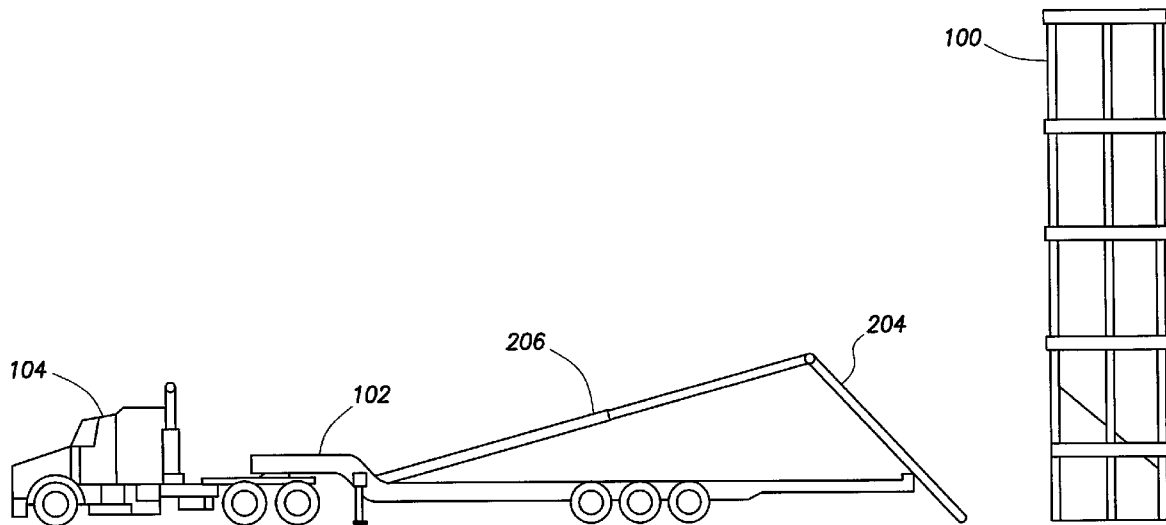




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**Hagan et al.**(10) **Pub. No.: US 2010/0071284 A1**(43) **Pub. Date: Mar. 25, 2010**(54) **SELF ERECTING STORAGE UNIT****Publication Classification**(76) Inventors: **Ed Hagan**, Hastings, OK (US);  
**Leonard Case**, Duncan, OK (US)(51) **Int. Cl.**  
**E04H 7/00** (2006.01)(52) **U.S. Cl.** ..... **52/192; 52/745.01**(57) **ABSTRACT**Correspondence Address:  
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Methods and apparatuses for storing materials on a well site are disclosed. A self erecting storage system includes a trailer and storage bin. A first latching mechanism is coupled to the trailer. A movable arm with a second latching mechanism is also coupled to the trailer. The storage bin has a first pin and a second pin. The first pin may be coupled to the first latching mechanism and the second pin may be coupled to the second latching mechanism.

(21) Appl. No.: **12/235,270**(22) Filed: **Sep. 22, 2008**

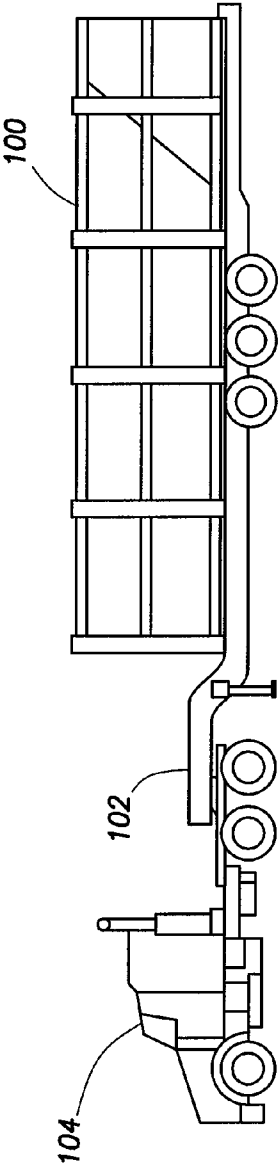


FIG. 1

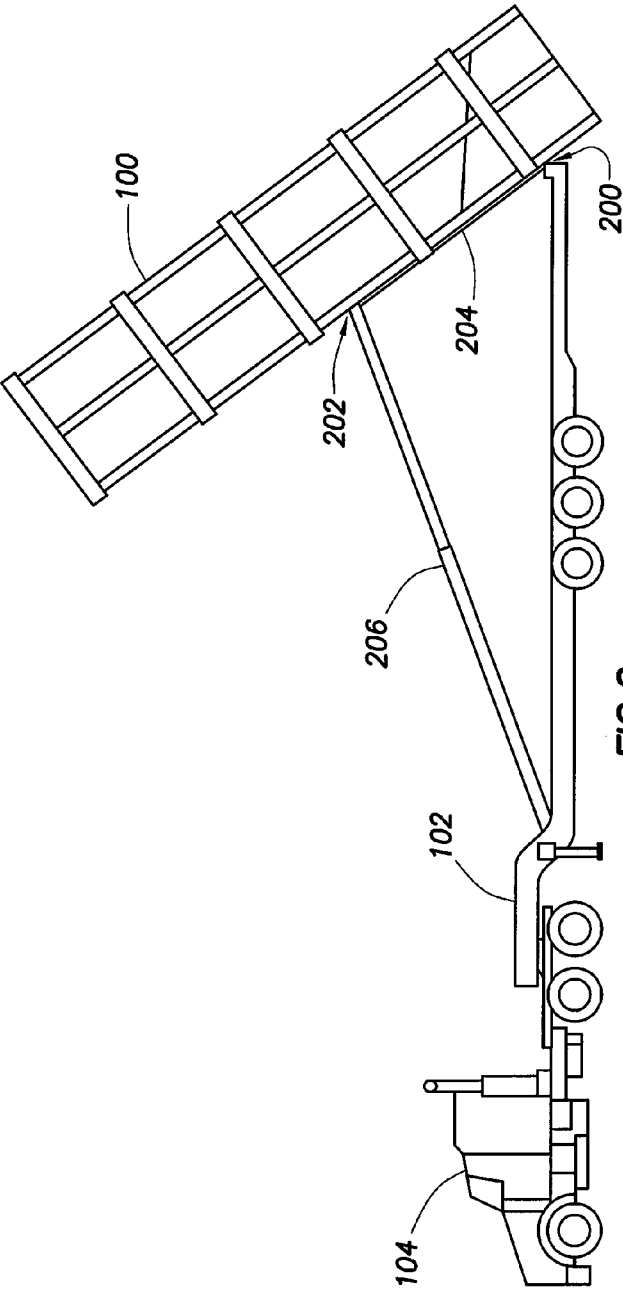
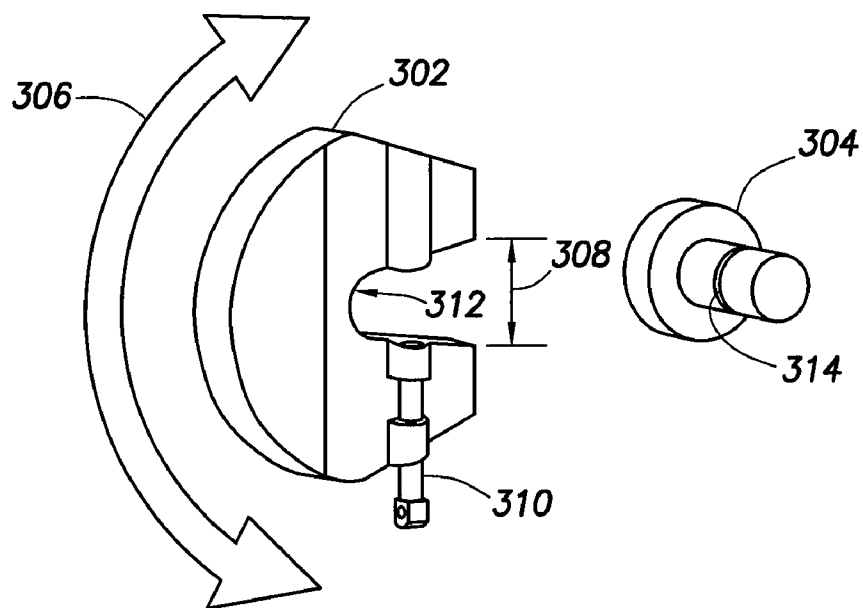
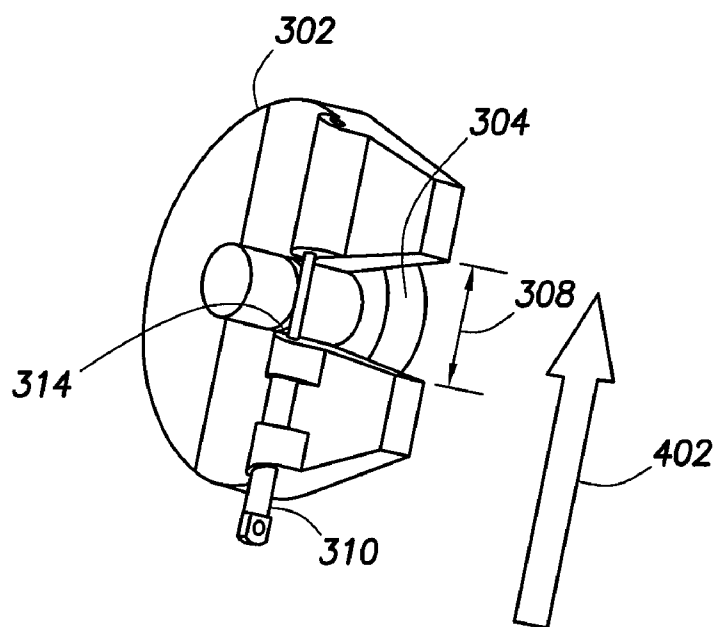


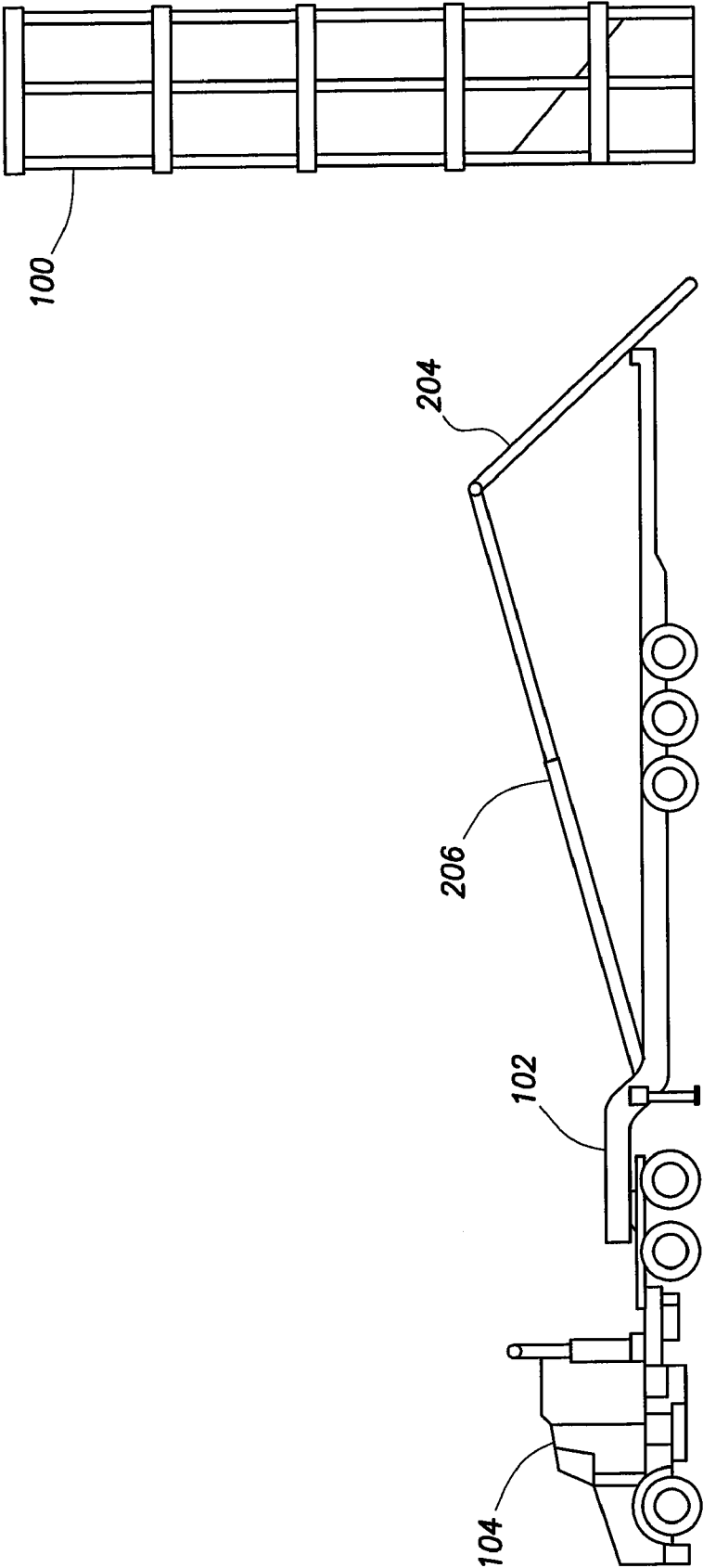
FIG. 2



**FIG.3**



**FIG.4**



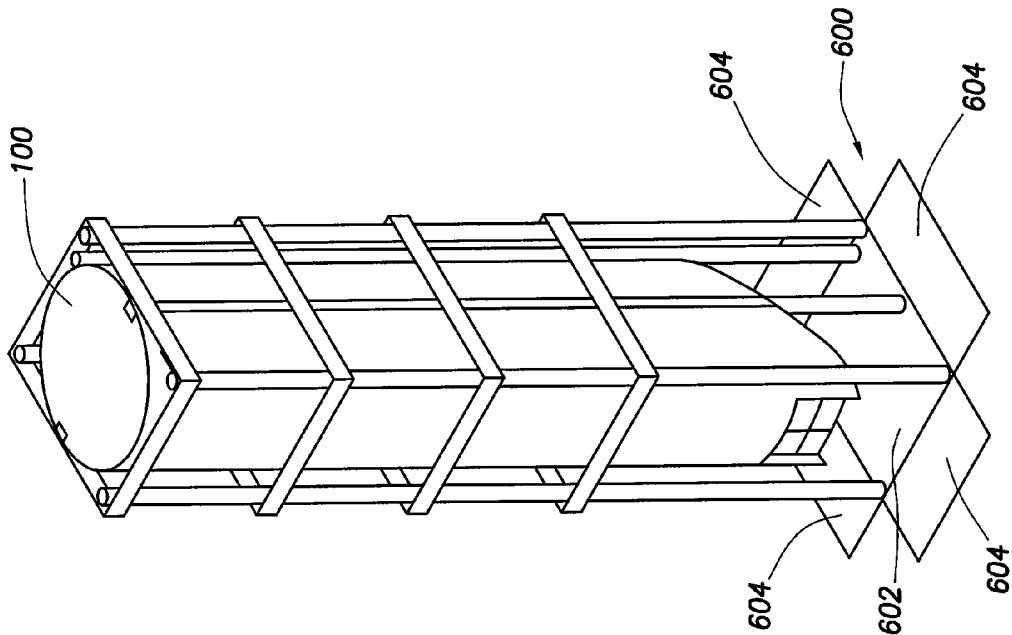


FIG. 6A

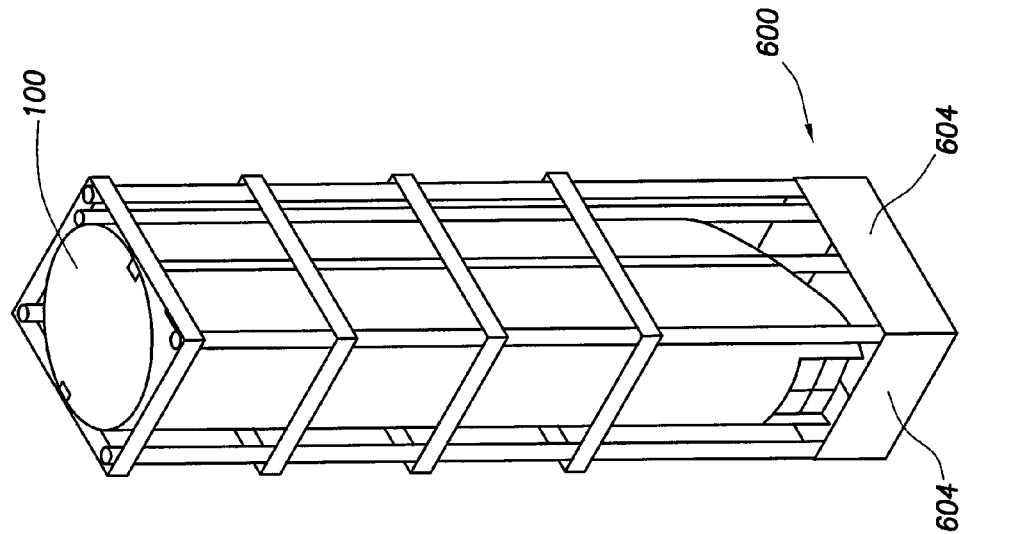


FIG. 6B

## SELF ERECTING STORAGE UNIT

### BACKGROUND

[0001] The present invention relates generally to oilfield operations, and more particularly to methods and apparatuses for storing materials on a well site.

[0002] Oil field operations are conducted in a variety of different locations and involve a number of equipments, depending on the operations at hand. The requisite materials for the different operations are often hauled to and stored at the well site where the operations are to be performed.

[0003] Considering the number of equipments necessary for performing oil field operations and ground conditions at different oil field locations, space availability is often a constraint. Currently, the materials necessary for performing oil field operations are often stored in storage bins. The storage bins are often in a trailer configuration with a large footprint.

[0004] For instance, in normal fracturing operations proppant or sand is combined with a fracturing fluid in a blender and then pumped by high pressure pumps into the well bore. Depending on the reservoir and well requirements, a large volume of materials may be required on location. In some pad frac applications several well bores may be treated without moving the fracturing equipment, therefore requiring up to 2,000,000 pounds of materials in a 24 hour period. The typical volume for a trailer storage device is often between 2500 sks to 3200 sks. As a result, an area of over 14000 square feet may be required for storing the 2,000,000 pounds of materials which is necessary for some pad frac applications. Considering the limitations on space availability on the field, the large footprint necessary for material storage is undesirable.

### FIGURES

[0005] Some specific example embodiments of the disclosure may be understood by referring, in part, to the following description and the accompanying drawings.

[0006] FIG. 1 is a material storage apparatus in accordance with an exemplary embodiment of the present invention.

[0007] FIG. 2 is a self erecting silo in accordance with an exemplary embodiment of the present invention.

[0008] FIG. 3 is a latch mechanism in accordance with an exemplary embodiment of the present invention.

[0009] FIG. 4 depicts the latch mechanism of FIG. 3 in the engaged position.

[0010] FIG. 5 is an erected self erecting silo in accordance with an exemplary embodiment of the present invention.

[0011] FIGS. 6A and 6B depict a self erecting silo with an extendable support base in accordance with an exemplary embodiment of the present invention.

[0012] While embodiments of this disclosure have been depicted and described and are defined by reference to example embodiments of the disclosure, such references do not imply a limitation on the disclosure, and no such limitation is to be inferred. The subject matter disclosed is capable of considerable modification, alteration, and equivalents in form and function, as will occur to those skilled in the pertinent art and having the benefit of this disclosure. The depicted and described embodiments of this disclosure are examples only, and not exhaustive of the scope of the disclosure.

### SUMMARY

[0013] The present invention relates generally to oilfield operations, and more particularly to methods and apparatuses for storing materials on a well site.

[0014] In one embodiment, the present invention is directed to a self erecting storage system comprising: a trailer; a first latching mechanism coupled to the trailer; a movable arm coupled to the trailer; a second latching mechanism coupled to the movable arm; a storage bin having a first pin and a second pin, wherein the first pin is couplable to the first latching mechanism, and wherein the second pin is couplable to the second latching mechanism.

[0015] In another embodiment, the present invention is directed to a method of raising a self erecting storage system comprising: placing a first storage bin on a trailer; coupling a first end of the trailer to a first location on the first storage bin; coupling a movable arm to a second location on the first storage bin, wherein the movable arm is coupled to a second end of the trailer; extending the movable arm, wherein the first storage bin is raised as the movable arm extends; decoupling the first location on the first storage bin from the first end of the trailer; and decoupling the second location on the first storage bin from the movable arm.

[0016] In another embodiment, the present invention is directed to a method of lowering a self erecting storage system comprising: coupling a first latching mechanism to a trailer; coupling an extendable arm to the trailer; coupling a second latching mechanism to the trailer; connecting the first latching mechanism to a first pin on a storage bin; extending the extendable arm; connecting the second latching mechanism to a second pin on the storage bin; retracting the extendable arm.

[0017] The features and advantages of the present disclosure will be readily apparent to those skilled in the art upon a reading of the description of exemplary embodiments, which follows.

### DESCRIPTION

[0018] The present invention relates generally to oilfield operations, and more particularly to methods and apparatuses for storing materials on a well site.

[0019] FIG. 1 depicts a material storage apparatus in accordance with an exemplary embodiment of the present invention. In one embodiment, the material storage unit is a silo 100. The silo 100 may be mounted on and transported to a desired location using a trailer 102 which may be pulled by a truck 104.

[0020] The trailer 102 may be used to transport the silo 100 to a desired location. In one embodiment, the trailer 102 is compatible with a number of silos (not shown) to be used at a desired location. In this embodiment the trailer 102 may be used to transport a number of different silos, one at a time, to desired locations. As would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, the silos may have different capacities. In this embodiment, all silos, regardless of capacity, are equipped with connecting points that have a fixed position relative to the trailer 102, thereby allowing the same trailer to be utilized for transporting the different silos.

[0021] As depicted in FIG. 2, the silo 100 is coupled to the trailer 102 using two sets of latching mechanisms 200 and 202. A first set of latching mechanisms 200 is attached at the rear end of the trailer 102 and acts as the stationary pivot point about which the silo 100 rotates. A second set of latching mechanisms 202 is attached to a lifting frame 204 coupled to the silo 100. In one embodiment, hydraulic cylinders 206 extend out from the trailer 102 and raise the silo 100 from a horizontal position to a vertical position. As the hydraulic

cylinders 206 extend, the lifting frame 204 raises the silo 100. Once the silo 100 has been raised to the vertical position by the hydraulic cylinders 206 the first latching mechanism 200 and the second latching mechanism 202 are disengaged.

[0022] FIG. 3 depicts a latch mechanism in accordance with an exemplary embodiment of the present invention. In one embodiment, the latch mechanisms 200, 202 are self aligning and self attaching latch mechanisms. In one exemplary embodiment, the latch mechanism 200, 202 may comprise a receiving latch 302 placed on the trailer 102 bed and the lifting frame 204 and corresponding latching pins 304 positioned on the silo 100. In one embodiment, the receiving latch 302 may be pivotable in the direction of the arrows 306. In this embodiment, the receiving latch 302 may pivot in order to self align with the latching pin 304, providing a self aligning latching system. For instance, when a self erecting silo is to be removed from the field, a trailer having a receiving latch 302 may be backed in towards the latching pin 304 on the silo. As the receiving latch 302 reaches the latching pin 304 it rotates, allowing the latching pin 304 to enter the opening 308 on the receiving latch 302. As depicted in FIG. 3, the receiving latch 302 may include a cylinder 310. Before the latching pin 304 is engaged with the receiving latch 302 the cylinder 310 may be in the retracted position. Once the receiving latch 302 has self aligned with the latching pin 304, the latching pin 304 moves into the opening 308 of the receiving latch 302 until it reaches the end portion 312 of the opening. The latching pin 304 may include a groove 314.

[0023] FIG. 4 depicts the latching pin 304 after it is engaged with the receiving latch 302. As depicted in FIG. 4, once the latching pin 304 reaches the end portion 312 of the opening 308, the cylinder 310 may be activated to extend in the direction of the arrow 402 through the groove 404 in the latching pin 304. Once the cylinder 310 is in the extended position, the receiving latch 302 and the latching pin 304 are latched together. As would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, the cylinder 310 may be extended and retracted from the truck 104 or a remote location thereby permitting remote operation of the latching mechanisms 200, 202. Further, as would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, a number of different methods may be used to remotely operate the latching mechanism. In one exemplary embodiment, the latching mechanisms may be unlatched remotely using an air cylinder, an electric mechanism or a hydraulic mechanism.

[0024] As depicted in FIG. 5, once the latching mechanisms 200, 202 have been disengaged, the lifting frame 204 is retracted and the trailer 102 may be taken away, leaving the silo 100 as a stand alone unit on the field. The trailer 102 can then be removed from the location to make space available for additional equipment and/or storage units on the field. In one embodiment the same trailer 102 may be used to transport additional silos to the field.

[0025] As depicted in FIGS. 6A and 6B, in one exemplary embodiment the silo 100 may rest on an extendable support base 500. The extendable support base 500 may enhance the silo's 100 stability, specially in inclement weather or on sub-standard soil/pad conditions. Specifically, the extendable support base 500 may be a solid plane reducing the load per unit area at the base. Consequently, the improved design disclosed herein will permit the stabilization of the silo 100 despite unfavorable conditions such as soft ground or inclement weather. In one embodiment, the extendable support base

500 may be 8 by 13 feet in dimension when retracted as depicted in FIG. 6A and may be enlarged to 10 by 15 feet when in the extended position as depicted in FIG. 6B. As would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, in different embodiments, the extendable support base may have different dimensions depending on the size of the storage bin and the conditions on the field. As would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, a number of different arrangements may be used to create an extendable support base 500.

[0026] In one exemplary embodiment, the extendable support base 500 may comprise a horizontal portion 502 coupled to four folding portions 504 which are movable between a vertical retracted position as depicted in FIG. 6A and a horizontal extended position as depicted in FIG. 6B.

[0027] Once a silo 100 is no longer required on the field, the trailer 102 may be transported back to the field. In one embodiment, a truck 104 may be used to transport the trailer 102. The trailer 102 is then backed into position and the first set of latching mechanisms 200 contacts the pins on the silo 100 and latches shut once the trailer 102 contacts the silo 100. Once the lower first set of latch mechanisms 200 is attached, the lifting frame 204 is raised hydraulically until the upper set of latching mechanisms 202 are latched to the upper pins. Once all the latches 200, 202 are engaged, the hydraulic cylinders 206 retract and the lifting frame 204 moves down, lowering the silo 100 onto the trailer 102 bed.

[0028] In one exemplary embodiment (not shown), the silo 100 may be equipped with load sensors which provide real-time metering of the materials in the silo by weight loss. U.S. patent application Ser. No. 11/930,756 (hereinafter "'756 Application"), assigned to Halliburton Energy Services, Inc., discloses exemplary systems and methods of conducting metering by weight loss and is incorporated herein by reference in its entirety. In one exemplary embodiment, the systems and methods disclosed in the '756 Application may be coupled to the silo 100 of the present invention to permit real-time metering by weight loss. In one exemplary embodiment, the silo 100 may be coupled to a plurality of sensors (not shown). The load sensors may be arranged to allow a determination of real-time weight loss while compensating for errors in the reading that may result from factors such as the wind load on the silo 100. The load sensors may be arranged so that an error in the load sensors' signal from a moment or a torque or off axis force produces equal in magnitude but opposite in polarity influence on that load sensor's output signal. These separate signals may then be combined, allowing the contribution of the moment and/or torque signal resulting from errors in the load sensor signal to cancel each other. In one embodiment, the error signal cancellation may be accomplished through a symmetrical arrangement of the load sensors. In one exemplary embodiment, a software application may be used to process the readings from the multiple load sensors to deduce the inaccuracies resulting from factors such as the wind load and determine the actual real-time weight loss from the silo 100. As would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, the load sensors may be load cells, load pins, or other suitable sensors.

**[0029]** It would be appreciated by those of ordinary skill in the art, with the benefit of this disclosure, that although the present invention is described with reference to a silo, other dry material storage units may also be utilized without departing from this disclosure.

**[0030]** Therefore, the present invention is well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the present invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the present invention. In addition, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee.

What is claimed is:

1. A self erecting storage system comprising:  
a trailer;  
a first latching mechanism coupled to the trailer;  
a movable arm coupled to the trailer;  
a second latching mechanism coupled to the movable arm;  
a storage bin having a first pin and a second pin,  
wherein the first pin is couplable to the first latching mechanism, and  
wherein the second pin is couplable to the second latching mechanism.
2. The self erecting storage system of claim 1, wherein the first latching mechanism and the second latching mechanism comprise a receiving latch.
3. The self erecting storage system of claim 2, wherein the receiving latch is rotatable.
4. The self erecting storage system of claim 3, wherein the receiving latch comprises a cylinder.
5. The self erecting storage system of claim 4, wherein the first pin comprises a groove.
6. The self erecting storage system of claim 5, wherein the cylinder is placed in the groove when in the extended position.
7. The self erecting storage system of claim 1, wherein the first pin is a latching pin.
8. The self erecting storage system of claim 1, wherein the latching mechanism is remotely operated.
9. The self erecting storage system of claim 1, wherein the storage bin is a silo.
10. The self erecting storage system of claim 1, further comprising a load sensor coupled to the storage bin.
11. The self erecting storage system of claim 1, further comprising an extendable base coupled to the storage bin.
12. The self erecting storage system of claim 1, wherein the movable arm is coupled to a hydraulic cylinder.
13. A method of raising a self erecting storage system comprising:  
placing a first storage bin on a trailer;  
coupling a first end of the trailer to a first location on the first storage bin;

coupling a movable arm to a second location on the first storage bin,  
wherein the movable arm is coupled to a second end of the trailer; extending the movable arm,  
wherein the first storage bin is raised as the movable arm extends;  
decoupling the first location on the first storage bin from the first end of the trailer; and  
decoupling the second location on the first storage bin from the movable arm.

14. The method of claim 12, wherein the first end of the trailer is coupled to the first location on the first storage bin by a latching mechanism;

15. The method of claim 14, wherein decoupling the first location on the first storage bin from the first end of the trailer is performed remotely.

16. The method of claim 14, wherein the latching mechanism is self aligning.

17. The method of claim 14, wherein the latching mechanism comprises a receiving latch and a latching pin.

18. The method of claim 13, further comprising:  
coupling the movable arm to a hydraulic cylinder;  
wherein the hydraulic cylinder extends the movable arm.

19. The method of claim 13, further comprising coupling the storage bin to a load sensor.

20. The method of claim 13, further comprising:  
placing a second storage bin on a trailer;  
coupling a first end of the trailer to a first location on the second storage bin;  
coupling a movable arm to a second location on the second storage bin,  
wherein the movable arm is coupled to a second end of the trailer; extending the movable arm,  
wherein the second storage bin is raised as the movable arm extends;

decoupling the first location on the second storage bin from the first end of the trailer; and  
decoupling the second location on the second storage bin from the movable arm.

21. The method of claim 20, wherein the first storage bin and the second storage bin have different capacities.

22. A method of lowering a self erecting storage system comprising:

coupling a first latching mechanism to a trailer;  
coupling an extendable arm to the trailer;  
coupling a second latching mechanism to the extendable arm;  
connecting the first latching mechanism to a first pin on a storage bin;  
extending the extendable arm;  
connecting the second latching mechanism to a second pin on the storage bin;  
retracting the extendable arm.

23. The method of claim 22, wherein the storage bin is a silo.

24. The method of claim 22, wherein the latching mechanism comprises a receiving latch and a latching pin.

\* \* \* \* \*