

E. J. BLOOD.
HYDROSTATIC SCALE OR EDUCATIONAL APPLIANCE.
APPLICATION FILED MAY 25, 1908.

931,840.

Patented Aug. 24, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

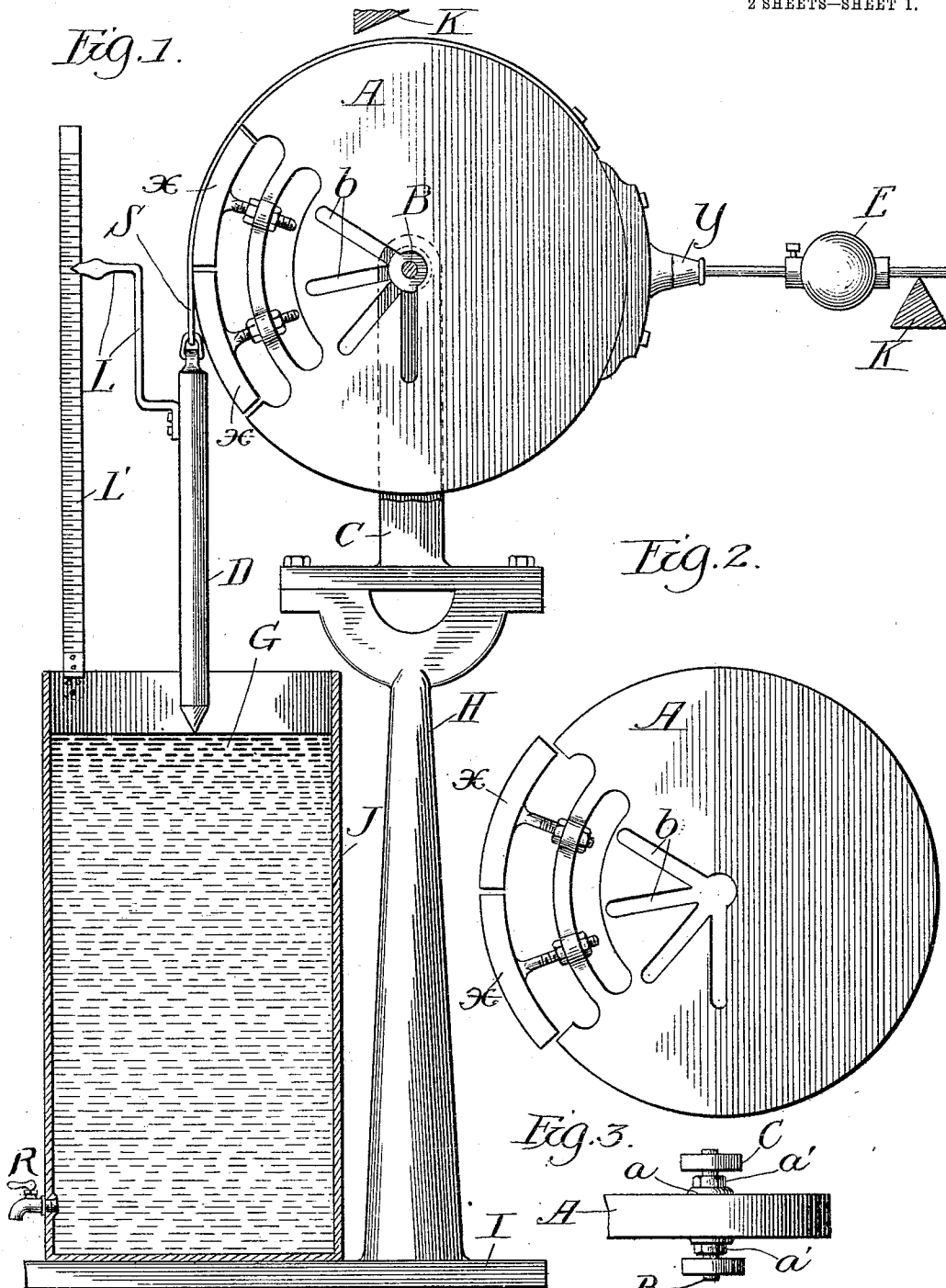


Fig. 2.

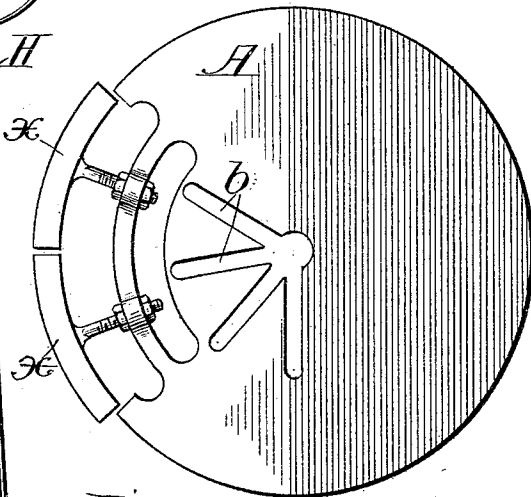
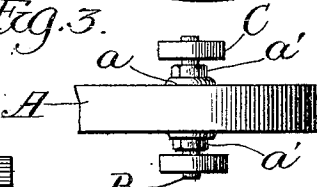


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

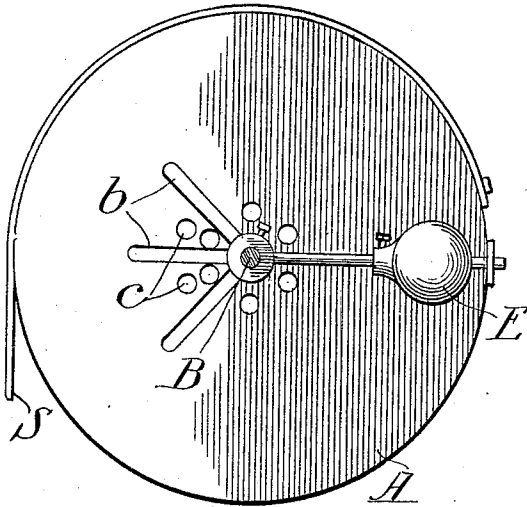


Fig. 7.

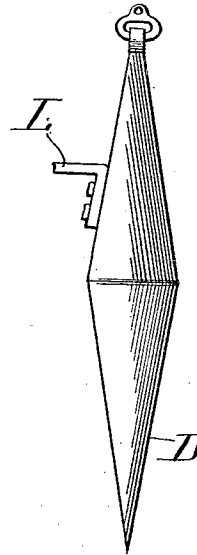


Fig. 5.

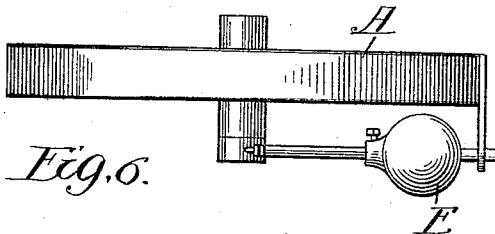
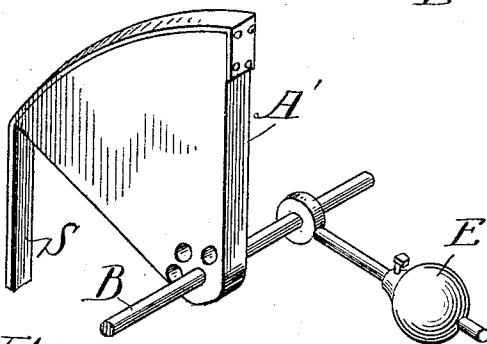
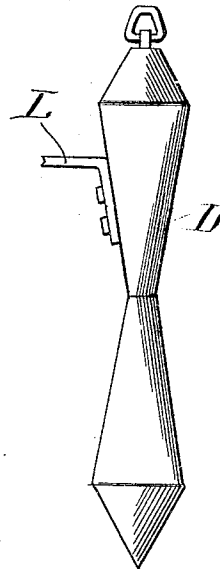


Fig. 8.



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HYDROSTATIC SCALE OR EDUCATIONAL APPLIANCE.

931,840.

Specification of Letters Patent.

Patented Aug. 24, 1909.

Application filed May 25, 1908. Serial No. 434,810.

To all whom it may concern:

Be it known that I, EDWIN J. BLOOD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydrostatic Scales or Educational Appliances, of which the following is a specification.

This invention relates to improvements in an apparatus whereby the leverage power of weight is counterbalanced by the expelling force of liquid in such a manner that these two forces increase and decrease simultaneously and alternately, when the working parts of the device are moved, and by the operation of which one can determine accurately the difference in the specific gravity of liquids and compounds of liquid and demonstrate the expelling force of different liquids.

The object of the invention is to provide a device of the above-named character, which shall be simple and inexpensive in construction, efficient in operation, and so made that certain parts thereof may be adjusted with respect to other parts or elements of the appliance to accomplish certain results under different conditions.

The invention consists of a pulley and lever hung on a single bearing adapted to be operated by hand power or other suitable means, and which is constructed so as to oscillate through a path or movement of about ninety degrees of a circle. The oscillation in one direction changes the lever from a horizontal position to a perpendicular position, and the reverse oscillation throws the lever back again from an upright position to a horizontal position. Thus, a weight near the outer end of the lever, when carried from a point nearly on a level with the bearing of the lever to a position nearly or directly over the bearing, or, in other words, from the point of its greatest leverage power to a position where it practically has no leverage power, must by this movement, from the start of the oscillation, gradually decrease in leverage power until it reaches the limit of the oscillation, where its leverage power is exhausted, or very nearly exhausted. But, from the start of the next and reverse oscillation the weight in being carried from a position nearly directly over the bearing (to the greatest distance it can reach or get from a plumb line drawn

through the bearing) gradually increases in its leverage power to the end of the oscillation. Thus, with every oscillation of the pulley and lever, the weight moves with either increasing or decreasing leverage power. When the weight is rising its leverage power decreases; when falling, its leverage power increases. On the opposite side of the bearing, from the lever which sustains the weight referred to, is suspended (over a vat containing liquid) a body which is both a weight and a plunger, and which is termed a plunger, and by means of a cord or belt this plunger is attached to the pulley referred to which is connected to the lever and bearing. The plunger is of sufficient weight to maintain a tension on the cord or belt when it is immersed to the lowest point it reaches in the liquid, but the plunger when at this lowest point is preferably not entirely immersed.

When the pulley and lever oscillate in the direction which causes the weight to rise, the plunger descends into the liquid and as the plunger is gradually immersed its leverage power on the pulley gradually decreases. At the same time the leverage power of the rising weight decreases also, as it draws near the limit of its oscillation to a point nearly over the bearing, in which position the leverage power of the weight is nearly exhausted, and at the same time, the plunger has descended into the liquid to the greatest depth it can reach and its leverage power is also nearly exhausted. By the next or reverse oscillation, the weight is gradually carried down away from over the bearings with increasing leverage power to a point nearly on a level with the bearing, to the point of its greatest leverage power, and at the same time the plunger was moving up out of the liquid, its leverage power on the pulley increasing simultaneously and at the same ratio that the leverage power of the weight increased on the lever when falling. The change of the leverage power of the plunger on the pulley is caused by the action on the plunger by the expelling force of the liquid at different depths. The change of the leverage power of the weight on the lever is caused by the different angles assumed by the lever in its movement through about ninety degrees of a circle.

In each oscillation of the combined pulley and lever, the plunger and weight move in

opposite directions. When the weight is made to rise, the plunger is made to fall. When the weight is made to fall, the plunger is made to rise. When the weight rises, its leverage power gradually decreases, and by the same oscillation the leverage power of the plunger decreases also as it descends into the liquid. When the oscillation makes the weight fall its leverage power increases. The same oscillation increases the leverage power of the plunger as it rises out of the liquid.

The expelling force of the liquid on the plunger counteracts the leverage power of the weight, and when the plunger and weight are properly adjusted, the equilibrium of the lever and pulley on the bearing is maintained, but the slightest change in the specific gravity of the liquid consequently affects and changes the expelling power of the liquid on the plunger, and any difference or change made in the liquid is shown on an indicator. The extension on the pulley to which the weight is attached is only a matter of convenience resulting in reduction of weight. Without the extension, the pulley can serve in the capacity of a lever on the side of the bearing to which the weight is attached, and on the opposite side of the bearing it serves as pulley in operating the plunger.

In the accompanying drawings, which serve to illustrate the invention—Figure 1 is a view in side elevation partly in section of a hydro-static scale or educational appliance, embodying one form of the invention; Fig. 2 is a face view of the combined lever and pulley detached from its support; Fig. 3 is a fragmental plan view of a portion of the combined lever and pulley, showing the means for mounting the same; Fig. 4 is a face view of a modified construction of the combined lever and pulley; Fig. 5 is a plan view of said modification; Fig. 6 is a detached perspective view of another modified form of the combined lever and pulley; and Figs. 7 and 8 are views in elevation of modified forms of the plunger.

Like letters of reference, refer to corresponding parts throughout the different views of the drawings.

A designates the body of the combined pulley and lever which is mounted on a bearing B which is supported between two up-rights C on a standard H mounted near a vat or tank J adapted to contain liquid G of any suitable kind. The bearing B passes through a central opening in the body A, which opening has radiating therefrom a series of slots *b* for the adjustment of the body on the bearing. On each side of the body A and surrounding the bearing B is a washer *a* which washers are clamped against the sides of the element A by means of nuts *a*¹ on the bearing.

E designates an adjustable weight on the extension Y of the combined lever and pulley, which has secured thereto at one of its ends a cord or belt S which operates on the periphery of the pulley A. Attached to the other end of the cord or belt S is a combined weight and plunger D which is suspended from the pulley by the cord or belt so that when the pulley is operated by hand power or otherwise the combined weight and plunger D will be lowered into or rise out of the liquid G in the tank J, which is located at a suitable point below the said plunger.

I is the base upon which rests the support H and vat J which contains the liquid G.

X—X are adjustable sections of the periphery of the pulley connected with the lever, and which is part of the combination of the pulley and lever A. These adjustable sections assist in establishing a uniform balance between the expelling force of the liquid exerted on the combined weight and plunger D and the leverage power of the weight E secured to extension Y of lever and pulley A.

K—K are stops at the terminals of the oscillations of the pulley and lever A, by which the amplitude of the oscillations is regulated, and which oscillations are limited to about ninety degrees of a circle which said terminals partially describe when in operation.

In Figs. 4 and 5 is shown a modification in the construction of the combined lever and pulley, which consists in supporting the adjustable weight E on a rod which extends from the bearing B to the periphery of the body A, and is suitably supported at each of its ends on said body and bearing. In this modification the body A has, in addition to the radial slots *b*, a number of openings *c* in which the bearing can be placed when it is desired to adjust the combined lever and pulley thereon.

In Fig. 6 is shown still another modification of the combined lever and pulley, in which a segmental piece A¹ forms the body and is mounted on the bearing B, while the adjustable weight E is mounted on a rod which extends from the bearing, as shown.

In Figs. 7 and 8 I have shown modified forms of the combined weight and plunger, which may sometimes be used in lieu of the construction shown in Fig. 1 of the drawings.

When the weight E is at its lowest point of descent and nearly on a level with the bearing B, and at or very near the lower stop K, it then exerts its greatest leverage power, and the combined weight and plunger D is at the same time exerting its greatest leverage power because at its highest elevation and hence less affected by the expelling force of the liquid than it is at any other position or level it takes during the movement of the pulley and lever A when oscillated. Hence, both the plunger D and weight E, when in the positions just referred

to, exert their greatest leverage power, and which, by reason of the adjustment of the lever and pulley A by bearing B and sections X—X, are about equal. A further movement of the lever A from the position it is in, when weight E is at its lowest point of descent, involves the rising of the weight E to a point nearly over the bearing B, and as it passes through the ninety degrees of a circle it gradually loses its leverage power at the same rate that the leverage power of the combined weight and plunger D decreases as it is lowered into the liquid G by the same oscillation of the lever A which raised the weight E. Thus, the adjustment of the bearing B and sections X—X is to make the leverage power of weight E and the expelling power of the liquid G, exerted on the combined weight and plunger D, counteract and balance each other during the oscillations of the lever Y and pulley A. To continue the oscillation of the lever Y and pulley A, when the weight E is at its highest point directly over the bearing B, involves the falling of the weight E from a position where its leverage power is but a trifle, it being almost directly over bearing B, and when weight E is in this position, the plunger and weight D is immersed in liquid G to such an extent that its leverage power is reduced to the same amount of leverage power possessed by weight E, and as weight E again descends, by reason of the oscillation of the lever and pulley A, its leverage power gradually increases until it arrives at a point nearly on a level with the bearing B, where it again possesses its greatest leverage power, and while it was falling to this position and gradually increasing its leverage power, the plunger D was also being raised out of the liquid and thereby its leverage power was being increased on the pulley and lever A gradually and at the same ratio that the leverage power of weight E increased. When the changing leverage power of both the plunger which is on the pulley and the weight which is on the lever are nicely adjusted, it will be seen that to change the specific gravity of the liquid would at once affect the expelling force exerted on the plunger and thereby disturb the equilibrium of the lever on the bearing, and the extent of the disturbance would be shown by the indicator. Thus, by this device, it is possible to compare liquids and test their expelling force.

R designates a means of drawing the liquid from vat J, and L an indicator by which any change made in the specific gravity of the liquid in the vat will be shown on the scale L¹, and which will also show the expelling force of different liquids. This device permits a comparison of the expelling force of different liquids to be made.

To adjust the pulley and levers to an

equilibrium, when one quality of liquid is in the vat, then to draw this liquid off and put the same quantity of another quality of liquid in, the difference of their expelling force would be shown by the register or indicator.

When the combined pulley and lever is in the position shown in Fig. 1 the weight on the lever side of the combined pulley and lever is nearly on a level with its bearing, at which point it possesses its greatest leverage power and is at the lower terminal of oscillation. The plunger weight on the pulley side of said lever is also at the point where it possesses its greatest leverage power and is at its highest terminal of oscillation. When the said two weights are in the positions referred to they are balanced on the bearing of the said combined lever and pulley. It is evident that the said plunger weight, in dropping in the manner of a rectilinear movement, would throw the weight, which is on the lever side of the said combined lever and pulley, to an upright position with great force if the plunger weight was permitted to drop without meeting resistance. This device provides resistance which can be regulated, and by which the gradual loss of the leverage power of the falling plunger weight as it enters the liquid may be slow or quick, and made to correspond to the rapidity with which the weight on the lever side of the said lever is, at the same time losing its leverage power. This regulation which causes the loss of the leverage power of the plunger weight to correspond with the loss of the leverage power of the weight on the lever side of said lever, in its upward movement, is done by means of the adjustable bearing and by the proper forming and loading of the plunger weight. In moving the said lever from the balanced position referred to, the weight on the lever side of said lever moves upward, the plunger weight on the pulley side of said lever moves downward, the plunger as it proceeds down into the liquid is, if properly regulated, being gradually deprived of its leverage power on the pulley side of said lever at a certain rate which can be regulated and which can be made to correspond to the loss of leverage power of the weight on the lever side of the said lever. Notwithstanding that, during the said oscillation the plunger weight on the pulley side of said lever, is being operated in the manner of a rectilinear movement, immersion is gradually taking its weight off of the pulley and it is being gradually more and more sustained by the liquid as it descends into it, and, by the same oscillation, the weight on the lever side of said lever is being gradually deprived of its leverage power as it is made to come to a position nearly directly

over the bearing on which it is being oscillated, and by a reverse oscillation each of the said weights simultaneously gain leverage power until reaching the end of said oscillation.

The movement of the combined lever and pulley is regulated so that when the weight attached to its lever end has reached the terminal of the oscillation, which carries it to a point nearly directly over its bearing, the leverage power of the said weight has, during the said oscillation, been reduced about ninety-nine per cent. The plunger weight on the pulley side of said lever has been, during the said oscillation, lowered into the liquid to an extent which has reduced its leverage power about ninety-nine per cent. also. This movement and device, to operate the two said weights whereby they each lose and gain leverage power simultaneously and alternately by the said oscil-

lations, is novel and valuable as an educational appliance.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters-Patent, is—

In an apparatus of the character described, the combination with a support, of a bearing journaled in the upper portion of the support, a pulley element having means for adjustably mounting it on the bearing and provided with adjustable sections at its periphery, a lever connected to said pulley element, a weight adjustable on said lever, a combined plunger and weight connected to the pulley element, and a liquid containing vessel located near the support and beneath the plunger.

EDWIN J. BLOOD.

Witnesses:

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