Oct. 30, 1951 P. R. CONTANT ET AL 2,572,989

ELECTRIC CLOCK DRIVE

Filed Oct. 27, 1948 2 SHEETS—SHEET 1

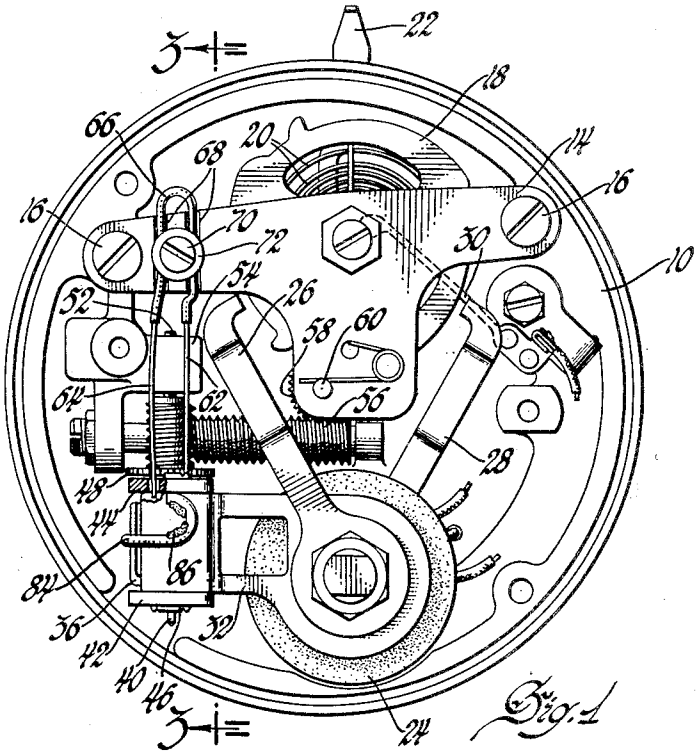


Fig. 1

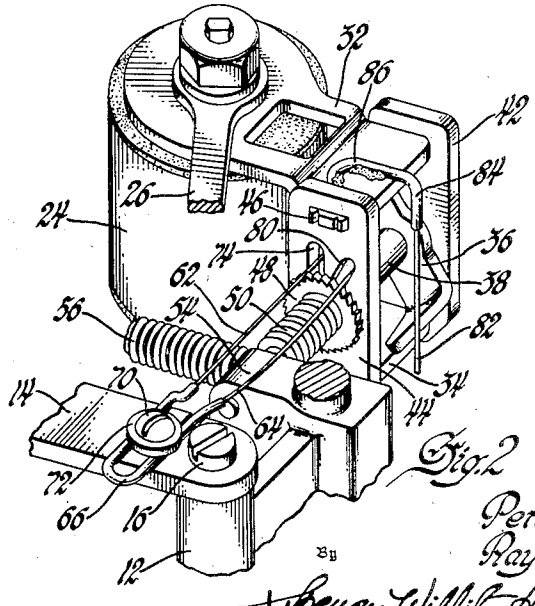


Fig. 2

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ELECTRIC CLOCK DRIVE

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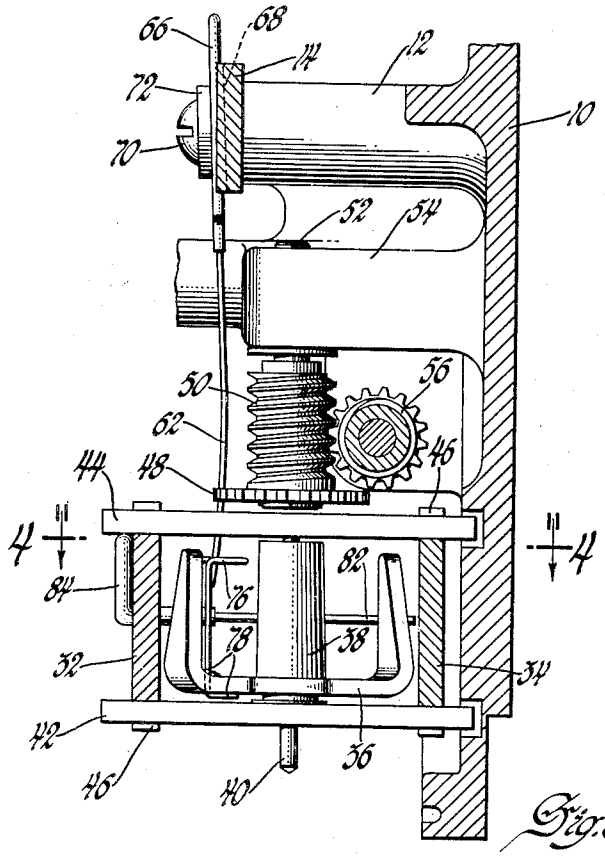


Fig. 5

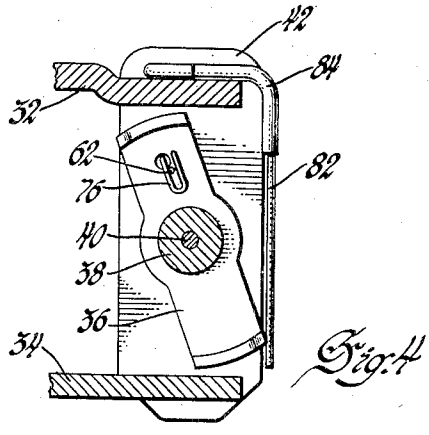


Fig. 4

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ELECTRIC CLOCK DRIVE

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18 Claims. (Cl. 74—126)

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The present invention relates generally to an electric clock drive and more particularly to a driving mechanism adapted to convert the oscillatory movement of a magnetically operated armature into rotary motion to be transmitted to the clock gear train.

One object of the invention is the provision of a driving mechanism including a pawl and ratchet arrangement which is simple in construction and reliable in operation.

A further object is to provide a driving mechanism wherein a spring wire drive pawl which is moved by the armature when the electromagnet is energized to advance a ratchet wheel is tensioned by this movement to return the armature to its normal position when the electromagnet is deenergized.

A still further object is to provide a spring wire detent or holding pawl to engage the ratchet wheel to prevent retrograde or backward motion thereof during the return stroke of the armature with a spring damper to contact the armature and arrest its motion on the return stroke.

Other features of the present invention including details of construction and the relative arrangement of the several parts will be apparent from or specifically noted in the following description of the embodiment shown in the accompanying drawings.

In the drawings:

Fig. 1 is a bottom plan view of an electric clock with the present driving mechanism.

Fig. 2 is an enlarged fragmentary perspective of the driving mechanism and associated clock parts.

Fig. 3 is an enlarged fragmentary section taken substantially on line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary section taken substantially on line 4—4 of Fig. 3.

Although it is contemplated and will be apparent from the following description that some features of the present driving mechanism are of general application and may be variously employed to convert oscillatory movement into intermittent rotary movement, the driving mechanism is shown herein as embodied in an electric clock construction such as disclosed in our copending application Serial No. 793,394, filed December 23, 1947, in which a single electromagnet is provided with poles associated with a timing mechanism including a balance wheel armature which controls and is sustained in oscillation by the intermittent energization of the electromagnet and with further poles associated with a separate driving mechanism including a driving armature which is adapted to be oscillated and operate the clock gear train by means of a pawl and ratchet arrangement.

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For an understanding of the present invention it is not necessary to disclose or describe all features of the clock construction which is generally shown in Fig. 1. This clock construction may include a base plate or frame 10 with spaced pillars 12 on which the bridge 14 is secured by screws 16. The pivot staff for the balance wheel armature 18 is journaled between the bridge and frame and provided with the usual hairspring 20 which may be adjusted by the regulator arm 22.

An electromagnet 24 is secured to the frame 10 and provided with upper and lower pole pieces 26 and 28, respectively, with the pole tips located adjacent the balance wheel armature 18. As is more fully shown and described in our above-identified application, a contact mechanism including a contact on the pivot staff whiich periodically engages the contact arm 30 during the oscillatory movement of the balance wheel armature 18 is adapted to control the intermittent energization of the winding of the electromagnet 24 to impart periodic magnetic impulses to the balance wheel armature to sustain it in oscillation.

Referring now to the driving mechanism for the clock gear train, the electromagnet is also provided with upper and lower pole pieces 32 and 34, respectively, which extend generally parallel to one another and terminate in spaced ends adapted to impart periodic magnetic impulses to a driving armature 36 which is mounted for oscillatory movement between the ends of these pole pieces. The armature 36 consists of a U-shaped member of magnetic material on a hub 38 secured to shaft 40 which is pivotally mounted in bearing plates 42 and 44 secured against the sides of the pole pieces 32 and 34 by tongues 46 on the pole pieces which extend through openings in the bearing plates.

As will be hereinafter described, the oscillatory movement of the armature 36 is converted into an intermittent, unidirectional rotary movement of a ratchet wheel 48 which is secured to a driving worm journaled on a shaft 52 supported by post 54 on the frame 10. The worm 50 meshes with a worm gear 56 which drives gear 58 on the center shaft 60 from which the clock hands can be driven in any conventional manner.

The mechanism to provide the desired movement of the ratchet wheel 48 in response to oscillation of the armature 36 by periodic energization of the electromagnet includes a drive pawl

62 to advance the ratchet wheel when the magnet is energized and a detent or holding pawl 64 to prevent retrograde or backward movement of the ratchet wheel when the magnet is deenergized.

The respective pawls 62 and 64 are preferably formed, as shown herein, by a single length of spring wire such as music wire with a metal tube 66 of brass or the like around an intermediate portion of the wire. The tube 66 may be readily bent into U-shape to provide the substantially parallel wire arms which form the pawls and the parallel arms of the U tube then positioned within slots 68 in the bridge 14 and rigidly secured thereto by a clamping screw 70 and washer 72. The ends of the tube 66 extend beyond the bridge 14 in the direction of the ratchet wheel 48 and may be bent after assembly of the several parts of the driving mechanism to accurately adjust the position and tension of the wire arms to provide the desired operation of the pawls 62 and 64. The free ends of the wire or the portions outside the metal tube 66 are not bent to provide this adjustment of the wire arms since it is desired to keep the arms free of localized stresses and thus ensure stability.

The wire arm forming the drive pawl 62 engages the periphery of the ratchet wheel 48 and then extends through a substantially vertical slot 74 in the bearing plate 44 as shown in Fig. 2 with its free end extending between the arms of a U-shaped wire guide 76 formed on one end of a spring wire 78 which has its other end secured to the armature 36 as shown in Figs. 3 and 4 to provide a yielding connection between the armature and the end of the drive pawl wire. The wire arm forming the detent or holding pawl 64 also engages the periphery of the ratchet wheel 48 and the free end of this arm extends through an inclined or diagonally arranged slot 80 in the bearing plate 44 as shown in Fig. 2. The wire arms are adapted to be initially positioned or adjusted by bending the ends of the metal tube 66 as heretofore described so that both arms are tensioned to resiliently engage the ratchet wheel with the drive pawl arm also tensioned against the left side of the slot 74 and the detent pawl arm also tensioned against the right side of the inclined slot 80 as viewed in Fig. 2.

Referring now to the operation of the driving mechanism, the driving armature 36 is shown in Fig. 2 in the position it assumes when the electromagnet is not energized. When the contacts of the timing mechanism close to thereby energize the winding of the electromagnet 24, the driving armature 36 will be rotated in a clockwise direction by the magnetic attraction of the pole pieces 32 and 34. The movement of the armature will be transmitted by spring wire 78 to the end of the drive pawl wire 62 and the intermediate portion thereof will rotate the ratchet wheel 48 in a clockwise direction. The extent of movement of the wire forming the drive pawl is limited by the width of the slot 74 which is preferably slightly larger than one tooth space of the ratchet wheel so that the ratchet wheel can be advanced only one tooth by the drive pawl when the magnet is energized.

During the clockwise rotation of the ratchet wheel 48 the detent or holding pawl 64 is forced upwardly along the right side of the slot 80 by the inclined face of a tooth of the ratchet wheel until it reaches the end of the tooth face when it will drop behind the tooth to hold the ratchet wheel against any rotation in a counterclockwise direction. The inclined or diagonal arrangement of the slot 80 is such that the end of the wire arm forming the detent or holding pawl will move radially with respect to the ratchet wheel to thereby reduce the frictional resistance to the displacement thereof by the ratchet wheel.

As the armature moves the end of the drive pawl 62 to advance the ratchet wheel in the manner heretofore described, the spring wire arm forming this pawl which is initially tensioned to engage the left side of the slot 74 in Fig. 2 will be placed under further tension so that when the electromagnet is deenergized upon opening of the contacts of the timing mechanism, the spring action of the drive pawl arm will move the armature in a counterclockwise direction to return it to the position shown in Fig. 2. During this return stroke of the armature the ratchet wheel is held against counterclockwise rotation by the detent pawl 64 and the drive pawl 62 slides over and then drops behind the next tooth of the ratchet wheel into position to again advance the ratchet wheel when the magnet is energized.

To prevent excessive vibration or rebound of the armature at the end of the return stroke such as might cause the drive pawl to again advance the ratchet wheel if of sufficient magnitude, a damper or stop spring 82 is provided to arrest the motion of the armature on the return stroke. This spring 82 may be formed of spring wire with a metal tube 84 of brass or the like around one end portion of the wire. The tube 84 is secured as by solder 86 on the upper pole piece 32 with the exposed portion of the wire extending downwardly and the tube 84 is adapted to be bent, if necessary, to adjust the position of the spring wire so that it will be engaged by the lower leg of the armature just before the armature reaches the end of the return stroke to cushion the armature movement in this direction and also act as a snubber since there is a slight rubbing action between the spring wire and the armature.

From the foregoing description it will be seen that in response to the periodic energization of the electromagnet 24 by the contacts of the timing mechanism, the armature 36 will be oscillated by movement in one direction by magnetic force and movement in the opposite direction by the spring action of the wire arm forming the drive pawl 62, and the oscillating movement of the armature will be converted to a step-by-step or intermittent unidirectional rotation of the ratchet wheel 48 which is transmitted to the clock gear train.

Although shown and described herein as embodied in an electric clock it will be understood that the driving mechanism is also capable of various other applications and all such applications together with changes or modifications in details of construction are contemplated as within the scope of the present invention as defined in the claims appended hereto.

We claim:

1. In an electric clock or the like having an electromagnet and means for periodically energizing said electromagnet, a ratchet wheel, and a driving mechanism for said ratchet wheel including a pivotally mounted armature adapted to be oscillated in response to energization and deenergization of said electromagnet, a U-shaped spring wire member having substantially parallel arms forming a drive pawl and a detent pawl, said drive pawl engaging said ratchet wheel with the free end of said pawl connected to said armature to advance said ratchet wheel during movement of said armature in one direction, and said detent pawl engaging said ratchet wheel to prevent reverse rotation of said ratchet wheel dur-

ing movement of said armature in the opposite direction.

2. In an electric clock or the like having an electromagnet and means for periodically energizing said electromagnet, substantially parallel pole pieces on said electromagnet, bearing plates extending between opposite sides of said pole pieces, an armature pivotally mounted in said bearing plates for oscillation between said pole pieces in response to energization and deenergization of said electromagnet, and means to convert the oscillatory movement of said armature to intermittent rotary movement including a driven shaft provided with a ratchet wheel adjacent one of said bearing plates, a spring wire drive pawl which is fixed at one end and engages said ratchet wheel adjacent the other free end thereof, said free end of said pawl extending through a slot in said bearing plate which limits the movement thereof with said free end connected to said armature and adapted to be moved thereby to advance said ratchet wheel during movement of said armature in one direction when said electromagnet is energized.

3. The combination set forth in claim 2 in which said spring wire drive pawl is adapted to be tensioned to move said armature in the opposite direction when said electromagnet is deenergized with a spring wire detent pawl to prevent reverse rotation of said ratchet wheel, said detent pawl being fixed at one end to engage said ratchet wheel adjacent the other free end thereof with said free end extending within a guide slot in said bearing plate.

4. In a driving mechanism having an oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a spring wire arm forming a drive pawl for said ratchet wheel, said wire arm being fixed at one end, and means for connecting the free end of said arm to said driving member with an intermediate portion of said arm in engagement with said ratchet wheel to advance said ratchet wheel upon movement of said oscillatory driving member in one direction.

5. The combination set forth in claim 4 with a second spring wire arm forming a detent pawl to prevent reverse rotation of said ratchet wheel, said second arm being fixed at one end and adapted to engage said ratchet wheel adjacent its free end.

6. In a driving mechanism having an oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a spring wire arm forming a drive pawl for said ratchet wheel, said wire arm being fixed at one end and adapted to engage said ratchet wheel adjacent its free end, and a yielding connection between the free end of said arm and said driving member whereby movement of said member in one direction will cause said arm to advance said ratchet wheel.

7. The combination set forth in claim 6 in which said yielding connection comprises a spring wire which is secured to said driving member at one end and provided with a U-shaped guide at its free end to receive the free end of said arm.

8. In a driving mechanism having a driving member, means to oscillate said member and convert the movement thereof to intermittent rotary movement of a driven member including

a ratchet wheel on said driven member, a resilient drive pawl having one end thereof fixed with its free end in engagement with said ratchet wheel and driving member, means to move said driving member in one direction to cause said drive pawl to advance said ratchet wheel, said drive pawl being tensioned to move said driving member in the opposite direction, and means to prevent rotation of said ratchet wheel during the movement of said driving member by said drive pawl.

9. In a driving mechanism having an oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a spring wire forming a drive pawl for said ratchet wheel, said wire being fixed at one end with its free end adapted to engage said ratchet wheel and said driving member, and a metal tube around said wire adjacent the fixed end thereof which is adapted to be manually bent to adjust the position of the free end of said wire.

10. In a driving mechanism having as oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a U-shaped spring wire having substantially parallel arms, one of said arms having the free end thereof adapted to engage said ratchet wheel and said driving member to constitute a drive pawl to advance said ratchet wheel on oscillation of said member in one direction, and the other arm having the free end thereof adapted to engage said ratchet wheel to constitute a detent pawl to prevent reverse rotation of said ratchet wheel on oscillation of said driving member in the opposite direction, and a metal tube around the U-shaped portion of said spring wire, said tube being relatively fixed and adapted to be manually bent to adjust the positions of the free ends of said wire arms.

11. In a driving mechanism for electric clocks or the like having an electromagnet adapted to be periodically energized and a driving armature mounted for oscillation in response to energization and deenergization of said electromagnet, a ratchet wheel, and a drive pawl having one end thereof in engagement with both said ratchet wheel and armature and actuated by movement of said armature in one direction when said electromagnet is energized to advance said ratchet wheel, said drive pawl being tensioned by said armature movement and acting through its engagement with said armature to move said armature in the opposite direction when said electromagnet is deenergized.

12. In a driving mechanism for electric clocks or the like having an electromagnet adapted to be periodically energized and a driving armature mounted for oscillation in response to energization and deenergization of said electromagnet, a ratchet wheel, a drive pawl having one end thereof in engagement with both said ratchet wheel and armature and actuated by movement of said armature in one direction when said electromagnet is energized to advance said ratchet wheel, said drive pawl being tensioned to move said armature in the opposite direction, and a detent pawl engaging said ratchet wheel to prevent reverse rotation thereof as said armature is moved in said opposite direction by said drive pawl when said electromagnet is deenergized.

13. The combination set forth in claim 12 in

which a yielding means is provided to engage said armature to arrest and cushion the movement thereof by said drive pawl.

14. In an electric clock or the like having an electromagnet and means for periodically energizing said electromagnet, substantially parallel pole pieces on said electromagnet, bearing plates extending between opposite sides of said pole pieces, an armature pivotally mounted in said bearing plates for oscillation between said pole pieces in response to energization and deenergization of said electromagnet, and means to convert the oscillatory movement of said armature to intermittent rotary movement including a driven shaft provided with a ratchet wheel adjacent one of said bearing plates, a drive pawl having one end thereof tensioned to engage said ratchet wheel and extending through a slot in said bearing plate which limits the movement of said pawl and with said end connected to said armature and adapted to be moved thereby to advance said ratchet wheel during movement of said armature in one direction when said electromagnet is energized.

15. The combination set forth in claim 14 in which said drive pawl is also tensioned to move said armature in the opposite direction when said electromagnet is deenergized with a detent pawl to prevent reverse rotation of said ratchet wheel, said detent pawl having one end thereof tensioned to engage said ratchet wheel and extending within a guide slot in said bearing plate.

16. In a driving mechanism having an oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a drive pawl having one end thereof mounted at one side of said ratchet wheel with its free end tensioned to engage with and extending beyond said ratchet wheel, and means for connecting the extending free end of said pawl to said driving member to advance said ratchet wheel upon movement of said oscillatory driving member in one direction.

17. In a driving mechanism having an oscillatory driving member, means to convert the oscillatory movement of said member to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a drive pawl having one end thereof mounted at one side of said ratchet wheel with its free end tensioned to engage with and extending beyond said ratchet wheel, and a yielding connection between the free end of said pawl and said driving member whereby movement of said member in one direction will cause said pawl to advance said ratchet wheel.

18. In a driving mechanism having a driving member, means to oscillate said member and convert the movement thereof to intermittent rotary movement of a driven member including a ratchet wheel on said driven member, a drive pawl having one end thereof mounted at one side of said ratchet wheel with its free end in engagement with said ratchet wheel and driving member, means to move said driving member in one direction to cause said drive pawl to advance said ratchet wheel, said drive pawl being tensioned to move said driving member in the opposite direction, and means to prevent rotation of said ratchet wheel during the movement of said driving member by said drive pawl.

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