

Dec. 7, 1965

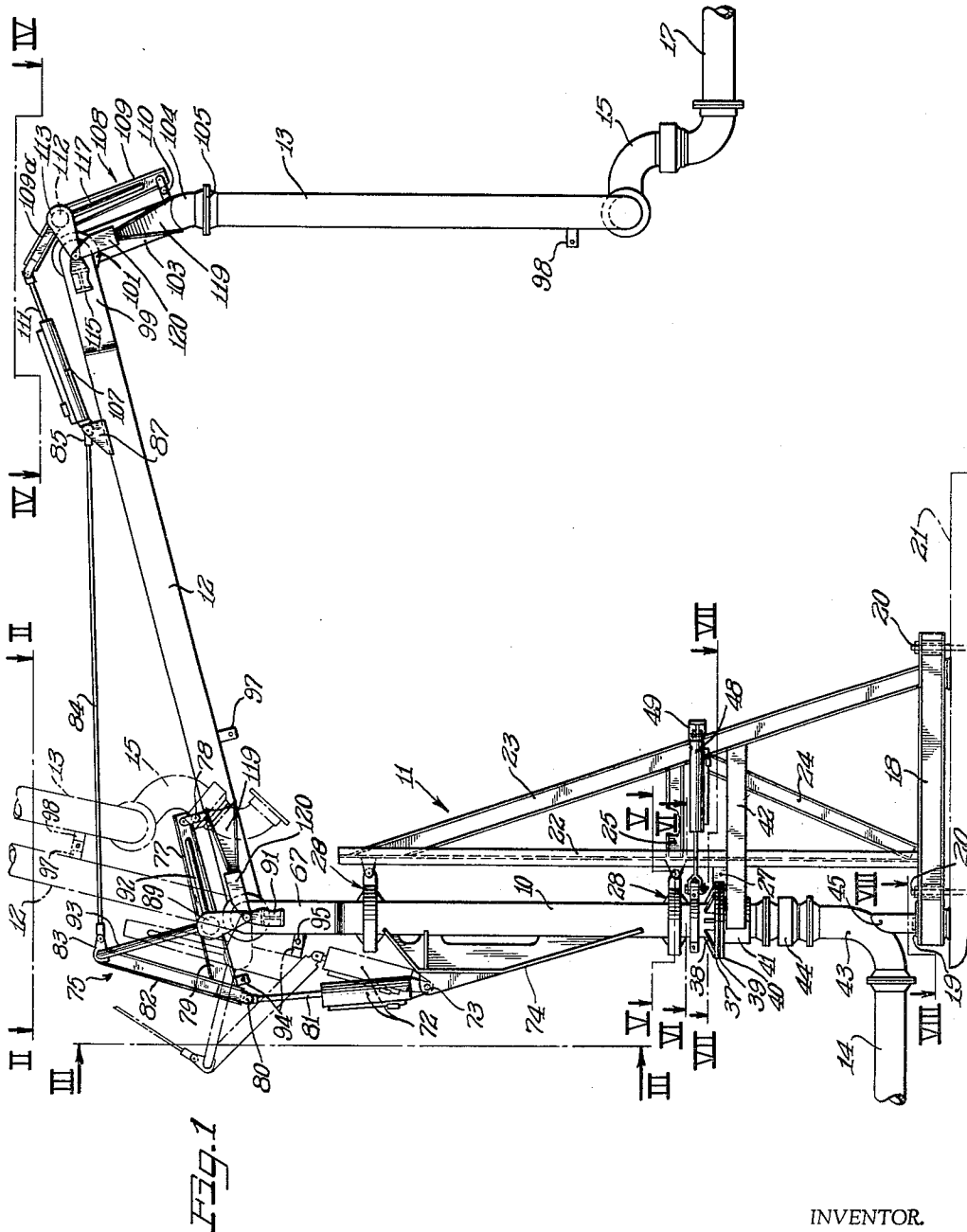
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3,221,771

ARTICULATED BOOM STRUCTURE WITH STABILIZING STRUCTURE

Filed March 4, 1963

3 Sheets-Sheet 1



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ARTICULATED BOOM STRUCTURE WITH STABILIZING STRUCTURE

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3 Sheets-Sheet 2

Fig. 2

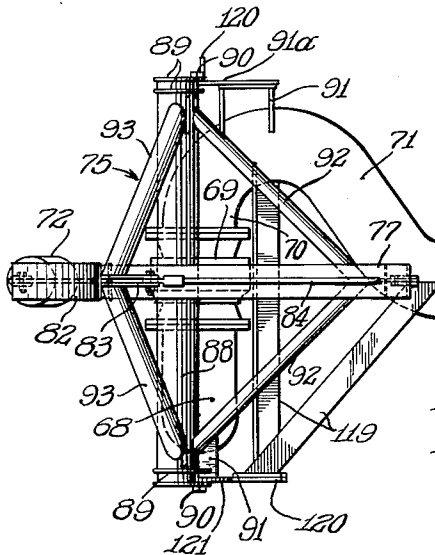


Fig. 3

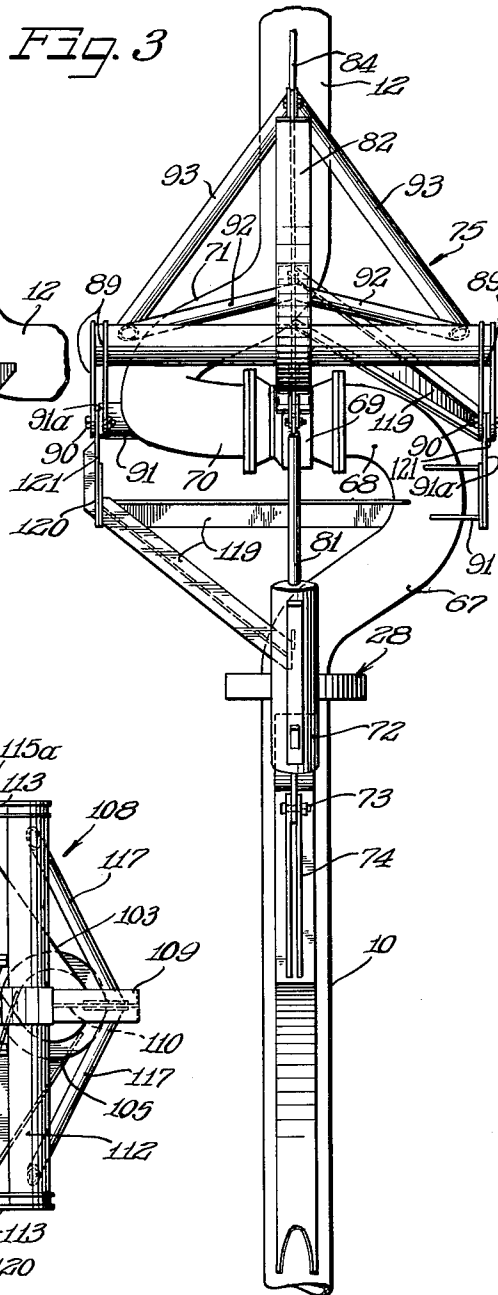
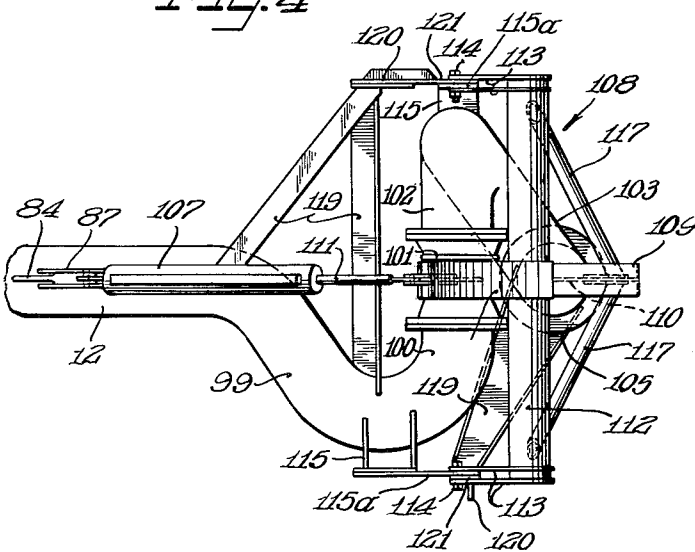


Fig. 4



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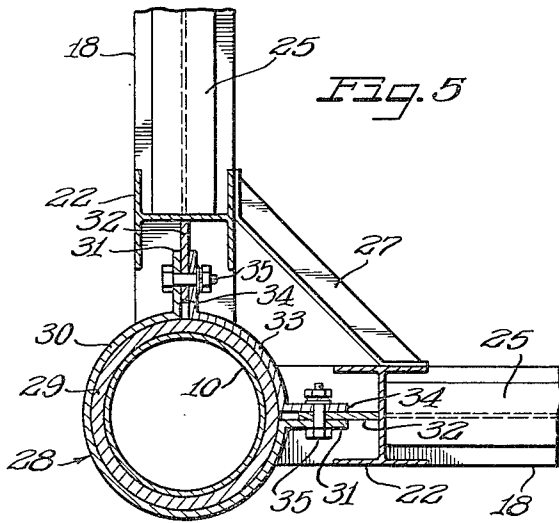


Fig. 5

Fig. 9

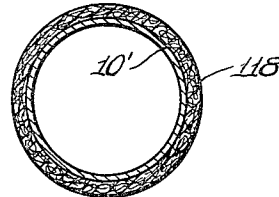


Fig. 8

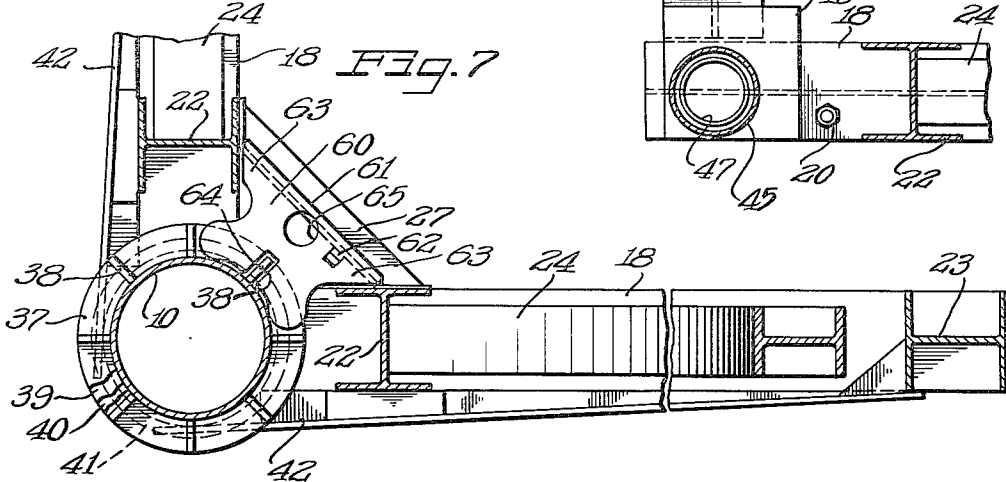
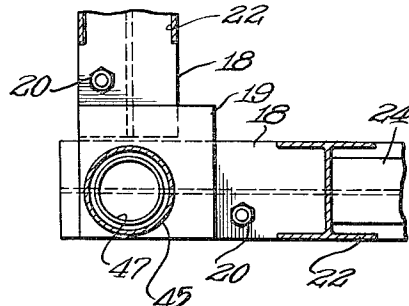
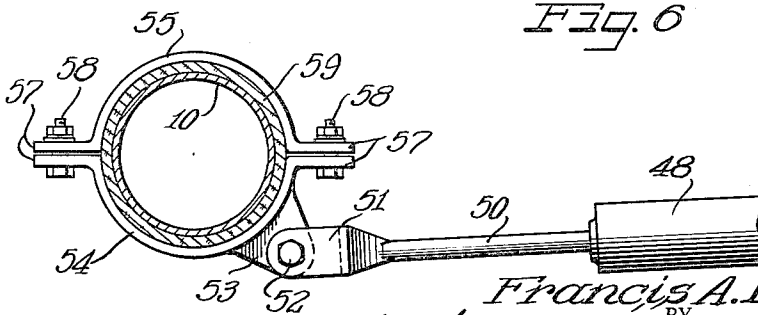


Fig. 7

Fig. 6



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3,221,771 ARTICULATED BOOM STRUCTURE WITH STABILIZING STRUCTURE

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18 Claims. (Cl. 137—615)

The present invention relates to improvements in articulated boom structures and is more particularly concerned with a new and improved arrangement which is especially useful in hydraulically motivated booms for transferring fluent materials between loading docks and piers and cargo vehicles, such as trucks, railway cars and marine vessels including tankers and barges.

Bulk fluid transfer, especially in marine shipping, presents numerous problems arising from size and height differences in dockage and vessel structures, the necessarily inherent mobility of the vessels relative to fixed dock and pier structures and including rise, fall, drift, pitch and roll of the vessels. Heretofore, various complexities of hoses and hose handling winches, jibs, cranes and the like, space requirements, etc., have also complicated this shipping problem.

Accordingly, it is an important object of the present invention to provide a highly efficient, versatile, reliable and extremely adaptable articulated boom structure which is especially suitable for bulk fluid transfer operations in marine shipping.

Another object of the invention is to provide a novel powered articulated boom structure embodying a new and improved articulating device for stable pivoting of the boom components.

A further object of the invention is to provide in a pivotally articulated bulk fluent material transfer boom assembly a new and improved actuating device with an efficient load bearing to swivel joint relationship of the device with respect to the relatively pivotally connected sections of the assembly.

Still another object of the invention is to provide new and improved means for applying motivating power for adjusting the attitude of articulated boom components relative to one another.

Yet another object of the invention is to provide new and improved means for supporting vertical, swivelly mounted riser components of an articulated boom structure.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view of an articulated boom structure embodying features of the invention;

FIGURE 2 is a fragmentary enlarged plan view of the boom structure taken substantially in the plane of line II—II of FIGURE 1;

FIGURE 3 is an enlarged vertical elevational view taken substantially in the plane of line III—III of FIGURE 1;

FIGURE 4 is a fragmentary enlarged plan view taken substantially in the plane of line IV—IV of FIGURE 1;

FIGURE 5 is a fragmentary enlarged sectional elevational detail view taken substantially on the line V—V of FIGURE 1;

FIGURE 6 is a fragmentary enlarged sectional elevational detail view taken substantially on the line VI—VI of FIGURE 1;

FIGURE 7 is an enlarged fragmentary sectional eleva-

tional detail view taken substantially on the line VII—VII of FIGURE 1;

FIGURE 8 is an enlarged fragmentary sectional elevational detail view taken substantially on the line VIII—VIII of FIGURE 1; and

FIGURE 9 is a sectional detail view showing a slight modification.

Representative of an articulated boom structure according to the present invention is that depicted in FIGURE 1, constructed and arranged for transfer of fluent material between a loading or unloading station and a vehicle. In this instance the structure is especially suitable for bulk transfer of fluent material in marine shipping. To this end, the structure includes a vertical riser 10 supported pivotally for swinging or swivel movement about a vertical axis by a standard 11. Carried by the upper end of the riser 10 is a boom assembly comprising at least one boom section 12, but in the illustrated form comprising a plurality of boom sections wherein the section 12 is the inboard section supporting at its outer end an outboard boom section 13. Through suitable connections and couplings the riser 10 and the boom sections 12 and 13 afford an articulated conduit adapted for connection at the lower end of the riser 10 with a pipe or conduit 14 serving either as a supply or delivery duct depending on the direction of flow desired. Suitable jointed connecting means comprising swivel joints, elbows, and the like, 15 on the free end of the outboard boom section 13 enable operative attachment thereof to a delivery or supply duct 17 which may be a manifold or tank connection, and the like.

A firm, stable support for the mast or riser 10 is afforded by the supporting standard structure 11 through the provision of a sturdy framework of structural steel members such as H-beams welded into a unitary structure. In a desirable arrangement, the framework comprises a pair of generally A-shaped frames in generally splayed relationship and each including a base bar 18 secured together at adjacent end portions thereof (FIG. 8) under the lower end of the riser 10, with a coupling plate 19 welded onto the upper side of the joint. These base bars are adapted to be secured as by means of tie bolts 20 to a supporting base such as a dock 21 (FIG. 1), which may be a waterside dock or pier, vehicle loading dock, or a vehicle deck, such as that of a railroad car or dolly, deck of a vessel, and the like.

Rising from each of the base bars 18, is a substantially rigid generally A-shaped frame which is substantially triangular in side elevation and comprises a vertical bar 22 secured at its lower end onto the base bar 18 and adjacent to that end of the respective base bar which is joined to the other base bar. Connecting the upper end portion of each of the vertical bars 22 with the outer or free end portion of the supporting base bar 18 is a diagonal buttress bar 23. This is reinforced by a truss bar 24 extending from the angle between the base bar 18 and the vertical bar 22 diagonally upwardly to adjacent the midpoint of the inner side of the buttress bar 23 and adjacent to a horizontal reinforcing bar 25 connecting the mid-area of the buttress bar 23 with the adjacent vertical bar 22. At least one transverse connecting bar 27 (FIGS. 5 and 7) is secured to and between the vertical bars 22 spaced substantially above the base bars 18.

Swivel connection of the riser or mast pipe 10 to the supporting framework of the standard 11 is desirably effected by means of a pair of vertically spaced swivel bearing assemblies 28 (FIGS. 1 and 5) each of which comprises a bearing ring 29 which may be of bronze encircling the cylindrical riser 10 in slidable bearing relation and within which the riser is rotatable. Attachment of the respective ring bearings 29 to the framework of the

standard is through the medium of a flanged split collar assembly comprising a yoke portion 30 having respective angular flanges 31 on its end portions each engaging one side face of a respective rigid connecting ear 32 on the adjacent vertical bar 22 defining an edge of one of the triangular frames of the standard, while a complementary collar portion 33 completing the collar, has angular opposite end flanges 34 engaging the opposite faces of the respective ears 32. Attachment means comprising bolts 35 extending through the respective sets of collar flanges and rigid connecting ears 32 secure the collar segments 30 and 33 in clamping engagement about the associated ring bearing 29 and to the rigid connecting ears 32. One of the bearing assemblies 28 is attached to the vertical frame bars 22 adjacent and in line with the horizontal reinforcing bars 25 and the other of the bearing assemblies 28 is attached adjacent to the upper ends of the vertical bars 22 and adjacent the upper ends of the buttress bars 23. This swivel connection is thoroughly resistant to the multiplicity of stresses and strains imposed on the riser 10 by the live and dead loads, and the various stresses to which it may be subjected by manipulations of, the boom sections 12 and 13.

Vertical thrust bearing means are provided for the mast or riser 10. In a heavy duty form such thrust bearing means comprise a downwardly facing annular flange 37 (FIGS. 1 and 7) rigidly secured by means including radial flange vanes 38 to and about the lower end portion of the riser 10 spaced below the lowermost swivel bearing assembly 28 and slidably thrusting in bearing relation against a bearing ring disk 39 supported by an upwardly facing thrust flange 40 carried by an annular ring bracket 41 supported in encompassing relation about the riser by a pair of convergently related cantilever support arms 42 respectively rigidly secured to the A-frame sections of the standard structure 11. By having the heavy duty thrust bearing assembly as supported by the arms 42 spaced substantially above the base of the standard structure, convenient mounting of coupling means on the lower end of the riser 10 is enabled, such for example as an L-member 43 and a swivel joint 44 by which connection is effected with the duct 14.

If desired, a thrust bearing may be provided for the L-member 43. For this purpose, a downward extension tube 45 is secured to the L-member coaxially with the upwardly extending end of the member and coaxial with the riser 10. At its lower end, the thrust bearing tube 45 rests against the connector plate 19 serving as a thrust bearing therefor. For maintaining the thrust bearing tube 45 in centered alignment with the riser 10 and against lateral displacement, and upwardly projecting rigid boss or centering ring 47 on the plate 19 may be provided as shown (FIGURE 8). This lowermost thrust bearing arrangement may serve as the entire vertical thrust bearing for the standard 10 in relatively lightweight construction, instead of the heavy duty thrust bearing arrangement 37, 38, 40, if preferred.

Means are provided for powered rotary or swivelling movements of the riser 10 as a mast for adjusting the boom supported thereby swingably about a vertical axis. For this purpose, a hydraulic cylinder actuator 48 (FIGURES 1 and 6) is provided having one end secured pivotally to a bracket 49 on one of the frame buttress bars 23 and its piston rod 50 secured as by means of a yoke or clevis 51 and a pin or bolt 52 to an ear 53 projecting from one-half portion 54 of a segmented clamp collar including a complementary half portion 55. Opposing attachment ears 57 on the respective opposite ends of the collar segments 54 and 55 are clampingly secured as by means of bolts 58 and draw the collar segments into gripping engagement with friction means such as a brake band 59 grippingly engaging the outer perimeter of the pipe of the riser 10 in substantially fixed embrace. Any suitable hydraulic control system may be employed for actuating the actuator 48 to effect oscillatory swivelling

of the riser 10 as required. Such a control arrangement adapted for this purpose is disclosed in Patent 2,984,985, dated February 23, 1961.

When it is desired to maintain the riser mast 10 locked in any rotatably adjusted position, or in an idle condition, a manually engageable and disengageable lock or latch device may be employed, such, for example, as disclosed in FIGURE 7, comprising a latch plate 60. This latch plate is so constructed and arranged that it is engageable upon the horizontal reinforcing bar 27 and has a depending flange 61 engageable with one side of a flange portion of the bar 27 and a depending detent 62 engageable with the opposite side of such flange portion to retain the latch plate against outward displacement horizontally from the bar 27. At each side, the latch plate 60 has a respective shoulder portion 63 opposing the adjacent face of the respective vertical standard bar 22. Locking engagement with the standard 10 is effected by a portion of the plate which projects between the vertical bars 22 for engagement of one of the radial vane flanges 38 within an interlock notch 64 in such portion. This notched locking portion of the latch plate 60 engages upon the thrust flange 37, substantially as shown. Through this arrangement, the rotary riser 10 is held positively against turning until the latch plate 60 is removed, in this instance manually, a finger hole 65 being provided therein to facilitate handling.

In order to enable swingable raising and lowering of the inboard boom section or member 12 about a horizontal axis adjacent to the upper end of the riser 10, the upper end portion of the riser is provided with an angular, elbow-like, or gooseneck yoke mast head 67 (FIGS. 1 and 3) having an inwardly directed connection terminal 68 disposed on a horizontal axis perpendicular to and intersecting the point of intersection of the longitudinal center axes of the straight vertical portion of the riser 10 and of the boom member 12. This terminal portion 68 is suitably connected by a swivel coupling 69 to a complementary, coaxial connecting terminal portion 70 on an angular, elbow-like or gooseneck inboard yoke end portion 71 of the boom member 12. Desirably, though not necessarily, the coupling 69 lies in the vertical plane of the central longitudinal axis of the riser 10 and boom member 12.

Novel means are provided for efficiently actuating the boom member 12 relative to the riser 10, and especially adapted to operate in the presence of the considerable cantilever forces imposed upon the boom member. Such means comprise a generally upwardly extending hydraulic cylinder actuator or motor 72 which is mounted at its lower end by pivot means 73 to a rigid bracket 74 secured, as by means of welding, to the steel pipe of the riser 10 between the two swivel bearings 28 and on the side of the riser 10 opposite to that from which the boom member 12 projects. This is also the side opposite to the supporting standard 11 which, by having the A-frames thereof splayed generally away from the swivel position of the riser 10, affords a wide range of movement accommodation clearance for the actuator 72 and its attachment bracket 74 with the riser 10 in the swivelling movements of the riser. As seen in FIG. 1, the bracket 74 projects a substantial distance laterally from the riser. It will be understood that the hydraulic actuator 72 is integrated in the hydraulic operating system which includes also the hydraulic actuator 48 by which the riser 10 is power swivelled.

Operative connection of the hydraulic power actuator 72 for actuating the boom member 12 is effected by coupling means which, because of its novelty in this art, and for want of a better term, has been designated as a bridle 75. This bridle, in effect, comprises a non-rigidly mounted, self-fulcrumed, rearward or inboard extension of the boom lever beyond the horizontal pivotal axis between the boom member 12 and mast head portion 67 of the riser 10 for efficient first class lever operation.

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In a desirable construction, the bridle 75 comprises a longitudinally extending lever arm 77 overlying the inboard straight end portion of the boom section 12, preferably in a vertical plane through the axis of the boom section and with the outboard end portion of the lever arm secured to the boom section by an attachment bracket-lug-link device 78 enabling automatic relative expansion and contraction and like adjustment movements of the arm and boom section. An inboard extension portion 79 of the lever arm 77 projects a suitable distance beyond the swivel coupling 69 and is connected by suitable pivotal connection 80 with the outer end terminal of a piston rod 81 projecting generally upwardly from the upper end of the actuating motor 72.

For compensation of bending loads, the inboard end portion of the lever arm section 79 carries rigidly thereon a generally upward extension, conveniently in the form of a diagonally upwardly and forwardly projecting mast or pylon arm or bar 82 carrying on its upper end a coupling 83 by which there is attached the inboard end of a guy rod 84. This rod provides a tensioned supporting means and extends forwardly or in an outboard direction over the boom member 12 and is connected by a suitable coupling 85 to a bracket 87 rigidly mounted on the upper side of the member 12 in spaced adjacency to its outboard end.

Stabilizing fulcrum means enabling fulcruming of the bridle 75 on the horizontal pivotal axis between the riser 10 and the boom section 12 comprise a horizontal stabilizer bar 88 extending equally beyond opposite sides of the lever arm 77 from adjacent juncture of the inboard extension 79 of the arm with the main outboard portion of the arm. The bar 88 is parallel with the adjacent boom pivoting axis and is of a length somewhat greater than, and extends equally beyond each end of, the S-shaped configuration defined by the gooseneck or yoke elbows of the coupled end portions 67 and 71, respectively, of the riser and boom members. At each end, the stabilizer bar 88 has a rigid, identical rocker arm 89 each of which comprises a pair of coextensive spaced, parallel plates and is of sufficient length to support the stabilizer bar and thus the bridle assembly in adequate operative spaced relation above the coupling 69. The free end portions of the rocker arms 89 are pivotally connected by bearing pivot means such as respective pins or bolts 90 to respective pivot brackets 91 rigidly secured as by welding to the adjacent elbows 67 and 71 and each provided with a respective flange plate journal arm 91a interleaved with the associated twin-plate rocker arm 89. The bearing pivots 90 are coaxial with the pivotal axis of the coupling 69. This arrangement has been found to be quite efficient and enables accurate axial alignment of the pivots 90 by welding on of the pivot and load bearing brackets 91 in separately adjusted relation to the axis of the swivel coupling 69 for smooth, bind-free operation of the swivel coupling and the bridle structure 75.

For reinforcement of the bridle structure, diagonal reinforcing bars 92 are rigidly secured between the end portions of the rigid stabilizer bar 88 and the outboard end portion of the lever arm 77. Similar reinforcing bars 93 are rigidly secured between the outer end portions of the bar 88 and the upper end portion of the pylon bar or arm 82. Thus, effective generally triangular structural frame construction is afforded for the bridle 75.

By operation of the actuating motor 72, raising and lowering of the boom is effected through the bridle 75 between an idle, out-of-service position as indicated in dot dash outline in FIGURE 1 and a preferred service position, exemplified in full lines in FIGURE 1. In the out-of-service position, a latching lug 94 on the inboard underside of the lever arm extension 79 registers with a complementary latching lug 95 on the mast head of the riser 10 and is locked thereto as by means of a locking pin or the like. Similarly, the boom members 12 and 13 are adapted to be locked together in a collapsed, idle

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position by means of a rigid latching lug 97 on the member 12 registering with a complementary latching lug 98 on the member 13 and adapted to be secured together as by means of a latching pin or the like as indicated in dash outline in FIGURE 1.

An arrangement similar to that afforded between the mast head of the riser 10 and the boom section 12 is afforded between the inboard boom section 12 and the outboard boom section 13 for enabling relative pivotal adjustment movement of the boom sections about a horizontal axis. For this purpose as best seen in FIGURES 1 and 4, the boom section 12 has an elbow-like gooseneck or yoke outboard end portion 99 providing a coupling terminal 100 disposed on a horizontal axis coaxial with a swivel joint coupling 101 by which a complementary coaxial terminal portion 102 on an elbow-like gooseneck or yoke portion 103 of an inboard end section 104 of the outboard boom member 13 is secured as by means of a flange coupling 105 to the main length of the outboard boom member.

While for some purposes it may be sufficient to equip the boom members with a freely manually adjustable swivel connection inclusive of the swivel joint coupling 101, for heavy duty purposes it is desirable to provide powered driving means for effecting adjustments. For this purpose actuating motor means such as a hydraulic actuator 107 are mounted on the boom member 12, conveniently utilizing the bracket 87 for pivotally attaching the inboard end of the hydraulic cylinder of the actuator 107. This actuating motor operates to swing the outboard boom section 13 vertically relative to the inboard boom section 12 through the medium of a bridle structure 108 on the order of the bridle 75 but modified in view of the smaller load which, in this instance, it must withstand.

Connection of the actuating motor 107 to the bridle 108 is through a lever arm 109 thereof overlying and connected at its outboard end portion to a bracket-lug-link device 110 secured to the boom section 104 and enabling automatic relative adjustment movements of the connected parts. A driving connection between the actuating motor 107 and the lever arm 109 is effected between an inboard extension 109a of the lever arm extending past the coupling 101 and pivotally connected to the outer end of a piston rod 111 projecting from the free end of the cylinder of the hydraulic motor 107.

A bearing load fulcrum for the bridle 108 on an axis concentric with the axis of the coupling 101 is afforded through a transverse stabilizer bar 112 extending equidistantly rigidly from each side of the operating lever 109 at junction thereof with the lever extension 109a and having coextensive identical transverse spacer arms 113 comprising respective pairs of flange plates at its respective opposite ends connected on pivot bearings 114 with respective brackets 115 rigidly mounted on the elbows of the connecting yokes of respectively the boom member 12 and the boom section 104. Respective journal plate flanges 114a of the brackets are interleaved with the flange plate arms 113, with the axes of the pivot bearings 114 coaxially aligned with the axis of the coupling 101. Stabilizing reinforcement for the bridle is afforded by rigid diagonal brace bars 117 respectively extending between and rigidly secured to the outer end portions of the cross bar 112 and the outboard end portion of the lever arm 109. Through this arrangement, actuation of the outboard boom member 13 can be readily effected swingably relative to the boom member 12 for adjustments desirable in coupling the boom to a nipple or duct as represented by the pipe 17. It also enables movement of the outboard boom member 13 between a collapsed position as shown in dash outline and an extended position as represented in full outline in FIGURE 1. It will be understood, of course, that the hydraulic actuating motor 107 is connected into the hydraulic

control system in which the hydraulic motors or actuators 48 and 72 are also connected.

In the hydraulic system, suitable means may be provided by way of pressure sensitive relief valves, or the like, for enabling swivelling or pivotal, non-powered adjustments of the various relatively swivelling and pivoted parts of the assembly to accommodate relative movements between the supporting structure for the boom assembly and the structure with which the outboard end of the boom assembly is connected while in service, such as the movements between a loading dock and a water-borne cargo vessel. Normally, however, the hydraulic motor actuators 48, 72 and 107 will hold the respective associated portions of the boom assembly in whatever adjusted position may have been effected by the hydraulic control system of the installation.

Where fluids of a character requiring insulation of the ducts of the boom structure are to be handled, an insulating jacket 118 (FIG. 9) may be provided thereabout. The pipe 10' will be understood to represent any portion of the conduit system of the boom structure inclusive of the riser and the boom sections as well as connecting elbows, L's and couplings. Such insulation is especially desirable when handling compressed gases at low temperatures, or fluids in heated condition where conservation of heat is desirable.

For balanced, equalized loading of the bearing structures at the pivotal joints between the riser 10 and the boom section 12, and between the boom sections 12 and 13, the several gooseneck yoke portions have associated therewith respective equalizer structures comprising, in each instance, a rigid yoke arm assembly 119 secured to and projecting from the hook-shaped side of the gooseneck portion and rigidly supporting a bracket structure 120 including a journal leaf or flange plate arm 121 parallel with and having a journal end coextensive with the journal plate flange arm 91a or 115a, as the case may be, of the bracket rigid on the gooseneck portion. The arms 121 are disposed in an interleaved relation with the respective double flange plate bearing arms of the associated bridle and the flange plate of the yoke-mounted bracket of the companion yoke assembly in each instance, with the bearing pin 90 or 114, as the case may be, securing all of the interleaved flange plate or arms on a common pivotal axis of the associated articulated members transverse to the axes of the members, and with the load bearing assemblies in substantially spaced relation, and on opposite sides of the joint. Through this arrangement, not only is the bearing load on the pivot joint efficiently equalized, but the bridle structure in each instance functions to avoid bending stresses and assures that the primary stresses are in direct tension and/or compression in the articulated members and the motivating structures.

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

I claim as my invention:

1. A boom structure including a pair of elongated members, means pivotally connecting said members on a pivot joint on an axis transverse to the axes of the members and including respective load bearing assemblies in substantially spaced relation and at opposite ends of said axis on opposite sides of said joint, one of said assemblies being fixedly supported by one of the members and the other assembly being fixedly supported by the other member, each of the members having substantially rigid load equalizing means pivotally engaging the assembly on the other member and on said axis, an actuating bridle carried by one of the members and having fulcrum means pivoted on said load bearing assemblies and on said axis, and an actuator carried by the other of said members and operatively connected to said bridle.

2. An articulated boom construction including: a vertical supporting structure, a vertical riser, a boom having an inboard portion pivotally connected on a horizontal axis to the upper end portion of the riser, a bridle structure attached to said inboard portion of the boom and having a stabilizer straddling the pivotal connection of the boom and the riser and having a pivotal fulcrum with its axis coaxial with said horizontal axis, and actuating means connected to said bridle structure and operable for thereby pivotally actuating the boom relative to the standard.
3. An articulated boom for conveying fluent material comprising: upright supporting structure, a vertical riser comprising a conduit having means on its lower end for connection with duct means and a gooseneck yoke portion on its upper end including a terminal on a horizontal axis, means connecting the riser to the upright supporting structure, a boom comprising a substantially rigid duct of substantial length having an inboard substantially gooseneck yoke portion with a terminal complementary to and coaxial with the riser terminal, a swivel joint connecting said terminals and enabling vertical adjustment movements of the boom about said horizontal axis, a lever structure attached to said inboard portion of the boom and having an extension beyond the swivel joint, and actuating means connected to said lever extension for actuating the boom, said lever structure including a pylon projecting upwardly and having a tie rod attached thereto and to an outboard portion of the boom.
4. An articulated boom construction including a vertical riser having a mast head, an articulated boom including an inboard section and an outboard section pivotally connected together, said inboard section having an inboard end portion pivotally connected to said mast head, a stabilized actuating bridle mounted on the inboard portion of the inboard boom section and having a fulcrum coaxial with the pivotal axis of the connection with the mast head, a motor carried by the riser and operatively connected to said bridle structure for pivotally actuating the inboard boom section relative to the riser, a bridle structure carried by the inboard portion of said outboard boom section and having a fulcrum coaxial with the pivot axis of the connection between said boom sections, and a motor carried by the outboard portion of the inboard boom section and attached to said bridle structure on the outboard boom section for pivotally actuating the outboard boom section relative to the inboard boom section.
5. In an articulated conduit boom structure including a pair of rigid conduit members having elongated portions disposed in a common plane and an articulated connection including a swivel joint having its axis perpendicular to said plane, the improvement comprising a bridle structure on one of said members, and an actuating motor on the other of said members and connected to said bridle structure for effecting relative pivotal movement of the members about said axis, said bridle structure comprising a lever carried by said one member and disposed in said plane and having an extension portion projecting beyond the joint, said motor being connected to said extension portion, a stabilizer bar rigid with and extending coaxially to

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opposite sides of said lever adjacent to said joint, rigid coextensive rocker arms projecting from the end portions of said bar, and means providing fulcrum bearings for said rocker arms coaxially with said joint axis and comprising 5
respective brackets one of which is carried by said one member adjacent to said connection and the other of which is carried by said other member adjacent to said connection.

6. In an articulated conduit boom structure including 10
a pair of rigid conduit members having elongated portions disposed in a common plane and an articulated connection including a swivel joint having its axis perpendicular to said plane,

the improvement comprising a bridle structure on 15
one of said members,

and an actuating motor on the other of said members and connected to said bridle structure for effecting relative pivotal movement of the members about said axis, 20

said bridle structure comprising a lever carried by said one member and disposed in said plane and having an extension portion projecting beyond the joint, 25

said motor being connected to said extension portion, a stabilizer bar rigid with and extending coaxially to opposite sides of said lever adjacent to said joint, rigid coextensive rocker arms projecting from the end portions of said bar, 30

means providing fulcrum bearings for said rocker arms coaxially with said joint axis and comprising respective brackets one of which is carried by said one member adjacent to said connection and the other of which is carried by said other member adjacent to said connection, 35

and diagonal brace bars extending between the opposite end portions of said stabilizing bar and an end portion of said lever remote from said stabilizing bar.

7. In an articulated conduit boom structure including 40
a pair of rigid conduit members having elongated portions disposed in a common plane and an articulated connection including a swivel joint having its axis perpendicular to said plane,

the improvement comprising a bridle structure on one of said members, 45

and an actuating motor on the other of said members and connected to said bridle structure for effecting relative pivotal movement of the members about said axis,

said bridle structure comprising a lever carried by said one member and disposed in said plane and having an extension portion projecting beyond the joint, 50

said motor being connected to said extension portion, a stabilizer bar rigid with and extending coaxially to opposite sides of said lever adjacent to said joint, 55

rigid coextensive rocker arms projecting from the end portions of said bar,

means providing fulcrum bearings for said rocker arms coaxially with said joint axis and comprising respective brackets one of which is carried by said one member adjacent to said connection and the other of which is carried by said other member adjacent to said connection, 60

a pylon bar extending from the end portion of the lever extension to which the motor is connected, 65
and a guy member connected to the upper end portion of the pylon bar and to said one member and remote from said joint.

8. In an articulated boom construction, an upright supporting structure, 70
a vertical riser having a mast head above said supporting structure,

a boom extending cantilever fashion from said mast head and pivotally connected thereto for vertical swinging movement relative to the riser, 75

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a lever projecting from the pivotally connected portion of the boom longitudinally beyond the pivotal connection,

an actuating motor carried by the riser and connected operatively to said lever,

the motor being operable to actuate the boom pivotally through said lever between an extended position and a position wherein said lever is adjacent to said mast head, and separable mechanical means separate from said motor for releasably locking the lever to the mast head in said position adjacent to the mast head.

9. In an articulated boom construction,

an upright supporting structure,

a vertical riser having a mast head above said supporting structure,

a boom extending cantilever fashion from said mast head and pivotally connected thereto for vertical swinging movement relative to the riser,

a lever projecting from the pivotally connected portion of the boom longitudinally beyond the pivotal connection, an actuating motor carried by the riser and connected operatively to said lever,

the motor being operable to actuate the boom pivotally through said lever between an extended position and a position wherein said lever is adjacent to said mast head,

means for releasably locking the lever to the mast head in said position adjacent to the mast head,

an outboard boom section pivotally connected to the outboard end of said first mentioned boom and pivotally adjustable relative thereto,

and means for locking said outboard boom section to said first mentioned boom in collapsed position relative thereto when the first mentioned boom is locked by said releasable means on the lever and said mast head.

10. A material handling boom structure including:

a supporting standard comprising a pair of upright triangularly shaped frames mounted in splayed relation and having respective upright edges disposed in convergent adjacency,

an upright riser disposed adjacent to said edges and having a mast head rising above said frames,

a boom member on and carried by said mast head, and bearing means carried by said frames and projecting from said edges into supporting engagement with said riser and pivotally connecting the riser to the standard.

11. A material handling boom structure as defined in claim 10, including means for latching the riser selectively against pivotal movement and comprising a removable mechanical latch member, and means on the standard and on the riser with which the latch member engages.

12. A material handling boom structure as defined in claim 10, in which said boom member is pivotally attached to said mast head for up and down movements, said bearing means comprising vertically spaced swivel bearings enabling movement of said riser about a vertical axis for horizontal swinging adjustments of said boom member, a boom member actuating motor device mounted on the riser between said swivel bearings, and means connecting said motor device to said boom member for pivotally actuating the boom member in said up and down movements.

13. A material handling boom structure as defined in claim 10, in which said riser carries ring bearing means thereon, and said bearing means carried by the frames comprises separable clamp means engaging the ring bearing means.

14. A boom structure as defined in claim 10, wherein said bearing means include an upwardly facing thrust bearing member, respective arms rigidly secured to said frames and projecting convergently beyond said edges

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and supporting said upwardly facing bearing flange, and a thrust bearing flange on the riser thrusting downwardly toward and supported by said upwardly facing bearing flange.

15. A material handling tubular boom structure including:

- a supporting standard comprising a pair of upright triangularly shaped frames mounted in splayed relation and having respective upright edges disposed in convergent adjacency,
- an upright tubular riser disposed adjacent to said edges and having a tubular mast head rising above said frames,
- a tubular boom member on and carried by said tubular mast head,
- bearing means carried by said frames and projecting from said edges into supporting engagement with said tubular riser and pivotally connecting the tubular riser to the standard,
- a tubular elbow mounted on said standard below and having a terminal end axially aligned with the lower end of the riser,
- and a swivel coupling connecting the lower end of the riser with said terminal of the elbow.

16. In an articulated boom construction including a pair of members and means pivotally connecting said members for swinging movement of one of the members relative to the other of the members about a predetermined pivotal axis,

- the improvement comprising a bridle structure carried by one of said members adjacent to said pivotal axis,
- means on said bridge structure pivotally connected with said means which pivotally connects said members and thereby providing a fulcrum for the bridle structure enabling it to move swingably with said one member about said axis,
- said bridle structure including an extension portion projecting past said axis and adjacent to said other of said members,
- motor means carried by the other of said members adjacent to said pivotal axis,
- and means operatively connecting the motor means with said extension portion for actuating said bridle structure to effect said swinging movement of said one member relative to the other of said members.

17. In a material handling boom structure of the character described,

- a supporting standard assembly,
- an upstanding riser pivotally supported by the standard and having an upper end portion,
- a boom member having an outboard portion and an inboard portion which is pivotally connected on a horizontal axis with the upper end portion of the riser,
- means including an upwardly projecting pylon having an upper end and a lower portion which is piv-

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otally connected to said riser on said horizontal axis, the riser also being connected to the inboard portion of the boom member so as to move therewith relative to said riser,

a guy member attached at one end to the upper end of said pylon and extending outboard therefrom along and converging toward the outboard end portion of said boom member,

and means securing said guy member to said outboard portion of said boom member whereby to place the guy member in tension between said pylon and said outboard portion of the boom member.

18. In an articulated boom structure including a pair of elongated members adapted to be relatively adjustably pivoted,

each of said members having a pivot yoke structure, each of said yoke structures including a gooseneck portion having a terminal,

means pivotally connecting said terminals on a common axis transverse to said elongated members,

a stabilizer frame having a rigid bar parallel to said axis and spaced from said gooseneck portions, co-extensive bearing brackets extending rigidly laterally from opposite ends of said bar and each including a pair of spaced journal flange plates,

respective bearing brackets on said gooseneck portions each having a journal flange plate extending across said axis,

the respective journal flange plates of the bearing brackets on the gooseneck portions and the respective pairs of journal flange plates of the stabilizer frame being interleaved across said axis, and pivot means pivotally connecting all of the interleaved journal flange plates on said axis.

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