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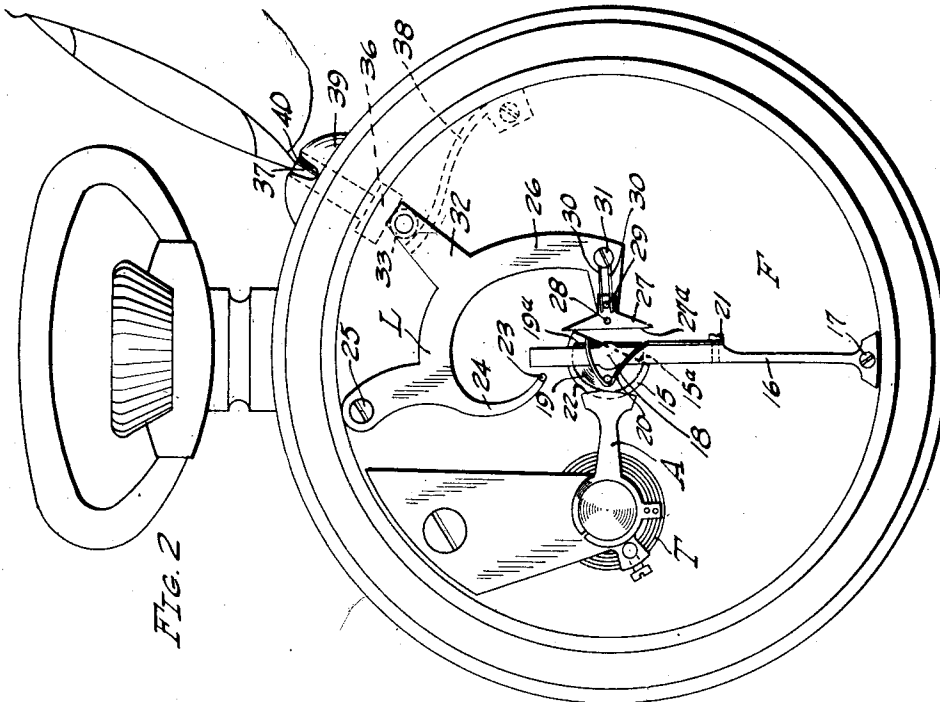
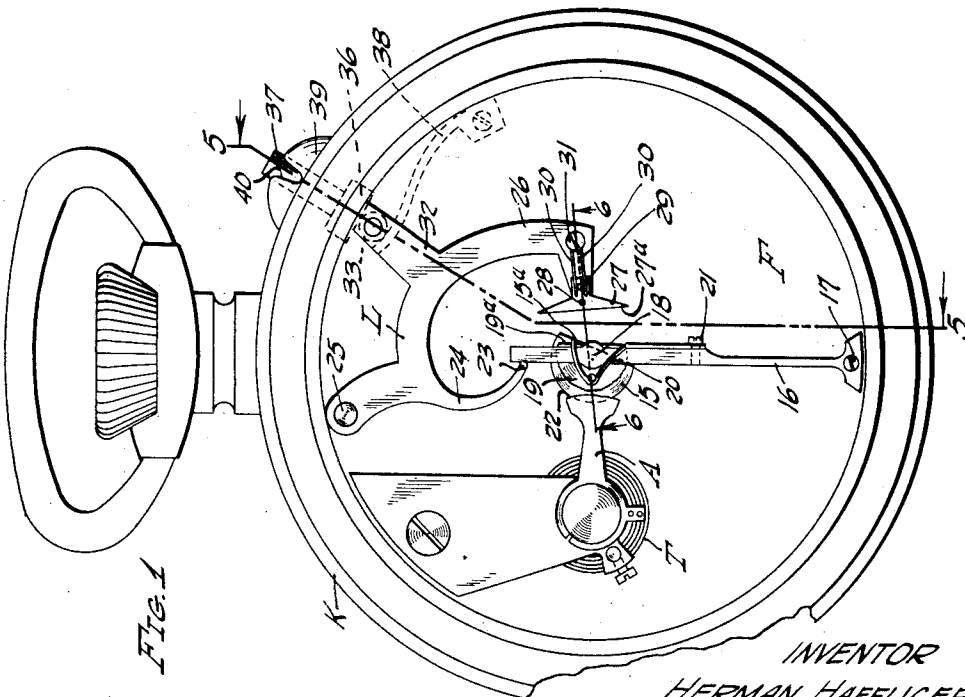
H. HAEFLIGER

1,835,391

TIMEPIECE REGULATOR

Filed June 26, 1928

3 Sheets-Sheet 1



INVENTOR
HERMAN HAEFLIGER
BY *Mum & Co.*
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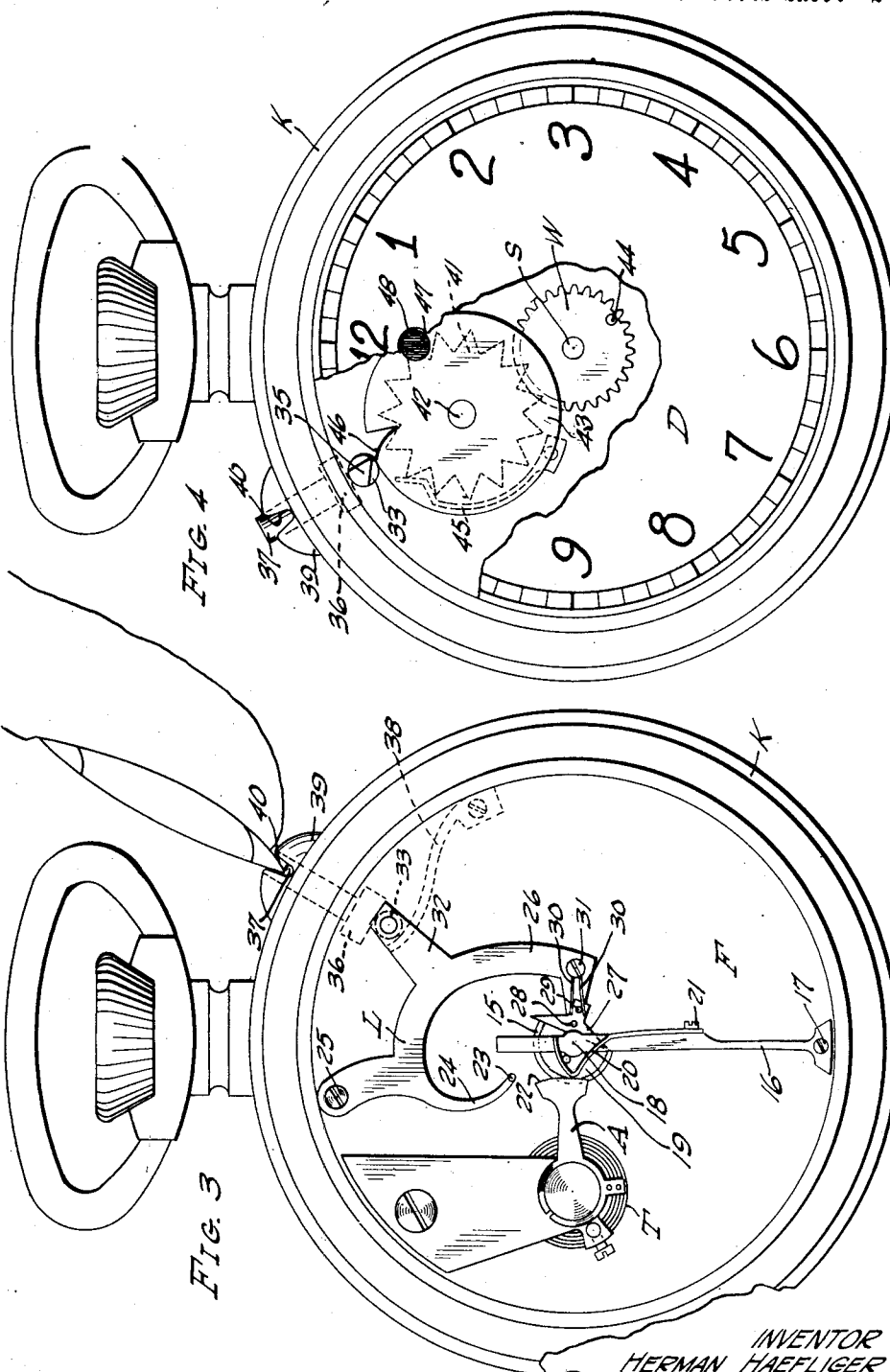
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3 Sheets-Sheet 2



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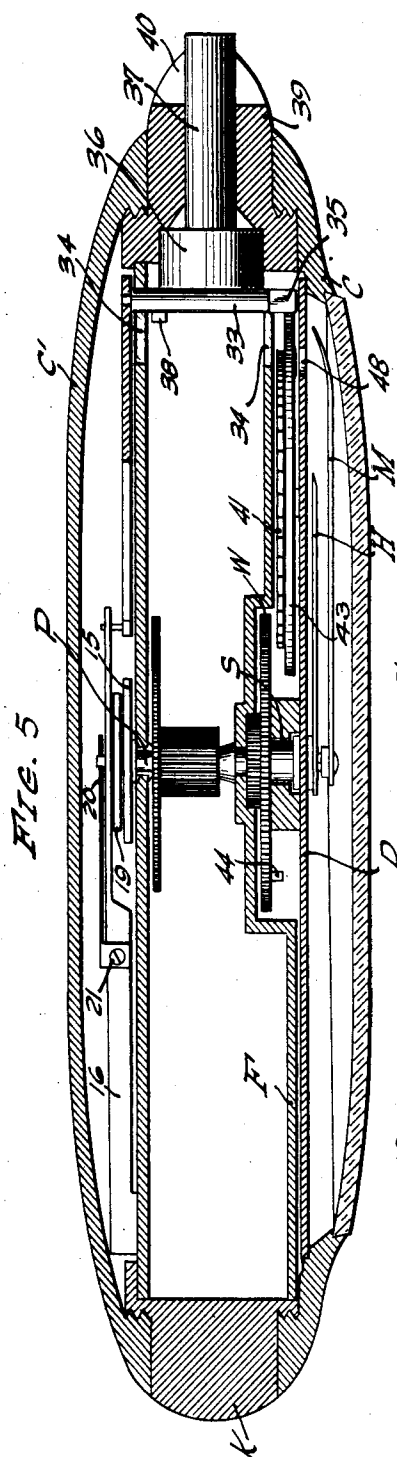
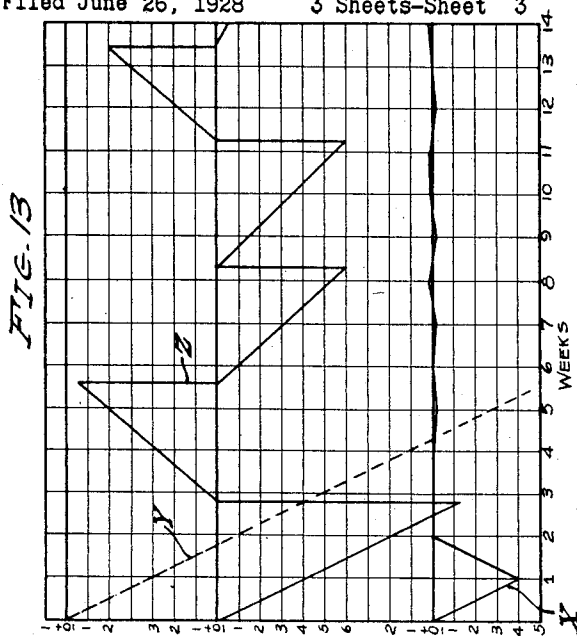
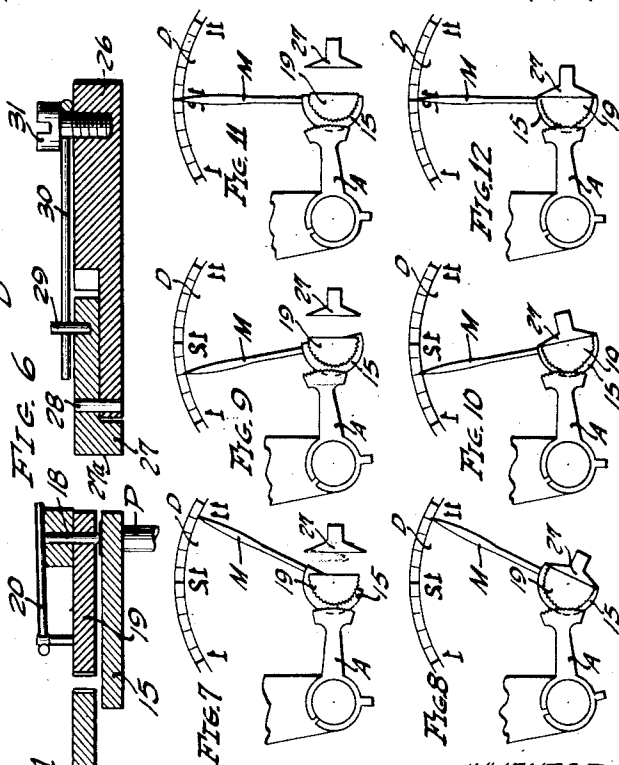
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

HERMAN HAEFLIGER, OF LOS ANGELES, CALIFORNIA; ALBERT HAEFLIGER, EXECUTOR OF SAID HERMAN HAEFLIGER, DECEASED, ASSIGNOR TO SELF-REGULATING WATCH CORPORATION, A CORPORATION OF DELAWARE

TIMEPIECE REGULATOR

Application filed June 26, 1928. Serial No. 288,311.

My invention has reference to watches, clocks or any instrument that measures time, and hereinafter referred to as timepieces.

Since the very inception of the art of horology, up to the present day, the only advancement made in controlling the running rate of a timepiece to measure time accurately is by extremely fine adjustments of its mechanism, but although reducing error, the most finely adjusted timepiece does not eradicate variations in the running rate and consequently all timepieces accumulate error and hence are incapable of measuring time accurately over any extended period. To compensate for accumulated errors or variations, a timepiece is regulated, readjusted, and reset from time to time, but as well understood by those skilled in the art, such expedients cannot stabilize the running rate permanently owing to the multitude of variable conditions under which a timepiece operates when in actual use.

My invention contemplates the provision of a mechanism capable of being incorporated in the present timepiece at a relatively small cost and without modification of its mechanism, and which is operable manually to correct the running rate of the timepiece in a manner to prevent accumulation of variations, fluctuations or errors therein over more than a relatively short period and for all practical purposes complete elimination of variations whereby the timepiece is caused to measure time accurately.

Aside from the paramount characteristic of obtaining absolute accuracy in the running rate of a timepiece, my invention is of unestimable value in respect to the manufacturing cost of present-day timepieces. It not only reduces the heretofore extremely fine adjustments and delicate mechanism in the more expensive timepieces, thus greatly reducing the cost of manufacture and permitting them to be much more substantially constructed, and hence less liable to breakage, but in its adaptation to the more cheaply constructed timepieces, it secures substantially equal accuracy in the measurement of time thus placing within reach of the masses instruments capable of keeping accurate time.

I will describe only one form of automatic self-timing mechanism for timepieces in its adaptation to a watch, and one method for correcting the running rate of a timepiece, each embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings:

Figure 1 is a view showing a watch in rear elevation and with the rear cover removed and having applied thereto one form of automatic self-timing mechanism embodying my invention;

Figs. 2 and 3 are views similar to Fig. 1 showing the two successive positions of the mechanism incident to an adjustment of the regulating arm of the watch;

Fig. 4 is a view showing the watch in front elevation with a portion of its dial broken away to reveal the signal and control means for the actuating means of the mechanism;

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is an enlarged fragmentary sectional view taken on the line 6—6 of Fig. 1;

Figs. 7 to 12 inclusive are views illustrating the mode of operation of the self-timing mechanism to secure a correction of the regulator of the watch;

Fig. 13 is a chart graphically illustrating the correction effected in the running rate of a watch by means of my mechanism and as compared to the accumulative running rate of a watch and to the running rate of a watch regulated in the usual manner.

Similar reference characters refer to similar parts in each of the several views.

My invention in its present embodiment is shown applied to a conventional form of watch having the usual case K with a front cover C and a rear cover C', both of which are movable. The watch movement includes the usual center post P to which is fixed the minute hand M. The tubular shaft S has the hour wheel W fixed thereto and the hour hand H, it being understood that the hands M and H are movable over the dial D. The frame F for the watch movement is secured within the case in the usual manner and at its rear side it is provided with a conventional regu-

lating arm A movable to vary the length of the hair spring T.

I do not wish to be limited or restricted to the precise timepiece above-described, as it will be understood that my invention is applicable to any timepiece movement having a regulating arm movable to increase or decrease the running rate of the movement according as the hair spring is lengthened or shortened.

The specific embodiment of my invention herein illustrated comprises a time cam 15 fixed to the center post P for rotation therewith and disposed at the rear side of the frame F, as illustrated in Fig. 5. A spring arm 16 is secured to the back of the frame F by means of a screw 17, and pivoted on this arm at the point indicated at 18 is a regulating cam 19. This cam 19 is urged to the position shown in Fig. 1 by means of a substantially V-shaped spring 20 secured to the arm by means of a screw 21. The cams 15 and 19 are of substantially semi-circular form to provide, respectively, straight edge portions 15^a and 19^a which constitute linear and active surfaces for a purpose to be described hereinafter. The curved edge of the cam 19 is preferably serrated and is adapted to have physical contact with a curved and serrated edge 22 of the regulating arm A so that as the cam 19 is rotated in one direction or the other about its axis 18 movement of the regulating arm A is produced to increase or decrease the running rate of the watch according as the same is rotated in one direction or the other.

When unrestrained, the spring arm 16 assumes the position shown in Fig. 2 in which the regulating cam 19 has operative connection with the regulating arm A.

Normally, however, the arm 16 occupies the position shown in Fig. 1 in which the cam 19 is out of physical contact with the arm A so that movement of the cam is ineffective to actuate the arm. The spring arm is maintained in this normal position by a pin 23 on the end of an arm 24 of a lever L fulcrumed on the frame at the point indicated at 25. The lever L is provided with a second arm 26 reversely curved in respect to the arm 24 and having an actuating cam 27 pivoted thereon at the point indicated at 28 and movable by actuation of the lever to engage the cams 15 and 19. This cam 27 is of substantially triangular formation to provide a straight edge portion 27^a, which constitutes a linear and active surface thereof which is adapted to have contact with the surfaces 15^a and 19^a of the cams 15 and 19. By means of the pivot 28 and a pin 29 engaged at opposite sides by leaf springs 30 secured to a post 31, a floating mounting for the cam is provided which permits it to assume a position in which its surface 27^a parallels the surfaces 15^a and 19^a in the final active position of the cam as illustrated in Fig. 3. It will be understood

that the springs 30 function to restore the cam 27 to its normal position when moved out of engagement with the cams 15 and 19, as illustrated in Fig. 1.

The lever L is provided with a third arm 32 having fixed to its outer end a pin 33 of such length as to extend through slots 34 of the frame F to the forward side of the latter where it terminates in a pawl 35.

The pin 33 is adapted to be engaged by the head 36 of a plunger to move the lever L from the normal position shown in Fig. 1 to the active position shown in Fig. 3 when the shank 37 of the plunger is pushed inwardly. Movement of the lever L to the active position is against the tension of a spring 38 engaging the pin 33 so that when the plunger 37 is relieved of inward pressure the lever can return to its normal inactive position. As shown in Fig. 5, the plunger shank 37 is movable in a sleeve 39 suitably secured within the watch case K and having a recess 40 in its outer end into which the plunger stem normally projects to be engaged by the finger nail of the operator, as illustrated in Fig. 2. The recessed end of the sleeve is shaped to prevent accidental operation of the plunger, as will be understood.

To insure the operation of my self-timing mechanism as intended, I provide a control means and signal, the former permitting operation of the mechanism only at prescribed intervals, and the signal visibly indicating when the mechanism should be operated. The control means comprises a toothed wheel 41 (Figs. 4 and 5), rotatable about an axis 42 and having fixed thereto a disk 43. The hour wheel W is provided with a pin 44 which, under rotative movement of the wheel, is adapted to engage the toothed wheel 41 for rotating the latter in a step by step movement. A spring pawl 45 engages the teeth of the wheel 41 so as to releasably secure the latter against rotation so as to maintain it in any position following movement thereof by the pin 44. The disk 43 is formed with a peripheral notch 46 adapted to receive the pawl 35 in order that the pin 33 may respond to the movement of the plunger in actuating the lever L.

When the notch 46 is out of registration with the pawl 35, the plunger cannot be operated as the pawl will engage the periphery of the disk and thus prevent movement of the pin 33. The disk 43 carries a signal 47 in the form of a spot, preferably red, and which, in one position of the disk, is adapted to appear in an opening 48 of the dial D.

In the operation of the control means, each revolution of the hour wheel W causes the pin 44 to engage the wheel 41 and move the latter a distance corresponding to that of one tooth. The wheel 41 is so designed as to require 14 revolutions of the hour wheel to produce one complete rotation of the wheel 41, and for the

reason that my self-timing mechanism is designed for operation at intervals of one calendar week. The position of the signal 47 on the disk 43 is such that it will appear in the opening 48 for a twelve-hour period every week and for the purpose of indicating to the owner of the watch that the self-timing mechanism should be operated at some particular hour within that period, as will be more fully described hereinafter. Under the actuation of the pawl 35, through operation of the plunger, the wheel 41 is adapted to be rotated the space of one tooth and independently of the hour wheel W, and to compensate for this movement and not interfere with the intended movement of the wheel by the pin 44, the wheel 41 is provided with fifteen teeth instead of fourteen. The positioning of the signal 47 is such that following movement of the pawl 35 into the recess 46 it is caused to disappear from the opening 48 under movement of the disk 43 by the pawl 35.

In the operation of the self-timing mechanism, the several parts of the mechanism normally occupy the positions shown in Fig. 1, in which the regulating cam 19 is disconnected from the regulating arm A and its active surface 19^a is parallel with a selected hour on the dial of the watch. In the present instance twelve o'clock has been selected as the hour, as it is probably the one most convenient at which to compare the time of the watch and correct its regulation, and furthermore, it permits a very practical arrangement of the parts of the mechanism in respect to the watch movement. As the self-timing mechanism is operated in accordance with any variation in the running rate of the watch in respect to the correct time, the time designated by the watch must be compared with the correct time as indicated by an accurately set and running timepiece—to be hereinafter referred to as the master clock—and as such, comparison is to be made at twelve o'clock, the selected hour, the active surface 19^a paralleling the selected hour may be said to indicate the correct time. The time designated by the watch at the instant of comparison is indicated in the self-timing mechanism by the position of the active cam surface 15^a of the cam 15, because such surface is at all times parallel to the minute hand. Thus, the active cam surface 15^a may be said to indicate the watch as distinguished from the correct or master clock time indicated by the active cam surface 19^a.

From the foregoing, it will be clear that once the watch is set to correct time where its running rate is without variation, the surfaces 15^a and 19^a will be parallel or flush one to the other each time the minute hand is at twelve o'clock sharp.

But where the watch varies in respect to the correct time, the surface 19^a will be out of parallelism with the surface 15^a, in con-

sequence of which it will assume an intersecting angular position thereto, the degree of which is determined by the variation in movement of the cam 15 as controlled by the running rate of the time piece. It will be understood, therefore, that when the lever L is actuated with the surfaces 15^a and 19^a in parallelism, advancement of the actuating cam 27 will be ineffective to rotate the regulating cam 19, although the latter is moved bodily into engagement with the regulating arm under the action of the spring arm, but the regulating cam remaining fixed in respect to its axis, no movement of the regulating arm is produced, as will be manifest from a consideration of Figs. 11 and 12. However, should the surfaces 15^a and 19^a occupy angular positions, as shown in Fig. 1, advancement of the cam 27 will cause it to first engage the surface 15^a, as shown in Fig. 2, and then the surface 19^a, but as the surface 15^a is fixed against movement the actuating cam is swung about its own axis until it finds a position in which its edge 27^a is parallel to the edge 15^a so that in its final position of advancement it always lies parallel and contiguous to the surface 15^a, as shown in Fig. 3. It is necessary that the actuating cam operate in this manner in order that after engaging the regulating cam it will rotate the latter to, but never beyond, a position in which the surface 19^a is flush with the surface 15^a. Thus, the exact degree of rotation of the regulating cam is at all times determined by its angular position with respect to the time cam.

It should be remembered that rotation of the regulating cam occurs subsequent to its bodily movement into operative engagement with the regulating arm so as to adjust the latter in accordance with the prescribed movement of the cam. In this shifted position of the regulating cam its axis is concentric to the axis of the time cam, whereas before it was eccentric.

It should be clear from the foregoing that the amount of movement or adjustment of the regulating arm to vary the running rate of the watch is determined by and directly proportional to the angular position of the regulating cam in respect to the time cam. However, the direction of movement of the regulating arm to increase or decrease the running rate of the watch is determined by the direction of rotation of the regulating cam.

To elucidate, when the regulating cam 19 is in the position shown in Figs. 1 and 7, actuation of the lever L causes the cam to engage the actuating cam below its axis thus rotating the cam in a clockwise direction to the position shown in Fig. 8 and thereby moving the regulating arm accordingly to increase the running rate of the watch. Conversely, when the regulating cam is in

the position shown in Fig. 9, a portion thereof above its axis is projected beyond the time cam to be engaged by the actuating cam and thus move the regulating cam in a counter-clockwise direction and to the position shown in Fig. 10, whereby the regulating arm is moved in a corresponding direction to decrease the running rate of the watch.

The principle upon which my present mechanism operates in respect to adjusting the regulator to increase or decrease the running rate as required to eliminate accumulation of running variations, and which operating principle was arrived at in an effort to secure absolute accuracy of proportion, is in correcting the running rate of a timepiece a week after setting and in an amount proportional to the amount of variation the timepiece has made in that week only thereby necessitating a correction of 200%. One week has therefore become a cardinal cycle of time for each correction.

In describing the operation of my invention when in actual use I will refer to Figs. 7 to 13 inclusive, Fig. 13 showing a chart graphically illustrating the running rate of a watch under three different conditions, the horizontal lines thereof representing time in minutes lost and gained as indicated by the numbering thereof, and the vertical lines representing time in weekly periods, the watch bearing my mechanism is first set accurately in respect to the master clock and sharply in respect to a selected hour, say twelve o'clock noon Monday. Exactly one week or one hundred and sixty-eight hours thereafter the plunger stem 37 is depressed thus actuating the regulating cam and in turn the regulating arm to increase or decrease the running rate of the watch an amount 100% in excess of its variation, if any, fast or slow.

For example, if at the end of the first week we find that the watch has lost four minutes, as illustrated in Fig. 7 and by the line X in Fig. 13, the time cam 15 will be in the position shown in Fig. 7 at the time the master clock registers twelve o'clock or at the instant my mechanism is manually operated, and consequently, when the actuating cam is advanced to the position shown in Fig. 8, the regulating cam will move the regulating arm an amount to secure exactly a 200% correction or twice the amount of the variation in running rate for the preceeding week. Half of this correction regulates and the other half restores the watch to correct or clock time at the end of the second week as will be seen by following the line X on the chart. At the end of the second week another correction is necessary by reason of the fact that in view of the 200% increase in the variation effected by the preceeding correction, the running rate, if not decreased, would cause the watch to continue to gain.

This second correction must be only half the amount of the first correction and on the opposite or slow side. Therefore, at the end of the second week and sharply two minutes past twelve o'clock noon watch time, the plunger stem is again depressed and the aforescribed correction effected so that the watch is now regulated as will be clear from a consideration of Figs. 9 and 10. Such regulation, however, does not compensate for the natural fluctuations of a timepiece which in finely adjusted watches are relatively small, generally a few seconds a week, while in poorly adjusted watches they may exceed a minute.

It should be understood that the mean average of fluctuation of any timepiece is the sum of the daily algebraic fluctuation. Consequently, all that remains in the operation of my mechanism to prevent accumulation of these natural fluctuations in the running rate of the watch is to continue to operate the mechanism in the same manner as previously described, that is, first correct the regulator for the full amount of its variation for the preceding week and then at the end of the following week for only half the amount of the first correction but on the opposite side or every time the watch is on clock time at the hour for correction. Thus, the watch will never vary from the correct time for more than the natural fluctuations it has for one week.

By comparing line X of the chart indicating how a watch or other timepiece may be regulated and such regulation maintained by my invention, with the accumulating running rate of a watch not regulated as indicated by the dash line Y, and the variation in the running rate of a watch regulated in the haphazard manner of today as indicated by the line Z it is believed that the difference in the regulation of a time-piece by my mechanism and the accuracy thereof will be apparent.

Although I have herein shown and described only one form of automatic self-timing mechanism for timepieces in its adaptation to a watch, and one method for correcting the running rate of a timepiece embodying my invention, it is to be understood that various changes and modifications may be made herein without departing from the spirit of the invention and the spirit and scope of the appended claims.

I claim:

1. A timepiece having a dial, a minute hand, a regulator, means for adjusting the regulator having an active surface, means for urging the adjusting means to a normal position in which its active surface occupies a definite position in respect to a selected hour graduation on the dial of the timepiece, means movable in accordance with movements of the minute hand and having an active surface at all times in parallelism with

the minute hand, and means for actuating the adjusting means in accordance with any difference in the relative positions of the said two active surfaces.

2. A timepiece having a dial, a minute hand, a regulator, means for adjusting the regulator, said means having an active surface, means for urging the adjusting means to normal position in which its active surface occupies a definite position in respect to a selected hour graduation on the dial of the timepiece, means for urging the adjusting means to a connected position in respect to the regulator, means movable in accordance with movements of the minute hand and having an active surface at all times in parallelism with the minute hand, and means for actuating the adjusting means in accordance with any difference in the relative positions of the said two active surfaces, said actuating means including means normally acting to maintain the adjusting means disconnected from the regulator but movable upon operation of the actuating means to release the adjusting means and thereby permit the latter to become connected to the regulator under the action of said urging means.

3. A timepiece regulating mechanism comprising regulator adjusting means for increasing and decreasing the running rate of a timepiece, means for controlling the adjusting action of the first means in respect to the regulator in accordance with the time indicated by the timepiece, and means for controlling operation of the regulator adjusting means in such manner that it is operable only at prescribed intervals.

4. A timepiece having a regulator, regulator adjusting means, means for controlling the adjusting action of the first means in accordance with the time indicated by the timepiece, manually operable means for actuating the first means whereby the regulator may be adjusted to increase or decrease the running rate of the timepiece according as the time indicated thereby is in advance or beyond a selected time, and means controlling actuation of the manually operable means in such manner that said means is operable only at prescribed intervals.

5. A timepiece as embodied in claim 4 wherein the timepiece includes an hour wheel, and the last-mentioned means includes mechanism adapted for operation by the hour wheel of the timepiece.

6. A timepiece as embodied in claim 4 wherein the last-mentioned means includes a signal adapted to be rendered visible only when the manually operable means is free to be operated.

7. An automatic self-timing mechanism for timepieces as embodied in claim 4 wherein the timepiece includes an hour wheel, and the last-mentioned means includes mechanism adapted for operation by the hour wheel of

the timepiece, and a signal visible only when the manually operable means is unrestrained in its operation by the said control means.

8. A timepiece comprising a regulating arm, a minute hand, a rotatable member adapted to have physical contact with the regulating arm to move the latter in one direction or the other to increase or decrease the running rate of the timepiece according as the member is rotated in one direction or the other, and a second member fixed to the center post of the timepiece for rotation with the minute hand, and an actuator manually operable to engage the first member and rotate the latter to a position corresponding to that of the second member and to thereby effect a prescribed movement of the regulating arm.

9. A timepiece comprising a regulating arm, a minute hand, a rotatable member adapted to have physical contact with the regulating arm to move the latter and thus increase or decrease the running rate of the timepiece, means for urging the rotatable member to a definite position about its axis, means for urging the rotatable member bodily into physical contact with the regulating arm, a second member rotatable by the minute hand, and an actuator normally maintaining the rotatable member out of contact with the regulating arm against the action of said urging means and operable to release the rotatable member and thus permit it to contact with the regulating arm and to simultaneously rotate the member so that it assumes the same position as the second member.

10. A timepiece comprising a regulating arm, a minute hand, a rotatable member adapted to have physical contact with the regulating arm to move the arm in one direction or the other according as the member is rotated in one direction or the other, said member having a linear surface, a second member adapted for rotation in unison with the minute hand and having a linear surface adapted to occupy angular positions with respect to the linear surface of the first member except when occupying the same circumferential position as the first member in which the two surfaces are flush one with the other, and an actuator having a member movable to engage the linear surfaces of the first two members and to thus rotate the first member until it occupies the same circumferential position as the second member whereby a prescribed movement of the regulating arm is produced.

11. A timepiece comprising a regulating arm, a minute hand, a rotatable member adapted to have physical contact with the regulating arm to move the arm in one direction or the other according as the member is rotated in one direction or the other, means for urging the member to a position in which it has physical contact with the regulating arm, said member having a linear surface, a

second member adapted for rotation in unison with the minute hand and having a linear surface adapted to occupy angular positions with respect to the linear surface of the first member except when occupying the same axial position as the first member when the two surfaces are flush one with the other, and an actuator having an element for holding the first member out of contact with the regulating arm and a second element movable to engage said linear surfaces and thus rotate the first member to the same position as the second member, the first element moving simultaneously with movement of the second element to release the first member in advance of the second element engaging the linear surfaces whereby the first member engages the regulating arm so that when subsequently rotated it actuates the latter.

12. A timepiece comprising a regulating arm, a minute hand, a spring arm, a regulating cam rotatable on said arm and adapted to be urged by the arm into a position with respect to the regulating arm to have physical contact therewith so as to move the latter in one direction or the other according as the cam is rotated in one direction or the other, said cam having a straight edge portion, a time cam adapted for rotation in unison with the minute hand of a timepiece and having a straight edge portion movable to occupy angular positions with respect to the straight edge portion of the regulating cam except when occupying the same circumferential position in which the two edge portions are flush one with the other, a spring for yieldably urging the regulating cam to a definite position in respect to a selected hour graduation on the dial of the timepiece, an actuator having an element movable to engage the straight edge portions of the cams and to thus rotate the regulating cam until it occupies the same circumferential position as the time cam, and means for moving the regulating cam into physical contact with the regulating arm whereby the regulating cam when rotated will actuate the regulating arm.

13. A timepiece comprising a regulating arm, a minute hand, a spring arm, a regulating cam rotatable on said spring arm and urged by the arm into a position with respect to the regulating arm to have physical contact therewith so as to move the latter in one direction or the other according as the cam is rotated in one direction or the other, said cam having a straight edge portion, a time cam adapted for rotation in unison with the minute hand and having a straight edge portion movable to occupy angular positions with respect to the straight edge portion of the regulating cam except when occupying the same circumferential position in which the two edge portions are flush one with the other, a spring for yieldably urging the reg-

ulating cam to a definite position in respect to a selected hour graduation on the dial of the timepiece, and an actuator comprising a lever movable to either of two extreme positions, said actuator having an arm engaging the spring arm to maintain the regulating cam out of physical contact with the regulating arm when the actuator is in one extreme position, and a cam on the lever adapted when the actuator is moved to the other extreme position to engage the straight edge portions of the first two cams and to thus rotate the regulating cam until it occupies the same circumferential position as the time cam, said arm being simultaneously movable to release the spring arm and thus allow the regulating cam to have physical contact with the regulating arm whereby under rotative movement of the regulating cam the regulating arm will be actuated.

14. A timepiece as embodied in claim 13 characterized by the lever being yieldably urged to the first mentioned position, a case for the timepiece, and a plunger operatively connected to the lever for actuating the latter from a point exteriorly of the case.

15. A timepiece comprising hands, a regulator adjusting means operable to vary the running rate of the timepiece, and means connected to one hand of the timepiece for movement therewith for controlling the adjusting action of the first means.

16. A timepiece comprising hands, a regulator adjusting means operable to vary the running rate of the timepiece, means connected to one hand of the timepiece for movement therewith for controlling the adjusting action of the first means, and manually operable means for actuating the first means whereby the regulator can be adjusted in accordance with the control provided by the second means.

Signed at Los Angeles, in the county of Los Angeles and State of California, this 21st day of June, 1928.

HERMAN HAEFLIGER.