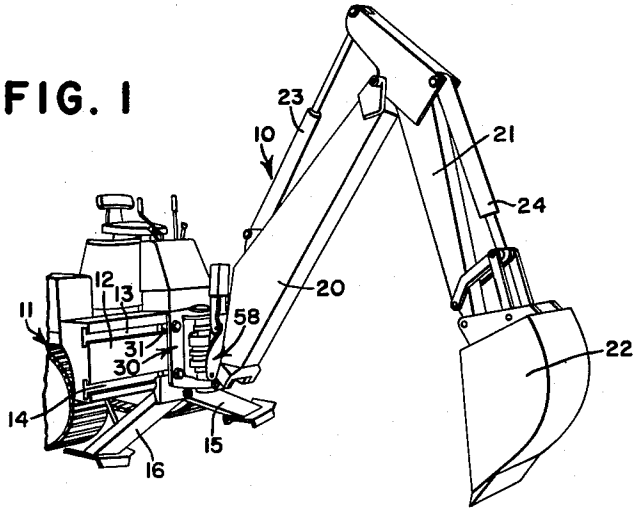
March 29, 1966 P. E. HANSER ET AL 3,243,053

BACKHOE

Filed Nov. 13, 1964 3 Sheets-Sheet 1

FIG. 1



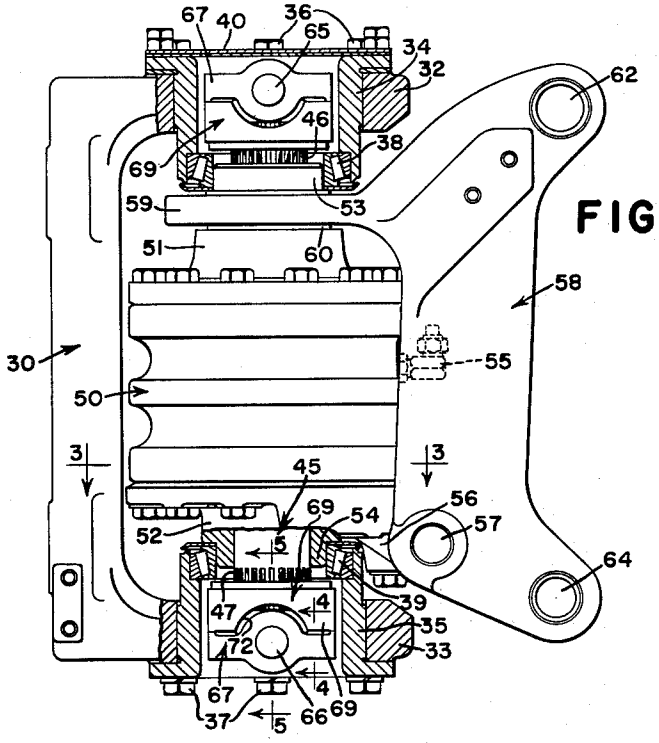


FIG. 2

INVENTORS
P. E. HANSER
E. R. WIEMANN

BY William A. Murray

ATTORNEY

March 29, 1966 P. E. HANSER ET AL 3,243,053

BACKHOE

Filed Nov. 13, 1964 3 Sheets-Sheet 2

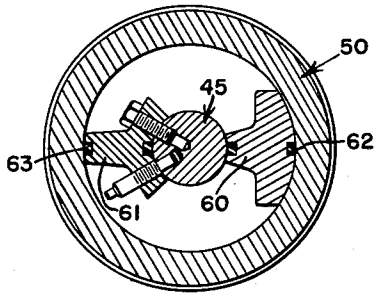


FIG. 3

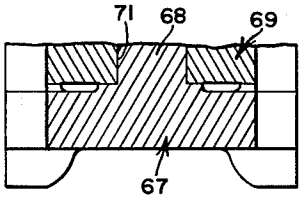


FIG. 4

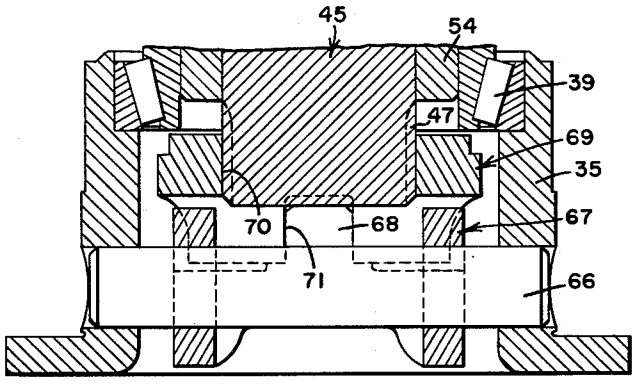


FIG. 5

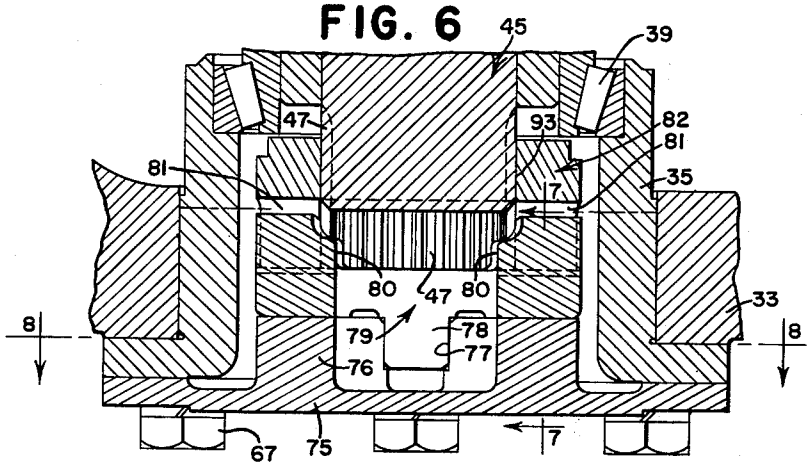
INVENTORS
P. E. HANSER
E. R. WIEMANN
BY William A. Murray
ATTORNEY

March 29, 1966 P. E. HANSER ET AL 3,243,053

BACKHOE

Filed Nov. 13, 1964 3 Sheets-Sheet 3

FIG. 6



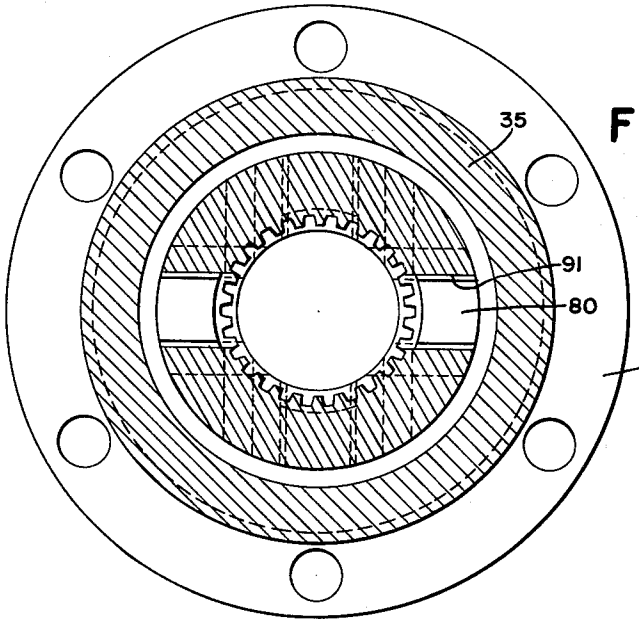


FIG. 8

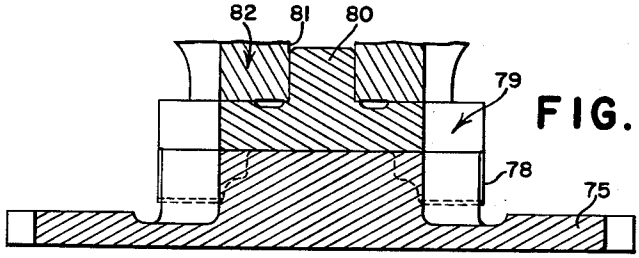


FIG. 7

INVENTORS
P. E. HANSER
E. R. WIEMANN

BY William A. Murray

ATTORNEY

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3,243,053
BACKHOE

Paul E. Hanser, Rock Island, and Edward R. Wiemann, Moline, Ill., assignors to Deere & Company, Moline, Ill., a corporation of Delaware

Filed Nov. 13, 1964, Ser. No. 411,057
8 Claims. (Cl. 212—66)

This invention relates to a backhoe and more particularly to the type of backhoe utilizing a rotary-type cylinder for swinging the backhoe boom angularly on an implement-supporting stand. Still more particularly the present invention relates to the type of backhoe utilizing a rotary-type cylinder and to the particular type of supporting structure that supports the central upright shaft of the rotary cylinder.

In U.S. Patent 2,994,446 which issued to Mr. A. J. Van Auwelaer and Oskar R. Johansson on August 1, 1961, there is shown and described a method of supporting an implement, of a backhoe type, on an upright supporting stand disposed on the rear of the tractor. The supporting structure for the backhoe boom is composed of an upright barrel closed at its upper and lower ends to swing about a fixed upright shaft supported at its upper and lower ends on the supporting stand. Vane means are provided between the barrel and shaft and hydraulic fluid is introduced and taken from opposite sides of the vanes so as to swivel the barrel about the upright shaft for the purpose of swinging the entire backhoe around the vertical axis of the shaft. The upright shaft has upper and lower splined ends received in rigid upper and lower supports fixed to the supporting stand and disposed to hold the shaft rigidly against movement. Surrounding the upper and lower ends of the shaft are journals for supporting the upper and lower ends of the barrel structure on the shaft.

A problem created by this type of arrangement is caused due to the fact that the journal supports for the barrel, while theoretically completely rigid and capable of holding the barrel structure, is in actual operation insufficient, due to manufacturing tolerances, wear, and deflection of the barrel structure under load, to retain complete concentricity between the shaft and barrel. Often the eccentricity between the barrel and shaft, when load is applied to the barrel, creates scouring on the shaft. Also, even with a small amount of eccentricity between the barrel structure and shaft, the vanes extending between the shaft and barrel becomes misaligned to permit leakage to occur between the fluid compartments, and the end result is the boom structure creeps angularly on the shaft in a small but very annoying degree to the operator.

It is the primary purpose of the present invention to provide articulate connections between the main frame and the upper and lower ends of the upright shaft permitting the shaft to be held against rotation but also permitting the upper and lower ends to move slightly in other directions so that the entire load produced on the barrel by the boom is carried on the thrust bearings at the upper and lower ends of the barrel structure. This will permit the upright shaft to move with the barrel in every movement other than angular. This, in effect, will prevent scouring of the upright shaft and will also eliminate the problem of leakage.

Other objects and advantages of the present invention will become apparent to those skilled in the art as the nature of the invention is better understood from the following description and as shown in the accompanying drawings.

FIG. 1 is a front and side perspective view of a backhoe carried on the rear portion of a tractor.

FIG. 2 is an enlarged view of the rotary hydraulic cylinder and supporting structure mounting the backhoe on the front side of a supporting stand. Portions are shown in section for the purpose of showing internal mechanism.

FIG. 3 is an enlarged sectional view taken substantially along the line 3—3 of FIG. 2.

FIG. 4 is an enlarged sectional view taken substantially along the line 4—4 of FIG. 2.

FIG. 5 is an enlarged sectional view taken substantially along the line 5—5 of FIG. 2.

FIG. 6 is an enlarged vertical sectional view of a modified form of a support at one end of the upright shaft and surrounding structure.

FIG. 7 is a sectional view taken substantially along the line 7—7 of FIG. 6.

FIG. 8 is a sectional view taken substantially along the line 8—8 of FIG. 6.

Referring now to the drawings, a backhoe, indicated in its entirety by the reference numeral **10**, is normally supported on the rear end of a tractor **11**, an upright transverse supporting stand **12** being provided between the tractor **11** and backhoe **10**. The supporting stand **12** has upper and lower transverse tracks **13**, **14** permitting the backhoe to move transversely along the supporting stand. A pair of depending and outwardly diverging stabilizing legs **15**, **16** extend from the supporting stand **12** and engage the ground to give additional support for the stand **12**.

The backhoe **10** includes a vertically and laterally swingable boom **20** pivotally connected at its upper end in conventional manner to a dipper stick **21** having a bucket **22** at its outer free end. Hydraulic cylinders **23**, **24** are provided between the boom **20** and the dipper stick **21** and the dipper stick **21** and bucket **22** respectively for positioning the dipper stick **21** and bucket **22**. A main U-shaped forwardly opening main structural member **30** is provided with guides at **31** for transverse movement along the tracks **13**, **14**, a suitable lock being provided to limit or lock the member against transverse movement. The structure **30** includes integrally joined upper and lower laterally extending supports **32**, **33**. The supports **32**, **33** have circular openings therein receiving vertically aligned journal supports **34**, **35**, respectively. The journal supports are bolted at **36**, **37** to the main supports **32**, **33**. The journal supports **34**, **35** carry upper and lower thrust bearings **38**, **39**. A cap plate **40** is disposed over the bearing support **34** and is bolted by the aforementioned bolts **36** thereto.

An upright shaft **45** is disposed concentric to the bearings **38**, **39** and has upper and lower splined ends **46**, **47** respectively above and below the bearings **38**, **39**. Concentric with the shaft is a barrel structure **50** closed by an upper laterally disposed end **51** and a lower laterally disposed end **52** that bears on the surface of the shaft **45** for swiveling about the axis of the shaft. The ends **51**, **52** have upper external round portions **53**, **54** journaled in the bearings **38**, **39** so as to support the shaft **45** in a vertical disposition. Hydraulic fittings, such as indicated in dotted representation at **55** in FIG. 2, are provided for passing fluid to and from the internal chamber of the barrel structure **50**. Provided in the chamber defined by the barrel **50** and shaft **45** is a pair of vanes **60**, **61** fixed to the barrel **50** and shaft **45** respectively. Rubber gaskets **62**, **63** extend around the vanes **60**, **61** so as to minimize leakage between compartments formed by the vanes. Fluid passing through the fittings **55** will move between opposite sides of the vanes **60**, **61** so as to extend or retract the fluid compartments between the vanes.

The barrel **50** has an integral forwardly directed portion, shown partially at **56**, pivotally carrying by pivot pin **57** a vertical boom support **58**. The boom support **58**

has at its upper end a rearwardly directed collar portion 59 having a circular opening therein that contacts and is mounted on an upper outer cylindrical-shaped surface on the head 51 of the barrel structure. The boom 20 is pivotally connected by a pivot pin 64 to the support 58. A hydraulic cylinder, not shown, is pivotally connected to the upper end of the support 58 and extends to the boom 20. Through the latter cylinder the entire boom 29 may be raised and lowered.

The splined ends 46, 47 of the main shaft 45 are connected to the upper and lower supports 32, 33 by articulate connecting means composed in parts of transverse horizontal pivot pins 65, 66. Since the connecting means are identical for both the upper and lower ends, similar reference numbers will be given to identical parts. The pin 66 pivotally supports an annular base member 67 having upwardly projecting lugs 68 on opposite sides of the pin 66 and extending transverse to the axis of the pin. An upper annular member 69 has an inner splined surface 70 receiving the splined end 47 of the shaft 45. The member 69 has downwardly opening recesses 71 receiving the upwardly projecting lugs 68 and permitting a limited quantity or amount of movement of the member 69 transversely to the axis of the pin 66. The member 69 also has semi-circular recesses 72 that permit the transverse movement of the member 69 relative to the member 67 without contact therein.

The purpose of having the articulate type of connection between the splined ends 46, 47 and the supports 32, 33 is to permit the shaft 45 to move continuously with, other than in an angular motion, the barrel 50. When it is desired to place a large load on the bucket, while digging or transporting material, there is a tendency, due to deflection of the material in the barrel structure, manufacturing tolerances, and wear, for the barrel structure 50 to be slightly inclined from the vertical. This would, of course, place a large load on the shaft 45 if opposite ends 46, 47 of the shaft 45 were held against any type of movement. By providing floating motion at the upper and lower ends 46, 47 of the shaft, the shaft is free to move with the barrel. Consequently the barrel and shaft remain concentric throughout all operations. This becomes significantly important because should an inclination, even though relatively small, occur between the shaft 45, and the barrel 50, there would occur considerable leakage around the outer peripheries of the vanes 60, 61 which would make the backhoe difficult to be retained in a desired location.

A modified form of the articulate connection between the ends 45, 46 and the supports 32, 33 is shown in FIGS. 6–8. The connection is composed of a plate 75 bolted by bolts 67 to the support 35. The plate 75 has an upwardly projecting annular boss portion 76 within the journal support 35. The boss 76 has recesses 77 opening to its upper edge that receives aligned depending lugs 78 of a middle annular shaped member 79 that rests on the surface of the upper edge of the boss 76 and is guided to slidably move in the recesses 77. The annular member 79 has upwardly projecting lugs 80 received in downwardly opening recesses 81 of an upper annular member 82, the latter member having an internal splined surface 93 for receiving the lower splined end 47 of the shaft 45. The lugs 80 are disposed at 90° relative to the lugs 78. Consequently, the member 82 is guided to slide on the member 79 at an angle of 90° relative to the direction of sliding movement that the lugs 78 move in their recesses 77. Also, if the shaft 45 is inclined slightly, the members 82 and 79 may raise or lower in the respective recesses to accommodate the inclination of the shaft.

As in the previous form of the invention, the connecting means between the respective upper and lower ends 46, 47 and the supports 32, 33 which prevent rotation of the shaft 45 are such as to permit a relatively free floating action of the shaft 45 when forces are applied

thereon by the barrel structure 50 and permit displacement of the shaft.

While only two preferred forms of the invention have been shown, it should be recognized that other forms and variations will occur to those skilled in the art. Therefore, while the preferred forms have been described for the purpose of concisely illustrating the principles of the invention, it should be understood there is no intention to limit or narrow the invention beyond the broad concepts set forth in the appended claims.

What is claimed is:

1. A swivel structure for an implement between a main frame and a boom comprising: an upright shaft; a barrel structure formed about the shaft with upper and lower ends bearing against the shaft to define with the shaft a closed annular fluid chamber; vane means between the shaft and barrel structure for dividing the chamber into expansible and contractible compartments; means for introducing and withdrawing fluid from the compartments to effect angular movement between the barrel structure and shaft; support means on the frame; means journaling upper and lower ends of the barrel structure on the support means for rotation about an upright axis; articulate connecting means between the support means and the shaft preventing angular movement of the shaft about its axis while permitting the shaft to shift with the barrel structure in other than angular motion; and means connecting the barrel structure to the boom.

2. The invention defined in claim 1 in which the articulate connecting means include a plurality of stacked members aligned with the shaft and offset from one end thereof, with the member farthest from the shaft being supported on the respective support and the member closest to the shaft being fixed to rotate with the shaft, the members being interlocked to shift radially and axially relative to one another and to prevent relative radial movement.

3. The invention defined in claim 1 in which the articulate connecting means includes a stack of interlocked members for rotation in unison and shiftable relative to one another in planes normal to the shaft with one of the members being mounted against rotation on the shaft and another of the members being supported against rotation on the support means.

4. A swivel structure for an implement between a main frame and a boom comprising: a shaft; a barrel structure formed about the shaft with opposite ends bearing against the shaft to define with the shaft a closed annular fluid chamber; vane means between the shaft and barrel structure for dividing the chamber into expansible and contractible compartments; means for introducing and withdrawing fluid from the compartments to effect angular movement between the barrel structure and shaft; support means on the frame journaling the barrel structure for rotation about the axis of the shaft; articulate connecting means between the support means and the shaft preventing angular movement of the shaft about its axis while permitting the shaft to shift with the barrel structure in other than angular motion; and means connecting the barrel structure to the boom.

5. A swivel structure for an implement between a main frame and a boom comprising: an upright shaft; a barrel structure formed about the shaft with upper and lower ends bearing against the shaft to define with the shaft a closed annular fluid chamber; vane means between the shaft and barrel structure for dividing the chamber into expansible and contractible compartments; means for introducing and withdrawing fluid from the compartments to effect angular movement between the barrel structure and shaft; upper and lower support means on the frame journaling the barrel structure for rotation about an upright axis; articulate connecting means between the support means and an end of the shaft preventing angular movement of the shaft about its axis while permitting the shaft to shift with the barrel in other than angular motion,

the articulate connecting means being composed of a first of two interlocking members being pivotally supported on the support means on an axis at right angles to the shaft axis and the second of two interlocking means being locked to rotate with the shaft and first member and being interlocked with the first member to shift relative to the first member transverse to the pivotal axis; and means connecting the barrel structure to the boom.

6. A swivel structure for an implement between a main frame and a boom comprising: an upright shaft; a barrel structure formed about the shaft with upper and lower ends bearing against the shaft to define with the shaft a closed annular fluid chamber; vane means between the shaft and barrel structure for dividing the chamber into expansible and contractible compartments; means for introducing and withdrawing fluid from the compartments to effect angular movement between the barrel structure and shaft; upper and lower support means on the frame journaling the barrel structure for rotation about an upright axis; articulate connecting means between the support means and an end of the shaft preventing angular movement of the shaft about its axis while permitting the shaft to shift with the barrel in other than angular motion, the articulate connecting means being composed of a stack of three radially extending members at the end of the shaft, a first member being connected to rotate with the shaft, a second member being fixed against rotation with the support means, and a third intermediate member between the first and second members with radially extending tongue and connections therewith whereby the members may shift laterally relative to one another; and means connecting the barrel structure to the boom.

7. On a power implement having a main frame and a boom directed outwardly from the support, the improvement comprising; an upright shaft having upper and lower ends; upper and lower supports on the frame adjacent the upper and lower ends of the shaft; journal blocks

on the upper and lower supports including thrust bearings engaging the respective upper and lower ends for resisting axial movement thereof; articulate connecting means between the members and the respective supports preventing angular movement of the members and shaft; a barrel formed about the shaft and having upper and lower radially disposed ends bearing on the shaft to effect a fluid seal between the shaft and barrel and to define with the shaft an annular fluid chamber, the radially disposed ends further having outer journal portions engaging the bearings; vane means between the shaft and barrel for dividing the chamber into fluid compartments; means passing fluid to and from the compartments for effecting angular movement between the shaft and barrel; means connecting the boom to the barrel; and articulate connecting means between at least one of the supports and the respective shaft for preventing angular movement of the shaft and accommodating minute movement of the shaft in other directions.

8. The invention defined in claim 1 in which the articulate connecting means includes a pair of stacked members at the end of the shaft, one member being fixed to rotate with the shaft and the other member being connected to the support means by a pivotal connection at a right angular relation to the axis of the shaft, and the pair of members is interlocked by radially extending lug and groove means permitting shifting of said one member transverse to the pivotal connection.

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HUGO O. SCHULZ, *Primary Examiner*.