Aug. 21, 1962 R. J. PAULUS ETAL 3,050,159

SELF-ERECTING PORTABLE MIXING PLANT OR THE LIKE

Filed Jan. 12, 1960 4 Sheets-Sheet 1

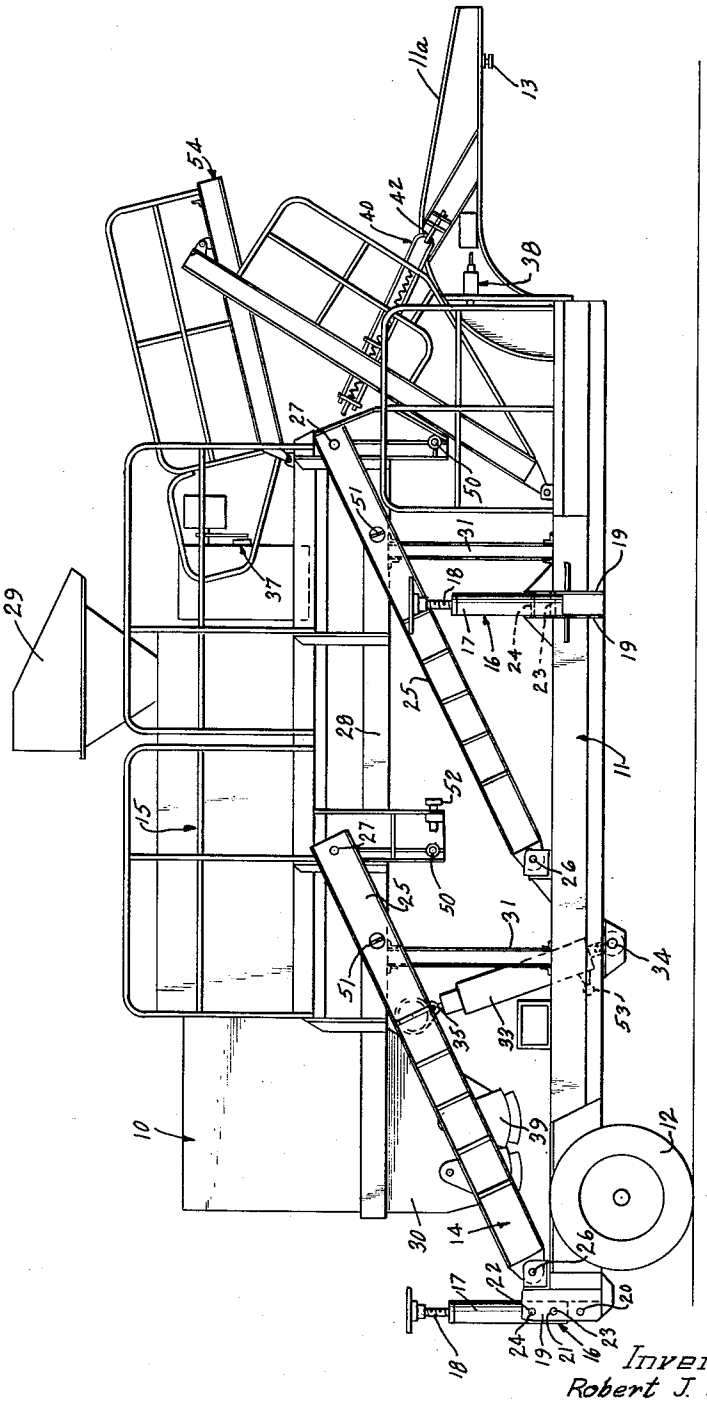


Fig. 1

Inventors
Robert J. Paulus
Robert E. Franham

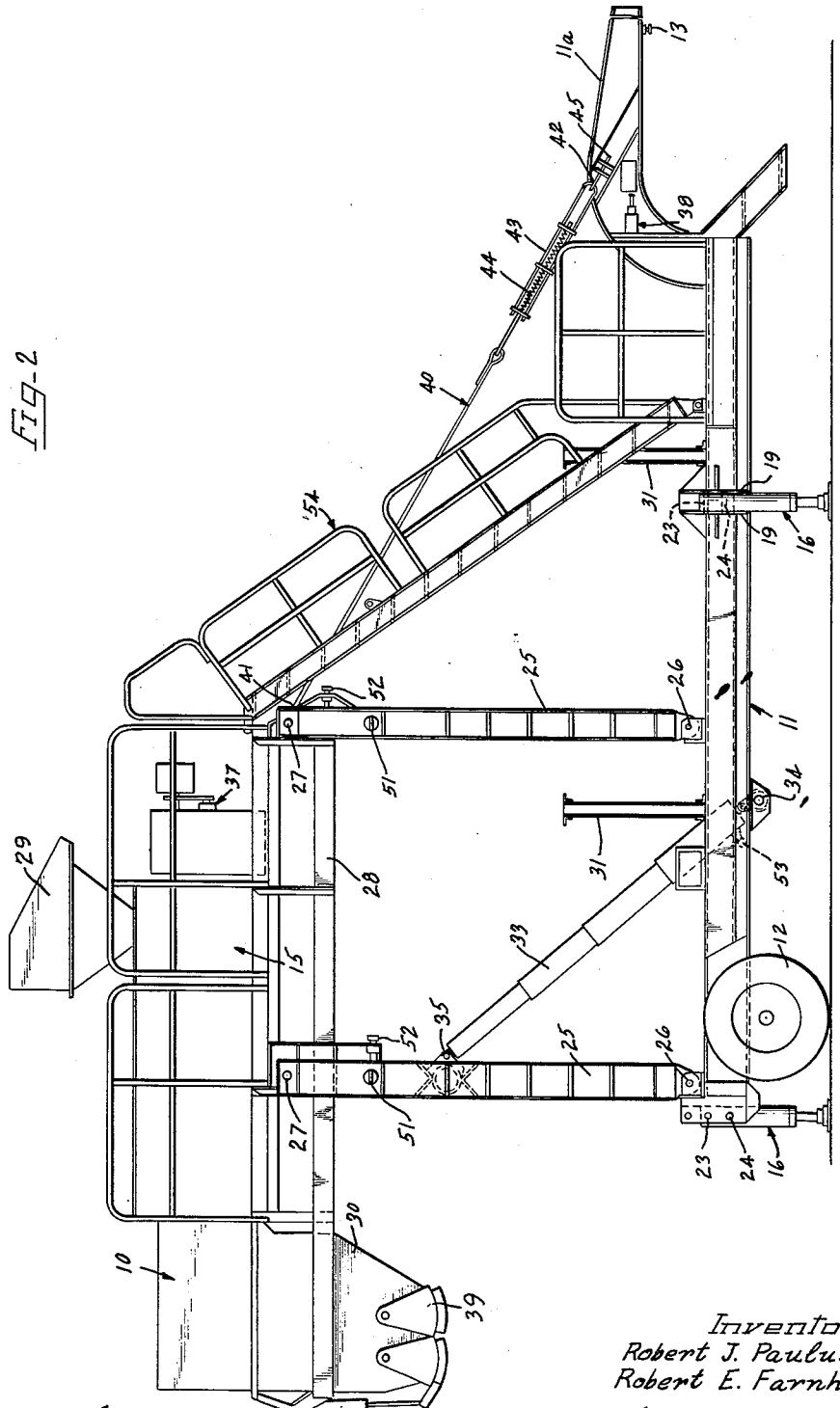
by Kill, Sherman, Meroni, Gross & Simpson Attys.

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FIG-2



Inventors
Robert J. Paulus
Robert E. Farnham

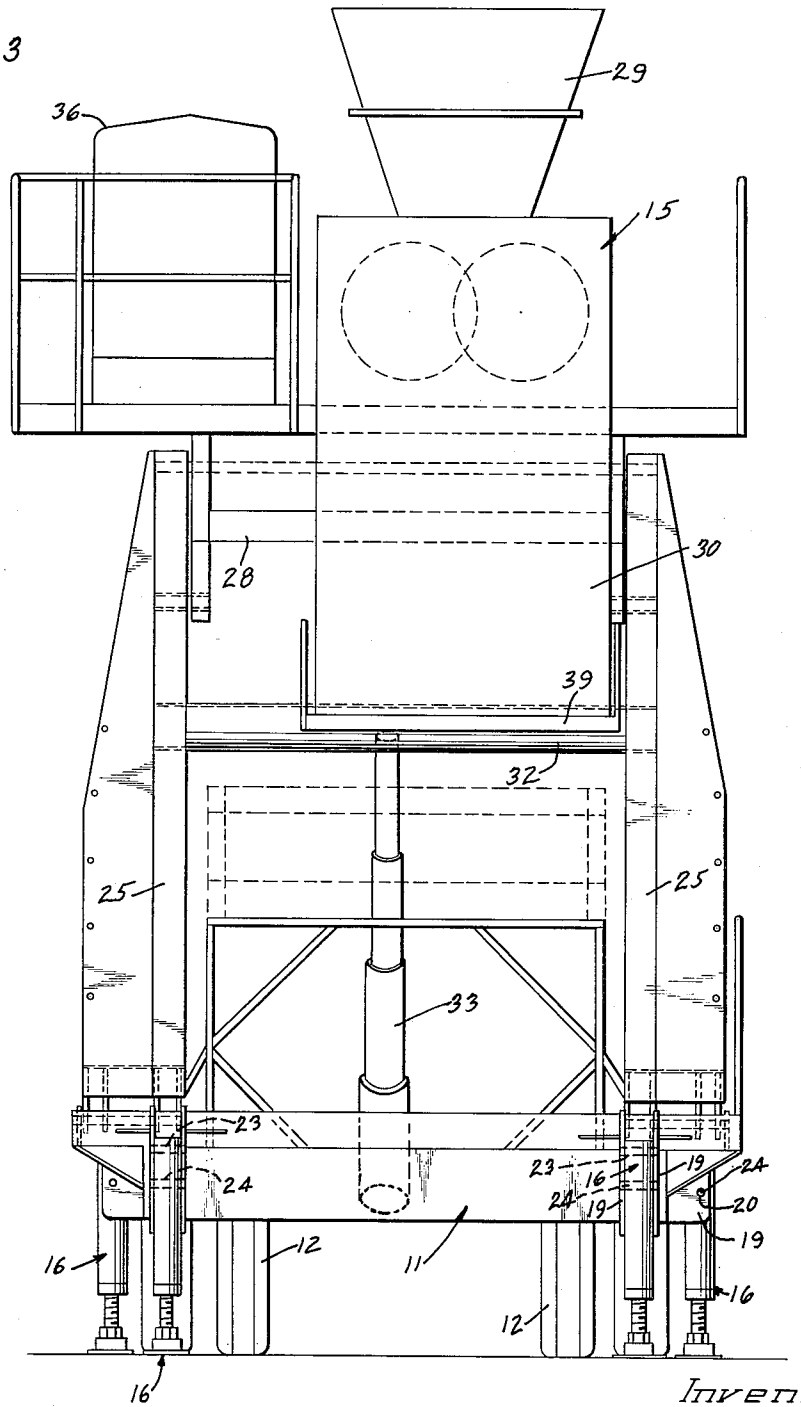
by Hill, Sherman, Meroni, Gross & Simpson Attys.

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SELF-ERECTING PORTABLE MIXING PLANT OR THE LIKE

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Fig. 3



Inventors
Robert J. Paulus
Robert E. Farnham

by Hill, Sherman, Meroni, Gross & Simpson Attys

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SELF-ERECTING PORTABLE MIXING PLANT OR THE LIKE

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Fig_4

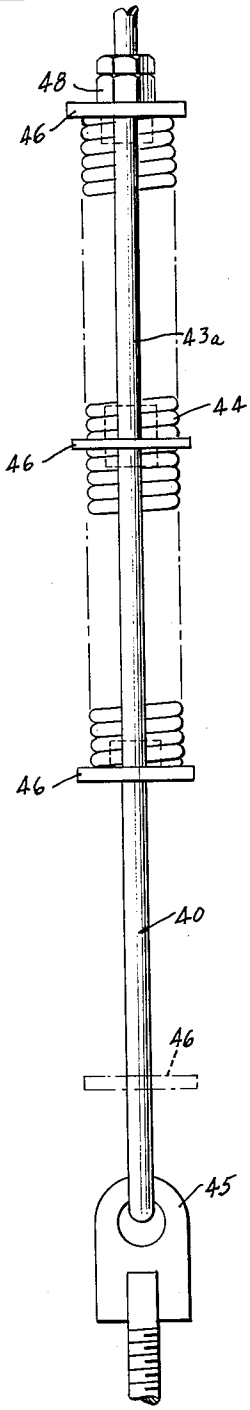


Fig_5

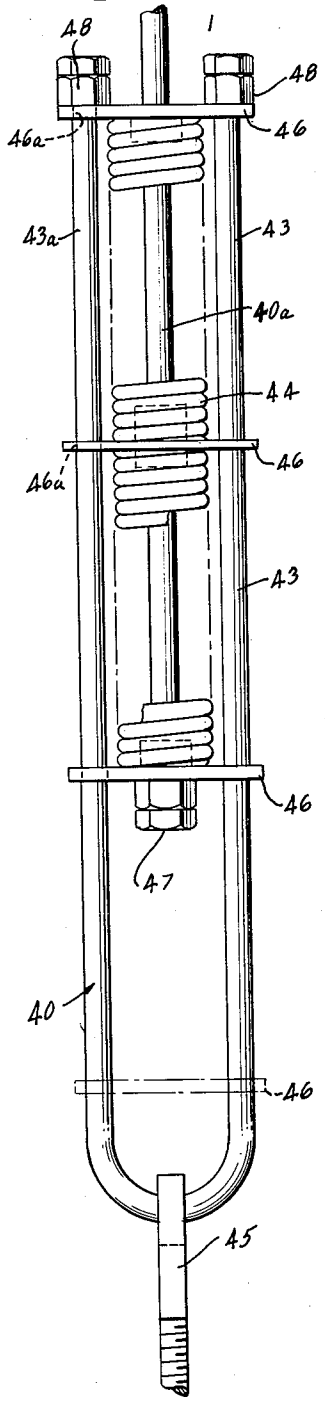
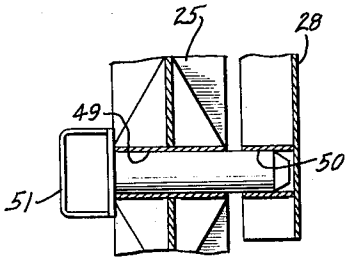


Fig_6



Inventors
Robert J. Paulus
Robert E. Farnham

by Hill, Sherman, Meroni, Gross & Simpson Attys.

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3,050,159

SELF-ERECTING PORTABLE MIXING PLANT OR THE LIKE

Robert J. Paulus, Aurora, and Robert E. Farnham, Naperville, Ill., assignors to Barber-Greene Company, Aurora, Ill., a corporation of Illinois

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10 Claims. (Cl. 189—11)

The present invention relates to a self-erecting device including a collapsible frame which is movable back and forth from collapsed and upright positions.

More particularly, the present invention relates to a self-erecting device including a mobile trailer having a collapsible frame mounted thereon and which frame carries a chute so that the chute may be elevated and more readily used.

Still more particularly, the present invention concerns a collapsible frame of the type described above and which frame carries an aggregate mixer which may be elevated with the chute and which is adapted to discharge its contents into the elevated chute.

An important feature of the present invention concerns a self-retracting locking and bracing mechanism which is cooperable with a hydraulic or pneumatic cylinder in elevating and lowering a collapsible frame.

In the past, many machines, particularly in the road construction field, have been operated in a stationary position sufficiently high above ground level to permit discharging of their products by gravity into trucks or trailers which are driven under one end. In order to facilitate the use of such machines, they must be sufficiently portable to be moved from one location to another over public highways. Time and manpower consumed in such a move increases production cost to a point where small jobs at many different locations cannot be bid successfully unless the moves can be made quickly and with a minimum of labor. To this end, many machines are constructed with integral wheels, axles, towing gear, etc. For operation they are jacked or lifted to the proper height and supported on blocking, jack legs, or structural framing for sufficient rigidity. Installing or removing the supports and bracing them becomes the most labor-consuming part of moving.

In accordance with the present invention, a self-erecting device has been provided and in the illustrated form includes a mixer of the continuous-flow type for mixing the aggregates used in constructing road bases. The self-erecting device is adapted to be used with any machine to be erected. A mixer and a discharge chute are mounted on a collapsible frame structure carried on a commercial low-bed trailer for maximum portability over public roads. A hydraulic cylinder has been provided for pivoting the collapsible frame structure with respect to the commercial-bed trailer so as to enable the collapsible frame structure to be moved from collapsed and elevated positions. In operation, the trailer serves as a sub-base and is supported on four short legs equipped with built-in screw jacks for leveling the same. It is not necessary to raise the trailer on these screw jacks more than enough to relieve the load on the tires. Thus, by merely manipulating the jacks and operating the cylinder, the self-erecting device may be placed in readiness for use at a new location.

In order to keep the manufacturing cost of the self-erecting device to a minimum, the collapsible frame structure is adapted to be elevated by means of a single-acting cylinder. Spring loaded cables are connected between the collapsible frame structure and the trailer, and are cooperable with the single acting cylinder to pull the collapsible frame structure out of an elevated position and to allow the load of the collapsible frame structure to

be carried by the single acting cylinder as the piston and piston rod are retracted within the cylinder.

Still another feacture of the present invention relates to the provision of releasable lockout means connected to the collapsible frame for maintaining the collapsible frame in an upright position so the hydraulic cylinder need not support the load of the collapsible frame after the collapsible frame has been elevated to an upright positions.

According to still another feature of the present invention, the collapsible frame has a pug mill and a chute mounted thereon which pug mill and chute are movable with the collapsible frame from collapsed and upright positions.

In view of the foregoing it will now be appreciated an important object of the present invention is to provide a portable self-erecting device for carrying suitable machines, such as a pug mill, a chute having a discharge gate, and the like and which device can be readily moved from one location to another with a minimum expenditure of time, labor and expense.

Still a further object of the present invention is to provide a simple, low cost collapsible frame structure for disposition on a portable trailer which collapsible frame structure serves as means to raise and lower a discharge chute, and other machines such as a mixer, if desired.

Other objects and features of the present invention will more fully appear in view of the following detailed description taken in connection with the accompanying drawings illustrating therein a single embodiment and in which:

FIGURE 1 is a side elevation of a portable self-erecting device including a portable trailer and with the collapsible frame supporting a suitable mechanism illustrated as a mixer and shown in a collapsed position;

FIGURE 2 is a side elevation of a portable self-erecting mixer of the type shown in FIGURE 1 only with the collapsible frame shown in an erect or upright position;

FIGURE 3 is a rear elevation of the mixer shown in FIGURE 2 with the collapsible frame again shown in an erect position;

FIGURE 4 is an enlarged fragmentary detail view of a spring loaded cable which is adapted for use with the collapsible frame for assisting in the moving of the frame from an elevated to a collapsed position;

FIGURE 5 is an enlarged fragmentary side elevation of the spring-loaded cable shown in FIGURE 4; and

FIGURE 6 is an enlarged fragmentary detail view, partially in section, illustrating the way in which pins may be used to lock the collapsible frame structure in an erect or upright position.

As shown on the drawings:

The reference numeral **10** indicates generally a portable self-erecting device or mixer or a self-erecting chute or hopper or a truck. The device **10** includes a mobile flat-bed trailer or trailer bed **11** which is mounted on wheels **12** at one end and which has a boom **11***a* adapted to be attached to the rear end of a truck by means of a connector or hook **13** disposed at the opposite end of the trailer.

Mounted upon the trailer **11** is a collapsible frame structure **14** including a collapsible frame or mixer frame **28**. Carried on the frame structure **14**, as illustrated, is a mixer or mixer structure or a pug mill or a suitable device **15** of the type that is advantageous to elevate. The illustrated mixer is of the continuous-flow type for mixing the aggregates used in constructing road bases, although any suitable device may be mounted upon the collapsible frame to be erected.

Mounted on the mobile trailer **11** and comprising a part of the collapsible frame structure **14** are four swingable screw jack legs **16**. Each of these legs **16** has a

leg portion 17 and a built-in screw jack 18 for leveling. It is not necessary to raise the trailer on these screw jacks 18 more than enough to relieve the load on the wheels or tires 12.

Each of the legs 16 is associated with a pair of plates 19—19 which are carried on the trailer 11. The plates 19—19 are provided with a series of vertically aligned jack plate holes 20, 21 and 22. A jack pivot pin 23 is at all times disposed within the holes 21 on the plates 19—19 to enable the leg 16 to be swingable relative to the trailer 11. A second or removable jack locking pin 24 may be alternately used in the plate holes 20 and 22 depending on whether the associated leg is in a lowered or elevated position. When the legs are lowered, the locking pin 24 is disposed in the lower pin holes 20 and when the leg 16 is elevated, the locking pin 24 is disposed in the upper plate holes 22 thereby providing means for locking the legs in the desired position.

In summary, the legs 16 are attached to the trailer with the two pins 23 and 24. When the locking pin 24 is removed, the leg 16 is swingable through an arc of 180° to enable the leg 16 to be placed in either an elevated or a lowered position. To secure the leg 16 in either the elevated or the lowered position, the locking pin 24 is then inserted through the appropriate plate holes 23.

The collapsible frame structure 14 includes four collapsible frame legs 25 which are each pivotally connected by means of a lower leg pivot 26 to the mobile trailer 11. The opposite ends of the frame legs 25 are pivoted by means of an upper leg pivot 27 to the mixer frame 28 which mixer frame constitutes a base portion of the device 15. These frame legs 25 are preferably manufactured from structural steel and are of equal length and serve to support the mixer frame 28. The opposite ends of the frame legs 25 pivot on horizontal, parallel axes perpendicular to the length of the trailer 11.

The device or mixer 15 has a mixer or pug mill inlet chute 29 at its front end and a mixer or pug mill outlet or discharge chute or hopper 30 at its rear end to aid in the operation of the mixer 15. The mixer 15 is positioned on the frame legs 25 on the trailer 11, so that in the erected position the discharge chute 30 of the mixer 15 is far enough beyond the rear or the truck trailer in overhanging relation to permit free access by any trucks to be loaded. In the lowered position the mixer 15 rests on trailer structural frame supports 31 on the trailer 11, low enough to meet height restrictions on average highways, yet high enough so that the parallelogram formed by the two pairs of frame support legs 25 with the trailer 11 and mixer frame 28 will remain stable. The mixer frame 28 remains horizontal at all times during raising or lowering of it. Frame cross braces 32 are disposed between the legs 25 of each pair. The cross braces are securely and permanently welded to the associated legs 25.

The longitudinal bracing between the front and rear pairs of legs 25 on either side must be collapsible and is taken care of by the components of this invention. With this invention, rigid bracing of the conventional type, which must be accurately positioned and laboriously installed or removed, is made unnecessary.

To raise the mixer 15 or the discharge chute 30 on its legs 25, lift means comprising an upwardly pushing single cylinder 33 of the single-acting type. The cylinder is attached to a lower cylinder pivot 34 on the trailer bed and is connected by means of an upper cylinder pivot 35 to the cross beam or cross brace 32 in the center of the rear pair of legs 25. The rear legs 25 were chosen because of the location of the center of gravity and the force diagram. The cylinder 33 is located so that its force is fully utilized in the lowered position. In other words, as the mixer 15 rises the angle changes to become less efficient and the extended smaller sleeves provide less force, but less is required since the support legs 25 carry a greater and greater percent of the load as they approach a vertical erect position. Either a hydraulic or a pneumatic type of cylinder may be used and a telescoping multi-sleeve cylinder is preferred because of space limitations.

Power for operating the cylinder 33 and its triple acting hydraulic ram is obtained from a power unit or engine 36 which is used to power the mixer 15, through a hydraulic pump 37 and a valve 38. The power unit may be gasoline, diesel or electric operated, as desired. The hydraulic system that is normally used to operate pug mill is also used to operate discharge gates 39 on the outlet chute 30.

While raising the collapsible frame structure 14, a self retracting locking and bracing mechanism 40 including a pair of spring-loaded cables 40*a* come into play when the mixer 15 is still several inches from its final position. One end of each cable 40*a* is attached to the mixer frame 28 at 41 (FIGURE 2), and another and opposite end is attached at 42 to the trailer 11. More specifically, the lower end of the cable 40*a* is attached to a yoke 43 on a compression spring 44. The yoke 43 is attached to the trailer 11 by means of an eye bolt 45.

The yoke 43 has a series of spring guides 46 along its length with arms 43*a* of the yoke slidably telescoped through holes 46*a* in the spring guides 46. The free end of the cable 40*a* is threaded and connected to the lowermost spring guide 46 on the yoke 43 by means of a lock nut 47. Before the free end of the cable is attached in place it is guided through a central area of the spring 44. The spring 44 and the guides 46 are held in assembly on the yoke 43 by means of lock nuts 48 which are in threaded assembly with yoke arms 43*a*. The end guides 46 bear against the opposite ends of the spring.

The lowermost spring guides are slidable along the length of the yoke arms 43*a* in operation as the spring is compressed when the collapsible frame structure 14 is moved into and out of erect or upright position. In other words, as the mixer 15 approaches the final operating position the springs 44 are compressed, cushioning the end of the stroke. The cable lengths may be adjusted in any suitable way such as by turning the lock nut 47 and the eye bolt 45 so that when the spring 44 is compressed solid, pin socket holes 49 in each leg 25 will match corresponding holes 50 in the mixer frame 28, permitting easy insertion of the locking pins 51 (FIGURE 6). The holes 49 and 50 and the locking pins 51 comprise releasable lock out means. When all the locking pins 51 are in place, pressure on the ram of the cylinder 33 is released and the spring tension binds the lock pins 51 in their sockets, holding the entire structure in a rigid unit. To aid in the alignment of the locking pin leg and frame holes 49 and 50 adjustable stops 52 are carried on the mixer frame 28 and which are adapted to abut against the legs 25 when they are erect.

To lower the collapsible frame structure 14 and the mixer 15, pressure must be applied to the lifting cylinder 33 to relieve the bind on the lock pins 51. This means that in the case of a hydraulic cylinder air must be bled from the upper end, or with a pneumatic cylinder the air must be compressed. If the lock pins 51 could be pulled without pressurizing the cylinder 33, it would be possible for the mixer 15 to drop a considerable distance before the cylinder 33 would support the weight, since when the ram of the cylinder 33 is extended for an appreciable length of time, the cylinder is bound to lose the pressure applied in raising the collapsible frame structure 14 and the mixer 15. The momentum of a sudden drop would severely damage or tear loose the ram anchorages 34 and 35 and the frame and mixer supports 31. This situation is prevented by providing a structure where it is necessary to pressurize the cylinder 33 before the lock pins 51 can be removed.

Another feature of the present invention concerns the installation of a special check valve **53** in the oil line to the ram of the cylinder **33**. This valve **53** provides a full flow of oil while the frame structure **14** is being lifted, but a restricted flow while the collapsible frame is being lowered so that it is impossible for the collapsible frame to drop or be lowered faster than a predetermined safe speed.

Summary

To start raising the mixer **15**, the jack legs **16** are lowered just enough to take the weight off the tires and level the trailer **11**. The mixer engine **36** is then started and the hydraulic valve **38** is used to raise the mixer **15** through the rugged triple acting hydraulic ram. After the mixer **15** has been raised to its total operating height, heavy pins **51** are inserted in both sides of the lifting arms **25** so the machine is held rigidly in place for operation. In practice, it has been found that it only takes two minutes to raise the mixer **15** into operating position.

When the mixer is in operating position, the discharge height under the clam shell gates **39** may be approximately 9 feet. The distance from the back of the trailer to the center of the discharge hopper is preferably five feet to enable the material being discharged from the discharge chute to be dropped readily into a truck.

The mixer **15** may be lowered back into traveling position just as easily as it was elevated into operating position. In order to lower the mixer **15**, it is necessary to remove the pins **51** and lower the mixer through the use of the hydraulic ram **33**. The spring-loaded cables **40*a*** are used to assist the ram **33** in the initial lowering of the mixer **15**. The trailer **11** is provided with a collapsible type of catwalk and stairway structure **54** which are hinged and folded in as the collapsible frame is collapsed.

The instant trailer has been found to be highly advantageous since it may be readily moved from job to job and is capable of being set up and taken down with a minimum of time and expense. It is not necessary to use truck pits for unloading the materials from the discharge chute **30**.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. A collapsible frame structure having a collapsible frame adapted to be mounted on a truck bed and including front and rear pairs of legs, means comprising a single acting cylinder adapted to be connected to the truck bed at one end and connected to the rear legs at an opposite end for erecting and for collapsing said collapsible frame, spring loaded cables each connected at one end to the collapsible frame and adapted to be connected to a truck bed at an opposite end to facilitate lowering the collapsible frame by providing the force needed to move the collapsible frame off of dead center on its support legs so that gravity will complete the lowering operation of the collapsible frame against the support of said cylinder, and releasable lock means connected to the collapsible frame for locking the legs when in an erect position so the pressure in the cylinder may be allowed to drop when the collapsible frame is in an erect position.

2. The frame structure of claim 1 further characterized by said releasable lock means including pin holes in the legs and the frame for receipt of the locking pins, and adjustable stops between the legs and the collapsible frame for aiding in the alignment of the pin holes when the collapsible frame is in an erect position.

3. The frame structure of claim 1 further characterized by said releasable lock means comprising locking pins which connect and lock the collapsible legs to the collapsible frame when the collapsible frame is in an erect position.

4. The frame structure of claim 3 further characterized by said spring loaded cables providing collapsible longitudinal bracing for the collapsible frame while in an erect position by exerting a constant pressure on the locking pins.

5. A collapsible frame structure including a collapsible frame having support legs adapted to be pivotally mounted on a trailer, lift means connected to the legs of said collapsible frame for pivoting and moving said collapsible frame relative to a trailer from a collapsed position to an upright position, said lift means comprising a single acting cylinder, and spring loaded cables each connected at one end to the collapsible frame and adapted to be connected to a trailer at an opposite end to facilitate lowering the collapsible frame by providing the force needed to move the collapsible frame off of dead center on its support legs so that gravity will complete the lowering operation of the collapsible frame against the support of said single acting cylinder.

6. A collapsible frame structure including a collapsible frame adapted to be mounted on a truck bed and including front and rear pairs of legs, means comprising a cylinder connected to the truck bed at one end and to the legs at an opposite end for erecting and for collapsing said collapsible frame, spring loaded cables connected to the collapsible frame and for connection to a truck bed to stabilize the frame when erected, and releasable lock means comprising locking pins which connect and lock the collapsible legs to the collapsible frame when the collapsible frame is in an erect position, said spring or loaded cables providing collapsible longitudinal bracing for the collapsible frame while in the erect position by exerting a constant pressure on the locking pins and providing means for preventing the locking means from becoming accidentally disengaged from locking position, the pins being disengageable from locking position by causing the cylinder to exert a force against the frame sufficient to relieve the frame of the load of the frame and the spring loaded cables.

7. The frame structure of claim 5 further characterized by having releasable lock means comprising locking pins for connecting and locking the legs in an upright position.

8. The frame structure of claim 7 further characterized by said spring loaded cables providing collapsible longitudinal bracing for the legs while in an upright position by exerting a constant pressure on the locking pins.

9. The frame structure of claim 7 further characterized by said releasable lock means including pin holes in the legs and the frame for receipt of the locking pins, and adjustable stops between the legs and the collapsible frame for aiding in the alignment of the pin holes when the legs are in an upright position.

10. The frame structure of claim 5 further characterized by said lift means having a check valve in communication with the cylinder which valve provides full flow of oil while the collapsible frame is being lifted and which provides a restricted flow while the collapsible frame is being lowered, so that it is impossible for the collapsible frame to drop or to be lowered faster than a safe speed.

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