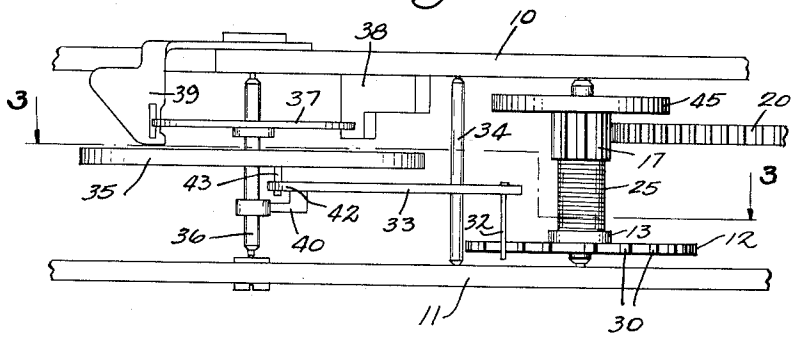
June 16, 1964 S. DINERSTEIN ETAL 3,137,122

RESILIENT MEANS FOR DRIVING ESCAPE WHEEL

Filed Jan. 4, 1962

Fig. 1



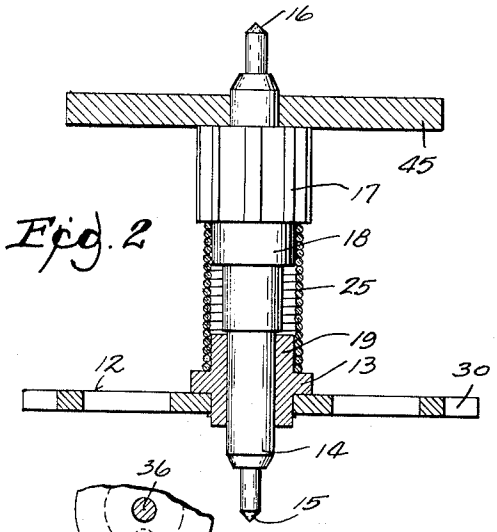


Fig. 2

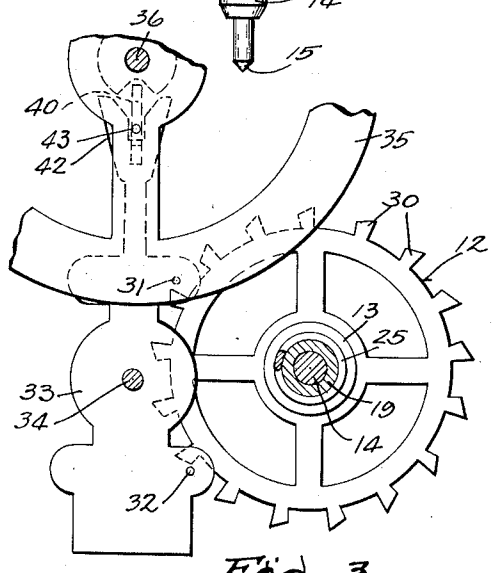


Fig. 3

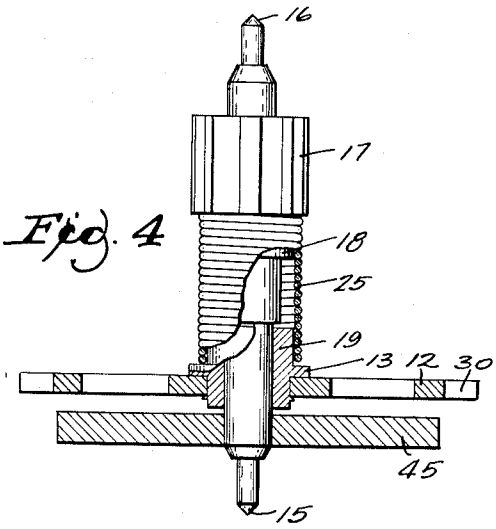


Fig. 4

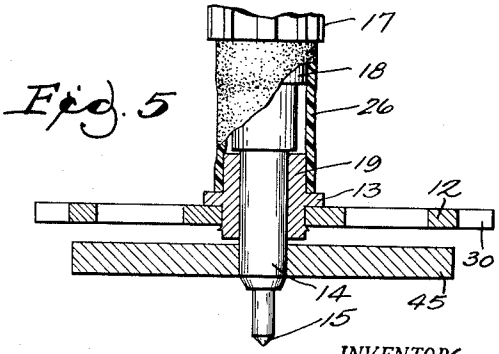


Fig. 5

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RESILIENT MEANS FOR DRIVING ESCAPE WHEEL

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This invention relates to improvements in timepiece escape silencing.

Timepiece movements equipped with well-known escape devices are subject to criticism because of the high noise level developed by the impact between the pallet arms and the teeth of the escape wheel. Even where the pallet arms have been provided with pallet pins of somewhat resilient material, the impact of such pins with the teeth of the escapement wheel has caused an objectionable noise. This is especially true where, as in automobile clocks, the associated panels and body structures to which the clocks are mounted are in themselves inherently resonant and tend to augment the sound produced by the clock.

As a part of discovery herein disclosed, it has been found that the provision of resilience at a certain portion of the drive of the escapement will so successfully modify the sound production of the timepiece movement as to satisfactorily solve the noise problem. This is particularly true where the provision of proper resilience in the drive is assisted by the provision of an inertia element close to the resilient drive element. Also, as an important part of this invention, the resilient element in the escapement drive is only frictionally engaged with the respective drive units to which it is attached.

More particularly stated, the attainment of great modification in sound level in an escapement controlled timepiece is provided where the stem or shaft upon which the escape wheel is mounted is not provided with a direct drive by means of a direct or integral connection between a driving member of the clock movement and the escape wheel itself; but there is a resilient driving means providing the sole driving connection to the escape wheel and such resilient driving means is not secured positively, but is only secured frictionally to the shafts, hubs or wheel between which it constitutes such sole driving connection.

In the drawings:

FIGURE 1 is a side elevation of the portion of a timepiece movement including the escape wheel and its immediate shaft assembly and driving element and including the pallet assembly, the balance wheel and hair spring assembly disclosing an embodiment of the invention.

FIGURE 2 is an enlarged view in elevation of the parts immediately associated with the escape wheel and its shaft mount with an inertia wheel fixed directly to the shaft near one end thereof, the escape wheel itself and the immediate driving element therefor being shown in vertical section.

FIGURE 3 is a diagrammatic rearrangement of the parts which would be included in a sectional view taken on line 3—3 of FIGURE 1.

FIGURE 4 is a view somewhat similar to FIGURE 2, but showing the inertia wheel adjacent the other end of the shaft of the escape wheel assembly.

FIGURE 5 is a fragmentary view somewhat similar to FIGURE 4, but showing a resilient drive member made of different material from that shown in FIGURES 1 to 4 inclusive.

The drawings show the invention embodied in a timepiece mechanism, the frame for which includes plate **10** and plate **11** spaced apart so that the pertinent parts of

the clock movement are mounted upon shafts extending between said plates. Immediately involved in the portion of the clock movement here disclosed is the escape wheel **12** fixed to a pilot portion below the flange of hub **13** which is freely revoluble on escape shaft **14**. This shaft extends between plate **10** and plate **11** as shown clearly in FIGURE 1 so as to be freely revoluble between bearing tips **15** and **16**. Fixed upon the escape shaft **14** is a pinion **17** and this pinion has a hub consisting of a driving collar **18** of the same diameter as the diameter of a driven collar **19** on the hub **13**.

It will be noted that a gear **20** is meshed with pinion **17** and in accord with usual practices, this gear **20** is a part of the clock movement (in this case, a gear on the clock minute hand shaft).

To complete the driving connection between gear **20** and the escape wheel **12**, provision is made in accord with this invention to transmit driving force from the hub **18** of pinion **17** to the surface **19** of hub **13**, and, very importantly, to only frictionally transmit such forces as will now be described. One form of the resilient driving means is shown in FIGURES 1, 2 and 4 in the form of a cylindrically, helically wound spring of "music" wire **25**. The internal diameter of the free, unloaded spring provided by this helically wound spring wire is only slightly smaller than the diameter of the collars **18** and **19**. Therefore it will be understood that the placement of the cylindrical spring **25** upon the hubs as shown clearly in FIGURE 2 involves some slight expansion of the cylindrical spring, thus establishing a friction drive between the hub surface **18** and the escape wheel with its hub surface at **19**.

A comparable resilient drive for an escape wheel is shown in FIGURE 5 where a cylindrical, resilient drive member is shown at **26**. This comprises a sleeve of rubber-like material, the internal diameter of which is slightly less than the diameter of the surfaces at **18** and **19** so that the resilient sleeve must be slightly expanded in order to be received upon the surfaces **18** and **19**. In each instance, the spring wire member **25** or the resilient rubber-like resilient member **26** provide resilient drive and impositive drive by reason of their inherent resiliency plus their mere frictional engagement upon the surfaces of the hub units between which a drive to the escape wheel is thus implemented.

It will be understood that the escape wheel **12** and its escape teeth **30** are impeded in their rotation by pallet pins **31** and **32** secured to pallet **33** which oscillates with its pallet shaft **34**. Pallet shaft **34** has its upper and lower ends in bearing relation to plates **10** and **11** as seen in FIGURE 1. It is this oscillating pallet mechanism which is controlled as to rate of oscillation by balance wheel **35** mounted on balance wheel shaft **36**. This balance wheel shaft is likewise in bearing relation at its upper and lower ends to the plates **10** and **11**. At **37**, is shown the usual hair spring, one end of which is secured to block **38** mounted to plate **10**. At **39** is the usual fan and rate adjusting means for changing the oscillatory period of the balance wheel **35**, and it will be understood that as the hair spring **37** oscillates, the guard pin **40** interacting with the slot in the roller and the fork **42** interacting with impulse pin **43** determine the oscillation of the pallet and, therefore, the desired rate of escape for the escape wheel under control of the pallet pins.

The direction of helical coil of the spring wire in spring **25** is important since the interaction of the spring and the respective hubs will include a tightening or clutching function when the spring is properly coiled. In determining the direction of coil, the particular escape wheel action will first be analyzed, and the stress at the time of impact of the pallet pin with a tooth of the

escape wheel will readily indicate the required direction of coil.

Under some circumstances to be determined empirically in accord with the inertia of the parts mounted upon the escape wheel shaft, it has been found helpful in combination with spring 25 or resilient sleeve 26 to add an inertia wheel 45, and the placement of this inertia wheel for best results may be in accord with that shown in FIGURE 2 or with that shown in FIGURES 4 or 5. It will be understood that this inertia wheel is fixed upon the escape wheel shaft immediately adjacent pinion 17, as shown in FIGURE 2, or fixed upon the shaft adjacent the escape wheel as shown in FIGURES 4 or 5. In this connection, it will be understood that the stiffness of the spring 25 and a determination as to the diameter of the spring wire used to form the spring 25, or the selection of the material and thickness of material used in sleeve 26 is such that the spring and sleeve are not intended within the scope of this invention to store energy for the drive of the escape wheel, but are intended to accept shock at the time of impact by the teeth of the escape wheel and the pallet pins 32. When the spring or the sleeve transmit clock work operating forces, either of them is amply strong to do so.

Thus when the escape wheel 12 is driven impositively and with a reserve resiliency by the gear 20 and pinion 17 because of the resilient cylindrical spring 25 or the resilient rubber-like cylinder 26, the tic-toc noise as the pallet pin is struck by the teeth 30 of the escape wheel results in an eight to ten decibel lessening of noise in an automobile clock. This is a really substantial reduction in noise level when one considers that the decibel level in an unmounted automobile clock has previously been in the neighborhood of 36 decibels, and according to H. H. Scott, Inc.'s "Noise Simplified," each 3 decibel reduction constitutes a halving of noise level. This is accomplished by using, in an automobile clock, a spring 25 formed of music wire .007 inch in diameter and wound in cylindrical form having .072 inch internal diameter; or it is accomplished through the use of a sleeve 26 made up of rubber-like material of low durometer hardness approximately .015 inch thick and shaped cylindrically in a tube having an internal diameter of .072 inch. Either of these is to fit upon hub diameters (18 or 19) of .075 inch.

We claim:

1. In a timepiece movement including a gear train timed by a balance wheel, hairspring, pallet, and pallet pins, a silent escapement mechanism directly interconnecting the gear train with the pallet pins comprising, in combination,

an escape stem comprising a positively driven subassembly and a resiliently driven subassembly; the resiliently driven subassembly consisting of a thin, flat escape wheel fixedly mounted on and intermittently rotatable with a central hub having a driven coupling collar thereon; the positively driven subassembly consisting of a rotatable shaft with a driven pinion, coupling collar and inertia wheel carried thereon and rigidly interconnected to each other for simultaneous movement; said inertia wheel being axially spaced from the escape wheel and being of substantial diameter, thickness and mass in relation thereto;

the collars carried by the aforesaid shaft and the aforementioned escape hub being coaxial with each other and projecting toward each other in opposite orientation, but with their ends substantially spaced apart;

said driving and driven collars being yieldably interconnected to each other by a resilient driver of generally sleeve-like form, with at least the opposite end portions of said driver having normal inside diameters no greater than the outer diameters of the aforesaid collars whereby the ends of the said driver may be telescoped thereon in assembly to snugly engage the aforesaid collars, but

with said driver contacting only said coupling collars and with open space within the driver in the area between the adjoining ends of the aforesaid collars to permit unobstructed flexing movement of an unsupported free-standing portion of the driver between said collars.

2. In a timepiece movement including a gear train timed by a balance wheel, hairspring, pallet, and pallet pins, a silent escapement mechanism directly interconnecting the gear train with the pallet pins comprising, in combination,

an escape stem, said stem consisting of a single rigid pinion shaft rotatable between pivots at its opposite ends, with a pinion fixed on said shaft and engaged with a driving gear of the aforesaid train; a driving collar on said shaft in fixed relation to the pinion thereon, and a slender bearing portion of said shaft located at a position axially spaced from said collar and pinion;

an escape hub having a central bore journalled for rotation on the aforesaid bearing portion of said pinion shaft, with a pilot portion of said hub adapted to carry as escape wheel, and a driven collar on said hub coaxial with and substantially larger than the central bore thereof;

a relatively thin, flat escape wheel having a multiplicity of escape teeth spaced about its periphery to engage the pallet pins; said escape wheel having a central aperture of diameter substantially larger than the diameter of said bearing portion of the pinion shaft and fixedly secured to said pilot portion of the aforesaid hub;

the collars carried by the aforesaid pinion and the aforementioned escape hub being coaxial with each other and projecting toward each other in opposite orientation, but with their ends substantially spaced apart, and with the intermediate portion of the pinion shaft between said collars of substantially smaller diameter than the outer diameters of said collars;

said driving and driven collars being yieldably interconnected to each other by a resilient driver consisting of a coil spring of multiple convolutions of wire, with a central unsupported section of said spring having a multiplicity of free-standing coils individually yieldable to expand and contract in accordance with twisting forces imposed thereon.

with the inside diameter of the driver substantially greater than the outside diameter of the portion of the pinion shaft surrounded thereby, leaving an open space within the driver spring in the area between the ends of the aforesaid collars to permit unobstructed flexing movement throughout a multiplicity of unsupported individually free-standing coils of the spring.

3. The combination of claim 2 wherein the driver spring is only frictionally secured to at least one of the collars, and is coiled in a direction whereby driving torque of the pinion exerts a pulling force on the spring tending to tighten the end coils thereof on said collar.

4. In combination of claim 1 wherein the escape wheel and hub are also free for at least limited movement in either of two opposite axial directions from their position of normal operating location and are yieldably held in a zone between their extremes of axial movement by said resilient driver.

5. In a timepiece movement including a gear train timed by a balance wheel, hairspring, pallet, and pallet pins, a silent escapement mechanism directly interconnecting the gear train with the pallet pins comprising, in combination,

an escape stem comprising a positively driven subassembly and a resiliently driven subassembly; the resiliently driven subassembly consisting of a thin, flat escape wheel fixedly mounted on and intermittently rotatable with a central hub having a driven coupling

collar thereon; the positively driven subassembly consisting of a rotatable shaft with a driven pinion and coupling collar carried thereon and rigidly interconnected to each other for simultaneous movement;

the collars carried by the aforesaid shaft and the aforementioned escape hub being coaxial with each other and projecting toward each other in opposite orientation, but with their ends substantially spaced apart;

said driving and driven collars being yieldably interconnected to each other by a resilient driver of generally sleeve-like form, with at least the opposite end portions of said driver having normal inside diameters no greater than the outer diameters of the aforesaid collars whereby the ends of said driver may be telescoped thereon in assembly to snugly engage the aforesaid collars, but

with said driver contacting only said coupling collars and with open space within the driver in the area between the adjoining ends of the aforesaid collars to permit unobstructed flexing movement of an unsupported free-standing portion of the driver between said collars.

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