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ELECTROMAGNETIC TIMEPIECE WITH OIL SHIELD

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Fig. 1

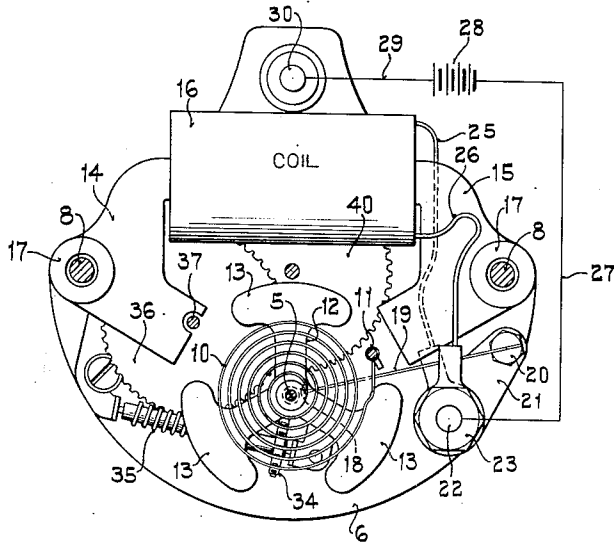


Fig. 3

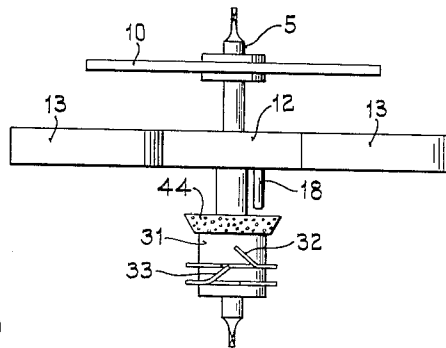
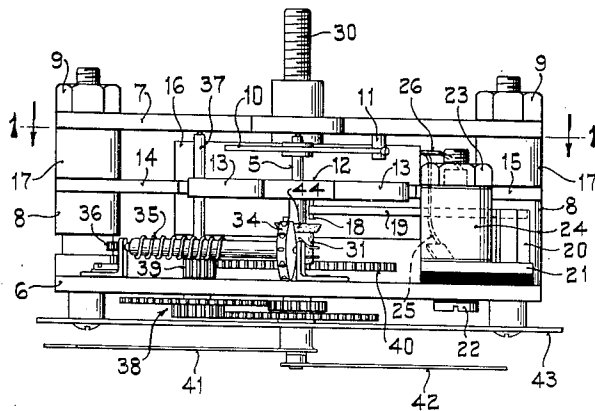


Fig. 2



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ELECTROMAGNETIC TIMEPIECE WITH OIL SHIELD

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3 Claims. (Cl. 58—28)

1

This invention relates to timing mechanisms, and more particularly to that type of mechanism designed for embodiment in time clocks, or for association with other instruments to control the operation of the latter at a predetermined time.

In a known type of timing mechanism the operation of the latter is effected by electro-magnetic energy. For this purpose, there is employed a balance wheel which constitutes an armature, said balance wheel or armature being connected with one side of a suitable source of current, such as a storage battery, and having a contact pin adapted to engage a resilient contact finger that is connected with the opposite side of said battery or current source. Engagement of the contact pin with the contact finger, which occurs upon rotation of the armature in opposite directions effected by the usual hair spring, completes the electric circuit to a coil or solenoid which is then energized and creates an electro-magnetic force in two oppositely disposed pole pieces, whereupon the armature or balance wheel is magnetically given an impulse in each direction, thereby sustaining the oscillations of said armature indefinitely so long as current is supplied to the timing mechanism.

The oscillations of the balance wheel are transmitted to a cam type escapement member which is carried by the balance wheel staff adjacent the contact pin and contact finger, and acts to intermittently rotate a cooperating escapement wheel in one direction only, thereby controlling the rate of movement of the usual reduction gears to effect operation of time indicating means, or to effect operation of an associated device at a predetermined time.

In order to reduce frictional drag of the cooperating escapement wheel and member on the balance wheel and thus insure accurate operation of the timing mechanism, it is the usual practice to lubricate said escapement member and wheel, as well as other parts of the mechanism, which is applied by the manufacturer upon assembling of said mechanism. The lubricant used is of a low viscosity to prevent congealing at low temperatures and drag on the timing mechanism, thereby insuring accurate operation of the timing mechanism at all temperatures.

Usually, after a short period of operation of the timing mechanism, the lubricant on the escapement wheel and member creeps along the latter and along the balance wheel staff onto the contact pin and contact finger. This objectionable result is aggravated when the timing mech-

2

anism is used in an inclined position, or when it is used with the balance wheel staff disposed vertically and such that the contact pin and contact finger are located beneath the escapement member. Under these conditions the lubricant on the contact pin and contact finger mixes with the scale or oxide produced by the fine spark created through breaking of the contacts and burning into the contact surfaces, and a paste or grease is thereby formed which acts as an insulator and prevents flow of electric current through the contacts to energize the coil, rendering the timing mechanism inoperative. It is then necessary to disassemble the timing mechanism and thoroughly clean the contacts before said mechanism can be of further use for its intended purpose.

It is accordingly one object of the present invention to provide a timing mechanism of the magnetically operated type having novel means for preventing lubricant used in said mechanism from affecting the accurate and efficient operation thereof, thus eliminating the difficulty above referred to.

Another object of the invention is to provide a novel lubricant intercepting and absorbing member for an electromagnetic timing mechanism whereby the balance wheel controlled contacts are maintained free from lubricant for effective operation of said mechanism.

A further object is to provide a novel metallic lubricant intercepting and absorbing member disposed between the escapement means and the contacts of an electro-magnetic timing mechanism, whereby lubricant used on said escapement means is prevented from "fouling" said contacts and rendering said mechanism inoperative.

A still further object is to provide a novel lubricant intercepting and absorbing member which may be incorporated in existing electro-magnetic timing mechanisms to prevent lubricant in said mechanism from fouling the electrical contact means and rendering said mechanism inoperative.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference char-

acters refer to like parts throughout the several views,

Fig. 1 is a horizontal section of an electro-magnetic timing mechanism constructed in accordance with the present invention, said section being taken on the line I—I of Fig. 2;

Fig. 2 is a side elevation of the mechanism shown in Fig. 1; and

Fig. 3 is an enlarged detail view of the balance wheel assembly shown in Figs. 1 and 2.

Referring to the drawings, the present invention is illustrated in connection with a timing mechanism of the clock type particularly adapted for installation in automobiles. As shown, said clock and timing mechanism comprise a balance wheel staff 5 journaled at its opposite ends in jeweled bearings (not shown) suitably mounted in plates 6 and 7. The latter are secured together in superposed spaced relation by two pillars 8, each having one end secured to plate 6, and the opposite end extending through plate 7 and externally threaded to receive a nut 9. Staff 5 has fixed thereto adjacent plate 7 a hair spring 10, one end of which is anchored in a stud 11 secured in said plate.

Oscillating motion is imparted to staff 5 by electromagnetic energy and by hair spring 10. For this purpose, staff 5 has fixed thereon intermediate its ends an iron balance wheel 12 constituting an armature and formed to provide three circumferentially spaced arcuate pallets 13. Arranged adjacent the path of movement of pallets 13 are two oppositely disposed pole pieces 14 and 15 having wound thereon a coil or solenoid 16. Pole pieces 14 and 15 are engaged over pillars 8 and fixedly held thereon in proper position relative to armature 12 by spacers 17 surrounding said pillars between said pole pieces and plate 7.

Secured to armature 12 and extending downwardly therefrom is a contact pin 18 adapted to make contact with the free end of a resilient contact finger 19 secured to a post 20 which, in turn, is secured to an arm 21. The latter is insulated from plate 6 and held thereon by a screw 22 that extends upwardly through said plate and arm 21, and has threaded on its upper end a nut 23. Screw 22 is also insulated from plate 6 and from a resistor 24 surrounding said screw between nut 23 and arm 21. A conductor 25 leading from coil 16 is connected between arm 21 and resistor 24, and a second conductor 26 leading from said coil is connected between said resistor and nut 23. Screw 22 is connected by a conductor 27 to one side of a source of electric power 28, the opposite side of said source being connected by a conductor 29 to a threaded post 30 secured in plate 6. In commercial use, post 30 serves as the means for mounting the clock mechanism on the instrument panel of the automobile, and since said panel is grounded, the latter serves as the conductor 29 for connecting the mechanism with one side of the power source or storage battery 28. The magnetic circuit for the actuating solenoid 16 and pole pieces 14, 15 may thus be traced from one side of battery 28 through conductor or panel 29, post 30, plate 6, pillars 8, plate 7, stud 11, hair spring 10, staff 5, armature 12, contact pin 18, contact spring 19, post 20, arm 21, conductor 25, coil 16, conductor 26, nut 23, screw 22, and conductor 27 to the opposite side of battery 28. The resistor 24 being located between the conductors 25 and 26 for coil 16 pro-

ducts the contacts 18, 19 against burning during long use.

When no current is supplied to solenoid 16, the armature 12 is disposed with its pallets 13 in the position shown in Fig. 1, and the contact pin 18 is engaged with contact finger 19. Assuming now that battery 28 is connected with screw 22 and post 30, oscillation of armature 12 is initially started by conducting the current for an instant around the contacts 18, 19 directly from plate 7 to post 20 by means of a manually operated conductor (not shown) provided for this purpose. In this manner coil 16 is subjected to the maximum energy of battery 28, and said coil and pole pieces 14, 15 are energized and magnetically whip the armature 12 in a clockwise direction, as viewed in Fig. 1, thereby contracting and energizing hair spring 10, and breaking the circuit at 18, 19. Armature 12 is now rotated counter-clockwise (Fig. 1) by hair spring 10, and the circuit is again closed for an instant by contacts 18, 19, again energizing coil 16 and pole pieces 14, 15, whereupon armature 12 is magnetically given an impulse in the counter-clockwise direction, thereby expanding and energizing hair spring 10. When the circuit is again broken by relative movement of the contacts, spring 10 rotates said armature in a clockwise direction and the cycle is repeated as long as current is supplied to screw 22 and post 30, thereby sustaining the oscillations of armature or balance wheels 12 and staff 5.

The oscillations of armature 12 are transmitted to an escapement member 31 (Fig. 3) secured to staff 5 beneath said armature and the contacts 18 and 19 and provided with two oppositely inclined cams 32 and 33 that alternately engage successive teeth on an escapement wheel 34 (Fig. 2) to impart intermittent movement to said wheel in one direction only. The operation of cams 32 and 33 is such that upon clockwise rotation of armature 12, cam 32 will engage a tooth on wheel 34 and move the latter, and upon counter-clockwise rotation of said armature, cam 33 will engage the same tooth and further move said wheel, thereby moving wheel 34 one tooth for each complete oscillation of armature 12.

Escapement wheel 34 is associated with and drives a worm 35, said wheel and worm being suitably journaled on plate 6. Worm 35 meshes with a worm gear 36 secured to a shaft 37 journaled in suitable bearings in plates 6 and 7. Worm gear 36 drives a reduction gear train 38 including gears 39 and 40, for operating time indicating hands 41 and 42 relatively and accurately, said hands cooperating with a dial 43 carried by plate 6.

Novel means are provided for preventing the lubricant that must be applied to cams 32 and 33 and to the teeth of escapement wheel 34 to reduce frictional drag on armature 12, from creeping along escapement member 31 and fouling the contacts 18 and 19, said means serving to intercept and absorb the creeping lubricant before it can reach the contacts 18 and 19. As shown, said lubricant intercepting and absorbing means or "thwarter" comprises a truncated cone-shaped disc 44 of a diameter larger than the diameter of escapement member 31 and surrounding the balance wheel or armature staff 5 between said escapement member and the contacts 18 and 19. Thwarter 44 is secured to staff 5 for oscillation therewith by a push fit, and while

it may be made of any suitable absorbing material, it is preferably of a porous metallic substance formed by compressing under comparatively heavy pressure a mixture of powdered or granulated metallic ingredients, such as copper and tin, the copper predominating, into a relatively hard and compact mass, and thereafter heat treating said mass to form an alloy or bronze of a porous character. After heat treating, the porous metallic substance is sized to the desired diameter and bored out to provide a central opening for reception of the staff 5. The porous metallic lubricant interceptor and absorber may also be made from a mixture of copper, tin and lead, or copper, tin and zinc, the copper in each case predominating. Thwarter 44, due to its location and absorbing qualities, will thus not only intercept any lubricant creeping from the escapement means 31, 34 before it can reach the contacts 18 and 19, but will also absorb said lubricant, thereby further insuring that said contacts will be maintained dry and free of lubricant for accurate and continued operation of the timing mechanism. In the illustrated embodiment of the invention, the diameter of the thwarter is substantially one and one-half times the diameter of escapement member 31, and the thickness is substantially equal to two-thirds the distance between said member and contact pin 18, the shape of the thwarter providing clearance for rotation of escapement wheel 34.

There is thus provided a timing mechanism of the electro-magnetic type wherein accurate and continued operation of the same is assured through the provision of novel means for preventing lubricant used in said mechanism from getting on and "fouling" the circuit making and breaking contacts thereof, said means preferably comprising a member made of a porous metallic substance and surrounding the balance wheel staff between the escapement means and the contacts, and acting to intercept and absorb any lubricant creeping from said escapement means before it can reach said contacts. The lubricant intercepting and absorbing member participates in the oscillation of the balance wheel staff and, accordingly, it is not subject to any wear and will last indefinitely. Further, because of the metallic construction of the lubricant intercepting and absorbing member, the timing mechanism is not subjected to any loose particles which will tend to clog or jam said mechanism. Additionally, the lubricant intercepting and absorbing member constitutes a new article of manufacture which can be incorporated in existing electro-magnetic timing mechanisms to prevent lubricant in said mechanism from fouling the contact members.

Although a single embodiment of the invention has been illustrated and described in the foregoing specification, it is to be expressly understood that changes may be made therein without departing from the spirit and scope of the

invention, as will now be clear to those skilled in the art. For example, a member made of felt, leather or any other absorbing material may be substituted for the porous metallic member 44. Likewise, a disc having a depending skirt partially surrounding the escapement member 31 may also be used. Also, the size and shape of the thwarter 44 may be varied from that hereinbefore given to suit various embodiments of said thwarter. For a definition of the limits of the invention, reference is had primarily to the appended claims.

What is claimed is:

1. In a timing mechanism of the type having a staff, a balance wheel on said staff, electro-magnetic means for imparting magnetic energy to said wheel, means including a contact pin on said wheel for periodically connecting a source of electric current with said electro-magnetic means, and a lubricated escapement member carried by said staff adjacent said contact pin, the combination therewith of a porous metallic member normally free of any lubricant and oscillatable with said staff and disposed between said contact pin and said member.

2. In apparatus of the character described having a staff, a balance wheel on said staff, electro-magnetic means for imparting magnetic energy to said wheel, and circuit closing means under the control of said wheel for periodically connecting a source of electric current with said electro-magnetic means, the combination therewith of a porous metallic thwarter normally free of any lubricant and secured to the shaft for intercepting and absorbing lubricating oil creeping along said shaft toward said circuit closing means.

3. A timepiece having a staff, a spring biasing the staff in one angular direction, electro-magnetic means biasing the staff in the other direction, and an electric contact member carried by the staff and operating to intermittently close and open the electro-magnetic circuit, a lubricated escapement on the staff, and a finely porous metallic wall on the staff between the lubricated escapement and the contact.

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