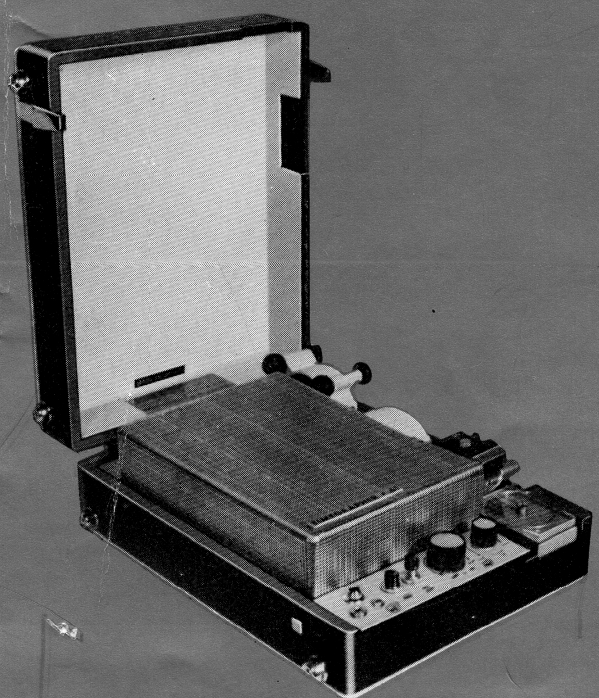
INSTRUCTION MANUAL
for
Electronic Watch Testing Machine

TIMEGRAPHER MODEL P-61



Instruction Manual For Timegrapher Model P-61

S/N F37564

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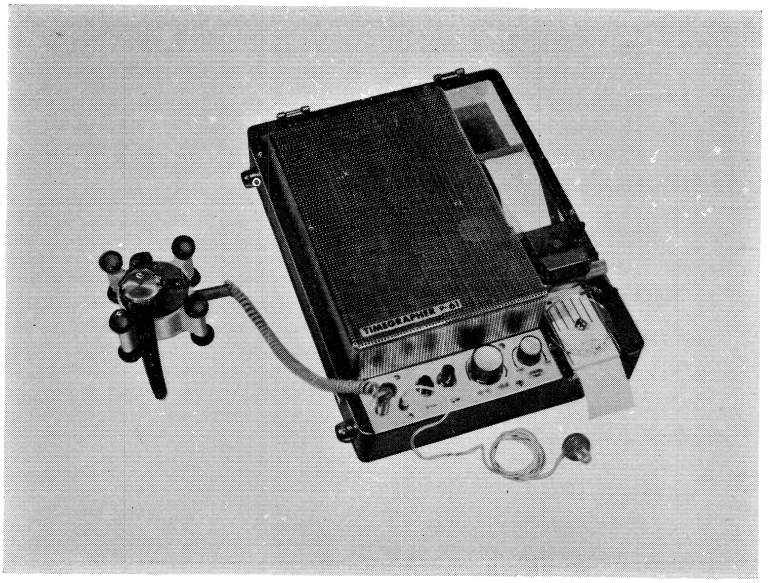
TIMEGRAPHER MODEL P-61

IMPORTANT FEATURES :

1. Extra small and lightweight :
   Made light for portability. Occupies little space, and is easy to carry.
2. High efficiency :
   Further technical improvements have been made due to our long experience and continuing research.
3. Carrying case unnecessary :
   The machine case is also a carrying case.
4. Stand microphone :
   By changing the position of the milk, it is possible to change the position of the watch being tested.
5. Easy operation :
   Starting has been further simplified. Operation is so easy that even a layman can use it.



PRINCIPLE AND CONSTRUCTION

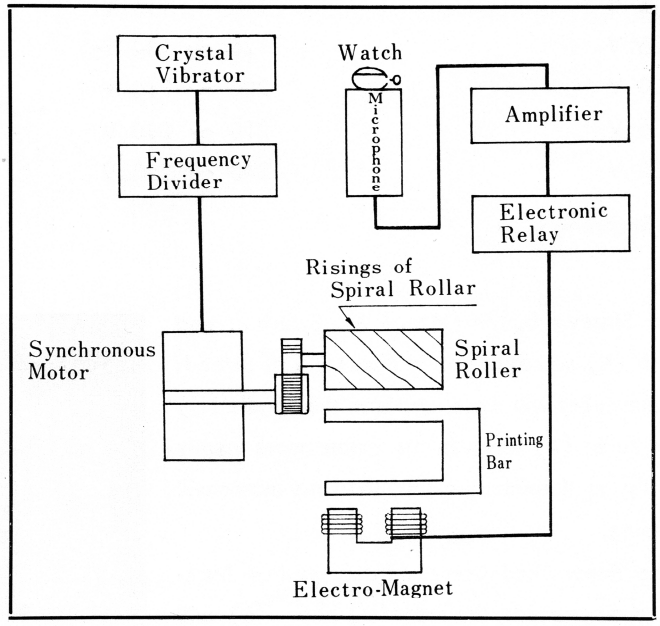
The use of a highly efficient quartz crystal plays an important role in the "TIME-GRAPHER". The exacting signal standard obtained from use of the crystal, is compared with the ticks of the watch and the result is recorded. Thus an accurate test of the watch is possible.

The frequency of the crystal is 5,280 cycles (5,280 vibrations per second), and this frequency is reduced to 60 cycles to synchronize with the motor. The motor turns the spiral roller (wtth 2 projections) at a speed of 15 rev. or 16.5 rev. per second (change being made by the crystal selector switch).

The tick of the watch activates the printing bar, and records the difference as compared with the frequency standard time by striking the projection of the spiral roller, as in the illustration below.

DIAGRAM OF MACHINE

Principles and Constructions



HOW TO OPERATE

I Preparation :

1. Remove the cover of unit and check whether all tubes are installed properly in sockets.
2. Plug power cord (O) into electric outlet.
3. Plug microphone cord (f) into jack (L) and the other end into jack (a) on Stand Microphone (P).
4. Plug earphone cord (e) into jack (M).
5. After cutting end of recording paper (S) to a V shape, place on paper stand (Q). Insert under spiral (X), between feed plates, and under paper holding plate (V). Be sure that paper feed lever (T) is lifted.
6. Push down button (J) of crystal switch to match the correct number of beats of the type of watch to be tested.

N.B. Voltage change plug (i) :

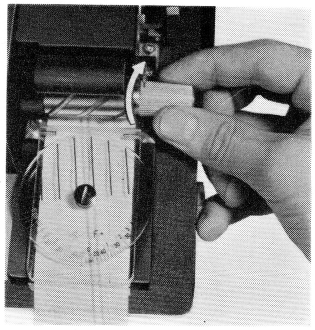
There are five types of voltage that this machine can be adjusted to by just changing the plug (i). It will be usually plugged into the correct voltage for your use at the factory. The voltages and ranges are as follows :

Voltages	Applicable Range of Voltage
115 V	110 ~ 115 V
125 V	120 ~ 130 V
200 V	200 ~ 210 V
225 V	210 ~ 230 V
250 V	240 ~ 250 V

II Starting & Stopping :

A. **Starting**

1. Press the Starting Button (H) of AC Switch . . and pilot-lamp (K) will light up. In about 20-30 seconds the vacuum tubes will warm up. Spin the handle (U) of spiral roller (X) towards the arrow mark gently and swiftly as if spinning a top, and the motor will start running.
2. When the Paper Feed Lever (T) is pushed backwards and downwards, the recording paper (S) will start feeding forward.



3. Gradually turn the volume control knob (H) clockwise, and the ticks will be heard, and a series of dots will appear on the recording paper.

B. Stopping

1. Pull Paper Feed Lever (T) up and the paper will stop feeding.
2. Return volume knob (H) to "DEC" and push switch button down to switch off.

N.B.

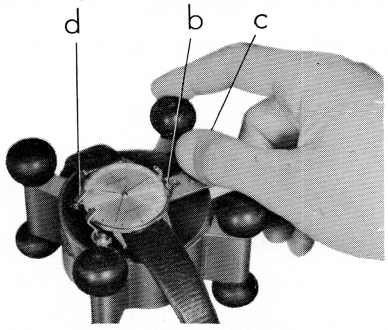
1. Racording should be made after adjusting volume knob (H) at optimum reaording position.
2. If there is a power stoppage or sudden change in voltage, be sure that the button (H) is returned to "DEC" position.

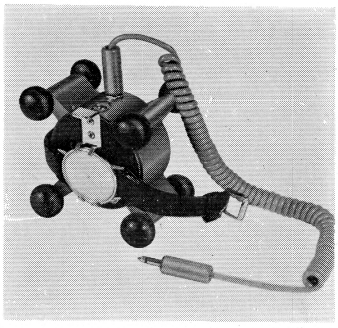
Microphone :

There are generally six different watch positions, i.e. dial up, dial down, crown up, crown down, 12-up and 12-down. Microphone should be used at every position for proper testing.

1. Holding watch :

   Pull handle (c) in figure and clamp watch between holding plate (b) and press firmly on oscillating plate (d) as the "tick" of the watch is obtained from this plate.



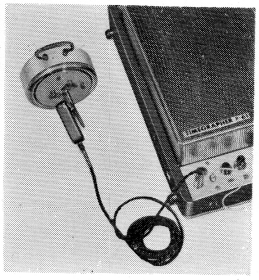


2. Change of position :

   Watch can be tested in six different position if tilted and placed as in illustration, however, for the last position it will be necessary to turn the watch around (due to the connecting cord of the mike).

3. Pick-up microphone :

   A handy midget microphone is available for testing wall clocks and alarm clocks, etc. Just by clipping on to any part of the clock it is possible to pick up the "ticks" **This will be supplied at extra-cost.**



Ⅳ Use of Earphone :

When using earphone, lift up bar of paper feed, and stop the printing sound. and it is easy to hear. Turn knob (H) to right and the tick becomes louder.

By using the earphone, the following can be detected :

(1) touching sounds of hair springs.

(2) unnatural sound caused by damaged balance staff and jewel hole.

(3) irregular sound caused by improper meshing of gears of the pallet fork & staff.

(4) when the balance with hairspring touches other parts and creates sounds.

(5) touching sounds of pallet fork & staff and roller table.

As above, by using the earphone one can find cause of trouble which were never before recognized, such as defects detected in the process of changing the position of the watch, which are not recorded on the tape.

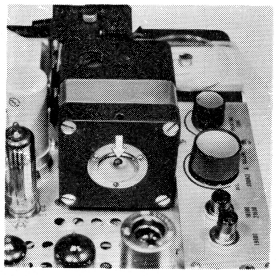
Ⅴ Ink Roller :

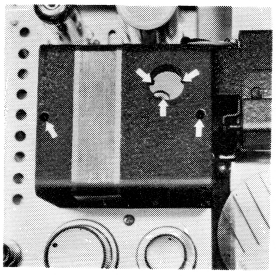
Non-drying ink has been used which has, by a special method, impregnated deeply into the sponge-like roller (W), so that it will withstand long use. However, if it should become necessary, apply a small amount of the spare ink over the roller with a brush (j). Stop roller when inking and use ink sparingly. New rollers may be obtained from us. Do not use stamp pad ink, as it dries quickly and fills pores and hardens the rubber roller.

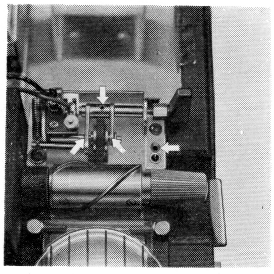
Ⅵ Oiling

First remove Grid cover (g)

A small amount of clock spring oil, or the like, should be added to the points shown by the arrow marks below about once a month (if necessary, more frequently). N.B. If dirt gets into oiling points, the machine may become inaccurate, so care should be taken to keep these points clean.

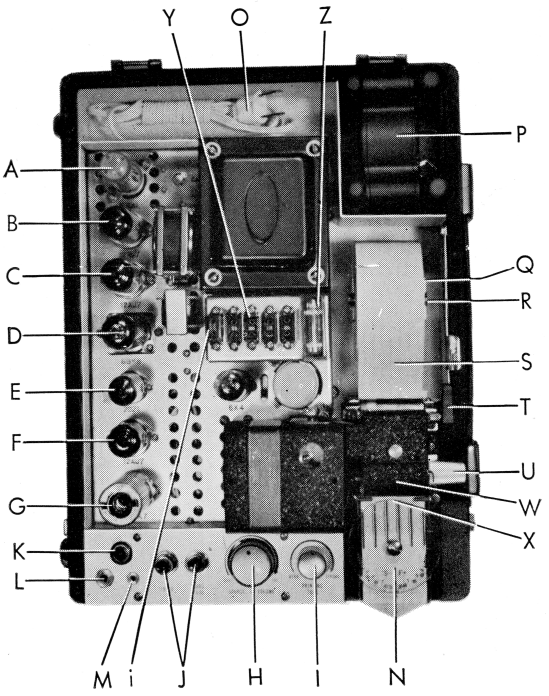


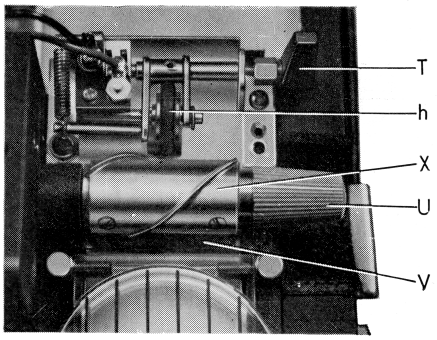




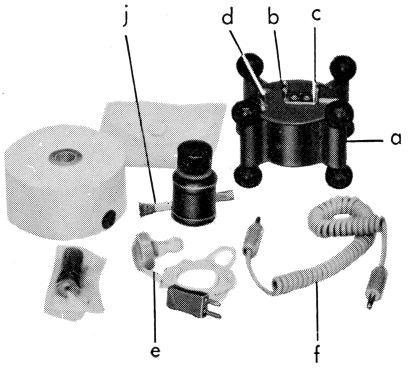
NAME OF PARTS

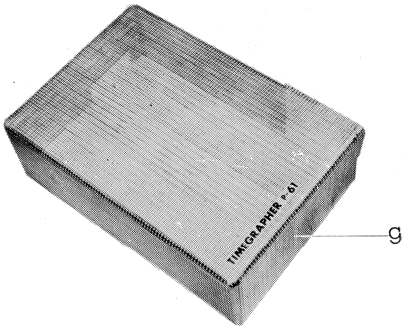
(A) Quartz Cystal
(B) Tubes 12AU7
(C) 〃 12AU7
(D) 〃 6BM8
(E) 〃 2D21
(F) 〃 12AU7
(G) 〃 12AX7
(H) Push Button switch for Power Source & Volume
(I) Knocking Intensity Adjusting Knob
(J) Crystal Changing Push Button
(K) Pilot Lamp
(L) Microphone Jack
(M) Receiver Jack
(N) Measure-Plate
(O) Plug Power Cord
(P) Microphone
(Q) Paper Stand
(R) Shaft
(S) Paper
(T) Paper Lever
(U) Handle
(V) Paper Holding Plate
(W) Ink Roller
(X) Spiral Roller
(Y) Voltage Changing Jack
(Z) Fuse





(a) Stand Microphone Jack
(b) Holding Plate
(c) Mike Handle
(d) Oscillating Plate
(e) Earphone
(f) Mikrophone Cord
(g) Grid Cover
(h) Paper Feed Roller
(i) Voltage Changing Plug
(j) Brush





RECORDINGS

I Principle of Recording

The recording paper is fed by a paper feed roller (h) under the spiral roller at a fixed speed where the printing bar strikes the spiral roller. When the watch is faster than the fixed speed of the revolution of the roller, the recorded line appears at an inclination towards the right, which means that there is a "gain" in time, and the reverse recording shows a "lose" of time.

II Number of Beats of Watches Cnd Clocks

Generally, the number of beats of watches are 5 beats per second, but some models now have 5.5 or 6 beats per second, while the clocks have various number of beats. However, most watches and clocks can be tested by the Timegrapher.

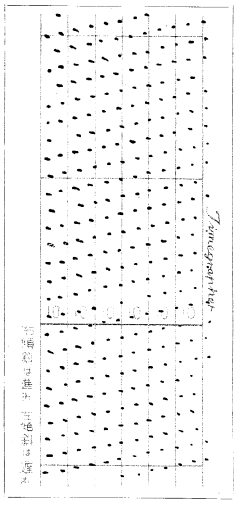
The relationship between numbers of beats and recordings are shown below.

(1) Recording appearing in one line :

Number of Ticks	
Per Hour	**Per Second**
36,000	10
21,600	6
19,800	5.5
18,000	5
12,000	3
5,400	1.5
4,320	1.2
3,600	1.0

(2) Recordings appearing in two lines :

Number of beats per hour 14,400, Number of beats per sec. 4.



(3) For watches requiring a change of signal standard, change crystal switch to 19,800 beats.

Number of beats per hour 19,800, Number of beats per sec. 5.5.

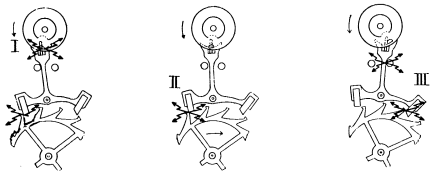
A graph to the left shows the recordings in which a watch has 5.5 beats per second but when crystal selector switch is not switched to 19,800 beats.

Ⅲ Recording and Volume Adjusting

It is most important to make recordings as clear as possible by adjusting the volume. Some watches show quite different graph lines according to the volume of sound (graphical examples shown below). Test watches where the line of dots shows the best uniformity as per the following figure (c), by turning the volume switch (H) from left to right gradually.

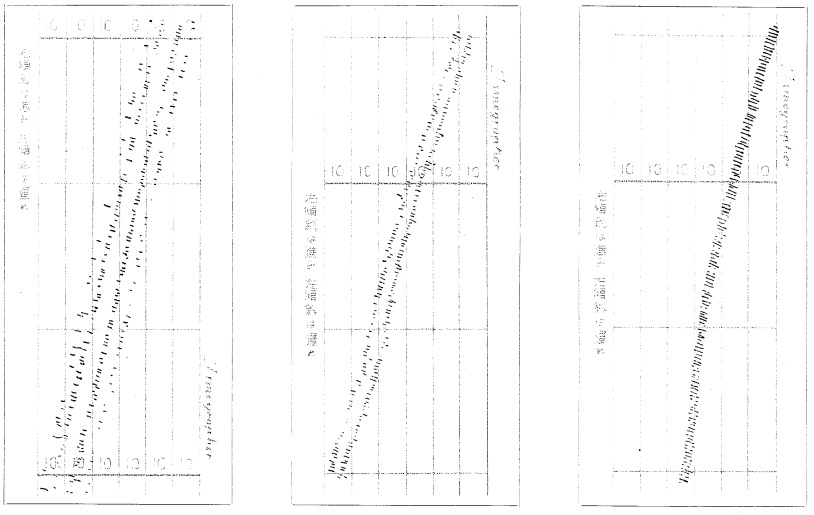
N. B. Tick of watch, consists of 3 sections. One of these three sections may sometimes be recorded irregularly on the paper when the setting of volume switch is not proper, It is most important to always record the 1st sound only, and to make it print clearly.

Ⅰ & Ⅲ shows sounds coming from two sections of the watch, as indicated by the arrows.



The graph (a) shows the recordings when the volume knob (H) is gradually turned towards the right and illus. "c" shows the best recording position.

(a) (b) (c)



Ⅳ Adjustment of Striking Sound :

If the striking sound is weak, a clear recording cannot be made, therefore, the striking sound knob (1) should be turned to the right to obtain the proper sound.

For stop watches, etc. which have a fast beat, the knob should be turned to the right for clear recording.

V Reading of Measure Plate (N) and Graph-paper (S)

The arrow mark on the square table indicates the daily rate of a watch (gain or loss per 24 hours) when blue lines of measure-plate are placed parallel with the recorded lines on the paper.

The black letters on measure-plate indicate the gain of time and the red letters indicate the loss of time.

VI Instant Reading by Graph-paper

The graph-paper used in this tester can measure gain or loss without using the measure-plate.

That is, you can measure gain or loss of time by counting the number of columns on which the dots are printed. (each column represents 10 seconds) within three sections (three sections which are separated by horizontal lines, represent 24 hours). See the following examples.

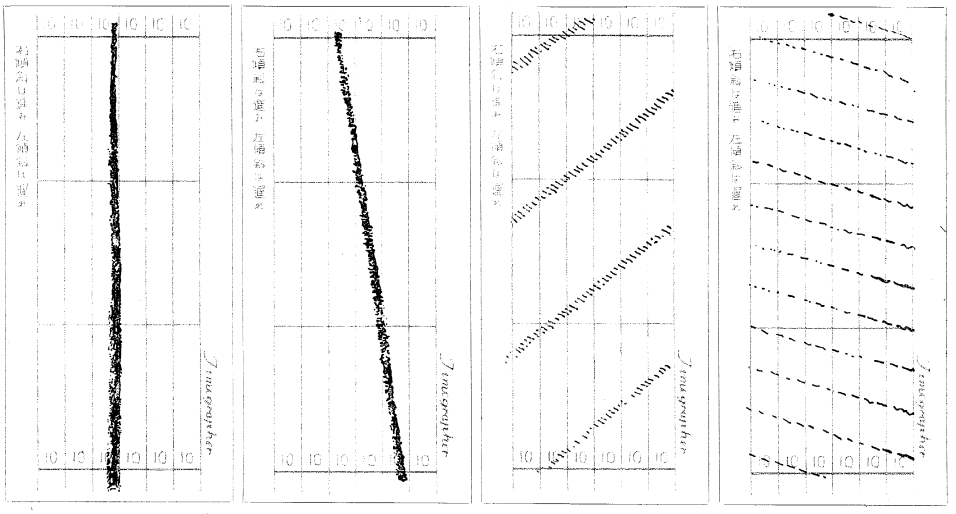
(1) No gain nor loss.

(2) Loss of 30 sec.

(3) Gain of 3 min.

(4) Loss of 10 min.

(1) (2) (3) (4)



HOW TO FIND DEFECTIVE PARTS IN WATCHES

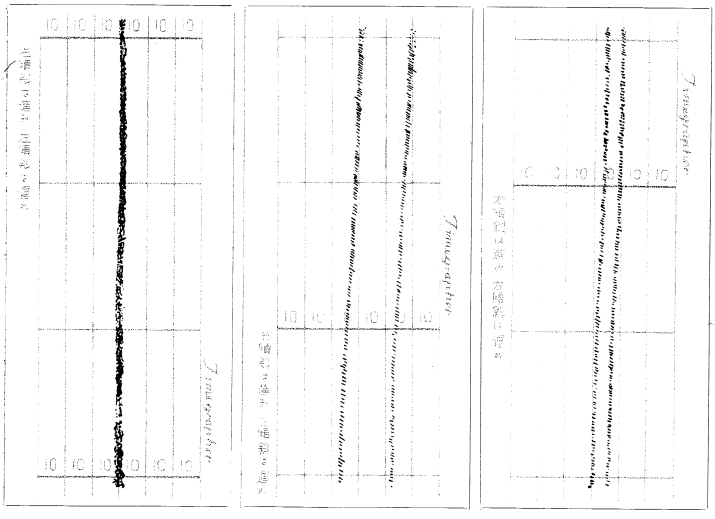
The following graphs show the condition of watches tested by the Timegrapher.

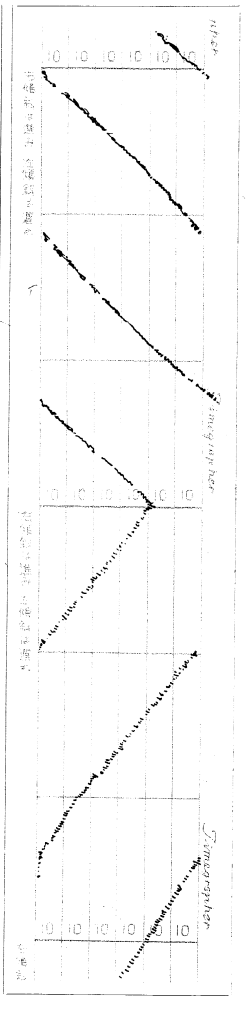
(5) This shows proper time keeping, neither gain nor loss.

(6) Amplitude (out of beat): These two lines of graph show unbalanced swing of impulse pin which will disturb normal operation of watch and has to be corrected.

(7) The space between two lines as per graph means a slight unbalanced swing of impulse pin, but is not so serious. This may be observed in many ordinary watches.

(5) (6) (7) (8)



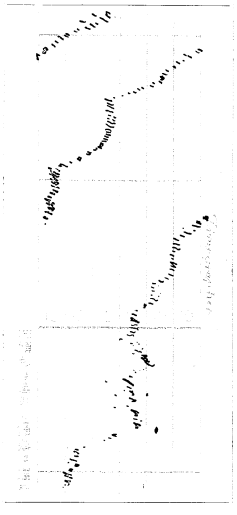


(8) Unbalance of balance wheel:

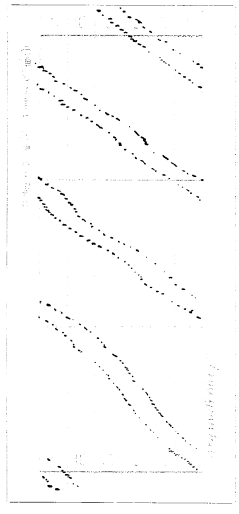
Right graph has been recorded at crown-up position and crowndown position.

When in crown-up position there is loss of 2 min. 40 sec. and when in crown-down position gains 2 min. Thus, you will see changes of isochronism of the watch because of the unbalance of balance wheel.

(9)



(10)



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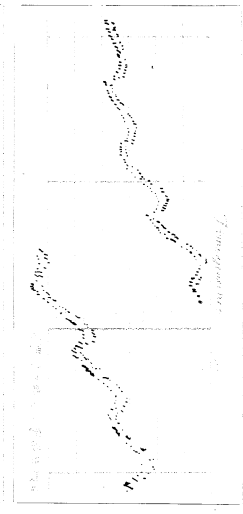

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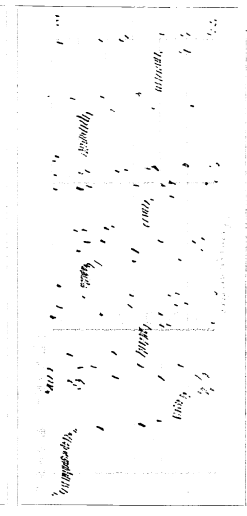

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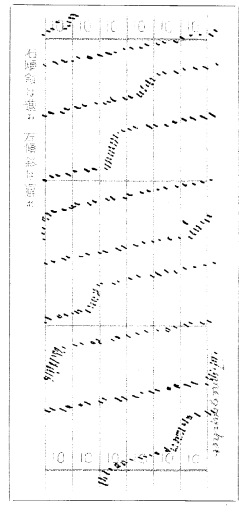

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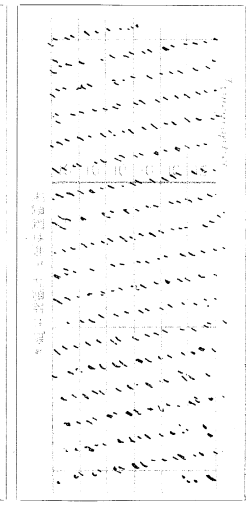


(9) This recording resulted by an inadequate oscillation of balance wheel (about 100° of oscillation). This watch has no oil and weak main spring.

(10) This is also as above •about 90°) with watch at 12 o'clock up position and the oil is sticky.

(11) This is an old watch slightly magnetized and the graph shows that escapement is faulty. Escape-pivot is worn out, and the teeth of escape wheel are uneven.

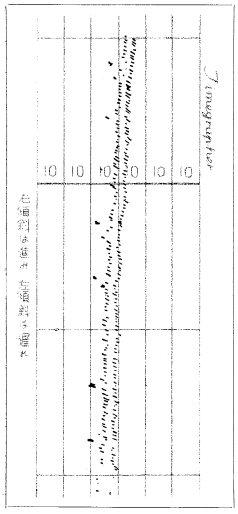
(12) Knockings :

Balance wheel is occasionally knocking, where recorded lines are always printing towards rhe right side.

(13) As knockings become frequent, the more recordings of knockings appear on the paper, decreasing the normal recordings.

(14) When knockings become very frequent, its recordings appear to be just iike the gain of time. In this case you can hear clearly sounds of knockings by receiver.

(15)



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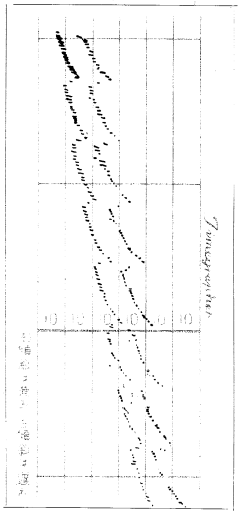

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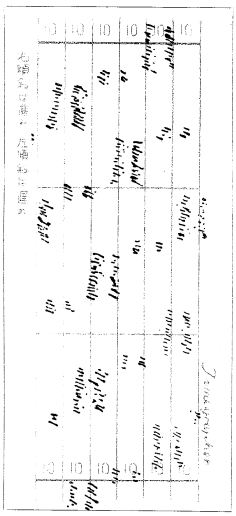

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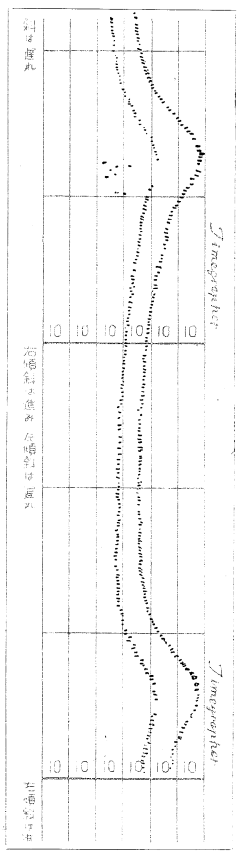

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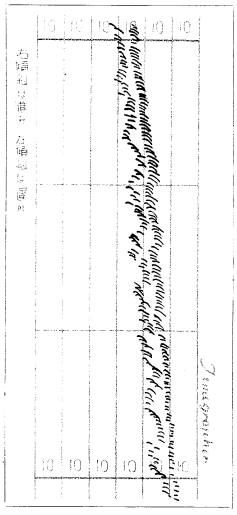


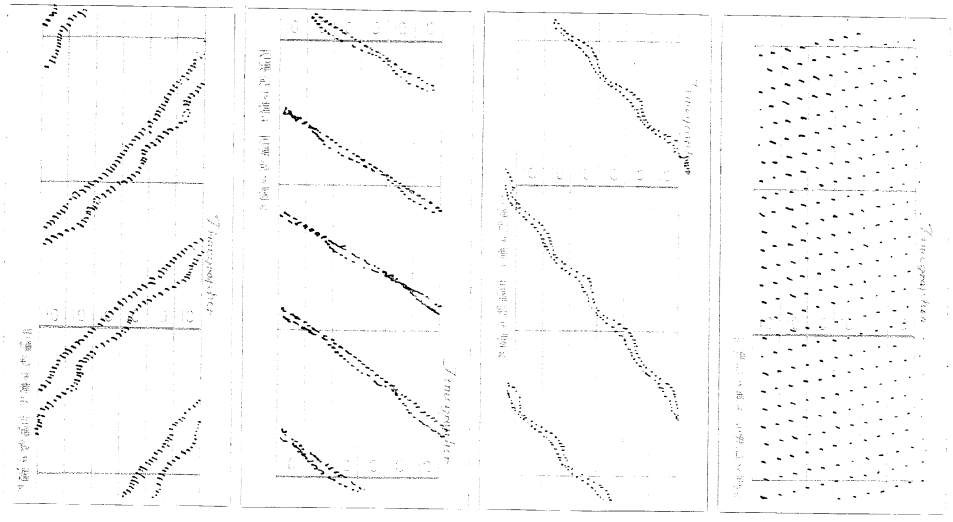
(15) Unevenness of escape wheel teeth: One of the teeth of escape wheel has a slight defect and one dot appears out of line.
(in case of 15 teeth in escape wheel).

(16), (17) The recordings indicate the improper meshing of escape wheel teeth with pallet jewel due ta unevenness of escape wheel teeth.

(18) Unevenness of the 4th wheel teeth: This shows a sudden change of oscillation of balance wheel caused by touching of second hand with crystal once a round, and also the same result would appear by unevenness of teeth of the 4th wheel.

(19) Condition of banking pine :
This watch loses 10 sec. per 24 hours due to some defects in esscapement. Impulse pin is not touching at fixed period with pallet fork due to maladjustment of banking pin and escapements.

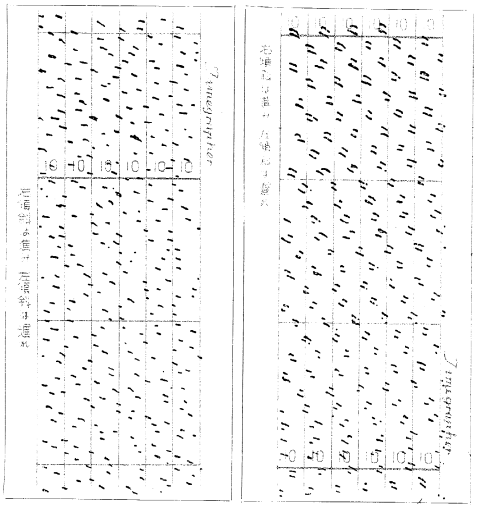
(20) (21) (22) (23)



(20), (21), (22) Escapements are magnetized :

These are recordings shown by the influence of magnetized escapements. Recorded lines are apt to show irregular swelling waves which are similar to a recording of an indequate oscilla tion of balance wheel. In such case, it is necessary to demagnetize them. Scrapping sound of hairspring can be sometimes heard in headphone.

(24) (25)

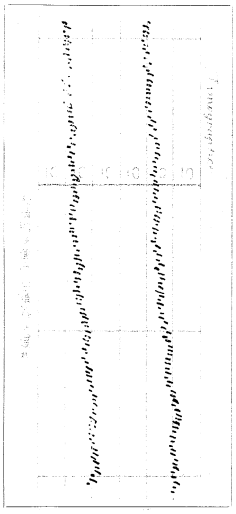


(23) This shows a recording of watch which has number of ticks 5.5 per second but measured without placing the crystal selector switch to 19,800 beats. Consequently it shows faulty gain of time.

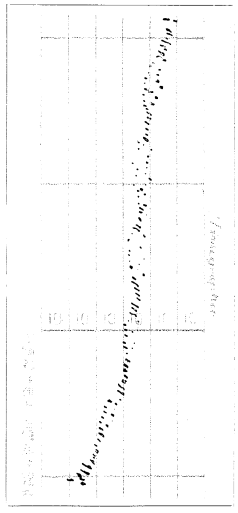
(24) Tangling of hair spring : Tangling of hair spring shows these disordered recordings. It can be heard as irregular sounds in the earphone.

(25) Oiled hairspring : This recording resembles a slow condition, but actually indicates much gain of time due to oil on hairspring. Rapid ticks will be heard in earphone, and recordings are printed always towards the right side.

(26)



(27)



(26) Clock :

This is a recording of an alarm clock which has 4 ticks per second and recordings appear always in two lines.

(27) This is also a recording of on alarm clock, which has, however, $3\frac{1}{3}$ ticks per second and recordings appear in one line.

TROUBLE SHOOTING FOR TIMEGRAPHER MODEL P-61

In case there happens any trouble in Timegrapher, it is necessary to check first the external conditions such as changes in voltage or neighbouring machines which generate electric noises, and further refer to the paragraph of "How to Operate"

How should it be handled about troubles which come from Timegrapher itself? This booklet presents the explanations for its possible troubles and gives guidances to one who experiences in adjusting and repairing radio and T. V.

The allowance for the voltage of each station of electric circuit is plus or minus 10% of the figures shown in the circuit diagram attached hereto when Timegrapher is working in order. According to the circuit diagram, the voltage of each station checked by a tester when electric circuit is, considered, not working in order.

The voltage figures in the diagram are measured by the vacuum-tube voltmeter (hereinafter referred to V. T. V. M.)

Both direct current ($\underline{V}$) and alternating current ($\underset{\sim}{V}$) shown in the diagram are measured by

		Input Resistance	Input Capacity
V. T. V. M.	D. C.	11 MΩ	Max. 1.6 PF.
	A. C.	1.5 MΩ & over	Max. 80 PF.

It is preferable to use V. T. V. M. as a voltmeter than Circuit Tester, because the circuit tester usually indicates somewhat lower voltage than that of V. T. V. M.

Troubles in Electrical System :

1. Symptom : Rectified direct current is not working in order.
   Check : The bulb (6 × 4) or power transformer.
2. Symptom : No tick sound of the watch can be heard by the receiver.
   Check : Microphone may not be working due to short or disconnection of wire system.
   Note : A. F. Amp. of Timegrapher has the same mechanical composition of sound amplifier used for radio and T. V.
3. Symptom : Ticking sounds of the watch is normal but the recardings do not appear on the paper.
   Check : Relay (2D21) may not be working. The parts which serve to change voltage such as electromagnet, resistor, condenser, etc. in relay (2D21) may need to be replaced. In rare occasion, the mechanical adjustment is required in the supporting rubber of printing bar.

Note : The machine is sensitive to the external noises such as electrical disturbances and other noises. With these noises, recording sounds do not correspond with fhe tcking of the watch. Therefore, make sure that there is no electric calculating machine, typewriter or any noise which will effect directly to the microphone in the neighbourhood.

4. Symptom : The recording shows a considerable gain or loss and irregularity even though the watch itself is very accurate. In case of the above troubles, the performance of X-tal OSC and Buff, Divider, Power Amp. and Motor (they serve to keep the standard of time) are not working correctly. The causes of troubles will be explained in the following paragraphs :

A. Causes : Crystal vibrator may not be generating its signals.
Check : Examine circuit of X-tal OSC and Buff.

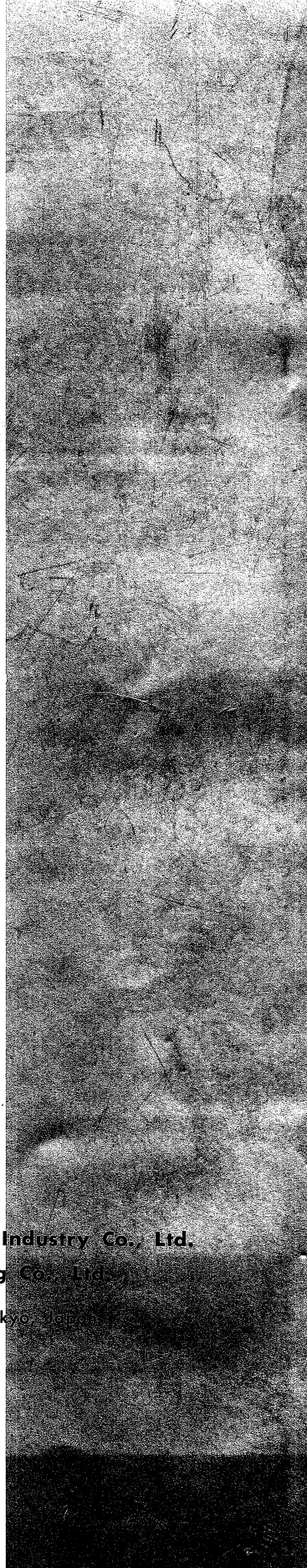
B. Causes : Crystal vibrator is working correctly but the frequency of Divider A is not reduced to the amount which is equal to 1/22 or 1/20 (240 c/s or 264 c/s)
Check : The amount of resistance and capacity, both of which are arranged in parallel to BT-3X, should be readjusted within the limit of described figures in the diagram in order to obtain the frequency of 240 c/s or 264 c/s.

C. Causes : Divider B does not have correct frequency.
Check : The amount of capacity arranged in parallel to BT-4X should be readjusted within the limit of described figures in the diagram in order to obtain the frequency of 1/4 (60 c/s or 66 c/s)
Note : When the troubles cannot be eliminated by adjusting capacity and resistance within the limit of described figures in the diagram, the related parts in Divider A and Divider B, and Vacuum tubes (12AU7, 6BM8) should be examined.

Power Ampifier is the same mechanical composition : as of radio and. T. V. except the following difference

In Timegrapher . . . Load is on Motor.
In Radio and T. V . . Load is on Speaker.

Motor Imp. 1KΩ



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