J. THOMSON.
Watch-Escapement.

No. 197,430. Patented Nov. 20, 1877.

Fig. 1.

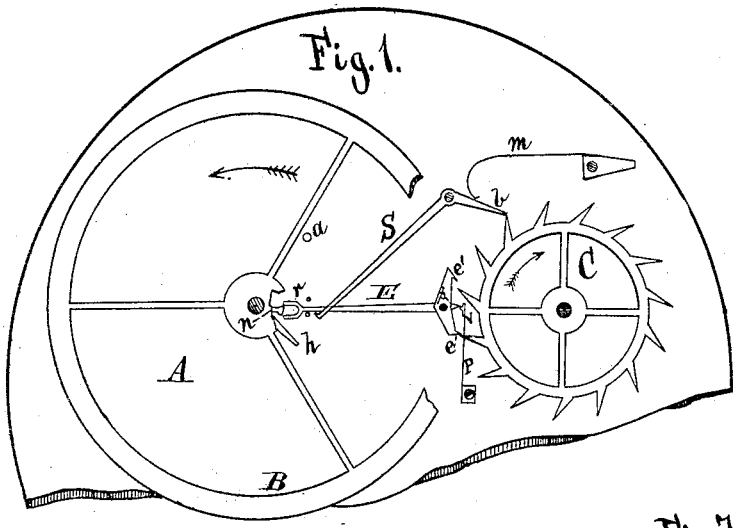


Fig. 7.

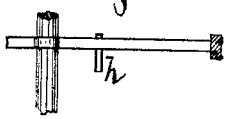


Fig. 2.

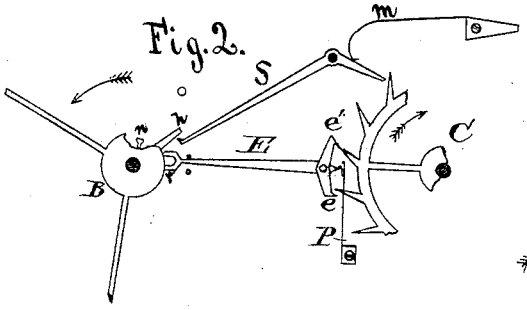


Fig. 3.

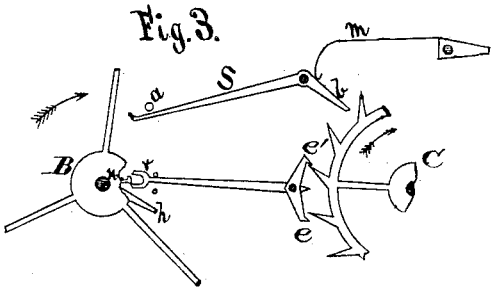


Fig. 4.

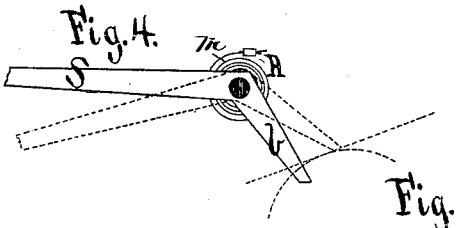


Fig. 5.

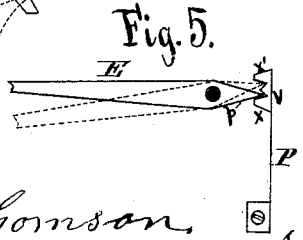
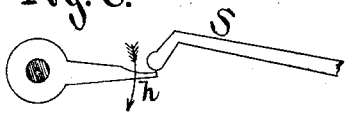


Fig. 6.



Witnesses:-

Alexander Thomson.

C. B. Moore

Inventor:-

John Thomson

UNITED STATES PATENT OFFICE.

JOHN THOMSON, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN WATCH-ESCAPEMENTS.

Specification forming part of Letters Patent No. **197,430**, dated November 20, 1877; application filed October 18, 1877.

To all whom it may concern:

Be it known that I, JOHN THOMSON, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Watch-Escapements, of which the following is a specification:

This invention relates to certain improvements upon the invention for which Letters Patent of the United States were granted to me the 28th day of August, 1877, No. 194,744, in which the impulse is given to the balance-wheel of a watch or other time-keeper by means of an impulse device operated by the escape-wheel, but acting independently of the same and of the escape-lever, whereby a uniform movement is transmitted to the balance-wheel, and the operation of the same is rendered entirely independent of any irregularities in the operation of the main works of the watch.

The object of my invention is to provide for the more accurate and reliable operation of the impulse device and the mechanism by which it is operated; and to this end it consists in the combination, with the lever which actuates the balance and the escape wheel, of an escape-lever constructed and arranged to give an alternate short and long drop to the escape-wheel, whereby the impulse-lever is thrown instantly into position for operation at the proper time, as more fully hereinafter set forth.

My invention also consists in the combination, with the escapement-lever, of a banking device, whereby said lever is held in position until the discharging-pallet enters the fork of the escapement-lever, and the accidental unlocking or "overbanking" of said escapement-lever is prevented.

My invention further consists in certain unions, combinations, and arrangements of the parts of the escapement, as more fully hereinafter specified.

In the drawings, Figure 1 represents a view of my improved escapement, showing the parts in position to give the impulse to the balance-wheel. Fig. 2 represents a view of the escapement, showing the parts, in the act of giving the impulse-stroke. Fig. 3 represents a view of the escapement, showing the position of the parts after the impulse-stroke has been given. Fig. 4 represents an enlarged detached view of the impulsator, showing the correct angles of the pallet and face. Fig. 5 represents an enlarged view of the safety banking device detached. Fig. 6 represents an enlarged detached view of the stroke-faces of the impulsator and impulse-pallet, and Fig. 7 represents a detached side elevation of the balance-pivot and cross-bar.

In the drawings, the letter A represents one of the supporting-plates of a watch or other time-keeper; B, the balance-wheel, and C the escapement-wheel. The letter E represents the escapement-lever, pivoted between the balance-wheel and the escapement-wheel, or to any other convenient part of the supporting-plate.

The letters *e e'* represent the pallets of the escapement-lever, and *r* its fork, in which the roller-jewel *n* of the balance-wheel works to actuate said escapement-lever.

The letter P represents a spring, secured at one end to a block attached to the supporting-plate A, its free end being provided with a banking-stop, V. (Shown on an enlarged scale at Fig. 5.)

The letter S represents the impulse-lever, pivoted at one side of the escapement-wheel; and *b*, its pallet, which is located in such position, with respect to the teeth of the escapement-wheel, as to be properly actuated thereby, as more fully hereinafter explained. The said impulse-lever extends forward into proper position to operate the pallet *h* of the balance-wheel, its motion being limited by means of a banking-stop, *a*, secured to the plate A of the watch.

The letter *m* represents the impulse-spring, which operates the impulse-lever to give the impulse to the balance-wheel.

The operation of my invention is as follows: As represented in Fig. 1 of the drawings, one of the teeth of the escapement-wheel C is in contact with the escapement-lever pallet *e*, while another tooth of the escapement-wheel holds the pallet of the impulse-lever back against its spring *m*, retaining said impulse-lever in position to give the impulse to the balance-wheel when the pallet *b* is released from the tooth of the escapement-wheel.

While the escapement-wheel and impulse-lever are in the above-described relative posi-

tions, the discharging-pallet *n* of the balance-wheel is just entering the lever-fork *r*. The balance, moving in the direction of the arrow, Fig. 1, carries the lever forward, and relieves the escape-wheel tooth at the pallet *e*, after which the parts assume the positions shown in Fig. 2.

The forward movement of the balance-wheel, having unlocked the escape-wheel, allows it to pass forward to the pallet *e'*, at the same time releasing the pallet *b* of the impulse-lever from the tooth of the escapement-wheel; the impulse-lever being then instantly set forward by the spring *m*, its forward end falls in contact with the pallet *h*, carrying it forward, and imparting the impulse to the balance-wheel. The impulse-lever moves forward until arrested by the banking-stop *a*, after which the balance-wheel takes its return movement, as shown in Fig. 3. By this movement the escape-wheel tooth will be relieved from the pallet *e'*, when another tooth, coming in contact with the impulse-lever pallet *b*, will cause the parts to again assume the positions shown in Fig. 1.

By reference to Figs. 1 and 2, it will be observed that the escape-wheel drop from the pallet *e* to the pallet *e'* is very slight, being just enough to allow the release of the impulse-lever S, but when the escape-wheel is again released at the pallet *e'*, Fig. 3, the drop is much greater than in the first instance. During the long escape-movement just described, the impulse-lever is thrown into position for action, the escape-wheel moving after the first instant o f relief entirely free and unimpeded until it strikes the impulse-pallet *b*. By this means the momentum of the train acquired while the long escapement is taking place, as well as the power of the mainspring, is utilized to set the impulse-lever into position for action, effecting this instantly, the stroke from the escape-wheel operating like the stroke of a hammer; and in order that the momentum may be as great as possible, the train-work, and especially the escape-wheel, should be made as heavy and solid as possible, instead of light and open, as ordinarily constructed.

Although the escape-wheel drop is alternately short and long, the alternate movements of the escapement-lever and pallets *e*·*e'* are identical. This provides for a uniform movement of the discharge-pallet and lever-fork, and prevents the watch from being "out of beat," which would be a serious obstacle to perfect time-keeping, as well as very disagreeable to a sensitive ear.

The face of the pallet of the impulse-lever *b* is so formed as to be tangent to the arc of its escapement-wheel, as shown on an enlarged scale in Fig. 4, in order that the discharge of the escape-wheel may be unimpeded, and, instead of the spring *m*, a spiral impulse-spring may be employed to actuate the impulse-lever upon its impulse-stroke. The impulse-lever should be carefully and perfectly poised, so that the impulse of the balance-wheel may be derived wholly from the impulse-spring, and be the same in whatever position the watch may be placed. In order to provide for perfect accuracy of the impulse-lever, its contact-faces and pallet should be so constructed that the distance from the center of the pivot of the impulse-pallet to the center of the pivot of the impulsator, measured through the center of the point of contact, shall be the same in any part of the arc of impulse, thus providing for a rolling action at the point of contact, instead of a sliding action, whereby the friction is reduced to a minimum. The contact-faces, in order to assist in effecting this object, are constructed in the form of a cycloidal or epicycloidal curve.

For watches of very cheap construction, the impulse-pallet *h* may be simply a pin passing through the balance cross-arm, as shown in Fig. 7.

The impulse-lever S may be made separate from its pallet, so that when the pallet is in correct adjustment with the escape-wheel the stroke-arm may be placed in such position as to give the balance-wheel any length of stroke, whereby the action of the balance-wheel is controlled by the duration of the impulse, as well as by the amount of motive power. The impulse-spring being adjustable, the power of the stroke will also be under complete control, and a watch or time-keeper will be produced requiring adjustment only in the balance and impulse lever pivots.

The operation of the safety banking device in connection with the other parts of my improved escapement is as follows: When the parts are in the position as shown in Fig. 5, the tooth V prevents the accidental shifting of the escapement-lever, but when moved by the balance the spring P allows the end *p* of the escapement-lever to pass to the position shown in dotted lines, the lever in the last half of its movement being assisted forward by the tension of the spring and the inclined face of the tooth. The teeth *x x*, as represented in Fig. 5, serve the purpose of banking-pins, to limit the throw of the escapement-lever.

This safety banking device is of special value where a short escapement-lever and a very small discharging-pallet are used, but does not preclude the use of the ordinary banking devices. By means of said safety banking device the balance-wheel is prevented from any possibility of contact with the escapement-lever except at the instant of discharge, and obviates the necessity of giving the pallets any "draw," or what is termed a "safety-lock."

The device may be applied to the side of the pallets, or to a pin through the forward part of the lever, the position shown not being arbitrary.

The lever-pallets *e e'* may be formed without faces, as shown, as all that is required of them is to alternately lock and escape the

train-work; but a very short face might be used with advantage with a lever having a wide fork.

To gain a longer leverage the escapement-lever may be pivoted to the opposite side of the escape-wheel from that shown, or at either side of said escapement-wheel.

What I claim, and desire to secure by Letters Patent, is—

1. In combination with the impulse-lever which actuates the balance-wheel and the escape-wheel, an escape-lever provided with pallets constructed and arranged to give an alternate short and long drop to the escape-wheel, whereby the momentum of the train-work is utilized to set the impulse-lever in position to give the impulse to the balance-wheel, substantially as set forth.

2. In combination with the escapement-lever, the banking-stop and its spring, whereby said escapement-lever is held in position until the discharging-pallet of the balance-wheel enters the fork of the escapement-lever, and the accidental unlocking or "overbanking" of said escapement-lever is prevented, substantially as set forth.

3. The combination of the impulse-pallet *h* of the balance-wheel and the impulse-lever S, having their bearing-surfaces constructed in the form of a cycloidal or epicycloidal curve, whereby a rolling motion is obtained and the friction reduced to a minimum, substantially as set forth.

4. In combination with the banking-stop V, the inclined teeth *x x*, for limiting the movement of the escapement-lever, substantially as and for the purposes specified.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of the subscribing witnesses.

JOHN THOMSON.

Witnesses:

J. W. MOORE,

CHAS. M. EVEREST.