

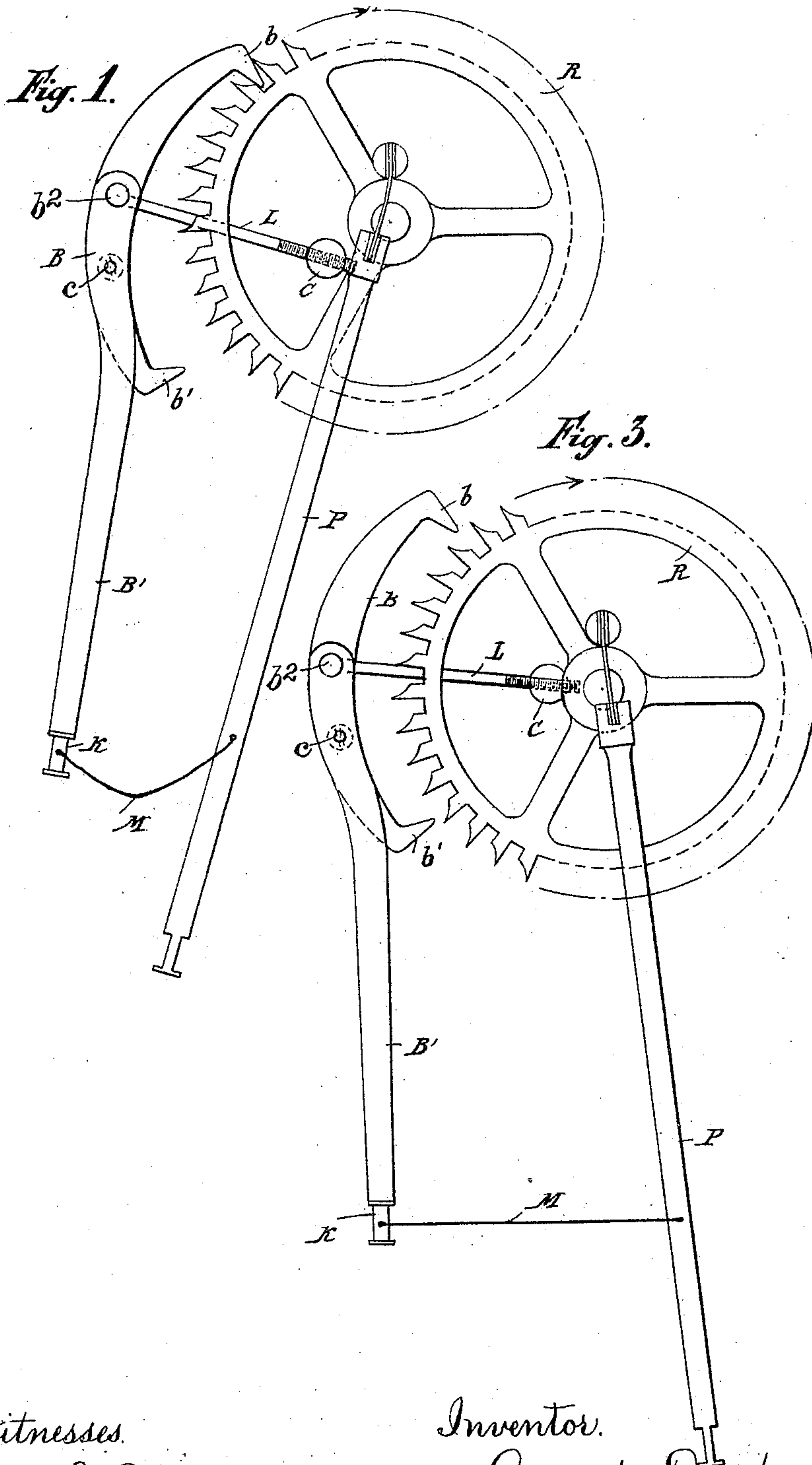
(No Model.)

3 Sheets—Sheet 1.

A. DARDENNE.  
PENDULUM ESCAPEMENT.

No. 574,984.

Patented Jan. 12, 1897.



Witnesses.  
Walter E. Allen.  
S. Allen.

Inventor.  
Auguste Dardenne.  
By *Knight Bros*  
Attorneys.

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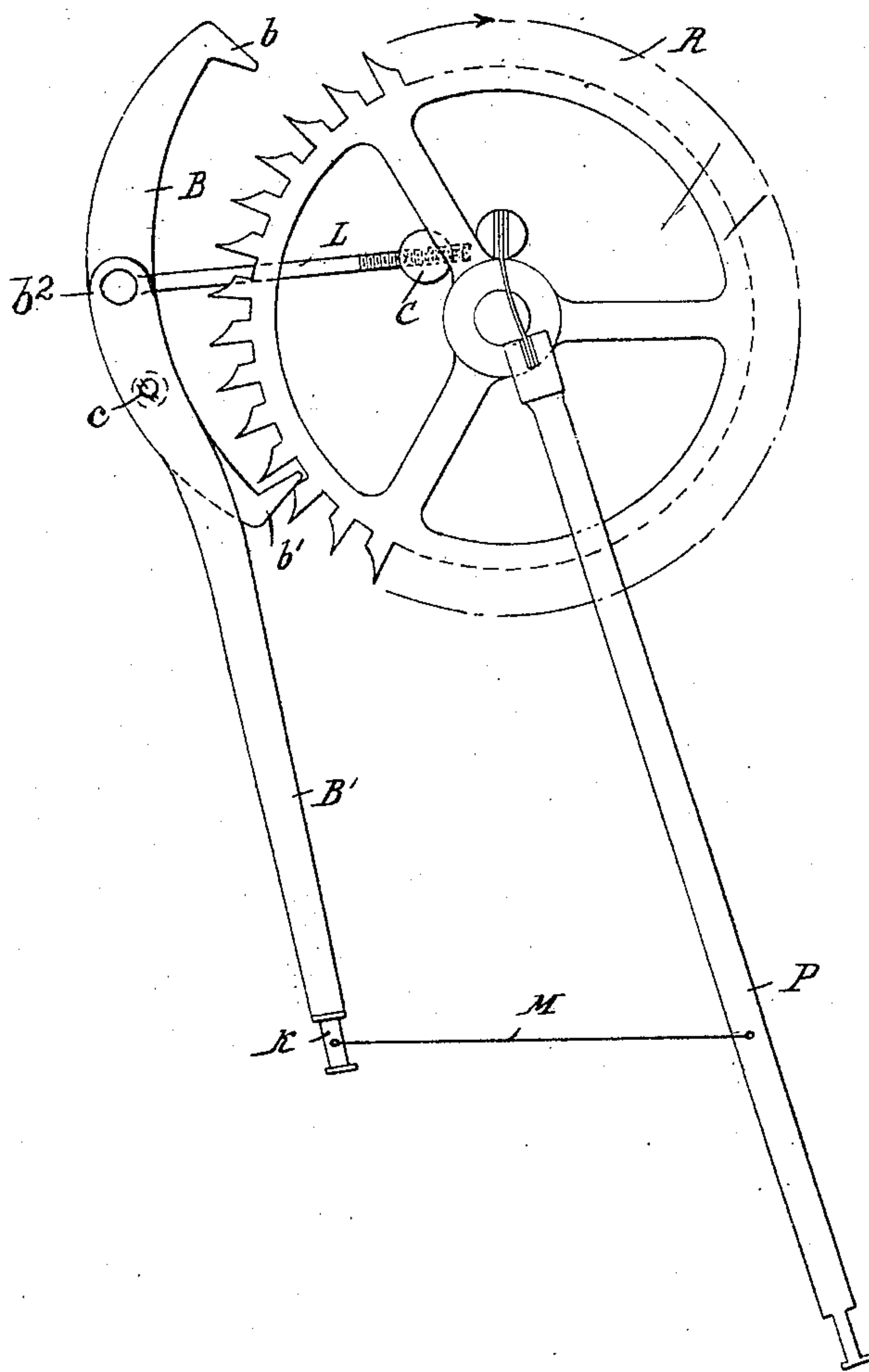
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*Fig. 2.*



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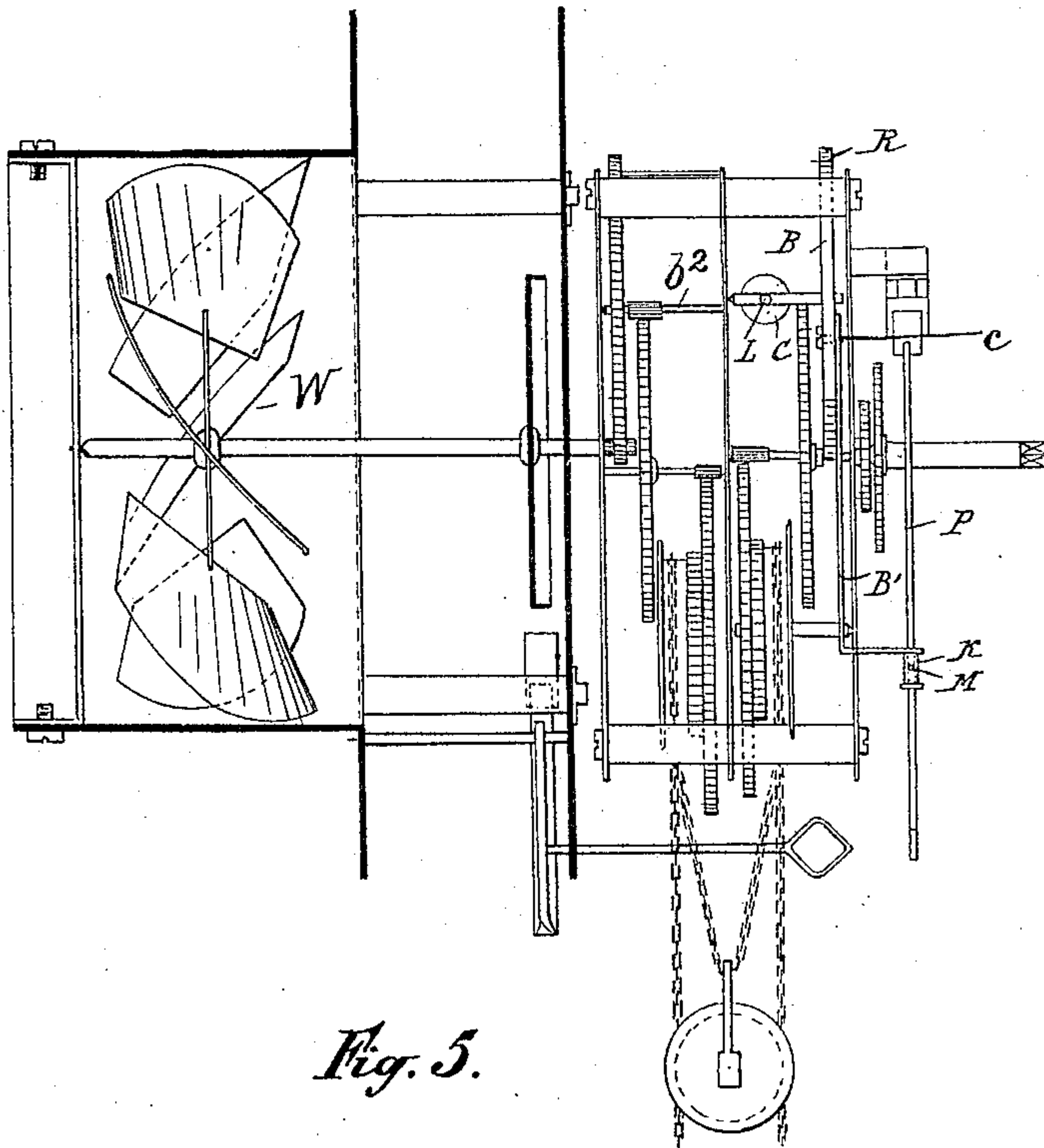
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PENDULUM ESCAPEMENT.

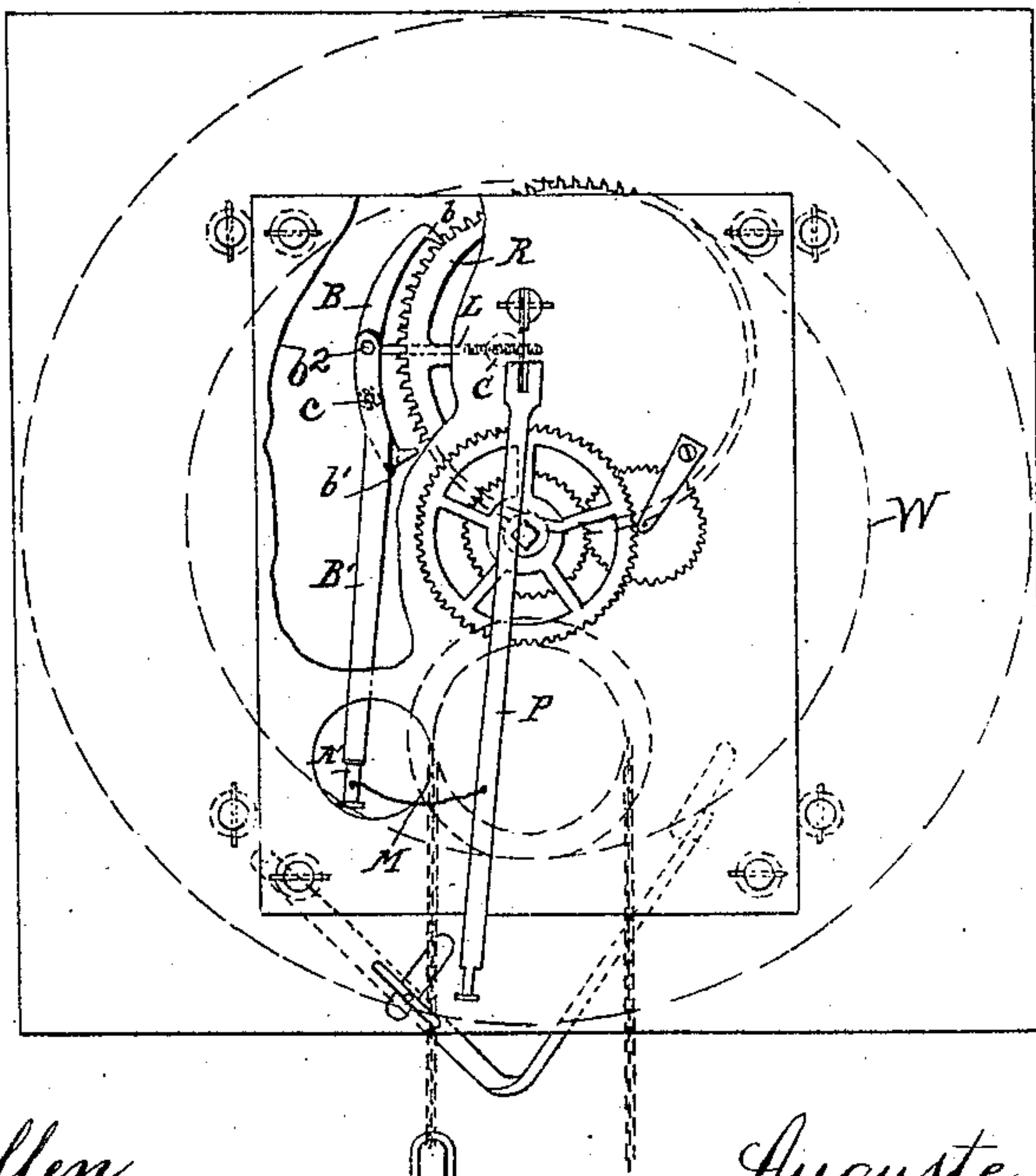
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*Fig. 4.*



*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

AUGUSTE DARDENNE, OF BRUSSELS, BELGIUM, ASSIGNOR TO LA SOCIÉTÉ ANONYME POUR L'EXPLOITATION DES BREVETS DARDENNE, OF SAME PLACE.

## PENDULUM-ESCAPEMENT.

SPECIFICATION forming part of Letters Patent No. 574,984, dated January 12, 1897.

Application filed August 11, 1894. Serial No. 520,076. (No model.) Patented in Belgium June 30, 1894, No. 110,764; in France July 9, 1894, No. 239,914; in England July 16, 1894, No. 13,690; in Germany July 17, 1894, No. 80,170; in Switzerland July 17, 1894, No. 8,696; in Italy July 17, 1894, No. 36,870/266, and in Austria July 27, 1894, No. 5,675.

*To all whom it may concern:*

Be it known that I, AUGUSTE DARDENNE, watchmaker, a subject of the King of Belgium, and a resident of Brussels, in the Kingdom of Belgium, have invented certain new and useful Improvements in Escapements for Pendulum-Clocks, of which the following is a specification.

Patents for this invention have been obtained in the following countries: Belgium, No. 110,764, dated June 30, 1894; France, No. 239,914, dated July 9, 1894; Great Britain, No. 13,690, dated July 16, 1894; Germany, No. 80,170, dated July 17, 1894; Switzerland, No. 8,696, dated July 17, 1894; Italy, No. 36,870/266, dated July 17, 1894, and Austria, No. 5,675, dated July 27, 1894.

In pendulum-clocks heretofore constructed the escapement-anchor has been connected to the pendulum in such a manner as to cause it to follow vigorously the movements imparted to it by the vibrations of the latter. In other words, the escapement-anchor is prevented from making any movement independent of the pendulum, or, in still clearer language, its movements are imparted to it directly by the pendulum. The result is that all irregularities inherent in the movement of the pendulum are necessarily communicated to the escapement-anchor and through the latter to the escapement-wheel, thereby compromising the regularity of the motion which it receives from the driving power. This all the more obvious from the fact that at each motion of the pendulum the engaged pallet of the escapement-anchor is constantly in motion during the whole time it is entering and leaving the teeth of the escapement-wheel.

The arrangement forming the subject of the present invention obviates the before-mentioned inconveniences through the peculiar manner of connecting the pendulum to the escapement-wheel, whereby at every half-motion of the pendulum one of the pallets of the escapement-anchor shall stop the escapement-wheel and hold it independent of the further movement of the pendulum for an almost definite and invariable period,

during which the pendulum is allowed to finish its half-motion in full liberty, while on the return motion the other pallet of the escapement-anchor shall stop the escapement-wheel in the ordinary way and receive from the latter a fresh impulse to recommence its motion. The result of this arrangement is to obtain for each complete vibration of the pendulum an invariable time for stopping and only a single impulse, which is quite sufficient, as during the next beat the pendulum gains enough force through its partial disconnection from the escapement-anchor to enable it to accomplish its return motion.

In order that my invention may be fully understood, I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 is a front elevation of my improved escapement for pendulum-clocks, showing the invariable position of stoppage. Fig. 2 is a similar view showing the same in position of impulse. Fig. 3 is a like view showing the position of the escapement-anchor immediately before its fall. Fig. 4 is a longitudinal section of a clock provided with my improved escapement and with my pneumatic winder to maintain the weight at a constant height. Fig. 5 is a front view of the clock.

As will be seen in the drawings, B is the escapement-anchor, which is not, as usual, arranged above the escapement-wheel R, but it is located at one side thereof, where it oscillates freely on its center of motion, which consists of a rock-shaft  $b^2$ , suitably mounted in the clock-frame. From this center or rock-shaft extends laterally and inwardly an arm or lever L, having a screw-threaded end, upon which is screwed or tapped an adjustable counterpoise or weight C, which determines the fall of the upper pallet  $b$  as soon as it is left to itself, that is to say, disengaged from the pendulum P, and carries the arm B' of the escapement-anchor to the extent of its outward movement by overbalancing the weight of the anchor-arm. This anchor-arm B' is fixed to the center or rock-shaft of the escapement-anchor and to the latter by a screw c or other suitable fastening and extends



downward either vertically or in a position more or less inclined from a vertical line, but always so that an action exerted by reason of the direction of the arm in contrary direction to that of the counterpoise C shall always be overcome by the latter and cannot prevent the fall of the upper pallet as soon as the escapement-anchor is liberated. The anchor-arm B' takes the place of the old fork-arm to effect connection between the escapement-anchor and the pendulum, but not in the old invariable and permanent manner, but in an adjustable and temporary manner, so that at a given moment the escapement-anchor shall find itself solely under the influence of the counterpoise and that the pendulum shall complete its motion in full liberty. For this purpose the lower extremity of the anchor-arm B' is connected to the pendulum by means of a connection effecting at the required times the said connection and disengagement of the two parts, and the member enabling these two functions to be realized in the most simple manner is a flexible connection M, preferably a cord capable of being lengthened or shortened at will to obtain the exact adjustment between the escapement-anchor and the pendulum by a rotatable stud K, turning with sufficient friction in the lower end of the anchor-arm B' and upon which the cord is wound. The adjustment being arranged between the lower end of the anchor-arm and the pendulum, the regulation of the entire system either fast or slow is effected by shifting the counterpoise C upon the arm L, so that no matter what is the position of the bob on the pendulum the speed can always be regulated by turning the counterpoise C on the arm L in such a manner that each motion corresponds always exactly with the passage of one tooth of the wheel in the desired time and at the fraction of motion during which the pendulum vibrates freely and the wheels are stopped.

The working of this escapement can be readily understood from the preceding description. The pendulum having accomplished its full motion toward the right (see Fig. 2) the lower pallet b' of the escapement-anchor stops the wheel in its movement in the direction of the arrow in the ordinary manner. Then in the commencement of its motion toward the left the tooth pressing against the lower pallet b' gives impulse to the clockwork to drive the pendulum toward the left, in which motion it is again assisted by the counterpoise C of the escapement-anchor as the flexible member or cord M is distended, that is to say, the pendulum and the escapement-anchor are connected together. This state of rigidity is maintained to about half of the motion of the pendulum, which is then in its vertical position. About this moment the upper

pallet b of the escapement-anchor commences to touch the face of the corresponding tooth, and from this moment it no longer moves with the pendulum, which continues its motion and slackens the flexible member or cord M, while the counterpoise C effects the fall of the upper pallet b, which then invariably stops the wheel during the period in which the pendulum completes its motion toward the left, which then returns to again distend the cord, raise the upper pallet b, and recommence the same motions. It will be noticed by this agency the wheel is stopped at each tooth or for one-half a stroke or vibration of the pendulum during a constant and invariable period.

It will be understood that the speed of oscillation is suitably regulated with relation to the rotation of the wheel. Thus the working of the clock will be of an almost absolute precision. This precision is further increased in having combined with the clockwork having my improved escapement, hereinbefore described, an automatic winding apparatus, (represented in Figs. 4 and 5,) consisting of a pneumatic fan or wind-wheel working so as to maintain the weight at about the same height of the spring at a constant tension if this latter motive power is used instead of a weight. The blades of this fan can be connected with a draft-flue or otherwise exposed to the action of a constant current of air, which operates it.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. An escapement for pendulum - clocks comprising an escapement-wheel, a pendulum, an escapement-anchor having an upper pallet, a lower pallet, and an anchor-arm, a rock-shaft, whereby the escapement-anchor is supported, having a laterally-extending arm provided with a counterpoise, and a flexible connection between the pendulum and the arm of the escapement-anchor; substantially as described.

2. An escapement for pendulum - clocks comprising an escapement-wheel, a pendulum, an escapement-anchor having an upper pallet, a lower pallet, and an anchor-arm provided with a rotatable stud at its lower end, a rock-shaft whereby the escapement-anchor is supported, having a laterally-extending arm provided with an adjustable counterpoise, and a flexible connection between the pendulum and the rotatable stud of the arm of the escapement-anchor; substantially as described.

AUGUSTE DARDENNE.

Witnesses:

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GREGORY PHELAN.