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WORLD'S ONLY
FULLY ILLUSTRATED

CHRONOGRAPH WATCH COURSE

VOLUME 2

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ILLUSTRATIONS

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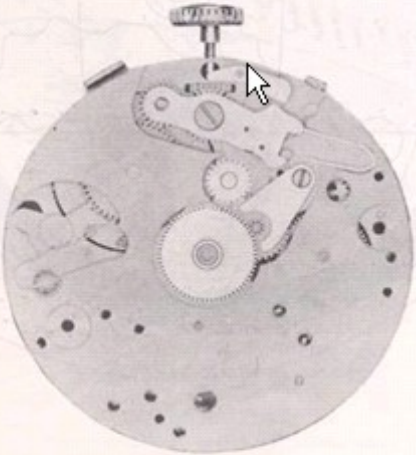
IDENTIFICATION OF CHRONOGRAPH



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THE WORLD'S FIRST FULLY

ILLUSTRATED TEXT BOOK

ON

CHRONOGRAPH REPAIRING

AND ADJUSTING

Copyright 1949
BY
William O. Smith, Sr.
PRESIDENT AND TECHNICAL DIRECTOR
AND
William O. Smith, Jr.
CHIEF ENGINEER, RESEARCH LABORATORIES

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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)

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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.

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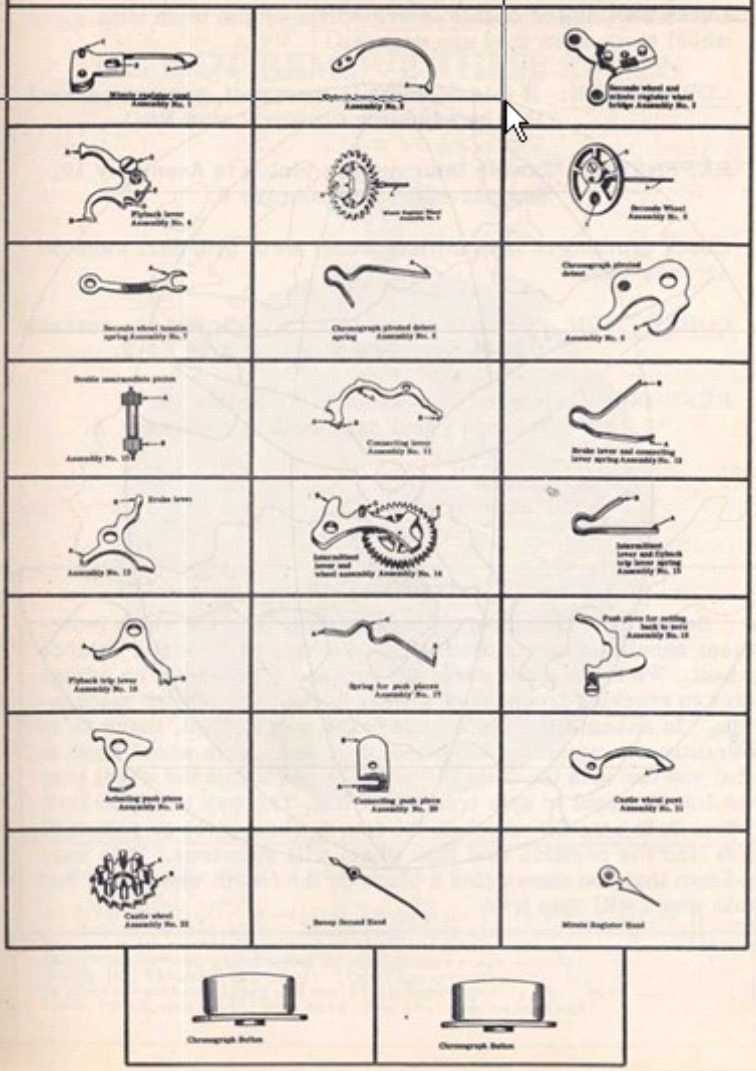
NOMENCLATURE OF PARTS FOR CHRONOGRAPH MECHANISM



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Adjusting Eccentric Studs -- Things To Check

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

1. Check depthing of double intermediate pinion teeth with wheel teeth when they are engaged.

   CORRECTION: If this depthing is incorrect, you can correct this by adjusting eccentric stud ES-1.

   REFERENCE: Double intermediate pinion is Assembly 10. Seconds wheel is Assembly 6.

2. Check depthing of intermittent wheel teeth with dart tooth on seconds wheel.

   CORRECTION: If this depthing is incorrect, you can correct this by adjusting eccentric stud ES-2.

   REFERENCE: Intermittent wheel is Assembly 14. Seconds wheel dart tooth is Assembly 6.

****Notice****

Before assembling chronograph mechanism, the watch movement should be assembled with exception of fork and balance wheel. We leave these parts out because it gives you an advantage in checking trueness of wheels in the chronograph mechanism. In assembling the chronograph mechanism, there is an advantage in replacing the wheel over the fourth wheel first so that you can spin the train of the watch and adjust the wheel over the fourth wheel to spin true in the flat. The way to adjust this wheel is to turn the wheel on the fourth wheel pivot or post until you find the position that this wheel will spin true. It is very seldom that you cannot find a place on the fourth wheel post that this wheel will spin true.

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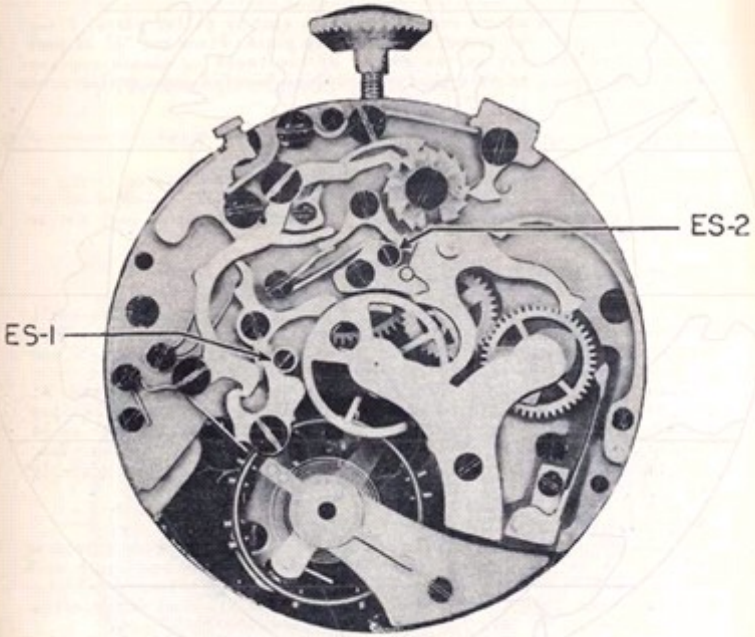
ADJUSTING ECCENTRIC STUDS

DO NOT REMOVE THESE STUDS



CAUTION

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.

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PART NO. 1

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL:

This pawl is held in place by beveled countersink screw BS-1. Remove this screw and pawl may be lifted from movement.
(The shape of screw for this part is shown at bottom of page)

B. HAZARDS IN DISASSEMBLY OF MINUTE REGISTER PAWL:

This pawl should be very carefully removed as the tension spring is thin and easily bent. A very slight bend in tension spring may cause pawl not to function properly when it is replaced.

C. ASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL:

Place post 'C' on minute register pawl in slot in pillar plate. Place slot 'B' in pawl over proper screw hole in plate. Place end 'A' of pawl so it rests directly in the center of two teeth on minute register wheel. With pawl in this position replace beveled countersink screw BS-1 to hold it in position.

D. HAZARDS IN ASSEMBLY OF MINUTE REGISTER PAWL:

Handle pawl very carefully when replacing it as the tension spring is very easily ruined. The end 'A' of pawl must be highly polished as any pits of rust or roughness at this location will cause pawl not to function properly.

E. ADJUSTING MINUTE REGISTER PAWL:

After replacing pawl, push push piece for setting back to zero until flyback lever returns minute register wheel to a zero position. With wheel in this position, loosen the screw that holds pawl to plate and adjust pawl so that end 'A' lies directly in the center of two teeth on minute register wheel. Now adjust the tension that holds end 'A' of pawl to minute register wheel teeth. This tension must be very light as a strong tension causes the minute register wheel to be unnecessarily hard to turn or it may cause the watch to stop. Yet, the tension must be strong enough for the pawl to function properly as described above.

F. FUNCTION OF MINUTE REGISTER PAWL:

The minute register pawl serves two purposes: 1. It holds a tension on minute register wheel so this wheel moves exactly one tooth each minute. 2. It holds minute register wheel in a stationary position so a bump cannot alter position of wheel until it is moved mechanically.

Reference: Minute register wheel is Assembly 5.
Push piece for setting back to zero is Assembly 18
Flyback lever is Assembly 4.

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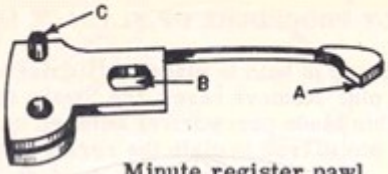
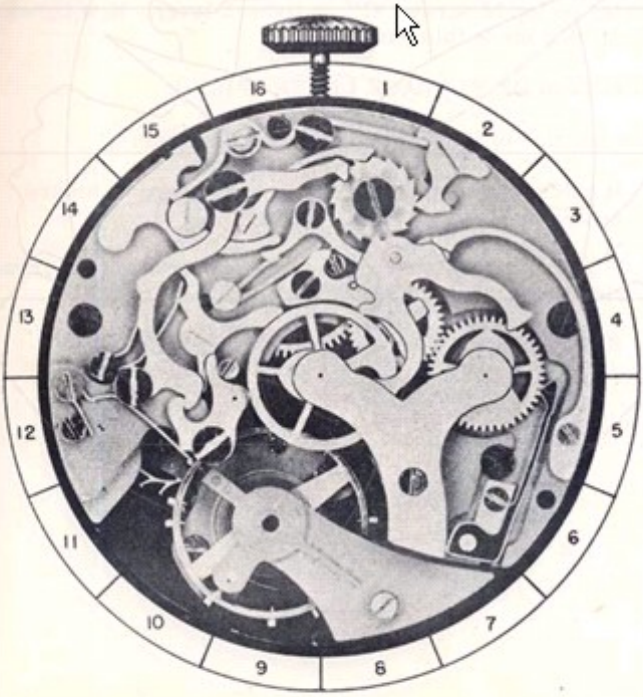


Minute register pawl
Assembly No. 1

OILING

The minute register pawl should not be oiled.



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PART NO. 2

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

The flyback lever is held in place by fillister head screw FS-1 and a steady pin. Remove screw and loosen spring from plate by sliding a thin blade screwdriver between spring and plate. When steady pin is free in plate the spring may be removed from watch.

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

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

Place spring in position on plate with steady pin in proper hole. Press spring down flush with plate and replace fillister head screw FS-1. Before tightening this screw, place end "A" of spring on top of screw "C" on flyback lever. Now tighten screw that holds this part in place.

C. FUNCTION OF FLYBACK LEVER SPRING:

The function of this spring is to do two things:

1. It holds a tension on flyback lever, forcing it toward center of watch.
2. It holds flyback lever down in place, preventing it from riding up and coming free from stud.

REFERENCE: Flyback lever is Assembly 4.

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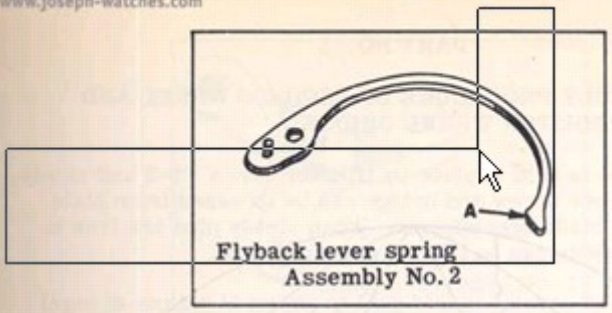

Flyback lever spring
Assembly No. 2

OILING

End 'A' of spring should be slightly moistened with oil at point it contacts screw 'C' on flyback lever.

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PART NO. 3

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

This bridge is held in place by fillister screw FS-2 and steady pins. Remove screw and bridge can be loosened from plate with a thin blade screwdriver. When steady pins are free in plate the bridge can be lifted from movement.

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

When loosening bridge from plate be sure to keep the bridge level. Any twisting of bridge may burr pivots on seconds wheel or minute register wheel or may chip jewels in bridge. Be careful not to mar plate or bridge with screwdriver.

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

Place bridge in position with steady pins over proper holes in plate. Now place seconds wheel and minute register wheel so the pivots on these wheels enter holes in jewels. Press bridge down with back of tweezers and replace fillister screw FS-2.

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

The function of this bridge is to hold the seconds wheel and minute register wheel upright so these wheels can function properly.

REFERENCE: Seconds wheel is Assembly 6
Minute register wheel is Assembly 5

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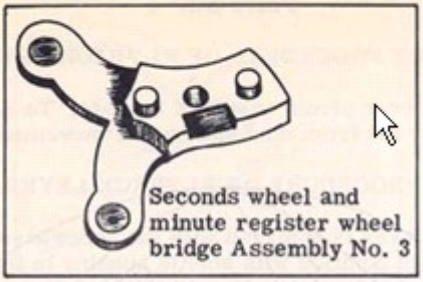

Seconds wheel and minute register wheel bridge Assembly No. 3

OILING

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

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PART NO. 4

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER:

The flyback lever pivots on a stud in plate. To remove this lever, simply lift from stud and free of movement.

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER:

The flyback lever is replaced with the screwhead "C" down. Place lever in position with hole in bushing in flyback lever over proper stud in plate. Now the flyback lever may be pressed down to its correct position.

C. FUNCTION OF FLYBACK LEVER:

The flyback lever has two functions:

1. It disengages intermittent wheel from seconds wheel dart tooth.

2. The ends "A" and "B" of flyback lever contacts the hearts on the seconds wheel and minute register wheel, forcing these wheels to return to a zero position.

REFERENCE: Seconds wheel dart tooth is Assembly 6-C.
Minute register wheel heart is Assembly 5-B.
Seconds wheel heart is Assembly 6-B.

REMARKS: The ends "A" and "B" of flyback lever must be of correct length to hold seconds wheel and minute register wheel in a stationary position when flyback lever is forced toward the center of the watch.

While holding flyback lever in contact with hearts, each wheel should be tested with a fine broach for any lost motion or turning of wheel. Any turning of either wheel will indicate the end of flyback lever for this wheel is too short.

The one end of flyback lever being too short may cause the wheel not to return to a zero position.

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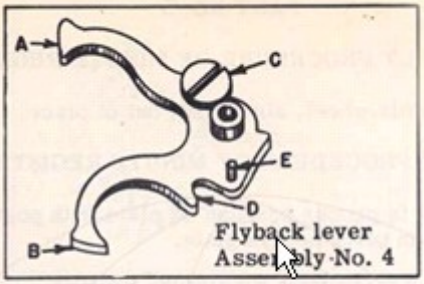

Flyback lever
Assembly No. 4

OILING

The flyback lever should be slightly moistened with oil at these points.

1. Stud flyback lever turns on.
2. Point 'D' on flyback lever that contacts pin 'C' on intermittent lever.
3. Pin 'E' on flyback lever that contacts end 'B' on flyback trip lever.

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PART NO. 5

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

To remove this wheel, simply lift out of place.

B. ASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

Place wheel in proper position on plate with post "A" of wheel down in pivot hole in plate.

C. FUNCTION OF MINUTE REGISTER WHEEL:

The function of this wheel is to do two things:

1. It registers the passage of minutes on the dial, this is done by a hand being attached to post "A" on the minute register wheel pinion.

2. It returns the minute register hand to a zero position. This is done by the flyback lever contacting the heart on the minute register wheel, forcing wheel and hand to a zero position.

REFERENCE: Minute register wheel heart is Assembly 5-B. Flyback lever is Assembly 4.

REMARKS: The minute register wheel is returned to a zero position by the flyback lever contacting the heart on the minute register wheel. The heart on this wheel is set eccentric. When the flat end of flyback lever contacts this eccentric heart, it forces the heart to turn. The heart will turn until the flat end of flyback lever sets across the two lobes at top of heart. With the pressure equalized on these two lobes, it will turn no further, and this would be a zero position.

The minute register wheel can return to a zero position clockwise or counter clockwise. It depends on the position of the heart when flyback lever is brought in contact with heart. If the wheel has turned less than 180^{0} from a zero position when flyback lever is brought in contact with heart, it will turn the opposite direction to which it was turning. If the wheel has turned past 180^{0}, the flyback lever will force it to continue to turn in the direction it was traveling until it reaches a zero position.

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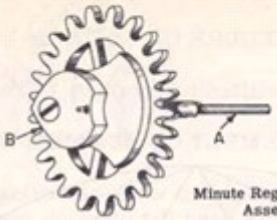
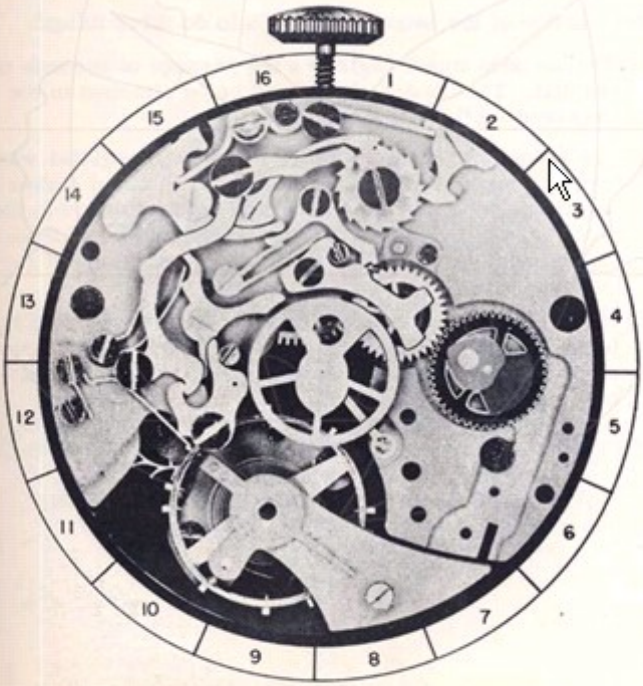


Minute Register Wheel
Assembly No. 5

OILING

The top and bottom pivots of minute register wheel should be oiled after bridge for this wheel is placed in watch. Oil these pivots as you would normally oil the train pivots in a watch.



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PART NO. 6

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL:

The seconds wheel is lifted out of place to remove it.

B. HAZARDS IN DISASSEMBLY OF SECONDS WHEEL:

Lift seconds wheel straight up when removing. Any twisting may burr the bushing or bend the pivot on seconds wheel.

C. ASSEMBLY PROCEDURE OF SECONDS WHEEL:

Place wheel in position with long post "A" down in hole in bushing in center of watch.

D. FUNCTION OF SECONDS WHEEL:

The function of the seconds wheel is to do three things:

1. The seconds wheel registers the passage of seconds on the dial. This is done by a hand being attached to the long post "A" on seconds wheel.
2. The seconds wheel must move the minute register wheel forward one tooth each time the seconds wheel makes one revolution. This is done by a dart tooth attached to the seconds wheel. This dart tooth meshes with the teeth on intermittent wheel which in turn moves the minute register wheel.
3. The seconds wheel must return the hand attached to it to a zero position. This is done by a heart being attached to seconds wheel which forces this wheel and hand to a zero position.

REFERENCE: Seconds wheel dart tooth is Assembly 6-C.
Intermittent wheel is Assembly 14-A.
Seconds wheel heart is Assembly 6-B.

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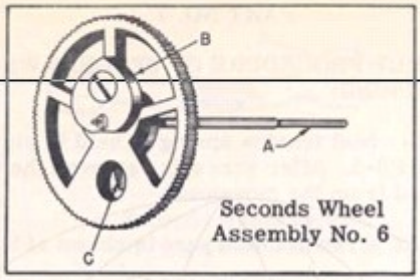
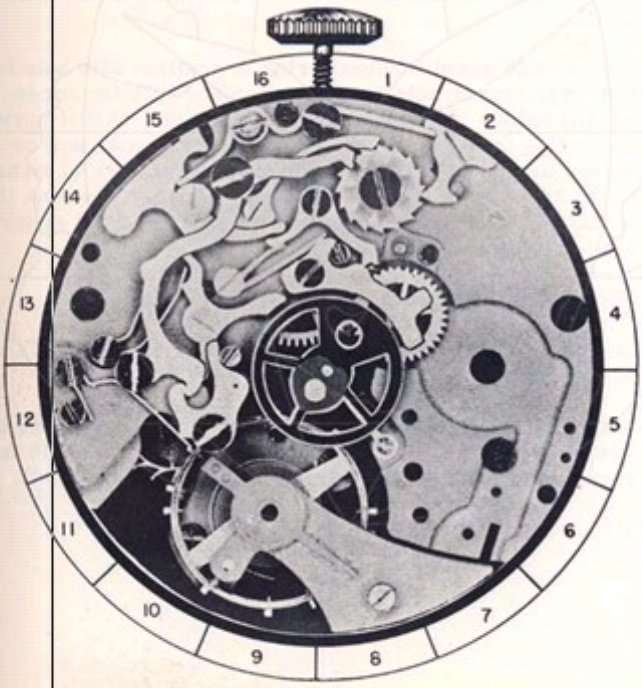


Seconds Wheel
Assembly No. 6

OILING

The top pivot of seconds wheel should be oiled after bridge for this wheel is placed in watch. The bottom pivot should not be oiled.



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PART NO. 7

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

The seconds wheel tension spring is held in place by fillister head screw FS-3. After screw is removed the tension spring may be lifted from the movement.

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

B. HAZARDS IN DISASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

This tension spring should be carefully removed, as this spring is very thin and can be easily bent.

C. ASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

Place seconds wheel tension spring in position with hole in spring over proper hole in plate. Replace fillister screw FS-3, but before tightening screw, center end "A" of spring over bushing for seconds wheel pivot. Screw may now be tightened to hold spring in proper position. Check to make sure spring is right side up. The only way to determine the side that should be up is to make sure that end "A" of spring is above the level of plate.

D. FUNCTION OF SECONDS WHEEL TENSION SPRING:

This spring holds a tension on seconds wheel to keep it running with an even action with no jumping or jerking.

E. REMARKS: When replacing this spring, the end "A" must be centered over bushing for seconds wheel pivot. This is to prevent any contact of spring with seconds wheel staff.

REFERENCE: Seconds wheel is Assembly 6.

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Seconds wheel tension spring Assembly No. 7

OILING

The seconds wheel tension spring should not be oiled.

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PART NO. 8

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

This spring is held in place by shouldered screw SS-1 and a fillister head screw. In removing this part it is only necessary to remove shouldered screw SS-1. After removing screw, spring will be free on plate and may be lifted out of place.

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

B. HAZARDS IN DISASSEMBLY OF CHRONOGRAPH PIVOTED DETENT SPRING:

Hold finger over spring when removing screw so that spring cannot shoot away.

C. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

Place spring in its proper position on plate. Hold finger over spring. Now replace shouldered screw SS-1 to hold this spring in place.

D. FUNCTION OF CHRONOGRAPH PIVOTED DETENT:

The function of chronograph pivoted detent spring is to force the chronograph pivoted detent in toward the center of watch. This engages the pinion "A" on double intermediate pinion with the seconds wheel.

REFERENCE: Chronograph pivoted detent is Assembly 9.
Double intermediate pinion is Assembly 10.

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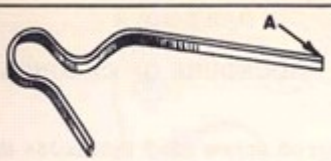

Chronograph pivoted detent spring Assembly No. 8

OILING

End 'A' of chronograph pivoted detent spring should be slightly moistened with oil at point it contacts chronograph pivoted detent.

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PART NO. 9

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

Remove shouldered screw SS-2 that holds this detent in place. After screw is removed, detent will be free on plate and may be removed.

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

B. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

Place detent in proper position on plate. Make sure that double intermediate pinion pivot has entered hole in bushing in pivoted detent. Hold detent in this position and replace shouldered screw SS-2 that holds detent in place. Detent should pivot easily under head of screw.

C. HAZARDS IN ASSEMBLY OF CHRONOGRAPH PIVOTED DETENT:

Be sure that pivot has entered bushing in chronograph pivoted detent before replacing shouldered screw. Failure to have pivot properly placed in bushing may result in bending of pivot or bridge.

D. FUNCTION OF CHRONOGRAPH PIVOTED DETENT:

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

REFERENCE: Double intermediate pinion is Assembly 10.
Seconds Wheel is Assembly 6

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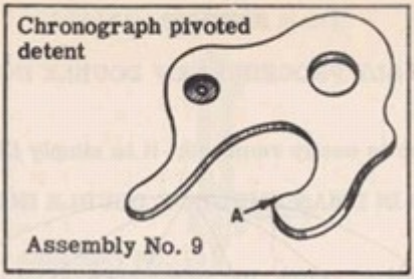

OILING

The following points on chronograph pivoted detent should be slightly moistened with oil.

1. The shoulder of screw that detent pivots on.
2. Point 'A' on pivoted detent that contacts end 'A' on connecting lever.
3. The pivot in bushing in detent should be oiled as you would properly oil a train pivot in a watch.

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PART NO. 10

A. DISASSEMBLY PROCEDURE OF DOUBLE INTERMEDIATE PINION:

This pinion is easily removed; it is simply lifted out of place.

B. HAZARDS IN DISASSEMBLY OF DOUBLE INTERMEDIATE PINION:

When removing pinion, lift pinion straight up as any tilting may bend pivot or burr bushing in plate.

C. ASSEMBLY PROCEDURE OF DOUBLE INTERMEDIATE PINION:

Place pinion in its proper position on plate with pivot on pinion in bushing hole in plate. Be sure that end "A" of double intermediate pinion is up.

D. FUNCTION OF DOUBLE INTERMEDIATE PINION:

Function of the double intermediate pinion is to transfer the power from the main train of the watch to the chronograph mechanism. This pinion continues to turn as long as the watch is running.

REMARKS: You will notice the pinion "A" on double intermediate pinion has very fine teeth. You will also notice on the seconds wheel that this wheel also has very fine teeth. The reason for this is that when the double intermediate pinion engages with the seconds wheel there is very little error in the meshing of these teeth.

For example: If the double intermediate pinion had large teeth and the seconds wheel had large teeth, when the intermediate pinion engaged with the seconds wheel, to engage it may have to shift the seconds wheel clock-wise or counterclock-wise so that these teeth could mesh. Naturally, this would cause a loss or gain in the time and would not give you a correct reading on the dial.

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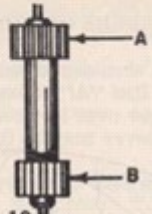
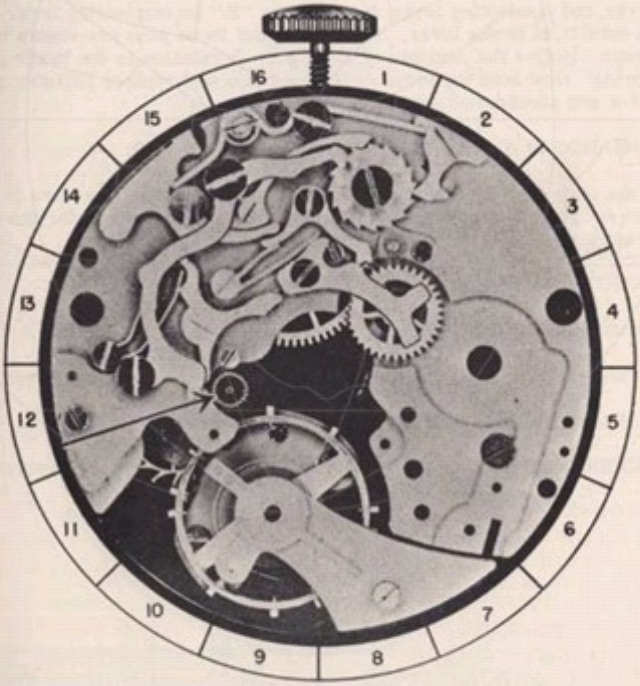
Double intermediate pinion



Assembly No. 10

OILING

The top and bottom pivots on double intermediate pinion should be oiled after chronograph pivoted detent is replaced. These pivots are oiled as you would properly oil the train pivots in a watch.



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PART NO. 11

A. DISASSEMBLY PROCEDURE OF CONNECTING LEVER:

This lever pivots on a shouldered stud on plate, and is held on stud by fillister screw FS-4. End "A" of lever works under head of shouldered screw SS-3. Hold finger over lever when removing these screws. When screws are removed, lever may be lifted from stud.

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

B. HAZARDS IN DISASSEMBLY OF CONNECTING LEVER:

Be sure to hold finger over connecting lever when removing screws so that lever cannot shoot away.

C. ASSEMBLY PROCEDURE OF CONNECTING LEVER:

Place lever in position with hole in lever over shouldered stud. Be sure to have pin "C" of connecting lever on the outside of end "B" of brake lever and connecting lever spring. Pin "B" on connecting lever must be on outside of brake lever. The position of these pins are shown in photograph. Notice the position of these pins in relation to the brake lever and spring. Now hold the lever in this position and replace fillister screw FS-4 and shouldered screw SS-3.

D. HAZARDS IN ASSEMBLY OF CONNECTING LEVER:

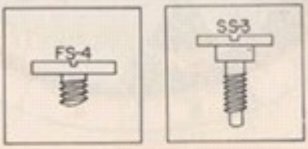
Make sure that the pins "B" and "C" on connecting lever are in their correct positions. If they are not set correctly, it will cause the chronograph not to function properly.

E. FUNCTION OF CONNECTING LEVER:

Function of the connecting lever is to do two things:

1. Disengage double intermediate pinion from the seconds wheel.
2. Disengage brake lever from the seconds wheel.

REFERENCE: Brake lever and connecting lever spring is Assembly 12.
Brake lever is Assembly 13.
Double intermediate pinion is Assembly 10.



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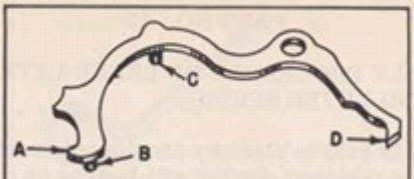

Connecting lever
Assembly No. 11

OILING

These points on connecting lever should be slightly moistened with oil.

1. Stud that connecting lever pivots on.
2. Pin 'B' on lever that contacts end 'A' of brake lever.
3. Pin 'C' on lever that contacts end 'B' on brake lever and connecting lever spring.

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PART NO. 12

A. DISASSEMBLY PROCEDURE OF BRAKE LEVER AND CONNECTING LEVER SPRING:

This spring is held in place by shouldered screw SS-4. When this screw is removed, spring will be free on plate and may be lifted out of place.

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

B. ASSEMBLY PROCEDURE OF BRAKE LEVER AND CONNECTING LEVER SPRING:

Place spring in its proper position on plate. Hold spring in this position with finger and replace shouldered screw SS-4 that holds this spring in place.

C. FUNCTION OF BRAKE LEVER AND CONNECTING LEVER SPRING:

The function of this spring is to do two things:

1. It engages the brake lever with the seconds wheel.

2. It holds the connecting lever engaged with the castle wheel.

REFERENCE: Seconds wheel is Assembly 6.
Connecting lever is Assembly 11.
Castle wheel is Assembly 22.

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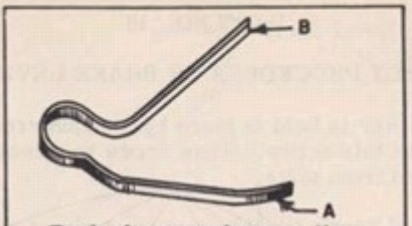

Brake lever and connecting lever spring Assembly No. 12

OILING

End 'A' on brake lever and connecting lever spring should be slightly moistened with oil at the point it contacts end 'B' on brake lever.

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PART NO. 13

A. DISASSEMBLY PROCEDURE OF BRAKE LEVER:

The brake lever is held in place by a shouldered screw SS-5 and pivots on this screw. When screw is removed the brake may be lifted from plate.

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

B. ASSEMBLY PROCEDURE OF BRAKE LEVER:

Place brake lever in its exact position as shown in photograph and replace shouldered screw SS-5.

C. FUNCTION OF BRAKE LEVER:

The function of the brake lever is to hold the seconds wheel in a stationary position when this wheel is disengaged from the chronograph mechanism.

REMARKS: The brake lever must be disengaged from the seconds wheel when the double intermediate pinion is engaged with the seconds wheel. If the brake lever is not disengaged at this time, the seconds wheel cannot turn, naturally, the watch would stop. The engaging and disengaging of brake lever with the seconds wheel is mechanically controlled by the connecting lever.

The brake lever is also manually controlled. When push piece for setting back to zero is pressed, the end of this push piece contacts the brake lever, disengaging brake lever from seconds wheel. This permits the flyback lever to bring the seconds wheel to a zero position.

REFERENCE: Seconds wheel is Assembly 6.

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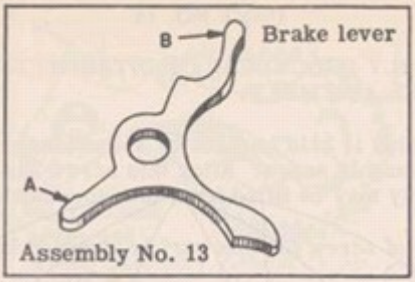
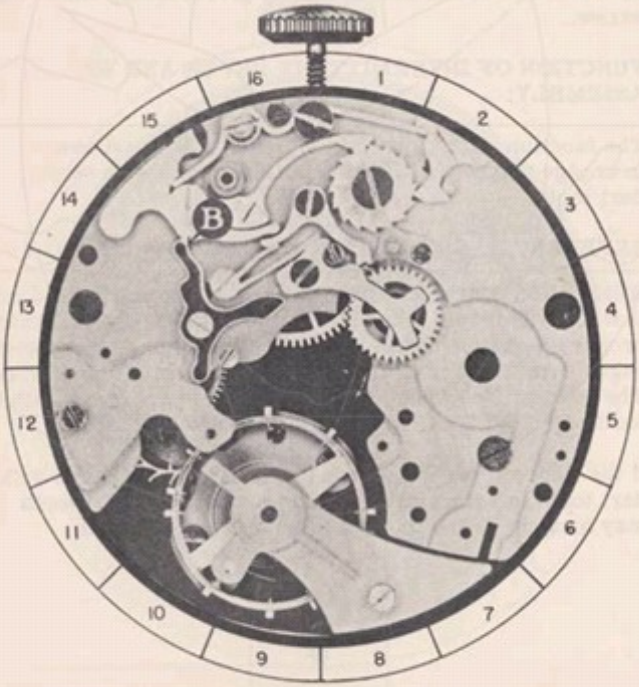


Assembly No. 13

OILING

The brake lever should be slightly moistened with oil at these points:

1. The shoulder of screw that brake lever pivots on.
2. End "B" of brake lever that contacts push piece for setting back to zero.



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PART NO. 14

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

This assembly is held in place by a shouldered screw SS-6 and pivots on this screw. After this screw has been removed, the assembly may be lifted from the movement.

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

B. ASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

Place assembly in its proper position on plate. The intermittent wheel on this assembly should be placed down. Hold assembly in place with finger and replace shouldered screw SS-6. Check to see that assembly pivots freely under head of screw.

C. FUNCTION OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

The function of the intermittent lever and wheel assembly is to engage and disengage intermittent wheel with seconds wheel dart tooth.

REFERENCE: Seconds wheel dart tooth is Assembly 6-C.

REMARKS: The intermittent wheel should be checked to see that it turns freely. Any friction on this wheel will hinder proper operation of chronograph. The intermittent wheel engages with the dart tooth to turn the minute register wheel. The intermittent wheel must be shifted out of mesh with dart tooth when the hands are returned to a zero position.

If the intermittent wheel was not shifted out of mesh with dart tooth in returning the hands to zero, the dart tooth may hang up on the tooth of minute register wheel.

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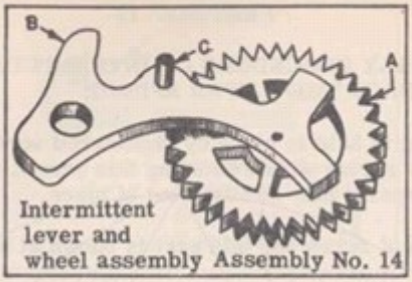
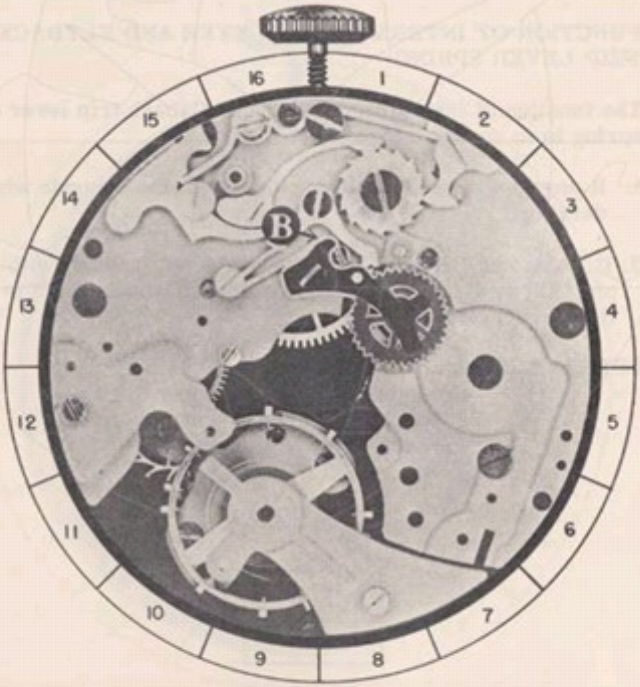


Intermittent lever and wheel assembly Assembly No. 14

OILING

The intermittent lever and wheel assembly should be slightly moistened with oil at these points.

1. Shoulder of screw that intermittent lever pivots on.
2. Point 'B' on intermittent lever that contacts end 'A' on intermittent lever and flyback trip lever spring.



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PART NO. 15

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND FLYBACK TRIP LEVER SPRING:

This spring is held in place by shouldered screw SS-7. Hold finger over spring when removing this screw. After screw is removed, spring may be lifted out of place.

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

B. ASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND FLYBACK TRIP LEVER SPRING:

Place spring in proper position on plate as shown in photograph. Hold finger over spring and replace shouldered screw SS-7 to hold this spring in place.

C. FUNCTION OF INTERMITTENT LEVER AND FLYBACK TRIP LEVER SPRING:

The function of intermittent lever and flyback trip lever spring is to do two things:

1. It engages the intermittent wheel with the seconds wheel dart tooth.

2. It holds end "B" of flyback trip lever in contact with pin "C" on flyback lever. This locks flyback lever in its correct position.

REFERENCE: Intermittent wheel is Assembly 14-A
Seconds wheel is Assembly 6.
Flyback trip lever is Assembly 16.
Flyback lever is Assembly 4.

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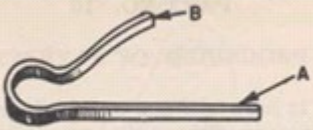
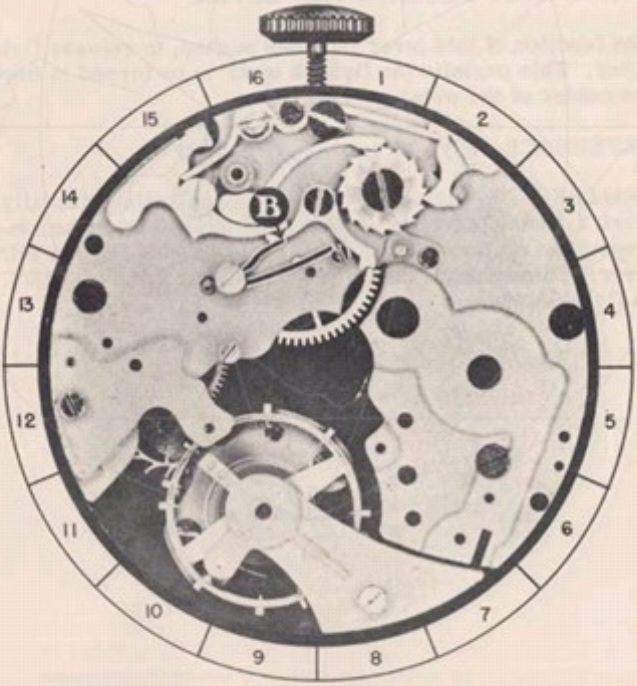


Intermittent lever and flyback trip lever spring Assembly No. 15

OILING

End 'A' of flyback trip lever spring, Part No. 15, that contacts end 'A' of flyback trip lever should be slightly moistened with oil.



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PART NO. 16

A. DISASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER:

This trip lever is held in place by shouldered screw SS-8. When screw is removed this trip lever will be free on plate and may be removed.

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

B. ASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER:

Place lever in its proper position on plate as shown in photograph. Now replace shouldered screw SS-8 to hold this part in place. After screw is replaced, check lever to see that it pivots freely under head of screw.

C. FUNCTION OF FLYBACK TRIP LEVER:

The function of this lever is, when pushed, to release flyback lever. This permits the flyback lever to be forced in toward the center of the watch.

REFERENCE: Flyback lever is Assembly 4.

REMARKS: The flyback trip lever is controlled manually. When the push piece for setting back to zero is pushed in toward the center of the watch, it contacts the flyback trip lever. This unhooks the flyback trip lever from pin "A" on flyback lever.

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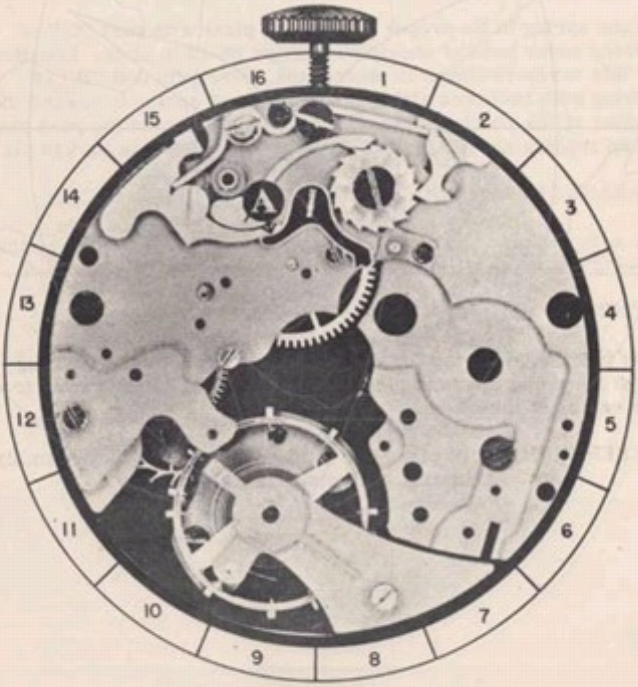
Flyback trip lever
Assembly No. 16

OILING

These points on flyback trip lever should be slightly moistened with oil.

1. The shoulder of screw that lever pivots on.
2. End 'A' of lever that contacts push piece for setting back to zero.



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PART NO. 17

A. DISASSEMBLY PROCEDURE OF SPRING FOR PUSH PIECES:

This spring is held in place by two shouldered screws but in removing this spring it is only necessary to remove shouldered screws SS-9 as shown in photograph. After the screw is removed, grip end "B" of spring with tweezers and unhook it from push piece. When this is done, spring may be slid from under head of other shouldered screw and removed.

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

B. HAZARDS IN DISASSEMBLY OF SPRING FOR PUSH PIECES:

When removing spring, hold finger on spring so that it cannot shoot away.

C. ASSEMBLY PROCEDURE OF SPRING FOR PUSH PIECES:

Place spring in its proper position on plate with part "C" of spring under head of shouldered screw SS-10 in plate. Location of this screw is shown in photograph. Now grip end "B" of spring with tweezers and move end "B" of spring in toward the center of the watch until it hooks onto end of actuating push piece. Then replace shouldered screw SS-9 that holds this part in place.

D. HAZARDS IN ASSEMBLY OF SPRING FOR PUSH PIECES:

Be sure to hold finger over spring when replacing screw so that spring cannot shoot away.

E. FUNCTION OF SPRING FOR PUSH PIECES:

The function of spring for push pieces is to hold the actuating push piece and the push piece for setting back to zero away from the center of the watch.

REFERENCE: **Push piece for setting back to zero is Assembly 18. Actuating push piece is Assembly 19.**

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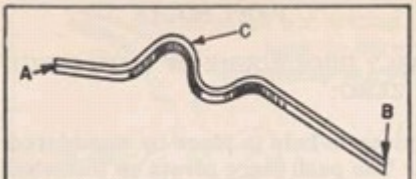
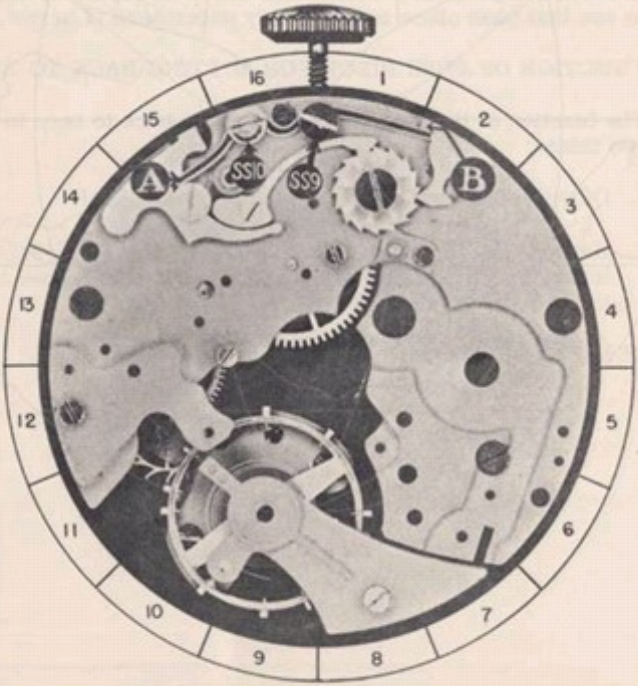


Spring for push pieces
Assembly No. 17

OILING

These points on spring for push piece should be slightly moistened with oil.
End 'A' that contacts push piece for setting back to zero.
End 'B' that contacts actuating push piece.



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PART NO. 18

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

This push piece is held in place by shouldered screw SS-11 and a stud. The push piece pivots on this stud. After shouldered screw is removed, push piece may be lifted out of place.

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

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

Place push piece on proper place on plate with steady pin in proper hole in plate. Now replace shouldered screw SS-11 to hold push piece in place. After screw is replaced, check to see that push piece moves freely under head of screw.

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

The function of the push piece for setting back to zero is to do two things:

1. Disengage the brake lever from seconds wheel.

2. Unhook end "B" of flyback trip lever from the flyback lever, thus permitting the flyback lever to be forced in toward center of watch.

REFERENCE: Flyback lever is Assembly 4
Flyback trip lever is Assembly 16
Brake lever is Assembly 13
Seconds wheel is Assembly 6

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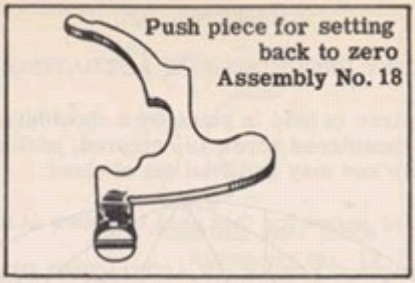
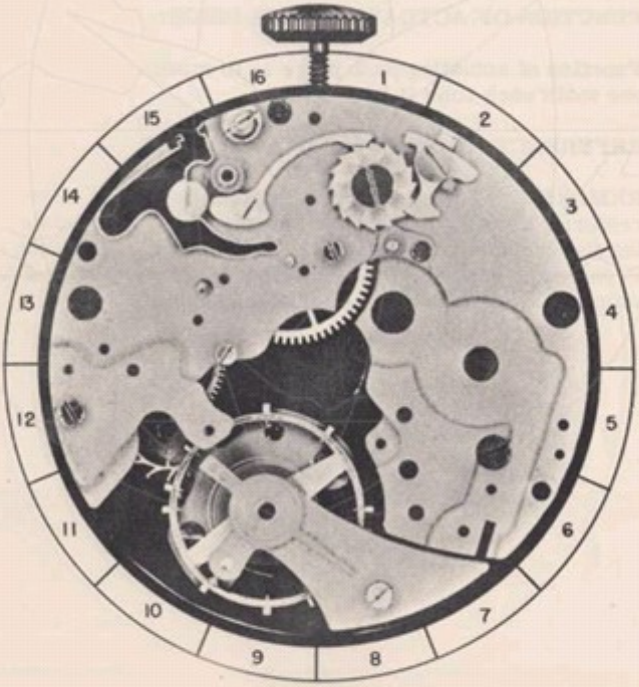


Push piece for setting back to zero Assembly No. 18

OILING

The stud that push piece for setting back to zero pivots on should be slightly moistened with oil.



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PART NO. 19

A. DISASSEMBLY PROCEDURE OF ACTUATING PUSH PIECE:

This push piece is held in place by a shouldered screw SS-12. When this shouldered screw is removed, push piece will be free on plate and may be lifted out of place.

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

B. ASSEMBLY PROCEDURE OF ACTUATING PUSH PIECE:

Place push piece in proper place on plate. Make sure that the hole in actuating push piece is directly over the hole in connecting push piece. Now hold actuating push piece in place with finger and replace shouldered screw SS-12 to hold these parts in place.

C. FUNCTION OF ACTUATING PUSH PIECE:

Function of actuating push piece is to move the castle wheel one tooth each time it is pressed.

REFERENCE: Castle wheel is Assembly 22.

REMARKS: When actuating push piece is pushed in toward the center of the watch, it forces the castle wheel to rotate, moving the castle wheel one tooth. When the actuating push piece is released, a spring forces it away from the center of the watch, placing it back to its original position.

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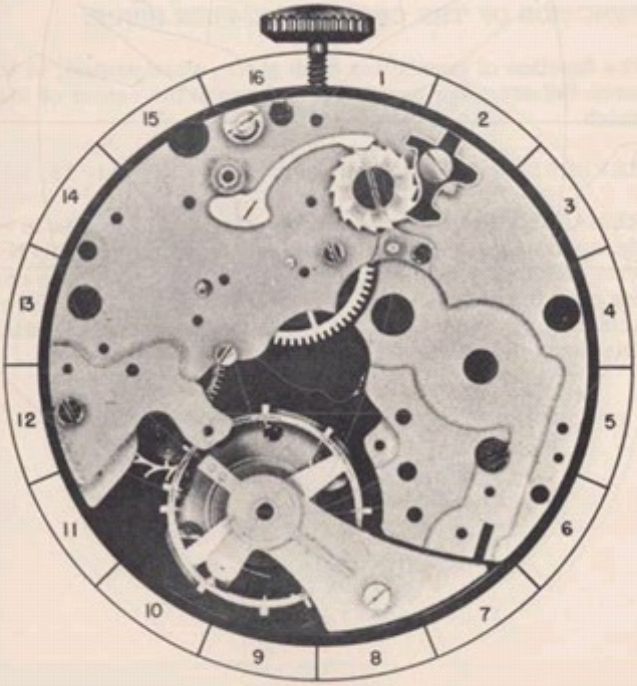
Actuating push piece
Assembly No. 19

OILING

The actuating push piece should not be oiled.



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PART NO. 20

A. DISASSEMBLY PROCEDURE OF CONNECTING PUSH PIECE:

After actuating push piece is removed, the connecting push piece will be free under plate. It can be removed by gripping end "A" of connecting push piece with a pair of tweezers and sliding it from beneath plate.

B. ASSEMBLY PROCEDURE OF CONNECTING PUSH PIECE:

Connecting push piece must be set to its proper position as shown in photograph. The procedure in doing this is to grip end "A" of push piece with pair of tweezers. Now slid end "B" of push piece between barrel and top plate to proper position. The screw that holds this part in place cannot be replaced until after the next part is assembled.

C. FUNCTION OF THE CONNECTING PUSH PIECE:

The function of connecting push piece, when pushed, is to force the actuating push piece in toward the center of the watch.

REFERENCE: Actuating push piece is Assembly 19.

REMARKS: Purpose of the connecting push piece is to connect the actuating push piece with the chronograph button. Naturally, when the button on a chronograph is pushed, it forces connecting push piece toward the center of the watch. This forces actuating push piece toward the center of the watch, naturally, this turns the castle wheel.

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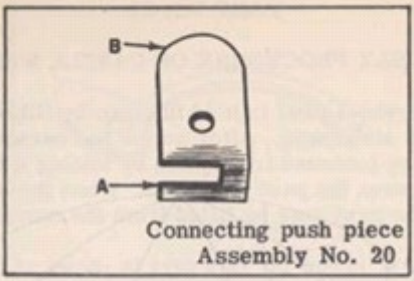
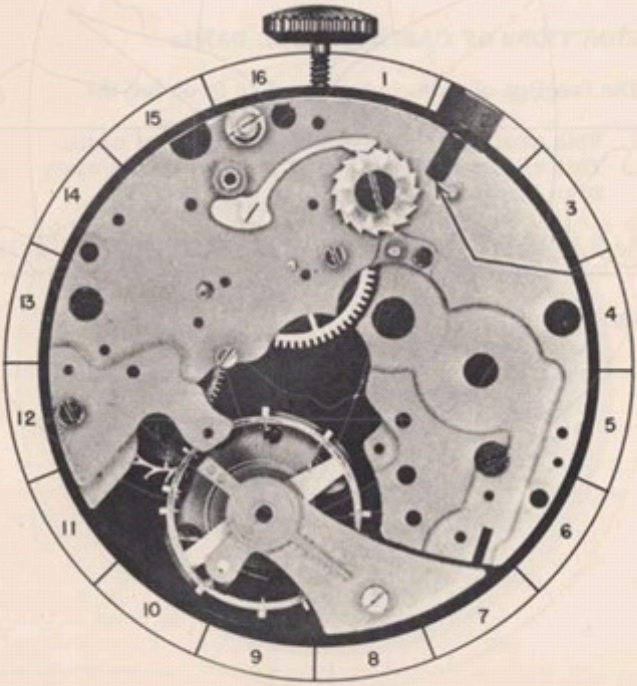


Connecting push piece
Assembly No. 20

OILING

The connecting push piece should not be oiled.



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PART NO. 21

A. DISASSEMBLY PROCEDURE OF CASTLE WHEEL PAWL:

The castle wheel pawl is held in place by fillister head screw FS-5 and a steady pin. After screw has been removed, the pawl may be loosened from plate by sliding a thin blade screwdriver between the pawl and plate. When the steady pin is free in plate, the pawl may be lifted from the movement.

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

B. ASSEMBLY PROCEDURE OF CASTLE WHEEL PAWL:

Place the castle wheel pawl on plate with the steady pin in proper hole. Have end "A" of the pawl between two ratchet teeth on castle wheel. Now replace fillister head screw FS-5 that holds this part in place.

C. FUNCTIONS OF CASTLE WHEEL PAWL:

The function of castle wheel pawl is to do two things:

1. This pawl correctly spaces the turning of castle wheel. This eliminates the possibility of the castle wheel setting at an incorrect position.

2. It holds the castle wheel in correct position until it is moved manually.

REFERENCE:
Castle Wheel is Assembly 22.
Castle Wheel Ratchet Teeth is Assembly 22-B.

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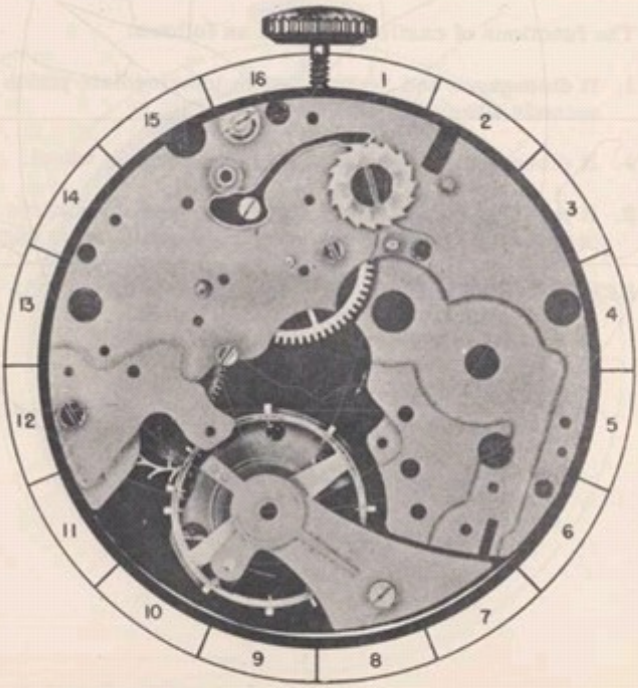
Castle wheel pawl
Assembly No. 21

OILING

The castle wheel pawl should not be oiled.



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PART NO. 22

A. DISASSEMBLY PROCEDURE OF CASTLE WHEEL:

The castle wheel is held in place by a shouldered screw SS-13. After this screw has been removed, castle wheel may be lifted from movement.

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

B. ASSEMBLY PROCEDURE OF CASTLE WHEEL:

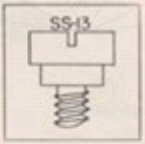
Place castle wheel in position on plate and replace the shouldered screw SS-13 that holds wheel in place. Check to see that wheel turns freely under head of screw, but does not have excessive freedom.

C. FUNCTIONS OF CASTLE WHEEL:

The functions of castle wheel are as follows:

1. It disengages end "A" of double intermediate pinion from seconds wheel.
2. It disengages the brake lever from seconds wheel.
3. It prevents flyback lever from being moved towards center of watch when chronograph mechanism is engaged.

REFERENCE: Intermediary pinion is Assembly 10-A.
Brake lever is Assembly 13.
Seconds wheel is Assembly 6.
Flyback lever is Assembly 4.



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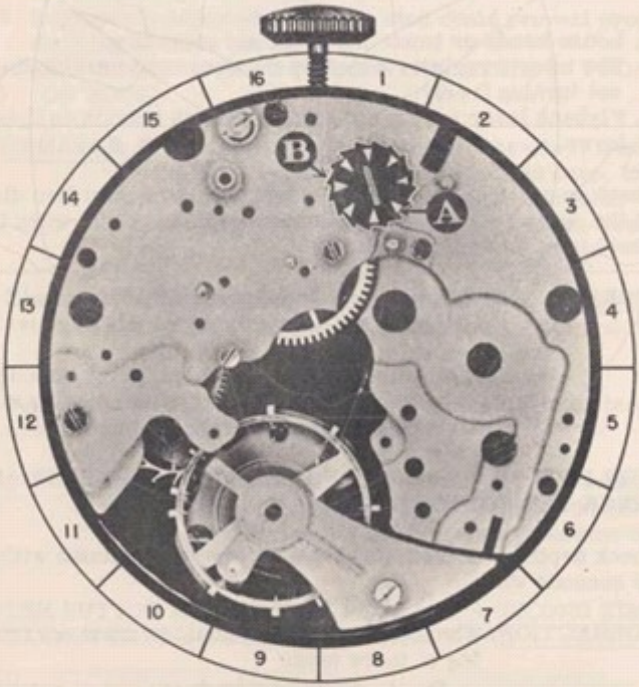
Castle wheel
Assembly No. 22

OILING

These parts of castle wheel should be slightly moistened with oil.

1. The shouldered screw that castle wheel pivots on.
2. The columns 'A' on castle wheel at the points they contact the parts of this mechanism.
3. The ratchet teeth 'B' on castle wheel should be slightly moistened with oil.



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FUNCTIONAL RESULTS

AFTER COMPLETELY ASSEMBLING CHRONOGRAPH WITH THE EXCEPTION OF BACK OF CASE PLACE CHRONOGRAPH IN FRONT OF YOU, PENDANT UP WITH BACK OF CHRONOGRAPH FACING YOU.

1. PUSH BUTTON AT LEFT OF PENDANT, RELEASE IT AND CHECK THE FOLLOWING:

(MAKE SURE castle wheel is in the proper position so button can be pushed)

A. Check to see that seconds wheel and minute register wheel return the hands connected to these wheels to a zero position.

CORRECTION: The following errors could prevent these hands from returning to a zero position:

1. Loose hands or hands not being set correctly.
2. The minute register wheel or the seconds wheel binding and not turning freely.
3. Flyback lever spring not holding enough tension on flyback lever.

B. Check to see that end "A" of minute register pawl lies directly in the center of two teeth on minute register wheel when this wheel is at a zero position.

CORRECTION: The pawl not being properly adjusted will cause it not to set correctly on minute register wheel.

Failure to have this pawl properly adjusted will result in minute register wheel moving after flyback moves away from heart.

2. PUSH BUTTON AT RIGHT OF PENDANT, RELEASE IT AND CHECK THE FOLLOWING:

A. Check depthing of teeth on double intermediate pinion with teeth on seconds wheel.

CORRECTION: The following errors could prevent correct depthing of these teeth:

Continued on next page

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1. Chronograph pivoted detent spring not holding enough tension on chronograph pivoted detent.
2. Chronograph pivoted detent not turning freely.
3. Improperly adjusted eccentric studs could prevent the proper depthing of these wheels.
   (SEE ADJUSTMENT OF ECCENTRIC STUDS IN FRONT OF BOOK)

B. Check depthing of seconds wheel dart tooth with intermittent wheel teeth.

CORRECTION: The following errors could prevent proper depthing of dart tooth with intermittent wheel teeth.

1. Intermittent lever not turning freely on shouldered screw in plate.
2. Improperly adjusted eccentric stud could prevent proper depthing of these parts.
   (SEE ADJUSTMENT OF ECCENTRIC STUDS IN FRONT OF BOOK)

REMARKS: If the depthing of the intermittent wheel teeth with the seconds wheel dart tooth is deep, the minute register wheel may move two teeth each time the seconds wheel makes one revolution.

If the depthing is shallow it may cause the minute register wheel not to move a full tooth and thus will not register the minutes on dial.

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 enough tension on seconds wheel.

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

A. Check to see that brake lever is in contact with seconds wheel.

Continued on next page

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Continued

CONNECTION: The following errors could prevent brake lever contacting seconds wheel.

1. Brake lever not turning freely under head of screw.
2. Brake lever and connecting lever spring not holding enough tension on brake lever.

B. Check to see that flyback lever has not moved toward the center of watch.

THE FOLLOWING ERRORS COULD PERMIT THE FLY-BACK TO MOVE TOWARD CENTER OF WATCHES:

1. The flyback trip lever and intermittent lever spring not holding proper tension on trip lever.
2. Flyback trip lever not pivoting freely on screw in plate.

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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.

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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 the 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 sweep second hand. The point on the tachometer scale where the sweep second hand stopped will indicate the average speed of the object in miles per hour.

SPLIT SECOND SCALE

B. This scale is divided into 300 divisions, each division 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.

MINUTE REGISTER

C. The minute register hand indicates on the dial the number of minutes that have elapsed since the beginning of the registration of the sweep second hand. (One complete revolution of the minute register hand indicates passage of 45 minutes. Two revolutions indicate passage of 1-1/2 hours.)

SECOND HAND

D. 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.

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THE CHRONOGRAPH DIAL

SETTING THE HANDS CORRECTLY ON A CHRONOGRAPH

After the chronograph is completely assembled and in working condition, 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 hands. 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 45 on minute register scale "C". After these hands are replaced, start chronograph mechanism with sweep second hand turning. Let 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 go back to their original position.

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