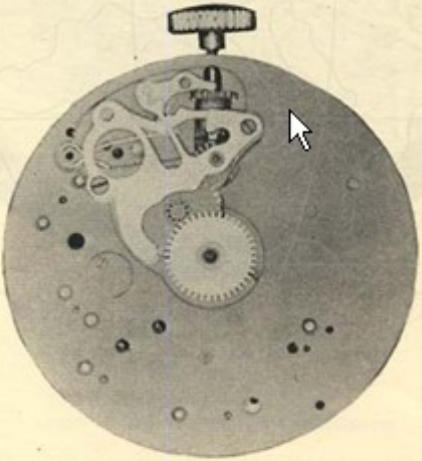
WORLD'S ONLY FULLY ILLUSTRATED CHRONOGRAPH WATCH COURSE

VOLUME 1

IDENTIFICATION OF CHRONOGRAPH



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THE WORLD'S FIRST FULLY

ILLUSTRATED TEXT BOOK

ON

CHRONOGRAPH REPAIRING

AND ADJUSTING

WESTERN PENNSYLVANIA HOROLOGICAL INSTITUTE, INC.
PITTSBURGH, PENNSYLVANIA

INSTRUCTIONS
For use of book

DISASSEMBLY OF THE CHRONOGRAPH MECHANISM:

1. Study the isometric drawing at top of page 1-A. The isometric drawing was made for the following purposes:

   A. It helps to identify the part to be removed.
   B. This drawing aids in pointing out certain locations on the part that are mentioned in the oiling procedure.
   C. The text refers to certain points on the part. These points are shown in the isometric drawing. This should aid you in finding the exact location on the part that is described in the text.
   D. It helps you to know the shape of the part in case a new part has to be made.

2. At the bottom of the page 1-A is a photograph of a chronograph. In this photograph is the same part painted in black. The part is in its exact location that this part occupies in the watch. Find this location in the watch.

3. Read the disassembly procedure and the hazards in disassembly on page 1 in this book.

4. Remove this part in the same procedure as described in the text.

5. A very important item in disassembling a chronograph is keeping the screws in order, much time will be lost in putting the chronograph together if screws are mixed up. This means you have to hunt for each screw, sometimes trying three or four screws before finding the correct one. It cannot be stressed too strongly that care should be taken so that screws are not mixed up. The system that we advise for beginners, is to replace each individual screw after each part is removed. This naturally eliminates the hazard of mixing up the screws and will save you much time in the end. Do this at least until you become so thoroughly familiar with the chronograph that you no longer feel it is necessary.

6. Continue to follow this procedure throughout the book and disassemble each part until the last part of the chronograph is removed.

ASSEMBLY OF THE CHRONOGRAPH MECHANISM:

7. When you are ready to assemble the chronograph mechanism, study the isometric drawing on the last part in this book. This drawing should aid you in identifying the part to be assembled.

8. At the bottom of this page is a photograph of a chronograph. In this photograph is the same part painted in black. The part is in its exact location that this part occupies in the watch.

9. Read the assembly procedure and the hazards in assembling for the last part in this book. (Continued on next page)

INSTRUCTIONS
(Continued)

10. Replace the part in its exact location as shown in photograph, using the procedure as described in the text.

11. After you find the correct location for this part in the watch, read the oiling procedure for this part. The oiling procedure for this part is located underneath the isometric drawing. It is best to read the oiling procedure before you put each part in place as there are certain parts that must be oiled immediately as it may prove difficult to oil them later.

12. Replace the screw that holds this part in place. Of course, the screws should be kept in order as we advised above, but if the screws are not in order or the watch was received with screws mixed up, you will find a screw drawn for each part that requires a screw at the bottom of the text page.

13. After replacing this part, replace the next part, etc., until the last part is replaced, which will be part No. 1. Each part should be replaced using the same procedure as described in the text.

(Naturally, the assembly of the chronograph is exactly the reverse of the disassembly)

14. After disassembling and assembling the chronograph mechanism, start on page 1 and read the function of this part. After reading the function of this part, continue to read the function of each part throughout the book. Study each part, one at a time. This text should help you to understand more fully the purpose of each part in the chronograph mechanism.

15. Now put movement in its case with dial on, then replace hands.

16. Study the text on functional results in this book, and check the chronograph mechanism as described in this text.

NOMENCLATURE OF PART FOR CHRONOGRAPH MECHANISM

17. After you have become familiar with the chronograph mechanism, you can disassemble and assemble the chronograph by using the nomenclature of parts as a guide. This makes it possible for you to use a procedure without going through each page in the book.

18. ADJUSTMENT OF ECCENTRIC STUDS:

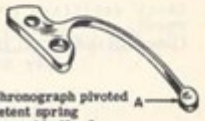
Read the text on adjustment of eccentric studs, this text should be read in reference to the eccentric stud picture. Now adjust each eccentric stud one at a time in the watch, as described in the text. Use the picture to show you the position of these studs.

19. On each page in this book the part number and the page number are the same. This makes it convenient for the reader and eliminates any confusion.

NOMENCLATURE OF PARTS FOR CHRONOGRAPH MECHANISM

Wheel over fourth wheel
Assembly No. 1.

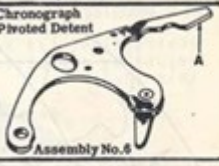
Minute Register Pawl
Assembly No. 2.



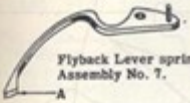
Chronograph pivoted
detent spring
Assembly No. 3.

Chronograph pivoted
detent bridge
Assembly
No. 4.

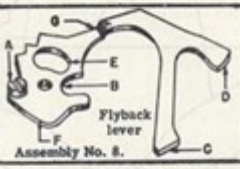
Intermediary Wheel
Assembly No. 5.



Chronograph
Pivoted Detent
Assembly No.6

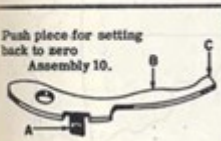


Flyback Lever spring
Assembly No. 7.



Flyback
lever
Assembly No. 8.

Push piece for setting
back to zero spring
Assembly 9.

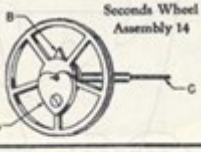


Push piece for setting
back to zero
Assembly 10.

Starter Push Piece
Assembly 11

Seconds Wheel and Minute
Register Wheel
Bridge
Assembly 12

Minute Register
Wheel
Assembly 13



Seconds Wheel
Assembly 14

Seconds Wheel Tension Spring
Assembly 15

Intermittent Lever Spring
Assembly 16

Intermittent lever and
wheel assembly
Assembly 17.

Sweep Second Hand

Minute Register hand

Chronograph button

Chronograph
button

ADJUSTING ECCENTRIC STUDS - THINGS TO CHECK

Listed below are a number of depthings and adjustments controlled by eccentric studs.

1. Check depthings of intermittent wheel with dart tooth on seconds wheel.
   (Correction) If this depthing is incorrect, you can correct this by adjusting eccentric stud ES-1.

   Reference: Intermittent wheel is Assembly 17 B.
   Seconds wheel dart tooth is Assembly 14 B.

2. Check depthing of intermittent wheel teeth with minute register wheel teeth.

   (Correction) If depthing is incorrect, you can correct this by adjusting eccentric stud ES-2. The intermittent lever pivots on this stud.

   Reference: Intermittent wheel is Assembly 17 B.
   Minute register wheel is Assembly 13.

3. Check intermittent wheel and make sure it disengages from seconds wheel dart tooth when flyback is brought all the way into the center of the watch.

   (Correction) If intermittent wheel does not disengage from seconds wheel dart tooth when flyback is moved all the way into the center of the watch, then you adjust eccentric stud ES-3 on intermittent lever.

   Reference: Intermittent wheel is Assembly 17 B.
   Seconds wheel dart tooth is Assembly 14 B.

4. Check intermediary wheel and make sure that it disengages with the seconds wheel when flyback is moved in toward the center of the watch.

   (Correction) If intermediary wheel does not disengage from seconds wheel when flyback is moved in toward the center of the watch, you can adjust eccentric stud ES-4 on flyback lever to correct this.

   Reference: Intermediary wheel is Assembly 5.
   Seconds wheel is Assembly 14.

5. Check depthing of teeth on intermediary wheel with seconds wheel.

   (Correction) If depthing is incorrect, you can correct this by adjusting eccentric stud ES-5 and eccentric stud ES-6.

   Reference: Intermediary wheel is Assembly 5.
   Seconds wheel is Assembly 14.

6. Check depthing of wheel over fourth wheel teeth with intermediary wheel teeth.

   (Correction) If this depthing is incorrect, you can correct this by adjusting eccentric stud ES-6 that chronograph pivoted detent pivots on.

   Reference: Wheel over fourth wheel is Assembly 1.
   Intermediary wheel is Assembly 5.

ADJUSTING ECCENTRIC STUDS

DO NOT REMOVE THESE STUDS

In disassembling or assembling chronograph it is a good policy not to turn eccentric studs. These eccentric studs are used to adjust one part to another and naturally in turning these studs you will lose the desired adjustment of the chronograph mechanism which will cause the chronograph to function incorrectly. Another reason for not turning these studs unless it is necessary is that they soon become loose and will not hold the desired adjustment.

PART NO. 1.

A. DISASSEMBLY PROCEDURE OF WHEEL OVER FOURTH WHEEL:

The wheel over the fourth wheel, fits friction tight on post of fourth wheel pinion. This wheel should be removed with a sweep wheel remover, but can be removed with two small thin edge screwdrivers. The screwdrivers are placed opposite each other under hub of wheel. One screwdriver is turned clockwise while the other screwdriver is turned counter clockwise.

B. HAZARDS IN DISASSEMBLY OF WHEEL OVER FOURTH WHEEL:

The wheel over the fourth wheel fits on the very small post of the fourth wheel pinion, which is, as you know, very delicate and easily bent or broken. The main reason why we selected this part to be removed first is to avoid accidents such as a slip with a screwdriver and so on. If the sweep wheel remover is held perfectly upright in removing wheel, the hazards of bending fourth wheel post will be eliminated.

C. ASSEMBLY PROCEDURE OF WHEEL OVER FOURTH WHEEL:

This wheel fits over fourth wheel post. It should be placed on post with the hub A of wheel down. The long hub B on wheel will be up. The wheel over the fourth wheel should be pushed down until it is level with the intermediary wheel. A hollow flat face punch should be used to push wheel down.

D. HAZARDS IN ASSEMBLING WHEEL OVER THE FOURTH WHEEL:

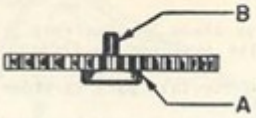
Use care in staking down this wheel so that you do not bend or break fourth wheel post. If movement is held level hazards of replacing this wheel will be eliminated.

E. FUNCTION OF WHEEL OVER FOURTH WHEEL:

The function of this wheel is to transfer the power from the train of the watch to the chronograph mechanism. This wheel continues to turn as long as the watch is running.

F. REMARKS:

Mechanically we should regard this wheel as the intermediate chronograph wheel, as it is the main wheel which transfers the power from movement train to the chronograph mechanism. The Swiss term for this part is wheel over fourth wheel and we will use this term to describe this wheel in this text.



Wheel over fourth wheel
Assembly No. 1.

OILING

The Wheel over Fourth Wheel should not be oiled.

PART NO. 2.

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL:

This pawl is held in place by chamfered flathead screw CS-1. After screw is removed the pawl may be lifted from plate.

(The shape of screw for this part is shown at the bottom of page.)

B. HAZARDS IN DISASSEMBLY OF MINUTE REGISTER PAWL:

The tension spring on this pawl is very thin and can be ruined by a slight slip of the tweezers or screwdriver.

C. ASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL:

Place slot B of minute register pawl over the screw hole in plate nearest to minute register wheel. Now replace chamfered flathead screw CS-1 that holds this pawl in place.

D. HAZARDS IN ASSEMBLY OF MINUTE REGISTER PAWL:

Handle pawl very carefully when replacing it as a slight slip of tweezers or screwdriver can ruin the delicate tension spring on pawl. Failure of the pawl to be properly adjusted to minute register wheel will result in improper working of chronograph or may cause watch to stop.

End A of pawl must be highly polished as any pits of rust or roughness at this location will prevent it from functioning properly.

E. ADJUSTING MINUTE REGISTER PAWL:

After replacing minute register pawl push flyback lever to center of watch until it has returned the minute register wheel to a zero position. Now adjust the end A of pawl so it lies directly in the center of two teeth on minute register wheel. The tension of end A of pawl on minute register wheel must be very light as any excess will cause the minute register wheel to be unnecessarily hard to turn, yet, the tension of pawl on wheel must be strong enough to hold the wheel in a stationary position until it is moved one tooth by the chronograph mechanism. The pawl should be adjusted so that when the flyback lever is moved away from minute register wheel the minute register wheel does not move.

F. FUNCTION OF MINUTE REGISTER PAWL:

The minute register pawl serves two purposes:

1. It holds the minute register wheel in place so that it moves exactly one tooth each minute.
2. It holds a tension on the minute register wheel so that a bump cannot alter position of wheel.

Minute Register Pawl
Assembly No. 2.

OILING

The Minute Register Pawl should not be oiled.

PART NO. 3.

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

This spring is held in place by fillister head screw FS-1 and a steady pin. After screw is removed, spring may be lifted free of plate.

(The shape of screw for this part is shown at the bottom of the page.)

B. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

Place spring in proper position on plate with steady pin over hole in plate. Push spring down to its correct place and replace fillister head screw FS-1.

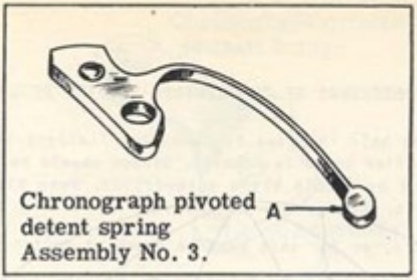
C. FUNCTION OF CHRONOGRAPH PIVOTED DETENT SPRING:

Function of this spring is to hold a tension on chronograph pivoted detent. It is this tension which moves the detent to engage the intermediary wheel with the seconds wheel.

Reference: Intermediary wheel is Assembly 5.
Chronograph pivoted detent is Assembly 6.

D. REMARKS:

The tension of this spring should be strong enough to move detent in toward the center of the watch and engage intermediary wheel with seconds wheel. It should hold these wheels engaged until it is mechanically disengaged by the chronograph mechanism.



Chronograph pivoted detent spring
Assembly No. 3.

OILING

The end of Spring A should be slightly moistened with oil at point of contact with chronograph pivoted detent.

PART NO. 4

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

This bridge is held in place by chamfered flathead screw CS-2 and steady pins. After screw is removed, bridge should be loosened from pivoted detent by a thin blade screwdriver. When steady pins are free of detent, bridge may be removed.

(The shape of screw for this part is shown at bottom of the page.)

B. HAZARDS IN DISASSEMBLY OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

When using a screwdriver to loosen the bridge from detent, care should be taken to keep bridge level as any twisting may damage pivots on intermediary wheel or burr the bushings in bridge or pivoted detent. The screwdriver should be carefully used to prevent marring of bridge or detent.

C. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

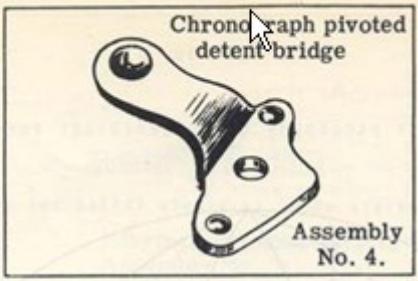
Place bridge on pivoted detent with steady pins over proper holes in pivoted detent. Place intermediary wheel so that pivot on this wheel will enter bushing hole in bridge. Bridge may now be pressed to proper place with back of tweezers and chamfered flathead screw CS-2 replaced in bridge.

D. HAZARDS IN ASSEMBLING CHRONOGRAPH PIVOTED DETENT BRIDGE:

Keep bridge level when pressing down to proper place as any twisting may burr the bushing in bridge or damage the pivot on intermediary wheel. The bridge and detent where these two parts come together should be checked to see that there are no burrs that would prevent bridge setting properly on chronograph pivoted detent.

E. FUNCTION OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

Function of this bridge is to hold the intermediary wheel in position so that it can function properly.



OILING

The pivot in bushing in chronograph pivoted detent bridge, should be oiled as you would properly oil a train pivot in a watch.

PART NO. 5

A. DISASSEMBLY PROCEDURE OF INTERMEDIARY WHEEL:

The intermediary wheel is simply lifted out of bushing in chronograph pivoted detent.

B. ASSEMBLY PROCEDURE OF INTERMEDIARY WHEEL:

When replacing intermediary wheel end of staff A should be up. This end of staff has a small polished hub which can easily be identified.

The pivot of intermediary wheel is placed in pivot hole in bushing of chronograph pivoted detent.

C. HAZARDS IN ASSEMBLY OF INTERMEDIARY WHEEL:

Pivot hole in bushing of chronograph pivoted detent should be carefully examined before replacing intermediary wheel. Any imperfections here will affect the time keeping of the watch and hinder proper operation of chronograph.

D. FUNCTION OF INTERMEDIARY WHEEL:

Function of intermediary wheel is to transmit the power from wheel over fourth wheel to the seconds wheel when these wheels are engaged. The intermediary wheel continues to turn as long as watch is running.

Intermediary Wheel
Assembly No. 5.

OILING

The bottom pivot of Intermediary Wheel should be oiled before placing pivot in place in chronograph pivoted detent. The top pivot should be oiled after bridge for the wheel is placed in watch.

5-A

PART NO. 6.

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

This detent is pivoted on eccentric stud and held in place by a shouldered screw SS-1. The point of detent nearest center slides under a shouldered screw SS-2. These screws must be removed. After both shouldered screws are removed the detent may be lifted from plate.

(The shape of screws for this part are shown at bottom of the page.)

B. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

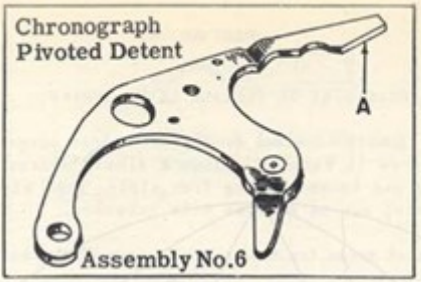
Place detent in proper position on plate with proper hole in detent over eccentric stud as detent pivots on this stud. Replace shouldered screw SS-1 that holds this part in place. Now replace shouldered screw SS-2. The end of pivoted detent nearest center slides under head of this screw.

C. HAZARDS IN ASSEMBLING CHRONOGRAPH PIVOTED DETENT:

The detent should pivot easily under the heads of these screws. It should have enough freedom to work properly and yet not have excess freedom.

D. FUNCTION OF CHRONOGRAPH PIVOTED DETENT:

The function of the chronograph pivoted detent is to engage and disengage intermediary wheel with the seconds wheel.



OILING

The Eccentric Stud that chronograph pivoted detent pivots on should be slightly moistened with oil. The part of chronograph pivoted detent "A" that contacts eccentric stud on flyback lever should be slightly moistened with oil.

6-A

PART NO. 7.

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

This spring is held in place by fillister head screw FS-2 and steady pin. When screw is removed, slide a finely sharpened screwdriver under spring and loosen spring from plate. When steady pin is free of plate spring may be removed with tweezers.

(The shape of screw for this part is shown at the bottom of page.)

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

To replace spring, move flyback lever as far as possible toward center of the watch. Place steady pin over proper hole in plate, then press spring to proper place with back of tweezers. Fillister head screw FS-2 may now be replaced.

C. HAZARDS IN ASSEMBLING OF FLYBACK LEVER SPRING:

When pressing spring to exact position be sure end of Spring A is not on top of flyback lever or spring may be bent or burred.

D. REMARKS:

End of Spring A which contacts flyback lever should be carefully examined for burrs. If any burrs are found they should be removed. This end of spring should be highly polished to work properly.

CAUTION - When polishing the end of spring be sure not to change shape of spring.

E. FUNCTION OF FLYBACK LEVER SPRING:

1. Function of this spring is to hold flyback lever in its proper position until it is manually moved.

2. It helps move flyback lever to proper position so that it can function correctly.

Everything contained in this technical book on complicated watches is entirely new and original, having been prepared wholly by William O. Smith, President of W. P. H. I. and his son, William O. Smith, Jr. Nothing has been copied or photographed from any publication. All pictures and photographs contained herein were produced within the walls of W. P. H. I.

These copyrighted Essembl-O-Graf text books on complicated watches such as: chronographs, calendar watches, split-second repeaters, special timers, etc., were prepared in our own Research Laboratory and Technical Departments. To produce such a book we soon found it necessary, due to the many intricate details, to establish the following departments: W.P.H.I.'s Technical Department, W.P.H.I.'s Drafting Department, W.P.H.I.'s Photographic Department, W.P.H.I.'s Commercial Art Department and W.P.H.I.'s Printing Plant. By having all these departments within our walls, we were able to expedite the work of disassembling, photographing, retouching, drafting and all the various phases required in the stupendous job of preparing the assembling procedure and technical details, comprising over sixty-seven (67) different trade names of chronographs. Therefore, all persons are hereby warned that everything contained herein is original material, text, illustrations, drawings, isometric drawings, photographs, art work, etc., and is the exclusive property of the above authors, and that the Western Pennsylvania Horological Institute is the only school permitted to use these text books, unless special contracts are granted to other horological schools.

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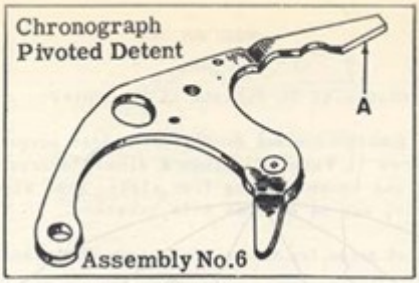


OILING

The Eccentric Stud that chronograph pivoted detent pivots on should be slightly moistened with oil. The part of chronograph pivoted detent "A" that contacts eccentric stud on flyback lever should be slightly moistened with oil.

6-A

PART NO. 7.

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

This spring is held in place by fillister head screw FS-2 and steady pin. When screw is removed, slide a finely sharpened screwdriver under spring and loosen spring from plate. When steady pin is free of plate spring may be removed with tweezers.

(The shape of screw for this part is shown at the bottom of page.)

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

To replace spring, move flyback lever as far as possible toward center of the watch. Place steady pin over proper hole in plate, then press spring to proper place with back of tweezers. Fillister head screw FS-2 may now be replaced.

C. HAZARDS IN ASSEMBLING OF FLYBACK LEVER SPRING:

When pressing spring to exact position be sure end of Spring A is not on top of flyback lever or spring may be bent or burred.

D. REMARKS:

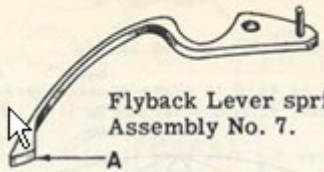
End of Spring A which contacts flyback lever should be carefully examined for burrs. If any burrs are found they should be removed. This end of spring should be highly polished to work properly.

CAUTION - When polishing the end of spring be sure not to change shape of spring.

E. FUNCTION OF FLYBACK LEVER SPRING:

1. Function of this spring is to hold flyback lever in its proper position until it is manually moved.

2. It helps move flyback lever to proper position so that it can function correctly.



Flyback Lever spring
Assembly No. 7.

OILING

The end of Flyback Lever Spring "A" that contacts Flyback Lever should be slightly moistened with oil.

PART NO. 8

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER:

The flyback lever is held in place by shouldered screw SS-3. When this screw is removed, flyback lever may be lifted from stud on plate.

(The shape of screw for this part is shown at the bottom of page.)

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER:

This lever is placed in movement with hole in lever over stud in plate, as lever pivots on this stud. The U shaped slot B of flyback lever should fit over end A of starter push piece. The flyback lever is held in place by shouldered screw SS-3, which fits in slot E of flyback lever. The flyback lever should work freely under the head of this screw.

C. FUNCTION OF FLYBACK LEVER:

The function of flyback lever is to do three things.

1. First, it disengages the intermediary wheel from the seconds wheel.

   Reference: Intermediary wheel is Assembly 5.
   Seconds wheel is Assembly 14.

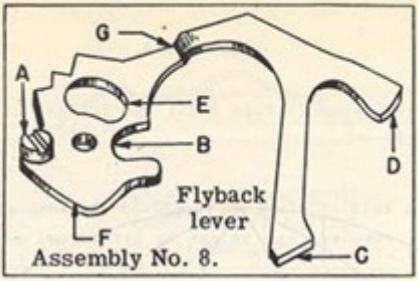
2. The flyback lever disengages intermittent wheel from seconds wheel dart tooth.

   Reference: Intermittent wheel is Assembly 17 A.
   Seconds wheel dart tooth is Assembly 14 A.

3. The ends of flyback lever D and C hits the hearts on seconds wheel and minute register wheel to bring the hands connected to these wheels back to zero.

   Reference: Seconds wheel hearts is Assembly 14 B.
   Minute register wheel heart is Assembly 13 A.

Due to the construction of this book, it is impossible to print at this place how function of flyback lever takes place. This explanation will be found on page 18.



Assembly No. 8.

OILING

The following parts of Flyback Lever should be slightly moistened with oil.

1. **Frictional points of contact in the "U" shaped slot "D" in flyback lever.**
2. **The stud that flyback lever pivots on.**
3. **The frictional surface "F" that contacts Eccentric Stud on Intermittent Lever.**
4. **The surface "G" that contacts push piece for setting back to zero.**

PART NO. 9

A. DISASSEMBLY PROCEDURE OF PUSH PIECE FOR SETTING BACK TO ZERO SPRING:

This spring is held in place by chamfered flathead screw CS-3. When this screw is removed, spring can be lifted out of place.

(The shape of screw for this part is shown at the bottom of page.)

B. HAZARDS OF DISASSEMBLY OF PUSH PIECE FOR SETTING BACK TO ZERO SPRING:

Do not remove screw before removing tension on spring as screw or spring may shoot away and be lost.

C. ASSEMBLY PROCEDURE OF PUSH PIECE FOR SETTING BACK TO ZERO SPRING:

Place spring in proper position on plate with end A of spring in proper hole in plate. Now replace chamfered flathead screw CS-3 that holds this spring in place. When this is done end B of spring can be placed on inside of push piece for setting back to zero.

D. FUNCTION OF PUSH PIECE FOR SETTING BACK TO ZERO SPRING:

Function of this spring is to hold a tension on push piece for setting back to zero. This tension holds the push piece away from the center of the watch.

Push piece for setting back to zero spring Assembly 9.

OILING

End of spring 'B' should be slightly moistened with oil at the point of contact with push piece for setting back to zero.

PART NO. 10.

A. DISASSEMBLY PROCEDURF OF PUSH PIECE FOR SETTING BACK TO ZERO:

This push piece is held in place by a left thread shouldered screw SS-4. After screw is removed push piece may be lifted from plate.

(The shape of screw for this part is shown at the bottom of the page.)

B. ASSEMBLY PROCEDURE FOR PUSH PIECE FOR SETTING BACK TO ZERO:

Move starter push piece for setting back to zero toward center of watch as far as it will go. Then place push piece for setting back to zero on proper place on plate. Replace left threaded shouldered screw SS-4. Push piece must work freely under head of screw. The left threaded screw can be identified by two lines running parallel to slot in head of screw.

Reference: Starter push piece is Assembly 11.

C. FUNCTION OF PUSH PIECE FOR SETTING BACK TO ZERO:

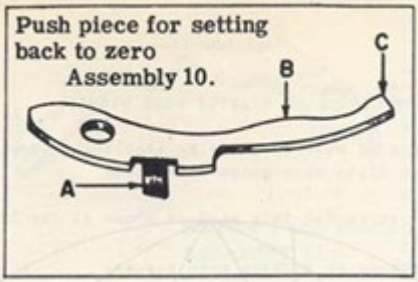
This push piece when pushed must move the flyback lever in toward the center of watch.

D. HOW FUNCTION TAKES PLACE:

1. Push piece for setting back to zero does two things:

a. First of all when end A of push piece for setting back to zero is pushed toward center of the watch, end B of push piece for setting back to zero hits starter push piece and forces starter push piece in toward the center of the watch and because starter push piece is connected to flyback it also forces flyback lever in toward the center of the watch. When end A of push piece is released a spring connected to push piece forces push piece for setting back to zero away from the center of the watch and back to its original position.

b. When end A of push piece for setting back to zero is pushed in toward the center of the watch the second time, end C of push piece for setting back to zero hits the flyback lever and forces flyback lever further in toward the center of the watch. When this has taken place, a spring connected to push piece for setting back to zero forces it away from the center of the watch and back to its original position.



OILING

The shoulder of screw 'SS 4' that push piece for setting back to zero pivots on should be slightly moistened with oil. End 'B' of push piece for setting back to zero which contacts starter push piece should be slightly moistened with oil.

PART NO. 11

A. DISASSEMBLY PROCEDURE OF STARTER PUSH PIECE:

This push piece is held in place by shouldered screw SS-5 and may be lifted from plate when screw is removed.

(The shape of screw for this part is shown at the bottom of page.)

B. ASSEMBLY PROCEDURE OF STARTER PUSH PIECE:

Lay push piece in proper position on plate. Replace shouldered screw SS-5. After replacing screw, check push piece to see that it moves freely under head of this screw.

C. FUNCTION OF STARTER PUSH PIECE:

Function of this piece is, when pushed, to bring flyback lever away from the center of the watch.

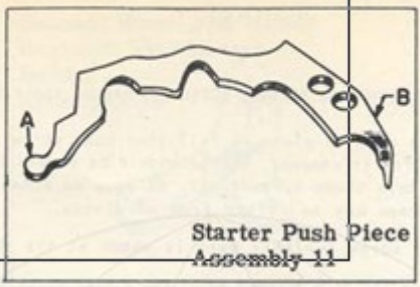
D. HOW FUNCTION TAKES PLACE:

1. Starter push piece works somewhat like a see-saw, it is pivoted in a position so that if you push down on starter push piece on end B, the opposite end A of starter push piece will raise up.

2. This starter push piece has a little ball on end A which works in a U shaped slot on flyback lever.

   Reference: U shaped slot in flyback lever is Assembly 8 B.

When starter push piece is pushed in toward the center of the watch by chronograph button, end A of starter push piece is forced away from the center of the watch and because end A of starter push piece is connected to the flyback lever, the flyback lever is also forced from the center of the watch.



Starter Push Piece
Assembly 11

OILING

The shouldered screw 'SS 5' that starter push piece pivots on should be slightly moistened with oil.

PART NO. 12

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

This bridge is held in place by fillister head screw FS-3 and steady pins. After screw is removed, bridge should be carefully loosened from plate with a thin blade screwdriver. As soon as steady pins are free in plate, bridge may be lifted free of pivots.

(The shape of screw for this part is shown at the bottom of page.)

B. HAZARDS IN DISASSEMBLY OF SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

When using a screwdriver to loosen the bridge, care should be taken to keep bridge level as any twisting may damage pivots on seconds wheel and minute register wheel or chip the jewels in bridge. The screwdriver should be carefully used to prevent marring of bridge or plate.

C. ASSEMBLY PROCEDURE OF SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

This bridge is placed on plate with steady pins over proper holes in plate. Place seconds wheel and minute register pivots so they will enter jewels in bridge. Bridge may now be pressed down to proper place with back of tweezers and fillister head screw FS-3 replaced.

D. HAZARDS IN ASSEMBLING SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

Be sure wheels are perfectly upright and pivots entering jewel holes before applying pressure to replace bridge. Failure to do this may result in bending the pivots of these wheels or chipping the jewels in the bridge.

E. FUNCTION OF SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

Function of this bridge is to hold the seconds wheel and minute register wheel in position to function properly.

Seconds Wheel and Minute Register Wheel Bridge Assembly 12

OILING

The pivots in the jewels in this bridge should be oiled as you would properly oil a train pivot in a watch.

PART NO. 13

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

The minute register wheel is simply lifted out of place.

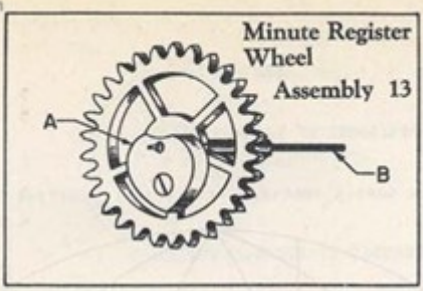
B. ASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

Place wheel in proper position on plate with post B of minute register wheel down in hole in plate.

C. FUNCTION OF MINUTE REGISTER WHEEL:

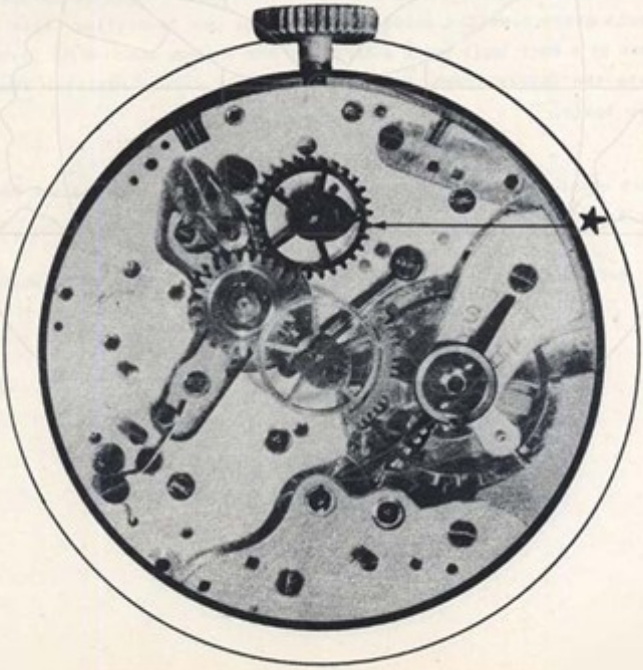
Function of this wheel is to record the minutes. This is done by a hand being attached to the post B on the minute register wheel pinion. This wheel is also equipped with a heart, used in returning the hand to a zero position.

Reference: See minute register wheel heart, Part A of this wheel.



OILING

The top pivot of the Minute Register Wheel should be oiled after bridge for this wheel is placed in watch. The bottom pivot of Minute Register Wheel should be oiled as you would properly oil a train pivot.



PART NO. 14

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL:

This wheel is easily removed. It is simply lifted out of place.

B. ASSEMBLY PROCEDURE OF SECONDS WHEEL:

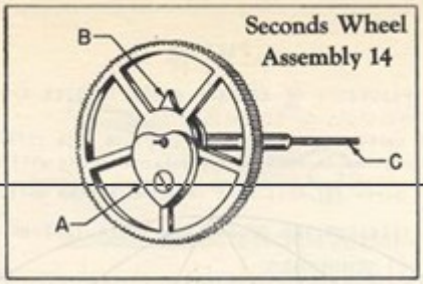
Place wheel in proper position on plate with post C of seconds wheel down in hole in plate.

C. FUNCTION OF SECONDS WHEEL:

Function of this wheel is to register the seconds on the dial by means of a hand being attached to the seconds wheel post B. Also the seconds wheel must move the minute register wheel forward one tooth every time the seconds wheel makes one revolution. This is done by a dart tooth being attached to the seconds wheel which meshes into the intermittent wheel and moves the minute register wheel one tooth.

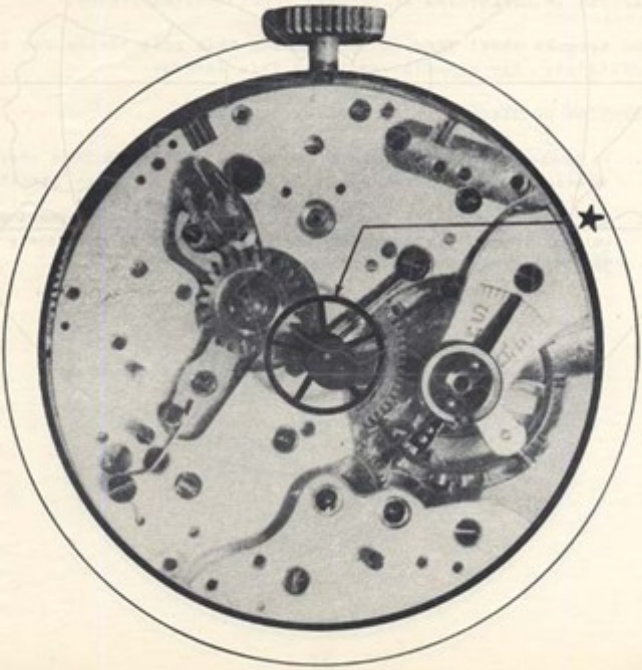
This wheel is also equipped with a heart used in returning the hand to a zero position.

Reference: See seconds wheel dart tooth part B of this wheel.
See seconds wheel heart part A of this wheel.



OILING

The top pivot of the seconds wheel should be oiled after bridge for this wheel is placed in watch.



PART NO. 15

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

Seconds wheel tension spring is held in place with fillister head screw FS-4. When this screw is removed the tension spring will be free on plate.

(The shape of screw for this part is shown at the bottom of the page.)

B. HAZARDS IN DISASSEMBLING OF SECONDS WHEEL TENSION SPRING:

Be careful in removing this spring. It is a very thin soft spring and easily bent.

C. ASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

This tension spring is placed on watch with hole in spring over hole in plate for fillister head screw FS-4. Be sure spring is right side up as bottom of spring A must be placed down on plate. Fillister head screw FS-4 may now be placed in movement but before tightening be sure spring is not over center hole far enough to touch post of seconds wheel.

D. HAZARDS IN ASSEMBLING OF SECONDS WHEEL TENSION SPRING:

The seconds wheel tension spring is a thin soft spring and easily mutilated. Use care in replacing this spring.

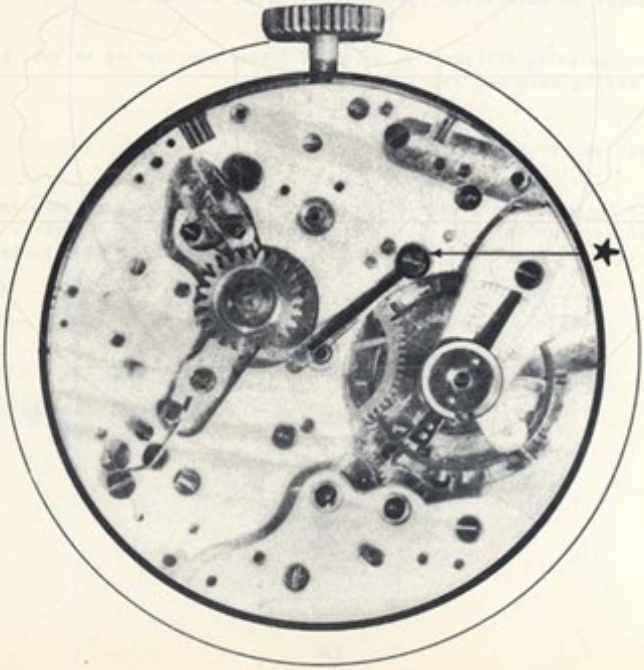
E. FUNCTION OF SECONDS WHEEL TENSION SPRING:

1. It keeps a tension on seconds wheel so that while this wheel is turning it has a smooth action with no jumping or jerking.
2. The second purpose of this spring is a brake to keep seconds wheel in a stationary position when the seconds wheel is completely free from the chronograph mechanism.

Seconds Wheel Tension Spring
Assembly 15

OILING

The seconds wheel tension spring should not be oiled.



PART NO. 16.

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER SPRING:

This spring is held in place by a fillister head screw FS-5. When this screw is removed, spring may be lifted from plate.

(The shape of screw for this part is shown at the bottom of the page.)

B. HAZARDS IN DISASSEMBLY OF INTERMITTENT LEVER SPRING:

This small wire spring is placed on movement with loop in spring over hole for fillister screw. The straight end of spring B is placed on inside of eccentric stud on intermittent lever. The other end of spring A is bent to fit down in hole in plate. The fillister head screw FS-5 can now be replaced.

Reference: Eccentric stud is 17 A.

C. HAZARDS IN ASSEMBLING INTERMITTENT LEVER SPRING:

When replacing fillister screw, hold finger over spring so that screw or spring does not shoot away.

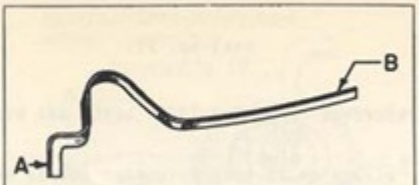
D. FUNCTION OF INTERMITTENT LEVER SPRING.

This spring holds a tension on eccentric stud on intermittent lever. This tension forces intermittent lever to pivot on eccentric stud engaging the intermittent wheel with seconds wheel dart tooth.

Reference: Intermittent wheel is Assembly 17 B.

Eccentric stud is Assembly 17 A.

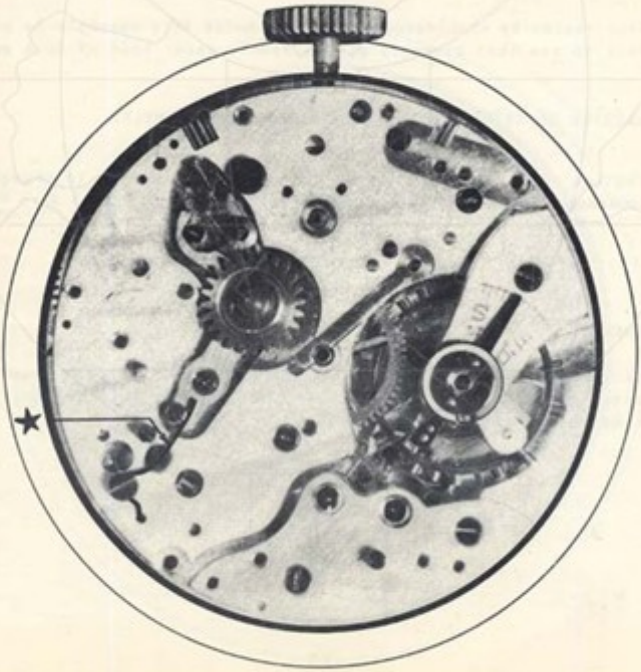
Seconds wheel dart tooth is Assembly 14 A.



Intermittent Lever Spring Assembly 16

OILING

End of spring 'B' should be slightly moistened with oil at point of contact with eccentric stud on intermittent lever.



PART NO. 17.

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

This assembly pivots on an eccentric stud and is held in place by shouldered screw SS-6. When this shouldered screw is removed, assembly can be lifted out of place.

(The shape of screw for this part is shown at the bottom of the page.)

B. ASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

Place this assembly in recess in plate with hole in assembly over eccentric stud on plate as assembly pivots on this stud. Now replace shouldered screw SS-6 that holds this assembly in place.

C. HAZARDS IN ASSEMBLING OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

After replacing shouldered screw that holds this assembly in place, check to see that assembly pivots freely under head of this screw.

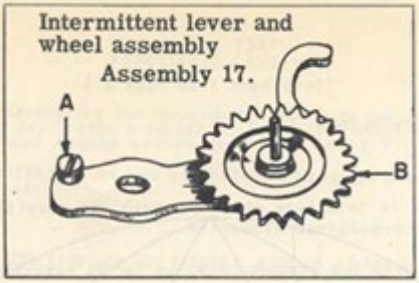
D. FUNCTION OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

Function of intermittent lever and wheel assembly is to engage and disengage the wheel on this assembly with the seconds wheel dart tooth.

Reference: Seconds wheel dart tooth is Assembly 14 A.

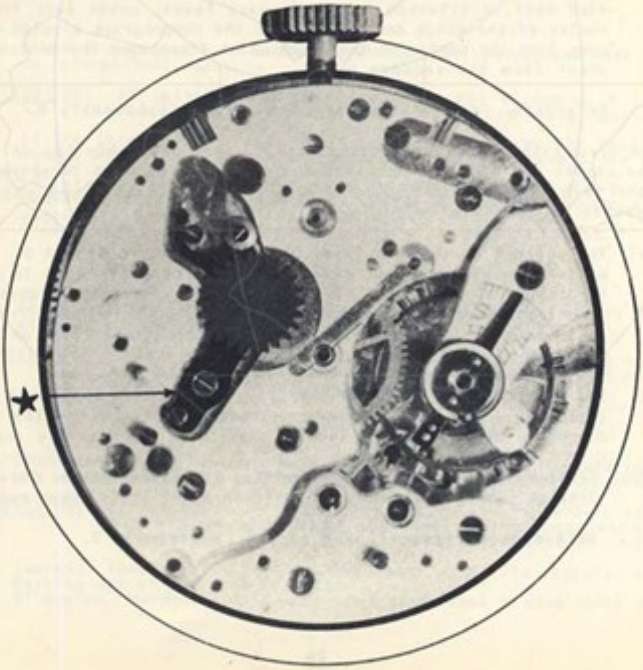
E. REMARKS:

The intermittent wheel transmits the power from seconds wheel dart tooth to the minute register wheel, of course, this can only take place when these wheel are engaged.



OILING

The Eccentric Stud that Intermittent Lever pivots on should be slightly moistened with oil. Do not oil Intermittent Wheel.



PART NO. 8.

(Continued from Page 8.)

HOW FUNCTION TAKES PLACE:

FLYBACK LEVER:

The flyback lever in this type of chronograph has complete control of the function of the chronograph mechanism.

Suppose we start with the flyback lever as far as possible from the center of watch and follow the function of this lever step by step as it is moved towards center of watch.

1. First press push piece for setting back to zero, Assembly 10, in as far as it will go and release it. When you have done this the flyback lever should have moved toward the center of watch, and results of this are as follows:

   (a) First of all the flyback lever has an eccentric stud attached to it. See stud on flyback lever, Assembly 8 A.
   This stud is in contact with the chronograph pivoted detent. When the flyback lever is moved in toward the center of the watch, this stud that is attached to the flyback lever, moves away from the center of the watch and also forces the chronograph pivoted detent away from the center of the watch which disengages the intermediary wheel from the seconds wheel.

   Reference: Chronograph pivoted detent is Assembly 6.

2. Now press push piece for setting back to zero, Assembly 10, in toward the center of watch for the second time and release it. When you have done this the flyback should have moved to the center of watch and results of this are as follows:

   (a) The angle F on flyback lever hits on eccentric stud A on intermittent lever and wheel assembly and forces this stud in toward the center of the watch. Thus forcing the intermittent wheel away from the center of the watch and disengaging this wheel from dart tooth on seconds wheel. See stud on intermittent lever and wheel Assembly 17 A.

   (b) The flyback lever hits the hearts on the seconds wheel and minute register wheel. The pressure on these hearts brings the wheels connected to these hearts back to their original starting position.

Remarks: Flyback lever spring fits in notches on flyback lever. This holds flyback lever to its correct position until it is moved manually.

Reference: Flyback lever spring is Assembly 7.

FUNCTIONAL RESULTS

After completely assembling the chronograph, check to see that parts function correctly. Below are listed a number of functional results that should occur along with the most common errors that will prevent their occurrence.

To give us a starting point, we will place the watch pendant up with back of watch facing us.

I. PUSH BUTTON ON THE RIGHT OF THE PENDANT, RELEASE IT AND CHECK THE FOLLOWING:

A. Check to see that intermediary wheel is properly engaged with seconds wheel.

CORRECTION: The following errors could prevent the intermediary wheel from properly engaging the seconds wheel.

1. The chronograph pivoted detent not pivoting freely.
2. The chronograph pivoted detent spring not having enough tension on chronograph pivoted detent to force it toward the center of the watch.
3. The flyback lever not moving to its proper position will cause improper engagement of these wheels.
4. Eccentric studs can cause faulty engagement of the intermediary wheel with seconds wheel.
   (See adjustment of eccentric studs in front of book.)

B. Check to see that dart tooth on seconds wheel is engaged with teeth on intermittent wheel.

CORRECTION: If intermittent wheel teeth do not engage with seconds wheel dart tooth. The following errors could cause this:

1. If the intermittent lever spring does not hold enough tension on intermittent lever to force intermittent wheel in toward the center of the watch.
2. If intermittent lever and wheel assembly does not pivot freely.
3. Eccentric studs could also cause faulty engagement of intermittent wheel with seconds wheel dart tooth.
   (See adjustment of eccentric studs in front of book.)

C. Check to see that seconds hand moves forward in a steady manner with no jumping or jerking.

CORRECTION: This irregular movement of the seconds hand is usually caused by the seconds wheel tension spring not holding proper tension on seconds wheel.

D. Check the minute register hand to see that it moves forward exactly one minute each time the sweep seconds hand makes one revolution.

CORRECTION: If the minute register hand does not move forward exactly one minute each time the sweep seconds hand makes one revolution. The following errors could cause this:

1. Improper tension of minute register pawl on minute register wheel.
2. Working end of pawl not polished.
3. Of course, improper fitted hand could cause hand to move incorrectly.

2. PUSH BUTTON TO LEFT OF PENDANT TOWARD CENTER OF WATCH AS FAR AS IT WILL GO, RELEASE IT AND CHECK THE FOLLOWING:

   A. Check to see that push piece for setting back to zero has returned to original position after pressure has been released.

      CORRECTION: The push piece may be prevented from returning to its original position by the following errors.

      1. The push piece binding and not pivoting freely.
      2. The push piece for setting back to zero spring not holding enough tension on push piece to force it away from the center of the watch.
      3. End C of push piece for setting back to zero having burrs on it and catching on flyback lever could prevent push piece from returning to its original position.

   B. Check to see that intermediary wheel is disengaged from seconds wheel.

      CORRECTION: These two wheels could be prevented from disengaging by the following errors:

      1. Failure of flyback lever to move to its proper position.
      2. The chronograph pivoted detent binding and not pivoting freely.
      3. Improper adjustment of eccentric studs.
         (See adjustment of eccentric studs in front of book)

   C. Check to see that seconds wheel stays in a stationary position and does not move even if watch is bumped.

      CORRECTION: The seconds wheel moving and not staying in a stationary position, can be caused by the seconds wheel tension spring not holding enough tension on seconds wheel.

3. PUSH BUTTON TO LEFT OF PENDANT A SECOND TIME, RELEASE IT AND CHECK THE FOLLOWING:

   A. Check to see that the ends of flyback lever are in contact with hearts on seconds wheel and minute register wheel.

      CORRECTION: If the ends of flyback lever are not in contact with hearts on seconds wheel and minute register wheel, the following error can cause this:

      1. Flyback lever spring improperly adjusted to flyback lever. The flyback lever spring should hold end of flyback lever in contact with hearts.

   B. Check to see that intermittent wheel teeth disengage from seconds wheel dart tooth.

      CORRECTION:

      1. Improper adjustment of eccentric screws usually prevents these two wheels from disengaging.
         (See adjustment of eccentric studs in front of book.)

   C. Check to see that minute register pawl lies directly in the center of two of minute register wheel teeth. Failure to have this adjusted properly will result in minute register hand moving after flyback lever is moved away from hearts.

      CORRECTION:

      1. Adjust minute register pawl so that it does lie directly center of two teeth when minute register hand has been returned to a zero position by flyback lever.

IDENTIFYING A CHRONOGRAPH OR STOP WATCH

The chronograph and stop watch are very similar in appearance in many respects, but there is a difference which will enable you to distinguish the chronograph from the stop watch.

The chronograph is a watch having at least one supplementary hand in addition to the regular hour, minute, and second hand which can be started, stopped or returned to zero at will. Thus the chronograph can be used as a regular timekeeping watch and may also be used in registering observations.

The stop watch is a watch which has only the necessary hands to register an observation, the hour, minute, and seconds hand being omitted. The stop watch is not used to indicate the time of day, but only to register the length of observations.

The stop watch is divided into two categories, the stop watch in which the balance wheel is continually in motion and the stop watch in which the balance wheel is in motion only during the actual timing of observations.

The advantage in the latter type is that the watch is running only during the actual timing operation. Thus there is less wear to the stop watch and the mainspring does not have to be wound so often. This is especially true in the stop watch which has a very rapid oscillation of the balance. The stop watch by altering the hairspring and balance wheel to increase the oscillation of the balance can be made to register 1/30, 1/50, or even 1/100 of a second. This increase in the oscillation of the balance in the stop watch is possible because the balance wheel is in motion only during the actual timing operation and the watch does not indicate the time of day.

The chronograph is designed to register the time correct to 1/5 of a second. It would be difficult to make a chronograph register correctly to less than 1/5 of a second, as the rapid oscillation of the balance would require too large a mainspring to run the watch for a twenty-four hour period, and the hour and minute hand would have to be geared down tremendously to keep the correct time.

The chronograph usually embodies the basic principles by which the stop watch performs its function, and to anyone familiar with the functions of the various parts of a chronograph should have no trouble understanding stop watch mechanism.

DIRECTIONS FOR READING CHRONOGRAPH DIAL

THE TACHOMETER

A. The tachometer is used to indicate the speed of an object in miles per hour. A tachometer can only indicate the average speed of an object traveling over a course of a measured mile.

METHOD OF USING TACHOMETER

1. Start chronograph sweep second hand at the exact moment the object starts to travel the measured distance of one mile.
2. When the object has traveled the course of one mile, stop the chronograph at the point on the tachometer scale where the sweep second hand stopped. It will indicate the average speed in miles per hour.

SPLIT SECOND SCALE

B. This scale is divided into 300 divisions. Each indicating 1/5 of a second every fifth division is marked with extra long lines denoting one second.

The main purpose of this scale is to measure a fraction of a second accurately.

SECOND HAND

C. The second hand indicates the passing of seconds and should move one space each second. One complete revolution of hand denotes passage of one minute. This hand is independent of chronograph mechanism and continues to register the seconds as long as watch is running.

TELEMETER

D. The telemeter is used to denote the number of miles between two points. This is done by comparing the speed of light to the speed of sound.

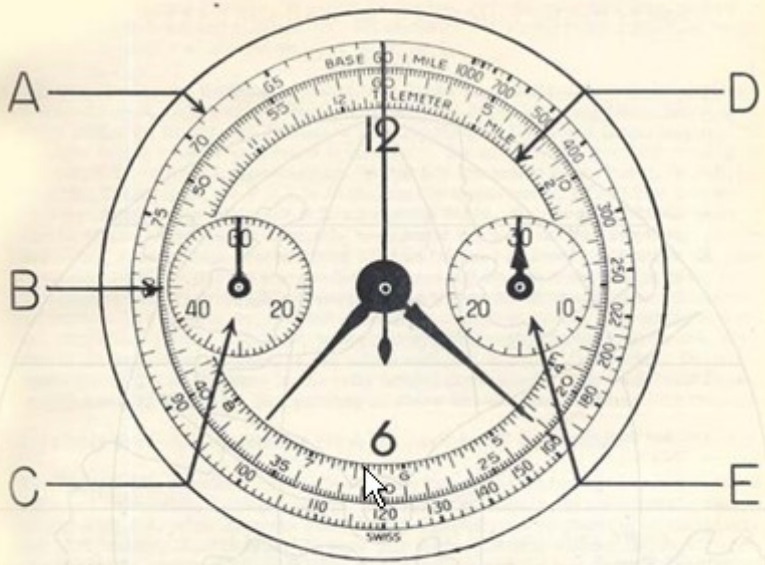
METHOD OF USING TELEMETER

1. Start chronograph sweep second hand when you see lightning.
2. Stop the chronograph sweep second hand when you hear the thunder. The point on the telemeter scale where the sweep second hand stopped will indicate the distance in miles the lightning is away from you.

MINUTE REGISTER

E. The minute register hand registers the number of minutes the chronograph has been in operation. This hand should move forward one space each minute that the chronograph is in operation.

THE CHRONOGRAPH DIAL



SETTING THE HANDS CORRECTLY ON A CHRONOGRAPH:

After the chronograph is completely assembled and in working condition, place chronograph in its case. Now replace the hands, replace the hour hand, minute hand and second hand as you would on a regular watch. At this point, do not replace the sweep second or the minute register hand. Now push the button and bring the flyback lever in toward the center of the watch. When the flyback lever is held in toward the center of the watch, place the sweep second hand at 60 on split second scale 'B'. Place the minute register hand at 30 on minute register scale 'E'. After these hands are replaced, start chronograph mechanism with sweep second hand turning. Leave chronograph mechanism run for at least one minute, now push the button to bring the flyback lever in toward the center of the watch again, and check to see that the minute register hand and the sweep second hand goes back to their original position.