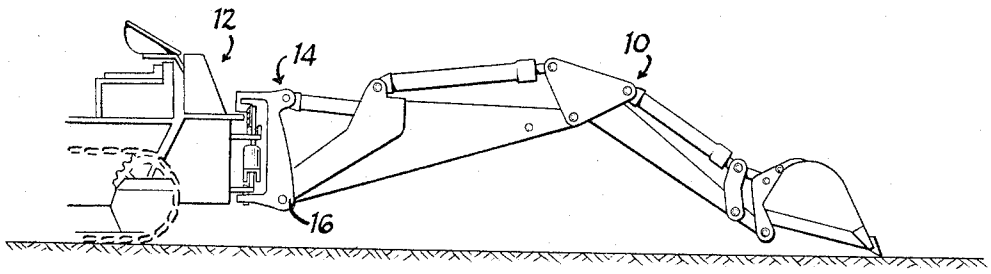
Oct. 11, 1966 J. F. SHUMAKER 3,278,046

BACKHOE SUPPORT

Filed June 5, 1964 2 Sheets-Sheet 1

FIG. 1



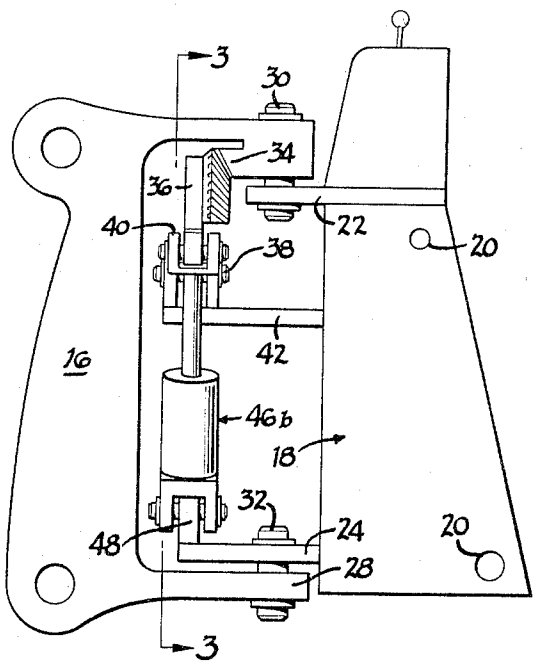


FIG. 2

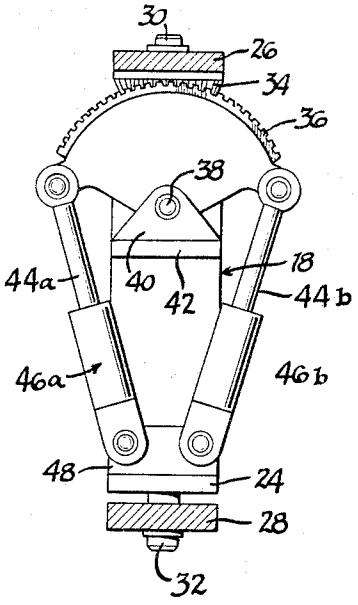


FIG. 3

INVENTOR.
JOHN F. SHUMAKER
BY
WILSON, SETTLE & CRAIG
ATTORNEYS

Oct. 11, 1966 J. F. SHUMAKER 3,278,046

BACKHOE SUPPORT

Filed June 5, 1964 2 Sheets-Sheet 2

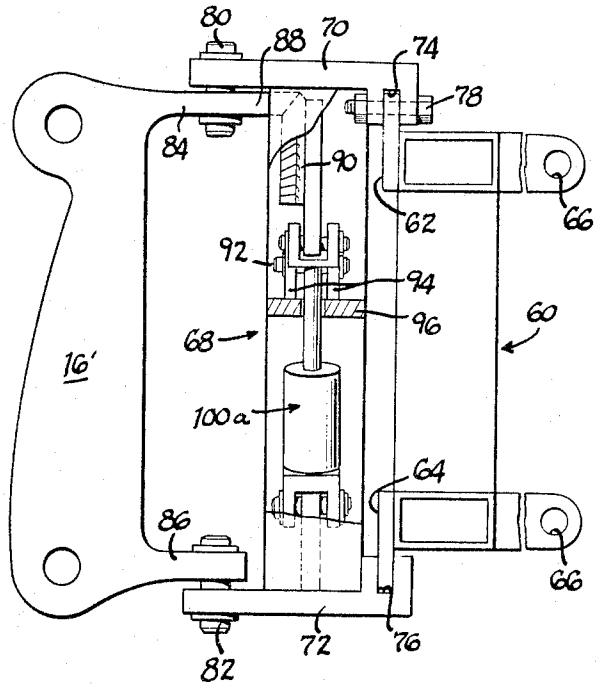


FIG. 5

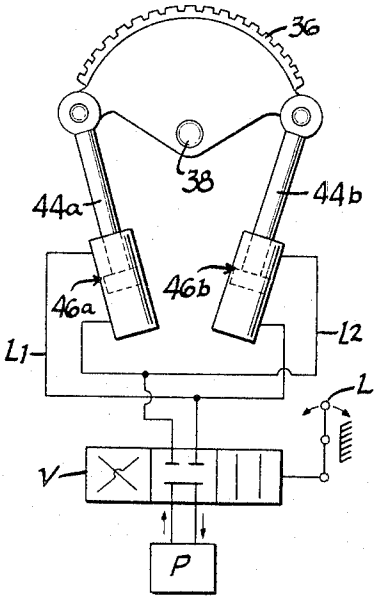


FIG. 4

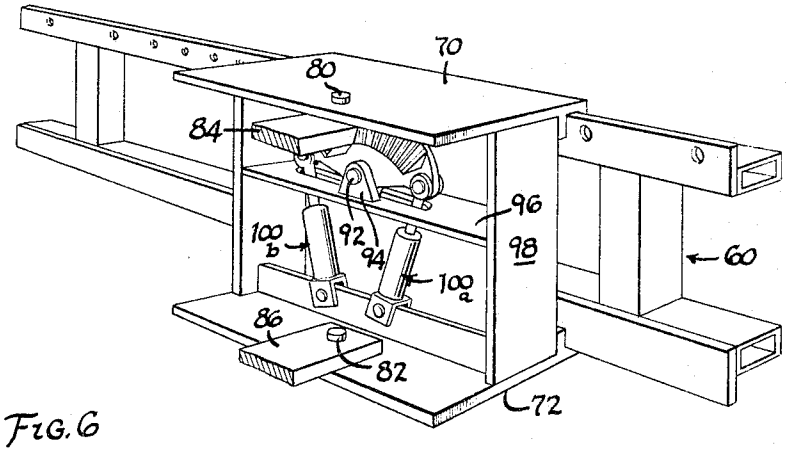


FIG. 6

INVENTOR.

JOHN F. SHUMAKER

BY

WILSON, SETTLE & CRAIG

ATTORNEYS

United States Patent Office

3,278,046
Patented Oct. 11, 1966

3,278,046

BACKHOE SUPPORT

John F. Shumaker, Mount Pleasant, Iowa, assignor to J. I. Case Company, Racine, Wis., a corporation of Wisconsin

Filed June 5, 1964, Ser. No. 372,792
4 Claims. (Cl. 212—68)

This invention relates to vehicle mounted backhoes, and more particularly to structure for supporting a backhoe upon a vehicle, such as a tractor, for pivotal movement about a vertical axis and for driving the backhoe in movement about the pivotal axis.

In the ordinary operation of a backhoe, as in digging a trench, for example, it is necessary that the backhoe after scooping dirt from the trench be lifted clear of the trench and swung to one side so that the dirt may be dumped from the bucket. The swinging movement is conveniently performed by mounting the backhoe for pivotal movement about a vertical axis and employing a hydraulically actuated linkage of some type to supply the power necessary to swing the backhoe. Because of the extremely rugged use to which these structures are subjected, many structures have proved unsatisfactory, because of difficulties in satisfying conflicting design requirements of compactness versus operational efficiency, accessibility of parts for maintenance versus exposure to dirt and stones, and efficient application of available power through mechanisms operable within operational clearances.

While many backhoes employ support assemblies where the vertical swing axis of the backhoe is fixed relative to the vehicle, increased flexibility of operation has led to the use of support assemblies in which the backhoe support may be shifted laterally from side to side upon the vehicle. Many backhoe swing structures which are satisfactory for use where the swing axis is fixed relative to the vehicle are not well adapted for use with side shifting backhoe supports, thus requiring dealers to carry greater inventories of special parts.

It is one object of the present invention to provide a backhoe support structure which is relatively compact and yet in which the various parts are easily accessible for maintenance.

It is another object of the invention to provide a backhoe support structure which employs a minimum number of parts and wherein the parts are easily manufactured or commercially available.

Still another object of the invention is to provide a backhoe support structure which is readily adaptable for use either in side shiftable backhoes or backhoes where the swing axis is fixed relative to the vehicle.

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 simplified side elevational view showing a vehicle mounted backhoe assembly employing a support embodying the present invention;

FIG. 2 is a detail side elevational view of one form of backhoe support embodying the invention;

FIG. 3 is a detail cross sectional view of the support of FIG. 2 taken on line 3—3 of FIG. 2;

FIG. 4 is a schematic diagram of a hydraulic control circuit;

FIG. 5 is a detail side elevational view of a modified form of support embodying the invention; and

FIG. 6 is a perspective view, with certain parts broken away or shown in section of the embodiment of FIG. 5.

Referring first to FIG. 1, there is shown a backhoe assembly designated generally **10** which is supported upon the back end of a crawler tractor **12** by a support structure designated generally **14**. With the exception of its mast or swing tower **16**, backhoe assembly **10** is of conventional, well known construction and has been shown solely to indicate the overall relationship between the backhoe assembly **10**, its support structure **14** and the vehicle, such as crawler tractor **12**.

Two embodiments of support structure **14** are shown in the drawings. In the embodiment of FIGS. 2 and 3, backhoe assembly **10** is supported from the vehicle **12** for pivotal movement about a stationary vertical axis. In the embodiment of FIGS. 5 and 6, backhoe assembly **10** is supported for pivotal movement about a vertical axis which can be shifted horizontally in a direction laterally of the fore and aft axis of the vehicle.

Referring first to FIGS. 2 and 3, one form of support embodying the present invention includes a mounting frame assembly designated generally **18** which is adapted to be fixedly attached to the frame of the vehicle as by suitably located bolt holes **20**. It will be appreciated that the general shape of the mounting frame **18** will vary in accordance with the construction of the frame of the vehicle to which it is to be attached. Projecting rearwardly from frame **18** are upper and lower pivot support arms **22** and **24**, respectively, which may either be formed integrally with or fixedly secured to frame **18**.

As best seen in FIG. 2, the mast or swing tower **16** is formed with forwardly projecting upper and lower arms **26** and **28**, upper arm **26** of the swing arm overlying upper pivot support arm **20** of frame **18**, while lower arm **28** of the swing tower underlies lower pivot support arm **24**. Vertically aligned pivot pin assemblies **30** and **32**, respectively, connect the upper and lower arms of frame **18** and swing tower **16** to each other and support the swing tower upon frame **18** for rotation about the vertical axis established by the pivot pin assemblies.

A bevel gear segment **34** is fixedly mounted upon upper arm **26** of the swing tower coaxially of the vertical axis of pivotal movement of swing tower **16** on frame **18**. Bevel gear segment **34** lies generally to the rear of pivot assembly **30** and is meshed with a second bevel gear segment **36**. Bevel gear segment **36** is pivotally supported by a horizontally extending pivot pin **38** supported in brackets **40** which are fixedly mounted upon a support platform **42** which is in turn fixedly mounted upon frame **18**. The horizontal axis defined by pivot pin **38** is parallel to the fore and aft axis of the vehicle.

As best seen in FIG. 3, bevel gear segment **36** is of semi-circular shape. Pivotally coupled to each end of gear segment **36** are the piston rods **44***a* and **44***b* of a pair of double-acting hydraulic power cylinder assemblies designated generally **46***a* and **46***b*. The opposite end of each cylinder assembly is pivotally coupled to a bracket **48**

which is fixedly mounted to the end of lower pivot support arm 24 which is projected rearwardly somewhat from pivot assembly 32 for this purpose.

Hydraulic power cylinders 46*a* and 46*b* are actuated by a hydraulic control circuit schematically shown in FIG. 4 to simultaneously drive in opposite directions.

Referring to FIG. 4, the control circuit for power cylinders 46*a* and 46*b* includes a manually actuated three-position four-way changeover valve V whose spool may be manually shifted as by a control lever L. Two ports of the valve are connected to the hydraulic pressure system P of the tractor, while the control ports are connected by hydraulic conduits L1 and L2 to the power cylinders. The two cylinders are cross connected, i.e., conduit L1 is connected to the rod end of cylinder 46*a* and to the head end of cylinder 46*b*, while conduit L2 is connected to the head end of cylinder 46*a* and the rod end of cylinder 46*b*.

In FIG. 4, the hydraulic circuit is shown in its neutral position wherein both hydraulic conduits L1 and L2 are blocked at their connection to valve V. Movement of control lever L to the right as viewed in FIG. 4 will position the straight through connections of valve V in alignment to connect the high pressure port of the pressure system to conduit L2 and to connect conduit L1 to the low pressure or intake side of the hydraulic system. The supplying of pressure to conduit L2 supplies pressure to the head end of cylinder 46*a* and to the rod end of cylinder 46*b*, thereby causing piston rod 44*a* to extend from its cylinder while piston rod 44*b* is retracted, this action causing gear segment 36 to rotate in a clockwise direction as viewed in FIG. 4. Upon manipulation of control lever L to place the cross connections of valve V in alignment with the valve ports, a reverse action takes place.

In FIGS. 5 and 6, an alternative form of structure is disclosed wherein a swing tower 16′ is supported upon a vehicle frame for movement about a vertical axis which may be adjusted laterally or transversely of the vehicle. In this embodiment of the invention, the vehicle mounting frame is constructed in the form of an open frame work 60 upon which are fixedly secured a pair of horizontally extending parallel rails 62 and 64. Frame 60 is adapted to be secured directly to the vehicle frame by suitable means, such as mounting bolt holes indicated at 66. As in the previous embodiment, it will be appreciated that the shape of frame 60 may vary in accordance with that of the frame of the vehicle upon which it is to be mounted. The primary consideration in the design of frame 60 is to provide a convenient means for attaching the frame to the vehicle which will locate the upper and lower rails 62 and 64 in a horizontal position extending perpendicular to the fore and aft axis of the vehicle.

A sliding frame designated generally 68 includes upper and lower sliding frame members 70 and 72, respectively, which are formed at their forward ends with grooves 74 and 76 which respectively slidably receive the upper and lower tracks 62 and 64 of mounting frame 60. To lock sliding frame 68 in selected positions along mounting frame 60, upper track 62 and the walls of upper grooves 74 are bored at suitable locations to receive a nut and bolt assembly 78. Upper and lower members 70 and 72 each carry vertical pivot assemblies 80 and 82, respectively, which are received in upper and lower arms 84 and 86 on swing tower 16′ to support the tower upon sliding frame 68 for pivotal movement about the vertical axis defined by pivot assemblies 80 and 82.

A bevel gear segment 88 coaxial with pivot assembly 80 is formed or fixedly mounted upon the forward end of upper arm 84 of swing tower 16′ and is in meshed engagement with a second bevel gear segment 90. Bevel gear 90 is supported upon a horizontal pivot 92 supported in brackets 94 mounted upon a horizontal platform 96 intermediate upper and lower frame members 70 and 72. Platform 96 is fixedly secured to and extends horizontally between a pair of vertically disposed side frame members 98 which in turn are secured to and extend between the upper and lower frame members 70 and 72 of sliding frame 68. As in the previous embodiment, bevel gear 90 is of generally semi-circular shape, and a pair of double-acting hydraulic cylinders 100*a* and 100*b* are coupled between the respective ends of gear segment 90 and lower frame element 72 of the sliding frame 68.

A circuit such as that shown in FIG. 4 may be employed to control the operation of hydraulic cylinders 100*a* and 100*b* in the manner described above. Horizontal adjustment of sliding frame 68 relative to the vehicle frame is accomplished by withdrawing locking bolt 78 and swinging the backhoe to one side and embedding the bucket in the ground. The backhoe is then actuated in the conventional manner to pull or push sliding frame 68 sideways along tracks 62 and 64 to the desired position, at which locking bolt 78 is then reinserted to lock the sliding frame in its adjusted position.

While exemplary embodiments of the invention have been disclosed, it will be apparent to those skilled in the art that the disclosed embodiments 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. A backhoe support structure for supporting a backhoe assembly on a vehicle comprising a frame adapted to be mounted on a vehicle, a swing tower adapted to support the backhoe assembly, said swing tower and said frame having a limited space between the same for accommodating the other elements of said support structure, pivot means mounting said swing tower upon said frame for pivotal movement about a vertical axis, a first bevel gear segment fixedly mounted on said swing tower for coaxial rotation therewith about said vertical axis, a generally vertically extending member in said limited space between said swing tower and said frame having a second bevel gear segment thereon in mesh with said first gear segment, means connecting said vertically extending member to said frame for pivotal movement thereof about a horizontal axis, and vertically disposed double acting hydraulic cylinder means connected to said frame and to said vertically extending member and located in said limited space between said swing tower and said frame, said cylinder means having vertically extending rod means movable vertically by actuation of said cylinder means to rotate said second gear segment about said horizontal axis and to thereby rotate said first gear segment about said vertical axis and thus pivot said swing tower about said vertical axis.

2. The backhoe support structure of claim 1 in which said hydraulic cylinder means comprises a pair of hydraulic cylinders each coupled at one end to said frame and coupled at its opposite end to said vertically extending member.

3. A backhoe support structure for supporting a backhoe assembly on a vehicle comprising a frame adapted to be mounted on a vehicle, a swing tower adapted to support the backhoe assembly, said swing tower and said frame having a limited space between the same for accommodating the other elements of said support structure, pivot means mounting said swing tower on said frame for pivotal movement about a first vertical axis, a first bevel gear segment affixed to said swing tower for coaxial rotation therewith about said vertical axis, a vertically extending pivot member in said limited space between said swing tower and said frame having a second bevel gear segment thereon in mesh with said first bevel gear segment, means connecting said vertically extending pivot member to said frame for pivotal movement thereof about a horizontal axis, and a pair of double acting hydraulic cylinders located in said limited space between said swing tower and said frame and each coupled at one end to said frame and coupled at the other end thereof to said vertically extending pivot member, one of said cylinders being connected to a portion of

said pivot member offset on one side of a second vertical axis and the other of said cylinders being connected to a portion of said pivot member on the opposite side of said second vertical axis, said cylinders having generally vertically extending rods movable vertically to rotate said second gear segment about said horizontal axis and to thereby rotate said first gear segment about said first vertical axis and thus pivot said swing tower about said first vertical axis.

4. The backhoe support of claim **3** further including means for mounting said frame upon the rear end of a vehicle for horizontal adjustment laterally of the fore and aft axis of the vehicle.

References Cited by the Examiner

UNITED STATES PATENTS

251,291	12/1881	Rodda	212—68 X
2,837,220	6/1958	Pehkonen et al.	214—138 X
2,903,142	9/1959	Wills	212—66
3,117,685	1/1964	Davis	214—138

FOREIGN PATENTS

1,046,255	7/1953	France.
1,071,311	12/1959	Germany.
43,875	12/1960	Poland.

HUGO O. SCHULZ, *Primary Examiner.*