

F. GUEUGNON.

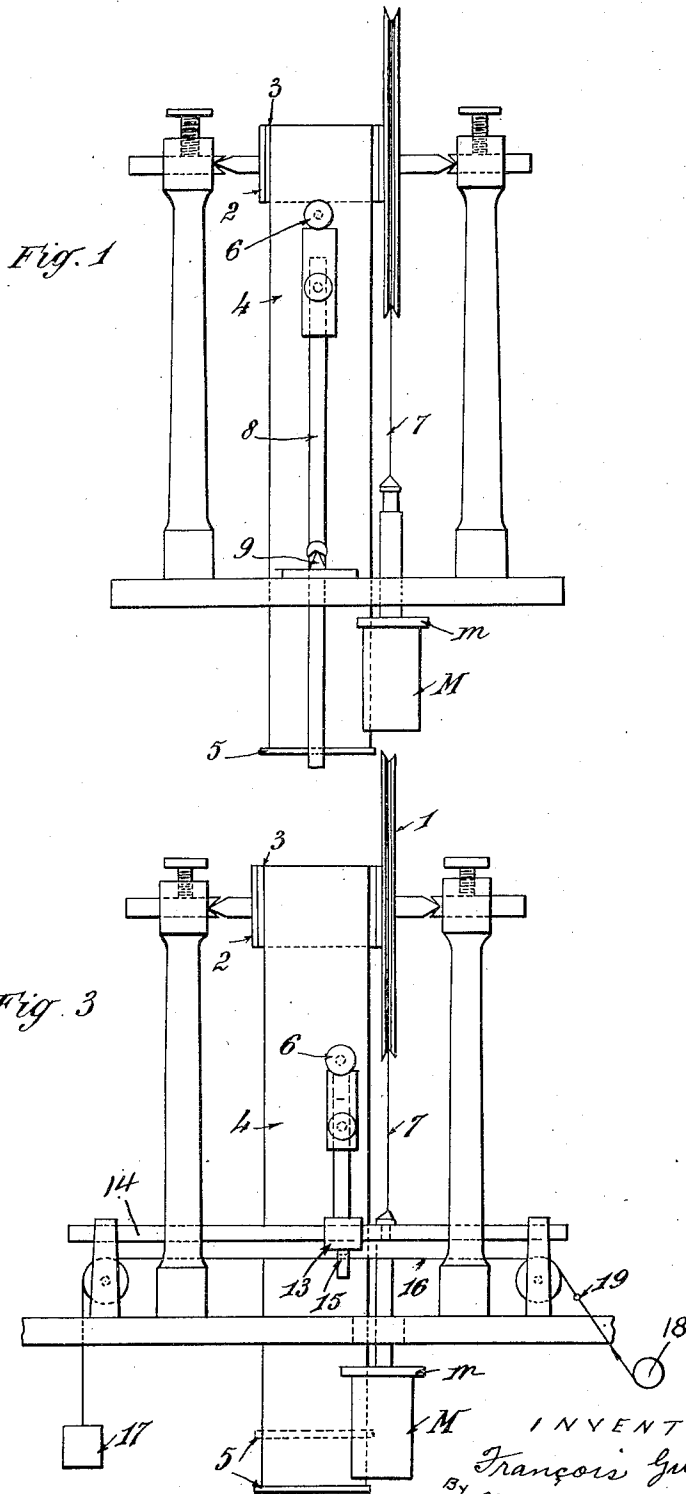
APPARATUS FOR RECORDING VARIOUS PHENOMENA BY THE MOVEMENT OF THE RECORDING STRIP.

APPLICATION FILED FEB. 23, 1918.

1,379,916.

Patented May 31, 1921.

4 SHEETS—SHEET 1.



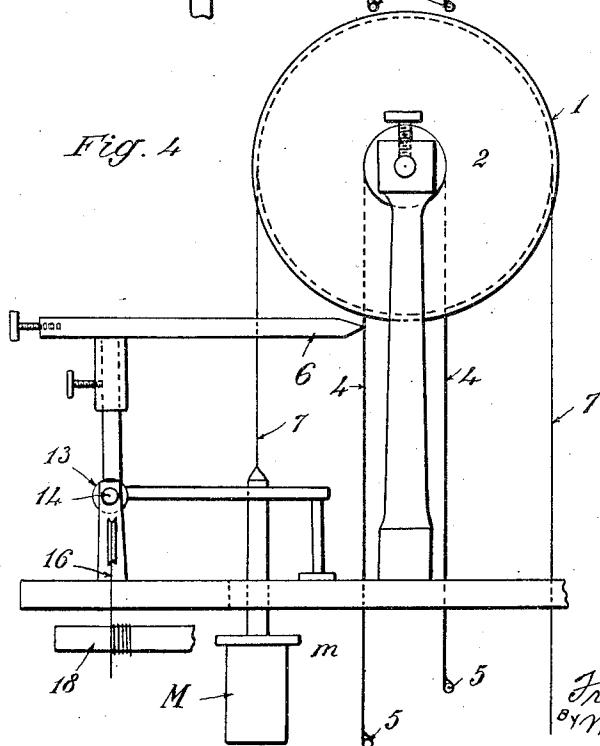
INVENTOR:
François Gueugnon
BY Wallace White, ATT'Y.

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4 SHEETS—SHEET 2..

Fig. 4



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Fig. 5

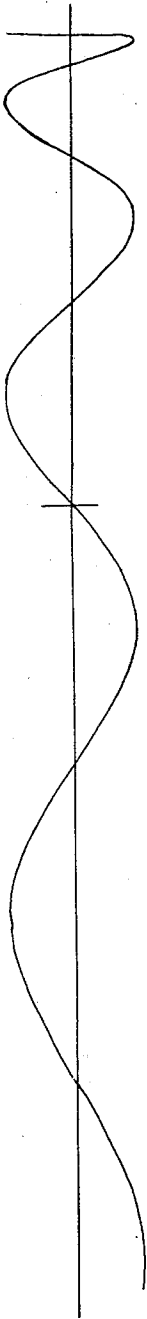


Fig. 6

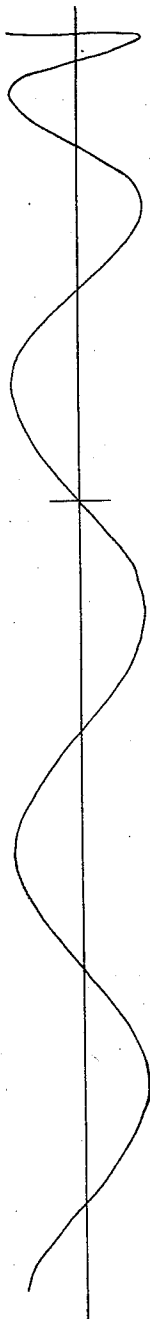
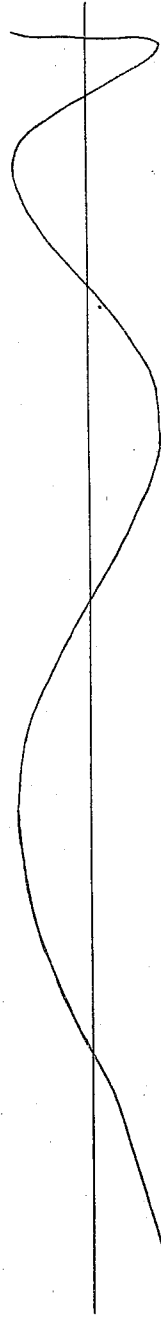


Fig. 7



Fig. 8



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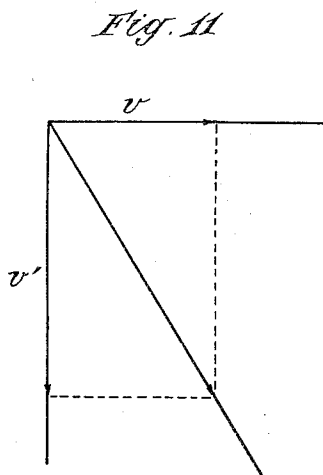
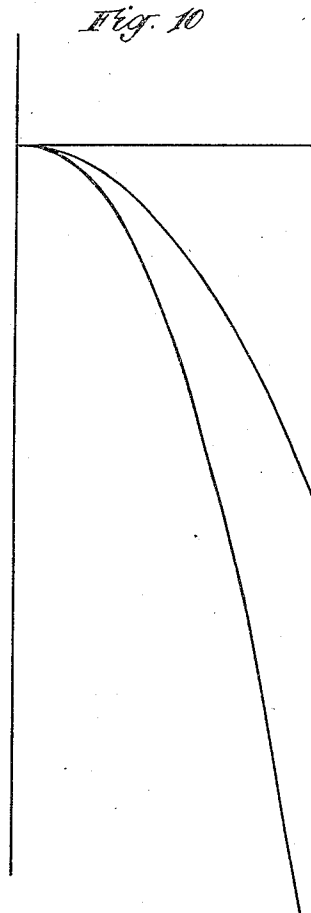
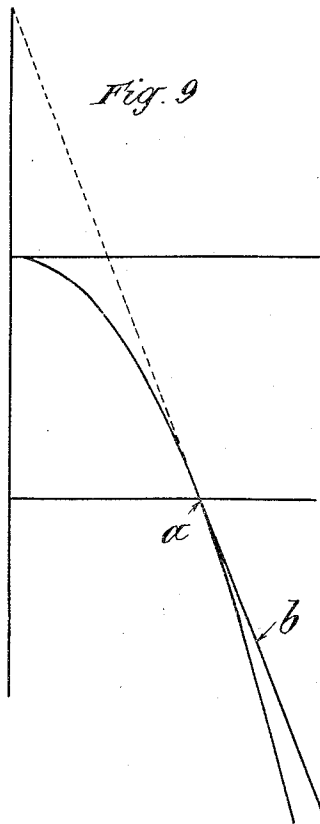
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INVENTOR:
François Gueugnon
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UNITED STATES PATENT OFFICE.

FRANÇOIS GUEUGNON, OF PARIS, FRANCE

APPARATUS FOR RECORDING VARIOUS PHENOMENA BY THE MOVEMENT OF THE RECORDING-STRIP.

1,379,916.

Specification of Letters Patent.

Patented May 31, 1921.

Application filed February 23, 1918. Serial No. 218,880.

To all whom it may concern:

Be it known that I, FRANÇOIS GUEUGNON, citizen of the Republic of France, residing at 54 Rue de Bondy, Paris, in the Republic of France, have invented new and useful Improvements in Apparatus for Recording Various Phenomena by the Movement of the Recording-Strip, of which the following is a specification.

The invention relates to an apparatus which is applicable in a general manner to the observation of all phenomena which are a function of time, and its principle is characterized by the fact that the displacement of the paper strip used for recording the diagram of the movement in question, is intimately connected with such movement and participates in all its variation either in their actual magnitude or on a reduced scale in known proportion.

In the apparatus used at present for the observation of these phenomena, the record strip is displaced by means of a clockwork movement or any other suitable motor, and at a known speed, but the displacement of this strip is always independent of the phenomenon under observation.

The accompanying drawings illustrate the principle of the apparatus.

Figures 1 and 2 show a diagrammatic view, in front and side elevation, of an apparatus designed according to the invention, and in which the record of the movement under observation is obtained by a pendulum device.

Figs. 3 and 4 are views which are respectively analogous to Figs. 1 and 2, and relate to an apparatus which differs from the preceding in the fact that the record of the movement is obtained by the use of a slide having a linear movement and displaced by a clockwork device.

Figs. 5 to 8 are curves which are produced by the first apparatus when the same is employed for verifying the laws of falling bodies and different principles of mechanics.

Figs. 9 to 11 are curves similar to the preceding and are produced by the apparatus shown in Figs. 3 and 4.

In the drawings, the same reference characters are used to denote similar parts in the two constructional forms of the apparatus.

When reduced to its essential details, the apparatus consists of a very easy running

pulley 1 having upon its shafts a drum 2, the diameters of the pulley and the drum being in known ratio. The drum is provided with a rubber sleeve 3 upon which is placed the paper recording strip 4 hanging freely from the sleeve 3.

Said recording strip may have two ends and be slightly stretched by means of two small weights or strips 5, one of which is attached to each end of said strip. The strip can also be formed by an endless band slightly stretched by means of a weight, this arrangement avoiding a difference of weight when the paper is unrolled.

The strip may be guided in any suitable manner, and it is drawn along by the drum by the simple action of its adherence to the rubber surface 3. In this way the strip always moves in accordance with the pulley 1. Supposing this pulley to rotate by the effect of the mechanical movement under observation, the paper strip will be displaced in function of this movement. A pointer 6 is disposed in front of the strip so as to be able to contact with a freely hanging part of the same. Said pointer is displaced in function of the time, and this allows of recording the curve representing the movement in question.

The present apparatus is specially adapted for use in verifying the laws of falling bodies and the different mechanical principles, and this use is specially referred to in the drawings.

To this effect, two equal masses M are hung at the two ends of a wire 7 running in the groove of the pulley 1. To one of the masses is added a small additional mass m , and this causes the movement of the system $2M+m$ with an acceleration which is a fraction of the acceleration produced by the mass m falling freely and alone. In this way the paper strip is displaced according to the same law as m .

As shown in the apparatus (Figs. 1 and 2) the curve can be recorded by making use of a pendulum movement, and in this case the recording point 6, properly adjusted, is carried on an extension of the rod 8 of a pendulum mounted upon the pivots 9 and swinging in a plane parallel to the plane of the paper. When the pendulum reaches the vertical position, it acts to produce the release of the mass causing the movement, and the record is made in the shape of an

alternate curve of sinusoid shape. In this way the law of distances can be verified (Fig. 5).

The device for releasing the mass may comprise, as shown, a vertical sleeve member 10 carrying two horizontal arms 11 and 12 and adapted to pivot about the vertical post 20 carried by the frame of the apparatus. The mass M normally lies by its own weight upon the arm 11, which presents a sufficient horizontal plane surface for retaining properly the same in position. The arm 12 may be deflected laterally by the oscillating pendulum 8 passing through the vertical position, whereby the arm 11 is disengaged laterally from the mass M and allows the same to drop.

In order to verify the law of speeds, all that is required is to stop the mass m at a given point which can be readily located on the curve. The movement then becomes uniform, and from now on the curve is an exact sinusoid (Fig. 6).

The curves shown in Figs. 7 and 8 have been obtained by verification of the principle of proportionality of forces to the accelerations produced by such forces upon a given mass.

In like manner it is possible to verify other mechanical principles, for instance the principle of inertia, or to examine movements of widely varying character. For instance it is specially easy to record the movement of a pendulum by displacing the strip at a uniform rate during the swing of the pendulum.

In the apparatus shown in Figs. 3 and 4 the strip is displaced in the same manner as above indicated, but the recording pendulum is now replaced by a record point having a uniform movement. In this case the point 6 is mounted in a sliding piece 13 which is adapted to slide upon the rod 14 parallel to the plane of the paper. This sliding piece carries a small opening 15 in its base, through which passes a wire 16 stretched by a small weight 17 attached to one end, the other end of the wire being wrapped around a shaft 18 which is driven by an independent clockwork. The wire carries a simple knot 19 at a suitable point, which acts to draw the sliding piece upon arriving at the opening 15. On the sliding piece is mounted a small projection which acts to release the mass immediately upon the starting of the sliding piece.

Verification of the law of distances was effected in an experiment made with the apparatus (Figs. 3 and 4), and the parabola shown in Fig. 9 was thus obtained. The experiment was recommenced under the same conditions but the additional mass was stopped by means of an open sliding piece not shown at an instant determined in ad-

vance, corresponding to a certain point a of the curve. The recording point now followed the parabola up to the point a , and then left this curve and followed a straight line b which is in fact the tangent to the parabola at a . In this way, it is demonstrated that the movement becomes uniform from the moment when the additional mass is suppressed. The verification of the law of speeds is of the greatest importance, and is here effected under this form for the first time.

In Fig. 10 are shown the curves obtained with the same apparatus when used to verify the proportionality of forces to the accelerations produced by them upon the same mass. This experiment can be made by having several small additional masses m of which a certain number are placed on one of the masses M and a different number upon the other mass M , provided of course the total weight of said additional masses m be always the same.

Fig. 11 shows the result of an experiment for obtaining the resultant of two uniform rectangular movements having the speeds v and v' . This result is obtained by communicating to the paper strip of the apparatus illustrated in Figs. 3 and 4 a uniform movement either by causing the wire 16 to pass over the pulley 1 through the medium of a proper gearing or by stopping through the medium of an open slide the additional mass m which produces the movement of the paper strip.

By the use of similar arrangements, the apparatus allows of obtaining the resultant of a great number of movements.

It is evident that the two recording devices can be mounted independent of each other or both together upon the same base.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

An apparatus for recording two movements of any desired character comprising in combination, a pulley, means for rotating said pulley according to any desired law, a drum operatively connected to said pulley, a paper strip passing over said drum and hanging loosely therefrom, weights carried by the paper strip and adapted to stretch the same, means for causing the adherence of the paper strip to the surface of the drum, a recording point adapted to contact with a freely hanging part of the paper strip, and means for moving said recording point according to any desired law, substantially as described and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANÇOIS GUEUGNON,