

ART. LV.—*A Simple Chronograph Pendulum;*
by C. BARUS.

To give time to the chronograph, a break-circuit chronometer or a seconds clock is usually employed. Frequently, however, one is not in possession of this elaborate apparatus, or it is not expedient to make use of it. The following simple mechanism by which an ordinary seconds pendulum is both kept in motion and made to record its oscillations on one or more chronographs sharply, may therefore merit description.

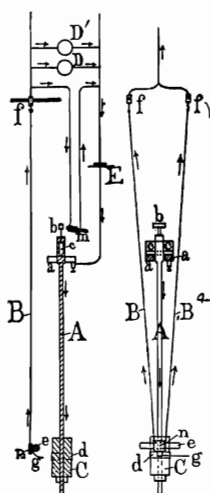


Fig. 1.

Fig. 2.

Figure 1 gives a sectional elevation of the device, figure 2 a side view with electric parts omitted. *A* is the seconds pendulum consisting of a light wooden rod (*A*) joining the heavy metallic bob *C* and the knife edge *c*. The latter is supported by the metallic plates *a*, and these and the bob are electrically connected. The top of the pendulum is surmounted by a soft iron armature *b*, actuated by the electromagnet *m* in the way presently to be described.

B is a longer and very much lighter pendulum, consisting of a flat bob *n* joined (bifilarly) by two very thin metallic wires (*B, B'*) to the adjustable suspension *f, f*. The bob *n* is prevented from oscillating toward the right by a rigid post *e*. A ribbon of platinum *d* is wrapped around the bob *C* and a quadrantal spring *g* of thin platinum foil projects from the bob *n* for the purpose of securing reliable electric contacts. The bob *n* consists of two small square parallel plates, between which the wires *B, B'* and the platinum strip *g* are clutched by a single central screw.

Current is obtained from batteries at *E* (two or more Leclanché cells) and circulates when the circuit is closed as shown by the arrows. *D, D'*, etc., are the chronographs to which time is to be given, these and the electromagnet *m* being joined in multiple arc.

The mode of action is easily intelligible. Whenever the circuit is closed by the bobs at *g d* a current passes through *m, D, D'*, etc.

Suppose the post *e* and the strip *g* to be removed, and the bobs *n* and *C* to be in inelastic contact. Then on moving *A* to the left, this pendulum will push the pendulum *B* in front

of it because the *time of oscillation of n is greater*. There will therefore be a magnetic pull in m throughout this motion. Conversely when both pendulums having reached their extreme elongation begin to return to the right, the bob C will run away from the bob n , and hence there will be no magnetic pull in m . Since the bob n is very light as compared with C , the result of these unilateral impulses applied at the proper time at b is to keep up the motion of the pendulum A .

In practice however the bobs n and C are never inelastic; neither is it at all desirable to keep up the contact for so long a time. In other words the record made at D would be irregular from interferences and the batteries would soon run down. Therefore the bob n is hung so that it would meet C when the latter is virtually at the end of its elongation, and a stop e prevents n from swinging further towards the right. Furthermore the spring g causes n to be hurled off ballistically and the contact is now quite momentary. Indeed n is made flat and in falling against e there is *no rebound*. I have found it advantageous to surround e with an end of rubber hose, and also to surround the ends of the armature b in the same manner to prevent them from sticking to the electromagnet. Again the pendulum B is made to lean slightly against the stop e , a slide at f being provided for this purpose.

The records show that the time of contact does not reach 0.1 sec., and this is the result which I wish to communicate. It is desirable to use electromagnets of high resistance to prevent exhausting the battery, though I have run the pendulum for days continuously with such means as I possessed. The apparatus can easily be made symmetrical by placing a second electromagnet similar to m , on the other side of b . This would furnish another set of records differing by about half a second from the first set.

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