Nov. 14, 1944. P. J. McCULLOUGH 2,362,836

CLOCK BALANCE WHEEL

Filed April 11, 1942

FIG. 1.

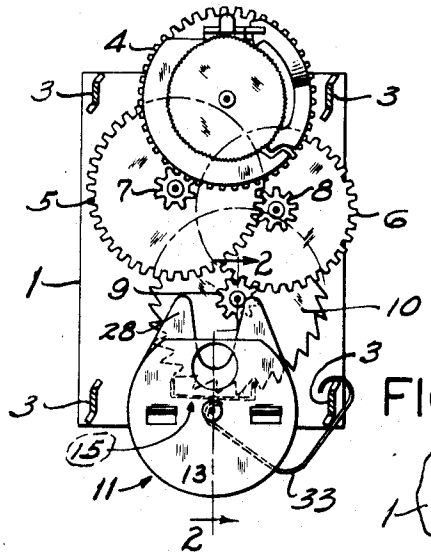


FIG. 2.

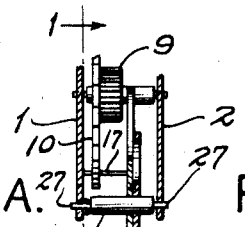


FIG. 1A.

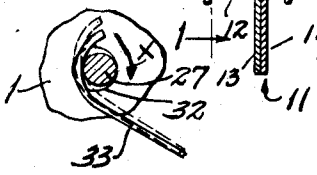


FIG. 2A.

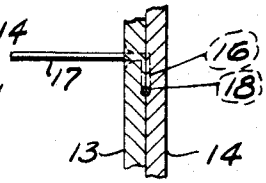


FIG. 3.

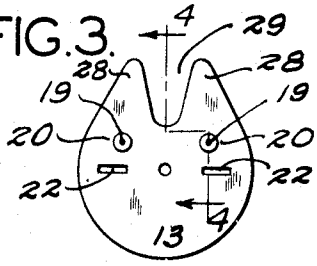


FIG. 5.

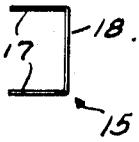


FIG. 7.

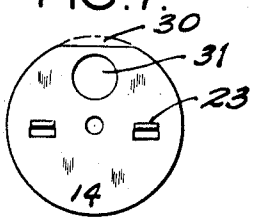


FIG 9.

FIG. 4.

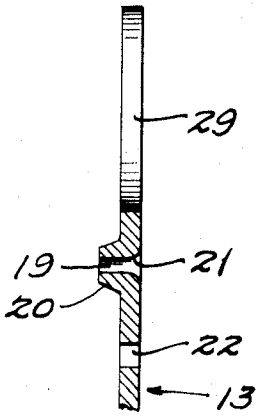


FIG. 6.

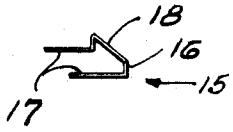
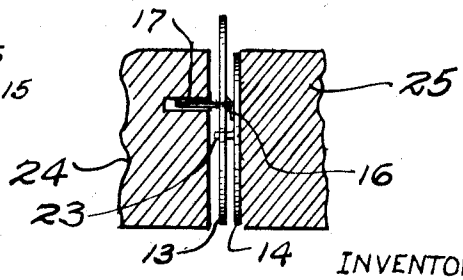


FIG. 8.



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CLOCK BALANCE WHEEL

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Application April 11, 1942, Serial No. 438,583

15 Claims. (Cl. 58—117)

The invention relates to clock mechanism and more particularly to the details of construction and the method of assembly of the parts of a balance wheel and the mounting of the same and is adapted for advantageous use in clockwork where economy of manufacture and assembly is important.

Reference is made to Patent No. 2,274,724 issued to the present applicant March 3, 1942, showing an electric toaster fitted with a clock of the class described. The present invention comprises improvements upon the balance wheel structure illustrated and described in the above-mentioned patent.

The main object of the invention is to effect quiet operation of parts adapted to be made and assembled in quantities and of inexpensive materials such as metal stampings.

This and other detailed objects as will appear below are attained by the structure illustrated in the accompanying drawing in which—

Figure 1 is a side view of a clock mechanism embodying the improved balance wheel.

Figure 1*a* is an enlarged detail view of a part shown in Figure 1.

Figure 2 is a detailed section taken approximately on the line 2—2 of Figure 1.

Figure 2*a* is an enlarged detail section of parts shown in Figures 1 and 2.

Figure 3 is an elevational view of one of the balance wheel discs.

Figure 4 is a transverse section through the same prior to its assembly and is drawn to an enlarged scale.

Figure 5 is an elevation and Figure 6 is an isometric of the pallet structure.

Figure 7 is an elevational view of the other of the balance wheel discs.

Figure 8 shows the two discs and the pallet in an intermediate assembly position and also shows opposing anvil elements used in the assembly.

Figure 9 is a detail of the shaft by which the balance wheel is journalled.

The clock frame comprises spaced side plates 1 and 2 held in spaced relation by posts 3. A train of gears 4, 5 and 6 with associated pinions 7, 8 and 9 are mounted upon respective shafts journalled in plates 1 and 2. The shaft for pinion 9 also carries a scape wheel 10. The above-mentioned parts do not in themselves comprise the present invention. The initial gear wheel 4 has a ratchet mechanism associated therewith which forms the subject matter of an application filed herewith by the present applicant, Serial No. 438,584, now Patent No. 2,302,131, issued November 17, 1942.

Associated with scape wheel 10 is a balance wheel 11 mounted on a shaft 12 journalled in plates 1 and 2. The body of the balance wheel consists of two substantially circular discs 13 and 14. The pallet structure preferably comprises a U member 15 (Figures 5 and 6) of small diameter spring wire having the inner end portions 16 of the legs bent at right angles to the major portions 17 of the legs and lying in the same plane as its cross bar 18 which is thereby offset from the general plane of the major portions 17 of the legs.

Prior to assembly, disc 13 is punched to provide openings 19 surrounded at one side of the disc by bosses 20, the corners of the openings at the opposite sides of the discs being rounded as indicated at 21. These openings are spaced apart and are of a size to freely receive pallet leg portions 17. Spaced from openings 19 are slots 22. Disc 14 is punched to provide upstanding lugs 23 spaced and shaped to be inserted in openings 22.

In assembling the balance wheel parts, the pallet legs are inserted through openings 19 in disc 13, and disc 14 is applied to disc 13 and the pallet, as indicated in Figure 8, with lugs 23 projecting through openings 22. The discs are then thrust together between opposing press elements 24 and 25, the pressure applied being great enough to embed pallet elements 16 and 18 in the opposing faces of the relatively soft discs 13 and 14 and to flatten and indent bosses 20 so as to distort the boss metal to thereby close against pallet elements 17 (see Figure 2*a*). At the same time lugs 23 are riveted over disc 13 to maintain the discs in assembled relation. The gripping of the pallet elements 16 and 18 positions and holds the pallet securely irrespective of the holding effected by the displacement of the metal forming the sides of apertures 19 to grip the pallet legs 17. The contour of the pallet structure clearly facilitates the assembly although not essential to all embodiments of the invention. For example, the cross bar could lie in the same plane as the upstanding legs 17 without offset 16, or the intermediate portion of cross bar 18 could be cut away and the upstanding elements 17 with adjacent base portions could be formed separately and the assembly would still be effective.

After shaft 12 is inserted through the central openings in discs 13 and 14, its pintles 27 are journalled in plates 1 and 2 with pallet ele-

ments 17 in cooperative relation with the teeth of scape wheel 10. The balance wheel may oscillate on its shaft to alternately engage and disengage pallet elements 17 with the scape wheel teeth and the spring qualities of the pallets give the wheel its oscillatory movement and function as does the hairspring in the usual clock mechanism. Furthermore, the yielding action of the spring pallets avoids the pronounced click usually present in cheap clock mechanisms and produces a quiet operation which is highly advantageous in timing devices for appliances such as toasters, etc.

Disc 13 has spaced ears 28 with a deep notch 29 between them. The ears are arranged to oppose opposite sides of the shaft for gear 9 and scape wheel 10 to limit the oscillatory movement of the balance wheel, as shown in Figure 1, and thereby prevent undue distortion and injury to the pallets. The cutting away of a segment of disc 14, as indicated at 30, and the provision of a large opening 31 in the adjacent portion of the disc serve to counterbalance the projecting ears 28 on disc 13.

To further contribute to the quiet efficient operation of the device and to avoid the necessity of fine fitting of the balance wheel shaft pintles in their bearings, there is provided what in effect is a roller bearing mounting of the shaft as best shown in Figure 1*a*. The aperture 32 for one of the shaft pintles 27 is made large enough to freely receive the pintle without fitting it closely. A spring member 33 has a bow-like contour with hooked ends, one of which engages one of the clock frame posts 3 and the other of which engages one of the saft pintles 27, without fitting it closely, and thrusts it towards the opposing bearing surface of the aperture 32.

With this construction the pintle is always in close contact with the opposing elements of the spring and the plate, thus avoiding play between these parts. As the balance wheel and shaft oscillate, the pintle rolls along the bearing face provided by aperture 32, and the adjacent hook portion of spring member 33 rides over the surface of the pintle. For example, when the balance wheel and pintle rotate in the direction of the arrow X in Figure 1*a*, the pintle will roll on the periphery of aperture 32 towards the top of the figure and the hook portion of spring 33 will ride on the pintle to the broken line position. Upon impact and reaction of the spring pallets and the scape wheel teeth, the direction of rotation of the pintle and of the rolling action of the pintle and the spring hook will be reversed and the parts will return to the solid line position shown in Figure 1*a*. Thus the forces thrusting the balance wheel shaft alternately in opposite directions are yieldingly absorbed and noise and wear are substantially eliminated. Spring 33 is at the end of shaft 12 abreast of the interengaging elements on the scape wheel and pallets and therefore opposses the alternating impact-produced forces in the plane where they are applied. There is no necessity for duplicating the spring at the opposite end of the shaft because of the length of the shaft and the corresponding reduction in the shifting force transmitted to this end of the shaft.

Also the pintle oscillates substantially free of friction between it and the opposing elements forming its bearing. The larger the diameter of aperture 32 and the flatter the adjacent hook of spring 33, the easier the movement and the less occasion for slippage of the pintle on its bearing forming elements in contrast to the continuous slippage resulting from an ordinary close-fitting bearing. If the radii of the arcs of the bearing forming elements for the pintle corresponded to the radius of the pintle, the spring thrust of the bearings would result in binding of the pintle so that the balance wheel could not function.

The above described structure attains the objects set forth in the introductory portion of this specification and results in a rugged, cheaply constructed clock mechanism which is so quiet as to be almost inaudible and which has a long useful life notwithstanding rough handling and other disadvantageous conditions under which clocks must work when used in the types of equipment mentioned.

The details of the structure and the manner of its assembly may be varied substantially from the specific disclosure herein without departing from the spirit of the invention, and the exclusive use of those modifications coming within the spirit of the claims is contemplated.

What is claimed is:

1. In a clock escapement device including a scape wheel, a balance wheel comprising a disc, a pallet structure consisting of a U of spring wire with its crossbar positioned at one side of the disc and with its legs extending through the disc and projecting from the opposite side thereof to yieldingly engage the scape wheel, and means holding the crossbar tightly against the adjacent side of the disc to secure the lower ends of the legs to the disc.

2. A device as described in claim 1 in which the inner portions of the legs of the U are bent at right angles to the projecting portions and to the crossbar and lie in the plane of the crossbar extending transversely of the projecting portions and are secured to the disc by the crossbar securing means.

3. In a clock escapement device including a scape wheel, a balance wheel comprising a pair of parallel discs, and a pallet structure consisting of a U of spring wire with its crossbar clamped between the discs and with its legs extending through one of the plates and projecting therefrom to yieldingly engage the scape wheel.

4. A device as described in claim 3 in which the inner end portions of the pallet U legs extend laterally from the upstanding portions of the legs to offset the U crossbar transversely of the plane of the legs and lie in the same plane as the crossbar and are clamped therewith between the plates to hold the pallet structure stable.

5. A device as described in claim 1 in which the pallet cros bar is embedded in the face of the disc.

6. A device as described in claim 3 in which the inner end portions of the pallet U legs extend laterally from the projecting portions of the legs, to offset the cross bar transversely of the plane of the legs, and lie in the same plane as the cross bar and are embedded with the cross bar in at least one of the discs to hold the pallet structure stable.

7. In a clock escapement device, a balance wheel, a shaft mounting the same and having a journal, a plate having an aperture receiving said journal and forming a bearing therefor, an element engaging one side of said journal and yieldingly thrusting the opposite side of the journal against a side of the bearing, the journal and element having rolling contact with each other whereby said element reciprocates transversely of the journal as the balance wheel oscillates.

8. Structure as described in claim 7 in which

the journal-engaging element consists in an arcuate hook on a spring secured at a point spaced from the element and leaving the element portion of the spring free to reciprocate.

9. Structure as described in claim 7 in which the shaft journal fits loosely in the receiving aperture and may roll along the periphery of its bearing as the shaft oscillates.

10. In a clock escapement device, a balance wheel, a shaft mounting the same and having a journal, and elements forming bearings for opposite sides of said journal, said elements being movable relative to each other transversely of the perpendicular between them through the journal to accommodate rolling of the journal along the elements as the balance wheel oscillates.

11. Structure as described in claim 10 which includes means yieldingly thrusting the bearing forming elements towards each other to avoid play of the journal transversely of the direction in which it may roll along said elements.

12. In a clock escapement device including a scape wheel, a balance wheel comprising a disc, spaced pallets each consisting of an elongated element of spring material projecting from one side of said disc to yieldingly engage the scape wheel and including a portion extending through said disc and bent parallel to the disc and uniting with the corresponding portion of the other pallet, and means securing the portions parallel to the disc to the adjacent side of the disc to hold the pallet structure in assembled relation with the disc.

13. In a clock escapement device including a scape wheel, a balance wheel comprising a disc, a pallet structure consisting of elongated elements of spring material projecting from one side of said disc to yieldingly engage the scape wheel and extending through said disc and including portions extending transversely of the elongated elements and merging with each other and embedded in the adjacent side of said disc, and means holding the bases embedded in the disc and thereby holding the elongated elements in desired position.

14. In a clock escapement device including a scape wheel, a balance wheel comprising a disc, a pallet structure consisting of a U spring wire with its cross bar embedded in one face of the disc and with its legs extending through the disc and projecting from the opposite side thereof to yieldingly engage the scape wheel.

15. In a clock escapement device, a balance wheel, a shaft mounting the same and having a journal, a plate having an aperture loosely receiving said journal and forming a bearing at one side thereof, an arcuate element engaging the other side of said journal and yieldingly thrusting the first-mentioned side of the journal against the opposite face of said aperture, the journal-engaging surfaces of the aperture and the arcuate element being elongated transversely of the perpendicular between them whereby said journal rolls along said surfaces and the element reciprocates transversely of said perpendicular as the balance wheel oscillates.

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