May 30, 1933. E. G. PLASTERER 1,912,094

EDUCATIONAL DEVICE

Filed May 7, 1932 2 Sheets-Sheet 1

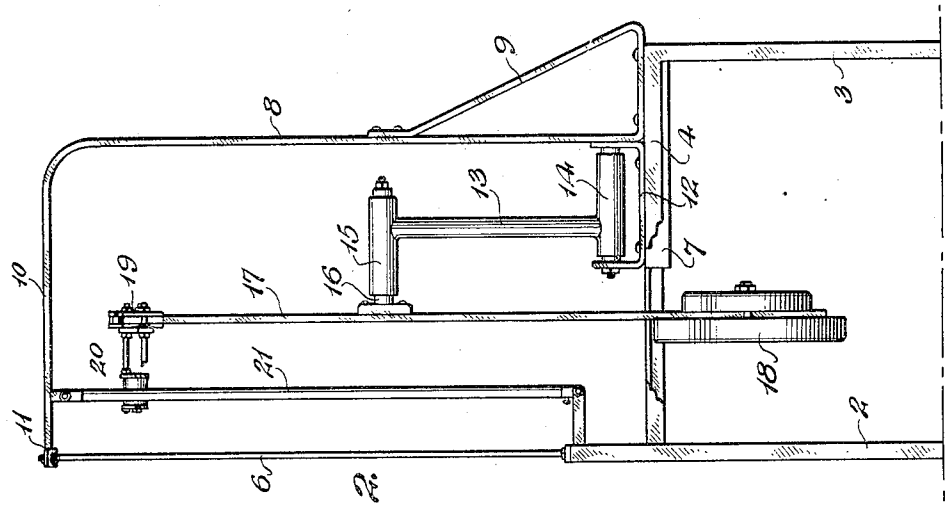


Fig. 2.

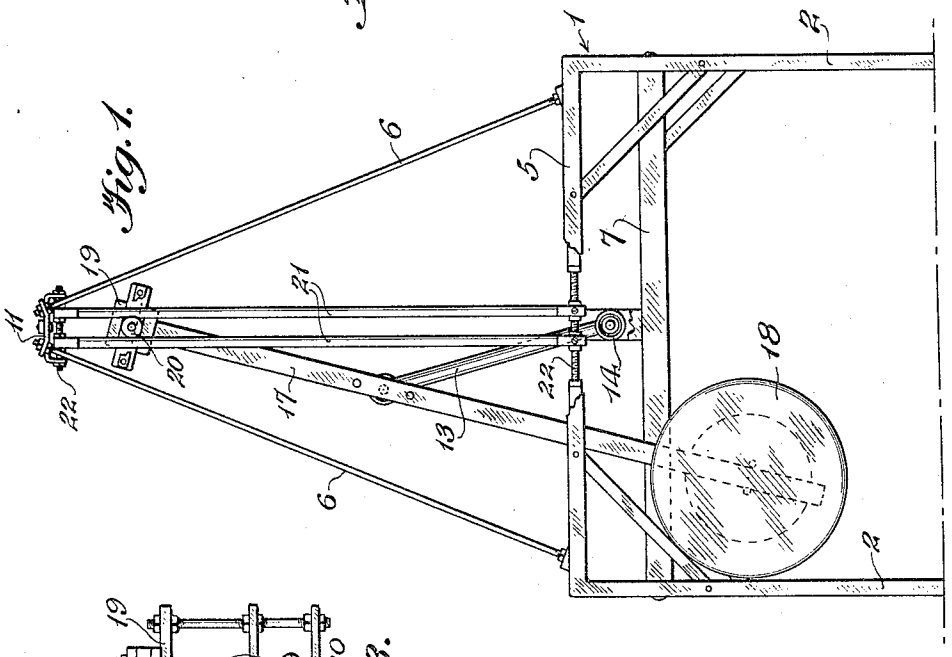


Fig. 1.

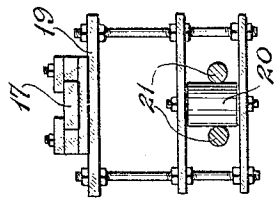


Fig. 3.

Inventor

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Fig. 4.

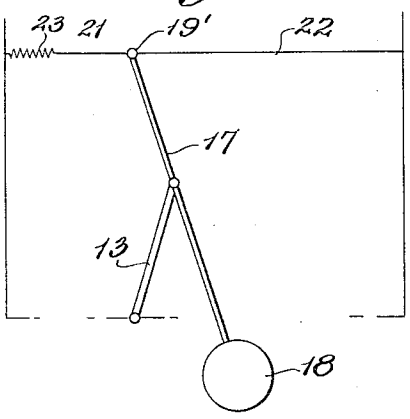
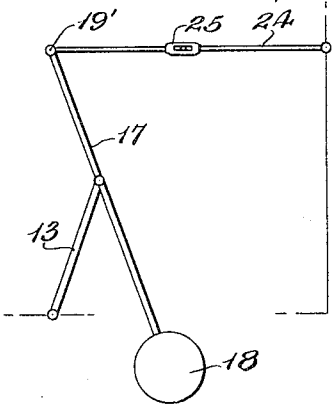


Fig. 5.



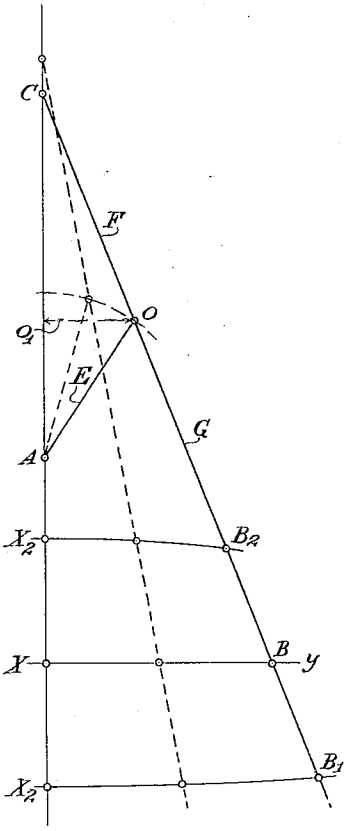


Fig. 7.

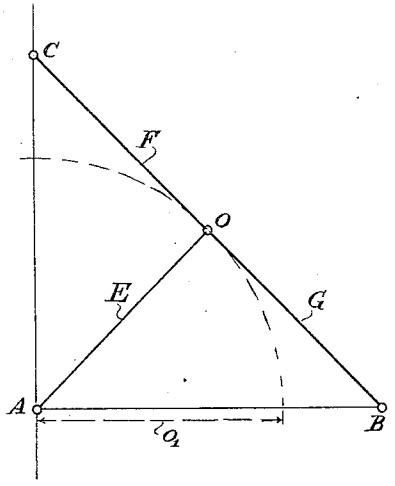


Fig. 6.

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Patented May 30, 1933

1,912,094

UNITED STATES PATENT OFFICE

EIFFEL GRAY PLASTERER, OF HUNTINGTON, INDIANA

EDUCATIONAL DEVICE

Application filed May 7, 1932. Serial No. 609,942.

The present invention relates to educational devices, more especially to a pendulum capable of demonstrating certain laws of physics or gravitation, and has for one of its principal objects to provide a device particularly useful in physical investigations for mechanically and graphically illustrating the principle of the pendulum.

Another important object of the invention resides in the provision of a device adapted to illustrate the effect of length on the time of oscillation, and for this purpose, the invention aims to provide a pendulum having means whereby the oscillations may be controlled, thus demonstrating that a pendulum having infinite length would have infinite time oscillation.

It is also an object of the invention to provide a device by which a weight or bob is caused by gravity to vibrate through arcs having radii of any length.

Other important objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

In order that the invention and its mode of operation may be readily understood by those persons skilled in the art, I have in the accompanying drawings and in the detailed description based thereupon set out possible embodiments of the same.

In these drawings:

Figure 1 is a front elevation of the device;

Figure 2 is a side elevation of the same;

Figure 3 is an enlarged detail showing the construction of the adjustable guide feature of the device;

Figure 4 is a schematic representation of a modification of the device;

Figure 5 is a similar showing of a further modification;

Figure 6 is a diagram illustrating the motion of the infinity pendulum, and

Figure 7 is also a diagram illustrating the various actions of the pendulum caused by the variable adjustment of the parts thereof.

Having more particular reference to the drawings wherein like characters of reference will designate corresponding parts throughout, my improved device may be stated to comprise a table frame 1 having a pair of front legs 2 and back legs 3, each of the latter being provided at its upper end with a horizontal bar 4 connected to the intermediate portion of the front legs 2. These front legs 2 are formed at their upper end with a transversal connecting bar 5 to which are secured a pair of upwardly extending and converging rods 6.

Fixed to the rearward portion of the horizontal bars 4 adjacent the back legs 3, is a board of the like 7, extending transversely of the table frame 1. Mounted upon said board 7 is a generally inverted L-shaped support 8 having its lower portion bent upon itself to form a brace 9. The upper portion 10 of the inverted L-shaped support 9 engages the free ends of the converging rods 6 by means of a plate 11 fixing said free ends of the rods 6. In this manner, it will be understood, that the inverted L-shaped support 8 may be rigidly maintained in its position on the frame.

Also mounted upon the board 7 forwardly of the support 8, is a U-shaped bracket 12 wherein is pivoted a lever arm 13, by means of an anti-friction fulcrum bearing 14. The free extremity of the lever arm 13 is likewise formed with a frictionless bearing 15 supporting a rotatable stub shaft 16 rigidly secured to the intermediate portion of a pendulum 17 provided at its lower end with an adjustable bob 18.

Associated with the pendulum 17, is a guide clamp 19 capable of adjustment at various points along the pendulum 17, and carrying a guide roller 20 movable between the pair of vertical and paralleling guide rods 21 disposed forwardly of the pendulum 17 and supported between the upper portion 10 of the inverted L-shaped support 8 and the connecting bar 5 of the frame 1. The guide rods 21 are preferably connected to said support and frame by means of screw threaded shanks 22, whereby said guide rods may be relatively adjusted to accommodate the guide roller 20.

In Figures 4 and 5 of the drawings, I have schematically shown modified constructions of the device, whereby the use of a guide roller

and guide rods may be dispensed with. In the arrangement particularly represented in Figure 4, the pendulum 17 provided with the bob 18 and carried by the pivoted lever arm 13, is associated with an adjustable clamp 19′ connected to one end of a relatively short wire or cable 21 and of a relatively long wire or cable 22. The free end of the relatively short wire or cable 21 is connected to a suitable support through the medium of a spring 23, whereas the free end of the relatively long wire or cable 22 is connected directly to another suitable support.

In the arrangement illustrated in Figure 5, the clamp 19′ adjustable on the pendulum 17, is connected to a sectional rod 24 adjustable in length by means of a turnbuckle 25 or the like, and having its free extremity connected for variable adjustment on a suitable support.

The operation and use of my improved device will be best understood by referring to the diagrams shown in Figures 6 and 7 of the drawings, wherein the reference character E corresponds to the pivoted lever; A indicates the pivotal point of said arm; O the connecting point of the arm to the pendulum; F the portion of the pendulum between the connecting point O and the adjustable guide clamp which is represented in the diagrams by the reference character C; and, G the portion of the pendulum between the connecting point O and the bob, the latter being designated by the character B.

Figure 6 represents a schematic diagram of the motion of the infinity pendulum, wherein the arm E is supported on the pivot point A and the arms F and G are supported by the fulcrum O. The point C sliding vertically in the guide identified by the reference character 21 in Figures 1 and 2 of the drawings. As will appear from this diagram, the motion of the pendulum B is in a true horizontal line. The lengths of the arms E, F and G being equal, the angular relation must vary in exact ratio, that is to say, any increase in the angular relation of E to the horizontal, must cause a corresponding increase in the angular relation between the horizontal and G in exactly the same degree. It will be thus understood, that the pendulum B moves in a straight horizontal line and will remain in whatever position it is placed, since gravity has no chance to produce motion, thereby providing a pendulum whose point of suspension is infinity.

When it is desired to provide a pendulum whose point of suspension is less than infinity, it will be readily appreciated that this may be accomplished by increasing the length of G with relation to F, while, on the other hand, the opposite effect, that is, an inverted arc, will be obtained by decreasing the length of G with relation to F.

Figure 7 is a schematic diagram of an infinity pendulum wherein the lengths of E, F and G are unequal. In this instance, the pendulum may be caused to move in a horizontal line by so proportioning the lengths of F and G with respect to E, as to cause the members E and F to vary the motion and angle of G in exactly the right ratio to cause B to move in a straight horizontal line. The relative lengths of E, F and G may be readily ascertained by the simple equation (E : F :: F : G) or ($F^2/E=G$). For example, if the length of E is 4″ and F is 6″, G must bear the same relation to F that F bears to E (1.5 to 1). Therefore, G must be 9″ in length to cause the pendulum to oscillate in a straight line. It will be readily apparent from the diagram, that any increase in the length of G will cause B to move in an arcuate path, while any decrease in G will produce an inverted arc. It should be noted that there is a limit to the distance O may travel without interfering with the principles just announced, that is to say, the distance O_1, representing the distance between the vertical and O, must not exceed a definite proportion, to wit, the ratio of O_1 to E must be the same as E to F or the ratio may be expressed thus: (O_1 : E :: E : F) or ($E^2F=O_1$). This last rule likewise applies to the diagram shown in Figure 6 and, in fact, it will be understood that the principles of both diagrams are the same in every respect, the diagram of Figure 7 being merely a variation of the simpler Figure 6.

Manifestly, the construction shown and described is capable of considerable modification and such modifications as come within the scope of my claims, I consider within the spirit of my invention.

I claim:

1. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, and means carried on the pendulum and adjustable thereon to vary its point of suspension.

2. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a guide roller carried on said pendulum and adjustable thereon to vary its point of suspension, and guide rods associated with said roller.

3. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a guide roller carried by said pendulum and adjustable thereon to vary its point of suspension, a pair of paralleling guide rods associated with said roller, and means to adjust said rods in relation to each other for accommodating said roller.

4. A depice of the character described comprising a pendulum, an adjustable bob for said pendulum, a pivoted lever supporting

said pendulum and oscillating therewith, and means carried by the pendulum and adjustable thereon to vary its point of suspension.

5. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a yeilding cable, and a clamp connecting said cable to the pendulum and adjustable on the latter to vary its point of suspension.

6. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a relatively short cable having one end yieldably fixed at a point remote from the pendulum, a relatively long cable having one end directly fixed at a point remote from the pendulum, said latter point being opposed to the fixing point of said relatively short cable, and a clamp connecting the free ends of said cables to the pendulum, and adjustable on the latter to vary its point of suspension.

7. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a sectional rod having one end fixed at a point remote from the pendulum, and a clamp connecting the other end of said rod to the pendulum, and adjustable on the latter to vary its point of suspension.

8. A device of the character described comprising a pendulum, a pivoted lever supporting said pendulum and oscillating therewith, a sectional rod having one end fixed at a point remote from the pendulum, a clamp connecting the free end of said rod to the pendulum and adjustable thereon to vary its length of suspension, and means between the sectional rods to vary the length thereof.

9. An educational device of the character described comprising a support, a lever, means for pivotally connecting one end of said lever to said support, a pendulum supported by and pivotally connected at a point intermediate of its length to said lever whereby the latter will oscillate therewith, a bob adjustably connected to the lower end of said pendulum, and means adjustably mounted upon said support and having connection with the upper end of said pendulum for varying the latter's point of suspension.

In witness whereof I have hereunto set my hand.

EIFFEL GRAY PLASTERER.