Master WATCHMAKING

SHOP TRAINING JOB GUIDES

LESSON 16

Truing Balance Wheels

—

Sections 360 - 365

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 16

Sections 360 to 365

TRUING BALANCE WHEELS

SEC. 360—Purpose of Truing

The truing and poising of the balance wheel are very closely related. Truing a balance wheel generally requires a great deal of practice. Your ability to true and poise a balance wheel has a tremendous bearing upon the results you will attain in adjusting and bringing a watch to time. The balance wheel must be true in the flat in order that it may rotate freely between the pallet bridge and the balance cock. The rim must have clearance between the pallet bridge and the center wheel. A balance wheel which is slightly out of true in the flat can be the cause of the watch stopping in certain positions.

A wheel must be true in the round and flat before it can be poised properly. It is impossible for a watch to keep accurate time in the various positions if the wheel is out of poise. Many times the question is asked, "Is it better to have the wheel true or poised?" The two are so closely related that it must be said that a wheel should be trued as nearly perfect as possible and then poised.

Truing in the flat is the adjustment required to have the rim of the balance wheel rotate in the same plane. The wheel is in the flat position when we look across the rim of the wheel.

Truing in the round is the adjustment required to have the rim of the balance concentric with the balance pivots. The wheel is in the round position when we look directly down on the wheel. Poising is the adjustment required to bring the balance wheel to the state of being balanced.

SEC. 361—Types of Balance Wheels

Figure 16-1 illustrates a bi-metallic balance wheel which has an inner rim of steel and an outer rim of brass. This is the most common form of balance wheel, and when the rim is cut toward the end it is known as a compensating balance.

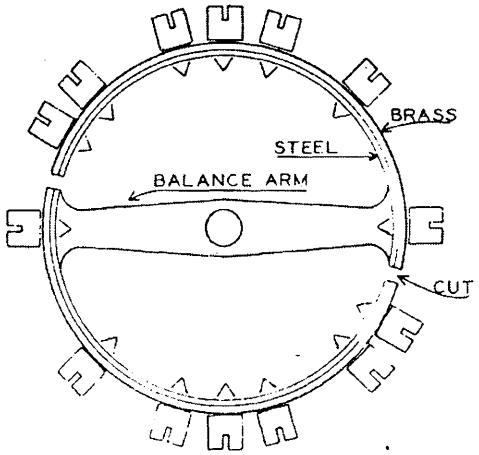

Fig. 16-1

Figure 16-2 is an illustration of a monometallic balance wheel. Notice that the rim of this type of wheel is **NOT** cut. It is sometimes referred to as a **SOLID** balance wheel. The better grades of watches which have monometallic balance wheels use a friction staff also, and it is not often that the watchmaker is required to true this type of wheel, as it is prac-

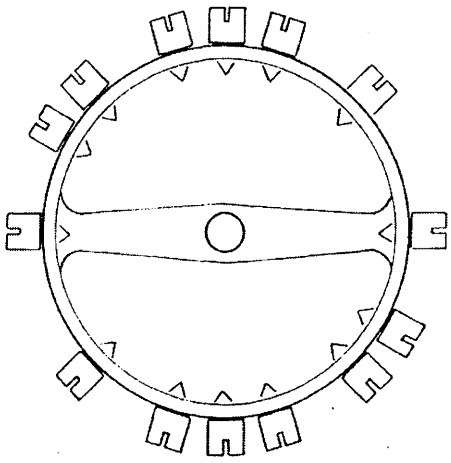

Fig. 16-2

tically impossible for the wheel to get out of true if properly handled. It is practically impossible to true this type of balance in the round. Truing in the flat can be accomplished if the workman is careful and understands thoroughly the principles of truing.

SEC. 362—The Truing Caliper

Figure 16-3 illustrates a parallel jaw truing caliper in which the center screw is used to open and close the jaws of the caliper. When the

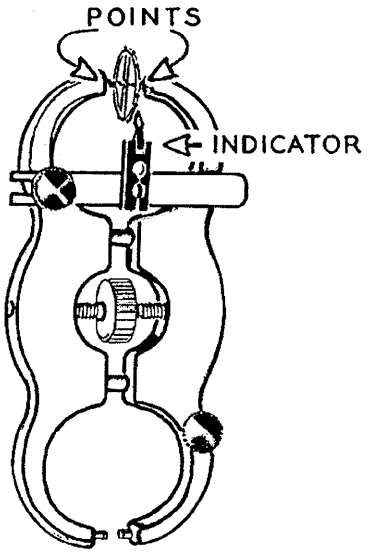

Fig. 16-3

balance staff and wheel are in place the jaws can be adjusted to hold the wheel in position without any further attention from the workman. This is probably the most popular of all truing calipers. The chief disadvantage is the fact that the screw must be loosened each time the balance is removed.

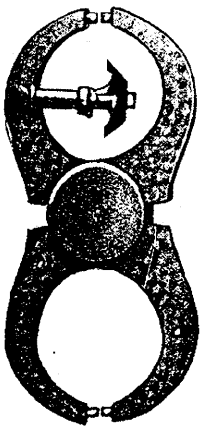

Fig. 16-4

The caliper shown in figure 16-4 does not have a center screw to keep the jaws closed on the cones of the balance pivots, and the workman must therefore exert enough pressure to keep the jaws closed while making any adjustments on the rim of the wheel. The indicator is a little more flexible than in some types because it is swung in a ball and socket.

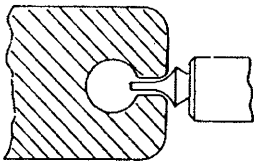

Fig. 16-5

Figure 16-5 illustrates an enlarged view of a point in the jaws of a truing caliper. Notice that the pivot does not come in contact with the point when the jaws are closed. The cone of the pivot rides on the countersink which is designed to receive it, and in this manner adjustments can be made on the rim of the wheel without damaging the pivots.

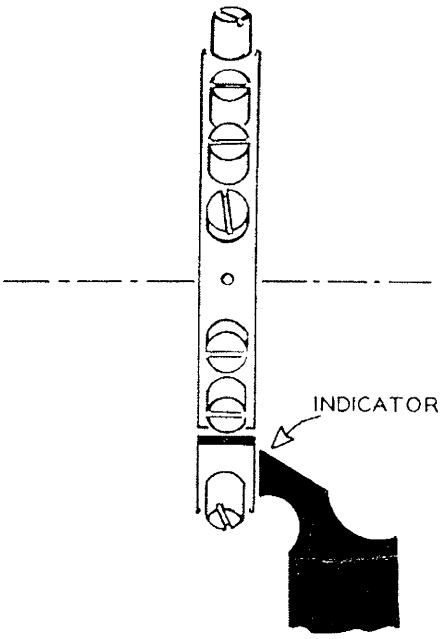

Fig. 16-6

Set the indicator in the position shown in figure 16-6 when truing in the flat. Figure 16-7 illustrates the indicator in the correct position when truing in the round.

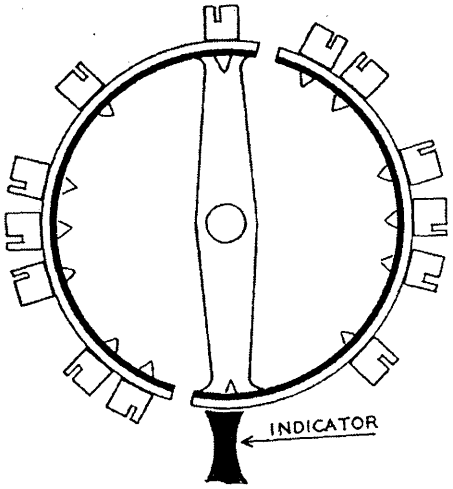

Fig. 16-7

SEC. 363—The Balance Screws

In figure 16-8, the balance screws set in the rim are lettered A, B, C, D, E, F, and G. Notice that set directly opposite each one of these screws on the other half of the rim is a corresponding screw. Example: A-1 is opposite A. B-2 is opposite B, etc. These screws give the balance the proper weight and have been placed in their respective locations by the factory for temperature adjustment. **Do not change their position.** If upon examination of a wheel you should find an unequal number of screws, for instance seven on one side and six on the other, it would be necessary to equalize the number by adding one. The absence of screws does not interfere with truing a balance but will hinder any attempts made to poise the balance or bring the watch to time.

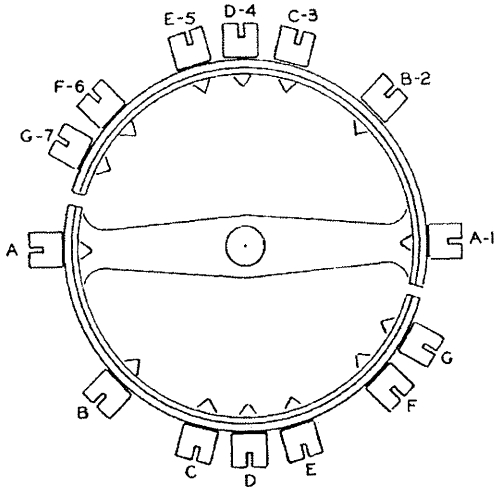

Fig. 16-8

SEC. 364—Truing in the Flat

If the balance wheel was true before replacing a balance staff and you have done your work carefully, you will find very little truing to be done; however, there are a great many times when in overhauling a watch for the first time you will find the balance out of true. Although another workman may not have the ability to true the balance wheel properly, you are not excused for doing the same. Check every balance for true and poise. The results you obtain when bringing a watch to time will depend upon the wheel being trued and poised. Use large balance wheels for practice work.

The following instructions are used in conjunction with the illustrations shown. These illustrations are for the purpose of demonstrating the procedure used when truing a balance wheel in the flat. Very few wheels will be out of true as badly as the one shown. The letters A, B, A1, B2, etc., correspond to the centers of the balance screws and their positions on the rim of the wheel as illustrated in figure 16-8.

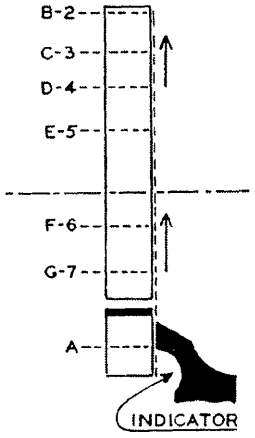

Fig. 16-9

1. Place wheel in caliper and set the indicator, figure 16-9.
2. Keep indicator as close to the rim as possible.
3. Keep edge of indicator parallel with rim of wheel.
4. The starting point is where the arm joins the wheel.
5. True each half separately.
6. After each bend or alteration, return to starting point.
7. Move wheel in direction of arrow, figure 16-9, until the distance between the rim of wheel and the indicator increases or decreases. For our purpose we will say this distance has increased.

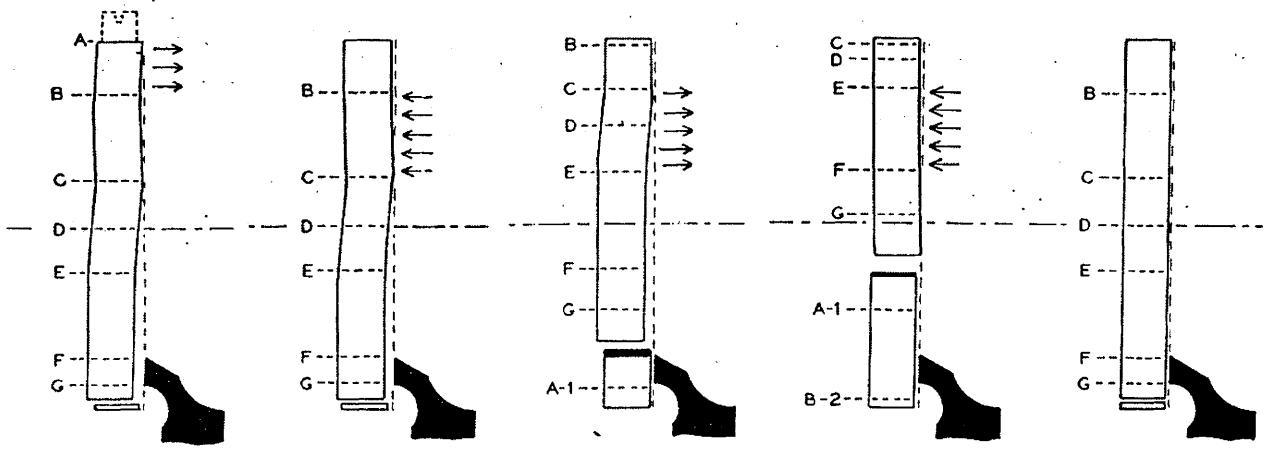

Fig. 16-10 Fig. 16-11 Fig. 16-12 Fig. 16-13 Fig. 16-14

8. Figure 16-10 illustrates this variation between the points A and B. The vertical dotted line is the path of the indicator.
9. Bending the rim of the wheel in the direction of the arrows between A and B will correct this section of the rim. Do not attempt to make any other corrections on the rim until this section is parallel to the indicator.
10. The section between B and C, figure 16-11, has moved toward the indicator. (Always return to starting position after each bend.) This section may be brought parallel to the indicator by bending at B in direction of arrows.
11. Return to starting point and check.
12. Section C to E, figure 16-12, has moved away from the indicator and must be bent at C in the direction of the arrows.
13. Return to starting point and check.
14. The section from E to the end of the rim has moved toward the indicator and must be bent back in the direction of the arrows, figure 16-13. This half of the wheel rim is now perfectly true in the flat and will appear as in figure 16-14.

This example is used to show some of the typical bends required when truing a balance in the flat. The average wheel requires very little bending. Usually one or two slight bends are sufficient to true the rim in the flat; however, remember after each bend to return the rim of the balance to the starting point.

At times you will have to adjust your indicator after each bend and also after returning the rim to its first position. To make the bends, place the rim of the balance between the thumb and second finger of the right hand. The caliper must be held firmly in the left hand. When making a bend, pressure must be exerted by the left hand in order to keep the jaws closed upon the cones of the pivots. Figure 16-15 illustrates the position of the thumb and finger when making a bend in the flat to the left. Notice that the thumb is slightly lower than the finger. The pressure is exerted by the thumb, the finger acting as the fulcrum. When making a bend to

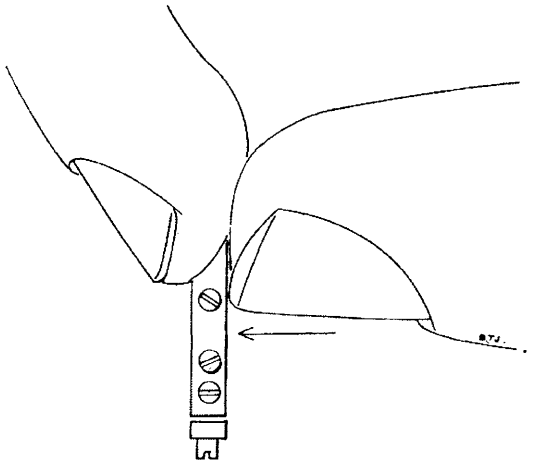

Fig. 16-15

the right the finger is lower than the thumb and the pressure is exerted by the finger, the thumb acting as the fulcrum.

When half of the wheel rim is true in the flat proceed to true the other half as follows:

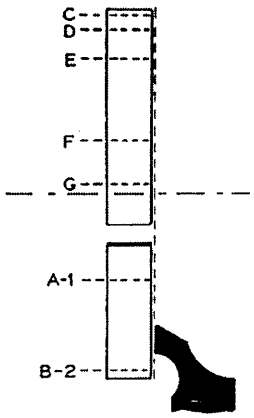

Fig. 16-16

Set indicator at A and turn rim half-way around. A-1 will be the starting point of the second operation, figure 16-16. The distance between the indicator and the rim of the wheel at A-1 should be the same as the distance between the wheel rim and A. If this distance is the same, proceed to true this half of the rim. If the arm of the balance requires bending, use

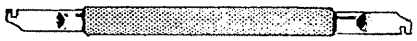

Fig. 16-17

the wrench illustrated in figure 16-17. Figure 16-18 illustrates the method of using this wrench. Place slot in wrench over arm and move in direction of arrows. It is not usually necessary to remove the wheel from the caliper when using the wrench in the flat. After both

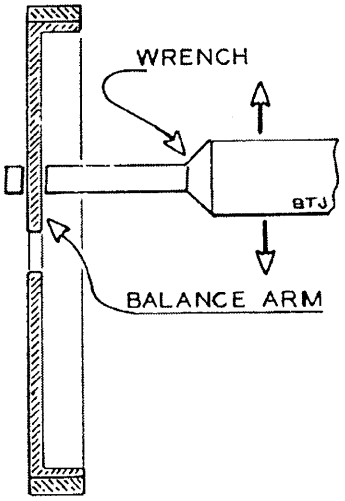

Fig. 16-18

sections of the balance have been trued, release the pressure of the left hand slightly and with the forefinger of the right hand, spin the wheel. If you have followed instructions carefully there should not be any variation of light between the indicator and the rim of the wheel. The wheel will then be TRUE IN THE FLAT.

SEC. 365—Truing in the Round

Truing a balance wheel in the round is similar to truing in the flat except that you will be unable to use your fingers when making the bends in the rim. The wrench illustrated in figure 16-18 is used primarily for this purpose.

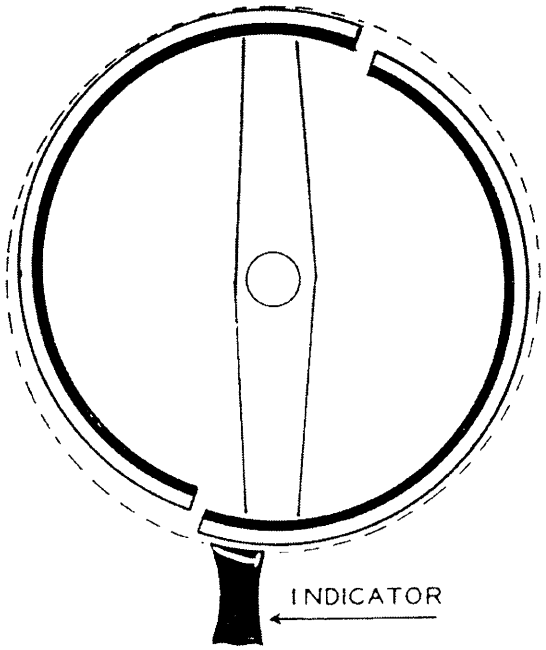

Fig. 16-19

Figure 16-19 is an illustration with both sections bent in. The dotted line indicates the path of the indicator.

1. Set indicator at point where the rim is joined by the arm. Indicator must follow curve of the rim.
2. Turn wheel slowly with forefinger of right hand while holding caliper in left hand. As the arm moves away from indicator the rim moves toward the indicator.
3. Place wrench over rim and bend in direction of arrow, being certain that you are applying pressure with the left hand, figure 16-20. Hold wrench lightly and be certain not to disturb the flat.
4. Bend rim in until it is the same distance

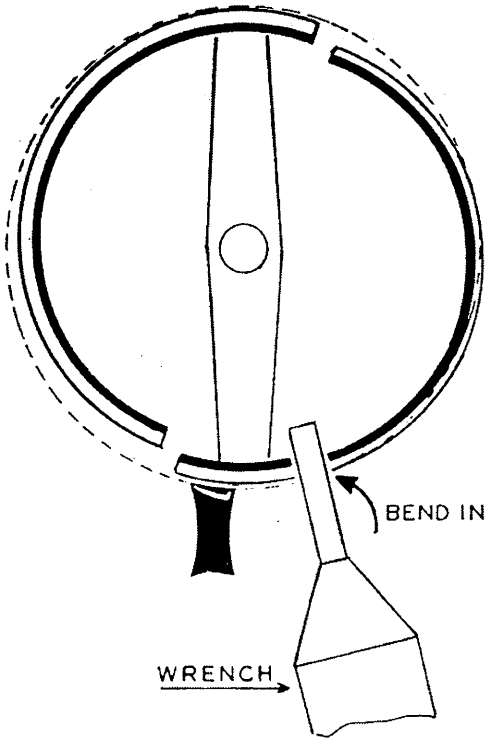

Fig. 16-20

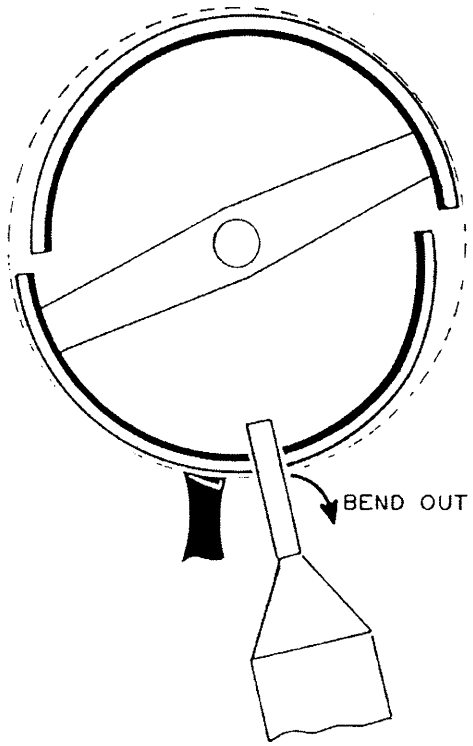

Fig. 16-21

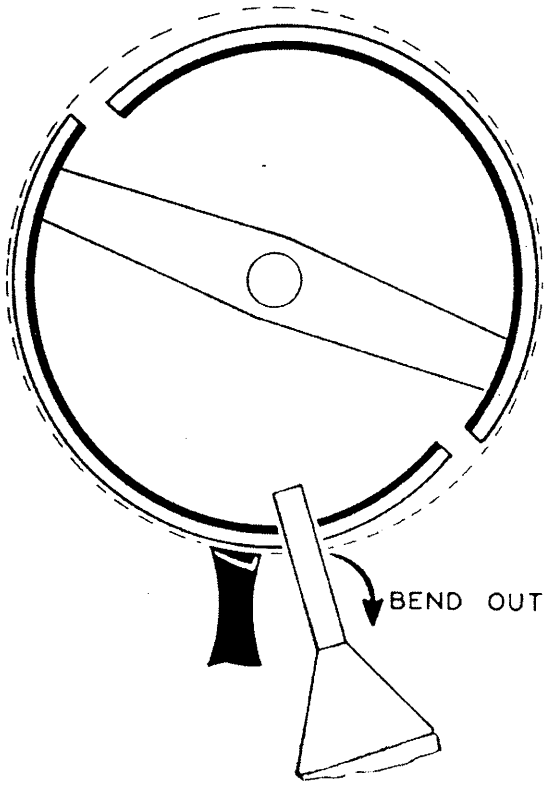

Fig. 16-22

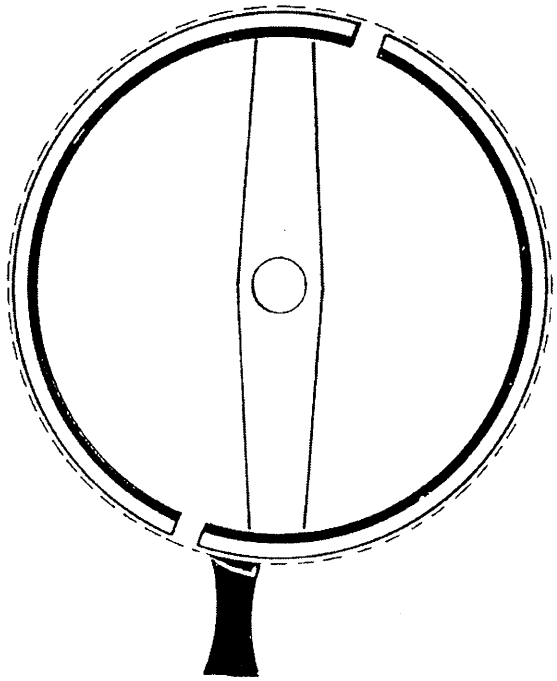

Fig. 16-23

as the starting point from the indicator.

5. Return to starting point, checking carefully the distance between the rim and the indicator. When certain that this section is correct proceed with the next section.

In figure 16-21 the rim of the balance wheel is true to point covered by the wrench. However, it must be bent out as illustrated by arrow. After bending it out check and proceed to next section.

The last section is bent out of true as in figure 16-22. When this half of the rim is true in the round, proceed to true the other half in the same manner. Spin the wheel as you did when checking the flat and the rim should not show any waves of light, figure 16-23.

Figure 16-24 illustrates the method used to true the rim of a balance wheel when one balance arm is shorter then the other. Make the first bend as close to the arm as possible and then proceed to true the rest of the rim as before. Now recheck in the flat. In your first attempts at truing wheels, you will in all probability have to check and recheck the round and flat several times before attaining perfection.

You will find that no matter how long you do watch repair work, there is a certain thrill that always accompanies a job that is well done.

You will soon be able to recognize quickly a balance that is out of true when it is in the watch. After truing the balance, test it in the watch as explained in this section. There may be times when it is necessary to raise or lower the arms slightly in order that the wheel will have the proper clearance. If your wheel seems to run true in the caliper but not in the watch, examine the pivots closely to see if they are

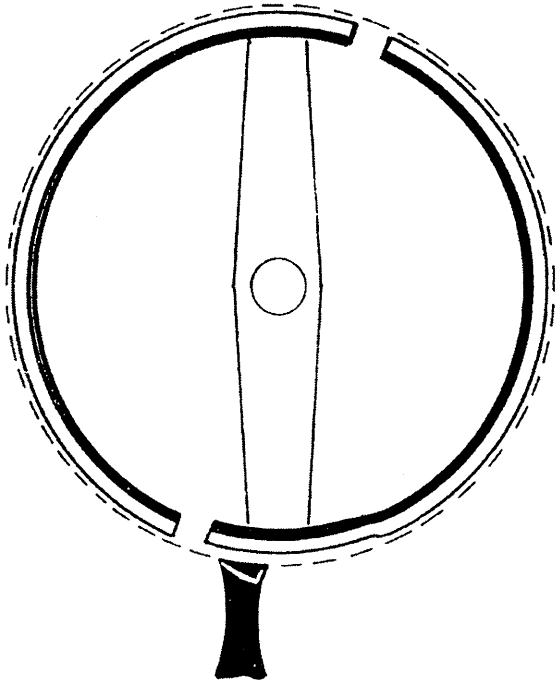

Fig. 16-24

bent. This may have happened if you relaxed the grip on your caliper while you were making a corrective bend. Mastery of truing and poising requires a great deal of practice; therefore, it is wise to obtain as many balance wheels as possible and practice at every opportunity.

As previously stated, the solid balance wheel, if handled properly, seldom gets out of true. However, when this type of wheel is out of true in the flat, it usually can be corrected by raising or lowering the arms slightly. When making bends of this type it is better to remove the wheel from the caliper so as not to bend or break the pivots.

UNIT	W 5
LESSON	16

Master Watchmaking

CHICAGO SCHOOL OF WATCHMAKING

JOB SHEET

W16-J1

TRUING BALANCE WHEELS

TOOLS, EQUIPMENT AND SUPPLIES:

1. Make the tool illustrated in Fig. 13-20, Section 321.
2. Make the tool illustrated in Figs 13-24-1 and 13-24-2, Section 324.
3. Make a set of three hairspring removing tools as illustrated in Fig. 15-3, Sec. 352.
4. Stake staffs in practice wheels. (See Lesson 15 and the Job Sheets in Lessons 15 and 17. Follow steps 12 through 18 on Job Sheet L17-J2.)
5. True practice balance wheels. (See Lesson 16)
6. Poise practice balance wheels. (See Lesson 17)

When you are satisfied with your work above, begin the exam:

PROCEDURE:

USE AN AMERICAN WATCH, preferably 12 or 16 size, 15 or more jewels.

1. Fit a factory staff to this watch, using the procedure outlined on Job Sheets L17-J1 or L17-J2 in this order:
   a. Follow steps 1 through 25 on the Job Sheet.
   b. Remove and replace the roller jewel. (Lesson 13, Sections 320 through 325.)

      NOTE: Replacement of the roller jewel is being done here for this exam because it is convenient and must be done before the wheel is poised. The job could have been done earlier or separately as is usual in repairing.

   c. Follow steps 26 through 30 on the Job Sheet.
   d. Disassemble the movement.
   e. Remove one of the train jewel settings.
   f. Remove jewel from setting and replace with a friction jewel. (See Lessons 12 and 14 Assignment Sheets and the Job Sheets in Lesson 14.)
   g. Replace jewel setting.
2. As watch submitted should be clean, finish disassembly and clean the movement. (Lesson 10 and Job Sheets for Lesson 10.)
3. Reassemble the watch, oil, and regulate.

(Continued)

TRUING BALANCE WHEELS (continued)

USE A SWISS MOVEMENT, preferably about 10 1/2 or 11 1/2 lignes, 15J or more:

4. Fit a factory staff to this watch, using the procedure outlined in Job Sheet L17-J2 in this order:

   a. Follow steps 1 and 2 on the Job Sheet.
   b. Step 3: Remove the upper balance hole jewel and replace with a friction jewel. (See Lesson 13 and the Job Sheets in Lesson 14.)
   c. Step 3: Remove the lower cap jewel from its setting and replace with a friction jewel.
   d. Follow steps 4 through 25 of the Job Sheet. (L17-J2)
   e. Remove and replace the roller jewel. (Lesson 13, Sections 320 through 325.)
   f. Follow steps 26 through 30 on the guide sheet.

5. As watch submitted should be clean, complete disassembly and clean the movement. (Lesson 10 and the Job Sheets in Lesson 10.)

6. Reassemble the watch, oil and regulate.

USE AN AMERICAN 7 JEWEL MOVEMENT, preferably 6,-12 or 16 size:

7. Completely disassemble the movement.

8. Reassemble each wheel and pallet fork individually in movement and check for proper endshake and sideshake. (Lesson 17, Section 372)

9. Close each pivot hole and refit to each pivot as outlined in Job Sheet L17-J6.

10. Remove and replace the pallet arbor. (Lesson 17, Sec. 375 and Job Sheets L17-J4 or L17-J5, depending upon the type of arbor.

11. Clean and oil the movement, reassemble and regulate.