

Oct. 24, 1939.

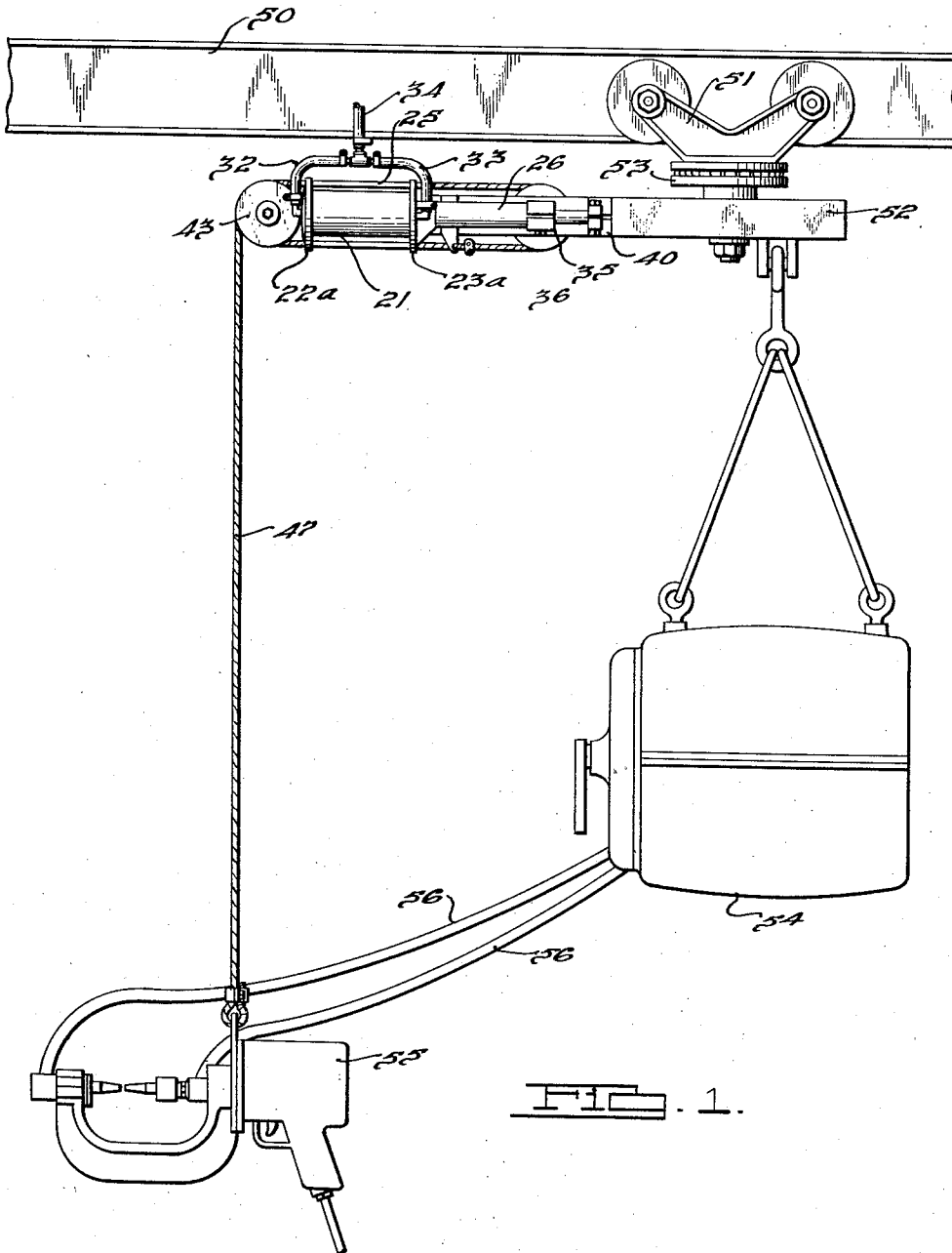
H. T. PLATZ

2,176,979

PNEUMATIC COUNTERBALANCING FIXTURE

Filed July 27, 1936

3 Sheets-Sheet 1



INVENTOR
Henry T. Platz.
BY
Dike, Colver & Gray
ATTORNEYS.

Oct. 24, 1939.

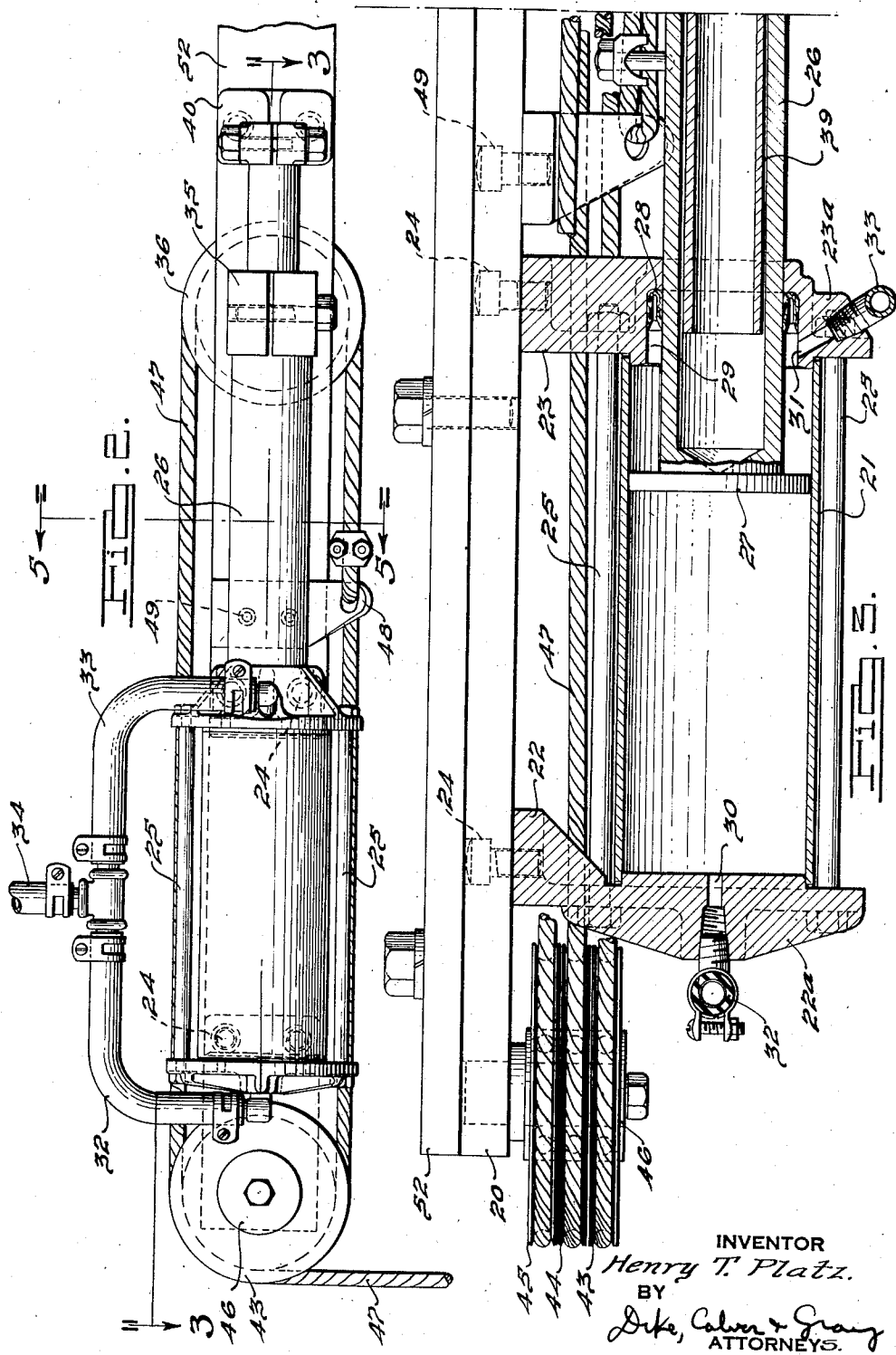
H. T. PLATZ

2,176,979

PNEUMATIC COUNTERBALANCING FIXTURE

Filed July 27, 1936

3 Sheets-Sheet 2



Oct. 24, 1939.

H. T. PLATZ

2,176,979

PNEUMATIC COUNTERBALANCING FIXTURE

Filed July 27, 1936

3 Sheets-Sheet 3

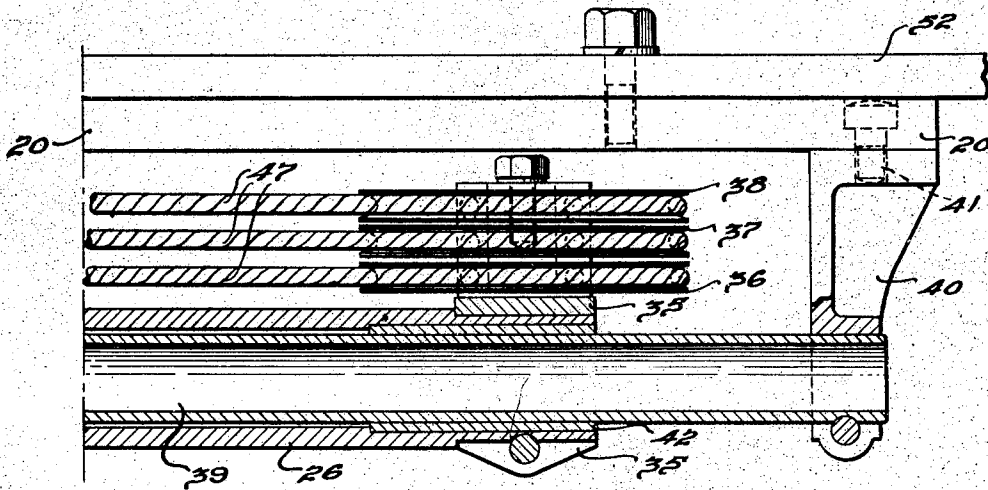


FIG. 4.

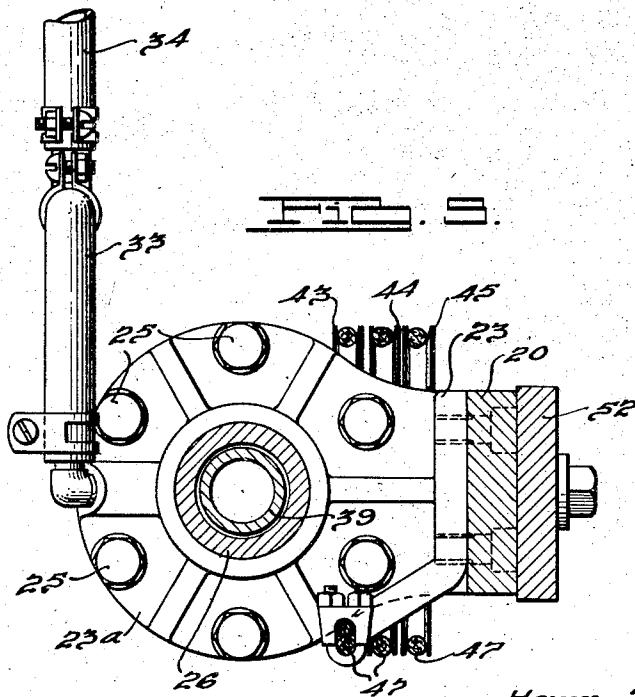


FIG. 5.

INVENTOR.
Henry T. Platz.
BY
Dike, Colver & Gray
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,176,979

PNEUMATIC COUNTERBALANCING FIXTURE

Henry T. Platz, Detroit, Mich., assignor to
Briggs Manufacturing Company, Detroit,
Mich., a corporation of Michigan

Application July 27, 1936, Serial No. 92,834

15 Claims. (Cl. 248—328)

This invention relates to balancing devices and more particularly to balancing devices of the fluid actuated type, such for example as pneumatic counterbalancing devices.

One of the objects of the present invention is to provide a novel and improved balancing device which is actuated by fluid pressure in the form which is readily available in industrial plants, such as air under pressure either above or below atmospheric pressure.

Another of the present invention is to provide an improved balancing device in which the objectional use of built-up counterbalancing weights swinging and moving through considerable vertical distances are eliminated and wherein improved fluid controlled mechanism of compact and simplified nature is provided for balancing heavy tools of various types used extensively in manufacturing plants.

A further object of the invention is to provide an improved counterbalancing device, particularly of the pneumatic type, having cable controlled relatively movable pulleys and adapted to be connected to a tool for supporting the same and wherein the relative movement of the pulleys consequent to the raising or lowering of the tool during use thereof is governed by means of a reciprocable pneumatically or fluid actuated member guided in a rectilinear path parallel to the path of relative movement of the pulleys.

A further object of the invention is to provide a counterbalancing device of the foregoing construction wherein the relative movement of the pulleys in a rectilinear or straight line path is controlled by the fluid or pneumatically actuated member.

The above and other objects and advantages of the invention will appear from the following description and appended claims when considered in connection with the accompanying drawings forming a part of this specification.

Fig. 1 shows a typical installation utilizing a counterbalancing device constructed in accordance with my invention.

Fig. 2 is a side elevation of the counterbalancing device.

Fig. 3 is a horizontal sectional view showing the left hand portion of the structure of Fig. 2, section being taken on the line 3—3 of Fig. 2.

Fig. 4 is a view similar to Fig. 3, showing the right hand portion of the structure.

Fig. 5 is an end view of the counterbalancing device showing the same as it appears looking from the left hand end thereof.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and

of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings there is shown, by way of example, a pneumatic counterbalancing device embodying the present invention, the device being exemplified in Fig. 1 for the purposes of illustration in connection with a typical installation wherein a tool, such as a spot welder, is supported or balanced by the counterbalancing mechanism.

The counterbalancing device of my invention comprises generally a pneumatic cylinder carrying a properly guided pneumatically actuated member; a pair of pulley blocks one of them being fixed with respect to said cylinder, while the other is adapted to be moved by said pneumatically actuated member, and a suitable cable passed with a plurality of turns around said pulleys, one end thereof being fixed, while its free end is adapted to support the balanced tool. Movement of the pneumatically actuated member and of the pulleys connected thereto through a predetermined distance causes the free end of the cable to rise or to fall through a distance which is measured by the product of said predetermined distance and the number of turns of said cable over said pulleys, the force available at said free end of the cable being measured by the quotient resulting from dividing the force applied to said pneumatically actuated member by said number of turns. If the force available at the free end of the cable is equal to the weight of the balanced tool, the latter will be exactly balanced at any height to which it may be brought. If, however, said force is somewhat greater than the weight of the tool, the latter will be raised by said force, when released, to a predetermined height.

Referring more specifically to Figs. 2 to 5, inclusive, the counterbalancing device is mounted on a supporting plate 20 and it comprises a cylinder 21 supported by the brackets 22 and 23 secured to said plate 20 by means of a plurality of screws 24. The extremities of said brackets 22 and 23 are turned down to provide suitable covers 22a and 23a for said cylinder 21 to which they are held by means of a number of retaining bolts 25. The cover 23a is bored through to provide for the passage of a hollow plunger 26 which has at its cylinder enclosed end a piston-like guide 27. Plunger 26 is sealed at said bore by a leather ring 28 held in the counterbore 29. Covers 22a and 23a are provided with air admitting orifices 30 and 31, respectively, which are connected by means of branch conduits 32 and 33 to a flexible air conduit 34 which, in turn, is operatively con-

nected to an air compressor or other source of compressed air.

The free end of the plunger 26 carries an arm 35 on which there are mounted sheaves or pulleys 36, 37 and 38, each of said pulleys being mounted on a ball bearing and capable of rotating independently of other pulleys. A cylindrical guide 39 clamped in a bracket 40 secured by screws 41 to the plate 20 enters the longitudinal bore of the plunger 26 and serves to guide said plunger in the reciprocating movements thereof. A bushing 42 is pressed into the counterbored end of the plunger 26 in order to reduce friction and permit replacement.

Stationary pulleys 43, 44 and 45 are mounted on a fixed pin 46 secured to the plate 20, each of said pulleys being mounted on a suitable ball bearing and capable of independent rotation. The cable 47, anchored at a bracket 48 secured to the plate 20 by means of screws 49, is passed with a plurality of turns around the pulleys 36, 43, 37, 44, 38 and 45, its free or moving end depending from said pulley 45 and adapted to carry the balanced tool.

In Fig. 1 there is shown for the purpose of illustration a typical installation in which the balancing device of my invention is utilized for balancing a spot welding tool. The structure illustrated in said figure comprises an overhead rail 50, preferably of I-shape section, suitably supported at a predetermined height. A trolley 51 having wheels adapted to travel on the lower flange of said rail or I-beam 50 carries a horizontally swinging beam 52 rotatably supported by a ball bearing type swivel 53 secured to said trolley 51. Said beam 52 supports at one of its extremities a transformer 54, while its other extremity carries the plate 20 on which the counter-balancing device is mounted. The spot welding tool 55 is secured to the moving end of the cable 47, and is electrically connected to the transformer by means of conductors 56. The respective distances, at which the weights of the transformer and of the counterbalancing device with the balanced tool are applied to the beam 52, are so chosen that the moments produced by said weights around the point of support of the beam are substantially equal and balance each other, or in other words, the beam 52 is substantially balanced at its support.

In operation, the tool 55 may be moved along the I-beam 50 as far as said beam and the character of the air conduit 34 permit. Swinging beam 52 permits moving said tool 55 sufficiently far on either side of the I-beam 50, thus making the operative distance range of the tool 55 quite sufficient for any practical requirements. It should be noted that because of the ball bearing mounting the beam 52 always turns toward the tool 55, and therefore when the tool is released, it is raised with a minimum number of oscillations of rapidly decreasing amplitude.

When air is admitted to the conduit 34 and from said conduit through the branch conduits 32 and 33 into the cylinder 21 on both sides of the piston-like guide 27, a force is exerted on the plunger 26, which force is equal to the product of unit air pressure in the cylinder 21 and the cross sectional area of the solid part of the plunger 26, both quantities being expressed in corresponding units. Said force, being transmitted by the plunger 26 to the pulley-carrying arm 35, moves the pulleys 36, 37 and 38 against the resistance of the cable 47 until they reach the bracket 40 serving in this instance as a stop.

At the tool-supporting end of the cable 47 there is available in these conditions a force which is somewhat less than one-sixth of the force exerted on the plunger 26 by the pressure of the air in the cylinder 21. The exact amount of reduction of the theoretical force available at the tool-supporting end of the cable 47 depends upon the mechanical efficiency of the plunger, piston-like guide, cylindrical guide and the pulleys. If the force actually available at the end of the cable 47 is equal to the weight of the tool 55, the same will be exactly balanced and will be at rest at any elevation to which it may be brought. However, in order to ensure automatic rising or return of the tool 55 to a predetermined height, I prefer the upward force available at the end of the cable 47 to exceed the weight of the tool 55 by approximately five pounds.

Although only one embodiment of the present invention has been illustrated and described, numerous changes in the form and arrangement of parts may be made without departing from the scope of my invention. For instance, the number or the arrangement of pulleys in the blocks may be changed; other types of fluids, such as water or oil may be used instead of air; branch conduits may be eliminated and fluid conducted to the cylinder by means of a single conduit; the piston-like guide being cut out or provided with a plurality of holes for equalizing the pressure on both of its sides; and for the plunger there may be substituted a long single acting piston, the latter permitting me to dispense with the piston-like guide, one cover, and the packing.

I claim:

1. In a counterbalancing device, a support, a cylinder mounted on the support, a fluid actuated reciprocable plunger guided within the cylinder, guide means exterior to the cylinder and mounted on said support independently of the cylinder for guiding said plunger in a rectilinear path, a fixed pulley carried by the support, and a cable actuated bodily movable pulley cooperating with the fixed pulley and movable with said plunger in a path parallel to the path of travel of the plunger.

2. In a counterbalancing device, a support, a cylinder mounted on the support, a fluid actuated reciprocable plunger guided within the cylinder, guide means exterior to the cylinder and mounted on said support independently of the cylinder for guiding said plunger in a rectilinear path, a fixed pulley carried by the support, and a cable actuated bodily movable pulley cooperating with the fixed pulley and attached to said plunger for movement therewith, said guide means providing a support for said movable pulley at a point remote from the cylinder when the plunger is fully extended.

3. In a counterbalancing device, a support, a cylinder carried by the support, a pulley fixed to the support, a plunger reciprocable through one end of the cylinder, a movable pulley carried by the plunger, a cable passing over the pulleys and depending from the fixed pulley, and guide means cooperating with the plunger and providing a support for said movable pulley at a point remote from the cylinder when the plunger is fully extended.

4. In a counterbalancing device, a support, a cylinder carried by the support, a pulley fixed to the support, a plunger reciprocable through one end of the cylinder, a movable pulley carried by the plunger, a cable passing over the pulleys and depending from the fixed pulley, and

guide means cooperating with the plunger and providing a support for said movable pulley at a point remote from the cylinder when the plunger is fully extended, said guide means being carried by said support and extending through the outer end of the plunger.

5. In a counterbalancing device, a support, a cylinder carried by the support, a pulley fixed to the support, a hollow plunger reciprocable through one end of the cylinder, a movable pulley carried by the plunger, a cable passing over the pulleys and depending from the fixed pulley, and guide means cooperating with the plunger and providing a support for said movable pulley at a point remote from the cylinder when the plunger is fully extended, said guide means comprising a shaft having one end mounted on the support and the other end extending into said plunger.

6. In a counterbalancing device, a support, a cylinder carried by the support, a pulley fixed to the support, a hollow plunger reciprocable through one end of the cylinder, a movable pulley carried by the plunger, a cable passing over the pulleys and depending from the fixed pulley, and guide means cooperating with the plunger and providing a support for said movable pulley at a point remote from the cylinder when the plunger is fully extended, said guide means comprising a member telescoped through the outer end of the plunger and fixed to the support beyond said outer end.

7. In a pneumatic counterbalancing device, a cylinder, a plunger slidably mounted in said cylinder, a guide provided at the inner end of said plunger, a guide concentric with said plunger and adapted to guide the outer end thereof along a predetermined path and supported independently of the cylinder, means for continuously and simultaneously admitting air under a substantially equal pressure at both sides of said first named guide, and counterbalancing means controlled by said plunger.

8. In a pneumatic counterbalancing device, a cylinder, covers mounted at both ends of said cylinders, a plunger slidably through one of said covers, a guide at the inner end of said plunger, a guide concentric with and extending interiorly of said plunger and adapted to guide the outer end thereof, two air conduits connected to suitable openings in said covers for conducting simultaneously compressed air to said cylinder on both sides of said first named guide, and counterbalancing means controlled by said plunger.

9. In a counterbalancing device, an overhead rail, a trolley adapted to travel on said rail, a horizontally swinging beam supported intermediate its ends by said trolley, a cylinder carried at one end of the beam, a reciprocable plunger slidably in said cylinder and guided at one end therein, means independent of the cylinder for guiding the opposite end of the plunger, a fixed pulley carried by said beam, a movable pulley carried by the plunger, a cable cooperating with the pulleys, said cable having an end anchored with respect to said cylinder and depending from the fixed pulley and adapted to support a tool at its lower end, and a weight suspended from the end of said beam opposite to the cylinder supporting end thereof.

10. In a counterbalancing device, a horizontally swinging beam, a cylinder mounted adjacent one end of the beam, a reciprocable plunger slidably in said cylinder and guided at one end therein, a fixed guide for the opposite end of the plunger,

a pulley movable with the plunger and secured thereto intermediate the cylinder and fixed guide, a fixed pulley carried by said beam, and a cable passing over said pulleys and depending from the fixed pulley.

11. In a counterbalancing device, a horizontally swinging beam, a cylinder carried by said beam, a reciprocable plunger slidably in said cylinder and guided at one end therein, a fixed guide for the opposite end of the plunger, means for mounting said guide on said beam, a pulley movable with the plunger and connected thereto intermediate the cylinder and said means, a fixed pulley carried by said beam, and a cable passing over said pulleys and depending from the fixed pulley.

12. In a counterbalancing device, a horizontally swinging beam, a cylinder carried by said beam, a reciprocable plunger slidably in said cylinder and guided at one end therein, a fixed guide for the opposite end of the plunger, means for mounting said guide on said beam, a pulley movable with the plunger and connected thereto intermediate the cylinder and said means, a fixed pulley carried by said beam, a cable passing over said pulleys and depending from the fixed pulley, and a single conduit means having branch conduits for introducing fluid under a substantially equal pressure to opposite ends of the cylinder.

13. In a counterbalancing device, a horizontally swinging beam, a cylinder carried by said beam, a reciprocable plunger slidably in said cylinder and guided at one end therein, a fixed guide for the opposite end of the plunger, means for mounting said guide on said beam, a pulley movable with the plunger and connected thereto intermediate the cylinder and said means, a fixed pulley carried by said beam, and a cable passing over said pulleys and depending from the fixed pulley, said plunger comprising a tubular shaft and said fixed guide comprising a member telescoped in said shaft.

14. In a counterbalancing device, a support, a cylinder secured to said support, a fluid actuated reciprocable plunger guided within said cylinder, means exterior to the cylinder for guiding said plunger in a rectilinear path, a fixed pulley carried by the support, a cable actuated bodily movable pulley cooperating with the fixed pulley and movable with said plunger in a path parallel to the path of travel of the plunger, and a single conduit means having branch conduits for introducing fluid under a substantially equal pressure simultaneously to opposite ends of the cylinder.

15. In a device for counterbalancing a portable tool, a supporting member, a cylinder secured to said member and having a plunger slidably fitted therein, means on both ends of said plunger to guide the same in a predetermined rectilinear path, a pulley bodily fixed with respect to said supporting member, a pulley connected to said plunger and bodily actuated thereby to be moved with respect to said fixed pulley; a cable having one end anchored at said support, and passed around said pulleys, the opposite end of said cable being adapted to carry said tool, and fluid conduit means adapted to maintain in said cylinder a predetermined pressure exerting a force on said plunger substantially equal to that produced by the weight of said tool.