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PNEUMATICALLY COUNTERBALANCED SUPPORT

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Fig. 1.

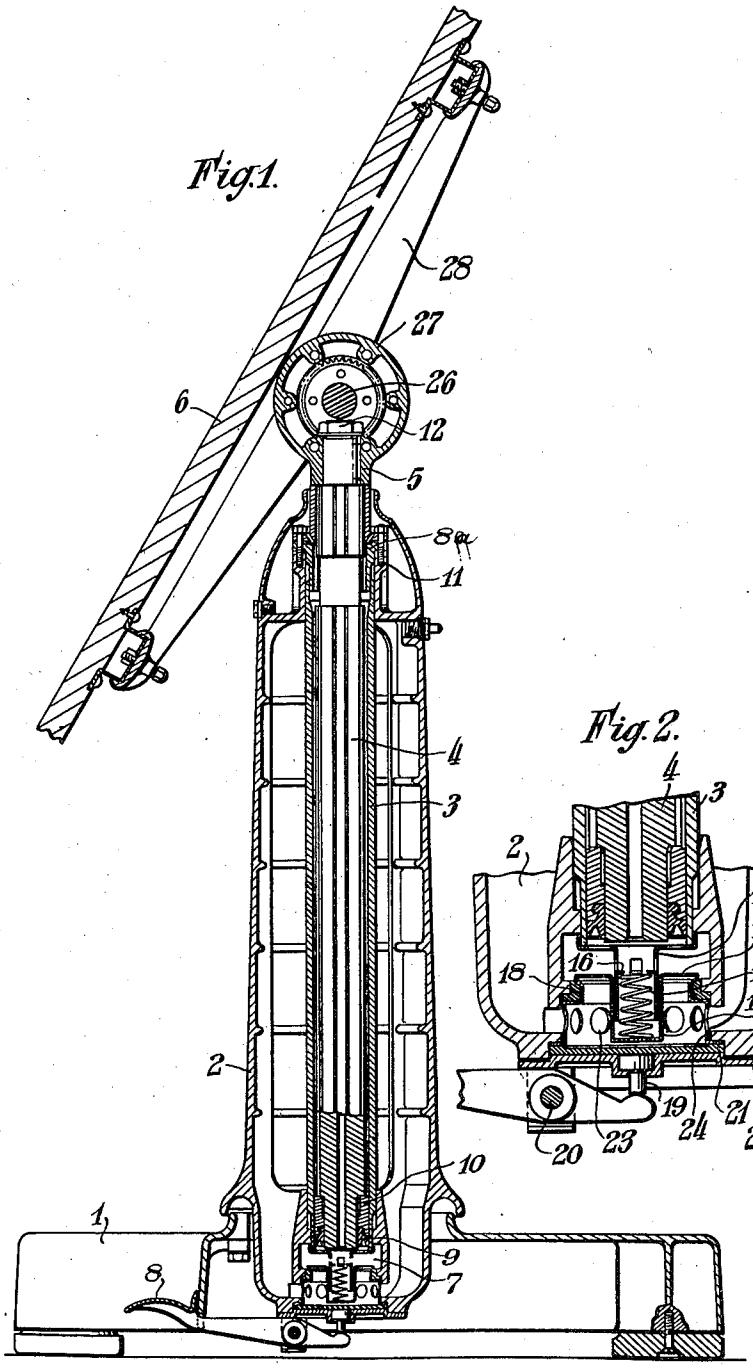

Fig. 2.

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PNEUMATICALLY COUNTERBALANCED SUPPORT

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2 Claims. (Cl. 248—161)

This invention relates to hydraulically actuated apparatus for raising and lowering at will more especially drawing tables for engineering draughtsmen and architects, although the invention is applicable to artists' easels, stands, dentists' chairs, surgical operating tables, and the like.

The object of the invention is to provide an improved apparatus in which the "load" to be supported is capable of upward, downward and tilting movement to any extent and angle by a slight manual action, instead of employing levers, pedals or the like, and further to avoid the use of counterweight such as employed in conventional apparatus at the present time.

It is known that apparatus of the type described are operated by an hydraulic pump acting on a ram, the manual or foot effort of the operator supplying the energy to lift the "load." The present invention differs from previous arrangements in that the "load" is kept in balance by hydraulic means and the only manual effort necessary is that which is sufficient to overcome mechanical friction of the working parts.

According to this invention there is provided an hydraulic apparatus comprising a member, for example a piston, for supporting the "load" which rests on a column of liquid within a chamber, for example a cylinder, which communicates with a reservoir also containing liquid, the liquid in the said reservoir being subject to pressure by compressed air, the said pressure being so calculated as to keep the load in balance, and valve control means disposed between said chamber and said reservoir.

The means of communication between the cylinder and the reservoir are valve controlled and capable of being closed or opened by means of a remote control such as a lever or a pedal or like device, so that when in the closed position the load remains in a required fixed position. When the said means of communication are opened, the "load" can be moved up and down by finger pressure, minimum resistance being offered by the working parts and by the flowing of the liquid medium from the cylinder to the reservoir.

In order that the invention may be clearly understood reference is directed to the accompanying drawing wherein:

Fig. 1 is a sectional elevation of a drafting table constructed in accordance with the invention, and

Fig. 2 is an enlarged view of the lower part of Fig. 1.

The drawing illustrates the preferred form of the invention as applied to a drafting table to be used by an engineering draughtsman, or architect although the invention has other applications. The drafting table, see more particularly Fig. 1, comprises a base or stand 1, a hollow pillar 2 mounted thereon and constituting a reservoir, a cylinder 3 axially mounted within the said pillar 2, and a ram 4 movable in the said cylinder 3. The head of the said ram 4 carries a tilting support mechanism 5, for a drawing board 6 fitted to the said tilting mechanism, means being provided for preventing leakage of the liquid between the ram 4 and the cylinder 3 and between said cylinder and interior of pillar 2, so that air-tight and leakage-proof joints are provided. In order to establish communication between the cylinder 3 and the pillar 2, a valve 7 situated axially of the table is fitted and is operable by a pedal 8 upon which foot pressure can be brought by the draughtsman when moving the board upward or downward. The foot pressure is arranged to open the valve 7, hereinafter described, which, through suitable passages, will allow the liquid medium to flow between the cylinder and the pillar.

Sufficient liquid medium is employed so as to allow for a maximum upward motion of the board whilst a good reserve of liquid remains in the pillar reservoir, preferably in the region where its cross section is constant for a certain height.

The ram 4 is splined from end to end and engages at the upper part thereof with a correspondingly splined sleeve 8a and at its lower end with the cylinder 3 by a cup leather 9 or other packing which is secured to the ram 4 by a ring member 10. The sleeve 8a is preferably formed in two parts both of which are secured to the pillar 2 by means of bolts 11, a slight relative rotary movement being permitted between the two parts in order to ensure a reasonably tight sliding fit between ram 4 and sleeve 8a. The tilting mechanism 5 is keyed to the ram 4 and is held in position by a nut 12.

The valve 7 which is fitted at the lower end of the cylinder 2 consists of a disc valve 13 having a tubular extension 14 which houses a spring 15 disposed between the lower end of the tubular member 14 and lugs 16 stamped out from the walls of a co-operating tubular extension 17 secured to the base of the cylinder 3. The disc valve 13 contacts with a seating 18 mounted in the lower part of the pillar and may be raised therefrom by an upward movement imparted by a tappet 19 when the pedal 8 is depressed to turn about a pivot 20. The tappet 19 bears against

a flexible diaphragm **21** secured in position by means of a plate **22** and providing an effective seal at the lower end of the pillar **2**. Oil from the reservoir in the pillar **2** can pass to the cylinder **3** when the disc valve is open through the passages **23** formed in a cage-like member **24** forming part of the valve assembly.

The upper internal portion of the pillar **2** is filled with compressed air, preferably pumped in at a fairly low pressure by a small bicycle or like pump. The compressed air acting upon the liquid will, when valve **7** is opened, apply a force on the ram **4** supporting the board **6** and its mechanism **5**, and when sufficient pressure has been pumped in the pillar, this force will balance the weight of the board and its mechanism.

It will be understood that the compressed air in this case acts as a spring and that if no leakage occurs and there is no excessive variations of temperature, the pressure will remain substantially constant being determined at the time of assembly of the apparatus. Moreover, the fact that such pressure can be varied by reduction or increase at the will of the operator, permits of various weights being placed on the ram, such as when fitting a different board according to the type and size of drawing the draughtsman is engaged upon. It will be appreciated that this air spring besides being variable as hereinbefore explained, is very much cheaper than a metal spring coil. Further, the rate of "deflection" can be set at a minimum by employing a large cross sectional area for the pillar reservoir, i. e. conducting to a large area of contact between air and liquid and a considerable volume of air.

When the desired position of the board has been obtained, the release of foot pressure on the control valve **7** will close the circuit of the liquid medium, and the board then is supported on the liquid column of the inner cylinder, and the liquid being uncompressible, will provide a solid permanent support, provided not by the compressed air, but by the liquid contained in the cylinder. Suitable ram cupping and packing prevents any loss of liquid and prevents change of position of the board.

Moreover, in a fixed position, extra load can be brought to bear on the board, such as one or more persons leaning thereon, without affecting the stability of the device, since the liquid medium is there to support the load.

Referring now to the tilting mechanism of the board, this comprises a shaft **26** longitudinally and slidably supported within a casing **27** and capable of being moved in a circular path therein. At each end of the shaft are attached cross members **28** to which the board **6** is bolted.

What I claim and desire to secure by Letters Patent is:

1. In a hydraulic lift, a base, an exterior cylinder constituting a reservoir for liquid in its lower part and for compressed air in its upper part, an interior cylinder supported in the exterior cylinder in coaxial relation thereto, a ram slidably mounted in the interior cylinder and projecting above the cylinders to support a load at its upper end, valve means at the bottoms of the cylinders affording controlled communication between said cylinders, and means exterior of the exterior cylinder for actuating said valve means, the exterior cylinder being provided at its lower end with a ported cage wherein the valve means is contained, said valve means comprising a seat located between the ports in the cage and the lower end of said interior cylinder, a valve normally resting on said seat and having a central tubular portion, a ported closure on the lower end of the interior cylinder having a tubular portion on which the tubular valve portion telescopes, and spring means within the telescoped tubular portion at the lower end of the interior cylinder and urging said valve against the valve seat.

2. In a hydraulic lift, a base, an exterior cylinder constituting a reservoir for liquid in its lower part and for compressed air in its upper part, an interior cylinder supported in the exterior cylinder in coaxial relation thereto, a ram slidably mounted in the interior cylinder and projecting above the cylinders to support a load at its upper end, valve means at the bottom of the cylinders affording controlled communication between said cylinders, the exterior cylinder being provided at its lower end with a ported cage wherein the valve means is contained, said valve means comprising a seat located between the ports in the cage and the lower end of said interior cylinder, a valve normally resting on said seat, spring means interposed between the lower end of the interior cylinder and urging said valve against the valve seat, a flexible diaphragm below said valve and adapted to engage and lift said valve, a tappet positioned to engage and lift said diaphragm and projecting through the bottom of the exterior cylinder, and a pedal for actuating said tappet.

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