Master WATCHMAKING

SHOP TRAINING JOB GUIDES

LESSON 11

Timing, Rating and Regulation

—

Sections 260 - 283

CHICAGO SCHOOL OF WATCHMAKING

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MASTER WATCHMAKING

A Modern, Complete, Practical Course

CHICAGO SCHOOL OF WATCHMAKING

Founded 1908 by Thomas B. Sweazey

Lesson 11

Sections 260 to 283

TIMING, RATING AND REGULATION

SEC. 260 — Timing, Rating and Regulation

Timing, rating and regulation are three different subjects. Timing is the operation required to bring a watch to time after it has been repaired. Rating is the observation and comparison of the variation of the daily rate of a watch after adjusting. Regulation refers to the adjustment of a watch to its owner's personal routine and habits.

In all of our work the lessons call for practice on specific jobs. This lesson on timing does not include rating, adjusting and regulation. The lessons to follow will instruct you in many other repairs which you must learn before you can properly time, rate and adjust a watch. Your practice watch will not always keep correct time in all positions because of your inability to make repairs which are necessary. As you proceed with each of the following lessons, you will understand more clearly the preceding lesson. Master each lesson, strive to do each job a little better. Speed will come only from continued practice, so PRACTICE, PRACTICE, PRACTICE.

FIG. 11-1

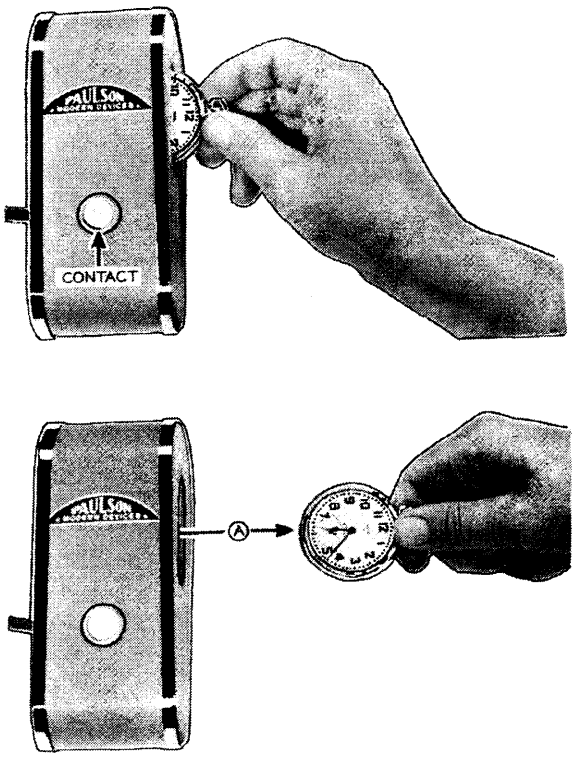


FIG. 11-2

SEC. 261 — Testing for Magnetism

Before attempting to make any repairs on a watch it should be tested for magnetism. A quick test can be made when the balance is in motion by placing a small compass which has had the magnetism removed directly over the balance cock, figure 11-1. If the watch is magnetized, the needle on the compass will move quickly from side to side and, in some cases, twirl completely around.

To remove magnetism it is necessary to have a demagnetizer. Figure 11-2 illustrates the demagnetizer in use. This demagnetizer is for use on alternating current only. Hold watch carefully inside demagnetizer as in figure 11-2. Close contact and pull watch away slowly from the demagnetizer in direction of arrow A.

When at arm's length release contact. Test with compass. In some cases, it becomes necessary to take the watch apart and demagnetize each part separately. Make it a practice to test your watch for magnetism and demagnetize if necessary before doing any and all repairs. When a watch is magnetized you cannot bring it to time .

SEC. 262—Experiment in Magnetism

Most watchmakers use a small magnetic compass to test for magnetism in watches. Before proceeding further with this lesson, let us make a simple experiment.

Material required: 1 Small Magnetic Compass
1 Demagnetizer
1 Piece Steel Rod

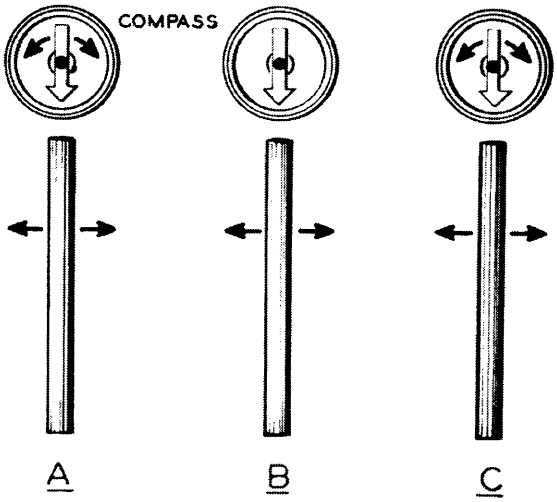


FIG. 11-3

Place your compass on bench, figure 11–3. Move the steel rod toward the compass directly in line with N (north) and, at the same time, move it from side to side as indicated by the arrows, diagram A. The closer the rod gets to the compass the greater the indicator will be agitated.

Now demagnetize the compass (figure 11–2), and repeat the operation, diagram B. This time the compass indicator will remain at rest.

Now magnetize the test rod by placing in demagnetizer, upper illustration of figure 11–2, and close contact. Release contact quickly WITHOUT REMOVING ROD from demagnetizer. The test rod will now be magnetized.

Repeat the previous operation, diagram C, and you will find the indicator of the compass again is agitated.

Suppose we substitute a watch for the test rod. Then in diagram A a watch containing steel parts can agitate the needle of a compass even though the watch is devoid of magnetism. However, in diagram B a watch containing steel parts cannot agitate the indicator of a compass if the watch is devoid of magnetism. But in diagram C a watch containing magnetism will agitate the compass needle even though the compass is devoid of magnetism.

From this test you can observe the fallacy of using a compass which contains a magnetic indicator. Any type of sensitive indicator devoid of magnetism would serve as well. Remember when you have demagnetized your compass it is no longer a compass. It becomes a testing device.

SEC. 263—Types of Master Regulators

In order to be able to time watches it will be necessary for you to have a Master timepiece. With a radio you will have no difficulty hearing the time signal given on most stations at the half hour and hour. Some jewelers or watch repairmen have a master clock with a seconds beat pendulum. Some have chronometers, others use electric clocks that are controlled by a Master system or any of the above-mentioned devices. A 12, 16 or 18 size watch that is an excellent timekeeper will be suitable.

SEC. 264—Some Causes of Watches Losing

In the timing of watches, there are a great many factors to be considered. If the watch to be regulated is in perfect order, timing, adjusting and regulation are not difficult.

Some of the most common faults causing watches to lose time are as follows: In pendant set pocket watches, if the sleeve is not adjusted correctly, it will allow the clutch to become engaged in setting position causing the watch to slow down or stop altogether (Lesson No. 2).

Be sure hands fit correctly. Check cannon pinion. If the cannon pinion is loose, your watch will lose erratically. This is a common fault and is easily overlooked by the beginner. Make the following test before removing hands. Test as shown in figure 11–4,

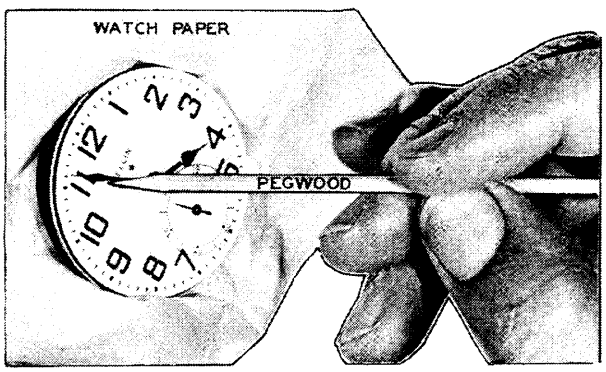


FIG. 11-4

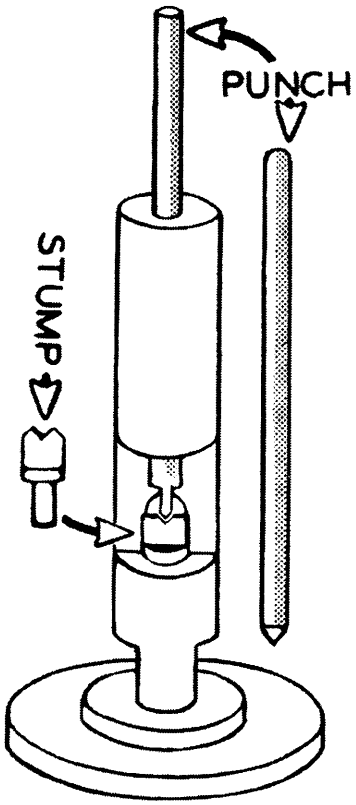


FIG. 11-5

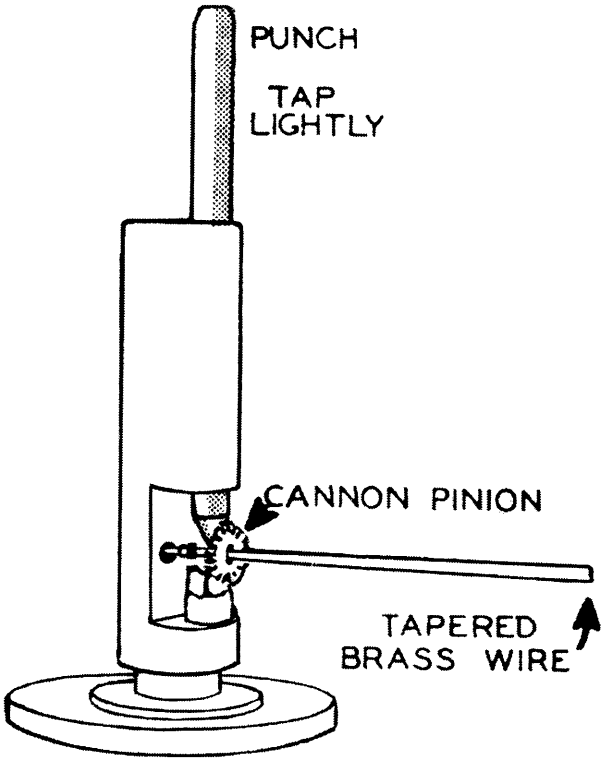


FIG. 11-6

moving minute hand from side to side. If cannon pinion is loose, the minute hand will move freely from side to side but if correct, you will meet with a little resistance. However, it cannot be too tight as it has to slip when setting parts are in the setting position but it must tight enough to turn with the center pinion. Figure 11–5 illustrates a cannon pinion tool used for tightening cannon pinions.

To tighten cannon pinion, place the small pointed punch in position and tap very lightly, figure 11–6. Use caution. A small tapered brass wire inserted into hole in cannon pinion will keep from crushing the pinion. A few light taps will bring better results than one heavy crushing blow.

Some watchmakers use a dull pair of cutting pliers as in figure 11–7.

FIG. 11-7

SEC. 265 — The Regulator

Figure 11–8–A shows an Elgin balance cock with the regulator set in its correct position as it comes from the factory. The regulator contains two pins usually made of brass which fit over the outside coil of the hairspring. These pins control the length of the hairspring when the regulator is moved. In most American watches the regulator is snapped in place on the balance cock. In Swiss and American watches using a Swiss type of jewel assembly the regulator is held in place by the upper cap jewel. Moving the regulator toward F (fast) will make the watch run faster. Moving the regulator toward S (slow) will make the watch run slower. On some watches these letters will be A (advance) and R (retard).

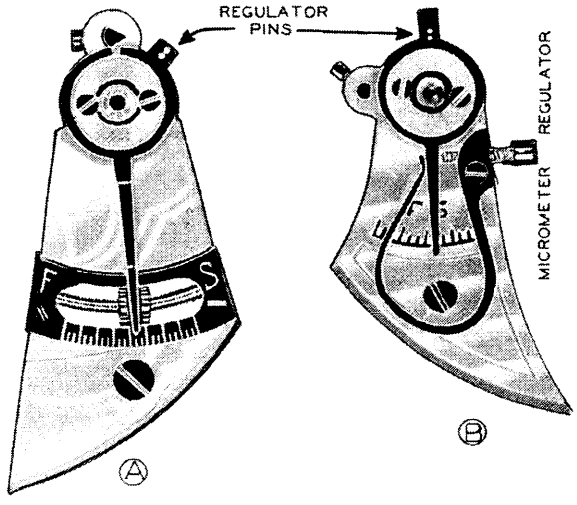


FIG. 11-8

Figure 11–8–B shows another type of regulator which has a micrometer screw that can be moved as much or as little as desired. It is found on better grade watches mostly of the quality used by railroad men. A full turn of the micrometer regulating screw makes a probable difference of from 10 to 25 seconds a day, depending on the make and size of the watch.

SEC. 266—The Regulator Pins

Check regulator pins. If they are too far apart, the watch will lose.

Figure 11–9 is a series of drawings illustrating their types and faults. The regulator pins at A are a common type used in American watches having a flat hairspring. The regulator pins at B, which are shorter, are used in both American and Swiss watches having an

FIG. 11-9

overcoil hairspring. The regulator pins at L are a common type of pin used in Swiss watches having a flat hairspring.

Regulator pins illustrated at H show the proper relation between the outside coil of the hairspring (the heavy black line) and the pins when the balance is at rest. Actually the amount of space between the hairspring and each of the pins is hardly visible even with a double loupe.

If the balance is moved from its position at rest either to the right or left, this coil will rest against one of these pins, in this case the one on the left, diagram J. Now the amount of space between the hairspring and the regulator pin can be determined visually and should be just enough to insure freedom of movement.

Figure 11–9, diagram C, illustrates regulator pins which are too far apart and are brought back to the correct position by bending as illustrated by dotted line. Diagram D illustrates regulator pins which are too far apart and are corrected by adjusting in a manner similar to that shown in diagram E. Diagram F illustrates regulator pins which are too close together and are corrected by adjusting in a manner similar to that shown in diagram G.

SEC. 267—Purpose of Regulator

The purpose of the regulator, which includes the regulator pins, is to lengthen or shorten the hairspring. The actual length of the hairspring is from the stud to the hairspring collet. The length of the hairspring is controlled by the regulator pins in the following manner:

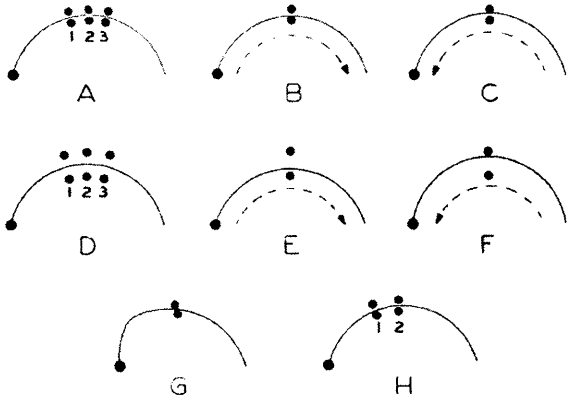


FIG. 11-10

Figure 11–10, diagram A, illustrates three sets of regulator pins (1–2–3). No. 2 represents the position of the regulator pins when the regulator is in the center of the F & S Scale and the balance is at rest. Notice that the hairspring does not touch either of the pins. Moving the regulator toward the "fast" No. 3 would shorten the hairspring and toward the "slow" No. 1 would lengthen the hairspring. Remember in these illustrations the balance is at rest and there is no change in the relation between the pins and the outer coil of the hairspring.

Now move the balance in the direction of the arrow in diagram B and the coil of the hairspring will move against the inside regulator pin. Move the balance in the direction of arrow in diagram C and coil will move against the outer regulator pin. Now as the balance swings back and forth the hairspring moves from one regulator pin to the other in this manner.

Diagram D illustrates three sets of regulator pins in the same position as those shown in A with the balance at rest, but the space between the regulator pins and the outside coil of the hairspring is excessive. In this case, the pins do not control the length of the hairspring as you can see, diagrams E and F. When the balance is moved in the direction of arrows E or F the outside coil of the hairspring does not come in contact with the pins; consequently, the regulator pins have no effect.

Diagram G illustrates regulator pins which are too close together and moving the regulator pins toward "slow" would cause it to bend in a manner similar to the illustration.

Diagram H illustrates what happens when the outside coil does not follow between the pins when the balance is at rest at illustrated in diagram A. In this case the pins at No. 2 are correct. Moving the regulator pins toward "slow" causes the inside regulator pin to contact the hairspring as shown at No. 1. Consequently, the watch may have a tendency to gain instead of lose as indicated on the scale.

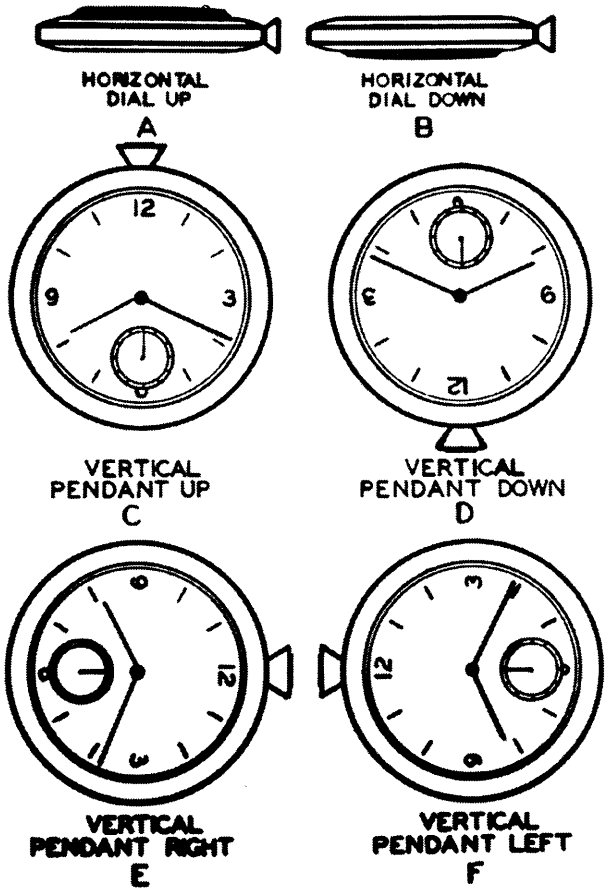


FIG. 11-11

SEC. 268 — Positions Used in Testing Motion

Hold watch dial down and notice motion. A watch in good order should have oscillation of from 1¼ to 1½ turns in this position.

Figure 11–11 illustrates the following positions: A—dial up, B—dial down, C—pendant up, E—pendant right, F—pendant left. These are known as the five positions. The sixth position is pendant down—D. When you see and hear of a watch being adjusted to five positions it means A, B, C, E, and F. These adjustments are usually made at the factory and if the watchmaker uses genuine material and skillfully does his work, he will not have any trouble in getting his repair jobs to keep time.

SEC. 269 — Determining Motion

Figure 11–12 is a drawing used to illustrate the method used to determine the motion of a balance. The balance wheel and arm at rest are shown by the heavy black lines.

If the balance and arm are moved from A to B, which is ⅛ of the circumference, and released, the balance will swing back in direction of line CD, and

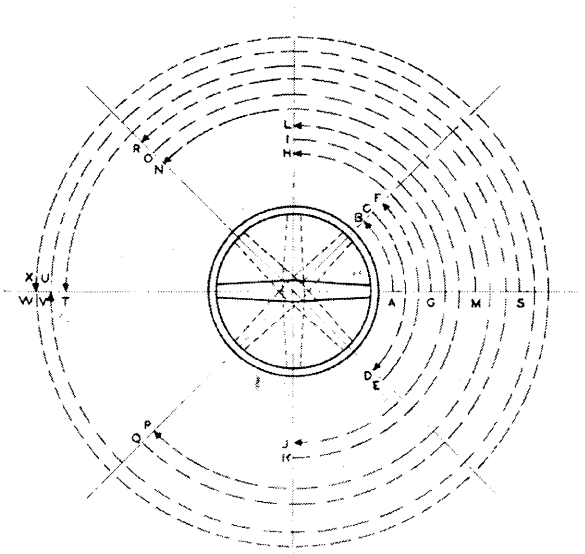


FIG. 11-12

back again from E to F, etc. The balance is then said to motion ¼ of a turn. If the balance moves from G to H and then back from I to J and then from K to L, etc., it will have a motion of ½ turn. M to N and O to P and Q to R illustrate ¾ of a turn. S to T and U to V and W to X, etc., illustrate one full turn.

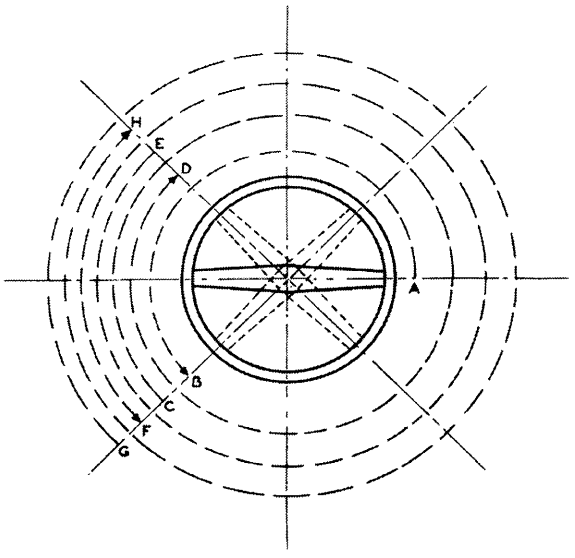


FIG. 11-13

Figure 11–13, A to B and C to D and E to F and G to H illustrate 1¼ turns. At 1½ turns the arms would appear to stop at positions illustrated by center lines.

SEC. 270—Testing Motion in Watch

In practice, stop the balance wheel completely using a bristle from a watch brush, release it and watch it swing back and forth until arms appear to meet at D and C and meet again at E and F. Now the balance has completed one full turn. If the watch is taking the correct motion, it will then appear to cross at E and F until it reaches the maximum swing, which will be from 1¼ to 1½ turns. Notice position of arms in relation to dotted line. This is after the wheel has made one full turn and arms appear to stop at G and H.

A watch should motion the same in position dial up and dial down. If it doesn't, it may be caused by several things among which the most common are dirt and old oil in jewels, burred pivots, hairspring out of level, loose hairspring stud and others. Before timing be certain the watch motions correctly.

After you are satisfied that the balance motions correctly dial up and dial down, test by letting the balance wheel fall toward the pallet fork. In this position a watch will have a tendency to slow down a trifle, not as much in pocket watches as in bracelet watches. However, it should not slow down more than ¼ of a turn.

SEC. 271—Some Common Causes of Watch Gaining

If a watch has an excessive rate of gain, the fault is generally found in the hairspring. However, there are cases when a balance screw may be loose and the screw will fall out. Check the balance wheel and ascertain if you have an equal number of screws on each side of the balance arms. If so, then check the hairspring. If the coils stick together, it may be from oil or magnetism. Check for magnetism. Clean balance and hairspring (Lesson 10) if coils of hairspring are oily.

At times a customer has jarred his watch in such a manner that the outside coil has become caught on the stud or between the regulator pins. Release carefully. The hairspring must be level and parallel to the arms of the balance wheel. The overcoil must pass through the regulator pins and must not touch the under side of the center wheel or balance bridge.

SEC. 272—Making Notes when Regulating

In timing a watch with a second hand set the second hand to coincide with second hand on your master timepiece. Set the minute and hour hands to correspond with hands on master timepiece. Make a note on back of watch tag or piece of paper the exact time the watch was set.

Figure 11–14 illustrates the notations made on the back of a watch tag. Following is an explanation: Monday, February 2, at 10 A.M., the watch was set. At 11 A.M. the watch had gained 5 seconds, entered on tag as +5. In 24 hours this watch would gain approximately 120 seconds (24×5) or two minutes. After making the necessary adjustment, the watch was reset and the ticket marked Reg. (regulate) and Set. At 1 P.M. the watch had gained two seconds, which is at the rate of 24 seconds per day $\frac{(24\times2)}{2}$. After making necessary adjustment the ticket was marked Reg. but it was not reset. At 6 P.M. it was still two seconds fast. Tuesday, February 3, at 9 A.M. it was 23 seconds slow which was at the rate of 40 seconds in 24 hours. Regulate and mark ticket Reg. At 6 P.M. watch was ten seconds slow showing a gain of 13 seconds in 9 hours or about 35 seconds per day. Watch was regulated again. Wednesday, February 4, 9 A.M. watch was 7 seconds slow showing a gain of 3 seconds in 15 hours. No regulation was made but watch was set.

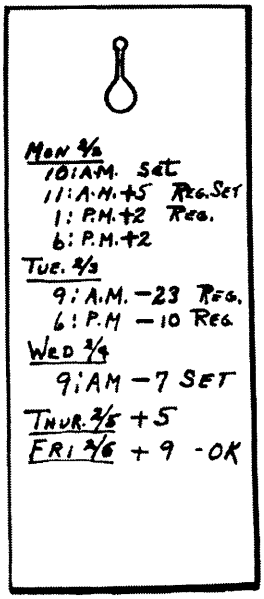


FIG. 11-14

Thursday, February 5—5 seconds fast in 24 hours

Friday, February 6—9 seconds fast in 48 hours

This watch now shows a slightly fast rate which is very desirable. Further regulation would be made from time to time if required.

In the case of a watch without a second hand, set accurately with a master timepiece watch every six hours or so at first. It sometimes takes three, four or five days to regulate accurately. This will explain the reason watchmakers take more time than customers anticipate for repairing.

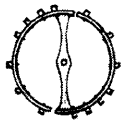
SEC. 273 — Hints on Timing Machines

Today in the larger shops the advent of the timing machine enables the watchmaker to time his watches more accurately and speedily than ever before. It is possible to take in a watch for repair and after bringing it to time return it to the customer the same day knowing that the watch will keep accurate time.

You will hear a great deal about time machines. Timing machines are electronic instruments used to test the rate of a watch in any position, enabling the repairman to predict the average rate of the watch to be timed as it will be when the owner carries it. The latest models translate the "tick" into a written record from which the watchmaker makes his observations. These machines are expensive for the beginner. However, the use of timing machines will be given in a later lesson.

TIMING WASHERS for AMERICAN and SWISS WATCHES

Place Washers on two opposite balance screws



Do not place Washers on meantime screws

26 0 to 18 Size

3¾ to 21 Ligne

Size and Rate Per 24 Hours Marked on Bottle

Number Order	American Sizes	Swiss Ligne Sizes	Rate Per 24 Hours
1	26/0-21/0-20/0	3¾ to 5½	20 Seconds
2	26/0-21/0-20/0	3¾ to 5½	40 Seconds
3	26/0-21/0-20/0	3¾ to 5½	1 Minute
4	26/0-21/0-20/0	3¾ to 5½	2 Minutes
5	26/0-21/0-20/0	3¾ to 5½	3 Minutes
6	26/0-21/0-20/0	3¾ to 5½	4 Minutes
7	18/0 to 6/0	6¾ to 9¾	20 Seconds
8	18/0 to 6/0	6¾ to 9¾	40 Seconds
9	18/0 to 6/0	6¾ to 9¾	1 Minute
10	18/0 to 6/0	6¾ to 9¾	2 Minutes
11	18/0 to 6/0	6¾ to 9¾	3 Minutes
12	18/0 to 6/0	6¾ to 9¾	4 Minutes
13	10/0-8/0-5/0	10½ to 11½	20 Seconds
14	10/0-8/0-5/0	10½ to 11½	40 Seconds
15	10/0-8/0-5/0	10½ to 11½	1 Minute
16	10/0-8/0-5/0	10½ to 11½	2 Minutes
17	10/0-8/0-5/0	10½ to 11½	3 Minutes
18	10/0-8/0-5/0	10½ to 11½	4 Minutes
19	4/0-3/0-0	12 to 13	20 Seconds
20	4/0-3/0-0	12 to 13	40 Seconds
21	4/0-3/0-0	12 to 13	1 Minute
22	4/0-3/0-0	12 to 13	2 Minutes
23	4/0-3/0-0	12 to 13	3 Minutes
24	4/0-3/0-0	12 to 13	4 Minutes
25	6-12	15 to 17	20 Seconds
26	6-12	15 to 17	40 Seconds
27	6-12	15 to 17	1 Minute
28	6-12	15 to 17	2 Minutes
29	6-12	15 to 17	3 Minutes
30	6-12	15 to 17	4 Minutes
31	16-18	19 to 21	20 Second
32	16-18	19 to 21	40 Second
33	16-18	19 to 21	1 Minute
34	16-18	19 to 21	2 Minute
35	16-18	19 to 21	3 Minute
36	16-18	19 to 21	4 Minutes

FIG. 11-15

SEC. 274 — Use of Timing Washers

Example: Watch set at: 9:00 A.M. Set
Reading at: 10:00 A.M. 8 Sec. Fast
Watch is running approximately 192 seconds fast per 24 hours or a trifle over 3 minutes per day

The most common way of slowing this watch down is to use balance washers to add weight to the wheel. Figure 11–15 illustrates a chart from a cabinet of balance timing washers. On the chart is a list of the different sizes of washers contained in the bottles. If the watch is 18 size, we would add a pair of washers from bottle 35 as it is marked three minutes per day. This, in all probability, would bring the watch within the range covered by the regulator and we would then proceed to make the final adjustment with the regulator. However, these washers will act differently on different makes of watches. It might happen that the three minute washers would be too heavy, in which case exchange them for a lighter pair. These washers are obtainable for all sizes of watches. Place washers on screws nearest the balance arms, figure 11–16. Balance screws are best removed and replaced with a balance screw holder, figure 11–17.

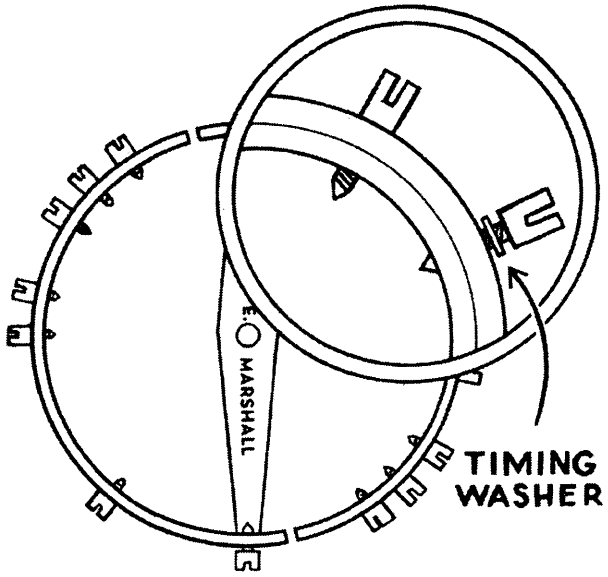


FIG. 11-16

FIG. 11-17

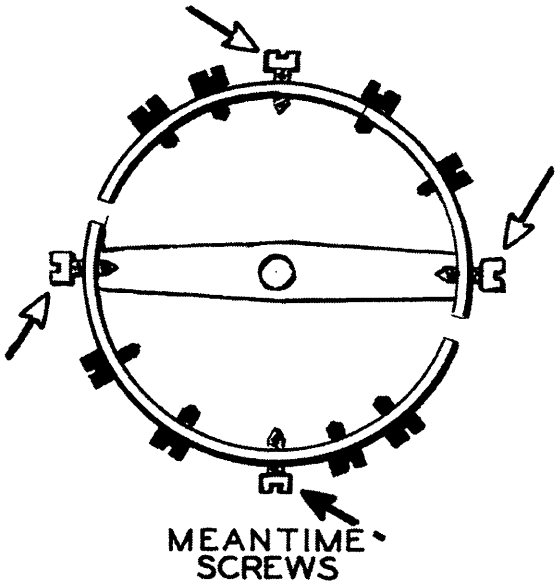


FIG. 11-18

SEC. 275 — Meantime Screws

On some balance wheels you may notice one or two pairs of balance screws that are noticeably different from the majority of screws. The heads of the screws are shorter and the threaded portion is longer. These are called meantime screws and are a feature of the Waltham movement. Other watch manufacturers use them in their better grade of movement such as railroad watches and fine pocket watches. These are not found on the majority of Swiss made movements. Figure 11–18 illustrates a balance having 4 meantime screws. Do not change the position of these screws when making repairs on the balance. The position of these screws is changed only when the daily rate is adjusted. Moving a pair of screws toward the center will cause the watch to gain. Moving a pair of screws outward from the center will cause the watch to lose. Always move a pair of screws and move them an equal amount. Caution: Never add timing washers or use an undercutter on the meantime screws.

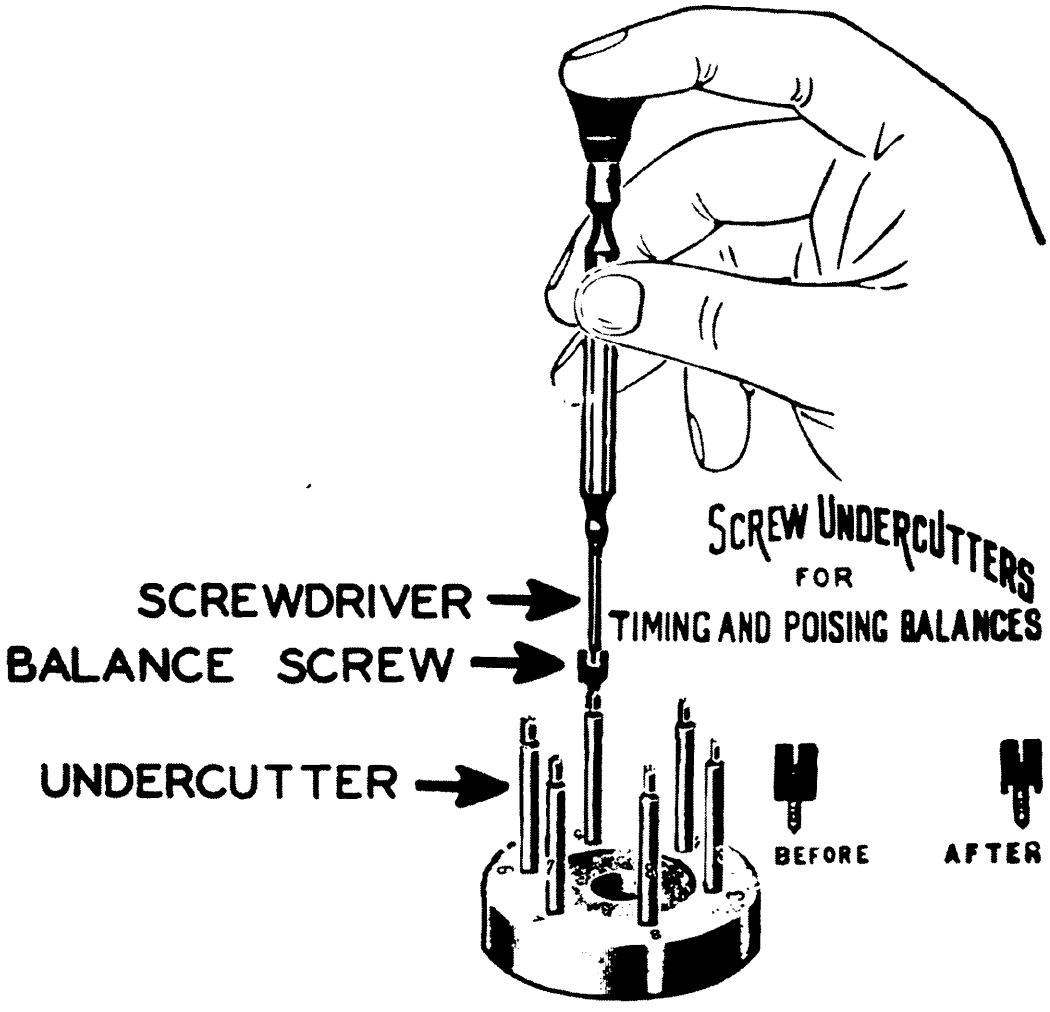


FIG. 11-19

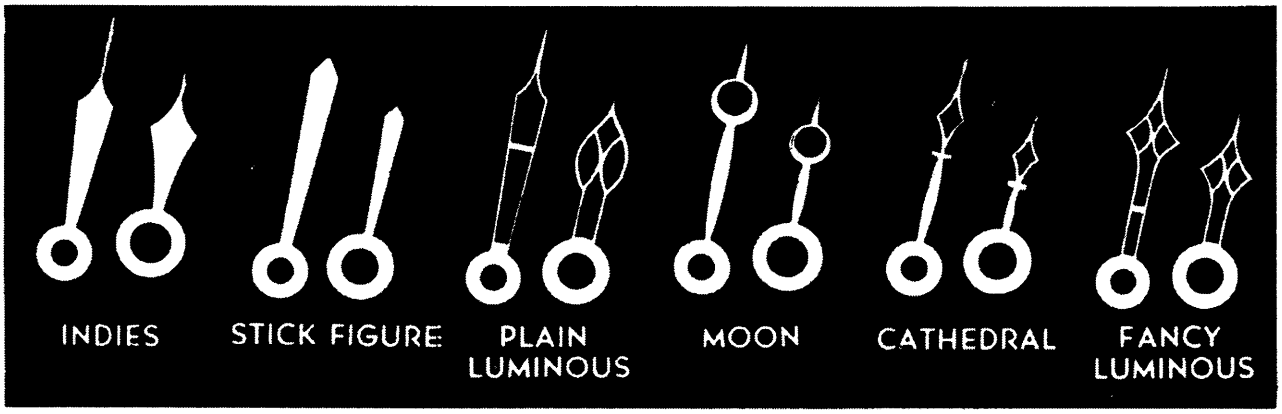


FIG. 11-20

SEC. 276 — Use of Undercutter

When a watch runs too slowly—that is, it cannot be regulated by the regulator, it is usually brought to time by removing a little weight from a pair of balance screws. This is done by use of an undercutter, figure 11–19. The use of this tool will be explained thoroughly in lesson on Poising.

For practice on this lesson try timing as many different watches as you can. Do not be afraid to do it over and over. Get the habit of making notes (figure 11–14) when timing a watch. Do not trust to memory.

SEC. 277 — Purpose and Types of Hands

It is necessary for you to understand at this time the purpose of the hands, the names of different style hands, and how to adjust and select hands. Inasmuch as you will not have all of the necessary tools at present, it isn't practical for you to replace hands on every watch that needs them. There will be times when you will need a lathe or a staking tool to do this job properly. You will acquire these tools as you progress with your training but it would not be practical for you to make a pipe for a second hand unless you had a lathe; and before you can make a pipe, you would have to have instruction in lathe work. However, the illustrations and the reading matter are for your information and reference work.

Hands are usually made from steel or brass; some are blued and some are gilded, others have luminous paint on them in order that they can be easily read at night. The average watch has three hands. They are the minute hand, which is the longest and which makes one revolution an hour, the hour hand which makes one revolution every twelve hours, and the second hand which makes one revolution a minute. The minute hand is fitted friction tight on the cannon pinion. The hour hand is fitted friction tight on the hour wheel. The second hand is fitted friction tight by means of a tube or pipe over the extended pivot of the fourth wheel.

In replacing hands for most American made watches the hands desired can be ordered by the name and size of watch; for example, 1 pair hands for Elgin 12 size. Figure 11–20 illustrates a variety of styles. It is best to send samples of broken hands or material when reordering.

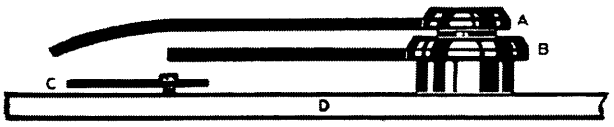


FIG. 11-21

SEC. 278 — Relation of Hands

Figure 11-21 is a drawing showing the relation of the hands to each other and to the dial. A is the minute hand, B the hour hand, C the second hand and D is the dial. Notice that the second hand (C) comes very close to the dial surface. Be certain the second hand clears the dial. Sometimes a piece of lint or broken glass wedged between the hand and the dial will cause the watch to stop.

SEC. 279 — The Second Hand

The second hand is replaced by pushing pipe over extended pivot of 4th pinion using the flat upper end of tweezers. This must be done carefully so as not to bend the 4th pinion. Figure 11–22 illustrates a pair of pliers used to hold a second hand. At A the second hand is held securely by the pipe and a small pivot broach is used to ream out the hole. Broach hole in the pipe carefully. The second hand should press on easily but securely. At B the hand is held by the pipe but with the end of the pliers. Closing the pliers will close the second hand pipe slightly.

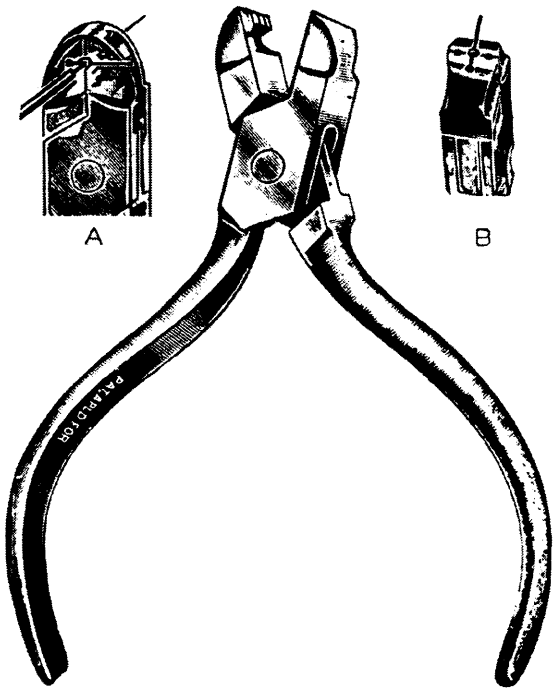


FIG. 11-22

SEC. 280 — The Hour Hand

The hour hand has a socket that fits snugly over the tube extending from the hour wheel and the top of the hand should be flush with the top of this tube and parallel to the dial, allowing for clearance between this hand and the second hand. This hand can be put in place by using tweezers, but the proper way is to use a hollow flat face staking tool punch. If a new hand fits too tightly, it can be opened by a cutting broach, figure 11–23. To close the socket, use a concave punch from staking set, figure 11–24.

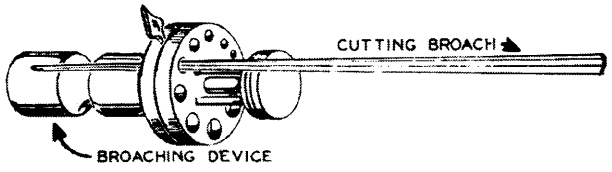


FIG. 11-23

SEC. 281 — The Minute Hand

The minute hand can be pressed on with tweezers but it is more practical to use a staking tool, figure 11–25, which has a stump at A upon which the lower end of the Center Pinion is resting. This prevents breaking the lower center jewel. Holes in minute hands are opened

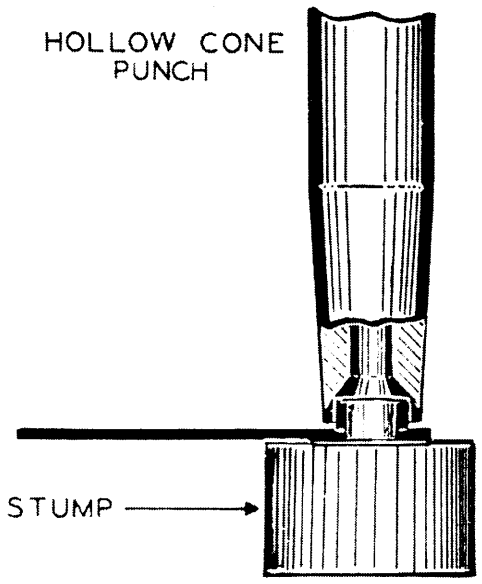


FIG. 11-24

with a broach, figure 11-23, and best closed with staking set using round faced punch, figure 11–26. In replacing hands be careful to see that hands register correctly. Set the pointer of the hour hand at 3. Set the pointer of the minute hand at 12 and replace. Your hands will then register correctly. When the minute hand is directly over any minute mark, the second hand should point to 60.

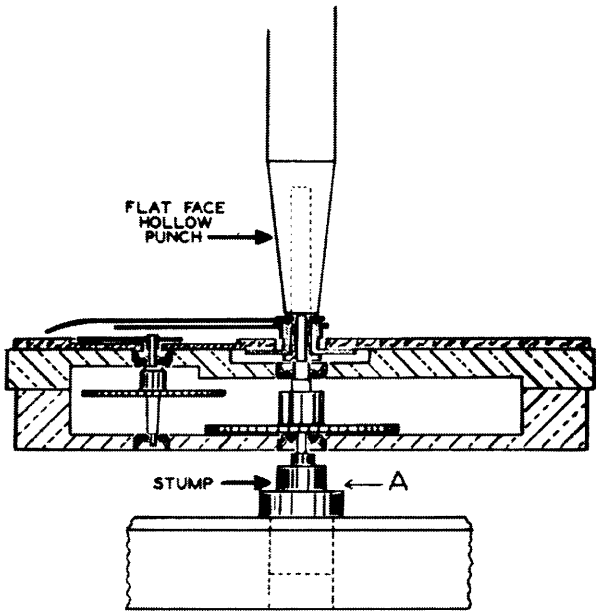


FIG. 11-25

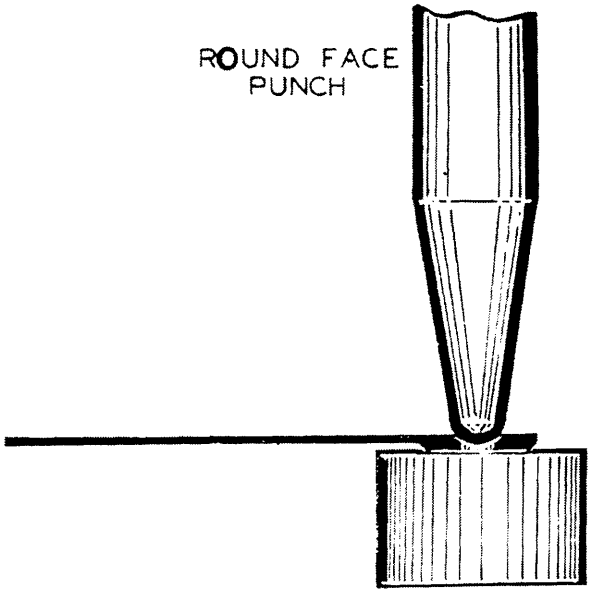


FIG. 11-26

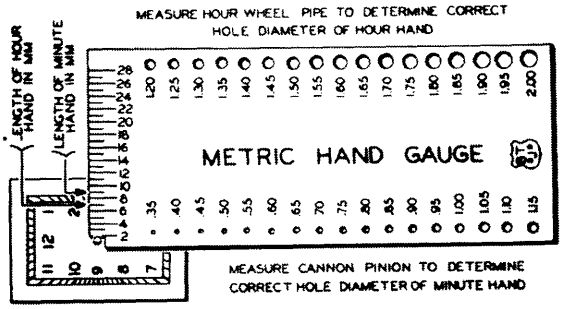


FIG. 11-27

SEC. 282 — Swiss Hand Gauge

Figure 11–27, which is self-explanatory, illustrates a hand gauge for measuring Swiss type hands.

Swiss hands can then be ordered by dimensions:

Example: 1 Blue Minute Hand—Length 12 mm
hole 10

SEC. 283 — Refilling Luminous Hands

It is possible to refill luminous hour and minute hands using a kit similar to figure 11-28. Generally it contains two different shades to match the figures on dial. Heat spatula slightly and with a small amount of paint applied to hand, quickly move spatula backward and forward, figure 11–29, until paint flows freely on hand. If necessary, trim off excess paint with razor blade. Apply paint sparingly; an excessive amount will cause the hands to catch. A sweep second hand is fitted to a pinion making one revolution per minute. In watches of this type, the cannon pinion is hollow. These come in several colors and also with luminous paint. They are replaced best with a punch and stump, figure 11–25.

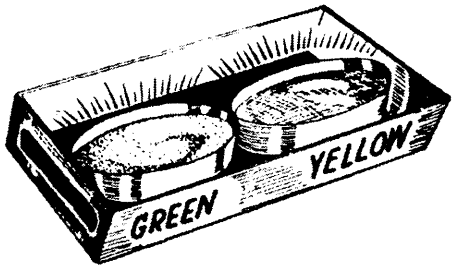


FIG. 11-28

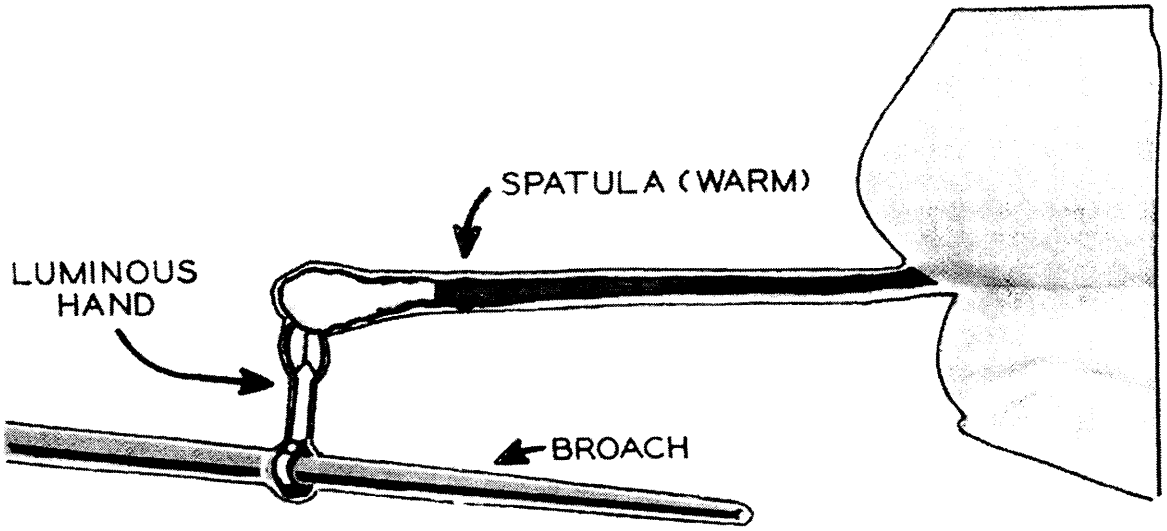


FIG. 11-29

TABLE OF CONTENTS: Unit WIII - Lesson 11

JOB SHEETS

TIMING, RATING AND REGULATION

TOOLS, EQUIPMENT AND SUPPLIES:

Compass - demagnatizer - tweezers - pegwood - screwdrivers - balance screw holder - undercutters - timing washers

PROCEDURE	REFERENCE
1. Test for magnetism.	Sec. 261
2. Set regulator in center of index.	Sec. 265
3. Check regulator pins.	Sec. 266
4. Test motion.	Sec. 268-269-270
5. Set hands to coincide with master clock or time piece. Start recording rates, entering the time set.	Sec. 272
6. Check watch with master clock at a later time. (2 - 4 - 6 hour intervals are preferred.)	
7. Calculate the amount of time in seconds or minutes your watch has lost or gained, per 24 hour period.	
8. Make a note of the loss or gain and the time of day.	
9. Make adjustment to compensate for loss or gain.	Sec. 267-274-275-276
10. Reset watch with master time piece.	
11. Repeat operations 5-6-7-8-9 until watch keeps satisfactory time.	

NOTE:

Regulate pocket watches to gain about 5 seconds per day in pendant up position.

Regulate wrist watches to gain about 10-15 seconds per day in pendant down position.

Further timing adjustments can be made to meet requirement of the wearer.

REGULATOR PINS:

TOOLS, EQUIPMENT AND SUPPLIES:

Pin vise - needle - regulator pins - bench block - abrasive stone - nippers

PROCEDURE

A. HOW TO REMOVE AND REPLACE A REGULATOR PIN

1. Remove regulator from balance bridge.

2. Push out old pin with fine needle in pin vise.
   NOTE: As pin is tapered, it is pushed out from the bottom side of the regulator.

3. With regulator properly supported, insert new tapered pin from top of regulator to a snug fit.

4. Cut off heavy end of protruding pin at a point approximately it's own diameter above the regulator. Smooth end of pin with fine abrasive stone.

5. Press the stub end firmly into the regulator.

6. Cut off and dress tip of new pin to length of other pin.
   NOTE: If the other pin is gate type, the new pin should be cut slightly shorter than the foot of the gate. Section 266.

7. Make required adjustment to make pins parallel and proper distance apart.

   NOTE: There are no tools specifically designed for adjustment of regulator pins. The normal adjustments may be spacing, bending to make parallel, etc. A small chisel shaped tool and a pair of tweezers can generally be used to adjust pins. Using illustrations D and E in Fig. 11-9 as an example; procedure for changing the left pin in D to look like the left pin in E may be to tilt left pin slightly away from the right pin, make the necessary bends in pin with a pair of tweezers and then tilt the pin back to the position shown in E.

B. GATE TYPE REGULATOR PINS

The construction of this regulator pin is such that it does not allow the hairspring to come out from between the regulator pins. The regulator generally has a slot for a screwdriver so that pin may be turned a quarter turn in either direction to release the hairspring. We recommend replacement of the entire regulator rather than attempting replacement of the gate type regulator pin.