United States Patent [19]
Channell

[11] 3,809,429
[45] May 7, 1974

[54] **SCISSOR FRAME ASSEMBLY**

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[22] Filed: **Feb. 12, 1973**

[21] Appl. No.: **331,621**

[52] **U.S. Cl.** .... **298/17 S**, 298/22 P, 298/22 J
[51] **Int. Cl.** **B60p 1/20**
[58] **Field of Search**...... 298/11, 22 R, 22 AE, 17 S, 298/22 P, 22 D, 22 J, 17.7, 17.6

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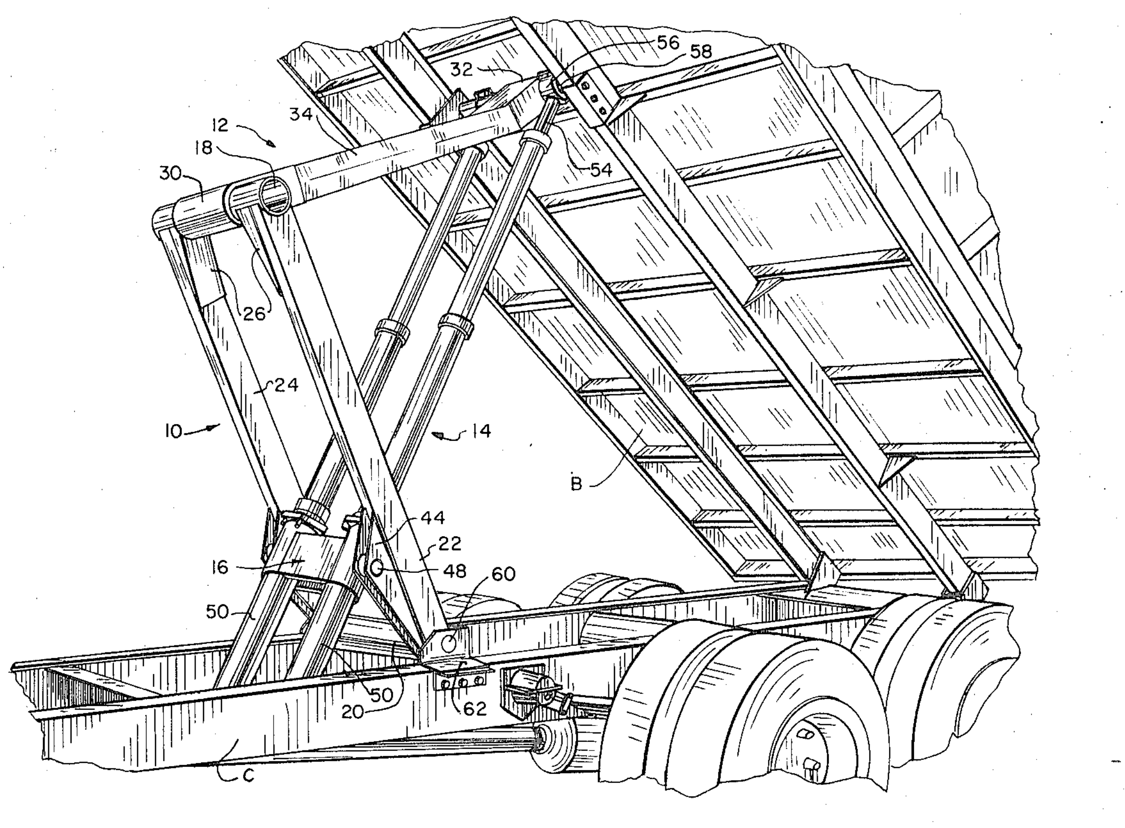
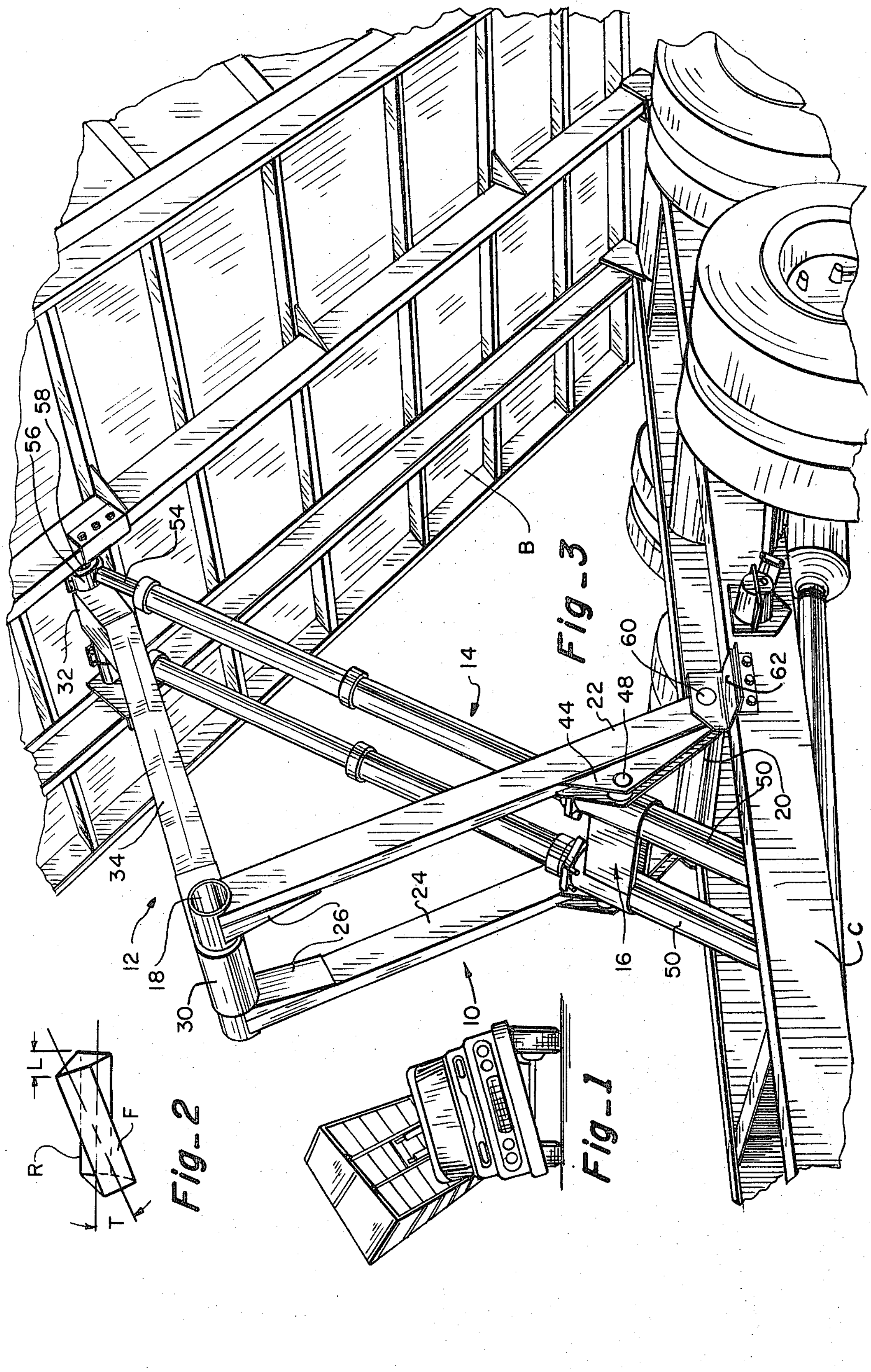
[57] **ABSTRACT**

A scissor frame assembly for use in dump vehicles especially designed to stabilize the dump bed when elevated in the face of laterally unbalanced loading of the bed. The main and tongue frame of the scissor frame assembly each employ a pair of elongate hollow cylindrical hinge tubes to establish the three pivot axes of the scissor frame assembly. The hinge tubes of each of the tongue and main frames are interconnected to each other by rigid frame members of hollow tubular transverse cross-section which have high resistance to twisting or longitudinal torsional forces and also against lateral bending forces. Each of the tongue frame and the main frame is designed to be an independently rigid frame in and of itself with one hinge tube of the two frames being telescopically and rotatively received on a hinge tube of the other frame to pivotally interconnect the two frames into the scissor frame assembly. The resulting construction has substantial rigidity against forces induced by unbalanced loading of the bed which tend to shift the hinge tube axes out of parallelism with each other or to shift the hinge tubes laterally relative to each other in a direction parallel to their axes. The frame assembly is designed to be employed either as a stabilizing frame in which raising and lowering of the bed is accomplished by an independently mounted hydraulic motor system or alternatively as a scissor hoist in which the hydraulic lift system is mounted upon and incorporated in the scissor frame.

11 Claims, 8 Drawing Figures

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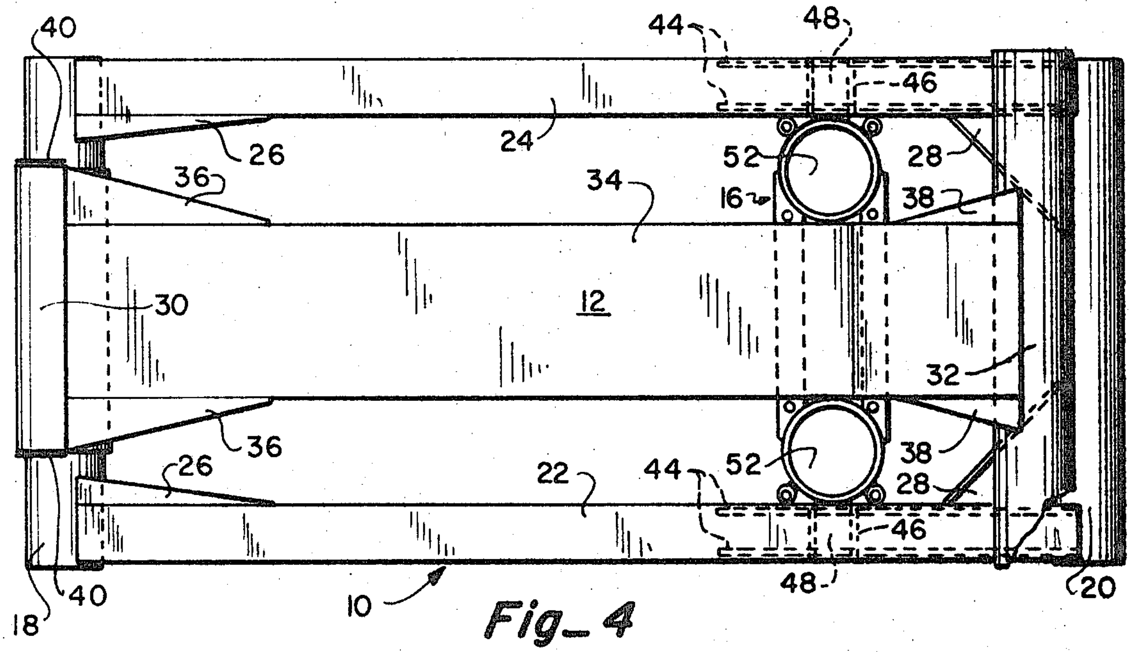


Fig_4

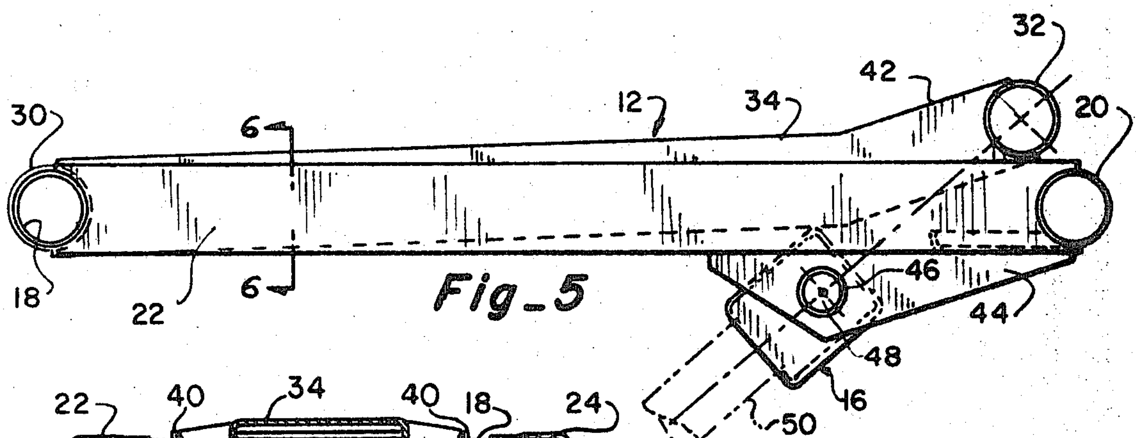


Fig_5

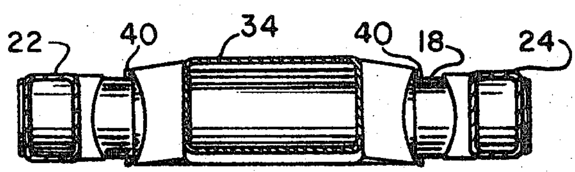
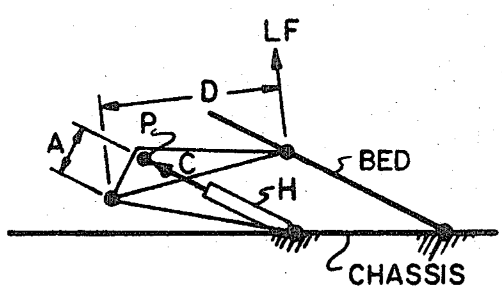


Fig_6



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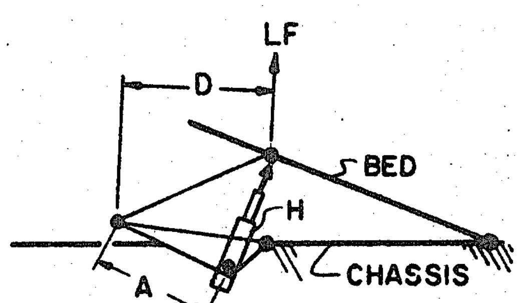

Fig_8

SCISSOR FRAME ASSEMBLY

BACKGROUND OF THE INVENTION

Scissor hoists are widely employed for use in elevating the tilting bed of dump vehicles. These hoists conventionally include a first link or frame assembly pivotally mounted on the truck frame or chassis and a second link or frame assembly pivotally connected to the truck bed and to the free end of the first link or frame assembly. A hydraulic motor is usually mounted to act between the two links or frame assemblies to increase the included angle between the two links during elevating of the tilting bed. While scissor frame assemblies of the foregoing type have been in use for many years, nearly all of such assemblies are designed in a manner which is solely concerned with the lifting action of the assembly on the assumption that the load in the truck bed will either be laterally balanced with respect to the longitudinal center line of the truck bed or that if a lateral imbalance exists the truck bed will possess sufficient rigidity to counter the imbalance. While this latter assumption is warranted in many cases, laterally unbalanced loading of the bed which is sufficient to produce a distortion or relative displacement of the forward end of the bed during elevating can produce a progressively increasing condition of instability because the directions of displacement or bed distortion created by the unbalanced loading forces are such that the forces become magnified by the displacement. The progressively increasing instability can rapidly approach a degree which will overturn the vehicle.

The tilting bed is mounted upon the truck frame by a tail hinge located at or very near the rearward end of the bed. The scissor hoist normally is coupled to the bed at a location spaced a substantial distance rearwardly of the front end of the bed in order to achieve a maximum tilting of the bed with a minimum stroke of the hydraulic motor. Thus, during elevation, a substantial portion of the front end of the bed is supported only by the bed frame work. Further, the transverse or lateral dimension of the hoist is usually much less than the width of the bed because the hoist normally has to retract to a position between the two longitudinally extending frame members of the dump body. With this arrangement, a load which is unbalanced laterally of the bed exerts two types of distorting forces on the tilting bed as it is being elevated. First, the unbalanced load induces a torsional or twisting force about the longitudinal center line of the bed. In addition to the torsional force, the unbalanced load also exerts a force tending to displace the forward end of the bed laterally relative to its rearward end.

It is believed apparent that any lateral displacement induced by an unbalanced load acts to shift the center of gravity of the unbalanced load farther away from the original center line of the system, thus increasing the effective lever arm of this force to further increase the torsional displacement. Increasing of the torsional displacement tends to gravitationally induce a shifting action of the load in a direction further increasing the degree of unbalance and thus the lateral displacement.

In addition to loads which are initially unbalanced, dumping sticky or frozen loads is a common problem. As the body is lifted near the top of its stroke and the load begins to dump, a portion of the load sticks in the upper corner of the box and this then causes a rapid tilting of the truck to that side.

Further, many presently available scissor hoists were designed at a time when the standard sizes of boxes or tilting beds were of smaller overall dimensions than many boxes in present day use. The larger dimensions of present day boxes magnifies the problem of lateral imbalance of the load.

This problem is one which has been almost completely overlooked in the design of presently available scissor hoists and the present invention is specifically designed to provide a scissor frame which is highly resistant to the above-described distortions or displacement of the truck bed in the face of laterally unbalanced loading.

Other objects and features of the invention will become apparent by reference to the following specification and to the drawings.

In The drawings:

FIG. 1 is a front view of a dump truck showing the bed elevated under an extreme condition of unbalanced loading;

FIG. 2 is a schematic diagram illustrating the distortions present in the bed of the dump vehicle of FIG. 1;

FIG. 3 is a perspective view of the present invention in a scissor hoist form;

FIG. 4 is a top plan view of the scissor frame assembly of FIG. 3;

FIG. 5 is a side elevational view of the assembly of FIG. 4;

FIG. 6 is a cross-sectional view taken on line 6—6 of FIG. 5;

FIG. 7 is a schematic diagram of a conventional scissor hoist; and

FIG. 8 is a schematic diagram of the hoist assembly of FIG. 3.

Referring first to FIGS. 1 and 2, these two figures have been included to illustrate the effects of laterally unbalanced loading of the tilting bed of a dump vehicle. While the problem is discussed in terms of a laterally unbalanced load in the truck bed, it should be borne in mind that a similar problem can arise with a balanced load where dumping is attempted on a side hill or surface inclined transversely of the vehicle or by a portion of a sticky load hanging up in the upper corner of the box. Further, it should be borne in mind that while the problem is created by an unbalanced loading of the truck bed, it becomes magnified when the degree of unbalance of the load is such as to produce a distortion of the truck bed. While the truck bed usually constructed with a gridlike framework of longitudinal and transverse frame members (see FIG. 3), the overall dimensions of the bed, the limited points of support provided by the tail hinge and hoist, the fact that additional weight and hence strength of the bed frame must be subtracted from the payload, and the range of weights of possible payloads all combine to produce a situation such that present day truck beds are not sufficiently rigid to completely resist distortion under all conditions.

Th two major distortions produced by a laterally unbalanced loading are schematically illustrated in FIG. 2 and include a lateral displacement L of the front end F of the bed relative to the rearward end, the rearward end being initially assumed to be substantially fixed because of its coupling by the tail hinge to the truck frame or chassis. In addition to the lateral displacement L, a laterally unbalanced load will also induce a torsional displacement T which takes the form of a twisting of the front end F of the bed relative to the rear end R about the longitudinal center line of the bed. It will be noted that both of these effects or displacement induced by an originally unbalanced load increase the degree of unbalance to tend to produce further displacement in the same direction. Lateral displacement L shifts the center of gravity of the load further away from the original longitudinal center line of the system thus increasing its effective lever arm to increase the torsional displacement T. Increasing the torsional displacement T further increases the lateral force exerted against the sidewall of the bed to increase the force inducing lateral displacement.

Further, the truck frame is susceptible to tilting because of the independent spring suspension of its rear wheels to permit tilting of the tail hinge to further increase the torsional displacement of the bed.

From the foregoing it can be seen that once displacement or distortion of the bed occurs further displacement tends to be induced and a progressively increasing condition of instability can occur. This can happen very rapidly with the truck operator being helpless to prevent his truck from turning over.

A scissor hoist especially designed to resist lateral and torsional displacements of the type referred to above is disclosed in FIGS. 3 through 6. The disclosed hoist includes four major components, best seen in FIG. 3: a generally rectangular main frame **10**, a tongue frame **12** a dual telescopic or multi-stage hydraulic cylinder system **14** and a trunnion assembly **16** mounting the cylinder system upon main frame **10.**

Main frame **10** includes a pair of rigid hollow cylindrical hinge tubes **18** and **20** which are fixedly interconnected to each other by a pair of spaced parallel side members **22** and **24** of a boxlike hollow tubular transverse cross-section shown in FIG. **6.** Stiffening gussets **26** and **28** (FIG. **4**) are welded between the hinge tubes and side frame members to produce an independently rigid generally rectangular frame with the axes of hinge tubes **18** and **20** disposed in co-planar parallel relationship with each other. Main frame **10** is especially designed to be extremely resistant to forces which tend to move the axes of hinge tubes **18** and **20** out of parallelism with each other, particularly twisting forces which tend to induce torsional displacement between the two hinge tube axes similar to the torsional displacement T illustrated in FIG. **2.** Resistance to torsional movement of this type is provided primarily by the cross-sectional configuration of side frame members **22** and **24**, the closed tubular cross-section possessing substantial rigidity against forces tending to twist the frame member about its longitudinal axis. Gussets **26** and **28** combined with the high resistance of frame members **22** and **24** to lateral bending movement presents an extremely high resistance to forces tending to shift one of hinge tubes **18** and **20** laterally, or in an axial direction, relative to one another.

Tongue frame **12** is similarly designed to be independently rigid and highly resistant to torsional and lateral displacement forces of the type referred to above. Tongue frame **12** includes a pair of rigid hollow cylindrical hinge tubes **30** and **32** rigidly interconnected to each other by a single tongue frame member **34** of a transversely expanded hollow boxlike cross-section best shown in FIG. **6.**

Stiffening gussets **36** and **38** (FIG. **4**) are likewise employed on tongue frame **12,** the hinge tubes, frame member and gussets being welded to each other.

Hinge tube **30** is dimensioned to rotatively and telescopically receive hinge tube **18** of main frame **10** to pivotally couple main frame **10** and tongue frame **12** to each other. Tube **30** is slidably assembled upon tube **18** prior to the assembly of tube **18** into main frame **10.** A pair of locating flanges **40** welded to tube **18** maintain tube **30** in an axially centered position upon tube **18.**

As best seen in the side view of FIG. **5,** the end of tongue frame member **34** opposite tube **30** is angularly offset as at **42** so that tube **32** is positioned above main frame **10** when the scissor frame assembly is in its closed position to minimize the height of the major portion of the assembly when closed.

Trunnion assembly **16** is mounted upon the underside of main frame **10** by structure which includes a pair of generally triangular suspension plates **44** welded to and projecting downwardly from the underside of each of frame members **22** and **24.** Transversely extending bearing tubes **46** are welded within aligned bores in suspension plates **44** and rotatably receive a pair of projecting stub shafts **48** fixedly mounted on the main body of trunnion assembly **16.** The base or outer cylinders **50** (FIG. 3) of the hydraulic lift assembly **14** are received in pockets **52** (FIG. **4**) of trunnion assembly **16,** while the inner telescopic shaft **54** of the telescopic cylinders **14** is coupled, as by a bearing collar **56** to the outer surface of hinge tube **32** immediately outboard of gussets **38.**

Referring to FIG. **3,** the assembly is mounted upon a dump vehicle by pivotally mounting hinge tube **32** upon a shaft **58** fixedly secured to the underside of the tilting truck bed B. A second shaft **60** mounted on the truck chassis C as by mounting brackets **62** is rotatively received within hinge tube **20.**

The arrangement of the hydraulic lift assembly relative to the scissor frame differs from that employed in the usual scissor hoist in a manner best seen in FIGS. 7 and 8. FIGS. 7 and 8 are schematic diagrams respectively showing the usual scissor arrangement in FIG. 7 and the arrangement of the present invention in FIG. **8.**

Referring first to FIG. **7,** the conventional scissor hoist arrangement finds a single stage hydraulic lift system H coupled between the pivotal mounting of the hoist upon the chassis and a point P located on the upper frame. The lifting force LF of the FIG. 7 arrangement is equal to the force developed by the hydraulic motor H multiplied by the ratio of the lever arms A over D. Because in the conventional arrangement the lever arm A is relatively small, a substantial force must be applied by the hydraulic cylinder H to achieve a given lifting force LF. Further, in the system shown in FIG. 7, a substantial bending moment is applied to the upper frame, which requires that this particular frame in the conventional scissor hoist be of extremely heavy and stiff construction. Further, because in the FIG. 7 system the direction of application of the force of the hydraulic system is at only a slight angle to the lower frame, the lower frame must possess an extreme amount of tensile resistance.

In the arrangement of the present application schematically diagrammed in FIG. 8, the lifting force LF is again equal to the hydraulic cylinder force multiplied by the ratio A over D. However, in the FIG. 8 arrangement, the arm A is relatively long thus enabling the system to produce a higher lifting force LF for a given force from the hydraulic motor than is possible in the system of FIG. 7. Further, there is little or no bending moment on the upper frame since the hydraulic force is applied substantially directly to the bed, while the reduced hydraulic force required means that the lower frame can be of relatively light construction. This enables the hoist of the present invention to be of substantially lighter construction than a conventional scissor hoist of the same capacity. The use of multi-stage hydraulic cylinders permits the use of this efficient high lift geometry.

A further advantage presented by the present system over the conventional scissors systems shown in FIG. 7 is that of a minimized overall height of the system in its closed position. In the system of FIG. 7, in order to achieve a sufficiently long lever arm A when the hoist is closed, pivot point P must be vertically offset from the pivot point coupling the two frames to each other. In order to achieve a sufficiently long arm A it is usually necessary to cut away some of the cross frame members on the underside of the truck bed B (see FIG. 3) in order to provide clearance for the elevated pivot point P. In the hoist of the application, the offset portion 42 of tongue frame member 34 can be located to project into the space between adjacent bed crossframe members to eliminate the necessity of cutting any crossframe members away for purposes of clearance.

While the foregoing invention has been described in terms of a truck hoist, a primary feature of the invention is the lateral and torsional rigidity of the assembled main frame 10 and tongue frame 12. As previously stated, each of these two frame elements 10 and 12 is constructed in a manner so that each of the frames is laterally and torsionally rigid in and of itself. Further, the extended area of bearing engagement between hinge tubes 30 and 18 which pivotally couples the two frames to each other affords a coupling in which torsional forces are spread out over a substantial area, while locating flanges 40 resist lateral displacement of the two hinge tubes relative to each other. Thus, in the assembled hoist, the lateral and torsional rigidity of the hoist provides a substantial degree of resistance to lateral or torsional displacement of the truck bed of the type illustrated in FIGS. 1 and 2.

The assembled main frames 10 and 12 provide the required lateral and torsional rigidity and may be employed for this purpose by themselves with the hydraulic lift system being mounted completely independently of the scissor frame.

While one embodiment of the invention has been described in detail, it will be apparent to those skilled in the art that the disclosed embodiment may be modified. Therefore, the foregoing description is to be considered exemplary rather than limiting and the true scope of the invention is that defined in the following claims.

I claim:

1. For use in combination with a dump vehicle having a chassis and a tilting dump bed mounted upon said chassis; a scissor frame comprising a tongue frame assembly and a main frame assembly, each of said frame assemblies comprising a pair of rigid elongate hollow cylindrical hinge tubes, frame member means of hollow tubular transverse cross section welded at opposite ends to said hinge tubes to locate and maintain said hinge tubes in spaced parallel relationship to each other, said frame members having substantial resistance to torsional and lateral bending forces to maintain said hinge tubes in their original parallel and lateral alignment, a hinge tube at one end of one of said frame assemblies being rotatably received within a hinge tube at one end of the other of said assemblies to pivotally couple said frame assemblies to each other, and pivot means fixedly mounted upon said chassis and said bed extending through the hinge tubes at the other ends of said frame assemblies to couple said scissor frame between said chassis and said bed.

2. The invention defined in claim 1 further comprising trunnion means mounted on said main frame assembly for pivotal movement about an axis extending parallel to the axes of said hinge tubes and below the plane of the axes of the main frame tubes and extensible hydraulic cylinder means mounted on said trunnion means and rotatively coupled to the hinge tube at said other end of said tongue frame, said tongue frame being pivotally coupled to said bed.

3. The invention defined in claim 1 wherein the frame member means of one of said frame assemblies comprises a pair of frame members of hollow tubular transverse cross section extending in spaced parallel relationship between the opposite ends of the hinge tubes of said one of said frame assemblies to define an open rectangular frame assembly, the frame member means of the other of said frame assemblies comprising a single frame member of hollow tubular transverse cross section extending between the central portions of the hinge tubes of the other of said frame assemblies to be between the frame members of said one of said frame assemblies when said scissor frame is in a closed position.

4. The invention defined in claim 3 wherein said single frame member includes linear main portion secured at one end to that hinge tube which rotatably receives a hinge tube of said one of said frame assemblies, and a vertically inclined end portion extending from the other end of said main portion and secured to the other hinge tube of said other frame assembly to support the last mentioned hinge tube above said one frame assembly when said scissor frame is closed.

5. The invention defined in claim 4 further comprising trunnion means mounted on said one of said frame assemblies for pivotal movement about an axis parallel to the axes of said hinge tubes and vertically offset from the plane of the axes of the hinge tubes of said one of said frame assemblies, a pair of extensible hydraulic cylinder means mounted on said trunnion means to respectively extend from said trunnion between the opposite sides of said single frame member and said pair of frame members to the hinge tube at said other end of said other of said frame assemblies, and means rotatively coupling said cylinder means to the last mentioned hinge tube at opposite sides of said single frame member.

6. A scissor hoist for mounting upon a dump vehicle chassis for tilting a dump bed in pivotal movement about a tail hinge coupling said bed to said chassis; said hoist comprising a generally rectangular main frame including a first pair of spaced parallel rigid hollow cy-

lindrical hinge tubes and a pair of spaced parallel rigid frame members of hollow tubular transverse cross section welded to and extending between the opposite ends of said first hinge tubes, first pivot means rotatably received within one of said first hinge tubes for mounting said main frame upon the vehicle chassis for pivotal movement about an axis parallel to that of the tail hinge, a tongue frame including a second rigid hollow cylindrical hinge tube rotatably mounted upon the other of said first hinge tubes between said pair of frame members, a rigid third frame member of hollow tubular transverse cross section welded at one end to said second hinge tube and projecting radially therefrom, a third rigid hollow cylindrical hinge tube welded to the other end of said third frame member in parallel relationship to said second hinge tube, second pivot means rotatably received within said third hinge tube for pivotally coupling said tongue frame to the dump bed, and extensible hydraulic motor means mounted on said main frame for pivotal movement about an axis parallel to and offset from the axes of said first hinge tubes and coupled to said third hinge tube for pivotal movement thereon.

7. The invention defined in claim **6** further comprising trunnion means pivotally mounting said motor means on said main frame, said trunnion means comprising a saddle, means pivotally supporting said saddle on said main frame, an pocket means in said saddle supporting said motor means.

8. The invention defined in claim **7** wherein said motor means comprises a pair of motors mounted in said saddle inwardly of said pair of frame members and outwardly of said third frame member.

9. The invention as defined in claim **7** wherein said means pivotally supporting said saddle comprises suspension plate means welded to the underside of each of said pair of frame members, bearing means in each of said suspension means establishing the pivotal axis of said saddle at a location below the plane containing the axes of said first hinge tubes, and shaft means fixedly mounted on said saddle and rotatably received within said bearing means.

10. In a scissor hoist for tilting the dump bed of a dump vehicle, said hoist including a lower frame pivotally mounted at one end on the dump vehicle, an upper frame pivotally mounted at one end on the other end of said lower frame and pivotally coupled at its opposite end to the dump bed; the improvement comprising multiple stage telescopic hydraulic cylinder means pivotally mounted on said lower frame at a location adjacent to but spaced from said one end thereof, and means coupling the other end of said cylinder means to said other end of said upper frame for pivotal movement coaxial with the pivot axis of said upper frame and truck bed.

11. The invention defined in claim **10** further comprising trunnion means supporting said one end of said motor means, and suspension means mounting said trunnion means on said lower frame for pivotal movement about an axis located below a plane containing the pivot axes at the opposite ends of said lower frame.

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