FLUID CONTROL SYSTEM FOR AERIAL TOWER
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ABSTRACT OF THE DISCLOSURE

A stop valve for a fluid motor provided to raise and lower the boom of an aerial tower, the stop valve comprising means defining a passage through which fluid flows to the motor, a member arranged alternatively to block the passage and to permit flow of fluid therethrough, and means defining a cylinder in which the member freely moves between its blocking position and its position permitting flow of fluid through that passage, the chamber being arranged for movement corresponding to the boom movement so that, when the boom approaches its rest position, the stop valve is operated to deenergize the motor.

Background of the invention

Field of the invention.—The present invention relates to aerial towers, and more particularly to the provision of a stop valve for a fluid motor arranged to raise and lower a boom of an aerial tower. The stop valve is arranged to deenergize the fluid motor when the boom approaches its rest position, thereby to relieve the fluid pressure on the motor when the boom is supported in its rest position.

Description of the prior art.—Mobile aerial towers of the so-called “cherry picker” type are well known and conventionally comprise a mobile platform or truck upon which a tower structure is mounted for three-dimensional operation. The tower structure conventionally includes a pedestal mounted on the truck and a rotatable platform mounted on the pedestal. An elongated lower boom is pivotally mounted on the rotatable platform at one end for swinging movement about a horizontal axis. To the other end of the lower boom is pivotally connected an upper boom for swinging movement about a horizontal axis. To the remaining, outer end of the upper boom is pivotally connected a personnel bucket which is at all times maintained in a level position regardless of the position and elevation to which the two booms may be moved. Suitable motors are connected to the rotatable platform and to the booms, respectively, by which rotary motion of the platform as well as relative swinging movement of the booms may be obtained. The booms are swingable to a lower position in which the personnel bucket is adjacent to the truck and to an elevated position of a desired height above the truck within the limits of the boom dimensions.

Such aerial tower structures are shown in the Lester L. Myers Patents Nos. 3,169,602, issued Feb. 16, 1965; 3,231,044, issued Jan. 25, 1966; and 3,233,700, issued Feb. 8, 1966. The lower boom of such aerial towers is supported in its rest position by a frame or saddle carried on the truck. Conventionally, a double-acting piston and cylinder arrangement is provided to pivot the boom on the platform, the piston rod of such arrangement being pivotally connected to the platform and the opposite end of the cylinder being pivotally connected to the boom. In the past, fluid under pressure has been applied to the cylinder until the boom is supported in its rest position on the above-mentioned saddle. Since no means has been provided for conveniently relieving the fluid pressure in the cylinder after the boom is lowered into its saddle, the boom is strongly urged against the saddle. In some instances, this urging of the boom against the saddle has resulted in substantial damage to the tower mechanism. It is the purpose of the present invention to relieve this forceful engagement of the boom with the saddle.

Summary of the invention

The present invention comprises a stop valve for a fluid motor provided to raise and lower the lower boom of an aerial tower, the stop valve comprising means defining a passage through which fluid flows to the motor, a member arranged alternatively to block the passage and to permit flow of fluid therethrough, and means defining a chamber in which the member freely moves between its blocking position and its position permitting flow of fluid through the passage, the chamber being arranged for movement when the boom moves so that when the boom approaches its rest position, the stop valve is operated to deenergize the motor. In the preferred embodiment of the present invention, the blocking member is a ball and the means defining a chamber is an elongated rectilinear tube in which the ball is free to roll under the influence of gravity, one end of the tube corresponding to the blocking position of the ball. This tube, which preferably is carried on the fluid motor, is arranged so that when the boom approaches its rest position, the ball will roll to its blocking position, thereby to deenergize the fluid motor. It is therefore an object of the present invention to provide a stop valve arranged to relieve the fluid pressure on a fluid motor used to position a boom when the boom is engaged with and supported by support means, thereby to prevent damage resulting from the urging of the boom against the support means.

Another object of the present invention is to provide such a stop valve comprising means defining a passage through which fluid flows to the fluid motor, a member arranged alternatively to block said passage and to permit the flow of fluid therethrough, and means defining a chamber in which said member freely moves between its blocking position and its position permitting the flow of fluid through the passage, the chamber being movable when the boom moves so that the member is acted upon by gravity.

Brief description of the drawings

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an elevational view, not necessarily to scale, showing the main elements of an aerial tower embodying the stop valve of the present invention;
FIG. 2 is a view showing the fluid motor used to pivot the lower boom of the aerial tower and the manner in which fluid is supplied to the fluid motor;
FIG. 3 is an enlarged elevation view of the stop valve shown connected to the fluid motor in FIG. 2;
FIG. 4 is a sectional view taken from FIG. 3 generally along the line 4—4; and
FIG. 5 is a sectional view of another stop valve which may be used to control the fluid motor of FIG. 2.

Description of the preferred embodiment

Referring to the drawings, and more particularly to FIG. 1 a frame 10, which may be the chassis of a truck is shown as having a supporting pedestal 12 mounted thereon, which pedestal carries a platform 14 for rotation about a vertical axis. Pivotally mounted on platform 14...
is an elongated, lower boom 16, the pivotal connection between platform 14 and boom 15 being provided by a horizontally extending pin or shaft 18. A fluid motor, generally indicated by reference numeral 19, is provided for pivoting boom 16 about the axis of the shaft 18. In the illustrative embodiment, the fluid motor 19 comprises a power cylinder 20 having one of its ends pivotally connected to boom 16 at 22 and its associated piston rod 23 pivotally connected to platform 14 at 24. As is conventional, the piston rod 23, which penetrates one end of cylinder 20, is connected to a piston 26 arranged for reciprocation in cylinder 20.

As shown clearly in FIG. 2, cylinder 20 is provided with an input fitting 28 at one of its ends and another input fitting 30 at the other of its ends. Specifically, piston 26 is arranged to reciprocate between the fittings 28 and 30 in response to the pressure of fluid provided through these fittings.

As indicated in FIG. 1, a pressurized fluid source 32, which may be a hydraulic pump, is provided for energizing the power cylinder 20, the source 32 being connected to the fitting 28 through a conduit 34, a valve indicated by reference numeral 36 and another conduit 38, and to the fitting 30 by a conduit 40, the valve 36, another conduit 42 and a stop valve, indicated generally by numeral 44.

Pivoting connected to the outermost end of the lower boom 16 is an elongated upper boom 46, the pivotal connection between these two booms being provided by means of a suitable pin or shaft 48 passing through the respective ends of these booms. This pin or shaft 48 has its axis arranged horizontally such that the two booms 16 and 46 may be relatively moved in a common vertical plane. A conventional personnel bucket 50 is pivotally mounted on the distal end of upper boom 46. Suitable controls, not shown, are provided for adjusting the position of platform 14 on the pedestal 12, the position of boom 16 relative to platform 14 and the position of boom 46 relative to boom 16. Of course, a suitable motor, not shown, must be provided for moving boom 46 relative to boom 16.

When the aerial tower illustrated in FIG. 1 is not being used, boom 16 is pivoted in the direction of the arrow 52 to its rest position and the upper boom 46 is pivoted in the direction of the arrow 54 to its rest position. When boom 16 is in its rest position, the distal end of boom 16 is supported on a saddle-like support 56 mounted on frame 10. The rest positions of booms 16 and 46 are shown by the dashed-line drawings of portions of the booms in FIG. 1.

It will be apparent, therefore, that in order to move the boom 16 toward its rest position on support 56, fluid must be provided through the input fitting 30 to move cylinder 20 in the direction of arrow 58 relative to piston 26, thereby to pivot the boom 16 in the direction of arrow 52. Likewise, in order to raise boom 16 from its position on support 56, fluid must be provided to cylinder 20 through the input fitting 28 to move the cylinder in a direction opposite to arrow 58.

The valve 36 is a conventional means for regulating the flow of fluid through two conduits, and since it is conventional, it need not be discussed in detail in this description. Specifically, the valve 36 is arranged that when fluid is permitted to flow into one of the input fittings 28, 30, fluid is permitted to leave the other fitting 28, 30. For example, when valve 36 is in one control position, fluid may flow from conduit 34, valve 36 and conduit 38 to the fitting 28 while fluid is flowing from cylinder 20 through the fitting 30, conduit 42, valve 36 and conduit 40 back to the source 32.

The stop valve 44 is preferably arranged that when boom 16 is substantially horizontal and ready to engage support 56, the flow of fluid from conduit 28 into fitting 30 will be stopped, and boom 16 will be permitted to gravitate slightly to its rest position on the support 56.

Referring now to FIGS. 3 and 4, the structure of the illustrative stop valve 44 will be discussed. The stop valve 44 comprises an elbow fitting 60 having an externally threaded portion 62 and an internally threaded portion 64, the axes of portions 62 and 64 forming an angle of approximately 135°. A passage 66 coaxially arranged in portion 62 is in communication with the opening defined by the internally threaded portion 64. An adapter 68 having a threaded, counterbore 70 therein is soldered, brazed, or otherwise secured to fitting 60 as indicated at 72. The adapter 68 is also provided with a passage 74 which is aligned with a passage 76 formed in the side of fitting 60 to be in communication with passage 66 and the space defined by the internally threaded portion 64. Thus, fluid can flow into the counterbore 70, through passages 74 and 76 and out of passage 66. Preferably, portion 62 is threaded into input fitting 30 of the cylinder 20, and conduit 42 is connected to counterbore 70.

Referring to FIG. 4, it will be seen that fitting 60 is formed to provide a radially outwardly and peripherally extending shoulder 78 about the upper portion of passage 66, the shoulder 78 providing a valve seat as will be discussed in the following paragraphs.

The stop valve 44 further comprises a tube 80, one end of which is open and the opposite end of which is closed. The open end of tube 80 is adapted to be inserted in the internally threaded portion 64 as shown in FIG. 4. A ball 82 is rollingly carried in the internal diameter of tube 80 so that when the tube 80 is inclined as shown in FIG. 4, ball 82 will be against the seat provided by shoulder 78 to close the passage 66. Of course, when the closed end of tube 80 is lower than the open end of the tube, the ball 82 will move to the position suggested by the dashed-line drawing of the ball 82 (FIG. 4) and the passage 66 will be in communication with passages 74 and 76. Thus, by positioning stop valve 44 on the power cylinder 20 as shown in FIG. 1, fluid flow to the cylinder through input fitting 30 is stopped when tube 80 is pivoted in the direction of arrow 84 (FIG. 1) until the open end of the tube is just slightly lower than the closed end of the tube. Preferably, ball 82 will block the flow of fluid through passage 66 just before the distal end of boom 16 engages support 56.

The length of tube 80 is critical because if the tube is too short, the ball 82 will close prematurely when fluid flow is desired. In one embodiment of the present invention, the tube 80 may be approximately four inches long and the internal diameter of the tube may be approximately 1/8 of an inch.

Referring now to FIG. 5, another embodiment of a stop valve will be discussed. The stop valve of FIG. 5, indicated generally by reference numeral 86, comprises a fitting 88 defining a passage 89 through which fluid may flow, a ball 90 arranged alternatively to block the passage of the fitting 88 and to permit the flow of fluid through said passage, and a tube 92, similar to tube 80, in which the ball 90 may freely roll between its position blocking the passage of the fitting 88 and its position which permits the flow of fluid through the passage 89.

As seen in FIG. 5, the passage 89 through the fitting 88 is defined by an internally threaded opening 94, a bore 96 at the lower end of the opening 94, a threaded opening 98 into which the tube 92 is threaded, a bore 100 which is concentric with the axis of the tube 92 and a bore 102 which is concentrically arranged in an externally threaded portion 104. There is a radially outwardly and peripherally extending shoulder 106 about the bore 100 providing a valve seat for the ball 90 when the ball is blocking the flow of fluid through the fitting 88. A street elbow 108 is connected to the threaded portion 104 to provide a means for selecting the desired inclination of the tube 92.

The stop valve 86 may be connected to the power cylinder 20 by threading the end 110 of the elbow 108 into the input fitting 30 and connecting the conduit 42 to
5 the threaded opening 94. The inclination of the tube 92 is selected by rotating the fitting 88 relative to the elbow 108.

While there have been discussed above the principles of this invention in conjunction with specific apparatus, it is to be clearly understood that this description is made by way of example and not as a limitation to the scope of the invention.

What is claimed is:

1. An apparatus of the character described comprising platform means, a boom having opposite ends, one end of said boom being connected to said platform means for pivotal movement about a generally horizontal axis, means for supporting the other end of said boom in a rest position, a fluid motor arranged to pivot said boom about said horizontal axis, conduit means for connecting said fluid motor to a pressurized fluid source, and valve means arranged to control the flow of fluid through said conduit means, thereby to energize and deenergize said fluid motor, said valve means comprising means defining a passage through which fluid flows, a member arranged alternatively to block said passage and to permit flow of fluid therethrough, and means defining a chamber in which said member freely moves between its blocking position and its position which permits flow of fluid through said passage, said chamber being arranged for movement corresponding to the movement of said boom so that, when the other end of said boom approaches said support means, said valve means is operated to deenergize said fluid motor.

2. An apparatus as in claim 1 wherein said member is a ball and wherein said means defining a chamber is an elongated rectilinear tube in which said ball is free to roll under the influence of gravity, one end of said tube corresponding to said blocking position.

3. An apparatus as in claim 2 wherein said tube is carried on said fluid motor so that, when said boom is in its said rest position, said tube is inclined so that said one end of said tube is lower than its opposite end.

4. An apparatus as in claim 1 wherein said fluid motor comprises a power cylinder having fluid inputs at each end, a piston arranged for reciprocation in said cylinder, and a piston rod connected to said piston and penetrating one end of said cylinder, said piston rod being pivotally connected to said platform means and said cylinder being pivotally connected to said boom, said passage being in communication with said input adjacent the end of said cylinder penetrated by said piston rod, and said member being arranged to block said passage when the other end of said boom approaches its said rest position.

5. An apparatus as in claim 4 wherein said means defining a passage is a fitting connected to said input, wherein said means defining a chamber is an elongated rectilinear tube mounted on said fitting, and wherein said member is a ball free to roll from end to end in said tube, said fitting having an aperture therein defining a portion of said passage, and one end of said tube being positioned so that said ball may close said aperture.

6. An apparatus of the character described comprising a pivotally mounted fluid motor, conduit means for connecting said fluid motor to a pressurized fluid source, and valve means arranged to control the flow of fluid through said conduit means, thereby to energize and deenergize said fluid motor, said valve means comprising means defining a passage through which fluid flows, a member arranged alternatively to block said passage and to permit flow of fluid therethrough, and means defining a chamber in which said member freely moves between its blocking position and its position which permits flow of fluid through said passage, said chamber being mounted for movement corresponding to the pivotal movement of said fluid motor so that, when said fluid motor approaches a predetermined position, said valve means is operated to deenergize said fluid motor.

7. An apparatus as in claim 6 wherein said member is a ball and wherein said means defining a chamber is an elongated rectilinear tube in which said ball is free to roll under the influence of gravity, one end of said tube corresponding to said blocking position.

8. A stop valve comprising a fitting defining a passage through which fluid flows, said fitting having an aperture therein defining a portion of said passage, a member arranged alternatively to open and close said aperture, an elongated chamber having first and second ends, said member being freely movable in said chamber between said first and second ends, said chamber being arranged relative to said fitting so that, when said member is at said first end, said aperture is closed, and so that, when said first end is moved to a position lower than said second end, said member will gravitate to said first end, thereby to close said aperture to block the flow of fluid through said passage.

9. A stop valve as in claim 8 wherein said member is a ball, and wherein said fitting is formed with a peripherally and laterally extending shoulder about said aperture to provide a valve seat for said ball.

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