No. 856,091. PATENTED JUNE 4, 1907.

O. OHLSON.

ESCAPEMENT.

APPLICATION FILED APR. 24, 1905.

2 SHEETS—SHEET 1.

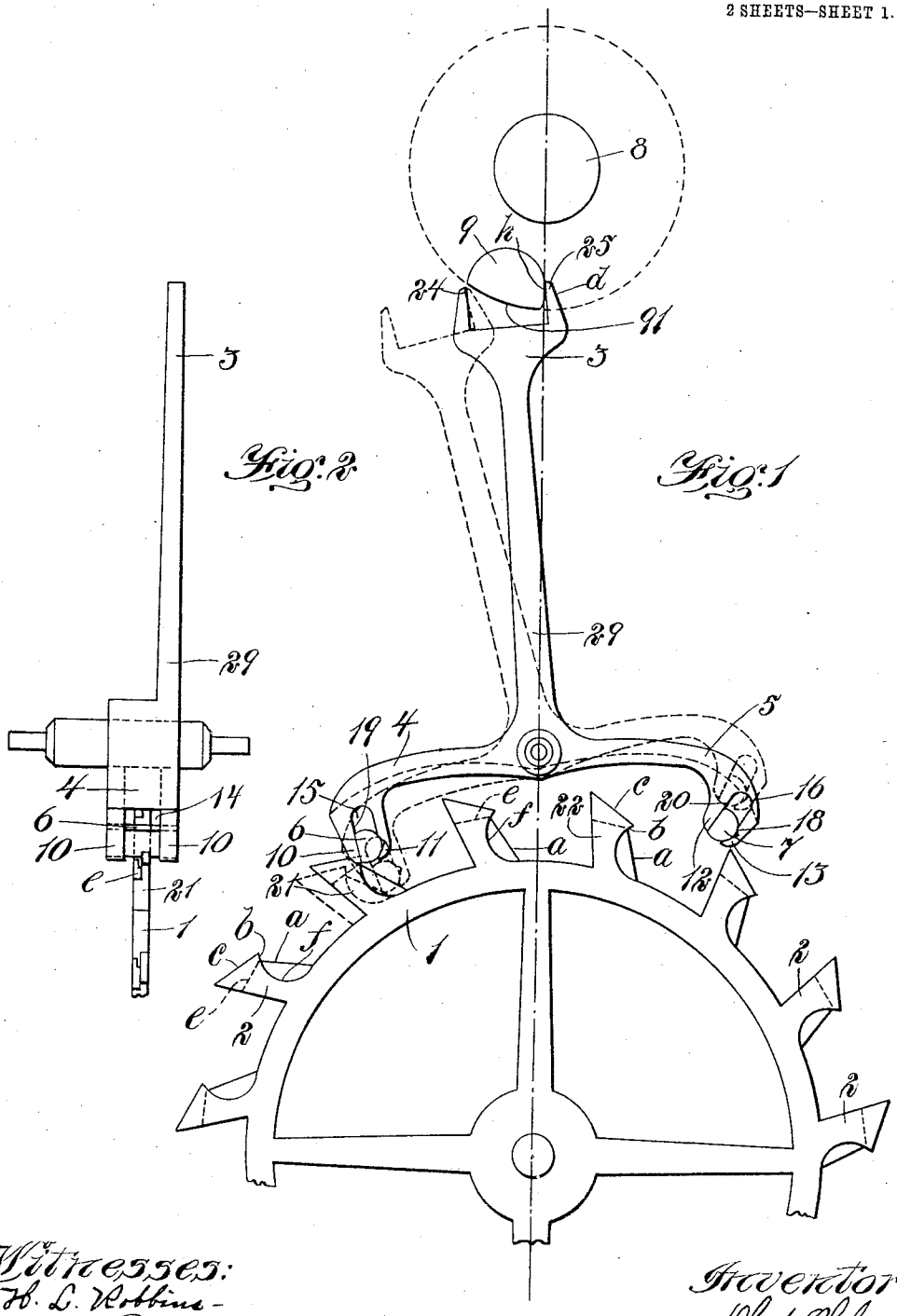


Fig. 2.

Fig. 1.

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Fig. 4

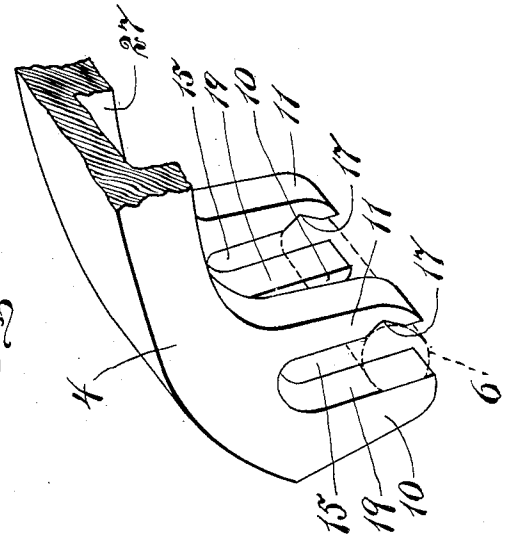


Fig. 5

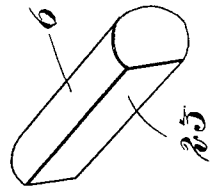


Fig. 3

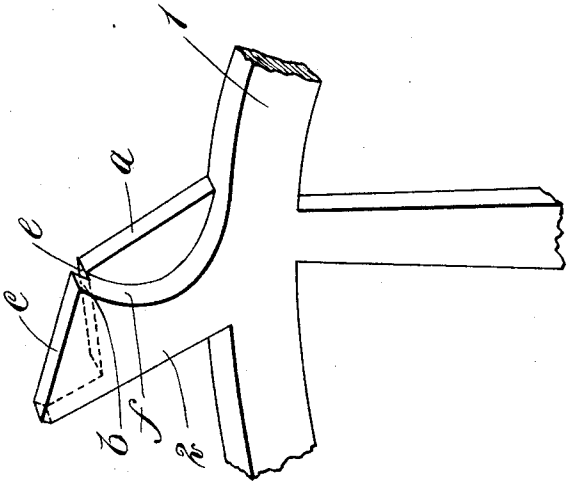
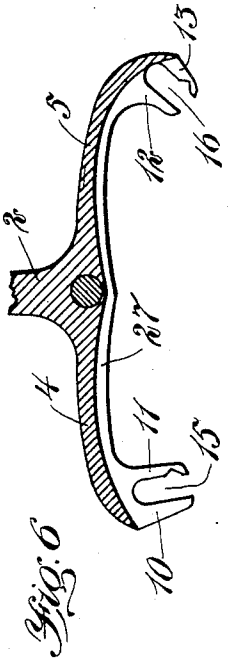


Fig. 6



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ESCAPEMENT.

No. 856,091. Specification of Letters Patent. Patented June 4, 1907.

Application filed April 24, 1905. Serial No. 257,154.

To all whom it may concern:

Be it known that I, OLOF OHLSON, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Escapements, of which the following is a specification.

This invention relates to escapement mechanisms for watch or clock movements and has for its object to provide a construction for such mechanism whereby overthrow of the balance roller jewel may be allowed for and danger of breaking such jewel thereby eliminated; to reduce the shock and friction of the roller jewel against the fork of the pallet; and finally to so construct the pallet and escape wheel-engaging jewels carried thereby that the jewels may be detachably and securely held without the use of cement and at the same time be accurately set in the pallet without the necessity of the expensive operation of adjusting the jewels for each watch.

A preferred construction embodying my invention is hereinafter described and claimed, and is illustrated in the accompanying drawings forming a part of this specification, in which,—

Figure 1 represents a front view of the escapement. Fig. 2 represents a side view as seen from the left of Fig. 1. Fig. 3 represents a perspective view of one of the escape wheel teeth. Fig. 4 represents a perspective view of one of the arms of the pallet, showing the jewel-holding jaws. Fig. 5 represents a perspective view of one of the pallet jewels. Fig. 6 represents a sectional view of the pallet arms.

The same reference characters indicate the same parts in all the figures.

The escape wheel 1 is adapted to turn in right-hand rotation as usual in escapements, and the teeth 2 instead of being inclined forwardly with respect to the direction of rotation as in the ordinary or club-toothed form of escape wheel, are inclined rearwardly. Each tooth has on its forward side a face *a* extending from the rim of the wheel and being backwardly inclined at an acute angle to a radius of the wheel passing through the point of intersection of said face with the rim. Adjacent the outer end of the face *a* the tooth has a second face *b* inclined at an angle to the face *a* and also outwardly and forwardly inclined with respect to a radius passing through said face. On the end of the tooth is the impulse face *c* inclined at an acute angle to that portion of the rim adjacent the tooth and also having an upward and rearward slope. The faces *b* and *c* have substantially the angularity of the corresponding forward, or holding, and impulse faces of the ordinary form of tooth and are adapted to co-operate with the jewels of the pallet to alternately hold the pallet while out of engagement with the balance and throw the pallet from one side to the other after it has been freed from the locking face of the balance.

29 represents the pallet having a fork 3 and lateral arms 4 5 which hold at their ends the jewels 6 7 which engage the escape wheel. 8 represents the staff and 9 the roller jewel of a balance wheel. As shown in Fig. 1, the pallet jewel 6 is engaged and held by the locking face of a tooth 21, the roller jewel being in the position it occupies when either just leaving or just coming into contact with the fork, the inclinations of the engaging faces on the jewel and tooth being such that the tooth draws down on the jewel and holds the pallet. When, however, the roller jewel moves to the right sufficiently far to carry the jewel past the corner of the tooth, the cam-like impulse face presses outwardly upon the jewel and throws the pallet over to the other side into position for its jewel 7 to be engaged by the locking face of tooth 22.

Ordinarily the pallets of escapements are prevented from swinging farther past the line of centers than a short distance to the left of the position shown in full lines in Fig. 1, banking pins being located one on each side of the pallet fork so as to limit their movement. It sometimes happens, however, that when the watch is jolted or shaken the balance swings far enough after leaving the pallet fork so that the roller jewel strikes the outer side of the fork at the point *d*. As the pallet, however, is held by a banking pin, it cannot move and the balance is abruptly stopped and given a sharp impulse in the other direction by the resilience of the fork. Sometimes when such a blow is a very sharp one, the roller jewel is broken and always there is a sharp shock which is injurious to

the watch. By the construction of my escape wheel I have avoided this objection and have been able to dispense both with the banking pins and also the guard pin usually carried by the pallet fork for preventing it from swinging by the center except when engaged by the roller jewel. With this construction whenever the balance is carried by upon a second revolution and strikes the point *d* of the pallet fork, the latter is allowed to move and carry the jewel 6 into contact with the inclined face *a* of the tooth wherewith it is engaged. As such surface is inclined, the escape wheel is forced backward against the pressure of the main spring and thereby resists yieldingly the impulse of the balance and brings the latter to a gradual stop without shock, and the watch train restoring itself, brings back the pallet, by means of the cam action of face *a* into its normal position and gives an impulse to the balance in the opposite direction. In cases, however, where the balance has an excessive momentum, such that the resistance of the clock train is not sufficient to check its movement, it slips entirely by the fork, moving the pallet into the position shown in dotted lines, from which position it is immediately restored to the full line position in the manner before stated, ready to be engaged by the roller jewel on the return of the balance. On account of the yielding resistance which the face *a* interposes to the extreme motion of the pallet, I may for convenience designate this face as the "resilient face," for although the face itself with respect to the tooth as a whole is not resilient, yet it is so relatively to the pallet.

It will be noted from Fig. 1, that the outer surface 91, that is, the surface farthest from the center of the balance and on the side toward the pallet, of the roller jewel 9 is given a curvature of cylindrical form instead of plane or elliptical as has been the practice heretofore. The center of gravity of this surface 91 is the axis of the balance, whereby such surface is concentric with the balance, and thereby whenever the balance has an excessive momentum and swings around a second time in the manner above described, so as to engage the end portions on the outer sides of the arms 24 25 of the fork, the cylindrical surface will slip by smoothly, or if the balance should stop its motion while this surface is in contact with one of the arms of the pallet fork and should reverse, the roller jewel would be able to slip away from the arm without displacing the latter and without danger of being locked and held. With a pallet jewel of the previously known forms there would be liability of the less advanced portion of the outer face of the roller jewel being held by one of the arms of the fork after the more protuberant portion had moved past the arm and the balance had started on its reverse movement before the whole extent of the roller jewel has passed by such arm.

One side of each tooth outwardly from the center of the wheel beyond the end of the resilient face, is removed along a surface *e*, while the opposite side of the tooth between the holding surface and circumference of the wheel throughout the extent of the resilient face is cut back to a surface *f*. The surfaces *e* and *f* overlap somewhat so that the faces *b* and *c* are located at one side of the resilient face *a*, that is, the faces *a* and *b* are laterally displaced from each other and if a section were taken perpendicular to the axis of the escape wheel through the middle of the wheel, said faces would be on opposite sides of such plane. On account of this construction the locking face is out of line with the resilient face so that as the pallet jewel is moved outwardly along the resilient face, any dust or other matter which may have found lodgment on such face is swept by the pallet jewel off the end of the resilient face without lodging against the locking face and so far filling up the notch formed by these faces as to prevent the pallet jewel being held by the locking face.

At the extremities of each of the arms 4 and 5 of the pallet are arranged jaws 10 11 and 12 13, there being two pairs of such jaws on each arm arranged side by side and separated by a space 14 at least as great as and preferably greater than the thickness of the escape wheel teeth. The arms 10 and 12 are rigid, while the arms 11 13 are yielding, being capable of slight displacement from the rigid jaws and adapted when released to spring back by their resiliency. Between the jaws of each pair are spaces 15 16, and the jaws 11 are provided each with a notch 17, the sides of which are inclined (that is, non-parallel) with respect to the rigid jaw 10; while the jaws 13 have corresponding notches 18 on the inner sides of the jaws, that is the sides toward the rigid jaws. The jaws 10 also have plane surfaces 19 having a predetermined angle of inclination with respect to the line of centers on which the escape wheel and pallet are journaled, the jaws 12 having corresponding surfaces 20, the angles upon which these surfaces are formed being such as to coact with the locking surfaces of the escape wheel teeth to hold the pallet.

The pallet jewels 6 7 are generally cylindrical in form and of length sufficient to extend transversely of the pallet across the spaces between the several pairs of jaws and to be grasped at their ends by said jaws. Each jewel has a flat surface 21 formed upon one side parallel to its axis and this surface is adapted to lie upon the surfaces 19 20 of the jaws 10 12, respectively, while the cylindrical

inclined surfaces on the sides of the jewels opposite the flat surface are adapted to project into the notches of the resilient arms and be retained by the inclined or offset surfaces of the notches between the jaws. It will be seen from the foregoing that in applying the jewel to the pallet, all that is necessary is to separate the resilient jaws slightly from the rigid ones and slip the jewel between them far enough to be engaged by the sides of the notches in the resilient jaws. The inclination of the plane surfaces of the rigid arms automatically adjusts the plane surfaces 23 of the jewels which engage the escape wheel teeth so that they are inclined at proper angles to be drawn toward the center of the escape wheel and locked by the locking faces of the teeth, while the position of the notches accurately determines the location of the jewels as a whole with respect to the distance by which they will project beyond the edges of the teeth. It is therefore evident that as soon as the jewels are slipped between the jaws of the pallet they are positioned with absolute accuracy for the work to be done by them both as regards their angular adjustment and their locations bodily with reference to the escape wheel and thus no additional and tedious adjustment of the jewels by skilled workmen is necessary.

With the usual form of pallet, even though the pallet frames and the jewels may have been made with the greatest possible accuracy it has still never been possible to assemble them and have the watch run accurately without some adjustment of the jewels, and this adjusting requires the most skilled and highest paid workmen so that the operation is the most expensive of all those required in making a watch. Also on account of the separate adjustment for each watch no pallet is adapted to run with an escape wheel except that for which it has been especially adjusted. The jewels also are retained in place by cement and in heating the cement to make it fluid, so that an adjustment may be effected, there is danger that the heat applied will be so great as to crack and destroy the stones. This necessity of adjustment is avoided with a pallet constructed according to the principles of my invention so that the expense of manufacturing watch movements is reduced and also the pallets of a certain size and style are all interchangeable and can therefore be used in connection with any escape wheel for a movement of the same style and size. Further the necessity of using cement to hold the jewels is avoided.

The portions of the jewels which engage the escape wheel teeth are located both between the separate jaws of each pair and the pairs of jaws so that no part of the jewels projects beyond the outline of the pallet. Thereby the stone is protected from injury, whereas in the ordinary form the stone is the most exposed part of the pallet and the part therefore which is most liable to be injured.

The pivotal points of the balance, pallet and escape wheel are arranged on a straight line, as usual, and the pallet fork is so constructed and arranged that its arms 24 25 are adapted to be arrested at the ends of their normal vibrations with the engaging point of one of them for the roller jewel on the line of centers. That is, *h* represents the point at which the roller jewel 9 engages the fork arm 25 and this point is stopped on the line of centers when the pallet has reached the limit of its normal swing to the left. Conversely when the pallet swings to the right and is stopped at the end of its normal vibration, the corresponding point of the arm 24 is on the same line. By reason of this construction when the roller jewel strikes either arm of the fork, the line of pressure is exactly perpendicular to the line of centers and the arcs upon which the engaging points of the pallet and roller jewel respectively swing are tangent, so that the entire momentum of the balance is applied to the best advantage in freeing the pallet from engagement with the escape wheel and there is no relative movement between the roller jewel and pallet fork to cause wear on the latter. In the ordinary form of escapement the part corresponding to the point *h* when swung to the left is carried past the line of centers and when engaged by the roller jewel in its movement to the right a certain amount of rubbing action is produced, which wears upon the fork. The momentum of the balance is also less effectively utilized with the result that the movement runs less smoothly and quietly.

Throughout the foregoing description, I have referred to the roller jewel and pallet jewels to designate the parts 9 6 and 7 respectively, but by the use of these terms I do not wish it to be understood that my invention is limited to the use of jewels or precious stones for these parts, since pins or bars of other hard material may be used without departing from the spirit of the invention. Therefore I desire it to be understood that by the term "jewel," I intend to include all materials which may be used in this connection.

I claim:—

1. In an escapement, an escape wheel having teeth formed each with an upwardly and rearwardly inclined face, and a forwardly inclined holding face, the first-named face being laterally displaced from the holding face, a pallet having arms and jewels carried by said arms to co-operate with said faces, each of said jewels having a plane surface located and inclined so as to lock with the holding face.

2. In an escapement, an escape wheel having teeth formed each with an upwardly and rearwardly inclined face, and a forwardly in-

clined holding face, the first-named face being laterally displaced from the holding face, and a pallet having arms each provided with portions arranged to engage with said faces and adapted to bear against said first-named face and force said escape wheel backward.

3. An escapement comprising a toothed escape wheel and a pallet having an engaging portion co-operating therewith, each tooth having a face inclined rearwardly to its line of motion at such an angle that pressure thereon by the engaging portion of the pallet will force the wheel backward, and having a forwardly inclined face for engaging and holding the pallet, said faces being located on opposite sides of a plane parallel to a side face of the tooth.

4. An escapement comprising a toothed escape wheel and a pallet having an engaging portion co-operating therewith, each tooth having a face inclined rearwardly to its line of motion at such an angle that pressure thereon by the engaging portion of the pallet will force the wheel backward, and having a forwardly inclined face adjacent the end and at one side of said rearwardly inclined face for engaging and holding the pallet.

5. A pallet for an escapement having an arm, a pair of jaws on said arm, one jaw of said pair being rigid and the other being yielding and resilient and provided with an offset inclined relatively to the rigid jaw so as to produce a space of less width between the jaws adjacent their ends than at a slight distance therefrom; and a member adapted to engage an escape-wheel grasped between said jaws and retained between them by said offset.

6. A pallet for an escapement having a pair of arms, a rigid and a yielding jaw mounted on each of said arms, the rigid jaw of one arm being further than the yielding jaw away from the pivot of the pallet, and the rigid jaw of the other arm being nearer than the corresponding yielding jaw to the pivot, and escape-wheel-engaging members grasped between said jaws.

7. An escapement comprising a pallet having two laterally-extending arms, an escape-wheel provided with teeth having locking portions, a pair of jaws, one rigid and one yielding, on each of said arms, and jewels grasped and held by said jaws, each jewel having a locking side adapted to engage with the locking portions of the escape-wheel teeth, and the rigid jaw of each pair being on the locking side of the jewel held thereby.

8. A pallet for an escapement having an arm, a pair of jaws on said arm, one jaw of said pair being yielding and resilient and the other rigid, the rigid arm having a plane jewel-engaging surface and the yielding jaw a recess, and a jewel adapted to be held between said jaws and having on one side a flat surface and on the other inclined surfaces for engagement with the plane surface and the recess of said jaws respectively.

9. A pallet for an escapement constructed with faces arranged for accurately positioning its jewels angularly, and with integral holding projections located to engage and hold the jewels against said faces and retain the portions of the jewels which engage the escape wheel in a definite, predetermined position with respect to their distance from said wheel.

10. A pallet for an escapement constructed with a surface having a predetermined definite inclination for accurately positioning angularly the locking face of an escape-wheel-engaging member, and with an integral resilient holding projection adjacent said surface and out of parallelism therewith located and arranged to receive said member between itself and the surface, and, by reason of its non-parallelism therewith, to place and retain said member in a fixed, predetermined position relatively to the end of said surface.

11. A pallet for an escapement having an arm and jewel-holding jaws thereon, one jaw being rigid and having a surface formed at a predetermined angle with the arm and adapted to engage the jewel and position angularly the holding face thereof, and a co-operating resilient jaw adapted to hold the jewel against the rigid jaw and having provisions for positioning the jewel bodily by its engagement therewith.

12. A pallet for an escapement having an arm and jewel-holding jaws thereon, one jaw being rigid and having a surface formed at a predetermined angle with the arm and adapted to engage the jewel and position angularly the holding face thereof, and a co-operating resilient jaw adapted to hold the jewel against the rigid jaw and having a notch arranged to receive a portion of the jewel and determine the position of the jewel as a whole.

13. A pallet for an escapement having arms, jaws arranged on each arm in pairs side by side and separated by a width as great as that of an escape-wheel tooth, one jaw of each pair being resilient and inclined between its ends convergently toward the opposing jaw; and an escape-wheel-engaging member extending across such space and having its ends grasped by said jaws.

14. A pallet for an escapement having on one of its arms jaws arranged in pairs side by side and separated by a space as wide as the thickness of an escape-wheel tooth, one jaw of each pair having a plane surface and the other a notch, and a jewel having a flat surface on one side and inclined surfaces on the other side extended across such space and grasped at its ends by said jaws, its flat side bearing against the plane surfaces and its inclined surfaces being engaged by the notches of the respective jaws.

15. A pallet comprising a jewel of gener-

ally cylindrical form having a flat surface parallel with its axis, and relatively yieldable jaws embracing the jewel, one of the jaws having a flat surface fitting against the flat surface of the jewel.

16. An escape wheel having its teeth formed on the forward side with two surfaces inclined to each other and located on different sides of a plane perpendicular to the axis of the wheel.

In testimony whereof I have affixed my signature, in presence of two witnesses.

OLOF OHLSON.

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