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[54] **BASKET-LEVELING SYSTEM FOR BOOM STRUCTURES**
12 Claims, 9 Drawing Figs.

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182/19
[51] Int. Cl. B66f 11/04
[50] Field of Search 182/2, 19,
141, 148

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ABSTRACT: A mobile aerial tower having a pivotally mounted boom for movement about a vertical and a horizontal axis, and a load-supporting platform such as a workman's basket supported on the outer end of the boom for pivoted movement about a horizontal axis, a reversible fluid motor for rotating the platform about the horizontal axis, a hydraulic control valve having a portion maintained in preselected orientation relative to the platform for controlling hydraulic fluid supply to the motor, and a pivotally supported weighted pendulum connected to the valve to continuously regulate fluid flow to the motor so as to maintain the platform in a preselected level condition.

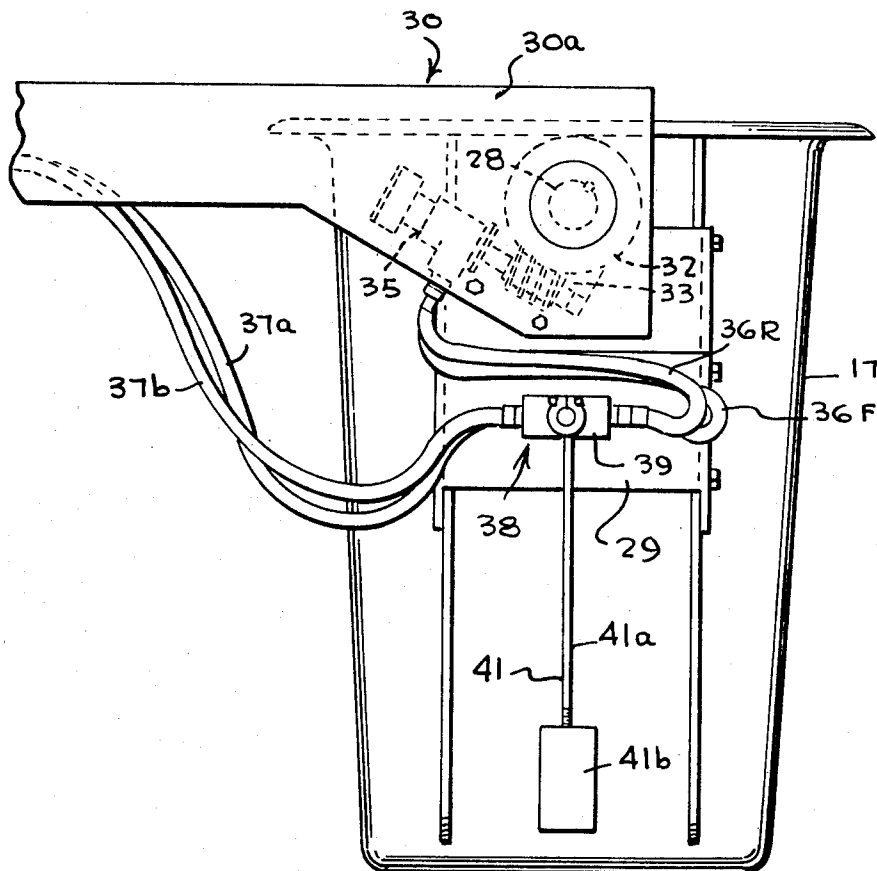


Fig-1

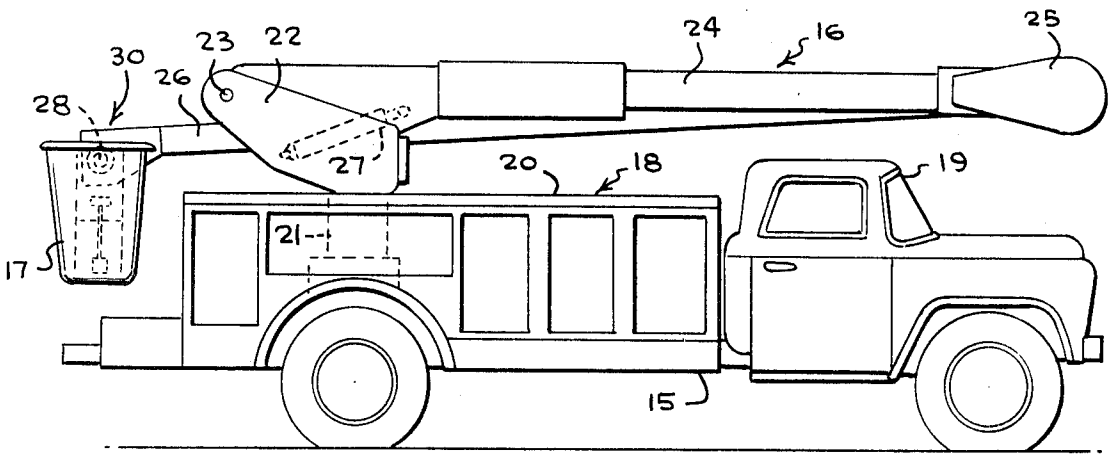
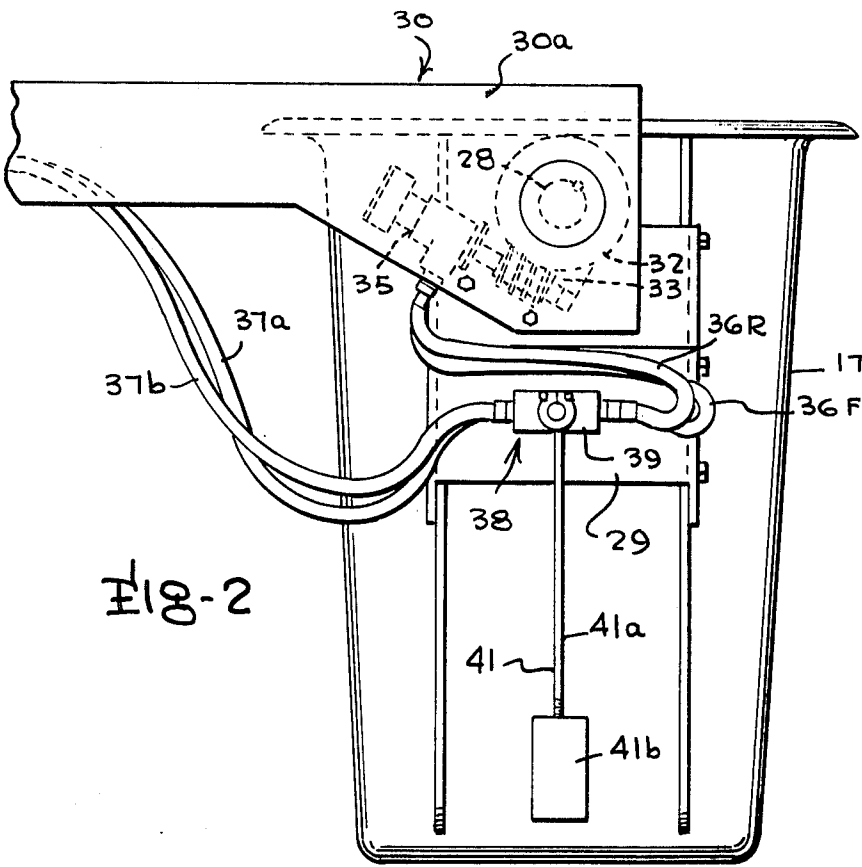


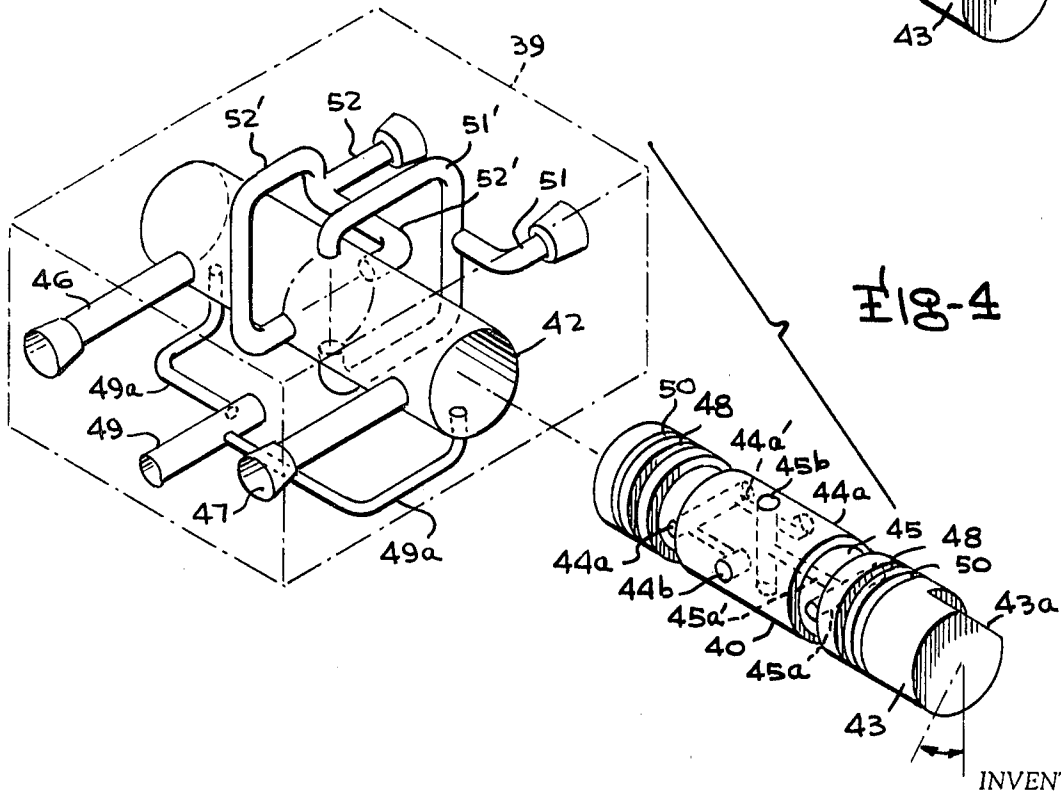
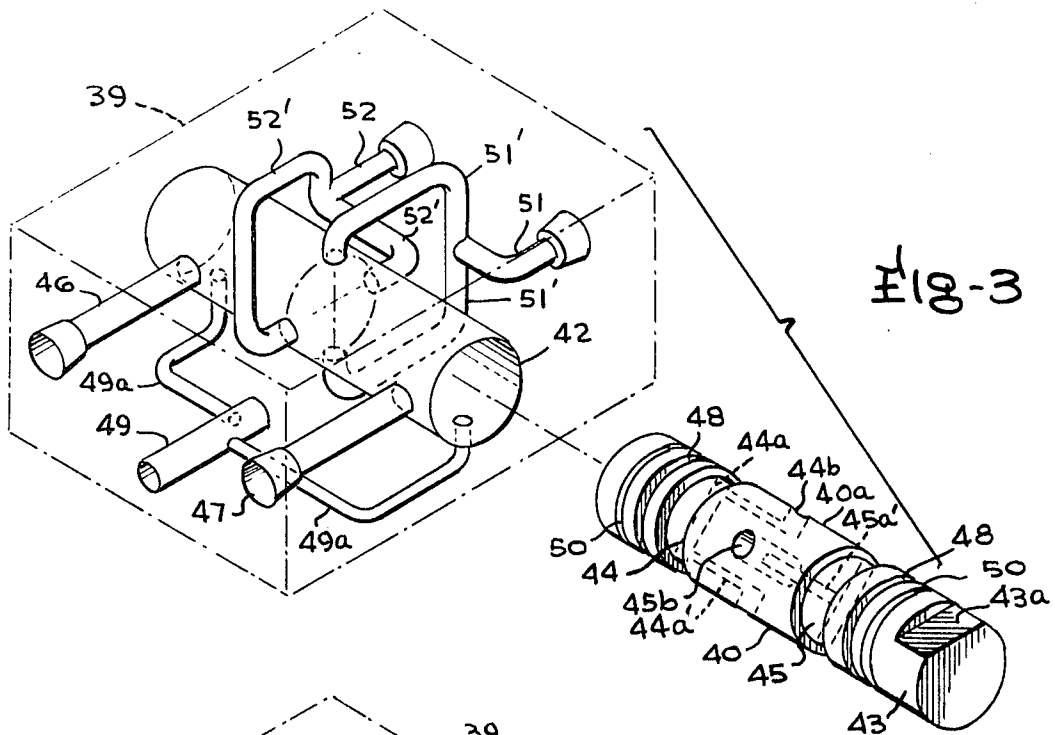
Fig-2



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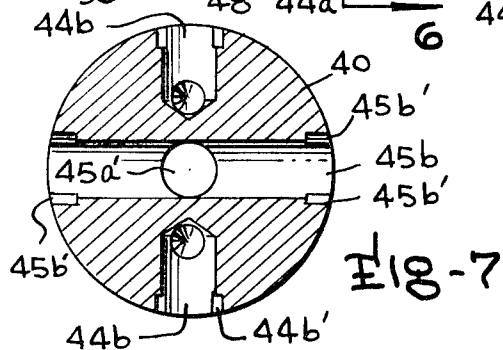
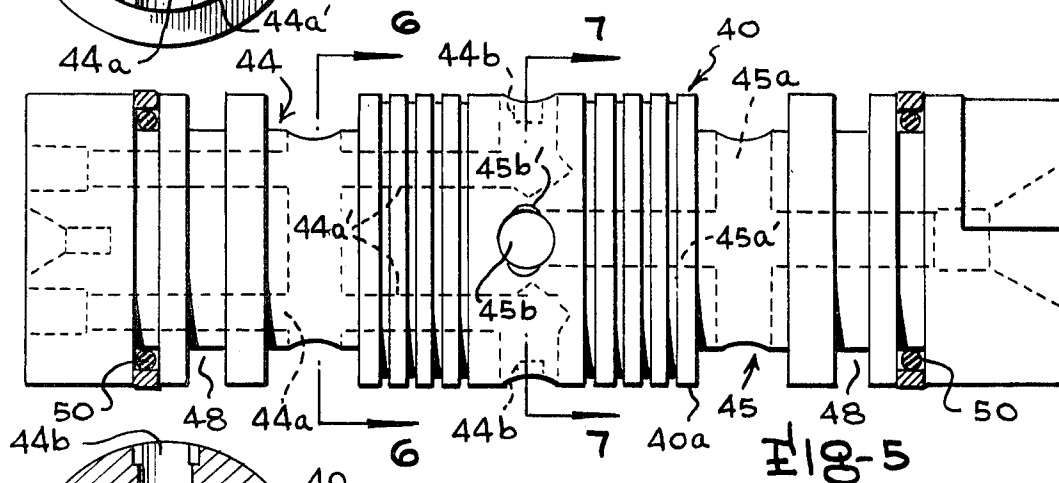
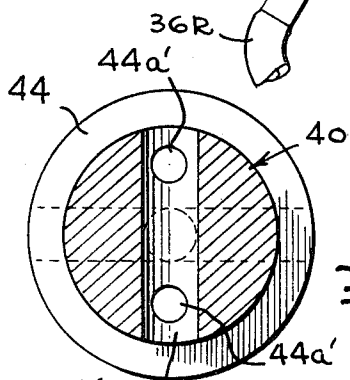
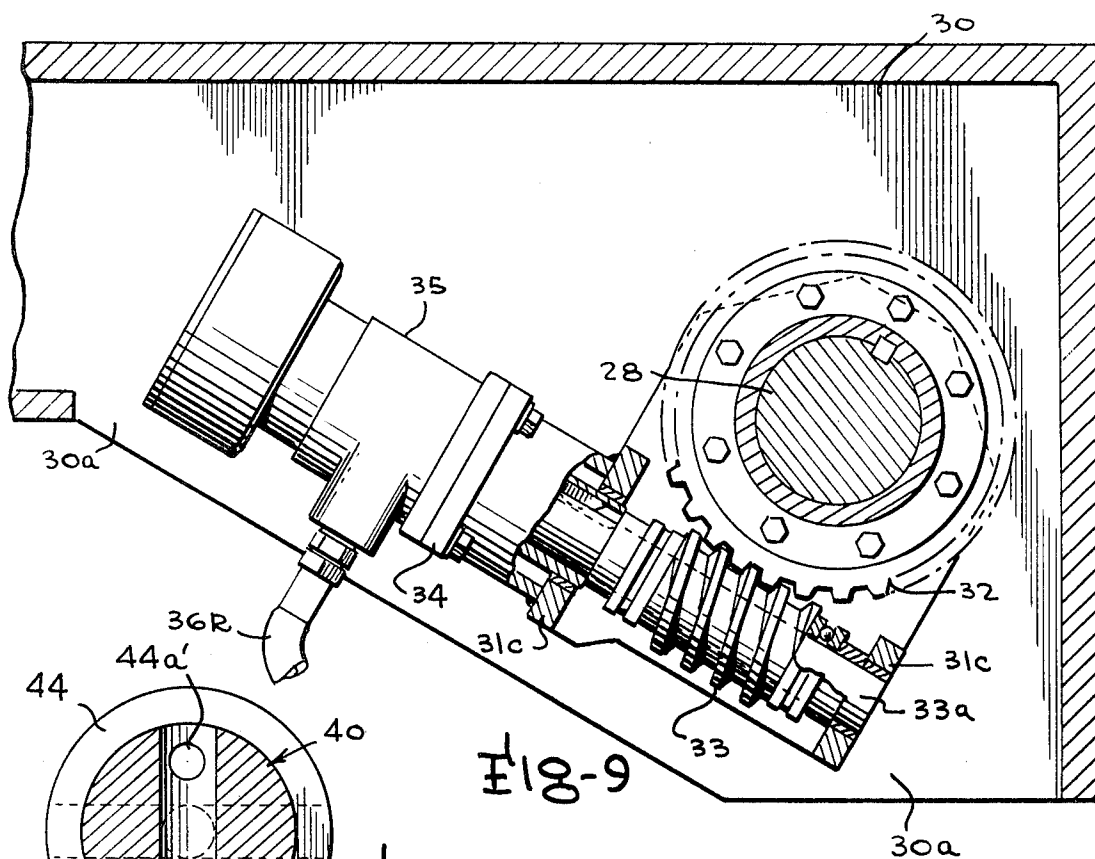
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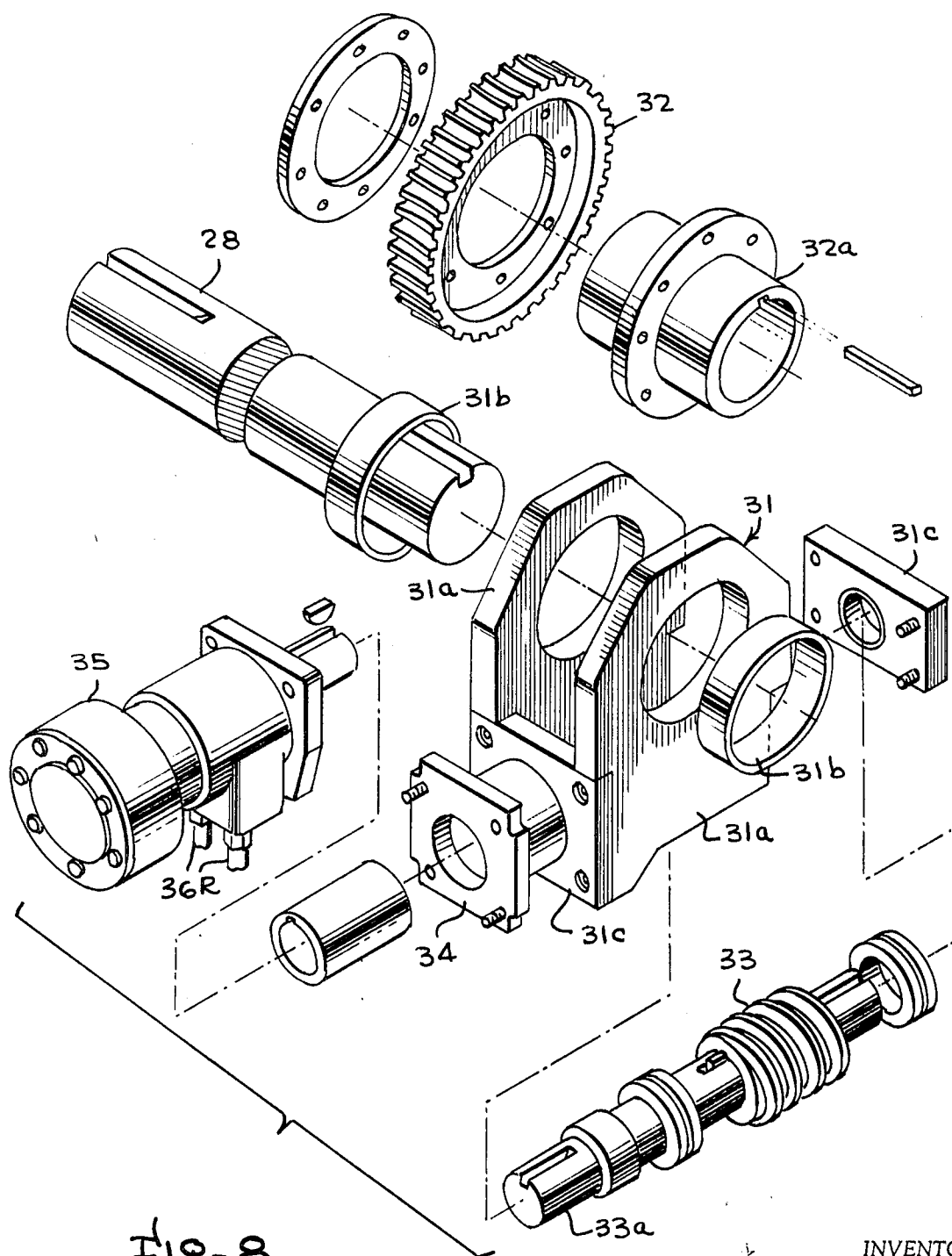


Fig-8

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BASKET-LEVELING SYSTEM FOR BOOM STRUCTURES

BACKGROUND AND OBJECTS OF THE INVENTION

The present invention relates in general to aerial tower type vehicles, such as vehicles having boom structures which are adjustable vertically and horizontally and have a worker's platform or basket at the outer end thereof for use by maintenance personnel in servicing telephone or power wires, trees, overhead traffic lights and the like, and more particularly to trucks having a pivotally mounted boom structure with a utility basket on the end thereof, wherein the utility basket is leveled continuously during movement of the boom structure by a gravity-operated valve and hydraulic system controlled thereby.

Service and maintenance trucks employed by public utilities and similar companies are ordinarily provided with some type of boom structure pivotally supported for movement about a horizontal axis on a base or mounting structure which is journaled on the vehicle for rotation about a vertical axis. Many of such service and maintenance trucks have employed a boom structure of the articulated type having a first or inner boom section pivotally supported at one end to the base or boom supporting pedestal structure, and a second or outer boom section pivotally supported at one end to the other end of the inner boom section for angular adjustment about a horizontal axis relative thereto and having a worker's platform or basket at the outer end of the outer boom section to support at least one worker at an elevated position. In other maintenance trucks, the workman's basket has been supported on the end of a telescopically extensible boom assembly. Either of these structures are more commonly called "aerial towers" and are particularly useful in servicing overhead traffic lights, street lamps, elevated signs and similar objects.

In such mobile aerial tower structures, the two pivotally joined boom sections, or the single telescopically extensible boom unit, are arranged to be selectively positioned to various angular and extended positions, and it is essential that some provision be made to maintain the worker's platform or basket level at all times. Preferably, the leveling arrangement should be automatically responsive to the movement of the tower so that the operator need only concern himself with controlling the tower movements.

Heretofore, the automatic leveling systems customarily employed to maintain the worker's basket level throughout the range of movement of the tower boom structure, have frequently employed a chain system, or a pivoted link and lever system, or a master-slave hydraulic servosystem, or a leveling cylinder connected to the basket and controlled by a manual valve in the cab or on the base pedestal. Such prior art systems involve a number of disadvantages. Insofar as the chain system is concerned, wherein an endless chain is trained about a pedestal sprocket and a sprocket on the basket mount to maintain the basket in a continuous selected angular disposition relative to the truck body regardless of the position of the boom structure, the chain system depends on many connectors, involving the possibility of accidental breakage, and requires turnbuckles or other tensioning means to minimize slack. In addition to the possible safety problems arising from the connection points in any such mechanical system, the relationship between the basket and the reference plane at the pedestal or truck is fixed, and the existence of the turnbuckles or tensioning means makes possible a preloading of the chain to an undesirable point where it can be readily overloaded and put the occupant of the basket in danger. The linkage and lever system is subject to the same disadvantages, as it is a mechanical connection system which relates the basket orientation to the orientation of the base plane of the truck or pedestal and has a number of mechanical connections which are a source of potential danger. Each of those two systems, as well as the master-slave hydraulic servosystem and the remote hydraulic system operated from the cab or pedestal, have the disadvantage of relying upon the function of some unit remote

from the basket to obtain proper operation of the mechanism at the basket which establishes the basket orientation. Also, those systems relate the position of the basket to boom positions rather than to some stabilized reference, and the mechanical linkage and chain systems position the basket with reference to the base plane of the truck, so that if the truck plane is off from a precise horizontal position, for example is at an inclination of 10° as is frequently the case on uneven terrain or road shoulders, the basket remains off from horizontal position by a similar angle.

An object of the present invention is the provision of an automatic platform leveling system for mobile aerial towers and the like, wherein the workers platform or basket is automatically maintained level at all times by a pendulum-controlled valve which regulates hydraulic fluid supply to a leveling motor regulating the orientation of the basket to maintain the basket in a level position throughout the range of movement of the boom by a gravity sensing device.

Another object of the present invention is the provision of a novel pendulum and valve leveling system for the worker's basket of aerial towers and the like wherein a pendulum-operated valve controls a leveling fluid motor which normally positions the basket relative to the boom structure, and wherein means are provided to permit the leveling system to be readily removed and replaced, or to permit setting of the worker's basket at a better work position or to permit manual tilting of the basket when desired such as to ease out an injured occupant or to dump out water or clean the basket.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings illustrating a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a side elevation of a utility maintenance truck having an articulated aerial tower boom structure and a pendulum and valve basket-leveling system constructed in accordance with the present invention;

FIG. 2 is a detailed view to enlarged scale illustrating the pendulum, valve and worm drive motor assembly for maintaining the workman's basket in the continuously leveled position in accordance with the present invention;

FIG. 3 is a somewhat diagrammatic exploded perspective view of the rotary valve body and valve spool employed in the present invention;

FIG. 4 is a diagrammatic view similar to FIG. 3, showing the valve spool oriented 45° to the right by the pendulum;

FIG. 5 is a side elevation view of the valve spool removed from the valve block;

FIGS. 6 and 7 are section views of the valve spool and body taken along the lines 6-6 and 7-7 of FIG. 5;

FIG. 8 is an exploded perspective view of the worm drive motor and gear mechanism for leveling the basket responsive to movement of the valve; and

FIG. 9 is a section view through the end of the boom.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, and particularly to FIG. 1, there is shown a mobile aerial tower type utility maintenance truck, generally indicated at 15, having an articulated boom structure 16 on the end of which is supported a workman's basket or platform 17. The truck is equipped with a utility body 18 of conventional configuration including a driver's cab 19 and the usual rearwardly extending panel body 20 having spaced parallel sidewall sections providing, for example, a series of built-in cabinets for the storage of tools, small parts, and similar items. In the example illustrated in FIG. 1, the boom structure 16 is pivotally supported on a boom pedestal 21, on which is rotatably mounted for movement about a vertical axis a mounting head 22 to which the

boom structure is pivotally coupled by a horizontal pivot shaft 23. The boom structure of the embodiment herein illustrated comprises a first or inner boom section 24 having its inner end coupled to the pivot shaft 23 and having an articulation assembly or saddle connection 25 at its outer end forming a pivot coupling with a second or outer boom section 26. The outer boom section 26 has the worker's platform 17 supported thereon by a structure later to be described. The inner boom section 24 is powered for vertical angular movement about the axis of the horizontal pivot shaft 23 in a conventional manner, as by the hydraulic cylinder unit 27 having a cylinder and a movable piston rod, one of which is coupled to the mounting head 22 and the other of which is coupled to the inner boom section 24. The outer boom section 26 is also adjusted angularly relative to the inner boom section 24 by any suitable means such as a hydraulic cylinder unit connected between these two members in conventional fashion, or by a mechanism such as that disclosed in my earlier patent application Ser. No. 756,075 entitled BOOM STRUCTURE FOR UTILITY TRUCKS AND THE LIKE, filed on Sept. 3, 1968.

The workman's basket 17 is supported on the outer free end of the outer boom section 26 by a transverse basket-supporting shaft 28 having an end with a kerf therein keyed in a mounting socket formation provided on the basket 17, for example by mounting bracket 29 fixed to the basket. The mounting socket formation provides a cylindrical socket sized to receive the end of the shaft 28 and a kerf therein to match the kerf in the shaft and receive a locking key which maintains the basket 17 and shaft 28 in preselected angular relation to each other. The shaft 28 extends through and is rotatably journaled in sideplate members 30a of the enlarged end formation 30 on the outer boom section 26. Between these sideplate members 30a is housed a worm and motor mounting bracket 31 having bracket side members 31a defining bearings 31b which surround the basket-supporting shaft 28 and provide supporting bearings for the tubular hub portion 32a of a driven worm wheel gear 32. The hub 32a of the gear 32 is keyed to the shaft 28 so as to be nonrotatable relative thereto. Journaled in opposite end members 31c of the mounting bracket 31 is the shaft portion 33a of the worm 33 whose teeth are in engagement with the worm wheel gear 32 to drive the latter, one end of the worm shaft 33a extending through a motor-mounting formation 34 and being keyed to the shaft of a reversible fluid motor 35 having forward and reverse fluid supply lines 36F and 36R connected to appropriate ports of the fluid motor to cause rotation of the motor in the forward or reverse directions. An example of such a motor is the motor designated a hydraulic ORBIT motor, manufactured by Char-Lynn Company of Minneapolis, Minn., disclosed for example in U.S. Reissue Pat. No. 25,291. Preferably the worm 33 and worm wheel 32 are so chosen as to produce a rate of rotation of the basket-supporting shaft 28 of about 1 revolution per minute under conditions of normal fluid supply to the fluid motor 35.

The reversible fluid motor 35 is fed with hydraulic fluid through the forward or reverse supply lines 36F and 36R from conduits 37a and 37b extending through the boom sections 24, 26 from a suitable source of supply, such as fluid reservoir and pump unit in or associated with the boom pedestal structure, the fluid being controlled by a leveling control valve 38 of the closed center, rotary, directional type. This leveling control valve 38 has a valve body 39 fixed to the basket 17 or to the mounting plate 29 fixed to the shaft 28 in a preselected orientation relative to the basket, and includes a valve spool 40 rotatable in the valve body 39 about an axis paralleling the axis of the basket-supporting shaft 28. The angular position of the valve spool 40 is regulated by a pendulum actuator 41 comprising a rod 41a fixed at its top to an end of the valve spool projecting from the body 39 and having a plumb weight 41b on the lower end thereof.

Referring now particularly to FIGS. 3, 4, 5, 6, and 7, illustrating details of the leveling control valve 38, the valve body 39 is generally in the form of a rectangular block having a

cylindrical bore 42 extending entirely therethrough sized closely to the diameter of the valve spool 40 to rotatably accommodate the spool. The spool 40 is of generally cylindrical configuration having a longer axial length than the length of the bore 42 to provide an exterior end portion 43 having a flat 43a thereon to be coupled to the upper end of the rod portion 41a of the pendulum actuator 41. Inwardly of the opposite ends of the bore 42, the valve spool 40 has a pair of annular distribution/collector grooves in the form of fluid-conveying circumferential channels 44, 45 which are aligned with and in continuous communication with the inlet ports 46, 47 of the valve body 39 connected to the supply conduits 37a, 37b extending to the source of hydraulic fluid. The spool 40 is sealed against leakage outwardly of the circumferential channels 44, 45 by fluid leak collector grooves 48, which are aligned with two branch ports 49a connected to a common drain port 49, and outwardly of the collector grooves 48 are seal grooves 50 each having an O-ring therein, as illustrated in FIG. 6, and a surrounding ring such as a Chicago rawhide Sirvon sealing ring. The valve spool 40 may, for example, be about 1.000 inch nominal diameter sized to provide 10.002 total diametral clearance with the bore 42 in the valve body 39.

Communicating with the circumferential channel 44 is a diametrical through port 44a having openings at opposite ends in the base of the channel 44 and having branches 44a' extending toward the center of the central valve portion 40a between the two grooves 44, 45 to terminate in a first pair of diametrically opposite port openings 44b aligned in a selected common plane perpendicular to the axis of the spool 40. Similarly, the channel 45 has a second diametrical through port 45a communicating therewith at openings in the base of the channel 45 and having a branch conduit 45a' connected to a diametrical port opening 45b opening through the periphery of the spool portion 40a at diametrically opposite locations also aligned in the selected plane occupied by the port openings 44b. These valve port openings 44b and 45b are designed to be selectively aligned with a first pair of outlet port branches 51' communicating with an outlet port 51 in the valve body 39 connected to the fluid motor forward supply line 36F, or with the branch outlet ports 52' communicating with the outlet port 52 of the valve body 39 connected to the reverse supply line 36R for the fluid motor 35. As is illustrated in FIG. 7, crescent-shaped enlargements 44b' and 45b' are provided at the end portions of the port openings 44b, 45b to form metering slots to obtain a desired condition of overlap or underlap between the related ports in the valve body and the openings in the valve spool to control the magnitude of dwell at the neutral position and consequentially the rate of response of the fluid motor to the control signals. For example, the diameter of the port openings 44a, 45a below the metering slots may be three-sixteenths of an inch, and the metering slots may extend the maximum diameter to a maximum of 0.250 inch and may have a maximum width of 0.125 inch where they intercept the normally cylindrical wall of the port openings 44a, 45a. It will also be observed from the drawings that the center portion 40a of the valve spool 40 is provided with a plurality of small circumferential grooves, for example spaced about five sixty-fourths inch apart and each having a width of about one thirty-second inch, to break up the shear resistance of the hydraulic fluid.

It will be observed, therefore, that the leveling control valve 38 is a closed center rotary, directional controlled valve acting to supply fluid in the proper direction to control the reversible fluid motor 35 and drive it in such a direction as to cause the worm 33 to rotate the gear 32 and shaft 28 a proper distance to maintain the basket level responsive to angular movement of the pendulum actuator 41. It will be observed a 90° rotational displacement between the valve spool 40 and the valve body 39 will provide full reversal of the operating fluid. When the relationship of the spool 40 and body 39 is at a point midway in the 90° arc, the valve is in neutral position. As previously mentioned, by sizing the metering slots 44b', 45b' in the spool 40 relative to the associated ports in the valve body, a

predetermined condition of overlap or underlap may be provided, thereby controlling the magnitude of dwell at the neutral position and consequently the rate of response to the control signal. Because of the particular construction illustrated, the porting and surfaces exposed to fluid pressure are in balance. This condition permits the use of a control signal of very low magnitude, theoretically only that sufficient to overcome seal friction, and provides the advantages that the valve may be oriented for operation when "neutral" is in any of the four 90° quadrants, the cylinder ports and the pressure or exhaust ports may have their functions reversed (i.e., the pressure/exhaust ports may be either pair and the motor may be connected to the remaining pair), fluid pressure may be applied to any of the four ports of the valve body so long as the companion port is the exhaust port, and once the pressure or exhaust ports have been established, the control function may be reversed in direction.

Assuming the leveling control valve to be in the position shown in FIG. 3, elevation of the boom sections 24 and 26, or either of the boom sections, would cause the pendulum actuator 41 to swing to the left of the vertical position illustrated in FIG. 2, producing a clockwise rotation of the valve spool 40 from the neutral position shown in FIG. 3 toward the position shown in FIG. 4. When sufficient movement has occurred to begin to place the port openings 44b in communication with the port branches 52' of the valve body 39, the port openings 45b being concurrently progressively placed in communication with the branch ports 51', fluid flow is established from the hydraulic fluid pressure source, for example the pump and reservoir at the pedestal or on the truck body, to cause operation of the reversible motor 35. Assuming conduit 37a is the pressure conduit, fluid pressure will be applied through the port 46, distribution-collector groove 44, port 44a, its branch 44a' and its opening 44b to the outlet branch ports 52', and thence through the forward conduit 36F to the reversible fluid motor 35 while the motor reverse line 36R is connected through ports 51, 51', opening 45b, port 45a, groove 45 and port 47 to return conduit 37b. The motor 35 is thus activated to drive the worm 33 and gear 32 so as to cause the basket-supporting shaft 28 to rotate in a clockwise direction at an appropriate rate during elevation of the boom structure to maintain the workman's basket 17 in horizontal or level position. Preferably, the motor drive and gears are selected so as to produce a basket rotation rate of about 1 revolution per minute.

The effect of the arrangement is to provide a isolated system which is not dependent upon operation of a master valve at the pedestal location or in the utility truck cab, all that is needed to operate the system being the hydraulic supply. The system responds to basket movement automatically without requiring any other function to enable it. The leveling control valve acts as a rotary four-way directional control valve wherein the valve spool has a pendulum attached thereto which, due to gravity, constantly seeks a vertical position. As long as a vertical reference line on the basket is in the same plane as the vertical centerline of the pendulum there is no motion. However, as the motion of the boom disturbs this relationship causing the pendulum to depart from the basket reference line, fluid power is admitted to the motor 35 activating the gear set which, in turn, rotates the basket about its shaft 28 to constantly seek to maintain an inphase relationship with the pendulum.

As a safety feature, an emergency power switch is provided in the basket to activate a remote circuit to shut off the hydraulic fluid to the cylinders which raise and lower the boom system and to shut off the hydraulic fluid to the electric worm motor 35. By reason of the present construction, if the leveling control valve 38 gets hung up and the basket fails to level itself, the operator has warning that something is wrong in the first 45° of rise and can take steps to protect himself, without being pitched out or being thrown into uncontrollable oscillation. If the fluid motor 35 won't stop from movement of valve 38, the emergency power switch in the basket permits

the warned operator to shut off the power before he is placed in a position from which he cannot recover.

It will be seen that particular advantages arise from the present system in that the basket is leveled regardless of the base plane of the truck. In other systems, if the truck plane is off 10°, the basket stays 10° off also. In the present system, since the fluid motor 35 is controlled from the leveling control valve 38 by the relative positions of the pendulum actuator 41 and the basket, the position of the basket is not specifically related to boom positions by the control system but is referenced to the vertical gravitational axis sought by the pendulum. Since the only connection between the leveling system and the pedestal or base portion of the truck is the hydraulic supply, the system can be readily removed and replaced by merely disconnecting the two supply lines.

As an optional feature, indicated in broken lines in FIG. 2, an auxiliary bypass valve 55 can be provided, for example to be operated from the basket or the pedestal or both, which bypasses the leveling control valve 38 to establish pressure and exhaust port connections between the supply conduits 37a and 37b, and the conduits 36F and 36R leading directly to the reversible fluid motor 35. By operation of the bypass valve 55, the fluid motor can be manually controlled to set the basket at a better work position, such for example as when the workman wants to shift his feet forward to gain a more stable center of gravity position for work. Also, when the basket has been lowered substantially to ground level, the auxiliary valve 55 can be manually operated to tilt the basket to a horizontal position to ease out a hurt occupant, or to dump water out, or to turn the basket upside down and steam clean it.

While the foregoing description of a preferred embodiment has been directed to a boom system which supports a single workman's basket, it will be apparent that two baskets can be provided, disposed on opposite sides of the boom and fixed to opposite ends of the shaft 28. In such a case, a single leveling control valve 38 mounted as previously described on one of the baskets or on a support plate fixed to the shaft 28 will control leveling of the pair of baskets in the same manner as with a single basket.

What I claim is:

1. A mobile aerial tower comprising a truck having a pivotally mounted boom supported for movement about a vertical axis and a first horizontal axis, a workman's basket supported on said boom at an outer end thereof for pivoted movement about a second horizontal axis, a reversible fluid motor coupled to said basket to rotate the basket about said second horizontal axis, a hydraulic control valve for controlling hydraulic fluid supply to said fluid motor, means maintaining a portion of said valve in preselected orientation relative to the basket, and a pivotally supported weighted pendulum connected to said hydraulic control valve to continuously regulate the flow of hydraulic fluid to said fluid motor so as to maintain the basket in a preselected level condition for any tilted positions of the boom throughout the range of movement of the boom.

2. A mobile aerial tower as defined in claim 1, wherein said hydraulic control valve comprises a valve body support in fixed angular relation to the basket and having a cylindrical bore therein and first ports for communicating hydraulic fluid to said bore from a supply source and from said fluid motor, and a rotatable, substantially cylindrical valve member in said bore having an exposed end portion connected to said pendulum to be angularly positioned thereby, said valve member having second ports therein selectively positioned relative to said first ports to normally place the valve in a neutral nonflow condition when the basket is level and to communicate with said first ports in combinations to activate the fluid motor to restore the basket to leveled condition as the basket and valve body are angularly tilted from leveled condition.

3. A mobile aerial tower as defined in claim 1, wherein said reversible fluid motor has an output shaft having a worm driven thereby and said basket is fixed to a horizontal shaft journaled in the end portion of the boom and having a worm gear fixed thereto to be driven by said worm.

4. A mobile aerial tower as defined in claim 2, wherein said reversible fluid motor has an output shaft having a worm driven thereby and said basket is fixed to a horizontal shaft journaled in the end portion of the boom and having a worm gear fixed thereto to be driven by said worm.

5. A mobile aerial tower as defined in claim 1, wherein said valve has a substantially cylindrical valve member and a valve body, said cylindrical valve member having a pair of axially spaced uninterrupted circumferential grooves defining a central cylinder portion therebetween, said first ports in said valve body including a pair of first port sections respectively communicating with said grooves and connected to fluid supply lines forming pressure and exhaust lines to said supply source and second port sections communicating with said fluid motor and with said bore in the zone between the locations of said grooves, and said valve member ports being arranged to interconnect said first and second port sections in relatively reversed relation upon rotation of said valve member in opposite directions from a selected neutral position.

6. A mobile aerial tower as defined in claim 2, wherein said cylindrical valve member has a pair of axially spaced uninterrupted circumferential grooves defining a central cylinder portion therebetween, said first ports in said valve body including a pair of first port sections respectively communicating with said grooves and connected to fluid supply lines forming pressure and exhaust lines to said supply source and second port sections communicating with said fluid motor and with said bore in the zone between the locations of said grooves, and said valve member ports being arranged to interconnect said first and second port sections in relatively reversed relation upon rotation of said valve member in opposite directions from a selected neutral position.

7. A mobile aerial tower as defined in claim 3, wherein said valve has a substantially cylindrical valve member and a valve body, said cylindrical valve member having a pair of axially spaced uninterrupted circumferential grooves defining a central cylinder portion therebetween said first ports in said valve body including a pair of first port sections respectively communicating with said grooves and connected to fluid supply lines forming pressure and exhaust lines to said supply source and second port sections communicating with said fluid motor and with said bore in the zone between the locations of said grooves, and said valve member ports being arranged to interconnect said first and second port sections in relatively reversed relation upon rotation of said valve member in opposite directions from a selected neutral position.

8. A mobile aerial tower as defined in claim 4, wherein said cylindrical valve member has a pair of axially spaced uninterrupted circumferential grooves defining a central cylinder portion therebetween, said first ports in said valve body including a pair of first port sections respectively communicating with said grooves and connected to fluid supply lines forming pressure and exhaust lines to said supply source and second port sections communicating with said fluid motor and with said bore in the zone between the locations of said grooves, and said valve member ports being arranged to interconnect said first and second port sections in relatively reversed relation upon rotation of said valve member in opposite directions from a selected neutral position.

9. A mobile aerial tower as defined in claim 5, wherein said cylindrical valve member has a pair of first uninterrupted circumferential grooves form fluid leak collector grooves spaced in outwardly flanking relation to said central cylinder portion and a pair of seal grooves spaced in outwardly flanking relation to said fluid leak collector grooves occupied by sealing ring means bearing radially outwardly against the surface of said bore to provide a seal against leakage of fluid.

10. A mobile aerial tower as defined in claim 6, wherein said cylindrical valve member has a pair of first uninterrupted circumferential grooves form fluid leak collector grooves spaced in outwardly flanking relation to said central cylinder portion and a pair of seal grooves spaced in outwardly flanking relation to said fluid leak collector grooves occupied by sealing ring means bearing radially outwardly against the surface of said bore to provide a seal against leakage of fluid.

11. A mobile aerial tower as defined in claim 7, wherein said cylindrical valve member has a pair of first uninterrupted circumferential grooves form fluid leak collector grooves spaced in outwardly flanking relation to said central cylinder portion and a pair of seal grooves spaced in outwardly flanking relation to said fluid leak collector grooves occupied by sealing ring means bearing radially outwardly against the surface of said bore to provide a seal against leakage of fluid.

12. A mobile aerial tower as defined in claim 8, wherein said cylindrical valve member has a pair of first uninterrupted circumferential grooves form fluid leak collector grooves spaced in outwardly flanking relation to said central cylinder portion and a pair of seal grooves spaced in outwardly flanking relation to said fluid leak collector grooves occupied by sealing ring means bearing radially outwardly against the surface of said bore to provide a seal against leakage of fluid.

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