Dec. 7, 1943. G. P. BENTLEY ET AL 2,335,904

ELECTRIC ALARM CLOCK

Filed July 1, 1940 3 Sheets-Sheet 1

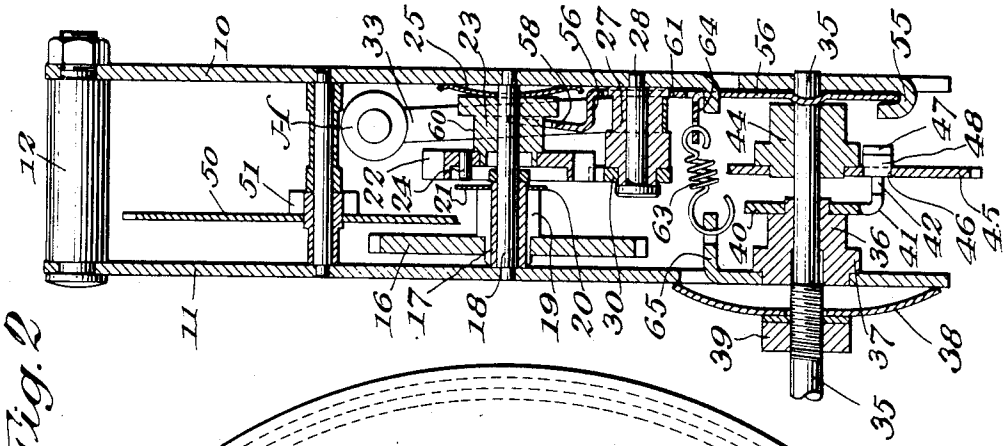


Fig. 2

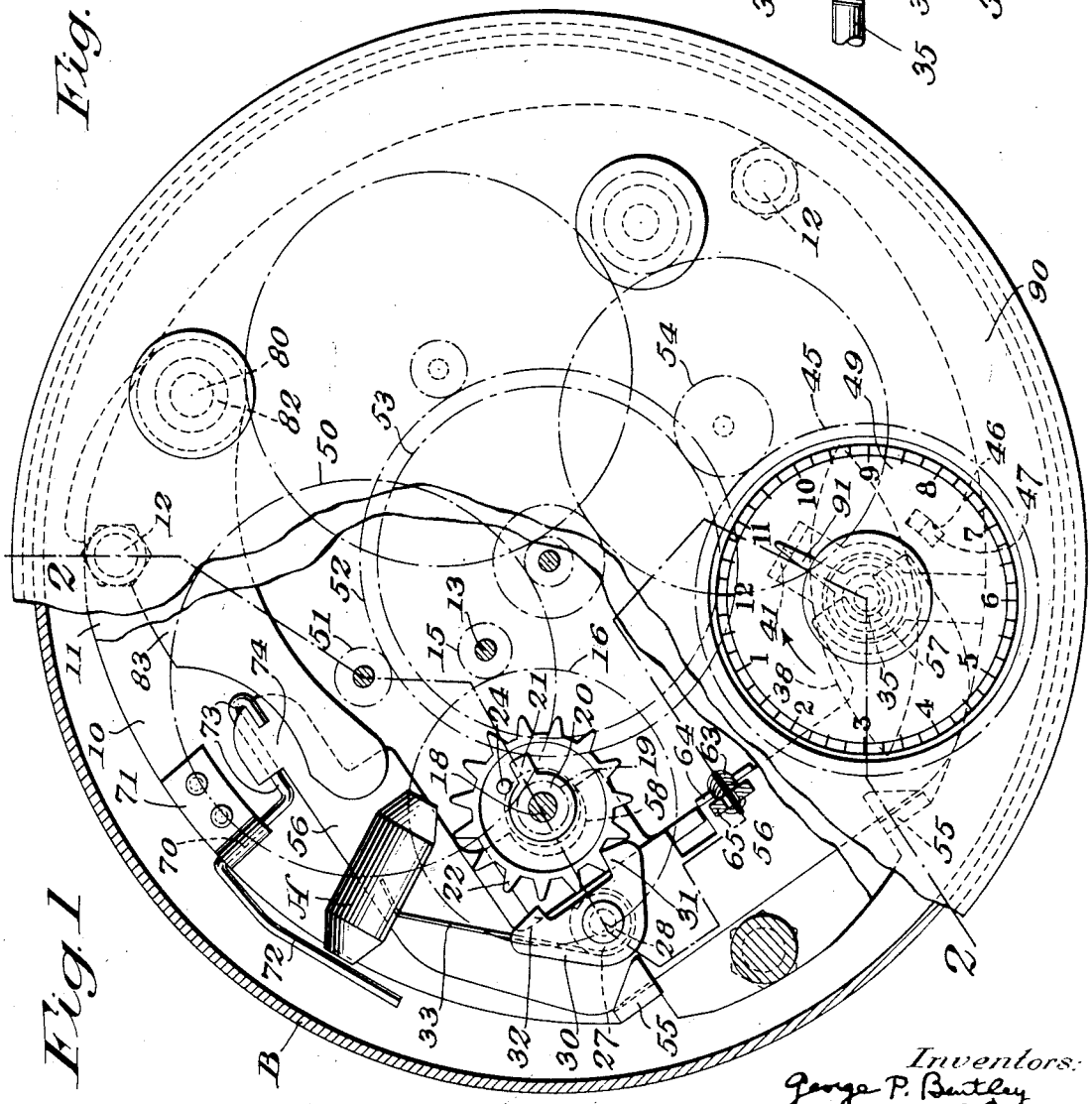


Fig. 1

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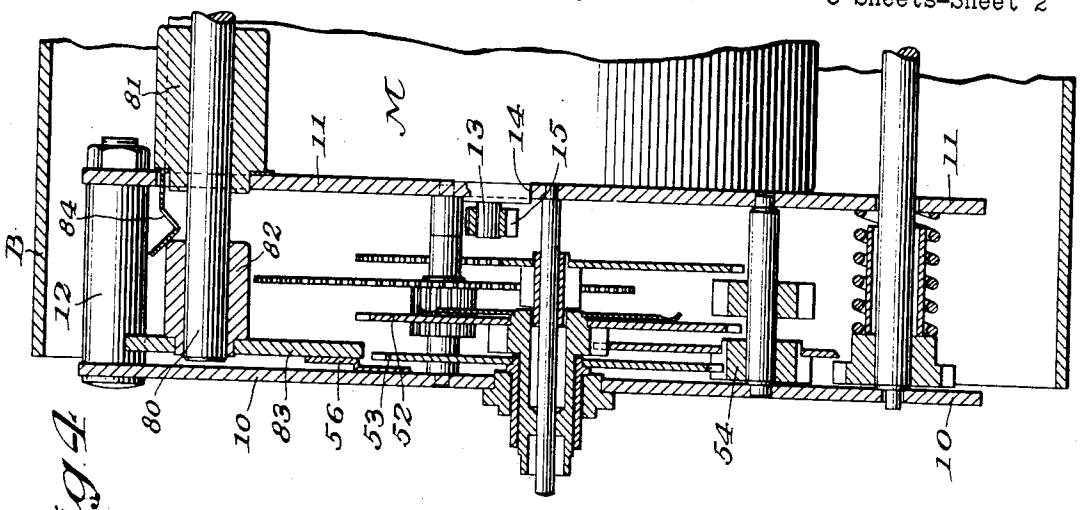



Fig. 4

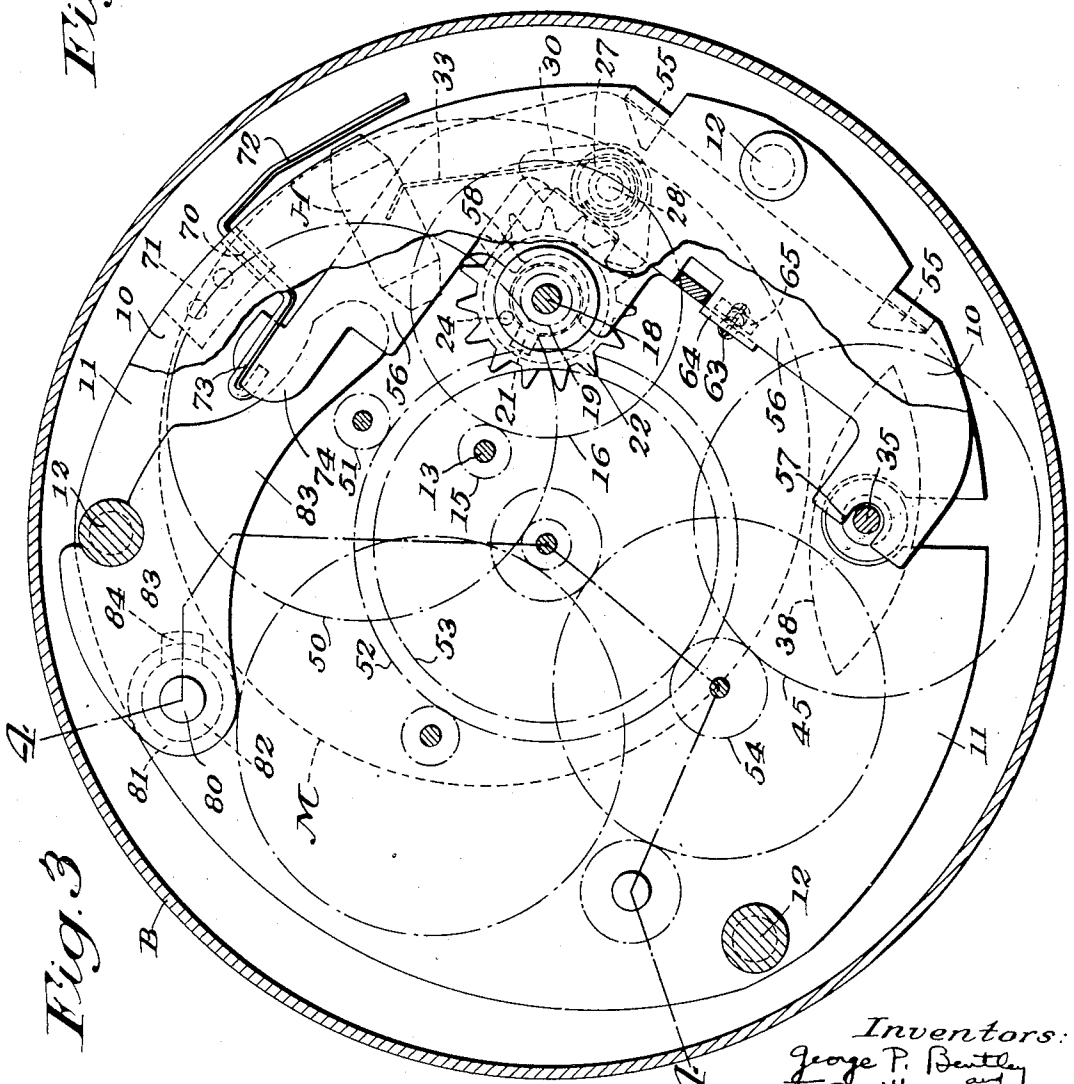



Fig. 3

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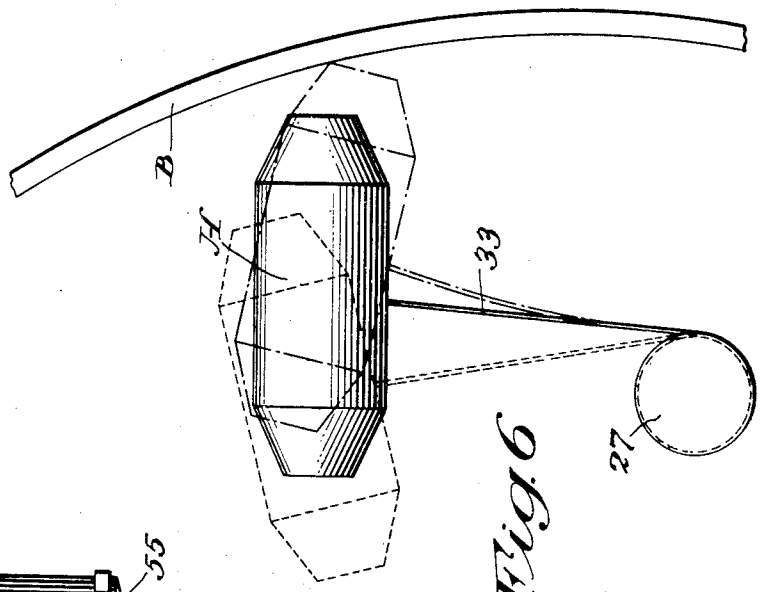



Fig. 6

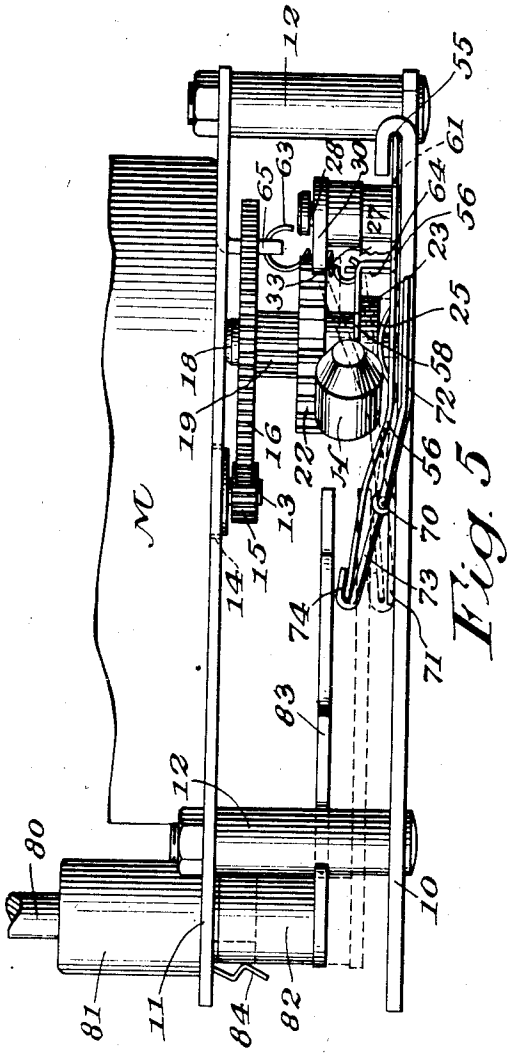



Fig. 5

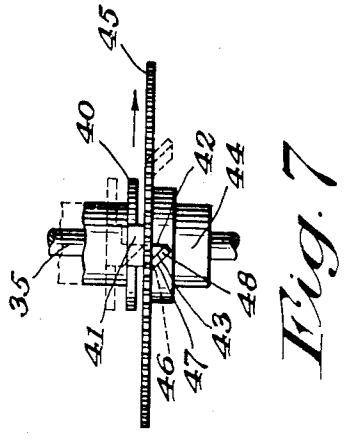



Fig. 7

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Patented Dec. 7, 1943

2,335,904

# UNITED STATES PATENT OFFICE

2,335,904

## ELECTRIC ALARM CLOCK

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Application July 1, 1940, Serial No. 343,392

9 Claims. (Cl. 58—38)

This invention relates to electric clocks and more particularly to an alarm mechanism for electric alarm clocks.

It is an object of the present invention to provide an improved alarm mechanism for electric clocks.

This and other objects of the invention will be more clearly understood from the following description in conjunction with the accompanying drawings and appended claims.

For the purpose of illustrating the invention, there is shown in the accompanying drawings a form thereof which is at present preferred, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized, and that the invention is not limited to the precise arrangement and organization of instrumentalities as herein shown and described.

Referring to the drawings, wherein like reference characters indicate like parts:

Fig. 1 is an elevational view, partly broken away, of an electric alarm clock embodying the invention, as viewed from the rear;

Fig. 2 is a sectional view taken substantially upon the line 2—2 of Fig. 1;

Fig. 3 is an elevational view, partly broken away, of the clock as viewed from the front;

Fig. 4 is a sectional view taken substantially on the line 4—4 of Fig. 3.

Fig. 5 is an elevational view of the clock, with some of the parts removed, as viewed from the right;

Fig. 6 is a detail sectional elevational view of a portion of the clock; and

Fig. 7 is a detail elevational view of another portion of the clock.

A clock embodying the invention, as illustrated in the accompanying drawings, comprises front and back plates 10 and 11 which are held in spaced relation by spacing studs 12. A clock motor M is suitably mounted on the back plate 11 so that its armature shaft 13 extends through an opening 14 in the back plate. A pinion 15 fixed upon the armature shaft 13 meshes with a gear 16 carried at one end of a sleeve 17 which is mounted for rotation upon a shaft 18 extending between and supported at its ends in the plates 10 and 11. A plate 20 is secured upon the other end of the sleeve 17 and is provided with a radially extending projection 21. A pinion 19 is formed on the sleeve 17 between the gear 16 and plate 20. A star wheel 22 is formed upon a sleeve 23 which surrounds the shaft 18 and is slidably and rotatably mounted thereon adjacent the sleeve 17. A pin 24 is fixed in the star wheel 22 so as to project therefrom parallel to its axis opposite the path of movement of the radially extending projection 21.

A sleeve 27 is mounted for rotation upon a stud shaft 28 projecting inward from the front plate 10. Spaced dogs 31 and 32 are formed on a plate 30 which is fixed to the sleeve 27 so as to engage alternately the teeth of the star wheel 22 as the star wheel is continuously rotated thereby causing oscillation of the sleeve 27. A flexible member 33 is secured at one end to the sleeve 27. A bell hammer H is fixed to the other end of the flexible member 33 so that it may be moved by the latter to engage a bell B which surrounds and projects forwardly beyond the end of the back plate 11.

The alarm setting mechanism of the clock comprises a shaft 35 which is mounted for rotation at its front end in the front plate 10 and extends through the back plate 11. A sleeve 36 is fixed upon the shaft 35 and fits into an opening in the back plate 11 which provides a bearing for rotatably supporting the shaft 35. The sleeve 36 is provided with a radially projecting flange 37 which engages the inner face of the back plate 11 and prevents axial movement of the shaft 35 to the left as viewed in Fig. 2. A leaf spring 38 surrounds the shaft 35 and its ends engage the outer surface of the back plate 11. A nut 39, threaded upon the shaft 35, engages the spring 38 and cooperates with the latter to prevent axial movement of the shaft 35 to the right, as viewed in Fig. 2. A plate 40 is fixed upon the inner end of the sleeve 36 and is provided with an extension 41 bent forwardly parallel to the axis of the shaft 35. The end of the projection 41 is formed with a cam having an inclined surface 43 and a flat surface 42 extending radially of the shaft 35. A sleeve 44 surrounds the shaft 35 and is slidably and rotatably mounted thereon. A gear 45 is fixed upon one end of the sleeve 44 and is provided with an opening 46 one edge of which extends radially to permit the cam portion of the projection to enter the opening. An inclined tab 47 extends from the other edge of the opening 46 and provides an inclined cam surface 48 adapted to cooperate with the cam surface 43. In the embodiment illustrated, a graduated hour dial 49 is formed upon the back of the clock housing 90 and surrounding the shaft 35. A plate carrying a pointer 91 is fixed to the shaft 35 in a prede-

termined relation to the projection 41 so that the latter will be opposite the opening 46 in the gear 45 at the time corresponding to the position of the pointer 91.

The gear 45 forms part of the clock timing mechanism which is driven by the pinion 15. Thus the pinion 15 engages the gear 16 which is mounted to rotate with the pinion 19. The pinion 19 engages the gear 50 which is mounted to rotate with a pinion 51. The pinion 51 engages a gear 52 which is mounted to rotate with a gear 53. The gear 53 engages a pinion 54 which meshes with the gear 45.

The front plate 10 is provided with a pair of spaced inturned tabs 55 which pivotally support a plate 56. The plate 56 is provided with spaced yokes 57 and 58. The yoke 57 surrounds the shaft 35 and extends between the front plate 10 and the adjacent end of the sleeve 44. The yoke 58 engages a groove 60 formed in the sleeve 23. The plate 56 is provided with an opening 61 through which the sleeve 27 projects. A spring 63 tends to move the plate 56 in a counterclockwise direction, as viewed in Fig. 2. One end of the spring 63 is connected to a tab 64 extending rearwardly from the plate 56 and its other end is secured to a tab 65 extending forwardly from the rear plate 11.

A rod 70 is pivotally mounted in a bearing formed in a strap 71 which is secured to the inner face of the front plate 10. The rod 70 is formed with arms 72 and 73 extending in opposite directions. The end of the arm 73 is bent around the end of an extension 74 of the plate 56 to provide a pivotal connection therebetween. The arm 72 is adapted to be moved into and out of the path of movement of the bell hammer H.

The alarm shut-off of the clock comprises a rod 80 which is slidably mounted in a bushing 81 fixed in the back plate 11. A collar 82 is fixed upon the inner end of the rod 80 and carries a plate 83 adapted to engage the extension 74 of the plate 56. A spring 84 is secured to the bushing 81 so as to engage the end of the collar 82 when the rod 80 is in the alarm shut-off position, that is, with the plate 83 carried thereby engaging the extension 74. When the rod 80 is moved to the right as viewed in Fig. 4, out of the alarm shut-off position, the spring 84 engages the periphery of the collar 82 and frictionally holds the rod 80 out of its alarm shut-off position.

In the normal operation of the clock when the alarm is not operating, the end of the projection 41, formed by the intersection of the cam surfaces 42 and 43, engages the back face of the gear 45 to force the sleeve 44 in engagement with the yoke 57 on the plate 56 and hold the latter in the position shown in Fig. 2. When the plate 56 is in this position, the sleeve 23 carrying the star wheel 22 is held in the position shown in Fig. 2 with the pin 24 out of the path of movement of the projection 21 and the spring 25 is held compressed.

The alarm mechanism is controlled to operate at a desired time by turning the shaft 35 to bring the pointer 91 opposite a number on the dial 90 corresponding to the time when it is desired to have the alarm operate. As shown in Fig. 1 the pointer is in a position to cause the alarm to operate at 11:00 o'clock. As the gear 45 is rotated it will reach a point such that the opening 42 in the gear is opposite the projection 41 at 11:00 o'clock. Then, the spring 63 will cause the plate 56 to pivot counterclockwise as viewed in Fig. 2 to move the sleeve 44 and gear 45 to the left thus causing the projection 41 to enter the opening 42. This movement of the plate 56 permits the spring 25 to move the star wheel 22 to the left as viewed in Fig. 2 to bring the pin 24 into the path of movement of the projection 21 and establish a driving connection between the motor M and the star wheel 22 through the pinion 15, gear 16, pinion 19 and plate 20 which carries the projection 21. Thus, the star wheel 22 is caused to rotate and its teeth successively engage the dog 31 upon the plate 30.

The impact of each tooth of the star wheel 22 against the dog 31 causes the sleeve 27 to rotate and move the plate 30, flexible member 33 and bell hammer H in a clockwise direction as viewed in Fig. 1 until the dog 32 engages the star wheel. Thus, the engagement of the dogs 31 and 32 with the star wheel limits the rotation of the sleeve 27 in opposite directions. If the clock should be stopped when the sleeve 27 is at its limit of rotation in a clockwise or counterclockwise direction, as viewed in Fig. 1, the bell hammer H will be positioned as shown by the dotted line and full line respectively in Fig. 6. Thus, the construction is such that the bell hammer is out of engagement with the bell B at all positions of rest. In the normal operation of the alarm mechanism, the rapid oscillation of the sleeve 27 causes the flexible member to flex and thus bring the bell hammer H in engagement with the bell B as shown by the dot-and-dash line in Fig. 6. The flexibility of the member 33 may be such that the natural frequency of the hammer H and flexible member 33 when sleeve 27 is held rigid is from 50% to 150% of, and preferably substantially equal to, the frequency or rate at which the teeth of the star wheel 22 oscillates the sleeve 27. When this mechanical condition obtains a small amount of oscillatory energy fed into sleeve 27 will cause a large amplitude of oscillation to be built up in hammer H limited only by collision of the hammer with the bell. This feature permits wide mechanical tolerances in the clearance between the hammer H and the bell B at any normal position of rest and due to the flexibility of the member 33 imparts a sharp impact to bell B without subsequent bouncing, contributing to a clear ring of the bell.

The continued rotation of the gear 45 causes the cam element 48 to engage the cam element 43 on the projection 41 and move the gear 45 and the sleeve 44 to the right as viewed in Fig. 2. This axial movement of the sleeve 44 causes the plate 56 to pivot clockwise as viewed in Fig. 2 against the action of the spring 63 and move the sleeve 23 carrying the star wheel 22 to the right to compress the spring 25 and bring the pin 24 out of the path of the projection 21 as shown in Fig. 2, thereby disconnecting the driving connection between the motor and the alarm mechanism.

In the normal operation of the clock, when the alarm mechanism is not in operation, the arm 72 of the rod 70 is positioned in the path of oscillation of the bell hammer H as shown in dotted line in Fig. 5 to prevent the latter accidentally hitting the bell if the clock is shaken or subjected to vibration. However, as the plate 56 is caused to pivot counterclockwise as viewed in Fig. 2 to actuate the alarm mechanism, the extension 74 of the plate 56 moves the rod 70 to cause the arm 72 to move out of the path of oscillation of the bell hammer H.

If it is desired to stop the operation of the alarm, the rod 80 is pushed to move it axially

to the left as viewed in Fig. 4, thus bringing the plate 83 in engagement with the extension 74 of the plate 56 to swing the rod 70 and move the arm 72 thereof into the path of oscillation of the bell hammer H.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

We claim:

1. In an electric clock having an electric motor and a timing mechanism operatively connected to said motor and including a rotatable element, the combination therewith of an alarm mechanism comprising an oscillatable member, a flexible member fixed at one end to said oscillatable member, a bell hammer fixed to the other end of said flexible member, driving means for oscillating said oscillatable member adapted to be operatively connected with said rotatable element and disconnected therefrom, and controllable means for connecting and disconnecting said driving means and said rotatable element including a manually operable alarm setting mechanism, a bell adapted to be engaged by said hammer, and means associated with said controllable means for preventing said hammer engaging said bell when said driving means is disconnected from said rotatable element.

2. In an electric clock having an electric motor, a timing mechanism operatively connected to said motor including a rotatable element and a rotatable wheel, the combination therewith of an alarm mechanism comprising an oscillatable member, a flexible member fixed at one end to said oscillatable member, a bell hammer fixed to the other end of said flexible member, driving means for oscillating said oscillatable member adapted to be operatively connected with said rotatable element including a movable element, a lever for controlling the movement of said movable element, means for slidably mounting said rotatable wheel in engagement with said lever, and a manually operable alarm setting mechanism having a cam element of said timing mechanism adapted to cooperate with a cam element on said wheel to control the sliding movement of the latter, a bell adapted to be engaged by said hammer, and means associated with said lever for preventing said hammer engaging said bell when said driving means is out of driving relation with said rotatable element.

3. In an electric clock having an electric motor and timing mechanism operatively connected therewith, said timing mechanism including a rotatable element, a sound-emitting member adapted to emit sound when struck, a hammer-arm bearing a hammer-head in operative juxtaposition with a portion of said sound-emitting member, driving means for oscillating said hammer-arm adapted to be operatively connected with said rotatable element and disconnected therefrom, means for connecting and disconnecting said driving means and said rotatable element, and means associated with said last-mentioned means for preventing said hammer-head from moving into contact with said sound-emitting member when said driving means is disconnected from said rotatable element.

4. In an electric alarm clock having an electric motor, a pair of spaced plates, a timing mechanism supported therebetween and operatively connected with said motor, said timing mechanism including two rotatable elements, one of which is axially shiftable, a shaft disposed between said plates supported by at least one of said plates, a bell hammer-arm pivotally secured to said shaft and bearing a bell hammer at its outer end, driving means for oscillating said hammer-arm including an axially shiftable portion and another portion movable thereby into and out of driving engagement with one of the aforesaid rotatable elements, a sidewise-tiltable plate hingedly secured at its one edge to one of said spaced plates and having two portions, one engaging said axially shiftable portion, and the other engaging the aforesaid axially shiftable rotatable element, and a manually-operable alarm setting member having camming means controlling the sliding movement of said axially shiftable rotatable element, and through it the driving connection between said hammer-arm oscillating means and the other rotatable element.

5. In an electric alarm clock having an electric motor and a timing mechanism operatively connected to said motor and including a rotatable element, an alarm mechanism including an oscillatable member, an arm extended therefrom bearing a bell hammer at its outermost end, means for oscillating said oscillatable member adapted for operative engagement with said rotatable element and disengagement therefrom, and controllable means for engaging and disengaging said first-mentioned means with said rotatable element including a manually operable alarm setting mechanism, a bell adapted to be engaged by said hammer, and means associated with said controllable means preventing said hammer from striking said bell when said first-mentioned means is disengaged from said rotatable element.

6. A clock alarm mechanism for sounding a ringing-type alarm signal wherein a single note is repeated in rapid succession to give a sustained signal of relatively substantial duration, said alarm mechanism including an elongated resiliently-flexible hammer-arm bearing a hammer-head at its one end, the other end thereof being pivotable about a fixed axis in close proximity thereto, the entire length of said arm intermediate said ends being of generally uniform resilience, mechanical means for oscillating said hammer-arm to-and-fro at some predetermined frequency, said means including a projection fixedly related to the pivotable end of said flexible hammer-arm, a toothed wheel having its teeth successively drivingly engageable with said projection to oscillate the latter, and with it said resiliently-flexible hammer-arm, and means for rotating said toothed wheel at a given speed, the natural frequency of said hammer-arm and hammer-head combination being approximately the same as the oscillation frequency, to cause said hammer-head to swing rapidly to-and-fro for relatively substantial distances beyond the limits to which it would have been brought had the hammer-arm been rigid, and a sound-emitting member positioned within the extended path of movement of the hammer-head, but outside the relatively shorter path which the latter would have described had the hammer-arm been rigid, thereby to sound a clear single note in repeated rapid succession to form a sustained ringing signal.

7. A clock alarm mechanism for sounding a ringing-type alarm signal wherein a single note is

repeated in rapid succession to give a sustained signal of relatively substantial duration, said alarm mechanism including a pivotally-mounted resilient hammer-arm carrying a hammer-head, mechanical means for oscillating said hammer-arm rapidly to-and-fro at some predetermined frequency, said resilient hammer-arm being free of any stop means when oscillating, and flexing at the end of each stroke by reason of sudden reversal of the force which causes it to oscillate, the natural frequency of said hammer-arm and hammer-head combination being from 50 to 150 per-cent of the oscillation frequency, to cause said hammer-head to swing rapidly to-and-fro for relatively substantial distances beyond the limits to which it would have been brought had the hammer-arm been rigid, and a sound-emitting member positioned within the extended path of movement of the hammer-head, but outside the relatively shorter path which the latter would have described had the hammer-arm been rigid, thereby to sound a clear single note repeated in rapid succession to form a sustained ringing signal.

8. A clock alarm mechanism for sounding a ringing-type alarm signal wherein a single note is repeated in rapid succession to give a sustained signal of relatively substantial duration, said alarm mechanism including a pivotally-mounted resilient hammer-arm carrying a hammer-head, mechanical means for oscillating said hammer-arm rapidly to-and-fro at some predetermined frequency, the natural frequency of said hammer-arm and hammer-head combination being from 50 to 150 per-cent of the aforesaid frequency, to cause said hammer-head to swing rapidly to-and-fro for relatively substantial distances beyond the limits to which it would have been brought had the hammer-arm been rigid, and a sound-emitting member positioned within the extended path of movement of the hammer-head, but outside the relatively shorter path which the latter would have described had the hammer-arm been rigid, thereby to sound a clean single note repeated in rapid succession to form a sustained ringing signal.

9. A clock alarm mechanism for sounding a ringing-type alarm signal wherein a single note is repeated in rapid succession to give a sustained signal of relatively substantial duration, said alarm mechanism including a pivotally-mounted resiliently-flexible hammer-arm carrying a hammer-head, the entire length of said arm being of substantially uniform resilience, mechanical means for oscillating said hammer-arm rapidly to-and-fro, said hammer-arm being free of any stop means when oscillating, and flexing at the end of each stroke by reason of sudden reversal of the force which causes it to oscillate, to cause said hammer-head to swing rapidly to-and-fro for relatively substantial distances beyond the limits to which it would have been brought had the hammer-arm been rigid, and a sound-emitting member positioned within the extended path of movement of the hammer-head, but outside the relatively shorter path which the latter would have described had the hammer-arm been rigid, thereby to sound a clear single note repeated in rapid succession to form a sustained ringing signal.

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