June 2, 1953 T. B. GIBBS 2,640,349

WATCH REGULATING APPARATUS

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FIG. 5

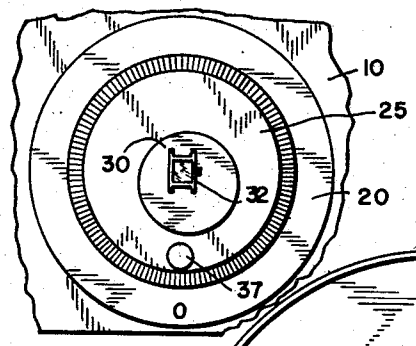


FIG. 6

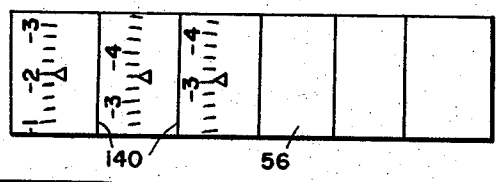


FIG. 1

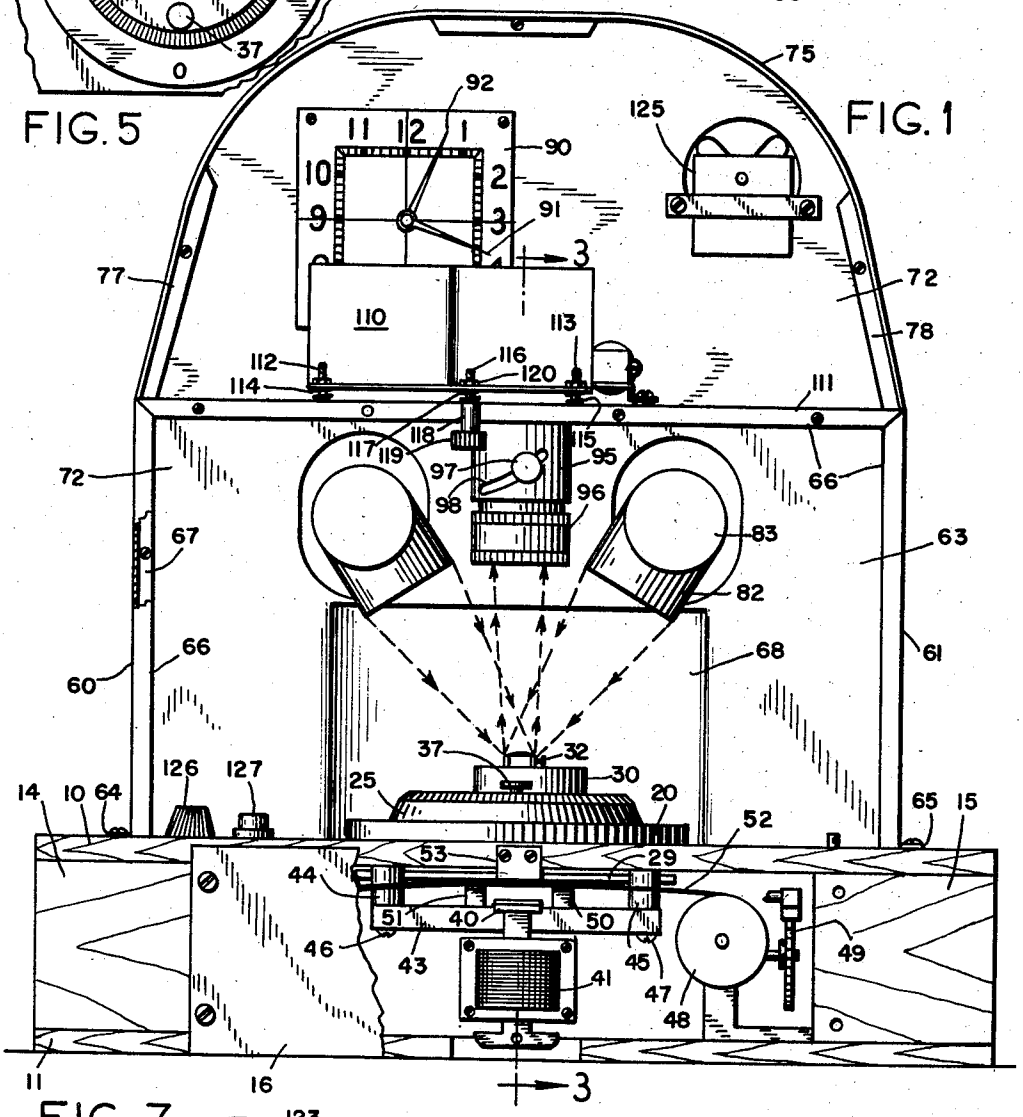
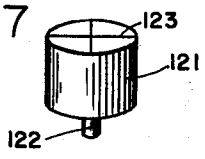


FIG. 7



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WATCH REGULATING APPARATUS

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FIG. 2

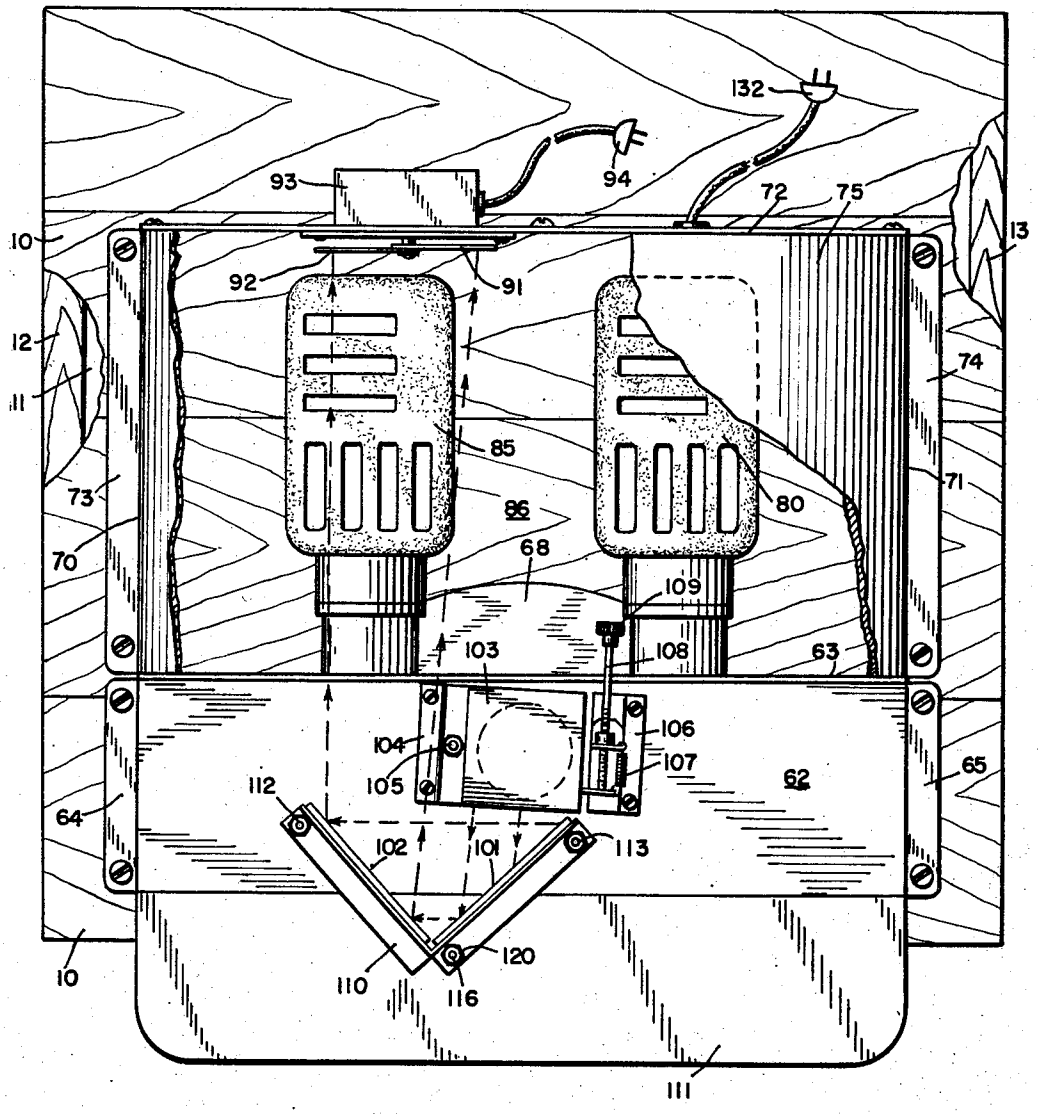
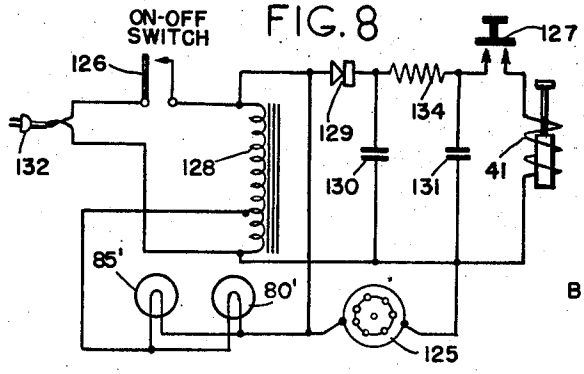


FIG. 8



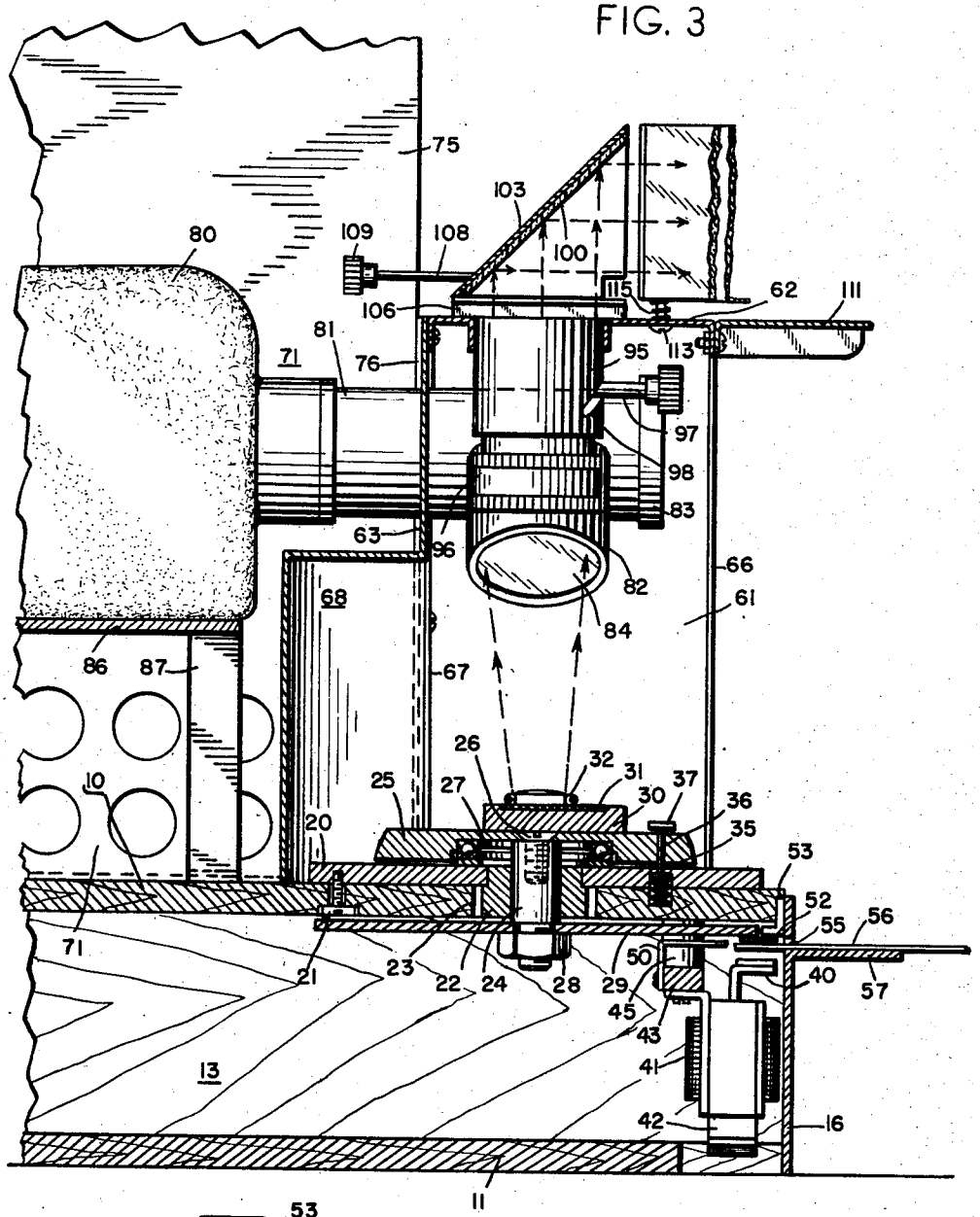
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WATCH REGULATING APPARATUS

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FIG. 3



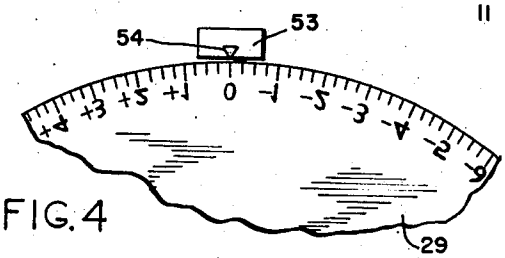


FIG. 4

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UNITED STATES PATENT OFFICE

2,640,349

WATCH REGULATING APPARATUS

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Application August 6, 1948, Serial No. 42,980

16 Claims. (Cl. 73—6)

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The present invention relates in general to watch regulating apparatus, more in particular to apparatus for use in watch factories for regulating small wrist watches, and the object of the invention is a new and improved apparatus of this character.

According to the present practice in the manufacture of watches they are wound and set to the correct time and are inspected after twenty-four hours to note the gain or loss, if any. The allowable error will depend on the grade of watch, but for good and better quality watches is not greater than one minute per day. The watches are usually tested in different positions, twenty-four hours in each position, and if a watch shows a gain or loss of more than one minute on any test it is regulated to correct its rate. Closer regulation may of course be required.

It will be seen that the inspection of watches, according to the above practice, involves accurate setting and accurate reading of the time shown after each twenty-four hour running period. This is difficult to accomplish, particularly so in the case of small ladies' wrist watches having square or rectangular dials. Errors of several minutes may easily occur in the setting or reading of such watches, rendering the practice unreliable and more or less unsatisfactory.

The invention is directed specifically to the problem indicated in the foregoing and provides means whereby the time shown by any small watch of the type referred to may be read quickly and accurately. This is accomplished by the aid of an optical system by means of which an enlarged image of the watch dial and hands may be projected on to the face of a standard clock. Means is provided for orienting the image of the watch dial with the clock dial and for aligning the image of a hand of the watch with the corresponding hand of the clock.

A special feature of the invention resides in the provision of printing mechanism for recording on a card the number of minutes a watch is fast or slow. This mechanism includes a type wheel which is set responsive to alignment of the image of the minute hand of the watch with the minute hand of the clock.

The invention will be described more in detail in the following specification, reference being had to the accompanying drawing, in which—

Fig. 1 is a front view of a machine embodying the invention;

Fig. 2 is a top view of the machine, with the cover or housing broken away to show parts beneath;

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Fig. 3 is a vertical section on the line 3—3, Fig. 1;

Fig. 4 is a partial view of the type wheel, as seen from below;

Fig. 5 is a top view of the watch support and rotatable table;

Fig. 6 shows a card with typical records printed thereon;

Fig. 7 shows a cylindrical block used in adjusting the optical system; and

Fig. 8 is a diagrammatic circuit drawing.

Referring to the drawings, the various parts of the machine are mounted on a hollow wooden base comprising the top 10, bottom 11 and sides 12 and 13. The rear of the base may be open while the front is closed by the two short wood pieces 14 and 15 and the metal plate 16. This plate is removable for inspection and repair of the printing machanism.

It will be convenient to first describe the arrangement for supporting a watch while the time shown thereby is being read with the aid of the optical system. This arrangement includes a heavy metal plate 20 which is secured to the top 10 of the base by means of three screws such as 21. The plate 20 has a central opening therein in which the sleeve 22 is received with a press fit. The sleeve 22 extends through an opening 23 in the top 10 and provides a bearing for the short vertical shaft 24. The circular table 25 is secured to the upper end of shaft 24 by means of the machine screw 26 while at its lower end the shaft carries the type wheel 29, which is clamped against a shoulder on the shaft by means of the nut 28. This assembly comprising the shaft 24, table 25, and type wheel 29 is supported on the plate 20 by a ball bearing indicated at 27, located in a recess in table 25.

A watch or timepiece to be tested such as indicated at 32 is supported on the table 25 by means of a relatively massive metal disc 30. A recess in the upper face of disc 30 contains a layer 31 of soft rubber or similar material on which the watch 32 is directly supported. The upper face of the table 25 and the bottom of the disc 30 are smooth and polished so that the disc 30 can be easily moved over the surface of the table in any direction.

The table 25 is normally locked against rotation by means of a spring pressed pin 35 which is mounted in a recess in plate 20 and extends upward into a hole drilled in the table 25. This hole extends through the table and is provided with a manually operable pin 36 which may be depressed by the button 37 the right amount

to force pin 35 entirely out of table 25 without, however, itself entering the hole in the plate 20. It will be clear that such depression of the pin 36 is effective to unlock the table 25 and free it for rotation.

In addition to the type wheel 29 the printing mechanism includes the rubber faced platen 40, operated by the core 42 of the solenoid 41, and a ribbon 52. The solenoid is supported on the bridge member 43, in the form of a square bar, which is attached to the lower side of the top 10 of the base by means of the tubular spaces 44 and 45 and screws 46 and 47. The ribbon 52 is carried on the spool 48 and another spool located behind plate 16, Fig. 1, and in the vicinity of the platen 40 is supported close to the type wheel 29 by the supports 50 and 51. These supports are fastened to the bridge member 43 by means of screws as shown in the case of support 50 in Fig. 3. The ratchet wheel 49 is connected to the spool 48 by a worm gear and forms part of a mechanism for advancing the ribbon gradually during the operation of the printing mechanism by the solenoid 41. This ribbon advancing mechanism is old and consequently it has not been considered necessary to show all the details.

The small L-shaped member 53 is fastened in a recess in the front edge of the top 10 of the base and projects downward and inwardly toward the edge of the type wheel 29. Member 53 is part of the printing mechanism and carries one type in the form of a triangle for printing a reference mark.

Fig. 4 shows the member 53 and part of the type wheel 29 as seen from below. The type wheel is shown in normal position, that is, the position it has when the rotatable table 25 is locked. In this position of the type wheel the zero on the scale is opposite the triangular reference type 54 on the fixed member 53. The scale on the type wheel is continuous, extending all around the periphery of the wheel. It is divided into two sections each encompassing an arc of 180 degrees and each comprising 30 main or minutes divisions. The divisions in the right hand section are numbered —1, —2, —3, etc., to —29 while the divisions in the other section are numbered +1, +2, +3, etc., to +29. The number 30 is common to both series and is opposite the digit 0 on the scale. Each minutes division has four sub-divisions which in terms of time units are 15 seconds divisions.

The reference character 57 indicates a shelf extending forward from the plate 16. Just above the shelf and in alignment with the platen 40 there is a slot 55 through which a card 56, resting on shelf 57, may be pushed to printing position. A card such as 56 with several time records printed thereon is shown in Fig. 6 and will be referred to in the explanation of the operation of the machine.

The table 25 and watch support 30 are enclosed in an open front housing which also serves to support parts of the optical system. This housing is preferably made of sheet metal and comprises the sides 60 and 61, formed integrally with the top 62, and the partition 63. The sides 60 and 61 are provided with feet 64 and 65 which rest on the top 10 and are fastened thereto by means of screws. The sides 60 and 61 and the top 62 are reinforced by an inwardly extending flange 66 in front and by a similar flange 67 in the rear. The partition 63 has a curved recess 68 to provide room for the plate 20 and table 25.

To the rear of the housing just described is another housing comprising the sides 70 and 71, the rounded top or hood 75 and the back plate 72. Sides 70 and 71 may be formed integrally with the hood 75 and are provided with feet 73 and 74 which rest on the top 10, as seen in Fig. 2. The side 71 has an inwardly extending flange 76, Fig. 3, which is secured to the flange 67 of the side 61. Side 70 has a similar flange by means of which it is fastened to the side 60. At the rear, flanges such as 77 and 78 are provided for attachment of the back plate 72.

The reference character 80 indicates a projector, details of which are not shown, but which may be of any suitable type. The projector shown herein is a Kodaslide Projector, Model 1A, manufactured by the Eastman Kodak Company. It comprises a lamp, a reflector, a pair of condensing lenses and a heat absorbing glass, all contained in the main housing 80, and a mirror and projection lens holder which is substituted for the projection lens holder furnished with the instrument. The mirror and projection lens holder is adjustable and comprises the tube 81 and the tube 82 extending at right angles to tube 81. The projection lens 84 is mounted at the end of tube 82. The mirror is not shown, but is supported on the end cap 83 at the intersection of the axes of tubes 81 and 82. It will be understood that the tube 81 extends through a suitable opening in the partition 63.

The projector above described is arranged to project a powerful beam of light on to the watch support 30. The beam should be adjusted to illuminate an area somewhat larger than the watches which are to be inspected or regulated with the aid of the machine and located substantially concentric with the rotational axis of the table 25.

The reference character 85, Fig. 2, indicates another projector which may be the same as the one just described. Both projectors are supported on a shelf 86, Fig. 3, which in turn is supported on the top 10 of the base by means of legs such as 87. The projector 85 projects a beam of light on to the same area of the watch support as the projector 80, as can be seen clearly from Fig. 1.

The standard clock or standard timepiece is shown in Figs. 1 and 2 and comprises the clock face or dial 90, the case 93, minutes hand 91, and seconds hand 92. The dial 90 is secured to the back plate 72 and the case 93 extends to the rear through an opening in the back plate. The clock movement contained in the case 93 includes a synchronous motor. It is driven by a standard frequency generator which supplies alternating current of constant frequency, so that the clock keeps correct time. A cord and plug 94 affords means for connecting the clock to the generator. A suitable standard frequency generator is shown in the U. S. patent to Gibbs et al. No. 2,304,813.

The optical system by means of which the image of a watch is formed on the dial 90 of the standard clock will now be described briefly. It includes a barrel 95 mounted on the top member 62 of the front housing and a lens holder 96 carrying a pair of lenses the axis of which is in vertical alignment with the rotational axis of the table 25. The lens holder is adjustable for focusing purposes by means of the rod 97 which extends through the inclined slot 98 and is connected to the lens holder 96 inside the barrel 95.

The optical system also includes the mirrors 100, 101, and 102. The mirror 100 is mounted in

a frame 103, which as a pivotal connection at 105 with the bracket 104 mounted on the top housing member 62. Another bracket 106, also mounted on member 62, carries the spring 107 and the threaded adjusting rod 108 having the knurled head 109. The spring 108 rotates the mirror frame in a counter-clockwise direction, Fig. 2, on the pivot 105, responsive to backing off the adjusting rod. Turning the adjusting rod in rotates the mirror frame in a clockwise direction. This arrangement provides for a few degrees of rotation of the frame, which is all that is necessary.

The mirrors 101 and 102 are mounted in the frame 110 which in turn is mounted partly on the top housing member 62 and partly on the forwardly extending shelf member 111. The latter functions as an eye shade and is attached to member 62 at the flange 66 as seen in Fig. 3. The frame 110 is spaced away from members 62 and 111 by three springs 114, 115, and 117. At the rear, the frame is held down against spring 114 and 115, which are under compression, by the two machine screws 112 and 113 which pass through housing member 62 and the frame and are provided with nuts as shown. In front, an adjusting member 118 is provided, having a knurled head 119 and an extension 116 which passes through the shelf member 111 and the frame 110, and is threaded into the nut 120. This nut may be soldered to the frame to prevent turning when the member 118 is adjusted.

The mirror frames are made adjustable so that the image of a point on the rotational axis of the table 25 may be exactly aligned with the center shaft of the standard clock. For this purpose a small hole is drilled in the screw 26, Fig. 3, on the rotational axis of the table and a small cylindrical block 121, Fig. 7, is provided. The use of this block 121 will be explained shortly.

The reference character 125 indicates a small motor for driving a fan to circulate air through the rear housing and past the projectors 80 and 85.

In Figs. 2 and 8 the reference character 132 indicates a plug for connecting to any convenient A. C. outlet to supply current to the machine. The reference character 126 indicates the main switch while 127 indicates a push button for operating the printing solenoid 41. This switch and push button are shown in Figs. 1 and 8. The latter figure also shows an auto transformer 128 for supplying current at the proper voltage to the lamps 80' and 85' of the projectors 80 and 85, a rectifier 129, a resistor 134 (about 2500 ohms) and condensers 130 and 131. The condenser 130 may have a capacity of about 8 micro-farads and condenser 131 a capacity of about 120 micro-farads, depending on the power required to effectively energize solenoid 41. The auto-transformer, rectifier, resistor and condensers may conveniently be assembled in the hollow base of the machine.

The operation of the machine will now be explained, it being assumed for this purpose that the machine is installed in a watch factory for use in inspecting and regulating small ladies' wrist watches such as the watch 32 shown in the drawings.

The machine should be supported off the floor on a suitable bench or table. The operator may be seated in front of the machine where she can observe the dial 90 of the standard clock and easily reach the watch support 30 with both hands. The shelf or eye shade 111 should extend forward far enough so that when the operator is in an easy position for looking at the dial of the standard clock she can, by glancing down, see about as far back as the unlocking button 37 but not the area on the watch support which is illuminated by the projectors. The eye shade thus enables the operator to protect her eyes from the glare which might otherwise result in eye strain.

The watches to be inspected may be delivered in a tray which can be deposited on the bench to one side of the machine and within easy reach of the operator.

When ready to start, the operator will close the main switch 126. This starts the fan motor 125 and energizes the lamps 80' and 85' in the two projectors. Condenser 130 is charged in series with the rectifier 129 to a potential nearly equal to the peak voltage of the supply line. Condenser 131 charges in series with resistor 134 and the rectifier 129 or condenser 130; depending on the instant polarity of the line voltage. The charging time of condenser 131 may be about 2 or 3 seconds or more.

If not already done, the operator should adjust the mirrors 100, 101, and 102. In order to do this the watch support 30 is removed from the table 25 and is replaced by the cylindrical block 121. This block has a centrally located pin 122 which fits in the hole drilled in screw 26, and cross hairs 123 which intersect on the rotational axis of table 25.

The projectors 80 and 85 being in operation, the top of block 121 is illuminated and the optical system forms an image thereof on the dial 90 of the standard clock. The operator will now adjust the lens holder 96, if necessary, to bring the image into sharp focus and will note if the image of the cross hairs 123 on the block 121 is in alignment with the cross hairs on the dial of the standard clock. If not, the image is brought to alignment by adjustment of the mirrors. The image is moved horizontally by adjustment of mirror 100 through the medium of knob 109, and is moved vertically by adjustment of mirrors 101 and 102 through the medium of knob 119. When these adjustments are completed the block 121 is removed and the watch support 30 is replaced on the table 25. This block 121 is not strictly necessary, but is useful for accurately aligning the image of the center of rotation of table 25 with the center shaft of the standard clock. It brings a set of cross hairs into a plane far enough above the support 30 so that the image thereof can be sharply focused on the standard clock dial.

Assuming that the standard clock is running, the machine is now ready for use. A tray of watches ready for inspection having been delivered at the machine, the operator takes a watch out of the tray and places it on the watch support 30 with the rotational axis of the watch hands normal to the plane of the table 25. The watch has been wound and set to approximately the correct time. It is placed on the support within the area illuminated by the projectors and with the stem of the watch at the right. No particular care need be taken in locating the watch on the suppor. It rests on the layer of rubber 31 and will stay where it is put.

While placing the watch in position the operator notes the appearance of its image superimposed on the dial of the standard clock. The image is erect, not reversed, the numeral 12 appearing at the top and the numerals 3 and 9 at

the right and left, respectively, where the corresponding numerals appear on the dial of the standard clock. Except by accident, however, the image of the watch dial will not be exactly superimposed on the standard clock dial, making it necessary for the operator to move the watch support **30** to adjust the position of the image, the watch support in this movement being adjusted in the plane of the table **25** which is normal to the rotational axis of the watch hands.

The operator can use both hands to move the support **30**. If the image is too far to the left the support is moved to the right and the image will move to the right. If the image is too high the operator moves the support toward her, which moves the image downward.

In other words, the image moves the way it would naturally be expected to move in response to movement of the watch by adjustment of the support, which facilitates the work for the operator. The support slides easily over the surface of the table **25**, but is sufficiently massive so that enough friction is developed to retain it in any position to which it is moved. The operator makes use of the main scale divisions opposite the numerals 9 and 3 of the image and 12 and 6 of the image and so orients the watch by movement of the support, that these scale divisions are superimposed on the cross hairs at the standard clock dial. Thus the image dial and the clock dial are brought to angular alignment and at the same time the center of the image dial is made to coincide with the center of the clock dial.

The operation just described is performed while the table **25** is locked in normal or zero position. The operator will now note the position of the minute hand in the image as compared to the position of the minute hand of the standard clock. These hands may be in alignment, but ordinarily they will not be and it may be assumed in the present case that the minute hand of the standard clock is somewhat in advance of the minute hand in the image. Accordingly, the operator will unlock the table **25** by depressing the button **37** and rotate the table about the rotational axis of the watch hands in a clockwise direction as seen in Fig. 5 in order to advance the image minute hand to the position of the clock minute hand. Here again the operator can use both her hands and since the image hand and clock hand have the same center of rotation it is possible to very accurately position the one directly over the other so that they both indicate the same time. This adjustment accomplished, the operator inserts a card such as **56** in the slot **55** and depresses the button **127** to actuate the printing mechanism.

The card **56** may have lines such as 140 printed thereon as guides so that successive records may be properly spaced apart on the card. For the first record, the card is inserted far enough to bring the first line in alignment with the edge of the slot. The rotation of the table **25** has rotated the type wheel **29** relative to the fixed reference type on the member **53** by a number of degrees which depends on the amount by which the watch **32** is slow. The printing mechanism is thus prepared for operation.

When the button **127** is depressed, the condenser **131** is discharged in series with the solenoid **41** and the solenoid is energized momentarily to attract its core **42**, the core being immediately retracted, however, because the solenoid cannot be operatively energized in series with the resistor **134**. The operator releases the button **127**, which restores, but need not exercise any particular care in this regard because the arrangement for energizing the solenoid by condenser discharge insures uniform operation each time. After the button **127** is restored, the condenser **131** charges again and is ready for another operation after a few seconds.

The momentary energization of solenoid **41** raises the platen **40** sharply and presses the card **56** against the ribbon **52** and the ribbon against the type wheel **29** and the member **53**, thus printing a record on the card which shows how far the type wheel has been rotated and how much the watch under inspection is too slow. Reference to Fig. 6 and to the first record printed on the card **56** shows that the watch is 2 minutes slow. If the watch has just been set this is the amount of the error in setting. It need not be corrected, since only the rate of the watch is of interest at this time.

The first record having been made as above described, the table **25** is restored to its zero position, where it becomes locked automatically, and the watch **32** just inspected is removed from the watch support and replaced in the tray, along with the associated card **56**. The operator then proceeds with the inspection of other watches in the tray in the same way, using an individual card for each watch and printing on each card a record which shows the exact amount the associated watch is fast or slow.

The next day the operator starts over again and inspects the same watches that she inspected on the previous day. Watch **32** is accordingly inspected as before and the second record is printed on the associated card **56**. This record shows that the watch is now 3 minutes and 30 seconds slow with respect to the standard clock and has lost 1 minute and 30 seconds in the 24 hour period just elapsed.

When all the watches in the tray have been inspected and records made of the respective times shown, the watches and their record cards are routed to the regulating department where such adjustments are made as appear to be needed.

After another period of 24 hours has elapsed the watches are again inspected and another record is made for each watch. These records should show improvements in the rates as the result of adjustments made in the regulating department. The record for watch **32** shows that it has gained 25 seconds and is now 3 minutes and 5 seconds slow with respect to the standard clock. One more adjustment will doubtless serve to make the rate substantially correct.

It will be seen that the invention provides a highly useful machine for watch factories, which makes it possible to accurately determine and record the time shown by small wrist watches, thereby greatly facilitating the regulation of such watches.

The invention having been described, that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

I claim:

1. Apparatus for use in regulating watches, comprising a standard clock, a member for supporting a watch, an optical system for projecting an image of said watch on to the face of said clock, and mounting means supporting said member for movement thereof in all directions in a plane normal to the rotational axis of the

watch hands to align the image of the watch dial with the dial of said clock and rotation thereof about the rotational axis of the watch hands to align the image of a hand of said watch with a hand of said clock.

2. Apparatus for use in regulating watches, comprising a standard clock, a support for a watch, an optical system for projecting an image of a watch on said support on to the face of said clock, a member on which said support is movable in a horizontal plane to align the image of the watch dial with the dial of said clock, and bearing means supporting said member for rotation to align the image of a hand of said watch with a hand of said clock, and means for adjusting said optical system to make the rotational axis of said image hand coincide with the center shaft of said clock.

3. Apparatus for regulating watches, comprising a standard clock, a support for a watch, an optical system for projecting an image of a watch on said support on to the face of said clock, a member having a polished surface on which said support rests and is slidable in any direction to align the image of the watch dial with the dial of said clock, and bearing means supporting said member for rotation to align a hand in said image with a hand of said clock, the rotational axis of said member being coincident with the rotational axis of the hands of said watch when the image of the watch dial is aligned with the clock dial.

4. Apparatus as claimed in claim 3, wherein the watch support is a relatively heavy metallic member having a polished lower surface and a friction layer on top for receiving the watch.

5. Apparatus for regulating watches, comprising a support for a watch, a standard clock, means for forming an image of the face of said watch on the face of said clock, mounting means for said support permitting rotation thereof to align a hand in said image with the corresponding hand of said clock, a type wheel and means for setting it by rotation of said support, and printing mechanism including said type wheel for recording the amount said watch is fast or slow.

6. Apparatus for regulating watches, comprising a standard clock, a type wheel, means for forming an image of a watch on the face of said clock, means for simultaneously rotating a hand in said image and said type wheel through equal angles, whereby the image hand is aligned with the corresponding clock hand, and means including said type wheel for printing a record indicative of the extent of said rotation.

7. Apparatus for regulating watches, comprising a rotatable support for a watch, means for locking and unlocking said support, a type wheel connected for rotation with said support and bearing two minutes scales extending in opposite directions around said wheel from a common zero, a fixed member associated with said wheel and bearing a reference mark which is opposite the said zero when said support is locked, means including said support for rotating a watch resting thereon by an amount depending on the difference in the times shown by said watch and a standard clock, and means including said type wheel and fixed member for printing a record indicative of the extent and direction of such rotation.

8. In a watch regulating apparatus, a support for a watch, a standard clock, an optical system for forming an image of the face of a watch on said support on the face of said clock, mounting means for said support permitting rotation thereof to align a hand in said image with the corresponding hand of said clock, a recording device including a rotatable element, and a driving connection between said support and said element.

9. In a watch regulating apparatus, a support for a watch, a standard clock, an optical system for forming an image of the face of a watch on said support on the face of said clock, mounting means for said support permitting rotation thereof to align a hand in said image with the corresponding hand of said clock, a recording device including a rotatable element and a relatively fixed element, means responsive to rotation of said support for rotating said rotatable element, and means including said elements for making a record showing the extent of such rotation.

10. In a watch regulating apparatus, a support for a watch, a standard clock, an optical system for forming an image of the face of a watch on said support on the face of said clock, mounting means for said support permitting rotation thereof to align a hand in said image with the corresponding hand of said clock, a recording device including a rotatable element, means responsive to rotation of said support for correspondingly rotating said element, and means cooperating with said element for making a record showing the extent and direction of such rotation.

11. In a watch regulating apparatus, a support for a watch, a standard clock, an optical system for forming an image of the face of a watch on said support on the face of said clock, mounting means for said support permitting rotation thereof to align a hand in said image with the corresponding hand of said clock, a recording device including a marking element, means responsive to rotation of said support for moving said element in either of two directions depending on the direction of said rotation, and means including said element for making a record showing the direction of said rotation.

12. In a watch regulating apparatus, a standard clock having a dial, cross hairs on said dial each aligned with a pair of oppositely disposed dial divisions, a support for a watch, means for projecting an image of a watch on said support on to said dial, means for moving the watch on said support to produce alignment of said cross hairs with the corresponding scale divisions of the image, and bearing means on which said support is rotatable to thereby rotate the aligned watch about the rotational axis of its hands to align a hand in said image with the corresponding hand of said clock.

13. In a watch regulating apparatus, a clock having a dial and a hand supported for rotation on a central axis, a support for a watch, means for rotatably mounting said support, an optical system for projecting on to said dial an image of an area of said support which includes its rotational axis, and means for adjusting said optical system to make the rotational axis in said image coincide with the rotational axis of said clock hand.

14. Apparatus for use in regulating watches, comprising a standard clock, a table and means for supporting it for rotation on a vertical axis, said table having a horizontal surface, a support for a watch resting on said table, said support being movable on said surface to bring the rotational axis of the hands of said watch into coin-

cidence with the rotational axis of said table, and an optical system arranged to project an image of the watch on to the face of said clock with the rotational axis of the watch hands in coincidence with the rotational axis of the clock hands, whereby a hand in the image of said watch may be aligned with the corresponding hand in said clock by rotation of said table.

15. Apparatus for accurately reading the time shown by a small watch, comprising a standard clock having a relatively large dial and mounted for observation by an operator, a table having a horizontal surface and supported for rotation by the operator about a vertical axis, means for illuminating an area of said surface which includes the point on said surface through which said axis passes, means for projecting an image of said area on to the face of said clock with the image of said point coincident with the rotational axis of the clock hands, and a watch support resting on said surface and on which said watch may be placed by the operator, said support being movable on said surface to locate the watch within said area with the axis of rotation of its hands coincident with the rotational axis of said table, whereby an image of the watch is superimposed on the clock and the operator can align one hand of the watch with the corresponding hand of the clock by rotating said table.

16. Watch regulating apparatus having, in combination, a member for supporting a standard timepiece, a second member for supporting a test timepiece to be regulated, an optical system for projecting an image of the dial of said test timepiece onto the dial of said standard timepiece, means supporting one of said members for adjustment of the member in all directions in a plane perpendicular to the axis of the timepiece supported thereon to orient the dial of the standard timepiece and the image of the test timepiece dial and bring the centers and corresponding markings of the two dials into coincidence, and other means supporting one of said members for rotational movement about the axis of the timepiece thereon to aline corresponding hands of the standard timepiece and the image of the test timepiece after orientation of the dials of the test timepiece image and of the standard timepiece.

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