This invention is concerned with improvements in the construction of self-winding watches which have inertia or impulse weights for producing a winding action upon the mainspring; and is, more particularly, directed to the construction and arrangement of such impulse systems.

A feature of the invention is the provision of parts and arrangement of such a winding system, in which the weight has a limited arcuate movement about the general axis of the watch mechanism and has its mass located at least in part in the same radial plane as parts of the going movement of the watch itself, and in which the parts of the impulse winding structure can be removed without dismantling the parts of the going movement of the watch.

Another feature of the invention is the provision of an impulse weight arrangement for a self-winding watch, in which the mounting sector may be selected of one material, and the impulse weight of another material, and these parts held fixedly together during their operation.

A further feature of the invention is the provision of a structure including a supporting sector and a weight in which the parts are detachably held together but which when in secured position are free of shake or relative movement.

With these and other features in view, as will appear in the course of the following specification and claims, an illustrative form of practicing the invention is shown on the accompanying drawings, in which:

Fig. 1 is a view, on an enlarged scale, of a watch movement removed from its case, and having the self-winding structure of this invention applied thereto.

Fig. 2 is a partial sectional view taken on planes represented by the lines 2—2 of Fig. 1, on a larger scale.

Fig. 3 is a view showing the layout of the impulse sector, on a larger scale.

Fig. 4 is a corresponding view on the scale of Fig. 1, with parts broken away, showing the impulse weight.

Fig. 5 is a cross-sectional view substantially on line 5—5 of Fig. 2.

In these drawings, the watch movement has the usual rear plate or cock construction for supporting the rear ends of the staves and the like, including the members 10 and 11. The member 10 extends beyond the center axis of the watch movement and carries (Fig. 2) a jewel bearing 12 for the staff 13 of a sweep-second hand employed in the illustrated watch movement. Since the particular construction of the watch movement itself is not a part of the present invention, no further detail of it is set out in the drawing or in this description, except that the wind ratchet 15 is pivotally supported on a shaft 14 and thus in part supported by plate 11; and the winding of this ratchet 15 acts through a train and accomplishes the winding of the mainspring in the barrel B supported in part by the barrel bridge 9, and the amount of winding produced by such motion is then maintained by the action of the holding pawl 16 pivotally supported by plate 11, and urged into its engaging position by the pawl spring 17.

The structure for moving the ratchet 15 includes the winding sector 20 which rocks about the axis of shaft 14 and has circular rack teeth 21 in mesh with the rack teeth 22 of the impulse weight sector 23. The winding sector 20 carries a pivot screw 25 on which is mounted the pawl 26, urged into engagement with the ratchet 15 by the pawl spring 27. Thus, as the winding sector 20 moves in a clockwise direction in Fig. 1, the pawl 26 causes the ratchet 15 to turn in the direction for winding the mainspring, the ratchet 15 being engaged, tooth by tooth, by the retaining pawl 16. During counterclockwise movement of the winding sector 20, the pawl 26 slips over the teeth of the ratchet 15, but the latter remains held by its pawl 16.

The impulse weight sector 23 is supported (Fig. 2) on a short arbor 30 which has its ends mounted in the bearings 31 carried respectively by the sub-plate 32 secured to the plate 10, and by the bridge piece 33 carried in spaced relation from plate 10. It will be noted that the axis of the arbor 30 is shown as coincident with the general central axis of the watch movement and of the sweep-second staff 13.

The impulse weight sector 23 (Fig. 3) has parts 35 of its periphery concentric with its axis, while another part 36 is eccentric thereto, being illustrated as formed by a circular arc having its center 37 located between the axis of the sector and its peripheral edge, so that the peripheral portion 35 extends radially beyond the portions 36. The impulse weight sector 23 has a hole 40 on the radial line 38 from the axis through the center-point 37, and thus located essentially opposite the mid-point of the peripheral portion 36. This hole 40 is illustrated as having a straight outer edge 41, and a semicircular inner edge 42, these edges being joined by short straight side edges 43.

The impulse weight 50 (Figs. 2 and 4) is
arcuate in shape, and is illustrated as extending through 180 degrees about the general axis of the watch movement. It is of essentially uniform cross-section from end to end, in having a radially inward face 51 which is cylin- drical, and an outer face 52 which is concentrically cylindrical. The upper and lower faces (Fig. 2) are illustrated as radial, but it is preferred to have a slight chamfer or bevel on the outer part of the upper face, that is, at the rear part of this structure as it is present in a watch.

A notch 54 is formed in the radially inward face 51 (Fig. 2) of the impulse weight, near this top thereof as shown in Fig. 2, the bottom of this notch being curved (Fig. 4) to correspond to the shape of the peripheral portion 56 of the impulse weight sector. Adjacent the center of length of this notch 54, a radial hole 56 is provided, with a counterbore 56 at the outer face 52 of the impulse weight, for receiving the locking screw 56. A counterbore hole 55 is provided at the inner surface 51 of the impulse weight, being of a greater diameter than the width of the hole 53 between the side edges 52.

A locking nut 55 (Fig. 5) is of generally circular outline, and of a size slightly smaller than the diameter of the counterbored hole 56. Two right-angled notches are cut into the edge of this nut, to provide a tongue 56 which can extend into the hole 56 of the impulse weight sector 23 to be guided thereby and prevented from turning about the axis of the nut. The internal thread in the locking nut 55 is relatively large, compared to the external thread of the screw 56, so that there is looseness and permissible rocking motion of these parts: in practice, the tolerances for which practice are proper.

In assembling the impulse sector with its weight, the sector has its peripheral portion 53 engaged in the notch 56, and the parts are moved slightly back and forth in the arcuate direction, while the locking nut is engaged with its tongue 56 in the hole 56 while its body is in the counterbored hole 56 and thus opposite the hole 55. At this time, Fig. 2, the peripheral portion 56 of the sector is a light pressure fit in the notch 56, and therewith these parts can slide, under pressure, with respect to one another, but cannot have a relative rocking motion about an axis at right angles to the plane of Fig. 2. The screw 56 is now engaged with the locking nut 55 and is tightened. The locking nut 55 now acts as a lever, with a fulcrum against the wall at the bottom of counterbored hole 56, in Fig. 2, and with pressure being applied at the middle of its length by the screw 56, so that its tongue 56 fits against the edge 41 of the hole 56, and draws the parts tightly together by the aforesaid sliding motion. In turn, as these small parts are tightened, a minor strain and minor deformation of the locking nut occurs, so that the screw 56 cannot become loosened accidentally. However, at any time of damage to the sector or the weight, the parts can be separated by forcible unscrewing of the screw 56.

This two-part construction permits the making of the impulse weight sector 23 of a material of high density, such as stainless steel, and the making of the impulse weight itself of a high density material such as a tungsten alloy which may have a density as high as 0.614 pound per cubic inch, in comparison to a density of 0.309 pound per cubic inch for leaded brass. Stainless steel and the tungsten alloy, however, have the difficulties that they do not permit easy fusing, soldering, brazing or welding methods, except under conditions which produce deformation of parts or discoloration; wherewith refinishing becomes necessary after the joining operation.

On the other hand, even though the parts for a self-winding watch are individually small, the loads considered in terms of pounds per square inch, may be high. In particular, when the impulse weight 50 (Fig. 1) approaches the end of its stroke, in response to a movement of the arm of the wearer of the watch, and therewith encounters the buffer spring 57 at that end, couples of a great strain build up at various parts of the winding system, along with a tendency toward relative peripheral slippage of the impulse sector and the impulse weight. The present arrangement, in which the tongue 56 of the locking nut is closely received between the edges 43 of the hole 43 and therewith prevented from turning about its own axis, and wherein the screw 56 cooperates with this nut in providing a maintained pressure between the parts, there is a very rigid fastening and securing of the pieces, so that they become essentially a unit and operate by the relative rotation about the common axis.

It is obvious that the specific form illustrated is not restrictive, and that the invention may be practiced in many ways within the scope of the appended claims.

What is claimed is:

1. An impulse winding assembly for a watch having supporting members, a mainspring, and means for winding the same including a winding sector the combination therewith of an impulse sector carried upon the supporting members and in driving relation with said winding sector, said impulse sector having a hole near its periphery, an impulse weight having a radially inward notch for receiving the peripheral edge of the impulse sector, a nut having a part guided in said hole and having a part engaged with the outward wall thereof, said nut also having another part engaged in said hole, and a screw mounted on the impulse weight and engaged with the nut between said engaged parts whereby to hold the impulse sector and weight together.

2. An impulse winding assembly for a watch having supporting members, a mainspring and a driving train mounted on said supporting members, the combination therewith of a winding sector and a driving pawl mounted on said winding sector and engaging said ratchet, an impulse sector, and means for detachably securing said supporting member, a winding ratchet rotatably mounted on said bridge piece and on said supporting member and connected for winding said mainspring, engaging said ratchet, a driving pawl mounted on said winding sector and engaging said ratchet, an impulse sector rockably mounted on and between said bridge piece and a said supporting member, said sectors being interengaged whereby movement of the impulse sector is transmitted to the winding sector, said impulse sector being flat and extending essentially in a radial plane of its axis of rocking and having an outwardly extending lug at its periphery, an impulse weight of arcuate form and essentially uniform cross-section, said weight having a groove of limited peripheral extent on its inner face essentially at its center of gravity for closely receiving said lug, and means for detachably securing said impulse sector and weight together, said bridge piece being separable from said supporting members where-
by said sectors and weights can be removed independently of said train.

EDWARD H. WILKENING.

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