Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 101

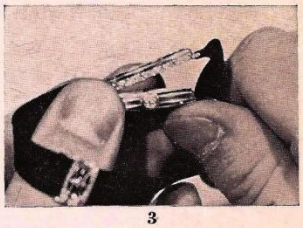
500-3-27-30 Revised
1000-5-21-30 1000-4-25-38
2000-8-10-32 1000-9-27-39
1000-5-26-37

SUBJECT:

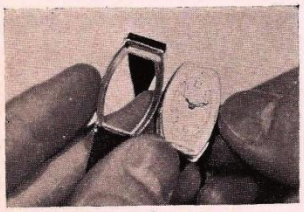
DIRECTIONS FOR REMOVING 18/0, 20/0, AND 21/0 SIZE MOVEMENTS FROM TWO-PIECE CASES

1
A round faced, knife edge case opener is most desirable for small case work.

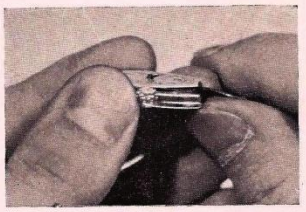
2
The balance wheel and case lip is located under the numeral 12. Bring case opener in contact with case lip.



3
A close firm grasp of case and case opener will prevent slipping and make the work more positive. A quick snap will separate upper and lower part.

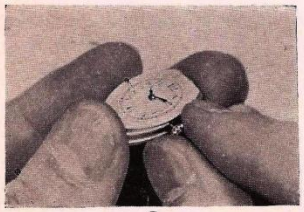


4
The movement is held friction tight in the lower part of the case.



5
The balance wheel is located in the movement directly under the numeral 12. Lift this end slightly.

6
Protect balance end of movement with first finger and lift the opposite end as shown.



7
Grasp the stem, shift the movement up and down in the case to equalize the friction that holds it.

8
The movement will gradually rise up and out of the case.

9
The 18/0 size movement has now been removed from the case.

Hamilton two-piece cases are scientifically designed with accurate bezel, extra heavy side walls and reinforced bottom piece. The movement size and case opening are finished to standard and uniform sizes, eliminating the necessity of shaving the side walls of the case to fit the movement. The movement is held rigid in its place without the pressure of the top piece.

The results of this accuracy in case construction are:

Dust proof cases.
Movements held rigid.
Cases will not spring open accidentally.
Crystals fit more accurately.
Cases easily opened and movements removed.

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Hamilton Watch Company

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T. D. 102

7-29	Revised
1000-1-30-31	1000-4-25-38
1000-5-25-35	1000-9-27-39
1000-6-15-36	

SUBJECT: Improved Friction Jeweling.

Grades 989, 989E, 995, 995A, 997, 980, 980A, 980B, 982, 987A are jeweled by an improved system, absolutely new to watch manufacture. Hamilton Improved Friction Jeweling is the result of years of experimentation and research, and possesses many distinctive features. Because of its departure from customary jeweling methods, we feel that an explanation of the principle of Hamilton Friction Jeweling will be of interest and advantage to the watchmaker and jeweler.

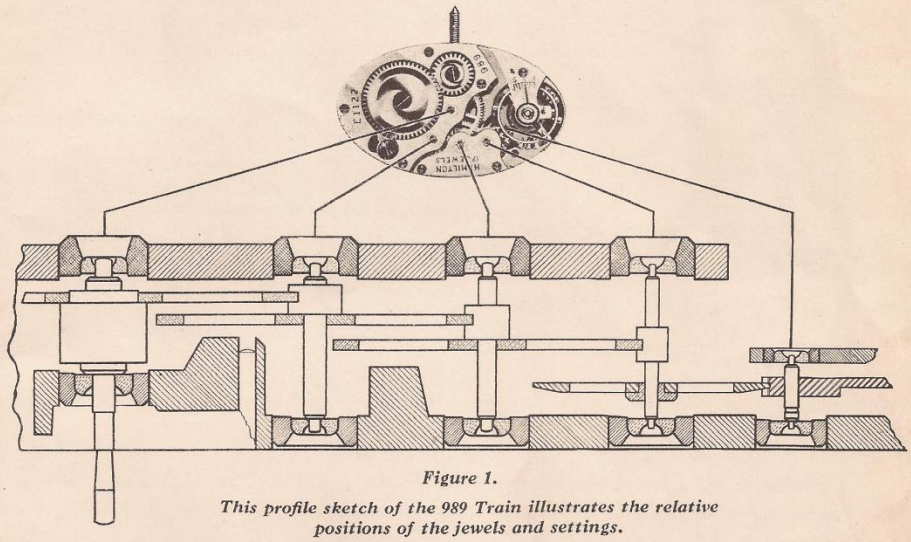

Figure 1.

This profile sketch of the 989 Train illustrates the relative positions of the jewels and settings.

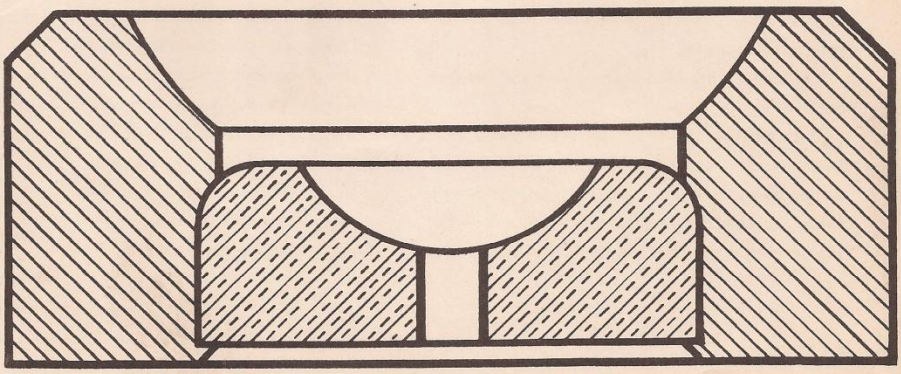

Figure 2.

An enlarged sectional view of the escape upper setting and jewel, in which the jewel has been forced friction tight into the setting.

(Over)

18-346

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: IMPROVED FRICTION JEWELING-CONTINUED

Jewel Replacements

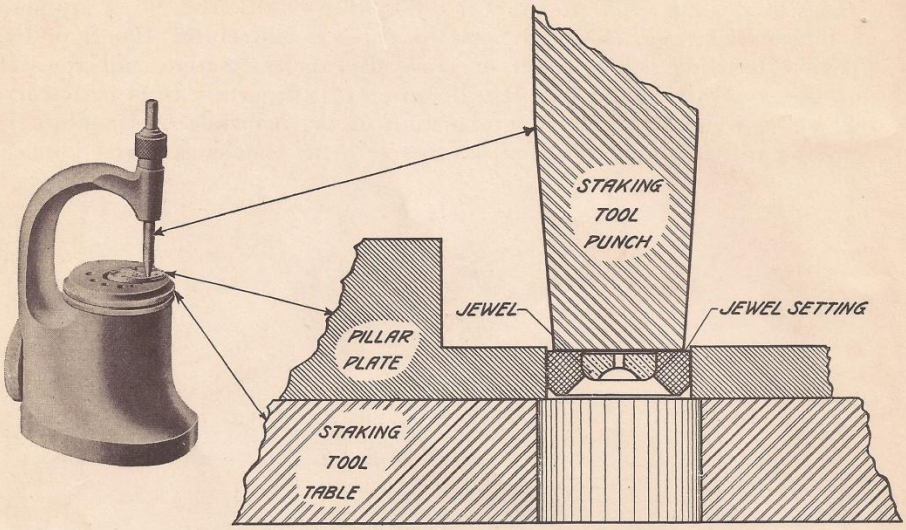

Figure 3.
This illustrates the manner in which the setting is driven out of the pillar plate of friction jeweled movement.

When replacing a broken jewel in a friction jeweled movement, all that is necessary is to drive out the entire setting as illustrated in Figure 3, using a standard staking set with a flat face punch smaller in diameter than the setting to be removed.

The settings are held in the plates and bridges *friction tight.*

With friction jeweling the repairman's task becomes very simple. He orders the complete setting needed — such as third upper, escape lower, or whichever one is to be replaced — for the size and grade stamped on the bridge. When this is procured, he simply pushes out the old setting and pushes in the new, thus eliminating the chucking, centering, truing, bezeling, facing, inserting, flushing, shouldering, backing-off and stripping which ordinarily are necessary.

These new jewel settings should be driven in the plates and bridges from the inside. The chamfered corner serves as a guide in locating the setting before it is driven to its position. Should the endshake be too short, either lower or upper setting can be driven out. In the same manner either setting can be driven in should the endshake be too long.

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1000-6-15-36
1000-5-26-37

SUBJECT: Semi-Friction Balance Jeweling

NOTE: This type of balance jeweling will be found in grades 986A, 987, 987F, 989, 989E and 912.

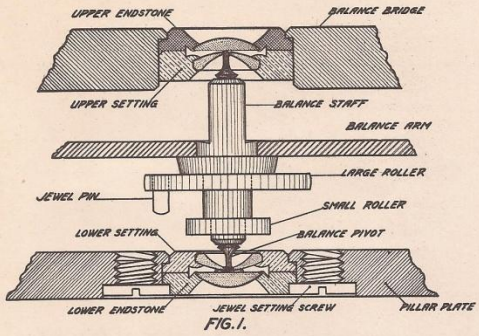

FIG. 1.

Fig. 1, shows a cross-section of the movement through the center line of the balance. This drawing represents the balance bridge, pillar plates, hole jewel and end-stone setting cut in half and the jewels and staff in their natural position.

To remove the upper balance settings

place the balance cock over a stump of a standard staking set in which there is a hole larger in diameter than the setting. Use a piece of peg wood with a face diameter slightly smaller than the endstone setting diameter and press both the endstone and hole jewel out of the cock at the same time. Some watchmakers prefer steel, nickel or brass punches to remove and replace the jewel settings. This is optional as care must be exercised with any style of punch.

To replace the upper balance settings

place the balance cock top side down on a piece of boxwood or bench. (Fig. 3.) Put the endstone in place and press tightly against the "seat," using pegwood smaller in diameter than the body size of the setting. The endstone setting should fit freely in the hole. Next, put the hole-jewel setting in place and press down tight against the endstone. This setting should fit friction tight in the hole, holding the endstone securely in place.

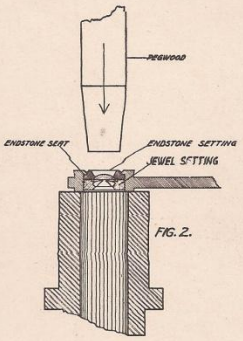

FIG. 2.

Tightening jewel settings

If the hole jewel does not fit tight enough in the hole to hold the endstone setting in place it may be "spread" (see Fig. 4) using a hollow punch from a standard staking set. *If care is exercised in removing the settings it will never be necessary to "spread" them.*

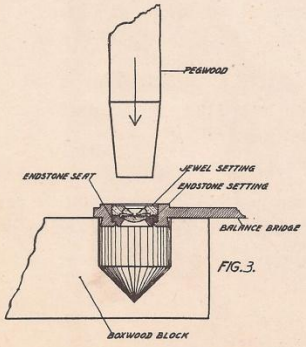

FIG. 3.

To remove the lower balance settings

unscrew the two jewel screws; place the pillar plate on the bench, dial side down, and with peg-wood press the jewel and end-stone settings out at the same time.

To replace the lower balance settings

These settings may be replaced in the same manner as any other capped jewel settings held in place by screws.

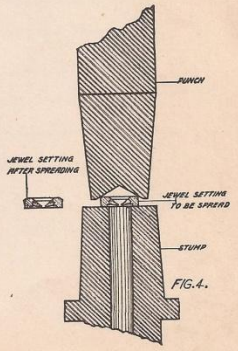

FIG. 4.

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500-2-26-30	1000-6-15-36
500-5-5-30	1000-5-26-37
2000-8-10-32	500-9-22-38
1000-5-25-35	1000-9-27-39

SUBJECT: Hamilton 12 Size Jeweled Motor Barrel

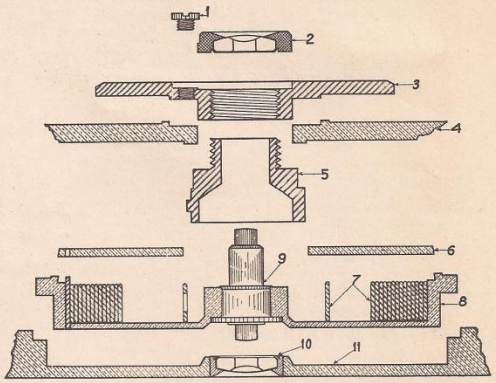
There are two styles of barrel arbors to be found in the 12 size Hamilton models. On the 900 and 920 models the arbor is held in the barrel with an arbor nut. On the 902, 904, 922 and Masterpiece models the barrel arbor is fixed friction tight and riveted secure to the barrel. It is not necessary on either model to remove the arbor. Neither is it necessary to remove the barrel top jewel from the ratchet wheel.

The Hamilton Jeweled Motor Barrel can be taken apart and assembled in the following manner, performing the operations in the order in which they are given:

1. Take out barrel bridge screws.
2. Remove barrel bridge and barrel complete.
3. Hold barrel bridge in left hand with thumb and second finger. Support ratchet wheel with first finger. (Protect ratchet wheel with chamois or soft cloth.)
4. Grasp barrel with fingers of right hand. Turn barrel quickly towards you. Pull barrel and barrel bridge apart.
5. Hold barrel bridge in left hand, same as for operation No. 3.
6. Grasp barrel hub with brass lined pliers. Turn quickly towards you and unscrew hub.
7. Remove barrel head and mainspring.

After cleaning, it must be assembled in the following manner:

1. Wind mainspring into barrel.
2. Oil mainspring and fit barrel head in place.
3. Oil barrel bridge for ratchet wheel and hub.
4. Place ratchet wheel in place on barrel bridge and hold with first finger.
5. Hold barrel bridge in thumb and second finger.
6. Use brass lined pliers and screw hub in place.



The complete Jeweled Motor Barrel unit consists of the following parts:

1. Barrel top jewel screw
2. Barrel top jewel and setting
3. Ratchet wheel
4. Barrel bridge
5. Barrel hub
6. Barrel head
7. Mainspring (in barrel)
8. Barrel
9. Barrel arbor (riveted to barrel)
10. Barrel lower jewel and setting
11. Pillar plate.

7. Hold barrel bridge in left hand and barrel in right. Bring barrel bridge and barrel together, with a slight pressure on the barrel, turn it quickly away from you, it will snap easily into position. This will complete the assembling of the Jeweled Motor Barrel unit.
8. Place in its position in the watch.

Care should be used, however, when snapping the barrel into position on the hub and bridge, so as not to break or chip the barrel top jewel.

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Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

SUBJECT: Fitting Balance Staffs and Jewels.

Balance staffs and jewels serve such an important purpose in the perfect performance of a watch that all possible care should be used when fitting new ones.

The fitting of a new balance staff involves a number of delicate operations which must be done with considerable accuracy. It is a necessary operation for those who wish to master the more interesting work of position adjusting, a subject that will be covered in later data sheets.

TOOLS

Fitting new staffs and jewels can be most efficiently accomplished when the workman is provided with the following tools:

Jacot lathe (Fig. 1)
Dorrington pivot polisher (Fig. 2)
Steel burnisher (Fig. 3)
Jasper pivot slip (Fig. 4)
No. 200 K. & D. roller remover (Fig. 5)
Hairspring collet remover (Fig. 6)
Staking tool set
Diamond point graver

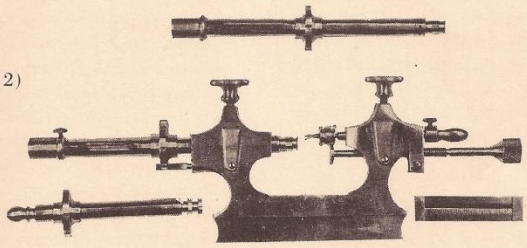

Fig. 1 — Jacot Lathe

ORDER OF WORK

The new staff and jewel should be fitted while the watch is unassembled and before cleaning. (Fig. 2 in Technical Data sheet No. 106 illustrates a bent and burred pivot running in a broken balance jewel). The operations can be performed in the following order:

1. Remove the hairspring with the hairspring collet remover (Fig. 6).
2. Remove safety and impulse roller, using a K. & D. roller remover (Fig. 5).
3. Remove staff from the balance (turn off burr from top or from the bottom shoulder with a graver).
4. Remove jewel and endstone (see T. D. 103).
5. Select the new staff and jewel.

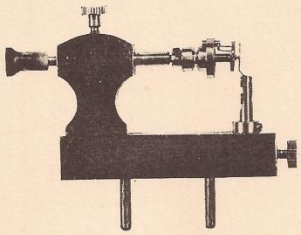

Fig. 2 — Dorrington Pivot Polisher

REMOVING THE HAIRSPRING

Fig. 6 shows a sketch of a very practical and handy tool to remove hairsprings. It can be made from a small rat tail file three or four inches in length, and ground to the shape illustrated. For a wide variety of work it may be necessary to have several sizes so the end that enters the hairspring collet slot (A in Fig. 9) will spread it very slightly, just enough to relieve the friction around the staff. Support the balance wheel on a steel block and very carefully press the hairspring remover into the collet slot, then turn and pull up at the same time. This will slide the collet off the staff very successfully.

Fig. 3 — Steel Burnisher

REMOVING THE ROLLER

Referring to Fig. 5 it will be noticed that the roller remover lip is placed under the safety or small roller. When the roller remover lip is ground thin enough to slip between the large roller and balance arm, care must be used so as to not break the roller remover. On the two-piece type rollers, it will be necessary to prepare special lips thin enough to go easily between the balance arm and the impulse roller. The attachments that come with the staking tool sets and those that are supplied separately are very recommendable for this work.

REMOVING STAFF FROM BALANCE

Due partly to burnishing and partly to steel that is slightly too hard, it is often difficult to turn the shoulder holding the balance on the staff. In most cases this can be overcome by the proper manipulation of a very sharp diamond point graver. Regardless whether the staff is "staked" or "rolled" to the balance, the surface of the steel at the staking and rolling point becomes harder than it is directly under the surface.

By keeping the point of the graver in the softer metal and allowing the edge to cut the hardened surface (always making the point of the graver follow the edge), it is possible to cut this hardened surface. Once the graver glazes over the top of the steel, it will be more difficult to cut and it will be impossible to penetrate the glazed surface with this particular graver unless it has been re-sharpened.

Occasionally one will find a staff that is too hard to turn with a graver. In this case, it is advisable to reverse the staff in the chuck and turn off the bottom shoulder. In many cases, especially on small balances, this method will be found preferable to attempting to cut the hard

SUBJECT: Fitting Balance Staffs and Jewels — (Continued)

Fig. 4 — Jasper Pivot Slip

Fig. 5 — K. & D. Roller Remover

burnished burr from the top.

JEWELS

Technical Data sheets 102 and 103 explain the Hamilton method of "Improved Friction Jeweling" which has been developed over a period of years with the desire to make it easier for the watchmaker to change and fit new train or balance jewels. Special attention is called to the diameter of balance jewels which provides for an oil chamber. This retains a generous supply of oil without danger of being drawn out by capillary attraction or of running down the balance staff and onto the hairspring.

SELECTING NEW STAFF AND JEWEL

Fig. 7 illustrates a very practical method of determining when the side shake is too great or not great enough. An 18/0 size balance staff is drawn perpendicular to the face of the endstone. If there is no side shake between the jewel and balance pivot, the staff will be held in this position. As the side shake increases the staff will tip on either side, forming an angle in proportion to the amount of side shake. As the side shake increases, the staff will tip a greater distance from the perpendicular until the jewel hole becomes so large that the jewel will not hold the staff in any angular upright position, and it will fall over after being placed in the jewel holes. The lines AB and CB represent an angle of 5° on each side of the perpendicular line. This will allow the maximum amount of side shake permissable on the 18/0 size. (.0001″).

Some practice is necessary to determine this angle as there is no way for the watch repair man to measure it. In practical use, therefore, the pivot can be placed into the jewel hole, allowing the pillar plate or balance cock to lay flat on the bench in a horizontal position. Any slight tipping back and forth that will permit perfect running freedom of the staff when placed in the balance and watch, can be used as a standard angle for practical use.

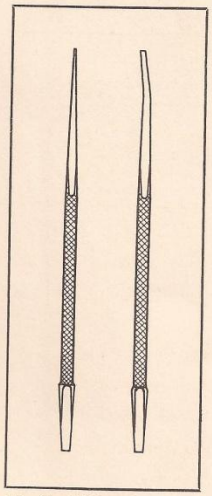

Fig. 6 — Hairspring Collet Remover

This is a very fine way to determine a perfect side shake, but it will require some practice and application before one becomes proficient in its use. Assuming that the side shakes are perfect on both the upper and lower pivots, the staff can then be staked to the balance, the rollers attached, and the balance wheel trued and poised.

The balance wheel should be tried in the plates at this time, when the side shake and endshake can be perfectly inspected. This is done by turning the plates in all positions to insure freedom of the staff. Care must be used when screwing the balance cock into position so as not to break the jewels in case the balance staff is too long, or one of the pivots is slightly too large.

SHAPE OF BALANCE PIVOTS

Fig. 8 shows an enlarged view of the proper shape for Hamilton balance pivots. It is absolutely necessary that both pivots present the same extent of metal surface to the endstone, so as to maintain the "motion" of the balance equal in the dial up and dial down positions. Both pivots may look alike, but when observing the motion of the balance when running, we find that the motions are not equal. This will cause an irregular rate between the dial up and dial down position. It is necessary to correct one or the other of the balance pivots.

The position in which the motion is the greatest will show a losing rate compared to the other horizontal position. This error can be quickly and easily corrected by the use of the Dorrington pivot polisher or Jacot lathe shown in Figs. 1 and 2.

The condition of the balance pivots is highly important because the theories underlying position adjustments are based to a great extent upon the condition and shape of the balance upper and lower pivot. They determine absolutely the amount of variation that will be produced in the dial up and dial down positions.

For this reason, we urge you to become as proficient as possible in the use of a Dorrington pivot polisher or Jacot lathe. A Dorrington pivot polisher is used as indicated in Fig. 2. Here the balance wheel has been placed in position with the lower pivot extending through the disc, which allows perfect vision of the balance pivot. It is operated with a bow as all lathes of this type are operated. The pivot having the most rounded face should be flattened to correspond to the other pivot. Stone the pivot with a jasper slip (Fig. 4) and burnish with the hardened steel burnisher shown in Fig. 3. Some practice is required to become an expert in the art of finishing

SUBJECT: Fitting Balance Staffs and Jewels — (Continued)

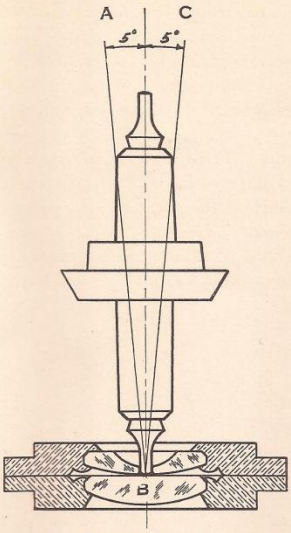

Fig. 7 — Determining the Angle of Side Shake

pivots, and we recommend to those who are not already using this system to practice on old balances in order to become sure of their work and their results.

The principle of these two lathes is to be highly recommended, as the balance staff runs between dead centers and will positively indicate when a balance staff is bent. Staffs that are slightly tight in the jewel holes, or staffs that do not have sufficient endshake, can be remedied by the successful manipulation of these lathes.

In conclusion, we wish to urge all watchmakers to use all possible care in the fitting of new staffs and jewels. Perfect balance staffs running in perfect jewels allow the escapement action to produce more positive results, and permits a more perfect control of the balance vibrations by the hairspring. The use of genuine staffs and jewels is also important, and will save considerable time and trouble in fitting.

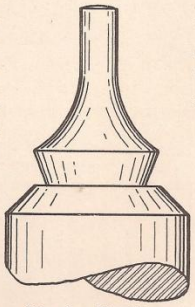

Fig. 8 — Hamilton Balance Pivot

DATA SHEETS

This discussion is the seventh in a series of Technical Data Sheets published by the Hamilton Watch Company for all Hamilton dealers. It is perhaps needless to add that, upon completion, the series will form a reference book of great value to all jewelers interested in watch repairing.

A short index of the sheets already published is given below. Certain numbers may be missing from your files. If you do not possess the series, we will be glad to furnish you with a complete set or any separate copies that you need. As they are punched to fit a standard loose leaf folder or notebook, you can with little trouble conveniently file them.

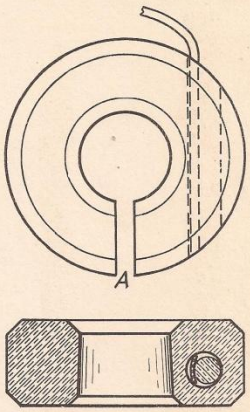

Fig. 9 — Hairspring Collet

For quick reference on specific subjects, these technical discussions will be of special benefit for selling your watch repair service to your customers. Communicate directly with the Technical Department, Hamilton Watch Company.

"Accuracy is the Secret of Success"
Strive for Accuracy in Your Work.

TECHNICAL DATA SHEETS PUBLISHED TO DATE

T. D. 101 — Directions for Removing 18/0 size Movement from Chevy Chase Case.

T. D. 102 — Improved Friction Jeweling.

T. D. 103 — Improved Balance Jeweling.

T. D. 104 — Hamilton 12 size Jeweled Motor Barrel.

T. D. 105 — Why Do Mainsprings Break?

T. D. 106 — Cleaning Watches.

T. D. 107 — Fitting Balance Staff and Jewels.

SUBJECT: Fitting Balance Staffs and Jewels — (Continued)

List of Jewels and Staffs for the new 989 18/0 size Hamiltons

Catalogue No.	
2727	Staff, Balance, S. R. Type
2777	Jewels, Balance Hole, Upper, Ruby, Gilt Setting
2778	Jewels, Balance Hole, Lower, Ruby, Gilt Setting
2779	Jewels, Balance Endstone, Upper, Ruby, Gold Setting
2780	Jewels, Balance Endstone, Lower, Ruby, Gilt Setting
2767	Jewels, Center, Upper, Ruby, Raised Gold Settings
2768	Jewels, Center, Lower, Sapphire, Gilt Setting
2769	Jewels, Third Upper, Ruby, Raised Gold Setting
2770	Jewels, Third Lower, Ruby, Gilt Setting
2771	Jewels, Fourth Upper, Ruby, Raised Gold Setting
2772	Jewels, Fourth Lower, Ruby, Gilt Setting
2773	Jewels, Escape Upper, Raised Gold Setting
2774	Jewels, Escape Lower, Ruby, Gilt Setting
2775	Jewels, Pallet Upper, Ruby, Gold Setting
2776	Jewels, Pallet Lower, Ruby, Gilt Setting
2783	Jewels, Roller or Jewel Pin, Sapphire
2781	Jewels, Pallet Stone, Receiving, Sapphire
2782	Jewels, Pallet Stone, Discharging, Sapphire

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SUBJECT: Balance Truing.

Balance truing is accomplished by means of a pair of balance truing calipers, balance truing wrenches, parallel pliers and brass lined tweezers.

Balance truing calipers are so constructed that the balance will be supported on the cones of the pivots as shown in Fig. 1 in which (A) is the conical portion of a balance pivot, (B) is the stump of the balance calipers (C) is a hole in the stump to allow freedom and to prevent the stump from becoming clogged with dirt which in time would mar and break the pivot.

The balance calipers are provided with an index which indicates when the balance wheel is true, in the round or flat. This index must be so arranged that it will be easily adjusted to different size balances and to retain an easy friction at all times, so the index can be brought close to or far away from the balance quite rapidly.

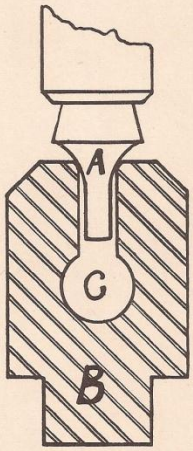


Fig. 1—Stump for Balance Calipers

The calipers are usually held in the left hand as shown in Fig. 2, for truing in the flat, and as shown in Fig. 3 for truing in the round. A certain grasp is taken with the thumb, 2d, 3rd and 4th fingers, leaving the first finger free to move the index forward and back. The method of holding the calipers is very important. So they can be easily rolled or shifted in the hand from the flat to the round position. Take special notice of the positions of the calipers in Figs. 2–3.

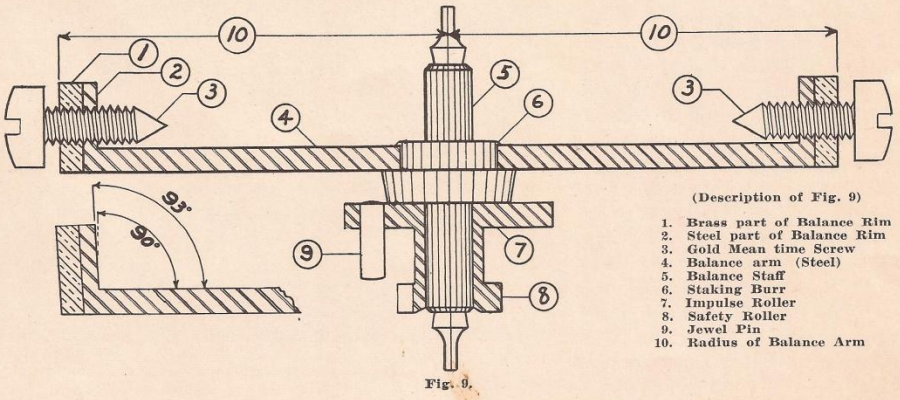
In the actual work of truing the balance there are three important rules to follow that will be of great assistance to those who desire to become expert balance truers.

1. True the balance in the "FLAT."
2. True the balance in the "ROUND."
3. Start at the arm and work towards the cut, both in the round and in the flat.

Truing in the Flat

In Fig. 2 the calipers, index, balance and hands are shown in correct position for truing in the flat. Start at the arm, adjust index, turn the balance slowly with the first finger of right hand so the height can be determined. Make both arms absolutely the same height, by pressing the low arm up or the high arm down. To raise the low arm, place the soft part of the thumb under the arm and with a firm pressure force the arm up. To lower the high arm place the soft part of the first finger on top of the arm and with a firm pressure force the arm down. CAUTION—always keep a firm pressure on the calipers with the left hand so they will not open up, for if they should open, you will break the balance pivots.

Some balance staffs will be so long and thin that it will not be safe to raise or lower the arms in this fashion, for fear of bending or breaking the staff. When this condition is met, place the staff and balance in a staking tool as for staking on a new staff, and with a firm pressure on the punch with the left hand, you can bend either arm up or down without fear of breaking the staff. Place



(Description of Fig. 9)

1. Brass part of Balance Rim
2. Steel part of Balance Rim
3. Gold Mean time Screw
4. Balance arm (Steel)
5. Balance Staff
6. Staking Burr
7. Impulse Roller
8. Safety Roller
9. Jewel Pin
10. Radius of Balance Arm

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Fig. 9.

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Balance Truing (Continued)

balance in calipers and proceed.

With both arms the same height, start at an arm, turn balance slowly toward the cut. If both balance rims follow the index as shown in Fig. 4 (a) the balance wheel can

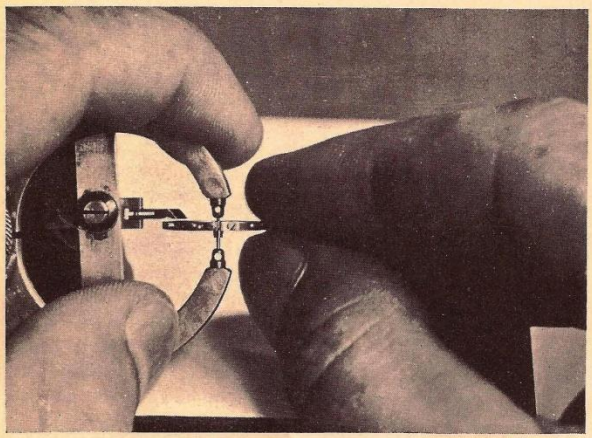


Fig. 2—Position for Truing in the Flat

be considered true in the flat. If the space between the index and balance rim increases as at (b) Fig. 4, it indicates that the balance is out of true in the flat and the rim will have to be raised so as to be absolutely the same height as the arm. Fig. 4 illustrates four sketches of the balance rim looking at it edgeways as though you were seated at your bench and looking at the balance in the position shown in Fig. 2. The index is shown at 1-2-3-4-5-6-7, and indicates where the balance rim is out of true, as the balance wheel is being turned in the calipers from the arm position toward the cut. The fingers of the right hand, Fig. 2, show the correct method of bending the rim up or down and by constant practice it will be possible to remove very short bends in this manner.

Suppose the index, Fig. 4 c, shows the rim to be low at screw 3 and as you proceed towards the cut the rim rises at screw 7 to the same height as at the arm, or even higher. This can be overcome by bending the rim up with the thumb and first finger, keeping the soft part of the thumb in such a position that it will have a tendency to retain the arm at its same height and at the same time raise the low part of the rim. The end of the rim will now have been raised still higher, and by moving the thumb and first finger forward and grasping the rim in such a manner that by a rolling pressure of the first finger over the support of the thumb the end of the rim can be thrown downward. *Constant practice of this method of rolling the fingers is absolutely necessary.* Again when the middle of the rim is lower than the arm or end of cut, Fig. 4 c, it can be corrected by grasping the rim with thumb, first and second fingers, having the thumb support the low part, then with first finger at arm and second finger at cut, squeeze upward on the thumb; this will lower each end and raise the middle. Never put a balance wheel on a block of any description and attempt to punch out the bends, you will only ruin the balance.

The thumb nail and first finger nail can be used with good results in removing sharp bends or kinks. This method of using the fingers for practically all of the truing in the flat is followed in all the watch factories where speed and accuracy are absolutely necessary.

In Fig. 4 d, the index is shown at 1,2, 3,4,5,6 and 7. The rim follows the index perfectly up to the 5th screw. Here the end of the rim takes an abrupt downward bend, and at the 7th screw the space between index and balance has increased. Remove balance from calipers, place in parallel pliers (Fig. 5), allowing end of rim to extend over the ends of pliers just a sufficient amount so as to support the rim in the middle of the kink, bend the rim up with brass tweezers. By the same reasoning several kinks can be followed up from the arm towards the cut and removed as you go. It is a hard task to put in words all of the moves and bends that can be resorted to, but to the man who really desires to master the art of balance

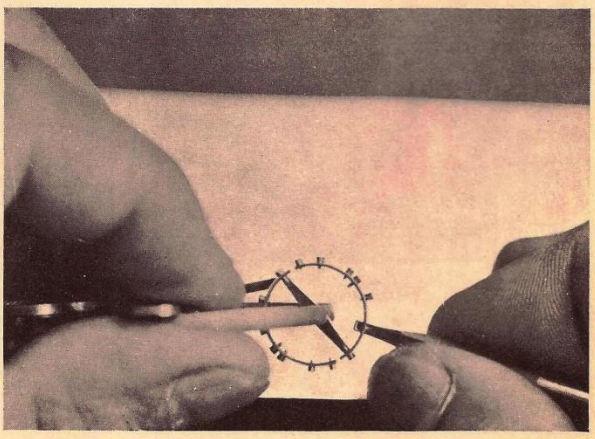


Fig. 3—Position for Truing in the Round

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Balance Truing—(Continued)

truing, constant practice on old balances is necessary. With an old balance under observation you need have no fear but strike out boldly, bending the rim up, then down, then raising the middle. Practice constantly, using all of the finger movements that you can figure out.

TRUING IN ROUND

The length of the arms can be determined by holding the calipers as in Fig. 3 and having index set accordingly. Turn both arms of the balance so they will be brought directly under the index. If you are properly seated at your bench you can set the index so that a small amount of light will be visible between index and balance rim. Get this distance well fixed in your mind, then turn to other arm. If the arm is shorter the light will be greater. If the arm is longer the light will be less or possibly none at all. The short arm must be stretched to make both arms exactly the same length. To stretch the balance arms, remove the rollers and place the short arm on a flat steel stump of a standard staking tool, select a punch that has been made for this purpose, and bring the punch close to the staff, having the balance arm between the punch and stump. The revolving disc will have to be set so that the punch will come in contact with the balance arm, close to the balance staff. Some practice will be required to do this job successfully, because if too hard a blow is struck the short arm will be converted into the long arm and then the other arm will have to be stretched. It is much better to give light blows, then try in the calipers to determine the result. If not enough, stretch again, always bringing the punch at the same place so as not to unnecessarily mar the balance arm. If the stretching operation is performed in this way the mark thus made will be on the lower part of the balance arm and when the rollers are replaced will be almost invisible.

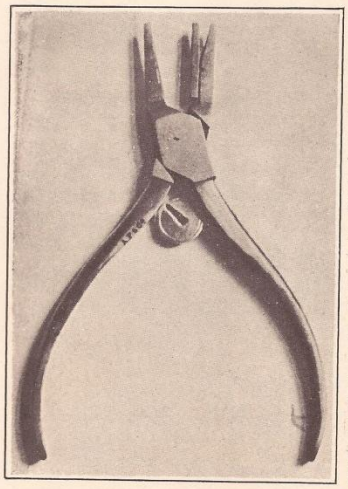


Fig. 5—Parallel Plier

When both arms are true, turn the balance slowly, from arm to cut. If the space between the index and arm increases or decreases it indicates that the balance is out of true in the round at the point where the rim fails to follow the index. Study Figs. 6, 7 and 8.

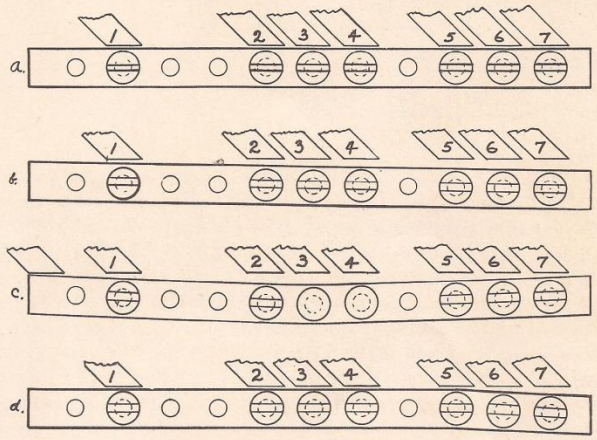


Fig. 4—Sketches of balance index and Balance Rim

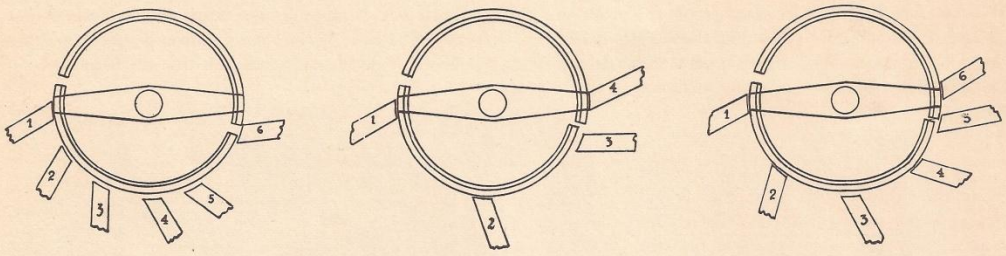
Always true from arm towards cut, and eliminate all bends as you go. In Fig. 3 the balance wrench is placed over the rim spanning a screw; it is possible now to bend the rim from this point so that the portion of the rim from this point towards the cut can be carried in or out.

Suppose when turning the balance from the arm to the cut, that the rim gradually bends inward as indicated by the index No. 4 in Fig. 6; and from this point the rim gradually bends outward. The rim must be grasped slightly beyond the arm and bent outward. This, if successfully done will make the rim true from the arm to index 4. At this point it will be necessary to grasp the rim with the balance truing wrench and bend the rim inward. These are the two bends necessary to correct the condition shown in Fig. 6. In Fig. 7 the rim follows the index to the point indicated by index No. 2. From this point on towards the cut it gradually bends inward. This will require one bend at point 2. Fig. 8 shows a rim badly out of true. At index 2 the rim bends inward towards index 3, from this point it bends outward to point 4, and from index 4 it bends inward to point 5. This condition will require three major bends, one bend at each index, 2-3-4. It may be necessary to do considerable touching up with a balance of this nature, and here is where a good eye and a fine touch is required to make a nice finished job.

In using the balance wrenches great care must be used so as not to twist the rim upward or downward. This

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Balance Truing—(Continued)



will create the double error of throwing the balance out of true in the flat, and also of putting in a kink in which two portions of the rim are not laying in the same vertical position. This can be explained by considering Fig. 9 in which (1-2) is the rim in cross section, the 93° angle indicates that the rim is not square with the arms. If a wrench of the type that straddles a screw is placed over the meantime screw and the end bent downward, it will cause the balance rim to be changed from the true vertical position to a position as indicated by the 93° angle. Upon trying the balance for true in the round, this arm would appear longer than the other one.

Some balance truers take advantage of this condition, and bend the Rim 1 and 2 so that the top part is carried farther away from the balance staff. The end at the cut will be raised quite high, and by holding the arm in a pair of parallel pliers the end of the cut can be bent down. This accounts in most part for balances that are met with, that seem impossible to true. One or two of these out of vertical conditions make a very poor balance wheel.

On high grade balances the index should indicate that the balance is true both on top and bottom. That is, in truing the balance as previously described, the balance is placed in the calipers in the same position that it would have in the watch, collet shoulder up and roller down. Now turn the balance end for end, having collet shoulder down and roller up and determine if balance is perfectly true. By so doing you will determine if the balance rim is laying in the same vertical position throughout. While the above statement is a theoretical truth, it is advisable on general watch work to true the balance with the index on top, because this is the condition originally established, and the side that is visible when running.

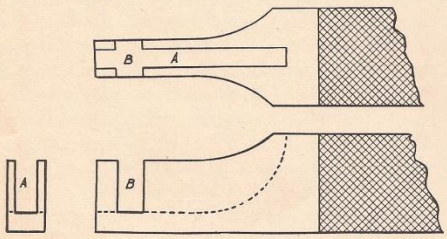


Fig. 10.

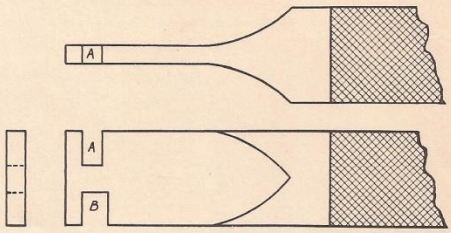


Fig. 11.

Fig. 3 illustrates a balance truing wrench placed over a balance screw. Details of this wrench are shown in Fig. 10 in which two slots (A-B) are provided, one cut longitudinally and one transversely. Fig. 11 illustrates a wrench that goes between the balance screws. Different size slots (A-B) cut transversely only can be provided so as to fit balance rims of various thickness.

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

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T D 109
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1000-5-25-35 1000-1-24-39
1000-4-25-38

SUBJECT: Poising the Balance

The balance wheel must be poised after it has been trued. It is poised with rollers attached and with hairspring removed.

The necessary tools for poising a balance are:

1. Poising calipers or
2. Poising block—Fig. 1.
3. Parallel Pliers Fig. 5. T.D. 108.
4. Balance screw undercutter Fig. 4.
5. Balance screw saw Fig. 5.
6. Balance screwdriver Fig. 3.
7. Balance screw scale Fig. 6.
8. Assortment of timing washers Fig. 2.
9. Assortment of balance screws.

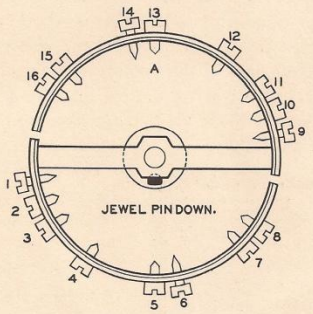
Other types of these tools are illustrated in the Material catalogs and can be obtained from your material dealer.

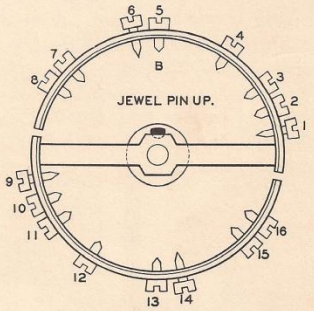
The reason for poising the balance lies in the theoretical principles underlying position adjustments. Here it is shown that errors in position rates are due in part to the counterpoise of the balance. The closest rates are always obtained when the balance wheel is constructed of first quality material having the least amount of variation in its composition, so that all parts are effected to the same extent by any change of temperature when the balance wheel is perfectly true and poised.

It must be definitely borne in mind, during the process of truing and poising the balance, that the relation of the weight of the balance to that of the strength of the hairspring is a prime controlling factor in making a watch run accurately. It is this principle of "isochronial vibration" that controls the escapement action and permits the power of the mainspring to release itself in regular intervals according to the number of vibrations developed by the train.

There is a positive cooperation of physical reactions in which a balance wheel that is too heavy or too light will cause the watch to loose or gain time. For this reason it is imperative that the greatest care be exercised when truing and poising the balance wheel so that the weight of the balance is not altered or the original relation of the balance wheel to that of the hairspring is not disturbed.

All Hamilton balances should vibrate 18,000 times per hour. The slightest increase or decrease in weight of the balance wheel when poising will cause the watch to gain or lose time in proportion to the amount of weight removed or added. Timing, therefore, serves the purpose of restoring to the balance and hairspring the





Balance Wheels A and B illustrate the effect of counterpoise upon position error. In A and B the balance wheel is heavy at screw 5 and 13, the weight being sufficient to cause the balance to be held in the vertical position shown. If these two balances are placed in watches and tested in three positions, dial up, dial down and pendant up, the pendant up position will show a gain or loss depending upon the balance motion as follows:

(A)—In this condition and in the pendant up position the watch will gain in the short arcs and lose in the long arcs of motion.

(B)—In this condition and in the pendant up position the watch will gain in the long arcs and lose in the short arcs of motion.

This gain or loss depending as it does on the "motion" of the balance, increases with counterpoise and decreases as the balance becomes more perfectly poised.

These two conditions will be taken up again under Position Adjustments and explained more in detail. The principle is described here to impress the necessity of a perfectly poised balance if accurate time is expected.

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TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: **Poising the Balance (Continued)**

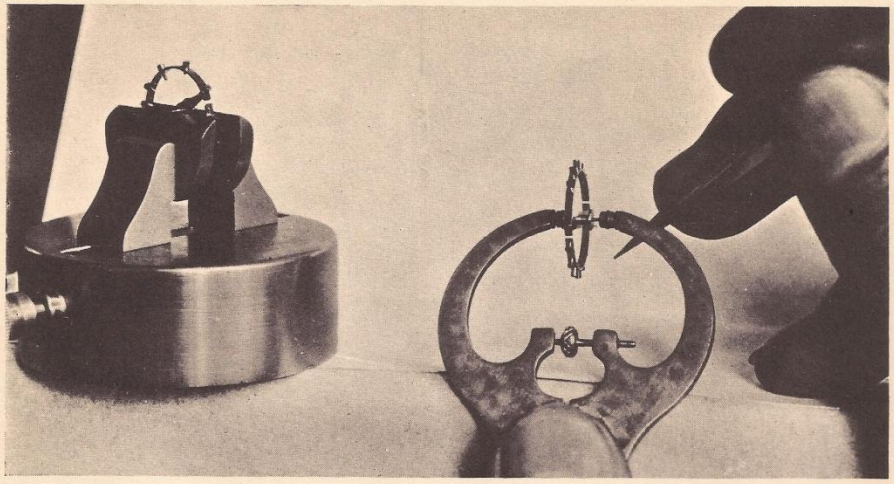


Fig. 1—Poising Block and Calipers

ability to vibrate in unison with the train development.

Figure 1 shows the correct way to use a pair of poising calipers or a poising tool. The principle of the poising tool is based on the action of gravity, in which the heaviest part of the balance wheel will have a tendency to fall to the lowest possible position. Suppose the balance screw on the side of the jewel pin drops rapidly to the lowest point in the circumference of the balance. It is obvious that this screw is too heavy and must be undercut to reduce its weight. Reducing the weight of a balance when poising means that the watch will gain a certain amount for each particle of weight so removed. Therefore, it is important to use care and judgment in poising a balance, as it will be necessary during the timing operation to replace this weight with timing washers or by turning out the meantime screws.

The poising calipers work under the principle of gravity and a displaced center of gravity. A balance badly out of poise will rapidly indicate such an error by the heavy screw falling to the lowest point. But after the balance has been brought to a fair state of perfection it can be revolved by agitating the calipers slightly with a pair of tweezers or a fine file.

The slightest counterpoise therefore can be detected by a refusal of the balance to continue this slow turning motion. The heavy portion of the rim or the heavy screw will destroy this motion and will drop to the extreme low point. This screw must be made lighter or a timing washer added to the opposite screw, as your judgment may dictate.

The actual work of poising consists of placing the balance wheel in the poising tool or in the poising calipers so as to have the most extreme end of each pivot supported. The balance wheel will now be suspended freely, and the force of gravity will cause the heaviest part of the balance rim to turn to the lowest point. A slight tapping of the poising block with the tweezers will aid the balance wheel to react to the force of gravity.

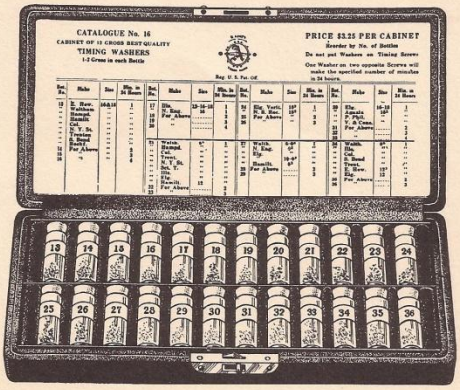


Fig. 2—Assortment of Timing Washers

Determine which screw is at the lowest point. Obviously this is then the heavy part of the balance and this screw must be undercut so as to reduce its weight. Place the balance in the parallel pliers with this screw up, use the balance screw driver to remove the screw, undercut slightly and then replace in the same hole. When the balance is heavy at a meantime screw, weight can be removed from the screws on each side.

It often happens that when a certain screw is undercut,

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Poising the Balance (Continued)

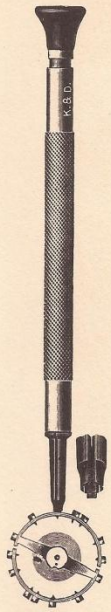


Fig. 3 Balance Screw Driver

the counterpoise will shift to another screw on the same side of the balance. In this case continue the poising operations as previously explained, and undercut this screw. When the weight shifts to the opposite side of the balance it shows that too much weight has been removed.

It is important to observe the position of the jewel pin in relation to the heavy side so as to determine if you are accomplishing the desired result or if you are gradually reducing the weight of the balance and shifting the counterpoise from one side of the balance to another. If it is necessary to remove considerable weight, it is advisable to add a timing washer to the screw directly opposite the heavy screw. This will maintain the original weight of the balance as nearly as possible.

If the balance wheel is supplied with friction fit timing screws, sometimes called meantime screws, their position from the balance rim should be noted. If they are turned out so that very few threads remain, it is advisable to add a timing washer to the light side of the balance. This will allow the timing screws to be turned in during the timing process.

Always bear in mind the importance of performing any operation on the balance wheel. It is suggested that much practice on old balances will be time well spent to perform first class work in poising balance wheels.

The hairspring can now be attached and the complete balance and spring dipped in the cleaning solutions and dried in boxwood sawdust. Remove all particles of sawdust from the hairspring under the roller and from the balance screws. Assuming that the watch has been cleaned, reassembled and repairs made, it is now possible to oil it and place the balance in position.

At this point, examine the balance for endshake and make sure the hairspring is level, centered and true. Be sure to see that the overcoil vibrates equally between the regulator pins.

The watch can now be timed, cased and rated.

Fig. 4—Balance Screw Undercutter

Fig. 5—Balance Screw Saw

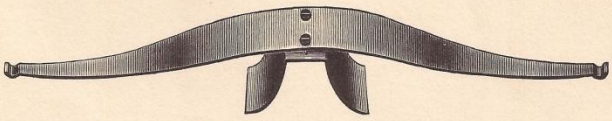
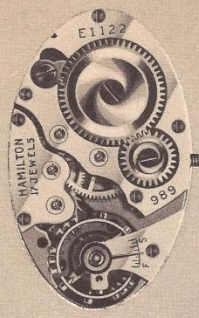


Fig. 6—Balance Screw Scale

Genuine HAMILTON WATCH MATERIALS

Grade 989, 18/0 Size



Enlarged view (twice size) of Hamilton 18/0 size, Grade 989 movement.

This page illustrates a factory nomenclature of individual parts, or sub-assembled parts of the popular 17 jewel grade 989, oval movement. In writing to any department of the Hamilton Watch Company or Material Wholesalers regarding these parts, identify by grade number and the name of part as shown under illustration below.

(Material shown below twice size)

Actual size view of the 18/0 size, Grade 989 movement

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 111

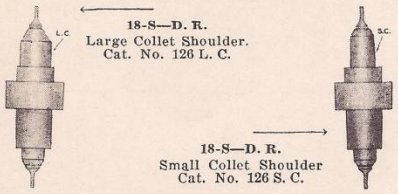
SUBJECT: Balance Staffs

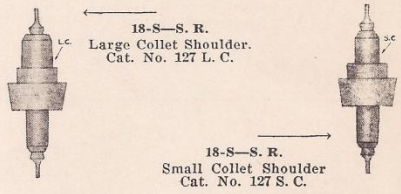
THE Hamilton Watch Company has from time to time found it necessary to make changes in the style and the dimensions of Hamilton balance staffs, due to new watch designs and improvements in the method of manufacture. These changes may sometimes make it difficult to obtain the correct balance staff immediately. This data sheet has been prepared in order to help the watch repairman distinguish these changes with the greatest possible ease. Be sure you obtain genuine staffs. They have the correct measurements making alterations unnecessary and cut down the time needed to fit new staffs into the watches.

ALL genuine Hamilton balance pivots are burnished by a new and improved method. No abrasives are used to burnish the pivot after the staff has been finished to size. A pivot manufactured in this way is superior to one produced by other methods as the burnishing has a tendency to work harden the pivot. The pores in the steel are closed to a great extent by work-hardening and thus a hard outer case is formed around the pivot. This burnishing makes the pivots smoother and better able to withstand wear. Staffs finished by this method have little tendency to pit endstones.

IT is commonly known that pivots polished with abrasive compounds retain some of the polishing material in the pores of the steel. When these pivots are running in oiled jewels, the oil mixing with the abrasives makes an excellent cutting compound, with the result that a hole is drilled in the endstone. All jewels used in Hamilton Watches are of the finest quality Rubies and Sapphires. With all the hardness of these jewels, if the balance pivots are not perfect, the jewels will pit and wear. It must be remembered the balance wheel oscillates 157,680,000 times yearly and it stands to reason that an imperfect staff due to this rapid motion is apt to damage the jewel in which it runs.

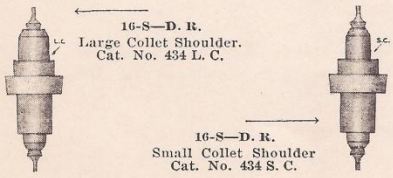
TYPES OF BALANCE STAFFS USED IN HAMILTON WATCHES

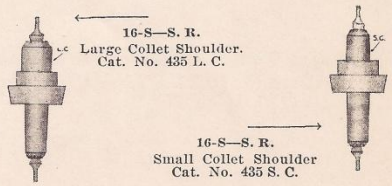




18-S staffs, both double and single roller types were made with large and small collet shoulders. In the illustrations, S. R. and D. R. mean single roller and double roller. L. C. and S. C. signify large and small collet shoulders.

In watches numbered over 100,000 only staffs having small collet shoulders were used. Watches with numbers under 100,000 may have used staffs with either large or small collet shoulders.



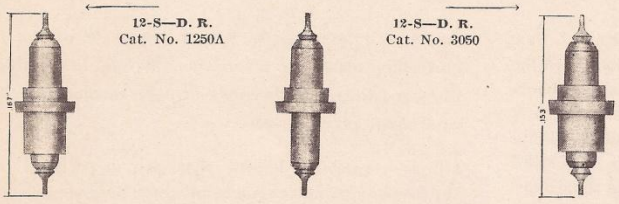


16-S staffs were made with large and small collet shoulders. Some watches numbered under 100,000 used staffs with large collet shoulders, others used staffs with small collet shoulders. Watches numbered over 100,000 used staffs with small collet shoulders.

18-346

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Balance Staffs



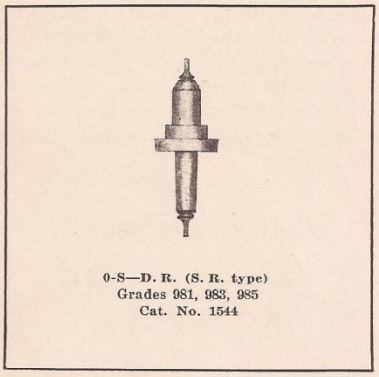
12-S staffs, in watches of grades 920, 900, 914, 910 with numbers under 1902601 used S. R. type staffs. (Catalogue No. 1250).

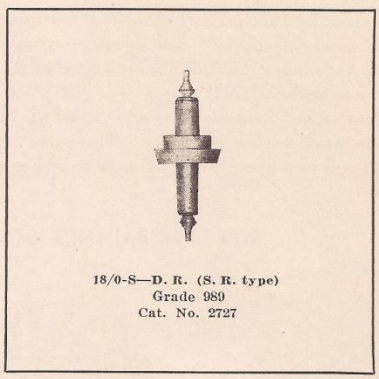
Watches of these grades, numbered from 1902601—700, used the D. R. staffs. (Catalogue No. 1250A).

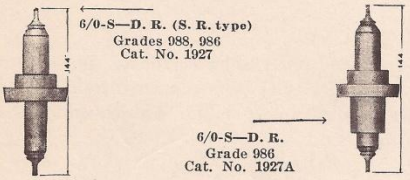
In watches from 1902701—800 the S. R. type staffs were used. (Catalogue No. 1250).

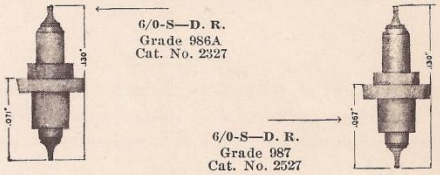
In watches from 1902801 D. R. type staffs, (Catalogue No. 1250A), were used.

12-S staffs in watches of grades 922, 904, 902, 918, 916, 912 are D. R. type. Catalogue No. 3050).









6/0-S staffs in Watches Grade 986 were both single roller and double roller. Watches Grade 986 before No. 2041401 used staffs, Catalogue No. 1927. Watches Grade 986 after No. 2041400 used staffs, Catalogue No. 1927A.

It is necessary to give full description and catalogue number of material desired. The Material Sales Department of the Hamilton Watch Co., suggest, whenever possible, sending the part to be duplicated, with orders for material. By doing this, you will insure yourself prompt and accurate service. Your co-operation will be greatly appreciated by this department.

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 112

2500 1000-4-25-38
1000-5-25-35 1000-9-27-39
500-5-26-37

SUBJECT: Removing and Replacing the Hamilton Floating Stud

The Hamilton floating stud principle for adjusted watches, adopted many years ago makes possible hairspring replacing without recentering and releveling.

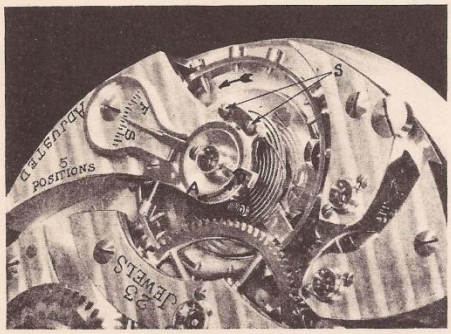


Fig. I

To remove the balance and hairspring, unscrew the two stud cap screws (s) just enough to release the stud before unscrewing the cock screw. (If the watch is to be washed, remove these two screws entirely). Do not pick the stud out from under the cap as this will put a short kink in the hairspring at the regulator pins, and cause bad regulation when replaced. Lift the balance cock up and away from the movement so that the balance will not catch on the center wheel and stretch the hairspring. The balance is now suspended by the hairspring. By tilting the cock toward the stud side, the stud will fall out.

When the hairspring has been staked on the balance staff in the proper location, and the balance and hairspring are ready to be replaced in the watch, pick up the balance by the arm or rim, placing the balance with the jewel pin in the slot of the fork. Move the balance around so that the stud is within the ark A B (as indicated in Figure I) where there is no chance of catching the overcoil in the regulator pins or the stud under the balance cock. With the balance in this position, screw on the balance cock and adjust the endshake. If the stud cap has been removed, replace it, turning in the screws only part way.

The stud floats back and forth within Arc A B. Now, with the forefinger of the hand that is holding the movement, swing the balance in the direction as indicated by the arrow. Holding the stud with the tweezers, place it under the cap, keeping the spring on the outside of the regulator pins. Then tip the hairspring between the regulator pins and swing the balance back until the jewel pin and fork are in neutral position and the hairspring is free between the regulator pins. It is always well to place the overcoil between the regulator pins before screwing down the stud cap screws. Holding the balance in this position, tighten the two stud cap screws.

Provided the hairspring has been leveled before and the overcoil has not been pulled out of shape in taking the balance out of the watch, the hairspring will not have to be leveled or circled. Neither will it be necessary to manipulate the regulator pins.

The new twelve size movements, grades 912, 916, 918, 902, 904, 922, should be held in the position shown in Figure II when screwing down the stud cap. That is, with the balance on the side away from you. In putting the balance in the watch the stud should be floating in the space between the center wheel and the cock, *not* between the stud cap and regulator pins. By keeping the stud in this position it is much easier to handle without injuring the overcoil.

Some types of studs may be swung into place when the balance is in the watch, while there are still other types which must be placed in the balance cock and fastened before placing the balance in the watch. But the Hamilton floating stud, as illustrated here, has proven the best for frequent removal and replacement without disturbing previous adjustments.

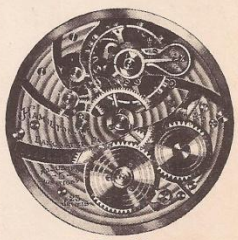


Fig. II

18-346

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T. D. 113

SUBJECT: TEMPERATURE COMPENSATION

BEFORE the compensation balance was introduced, watches varied in rate as much as five or six minutes in 24 hours with ordinary changes of temperature. This variation of rate in temperature was caused by three factors:

1. Expansion or contraction of the balance in heat or cold.
2. Changes in the length of the hairspring caused by expansion in heat and contraction in cold.
3. Differences in the elastic force of the hairspring caused by changes in temperature.

Ferdinand Berthoud and other scientists estimated that approximately 82% of the error in time caused by changing temperatures was due to the change in elastic force of the metal (usually steel) from which the hairspring was made. The expansion and contraction of the balance accounted for most of the remaining variation in rate. Since Berthoud performed his experiments, it has been discovered that changes in the length of the hairsprings are offset by the changes in thickness and width. Therefore, any variation in rate from this cause is negligible.

The bi-metallic balance was designed to overcome the difficulties ensuing from such changes in the balance or hairspring in heat and cold. Two metals are used in the manufacture of this balance. The arms are steel; the rim is formed of steel with an outer ring of brass firmly brazed to it.

By using as an illustration Fig. (1), a straight strip of brass firmly brazed to a steel strip of equal length, it is easy to discern how a compensation balance performs. The coefficient of expansion of brass is 0.00000957; of steel 0.00000636. That is brass expands about 7/10 more rapidly than steel. In heat the steel strip, expanding less rapidly than the brass, draws the brass strip, making the arc B.C. In cold the brass contracts more rapidly and the strip is drawn by the shorter brass strip, forming the arc A.D.

The rims of a compensation balance are deflected from the true circle by changing temperatures in the same manner that a straight strip of metal is deflected. This action is shown in Figures 2, 3 and 4. Heat expands the metals composing the balance, elongating the arm and the rim, but the brass expands more rapidly than the steel and causes the rim to curve inward (Fig. 2). Cold acts on the balance in a reverse manner, the loose ends moving outward from the center of the balance (Fig. 4). It may readily be seen that a cut bimetallic balance will be true as in Fig. 3 in but one temperature, that in which it was trued. In Figures 2 and 4 the dotted lines show how the rims move away from the "true" position, the arms moving in the opposite direction to that of the loose ends.

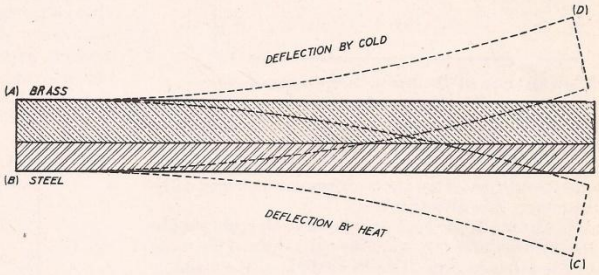


Fig. 1

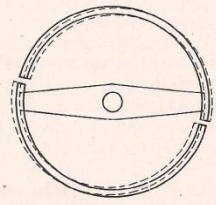


Fig. 2

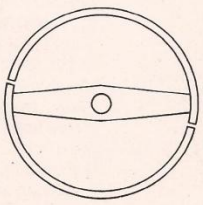


Fig. 3

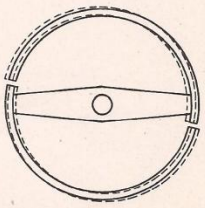


Fig. 4

30-346

TECHNICAL DATA—HAMILTON WATCH COMPANY

SUBJECT: Temperature Compensation

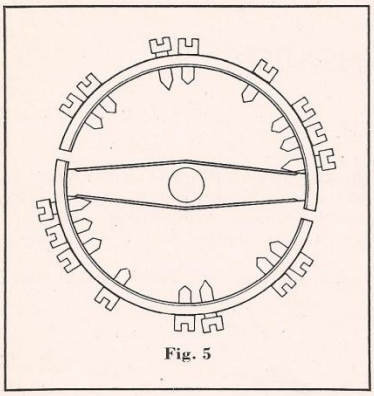


Fig. 5

Movements of Balance Screws Necessary For Compensation

The position of the screws in a 16 size Hamilton balance before compensation adjustment is illustrated in Fig. 5. By experience this was found to be a good average arrangement and very often the watches compensate without disturbing this arrangement.

Watches losing in the heat compared to the cold should have the screws shifted by opposite pairs toward the loose ends of the balance rims. The loose ends of the balance bearing the transferred screws are carried toward the center producing a gaining rate compensating for the loss in rate due to the loss of elasticity by the hairspring. Fig. (6) shows a balance with the screws all moved to the loose end before it would compensate. This illustrates the extreme compensation possible.

In cold, the brass in the rim contracts more than the steel. The loose ends move away from the center and the weight of the screws concentrated toward the loose ends, being farther from the center, reduces the fast rate in the cold temperature. The movement of the bimetallic strip is greater toward its free end, and the more weight there is near the free end the greater is the compensating effect of the balance.

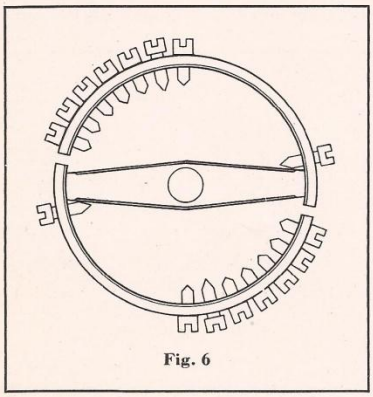


Fig. 6

The rate being faster in heat than in cold, the screws should be moved away from the loose ends. Fig. (7) illustrates the extreme limit of compensation for this condition.

By examining Figures (2) and (4) it may be seen that there is a neutral point in the rim, where changes in temperature have no effect. Moving the screws near this point has very little effect on the compensation adjustment of the balance.

The compensation for temperature effected by the bimetallic balance is not quite perfect. The elasticity or stiffness varies with temperature according to one law; the compensating effect of a bimetallic balance varies according to a different law. Therefore, the compensation adjustment may be made exact for any two given temperatures but will not be exact for temperatures between the two or beyond them. This compensation error is known as the *middle temperature error*. For use in chronometers, many auxiliary compensation devices have been invented but the best of these do no more than lessen

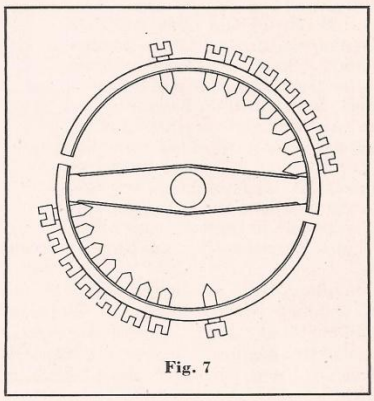


Fig. 7

the error. Until recently, very little could be done to rectify this error in watches, but a few years ago the problem of the middle temperature error was partly solved by one of the brilliant researches of Dr. Ch. Ed. Guillame on nickel steel alloys. Now the finest watches are equipped with invar bimetallic balances which may be adjusted to decrease the middle temperature error.

Hamilton watches are compensated for temperatures between 40° F. and 95° F., approximately 5° C. and 35° C., a watch seldom being exposed to temperatures beyond these extremes. Temperature adjustments are made at the factory and no trouble should be encountered from this source. After the temperature adjustment has been made, the balance screws should not be shifted from one screw hole to another, otherwise the adjustment will be destroyed. If the position of the screws is not changed the temperature adjustment is not disturbed very much by truing and poising the balance. In case the hairspring must be changed the new hairspring must have the same characteristics as the old, otherwise the watch will not compensate.

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 114
7-8-31-3M 1000-4-25-38
2000-7-25-33 1000-9-27-39
1000-5-26-37

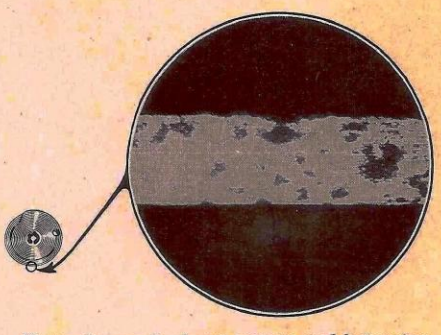
SUBJECT: The Effect of Rust on Hairsprings

A rusty hairspring is detrimental to the time keeping quality of a watch. A certain sign of a rusty hairspring is when the watch continually runs slower and slower. A watch having a minute spot of rust on the hairspring may be adjusted perfectly without any disturbance of the adjustment becoming immediately apparent, but after a period of time the rust begins to spread into the pores and weakens the structure of the steel, the resiliency of the spring decreases and the watch runs slow. Should the rust spots be on the overcoil of the hairspring between the regulator and the stud the effects of the rust will be noticed sooner than when on other portions of the spring, but no matter where the rust is found it will cause trouble.

Very little can be done to check the spread of rust and it is the wise repairman who will always fit a new hairspring when rust is found on any part of the hairspring.

Rusty hairsprings are generally caused by moisture condensing on the hairspring forming iron oxide. It is especially noticeable in localities subject to very humid weather conditions. It is also caused by acid fumes seeping into the movement, should the person wearing the watch be in a locality subject to acid fumes. Many rusty hairsprings on wrist watches are caused by vapors from perspiration seeping through the back of the case and settling on the delicate steel hairspring.

To avoid any possible chance of rust, every precaution is employed in the Hamilton factory. Throughout the hundreds of operations involved in manufacturing watches, the hairspring is not touched by the workers' hands. Tweezers and calipers are used exclusively. When watches are tested for compensation in hot and cold cabinets, special moisture-proof containers are used to prevent condensation of moisture on the movement. Inspectors are trained to detect a small spot of rust on a hairspring and when found a new hairspring is always fitted.



Photomicrograph of rust spot on steel hairspring enlarged 75 diameters

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Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
TD 116

3000-9-12-31 500-5-26-37
1000-5-25-35 1000-4-14-39
1000-6-15-36

SUBJECT:

WATCH SIZES

BASED ON THE DIAMETER OF AN 0 SIZE PILLAR PLATE = $\frac{35}{30}$ INCHES
SIZE NO.=NUMBER OF THIRTIETHS OF AN INCH IN EXCESS OF $\frac{35}{30}$ INCHES
$\frac{1}{30}$ IN.=1 SIZE = .8466 M.M. = .3753 FRENCH LIGNES = $\frac{144}{384}$ FRENCH LIGNES (APPROX.)
1 FRENCH LIGNE = 2.2559 M.M. 1 INCH = 25.40005 M.M.

SIZE		DIAMETER OF PILLAR PLATE				SIZE		DIAMETER OF PILLAR PLATE			
AMERICAN	SWISS	FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLI-METERS	FRENCH LIGNES	AMERICAN	SWISS	FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLI-METERS	FRENCH LIGNES
36	36	2 $\frac{11}{30}$	2.367	60.10	26 $\frac{237}{384}$	0	0	1 $\frac{5}{30}$	1.167	29.63	13 $\frac{52}{384}$
35	35	2 $\frac{10}{30}$	2.333	59.26	26 $\frac{94}{384}$	00	-1	1 $\frac{4}{30}$	1.133	28.79	12 $\frac{293}{384}$
34	34	2 $\frac{9}{30}$	2.300	58.41	25 $\frac{334}{384}$	000	-2	1 $\frac{3}{30}$	1.100	27.94	12 $\frac{149}{384}$
33	33	2 $\frac{8}{30}$	2.267	57.57	25 $\frac{190}{384}$	4/0	-3	1 $\frac{2}{30}$	1.067	27.09	12 $\frac{5}{384}$
32	32	2 $\frac{7}{30}$	2.233	56.73	25 $\frac{46}{384}$	5/0	-4	1 $\frac{1}{30}$	1.033	26.25	11 $\frac{246}{384}$
31	31	2 $\frac{6}{30}$	2.200	55.88	24 $\frac{286}{384}$	6/0	-5	1	1.000	25.40	11 $\frac{102}{384}$
30	30	2 $\frac{5}{30}$	2.167	55.04	24 $\frac{143}{384}$	7/0	-6	$\frac{29}{30}$	.967	24.55	10 $\frac{343}{384}$
29	29	2 $\frac{4}{30}$	2.133	54.19	23 $\frac{383}{384}$	8/0	-7	$\frac{28}{30}$	.933	23.71	10 $\frac{199}{384}$
28	28	2 $\frac{3}{30}$	2.100	53.35	23 $\frac{239}{384}$	9/0	-8	$\frac{27}{30}$	.900	22.86	10 $\frac{56}{384}$
27	27	2 $\frac{2}{30}$	2.067	52.50	23 $\frac{95}{384}$	10/0	-9	$\frac{26}{30}$	.867	22.01	9 $\frac{296}{384}$
26	26	2 $\frac{1}{30}$	2.033	51.65	22 $\frac{336}{384}$	11/0	-10	$\frac{25}{30}$	.833	21.17	9 $\frac{152}{384}$
25	25	2	2.000	50.80	22 $\frac{192}{384}$	12/0	-11	$\frac{24}{30}$	.800	20.32	9 $\frac{8}{384}$
24	24	1 $\frac{29}{30}$	1.967	49.96	22 $\frac{48}{384}$	13/0	-12	$\frac{23}{30}$	.767	19.48	8 $\frac{249}{384}$
23	23	1 $\frac{28}{30}$	1.933	49.11	21 $\frac{288}{384}$	14/0	-13	$\frac{22}{30}$	.733	18.63	8 $\frac{106}{384}$
22	22	1 $\frac{27}{30}$	1.900	48.26	21 $\frac{144}{384}$	15/0	-14	$\frac{21}{30}$	.700	17.78	7 $\frac{341}{384}$
21	21	1 $\frac{26}{30}$	1.867	47.42	21 $\frac{1}{384}$	16/0	-15	$\frac{20}{30}$	.667	16.94	7 $\frac{193}{384}$
20	20	1 $\frac{25}{30}$	1.833	46.57	20 $\frac{241}{384}$	17/0	-16	$\frac{19}{30}$	.633	16.08	7 $\frac{49}{384}$
19	19	1 $\frac{24}{30}$	1.800	45.72	20 $\frac{97}{384}$	18/0	-17	$\frac{18}{30}$	.600	15.24	6 $\frac{290}{384}$
18	18	1 $\frac{23}{30}$	1.767	44.87	19 $\frac{337}{384}$	19/0	-18	$\frac{17}{30}$	.567	14.40	6 $\frac{147}{384}$
17	17	1 $\frac{22}{30}$	1.733	44.03	19 $\frac{193}{384}$	20/0	-19	$\frac{16}{30}$	.533	13.54	6 $\frac{2}{384}$
16	16	1 $\frac{21}{30}$	1.700	43.18	19 $\frac{50}{384}$	21/0	-20	$\frac{15}{30}$	.500	12.70	5 $\frac{242}{384}$
15	15	1 $\frac{20}{30}$	1.667	42.33	18 $\frac{290}{384}$	22/0	-21	$\frac{14}{30}$	.467	11.86	5 $\frac{98}{384}$
14	14	1 $\frac{19}{30}$	1.633	41.49	18 $\frac{146}{384}$	23/0	-22	$\frac{13}{30}$	.433	11.00	4 $\frac{338}{384}$
13	13	1 $\frac{18}{30}$	1.600	40.64	18 $\frac{2}{384}$	24/0	-23	$\frac{12}{30}$	.400	10.16	4 $\frac{192}{384}$
12	12	1 $\frac{17}{30}$	1.567	39.79	17 $\frac{242}{384}$	25/0	-24	$\frac{11}{30}$	.367	9.32	4 $\frac{48}{384}$
11	11	1 $\frac{16}{30}$	1.533	38.95	17 $\frac{99}{384}$	26/0	-25	$\frac{10}{30}$	.333	8.46	3 $\frac{299}{384}$
10	10	1 $\frac{15}{30}$	1.500	38.10	16 $\frac{339}{384}$	27/0	-26	$\frac{9}{30}$	.300	7.62	3 $\frac{145}{384}$
9	9	1 $\frac{14}{30}$	1.467	37.25	16 $\frac{195}{384}$	28/0	-27	$\frac{8}{30}$	.267	6.78	3 $\frac{1}{384}$
8	8	1 $\frac{13}{30}$	1.433	36.41	16 $\frac{51}{384}$	29/0	-28	$\frac{7}{30}$	.233	5.92	2 $\frac{240}{384}$
7	7	1 $\frac{12}{30}$	1.400	35.56	15 $\frac{292}{384}$	30/0	-29	$\frac{6}{30}$	.200	5.08	2 $\frac{97}{384}$
6	6	1 $\frac{11}{30}$	1.367	34.71	15 $\frac{147}{384}$	31/0	-30	$\frac{5}{30}$	.167	4.24	1 $\frac{336}{384}$
5	5	1 $\frac{10}{30}$	1.333	33.87	15 $\frac{3}{384}$	32/0	-31	$\frac{4}{30}$	.133	3.38	1 $\frac{191}{384}$
4	4	1 $\frac{9}{30}$	1.300	33.02	14 $\frac{243}{384}$	33/0	-32	$\frac{3}{30}$	.100	2.54	1 $\frac{48}{384}$
3	3	1 $\frac{8}{30}$	1.267	32.17	14 $\frac{99}{384}$	34/0	-33	$\frac{2}{30}$	.067	1.702	$\frac{289}{384}$
2	2	1 $\frac{7}{30}$	1.233	31.33	13 $\frac{340}{384}$	35/0	-34	$\frac{1}{30}$	.033	.846	$\frac{144}{384}$
1	1	1 $\frac{6}{30}$	1.200	30.48	13 $\frac{196}{384}$	36/0	-35	0	.0	.000	0
0	0	1 $\frac{5}{30}$	1.167	29.63	13 $\frac{52}{384}$						

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Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

INDEX
T. D. 117
1000-6-15-36 1000-9-4-40
500-7-23-37 1500-8-1-41
1000-4-25-38 300-5-21-46
1000-9-27-39

SUBJECT:

Service and Repair Hints for 21/0 995, 995A and 721 Watches

CASES: The cases selected for the 21/OS — 995 movement are of two-piece construction. The movement is held friction tight in the cup or bottom part, and the bezel or crystal part snaps friction tight over the cup. This type construction gives minimum chance for dirt and moisture to get into the movement.

TO REMOVE MOVEMENT FROM CASE

Always keep in mind that the balance is at the end under the numeral "12."

Fig. 1

Remove bezel by inserting case knife between lug on cup and ribbon supports. A slight twisting motion will loosen the bezel. (See Fig. No. 1.)

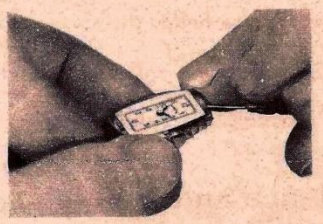


Fig. 2

Insert the blade of a small screw driver between the case seat of movement and top of case cup at the balance end first. (See Fig. No. 2.)

Fig. 3

Twist the screw driver and raise the movement slightly at that end first, then with the screw driver raise the other end. (See Fig. No. 3.) (Use your eyeglass when inserting and twisting screw driver.)

Fig. 4

Pull the stem into setting. Grasp the cup in the left hand and the stem with the right hand, as illustrated in Fig. No. 4. If both ends have been raised by the screw driver, it should be easy to lift the movement from the case.

CAUTION: *Care should be exercised in raising the movement so that the screw driver blade does not slip and break the balance staff.*

30-346

To Replace Movement in Case

Pull stem into setting so that the crown will clear the case as much as possible. Hold the movement by the stem and proceed to insert movement in the cup. The balance is very close to the edge of one end of the movement under the "12," therefore insert this end of the movement first as in Figure 4 then snap the other end down on the case seat. If it does not snap into place with reasonable pressure, do not force it but examine all around the movement seat and be sure the dial foot screws are below the surface of pillar plate. By following these directions there is no danger of breaking the balance staff.

Balance and Hairspring

The 995 watches are equipped with an ELINVAR* hairspring and a mono-metallic balance (See Technical Bulletin No. 115 for further details of ELINVAR hairspring and mono-metallic balance construction). There is a distinct advantage in using the combination of Elinvar hairspring and mono-metallic balance in extremely small watches. No truing is necessary for the repairman and the poise remains undisturbed. The Phillip style of Breguet overcoil has been used and watch repairmen will find it less difficult to center and circle the hairspring with this style of overcoil.

To Clean and Reoil

Most of your repair and service work on this 995 watch will be cleaning and reoiling. You will find that this watch has been constructed so that it is easy to disassemble and reassemble. We recommend that this small size watch should be cleaned and reoiled every eight to ten months. Often when the watch has been constantly running, cleaning and reoiling will only be necessary every year, but if the watch has been idle and the balance not moving for any length of time, it must be cleaned and reoiled every six to eight months to get the maximum timekeeping efficiency of such a small watch.

The method of cleaning and reoiling should be similar to that explained in T. D. No. 106. BE EXTRA CAREFUL IN WASHING THE BALANCE AND HAIRSPRING BECAUSE IT IS THE MOST DELICATE PART OF THE MECHANISM. It should not be necessary to remove the hairspring from the balance when cleaning unless the pivots or some other part of this assembly have been damaged.

You will very seldom be called upon to fit a new hairspring since it is ELINVAR and will not rust under normal conditions. Be careful in handling the hairspring and if it is not damaged you should have little trouble with the balance assembly.

We recommend that a good grade of watch oil be used to oil the 995 watches.

* TRADE MARK "ELINVAR" REG. U. S. PAT. OFF.

Exclusive licensee under U. S. "Elinvar" Patents No. 1,313,291 dated August 19th, 1919 and No. 1,454,473 dated May 8th, 1923.

To Repair and Replace Broken Balance Staff

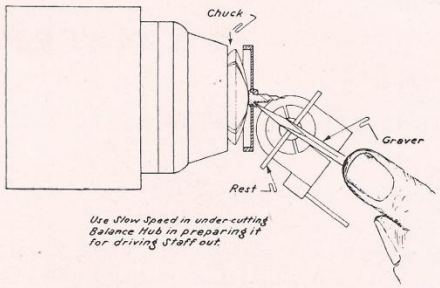


Fig. 5

First, remove hairspring and rollers as explained in T. D. No. 107, then hold the balance staff in your lathe by chucking it on the collet end. With a sharp graver cut off the balance seat (See Fig. No. 5) and then drive the staff out from the roller end (See Fig. No. 6). *NEVER ATTEMPT TO DRIVE THE STAFF OUT OF THE BALANCE WITHOUT CUTTING OFF THE BALANCE SHOULDER OR YOU WILL RUIN THE BALANCE.*

The new staff can be staked in the balance the same as in large watches, but always remember you are working on small delicate parts and use the utmost care characteristic of a good watchmaker.

To Regulate and Time 995 Watches

When the regulator pins and the hairspring overcoil are properly adjusted the 995 watches can be timed by moving the regulator on the balance cock. Each division on the index is equal to a change in time of approximately 60 seconds per 24 hours.

The watches are brought to time at the factory by changing the balance screws. Very delicate and expensive scales are used to weigh the balance screws. We realize that it is practically impossible for every repair shop to be equipped with these expensive balance screw scales, therefore, we have made " balance screw timing washers " which are available from our Material Sales Department. In ordering timing washers for the 21/OS—995 watch specify by " Timing Washer Number."

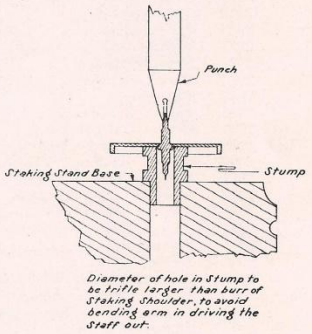


Fig. 6

Timing Washers for 21-0 995 Watches

Number	*Timing Data*
1	1 pair = 3½ sec. per hr. or 95 sec. in 24 hours
2	1 pair = 5½ sec. per hr. or 135 sec. in 24 hours
3	1 pair = 6½ sec. per hr. or 155 sec. in 24 hours
4	1 pair = 9 sec. per hr. or 221 sec. in 24 hours

NOTE: — Washers should be placed exactly opposite each other so that poise is undisturbed. Use only one washer under each screw.

List of Hamilton Watch Material for 21/0 Size No. 995 and No. 995A

Material for 21/0 Size Grade 995

Cat. No.	Parts
2911	Arbor, Barrel
2934	Arbor, Pallet
2953	Balance, with gold screws
2954	Balance, with gold screws and staff fitted
2955	Balance, with gold screws, staff, hairspring and rollers complete
2905	Barrel
2906	Barrel, with arbor fitted
2919	Click
2915	Clutch
2935	Dial, Silver, Grain finish, Inlaid enamel numerals
2923	Hands, Moderne, Hour and minute
2977	Jewels, Balance hole, upper, Sapphire, Gilt setting
2978	Jewels, Balance hole, lower, Sapphire, Gilt setting
2979	Jewels, Balance endstone, upper, Sapphire, Gold setting, Steel cap
2980	Jewels, Balance endstone, lower, Sapphire, Gilt setting
2967	Jewels, Centre, upper, Ruby, Gold setting, Friction
2968	Jewels, Centre, lower, Sapphire, Gilt setting, Friction
2969	Jewels, Third, upper, Ruby, Gold setting, Friction
2970	Jewels, Third, lower, Ruby, Gilt setting, Friction
2971	Jewels, Fourth, upper, Ruby, Gold setting, Friction
2972	Jewels, Fourth, lower, Ruby, Gilt setting, Friction
2973	Jewels, Escape, upper, Ruby, Gold setting, Friction
2974	Jewels, Escape, lower, Ruby, Gilt setting, Friction
2975	Jewels, Pallet, upper, Ruby, Gold setting, Friction
2976	Jewels, Pallet, lower, Ruby, Gilt setting, Friction
2983	Jewels, Roller or Jewel pin, Ruby
2981	Jewels, Pallet stone, Receiving, Sapphire
2982	Jewels, Pallet stone, Discharging, Sapphire
2922	Lever, Setting
2918	Lever, Clutch
2921	Mainspring
2929	Pinion, Cannon
2914	Pinion, Winding
2958	Regulator
2963	Roller, Combination, complete with pin
2984	Screws, Balance, Gold
2992	Screws, Balance upper endstone cap
2990	Screws, Banking
2987	Screws, Barrel and train bridge
2994	Screws, Pallet bridge
2996	Screws, Setting cap spring
2995	Screws, Hairspring stud
2986	Screws, Balance cock
2988	Screws, Click
2998	Screws, Winding Wheel hub
2997	Screws, Ratchet wheel
2993	Screws, Balance lower jewel
2991	Screws, Dial foot
2900	Screws, Setting lever
2989	Screws, Clutch lever spring
2920	Spring, Click
2925	Spring, Clutch lever
2940	Spring, Setting cap
2961	Spring, Hair, Breguet, Elinvar, Colleted and studded
2927	Staff, Balance, S. R. Type
2926	Stem, Winding

Material for 21/0 Size Grade 995A

Cat. No.	Parts
5010	Hub—winding wheel
2977A	Jewels—balance hole, upper, and lower sapphire, gilt setting, friction
2979A	Jewels—balance endstone, upper, sapphire, steel cap
2980A	Jewels—balance endstone, lower, sapphire, nickel cap
2929A	Pinion—cannon
2958A	Regulator
2998A	Screws—winding wheel hub
5096	Screws—balance lower jewel
2989A	Screws—clutch lever spring
2961A	Spring—hair, breguet
2928A	Staff—center and pinion
2966A	Stud—hairspring
2945A	Wheel—center, staff and pinion, flat arm, gilt
2946A	Wheel—center, complete, flat arm, gilt
2941A	Wheel—hour
2908A	Wheel—winding
2907A	Wheel—ratchet

Notation: — All other parts for 995A movement are the same as fitted in the regular 995 movement.

Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

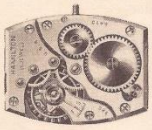
INDEX
T. D. 119
15000-4/1/35 1000-5-26-37
1000-6/13/35 1000-4-14-39

SUBJECT:

Grades 980 and 982 - 14/0 Size Watches
Construction Features and Service Information

The introduction of Hamilton Watch Grades 980 and 982 opens a new era of small watch engineering. Modern styling demanded a thin movement and in order to secure this, new engineering principles were used so the finished product would perform accurately and could be easily repaired. The clearance between moving parts is much greater than will be found in other thin watches — a feature achieved by thinning down the parts themselves to the minimum compatible with safe and efficient operation. An examination of the movement will also reveal that the moving parts—particularly the balance wheel—are extremely large for such a small movement.

GRADE 980

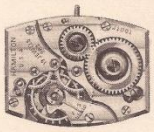


Nickel plates and bridges, hard, untarnishable precious metal plated with soft line finish, extra heavy pillar plate, parts interchangeable, escapement engineered to deliver equal and maximum power, and to give the greatest possible safety action, the latest and most scientific method of improved friction jeweling which provides positive interchangeability, 17 ruby and sapphire jewels, Elinvar hairspring and monometallic balance wheel.

FLAT  DIAL

The illustration above shows the 980 movement with the flat dial in position. Special attention was paid to the manufacture of a precision fitting dial — engineered and made in the Hamilton factory.

GRADE 982



Nickel plates and bridges, hard untarnishable precious metal plated, extra heavy pillar plate, finely damaskeened, interchangeable parts, scientifically designed escapement which delivers equal and maximum power and gives greatest possible safety action, improved friction jeweling, 19 ruby and sapphire jewels, Elinvar hairspring and monometallic balance wheel. Built in temperature adjustments.

CURVED  DIAL

Here is the new one-piece curved dial especially developed for this watch. Note how snugly the underside parallels the pillar plate — a feature which automatically aligns the dial with the bezel opening. The dial feet are not separate units: they are a part of the dial itself.

(Illustrations Above Are Actual Size)

●

SPECIAL NOTE: When ordering cannon pinions, hour wheels, or center staffs, note that more than one length is available — one for the flat dial and others for the curved dials. When ordering any of the above parts for the repair of Hamilton grades 980 or 982, be sure to specify name or style of case.

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INTERCHANGEABILITY

The word interchangeability has a true value for watchmakers working on the new 14/0 size Hamilton grades 980 and 982. With exception of the hairspring—which must, of course, be vibrated to the balance wheel—all parts including plates, bridges, jewels, and pinions, are perfectly interchangeable.

This has been made possible by the reduction of tolerances through the development of special die and tool equipment.

From the standpoint of the watchmaker, interchangeability means that these new watches will be easier to repair and that fewer adjustments need be made after it has been reassembled.

TRAIN AND BALANCE ASSEMBLY

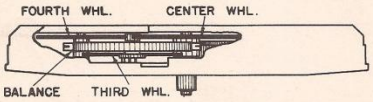


Figure 1

Profile sketch of Grade 980 train, illustrating relative position of the balance and train wheels.

The position of the balance wheel permits the use of a larger balance than is customary in a watch of this size and also makes it relatively simple to remove. The balance wheel swings between the third and fourth wheels — having a clearance of .006 inches.

When replacing a broken balance staff it is advisable to remove the old staff by under cutting the hub as shown in Fig. 2, and removing the staff as shown in Fig. 3. This prevents bending the arms up or down, or enlarging the hole in the balance. After restaking in the usual manner, the balance wheel will have the proper clearance between the third and four wheels.

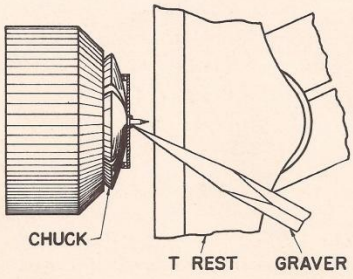


Figure 2

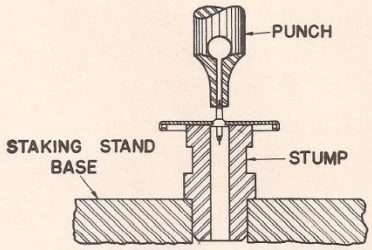


Figure 3

BALANCE & HAIRSPRING ASSEMBLY

One of the features of the grade 980 and 982 movement is the use of the Elinvar hairspring and monometallic balance wheel which eliminates the middle temperature error and reduces inaccuracies caused by magnetism, moisture, and extreme temperature changes.

There is a distinct advantage to the repairman in the use of this type of balance wheel assembly for after a balance staff has been replaced (if it has not been damaged in the process) no truing or poising of the balance wheel is necessary.

SPECIAL NOTE: We recommend turning off the lower shoulder of the balance staff as shown in Fig. 2, because the staking and "rolling-in" operations tend to work-harden the steel under the collet at the top—making it more difficult to turn.

IMPROVED FRICTION JEWELING

The Hamilton method of improved friction jeweling is one of the most important features of the 14/0 size Hamilton watch. Positive interchangeability is assured and the process of replacing damaged jewels materially simplified.

REMOVING TRAIN OR BALANCE JEWELS

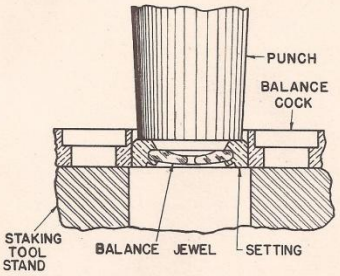


Figure 4

Broken train or balance jewels may be removed by driving out the entire setting as illustrated in Fig. 4, using a standard staking set with a flat face punch smaller in diameter than the setting to be removed.

REPLACING TRAIN JEWEL SETTINGS

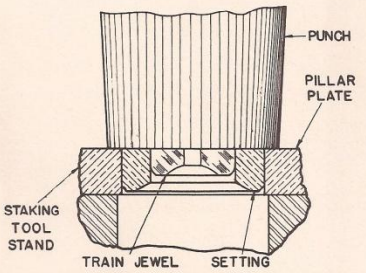


Figure 5

All train jewels with settings should be replaced by driving the setting into the plates or bridges from the inside as illustrated in Fig. 5. A flat face punch with a face diameter larger than the complete setting should be used first as illustrated. This will permit driving the face of the setting flush with the plate or bridge surface immediately surrounding the setting. The endshake should now be examined and if more endshake is required the face of the setting can be driven slightly below flush in the same manner as shown in Fig. 4, for removing the setting.

REPLACING BALANCE JEWELS

The balance upper and lower jewels should be driven in place from the *outside* using a flat face punch larger in diameter than the setting and driving the jewel and setting flush with the surrounding surface, as shown in Fig. 6. This establishes the hole jewel in its proper position so that the endstone will lay flush and parallel with the hole jewel.

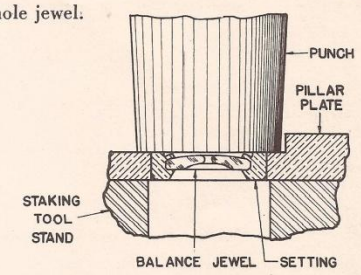


Figure 6

On the 14/0 size 980 or 982 Hamilton Watch, the balance upper and lower hole jewels are fitted friction tight in the pillar plate and balance cock. They can be removed and replaced as shown in Figs. 4 and 6.

When disassembling the watch for cleaning, remove the endstone cap only, the hole jewels will remain in their respective places and can be cleaned with the plates and bridges.

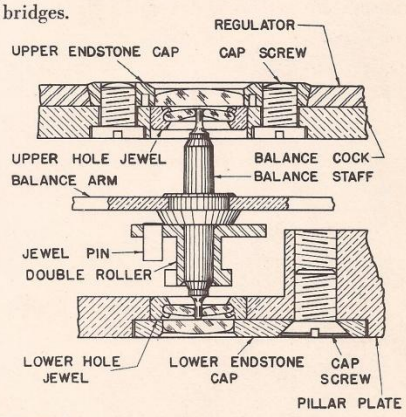


Figure 7

Cross section view of balance upper and lower hole jewels and endstones. Note the large, scientifically shaped endstones spaced to provide oil reservoir.

Hamilton Watch Materials

Covering New Movements

14/0 Size — Grades 980, 980A, 980B and 982

Grade 980 — 17 Jewels

Catalog No.	
5011	Arbor, Barrel
2934	Arbor, Pallet
5053	Balance, Gold Screws
5054	Balance and Staff, Gold Screws
5055	Balance Complete, Gold Screws
5005	Barrel
5006	Barrel and Arbor
5013	Cap, Setting Wheel
5019	Click
5015	Clutch
5065	Collet, Hairspring
5010	Hub, Winding Wheel
5077	Jewels, Balance Hole, Upper, Sapphire, Gilt Setting
5077	Jewels, Balance Hole, Lower, Sapphire, Gilt Setting
5079	Jewels, Balance Endstone, Upper, Sapphire, Steel Cap
5080	Jewels, Balance Endstone, Lower, Sapphire, Nickel Cap
5067	Jewels, Center, Upper, Ruby, Gold Setting
5068	Jewels, Center, Lower, Sapphire, Gilt Setting
5069	Jewels, Third, Upper, Ruby, Gold Setting
5070	Jewels, Third, Lower, Ruby, Gilt Setting
5069	Jewels, Fourth, Upper, Ruby, Gold Setting
5072	Jewels, Fourth, Lower, Ruby, Gilt Setting
5073	Jewels, Escape, Upper, Ruby, Gold Setting
5074	Jewels, Escape, Lower, Ruby, Gilt Setting
5075	Jewels, Pallet, Upper, Ruby, Gold Setting
5076	Jewels, Pallet, Lower, Ruby, Gilt Setting
2983	Jewels, Roller or Jewel Pin, Ruby
5081	Jewels, Pallet Stone, Receiving, Sapphire
5082	Jewels, Pallet Stone, Discharging, Sapphire
5022	Lever, Setting
5018	Lever, Clutch
5021	Mainspring, Str. 11
5056	Pallet and Fork
5057	Pallet, Fork and Arbor
5029	Pinion, Cannon
5033	Pinion, Escape, Straight Pivots
5032	Pinion, Fourth
5031	Pinion, Third
5014	Pinion, Winding
5058	Regulator
2963	Roller, Combination, Complete
5084	Screws, Balance, Gold
5092	Screws, Balance Upper Endstone Cap
2990	Screws, Banking
5087	Screws, Barrel and Train Bridge
5094	Screws, Pallet Bridge
5096	Screws, Setting Wheel Cap
5095	Screws, Hairspring Stud
5086	Screws, Balance Cock
5088	Screws, Click
5098	Screws, Winding Wheel Hub
5097	Screws, Ratchet Wheel
5096	Screws, Balance Lower Jewel
5091	Screws, Dial Foot
5000	Screws, Setting Lever
5096	Screws, Setting Lever Spring
2320	Spring, Click
5025	Spring, Clutch Lever
5040	Spring, Setting Lever
5061	Spring, Hair, Breguet
5027	Staff, Balance, S. R. Type
5028	Staff, Center and Pinion
5026	Stem, Winding
5066	Stud, Hairspring
5044	Wheel, Center, Flat Arm, Gilt
5045	Wheel, Center, Staff and Pinion, Flat Arm, Gilt
5046	Wheel, Center, Complete, Flat Arm, Gilt
5047	Wheel, Third, Flat Arm, Gilt
5048	Wheel, Third and Pinion, Flat Arm, Gilt
5049	Wheel, Fourth, Flat Arm, Gilt
5050	Wheel, Fourth and Pinion, Flat Arm, Gilt
5051	Wheel, Escape, Steel
5052	Wheel, Escape and Pinion, Steel
5041	Wheel, Hour
5042	Wheel, Minute
5016	Wheel, Intermediate
5008	Wheel, Winding
5007	Wheel, Ratchet

Grade 980A — 17 Jewels

5029B	Pinion, Cannon and Wheel
5028B	Pinion, Center and Staff
2529A	Pinion, Minute Hand
5034	Post, Auxiliary Minute
5062	Post, Main Hand
2996	Screw, Minute Wheel Spring
5012	Spring, Minute Wheel
5063	Washer, Hour Wheel
5045B	Wheel, Center and Pinion
2541A	Wheel, Hour
5042A	Wheel, Minute
	All other parts same as Grade 980

Grade 980B — 17 Jewels

5009	Pinion, Cannon, Complete
5028B	Pinion, Center and Staff
2529A	Pinion, Minute Hand
5064	Post, Main Hand
5063	Washer, Hour Wheel
5045B	Wheel, Center and Pinion
5090	Wheel, Hour Complete
5043	Wheel, Auxiliary Minute
5035	Wheel, Minute Hand
	All other parts same as Grade 980

Grade 982 — 19 Jewels

5036	Cap, Escape Upper Endstone
5080	Cap, Escape Lower Endstone
5038	Screws, Escape Upper and Lower Cap
5052A	Wheel, Escape Complete
5033A	Pinion, Escape
5007A	Wheel, Ratchet
5008A	Wheel, Winding
5037	Jewel, Escape Upper Hole
5039	Jewel, Escape Lower Hole
	All other parts same as Grade 980

See Retail Material Price List for Prices

Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

INDEX
TD 120

15,000 9-15-36 1000-4-25-38
1000-5-26-37 1000-9-27-39

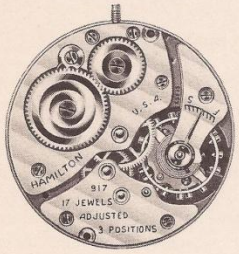
SUBJECT:

Grades 917 and 921 Pocket Watches
Construction Features and Service Information

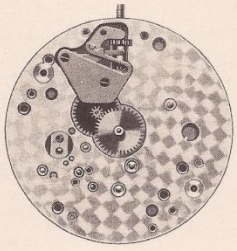
The new Grades 917 and 921 Hamilton Pocket Watches are a distinct advance in fine watch construction. They are the result of the most modern developments of our Research Laboratory, combined with sound engineering fundamentals which have been proven by our many years experience in the exclusive manufacture of fine watches. An examination of these movements will reveal that they are of exceptionally sturdy construction throughout. The pillar plate and bridges are unusually rigid, yet nowhere have clearances or accessibility been sacrificed.

True interchangeability of parts, an exclusive Hamilton feature, is provided throughout, except, of course, in the case of the hairspring.

The Grade 917 movement is the first in its price class to be adjusted to three positions. This has been made possible by the special die and tool equipment and the precision methods used at the Hamilton factory.



Grade 917



Dial Side, 917

Grade 921

(Illustrations are actual size)

GRADE 917

Plates and bridges made of nickel, attractively damaskeened, and plated to afford maximum protection against tarnish and scratches—interchangeable parts—the latest improved friction jeweling—dependable, simplified stemwork—Elinvar hairspring and monometallic balance with built in temperature adjustments—17 ruby and sapphire jewels—adjusted to 3 positions.

GRADE 921

Plates and bridges made of nickel, attractively damaskeened, and plated to afford maximum protection against tarnish and scratches—interchangeable parts—improved friction jeweling—dependable, simplified stemwork—Elinvar hairspring and monometallic balance with built in temperature adjustments—highly efficient jeweled motor barrel unit—21 ruby and sapphire jewels—adjusted to 5 positions.

18-346

STEMWORK

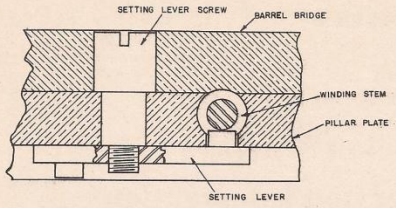


Figure 1

The improved stemwork in these movements is very simple and dependable. All parts have been designed very ruggedly to withstand abuse, assure security and function smoothly.

The setting lever screw is blued to distinguish it from the bridge screws. It should also be noted that this screw has no collar to retain the screw under the barrel bridge. (See figure 1.) After loosening the screw it is necessary to maintain a slight pressure with the screw driver in order to disengage the setting lever pin from the winding stem to permit removal of the stem. The purpose of this arrangement is to avoid the possibility of forcing the setting lever against the dial.

BALANCE AND HAIRSPRING ASSEMBLY

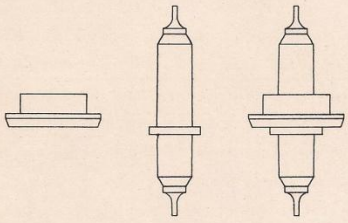


Figure 2

These movements are equipped with the exclusive Elinvar hairspring and solid monometallic balance unit, which minimizes the effects of magnetism, moisture and temperature changes.

The balance staff is of two piece construction (figure 2), providing the most convenient method possible for replacing broken staffs, and always insuring satisfactory repair work. By properly supporting the balance wheel hub on a staking tool the staff can be driven out directly. When driving in a new staff the balance should be placed on a staking stand as shown in figure 3, making sure the hole in the stump is smaller than diameter of hub thus avoiding distortion of balance arm. The collar on the staff is used as a driving shoulder, and the punch used should fit the staff very closely so that the pressure of the punch will be uniform all around the collar.

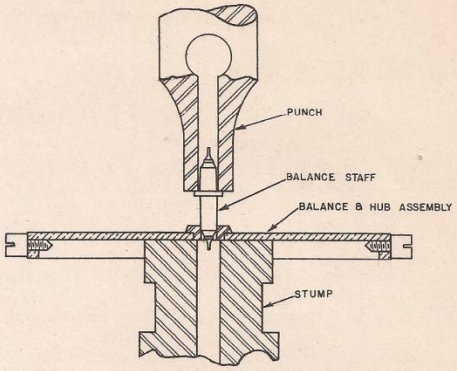


Figure 3

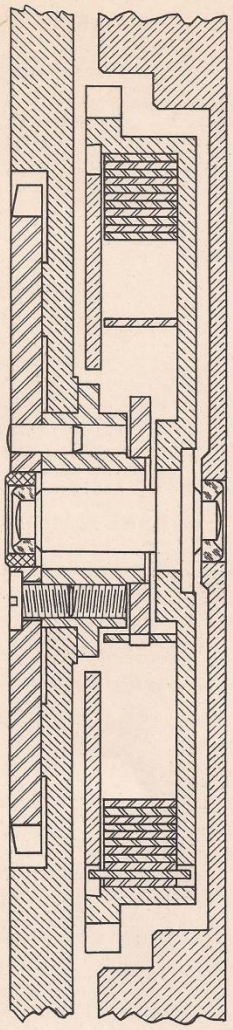
MOTOR BARREL UNIT

A new type of jeweled motor barrel unit has been incorporated in the design of the grade 921 movement. The assembly and component parts are illustrated in figures 4 and 5 respectively. The floating mainspring hook (H) permits greater freedom and self adjustment of the mainspring in the barrel, resulting in a very smooth transfer of power to the train.

In dismantling this unit it is preferable to first remove the ratchet wheel screws and ratchet wheel and then take off the barrel bridge.

The procedure in assembling is as follows:

1. Wind the mainspring in the barrel, oil and snap on the cap.
2. Insert the floating mainspring hook (H) so that it engages the inner terminal of the mainspring.
3. Insert the square of the ratchet wheel arbor (E) into the mainspring hook and lubricate the ratchet wheel arbor.
4. Place this assembly on the pillar plate, along with the center wheel, and assemble the barrel bridge.
5. Lubricate the ratchet wheel seat on the barrel bridge, and fit on the ratchet wheel. This is done by lining up the wheel on the two dowel pins. Then, maintaining a slight pressure on the ratchet with the left index finger, move the barrel so that the arbor pivot enters the jewel hole. (It is well to protect the ratchet wheel with chamois or soft cloth.)



Motor Barrel Assembly

Figure 4

The barrel upper jewel and setting are friction driven into the ratchet wheel. This, combined with the dowel pin arrangement for locating the ratchet on the ratchet wheel arbor, always insures a perfect upright between the upper and lower jewels.

The barrel arbor is staked permanently to the barrel.

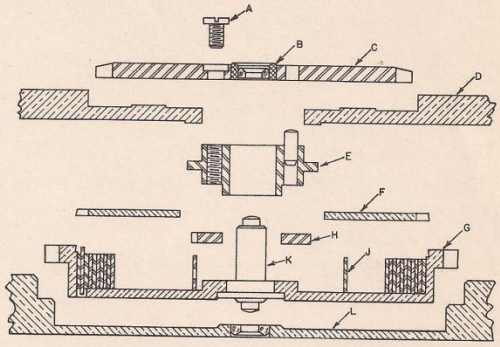


Figure 5

A—Ratchet Wheel Screw	F—Barrel Cap
B—Barrel Upper Jewel and Setting	G—Barrel
C—Ratchet Wheel	H—Mainspring Hook
D—Barrel Bridge	J—Mainspring
E—Ratchet Wheel Arbor	K—Barrel Arbor
	L—Pillar Plate

FRICTION JEWELING

The Hamilton method of improved friction jeweling is another important feature of these movements. Replacement of broken jewels is simple and quickly done. When dismantling the watch for cleaning it is only necessary to remove the endstone caps, the hole jewels being left undisturbed in the plate and bridge.

For detailed information regarding Friction Jeweling see Hamilton Technical Data Bulletins T. D. No. 102 and 119.

These movements are timed and tested on the Time-Microscope* to guarantee accurate and dependable timekeeping.

*"Time-Microscope" Reg. U.S. Pat. Off.

Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

INDEX
T D 123
15,000-7-29-38
1000 Revised 2-1-40

SUBJECT: GRADE 911 22/0 SIZE MOVEMENT

CONSTRUCTION FEATURES AND SERVICE INFORMATION

"America's Most Accurate Small Watch" is the creditable expression chosen by watch experts, everywhere, to describe Hamilton's Grade 911. This movement has been especially recognized because of its contribution of several important technical innovations. And its precision performance combined with desirable small size and a cushion shape which permits greater variety of case styling have earned equal wide acclaim from thousands of satisfied wearers. To examine a Grade 911 movement, first remove the bezel. Then *be sure to note the small slot in the cup between numeral six (6) and seven (7)* — as shown in Figure 1. This slot is provided for removing the movement from the cup. Due to the unusual position of the balance wheel in this movement serious damage may result if the watch-maker attempts to separate movement from the cup in the customary manner. Although the balance wheel is well protected by the shape of the pillar plate it is advisable to exercise extreme care in this operation.

FIGURE 1

GENERAL SPECIFICATIONS (Figure 2)

Plates and bridges of Grade 911 are of nickel silver with soft line finish, rhodium plated to provide a hard untarnishable surface. There are 17 ruby jewels. Except for the hairspring, true *interchangeability* of parts is provided throughout the movement. The stem work is simple, sturdy, and dependable. The Elinvar hairspring is vibrated to a harder, more durable monometallic AURIUM balance wheel. A unique method of utilizing the space in the movement permits the use of a large improved escapement. The winding wheel is supported accurately and rigidly by a large sturdy hub.

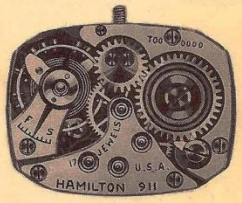


FIGURE 2

Enlarged view (three times actual size) of 911 movement

FRICTION JEWELING

Hamilton Grade 911 employs the most modern system of friction jeweling. The specially large hole jewels are inserted directly into the plates and bridges — a feature which permits the use of larger stronger jewels. Only highest quality friction jewels are used to insure accuracy and concentricity.

When replacing bar jewels it is recommended that the old jewels be removed by driving from the outside as illustrated in Figure 3.

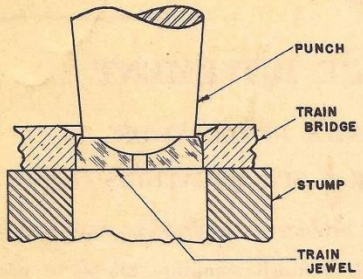


FIGURE 3

The new jewel should be inserted from the underside as illustrated in Figure 4.

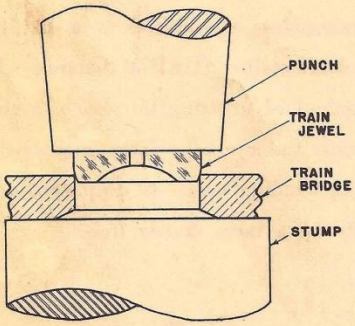


FIGURE 4

Balance olive hole jewels should be driven out from the underside (figure 5)

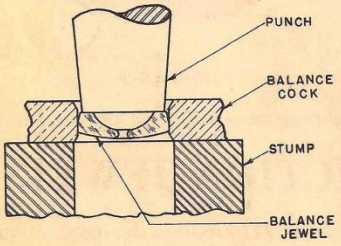


FIGURE 5

and replaced from the top side as shown in Figure 6, using a flat punch with a hole in the center slightly larger than the size of the hole in the jewel. Careful

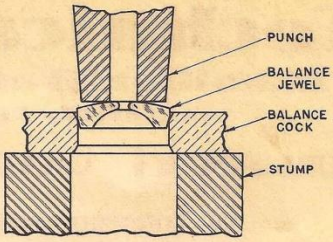


FIGURE 6

measurements should be made so that the jewel is .02 mm. below flush with the balance endstone cap seat. See Figure 7.

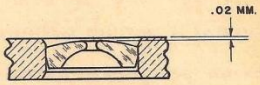


FIGURE 7

If these instructions are followed, and genuine Hamilton material used, it will seldom if ever be found necessary to ream or modify the hole in any way. In doing this work, a standard staking set or any of the special friction jeweling tools on the market can be used. In all cases where the finished side of the bridge is in contact with the stump as in Figures 4 and 5, be sure to use a stump having a highly polished flat surface so as not to damage the finish.

MAINSPRINGS

For repair jobs where only the changing of a mainspring is required, it is not necessary to disturb the train bridge. Simply remove the ratchet wheel and barrel bridge, and the barrel will lift out without any difficulty.

CANNON PINION

The cannon pinion used in this movement is of the closed end type (blind hole). Be sure when cleaning and reassembling the movement that this hole is perfectly clean.

BALANCE STAFF

When removing a broken balance staff from a balance wheel it is advisable to turn off the seat of the hub before driving out the staff. This procedure is described in Hamilton Technical Data Bulletins 117 and 119.

17-346

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

SUBJECT: REGULATION

Watch regulation comprises three subjects — Timing, Rating and Regulation. Timing is the bringing to time of a watch after it has been repaired. Rating is the observation and comparison of the variation of the daily rate of a watch after adjusting it or while it is on the watch rack. Regulation for the most part refers to adjustment of a watch to fit a watch owner's routine habits.

TIMING

After cleaning, repairing and general order work is completed, a watch may show a gain or loss in timing because of one or more of the following conditions:

(a) Varying balance vibrations caused in truing the balance rims. Hamilton balances are solid monometallic parts which once trued remain true unless mishandled during the process of repairing a watch. This is made possible through the use of Elinvar hairsprings.

(b) Varying balance vibrations resulting because the balance wheel was made heavier or lighter during poising. The solid Hamilton monometallic balances, used with Elinvar hairsprings, seldom need repoising. This allows easier timing after repairs.

(c) The effective length of the hairspring may have been altered by opening or closing the regulator pins.

(d) The balance motion may have been increased or decreased through fitting a new balance staff or mainspring.

(e) Loss or gain may be shown as a result of fitting a new hairspring.

Such errors can usually be corrected by inserting Hamilton timing washers, or by moving the meantime screws in the balances equipped with them.

Hamilton watches, equipped with Elinvar hairsprings and monometallic balances, usually require nothing beyond routine regulation to bring them to time after repairing.

RATING

The rate of a watch is determined by the amount of time it gains or loses in a day. A perfect rate is one in which the gain or loss is exactly the same each day. A good rate is one in which the gain or loss is nearly the same each day. A poor rate is one in which the gain or loss varies from day to day; such as, gaining one day and losing the next.

The definition of good rate, however, varies with the size and quality of a watch. Chronometers, the standard navigation timepieces, are considered as nearly perfect in rate as it is possible to obtain in a portable timepiece. They are kept in one position always, with gimbal mountings. Even so, some of the best are allowed a variation of 3/5 of a second per day. The smaller a watch, the greater are the limits within which daily variation is considered a good rate. The variation allowed for a small lady's watch would be greater than that allowed for a man's wrist watch. In the same way, the variation allowed for a man's wrist watch would be greater than that allowed for a pocket watch.

Railroad watches are expected to keep time within 30 seconds per week. These, of course, are large high-grade position adjusted timepieces and as the size of the watch decreases, greater and greater limits must be allowed.

PERSONAL REGULATION

Various factors affect the performance of any watch. For this reason, regulation of a watch to its owner's routine is very necessary. As an instance, a man occupied at a desk has a routine and habits differing from those of a mechanic; or, a typist and her routine cannot be compared to a housewife. Individually, watches worn by these persons would be subjected to widely different conditions during a day's time. And a difference in watch performance would result. Some persons do not wear their watches regularly every day, and they allow them to lie in a flat position while not being worn. Others wind their watches at irregular intervals. Even changing a pocket watch from a trouser's pocket to a vest pocket may result in a variation of several seconds in its daily rate. In addition, small watches are greatly affected by changes in climatic or temperature conditions. Accurate timekeeping is considerably influenced by these things.

Thus, varying conditions under which a watch is required to perform, and over which there is no control,

explains why a new watch, or even a repaired watch may need more regulation than sometimes seems reasonable.

Most important to you, therefore, it is always advisable to explain to watch purchasers or repair clients, with utmost diplomacy, that a watch may gain or lose

When you sell or repair a watch, diplomatically explain the possibility of gain or loss in timing during the first few weeks it is carried.

time during the first few weeks they carry it. This will prepare and encourage customers to return their watches once a week for comparison and regulation, when necessary. Too, it will open an opportunity to make people "watch conscious"; making them realize that accurate performance in a watch is almost wholly dependent on the care it receives from them.

HAMILTON HAIRSPRINGS

All Hamilton watches are now made with Elinvar hairsprings. The complete line of men's and women's wrist, strap and pocket watches carry this exclusive Hamilton feature which protects them against many of the inaccuracies caused by moisture, magnetism, and extreme temperature changes.

When ordering hairsprings for Elinvar equipped watches, order by grade number. Weak, medium or strong springs are available for each grade. For closer timing, send the balance-wheel to the Hamilton Material Sales Dept. to have the hairspring vibrated. Following is a list of Hamilton models equipped with Elinvar hairsprings.

Size	*Grade*	*Size*	*Grade*
16	992E	14/0	980A
16	950E	14/0	980B
10	923	14/0	982
10	921	18/0	989E
10	917	20/0	997
6/0	987E	21/0	995
6/0	987A	21/0	995A
14/0	980	22/0	911

For old style bi-metallic balance watches, equipped with steel hairsprings, refer to the following chart when ordering new hairsprings:

HAMILTON HAIRSPRING CHART

When Ordering New Hairsprings for Hamilton Watches With Bi-Metallic Balances — Examine the Balance Screws — The Kind and Number of Screws Determine the Hairspring Number.

Size	Bi-Metallic Balance with Gold Screws				Bi-Metallic Balance with Brass Screws			
	12-Screws	14-Screws	16-Screws	18-Screws	12-Screws	14-Screws	16-Screws	18-Screws
18–16	3	4	5	6	0	1	2	3
12	5	6	7	8	1	2	3	4
6/0	Not Indicated by Strength Numbers							
18/0	Send Balance Wheel to Hamilton Material Sales Department to Have Hairspring Vibrated							

Use of Hamilton Hairspring Chart

For example, a hairspring is required for a 16 size 992 — 21 jewel Bi-Metallic Hamilton balance. Examination of the balance shows that it contains 14 regular gold screws and four gold meantime screws, a total of 18 screws. Observation of the chart indicates that hairspring No. 6 is the required strength for this balance. The order should read 16 size 992 hairspring No. 6.

REGULATION CHARTS

(1)

Effect of One Full Turn of Regulator Screw	
Size or Grade	Seconds per day
18 and 16	18 to 22
12	12 to 14
10 Grade—921 and 923	12 to 14

(2)

Effect of One Full Graduation of Index	
Size or Grade	Seconds per day
10 Grade—917	30 to 40
6/0 Old—fine Index	10 to 12
6/0 New—coarse index	35 to 45
14/0—Grades 980, 982, 980A, 980B	35 to 45
18/0—Grades 989 and 989E	40 to 50
20/0—Grade 997	50 to 60
21/0—Grades 995 and 995A	50 to 60
22/0—Grade 911	50 to 60

(3)

Effect of Meantime Screws		
Size	No. of Turns of Meantime Screws	Seconds per Hour
18–16	1 Full Turn on 4 Screws	6
18–16	½ Turn on 4 Screws	3
18–16	¼ Turn on 4 Screws	1.5
18–16	¼ Turn on 2 Screws	.75
12	1 Full Turn on 4 Screws	4
12	½ Turn on 4 Screws	2
12	¼ Turn on 4 Screws	1
12	¼ Turn on 2 Screws	.5
6/0	1 Full Turn on 4 Screws	10
6/0	½ Turn on 4 Screws	5
6/0	¼ Turn on 4 Screws	2.5
6/0	¼ Turn on 2 Screws	1.25
18/0	1 Full Turn on 4 Screws	10
18/0	½ Turn on 4 Screws	5
18/0	¼ Turn on 4 Screws	2.5
18/0	¼ Turn on 2 Screws	1.25

For watches which are not equipped with meantime screws, timing washers for Hamilton watches are available through the Hamilton Material Sales Department, or your watch material supply house.

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 125
2000-11-15-40
10M-2-8-41

SUBJECT: JEWEL PIN LOCATION

The adjoining illustrations show location of the jewel pin and hairspring stud on Hamilton balances. Jewel pins are located at right angles to the balance arm in all watches except the 6/0 size, grades 987F, 987E, 987A and the 14/0 size, grades 980, 980A, 980B and 982. The jewel pins in these grades are located as shown in figures 2 and 3 in order to make it possible to time them at the factory with the Hamilton "Time Microscope."

The location of the jewel pin in relation to the balance arm has nothing to do with timekeeping as long as balance unit is perfectly poised.

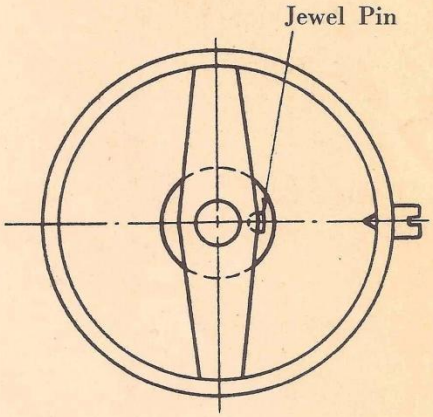
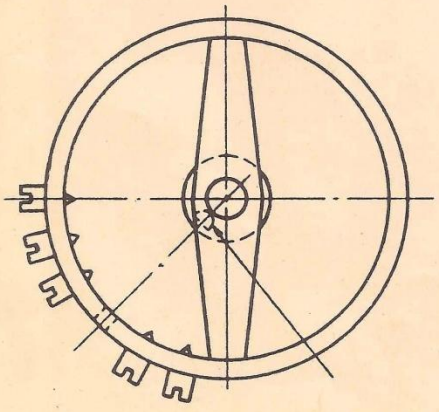


FIG. 1

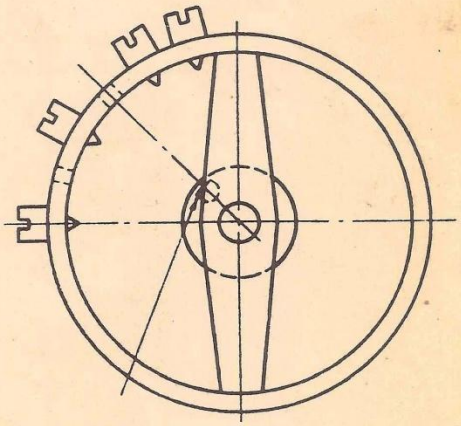
Showing a watch balance with jewel pin at right angles to balance arm.



Jewel Pin

FIG. 2

14/0 size, Grade 980 Watch Balance. Note that the jewel pin is not located at right angles to the balance arm.



Jewel Pin

FIG. 3

6/0 size, Grade 987A Watch Balance. Note that the jewel pin is not located at right angles to the balance arm.

23-346

1269

Technical Data

Hamilton Watch Company

LANCASTER, PENNSYLVANIA

INDEX
T D 126
16,000 1-8-40

SUBJECT: Grade 721 - 21/0 Size Watch

Hamilton Grade 721 is a complete new watch in the important 21/0 size. It has been designed to eliminate certain weaknesses common to all small watches, and the many basic innovations in its design and construction insure an extremely rugged movement which is capable of maintained accuracy.

Many of the technical developments and improvements — which assure smoother operation and greater ease of repair — are also incorporated in the recent Grade 911 Hamilton movement.

QUICK STARTING AND UNIFORM POWER are assured by improved escapement and newly designed center, third and fourth wheels; and third, fourth and escape pinions.

NEW TOP-GROOVED BALANCE STAFF and a balance wheel made of the harder new alloy Aurium for greater rigidity are features of the new 721 grade movement. They also permit rapid removal of staff and greatly reduce danger of damage to balance wheel hole.

BALANCE PIVOT AND JEWELS have been scientifically proportioned to reduce friction and insure better retention of oil. High quality ruby and sapphire olive hole jewels are used in the escapement and pallet upper and lower bearings, likewise for better oil retention and reduction of friction.

INTERCHANGEABILITY — Manufacturing tolerances have been closely held and all parts of the 721 movement are perfectly interchangeable with genuine Hamilton 721 grade material and parts listed on the reverse side of this sheet. Because of this and other design improvements this movement is particularly easy to repair.

FINISH — Plates and bridges are rhodium plated for protection against rust and tarnish; a new damaskeening pattern adds a final mark of beauty and quality.

SPECIAL NOTES

The center, third and fourth wheels; and the third, fourth and escape pinions are not interchangeable with those used in other grades. When ordering parts for this movement, consult attached material and parts list and be sure to specify Grade 721.

For instructions covering the removal and replacement of balance jewels, please refer to T. D. sheets Nos. 119 and 123.

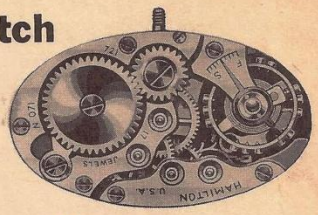


Photo enlarged 2½ times
FIG. 1
17 ruby and sapphire jewels. Elinvar hairspring, Aurium alloy (monometallic) balance wheel.

NEW HAMILTON TOP-GROOVED BALANCE STAFF*

While the correct and safest way to remove this staff is by turning off its seat as described in Hamilton TD sheet No. 119, with proper precaution it is possible to drive out this staff directly, without distorting the balance wheel hole.

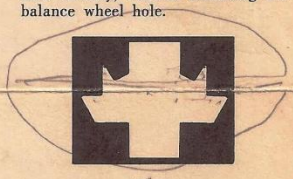


FIG. 2
Photo enlarged approx. 25 times
Cross section of a Grade 721 balance staff showing the "Top" groove for riveting the staff to the balance wheel.

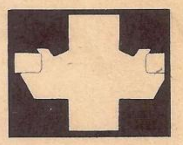


FIG. 3
Photo enlarged approx. 25 times
Cross section showing the staff riveted in the balance wheel. Note that the staff is held securely without distorting the metal of the balance wheel arm.

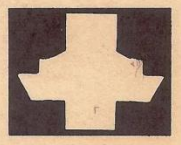


FIG. 4
Photo enlarged approx. 25 times
Cross section of the staff after having been driven out of the balance wheel in a staking tool. Note that the rivet has broken off clean. No burrs are left to damage the hole of the balance wheel arm.

*Pat. Pending

1177 (OVER)

HAMILTON WATCH MATERIALS

Grade 721 — 21/0 Size — 17 Jewels

2934	Arbor, Pallet
2911	Arbor, Barrel
3253	Balance—Gold screws
3254	Balance and staff—Gold screws
3255	Balance complete—Gold screws
2905A	Barrel
2906A	Barrel and Arbor
2919	Click
2915	Clutch
2965	Collet
5010	Hub, Winding wheel
6278	Jewel, Balance Upper and Lower—unset
2979A	Jewel, Balance upper endstone cap
3280	Jewel, Balance lower endstone cap
2967	Jewel, Center upper—gold
2968A	Jewel, Center lower—unset
2969	Jewel, Third upper—Gold
2970A	Jewel, Third lower—unset
2969	Jewel, Fourth upper—Gold
2970A	Jewel, Fourth lower—unset
2973	Jewel, Escape upper—Gold
2974A	Jewel, Escape lower—unset
6275	Jewel, Pallet upper—unset
6275	Jewel, Pallet lower—unset
2983	Jewel, Roller or Jewel Pin
2981	Jewel, Pallet stone—Receiving
2982	Jewel, Pallet stone—Discharging
2918	Lever, Clutch
2922	Lever, Setting
2921	Mainspring—Str. 7½MM.
2956	Pallet and Fork
2957	Pallet Fork and Arbor
2990A	Pins, Banking
2929A	Pinion, Cannon
3233	Pinion, Escape
3232	Pinion, Fourth
3231	Pinion, Third
2914	Pinion, Winding
6258	Regulator
2963	Roller—Combination
2984	Screws, Balance—gold
2992	Screws, Balance upper endstone cap
5096	Screws, Balance lower endstone cap
2986	Screws, Balance cock
2987	Screws, Bridge—Barrel and Train
2994	Screws, Bridge—Pallet
2988	Screws, Click
2790	Screws, Dialfoot
2900	Screws, Setting lever
6295	Screws, Hairspring Stud
2989A	Screws, Clutch Lever Spring
5096	Screws, Setting Cap Spring
2997	Screws, Ratchet Wheel
2998A	Screws, Winding Wheel
2920	Spring, Click
2925	Spring, Clutch Lever
3261	Spring, Hair—Breguet
2940	Spring, Setting Cap
3227	Staff, Balance
2928A	Staff, Center and Pinion
2926	Stem, Winding
3266	Stud, Hairspring
3244	Wheel, Center
3245	Wheel, Center and Pinion
3246	Wheel, Center complete
3247	Wheel, Third
3248	Wheel, Third and Pinion
3249	Wheel, Fourth
3250	Wheel, Fourth and Pinion
6251	Wheel, Escape
3252	Wheel, Escape and Pinion
2941A	Wheel, Hour
2942	Wheel, Minute
2907A	Wheel, Ratchet
2916	Wheel, Setting
2908A	Wheel, Winding

For Prices See Retail Material Price List

Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

INDEX
T. D. 127
2000-11-1-40 Revised
10M-2-8-41 500-11-22-43
500-5-21-46

SUBJECT:

Grade 992B - New 21 Jewel Lever Set Railway Special

Ten years of direct research, and nearly fifty years experience in manufacturing high-grade watches exclusively have gone into the design and construction of the Hamilton 992B Railway Special — America's finest and most accurate railroad watch.

This is a completely new movement from winding arbor to balance wheel, and its parts are not interchangeable with those of previous 992's.

992B is a 16 size, lever set movement with 21 *friction set* ruby and sapphire jewels. It is adjusted to temperature and *six* positions. All parts — with exception of the hairspring — are perfectly interchangeable. In addition to major technical advances (fully described in this data sheet) other changes have greatly simplified the problems of cleaning, repairing and adjusting.

Winding and setting mechanism has been designed for increased strength and ease of handling. The shipper lever is held in position by a screw that comes through the pillar plate from the back of the movement and is threaded into the lever. This screw is blue for identification and need not be loosened or removed before taking

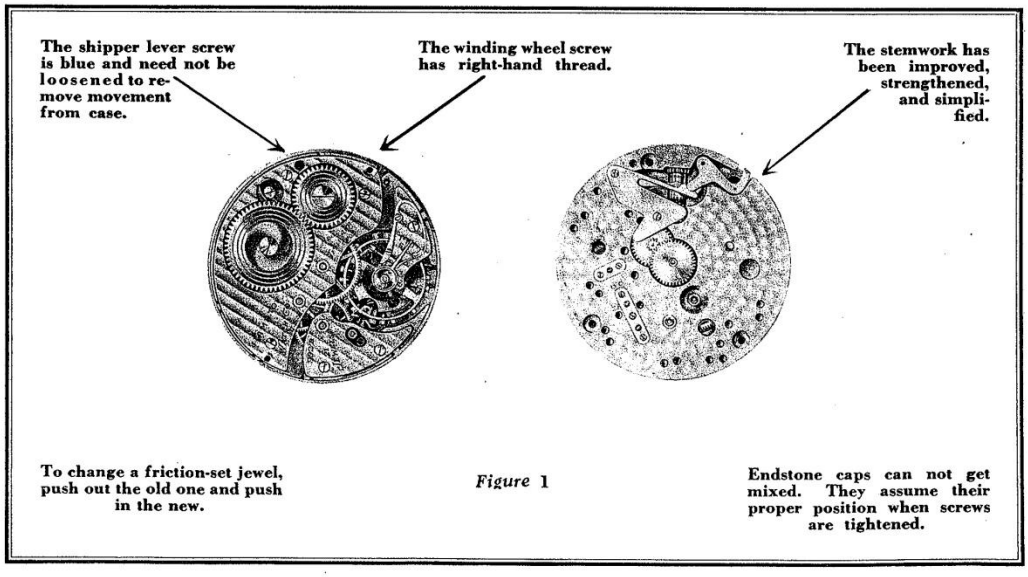


Figure 1

34. 346

the movement from the case. The winding wheel is mounted on a steel shaft and is held in position by a screw with a *right-hand thread.* This change in design standardizes the screws in this movement. All screws have right-hand threads. Furthermore, this winding wheel construction provides smoother action by steel bearing on nickel-silver, and prevents grease from working its way up onto the movement. The winding arbor, when in place, is surrounded by the pillar plate and is held in position by a clip which can be removed by lifting it straight up with tweezers. This unique feature in stemwork design makes possible the removal of the barrel bridge without disturbing the winding mechanism.

and bridges The hole jewels cannot get mixed or lost and the endstone caps are all of different shapes so that they can easily be returned to their original positions.

Hamilton's new whue Elinvar hairspring is introduced for the first time in the 992B. Self-compensating for changes of temperature, protected against the effects of residual magnetism, and resistant to rust and corrosion, the new Elinvar hairspring has the hardness and elasticity of tempered steel. The chances of damaging the hairspring or of disturbing fine adjustments have been reduced to a minimum. The two-piece balance staff, identified by the blue hub, can be changed without destroying trueness or poise of the balance.

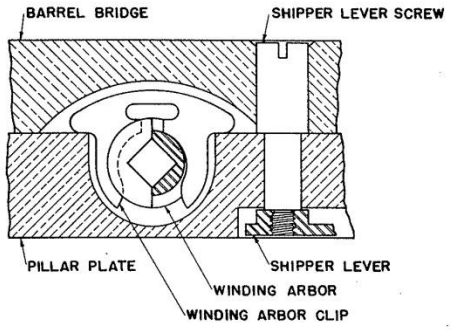


Figure 2

Friction jeweling in this movement contributes its share to accuracy of location of train and escapement parts, and ease of handling when being assembled. To replace a broken jewel, it is only necessary to push the old one out and the new one to the proper depth.

All the jewels have been standardized. When cleaning the movement remove the endstone caps and wash the hole jewels without removing them from the pillar plate

To regulate the 992B, one full turn of the regulator screw will change the rate approximately fifteen seconds per day. One full turn of two meantime screws on the balance wheel will change the rate about three seconds per hour.

Caution — When ordering repair parts for this new 992B Railway Special, use material catalog numbers listed on the back page of this sheet. If you order parts without catalog number, be sure to specify new grade 992B.

REMOVING TRAIN OR CAPPED JEWELS

Broken train or balance jewels may be removed by driving out the entire setting as illustrated in Fig. 3, using a standard staking set with a flat face punch smaller in diameter than the setting to be removed.

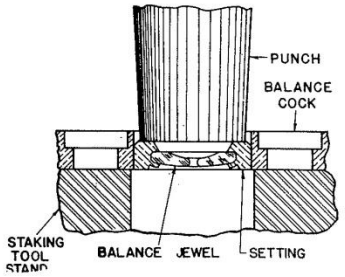


Figure 3

REPLACING TRAIN JEWEL SETTINGS

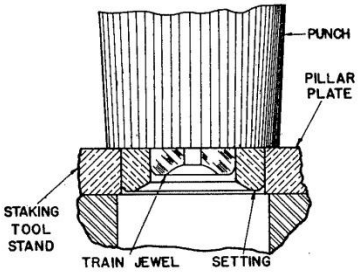


Figure 4

All train jewels with settings should be replaced by driving the setting into the plates or bridges from the inside as illustrated in Fig. 4. A flat face punch with a face diameter larger than the complete setting should be used first as illustrated. This will permit driving the face of the setting flush with the plate or bridge surface immediately surrounding the setting. All lower jewels are set correctly when flush. For proper end-shake the center and third *upper* jewels should be pushed .004″ below flush, and the fourth *upper* should be pushed .014″ below flush by using a punch smaller in diameter than the setting, as shown in Fig. 3.

REPLACING CAPPED JEWELS

The escape, pallet and balance upper and lower jewels should be driven in place from the outside using a flat face punch larger in diameter than the setting and driving the jewel and setting flush with the surface of the endstone cap recess, as shown in Fig. 5. This establishes the hole jewel in its proper position so that the endstone will lay flush and parallel with the hole jewel.

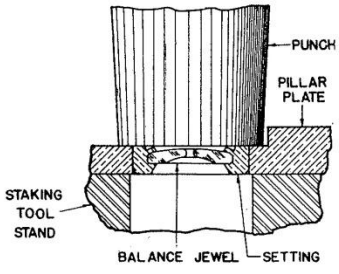


Figure 5

HAMILTON WATCH MATERIALS

Grade 992B — 16 Size — 21 Jewels

Description — All jewels are in friction settings. All upper settings are gold. Center wheel is round arm, gold. Third and fourth wheels are round arm, gilt. Escape wheel is steel

Cat. No.	Parts
609	Arbor—barrel
610	Arbor—pallet
611	Arbor—winding
601A	Balance—and hub
612	Balance—and staff
613	Balance—complete
614	Barrel
615	Barrel—and arbor
616	Click
617	Clip—winding arbor
618	Clutch
387A	Collet—hairspring
619	Endstone—balance upper cap
620	Endstone—balance lower cap
621	Endstone—escape upper cap
622	Endstone—escape lower cap
623	Endstone—pallet upper cap
622	Endstone—pallet lower cap
604A	Hub—balance
624	Jewel—balance upper and lower
625	Jewel—center upper
626	Jewel—center lower
627	Jewel—escape upper
627	Jewel—escape lower
628	Jewel—fourth upper
629	Jewel—fourth lower
630	Jewel—pallet upper
627	Jewel—pallet lower
628	Jewel—third upper
629	Jewel—third lower
631	Jewel—pallet stone—right
632	Jewel—pallet stone—left
479	Jewel—roller
678	Lever—clutch
679	Lever—shipper
633	Pallet—and fork
634	Pallet—fork and arbor
*635	Pin—banking
636	Pinion—cannon
637	Pinion—escape
638	Pinion—fourth
639	Pinion—third
640	Pinion—winding
641	Regulator
642	Roller—large
643	Roller—and pin

Cat. No.	Parts
644	Roller—small
481	Screw—balance
482A	Screw—balance meantime
†495	Screw—banking
645	Screw—bridge and balance cock
646	Screw—bridge, pallet
647	Screw—case
648	Screw—click
649	Screw—dial foot
650	Screw—jewel, balance upper cap
6093	Screw—jewel, balance lower cap
6093	Screw—jewel, escape upper cap
6093	Screw—jewel, escape lower cap
1366	Screw—jewel, pallet upper cap
6093	Screw—jewel, pallet lower cap
651	Screw—lever, shipper
518	Screw—regulator
652	Screw—spring, regulator
6096	Screw—spring, setting cap
1798	Screw—stud, hairspring
653	Screw—wheel, ratchet
654	Screw—wheel, winding
655	Spring—click
656	Spring—clutch lever
675	Spring—hair
534B	Spring—main—Str. 15½ MM
657	Spring—regulator
658	Spring—setting cap
659	Staff—balance
660	Staff—center and pinion
677	Stud—hairspring
661	Wheel—center
662	Wheel—center, staff and pinion
663	Wheel—center, complete
664	Wheel—escape
665	Wheel—escape and pinion
666	Wheel—fourth
667	Wheel—fourth and pinion
668	Wheel—hour
6042	Wheel—minute
669	Wheel—ratchet
670	Wheel—setting
671	Wheel—third
672	Wheel—third and pinion
673	Wheel—lower winding
674	Wheel—winding

*Used to serial No. C4048
†Began with serial No. C4049

For Prices See Retail Material Price List

It Pays to Use Genuine Hamilton Watch Materials

All parts, with the exception of the center wheel, may be cleaned in regular cleaning solutions, ending with a rinse in pure alcohol and drying by spinning or with clean boxwood sawdust.

To prevent any possibility of cleaning solution or other foreign matter remaining in the hollow center staff, it is strongly recommended that the center wheel be cleaned only in a highly volatile degreasing agent, such as benzine, carbon-tetrachloride, or naphtha, and followed by immediate drying with a blast of dry air. It is not advisable to clean the bushings in the center staff with pegwood. A piece of pegwood might break off inside the staff and cause much trouble. Should the bushings need extra cleaning or polishing, a round burnishing broach should be used.

The accompanying illustration shows the seconds-setting mechanism in a setting position with the stem pulled out. Both springs of the mechanism should be adjusted so that in this position the lever arm comes firmly in contact with the balance without exerting excessive strain on the pivots. The arm is so designed that the balance will be stopped when the lever comes in contact with the balance either on or between screws. When the stem is pushed in after setting the hour and minute hands, the balance starts immediately due to the action of the lever arm as it returns to running position. It is well to test the action of the seconds-setting mechanism, before assembling the train after cleaning, by placing the balance wheel and cock on the pillar plate and pulling the stem from wind to set a few times. Be sure there is neither too little nor too much tension in the springs.

After assembling the train, wind the mainspring a little before the pallet is in place to be sure the center-seconds wheel is still true. See that it does not strike the winding wheel or jewel settings, and that it does not ride up over the center-seconds pinion. Tension of the stabilizer spring should be sufficient to hold the pinion against the end of the center staff without too much pressure. When replacing the second hand, place the movement in a staking tool with a flat faced stump and the second hand can be pushed to a snug friction fit.

If the watch is regulated a few seconds per day on the fast side, it can very conveniently be set to the exact second by stopping the second hand by pulling out the stem and pushing it in at a given time signal.

Material for 6/0 Size Grade 987S — 17 Jewels — Sweep Seconds

Cat. No.	Parts
2509	Cap—seconds setting
2524	Jewel—center upper
2530	Jewel—fourth upper
2537	Jewel—third upper
2510	Lever—second setting
2512	Pinion—center seconds and staff
2551	Pinion—fourth
2566	Pinion—third
5096	Screw—seconds setting cap
2517	Screw—stabilizer spring
6225	Spring—seconds setting lever
2538	Spring—stabilizer
2540	Staff—center and bushing
2562	Wheel—center seconds
2539	Wheel—center, staff and bushing
2563	Wheel—center complete
2544	Wheel—fourth and pinion
2556	Wheel—third and pinion

All other parts same as Grade 987A

NOTICE — Change catalog numbers on your 987A supplement to correspond with the following:

2534	Balance
2535	Balance—and staff
2536	Balance—complete
2319	Click

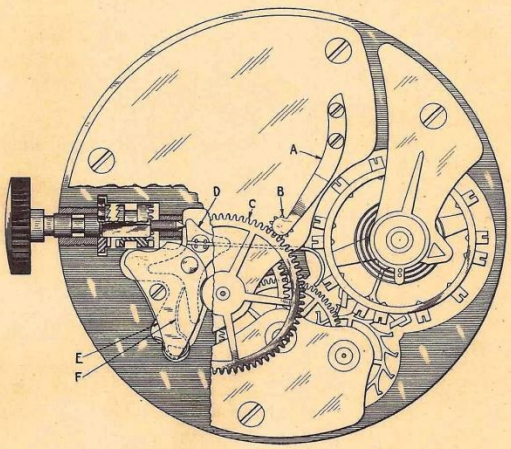
Technical Data

Hamilton Watch Company
LANCASTER, PENNSYLVANIA

INDEX
T D 128
2000-11-1-40
10M-2-8-41

SUBJECT:

987S Seconds-Setting Sweep-Second Strap Watch,* Cleaning and Adjusting



A—Stabilizer Spring
B—Center-seconds Pinion
C—Center-seconds Wheel
D—Seconds-setting Lever
E—Seconds-setting Lever Cap
F—Seconds-setting Lever Spring

*Patent Pending

Built around Hamilton's 6/0 Size, 987A, the new sweep-second movement with seconds-setting mechanism is simple in design and sturdy in construction. Cleaning and adjusting this movement will not be difficult if reasonable care is exercised. However, due to the addition of extra moving parts and the resulting drag on such a delicate mechanism, cleaning and re-oiling is advisable at more frequent intervals than with ordinary watch movements.

Preparation for cleaning should begin with removing the dial and hands, after which the stabilizer spring (A) on the barrel bridge and the center-seconds pinion (B) can be removed without trouble. Next the center-seconds wheel (C) should be removed from the third pinion. It is mounted friction tight on the third pinion and can be removed by turning it slowly in a counterclockwise direction with a piece of pegwood. The wheel can thus be taken off and replaced without the necessity of retruing it.

The rest of the movement may then be taken apart as usual, ending with the removal of the seconds-setting lever (D), cap (E) and spring (F) on the pillar plate.

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