

(No Model.)

J. COFFIN.

APPARATUS TO ILLUSTRATE CENTRIFUGAL FORCE.

No. 388,476.

Patented Aug. 28, 1888.

Fig. 1.

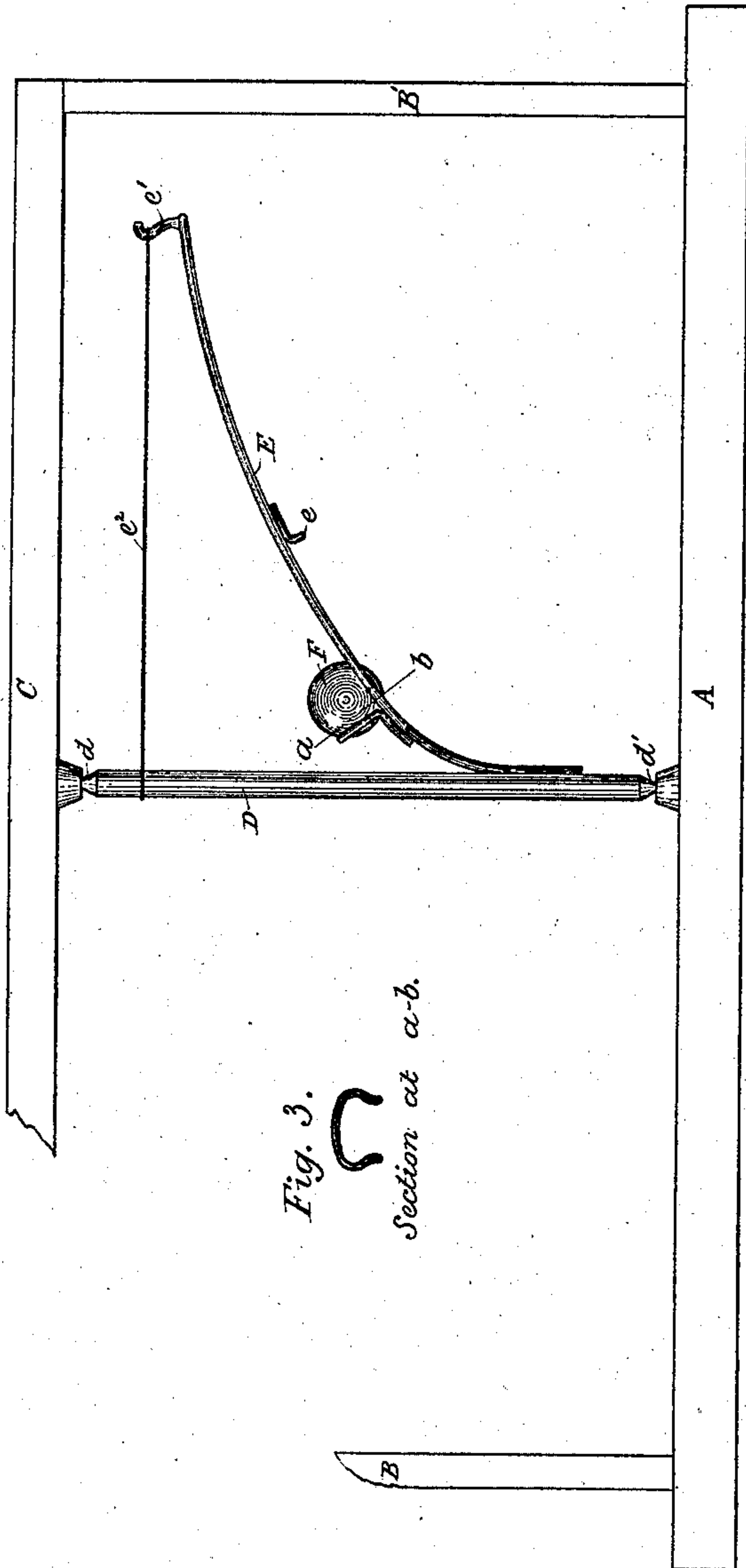
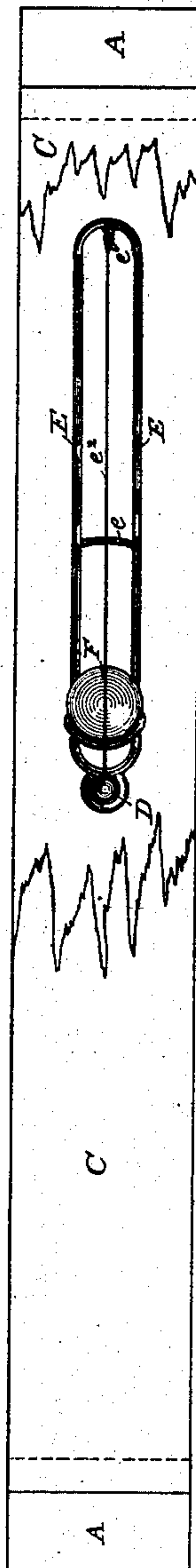


Fig. 3.

Section at a-b.



Fig. 2.



WITNESSES.

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APPARATUS TO ILLUSTRATE CENTRIFUGAL FORCE.

SPECIFICATION forming part of Letters Patent No. 388,476, dated August 28, 1888.

Application filed April 12, 1888. Serial No. 270,493. (No model.)

To all whom it may concern:

Be it known that I, JOHN COFFIN, a citizen of the United States, residing at Johnstown, in the county of Cambria and State of Pennsylvania, have invented a certain new and useful Apparatus for the Use of Schools to Illustrate the Effect of the Central Forces on Heavenly Bodies; and I hereby declare that the following is a full, clear, and exact description of the same.

My invention consists in a ball adapted to travel in an orbital path, thus being under the influence of the centrifugal force, and an arrangement by which the attractive force acting on the planets and satellites is simulated. The mechanical devices by which I accomplish this end consist in a vertical spindle free to revolve on its pivoted ends. This spindle is made to carry a tramway formed by a double wire. The center line of this tramway lies in the plane of the vertical spindle, and its shape in this plane is curved convexly toward the spindle—that is, the curve is convex on its upper side and its outer end is the highest point. A heavy ball rests on this tramway and is free to roll thereon. From the shape of the tramway the tendency of the ball is to roll toward the vertical spindle, and the nearer it approaches the spindle the greater this tendency is, for the grade becomes steeper. The force tending to move the ball toward the vertical spindle is thus an increasing one, as the ball moves inward, similar to the force of gravitation on a planet or satellite, and if the vertical spindle carrying the tramway and ball be put in revolution a corresponding centrifugal force is introduced. In the heavenly bodies most orbital motions are elliptical, with the attractive center in one of the foci of the ellipse, and when the body is nearest the attractive center it moves faster. To cause my device to work successfully, I make the spindle and tramway as light as possible consistent with strength, and use a very heavy ball, so that the weight of the ball greatly exceeds the weight of its revoluble support, and thereby preventing the inertia of the revolving support from interfering with the free motion of the ball.

Referring to the annexed drawings, which form part of this specification, Figure 1 is a vertical elevation of my apparatus. Fig. 2 is

a plan view of the same with a part of the frame broken away, so as to show more clearly the revoluble tramway. Fig. 3 is a transverse section of the tramway.

Like letters of reference refer to like parts throughout.

The frame of the apparatus consists in the base A, the two uprights B and B' and the top piece, C.

D represents the vertical spindle located centrally in the frame and pivoted to it at d and d' .

E is the tramway attached to the vertical spindle. The tramway E is curved convexly toward the vertical spindle. Its most removed end is its highest point, and its nearest end its lowest point, as shown. The tramway E is made very light, and is preferably constructed of two light parallel wires bridged at suitable intervals by short U-shaped wires, one of which is represented at e' . I describe the tramway as consisting of two parallel wires; but it may be really one wire bent double on itself at the outermost point of the tramway, as shown in the drawings. To increase the stiffness of the tramway E, I form integral with it or attach to it a vertical projection, e' , and connect the top of this vertical projection with the vertical spindle by means of a light cord or fine wire, e'' . The projection e' also serves as a limit to the outward movement of the ball.

F is a ball, preferably of iron, brass, or other heavy material, resting freely on the curved tramway E.

Having fully described the several parts of my invention, its operation is as follows: The ball is placed on the outer end of the tramway and the whole set in revolution on the spindle by means of an impulse given by the hand. The ball will now revolve in a circular orbit held against the projection e' by its centrifugal force; but after it has lost some of its motion it will leave the projection e' and revolve in perfect equilibrium in its orbit, subject to forces like in their nature to those acting on bodies revolving around the sun. Slight disturbances will cause the ball to oscillate out and in on the curved tramway, thereby giving it an elliptical orbital motion with the vertical spindle in one of the foci; or an outside disturbance can be given it by the hand, causing the ball to move in an orbit of great eccen-

tricity, similar to a comet. When doing so, the great difference in velocity when at its nearest and farthest points from the vertical spindle (corresponding to the perihelion and aphelion of a comet) is impressive.

Having fully described my apparatus and the manner of using it, what I claim as my invention is—

1. In an apparatus for illustrating the effect of the central forces on heavenly bodies, the combination of a main frame, a vertical spindle pivotally supported by the main frame, a tramway convexly curved toward the vertical spindle, and a ball resting on the tramway, substantially as specified and shown.

2. In an apparatus for illustrating the effect

of the central forces on the heavenly bodies, the combination of a pivotally-supported vertical spindle and a radial tramway attached to the said vertical spindle and being convexly curved toward it, substantially as specified and described.

3. In an apparatus for illustrating the effect of central forces, the combination of a vertical pivoted revoluble spindle, a radial tramway firmly attached thereto, and a ball free to roll on the said tramway, substantially as specified and described.

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Witnesses:

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