May 15, 1962 P. A. SIDELL ET AL 3,034,280

24-HOUR TIME ALARM

Filed Sept. 28, 1959 4 Sheets-Sheet 1

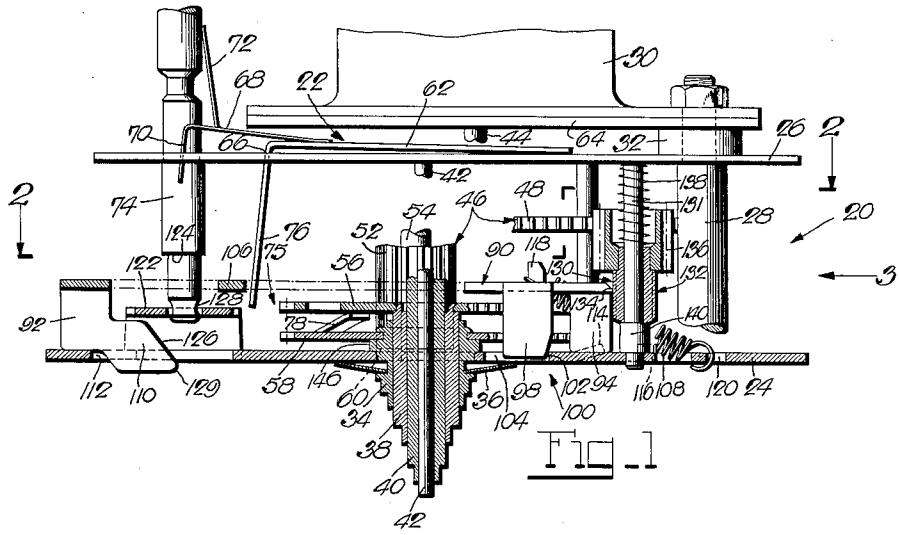


Fig. 1

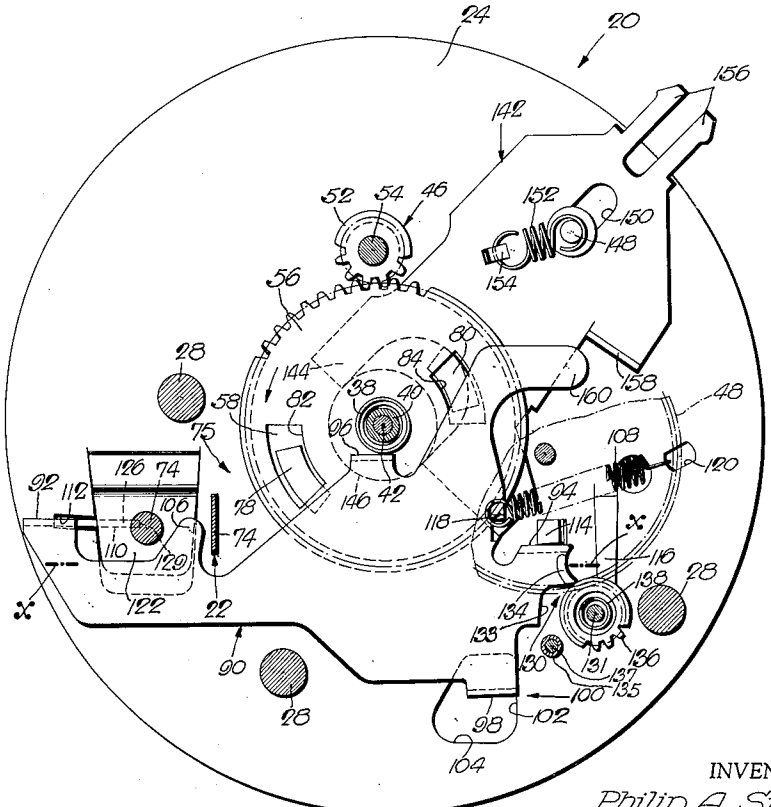


Fig. 2

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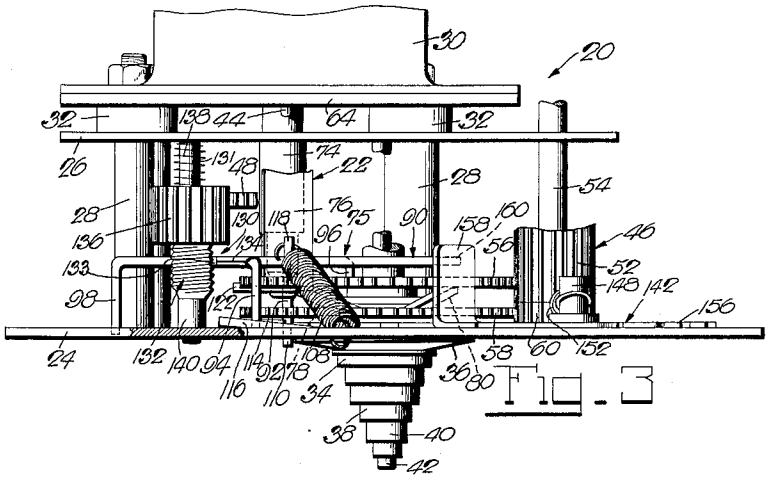


Fig. 3

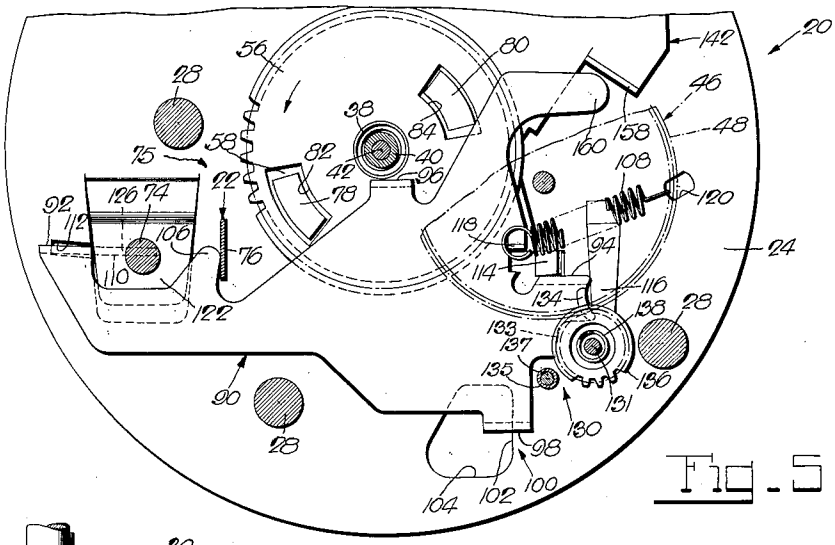


Fig. 5

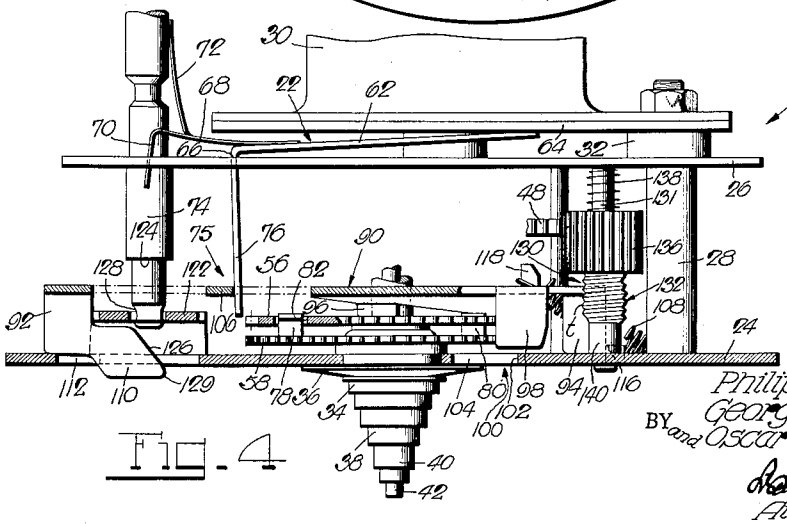


Fig. 4

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24-HOUR TIME ALARM

Filed Sept. 28, 1959 4 Sheets-Sheet 3

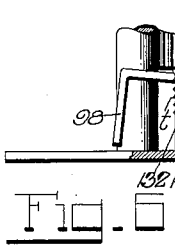


Fig. 6

Fig. 7

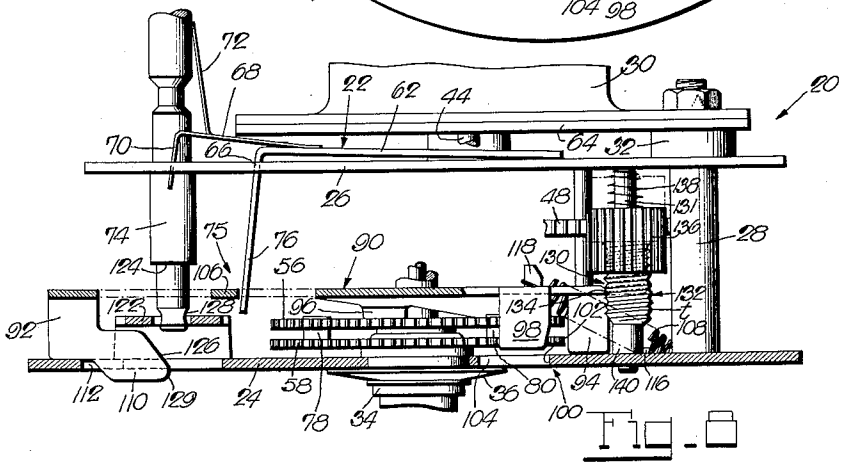


Fig. 8

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24-HOUR TIME ALARM

Filed Sept. 28, 1959 4 Sheets-Sheet 4

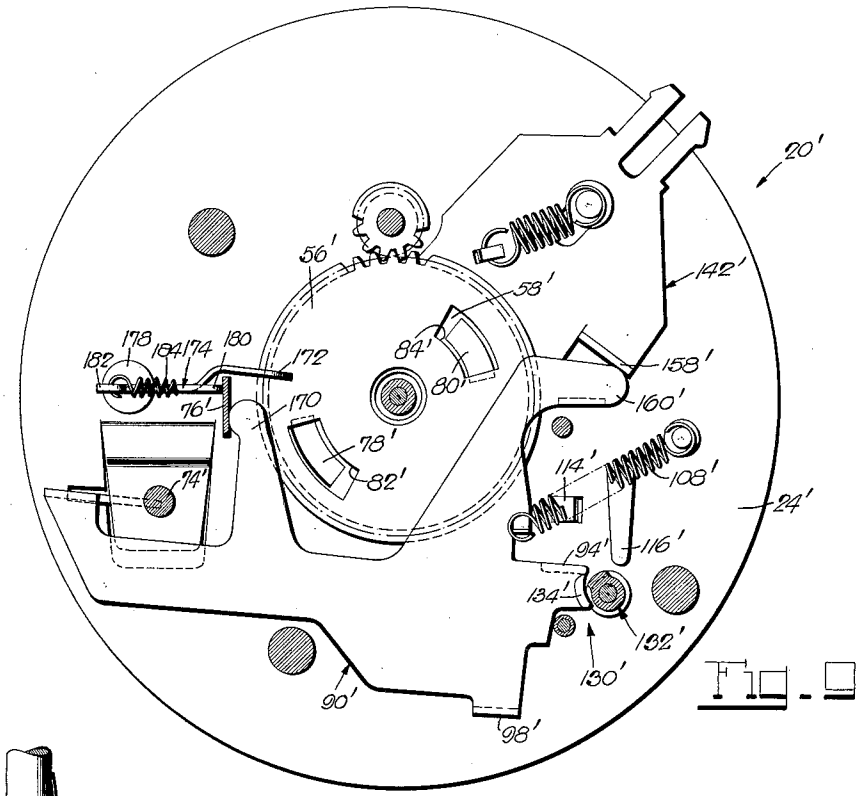


Fig. 9

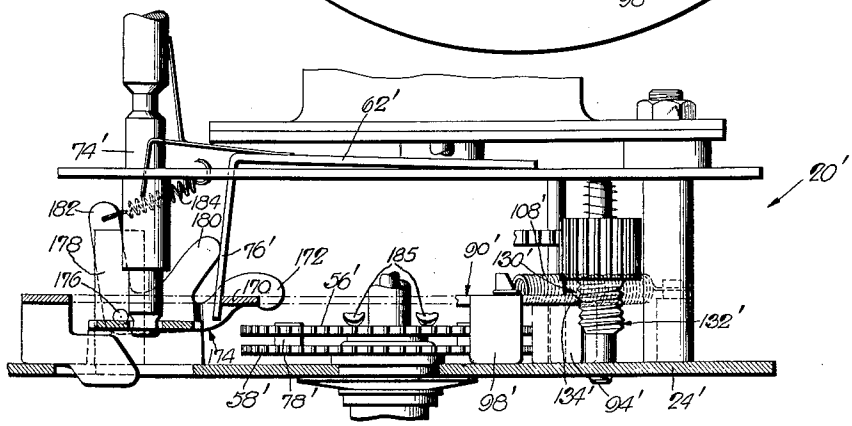


Fig. 10

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United States Patent Office 3,034,280 Patented May 15, 1962

3,034,280
24-HOUR TIME ALARM

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Filed Sept. 28, 1959, Ser. No. 842,809
3 Claims. (Cl. 58—21.1)

This invention relates to time alarms in general, and to on-and-off controls for 24-hour time alarms in particular. This application is a continuation-in-part of Serial No. 821,590, filed June 19, 1959.

The time alarm with which the present invention is concerned is of the type which will automatically repeat an alarm at the exact preset time, but only at intervals of multiples of twelve hours, and especially, though not exclusively, at intervals of 24 hours, even permitting different setting of the alarm time as often as desired with the repeat alarms fully responding to each new alarm time setting, and with the only requirement for continuing the repeat alarms indefinitely being the shut-off of each alarm.

It is an object of the present invention to provide a 24-hour time alarm or clock which in point of construction is nearly as simple as conventional 12-hour time alarms and performs as reliably as the latter.

It is another object of the present invention to provide a 24-hour time alarm of this type which on mere manipulation of a conventional alarm shut-off member is converted into a 12-hour time alarm of entirely accustomed usage, even to the extent of requiring after the shut-off of each alarm additional prior setting of each successive alarm for its run-off at the set alarm time, and which may at any time be reconverted into an automatic 24-hour time alarm on mere manipulation of another control member for shutting-off each automatic 24-hour alarm. With this arrangement, there is afforded the simplest possible alarm control, involving inevitable shut-off of each automatic 24-hour alarm which is all that is required for its next automatic repeat, and involving accustomed handling of a conventional alarm shut-off member of a 12-hour time alarm for a change or interruption in a daily automatic 24-hour alarm schedule.

It is a further object of the present invention to provide a 24-hour time alarm of this type which has as its main or primary control an entirely conventional 12-hour alarm control that functions as usual to set off an alarm at the preset time once in every twelve hours unless restrained by the manual shut-off lever to forego each alternate alarm, and which has a supplemental control of a few simple parts, involving in one form no more than a time-driven member and the aforementioned 24-hour alarm shut-off member, which on momentary manipulation of the latter locks the action of the 12-hour alarm control for a drive period of the time-driven member in excess of twelve hours, thus canceling each alternate alarm under the 12-hour alarm control on shut-off of each actual 24-hour alarm.

Other objects and advantages will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

FIG. 1 is a fragmentary view, partly in section, of a time alarm embodying the present invention;

FIG. 2 is a section through the time alarm taken substantially on the line 2—2 of FIG. 1;

FIG. 3 is a fragmentary view of the time alarm as seen in the direction of the arrows 3 in FIG. 1;

FIGS. 4 and 5 are fragmentary views of the time alarm

similar to FIGS. 1 and 2, respectively, but showing certain operating and control parts of the time alarm in different positions;

FIG. 6 is a fragmentary view of the time alarm similar to FIG. 3, but showing certain operating and control parts of the time alarm in different positions;

FIGS. 7 and 8 are fragmentary views of the time alarm similar to FIGS. 5 and 4, respectively, but showing certain operating and control parts of the time alarm in still other different positions;

FIG. 9 is a section through a time alarm embodying the present invention in a modified manner; and

FIG. 10 is a fragmentary side view, partly in section, of the modified time alarm of FIG. 9.

Referring to the drawings, and more particularly to FIGS. 1 to 8 thereof, the reference numeral 20 designates a movement presently of a clock, having an alarm 22. The movement 20 comprises front and rear plates 24 and 26 which are held spaced apart by pillars 28, and which support the various operating parts of the movement and the controls for the alarm. Thus, the prime mover of the movement, presently a synchronous motor 30, is mounted in back of the rear plate 26 through intermediation of the pillars 28 and spacers 32. Mounted in the front plate 24 are a plurality of nested time shafts or sleeves, of which an outermost alarm shaft 34 is directly mounted in the front plate 24 for rotation against a friction washer 36 to set an alarm hand to any desired alarm time on a 12-hour time dial (neither shown). Independently turnable in the alarm shaft 34 is an hour shaft 38 in which a minute shaft 40 is independently turnable, the nested shafts being further turnable on a fixed arbor 42 on the rear plate 26. The output shaft 44 of the synchronous motor 30 is operatively connected in conventional manner with the minute shaft 40 through a suitable reduction gear train (not shown) which in the present instance drives the minute shaft 40 through one complete revolution in an hour's time. A conventional gear train 46 of twelve-to-one speed reduction operatively connects the minute shaft 40 with the hour shaft 38, this gear train presently including a gear 48, a loose pinion 52 on a manually turnable alarm-setting shaft 54 and a meshing gear disc 56 which is carried by the hour shaft 38 (FIGS. 1 to 3). Accordingly, the hour shaft 38 is, in the present instance, driven through one-twelfth of a revolution for each complete revolution of the minute shaft 40. The present movement also includes conventional provisions (not shown) for setting the hour and minute shafts 38 and 40.

The alarm shaft 34 carries a gear disc 58, presently of the same diameter as the adjacent gear disc 56 on the hour shaft 38, which is in mesh with a pinion 60 (FIG. 3) on the setting shaft 54 by means of which the customary hand on the alarm shaft 34 may be set to a desired alarm time.

The movement described so far is entirely conventional and forms no part of the present invention except as it enters into combination therewith.

The alarm 22 includes a conventional electromagnetically impulsed resilient vibrator or reed 62 which emits an audible alarm sound or buzz on being vibrated against a field plate 64 of the motor 30 by magnetic leakage flux therefrom. To this end, the vibrator 62 is presently pivoted at 66 in the rear plate 26 for swinging motion into the alarm-off and alarm-on positions shown in FIGS. 1 and 4, respectively, in which the same does not respond, respectively does respond, to leakage flux from the motor, the vibrator 62 being normally urged by a spring 68 into its alarm-off position in which it rests against the rear plate 26. The spring 68 is presently L-shaped and anchored with its shorter leg 70 to the rear plate 26, and has an integral leg 72 bearing against a

stem 74 to preload the spring. The vibrator 62 has a relatively stiff depending arm 76 with which to swing the vibrator into its alarm-on position.

A 12-hour alarm control 75 includes the gear discs 56 and 58 on the hour and alarm shafts 38 and 34, of which the driven disc 56 together with the hour shaft 38 are at the set alarm time shifted axially in conventional manner to start an alarm cycle of the vibrator 62. To this end, the disc 58 on the alarm shaft 34 is provided with cam means, presently two diametrically opposite, inclined cam lugs 78 and 80 which are struck from this disc at different radial distances from its center axis, and which are adapted to cooperate with arcuate slots 82 and 84, respectively in the adjacent driven companion disc 56 on the hour shaft 38. The slots 82 and 84 are at the same different radial distances from the center axis of the disc 56 as are the respective cam lugs 78 and 80 from the axis of the disc 58, wherefore these slots will operatively align with their respective cam lugs only once during each revolution of the hour shaft 38, i.e., once every twelve hours, and permit the disc 56 with the hour shaft 38 to move from the retracted position in FIG. 1 into the projected position in FIG. 4. With the disc 56 on the hour shaft 38 being driven in counterclockwise direction as viewed in FIGS. 2 and 5, it stands to reason that this disc will, on movement into its projected position (FIGS. 4 and 5), remain in this position for a time period depending on the arcuate lengths of its slots 82 and 84, the cam lugs 78 and 80 on the set alarm disc 58 then camming the disc 56 into its retracted position on the continued drive of the latter with the hour shaft 38. The disc 56 and hour shaft 38 are normally urged into the projected position in FIG. 4 by means described hereinafter.

The alarm disc 58 and the time-driven companion disc 56 with their cam lugs 78 and 80 and slots 82 and 84 are adapted to perform the conventional function of controlling the time start of an alarm cycle as well as another function to be described hereinafter. The aforementioned stem 74, which is a part of the 12-hour alarm control 75, is an alarm shut-off plunger manually operable to terminate an alarm cycle at any time and render the alarm control 75 inoperative or operative for any length of time.

According to one form of the present invention, the operating connection which links both, the time-driven disc 56 and the alarm shut-off plunger 74 with the vibrator 62, is a single actuator 90 which is another part of the 12-hour alarm control 75, and presently is in the form of a plate having a longitudinal axis x—x (FIG. 2). This plate is formed with integral lug or leg formations 92, 94, 96 and 98 (FIGS. 1 to 3), of which the leg formations 92 and 94 serve as a longitudinal fulcrum for the actuator 90 with which the latter rests, and is also rockable as well as movable, on the front plate 24. The lug formation 96 on the actuator 90 serves as a follower to cooperate with the axially shiftable disc 56 in rocking the actuator on the front plate 24 (FIGS. 3 and 6). Finally, the lug formation 98 on the actuator 90 is part of a device 100 for arresting the actuator in a certain alarm-off position (FIGS. 1 and 2) and for releasing the same for movement into a certain alarm-on position (FIGS. 4 and 5), this arresting device further providing a lock shoulder 102, presently formed by an edge of a slot 104 in the front plate 24, with which the actuator lug 98 is in locking engagement in the alarm-off position of the actuator (FIGS. 1 and 2). When the actuator 90 is in its alarm-off position, an operating finger 106 thereof is retracted from the arm 76 of the vibrator 62 which is then in its inoperative position. The actuator lug 98 is thus held in locking engagement with the shoulder 102 when the actuator 90, under the control of the retracted disc 56 assumes the rock position in FIG. 3, and the actuator is released in its alarm-off position for movement into its alarm-on position when the actuator rocks

in follower relation with the disc 56 on movement of the latter into its projected position (FIG. 6) in which the actuator lug 98 is clear of the lock shoulder 102. When the actuator 90 is thus released in its alarm-off position on projection of the disc 56, the actuator will by a spring 108 be advanced into its alarm-on position (FIGS. 4 and 5) in which its operating finger 106 engages the arm 76 of the vibrator 62 and rocks the latter into its operative or alarm-sounding position. The alarm cycle may then be terminated on certain manipulation of the shut-off plunger 74, resulting in retraction of the actuator 90 into its alarm-off position and, hence, retraction of its operating finger 106 from the arm 76 of the vibrator 62 and ensuing spring-return of the latter to its inoperative or alarm-off position (FIG. 1).

The actuator 90 is guided for linear movement into its alarm-on and alarm-off positions. To this end, an extension or detent 110 on the fulcrum leg 92 of the actuator projects into a presently linear slot 112 in the front plate 24, and the other fulcrum leg 94 of the actuator is urged by the action of the spring 108 against a guide lug 114 which is conveniently struck from the front plate 24. To hold the resilient vibrator 62 in proper operating position for a satisfactory buzzing sound (FIG. 4), the actuator 90 in its alarm-on position bears with its fulcrum leg 94 against a stop 116 which is conveniently struck from the front plate 24 (FIGS. 3 and 5). The action spring 108, which is preloaded, is anchored with its ends to a bent-up finger 118 on the actuator 90 and in a slot 120 in the front plate 24. This spring 108 is so inclined to the longitudinal actuator axis x—x as well as to the front plate 24 (FIGS. 1 and 2) that it has component forces urging the actuator 90 into its alarm-on position and against the guide lug 114, as well as into follower relation with the disc 56 and also into rest on the front plate 24.

The alarm shut-off plunger 74 is guided in the rear plate 26 and in a ledge 122 conveniently struck from the front plate 24 and overlying the fulcrum extension 110 on the actuator 90. The shut-off plunger 74, when in its retracted position (FIGS. 1 and 4) in which it is yieldingly held by the spring leg 72, does not in any way interfere with the movement of the actuator 90 into its alarm-on position. However, when the actuator 90 is in its alarm-on position (FIG. 4), the plunger 74 will, on manual inward movement into a projected position in which its annular shoulder 124 bears against the ledge 122, cam the actuator from its alarm-on position into its alarm-off position and lock the same in this position, the fulcrum extension 110 on the actuator 90 being to this end provided with a cam edge 126, and the end of the plunger 74 being preferably peripherally grooved at 128 for releasable interlock with the rounded edge 129 of the fulcrum extension 110 of the actuator in its alarm-off position.

With the movement 20 in operation and the disc 58 set for a certain alarm time, and with the actuator 90 arrested in its alarm-off position and the shut-off plunger 74 in its retracted position (FIGS. 1 to 3), everything is set for the alarm to sound at the preset time. At that time, the slots 82 and 84 in the driven disc 56 will come into full alignment with the respective cam lugs 78 and 80 in the set alarm disc 58 (FIG. 5), with the result that the disc 56 will, under the urgency of the action spring 108 and through intermediation of the actuator 90, be moved axially into its projected position with the actuator following for retraction of its lug 98 from locking engagement with the shoulder 102 (FIG. 6). The now released actuator 90 will quickly be spring-advanced into its alarm-on position, bringing the vibrator 62 into and holding it in its operating position (FIG. 4) for an audible buzz alarm. The alarm cycle may at any time be terminated by simply pushing the shut-off plunger 74 into its aforementioned projected position with ensuing retraction of the actuator 90 into its alarm-off position.

If at that time the driven disc 56 has not yet been shifted back into its retracted position by the cam lugs 78 and 80 on the set alarm disc 58 (FIG. 1), the actuator 90 will on its return to alarm-off position not become arrested by the described arresting device 100 since the actuator lug 98 is then still clear of the front plate 24 (FIG. 6). However, with the shut-off plunger 74 in its inner or projected position holding the actuator 90 locked in its alarm-off position, the actuator lug 98 will be returned into locking engagement with the shoulder 102 when the actuator follows the disc 56 on its subsequent return into retracted position (FIGS. 1 and 2). Should the shut-off plunger 74 not be pushed into its projected position by the time the disc 56 is returned into its retracted position, the alarm will continue to sound until the plunger 74 is pushed into its projected position. This is due to the fact that the prior return of the disc 56 into its retracted position will merely rock the actuator with its arresting lug 98 against the front plate (FIG. 5), but not into slot 104 therein with which it is then out of alignment, and will thus merely condition the actuator for arrest by the shoulder 102 on its subsequent return into alarm-off position.

As already mentioned, the time period in each twelve hours during which the driven disc 56 will remain in its projected position depends on the arcuate lengths of the slots 82 and 84 in this disc, and this time period, hereinafter referred to as the automatic alarm period, may for present practical purposes vary from a few minutes to half an hour, for example. With each alarm cycle presently terminated by the action of the shut-off plunger 74, the latter will have to remain in its projected or actuator-locking position for over twelve hours following each alarm in order to prevent a repeat alarm every twelve hours, as will be readily understood. Hence, it is only after the lapse of the first twelve hours from the shut-off of the last alarm, and usually at bedtime, that the shut-off plunger 74 is retracted to condition the alarm for its next cycle, under the 12-hour control 75, twenty-four hours after the start of the last alarm cycle plus or minus such time as is involved if the alarm has been set for a different time in the meantime.

The discs 56 and 58, shut-off plunger 74 and actuator 90 of the described 12-hour alarm control 75 are in this instance identical in construction and performance with similar parts of a 12-hour alarm control disclosed in our copending application, Serial No. 821,590, filed June 19, 1959. Combining with the main or 12-hour alarm control 75 for one exemplary form of the invention is a supplemental alarm control 130 which, when used as desired, coacts with the control 75 in serving as an automatic 24-hour alarm control.

The present supplemental alarm control 130, which when used is linked directly with the actuator 90, includes a holding element 132 for the actuator 90 in an alarm-off position. The holding element 132 is, in the present instance, in the form of a time-driven worm with which a single tooth 134 on the actuator 90 in alarm-off position is adapted to mesh for its ride thereon for a time period in excess of twelve hours and then run-off therefrom. More particularly, the actuator 90 is moved into an alarm-off position and simultaneously into mesh with the holding worm 132 (FIG. 7) on manipulation of an automatic alarm shut-off member or slide 142 to-be-described, with the alarm shut-off plunger 74 being then retracted in its inoperative position to permit such movement of the actuator 90, and with the actuator remaining locked to the holding worm 132 while in mesh therewith and, hence, remaining locked in its alarm-off position (FIG. 7) until it rides off the holding worm. To this end, the holding worm 132 is freely turnable, and presently also axially slidable, on a shaft 131 which is mounted in the front and rear plates 24 and 26, and this worm is also provided with a pinion 136 for its drive from the exemplary gear 48 of the gear train 46. The holding worm 132 is normally urged by a spring 138 into the starting position shown in FIGS. 1, 3 and 4, in which it is nearest the front plate 24 and bears against a collar formation 140 on the shaft 131.

For movement of the actuator 90 from its alarm-on position into mesh or locking engagement of its tooth 134 with the worm 132 in its starting position, there is provided the aforementioned slide 142 which is guided on the front plate 24 for movement, presently radially of the nested shafts 34, 38 and 40. To this end, the inner slotted end 144 of the slide 142 is guided on a collar formation 146 on the alarm shaft 34, and the slide 142 further has a pin and slot connection 148, 150 with the front plate 24, the pin 148 being presently projecting from the front plate 24 and the slot 150 being provided in the slide 142. A spring 152, presently anchored with its ends to the pin 148 and to a struck-up lug 154 on the slide 142, normally urges the latter into the retracted or home position shown in FIG. 2. The slide 142, which for its manual inward motion or depression into the operative position shown in FIG. 7 has a terminal end 156 for the reception of a suitable handle or knob (not shown), is also provided with an upturned shoulder 158 which in any position of the actuator 90 is in operative alignment with an arm 160 on the latter.

Assuming now that the operating and control parts of the alarm system assume the positions shown in FIGS. 1 to 3, and further assuming that the next following alarm cycles are to be under the sole control of the 12-hour alarm control 75, it is apparent that the next alarm cycle is about 15 minutes off the set alarm time according to the near alignment of the slots 82 and 84 in the disc 56 with the cam lugs 78 and 80 on the companion disc 58 (FIG. 2). After the lapse of these 15 minutes, the slots 82 and 84 in the driven disc 56 will come into full register with the respective cam lugs 78 and 80 on the set alarm disc 58 (FIGS. 4 and 5), with the result that the alarm will go on, the vibrator 62 then being swung into its operative position. After the alarm has served its purpose, the same is interrupted by pushing in the shut-off plunger 74 which will cause retraction of the actuator 90 into its alarm-off position (FIG. 2), as will be readily understood. With the actuator 90 thus retracted, its leg 98 is in alignment with the slot 104 in the front plate 24 and will move into interlock with the arresting shoulder 102 on the following cammed retraction of the driven disc 56 and ensuing follower rocking motion of the actuator 90. However, the shut-off plunger 74 is left in its depressed or inward position for more than 12 hours after the shut-off of the alarm in order to hold the actuator 90 in its alarm-off position and prevent the next alarm exactly twelve hours after the start of the last alarm when the driven disc 56 again goes through its cam-controlled cycle of forward projection and then retraction. The shut-off plunger 74 may thereupon be retracted at any time for the sounding of the next alarm exactly 24 hours after the start of the last audible alarm, the actuator 90 being after the retraction of the shut-off plunger 74 held in its alarm-off position by the arresting device 100 and released for spring return to its alarm-on position on the next forward projection of the driven disc 56 at the preset alarm time. The time alarm may thus be used for as many repeat alarms under the sole control of the 12-hour alarm control 75 as is desired.

Assuming now that it is desired to place the time alarm under automatic 24-hour alarm control after the present alarm (FIGS. 4 and 5), the present alarm will be interrupted after the desired duration on shifting the actuator 90 from its alarm-on position into an alarm-off position, not by inward depression of the shut-off plunger 74 but rather by momentary inward depression of the slide 142, with the result that the actuator is shifted into the alarm-off position shown in FIG. 7 and simultaneously brought with its tooth 134 into meshing engage-

ment with the holding worm 132 (see also FIG. 8). The worm 132 then being in its starting position the same will by the meshing actuator tooth 134 be cammed axially very gradually until it reaches the dot-and-dash line end position in FIG. 8 after a time lapse in excess of twelve hours, whereupon the actuator tooth 134 will ride off the worm. In thus locking the actuator 90 in the alarm-off position in FIG. 7 for the duration of the ride of its tooth 134 on the holding worm 132 in excess of twelve hours after the described shut-off of the last audible alarm, the actuator will assuredly be held in this alarm-off position on the next forward projection and subsequent retraction of the driven disc 56 twelve hours after the last alarm-responding projection and retraction of this disc, thereby compelling the 12-hour alarm control 75 to omit the next 12 hour alarm. When the actuator tooth 134 finally rides off the worm 132, the actuator 90 will by the action spring 108 be drawn into the alarm-off position shown in FIG. 2 in which its leg 98 is locked to the shoulder 102, it having been brought into locking relation therewith on the previous rocking motion of the actuator in following relation with the disc 56 on its preceding retraction (FIG. 1). The actuator 90 has thus been transferred from the supplemental control 130 to the 12-hour alarm control 75 after the lapse of over 12 hours from the last audible alarm, with the next audible alarm going off exactly 24 hours after the start of the last audible alarm and under the control of the 12-hour alarm control 75 when the disc 56 is projected at the next arrival of the set alarm time and the actuator 90 is in consequence rocked out of arresting relation with the shoulder 102 for spring return to its alarm-on position (FIGS. 4 and 5). The alarm then sounding may be interrupted at any time, even after the aforementioned automatic alarm time, by mere momentary inward depression of the slide 142 which is all that is required for setting off the next automatic alarm exactly 24 hours from the start of the alarm just shut-off. The time alarm may thus continue on automatic 24-hour alarm indefinitely, the only requirement being that each alarm be shut-off by momentary depression of the slide 142.

If it is desired to change an established daily automatic 24-hour alarm schedule, by desiring a repeat alarm within 12 hours, or if it is desired to interrupt such a daily automatic 24-hour alarm schedule, as for a weekend or during the user's absence for over a day, it is merely necessary to place the alarm under the sole control of the 12-hour alarm control or to shut-off the alarm for any desired length of time, both by manipulation of the shut-off plunger 74, as will be readily understood.

It follows from FIGS. 5 and 7 that the actuator 90, in its movement from alarm-on position into mesh with the holding worm 132, is shifted not only longitudinally of its axis *x—x* but additionally transversely thereof, the shoulder 158 on the slide 142 being disposed accordingly. In order to permit this additional motion of the actuator 90, even in any of its rocking positions on the front plate 24, its floating detent and slot connection 110, 112 with the front plate 24 is additionally in the form of a universal connection by providing adequate clearance between the detent 110 and the slot 112 (FIGS. 1, 2, 3, 6 and 7). Also, in order securely to retain the actuator tooth 134 in meshing or locking engagement with the worm 132 for its full ride thereon despite the component pull-off force of the action spring 108 and even in case of shock or vibration, the worm 132 is driven counter-clockwise (FIG. 7) so that the friction to which it subjects the actuator tooth 134 will more than counteract this component pull-off force of the action spring 108. Moreover, the actuator tooth 134 is preferably curved in outline and arranged so that it will hook the worm 132 while in mesh therewith (FIG. 7). Also, while the return spring 138 of the worm 132 may be relatively weak, its force will never be permitted to rock the actuator 90 out of follower relation with the axially movable disc 56 by preferably arranging the tooth 134 of the actuator in safe proximity to its fulcrum leg 94 (FIGS. 7 and 8). Further, to control the contact pressure between the actuator tooth 134 and the worm 132, an edge 133 of the actuator bears against a roller 135 on a fixed stud 137 when the actuator tooth 134 is in mesh with the worm 132 (FIG. 7).

As already mentioned, the time required for the actuator 90 to ride with its tooth 134 on the holding worm 132 and finally off the latter is in excess of twelve hours, and this is, of course, imperative for proper performance of the supplemental alarm control 130. The absolute minimum time of the meshing engagement of the actuator tooth 134 with the holding worm 132 is 12 hours plus slightly more than the aforementioned automatic alarm time, i.e., the time required for each cam-controlled projection and subsequent retraction of the time-driven disc 56 which in the present example may be assumed to be 30 minutes. Accordingly, in the present example the absolute minimum time of mesh of the actuator tooth 134 with the holding worm 132 should be twelve and a half hours plus at least a few minutes, with the latter minutes added to make quite certain that the disc 56 has been fully returned to its retracted position and, hence, has conditoned the actuator 90 for arrest in its alarm-off position (FIGS. 3 and 7) immediately on the ride-off of the actuator tooth 134 from the holding worm 132, as will be readily understood. However, this absolute minimum time of mesh of the actuator tooth 134 with the holding worm 132 is largely impractical since it would not permit adjustment of the alarm time to a time slightly later than the previous alarm time, such as adjusting the alarm time from 8 to 8:30, for example. If the alarm time were adjusted in this exemplary fashion after the sounding of the last alarm at 8 a.m. and before the next projection and retraction cycle of the time-driven disc 56, the next alarm would inevitably sound at 8:30 p.m. on the same day even though the time alarm is under automatic 24-hour alarm control. Accordingly, allowance is preferably made for adjustment of the alarm time within limits that will meet all normal requirements, such as setting the alarm for 7 o'clock on weekdays and for 9 o'clock on Sundays, and may even meet exceptional requirements, such as setting the alarm normally for 6 o'clock and for a particular day for 9:25 o'clock, with the normal alarms to go off at 6 a.m. and with the exceptional alarm to go off at 9:25 a.m. This may readily be achieved by arranging the time of mesh of the actuator 90 with the holding worm 132 for 16 hours, for example. In that case, the last normal 6 a.m. alarm prior to adjustment of the alarm time to 9:25 o'clock may be shut-off at 6:01, for example, at which time the actuator 90 is shifted into mesh with the holding worm 132. The alarm time is then adjusted to 9:25 o'clock. Since the actuator 90 remains in mesh with the holding worm 132 for the assumed 16 hours, i.e. until 10:01 p.m. on the same day, and is until then held in alarm-off position by the holding worm (FIG. 7), the next projection and retraction cycle of the time-driven disc 56 from exactly 9:25 p.m. until 9:55 p.m. on the same day (with assumed automatic alarm time of 30 minutes) will be ineffectual for the sounding of an alarm. With the actuator 90 thus riding-off the holding worm 132 at 10:01 p.m., i.e. after the just concluded ineffectual projection and retraction cycle of the disc 56, the actuator is immediately arrested in alarm-off position by the arresting means 100 (FIGS. 1 and 2) and is now solely under the 12-hour alarm control 75, meaning that the next alarm will go off with the next projection of the disc 56 which takes place at exactly 9:25 a.m. of the next day, as desired.

Let it now be assumed that with the same exemplary 16-hour mesh period of the actuator 90 with the holding worm 132 the normal daily alarm time at 6 a.m. is to be adjusted for a particular day to 2:35 a.m. In that case, the alarm time is adjusted to 2:35 o'clock after the

sounding of the 6 a.m. alarm on the day prior to this particular day. Let it be assumed for the sake of simplicity that this alarm has been shut-off the moment it sounded, so that the actuator **90** has been shifted into mesh with the holding worm **132** at 6 a.m. on this prior day. Accordingly, the actuator **90** will by the holding worm **132** be held in alarm-off position (FIG. 7) for 16 hours, i.e. until 10 p.m. on the same day, with the result that no alarm will go off at 2:35 p.m. on that day. The actuator **90**, being released from the holding worm **132** at 10 p.m. on that day, is then solely under the 12-hour alarm control **75**, with the result that the actuator will be released for spring return to its alarm-on position on the next projection of the time-driven disc **56**, and the next alarm will sound at exactly 2:35 a.m. on the following, particular day as desired. Thus, with the exemplary 16-hour mesh period of the actuator **90** with the holding worm **132**, the alarm time may safely be adjusted at any time an approximate maximum of 3 hours and 25 minutes, either ahead or backwards, from any set alarm time, and the automatic 24-hour alarm will correctly respond each time. This exemplary maximum alarm time adjustment of 3 hours and 25 minutes either way from any set alarm time may, of course, be changed to meet other alarm requirements by selecting a different period of mesh of the actuator with the holding worm which in any event must be in excess of twelve hours for reasons well understood by now. Also, the time alarm may through proper use of the 12-hour alarm control **75** meet most any alarm requirements that cannot be met directly by the automatic 24-hour alarm control.

It follows from the preceding that the period of mesh of the actuator **90** with the holding element **132**, in this instance, a worm, is quite long and is for practical reasons quite considerably in excess of 12 hours. Of course, the drive of the holding element **132** may for that purpose be derived from any suitable part of the gearing of the timing mechanism of the time alarm, such as the speed reduction drive **46** of the hour shaft **38**, for example. Of course, the drive of the holding worm **132** and the number of turns of its single thread *t* together determine the period of mesh of the actuator therewith, and these factors are obviously matters of choice in arriving at a desired mesh period. In this connection, the mesh period may be chosen, for example, to be in excess of 36 hours and less than 48 hours for a 48-hour repeat alarm, as will be readily understood. Thus, a repeat alarm at intervals of any desired multiple of twelve hours may be achieved merely by selecting the proper mesh period and, hence, the drive of the holding element **132**.

Reference is now had to FIGS. 9 and 10 which shows a modified time alarm **20'**. This modified time alarm adapts the featured supplemental alarm control **130'** with its time-driven holding element **132'** to a 12-hour alarm control of which the time-driven disc **56'** is conventionally operatively linked directly with the vibrator **62'**, presently with its arm **76'**. In the present time alarm, the actuator **90'** is a definite part of the supplemental alarm control **130'**, but it is also included in the 12-hour alarm control by virtue of its added function as an operative link between the latter and the main shut-off plunger **74'** as hereinafter more fully described. The present time alarm also permits a 24-hour alarm and a non-repeat or automatic repeat 12-hour alarm at the option of the user.

The actuator **90'** is constructed and arranged exactly as the actuator **90**, with the important exceptions that the leg **98'** of the present actuator **90'** bears at all times against the front plate **24'** and is at no time interlocked with the latter in the alarm-off position of the actuator (FIG. 9), and the latter is not in follower relation with the cyclically axially moving time-driven disc **56'**. The actuator **90'** has its arm **160'** in the path of the shoulder **158'** on the slide **142'**, so that on momentary inward depression of this slide the actuator is not only brought with its tooth **134'** into mesh with the holding worm **132'**, but is also shifted into the alarm-off position shown in FIGS. 9 and 10 in which its arm **170** positively locks the arm **76'** of the vibrator **62'** in the inoperative position of the latter.

Cooperating with the time-driven disc **56'** is a follower arm **172** of a lever **174** which is pivoted at **176** in a post **178** on the front plate **24'**. The lever **174** has two further arms **180** and **182** of which arm **182** is anchored to one end of a spring **184** which normally urges the lever in a clockwise direction (FIG. 10), with the remaining arm **180** of the lever being yieldingly urged against the face of the vibrator arm **76'** opposite to that which confronts the arm **170** of the actuator **90'**. The time-driven disc **56'** is presently urged into its projected position (FIG. 10) by a suitably mounted spring **185**. The lever **174** and discs **56'**, **58'** form a 12-hour alarm control device which functions independently of the supplemental alarm control **130'** and does not have the actuator **90'** as a part thereof.

Assuming that the slide **142'** is presently momentarily depressed inwardly for shifting the actuator **90'** into its alarm-off position and also into mesh with the holding worm **132'** (FIG. 9), the arm **170** of the actuator will positively move the vibrator arm **76'** into and hold it in alarm-off position, compelling the lever **174** to follow the vibrator arm into the position shown in FIG. 10 against the tendency of the spring **184** to urge the lever with its arm **172** into engagement with the still projected time-driven disc **56'**. With the actuator **90'** and the lever **174** held in the alarm-off positions shown by the holding worm **132'** for the period of its mesh with the actuator tooth **134'** in excess of 12-hours, the next projection cycle of the disc **56'** twelve hours after the start of the last alarm will be ineffectual alarmwise, and the disc **56'** will, prior to the release of the actuator from the holding worm **132'**, be returned to its retracted position to hold the lever **174** and its arm **172** in the alarm-off position (FIG. 10) until the next projection cycle of the disc **56'**. The actuator **90'** will on its release from the holding worm **132'** be urged by the action spring **108'** into an alarm-on position in which its fulcrum leg **94'** bears against the stop lugs **114'** and **116'** on the front plate **24'** and its arm **170** is retracted from the vibrator arm **76'** sufficiently to permit the latter to be swung into alarm-on position by the lever **174** on the next projection cycle of the disc **56'**. With the start of this next projection cycle of the disc **56'** exactly 24 hours after the start of the last alarm, the arm **172** of the lever **174** will by the urgency of its spring **184** follow the projecting disc **56'** and with its arm **180** force the vibrator arm **76'** into alarm-on position for a possible maximum automatic alarm time determined by the coordination of the arcuate slots **82'**, **84'** and cam lugs **78'**, **80'** in the time-driven disc **56'** and the companion disc **58'**, respectively. However, the alarm will usually be shut-off soon after its start, by momentary depression of the slide **142'** as described, which will result in an automatic repeat alarm exactly 24 hours after the start of the alarm just shut-off or such time thereafter as is called for by adjustment of the alarm time in the meantime within the general limits expounded hereinbefore. Of course, the alarm may also be shut-off by inward projection of the main shut-off plunger **74'** which then will act through intermediation of the actuator **90'** and its arm **170** in positively moving the vibrator arm **76'** into the alarm-off position shown. Also, by not using the slide **142'** for shutting-off an alarm or intervening with the main shut-off plunger **74'** between automaic 24-hour alarms, the alarm may be placed solely under the 12-hour alarm control with the aid of the main shut-off plunger **74'** and the actuator **90'**, as will be readily understood. Moreover, under the same conditions just mentioned, but on leaving the main shut-off plunger **74'** retracted, the alarm may be placed solely under the 12-hour alarm

control for fully automatic 12-hour repeat alarms, with the duration of each alarm being determined by the discs 56', 58'.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

What is claimed is:

1. An alarm control for a time alarm with a timing mechanism, comprising an alarm member movable into alarm-on and alarm-off positions and normally urged into alarm-off position; an actuator movable into first and second positions to move said alarm member into and hold it in alarm-off position and to permit its movement into alarm-on position, respectively, and being normally urged into said second position; a holding element driven by said timing mechanism; manual means for moving said actuator into said first position in which it is locked to said element for release therefrom for return to said second position only after a drive period of said element in excess of twelve hours; and an independent control device, including presettable twelve-hour alarm time means, urging said alarm member into alarm-on position at the preset alarm time for a predetermined period once every twelve hours and with a force greater than that with which it is urged into alarm-off position.

2. An alarm control as set forth in claim 1, which further comprises a support plate with a plane surface on which said actuator is freely slidable into and between said first and second positions and urged into said second position.

3. An alarm control as set forth in claim 1, which further comprises a support plate with a plane surface on which said actuator rests in non-tiltable fashion and is freely slidable thereon into and between said first and second positions and urged into said second position.

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