(No Model.)

C. M. CROOK.

ELECTRIC WINDING MECHANISM FOR CLOCKS.

No. 534,320. Patented Feb. 19, 1895.

Fig. 1.

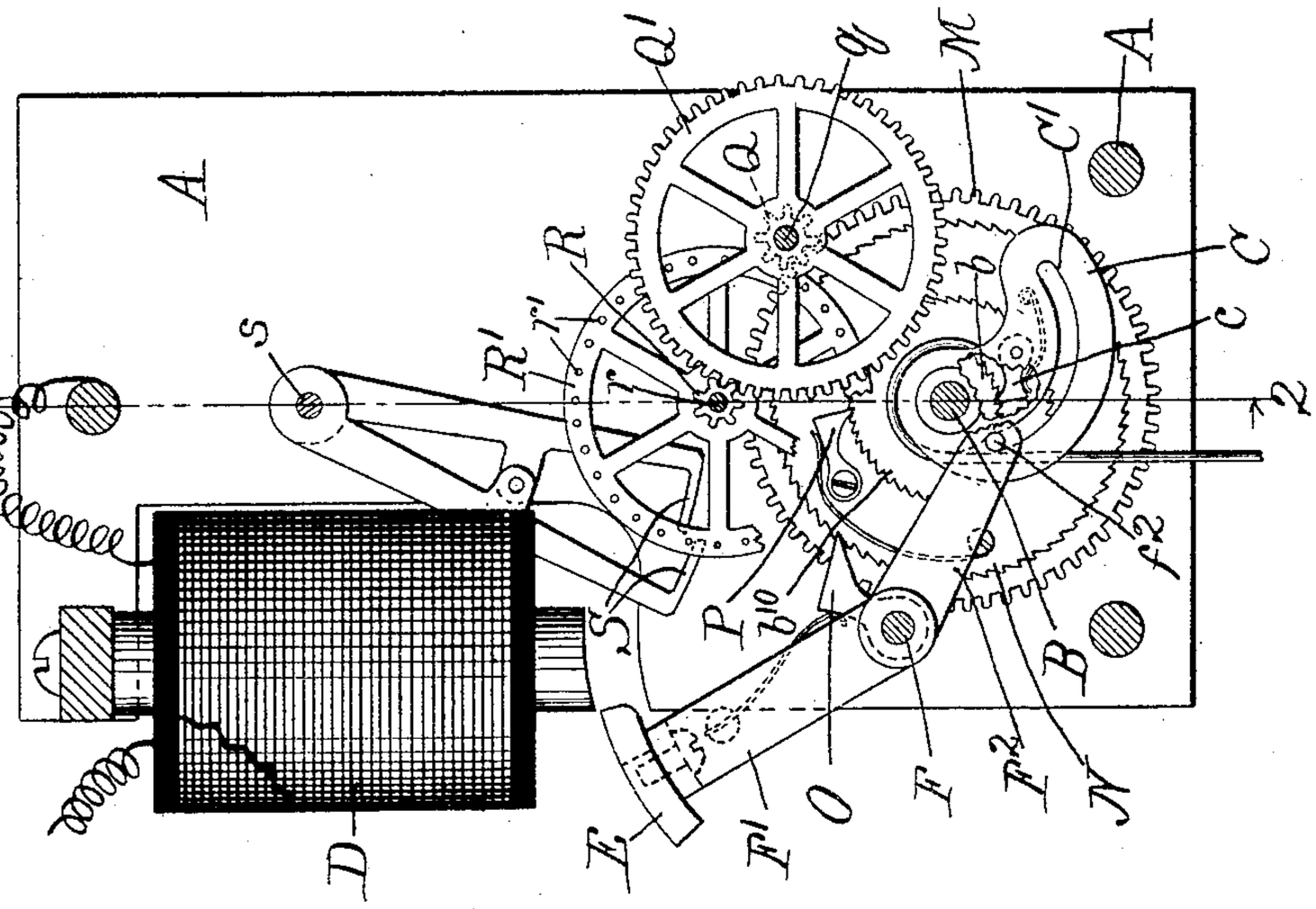


Fig. 2.

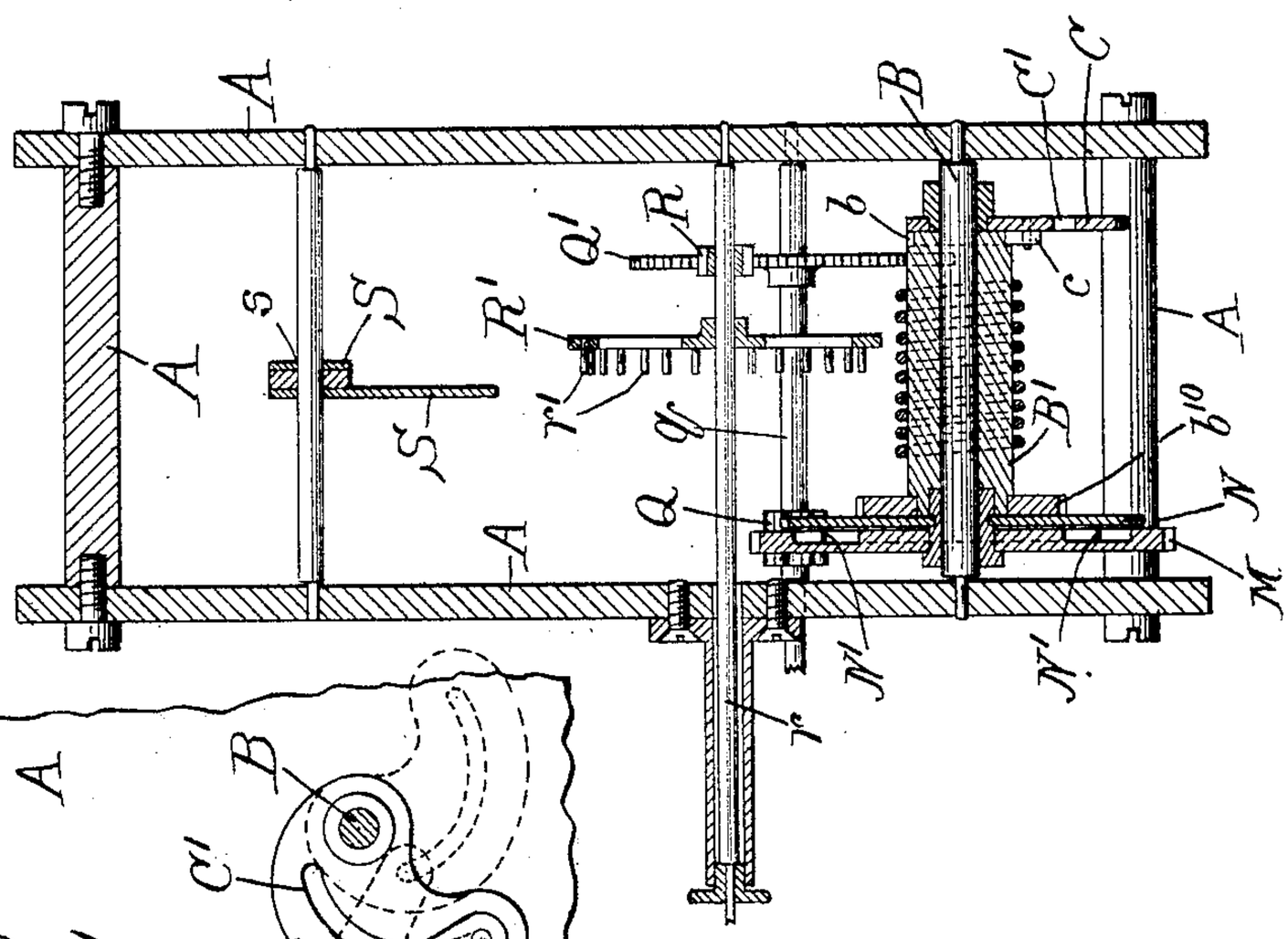
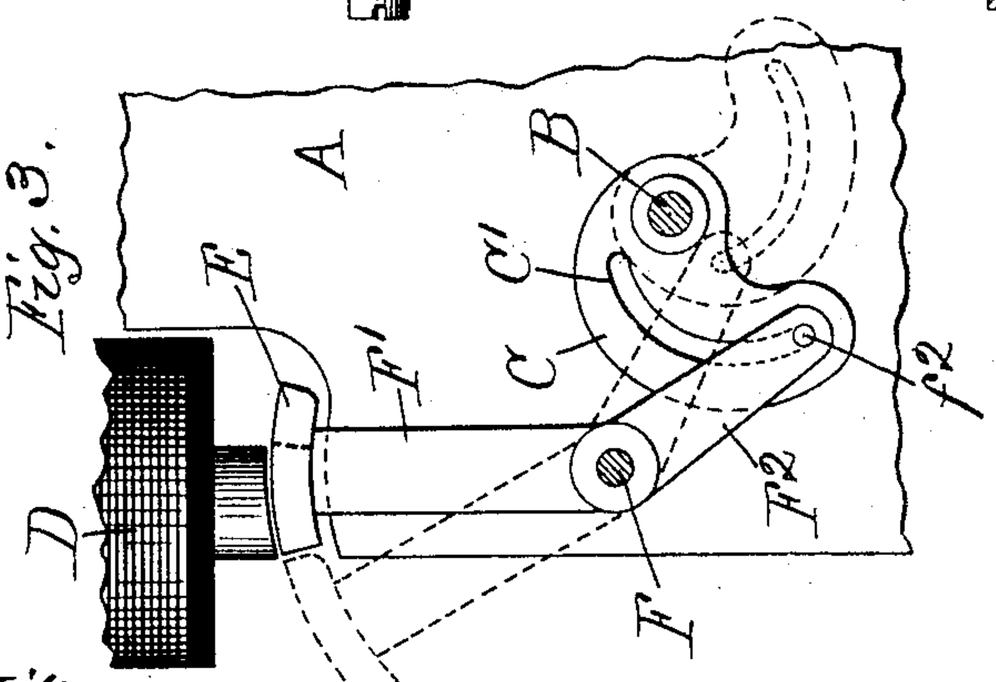


Fig. 3.



Witnesses.
E. T. Wray.
Jean Elliott.

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his attys

UNITED STATES PATENT OFFICE.

CHARLES M. CROOK, OF CHICAGO, ILLINOIS.

ELECTRIC WINDING MECHANISM FOR CLOCKS.

SPECIFICATION forming part of Letters Patent No. 534,320, dated February 19, 1895.

Application filed December 15, 1894. Serial No. 531,875. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. CROOK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Winding Mechanism for Magnetic Chronometers, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings:—Figure 1 is a front elevation of a portion of the movement of a chronometer having my improved winding devices, certain parts being broken away to show other parts behind them. Fig. 2 is a section at the line 2—2 on Fig. 1. Fig. 3 is a detail elevation of the device immediately actuating the winding shaft drum or barrel, showing the two positions, one in dotted line corresponding to the position shown in Fig. 1, and the opposite extreme position shown in full line.

The character of the movement to which my device is shown applied is one in which the seconds hand is at the same center as the other hands. I have not illustrated what is known as the "face train" or train leading from the driving train to the hour and minute hands, because my invention has to do only with the winding devices.

Various parts of the frame are indicated by the letter A.

B is the main shaft, or shaft to which the motive power is primarily applied. I have represented the movement designed to be driven by a weight, and have therefore shown upon this shaft a drum B′ for winding the cord-carrying weight. My invention, however, is not limited to a weight-actuated mechanism.

C is a lever pivoted concentrically with the winding drum shaft or barrel, and having a pawl *c* co-operating with a ratchet disk *b* on the winding drum to rotate the latter by a step motion as the lever is oscillated about the shaft.

D is an electro-magnet which may be energized by a circuit indicated by the leading-in wires. It will be understood that this circuit is closed at intervals by suitable contact devices in train, and as these contact devices may be of any familiar character they are not represented.

E is the armature for the magnet. It is carried at the end of the lever F′ of the rock shaft F, which has another lever arm F^2 projecting from the rock-shaft within the sweep of the lever C,—that is, so that the two levers pass near each other and sweep about their respective pivots. The lever arms F′ and F^2 may be treated as constituting a single lever fulcrumed at the rock-shaft, and it will be so referred to. The lever C has a slot C′ constituting a cam track which is widely eccentric with respect to the fulcrum of the lever, and the lever arm F^2 has an abutment f^2, preferably a stud and roll, to avoid friction, which enters the cam track *c*′, and thereby engagement between the two levers is effected. When the armature E is not attracted by the magnet, it is in the position shown in full lines in Fig. 1, and in that position the abutment f^2 is at the inner end of the cam track *c*, that is, the end nearest the pivot of the lever C. The sweep of the lever arm F^2 produced by the movement of the armature from the position shown in Fig. 1 to the position shown in Fig. 3, such movement being induced by the energizing of the magnet and the consequent contact of the armature theretoward, carries the abutment away from the center of the shaft B a distance equal to the total eccentricity of the cam track; and the circumferential or angular extent of the cam track,—that is, its extent in the circuit of the shaft B,—is greater than the angular movement of the lever arm F^2, which sweeps across the eccentricity of the cam track, as stated. The ratio between the two angles,—to-wit: the angle measured at the axis of the shaft B by the total extent of the cam track, and the angle measured at the axis of the rock-shaft by the sweep of the lever arm F^2, may be made greater or less, as desired, within certain limits of practicability dependent upon the friction of the parts, &c. As I have designed the angular extent of the cam track is about three times the angular sweep of the lever F^2; from which it results that for a given angular movement of the lever F^2, I obtain three times the angular movement of the lever C. Furthermore, through the latter part of the movement of the abutment f^2, caused by the attraction of the armature to the magnet, said abutment is operating upon

the lever C, and by means of the pawl and ratchet engagement of the latter with the winding drum, is operating upon the latter with a leverage greater than its movement, the increase of leverage being regularly progressive from the commencement to the end of the movement; and the precise form of the curve of the cam track may be made such as to adapt this gain of leverage to the purpose sought as accurately as desired. The first purpose of thus multiplying the movement is to take advantage of the necessarily short movement of the armature to produce as long a winding movement as possible with the amount of power developed by the magnet, and the second purpose is one which will be understood upon considering that while a magnet is energized the armature at its most remote position from the poles is attracted to the poles the line of force operating between the magnet and the armature being one which would be drawn from the true magnetic pole, which is a little back of the end of the mechanical pole, to the magnetic center of the armature; but that the armature cannot follow this line of force, being compelled to follow the curve about its rock shaft, and that, while at the commencement of its movement it travels approximately in the direction of the line of attraction, its angle of variance from that direction increases rapidly as its magnetic center approaches a line drawn from the center of its rock shaft to the magnet pole; and that, when that line is reached by the magnetic center of the armature, the attraction of the magnet no longer tends to induce motion of the armature, but tends rather to hold it at that point, which is the point of greatest approximation of the armature to the poles. Although, therefore, the force of attraction of the magnet for the armature increases as the armature approaches the magnet, the proportion of the force which is available to produce motion of the armature or any part moved thereby, is diminishing more rapidly than the total force itself is increasing. The result would be,—with a uniform resistance or uniform work to be done by the armature's movement,—that the force would have to be at the commencement much greater than necessary for the work, or else it would be insufficient before the end of the movement. By providing for the progressive gain of leverage of the lever arm F^2 in its action upon the lever C, by means of the eccentric cam track described I aim to compensate for the progressive loss of motive power as the armature approaches the magnet, so that the total sweep of the armature, which is necessarily short at best, may be available to produce winding movement to the full extent of the power developed at all points of the armature's movement. In producing the precise rate of progression of leverage desired or necessary in order to compensate for the progressive loss of the power due to the attraction of the magnet for its armature as the latter moves, the distance between the rock-shaft F and the shaft B, and the relation of the length of the lever arm F^2 to that distance, have to be considered, and the gain of leverage is partly offset by some loss of advantage due to the progressive change in the angle at which the abutment acts upon the cam track.

Without attempting to define mathematically the most advantageous position and shape, I find that which I have illustrated to be fairly serviceable and to be substantially adapted to the purposes stated.

I have shown other parts of the chronometer movement which are not directly concerned in my invention, but which are illustrated merely to indicate the feasibility of applying my invention to such a movement. These parts which may be mentioned without further description are,—the gear wheel M, or main gear wheel on the shaft B, the retaining wheel N and the retaining spring N′, which connects said wheel to the gear wheel, the pole O, which locks the retaining wheel (this pole is conveniently mounted on the rock-shaft F, which is suitably located for that purpose); the pawl P, pivoted on the retaining wheel and engaging the ratchet b^{10} on the winding drum; the pinion Q on the shaft q, meshing with the great wheel, and the gear Q′ on the same shaft meshing with the pinion R on the shaft r which has the escapement wheel R′ with pin teeth r' co-operating with the escapement fingers S pivoted at s, and adapted to be oscillated by a pendulum in any familiar manner.

The intermediate shaft q extends through the front of the frame and is the shaft from which the face train may be driven.

I claim—

1. In a chronometer, in combination with the winding-up shaft, drum or barrel, a lever pivoted concentrically therewith, and a device by which the lever rotates the shaft, drum or barrel in one direction; an electro-magnet and its armature and a lever which carries the latter; the said two levers having one an eccentric cam track and the other an abutment adapted to engage the cam track to actuate the lever as the armature is reciprocated: substantially as set forth.

2. In a chronometer, in combination with the main winding-up shaft, drum or barrel, a lever pivoted concentrically therewith and having an eccentric cam track; a device by which the lever rotates the shaft, drum or barrel in one direction; an electro-magnet and its armature and a lever which carries the latter having an abutment which engages the cam track of the other lever: substantially as set forth.

3. In a chronometer, in combination with a winding-up shaft, drum or barrel, a lever pivoted concentrically therewith and having an eccentric cam track; the pawl and ratchet device by which it may rotate the shaft, drum or barrel, an electro-magnet and its armature

and a lever which carries the latter, provided with an abutment adapted to engage the cam track; the pivots of said levers and the length of the abutment-carrying lever being so related to each other, and the eccentric cam track being of such form that the angular movement of the abutment-carrying lever which causes its abutment to sweep across the entire eccentricity of the cam track, is less than the angular extent of the cam track about the fulcrum of the lever having the same: substantially as set forth.

4. In a chronometer, in combination with a winding-up shaft, drum or barrel a lever pivoted concentrically therewith, and a pawl and ratchet device by which it rotates the shaft, drum or barrel, said lever being provided with a cam track eccentric to the shaft; the electro-magnet and its armature and the lever which carries the latter having an abutment adapted to engage the cam track at the inner point of the latter when the armature is remote from the magnet, and to sweep across the eccentricity of the cam track as the armature approaches the magnet, the angular extent of the cam track being greater than the angular movement of the abutment-carrying lever which is measured by the eccentricity of the cam track: substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 21st day of June, 1894.

CHAS. M. CROOK.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.