

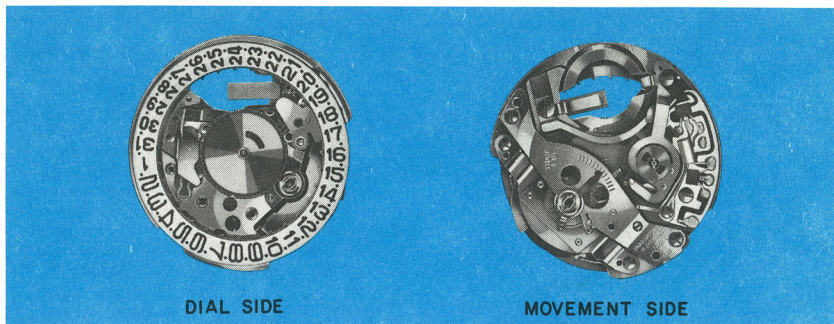
TIMEX model 87

electronic
calendar watch

13½ lig.
30.50 mm
1.201 in.

SERVICE MANUAL
MODEL 87

the TIMEX model 87 movement



The Timex Model 87 (Caliber 882) is a $13\frac{1}{2}$ ligne electronic watch movement. The miniature energy cell, time drive, date indexing, hand setting, the case and the crystal are identical to the Models 84 and 85. In the Model 87, the electric contact of the Model 84 has been replaced by an electronic thick-film circuit consisting of two silicon planar transistors, one capacitor and four resistors. The electronic circuit is connected to the moving coil on the balance wheel by a second small hairspring.

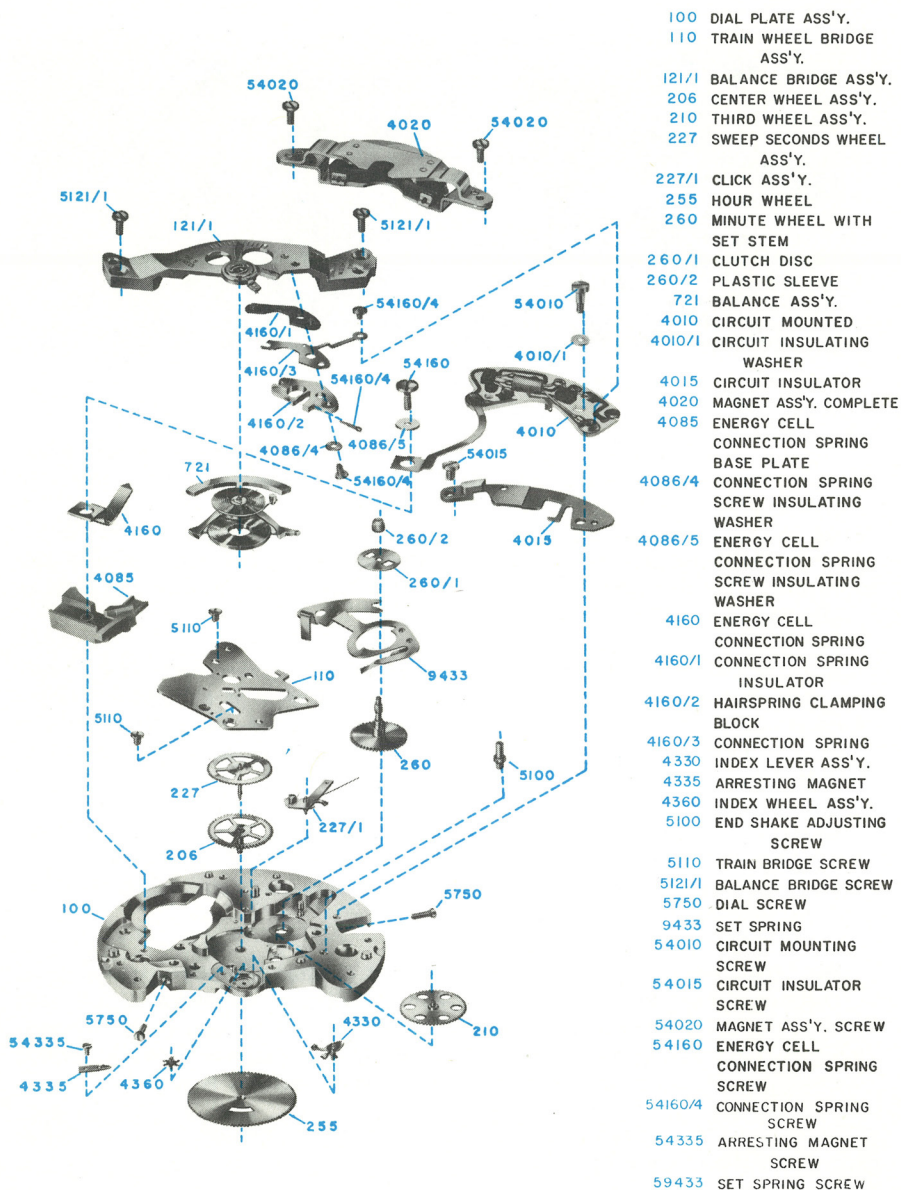
A switch actuated by the hand setting mechanism disconnects the flow of current in the electronic circuitry when the crown set wheel is pulled out into the set position. When the crown set wheel is in this position, the watch is stopped allowing time to be set to the exact second. In addition, the energy cell is not being discharged.

The Timex electronic has an hourly beat of 21,600. The large balance has a temperature compensating hairspring system and the rate can be adjusted in the usual way by moving the regulator. The Timex electronic can be checked in all positions on a normal watch rate recorder.

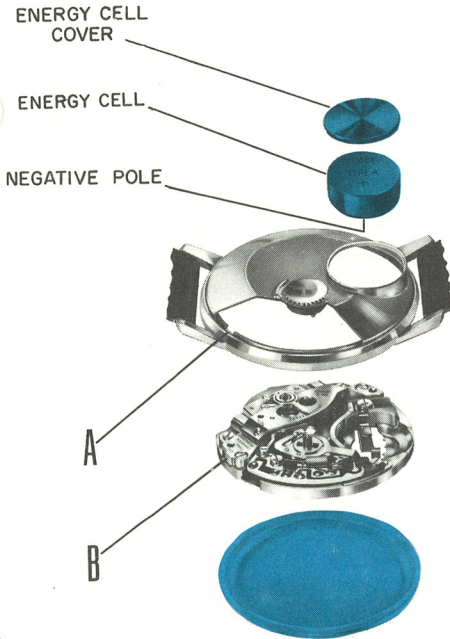
The Timex electronic can be dismantled and repaired with conventional tools. There is no need for special knowledge of electricity or electronics, or any need for complicated electrical measuring or inspection devices, new tools or microscopes. For checking the battery voltage, a high ohm voltmeter (about 20,000 ohm per volt), which is now in use in most repair stations, is sufficient.

Since watch contains permanent magnets, no attempt should be made to demagnetize the watch.

the TIMEX model 87 movement (exploded view)



Disassembly of Movement (model 87)



The first step in removing the movement from the case is to remove the energy cell. To avoid damage to the watch case, the energy cell cover should be opened only at the spot indicated on the caseback (arrow and words "lift here" stamped on the caseback). Check the voltage of the energy cell. Any energy cell with a voltage of less than 1.5 volts, or one which is known to have been in service in excess of one year, should be replaced. Avoid short circuiting of the cell by metallic connections between the outer case and the negative pole of the cell, as this short circuit could shorten the life of the cell.

Next, remove the crystal using a Timex crystal lift or conventional crystal lift. The movement can now be removed through the front of the case. Note the locating notch in the bezel seat (A) and the corresponding key on the balance bridge (B).

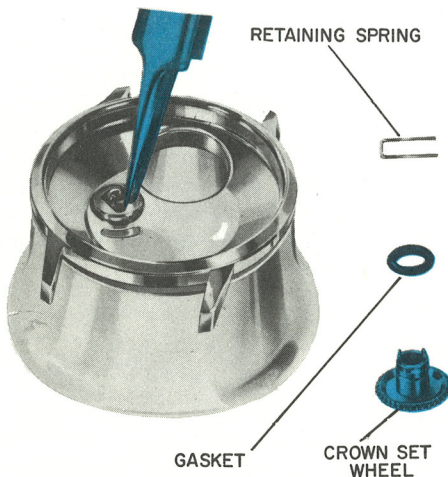
No attempt should be made to remove the caseback as it is fixed in place with epoxy resin.

The crown set wheel remains with the caseback. An automatic coupling device connects it with the setting stem when the movement is replaced in the case.

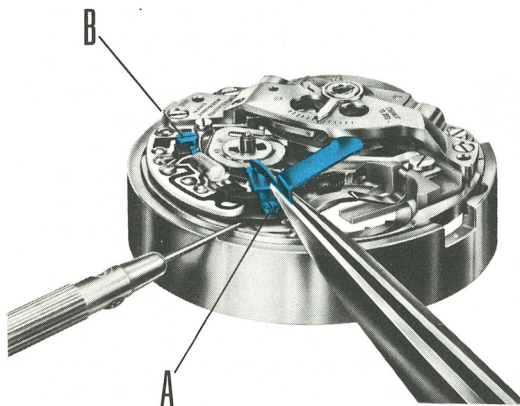
Should it be necessary to remove the crown set wheel, use the following procedure:

- Lift crown set wheel to "stop" position.
- Spread retaining spring open with tips of tweezers and push crown set wheel down through rear of case.

If necessary, the retaining spring and gasket can now be removed.

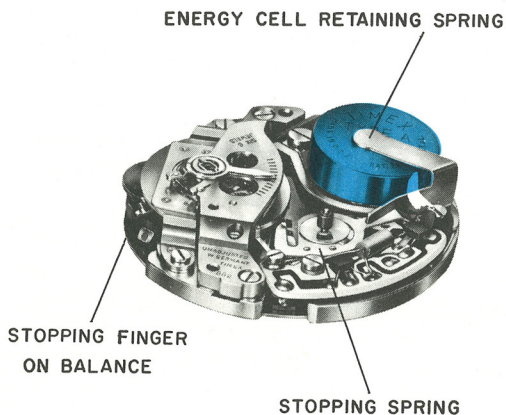


Disassembly of Movement Cont'd.



To examine the function of the movement, place the movement on a suitable movement ring and clamp the energy cell in place with an energy cell retaining spring. THIS SPRING IS AVAILABLE UPON REQUEST FROM THE TIMEX MATERIAL SALES DIVISION.

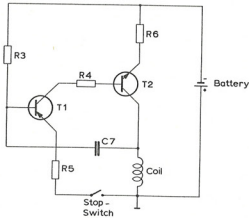
To assemble the energy cell retaining spring, loosen screws A and B. Lift the switch insulation by a screw driver and insert the energy cell retaining spring between the switch insulation and the hand setting spring. Finally, tighten screws A and B. One end of the energy cell retaining spring depresses the stopping spring fixed to the movement and allows the balance to be turned freely.



The negative pole of the energy cell must contact the connection spring (No. 4160 on exploded view). Current from the negative pole flows through the connection spring to the connection yoke of the electronic circuit. These parts are insulated from the remainder of the movement. The positive pole of the energy cell contacts the energy cell retaining spring and thus flows to the plate No. 100. Never cause a metallic connection between the insulated and uninsulated parts of the movement as this short circuit could shorten the life of the energy cell.

Disassembly of Movement Cont'd.

The electrical impulses given by the electronic circuit are transferred to mechanical driving impulses for the balance in the same manner as the Model 84. The impulse current flows through the balance drive coil and the magnetic south pole of the coil is attracted by the north pole and re-pulsed by the south pole of the permanent magnet system. The electronic circuit is triggered by the voltage which is induced in coil of balance when moving through the permanent magnet system.

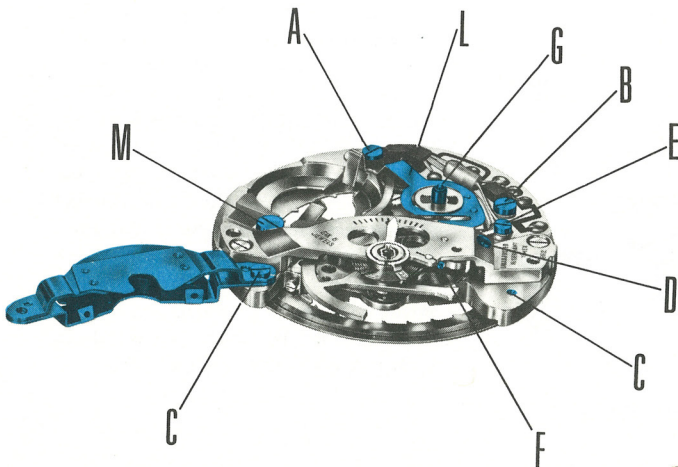


CIRCUIT DIAGRAM

The permanent magnet system together with the shunt bridge can be rotated out of position so that the balance and hairspring are visible. To do so, remove one screw (C). If desired, this assembly may be completely removed by removing both screws (C).

After removal of the permanent magnet from the movement, the balance bridge and balance can be removed.

Screw (D) serves to adjust endshake of the balance and is fixed in place with epoxy. Before disassembling of balance bridge, screw (E), which connects the electronic circuit to the balance bridge, must be removed. Furthermore, the bronze hairspring must be removed by loosening of screw (F). The hairspring stud may be pressed out of the balance bridge to separate the bridge and balance. The bronze hairspring clamping block is insulated from the balance bridge. An insulating washer is located beneath the screw holding the bronze hairspring clamping block—be certain that the washer is in place during re-assembly, otherwise a short circuit will occur. The crown set wheel stem (G) is also the staff of the minute wheel, and, as such, is connected to the crown set wheel on the caseback through a clutch device.



Disassembly of Movement Cont'd.

In illustration 1, the crown set wheel is depressed to its running position. The clutch disc is kept out of engagement with the stem and the setting spring is depressed. In this position, the projection on the setting spring is kept out of engagement with the stopping finger of the balance. The nose (H) of the stop switch must touch the rivet (J) of the setting spring.

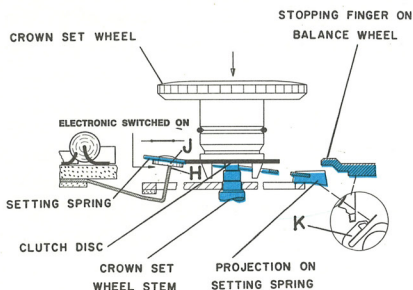


ILLUSTRATION 1

In illustration 2, the crown set wheel is in the set position. The clutch disc now engages with the square portion of the stem and couples the stem and crown set wheel, thus allowing the hands to be set. This position of the crown set wheel also allows the setting spring to move upwards and butt against the stopping finger on the balance, thus stopping the balance. The nose (H) of the stop switch must be clear of rivet (J) of setting spring, thus interrupting the starting current of the electronic circuit.

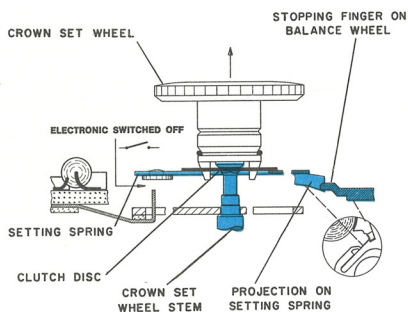


ILLUSTRATION 2

Should the setting spring require adjustment, use the following procedure. Move the crown set wheel upwards so that the clutch disc is just out of engagement with the square portion of the set stem (illustration 3). The clutch disc will rest against the bottom of the square portion of the stem. In this position, the projection on the setting spring must contact the stopping finger on the balance by the amount shown. When the crown set wheel is pulled into the set position (illustration 2), the stopping finger on the balance must be in full contact with the projection on the setting spring. For this adjustment, bend the setting spring in the area marked (K). The nose (H) of the stop switch must be clear of the rivet (J) on the setting spring by at least $\frac{1}{2}$ to $1\frac{1}{2}$ times the thickness of the setting spring. If necessary, adjust this clearance by bending the setting spring in area (L), (page 87.5).

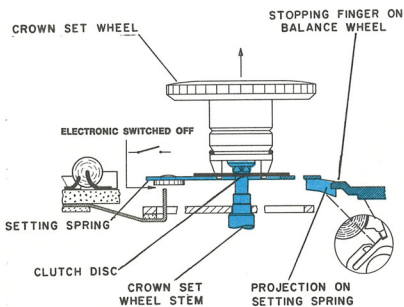
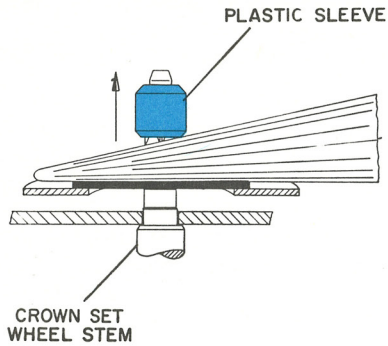
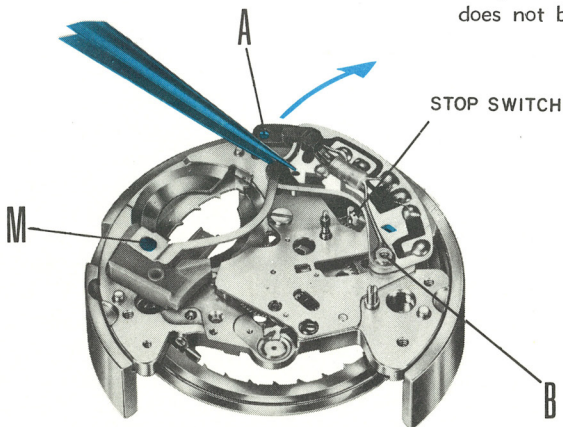


ILLUSTRATION 3

Disassembly of Movement Cont'd.



To remove the clutch mechanism from the movement, first lift the plastic sleeve from the stem with tweezers as shown. The tip of your finger should be placed on top of the plastic sleeve during this operation to avoid loss of the sleeve. Next, remove the clutch disc. Next, the screw "A" and the setting spring. The electronic circuitry can now be taken off by removing screws "B" and "M". Screws at position "B" and "M" are provided with insulating washers which must be repositioned during re-assembly, otherwise a short circuit will occur. The screw at position "M" should also be removed. Now lift the circuit base, as shown in the picture, turn it in the direction of the arrow until the stop switch clears the train bridge. Take care that stop switch does not become damaged.



Disassembly of Movement Cont'd.

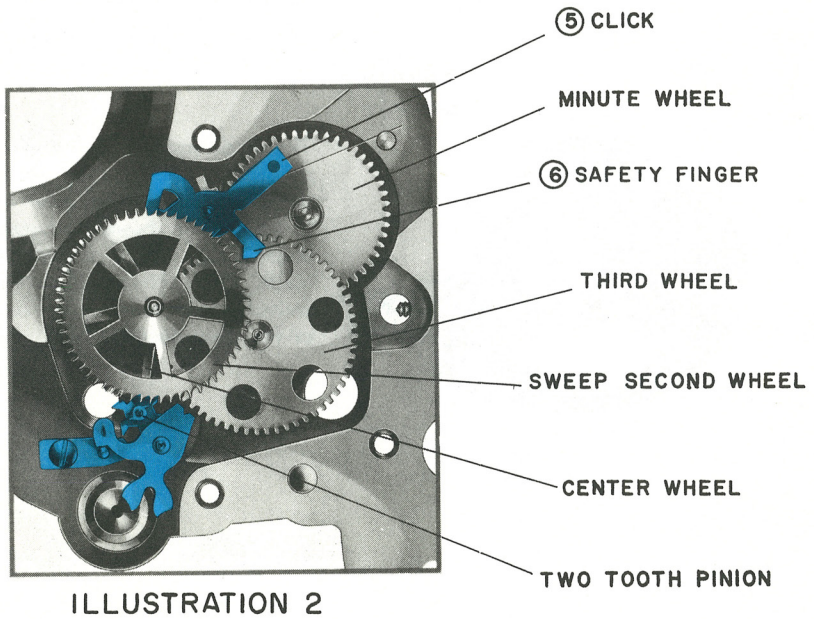
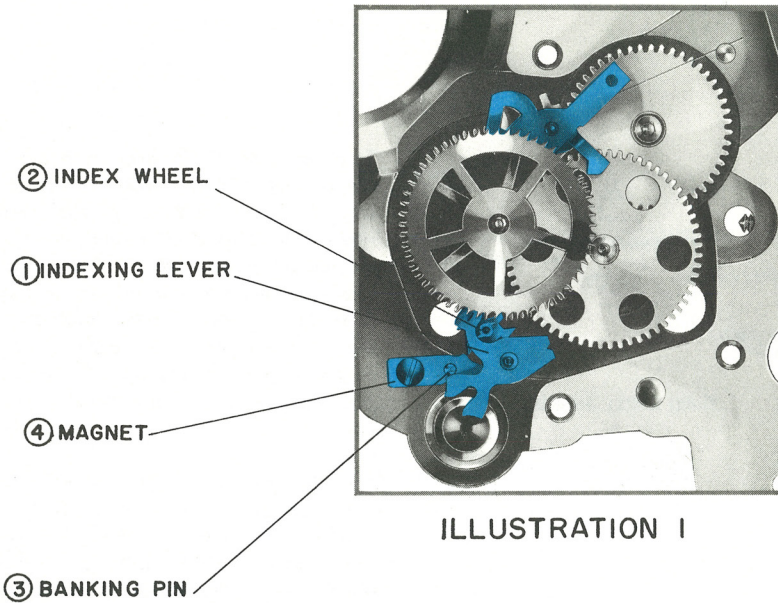
The illustrations on the facing page show the gear train exposed (i.e., train bridge removed).

The action of the gear train is as follows:

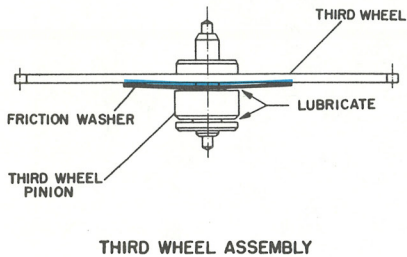
In illustration 1, the balance, when moving counterclockwise, will move the indexing lever (1) to the left. The lever contains a steel "D" shaped pin which advances the index wheel (2) forward one tooth. After it has advanced the index wheel forward one tooth, the indexing lever comes to rest against the banking pin (3). The tip of one tooth on the index wheel is attracted and held in position by the magnet (4). Since the index wheel is magnetically fixed in position, the steel "D" shaped pin on the index lever cannot move of its own accord out of its position between the teeth of the index wheel.

In illustration 2, when the balance moves clockwise, it moves the index lever to the right. The steel "D" shaped pin will now move the index wheel backwards slightly until the pin clears the tooth of the index wheel. The index lever comes to rest against the banking pin (3) and is held by the magnetic attraction between the magnet (4) and the steel "D" shaped pin. The instant the steel "D" shaped pin clears the tooth of the index wheel, the magnetic attraction retracts the wheel back to its original position where it is set for another one-tooth advancement during the next counterclockwise rotation of the balance. When the index wheel has thus been moved forward three teeth, one tooth of the two-toothed pinion fixed to the index wheel engages the sweep second wheel and rotates it forward one tooth. This one tooth rotation of the sweep second wheel, aided by the click (5) provides the one second "jump" of the sweep second hand. The safety finger (6) insures that no more than one tooth of the sweep second wheel will index at a time. The click spring must be locked as shown in the illustration. Pre-tension of the click spring should amount of $2 - 2\frac{1}{2}$ times the diameter of the locking pin.

Disassembly of Movement Cont'd.



Disassembly of Movement Cont'd.



The remainder of the gear train functions in the normal manner. The sweep second wheel pinion drives the third wheel. The third wheel pinion, in turn, rotates the center wheel. The center wheel carries the minute hand. The teeth of the center wheel mesh with the minute wheel. The staff of the minute wheel projects through to the dial side and carries the minute pinion.

The dial train friction is provided by the third wheel assembly. A friction washer is interposed between the third wheel pinion and the third wheel. It is important to carefully lubricate this as indicated after cleaning.

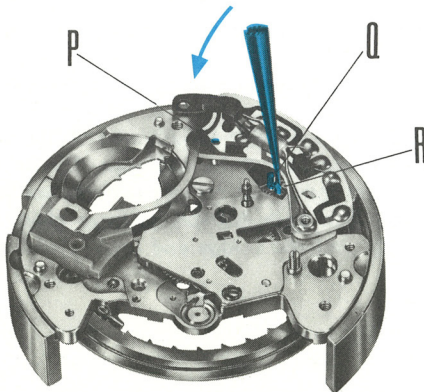


The index magnet may be removed to check the train. During removal of the magnet, the index lever must be in the position shown in illustration 1, page 87.9. When assembling the hands, it is important that the sweep second wheel assembly be supported at the pivot to avoid damage.

Assembly of Electronic Circuitry

To assemble, position the electronic circuit, as shown in the illustration, above pin "P." Push down the stop switch to a level slightly below the nose of the train bridge "R". While holding the stop switch down, move the circuit to its final position over pin "P". This will lock the switch into position below the nose of the train bridge "R". Be certain that the stop switch insulator, which is part of the circuit board, is in its proper position between the nose of the bridge "R" and the stop switch. (Note—the stop switch is insulated from the bridge.) Use care to avoid damage to the stop switch. Now assemble the setting spring and the screws holding the circuit board.

Use the disassembly procedures as a guide for further reassembly. When replacing the movement into the case, pull the crown set wheel out into set position to facilitate entry of the setting stem into the crown set wheel.



Cleaning, Lubricating and Timing The TIMEX Electronic

- 1) The movement including electronic circuit may be cleaned in the usual method using normal watch cleaning and rinsing solutions. The balance must be cleaned separately to prevent damage to the coil. Do not clean the energy cell with any liquid. If necessary, it should be wiped with a dry cloth only.
- 2) After cleaning, any particles adhering to the magnet should be carefully removed before assembly. A piece of scotch tape rolled to a point will be found useful in removing particles. (This process should not be used when the movement is assembled as there is danger of severing the lead wires of the balance coil.) The other parts of the movement must be free of particles, especially steel or nickel which would be attracted by the magnet. Needless to say, the watch should not be demagnetized.
- 3) The movement should be re-oiled in the normal manner using only high grade watch oils (oil used in factory assembly is Elgin M 56 b). Under no circumstances should oil or grease containing silicone be used.

The particular points requiring lubrication are as follows:

- a) The jewel bearings and pivots of the train wheels and balance.
- b) The minute wheel and set stem bearing surfaces.
- c) The steel "D" shaped pin on the index lever.
- d) The surface of the click which rests against the sweep second wheel.
- e) The third wheel assembly as indicated on page 87.9.
- f) The pipe of the crown set wheel so that the lubricant will seep down to the rubber waterproofing gasket which surrounds the pipe.

Never lubricate the connection point between stop switch and setting spring.

- 4) The best performance of the Timex electric is achieved if the hairspring does not vibrate between the pin and key of the regulator. The outside edge of the hairspring should be in light permanent contact with the inside edge of the regulator key. Make sure that **both** hairsprings have good clearance to all other movement parts, e.g., balance bridge and upper shunt of driving magnet.