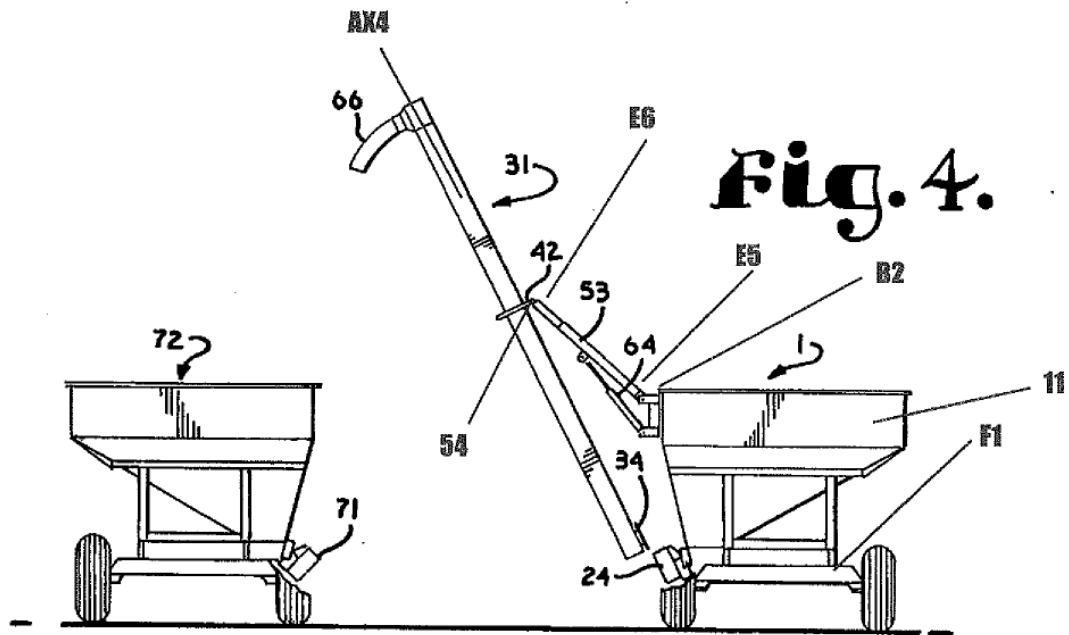


Fig. 3.



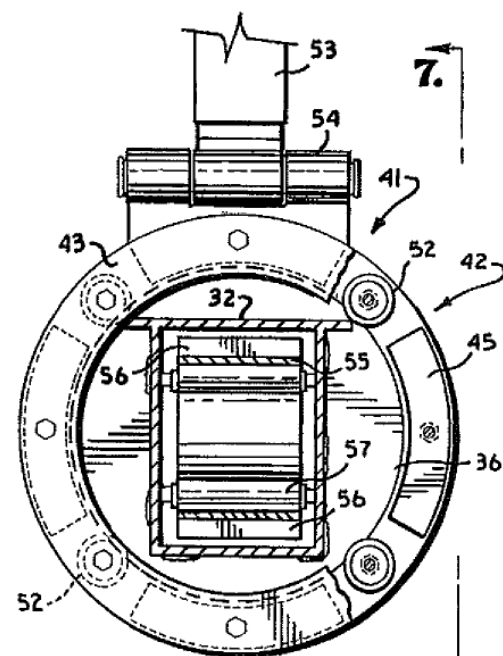


Fig. 6.

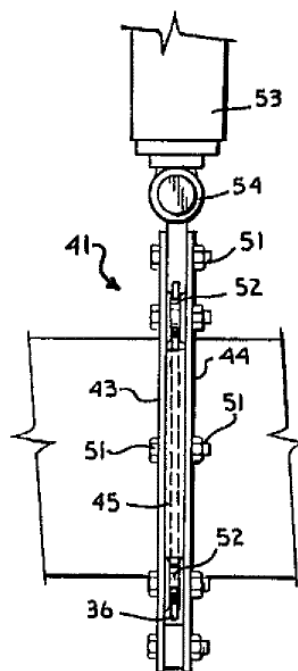


Fig. 7.

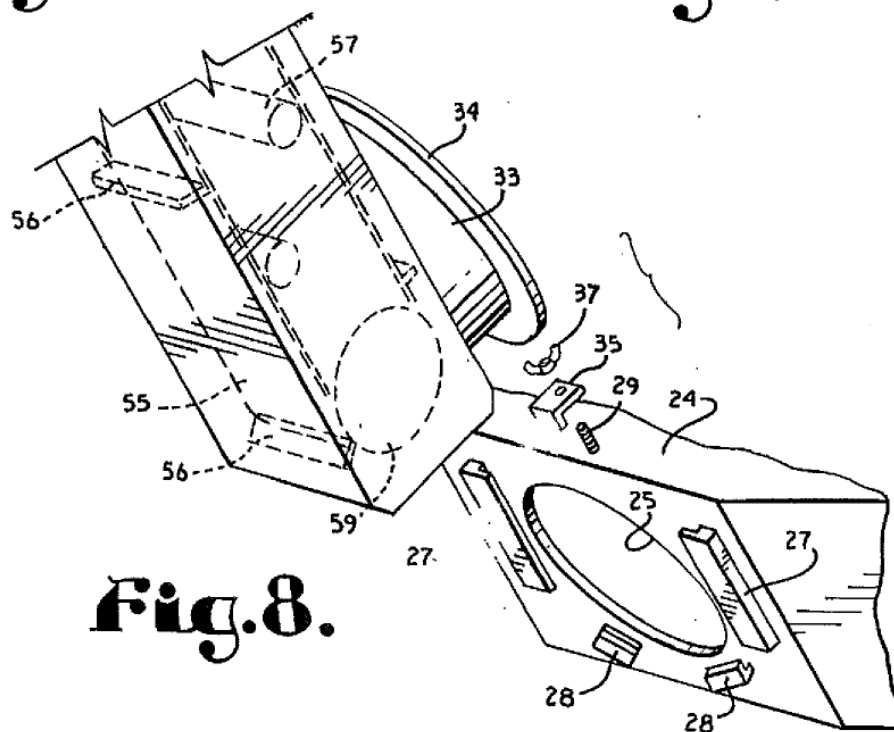
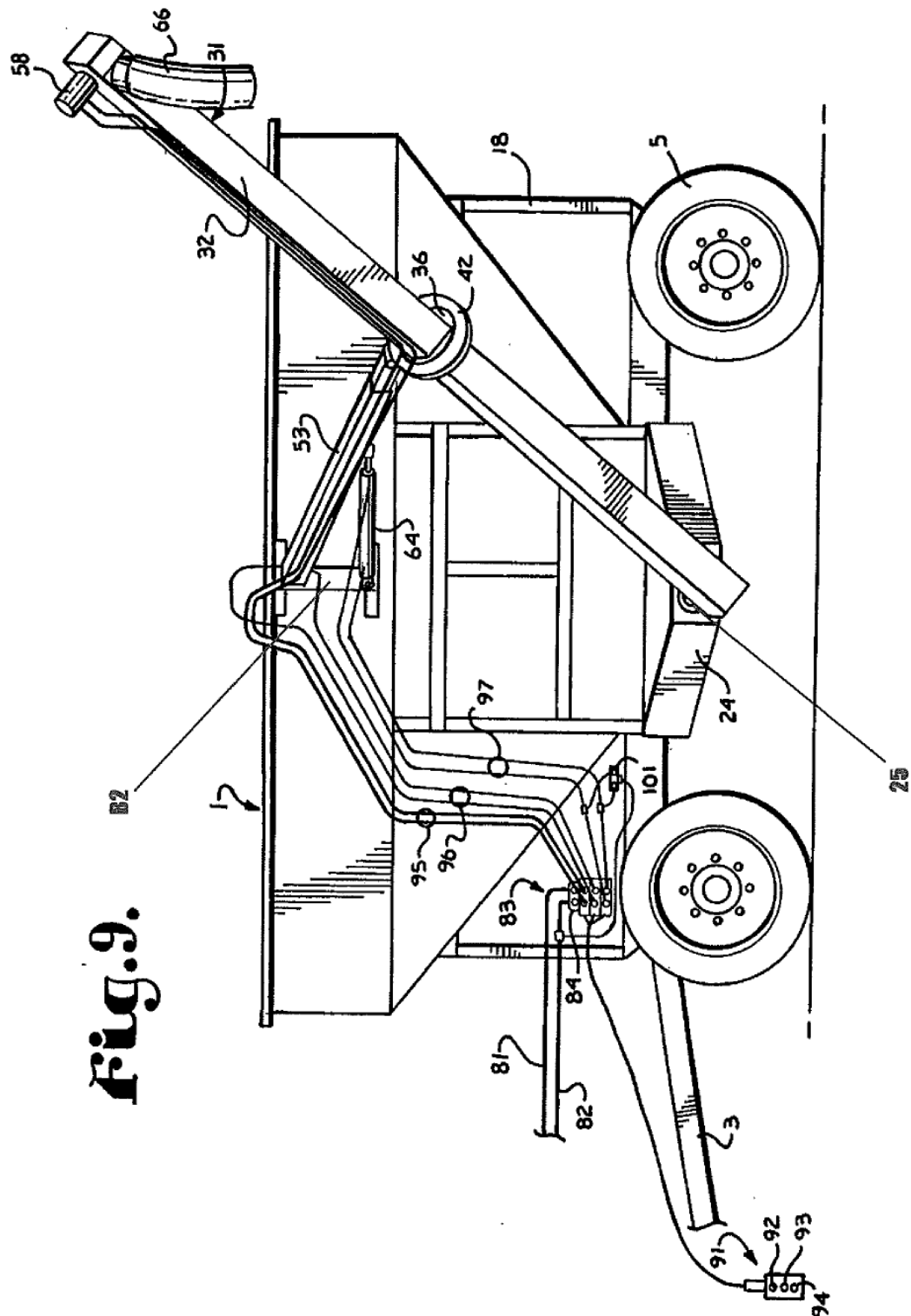


Fig. 8.



6. 5

SEED CART WITH LOADING/UNLOADING CONVEYOR SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a bulk seed cart of the type used to transport and discharge bulk certified seed and other particulate agricultural products. The inventive cart is equipped with a belt-type conveyor which is detachably coupled to a discharge hopper positioned proximate the bottom of the seed cart. The conveyor is supported by a swivel attached to the end of a telescoping boom assembly. The conveyor can thus be pivoted from side to side and lifted or lowered via the boom assembly. In addition, the conveyor can be removed from its connection to the seed cart, swiveled 180 degrees, and used to load seed into the seed cart.

2. Description of the Related Art

Seed for agricultural operations has traditionally been sold and distributed in relatively small quantities, such as 50 lb. bags. As modern agricultural operations have increased in size and demands for efficiency have increased, seed producers have started delivering seed in larger, bulk quantities. A number of manufacturers have produced specialized carts for handling this bulk seed. These carts typically include a conveyor attached proximate the bottom of the seed cart for off-loading the seed. While grain carts typically use auger-type conveyors, some seed carts, due to the rather fragile nature of the seed, have incorporated belt-type conveyors instead. One version of bulk seed cart is described in U.S. Pat. No. 5,257,893 to Sevits. The Sevits cart includes a frame designed to receive and dispense large bulk bags of seed by dropping them downward into a chute from a spout formed in the bottom of the bag. A built-in auger conveyor then collects the seeds from the chute and conveys them up the conveyor to a destination, such as to bins in a planter or seed drill. The auger conveyer can be pivoted from side to side to vary the dispensing angle of the seeds.

A problem with seed carts such as that described in the Sevits patent, as well as with more conventional carts which resemble grain carts, but with specialized features for accommodating and dispensing loose bulk seed, is the loading of seed into the cart. For example, in the case of the Sevits cart, heavy bulk bags must be loaded mechanically via a fork lift, crane or the like, which, for field operations, can be impossible, and is, at best, inconvenient for many other operations. In the case of more conventional carts, loose seed must typically be loaded from above the cart, or, if from ground level, via a separate belt or auger-type conveyor attachable to seed sources such as storage bins, trucks, etc. Again, such a conveyor is not always readily available, particularly for field operations.

Accordingly, it is clear that a need exists for an improved bulk seed cart with a self contained conveyor which can be used both for loading and for unloading the seed cart. Such a conveyor should be capable of both pivoting side to side to change unloading angles, and should be capable of being removed from the seed cart, swiveled at least 180 degrees, and attached to a seed source such that it can be used to load seed into the cart as well as unload seed out of the cart.

SUMMARY OF THE INVENTION

In the practice of the present invention, a bulk seed cart includes a seed bin with sloping sides converging at a bottom mounted discharge hopper. The hopper includes a

discharge opening and a motor driven belt-type conveyor is removably connected to the hopper for unloading seed from the cart and selectively discharging the seed into receptacles, such as seed bins on a planter or seed drill. The conveyor is supported by a telescoping boom mounted on the side of the cart and the boom, and attached conveyor, can be raised or lowered via an attached hydraulic lifting cylinder. The boom can be pivoted from side to side and the conveyor is attached to the boom via a swivel assembly including a swivel plate attached to the conveyor and a swivel ring attached to the boom. The swivel assembly, once the conveyor is detached from the seed cart, allows the conveyor to be swiveled 180 degrees and attached to a nearby source of seed, such as another seed cart, a stationary bin, a truck or railroad car, etc., with the conveyor being directed toward the seed bin in the seed cart. Seed can thus be unloaded from the source and loaded into the seed cart via the conveyor. The lifting cylinder, the telescoping boom and the conveyor hydraulic motor are all controllable via a single remote control module.

OBJECTS AND ADVANTAGES OF THE PRESENT INVENTION

The objects and advantages of the present invention include: providing an improved bulk seed cart; providing such a seed cart with a storage bin which has sloping sidewalls converging into a discharge hopper attached to the bottom of the bin; providing such a seed cart with a conveyor which is removably attachable to the discharge hopper for unloading seed from the cart; providing such a seed cart in which the conveyor is supported by a telescoping boom which can be selectively raised and lowered and extended and retracted to position the conveyor at a desired angle and in a desired direction; providing such a seed cart in which the conveyor is attached to the boom via a swivel assembly; providing such a seed cart in which the conveyor can be removed from its connection to the cart discharge hopper, swiveled 180 degrees, and attached to a nearby source of bulk feed; providing such a seed cart which can be directed from the source of seed back into the top of the storage bin on the seed cart so as to load seed from the source into the seed cart; providing such a seed cart conveyor which is driven via a hydraulic motor; providing such a seed cart with a push button remote control module which controls the hydraulics for the telescoping boom, the hydraulic lifting cylinder and the conveyor hydraulic motor; and providing such a seed cart which is economical to manufacture, efficient and convenient in operation, capable of a long operating life and which is particularly well adapted for the proposed usage thereof.

Other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention.

The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a seed cart in accordance with the present invention with an attached conveyor supported by a telescoping boom and lifting cylinder.

FIG. 2 is another perspective view of the seed cart of FIG. 1, illustrating the interior of the seed bin and a number of cross braces for bracing the telescoping boom and the lifting cylinder.

FIG. 3 is a side elevational view of the seed cart of FIG. 1, illustrating the conveyor pivoted to the left in solid lines and, in dotted lines pivoted to the right.

FIG. 4 is a partially schematic end elevational view of the seed cart of FIG. 1 along with a complementary seed source cart which serves as a source of seed for the inventive cart, and with the conveyor being removed from engagement with the inventive cart for connection to the complementary seed source cart.

FIG. 5 is a partially schematic end elevational view of the seed cart of FIG. 1 along with a complementary stationary seed source bin, and with the conveyor swiveled 180 degrees and inserted into a mating discharge hopper in the bin.

FIG. 6 is a greatly enlarged, fragmentary cross-sectional view, taken along line 6—6 of FIG. 1, illustrating a two dimensional swivel mount for the seed cart conveyor.

FIG. 7 is a greatly enlarged, fragmentary cross-sectional view, taken along line 7—7 of FIG. 6, and further illustrating the structure of the swivel mount for the seed cart conveyor.

FIG. 8 is a greatly enlarged, fragmentary perspective view illustrating the removable connection of the belt-type conveyor to the seed cart discharge hopper with the conveyor belt shown in phantom lines.

FIG. 9 is an enlarged, partially schematic, side elevational view of the seed cart of FIG. 1, illustrating the hydraulic system and controls for the conveyor, the telescoping boom and the lifting cylinder.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

I. Introduction and Environment

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific structural and functions details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

Certain terminology will be used in the following description for convenience and reference only and will not be limiting. For example, the words "up", "down", "right" and "left" will refer to directions in the drawings to which reference is made. The words "in" and "out" will refer to directions toward and away from, respectively, the geometric center of the structure being referred to. Said terminology will include the words specifically mentioned derivatives thereof and words of similar import.

II. Seed Cart

Referring to the drawings in more detail, reference numeral 1 in FIGS. 1-3 generally designates a seed cart in accordance with the present invention. The cart 1 comprises a lower frame 2 connected to a tongue 3. The frame 2 is supported by two axles 4, each with a pair of wheels 5 attached thereto.

A grain bin, generally indicated as 11, comprises an upper portion 12 with substantially vertical sidewalls 13-16. The grain bin 11 is supported by a pair of rectangular frames 18 which are attached to and extend upward from respective opposite ends of the lower frame 2. Extending downward from the upper portion 12, the bin includes a lower portion 20 with three triangular sidewall extensions 21, 22, and 23 (FIG. 2) each of which tapers inward and downward to converge at an inlet (not shown) which opens into a discharge hopper 24. In a conventional fashion, this structure

directs all seed or other particulate material stored in the bin 11 toward the discharge hopper 24. The discharge hopper 24 slopes downward and inward toward a circular discharge opening 25 such that all seed or other particulate material in the hopper 24 is directed toward the circular discharge opening 25. The discharge hopper 24 includes a number of brackets 27 and 28 attached to the outside thereof and which partially surround the circular opening 25. A threaded stud 29 extends upward from the top of the discharge hopper 24. The lower portion 20 of the bin 11 includes a fourth triangular sidewall 30 which is oriented substantially vertically.

A belt-type conveyor 31 includes an elongate housing 32 which is preferably rectangular in cross section. A circular flange 33 is connected to and extends outward from the bottom of the conveyor housing 32. The flange 33 mates with the circular opening 25 in the hopper 24 (FIG. 8). The circular flange 33 has attached thereto a perimeter circular plate 34 which is insertable into the brackets 27 and 28 and is retained in position adjacent the opening 25 via a securing wedge 35 fitted onto the threaded stud 29 and held there via a wing nut 37. The conveyor 31 is thus removably coupled to the hopper 24. The conveyor housing 32 is pivotable from side to side relative to the hopper 24, as shown in FIG. 3, while remaining attached thereto.

Approximately two-thirds of the way up the conveyor housing 32, a circular swivel plate 36 is welded about the periphery of the housing 32. The swivel plate 36 forms a part of a swivel assembly 41 which also includes a swivel ring assembly 42. The swivel assembly 41 is best illustrated in FIGS. 6 and 7. The swivel ring assembly 42 includes an upper and a lower ring 43 and 44, respectively, separated by a plurality of spacing bars 45 arrayed about the periphery of the rings 43 and 44. A plurality of threaded bolts and mating nuts 51 extend through the rings 43 and 44 and the spacing bars 45 to clamp the rings 43 and 44 together in a spaced configuration. A plurality of bearing rollers 52 are rotatably held between the rings 43 and 44, with the rollers 52 supporting and engaging the swivel plate 36 such that the swivel plate 36, and the attached conveyor housing 32, can freely swivel 180 degrees or more within the swivel ring assembly 42. The swivel ring assembly 42 is pivotably attached to a telescoping boom 53 via a hinge 54.

FIG. 6 also illustrates the interior of the conveyor housing 32 which encloses an endless conveyor belt 55 which carries a plurality of spaced paddles 56 for carrying seed upward through the conveyor 31. A number of idler rollers 57 keep the belt 55 apart as it passes over itself and a hydraulic conveyor drive motor 58 (FIG. 1) is connected to drive the belt 55. A return conveyor roller 59 is positioned proximate the bottom of the conveyor housing 32 near the circular flange 33.

The telescoping boom 53 is attached near the top of a vertically oriented tube 61 which tube 61 is, in turn, pivotably attached to the upper sidewall 16 of the seed bin 11 via a pair of supports 62 and 63. A hydraulic lifting cylinder 64 is attached at one end to the tube 61 and at a second end to the telescoping boom 53. A plurality of cross braces 65 are positioned inside of the seed bin 11 in order to provide enhanced strength and rigidity to the sidewall 16, and thus to provide adequate support for the telescoping boom 53 and the lifting cylinder 64.

III. Operation

The conveyor 31 can thus be used to unload seed from the cart 1 via the discharge hopper 24, which seed is carried up the conveyor housing 32 via the belt 55 and paddles 56 to the top thereof where the seed enters a flexible discharge tube

66. The combination of the telescoping boom 53, the lifting cylinder 64 and the pivotable connection of the conveyor 31 to the discharge hopper 24 allows discharged seed to be directed at virtually any desired location or height along the conveyor side of the seed cart 1.

FIGS. 4 and 5 illustrate the enhanced versatility of the inventive seed cart 1 and conveyor 31. In FIG. 4, the combination of the lifting cylinder 64 and the telescoping boom 53 are used to lift the conveyor 31 out of engagement with the discharge hopper 24 in the seed cart 1. The conveyor 31 is then swiveled 180 degrees relative to the boom 53 via the attached swivel plate 36 and the swivel ring assembly 42. The lifting cylinder 64 and the boom 53 are then lowered, thus allowing the conveyor 31 to be engaged with a mating discharge hopper 71 in a companion seed cart 72 (FIG. 4) or a similar hopper 71 in a companion seed bin 73 (FIG. 5). The conveyor 31, in addition to performing an unloading function, thus also serves a dual function of allowing the seed cart 1 to be loaded from an exterior seed source, such as the cart 72 or the stationary bin 73. Of course, while the cart 72 and the bin 73 have been shown as a seed source for loading the seed cart 1, any suitable source of seed can be connected to the conveyor 31, such as a semi-trailer or railroad car, silo, etc.

IV. Hydraulic System and Control

FIG. 9 illustrates the hydraulic system and control for operation of the seed cart 1. A hydraulic pressure line 81 and a return line 82 are connected to a hydraulic pump on a pulling tractor (not shown). The lines 81 and 82 terminate in a three function solenoid valve 83 equipped with three solenoid controlled valves 84-86. The solenoid valves 84-86 are connected to a wired remote control module 91 equipped with three two-way switches 92-94 which switches 92-94 respectively control the valves 84-86. The solenoid valve 84 is connected to hydraulic line pair 95 which selectively supply and return pressurized hydraulic fluid to and from the hydraulic conveyor drive motor 58. The valve 85 is connected to line pair 96 which selectively supplies and returns pressurized hydraulic fluid to the telescoping boom 53. Finally, the valve 86 is connected to line pair 97 which selectively supplies and returns pressurized hydraulic fluid to the lifting cylinder 64. A dampening float control 101 is provided to bypass excess pressure from the lifting cylinder 64 to dampen any dramatic shifts in the position of the boom 53.

With the seed cart hydraulic system and control illustrated in FIG. 9, an operator can remotely control the lifting and lowering of the boom 53 via the lifting cylinder 64, the extension and retraction of the boom 53 itself, and the on or off state of the conveyor drive motor 58. This allows for much safer and more reliable operation of the seed cart 1 by allowing an operator positioned on the ground to achieve this three way control. It should be noted that, while the remote control module 91 has been illustrated as a wired connection, a radio linked control module could be substituted therefor.

While the cart 1 has been described herein as a bulk seed cart, it should be noted that the present invention, including the detachable, swiveling conveyor 31, can also be used advantageously with grain carts, trucks or other granular materials carriers. While the conveyor 31 has been described as a belt-type conveyor due to the relatively fragile nature of bulk seed, an auger-type conveyor could also be detachable connected in a similar fashion.

It is thus to be understood that while certain forms of the present invention have been illustrated and described herein, it is not to be limited to the specific forms or arrangement of parts described and shown.

What is claimed and desired to be secured by Letters Patent is as follows:

1. A storage and transport vehicle comprising:
 - a. a discharge point;
 - b. a storage bin connected to said discharge point;
 - c. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing; and
 - d. a conveyor support structure, said support structure including a swivel assembly attaching said conveyor housing to said support structure and also including a telescoping boom with an inner end pivotably attached to an exterior side of said bin and a cylinder attached to said boom, said swivel assembly being attached to an outer end of said boom, thus allowing said conveyor to be selectively swiveled at least 180 degrees about said outer end of said boom.
2. A vehicle as in claim 1, wherein said conveyor includes a drive motor, said vehicle further comprising a remote control which allows an operator to selectively extend and retract said telescoping boom, to selectively extend and retract said lifting cylinder, and to selectively start and stop said conveyor motor.
3. A vehicle as in claim 1, wherein said conveyor is a belt-type conveyor with an endless belt driven by said motor, said belt supporting a plurality of paddles for transporting granular material along an interior of said conveyor housing.
4. A storage and transport vehicle comprising:
 - a. a discharge point;
 - b. a storage bin connected to said discharge point;
 - c. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing; and
 - d. a conveyor support structure, said support structure including a swivel assembly attaching said conveyor housing to said support structure, said swivel assembly allowing said conveyor to be selectively swiveled at least 180 degrees about said support structure said swivel assembly comprising
 - e. a swivel plate rigidly secured about said conveyor housing; and
 - f. a swivel ring assembly pivotably attached to said support structure, said swivel ring assembly accommodating said swivel plate such that said swivel plate, and said attached conveyor, can be freely swiveled about a longitudinal axis of said conveyor housing.
5. A vehicle as in claim 4, wherein said swivel ring assembly comprises:
 - a. an upper and a lower swivel ring; and
 - b. a plurality of bearings connected between said upper and lower swivel rings, said bearings arrayed about the periphery of said swivel plate such that said swivel plate is supported by and can be swiveled relative to said bearings.
6. A storage and transport vehicle comprising:
 - a. a discharge point;
 - b. a storage bin connecting to said discharge point;
 - c. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing; and
 - d. a conveyor support structure, said support structure including a telescoping boom having an inner end pivotably attached to said bin and a swivel assembly pivotably attached proximate an outer end of said

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boom, said swivel assembly also being attached to said conveyor housing so as to allow said conveyor to be selectively swiveled at least 180 degrees relative to said telescoping boom, and a lifting cylinder attached directly to said telescoping boom, said lifting cylinder selectively lifting said boom and the attached swivel assembly and conveyor.

7. A vehicle as in claim 8, wherein said conveyor includes a drive motor, said vehicle further comprising a remote control which allows an operator to selectively extend and retract said telescoping boom, to selectively extend and retract said lifting cylinder, and to selectively start and stop said conveyor motor.

8. A vehicle as in claim 6, wherein said conveyor is a belt-type conveyor with an endless belt driven by said motor, said belt supporting a plurality of paddles for transporting granular material along an interior of said conveyor housing.

9. A storage and transport vehicle comprising:

- a. a discharge point;
- b. a storage bin connecting to said discharge point;
- c. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing; and

d. a conveyor support structure, said support structure including a telescoping boom having an inner end pivotably attached to said bin and a swivel assembly pivotably attached proximate an outer end of said boom, said swivel assembly also being attached to said conveyor housing so as to allow said conveyor to be selectively swiveled at least 180 degrees relative to said telescoping boom said swivel assembly comprising:

- i. a swivel plate rigidly secured about said conveyor housing; and
- ii. a swivel ring assembly pivotably attached to said boom, said swivel ring assembly accommodating said swivel plate such that said swivel plate, and said attached conveyor, can be freely swiveled about a longitudinal axis of said conveyor housing.

10. A conveyor system for attachment to a storage container, said storage container including a discharge point, said system comprising:

- a. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing;
- b. a conveyor support structure, said support structure including a telescoping boom with an inner end pivot-

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ably attachable to said container, and a swivel assembly pivotably attached proximate an outer end of said boom, said swivel assembly also being attached to said conveyor housing so as to allow said conveyor to be selectively swiveled at least 180 degrees relative to said telescoping boom; and

c. a lifting cylinder attached between said telescoping boom and said container.

11. A conveyor system as in claim 10, said conveyor including a drive motor, said conveyor system further comprising a remote control which allows an operator to selectively extend and retract said telescoping boom, to selectively extend and retract said lifting cylinder, and to selectively start and stop said conveyor motor.

12. A conveyor system as in claim 10, wherein said conveyor is a belt-type conveyor with an endless belt driven by said motor, said belt supporting a plurality of paddles for transporting granular material along an interior of said conveyor housing.

13. A conveyor system for attachment to a storage container, said storage container including a discharge point, said system comprising:

a. a conveyor detachably connectable to said discharge point, said conveyor including an elongate housing;

b. a conveyor support structure, said support structure including a telescoping boom with an inner end pivotably attachable to said container, and a swivel assembly pivotably attached proximate an outer end of said boom, said swivel assembly also being attached to said conveyor housing so as to allow said conveyor to be selectively swiveled at least 180 degrees relative to said telescoping boom; and

c. a lifting cylinder attached to said telescoping boom said swivel assembly comprising

- i. a swivel plate rigidly secured about said conveyor housing; and
- ii. a swivel ring assembly pivotably attached to said boom, said swivel ring assembly accommodating said swivel plate such that said swivel plate, and said attached conveyor, can be freely swiveled about a longitudinal axis of said conveyor housing.

* * * * *

EXHIBIT 3

(LIGHT BLUE)

Parts Manual

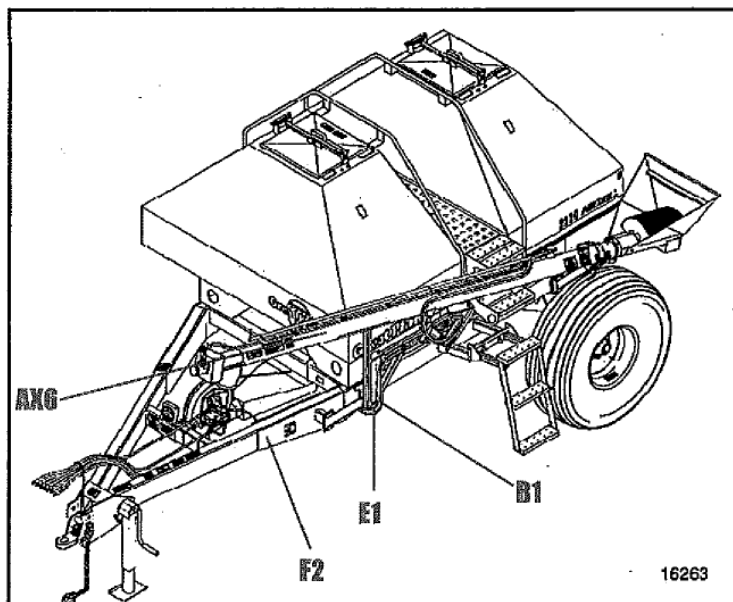
Model ADC2220
Air Drill Cart

Great Plains
Manufacturing, Inc.
P.O. Box 5060 • Salina, Kansas 67402-5060



Read the Operator's manual entirely. When you see this symbol, the subsequent instructions and warnings are serious - follow without exception. Your life and the lives of others depend on it!

Great Plains



Cover illustration may show optional equipment not supplied with standard unit.

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3) GREAT PLAINS/AIR DRILLS/AIR DRILL CARTS

167-073P

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UM-PK0000731

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1-0

General Information

General Information

Revisions to Parts Manual

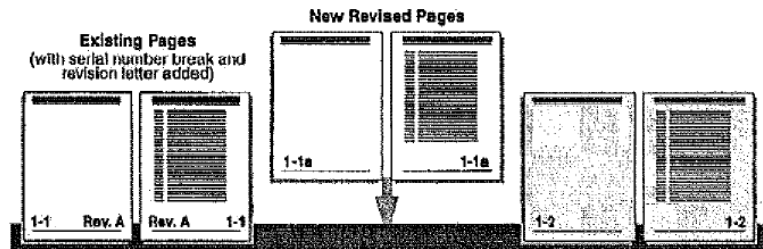
When changes to equipment become necessary, new illustrations and parts list will be sent to all Great Plains dealers. There are two types of revisions to the manual, major and minor. Please read the following for more information on these revisions.

Major Revisions:

For a major revision, serial number breaks will be added to the existing illustration and parts list while retaining the same page numbers.

A new revised illustration and parts list will be created and given the same page number as the existing illustration and parts list with the addition of a letter (a, b, c, etc.) showing which revision is most recent. Refer to Figure 1 for placement of new revised pages.

All four pages should replace/be added to your current catalogue pages as soon as they are received. Failure to do so will lead to confusion when ordering parts. Make sure to destroy obsolete pages.

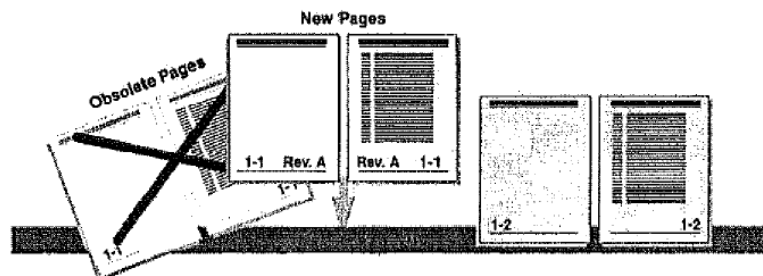


Major Revision New Page Placement
Figure 1

Minor Revisions:

For a minor revision, the existing illustration and parts list will be updated and retain their page numbers. Rev. A, B, C, etc. will be added to the bottom of the page indicating the most recent revision. Refer to Figure 2 for placement of new pages.

These new pages will replace the old ones in your current catalogue. Update your catalogue as soon as you receive the revised pages.



Minor Revision New Page Placement
Figure 2

Paint and Manual Information

Repaint parts where paint is worn or scratched to prevent rust. Aerosol beige touch-up paint is available from your dealer.

Replacement manuals are available from your dealer. Order Great Plains part 167-073P.

Replacement Hardware

All bolts and nuts are grade 5 unless otherwise noted. The use of improper grades of hardware can result in personal injury, damage to equipment, or loss of property. See "Hardware Legend" on page 1-2, for hardware abbreviations used within all parts lists.

General Information

Current Page Listing

A Current Page Listing is provided to Great Plains dealers to show the issue date of each page as a check sheet covering the entire parts manual. Your catalogue should be updated as soon as new pages are received. Failure to do so will lead to confusion when ordering parts. Make sure to destroy obsolete pages.

Page	Revision	Issue Date	Page	Revision	Issue Date
Cover	Original	5/1/97			
TOC	Original	5/1/97			
1-1	Original	5/1/97			
1-2	Original	5/1/97			
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1-6	Original	5/1/97			
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6-7	Original	5/1/97			
7-1	Original	5/1/97			
7-2	Original	5/1/97			
8-1	Original	5/1/97			

Hardware Legend

AR	As Required
BLADE	Blade Bolt
C	Cap Screw
CP	Cotter Pin
CPHSSS	Cup Point Hex Socket Set Screw
CPSHSS	Cup Point Square Head Set Screw
CPSQHSS	Cup Point Square Head Set Screw
CRFCHMS	Cross Recess Flat Countersunk Head Mach. Screw
CRPHMS	Cross Recess Pan Head Machine Screw
CRPHTF	Cross Recess Pan Head Thread Forming
CRRHMS	Cross Recess Round Head Machine Screw
CRTHMS	Cross Recess Truss Head Machine Screw
CSNB	Countersunk Square Neck Bolt
FHMS	Flat Head Machine Screw
FTC	Full Thread Cap Screw
H	Hex Nut
HCLN	Hex Center Lock Nut
HFLCS	Hex Flange Lock Cap Screw
HFS	Hex Flange Screw
HFSLN	Hex Flange Serrated Lock Nut
HFSS	Hex Flange Serrated Screw
HHCS	Hex Head Cap Screw or Metric Bolt
HSBHCS	Hex Socket Button Head Cap Screw
HSFCHCS	Hex Socket Flat Countersunk Head Cap Screw
HSCHCS	Hex Socket Head Cap Screw
HSSS	Hex Socket Head Screw
HTLN	Hex Top Lock Nut
HHWCS	Hex Washer Head Cap Screw
HHWMS	Hex Washer Head Machine Screw
HXBHCS	Hex Socket Button Head Cap Screw
J	Hex Jam Nut
JIC	37 Degree Tapered Thread
L	Helical Spring Lock Washer
LUG	Lug Bolt
NFC	National Fine Cap Screw
NPSM	National Pipe Straight Mechanical
NPTF	National Pipe Taper Fuel
P	Wide Plain Washer
PHMS	Pan Head Machine Screw
PLOW	Plow Bolt
RHMS	Round Head Machine Screw
RHSNB	Round Head Square Neck Bolt
SCREW LEVELING	Leveling Screw
SCREW THUMB	Thumb Screw
SCREW WELD	Weld Screw
SFCHMS	Slotted Flat Countersunk Head Machine Screw
SFHMS	Slotted Fillister Head Machine Screw
SP	Spool
SP SCREW	Special Screw
SQHSS	Square Head Set Screw
SRHMS	Slotted Round Head Machine Screw
SSS	Socket Set Screw
STCS	Self Tapping Cap Screw
STHMS	Slotted Truss Head Machine Screw
WHEEL	Wheel Studs and Hub Long Bolts
WING	Wing Bolt

General Information

Part Number Service Coding

Within the following parts lists some part numbers are coded for revisions and interchangeability.

Legend:

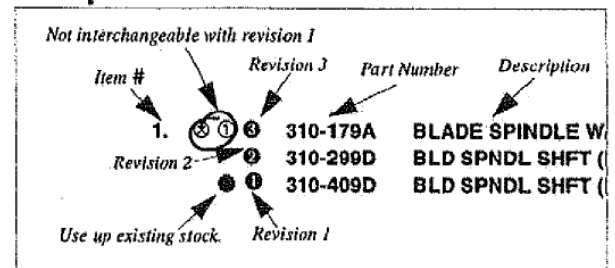
Newest serial numbers are listed first.

Bold face type indicates parts that are serviced. These parts are considered interchangeable, if it supersedes another part, unless otherwise noted.

- (S/N 20001+) Includes serial numbers 20001 and above (to the newest numbers)
- (S/N 10001↔20000) Includes serial numbers between and including 10001 and 20000
- (S/N 10000-) Includes serial numbers 10000 and below (to the oldest number)

- ① First revision, e.g.; ② is 2nd revision, ③ is 3rd revision, etc.
(Greater numbers are the newest.)
- The existing stock for this part should be used up before ordering the new part.
- ⊗ Not interchangeable
- ⊗①② Revision 2 is not interchangeable w/1

Example:



Part Number Index

The Part Number Index is a numeric index of all part numbers included in this manual. The index shows what page

or pages the part is used. With each revision a revised or addition page will be given.

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1008493	7-2	1	1284	6-4	7	166-413D	7-1	44
1000495	7-2	2	1285	6-3	5	166-451D	5-5	17
10084XX	7-1	42		6-4	5	166-463D	7-1	21
107-112D	3-1	10	15039	4-1	37	166-479D	2-3	2
1079	6-3	2	161-131D	5-1	13	166-512D	7-1	12
	6-4	2		5-3	6	167-035H	2-5	18
1084	6-3	7	166-064H	2-7	11	167-044H	2-5	33
1088-210	6-3	4	166-105H	2-1	1	167-048H	2-5	17
	6-4	4	166-106H	5-2	10	167-049H	2-5	14
1089-210	6-3	3	166-107H	5-5	6	167-050H	2-5	9
	6-4	3	166-108H	7-1	16	167-051H	2-5	8
113-164D	7-1	38	166-109H	7-1	15	167-054H	2-5	15
1132-4	6-4	8	166-110H	7-1	20	167-055L	2-6	6
116-037H	2-2	11	166-113H	7-1	26	167-063H	2-5	32
116-038H	2-2	12	166-114H	5-2	15	167-067L	2-6	5
116-042H	2-2	3	166-117H	2-7	20	167-078K	6-1	12
116-055D	2-2	13	166-118H	2-7	8		6-2	3
116-061H	2-2	2	166-119H	4-1	9	167-089A	2-5	
116-062D	2-2	15	166-120H	2-7	1	167-112D	2-5	23
116-064D	2-2	9	166-123H	7-1	28	167-171D	6-5	20
116-065D	2-2	6	166-124H	7-1	18	167-172D	2-5	27
116-066D	2-2	8	166-125H	7-1	1	167-173D	2-5	38
116-068D	2-2	4	166-126H	7-1	4	168-094D	4-1	14
116-069D	2-2	1	166-293D	7-1	30	168-123D	5-1	31
119-032D	2-7	19	166-300D	7-1	29	168-141D	4-1	5

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168-158H	5-6	37	170-034H	2-1	3		7-1	5
	5-7	37	170-058H	2-1	4	802-010C	2-7	4
168-164H	5-6	13	17089	4-1	28		5-1	3
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168-180H	4-1	30	194-070D	2-1	8		5-5	3
168-183D	5-1	31	20002	4-1	36		7-1	45
168-185H	3-1	8	204-221D	5-5	10	802-013C	5-5	15
168-186H	3-1	7	21121	4-1	29	802-014C	3-1	24
168-187D	5-6	22	23318	4-1	26		7-2	28
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168-187K	2-5	28	30102322	6-7	1		5-2	11
168-188D	5-6	26	3146A91	7-2	6		5-6	29
	5-7	26	3198A1	7-2	5		5-7	29
168-188S	3-1	14	41478	7-2	7	802-024C	6-1	4
168-189H	3-1	13	5070	6-6	4		7-2	22
168-190H	3-1	4	5075	6-6	5	802-029C	5-6	9
168-191H	5-3	1	5089	6-6	1		5-7	9
168-192H	5-3	10	5106	6-6	2	802-047C	7-1	25
168-193H	5-6	30	54008	7-2	3	802-058C	5-3	4
168-194H	5-7	30	6318C	7-2	8	802-059C	5-1	15
168-195H	5-0	35	6382C	7-2	4	802-070C	7-1	24
168-196H	5-7	35	6514A1	7-2	24	802-078C	2-5	31
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	5-7	20	800-034C	4-1	4		5-7	16
168-209D	5-6	31	800-042C	2-2	5	802-082C	7-1	9
	5-7	31	800-044C	6-1	16	802-087C	5-6	14
168-212D	5-6	2	800-046C	2-2	7		5-7	14
	5-7	2	800-051C	5-5	12	802-091C	2-6	4
168-213D	5-6	38		7-1	36	802-092C	7-2	15
	5-7	38	800-080C	5-4	6	802-115C	7-1	22
168-240D	5-1	20	800-064C	4-1	20	802-159C	2-5	11
168-243D	3-1	31	800-066C	5-6	39		2-7	14
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168-246H	5-5	8	800-088C	5-6	40		7-1	39
168-247H	5-6	4		5-7	40	802-166C	2-1	9
	5-7	4	800-179C	3-1	1	802-167C	3-1	20
168-250K	2-4	5	800-180C	4-1	22	802-172C	7-1	32
168-251D	3-1	19	800-285C	7-1	6	802-182C	2-3	6
168-269D	3-1	15	801-002C	4-1	15	802-226C	2-1	16
168-276D	5-1	6		4-1	17		2-5	13
	5-2	3	801-003C	2-5	5		7-1	2
	7-2	23	801-023C	5-6	36	802-258C	7-2	17
168-283D	5-6	3		5-7	36	802-289C	2-5	10
	5-7	3	801-035C	5-1	2	802-303C	2-3	1
168-300D	5-6	7	801-052C	2-2	16	802-317C	2-1	10
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168-308D	5-1	19		4-1	35	802-375C	4-1	18
168-323D	3-1	22		5-1	26	802-390C	2-5	24
168-354D	5-2	2	801-081C	4-1	25	802-473C	7-2	27
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	5-6	34		6-1	13		3-1	29
	5-7	34		6-5	23		4-1	34
	6-5	24		7-2	13		5-1	25
	7-2	16	804-007C	3-1	3	804-135C	2-5	26
803-008C	2-7	7		6-1	12		2-7	16
	5-1	9		6-5	22	804-136C	2-5	25
	5-2	12		7-2	20	805-023C	5-5	16
	5-6	14	804-009C	2-7	5	805-032C	5-5	1
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803-014C	2-5	6		5-2	14	805-189C	7-1	31
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	3-1	25		2-7	3	806-067C	4-1	6
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	5-2	7	804-013C	2-7	9	807-031C	7-1	37
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	5-7	18		4-1	11		5-7	23
	6-1	10		5-2	6	807-073C	2-1	17
803-015C	5-6	11		5-6	17	807-123C	5-5	11
	5-7	11		5-7	17	808-046C	5-1	14
803-019C	7-1	3		6-1	9		5-3	5
803-020C	2-1	5		7-2	19	808-062C	5-1	33
	2-6	3	804-014C	5-6	10		5-2	1
	4-1	8		5-7	10	808-125C	5-1	1
	6-5	25	804-015C	2-1	6	808-191C	5-2	16
	7-1	11		2-6	2	808-192C	3-1	30
803-021C	5-1	10		4-1	7	808-237C	5-1	16
	5-3	9		6-5	26	809-009C	5-3	11
803-027C	7-1	14		7-1	10	809-065C	5-2	6
803-030C	5-6	24	804-017C	2-1	15	809-188C	5-1	17
	5-7	24		2-6	1	809-189C	5-1	29
803-034C	2-1	14	804-021C	5-1	12	809-190C	5-2	17
803-064C	2-5	35		5-3	7	809-191C	5-3	3
	3-1	26	804-022C	5-1	11	809-192C	5-1	29
	4-1	31		5-3	8	810-037C	6-2	9
	5-1	22	804-023C	7-1	13	810-267C	7-2	10
803-078C	7-2	21	804-025C	5-5	5	810-268C	6-1	22
803-084C	7-2	14	804-028C	2-3	11		6-4	1
803-095C	2-3	12	804-029C	7-1	19		7-1	33
803-147C	2-5	12	804-030C	2-1	13	810-273C	4-1	13
	7-2	12	804-036C	2-5	20		6-2	13
803-219C	2-3	8		2-7	15	810-274C	6-1	7
	2-4	2		5-5	13		6-3	1
803-230C	4-1	21		7-1	40	810-345C	6-5	4
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804-004C	2-5	2		3-1	28	810-348C	6-5	16
						810-349C	6-5	1

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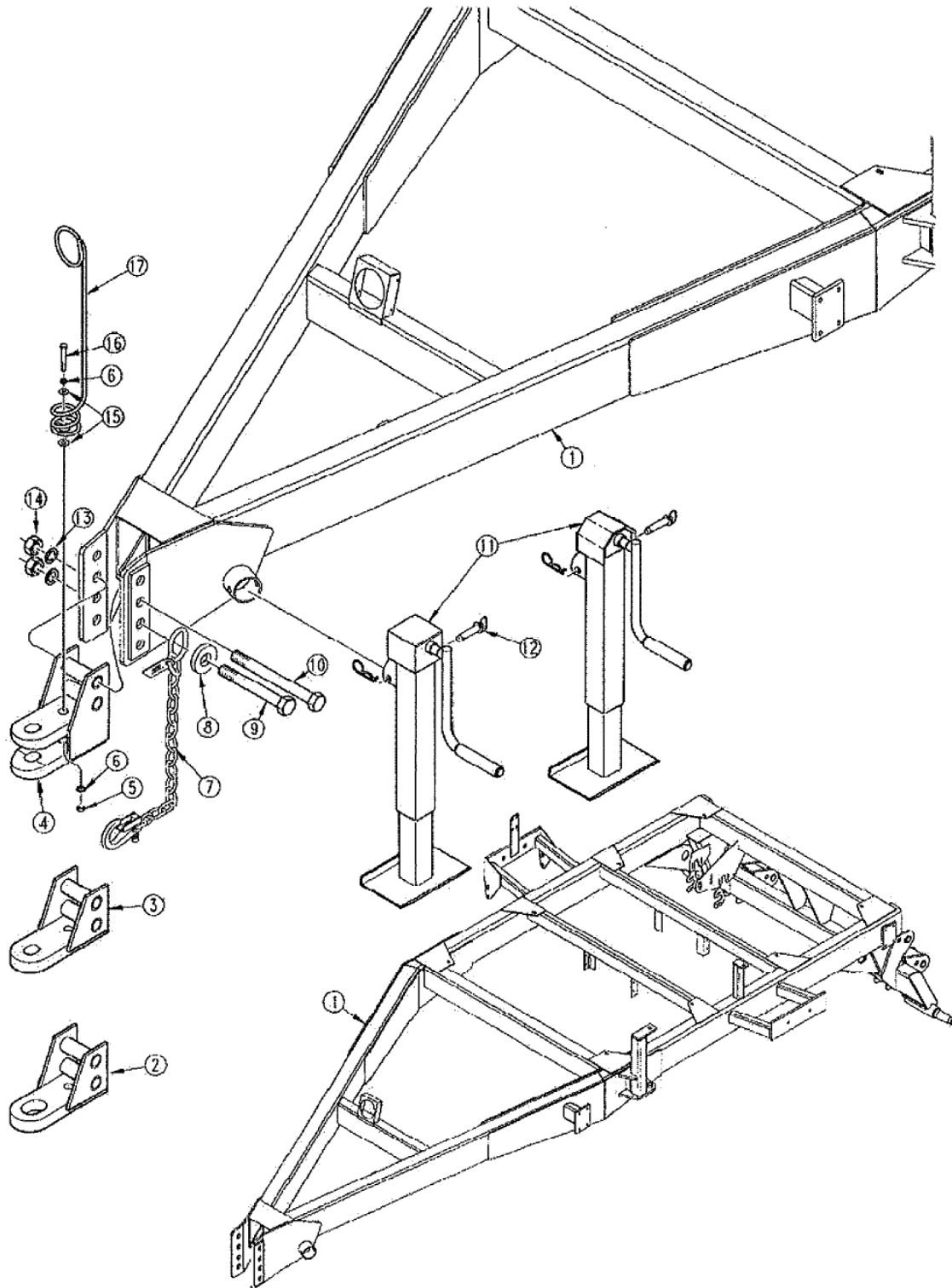
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811-077C	6-2	7	817-255C	6-3	6	835128	7-2	11
811-078C	6-5	2		6-4	6	85020105	6-7	2
811-079C	6-5	6		7-1	27	890-277C	2-3	13
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811-170C	6-5	12	818-557C	8-1	13	890-471C	4-1	1
811-192C	6-1	13	818-560C	8-1	14	890-472C	4-1	2
811-195C	6-2	5	818-594C	8-1	24	990-024R	5-6	12
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811-282C	6-5	3	818-597C	8-1	25	CP2-10	6-6	3
811-324C	6-1	14	818-598C	8-1	22	P602122	2-3	3
811-416C	6-5	17	818-620C	8-1	7	P758400-8	2-3	17
811-488C	6-1	15	818-622C	8-1	6	P758401-8	2-3	7
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811-516C	6-2	1	818-627C	8-1	3	VA-111004-2	5-1	21
811-548C	6-1	5		8-1	17	VA-278000	3-1	33
811-582C	6-5	14	818-628C	8-1	31	VA-278001	5-1	24
811-627C	6-5	11	818-630C	8-1	12	VA-291000	4-1	33
811-649C	6-1	17	818-632C	8-1	18	VA-294000	2-5	34
811-650C	6-1	1	818-633C	8-1	1	VA-490001	5-4	1
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811-666C	6-1	8	818-653C	8-1	9	VA-490702	5-4	5
811-678C	6-5	7	818-654C	8-1	8			
811-679C	6-2	2	818-667C	8-1	10			
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816-199C	3-1	11		5-2	5			
816-201C	3-1	5	822-074C	5-6	8			
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817-007C	2-5	3	822-106C	2-3	4			
817-018C	3-1	18	822-107C	2-3	5			
817-056C	5-5	7	822-115C	2-3	9			

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[illegible]

Hitch and Frame Assembly



16032

2-1

Model ADC2220 Air Drill Cart 167-073P

5/1/97

UM-PK0000740

Hitch and Frame Assembly

Ref.	Part No.	Part Description	Comments
1.	166-105H	2220 CART FRAME WELDMENT	
2.	170-033H	SINGLE HITCH STRAP-LARGE	
3.	170-034H	SINGLE HITCH STRAP-SMALL	
4.	170-058H	FOLDING DRILL CLEVIS HITCH	
5.	803-020C	NUT HEX 1/2-13 PLT	
6.	804-015C	WASHER LOCK SPRING 1/2 PLT	
7.	890-398C	SAFETY CHAIN 40000 LB	
8.	194-070D	SAFETY CHAIN WASHER	
9.	802-166C	HHCS 1 1/4-7X9 1/2 GR5 SPTH	
10.	802-317C	HHCS 1 1/4-7X11 GR5 SPTH	
11.	⊗ 890-610C	SQ TB JACK 10000 LB 10 STROKE	(S/N Y1010+)
	Ⓢ 116-065K	JACK REPLACED BY 890-610C	(S/N Y1000↔Y1009)
12.	805-081C	PIN HITCH 3/4 X 4 3/8	
13.	804-030C	WASHER LOCK 1 1/4 SPRING PLT	
14.	803-034C	NUT HEX 1 1/4-7 PLT	
15.	804-017C	WASHER FLAT 1/2 USS PLT	
16.	802-226C	HHCS 1/2-13X2 3/4 GR5	
17.	807-073C	SPRING HOSE LOOP HEAVY	

Legend: Ⓢ = 1st revision; ⊗ = 2nd revision; ⊕ = 3rd revision; ⊕ = use up existing stock; ⊗ ⊕ = not interchangeable; ⊗ ⊕ = for example: revision 2 is not interchangeable w/revision 1

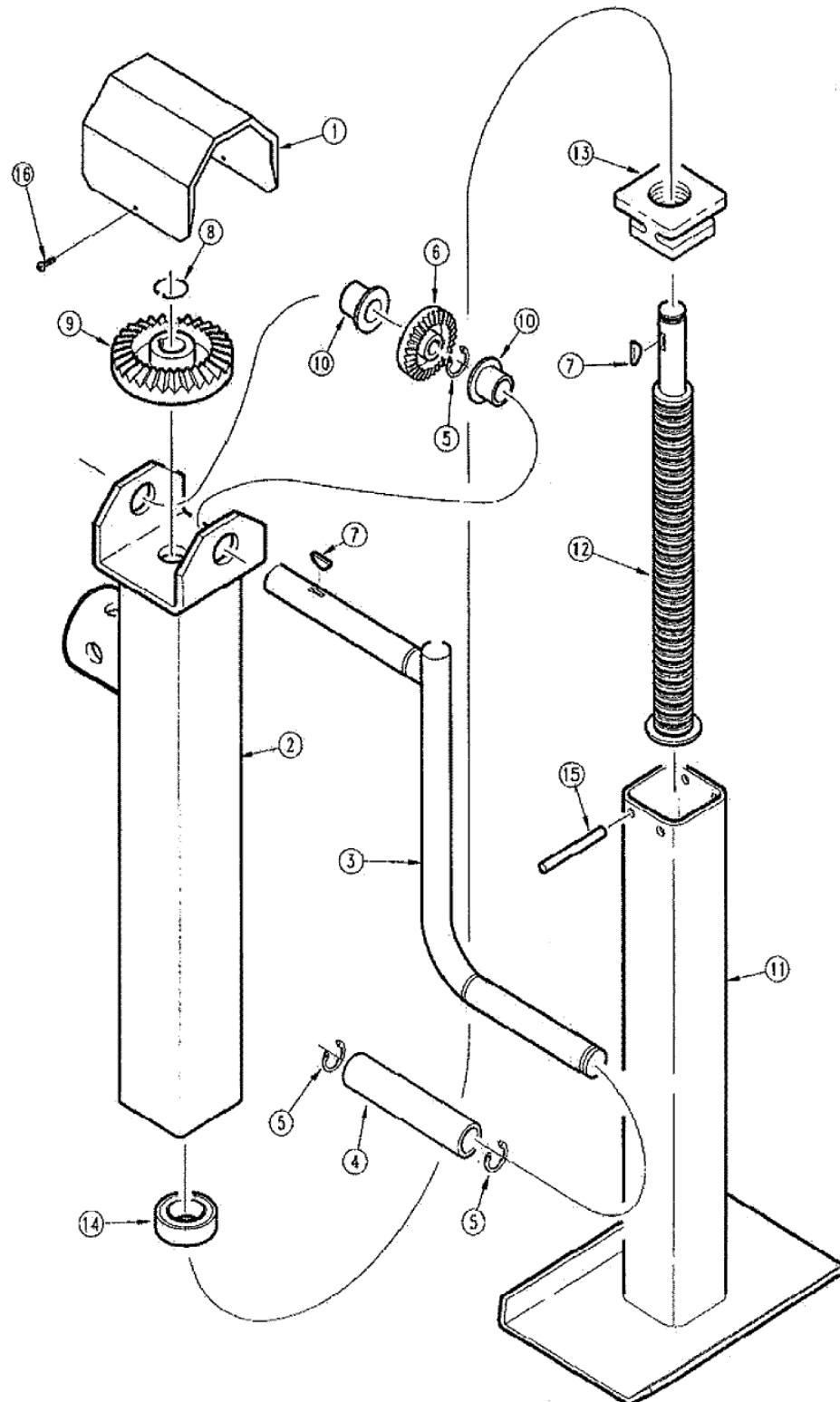
5/1/97

Model ADC2220 Air Drill Cart 167-073P

2-1

UM-PK0000741

Rotating Square Jack (116 065K) (S/N Y1000-Y1009)



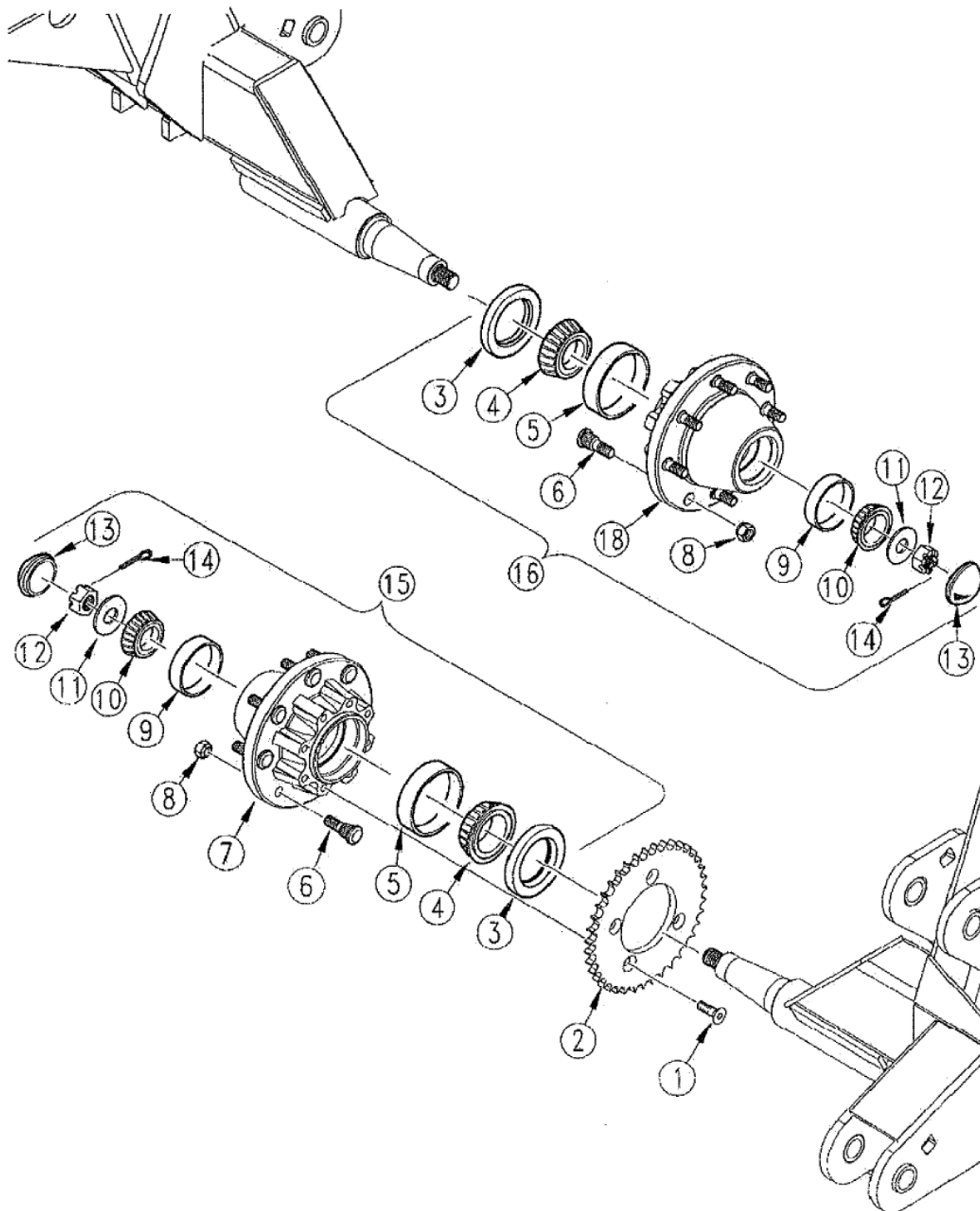
10510

Rotating Square Jack (116-065K) (S/N Y1000-Y1009)

Ref.	Part No.	Part Description	Comments
1.	116-069D	JACK LID	
2.	116-061H	ROTATING JACK HOUSING	
3.	116-042H	ROTATING JACK CRANK HANDLE	
4.	116-068D	JACK CRANK HAND GRIP	
5.	800-042C	EXTERNAL E RING 3/4 I.D.	
6.	116-065D	BEVEL GEAR 15T 7 PITCH 26.6 PA	
7.	800-046C	WOODRUFF KEY #606	
8.	116-066D	JACK CRANK BUSHING	
9.	116-064D	BEVEL GEAR 30T 7 PITCH 63.4 PA	
10.	800-015C	SNAP RING EXT .750 .078 T	
11.	116-037H	JACK LEG WITH FOOT	
12.	116-038H	JACK SCREW WITH STOP	
13.	116-055D	JACK NUT	
14.	822-055C	BANDED THRUST BRG 3/4 I.D.	
15.	116-062D	JACK NUT PIN	
16.	801-052C	SCR P.H. 8X3/8 TYPEB THD FORM	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥ ⑦ = for example: revision 2 is not interchangeable w/revision 1

Left and Right Hubs



10034

Left and Right Hubs

Ref.	Part No.	Part Description	Comments
1.	02-303C	HSFCHCS 1/2-20X1 1/4 BLK	
2.	166-479D	SPROCKET, 2220 MAIN DRIVE	
3.	P602122	ARMSTRONG SEAL 815-075C, -076C	
4.	822-106C	BEARING CONE 2.25 ID 387	
5.	822-107C	BEARING CUP 2.25 ID 382A	
6.	802-182C	HUB STUD 5/8-18X2 3/8 GR5	
7.	P758401-8	ARMSTRONG DRIVE HUB 815-076C	
8.	803-219C	NUT LUG 5/8-18 X 90 DEG PLT	
9.	822-115C	BEARING CUP LM501310	
10.	822-048C	BEARING CONE #LM 501349	
11.	804-028C	WASHER FLAT 1 USS	
12.	803-095C	NUT HEX SLOTTED 1-14	
13.	890-277C	GREASE CAP 3.125 X .38	
14.	805-060C	PIN COTTER 7/32 X 2	
15.	815-076C	HUB ASS'Y 8 BOLT W/BRAKE HOLES	
16.	815-075C	HUB ASSEMBLY 8 BOLT 6 PILOT	
17.	P758400-8	ARMSTRONG HUB MACH. 815-075C	

Legend: ● = 1st revision; ○ = 2nd revision; ○ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ○ = for example: revision 2 is not interchangeable w/revision 1

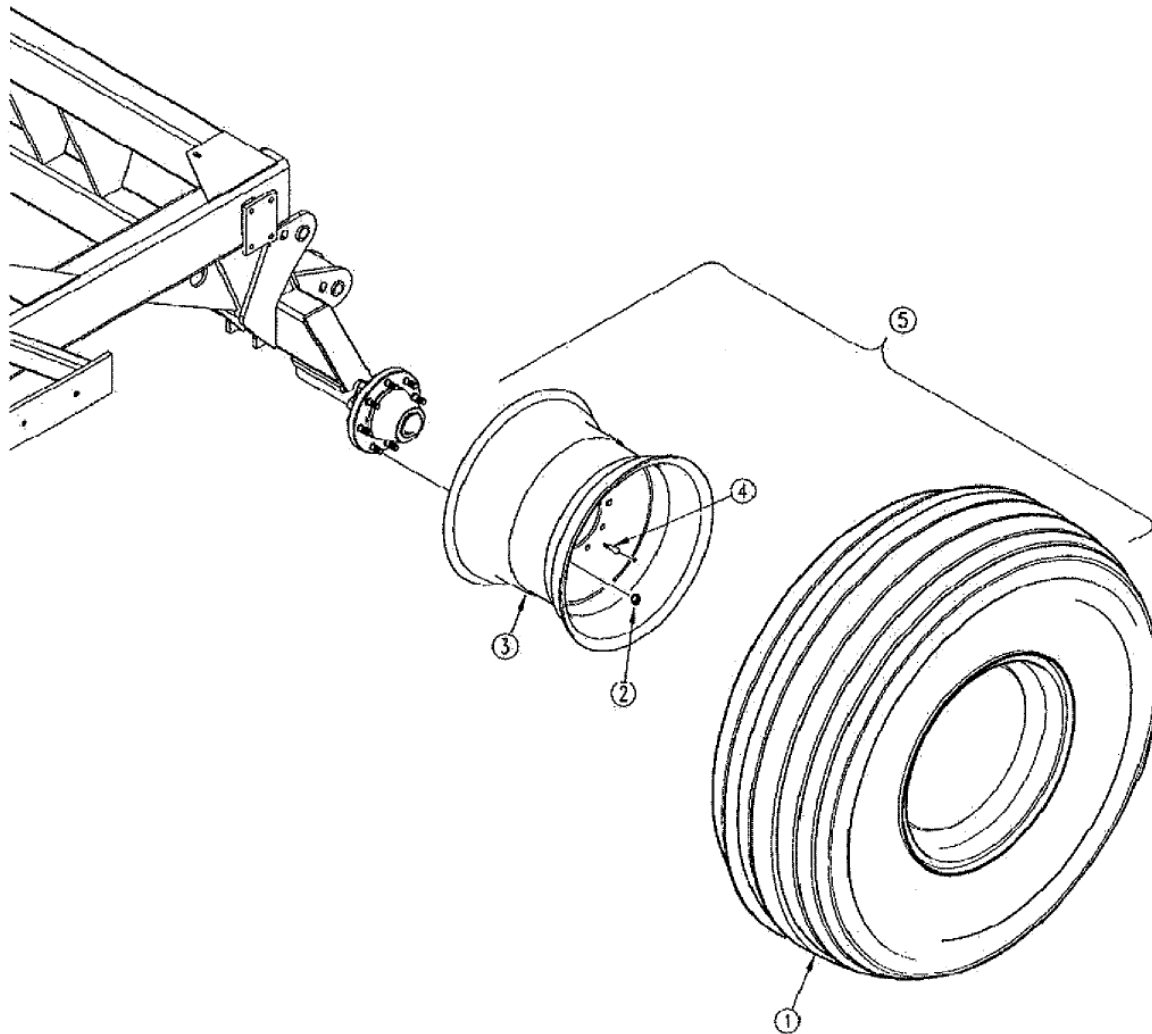
5/1/97

Model ADC2220 Air Drill Cart 167-073P

2-3

UM-PK0000745

Hub and Wheel



16038

Hub and Wheel

Ref.	Part No.	Part Description	Comments
1.	814-156C	TIRE 21.5L-16.1SL 10 PLY	
2.	803-219C	NUT LUG 5/8-18 X 90 DEG PLT	
3.	814-155C	WHEEL W16C X 16.1 8 BOLT	
4.	816-035C	VALVE STEM TR415X.625X1 1/4 LG	
5.	168-250K	WHEEL AND TIRE ASSY 21.5X16.1	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ① ⊗ = for example: revision 2 is not interchangeable w/revision 1

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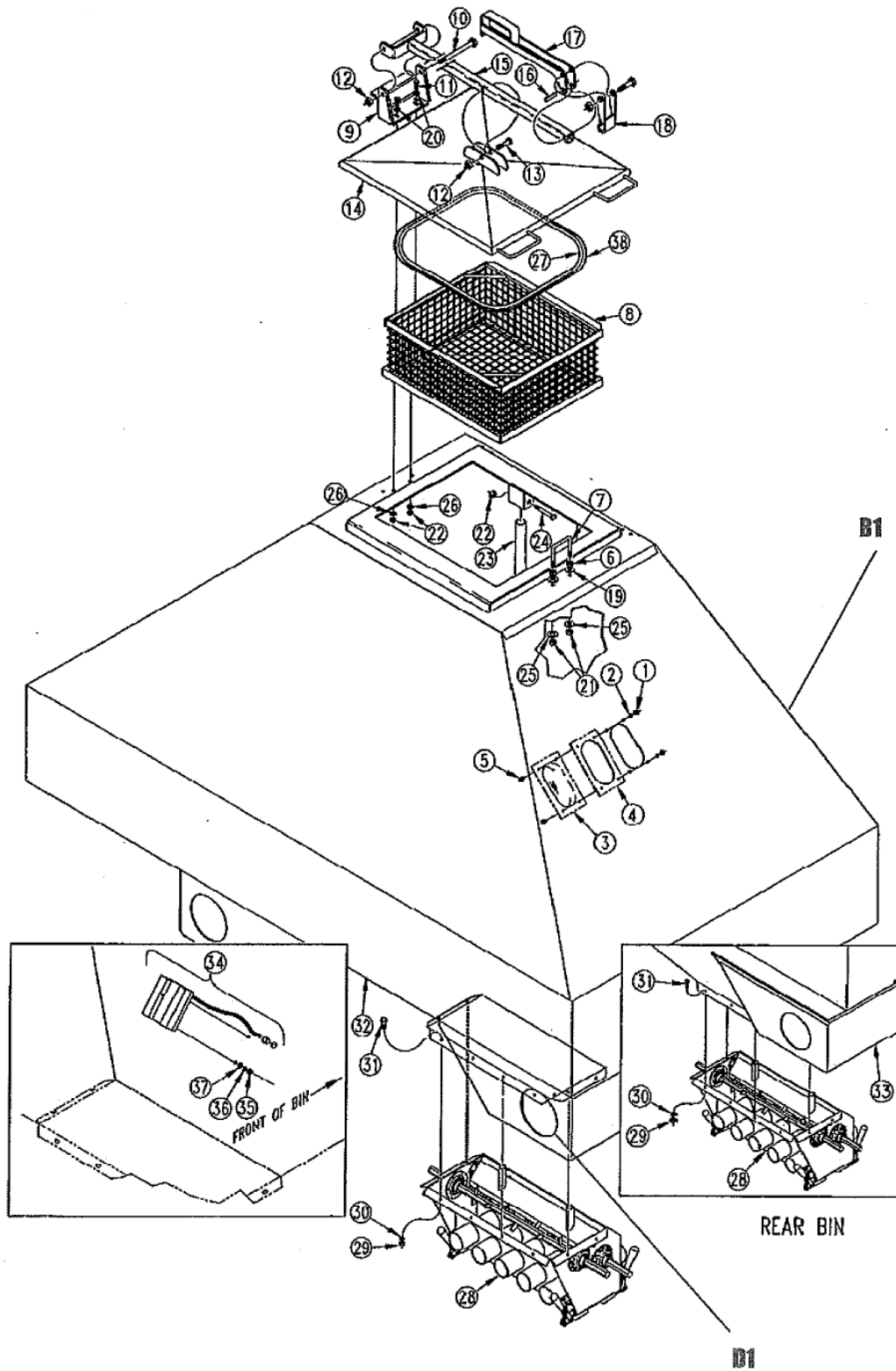


Model ADC2220 Air Drill Cart 167-073P

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UM-PK0000747

Bin Assembly



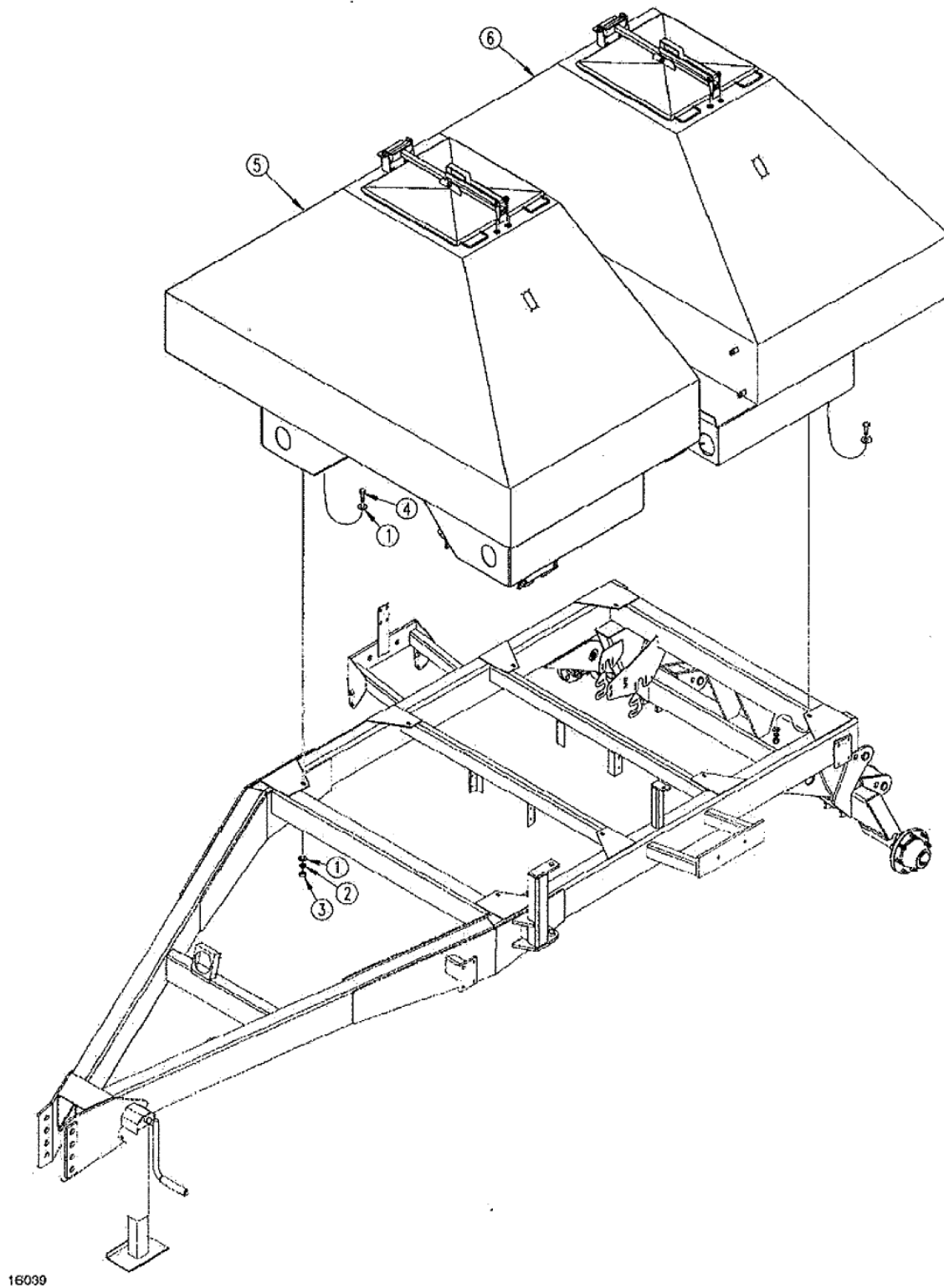
16137

Bin Assembly

Ref.	Part No.	Part Description	Comments
1.	803-001C	NUT HEX 10-24 PLT	
2.	804-004C	WASHER INTERNAL STAR #10 PLT	
3.	817-007C	GRAIN LEVEL SIGHT GLASS	
4.	816-013C	SIGHT GLASS GASKET	
5.	801-003C	SCREW RD HD SLT 10-24X1/2 PLT	
6.	803-014C	NUT HEX 3/8-16 PLT	
7.	806-077C	U-BOLT 3/8-16 X 2 5/8 X 2 3/4	
8.	167-051H	AIR DRILL HOPPER BASKET	
9.	167-050H	AIR DRILL BIN LID HINGE	
10.	802-289C	HHCS 1/2-13X8 GR5	
11.	802-159C	HHCS 5/16-18X1 GR5	
12.	803-147C	NUT HEX NYLOCK 1/2-13	
13.	802-226C	HHCS 1/2-13X2 3/4 GR5	
14.	167-049H	AIR DRILL BIN LID	
15.	167-054H	BIN LID PIVOT BAR WELDMENT	
16.	805-169C	PIN ROLL 1/2 X 1 3/4	
17.	167-048H	AIR DRILL BIN LID HANDLE WLMNT	
18.	167-035H	AIR DRILL BIN LID HOOK	
19.	804-012C	WASHER FLAT 3/8 SAE PLT	
20.	804-036C	WASHER FLAT 5/16 SAE PLT	
21.	803-013C	NUT LOCK 3/8-16 PLT	
22.	803-011C	NUT LOCK 5/16-18 PLT	
23.	167-112D	PRESSURE RELIEF PIPE	
24.	802-390C	HHCS 5/16-18X3 1/4 GR5	
25.	804-136C	WASHER FLAT 3/8 NEOPRENE PLT	
26.	804-135C	WASHER FLAT 5/16 NEOPRENE PLT	
27.	167-172D	AIR DRILL BIN LID SEAL	
28.	168-187K	METERING BOX ASSEMBLY	
29.	803-006C	NUT HEX 1/4-20 PLT	
30.	804-006C	WASHER LOCK SPRING 1/4 PLT	
31.	802-078C	HHCS 1/4-20X5/8 GR5	
32.	167-063H	100 BU REAR BIN WELDMENT	
33.	167-044H	100 BUSHEL BIN WELDMENT	
34.	VA-294000	VANSCO SMART BIN LEVEL SENSOR	
35.	803-064C	NUT HEX 8-32	
36.	804-043C	WASHER LOCK #8	
37.	804-088C	WASHER FLAT #8 SAE PLT	
38.	167-173D	BIN LID SEAL UPDATE SPACER	
	167-089A	BIN LID SEAL FIELD UPDATE KIT	Includes items 27 & 36

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ⊙ = for example: revision 2 is not interchangeable w/revision 1

Bin to Frame



Bin to Frame

Ref.	Part No.	Part Description	Comments
1.	804-017C	WASHER FLAT 1/2 USS PLT	
2.	804-015C	WASHER LOCK SPRING 1/2 PLT	
3.	803-020C	NUT HEX 1/2-13 PLT	
4.	802-091C	HHCS 1/2-13X1 1/2 GR5	
5.	167-067L	100 BU REAR BIN ASSEMBLY	
6.	167-055L	100 BUSHEL BIN ASSEMBLY '95	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ① ② = for example: revision 2 is not interchangeable w/revision 1

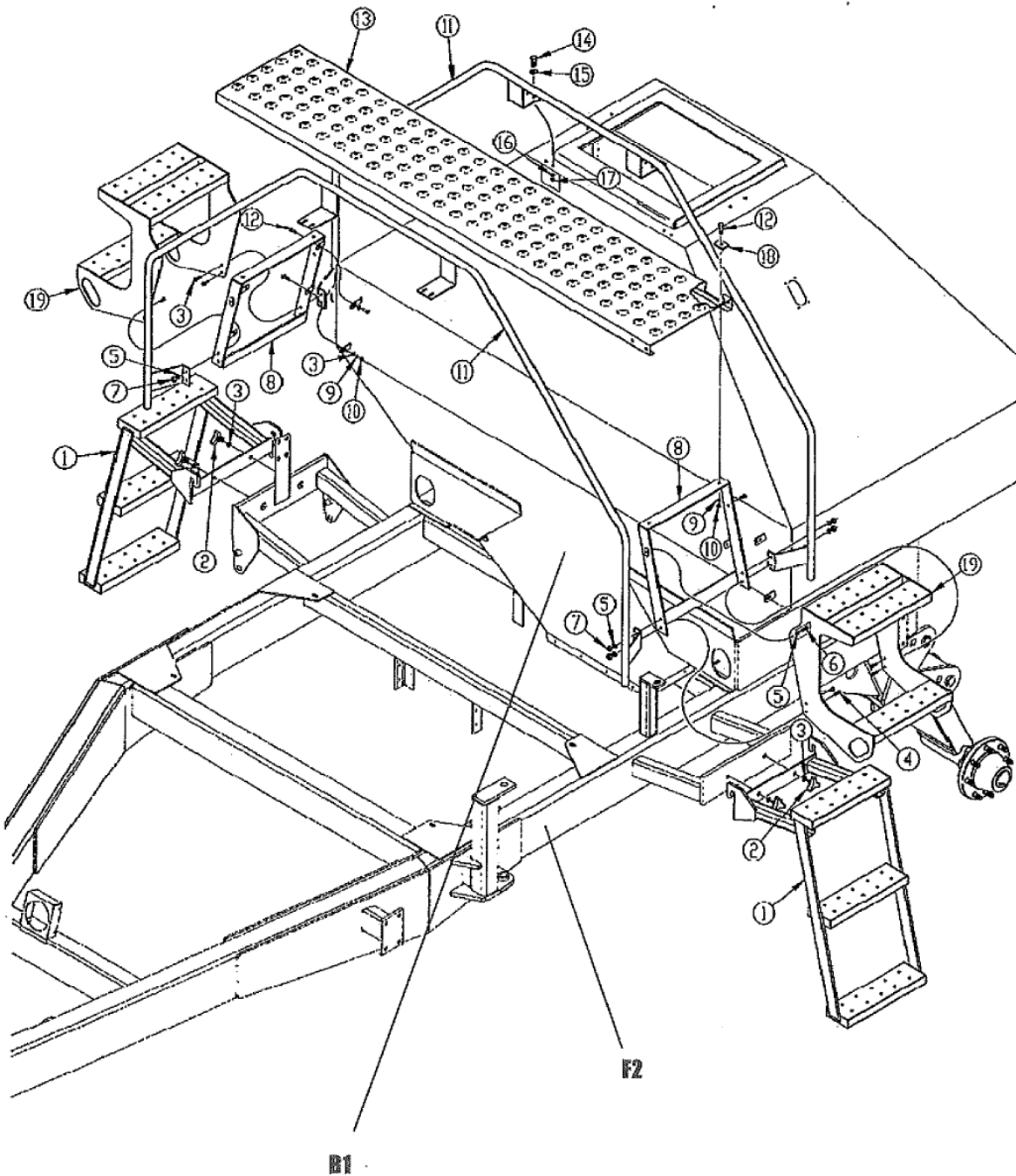
5/1/97

Model ADC2220 Air Drill Cart 167-073P

2-6

UM-PK0000751

Step and Handrail



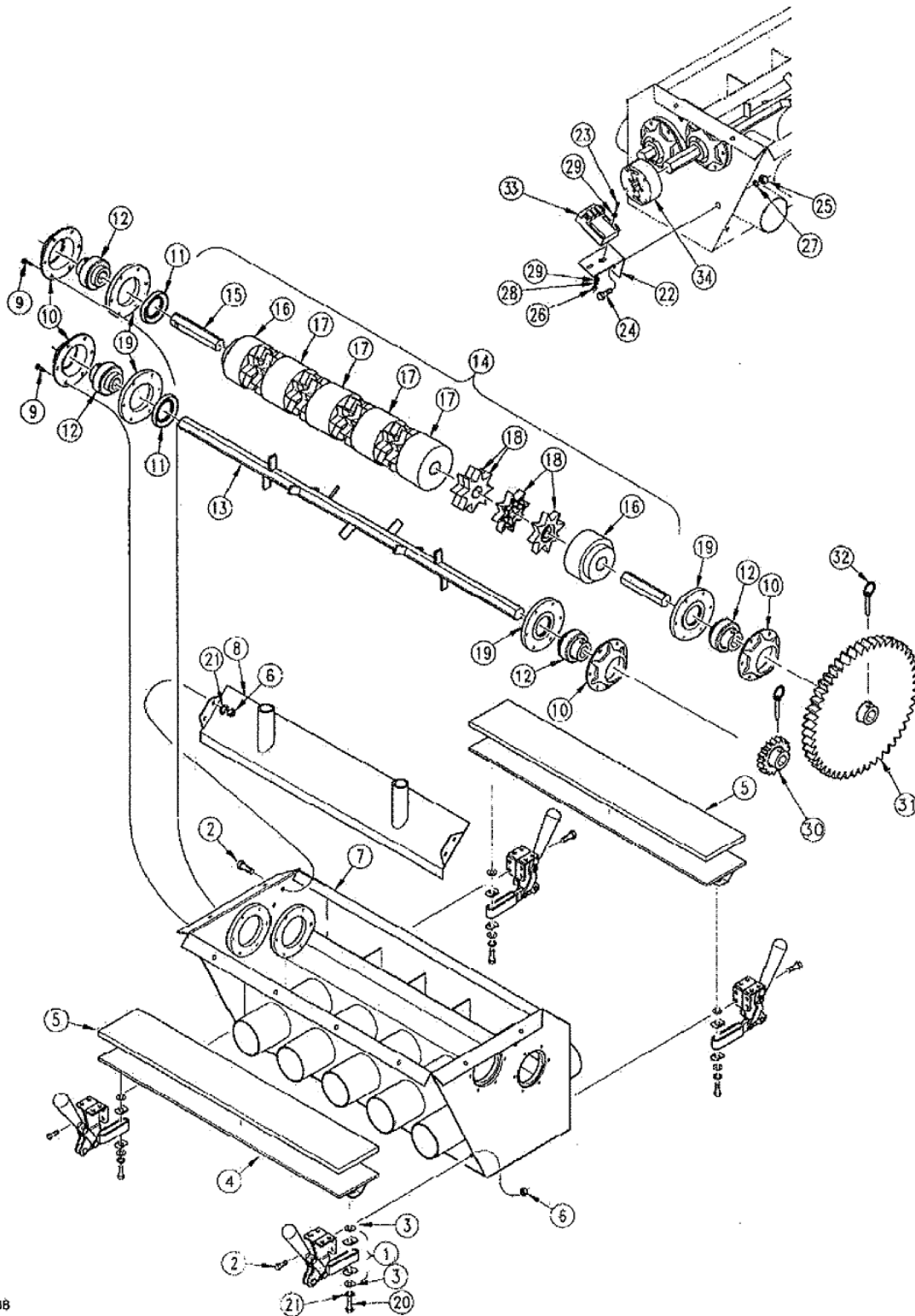
16043

Step and Handrail

Ref.	Part No.	Part Description	Comments
1.	166-120H	2220 LOWER LADDER WELDMENT	
2.	817-131C	KNOB, TRANS. SHIELD	
3.	804-012C	WASHER FLAT 3/8 SAE PLT	
4.	802-010C	HHCS 5/16-18X1 1/4 GR5	
5.	804-009C	WASHER LOCK SPRING 5/16 PLT	
6.	802-007C	HHCS 5/16-18X3/4 GR5	
7.	803-008C	NUT HEX 5/16-18 PLT	
8.	166-118H	2220 UPPER LADDER MNT WLDMNT	
9.	804-013C	WASHER LOCK SPRING 3/8 PLT	
10.	803-014C	NUT HEX 3/8-18 PLT	
11.	166-064H	AIR DRILL HANDRAIL WELDMENT	
12.	802-017C	HHCS 3/8-16X1 GR5	
13.	119-155D	WALKBOARD 3 PT 15'	
14.	802-159C	HHCS 5/16-18X1 GR5	
15.	804-036C	WASHER FLAT 5/16 SAE PLT	
16.	804-135C	WASHER FLAT 5/16 NEOPRENE PLT	
17.	803-011C	NUT LOCK 5/16-18 PLT	
18.	119-032D	3-PT STEP RETAINER	
19.	166-117H	2220 UPPER LADDER WELDMENT	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥⑦ = for example: revision 2 is not interchangeable w/revision 1

Meterbox



16138

Meterbox

Ref.	Part No.	Part Description	Comments
1.	800-179C	DESTACO HOLD DOWN ACTION CLAMP	
2.	802-078C	HHCS 1/4-20X5/8 GR5	
3.	804-007C	WASHER FLAT 1/4 SAE PLT	
4.	168-180H	CALIBRATION LID WELDMENT	
5.	816-201C	METERING BOX ACCESS SEAL	
6.	803-006C	NUT HEX 1/4-20 PLT	
7.	168-186H	METERING BOX WELDMENT	
8.	168-185H	METERING BOX TOP PANEL WELDMNT	
9.	801-104C	HWHSTS #10-24 X 1 TYPE F	
10.	107-112D	BEARING FLANGE-3/16 DIA HOLES	
11.	816-199C	METERING BOX BEARING SEAL	
12.	188-009V	BEARING .755 HEX BORE W/S-S	
13.	168-189H	AGITATOR SHAFT WELDMENT	
14.	168-188S	METERING BOX STAR SHAFT ASSY	
15.	168-269D	METER SHAFT	
16.	817-207C	METERING BOX END SPACER	
17.	817-206C	METERING BOX MIDDLE SPACER	
18.	817-018C	AGITATOR 8 POINT HALF	
19.	168-251D	METERING BOX SEAL FLANGE	
20.	802-167C	HHCS 1/4-20X1 1/2 GR5	
21.	804-003C	WASHER FLAT #8 BRASS	
22.	168-323D	MONITOR SWITCH MOUNT BKT	
23.	801-067C	SCREW RD HD 8-32 X 1 LG PLT	
24.	802-014C	HHCS 3/8-16X3/4 GR5	
25.	803-014C	NUT HEX 3/8-16 PLT	
26.	803-064C	NUT HEX 8-32	
27.	804-013C	WASHER LOCK SPRING 3/8 PLT	
28.	804-043C	WASHER LOCK #8	
29.	804-088C	WASHER FLAT #8 SAE PLT	
30.	808-192C	GEAR 17 TOOTH QUICK CHANGE	
31.	168-243D	GEAR 54 TOOTH QUICK CHANGE	
32.	805-158C	PIN LYNCH 5/16 X 2 11/32	
33.	VA-278000	VANSCO SMART SHAFT SENSOR	
34.	VA-111004-2	2 MAGNET ACTUATOR 3/4 HEX	

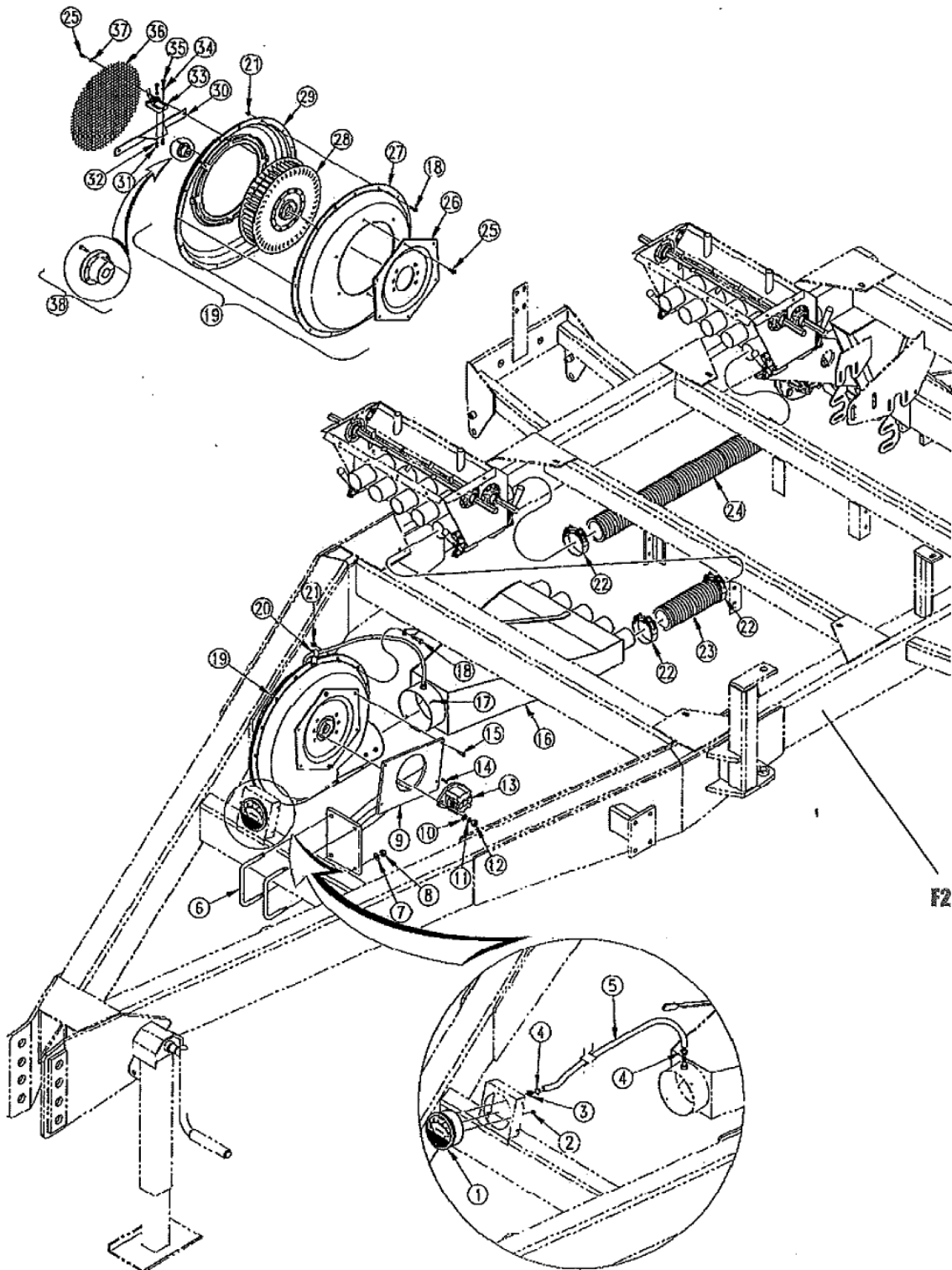
Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥ ⑦ ⑧ = for example; revision 2 is not interchangeable w/revision 1

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Model ADC2220 Air Drill Cart 167-073P

3-1

Fan and Transition



16052

Fan and Transition

Ref.	Part No.	Part Description	Comments
1.	890-471C	MAGNEHELIC PRES GAGE-0-50inH2O	
2.	890-472C	BREATHER FILTER VENT 1/8 NPT	
3.	830-276C	AD 1/8MNPT X 1/4HB BRASS	
4.	800-034C	CLAMP HOSE 9/16 DIA.	
5.	168-141D	AIR GAUGE HOSE 36	
6.	806-067C	U-BOLT 1/2-13 X 6 1/32 X 4 1/4	
7.	804-015C	WASHER LOCK SPRING 1/2 PLT	
8.	803-020C	NUT HEX 1/2-13 PLT	
9.	166-119H	2220 FAN MOUNT WELDMENT	
10.	804-012C	WASHER FLAT 3/8 SAE PLT	
11.	804-013C	WASHER LOCK SPRING 3/8 PLT	
12.	803-014C	NUT HEX 3/8-16 PLT	
13.	810-273C	HYD MOTOR 7/8ORBF	
14.	168-094D	HYD MOTOR 1/8 KEY	
15.	801-002C	SCREW HEX SLT10-16X3/8P.THD CT	
16.	168-205H	FAN OUTLET TRANSITION	
17.	801-002C	SCREW HEX SLT10-16X3/8P.THD CT	
18.	802-375C	HFSS 1/4-20X1 GR5	
19.	890-395C	6 HYDRAULIC FAN KIT W/ SCREEN	
20.	800-064C	HOSE CLIP 13/16 ID	
21.	803-230C	NUT HEX FLANGE 1/4-20 PLT	
22.	800-180C	2 1/2 AIR HOSE BAND CLAMP	
23.	168-364D	2 1/2 INCH AIR HOSE 21 1/2 LG	
24.	168-363D	2 1/2 INCH AIR HOSE 34 LG	
25.	801-081C	SCREW HEX SELF TAP 1/4-20X3/4	
26.	23318	HYDRAULIC MOTOR MOUNT PLATE	
27.	23320	6 FAN HOUSING LH SIDE	
28.	17089	13 FAN IMPELLER	
29.	21121	6 FAN HOUSING RH SIDE	
30.	168-180H	AIR DRILL FAN SENSOR BRACKET	
31.	803-064C	NUT HEX 8-32	
32.	804-043C	WASHER LOCK #8	
33.	VA-291000	VANSCO SMART FAN SPEED SENSOR	
34.	804-088C	WASHER FLAT #8 SAE PLT	
35.	801-067C	SCREW RD HD 8-32 X 1 LG PLT	
36.	20002	3/8 MESH FAN SCREEN	
37.	15039	FLAT WASHER 1/4	
38.	890-396C	BUSHING - FAN	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ② = for example: revision 2 is not interchangeable w/revision 1

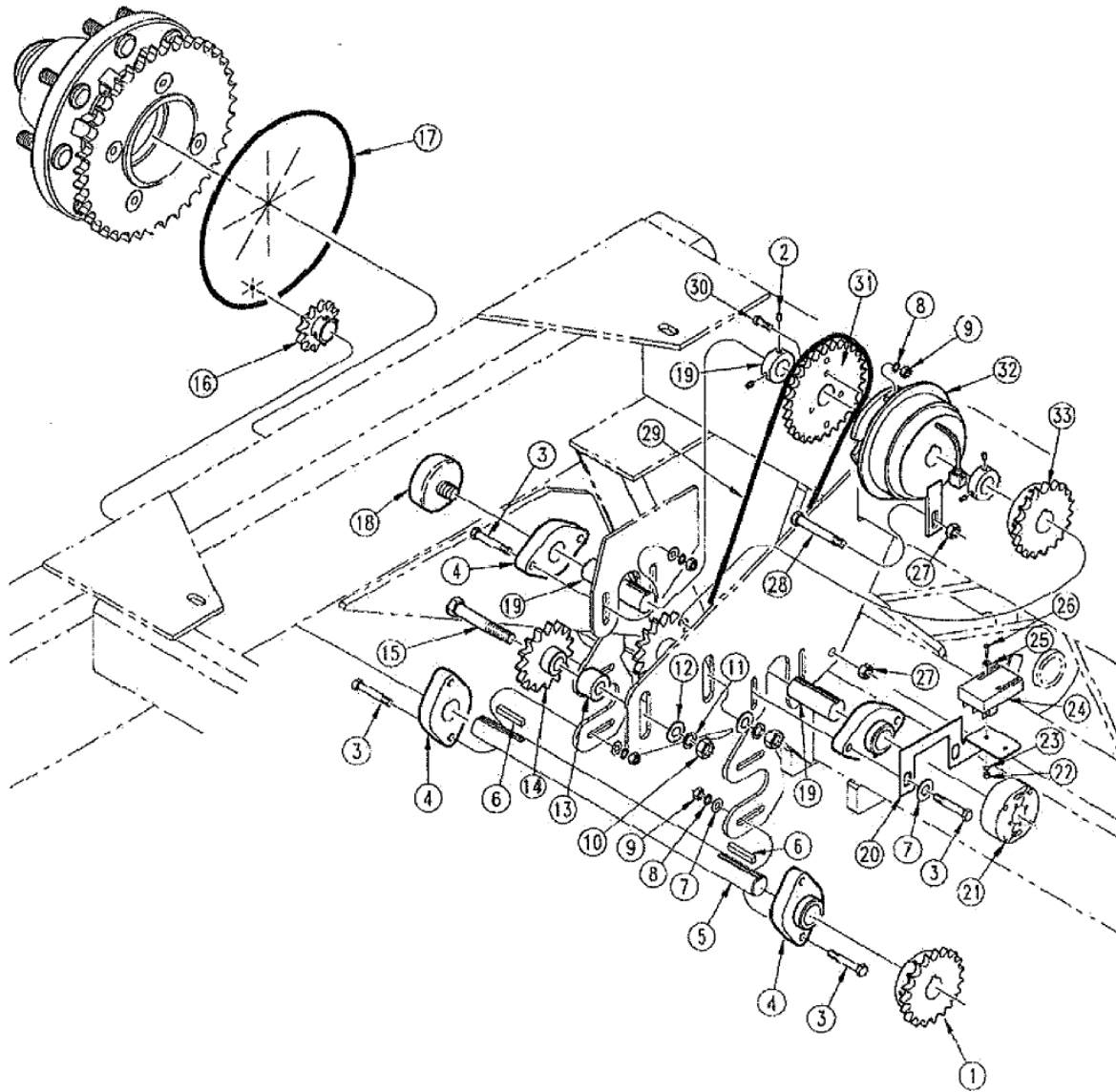
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Model ADC2220 Air Drill 167-073P

4-1

UM-PK0000757

Drive Wheel to Electric Clutch

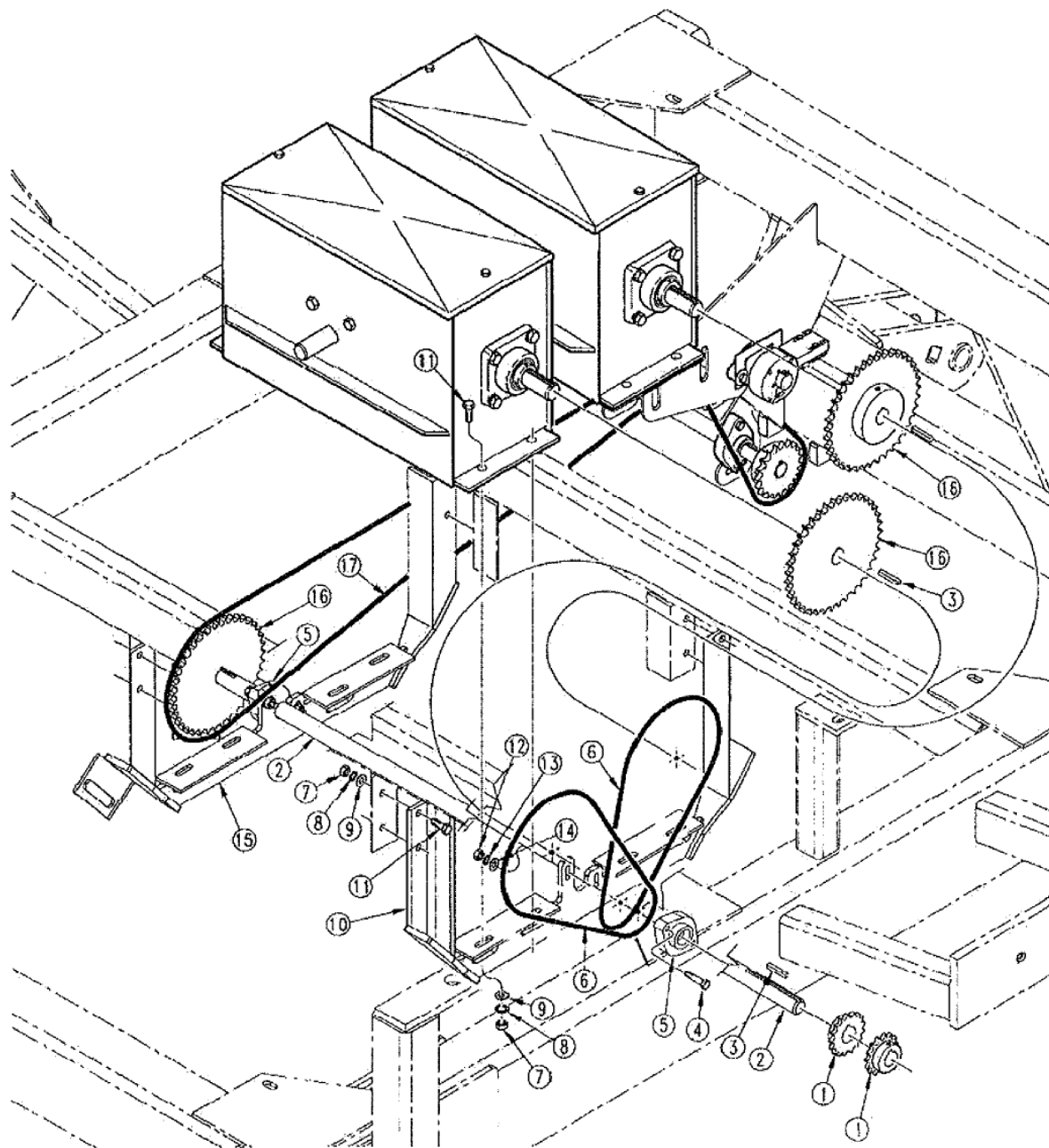
16087

Drive Wheel to Electric Clutch

Ref.	Part No.	Part Description	Comments
1.	808-125C	SPKT 40B19X1 B MAX .875 THRU	
2.	801-035C	SCREW SET 5/16-18 SKT KP X 3/8	
3.	802-010C	HHCS 5/16-18X1 1/4 GR5	
4.	822-073C	BEARING 2 BOLT CAM LOCK 1 BORE	
5.	168-355D	2220 MAIN DRIVE SHAFT	
6.	168-276D	KEY 1/4 X 1/4 X 1 3/8 LG	
7.	804-010C	WASHER FLAT 5/16 USS PLT	
8.	804-009C	WASHER LOCK SPRING 5/16 PLT	
9.	803-008C	NUT HEX 5/16-18 PLT	
10.	803-021C	NUT HEX 5/8-11 PLT	
11.	804-022C	WASHER LOCK SPRING 5/8 PLT	
12.	804-021C	WASHER FLAT 5/8 SAE PLT	
13.	161-131D	SPEED CHANGE SPACER	
14.	808-046C	SPKT 40A17 IDLER	
15.	802-059C	HHCS 5/8-11X3 GR5	
16.	808-237C	SPKT 60B11 X 1 BORE W/KW & SS	
17.	809-188C	CHAIN DOUBLE RL #60-2X39PI W/C	
18.	890-437C	ACRE METER AIR DRILL 2220	
19.	168-308D	AIR DRILL CLUTCH SHAFT	
20.	168-240D	METER SHAFT SENSOR MNT BRACKET	
21.	VA-111002-2	2 MAGNET ACTUATOR	
22.	803-064C	NUT HEX 8-32	
23.	804-043C	WASHER LOCK #8	
24.	VA-278001	VANSCO SMART GND SPD SENSOR	
25.	804-088C	WASHER FLAT #8 SAE PLT	
26.	801-067C	SCREW RD HD 8-32 X 1 LG PLT	
27.	803-014C	NUT HEX 3/8-16 PLT	
28.	802-318C	HHCS 3/8-16X5 GR5	
29.	809-192C	CHAIN RL 2040A X 51 PITCH W/C	45" DRILLS
	809-189C	CHAIN RL 2040A X 53 PITCH W/C	35" DRILLS
30.	802-159C	HHCS 5/16-18X1 GR5	
31.	168-123D	40A29 CLUTCH SPROCKET	45" DRILLS
	168-183D	40A38 CLUTCH SPROCKET	35" DRILLS
32.	823-074C	AIR DRILL ELECTRIC CLUTCH	
33.	808-062C	SPKT 40B15 X 1 B W/KW & SS	

Legend: Ⓢ = 1st revision; Ⓣ = 2nd revision; Ⓤ = 3rd revision; Ⓟ = use up existing stock; Ⓠ = not interchangeable; Ⓡ Ⓡ = for example: revision 2 is not interchangeable w/revision 1

Electric Clutch to Gearbox Drive

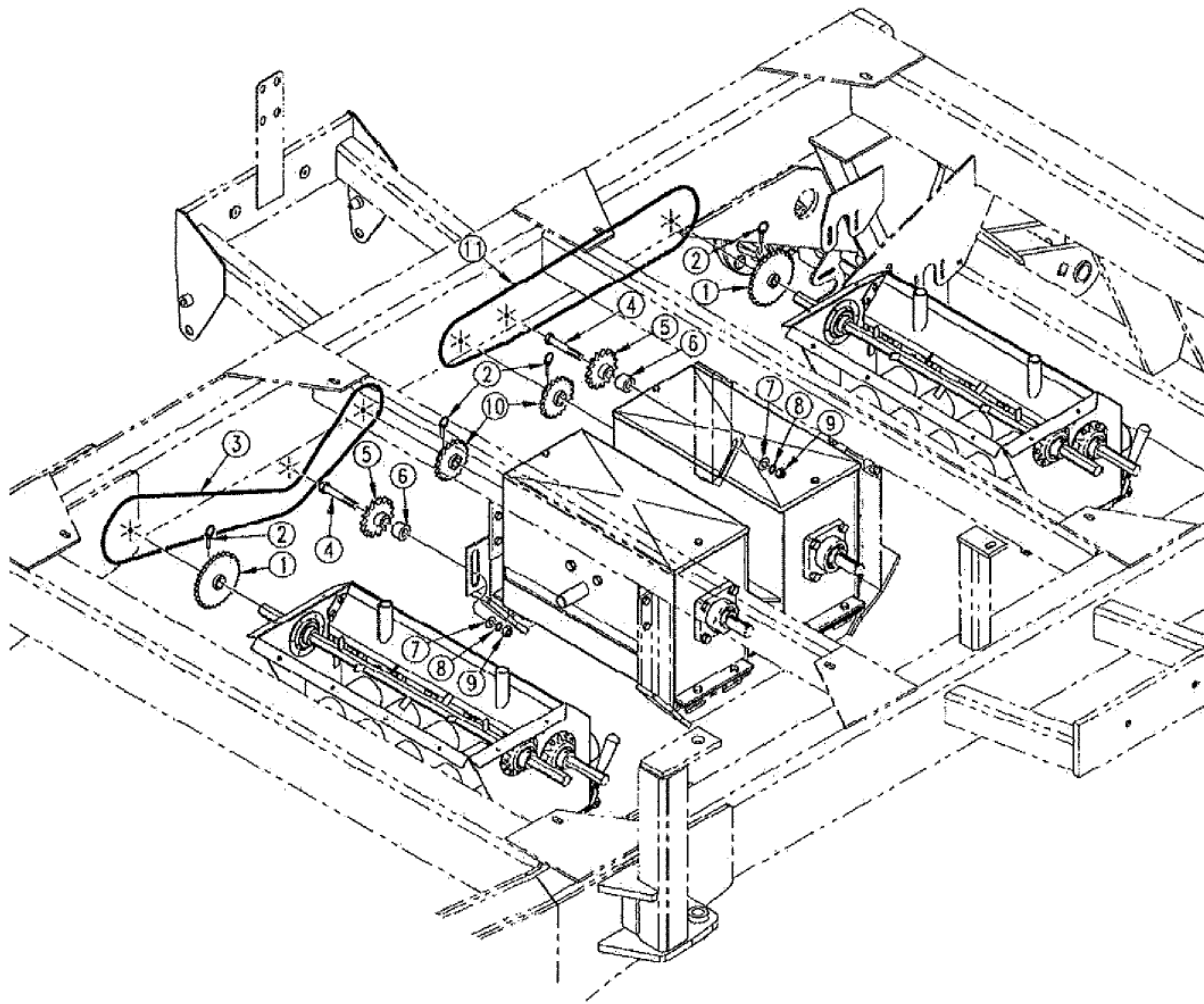


16089

Electric Clutch to Gearbox Drive

Ref.	Part No.	Part Description	Comments
1.	808-062C	SPKT 40B15 X 1 B W/KW & SS	
2.	168-354D	2220 GEARBOX JACKSHAFT	
3.	168-276D	KEY 1/4 X 1/4 X 1 3/8 LG	
4.	802-010C	HHCS 5/16-18X1 1/4 GR5	
5.	822-073C	BEARING 2 BOLT CAM LOCK 1 BORE	
6.	809-065C	CHAIN RL 40 X 61 PITCH	
7.	803-014C	NUT HEX 3/8-16 PLT	
8.	804-013C	WASHER LOCK SPRING 3/8 PLT	
9.	804-012C	WASHER FLAT 3/8 SAE PLT	
10.	166-108H	GEARBOX BRACKET WELDMENT LH	
11.	802-017C	HHCS 3/8-16X1 GR5	
12.	803-008C	NUT HEX 5/16-18 PLT	
13.	804-009C	WASHER LOCK SPRING 5/16 PLT	
14.	804-010C	WASHER FLAT 5/16 USS PLT	
15.	166-114H	GEARBOX BRACKET WELDMENT RH	
16.	808-191C	SPKT 40B45 1 BORE W/KW & SS	
17.	809-190C	CHAIN RL 2040A X 98 PITCH W/C	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ⊗ = for example: revision 2 is not interchangeable w/revision 1

Gearbox to Meter Box Drive

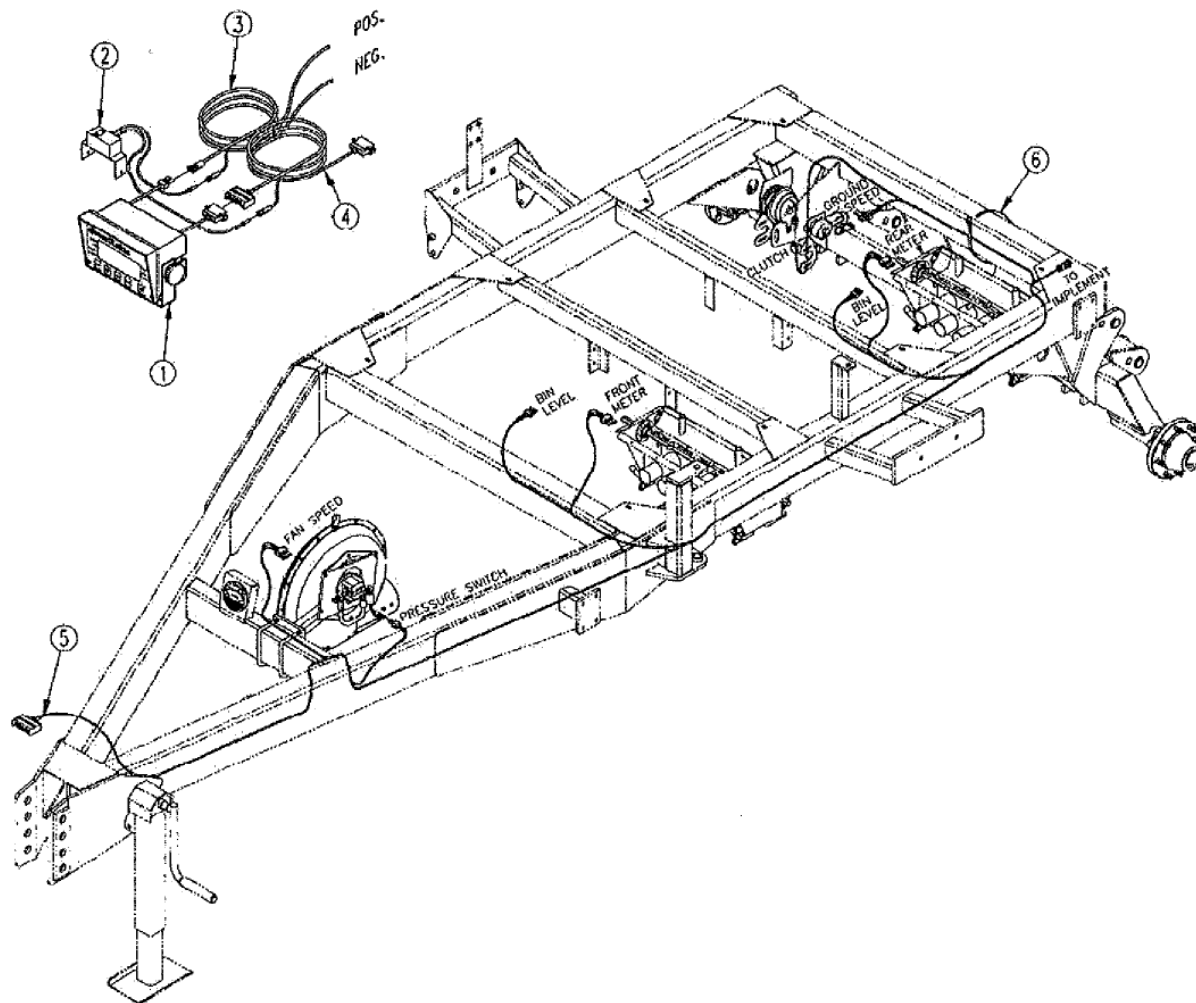
16130

Gearbox to Meter Box Drive

Ref.	Part No.	Part Description	Comments
1.	168-191H	30T QUICK CHANGE SPKT WELDMENT	
2.	805-158C	PIN LYNCH 5/16 X 2 11/32	
3.	809-191C	CHAIN RL 2040A X 47 PITCH W/C	
4.	802-058C	HHCS 5/8-11X2 1/2 GR5	
5.	808-046C	SPKT 40A17 IDLER	
6.	161-131D	SPEED CHANGE SPACER	
7.	804-021C	WASHER FLAT 5/8 SAE PLT	
8.	804-022C	WASHER LOCK SPRING 5/8 PLT	
9.	803-021C	NUT HEX 5/8-11 PLT	
10.	168-192H	20T QUICK CHANGE SPKT WELDMENT	
11.	809-009C	CHAIN RL 20-40A 46 PITCH	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ① ⊗ = for example: revision 2 is not interchangeable w/revision 1

Vansco Monitor/Harness



16139

Vansco Monitor/Harness

Ref.	Part No.	Part Description	Comments
1.	VA-490001	VANSCO ADC2220 MUX CONSOLE	
2.	VA-490002	ADC2220 CLUTCH SWITCH BOX	
3.	VA-490700	VANSCO ADC2220 POWER LEAD	
4.	VA-490701	VANSCO ADC2220 CONSOLE OUTPUT	
5.	VA-490702	VANSCO ADC2220 CART HARNESS	
6.	800-060C	CABLE TIE .19X14.25 3DIA 50LB	

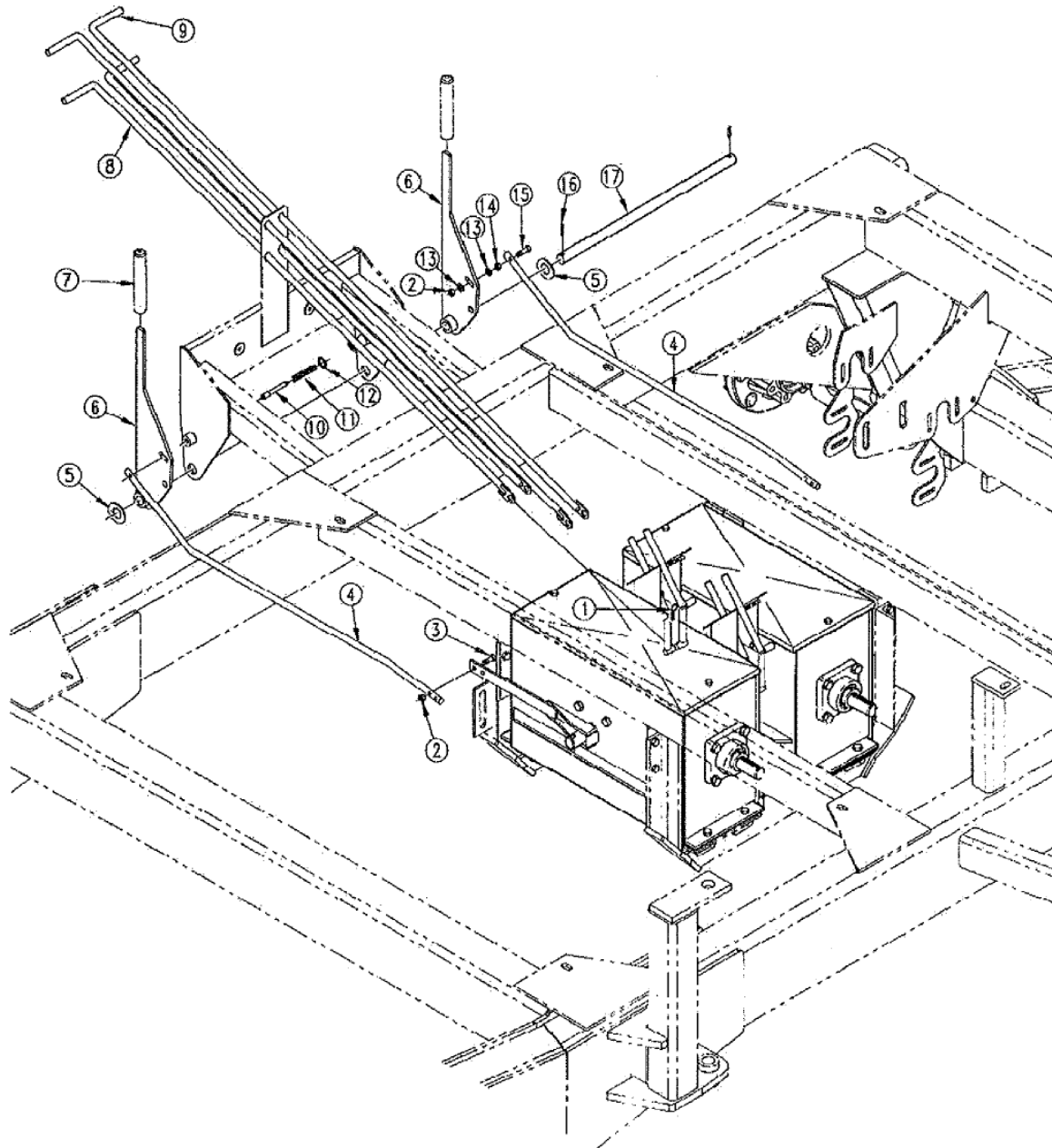
Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥ ⑦ = for example: revision 2 is not interchangeable w/revision 1

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Gearbox Covers



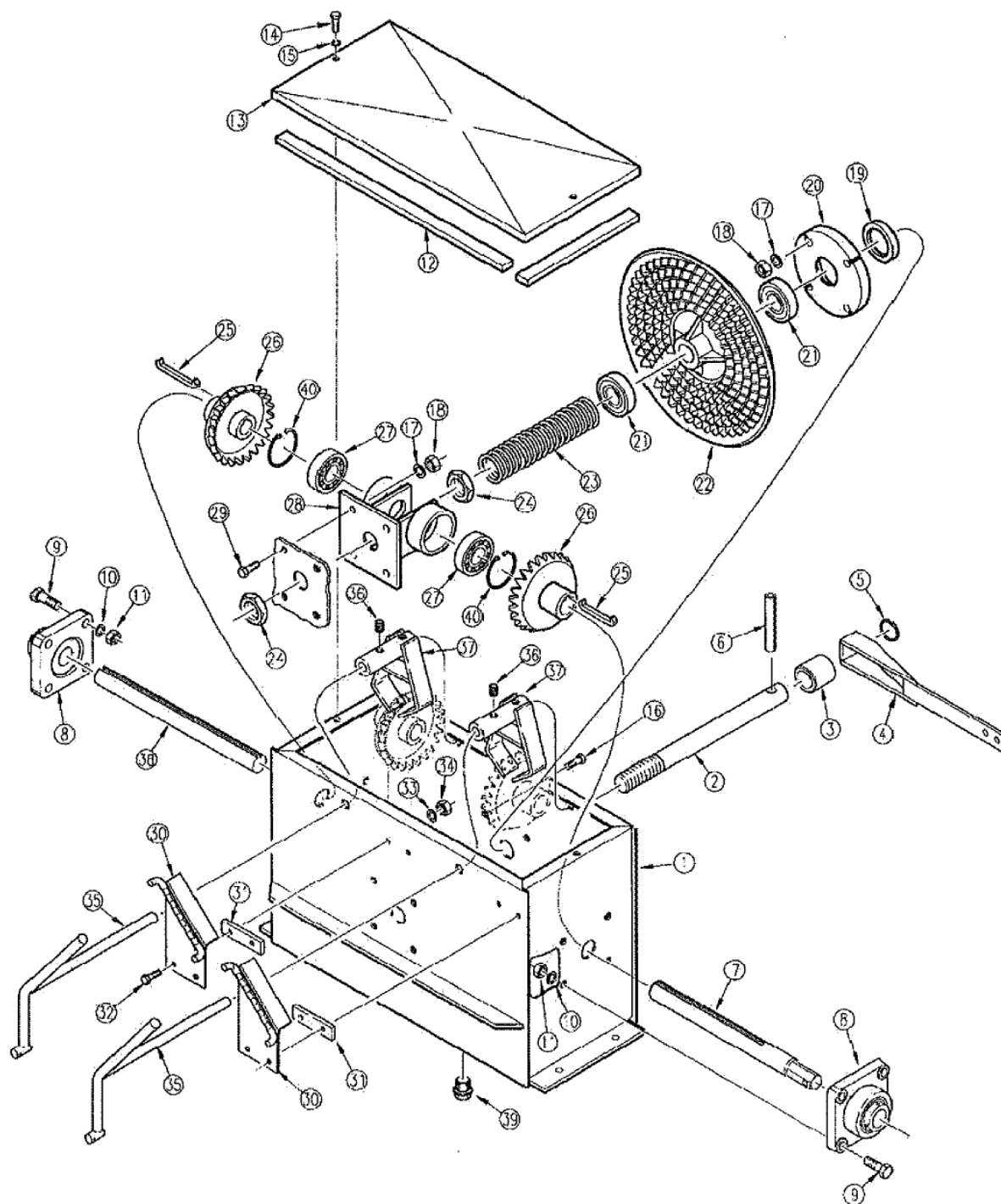
1G169

Gearbox Levers

Ref.	Part No.	Part Description	Comments
1.	805-032C	PIN HAIR COTTER .148 WIRE	
2.	803-011C	NUT LOCK 5/16-18 PLT	
3.	802-010C	HHCS 5/16-18X1 1/4 GR5	
4.	168-358D	2220 CLUTCH LINKAGE ROD	
5.	804-025C	WASHER FLAT 3/4 SAE PLT	
6.	166-107H	CLUTCH HANDLE WELDMENT	
7.	817-056C	30" 3-SEC TRANS LOCK-UP GRIP	
8.	168-246H	2220 GEARSHIFT HNDL WLDMT-SHRT	
9.	168-245H	2220 GEARSHIFT HNDL WLDMT-LG	
10.	204-221D	PLUNGER	
11.	807-123C	SPRING COMP .39X1.12X.047W	
12.	800-051C	RING, SPLIT 1-1/4 I.D.	
13.	804-036C	WASHER FLAT 5/16 SAE PLT	
14.	803-008C	NUT HEX 5/16-18 PLT	
15.	802-013C	HHCS 5/16-18X1 3/4 GR5	
16.	805-023C	PIN ROLL 3/16X1 1/4 PLT	
17.	166-451D	CLUTCH HANDLE PIVOT SHAFT	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥ ⑦ ⑧ = for example: revision 2 is not interchangeable w/revision 1

Front Gearbox (168-248K)

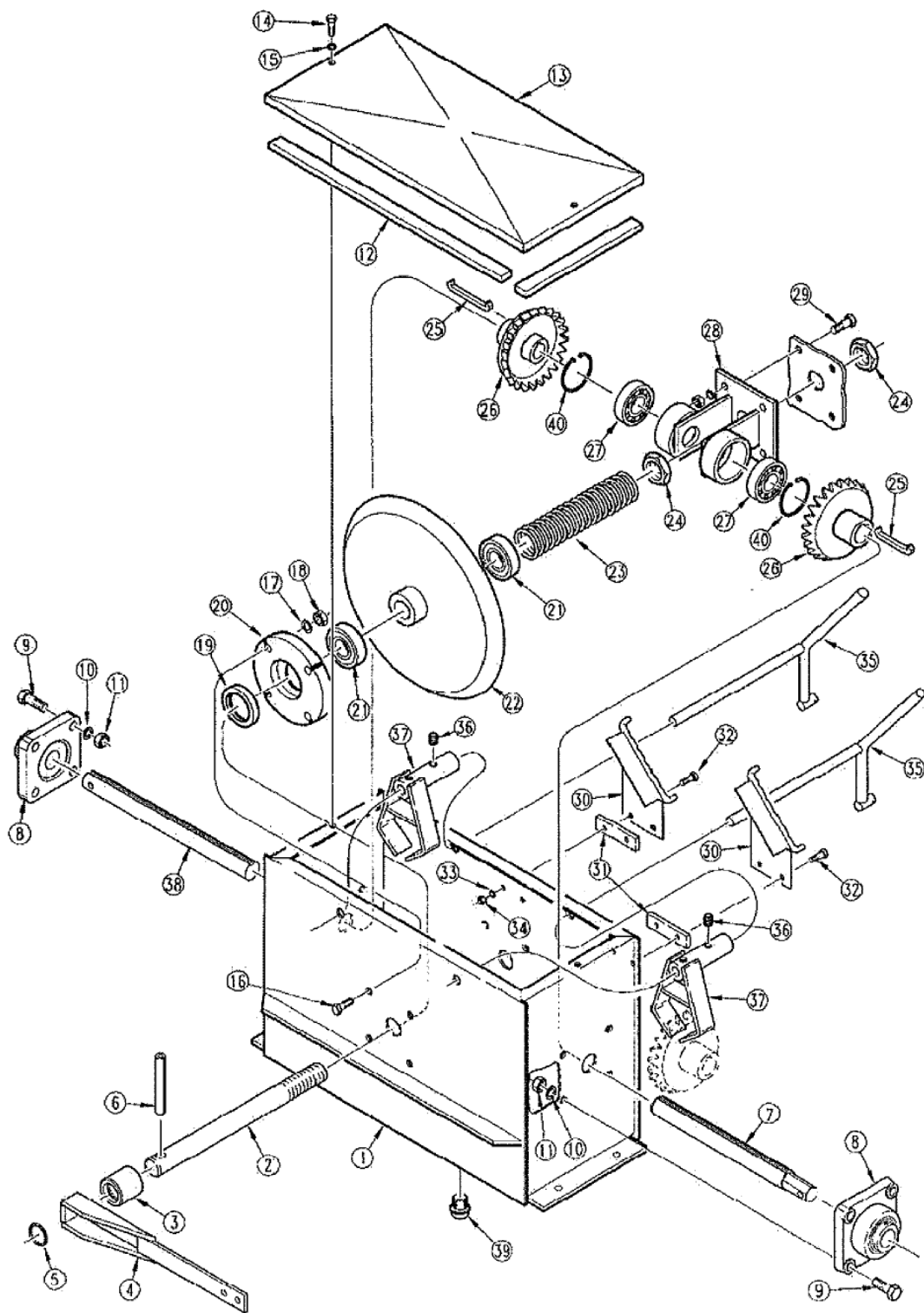


16180

Front Gearbox (168-248K)

Ref.	Part No.	Part Description	Comments
1.	168-155H	FRONT GEARBOX HOUSING	
2.	168-212D	PLATE GEAR SHAFT	
3.	168-283D	GEARBOX LEVER CLUTCH TUBE	
4.	168-247H	GEARBOX SHIFT LINKAGE RAMP LG	
5.	816-166C	O-RING 1 ID X 1 1/4 OD X 1/8	
6.	805-169C	PIN ROLL 1/2 X 1 3/4	
7.	168-300D	GEARBOX OUTPUT SHAFT W/HEX	
8.	822-074C	BEARING 4 BOLT CAM LOCK 1 BORE	
9.	802-029C	HHCS 7/16-14X1 1/2 GR5	
10.	804-014C	WASHER LOCK 7/16 PLT	
11.	803-015C	NUT HEX 7/16-14 PLT	
12.	990-024R	SEAL 5/16 X 3/4 DOR-TITE TRAY	
13.	168-164H	GEARBOX LID	
14.	802-087C	HHCS 5/16-18X1 SS	
15.	804-009C	WASHER LOCK SPRING 5/16 PLT	
16.	802-079C	HHCS 3/8-16X1 1/4 GR5	
17.	804-013C	WASHER LOCK SPRING 3/8 PLT	
18.	803-014C	NUT HEX 3/8-16 PLT	
19.	816-053C	SEAL OIL 1 1/2 X 2 1/8 X 5/16	
20.	168-208D	CLUTCH SEAL HOUSING	
21.	822-069C	BEARING THRUST 1 ID X 2 ODX5/8	
22.	168-187D	MULTI GEAR PLATE GEAR	
23.	807-041C	SPRING GEARBOX CLUTCH	
24.	803-030C	NUT HEX JAM 1-8 PLT	
25.	890-353C	GEARBOX BEVEL GEAR KEY	
26.	168-188D	24T BEVEL PINNION GEAR	
27.	822-070C	BEARING BALL 1 ID X 2 OD X 5/8	
28.	168-157H	GEARBOX BEARING MOUNT	
29.	802-017C	HHCS 3/8-16X1 GR5	
30.	168-193H	GEARBOX SHIFT INDICATOR - REAR	
31.	168-209D	GEAR INDICATOR SPACER	
32.	802-004C	HHCS 1/4-20X3/4 GR5	
33.	804-006C	WASHER LOCK SPRING 1/4 PLT	
34.	803-006C	NUT HEX 1/4-20 PLT	
35.	168-195H	GEARBOX SHIFTER/IND WLDMT REAR	
36.	801-023C	SCREW SET SH 3/8-16X3/8 TYPE C	
37.	168-158H	SHIFT FORK	
38.	168-213D	GEARBOX INPUT SHAFT	
39.	800-066C	DRAIN PLUG 3/4-16 UNF PLATED	
40.	800-086C	SNAP RING INT 2.000	

Legend: ● = 1st revision; ○ = 2nd revision; ○ = 3rd revision; ● = use up existing stock; ⊕ = not interchangeable; ⊕ ⊕ = for example: revision 2 is not interchangeable w/revision 1

Rear Gearbox (168-249K)

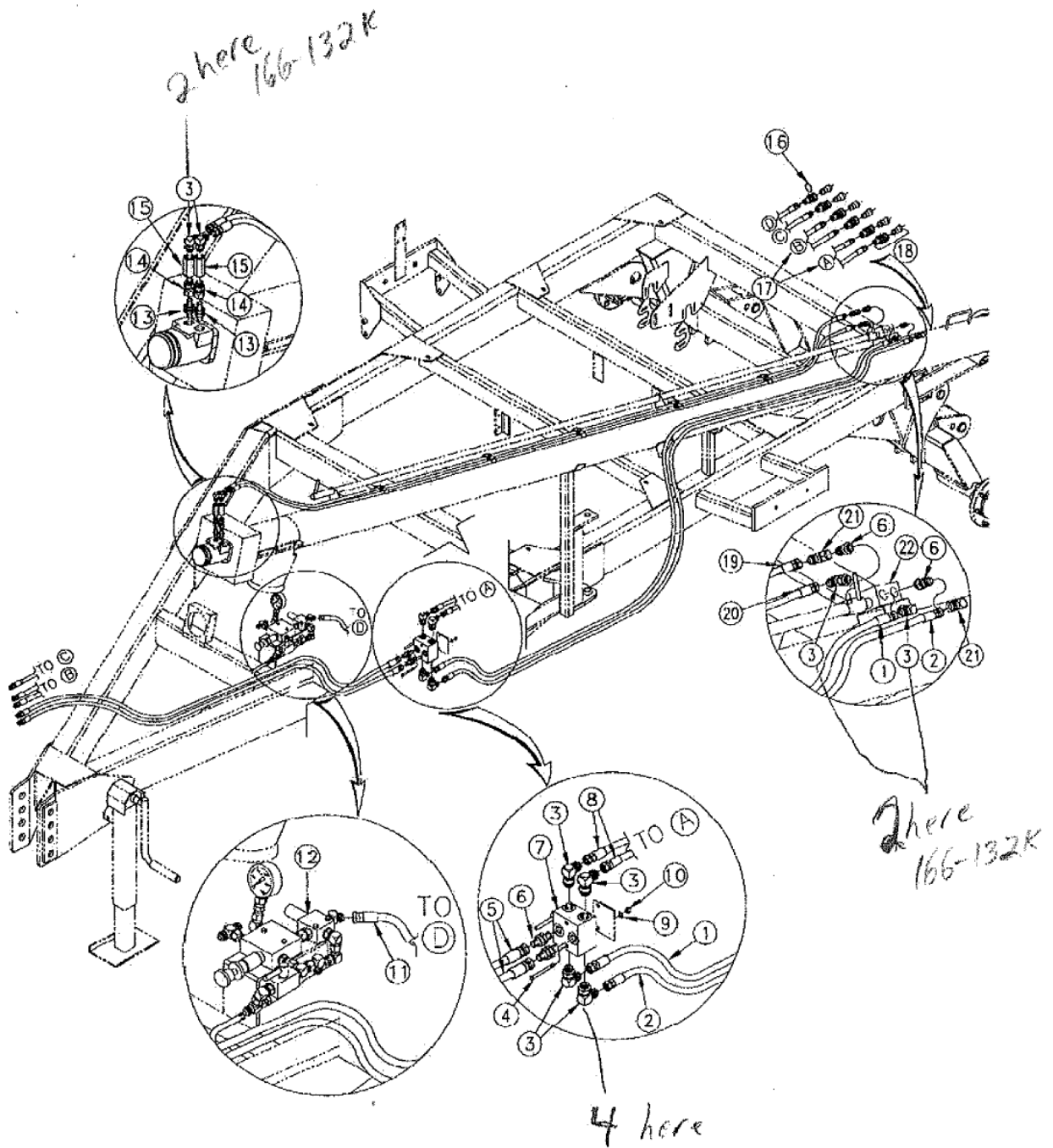
16187

Rear Gearbox (168-249K)

Ref.	Part No.	Part Description	Comments
1.	168-156H	REAR GEARBOX HOUSING	
2.	168-212D	PLATE GEAR SHAFT	
3.	168-283D	GEARBOX LEVER CLUTCH TUBE	
4.	168-247H	GEARBOX SHIFT LINKAGE RAMP LG	
5.	816-166C	O-RING 1 ID X 1 1/4 OD X 1/8	
6.	805-169C	PIN ROLL 1/2 X 1 3/4	
7.	168-300D	GEARBOX OUTPUT SHAFT W/HEX	
8.	822-074C	BEARING 4 BOLT CAM LOCK 1 BORE	
9.	802-029C	HHCS 7/16-14X1 1/2 GR5	
10.	804-014C	WASHER LOCK 7/16 PLT	
11.	803-015C	NUT HEX 7/16-14 PLT	
12.	990-024R	SEAL 5/16 X 3/4 DOR-TITE TRAY	
13.	168-164H	GEARBOX LID	
14.	802-087C	HHCS 5/16-18X1 SS	
15.	804-009C	WASHER LOCK SPRING 5/16 PLT	
16.	802-079C	HHCS 3/8-16X1 1/4 GR5	
17.	804-013C	WASHER LOCK SPRING 3/8 PLT	
18.	803-014C	NUT HEX 3/8-16 PLT	
19.	816-053C	SEAL OIL 1 1/2 X 2 1/8 X 5/16	
20.	168-208D	CLUTCH SEAL HOUSING	
21.	822-069C	BEARING THRUST 1 ID X 2 ODX5/8	
22.	168-187D	MULTI GEAR PLATE GEAR	
23.	807-041C	SPRING GEARBOX CLUTCH	
24.	803-030C	NUT HEX JAM 1-8 PLT	
25.	890-353C	GEARBOX BEVEL GEAR KEY	
26.	168-188D	24T BEVEL PINNION GEAR	
27.	822-070C	BEARING BALL 1 ID X 2 OD X 5/8	
28.	168-157H	GEARBOX BEARING MOUNT	
29.	802-017C	HHCS 3/8-16X1 GR5	
30.	168-194H	GEARBOX SHIFT INDICATOR - FT	
31.	168-209D	GEAR INDICATOR SPACER	
32.	802-004C	HHCS 1/4-20X3/4 GR5	
33.	804-006C	WASHER LOCK SPRING 1/4 PLT	
34.	803-006C	NUT HEX 1/4-20 PLT	
35.	168-196H	GEARBOX SHIFTER/IND WLDMT FRNT	
36.	801-023C	SCREW SET SH 3/8-16X3/8 TYPE C	
37.	168-158H	SHIFT FORK	
38.	168-213D	GEARBOX INPUT SHAFT	
39.	800-066C	DRAIN PLUG 3/4-16 UNF PLATED	
40.	800-088C	SNAP RING INT 2.000	

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Hydraulic System



16224

6-1

Model ADC2220 Air Drill Cart 167-073P

5/1/97

UM-PK0000772

Hydraulic System

Ref.	Part No.	Part Description	Comments
1.	811-650C	HH3/8R2 226 3/4FJIC	
2.	811-652C	HH3/8R2 228 3/4FJIC	
3.	811-083C	EL 3/4MJIC 3/4MORB	
4.	802-024C	HHCS 3/8-16X3 GR5	
5.	811-548C	HH3/8R2 159 1/2MNPT 3/4FJIC	
6.	811-088C	AD 3/4MORB 3/4MJIC	
7.	810-274C	DOUBLE SELECTOR VALVE 3/4FORB	
8.	811-666C	HH3/8R2 120 3/4FJIC 3/4MORB	
9.	804-013C	WASHER LOCK SPRING 3/8 PLT	
10.	803-014C	NUT HEX 3/8-16 PLT	
11.	811-681C	HH3/8R2 140 3/4MORB 9/16FJIC	
12.	167-078K	NTA35 CONTROL VALVE SUB ASSY	
13.	811-192C	AD 3/4MJIC 7/8MORB	
14.	811-324C	AD 3/4MORB 3/4FJIC	
15.	811-488C	CP 3/4 FORB 3/4 FORB	
16.	800-044C	SNAP RING EXT 1 1/2 SHAFT	
17.	811-649C	HH3/8R2 275 1/2MNPT 3/4MORB	
18.	811-204C	CP 3/4FORB QD BH	
19.	811-653C	HH3/8R2 158 3/4FJIC	
20.	811-651C	HH3/8R2 154 3/4FJIC	
21.	811-150C	EL 3/4FJIC 3/4MJIC	
22.	810-268C	VALVE 4 WAY 3 POS OP CEN DIR	

4 Auger Assy

6 extra?

6 Auger PKG

4 Cart Main

Auger assy - 11 motor
11 valveAuger bundle - 4 endable
diverter

Legend: * = 1st revision; ** = 2nd revision; *** = 3rd revision; * = use up existing stock; * = not interchangeable; * * = for example; revision 2 is not interchangeable w/revision 1

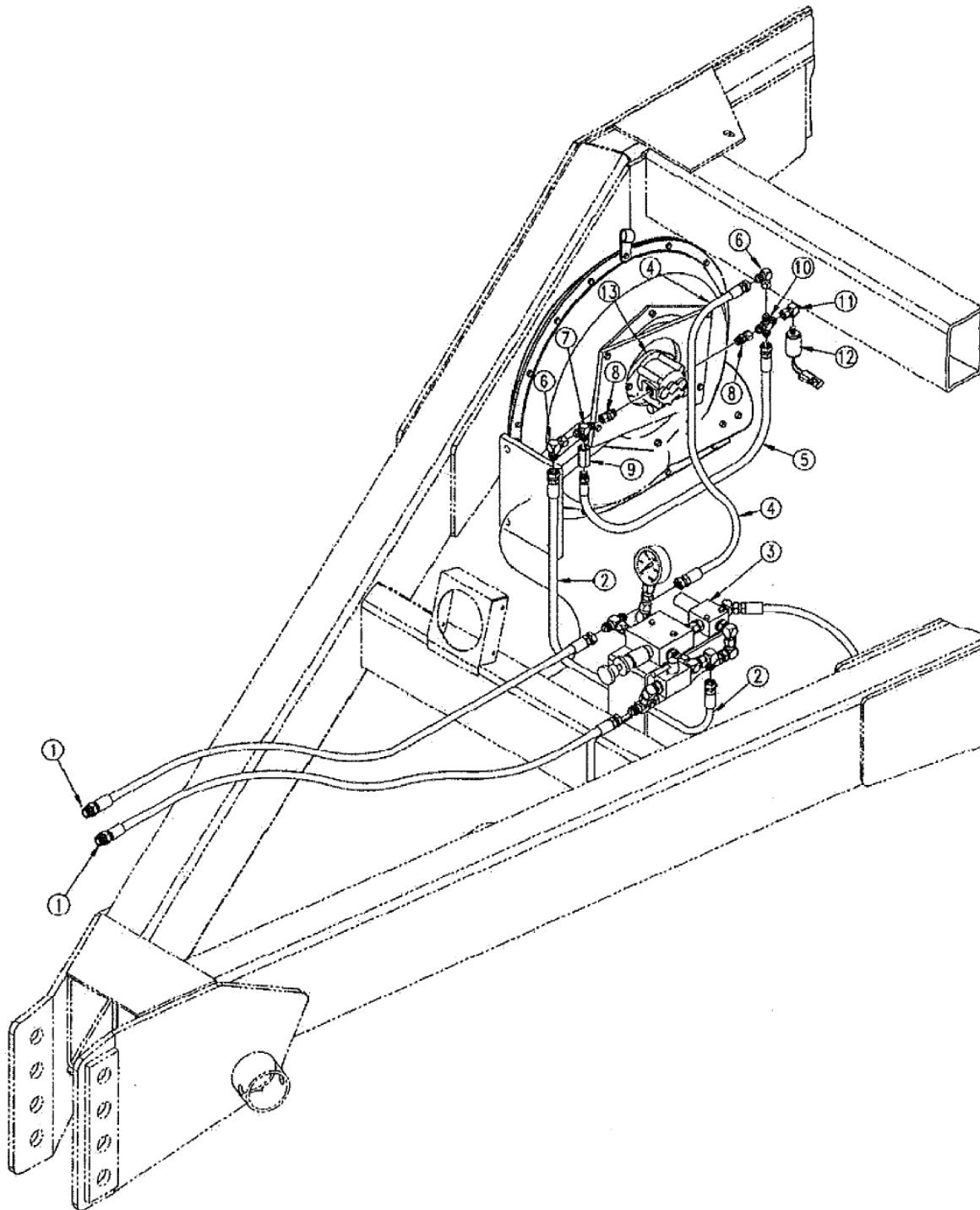
5/1/97

Model ADC2220 Air Drill Cart 167-073P

6-1

UM-PK0000773

Fan Hydraulic System



16245

Fan Hydraulic System

Ref.	Part No.	Part Description	Comments
1.	811-516C	HH1/2R2 142 3/4FJIC 1/2MNPT	
2.	811-679C	HH1/2R2 26 3/4FJIC 3/4FJIC	
3.	167-078K	NTA35 CONTROL VALVE SUB ASSY	
4.	811-680C	HH1/2R2 11 3/4FJIC 3/4FJIC	
5.	811-195C	HH1/2R1 028 3/4FJIC 3/4MORB	
6.	811-150C	EL 3/4FJIC 3/4MJIC	
7.	811-077C	TE 3/4MORB 3/4MJIC 3/4MJIC	
8.	811-502C	AD 7/8MORB 3/4FJIC	
9.	810-037C	VALVE LINE CHECK	
10.	811-147C	CR 3/4MJIC	
11.	811-503C	EL 3/4FJIC 1/8NPTF	
12.	823-083C	PRESSURE SWITCH 800# NO	
13.	810-273C	HYD MOTOR 7/8ORB	

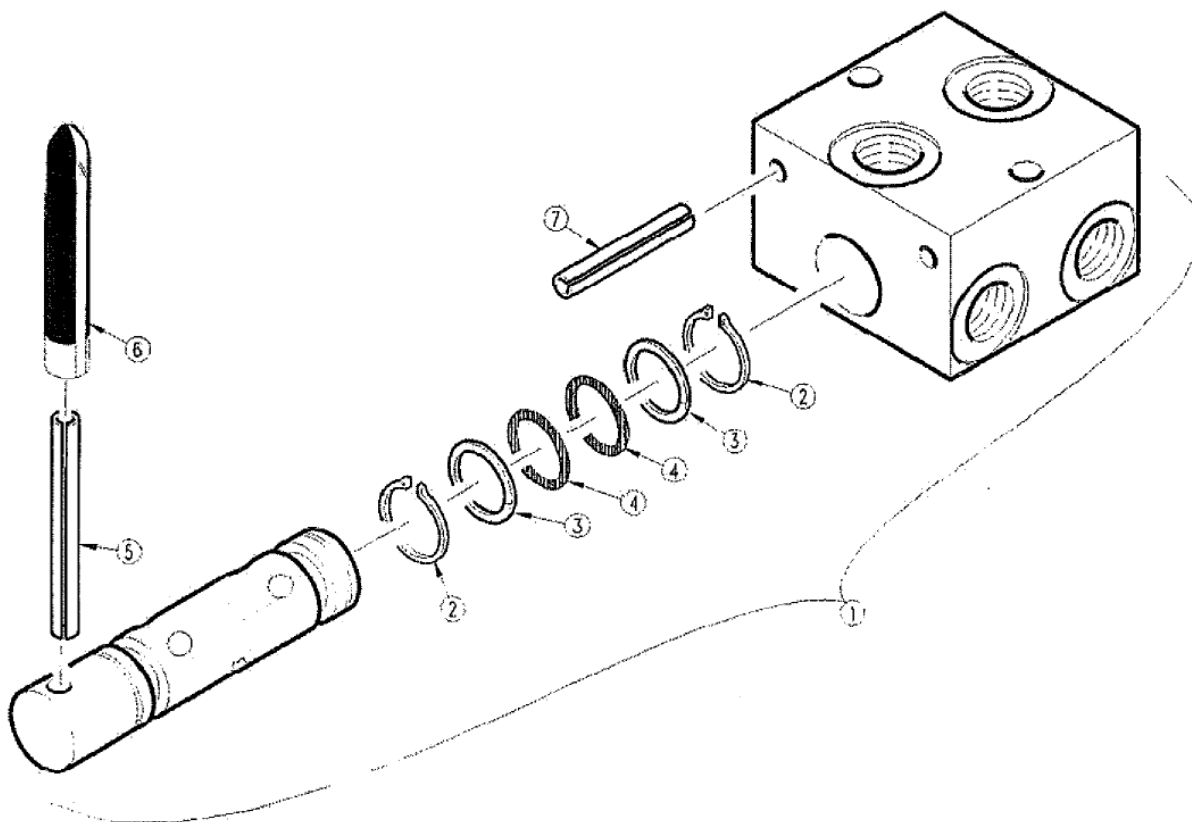
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Model ADC2220 Air Drill Cart 167-073P

6-2

Double Selector Valve (810-274C)



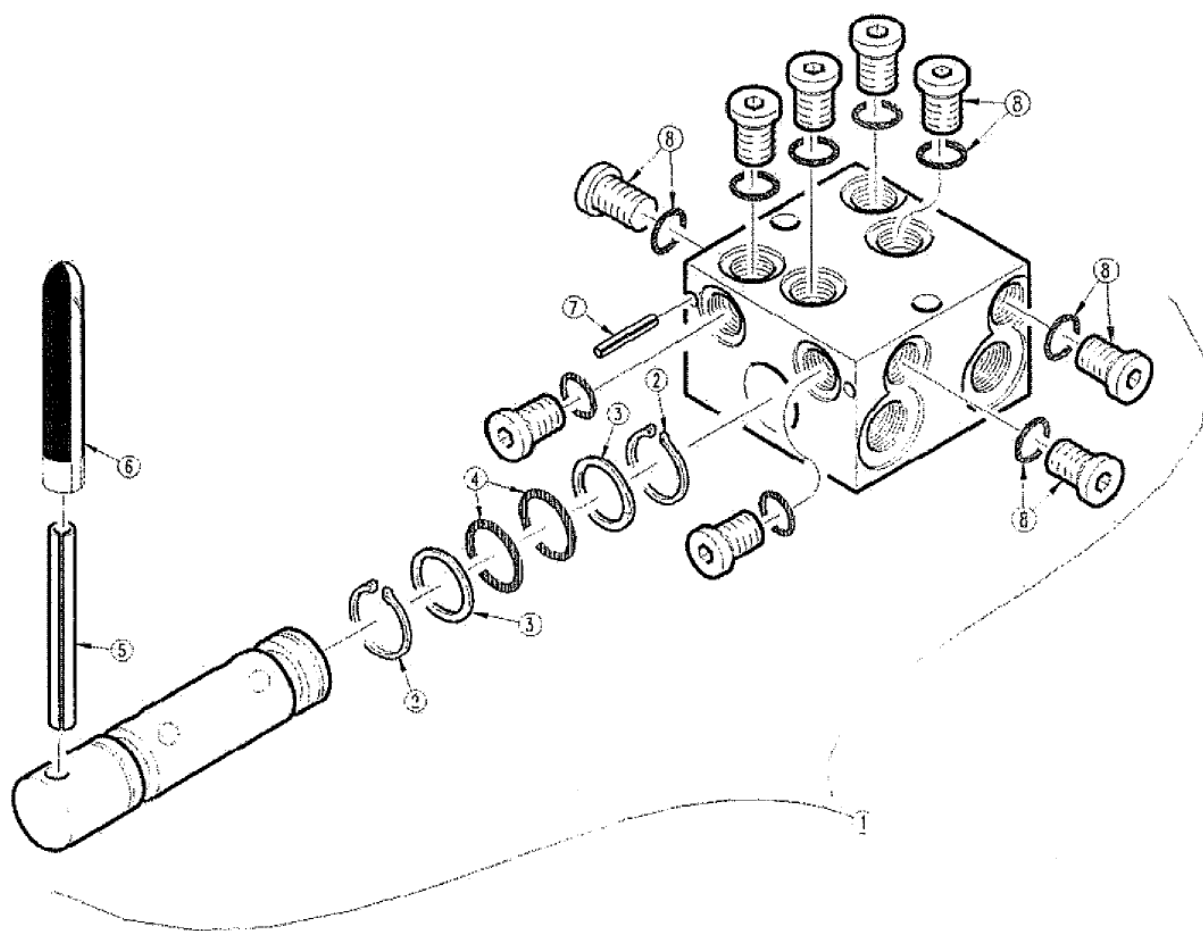
14927

Double Selector Valve (810-274C)

Ref.	Part No.	Part Description	Comments
1.	810-274C	DOUBLE SELECTOR VALVE 3/4FORB	
2.	1079	SH RETAINING RING TRU ARC	
3.	1089-210	SHOEMAKER TEFLON BACK UP	
4.	1088-210	SHOEMAKER O-RING BUNA N 70DURO	
5.	1285	SH GROOVE PIN	
6.	817-255C	BLACK VINYL GRIP	
7.	1084	SH PIN, SPRING 0.25 DIAMETER	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥①② = for example: revision 2 is not interchangeable w/revision 1

Valve 4Way 3Pos Op Cen Dir (810-268C)



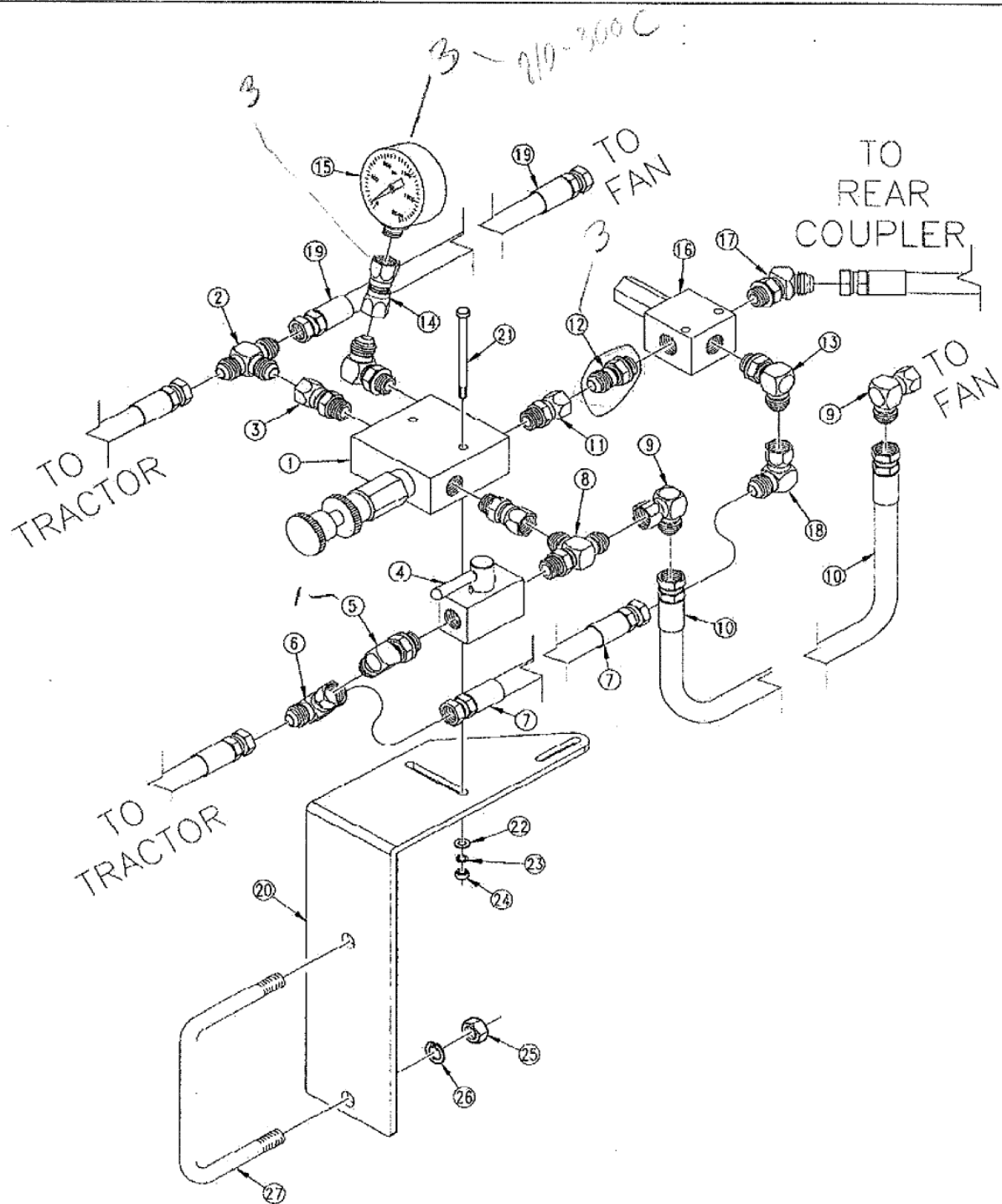
14928

Valve 4Way 3Pos Op Cen Dir (810-268C)

Ref.	Part No.	Part Description	Comments
1.	810-268C	VALVE 4 WAY 3 POS OP CEN DIR	
2.	1079	SH RETAINING RING TRU ARC	
3.	1089-210	SHOEMAKER TEFLON BACK UP	
4.	1088-210	SHOEMAKER O-RING BUNA N 70DURO	
5.	1285	SH GROOVE PIN	
6.	817-255C	BLACK VINYL GRIP	
7.	1284	SHOEMAKER STOP PIN	
8.	1132-4	SHOEMAKER PLUG, HEX SOCKET	

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NTA35 Control Valve (167-078K)



16256

NTA35 Control Valve (167-078K)

Ref.	Part No.	Part Description	Comments
1.	810-349C	VALVE PRESS RED W/ CHK 1/16 OR	Refer to page 6-6
2.	811-078C	TE 3/4MJIC	
3.	811-282C	AD 3/4FJIC 9/16MORB	
4.	810-345C	VALVE 90 DEGREE SHUT-OFF	
5.	811-063C	EL 3/4MJIC 3/4MORB	
6.	811-079C	TE 3/4FJIC 3/4MJIC 3/4MJIC	
7.	811-678C	HH3/8R2 8 1/2 3/4FJIC 9/16FJIC	
8.	811-080C	TE 3/4MJIC 3/4MORB 3/4MJIC	
9.	811-150C	EL 3/4FJIC 3/4MJIC	
10.	811-679C	HH1/2R2 26 3/4FJIC 3/4FJIC	
11.	811-627C	AD 9/16MORB 9/16FJIC	
12.	811-170C	AD 9/16MORB 9/16MJIC	
13.	811-085C	EL 9/16MJIC 9/16MORB	
14.	811-582C	AD 9/16FJIC 1/4FNPT	
15.	810-347C	PRESSURE GAUGE 2000 PSI	
16.	810-348C	RELIEF VALVE 1500 PSI TAMP PRF	Refer to page 6-7
17.	811-416C	EL 45 9/16MJIC 9/16MORB	
18.	811-169C	EL 9/16MJIC 9/16FJIC	
19.	811-680C	HH1/2R2 11 3/4FJIC 3/4FJIC	
20.	167-171D	NTA35 VALVE MOUNT PLATE	
21.	802-551C	HHCS 1/4-20X2 1/4 GR5	
22.	804-007C	WASHER FLAT 1/4 SAE PLT	
23.	804-006C	WASHER LOCK SPRING 1/4 PLT	
24.	803-006C	NUT HEX 1/4-20 PLT	
25.	803-020C	NUT HEX 1/2-13 PLT	
26.	804-015C	WASHER LOCK SPRING 1/2 PLT	
27.	806-067C	U-BOLT 1/2-13 X 6 1/32 X 4 1/4	

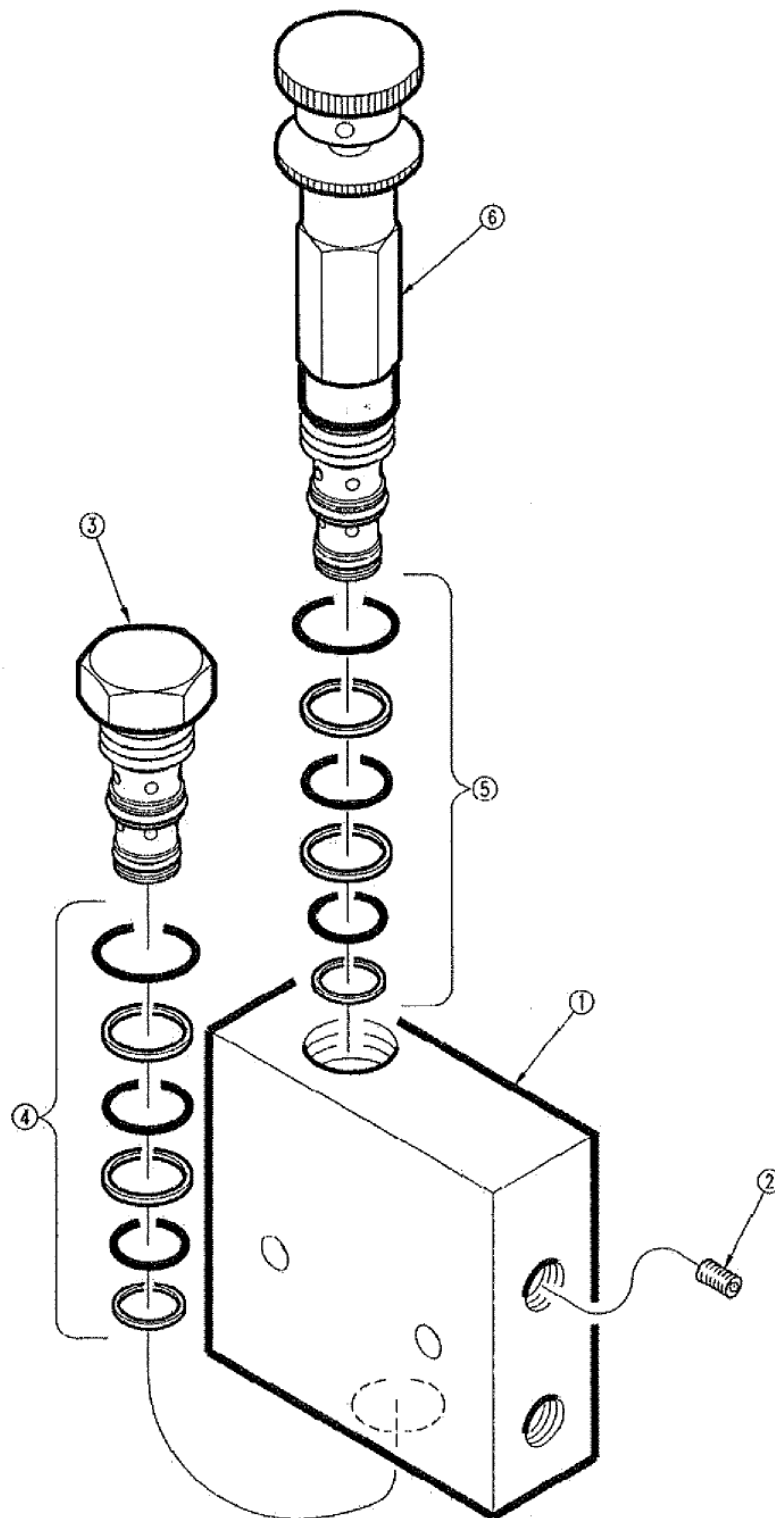
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UM-PK0000781

Pressure Reducing Valve (810-349C)

16442

Pressure Reducing Valve (810-349C)

Ref.	Part No.	Part Description	Comments
1.	5089	VALVE BODY PRV W/CHECK SHOEMKR	
2.	5108	PLUG, WITH .062 ORIFICE	
3.	CP2-10	CARTRIDGE CHECK SHOEMAKER	
4.	5070	SEAL KIT CHECK VALVE SHOEMAKER	
5.	5075	SEAL KIT PRESS RED V SHOEMAKER	
6.	PRPIL-10-K-25	CARTRIDGE PRESS RED SHOEMAKER	

Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; ④ = use up existing stock; ⑤ = not interchangeable; ⑥ ⑦ ⑧ = for example: revision 2 is not interchangeable w/revision 1

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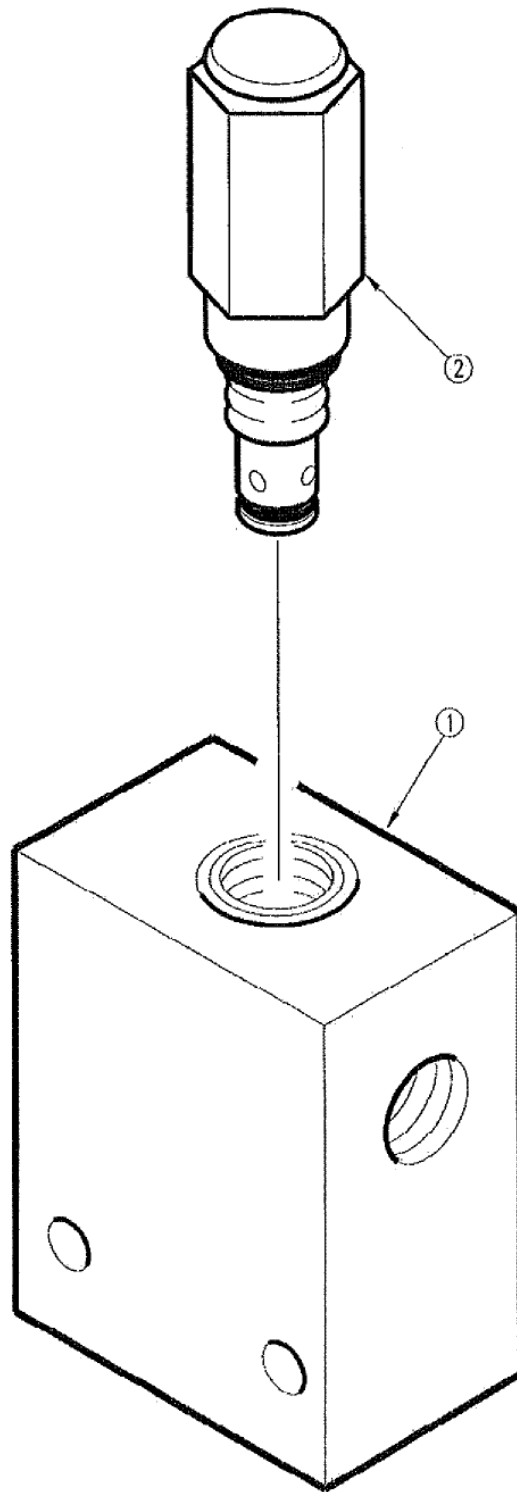


Model ADC2220 Air Drill Cart 167-073P

6-6

UM-PK0000783

Relief Valve (810-348C)



16441

Relief Valve (810-348C)

Ref.	Part No.	Part Description	Comments
1.	30102322	DELTA 3 PORT RELIEF VALVE BODY	
2.	85020105	DELTA RELIEF VALVE CARTRIDGE-1500 PSI	

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5/1/97

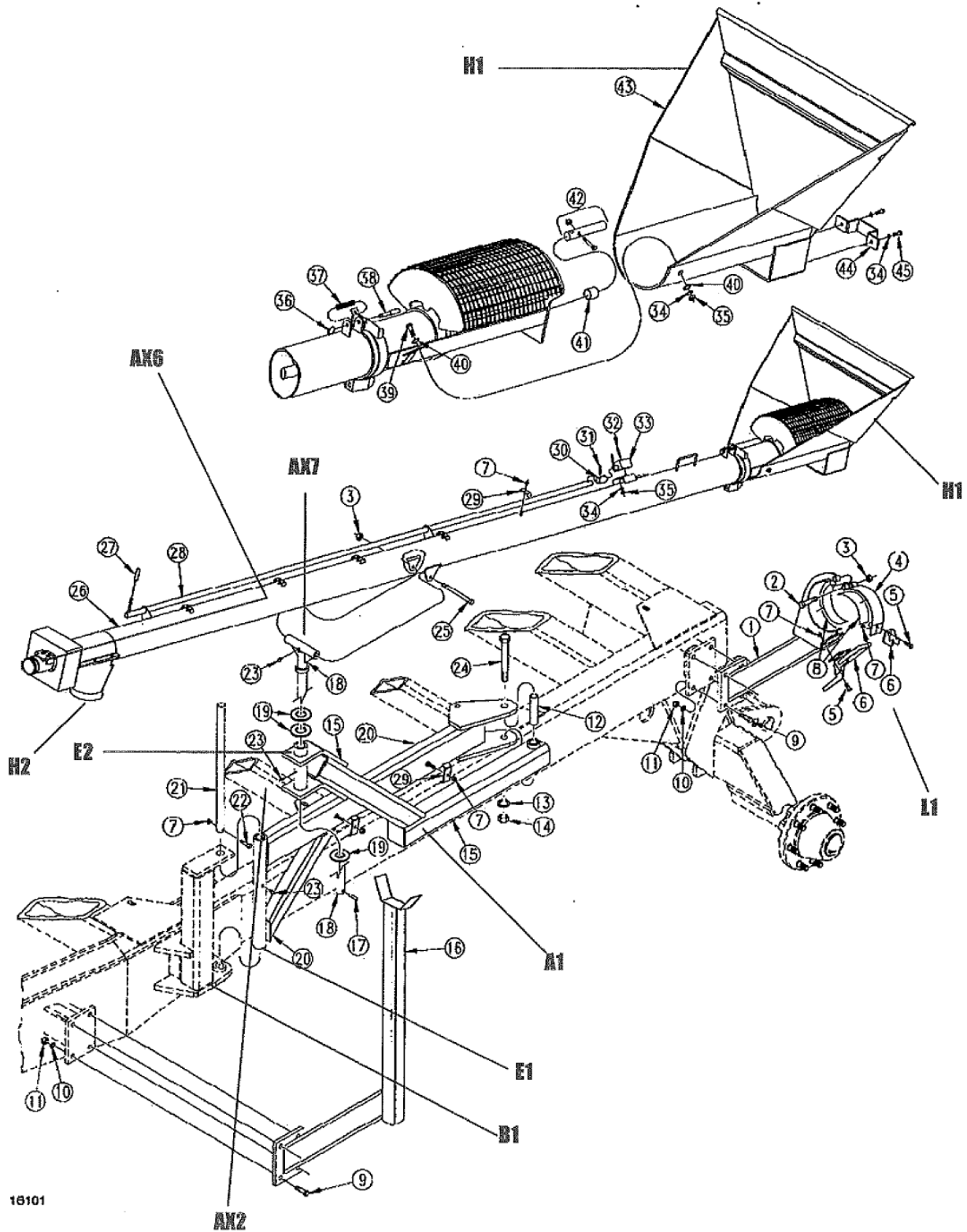


Model ADC2220 Air Drill Cart 167-073P

6-7

UM-PK0000785

Auger



Auger

Ref.	Part No.	Part Description	Comments
1.	166-125H	2220 REAR TRANSPORT SUPPORT	
2.	802-226C	HHCS 1/2-13X2 3/4 GR5	
3.	803-019C	NUT LOCK 1/2-13 PLT	
4.	166-126H	2220 RR TRANSPORT LATCH WLDMNT	
5.	802-007C	HHCS 5/16-18X3/4 GR5	
6.	800-285C	AUGER LATCH CLAMP	
7.	803-011C	NUT LOCK 5/16-18 PLT	
8.	816-203C	AUGER CLAMP PAD - INSIDE	
9.	802-082C	HHCS 1/2-13X1 3/4 GR5	
10.	804-015C	WASHER LOCK SPRING 1/2 PLT	
11.	803-020C	NUT HEX 1/2-13 PLT	
12.	166-512D	2220 OUTER PIVOT SPACER TUBE	
13.	804-023C	WASHER LOCK SPRING 3/4 PLT	
14.	803-027C	NUT HEX 3/4-10 PLT	
15.	166-109H	OUTER SUPPORT ARM WELDMENT	
16.	166-108H	2220 AUGER STORAGE SUPPRT FRNT	
17.	805-249C	PIN ROLL 3/8 X 2 PLT	
18.	166-124H	2220 AUGER SWIVEL SUPPORT	
19.	804-029C	WASHER FLAT 1 SAE	
20.	166-110H	INNER SUPPORT ARM WELDMENT	
21.	166-463D	INNER SUPPORT ARM SHAFT - LONG	
22.	802-115C	HHCS 5/16-18X2 GR5	
23.	800-001C	GREASE ZERK STRAIGHT 1/4-28	
24.	802-070C	HHCS 3/4-10X6 GR5	
25.	802-047C	HHCS 1/2-13X6 GR5	
26.	166-113H	6 IN AUGER WLDMNT 2220	
27.	817-255C	BLACK VINYL GRIP	
28.	166-123H	2220 AUGER VALVE REMOTE HANDLE	
29.	166-300D	AUGER HOSE SUPPORT CLAMP	
30.	166-293D	AUGER VALVE LINK COUPLER	
31.	805-189C	PIN ROLL 5/16 X 1 1/4 PLT	
32.	802-172C	HHCS 5/16-18X2 1/2 GR5	
33.	810-268C	VALVE 4 WAY 3 POS OP CEN DIR	
34.	804-009C	WASHER LOCK SPRING 5/16 PLT	
35.	803-008C	NUT HEX 5/16-18 PLT	
36.	800-051C	RING, SPLIT 1-1/4 I.D.	
37.	807-031C	MARKER LOCK SPRING	
38.	113-164D	MARKER LOCK PIN	
39.	802-159C	HHCS 5/16-18X1 GR5	
40.	804-036C	WASHER FLAT 5/16 SAE PLT	
41.	890-417C	AUGER FLIGHTING BUSH - BRONZE	
42.	10084XX	6 IN AUGER TAIL STUB	
43.	166-405D	8 A.D. AUGER HOPPER W/HOLES	
44.	166-413D	AUGER STRAP HANDLE	
45.	802-010C	HHCS 5/16-18X1 1/4 GR5	

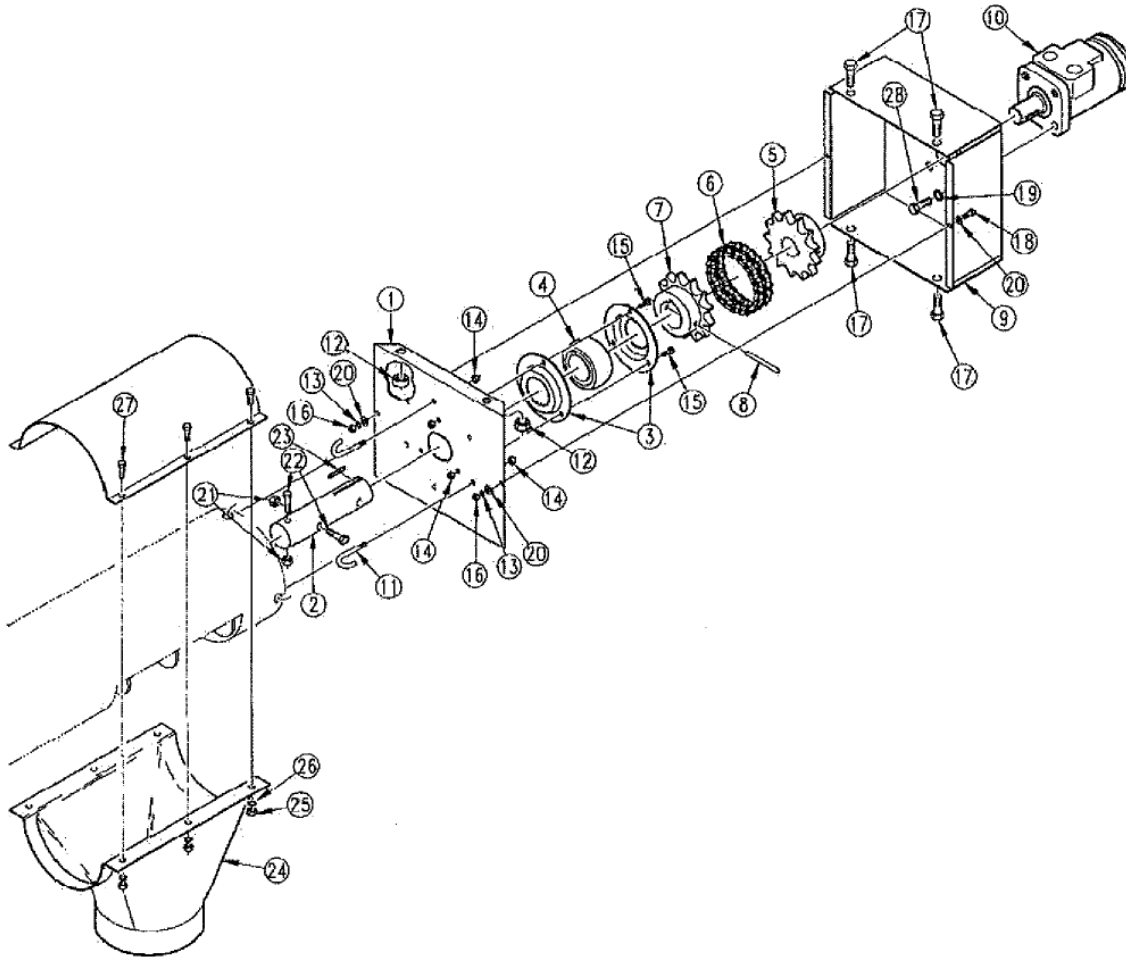
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Model ADC2220 Air Drill Cart 167-073P

1-1

UM-PK0000787

Auger Hydraulic Drive

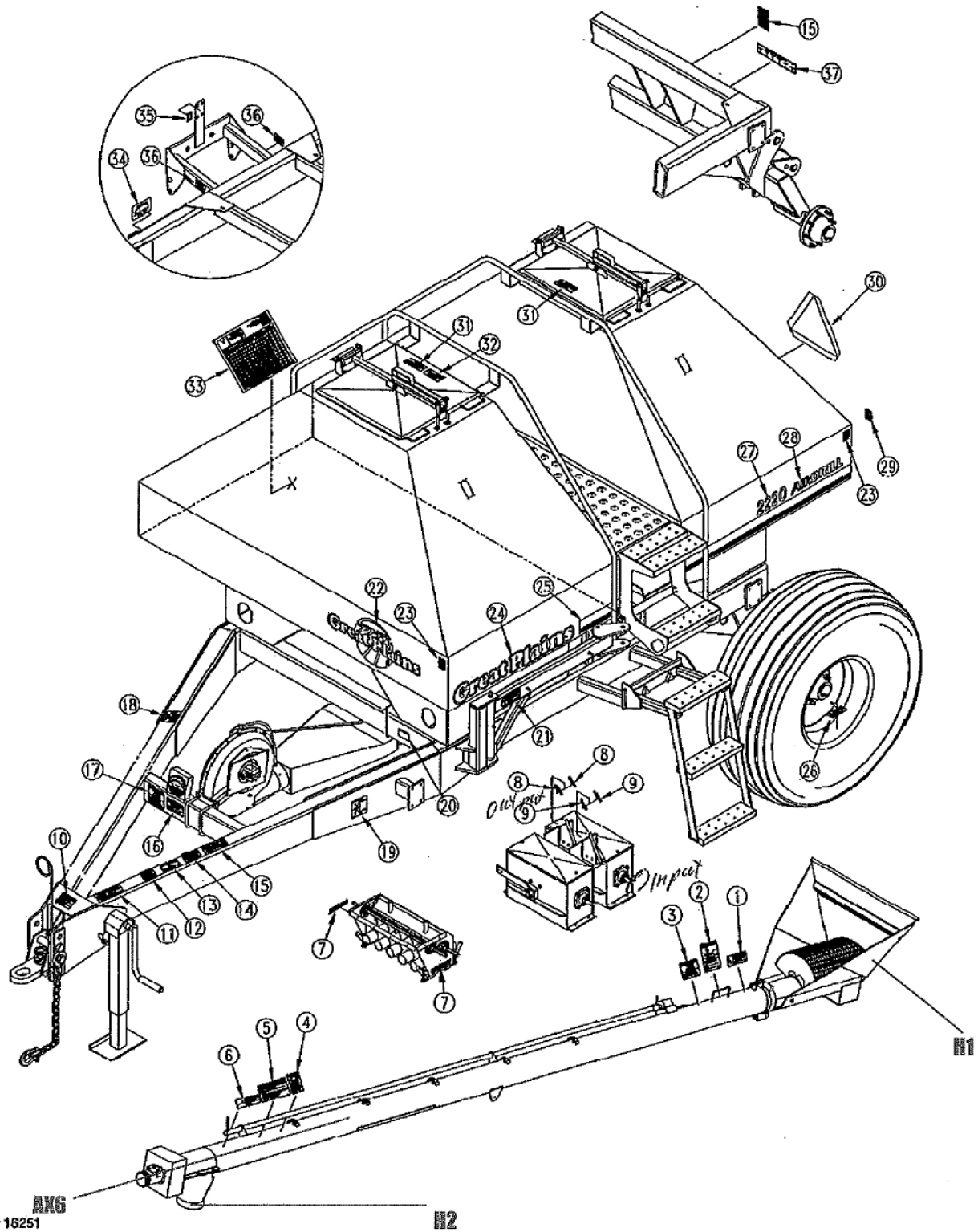
16309

Auger Hydraulic Drive

Ref.	Part No.	Part Description	Comments
1.	1008493	HEAD PLATE FOR 6 IN HYD AUGER	
2.	1008495	6 IN AUGER HEAD STUB	
3.	54008	FLANDETTE BRG 1 IN - 3 HOLE	
4.	6382C	BEARING 1 IN SPHERICAL	
5.	3198A1	FLEX COUPLER HALF 1	
6.	3146A91	FLEX COUPLER CHAIN	
7.	41478	FLEX COUPLER HALF 1 1/4	
8.	6318C	PIN ROLL 3/8 X 2	
9.	1004175	HYD MOTOR MOUNT WLDMT	
10.	810-267C	HYD MOTOR 7/8 ORBF	
11.	835128	J-BOLT 5/16	
12.	803-147C	NUT HEX NYLOCK 1/2-13	
13.	804-006C	WASHER LOCK SPRING 1/4 PLT	
14.	803-084C	NUT HEX NYLOCK 5/16-18 PLT	
15.	802-092C	RHSNB 5/16-18X3/4 GR5	
16.	803-006C	NUT HEX 1/4-20 PLT	
17.	802-258C	HHCS 1/2-13X1 GR5	
18.	802-004C	HHCS 1/4-20X3/4 GR5	
19.	804-013C	WASHER LOCK SPRING 3/8 PLT	
20.	804-007C	WASHER FLAT 1/4 SAE PLT	
21.	803-078C	NUT LOCK 3/8-16 NYLON INSERT	
22.	802-024C	HHCS 3/8-16X3 GR5	
23.	168-276D	KEY 1/4 X 1/4 X 1 3/8 LG	
24.	6514A1	6 IN - 90 DISCHARGE SPOUT	
25.	803-008C	NUT HEX 5/16-18 PLT	
26.	804-009C	WASHER LOCK SPRING 5/16 PLT	
27.	802-473C	HHCS 5/16-18X2 FTHD	
28.	802-014C	HHCS 3/8-16X3/4 GR5	

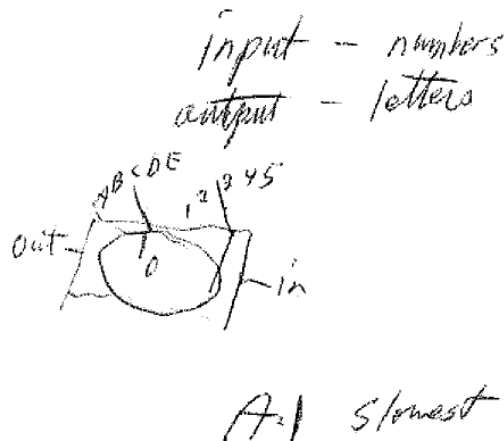
Legend: ① = 1st revision; ② = 2nd revision; ③ = 3rd revision; Ⓐ = use up existing stock; Ⓑ = not interchangeable; Ⓐ Ⓑ = for example: revision 2 is not interchangeable w/revision 1

Label Placement



Label Placement

Ref.	Part No.	Part Description	Comments
1.	818-633C	DECAL DANGER GUARD MISSING AUG	
2.	818-634C	DECAL DANGER AD ROTATING AUGER	
3.	818-627C	DECAL DANGER ELECTROCUTION AUG	
4.	818-339C	DECAL WARNING HIGH PRESSUR SML	
5.	818-635C	DECAL CAUTION AD AUGER GENERAL	
6.	818-622C	DECAL WARNING OVERHEAD AUGER	
7.	818-620C	DECAL METER BOX LID NOTICE	
8.	818-654C	DECAL A.D. GBX LTTER INDICATOR	
9.	818-653C	DECAL A.D. GBX NMBER INDICATOR	
10.	818-667C	DECAL CAUTION 2250 AD TOWING	
11.	818-188C	DECAL WARNING 20 MPH TRANS LRG	
12.	818-630C	DECAL CAUTION AD GENERAL INST	
13.	818-557C	DECAL DANGER CANNOT READ ENG	
14.	818-560C	DECAL NOTICE TO OWNER-NO WARRA	
15.	818-339C	DECAL WARNING HIGH PRESSUR SML	
16.	818-625C	DECAL NOTICE TRACTOR HYD AD95	
17.	818-627C	DECAL DANGER ELECTROCUTION AUG	
18.	818-632C	DECAL WARNING AD FAN HAZARD	
19.	818-772C	DECAL AUGER - MARKER	
20.	819-080C	ADC2220 ID PLATE	
21.	818-623C	DECAL WARNING PINCH POINT AUG	
22.	818-598C	DECAL GP LOGO - LARGE	
23.	818-229C	DECAL AMBER REFLECTOR	
24.	818-594C	DECAL GREAT PLAINS	
25.	818-597C	DECAL 4 COLOR STRIPE	
26.	818-780C	DECAL CAUTION 28 PSI 110 TORQ	
27.	818-720C	DECAL 2220	
28.	818-595C	DECAL AIR DRILL	
29.	818-230C	DECAL RED REFLECTOR	
30.	818-003C	DECAL SLOW MOVING VEHICLE	
31.	818-628C	DECAL WARNING AD BIN HAZARDS	
32.	818-189C	DECAL CAUTION AIR LEAKS	
33.	818-773C	DECAL SEED RATE ADC2220	
34.	818-774C	DECAL CALIBRATION ADC2220	
35.	818-651C	DECAL 2250 A.D. SHIFT LEVERS	
36.	818-776C	DECAL ADC2220 CLUTCH LEVERS	
37.	818-814C	DECAL NTA35 HOSE CONN INST	



Legend: ● = 1st revision; ● = 2nd revision; ● = 3rd revision; ● = use up existing stock; ⊗ = not interchangeable; ⊗ ⊗ = for example: revision 2 is not interchangeable w/revision 1

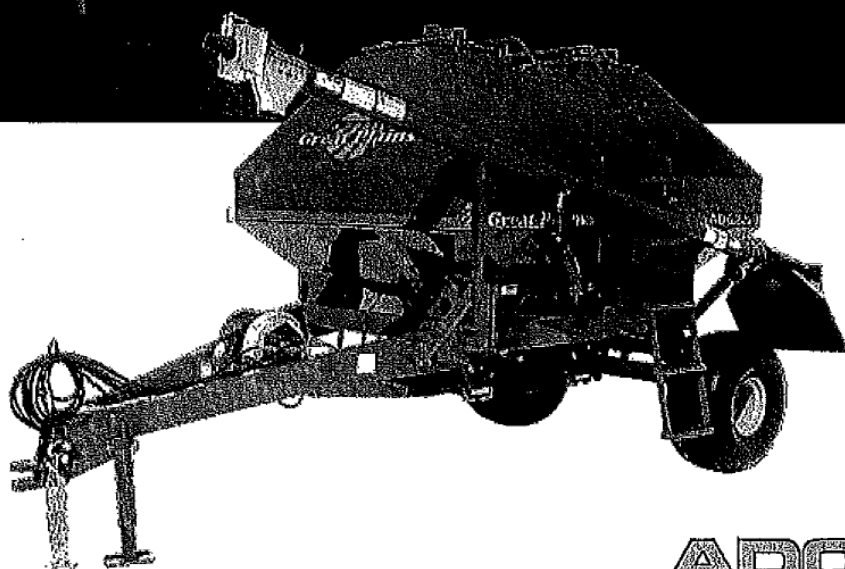
5/1/97

Model ADC2220 Air Drill Cart 167-073P

8-1

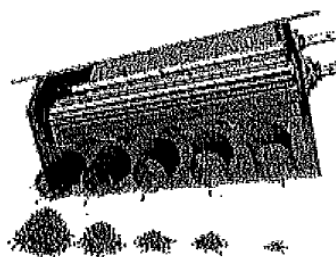
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from Great Plains



The ADC2220 cart is designed as an economical high capacity bulk seeding alternative to conventional linear box drills. The ADC2220 is

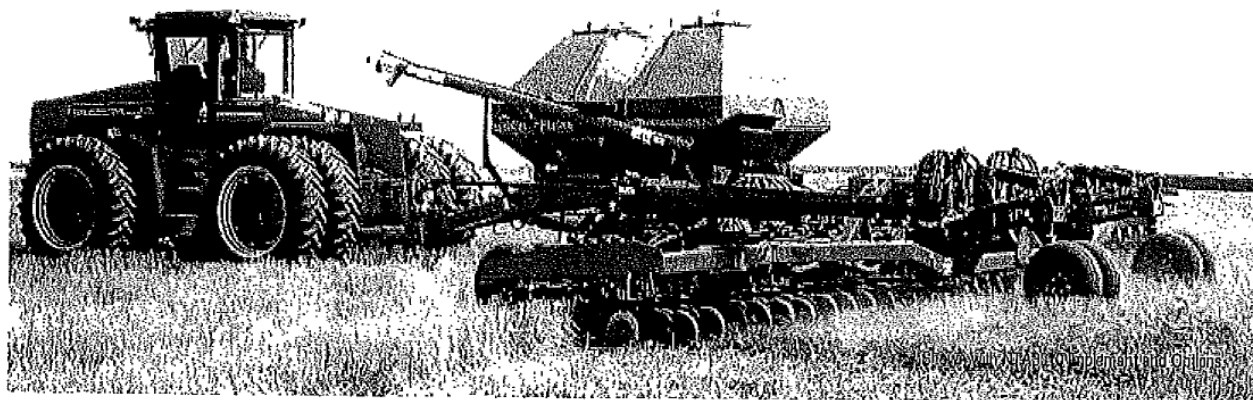
a pull-between cart designed to be semi-mounted to either HD, No-Till or Min-Till pull-behind Great Plains air implements.



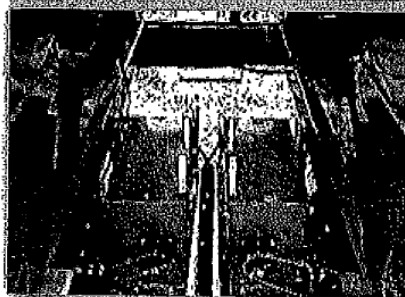
Competitive meters can cross-feed when on slopes (bottom image), starving "uphill" openers. Great Plains' meter box (top image) has one star wheel per tower, eliminating cross-feeding and increasing planting consistency.

Dual purpose design allows you to load and unload with the same auger. It stores conveniently on the side of the cart and is balanced to allow easy handling..

Our pull between Air Drill carts feature a semi-mounted cart-to-⁴implement design. This design allows the implement to "Float" independent of the air cart and shortens the overall length on the air drill by up to 15'. This feature also give the cart and implement the ability to back into machine sheds and field corners.

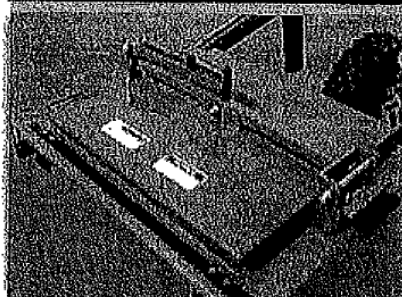


VERSATILE GEARBOXES



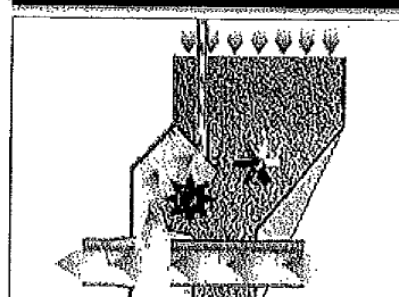
Five input and five output settings provide twenty five gear combinations without changing sprockets or breaking chains.

220 BUSHEL HOPPER DESIGN



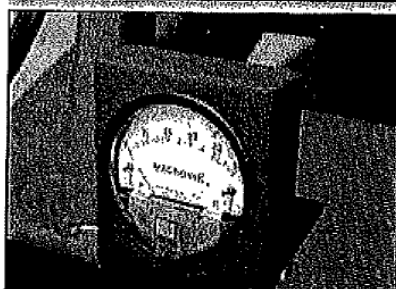
Two 110 (3,876L) bushel steel hoppers provide ample capacity. The ADC2220 can be set up with seed in both hoppers or seed in one and fertilizer in the other.

PRESSURIZED TANKS



Pressurized hoppers allow seed to enter the air flow without restrictions for exceptional metering.

EASY READ PRESSURE GAUGE



Quickly check the fan pressure from the cab with the large pressure gauge conveniently located at the front of the cart.

220 BUSHEL AIR CART SPECIFICATIONS

Model Name	ADC2220
Capacity	2-110 bu. (3,876L) Steel Hoppers
Weight	5360 lbs (2,431kg)
Width	12' 2" (3.70m)
Height	10' 6" (3.20m)
Length	18' 10" (5.74m)
Tire Size	16.5 - 16.1
Auger Size	6" (15.24cm)

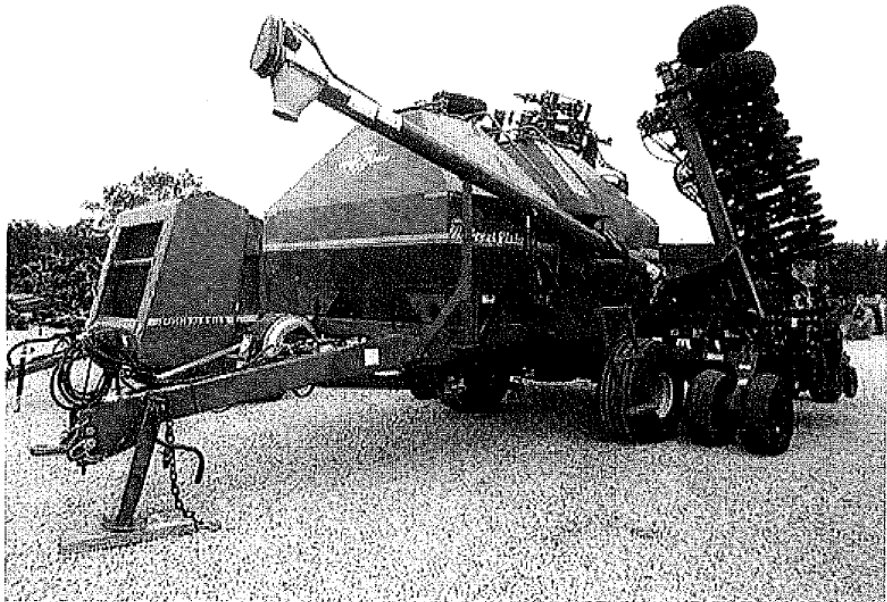
OPTIONS

Small Diameter Clevis
Small Diameter Strap
Large Diameter Cast Hitch

Note: All specifications subject to change without notice.
*Weights based on 7.5" (19.05cm) spacing and will vary depending on options.

1997 GREAT PLAINS NTA3510

[Hide Main Picture](#)



Equipment Specifications	
Year	1997
Manufacturer	GREAT PLAINS
Model	NTA3510
Price	US \$38,500
Location	Cheney, Kansas
Serial Number	GP-Z1014/GP-Y1014
Condition	Used
Stock Number	IMP0259ADC
Width	420 in
Spacing	7.5 in

General Information	
35' no-till drill with 220 bu. air cart, 7 1/2" spacing, Coulters, D/D openers, 3x13 P/W	

Detailed Description

Great Plains NTA 3510 35' no-till drill, with ADC2220 220 bu. air cart 2 110 bu bins, 7 1/2" spacing, Coulters, D/D openers, 3x13 P/W, Hyd. weight transfer for wing down pressure, used this spring and ready to go. (Located on the farm).

Number of Openers: 55, Air Cart, Tank Capacity: 110x2, Row Spacing: 7.5, Width: 420

Contact:

McLaughlin Equipment, Inc.

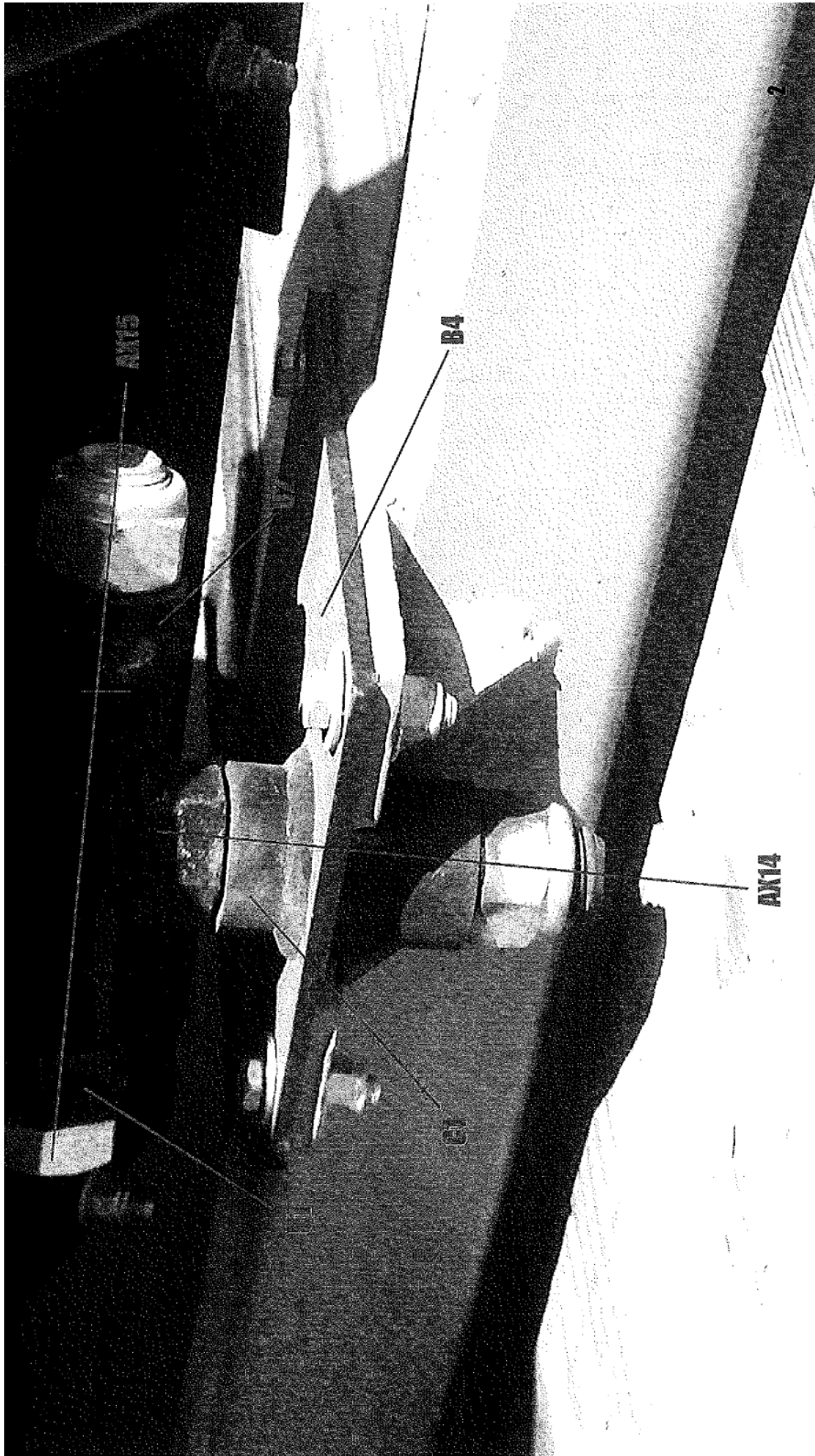
Machine is located in:

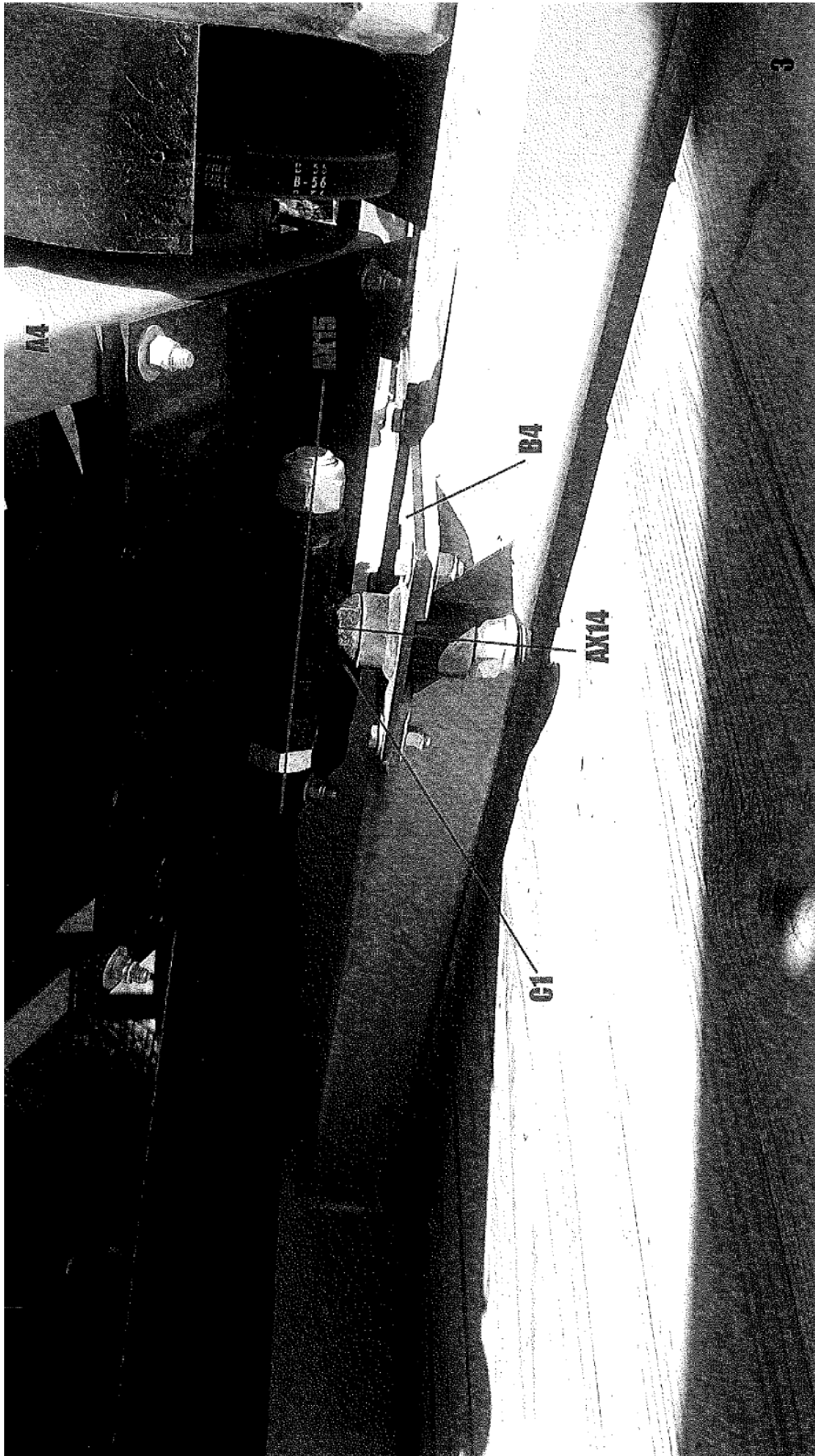
Cheney, Kansas

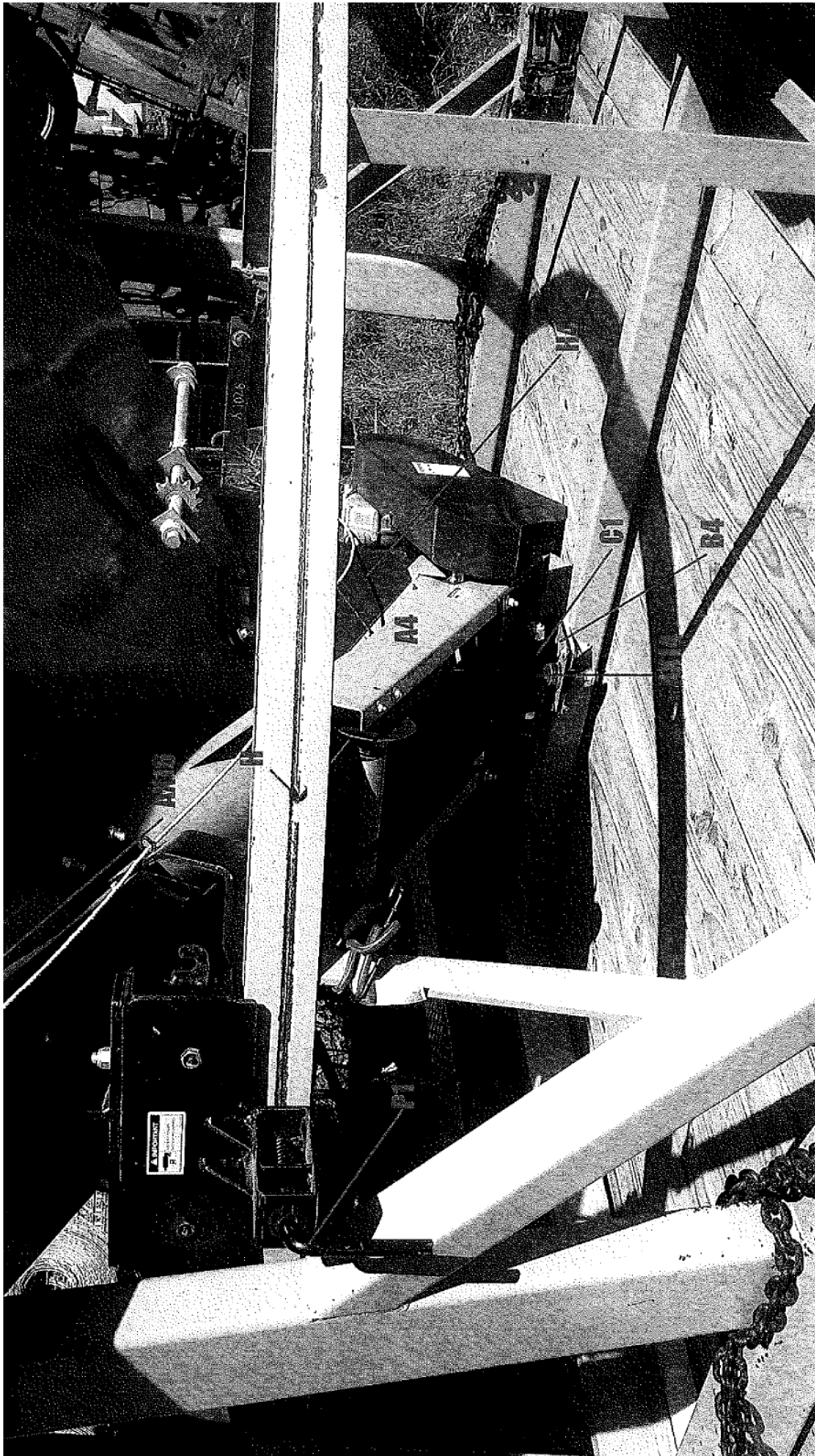
Phone: (888)640-3112

EXHIBIT 4

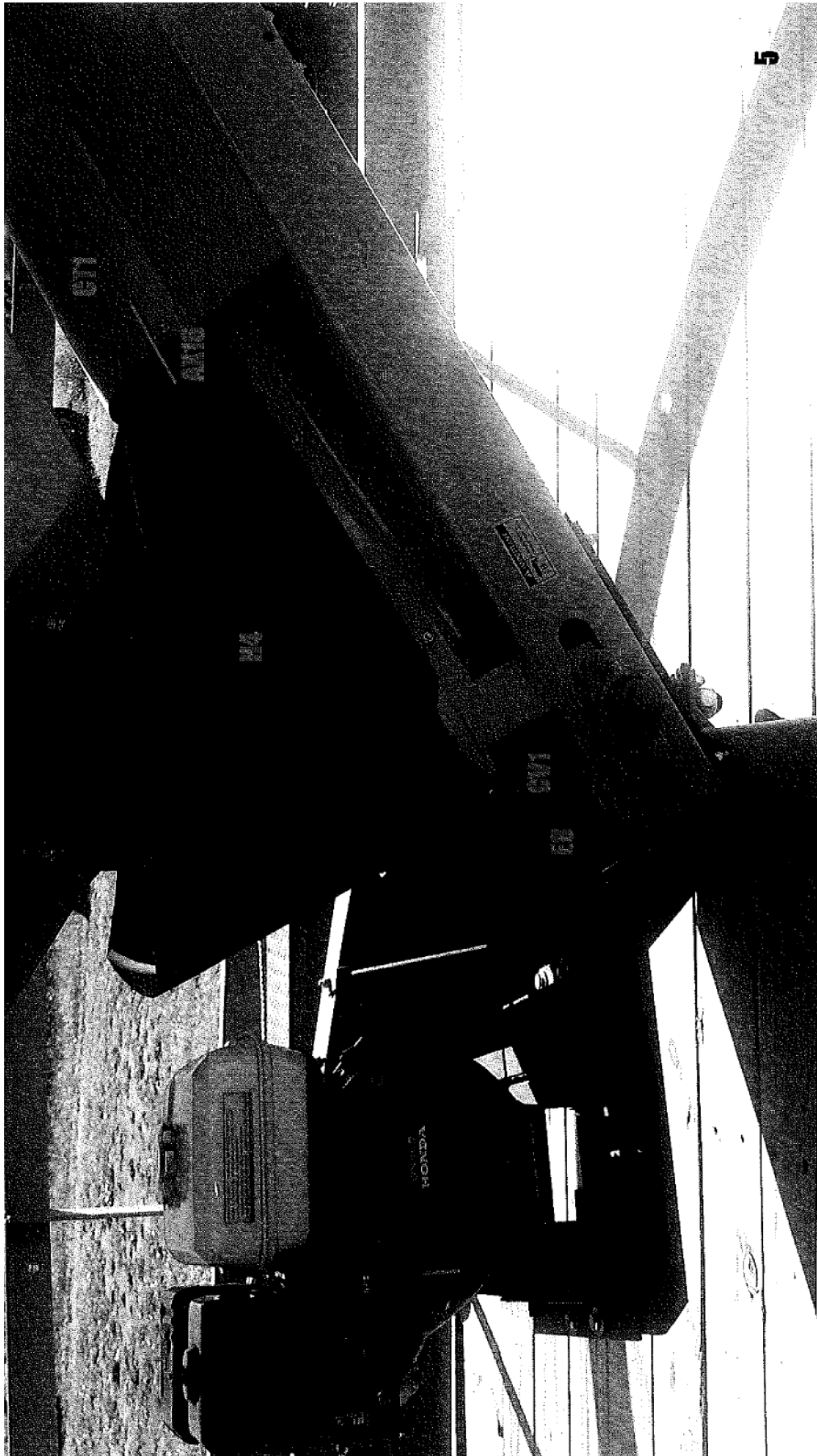








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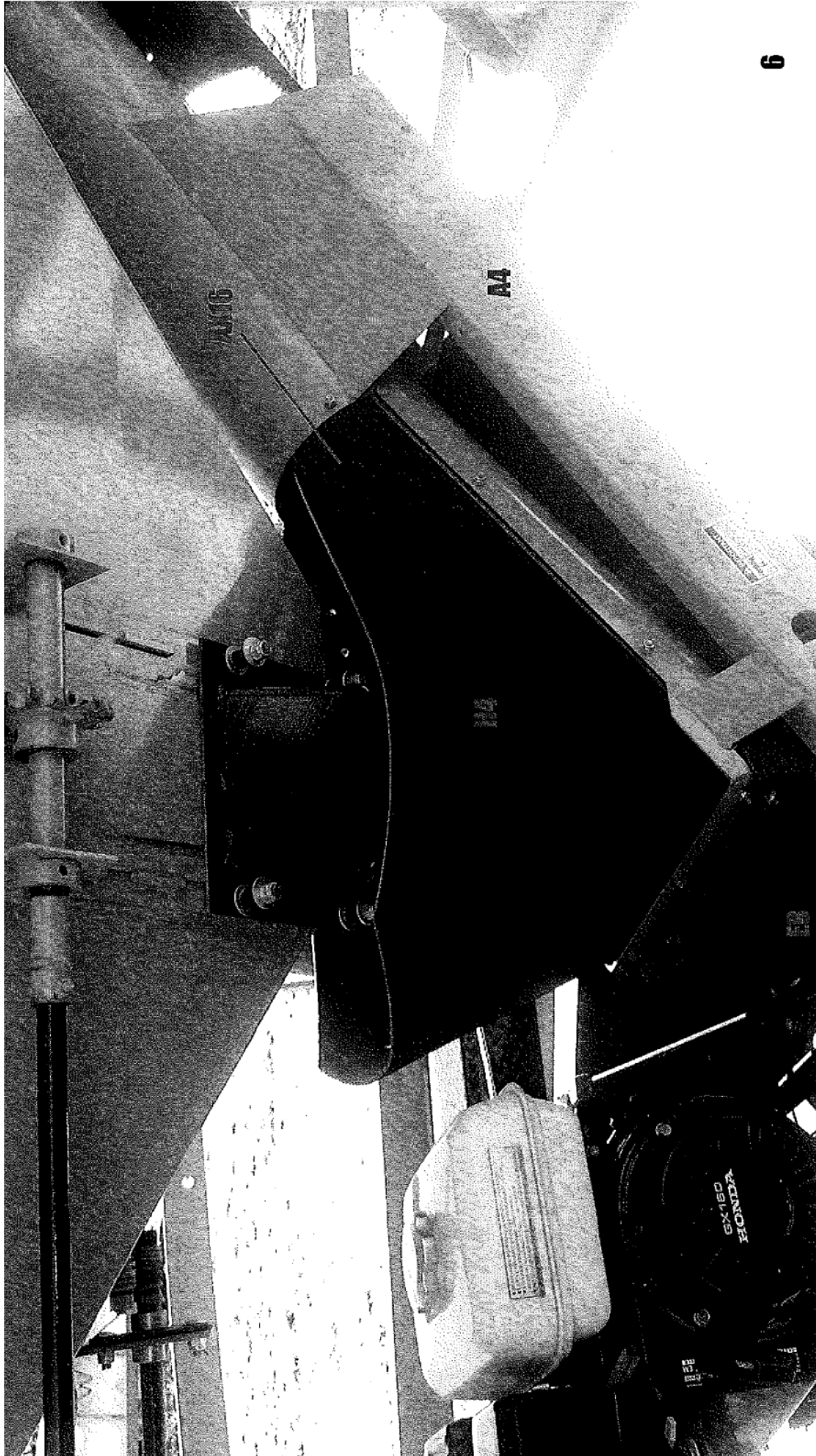


EXHIBIT 5

DECLARATION OF MICHAEL D. MARSTON

I, Michael D. Marston, do declare and state:

1. I am a licensed mechanical engineer in the state of Michigan.
2. I thoroughly reviewed the Great Plains Manual dated 5/1/1997.
3. A 1997 Great Plains ADC2220 bearing serial number GP-Y1014 was listed on www.tractorhouse.com for sale.
4. The ADC2220 shown in aforementioned listing conforms to what is in the Great Plains Manual dated 5/1/1997.
5. I called Great Plains Manufacturing Company and verified that the ADC2220 bearing serial number GP-Y1014 listed in the www.tractorhouse.com listing was made on June 18, 1997.
6. The aforementioned ADC2220 unit was sold to a dealer in Delaware that same year.
7. I declare that all statements made herein are my own knowledge and are true and that all statements made herein are on information believed to be true. I further declare that these statements were made with knowledge that willful false statements are punishable by fine, imprisonment, or both under Section 1001, Title 18, of the United States Code.

10/24/13
Date

Michael D. Marston
Michael D. Marston

EXHIBIT 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT NO.: 8,221,047
ISSUED: July 17, 2012
FOR: Seed Carrier with Pivoting Conveyor

DECLARATION OF ERICK FLINN

SIR:

I, Erick Flinn, do declare and state:

1. I am an engineer at Par-Kan Company.
2. I have worked at Par-Kan for over 6 years.
3. During my time at Par-Kan I have worked on seed carts, grain wagons, seed tenders, and similar agricultural implements.
4. We have designed seed tenders having supports for a conveyors where the support for the conveyor is above the conveyor, and also in other cases where the support for the conveyor is below the conveyor.
5. Generally in the art of seed and grain carts either auger or belt driven conveyors may be used interchangeably to convey agricultural product through the conveyor effectively.
6. I thoroughly reviewed the service manual for the Great Plains ADC2220 seed cart dated 5/1/1997 and it accurately describes the ADC2220 I personally inspected on September 10, 2012.
7. Additionally, I have reviewed a later edition the Great Plains ADC2220 manual dated 3/1/2000 including pages dated 3/16/1998 provided by Michael Marston and it accurately describes the ADC2220 I personally inspected on September 10, 2012.
8. The ADC2220 has a frame as shown on page 2-1 of the ADC2220 manual dated 5/1/1997.
9. The ADC2220 has an inner support arm 20, and an outer support arm 15.
10. The outer support arm 15 pivots near a first end about a vertical axis defined by outer pivot spacer tube 12.

UM-PK0000807

11. The outer support arm 15 is connected to inner support arm 20 with a U-shaped member, or a pin and clevis with the pin being bolt 24.
12. The outer support arm 15 also includes an auger swivel support 18 that allows the auger 26 to pivot about a second vertical axis near the second end of the outer support arm 15.
13. Support arm 15 forms an acute angle with the frame.
14. The auger 26 shown in the ADC2220 manual dated 5/1/1997 may be pivoted so that the hopper 43 of the auger 26 may be below the discharge chute of the main hopper for receiving product dispensed from the main hopper discharge so that the auger 26 may be used to unload the ADC2220.
15. The auger 26 may also be positioned so that the auger discharge end is above the main hopper to dispense agricultural product into the main hopper. This is a loading position.
16. Part numbered 4 in the ADC2220 manual dated 5/1/1997 is a mechanism for locking the auger from pivoting during travel.
17. Part numbered 16 in the ADC2220 manual dated 5/1/1997 is designed for supporting the auger in a locked position during travel.
18. The auger includes a stand shown on page 7-1 of the ADC2220 manual dated 5/1/1997 for supporting the hopper 43 of the auger when it is positioned on the ground in a loading position. This stand is located on the bottom of the hopper 43.
19. Referring to the ADC2220 manual dated 3/1/2000 pages 7-1 and 7-2 dated 3/16/1998 show that pin 46 and cotter pin 47 may be used to lock the arms 15 and 20 due to pin 46 being inserted into at least one mating hole on the frame.
20. I have inspected a Convey-all seed tender on September 11, 2012 and took photographs of the same.
21. After consulting with Convey-all the maker of the seed tender shown in the photographs in Appendix F, Convey-all has informed me that the first two digits of the serial number on the unit indicate the year of manufacture.
22. The seed tender I inspected was manufactured in 2005.
23. The seed tender has a spring pin that extends into one of several holes in an arc shaped rail to lock the conveyor into a desired position.

25. The arc shaped rail is welded to the frame below the main hopper.

26. I declare that all statements made herein are my own knowledge and are true and that all statements made herein are on information believed to be true. I further declare that these statements were made with knowledge that willful false statements are punishable by fine, imprisonment, or both under Section 1001, Title 18 of the United States Code.

9/12/2012

Date

Erick Flinn

Erick Flinn

EXHIBIT 7

(12) **United States Patent**
Meyer(10) **Patent No.:** **US 7,500,814 B2**
(45) **Date of Patent:** **Mar. 10, 2009**(54) **CONVEYOR POSITIONING SYSTEM FOR AN AIR CART IN AN AGRICULTURAL SEEDER**(75) Inventor: **Bradley J. Meyer**, Bismarck, ND (US)(73) Assignee: **Deere & Company**, Moline, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 424 days.

(21) Appl. No.: **11/247,520**(22) Filed: **Oct. 11, 2005**(65) **Prior Publication Data**

US 2007/0079739 A1 Apr. 12, 2007

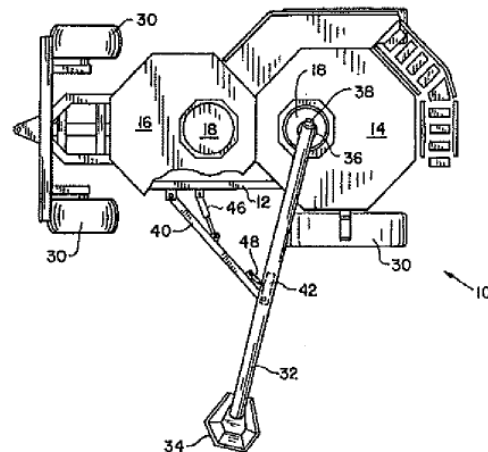
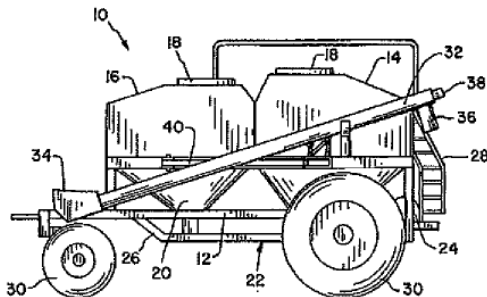
(51) Int. Cl.
B65F 9/00 (2006.01)
B65G 1/00 (2006.01)
B65G 65/00 (2006.01)
B65G 67/00 (2006.01)
B60P 1/00 (2006.01)(52) U.S. Cl. **414/327; 414/343; 414/391; 414/398; 414/523; 414/526; 414/528; 414/920; 198/311; 198/317; 198/318; 198/861.4**(58) **Field of Classification Search** 414/523, 414/528, 327, 343, 390, 391, 393, 398, 526, 414/519, 520, 920; 198/311, 317, 813, 861.4, 198/312, 318
See application file for complete search history.(56) **References Cited**

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4,742,938 A	5/1988	Niewold	222/381
5,108,249 A	4/1992	Kinzenbaw et al.	414/523
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5,979,343 A	11/1999	Gregor et al.	111/175
6,093,926 A	7/2000	Mertins et al.	250/222.1

Primary Examiner—Christopher J. Novosad(74) *Attorney, Agent, or Firm*—Taylor & Aust, P.C.(57) **ABSTRACT**

An air cart for use in an agricultural seeder includes a frame; a material tank carried by the frame; an arm pivotally coupled with the frame; a conveyor coupled with the arm for conveying material to the tank; and a hydraulic positioning system coupled with the conveyor for automatically moving the conveyor to a selected one of a plurality of predetermined positions.

15 Claims, 3 Drawing Sheets

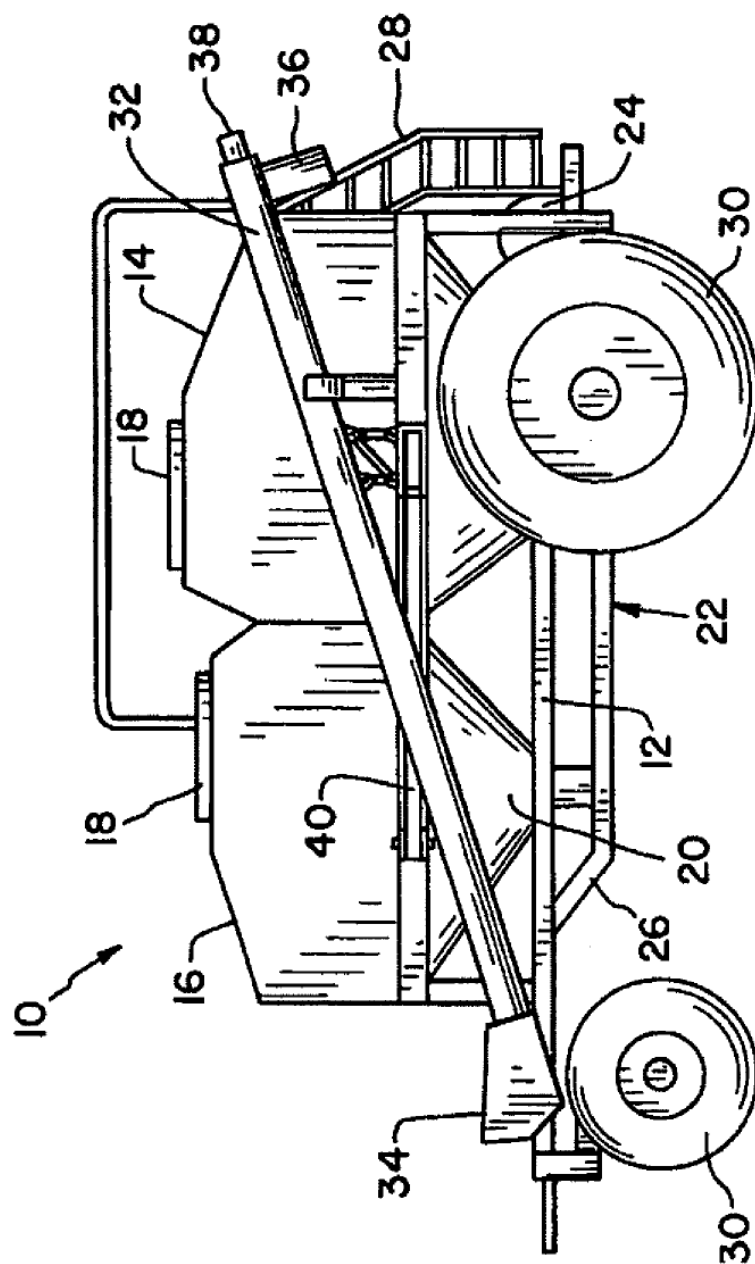


Fig. 1

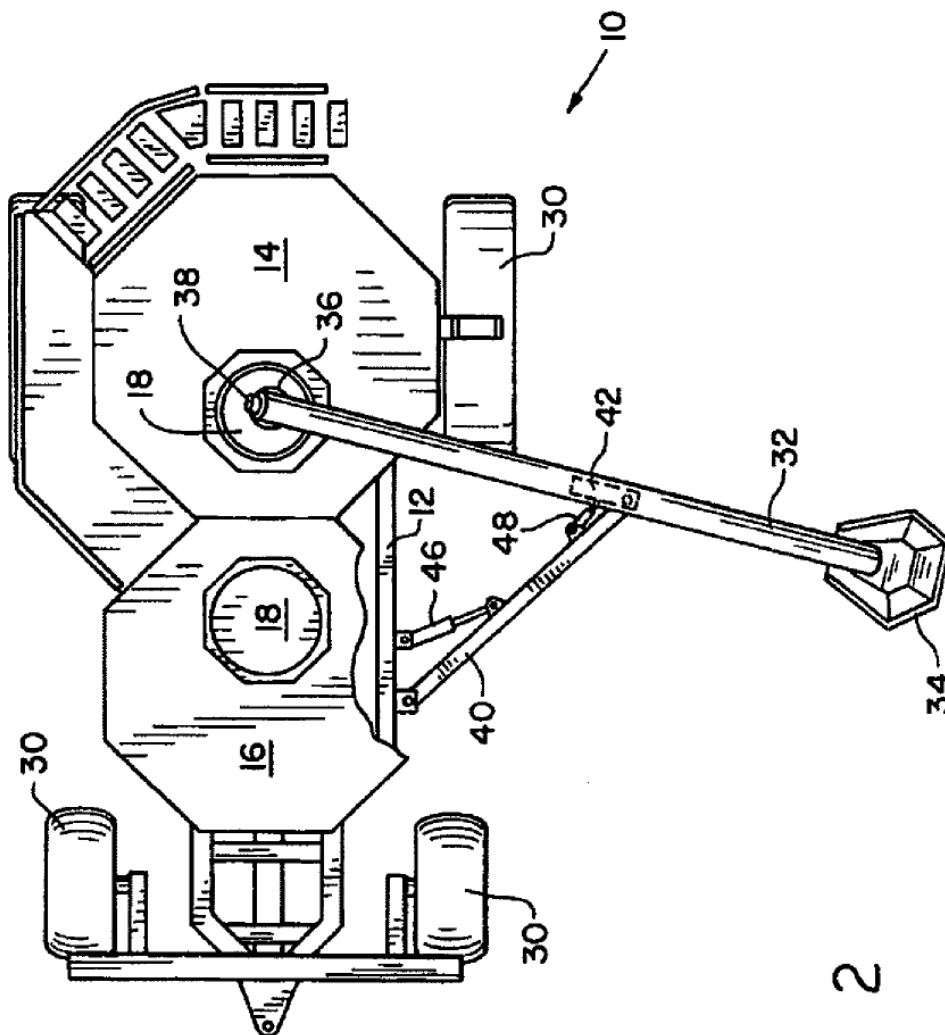
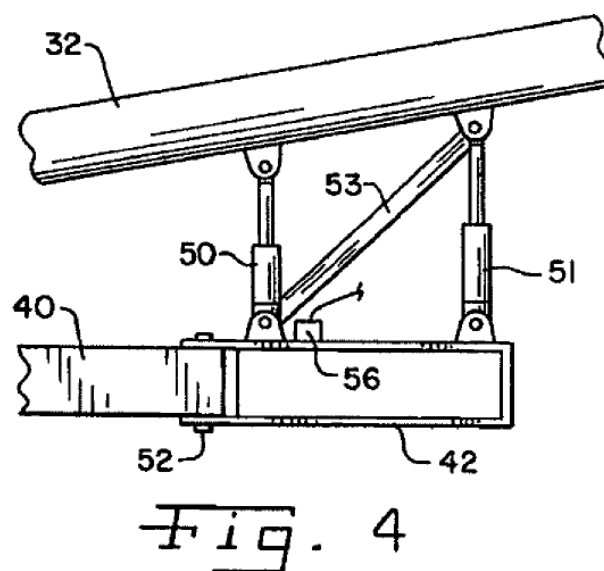
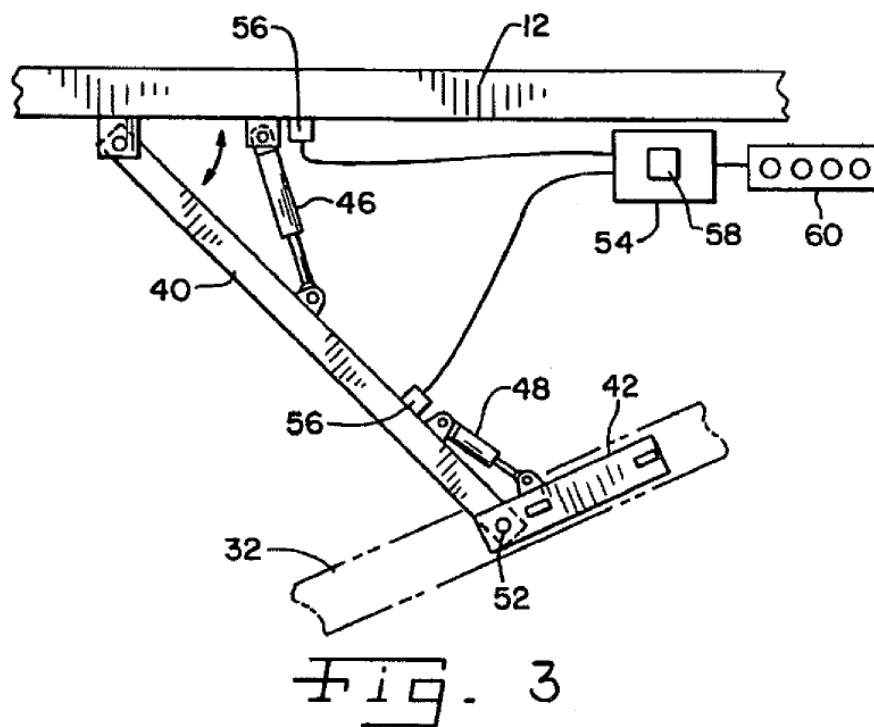


Fig. 2



1

CONVEYOR POSITIONING SYSTEM FOR AN AIR CART IN AN AGRICULTURAL SEEDER

FIELD OF THE INVENTION

The present invention relates to agricultural seeders, and, more particularly, to conveyor systems for air carts associated with such seeders.

BACKGROUND OF THE INVENTION

Air seeders are commonly towed by a traction unit, e.g., an agricultural tractor, to apply seed and/or fertilizer to a field. An air seeder has as a primary component a wheeled air cart which includes one or more frame-mounted tanks for holding material, typically seed and/or fertilizer. It is generally advantageous to tow an air cart in combination with a tilling implement, one behind the other, to place the seed and fertilizer under the surface of the soil. Air seeders generally include a metering system for dispensing material from the tanks and a pneumatic distribution system for delivering the material from the tanks to the soil. A centrifugal fan provides at least one airstream which flows through the pneumatic distribution system. Material is first introduced to the air stream by the metering system at a primary distribution manifold located below the metering system. Material is carried by the air stream through distribution lines to a series of secondary distribution manifolds, which in turn distribute the material through distribution lines to seed boots mounted behind ground openers on the tilling implement so that the product may be evenly delivered to the ground which is tilled by the tilling implement.

An air cart as described above typically includes a conveyor in the form of an auger or belt which is primarily used for loading the one or more tanks, but may also be used for unloading the one or more tanks. Such conveyors may be long and heavy, and thus are usually movably mounted to the frame of the air cart so that the operator is not required to lift and move the entire weight of the conveyor. Nonetheless, such conveyors still remain difficult for some operators to position for loading, unloading and transport, especially with wind or on sidehill terrain.

What is needed in the art is an air cart with a conveyor that can be simply, quickly and easily positioned at loading, unloading and transport positions.

SUMMARY OF THE INVENTION

The present invention provides an air cart having a hydraulic positioning system which automatically moves a conveyor to a selected predetermined position stored in a memory for loading, unloading or transport.

The invention comprises, in one form thereof, an air cart for use in an agricultural seeder, including a frame; a material tank carried by the frame; an arm pivotally coupled with the frame; a conveyor coupled with the arm for conveying material to the tank; and a hydraulic positioning system coupled with the conveyor for automatically moving the conveyor to a selected one of a plurality of predetermined positions.

The invention comprises, in another form thereof, a method of operating an agricultural seeder, including the steps of: providing an air cart including a frame, at least one material tank carried by the frame, a conveyor coupled with the frame for conveying the material, and a hydraulic positioning system coupled with the conveyor; selecting one of a plurality of predetermined positions of the conveyor; and

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actuating the hydraulic positioning system to automatically move the conveyor to the selected position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of an embodiment of an air cart of the present invention with the conveyor in a transport position;

FIG. 2 is a top view of the air cart of FIG. 1 with the conveyor in a loading position;

FIG. 3 is a top, fragmentary view of a portion of the air cart shown in FIGS. 1 and 2; and

FIG. 4 is a side, fragmentary view of a portion of the air cart shown in FIGS. 1-3.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, and more particularly to FIGS. 1 and 2, there is shown an embodiment of an agricultural material handling implement in the form of an air cart 10 for use in an air seeder. Air cart 10 typically is pulled behind a tillage implement (not shown) including a number of openers for forming parallel seed trenches in the soil in which the singulated seeds are deposited in known manner. Air cart 10 may also be configured as a forecart which is pulled in front of the tillage implement by a traction unit such as a tractor (not shown).

Although configured as an air cart in the embodiment shown, the agricultural implement may also be in the form of a different type of implement which carries a material which can be conveyed, such as a gravity wagon, planter, etc.

Air cart 10 generally includes one or more tanks which hold a material to be deposited in the seed trenches formed in the soil, such as seed and/or fertilizer. In the embodiment shown, air cart 10 includes a first tank 14 and second tank 16. First tank 14 and second tank 16 each include an inlet 18 for receiving material, and an outlet 20 for discharging material to pneumatic distribution system 22 also carried by frame 12. Pneumatic distribution system 22 includes a centrifugal fan 24 which blows air at a predetermined flow rate and pressure through air distribution lines 26 to the tillage implement ahead of air cart 10.

Frame 12 also carries a stair and walkway 28, wheels 30 and conveyor 32. In the embodiment shown, conveyor 32 is in the form of an auger, but may also be in the form of a belt if desired. Conveyor 32 is primarily used to load material into tanks 14 and 16, but may also be used to unload material remaining within tanks 14 and 16 after planting is complete. Conveyor 32 includes an inlet 34 in the form of a loading hopper, an outlet 36 in the form of an unloading chute, and a hydraulic motor 38 adjacent outlet 36 for driving an internal flighting (not shown).

Conveyor 32 is generally moveable in three primary directions, i.e., toward and away from frame 12, up and down, and in a rotational direction about a generally vertical axis. To that end, a first arm 40 is pivotally coupled with frame 12. The outboard end of first arm 40 is moveable toward and away from frame 12 through the pivotal action, and is itself pivotally coupled with a second arm 42.

A hydraulic positioning system including a first hydraulic cylinder 46, second hydraulic cylinder 48, third hydraulic cylinder 50 and fourth hydraulic cylinder 51 effects movement of conveyor 32 in the three primary movement directions noted above. First hydraulic cylinder 46 is coupled between first arm 40 and frame 12 to effect the pivotal movement therebetween in a generally horizontal plane. Second hydraulic cylinder 48 is coupled between first arm 40 and second arm 42 to effect rotational movement of conveyor 32

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about generally vertical pivot pin 52 interconnecting first arm 40 and second arm 42. Third hydraulic cylinder 50 and fourth hydraulic cylinder 51 are coupled between second arm 42 and the bottom of conveyor 32 to effect up and down movement of conveyor 32. Third hydraulic cylinder 50 and fourth hydraulic cylinder 51 may be operated sequentially or concurrently to effect up and down motion and up and down pivoting of conveyor 32. A cross bar linkage 53 extending between the bottom link of hydraulic cylinder 50 and the top link of hydraulic cylinder 51 prevents undesirable side to side motion of conveyor 32 (in the plane of the drawing shown in FIG. 4), while still allowing generally vertical and pivoting motion of conveyor 32.

According to an aspect of the present invention, conveyor 32 is moved in the primary movement directions using hydraulic cylinders rather than manually moved as is the case with known designs. Additionally, the hydraulic positioning system senses a current position of conveyor 32 and automatically moves conveyor 32 to a selected one of a plurality of positions including one or more loading positions, one or more unloading positions, and a transport position. More particularly, an electrical processing circuit 54 is carried by air cart 10 and may be digital or analog based. The exact mounting position of electrical processing circuit 54 on air cart 10 can be selected depending upon the application. Electrical processing circuit 54 is electrically coupled with one or more sensors 56 for sensing the current position of conveyor 32. In the embodiment shown, sensors 56 may be potentiometers that are coupled with a frame member adjacent a hydraulic cylinder and sense rotational movement of the cylinder relative to the frame member during use. It may also be desirable to place a sensor under conveyor inlet 34 to sense contact with the ground. Electrical processing circuit 54 is also electrically coupled with an indicator 58, preferably in the form of a visual display, for indicating to an operator the position of conveyor 32. Visual display 58 may be incorporated, e.g., in a GPS based monitoring and display system in the operators cab of the tractor. Alternatively, visual display 58 may be integrally incorporated into electrical processing circuit 54 on board air cart 10. Of course, other possibilities are also available, such as a dedicated visual display in the operators cab.

Electrical processing circuit 54 is also electrically coupled with an input device 60 which may include a number of depressible buttons corresponding to the number of predetermined positions of conveyor 32. In the embodiment shown, input device 60 is mounted directly to air cart 10 for access by an operator on the ground. Input device 60 may separately or concurrently be provided within the operators cab through the use of a dedicated device or incorporation into another device (such as a touch screen on a GPS system).

During operation, the various air and electrical connections of air cart 10 are coupled with the tillage implement and tractor as appropriate. Since air cart 10 includes a first tank 14 and second tank 16, conveyor 32 is moveable to a first loading position in which conveyor outlet 36 is positioned above inlet 18 of first tank 14 (FIG. 2), and a second loading position in which conveyor outlet 36 is positioned above inlet 18 of second tank 16. Conveyor 32 may also be positioned at an unloading position in which conveyor inlet 34 is positioned below a clean out plate (such as at the bottom of the air distribution manifold below second tank 16) for unloading unused material. Conveyor 32 is also moveable to the transport position shown in FIG. 1 after a loading or unloading operation. Conveyor 32 is moved to a selected position by depressing a corresponding button on an input device 60 located on board air cart 10 or in the operators cab. The

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position of conveyor 32 is sensed and electrical processing circuit 54 controls first hydraulic cylinder 46, second hydraulic cylinder 48 and/or third hydraulic cylinder 50 in a concurrent or sequential manner to move conveyor 32 to the selected position. The control logic necessary for controlling movement of conveyor 32 may be effected using suitable electrical hardware, software and/or firmware. Depending upon the contour of the ground or other factors, it may be desirable or necessary to place conveyor 32 in a "float" position after being moved to the selected position such that the bottom end of conveyor 32 slowly moves to and rests upon the ground. After a selected loading or unloading operation, the button corresponding to the transport position may be depressed and conveyor 32 is automatically moved back to the transport position shown in FIG. 1.

Having described the preferred embodiment, it will become apparent that various modifications can be made without departing from the scope of the invention as defined in the accompanying claims.

Assignment

The entire right, title and interest in and to this application and all subject matter disclosed and/or claimed therein, including any and all divisions, continuations, reissues, etc., thereof are, effective as of the date of execution of this application, assigned, transferred, sold and set over by the applicant(s) named herein to Deere & Company, a Delaware corporation having offices at Moline, Ill. 61265, U.S.A., together with all rights to file, and to claim priorities in connection with, corresponding patent applications in any and all foreign countries in the name of Deere & Company or otherwise.

The invention claimed is:

1. An agricultural implement, comprising:
 - a frame;
 - at least one material tank carried by said frame;
 - a conveyor coupled with said frame for conveying the material;
 - a hydraulic positioning system coupled with said conveyor for moving said conveyor in at least two directions to a selected one of a plurality of predetermined positions; and
 - at least one sensor for sensing a position of said conveyor.
2. The agricultural implement of claim 1, wherein said at least two directions include at least two of:
 - a generally horizontal direction;
 - a generally vertical direction; and
 - a rotational direction.
3. The agricultural implement of claim 1, further including at least one arm interconnecting said conveyor with said frame.
4. The agricultural implement of claim 3, wherein said at least one arm includes a first arm coupled with a second arm, and said positioning system includes a first hydraulic cylinder coupled between said first arm and said frame, and a second hydraulic cylinder coupled between said first arm and said second arm.
5. The agricultural implement of claim 4, wherein said first arm and said second arm are coupled together using a generally vertical pivot pin.
6. The agricultural implement of claim 1, wherein each said tank has an inlet and said conveyor has an outlet, said positioning system configured for positioning said conveyor outlet relative to a selected tank inlet.
7. The agricultural implement of claim 1, including an outlet associated with at least one said tank, said conveyor

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having an inlet, said positioning system configured for positioning said conveyor inlet relative to said tank outlet.

8. The agricultural implement of claim 1, including an indicator for indicating a position of said conveyor.

9. The agricultural implement of claim 8, wherein said indicator comprises a visual display.

10. The agricultural implement of claim 1, wherein said conveyor comprises one of an auger and a belt.

11. The agricultural implement of claim 1, wherein said agricultural material handling implement comprises an air cart.

12. The agricultural implement of claim 1, wherein each said material tank carries at least one of seed and fertilizer.

13. The agricultural implement, comprising:
 a frame;
 at least one material tank carried by said frame;
 a conveyor coupled with said frame for conveying the material; and
 a hydraulic positioning system coupled with said conveyor for moving said conveyor in at least two directions to a selected one of a plurality of predetermined positions;
 at least one arm interconnecting said conveyor with said frame, said at least one arm includes a first arm coupled with a second arm, and said positioning system includes a first hydraulic cylinder coupled between said first arm and said frame, and a second hydraulic cylinder coupled between said first arm and said second arm; and
 a third hydraulic cylinder coupled between said second arm and said conveyor.

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14. An agricultural implement, comprising:
 a frame;

at least one material tank carried by said frame;

a conveyor coupled with said frame for conveying the material; and

a hydraulic positioning system coupled with said conveyor for moving said conveyor in at least two directions to a selected one of a plurality of predetermined positions, said positioning system including at least two hydraulic cylinders coupled with said conveyor, and including an electrical processing circuit coupled with each said hydraulic cylinder, said electrical processing circuit actuating at least one said hydraulic cylinder to position said conveyor at one of said plurality of predetermined positions.

15. The agricultural implement of claim 14, wherein said at least one tank includes a first tank and a second tank, each of said first tank and said second tank including an inlet and an outlet, said conveyor including an inlet and an outlet, said one of a plurality of predetermined positions including one of:
 a first position in which said conveyor outlet is positioned in association with said first tank inlet;
 a second position in which said conveyor outlet is positioned in association with said second tank inlet;
 a third position in which said conveyor inlet is positioned in association with at least one of said first tank outlet and said second tank outlet; and
 a transport position.

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