Master WATCHMAKING

SHOP TRAINING JOB GUIDES

LESSON 6

Motor and Jeweled Barrels

—

Sections 165 - 181

CHICAGO SCHOOL OF WATCHMAKING

2330 N. Milwaukee Ave. • Chicago 47, Illinois

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MASTER WATCHMAKING

A Modern, Complete, Practical Course

CHICAGO SCHOOL OF WATCHMAKING

Founded 1908 by Thomas B. Sweazey

Lesson 6

Sections 165 to 181

Lesson 6. — Motor and Jeweled Barrels.

Section 165

WHEN the mainspring breaks and its power is released all at once, there is a sharp recoil on the barrel and when this is transmitted to the train there may be pivots and teeth not strong enough to stand the blow. Before the advent of the safety pinion it was no uncommon thing to find broken or bent train pivots and teeth due to this recoil from a broken mainspring.

Sec. 166 — The Safety Pinion

The introduction of the safety pinion protected the train from this shock. This pinion is mounted on the center staff in such a way that it can turn in one direction but is held in its proper position when the power is applied from the barrel.

One form is shown in figure 110, in which the pinion A is hollow and threaded to fit the threaded part of the center staff at B. When the pinion is screwed in place the power from the barrel has a tendency to tighten it on the staff.

Should the mainspring break in the watch the recoil forces the barrel in the other direction and loosens the pinion from the staff allowing the barrel to spin without damage to the teeth or pivots. In figure 111 the pinion is shown in about the position it would assume when driven off by the recoil of a broken mainspring. Before replacing in the watch the pinion should be screwed down to the shoulder at C.

Later the motor barrel of the type shown in the next section was introduced and this too protects the train from the shock of a broken mainspring, in fact it is sometimes called the safety barrel.

Sec. 167 — The Motor Barrel

In the going barrel as we learned in our previous lesson, the teeth for the first wheel of the watch train are cut in the barrel making it the first wheel of the watch. In the motor barrel shown here, the barrel and first wheel are two separate parts and are connected to each other by the mainspring — one end of the mainspring being hooked to the barrel and the other end to the first wheel.

A very good example for the students first work in this type of barrel is found in a Waltham 16 size movement shown in figure 114. This model is known as a three quarter plate movement as opposed to the older full plate model used in our last lesson and is much easier for the beginner to take down and reassemble. Practically all pocket watches now are either three quarter plate or bridge models.

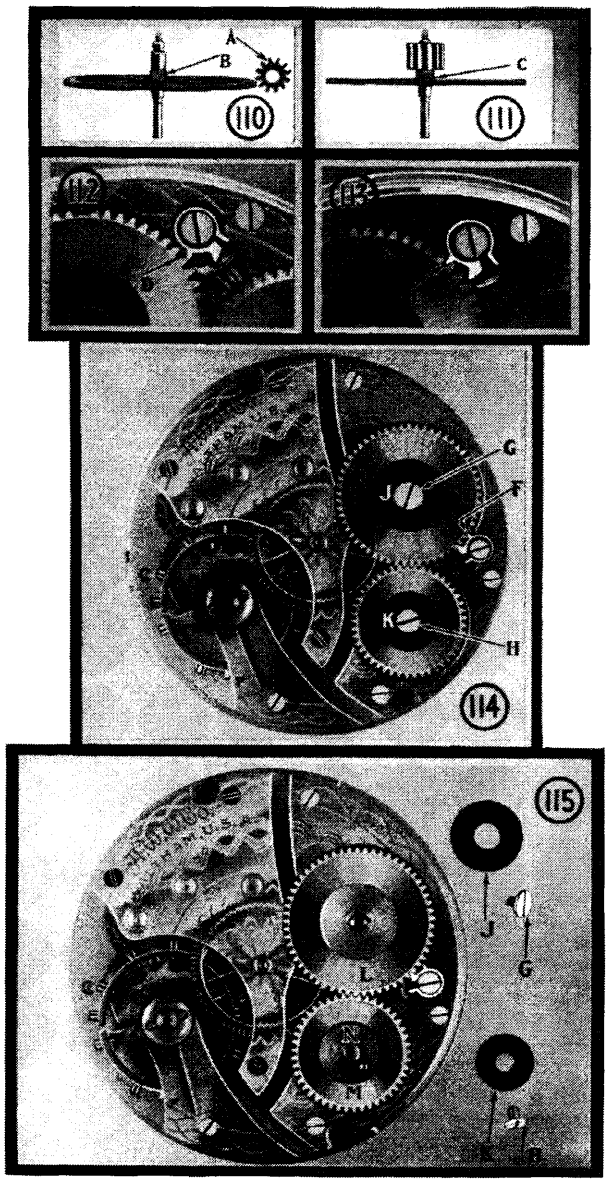
Sec. 168 — Recoiling Click

This movement has exposed winding wheels with a recoiling click. The advantage of this style is that after winding as far as possible the click allows the ratchet wheel to back up and the coils of the mainspring are not drawn too tightly together. With the click shown in our last lesson in figure 90 it is possible to wind the coils of the mainspring so closely together that there is a sort of adhesion produced by friction on each other and the balance does not attain a full motion until the watch has run long enough to loosen these coils.

In figure 112 is shown this recoiling click, over twice its actual size, just ready to drop off the tooth of the ratchet wheel. After it has dropped into the space at D the power of the mainspring pulls it back as shown at E figure 113 and F figure 114, thus allowing the ratchet wheel to "recoil" or back up slightly after having been wound to its highest point.

Sec. 169 — Replacing a Mainspring in Motor Barrel

With this model it is not necessary to remove the balance in order to get at the mainspring. The winding wheels and click being exposed some prefer to let down the power before taking the movement from the case. This can be done by holding the crown while pressing back the click by means of a screw driver. If the movement is out of the case use the proper



sized bench key as described in the previous lesson to release the power.

Next take out the two screws at G and H figure 114 and remove the two steel discs J and K after which it will appear as in figure 115 in which J represents the ratchet wheel disc, G the ratchet wheel screw, K the crown wheel disc and H the crown wheel screw.

Lift off the ratchet wheel at L and the crown wheel at M. When you remove the crown wheel at M it will bring with it the crown wheel washer at N. It is not necessary to take off the crown wheel in order to replace a mainspring as the barrel bridge is easily removed with this wheel in place but as this lesson is to familiarize you with this part of the watch it is well to take it down just as I have done in these illustrations.

In figure 116 are these parts as they appear after being removed. L the ratchet wheel, M the crown wheel, and N the crown wheel washer. Notice the hole at O in the crown wheel washer which fits over the screw P on the barrel bridge.

The hole Q in the ratchet wheel is finished square as may be seen in this photograph and fits over the square end of the barrel arbor at R. In figure 115 this can be seen as it appears when assembled.

Sec. 170 — Remove the Barrel Bridge

Loosen and remove the barrel bridge screws at S figure 116, and with a pair of tweezers lift off the barrel bridge to the position shown in figure 117. This leaves the barrel and first wheel at T exposed. The Barrel Bridge at U is turned over in order that you may see how it appears from the lower side.

In section 131 of the last lesson I described and showed the steady pins on the balance cock of the movement used in demonstrating a going barrel. Not only are steady pins used on the balance cock but on any bridge which it is necessary to locate accurately on one of the plates. On the bottom of the barrel bridge in figure 117 are shown the two steady pins at A, which fit into the holes B on the lower plate.

Steady pins should be so fitted in their holes that there is no side play yet must allow the bridge to be released easily when the screws are removed. These requirements are met in the Waltham style of steady pins, which are tapered and fit in holes bored to match the pins. This insures an easy method of separating or assembling the bridges and balance cock.

The barrel with the first wheel is easily lifted out as shown in figure 118. It is seen turned over with the steel barrel, V, uppermost. The barrel arbor may be lifted out or it could have been removed when in the position shown in figure 117, by grasping the barrel arbor with a pair of tweezers and lifting straight up.

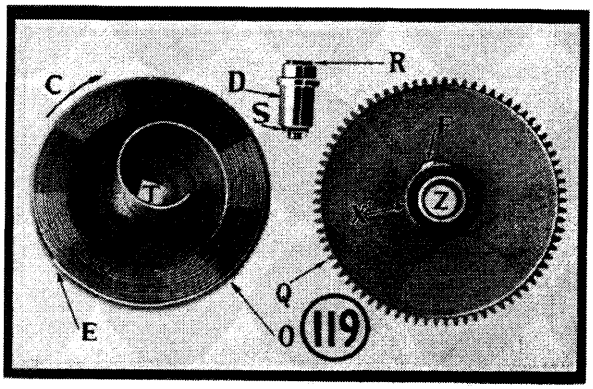
Sec. 171 — Disengage Inner End of Mainspring

Take hold of the barrel with one hand and the first wheel with the other and disengage the inner end of the mainspring by twisting toward the right.

In figure 119 is shown an enlarged view of the barrel at O with the mainspring in place, the barrel arbor at D and the first wheel or main wheel at Q. The mainspring has a hole end that slips over the hook in the barrel at E. As explained before this type of mainspring

should be bent to a shorter curve right at the tip in order to keep it from pulling off the hook. This bend can be seen at E.

In the going barrel described in our last lesson, the barrel turned with the wheel and the arbor turned only while the watch was being wound. In this style of barrel the arbor turns while the watch is being wound and the lower square end at S fits into the square hole of the barrel at T causing the barrel to turn with the arbor. That portion D of the arbor fits in the hole in the first wheel at Z and is the axis



upon which the first wheel turns when the watch is running.

The hub at X with its hook for the inner end of the mainspring at F instead of being secured to the barrel arbor is fastened to the first wheel.

Sec. 172 — Ratchet Wheel, Arbor and Barrel, Turn As One Piece

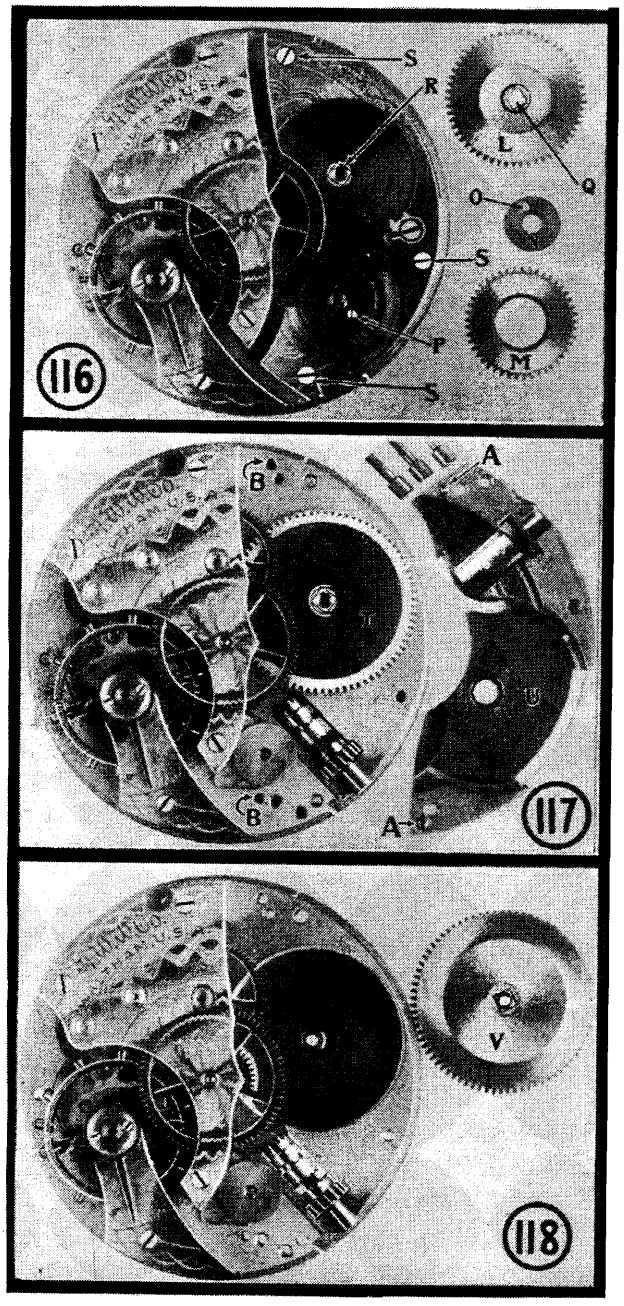
When the ratchet wheel L figure 115 is turned in winding the watch, it turns the arbor, the upper square of the arbor at R figure 116 being held in the square hole in the ratchet wheel at Q figure 116. The arbor extending through and turning on the inside of the first wheel at Z figure 119 also turns the barrel in the direction of the arrow C.

The inner end of the mainspring being hooked to the hub on the first wheel at F is held still as the barrel revolves in winding and the mainspring is wound around the hub at X and the power is applied to the first wheel from this hub.

If the mainspring breaks the recoil is taken through the barrel and ratchet wheel rather than through the first wheel and train, consequently no shock is transmitted through the train to the injury of the smaller parts.

In replacing a mainspring in this model select a barrel in your winder of the proper size to fit this steel barrel and wind in your mainspring, leaving enough of the tip protruding, to hook easily into the watch barrel, and transfer from the winding barrel to the watch barrel. Notice that this mainspring is coiled to the left in the watch barrel.

Shape the inner end to fit closely around the hub on the first wheel, testing it to see that it is hooked, and then oil your mainspring as in the going barrel. Adjust the hole in the first wheel until it is directly over the square hole in the barrel and put a small amount of clock oil on the part D, slip the arbor into position



and manipulate by grasping the square at R with a pair of tweezers, until the lower square end slips into the square hole in the barrel and it will appear as shown in figure 118.

Sec. 173 — Assembling This Type.

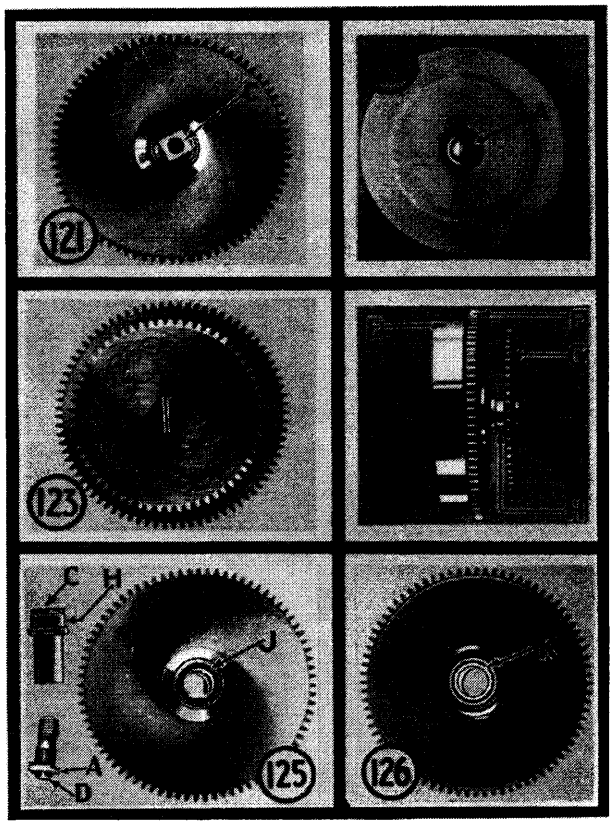
Assemble these parts by reversing the process of taking down, set the barrel in its position as in figure 117 being careful not to allow the lower square of the arbor at S figure 119 to slip out of the square hole in the barrel at T.

Replace the barrel bridge and set the screws as in figure 116. With your oiler place a small amount of clock oil where the upper end of the barrel arbor comes through the barrel bridge and also a like amount where the lower end or pivot of the arbor comes through the bottom plate. Set the crown wheel in place. Place a little clock oil in the shoulder of the crown wheel where the crown wheel washer came in contact with it. Now set the crown wheel washer in its place with the hole O figure 116 directly over the screw P. Replace the ratchet wheel with the square hole fitted on the square of the winding arbor and the click on the outside of the wheel as in figure 115. Place the steel discs in the proper positions and set the screws holding them in place and your movement should appear as in figure 114.

Sec. 174 — Jeweled Barrel

The addition of jewels for bearings in watches in place of the metal bushings which were formerly used has been a great factor in reducing the friction found in the train and escapement. Many of the uninitiated get the idea that the jewels are placed in a watch merely for their intrinsic and ornamental value, the same as diamonds in a watch case.

This is not the reason but rather on account of their extreme hardness and the fine polish that can be given to them are they used as



bearings to reduce the friction of the pivots. The hole jewels used for this purpose in the train are made of hard stone such as ruby, sapphire or garnet. Each has a hole drilled through it, this hole being highly polished and of a diameter to fit the pivot for which it is intended.

As jewels became popular in watches, customers were inclined to judge the value of a watch by the number of jewels that it contained. Some manufacturers endeavoring to get as many jewels as possible in their watches placed jewels at each end of the barrel arbor, these jewels being set in the upper and lower plates. If you will refer to section 137 in lesson 5 you can see that the only time such jewels would reduce friction would be in winding the watch because the barrel arbor in the type of barrel then in use, that is the going barrel, turns only when the watch is being wound.

However, with the introduction of the motor barrel it became possible to use jewels that would actually reduce the friction on these heavier parts when the watch was running.

Sec. 175 — Waltham Jeweled Barrel

In figure 120 is shown a Waltham movement in which is found a barrel much on the order of the one I have been describing in previous

sections of this lesson. This barrel however is jeweled but may be removed from the movement by taking off the ratchet wheel and barrel bridge the same as with the other one.

Figure 121 shows the top of this jeweled barrel and figure 122 the lower side. At A in figure 122 is a shoulder or flange on the lower end of the arbor which holds the steel barrel B in place.

The arbor in this jeweled barrel consists of two parts as shown in figure 125, the upper part with its square at C being the same end that is shown at C in figure 121 and the lower part with the pivot D and the shoulder at A is the part that shows in figure 122.

In order to take this barrel apart it is necessary to unscrew these two parts of the arbor which is done by placing the ratchet wheel on the square end holding it there with the ratchet wheel screw as shown in figure 123. Figure 124 is a side view of this assembly with the ratchet wheel and ratchet wheel screw in place, in which E represents the barrel, F the first wheel and G the ratchet wheel, while the arbor may be seen extending out of the first wheel at H. This corresponds to the part H of the arbor shown in figure 125.

Grasp the barrel part E in one hand and the ratchet wheel G in the other and twist to the left, just as you would in taking off the screw bezel of a watch case. When you do this the upper portion of the barrel arbor may be removed with the ratchet wheel while the lower part will come out of the barrel section.

The jewels are set in the main wheel, one of them being in the upper part as indicated by the arrow at J figure 125, and the other one in the lower part of the hub as shown at K in figure 126.

In replacing a mainspring we go through the same operation that we did in replacing one in the motor barrel shown in figure 119.

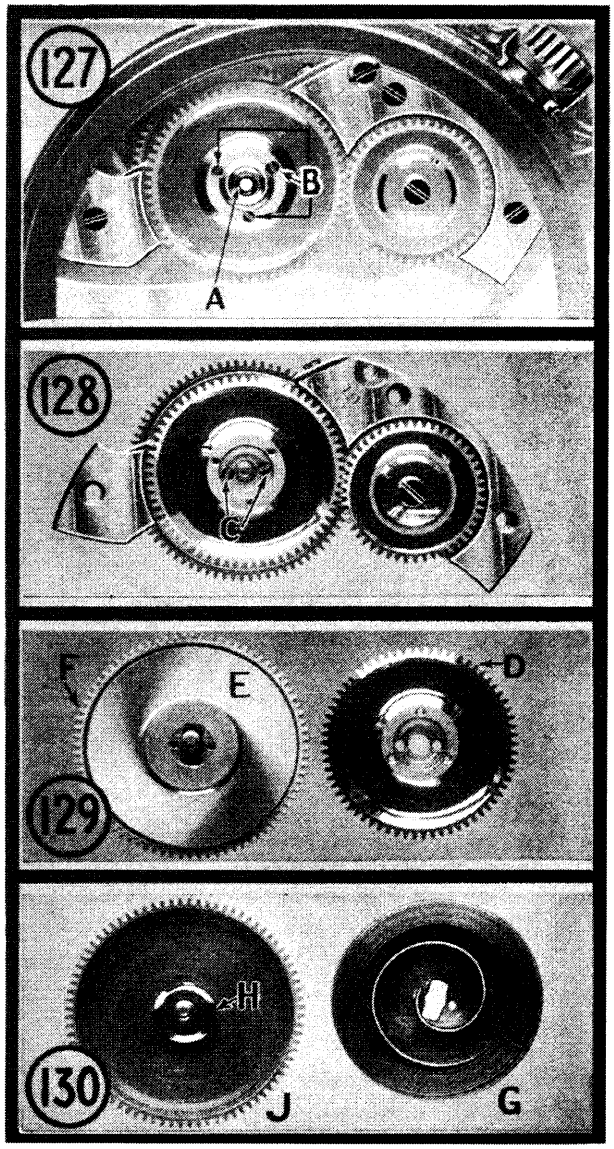
Sec. 176 — Howard Barrel with Jewels

In the Howard Watch, the winding parts of which are shown in figure 127, the jeweling of the barrel is treated in a different way.

The jewel at A is in the setting held in a recess in the ratchet wheel by means of the three screws at B. Removing these three screws and lifting out the jewel in its setting, the ratchet wheel appears as in figure 128. In this photograph I have shown this assembly with the barrel bridge removed from the plate in order to avoid confusion.

The ratchet wheel is secured to the steel barrel by means of the two screws shown at C in figure 128. By removing these two screws you are able to lift off the ratchet wheel and separate the barrel and first wheel from the barrel bridge as in figure 129, where D is the ratchet wheel, E the barrel and F the first wheel of the watch. After releasing the inside end of the mainspring from the arbor which is connected with the first wheel F, the barrel can be lifted out as shown in figure 130 where the barrel with its mainspring is seen at G and the first wheel at J.

The arbor, first wheel and the hub H act as one piece and when the watch is being wound the ratchet wheel and barrel rotate much the same as the Waltham Jeweled Barrel described in the previous section.



In this type the effect of having the first wheel running in jeweled bearings is reached by a different plan, the ends or pivots of the arbor running in the jewels, the upper one in a setting held in the ratchet wheel — A figure 127 — the lower jewel in the lower or pillar

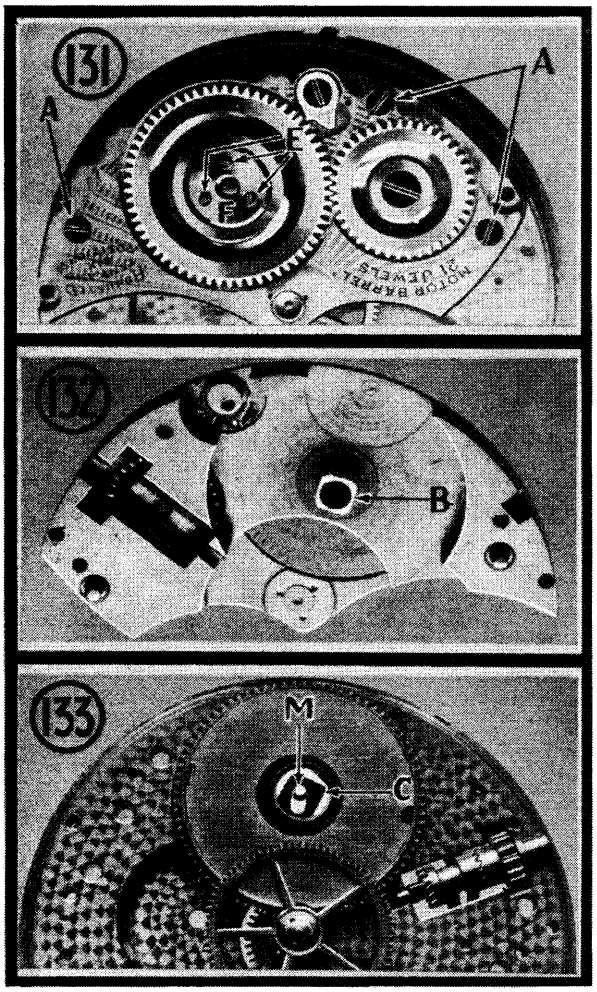


plate of the movement. The jeweled bearings being placed at the extreme ends of the barrel arbor permit the use of smaller pivots, thus reducing the friction to a minimum. This advantage of smaller pivots in the jewels is also found in the Illinois and Hamilton types described in the next two sections.

Sec. 177 — Illinois Barrel

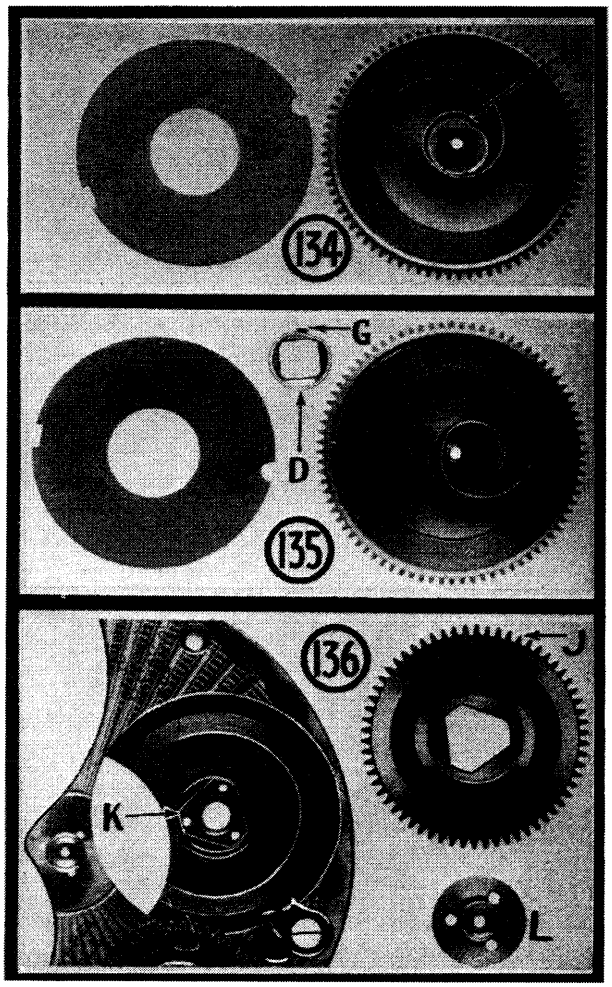
In figure 131 is shown the barrel bridge of a 16 size Illinois movement in its position on the lower plate, together with the ratchet and crown wheel.

This type of Illinois barrel is different from the other models shown in that it is not necessary to take apart the ratchet unit in order to get at the barrel. Remove the three bridge screws shown at A, and it is possible to lift the barrel bridge and with it the ratchet unit without disturbing the barrel.

Figure 132 is this assembly on the barrel bridge after it has been lifted off the bottom plate and turned over in order to show it from the other side. Figure 133 shows the way the barrel appears after lifting off the bridge. The square on the ratchet hub at B, figure 132, fits into the square hole of the snailed hub at C figure 133.

In figure 134 is shown the barrel with the cap or barrel cover removed and again in figure 135 the barrel and cap with the snailed hub taken out and shown at D. This hub carries the hook at G on which the inner end of the mainspring catches. See H in figure 134.

Only when you want to make a thorough cleaning of the watch is it necessary to take



apart the ratchet unit and to do this remove the three screws shown at E in figure 131, lift out the cap F and remove the ratchet wheel. The parts are shown in figure 136 where J re-

presents the ratchet wheel with the triangular shaped opening which fits over the tri-squared top of the ratchet hub at K. At L is shown the lower side of the ratchet cap. This cap is made of nickel and the bearing for the upper end of the barrel staff or arbor at M figure 133 is in the cap. In the 23 jeweled movement this cap is fitted with a jewel for the barrel staff bearing. In cleaning this unit it is necessary to clean each part individually and re-oil as you assemble it.

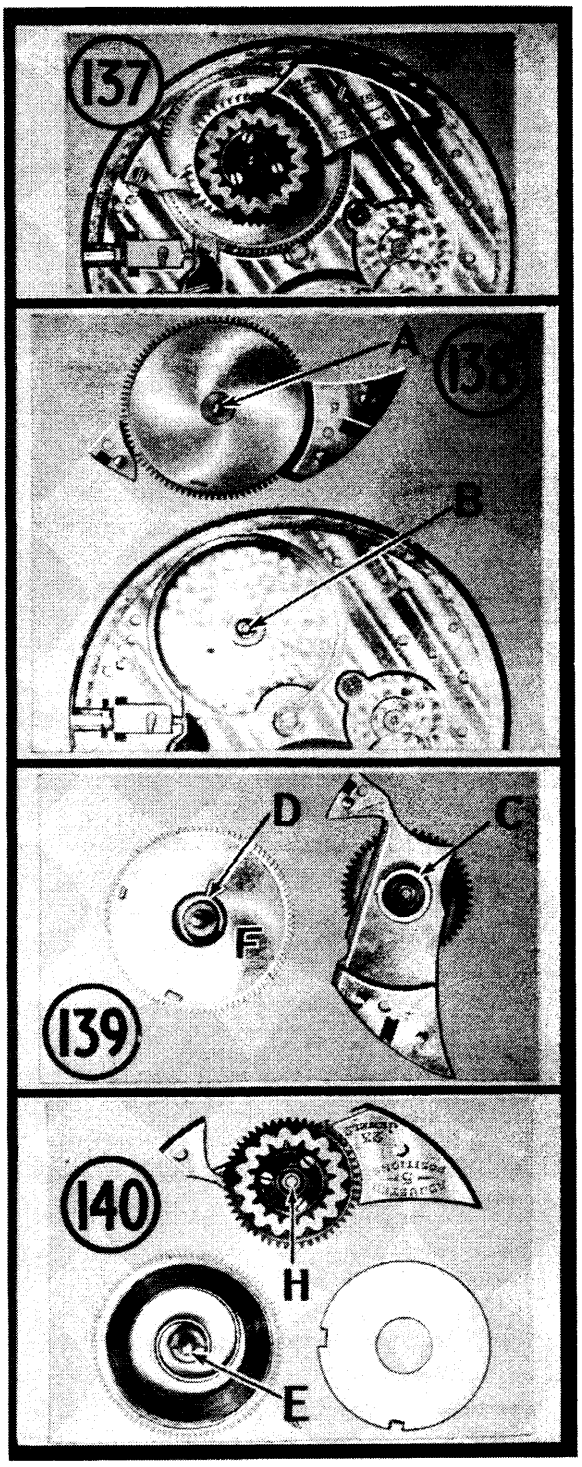
In replacing the barrel bridge with ratchet unit attached as shown in figure 132 and with the barrel in its place on the lower plate as in figure 133, come down from the top with the barrel bridge with the square at B over the motor barrel staff at M and gently press on the barrel bridge. See that your center wheel and pinion is in place and with your tweezers revolve the ratchet wheel and the parts should fall together easily. Place the barrel bridge screws in place, tighten down and your assembly is complete.

Sec. 178 — Hamilton Barrel with Jewels

The barrel from a 12 size, 23 jeweled Hamilton watch shown in figure 137, like the Illinois, may be removed without taking the ratchet unit apart. Loosening the barrel bridge from the plate and turning it over as in figure 138 gives an opportunity to view the lower part of the barrel and the pivot at A which fits in the lower jewel set in the plate at B. By manipulating the barrel and unhooking the inner coil of the mainspring from the hub it is possible to separate the parts as shown in figure 139 in which C is the hub, D the inner coil of the mainspring and F the cap of the barrel. In order to oil the barrel bridge for ratchet wheel and hub or when cleaning the watch, it is necessary to disassemble these parts and this is accomplished by grasping the barrel bridge and ratchet wheel in the left hand and with a pair of brass lined pliers grip the hub (C figure 139) and turn toward you.

Figure 140 shows the bridge with the upper jewel in its place in the ratchet unit, also the cap removed from the barrel showing the position of the coils of the mainspring. E is the upper pivot of the barrel arbor which fits in the jewel at H.

Right at this time you may not have the opportunity of working upon these different styles of motor and jeweled barrels but as they come in to you for repairs, it will be



possible to take them down without trouble if you follow the instructions found in this lesson.

It is an easy matter to handle them providing you know how they are assembled but difficult to study out the proper steps in taking apart and re-assembling without such knowledge.

Sec. 179 — Earning While Learning

Having mastered this and the preceding lessons, you may feel inclined to realize some financial returns on your knowledge thus acquired. This, of course, depends upon your ability, previous experience, and the circumstances under which you work. Some states require you to be a registered watchmaker before you enter the field of watchmaking. In others, you can do work if you are an apprentice under the supervision of a watchmaker who is registered. (The laws vary in license states.) In most states, watch repairing, like many other fields, is open to the individual's talent and does not require a license.

This does not imply that an incompetent workman can succeed. Your best chance for success rests upon your ability to do expert watch repairing and to give the public its money's worth.

Because you have satisfactorily progressed with your lessons to this point, it does not follow that you now are qualified to handle all watch repair work. Trying to do all kinds of repair at this time may easily lead to trouble and dissatisfied customers. It is better to wait until you are further trained to make general repairs.

Remember, the person who carries a watch wants the same time keeping qualities it had when it came from the factory. Most of all, he wants reliable service at a fair price rather than inferior work at cut rates. Be fair to your customer and to yourself. If you are not able to make repairs for people, however much you would like to, explain your reasons to them. You won't hurt their feelings but you might hurt their watch.

If you are in a position to accept minor repairs, do not attempt anything with which you are not familiar.

Sec. 180 — A Good Rule to Follow

A rule that has helped many watchmakers toward success is not to make five and ten cent adjustments on watches. Moving the regulator, tightening a screw, or similar minor adjustments, which take only a moment's time, should be considered opportunities to establish "good will." Doing small favors like these make people look upon you as a friend and influences them into being future customers.

It takes practice on many types of watches before you will recognize the repairs which are required; therefore, practice on watches—and lots of them—until you acquire the ability to make repairs quickly and efficiently. Build your name as one who is learning to be a Master Watchmaker, tend strictly to your learning, and it won't be too long before you will be entitled to do work and get a proper return for it.

Sec. 181 — Learn the Vocabulary of Your Vocation

Make it a point to become familiar with the proper technical or trade names of the different parts of a watch so that you can talk of them with other members of the trade and make yourself understood. It is no uncommon thing to hear of a "ring" on a watch case when "bow" is meant, "shaft" for "balance staff", "chain drive" for "fusee", "Face" for "Dial" etc.

In these lessons be sure you know the proper pronunciation of the words used. Do not pronounce bow as you would the bow of a ship but rather as you would in bow and arrow. In this new vocabulary which you are learning, make use of your dictionary. Look up the pronunciation of each new word and then memorize it. Make it a habit to talk about your work with your friends and members of your family and in your conversation use these new words. See if they know the correct names used in describing parts of a watch but do not go beyond your own depth! Keep on the safe side and discuss only that with which you are thoroughly familiar. In other words, don't discuss Escapements while you are still studying Mainsprings in Watches.

Looking Forward

In the lessons so far it has been taken for granted that the mainspring in each practice watch was of correct dimensions for that particular movement but in the next lesson you will be taught the methods of selecting mainsprings and also shown some interesting experiments relating to the proper length required to get the most service from them.

Your lesson will include several charts showing the Dennison and Metric measurements along with an illustration of each tip on 135 mainsprings. These charts will help you select mainsprings for American watches. For Swiss and other American mainsprings not listed, use a material catalog.

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JOB SHEETS

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Master Watchmaking

CHICAGO SCHOOL OF WATCHMAKING

JOB SHEET
W6-J1

MAINSPRINGS: Waltham Motor Barrel

TOOLS, EQUIPMENT AND SUPPLIES:

Screwdrivers - tweezers - movement holder - mainspring winder - oil - oiler - bench key

PROCEDURE	REFERENCE
HOW TO REMOVE AND REPLACE MAINSPRING IN WALTHAM MOTOR BARREL	
1. Let down the power either before or after removing the movement from the case.	Sec. 169
2. Remove the ratchet wheel.	
3. Remove the barrel bridge.	Sec. 170
4. Lift out barrel with first wheel and arbor.	
5. Remove barrel arbor.	Sec. 171
6. Disengage the inner end of mainspring from hub on first wheel and separate the first wheel from the barrel.	
7. Remove the mainspring.	
8. Select new mainspring if needed.	
9. Insert mainspring in the barrel and oil.	
10. Place first wheel on barrel engaging the hub with the mainspring.	Sec. 173
11. Replace arbor and oil.	
12. Put barrel assembly in the movement.	
13. Replace barrel bridge and ratchet wheel.	
14. Check winding.	

NOTE: When installing a new spring it is adviseable to form the outer end of the spring to conform with the curvature of the barrel so it will engage with the hook and not slip when wound.

UNIT	II
LESSON	6

Master Watchmaking

CHICAGO SCHOOL OF WATCHMAKING

JOB SHEET
W6-J2

MAINSPRINGS: Waltham Jeweled Barrel

TOOLS, EQUIPMENT AND SUPPLIES:

Screwdrivers - tweezers - movement holder - mainspring winder - oil - oiler - bench keys

PROCEDURE — REFERENCE

HOW TO REMOVE AND REPLACE MAINSPRING IN WALTHAM JEWELED BARREL — Sec. 175

1. Let down the power either before or after removing the movement from the case.
2. Remove the ratchet wheel.
3. Remove the barrel bridge.
4. Lift out barrel with first wheel and arbor.
5. Replace ratchet wheel and screw.
6. Unscrew the two piece arbor.
7. Disengage the inner end of the mainspring from the hub on first wheel and separate the first wheel from the barrel.
8. Remove the mainspring.
9. Select new mainspring, if needed.
10. Insert new mainspring in the barrel and oil.
11. Place first wheel on barrel, engaging the hub with the mainspring.
12. Replace the two piece arbor and tighten.
13. Remove the ratchet wheel.
14. Put barrel assembly in the movement.
15. Replace barrel bridge.
16. Replace ratchet wheel.
17. Check winding.

UNIT	II
LESSON	6

Master Watchmaking

CHICAGO SCHOOL OF WATCHMAKING

JOB SHEET

W6-J3

MAINSPRINGS: Howard Jeweled Barrel

TOOLS, EQUIPMENT AND SUPPLIES:

Screwdrivers - tweezers - movement holder - mainspring winder - oil - oiler - bench keys

PROCEDURE	REFERENCE
HOW TO REMOVE AND REPLACE MAINSPRING IN HOWARD JEWELED BARREL	Sec. 176
1. Let down the power either before or after removing the movement from the case.	
2. Remove screws and jewel setting in ratchet wheel.	Fig. 127
3. Remove ratchet wheel.	Fig. 128
4. Remove barrel bridge.	
5. Unhook mainspring and separate first wheel from barrel.	Fig. 130
6. Remove mainspring.	
7. Select new mainspring if needed.	
8. Insert mainspring in barrel and oil.	
9. Place first wheel on barrel engaging inner end of mainspring with hub.	
10. Put barrel assembly in movement.	
11. Replace barrel bridge.	
12. Replace ratchet wheel.	
13. Replace jewel setting.	
14. Check winding.	

MAINSPRINGS: Illinois Motor Barrel

TOOLS, EQUIPMENT AND SUPPLIES:

Screwdrivers - tweezers - movement holder - mainspring winder - oil - oiler - bench keys

PROCEDURE REFERENCE

HOW TO REMOVE AND REPLACE MAINSPRING IN ILLINOIS MOTOR BARREL

1. Let down the power either before or after removing the movement from the case.
2. Remove the barrel bridge without disturbing the ratchet wheel. Sec. 177
3. Lift out the barrel.
4. Remove the cap from the barrel.
5. Remove the mainspring.
6. Select a new spring if needed.
7. Insert spring in barrel and oil.
8. Replace barrel cap.
9. Put barrel in movement.
10. Replace barrel bridge and ratchet wheel.
11. Check winding.

UNIT	II
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Master Watchmaking

CHICAGO SCHOOL OF WATCHMAKING

JOB SHEET
W6-J5

MAINSPRINGS: Hamilton Jeweled Barrel

TOOLS, EQUIPMENT AND SUPPLIES:

Screwdrivers - tweezers - movement holder - mainspring winder - oil - oiler - bench keys

PROCEDURE	REFERENCE
HOW TO REMOVE AND REPLACE MAINSPRING IN HAMILTON JEWELED BARREL	Sec. 178
1. Let down power either before or after removing the movement from the case.	
2. Remove the barrel bridge. (Barrel is attached and will come out with bridge.)	Fig. 137-138
3. Unhook inner end of mainspring and lift off barrel.	Fig. 139
4. Remove barrel cap.	
5. Remove the mainspring.	
6. Select new mainspring if needed.	
7. Insert mainspring in barrel and oil.	
8. Replace cap.	
9. Engage inner end of spring, assemble barrel, hub and ratchet assembly.	
10. Replace barrel and bridge.	
11. Check winding.	