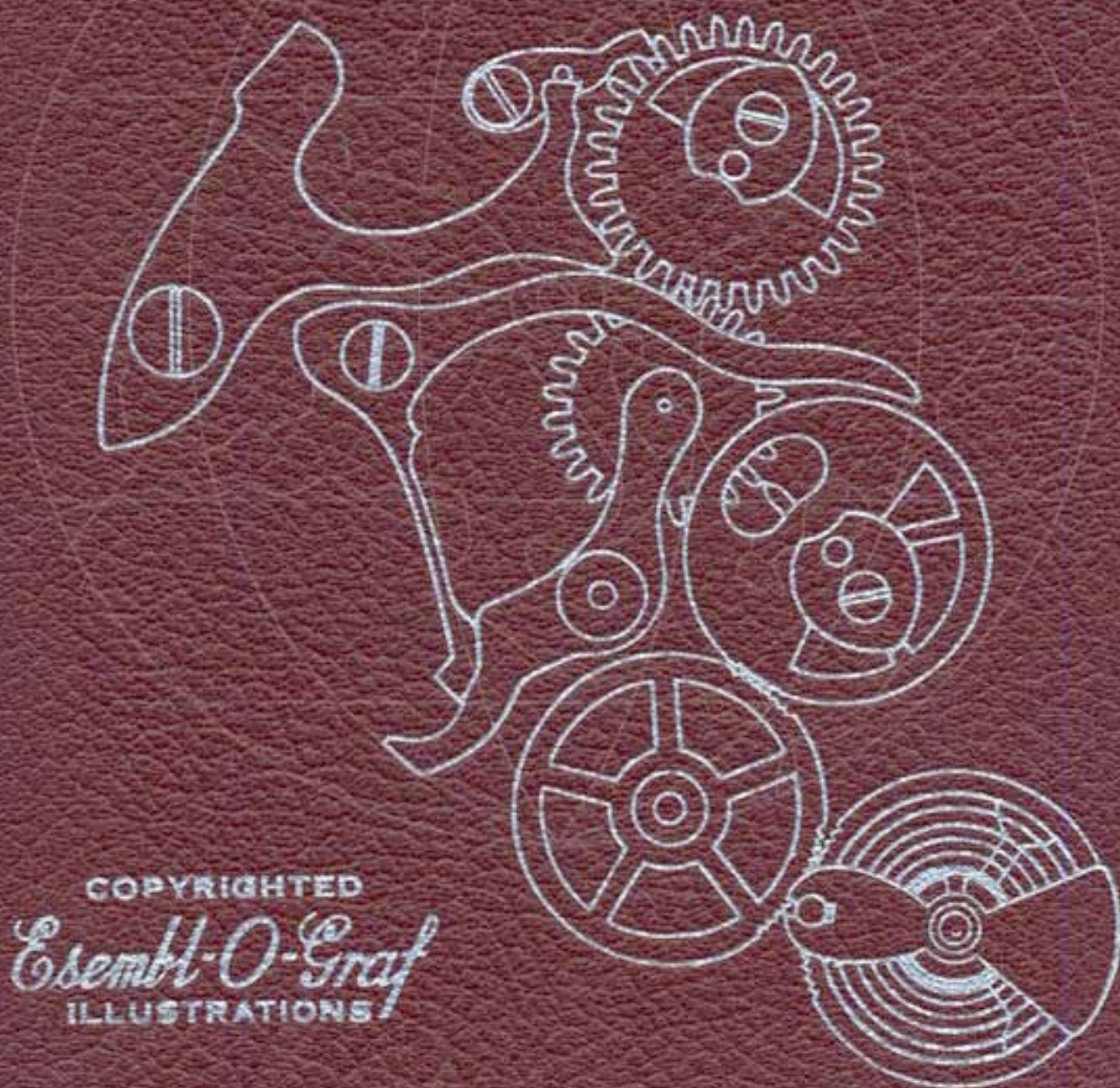
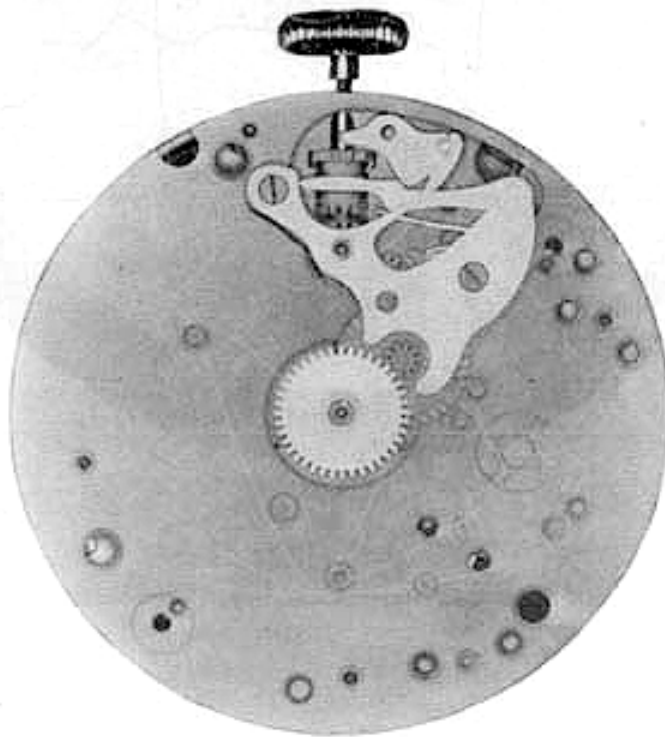


WORLD'S ONLY
FULLY ILLUSTRATED
CHRONOGRAPH WATCH COURSE
VOLUME 11



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Essemt-O-Graf
ILLUSTRATIONS

IDENTIFICATION OF CHRONOGRAPH



15L

LEMANIA

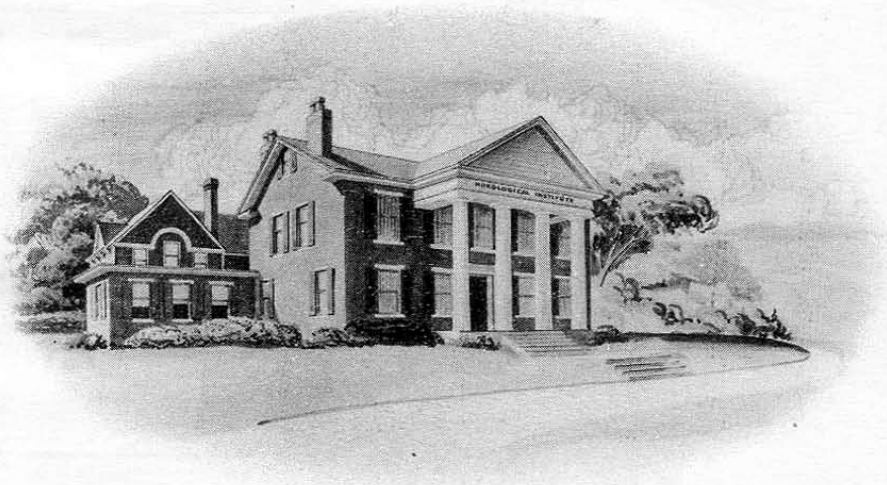


CAL. 15TL-2P



ESEMBL-O-GRAF

THE WORLD'S FIRST FULLY
ILLUSTRATED TEXT BOOK
ON
CHRONOGRAPH REPAIRING
AND ADJUSTING



BY
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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 PARTS 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



Push Piece for Setting Back
to Zero Assembly No. 1



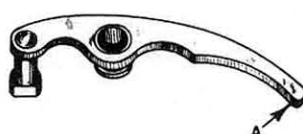
Push Piece for Setting Back
to Zero Coil Spring and
Plunger Assembly No. 2



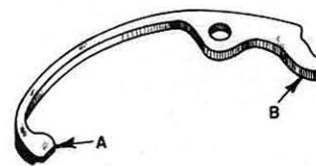
Wheel Over Fourth Wheel
Assembly No. 3



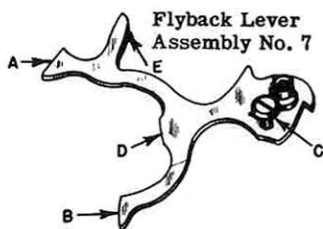
Flyback Trip Lever and
Actuating Push Piece Spring
Assembly No. 4



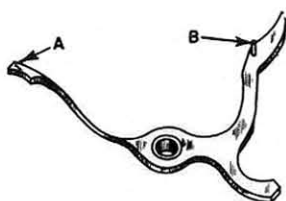
Flyback Trip Lever
Assembly No. 5



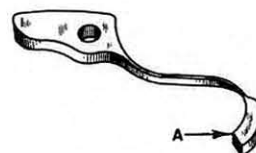
Flyback Lever Spring
Assembly No. 6



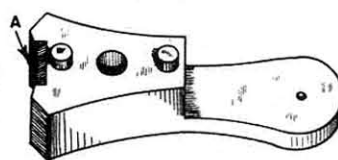
Flyback Lever
Assembly No. 7



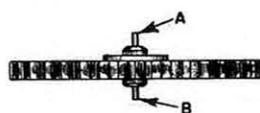
Brake Lever Assembly No. 8



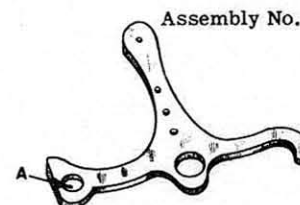
Chronograph Pivoted Detent
Spring Assembly No. 9



Chronograph Pivoted Detent
Bridge Assembly No. 10

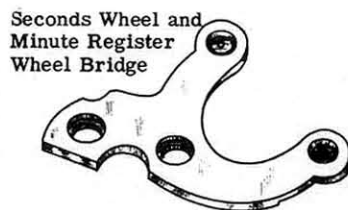


Intermediary Wheel
Assembly No. 11

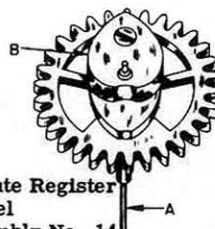


Assembly No. 12

Chronograph Pivoted Detent



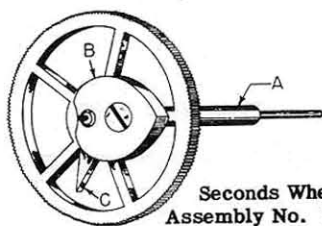
Assembly No. 13



Minute Register
Wheel
Assembly No. 14

Continued on next page

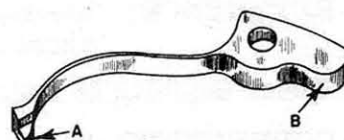
NOMENCLATURE OF PARTS FOR CHRONOGRAPH MECHANISM



Seconds Wheel
Assembly No. 15



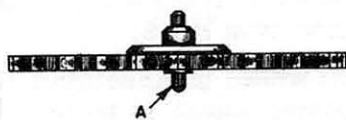
Seconds Wheel Tension Spring
Assembly No. 16



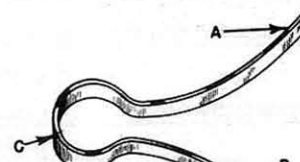
Intermittent Lever and Wheel
Assembly Spring
Assembly No. 17



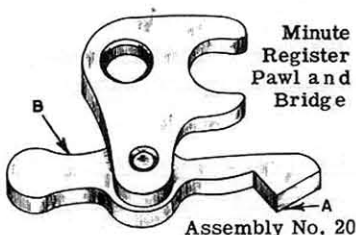
Intermittent Lever
and Wheel Assembly
Assembly No. 18



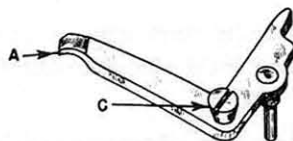
Intermittent Wheel
Assembly No. 18-B



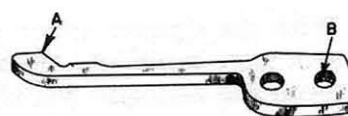
Minute Register Pawl Spring
Assembly No. 19



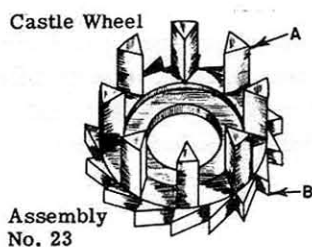
Minute
Register
Pawl and
Bridge
Assembly No. 20



Actuating Push Piece
Assembly No. 21



Castle Wheel Pawl
Assembly No. 22



Castle Wheel
Assembly
No. 23



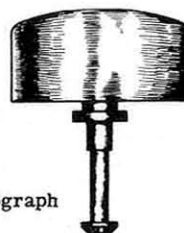
Chronograph Button



Minute Register Hand



Sweep Second Hand



Chronograph
Button

ADJUSTING OF ECCENTRIC AND ADJUSTING STUDS-THINGS TO CHECK:

1. Check depthing of intermediary wheel teeth with the wheel over fourth wheel teeth.

CORRECTION: If this depthing is incorrect, it can be corrected by adjusting eccentric stud ES-6.

REFERENCE: Intermediary wheel is Assembly 11.
Wheel over fourth wheel is Assembly 3.

2. Check depthing of intermediary wheel teeth with the seconds wheel teeth.

CORRECTION: If this depthing is incorrect, it can be corrected by adjusting stud AS-5.

REFERENCE: Intermediary wheel is Assembly 11.
Seconds wheel is Assembly 15.

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

CORRECTION: If this depthing is incorrect, it can be corrected by adjusting eccentric stud ES-2.

REFERENCE: Intermittent wheel is Assembly 18-B.
Minute register wheel is Assembly 14.

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

CORRECTION: If this depthing is incorrect, it can be corrected by adjusting stud AS-3.

REFERENCE: Seconds wheel dart tooth is Assembly 15-C.

5. With the flyback lever holding the seconds wheel and minute register wheel at a zero position, check to see that the intermittent wheel is disengaged from the seconds wheel dart tooth.

CORRECTION: If this wheel is not disengaged from the dart tooth, this condition can be corrected by adjusting eccentric stud ES-4.

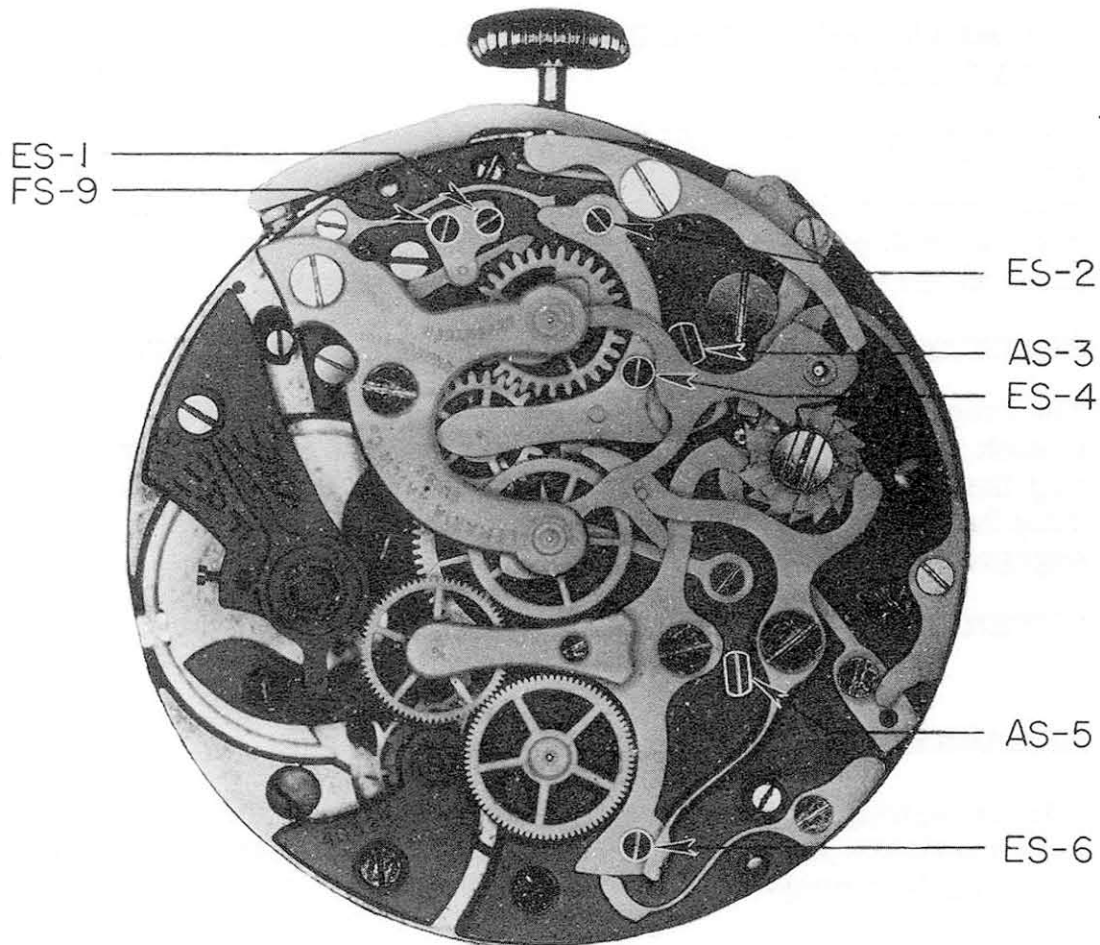
6. Check to see that the end "A" of minute register pawl lies directly in the center of two teeth on the minute register wheel, when this wheel is held at a zero position by the flyback lever.

CORRECTION: If the end "A" of minute register pawl does not set correctly between the teeth of the minute register wheel, loosen fil-
lister head screw FS-9 in minute register pawl bridge and
adjust pawl with eccentric stud ES-1. Now tighten screw
in bridge.

REFERENCE: Minute register wheel is Assembly 14.
Minute register pawl is Assembly 20-B.

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.

PART NO. 1

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

The stem and crown must be removed before removing this part. To remove the push piece for setting back to zero, grip end "A" of push piece with a pair of tweezers and move the end "A" away from center of watch. This will place the push piece in position so the hook "B" on push piece can be unhooked from stud between upper and lower plates.

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

The stem and crown must be removed before replacing this part. Slide the hook end "B" of push piece between upper and lower plate at point "C" shown on photograph. Now hook end "B" of push piece on stud between the plates and turn the push piece to its proper position shown in photograph.

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

The function of the push piece for setting back to zero is to unhook the flyback trip lever from the flyback lever, permitting the flyback lever to be forced toward center of watch. This function can take place only when the chronograph is disengaged.

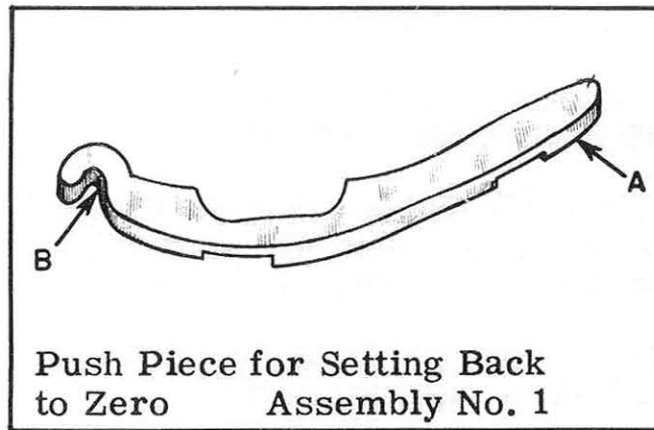
REFERENCE: Flyback trip lever is Assembly 5.
Flyback lever is Assembly 7.

REMARKS:

When repairing a chronograph, it is most important that the screw-drivers are properly sharpened and the correct size of screw-driver blade used for each screw slot.

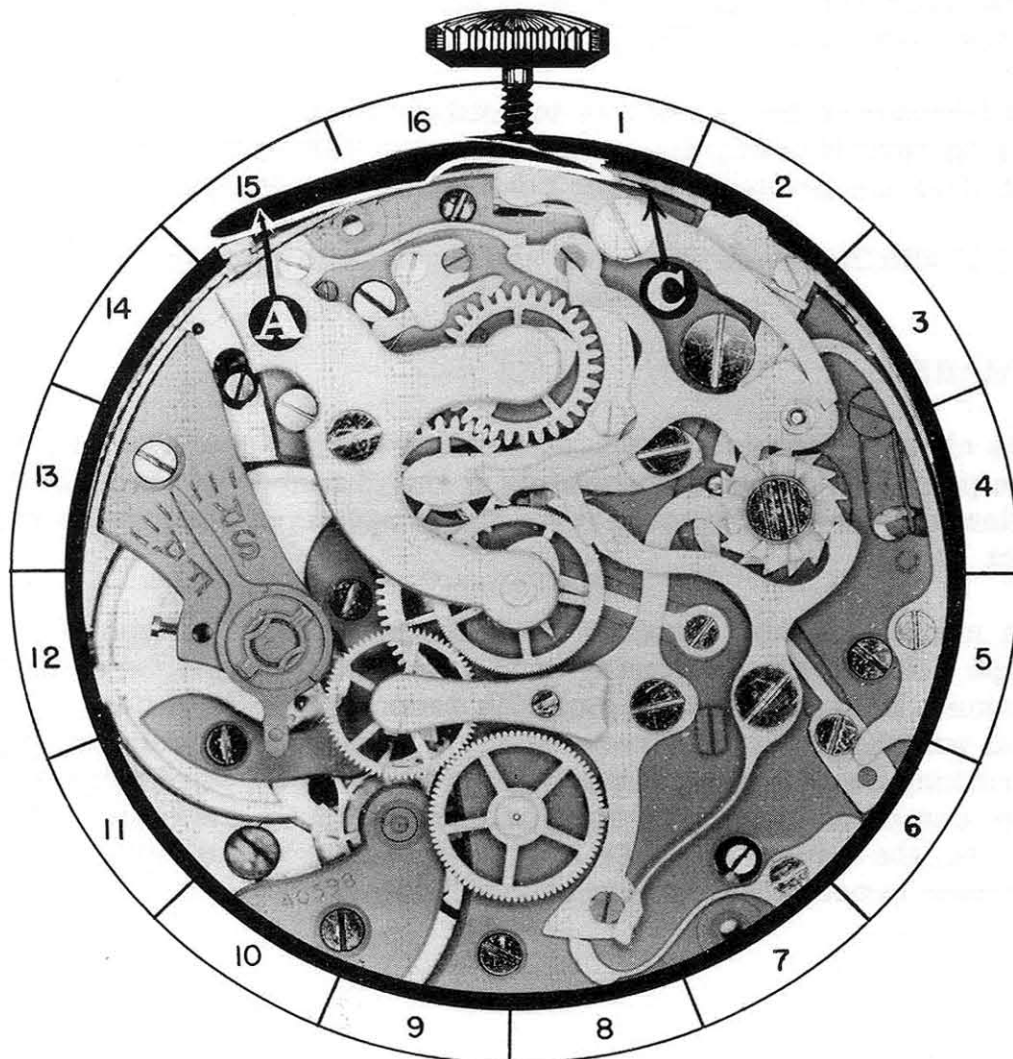
Most of the screw-heads in the chronograph are highly polished and are very easily marred by a slight slip of the screw-driver. To repair a chronograph and leave these screw-heads marred will indicate carelessness, either in the sharpening or use of the screw-driver.

The proper sharpening of screw-drivers and tweezers will also eliminate a lot of unnecessary breakage, marring of plates, and loss of parts.



OILING

The push piece for setting back to zero should not be oiled.



1-A

PART NO. 2

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

This spring is located in division 15 of the Esembl-o-graf Circle. To remove this spring, grip part "A" of spring with tweezers and slide it out from between the upper and lower plate.

B. ASSEMBLY PROCEDURE OF PUSH PIECE FOR SETTING BACK TO ZERO COIL SPRING AND PLUNGER:

Place the end "B" of coil spring in slot between upper and lower plate. This slot is located in division 15 of the Esembl-o-graf Circle, and is indicated by the letter "D" in the photograph. Now push the spring in slot until it is in position shown in the photograph. Check to make sure the plunger "C" is in the coil spring.

C. FUNCTION OF PUSH PIECE FOR SETTING BACK TO ZERO COIL SPRING AND PLUNGER:

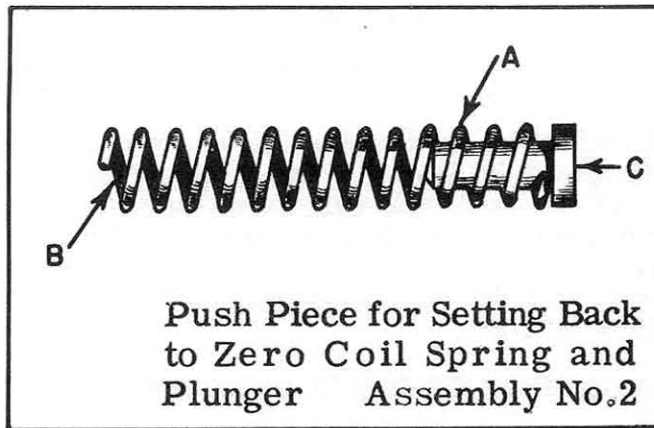
The function of this spring is to hold the push piece for setting back to zero in a negative position and to return it to this position after the pressure on the push piece is released.

REFERENCE: Push piece for setting back to zero is Assembly 1.

REMARKS:

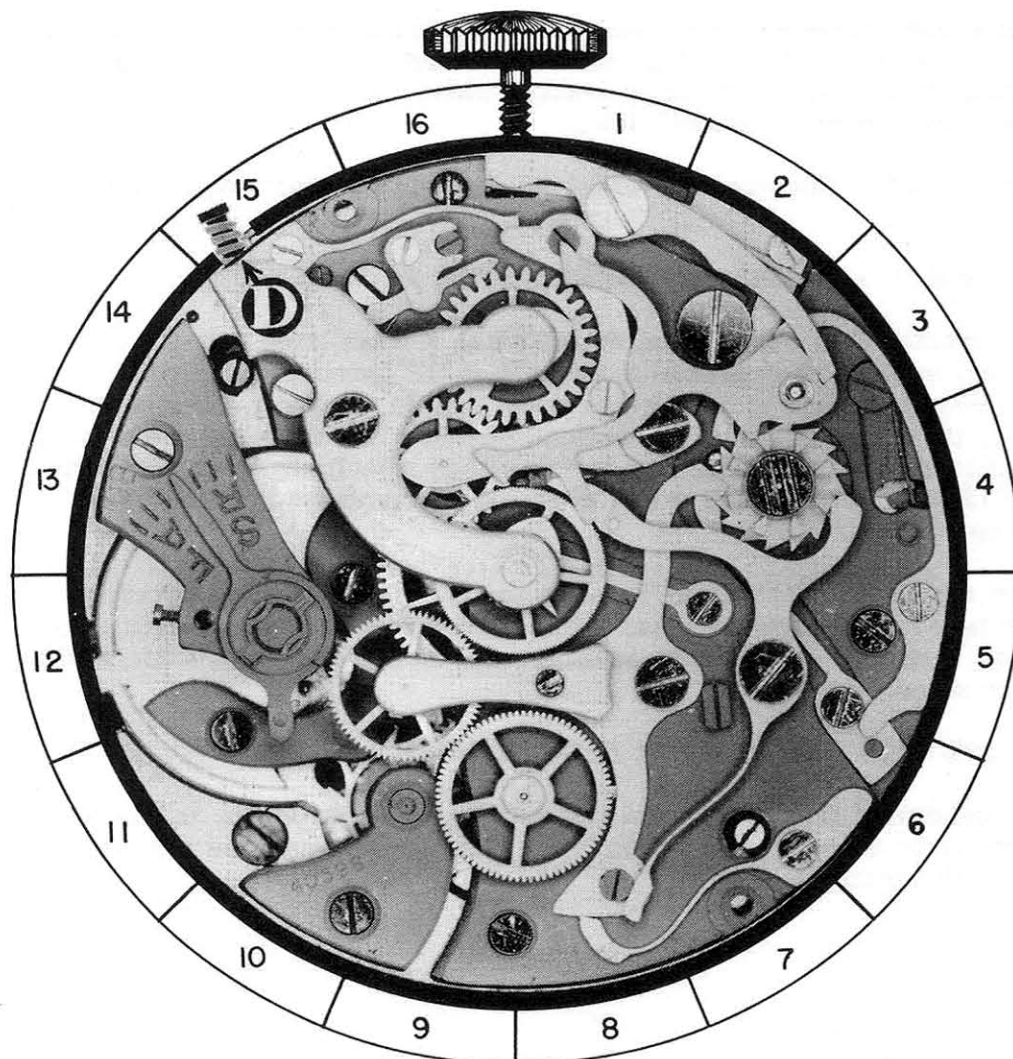
This chronograph is a semi-instantaneous type of chronograph. It is possible to note immediately if the chronograph is a semi-instantaneous type, by observing the progress of the minute register hand.

The minute register hand on the semi-instantaneous type of chronograph will remain stationary until about the 58th second of registration. Between the 58th and 60th second of registration, the hand will move forward very slowly. At the 60th second of registration, the minute register hand will move forward very quickly to complete the registration of one minute on the dial. Of course, the minute register hand progresses in the same manner for each consecutive minute of registration.



OILING

The push piece for setting back to zero coil spring and plunger should not be oiled.



2-A

PART NO. 3

A. DISASSEMBLY PROCEDURE OF WHEEL OVER FOURTH WHEEL:

The wheel over fourth wheel fits friction tight on the post of fourth wheel pinion. This wheel should be removed with a sweep wheel remover, but can be removed with two small, thin-edge screw-drivers. The screw-drivers are placed opposite each other under hub of wheel. One screw-driver is turned clockwise, while the other screw-driver is turned counter-clockwise. This will free the wheel from the fourth wheel pivot, permitting it to be lifted out of place.

B. HAZARDS IN DISASSEMBLY OF WHEEL OVER FOURTH WHEEL:

The wheel over 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 this wheel is selected to be the first part to be removed from the plate is to avoid accidents, such as the slip of the screw-driver, etc., causing damage to this wheel. Should the sweep wheel remover be used in removing this wheel, it must be held perfectly upright. This will help prevent bending or breaking of fourth wheel post.

C. ASSEMBLY PROCEDURE OF WHEEL OVER FOURTH WHEEL:

This wheel fits over fourth wheel post. It should be placed on post with hub "A" on wheel down. The wheel over fourth wheel should be pressed down until it is flush with intermediary wheel. A hollow flat face punch should be used to push wheel down.

REFERENCE: Intermediary wheel is shown in isometric drawing on Page 11-A.

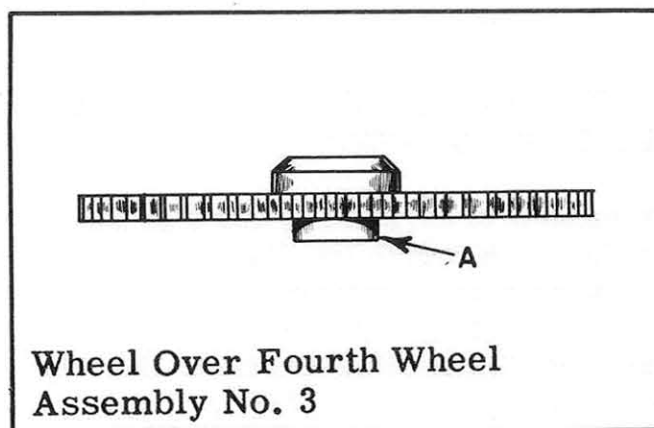
D. HAZARDS IN ASSEMBLY OF WHEEL OVER FOURTH WHEEL:

When staking this wheel down, do not stake it down level with the intermediary wheel. The vertical movement of the chronograph pivoted detent is more pronounced in this chronograph than in most any other type. Due to this more pronounced vertical movement, if the wheel over fourth wheel is staked down level, the intermediary wheel may drop below the level of wheel over fourth wheel when the chronograph is placed in a dial up position.

From the above information, you can see the wheel over fourth wheel must be set to a happy medium. This means that if the chronograph is placed in dial up or dial down position, the meshing of these wheels will be the same.

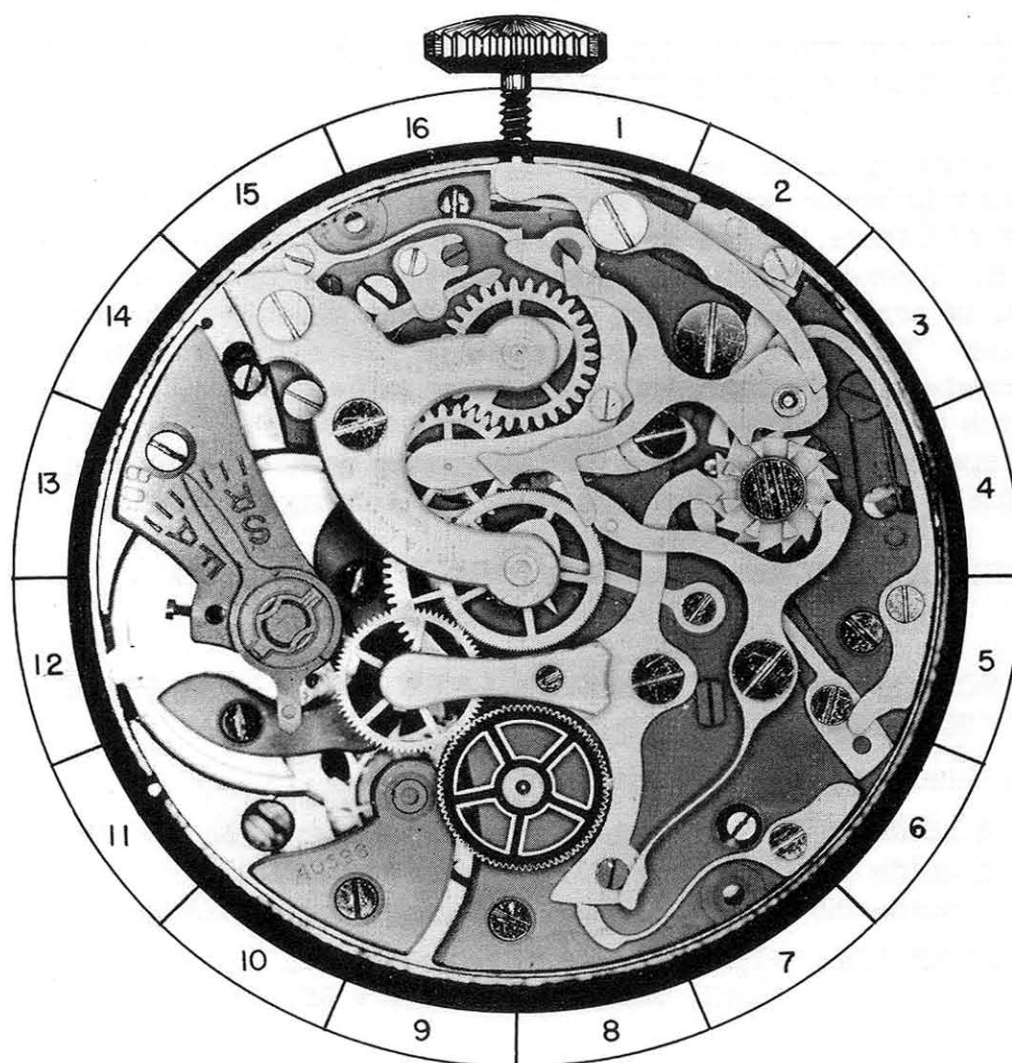
E. FUNCTION OF WHEEL OVER FOURTH WHEEL:

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.



OILING

The wheel over fourth wheel should not be oiled.



3-A

PART NO. 4

A. DISASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER AND ACTUATING PUSH PIECE SPRING:

This spring is located in division 1 and 2 of the Esembl-o-graf Circle and directly underneath the flyback trip lever. To remove it, lift end "A" of spring to unhook it from the screwhead "C" as shown in the photograph. This will release the tension on the spring, and it may be removed from under the trip lever.

REFERENCE: Flyback trip lever is Assembly 5.

B. HAZARDS IN DISASSEMBLY OF FLYBACK TRIP LEVER AND ACTUATING PUSH PIECE SPIING:

When lifting the end "A" of spring from the screwhead, a heavy pair of tweezers should be used, to prevent spring from snapping away and being lost.

C. ASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER AND ACTUATING PUSH PIECE SPRING:

This spring should be placed in position directly under the flyback trip lever, which is located in division 1 and 2 of the Esembl-o-graf Circle. Place the end "B" of spring on the inside of post on the flyback trip lever. Now hook end "A" of spring on the inside of screwhead "C" on actuating push piece as shown in photograph. The end "A" of spring will be much easier to hook on screwhead if the actuating push piece is held toward outside of watch with pegwood. The screwhead "C" as shown in photograph is tapered to hold the end "A" of spring down on actuating push piece to prevent it from riding up and coming out of place.

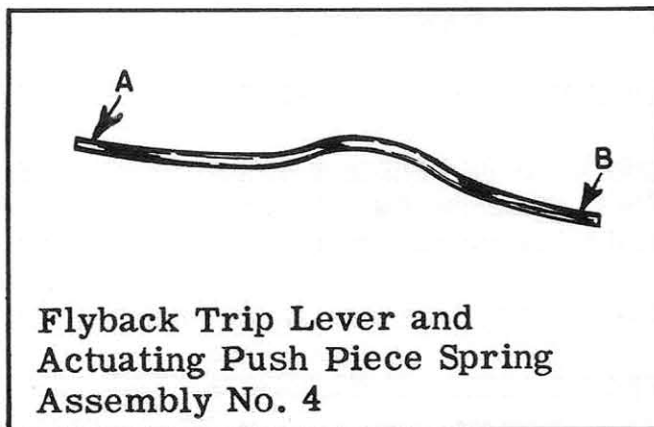
REFERENCE: Actuating push piece is Assembly 21.
Flyback trip lever is Assembly 5.

D. FUNCTION OF FLYBACK TRIP LEVER AND ACTUATING PUSH PIECE SPRING:

The functions of this spring are:

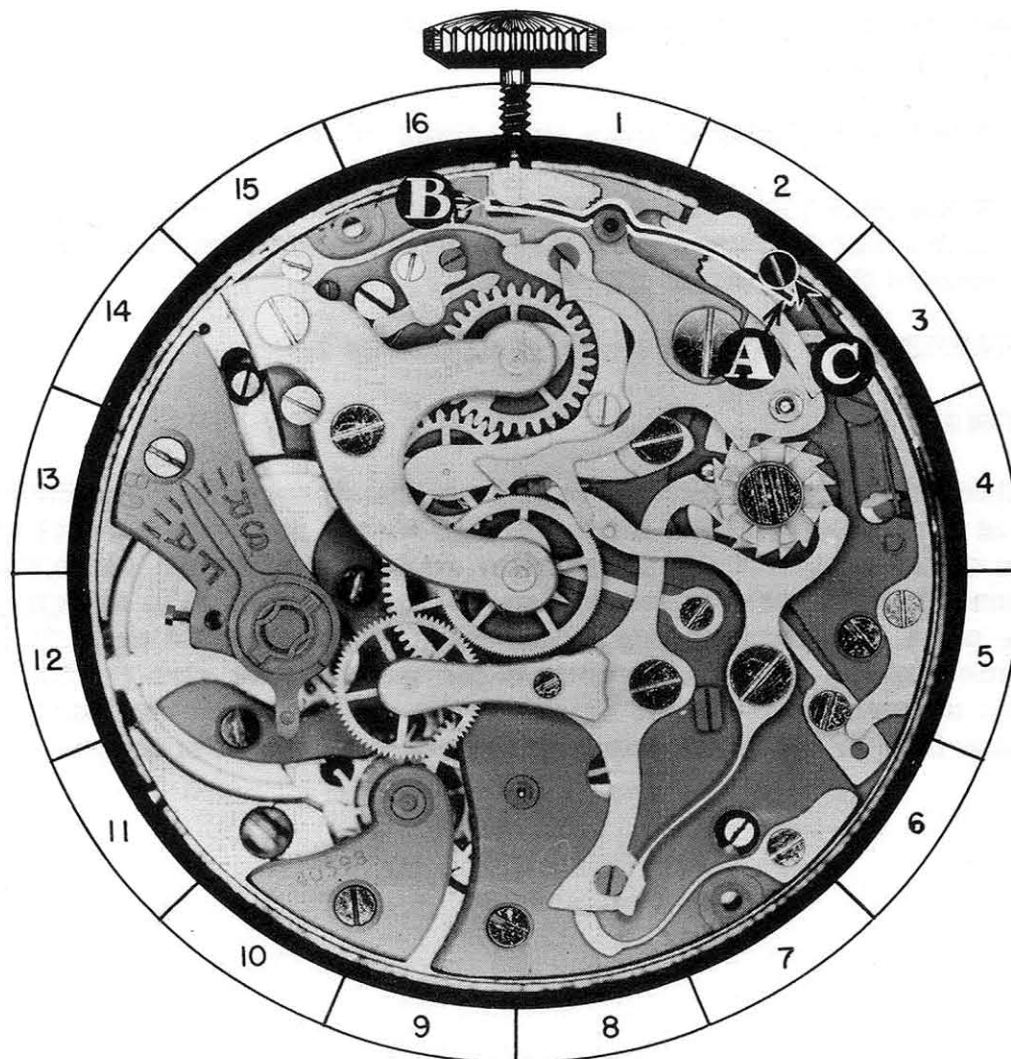
1. It holds the actuating push piece away from the center of watch.
2. It holds the flyback trip lever in contact with flyback lever.
3. It holds the end "A" of push piece engaged with castle wheel.

REFERENCE: Flyback lever is Assembly 7.
Castle wheel is Assembly 23.



OILING

1. End "A" of this spring should be slightly moistened with oil at point of contact with actuating push piece.
2. End "B" of this spring should be slightly moistened with oil at point of contact with flyback trip lever.



4-A

PART NO. 5

A. DISASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER:

The flyback trip lever is held to a hollow post on plate by fillister head screw FS-1. Remove the fillister head screw and lever may be lifted from the hollow post and free of movement.

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

B. ASSEMBLY PROCEDURE OF FLYBACK TRIP LEVER:

Place the hole in bushing in flyback trip lever over the hollow post on plate. Now press the flyback trip lever down on hollow post. Check to make sure end "A" of trip lever is not on top of flyback lever and replace fillister head screw FS-1 to hold trip lever in place. Trip lever should pivot freely under head of screw.

C. FUNCTION OF FLYBACK TRIP LEVER:

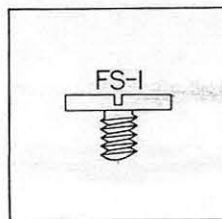
When the chronograph is disengaged, the flyback trip lever serves two purposes:

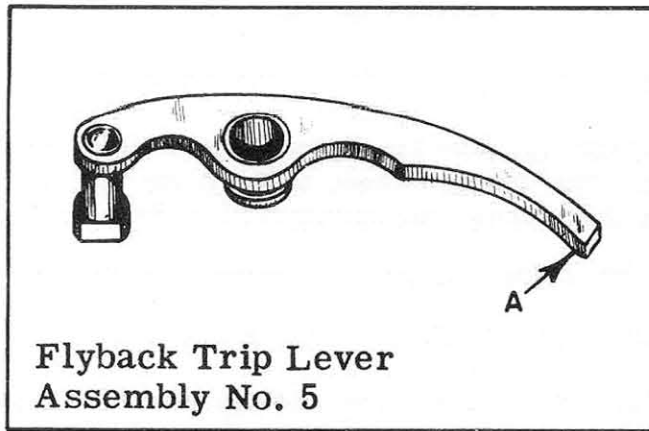
1. It holds the flyback lever away from center of watch.
2. When push piece for setting back to zero is pushed, the flyback trip lever releases the flyback lever, permitting it to be forced toward the center of the watch.

REFERENCE: Flyback lever is Assembly 7.

REMARKS:

After replacing the tension springs in the chronograph mechanism, it is advisable to check these springs to see that they are not scraping on the plate. Many times after replacing a spring, the spring cannot hold its proper tension on the part because it is scraping on the plate. To correct this, place the spring on a lead anvil in the same way that you would place in the watch. Now give the top surface of spring a few light taps with the watchmaker's hammer. Now place the spring in the watch and check to see that it is free.





OILING

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

1. The post on which the flyback trip lever pivots.
2. End "A" of flyback trip lever at point of contact with flyback lever.



5-A

PART NO. 6

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

To remove this spring, turn the flyback lever to the position shown in the photograph. The spring is held to the plate by fillister head screw FS-2. Remove this screw and spring will be free on movement.

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

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER SPRING:

Before replacing the flyback lever spring, turn the flyback lever to the position shown in the photograph. Now place flyback lever spring on plate in position shown in the photograph, with the end "A" of spring contacting screw-head "C" under flyback lever. The end "B" of spring should contact screw "D" as shown in photograph. Now place hole in spring over proper hole in plate and replace fillister head screw FS-2. After replacing screw, check to see that end "A" of spring is between the screw-head "C" and the flyback lever.

REFERENCE: Flyback lever is Assembly 7.

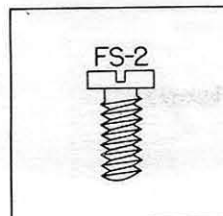
C. FUNCTION OF FLYBACK LEVER SPRING:

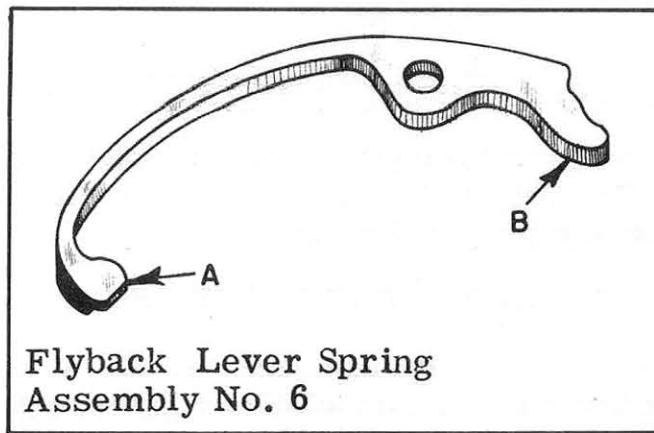
The function of flyback lever spring is to do two things:

1. It forces the flyback lever to the center of watch.
2. It holds the flyback lever down on post on plate.

REMARKS:

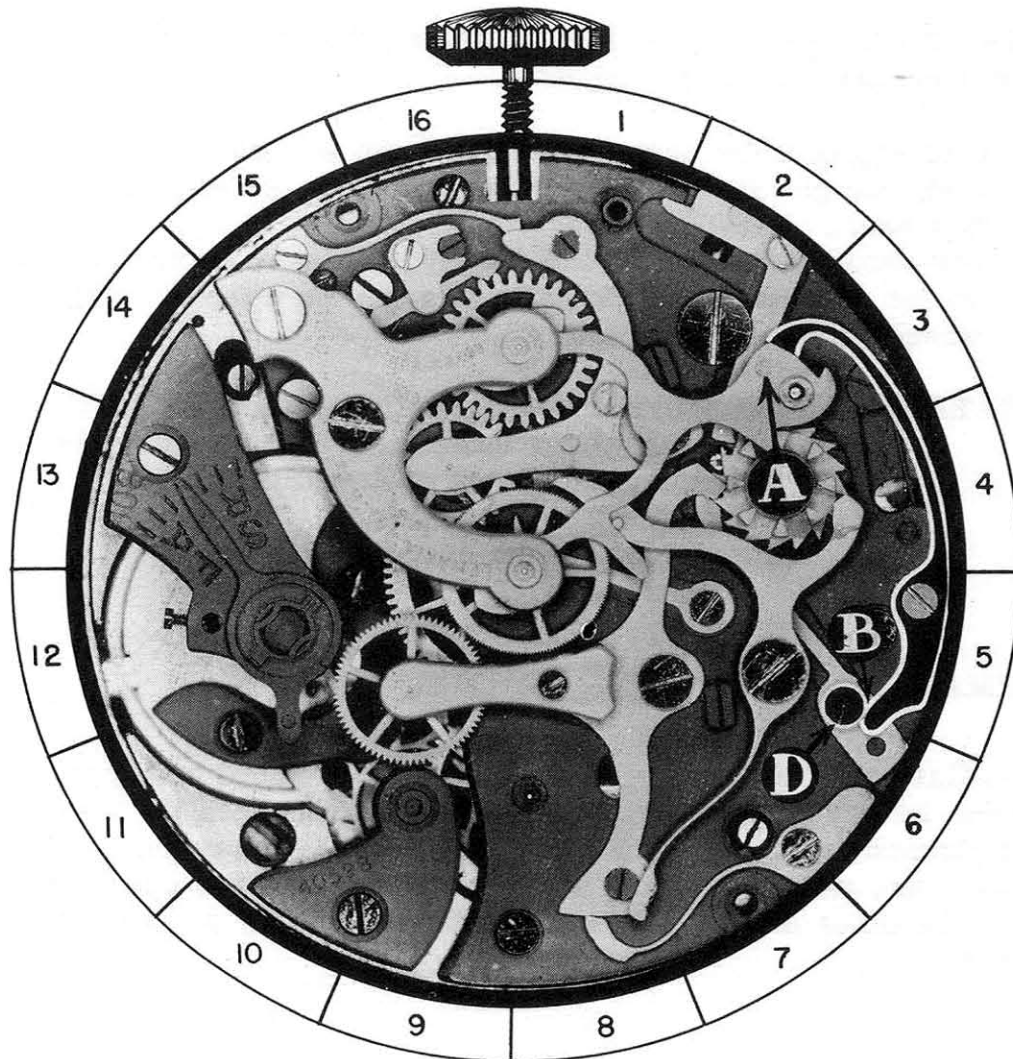
After replacing the flyback lever spring and the spring is holding the flyback lever in contact with the seconds wheel and minute register wheel hearts, check the seconds wheel and minute register wheel to see if either of these wheels will turn. The minute register wheel should turn slightly at this point, but the seconds wheel should be held very tight by the flyback lever. It is most essential that the seconds wheel be held stationary by the flyback lever at a zero position. In the case of the minute register wheel, it does not have to be held absolutely stationary by the flyback lever. The minute register pawl will serve this purpose. The only thing that the minute register wheel should be checked for is to see that the minute register wheel will not turn far enough to one side or the other to let the minute register pawl drop into another tooth. This will assure that the minute register wheel will also be brought back to a zero position.





OILING

The surface "A" should be slightly moistened with oil, at point of contact with screw on flyback lever, before replacing spring on movement.



6-A

PART NO. 7

A. DISASSEMBLY PROCEDURE OF FLYBACK LEVER:

Move flyback lever in the position shown in the photograph before removing it. To remove flyback lever, lift straight up on lever freeing it from the post on the plate.

B. ASSEMBLY PROCEDURE OF FLYBACK LEVER:

Flyback lever should be replaced with the screw-head "C" down. Place flyback lever in position with hole in bushing in flyback lever over the post on the plate. Now press flyback lever down on post. At this point, check to see that the flyback lever is not hitting on top of the pin on the brake lever or on top of the screw-head "F" on the intermittent lever. After the flyback lever is down in place, check the flyback lever to see that it pivots freely on the post on the plate.

C. FUNCTION OF FLYBACK LEVER:

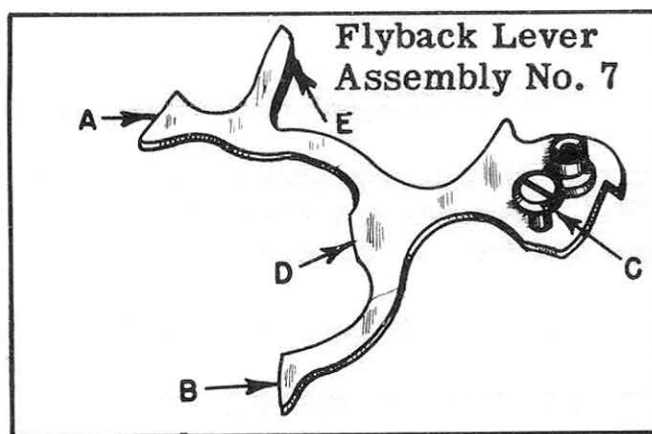
When the flyback lever is forced toward the center of watch, it performs the following functions:

1. It disengages the brake lever from the seconds wheel.
2. It disengages the intermittent wheel from the seconds wheel dart tooth.
3. The ends "A" and "B" of the flyback lever contact the hearts on the seconds wheel and minute register wheel forcing these wheels to a zero position.

REFERENCE: Seconds wheel dart tooth is Assembly 15-C.
Minute register wheel heart is Assembly 14-B.
Seconds wheel heart is Assembly 15-B.
Brake lever is Assembly 8.
Intermittent lever and wheel assembly is
Assembly 18.

REMARKS:

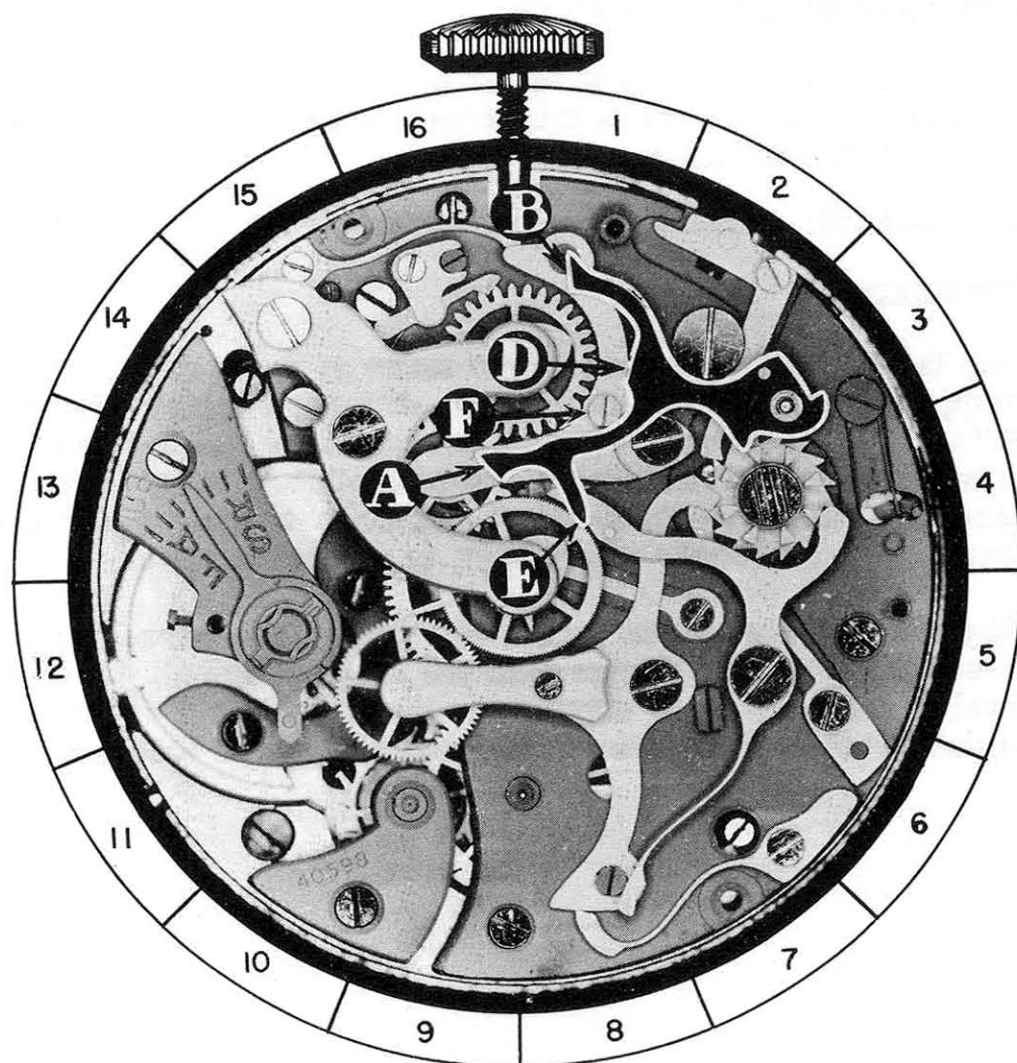
The flat ends "A" and "B" of flyback lever must be highly polished, as any roughness or pits of rust at this location may cause the flyback lever not to function properly. When polishing these ends, care should be taken so as not to shorten one end more than the other or they will not function correctly as described above.



OILING

Slightly moisten the flyback lever with oil at these points:

1. The post on which the flyback lever pivots.
2. End "E" that contacts pin "B" on brake lever.
3. Surface "D" that contacts stud "F" on intermittent lever.



7-A

PART NO. 8

A. DISASSEMBLY PROCEDURE OF BRAKE LEVER:

The brake lever is held on a hollow post on plate by fillister head screw FS-3. Remove this screw, and brake lever may be lifted from post and free of movement.

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

B. ASSEMBLY PROCEDURE OF BRAKE LEVER:

Place the brake lever in position with hole in bushing in brake lever over hollow post on plate. Replace fillister head screw FS-3, but before tightening screw, check to see that end "A" of brake lever is on outside of screw "D" as shown in the photograph. The brake lever should pivot freely under head of screw.

C. FUNCTION OF BRAKE LEVER:

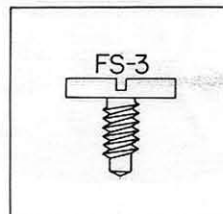
The function of the brake lever is to hold the seconds wheel in a stationary position, when this wheel is disengaged from the chronograph mechanism.

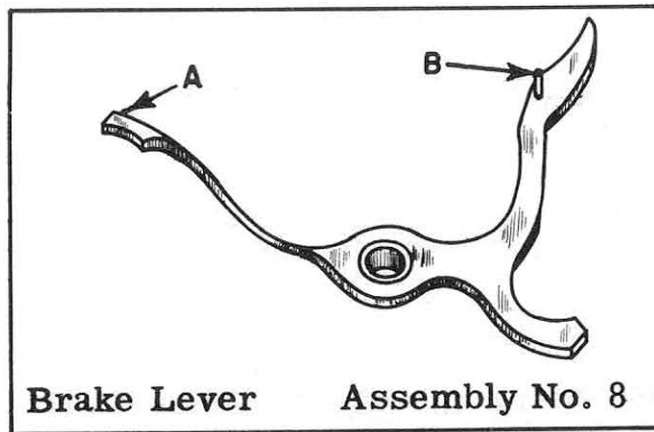
REFERENCE: Seconds wheel is Assembly 15.

REMARKS:

When the flyback lever is brought towards the center of the watch, the surface "E" on the flyback lever contacts the pin "B" on the brake lever. This disengages the brake lever from the seconds wheel. Naturally, the brake lever must be disengaged from the seconds wheel at this time so that the flyback lever can turn seconds wheel back to a zero position.

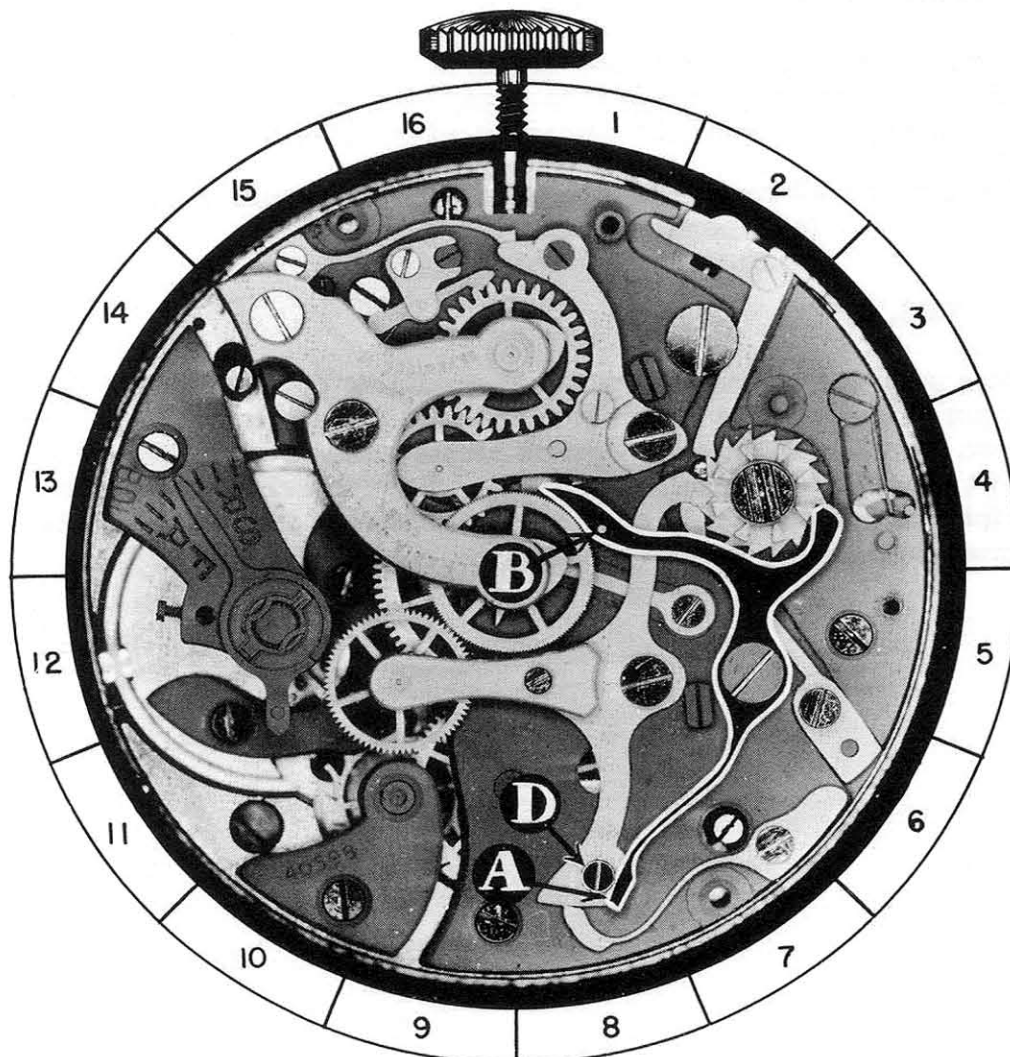
When the castle wheel is turned to a position to permit the intermediary wheel to engage with the seconds wheel, the castle wheel at the same time disengages the brake lever from the seconds wheel. This frees the seconds wheel so that it can turn.





OILING

The post on which brake lever pivots should be slightly moistened with oil.



8-A

PART NO. 9

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

This spring is held in place by fillister head screw FS-4 and a steady pin. To remove this spring, remove fillister head screw FS-4 and lift straight up on spring, freeing the steady pin from the hole in the plate.

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

B. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT SPRING:

Place the chronograph pivoted detent spring in position on plate, with steady pin in proper hole in plate. The end "A" of spring should be on top of chronograph pivoted detent. Now replace fillister head screw FS-4, but before tightening screw, place the end "A" of spring in position shown in photograph. Now tighten fillister head screw to hold the spring in place.

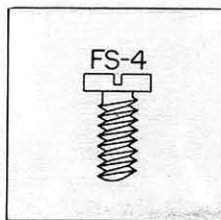
C. FUNCTION OF CHRONOGRAPH PIVOTED DETENT SPRING:

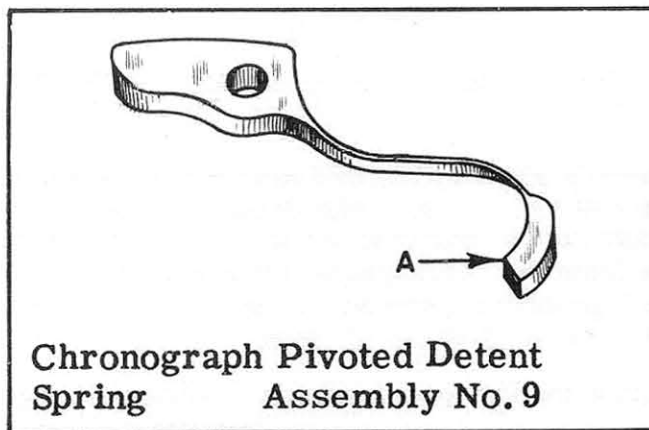
The chronograph pivoted detent spring holds a tension on the chronograph pivoted detent, forcing it to engage the intermediary wheel with the seconds wheel, when the castle wheel permits it to do so.

REFERENCE: Chronograph pivoted detent is Assembly 12.
Intermediary wheel is Assembly 11.
Seconds wheel is Assembly 15.

REMARKS:

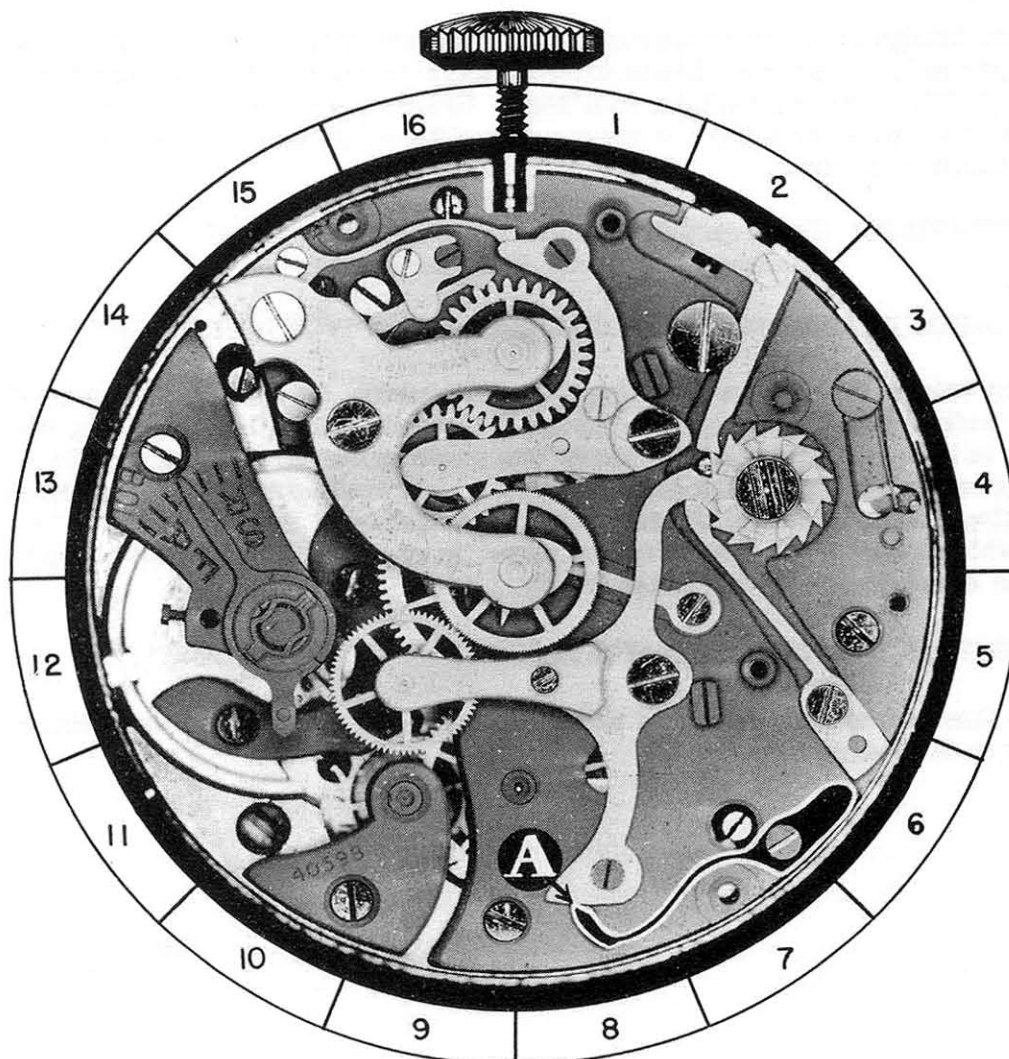
At this point the intermediary wheel should be checked to see that it will not rise enough to be out of mesh with the seconds wheel. Any excess freedom of the chronograph pivoted detent under the head of screw, plus the endshake of the intermediary wheel, may permit the intermediary wheel to drop below the seconds wheel, when the chronograph is in a dial up position.





OILING

End "A" of chronograph pivoted detent spring should be slightly moistened with oil at point of contact with chronograph pivoted detent.



9-A

PART NO. 10

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

This bridge is held in place by beveled countersink screw BS-1 and steady pins. Remove screw and loosen bridge from chronograph pivoted detent by sliding a thin blade screw-driver under the notch "A" in the bridge. When loosening bridge from the chronograph pivoted detent, hold finger over bridge so that bridge cannot jump out of place. When steady pins are free in detent, bridge 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 BRIDGE:

When using a screw-driver to loosen bridge from detent, care should be taken to keep bridge level, as any twisting may damage pivot on intermediary wheel or burr the bushing in the bridge or pivoted detent. The screw-driver should be carefully used, to prevent marring the bridge or detent.

C. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

Place bridge on the chronograph pivoted detent with the steady pins over proper holes in detent. Place intermediary wheel so that the pivot on this wheel will enter the bushing in bridge. Bridge may now be pressed down to proper place with back of tweezers and beveled countersink screw BS-1 replaced in bridge.

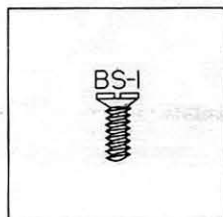
REFERENCE: Chronograph pivoted detent is Assembly 12.
Intermediary wheel is Assembly 11.

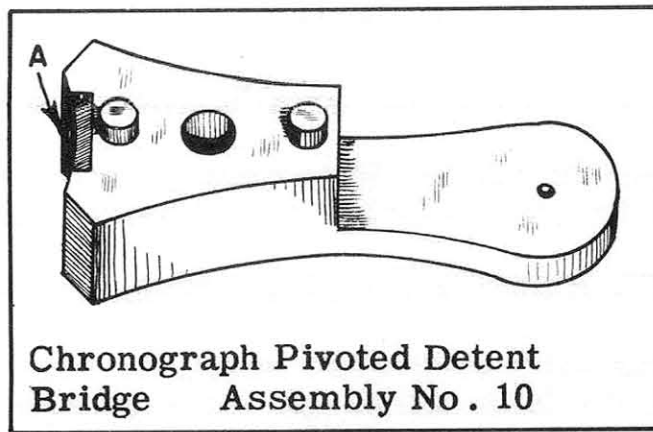
D. HAZARDS IN ASSEMBLY OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

Keep bridge level when pressing down into place, as any twisting may burr the bushings in the bridge or damage the pivots on the intermediary wheel. The bridge and detent, where these two parts come together, should be checked to see that there are no burrs which would prevent the bridge from setting properly on the chronograph pivoted detent. At this point, it is advisable to check the intermediary wheel to see that it has proper endshake. Also check to see that it spins freely.

E. FUNCTION OF CHRONOGRAPH PIVOTED DETENT BRIDGE:

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

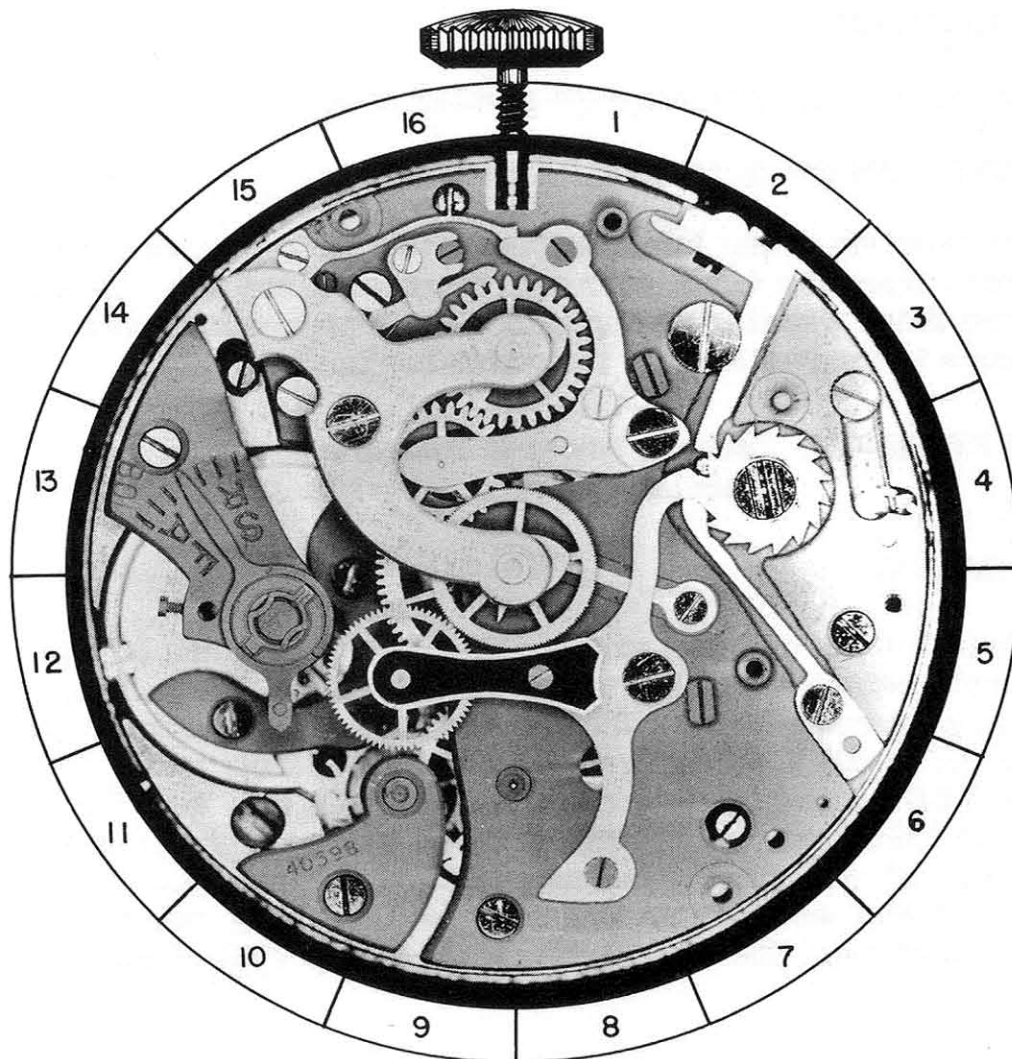




**Chronograph Pivoted Detent
Bridge Assembly No . 10**

OILING

The pivot in bushing hole in this bridge should be oiled as you would properly oil a train pivot in a watch.



10-A

PART NO. 11

A. DISASSEMBLY PROCEDURE OF INTERMEDIARY WHEEL:

When removing the intermediary wheel, lift the wheel straight up to remove the pivot from the chronograph pivoted detent.

B. ASSEMBLY PROCEDURE OF INTERMEDIARY WHEEL:

When replacing the intermediary wheel, the end "A" of staff on this wheel should be placed up. Place the bottom pivot "B" of staff in hole in bushing of chronograph pivoted detent.

C. HAZARDS IN ASSEMBLY OF INTERMEDIARY WHEEL:

The pivot hole in the bushing in chronograph pivoted detent should be carefully examined before replacing the intermediary wheel. Any imperfections here will affect the timekeeping of the watch, and hinder the proper operation of the chronograph.

REFERENCE: Chronograph pivoted detent is Assembly 12.

D. FUNCTION OF INTERMEDIARY WHEEL:

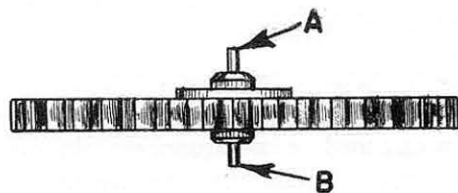
The function of the intermediary wheel is to transfer the power from the wheel over fourth wheel to the seconds wheel when these wheels are engaged. The intermediary wheel continues to turn as long as the watch is running.

REFERENCE: Seconds wheel is Assembly 15.

Wheel over fourth wheel is Assembly 3.

REMARKS:

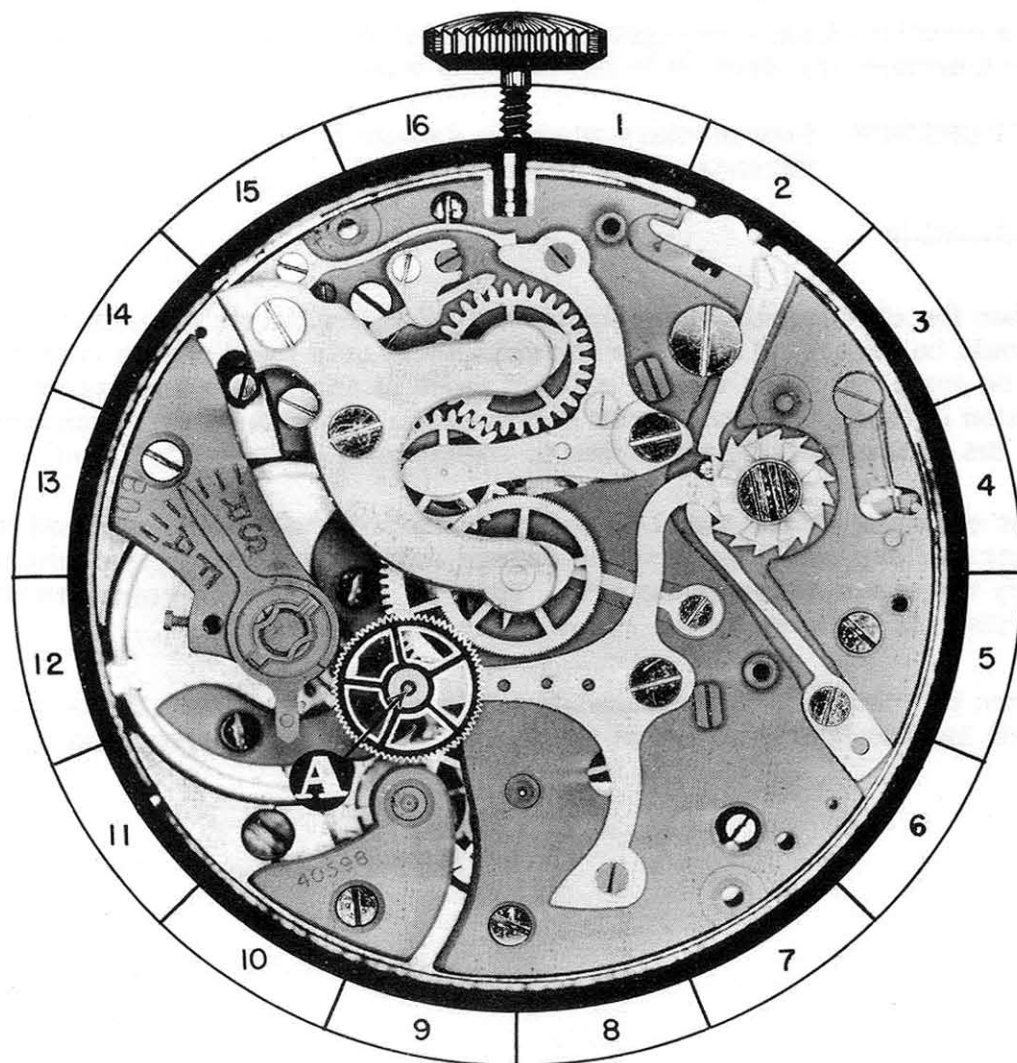
A careful and detailed examination should be made of all wheels before replacing in the chronograph. Each wheel should be examined for burred pivots, bent or burred teeth, dirt or small pieces of grit wedged between the teeth. When the VEE shaped teeth of one wheel meshes into the VEE shaped teeth of another wheel, there is very little clearance between the teeth, and because of this, the smallest piece of grit or dirt wedged into one of these teeth may stop the chronograph. The intermediary wheel has VEE shaped teeth.



Intermediary Wheel
Assembly No. 11

OILING

The bottom pivot on intermediary wheel should be oiled before replacing wheel on chronograph pivoted detent. The top pivot is oiled after bridge for this wheel is replaced.



11-A

PART NO. 12

A. DISASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

The chronograph pivoted detent is held in place by shouldered screw SS-1 and an eccentric stud. This detent pivots on this stud. After shouldered screw SS-1 is removed, chronograph pivoted detent can be lifted straight up, freeing the hole in the pivoted detent from the eccentric stud on the plate.

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

B. ASSEMBLY PROCEDURE OF CHRONOGRAPH PIVOTED DETENT:

Place the hole "A" in chronograph pivoted detent over the eccentric stud on the plate, as shown in the photograph. Now replace shouldered screw SS-1 that holds the chronograph pivoted detent in place. After this detent is replaced, check the detent to see that it pivots freely under the head of shouldered screw SS-1.

C. FUNCTION OF CHRONOGRAPH PIVOTED DETENT:

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

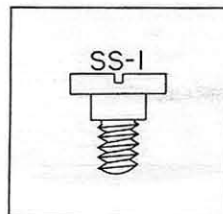
REFERENCE: Intermediary wheel is Assembly 11.
Seconds wheel is Assembly 15.

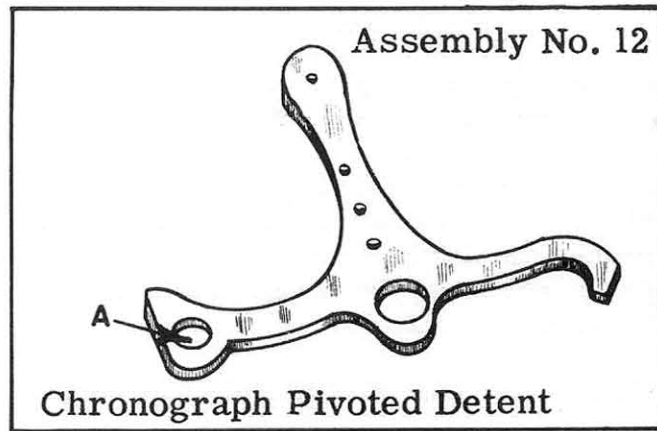
REMARKS:

When the chronograph mechanism is disengaged, the intermediary wheel should be separated from the seconds wheel only the distance necessary to be sure that these wheels will not touch at any time. Any excess separation of these two wheels will increase the "Movement of Translation" as the intermittent wheel moves to engage with the seconds wheel.

For example: If the wheel over fourth wheel is held stationary and the intermediary wheel is moved to engage with seconds wheel, the intermediary wheel must turn on its axis. This turning of the intermediary wheel on its axis is known as the "Movement of Translation".

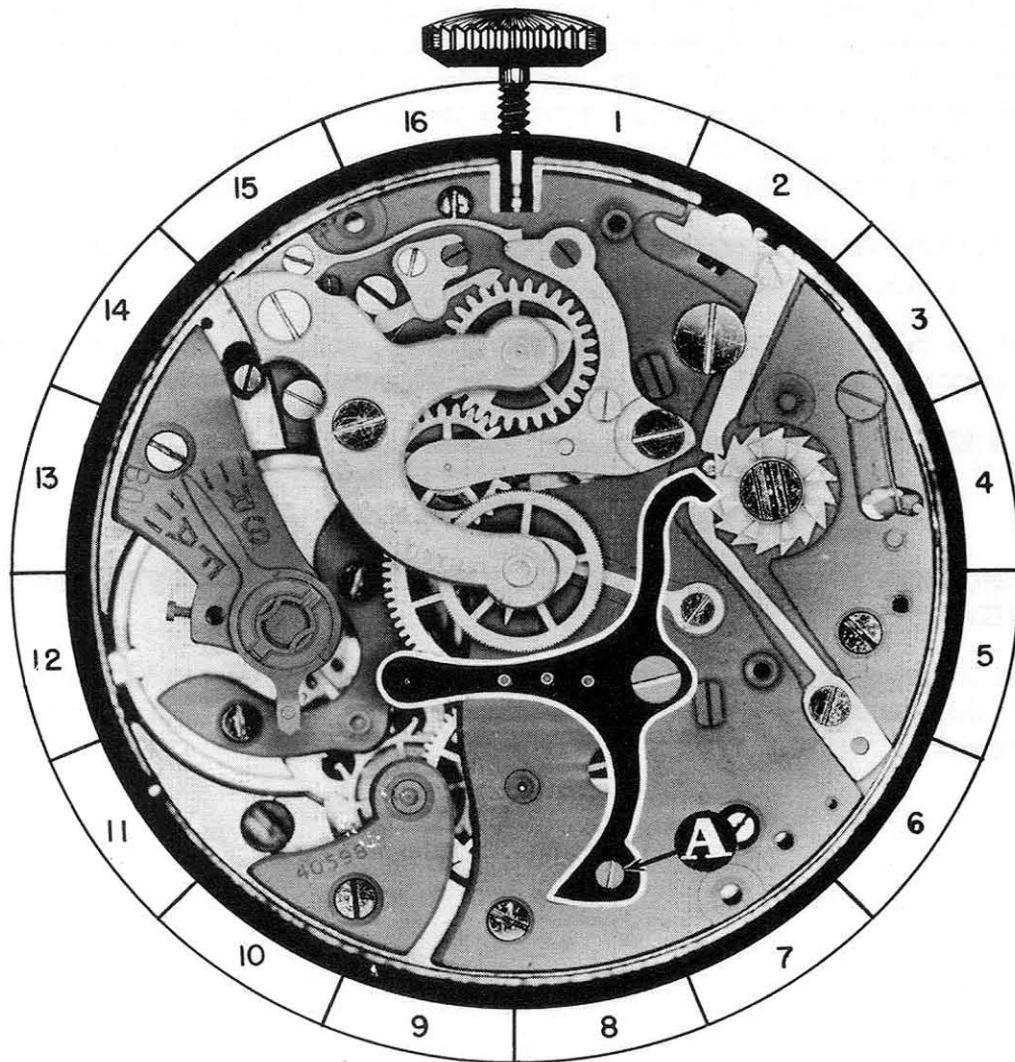
When the "Movement of Translation" is excessive, it may cause the seconds hand to jump forward at the instant chronograph is engaged.





OILING

The eccentric stud on which chronograph pivoted detent pivots should be slightly moistened with oil.



12-A

PART NO. 13

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

This bridge is held in place by identical fillister head screws FS-5 and FS-6. Remove these screws, and grip the bridge with a pair of tweezers and loosen the bridge from the two posts on the plate. After the bridge is free from the hollow posts on the plate, bridge may be lifted from movement.

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

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

When removing bridge from hollow posts, avoid twisting of bridge as this may damage the pivots or may chip the jewels in the bridge.

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

Place the bridge in position with the proper holes in bridge over posts in plate. Place the top pivot of seconds wheel and minute register wheel so that they will enter the jewel holes in the bridge. Bridge may now be pressed down to proper place with back of tweezers and fillister head screws FS-5 and FS-6 replaced. These screws are identical and may be placed in either post.

D. HAZARDS IN ASSEMBLY OF SECONDS WHEEL AND MINUTE REGISTER WHEEL BRIDGE:

Before replacing the screws in the bridge, check to see that minute register pawl is not under the minute register wheel.

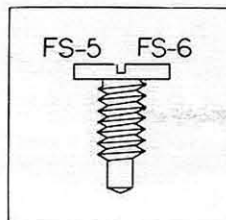
REFERENCE: Seconds wheel is Assembly 15.

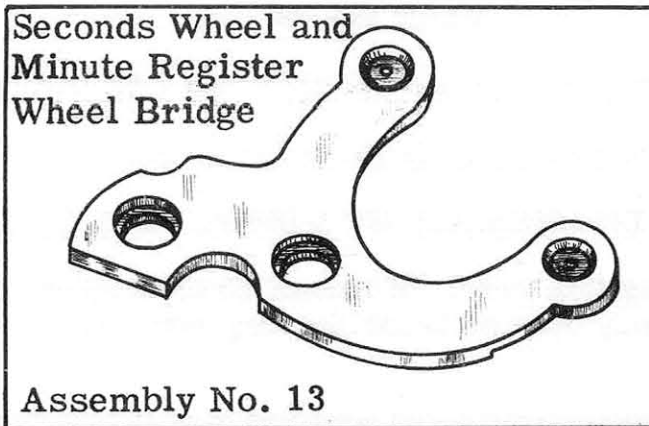
Minute register wheel is Assembly 14.

Minute register pawl is Assembly 20-A.

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

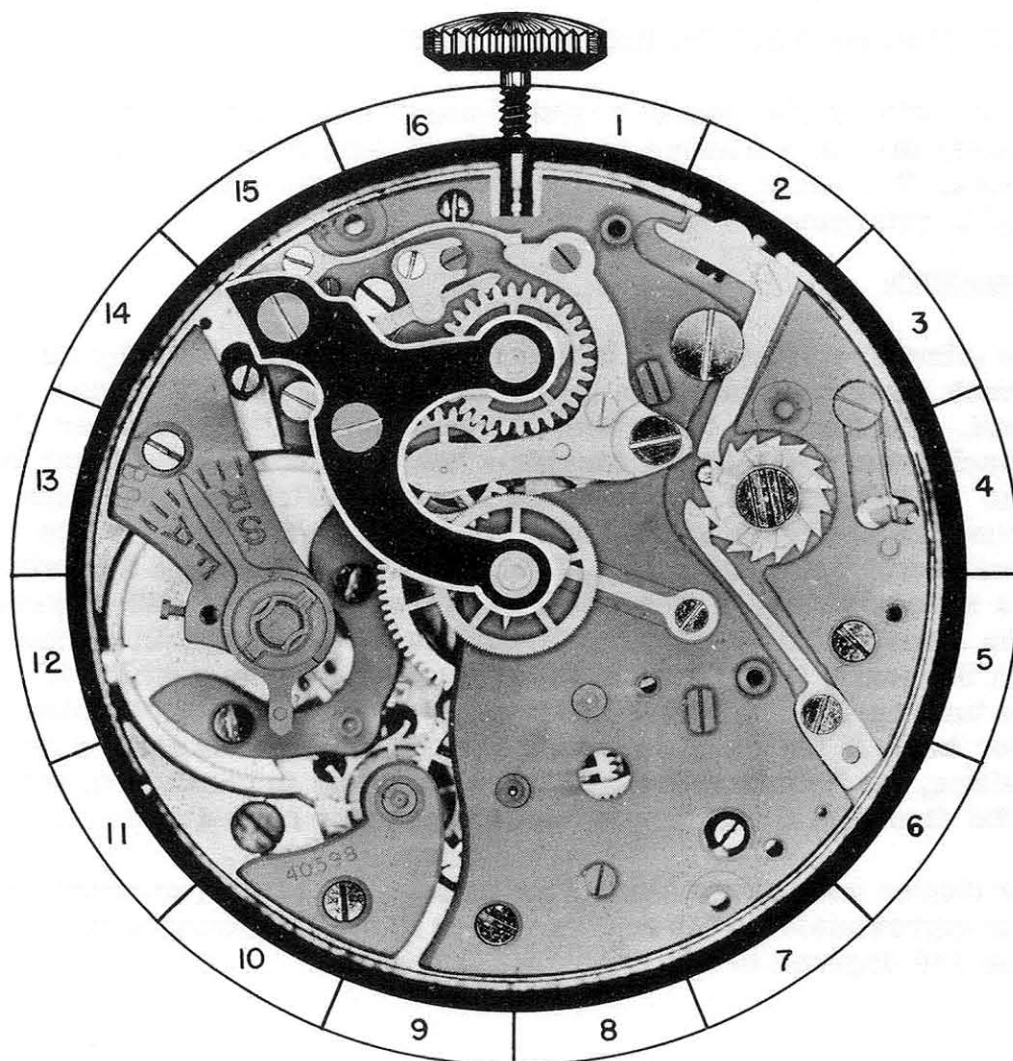
The function of this bridge is to hold top pivots of seconds wheel and minute register wheel in position, so that these wheels function properly.





OILING

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



13-A

PART NO. 14

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

To remove this wheel simply lift it out of place.

B. HAZARDS IN DISASSEMBLY OF MINUTE REGISTER WHEEL:

When removing this wheel, lift wheel straight up out of watch, as any twisting may bend or break the long pivot on the minute register wheel.

C. ASSEMBLY PROCEDURE OF MINUTE REGISTER WHEEL:

Place the long pivot "A" of the minute register wheel down in the proper hole in plate. Now move the end "A" of pawl from under the wheel, and place the minute register wheel in proper position. When the end "A" of pawl is released, the end "A" of this pawl should mesh with the teeth on minute register wheel.

REFERENCE: Minute register pawl is Assembly 20-B.

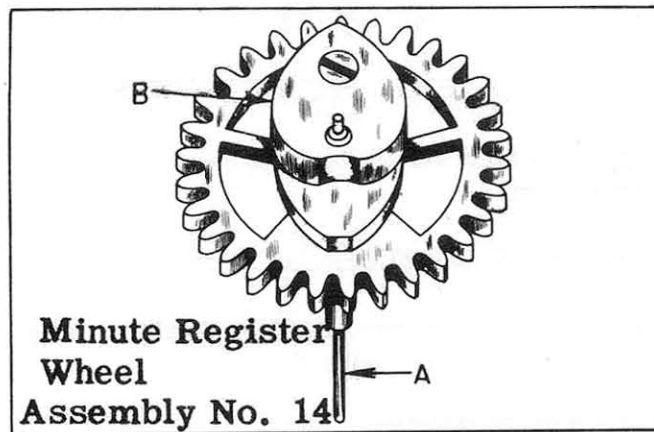
D. FUNCTION OF MINUTE REGISTER WHEEL:

The function of the minute register wheel is to register the minutes that have elapsed since the beginning of the registration. The heart "B" on the minute register wheel is used in returning the hand to zero.

REMARKS:

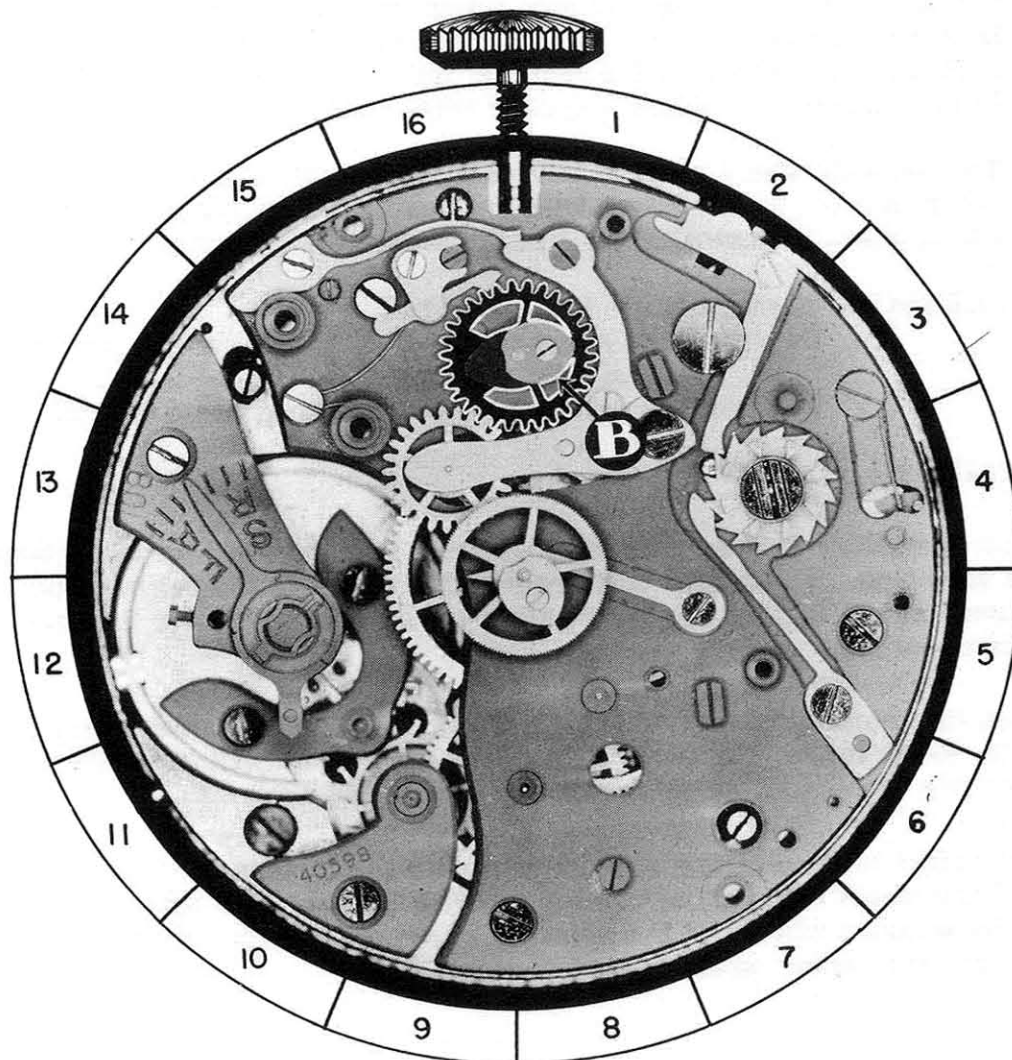
The minute register wheel is returned to a zero position by the flyback lever contacting the heart "B" on the minute register wheel. The heart on this wheel is set eccentric. The flat end of flyback lever contacts the eccentric heart and forces the heart to turn. The heart will turn until the flat end of flyback lever sets across the two lobes at the top of the heart. With the pressure equalized at these two points, it will turn no further and this will be a zero position. If this wheel has turned less than 160 degrees from a zero position when the flyback lever is brought in contact with the heart, it will turn in the opposite direction to which it was turning to bring this wheel back to a zero position. On the other hand, if the wheel is turned passed 160 degrees from a zero position, the flyback lever will force the heart to continue to turn in the direction it was turning until it reaches a zero position.

The degree used above should not be taken as exactly correct, as it is approximate. This degree varies in most chronographs from 150 degrees to 170 degrees.



OILING

The bottom pivot of minute register wheel should be oiled as you would properly oil a train pivot in a watch. The top pivot is oiled after bridge for this wheel is replaced.



14-A

PART NO. 15

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL:

The seconds wheel is lifted straight up to remove the long pivot from the hollow center pinion.

B. ASSEMBLY PROCEDURE OF SECONDS WHEEL:

Place seconds wheel in its proper position with the long pivot "A" down in the hollow center wheel pinion.

C. 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 pivot "A" on the 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 the dart tooth "C" attached to the seconds wheel. This dart tooth meshes with the teeth on the intermittent wheel which in turn moves the minute register wheel one tooth.
3. The seconds wheel must return to a zero position, when the flyback lever is brought in contact with the heart on this wheel. Seconds wheel heart is shown as "B" in the isometric drawing.

REFERENCE: Flyback lever is Assembly 7.

Dart tooth on seconds wheel is shown as "C" on the isometric drawing.

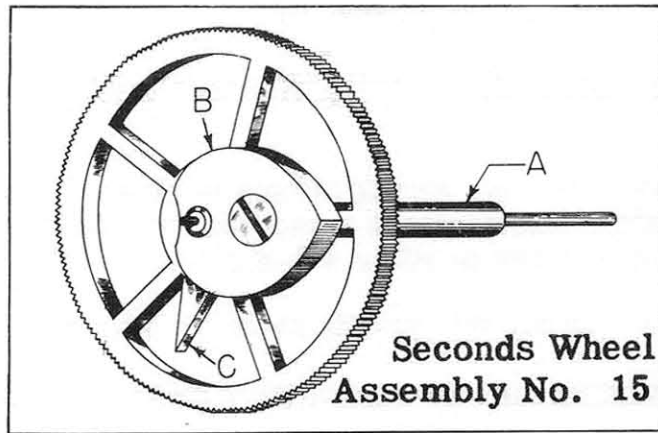
Intermittent lever and wheel assembly is Assembly 18.

REMARKS:

When examining the seconds wheel, notice that the teeth on this wheel are very fine. These fine teeth reduce the error in the register of seconds at the instant the intermediary wheel engages with the seconds wheel.

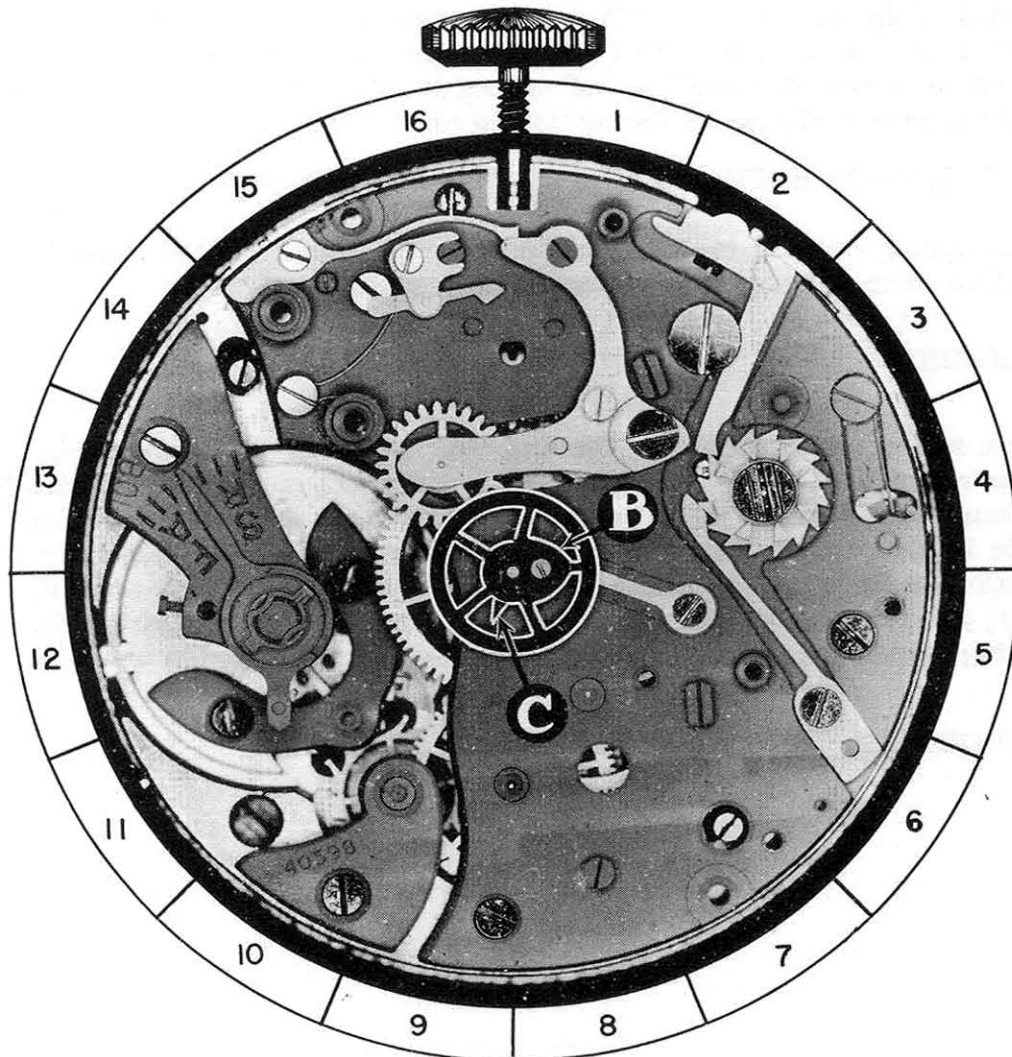
When the intermediary wheel teeth engage with the seconds wheel teeth, more times than not, the intermediary wheel will not engage perfectly without the seconds wheel turning slightly.

This slight turning of the seconds wheel at the instant the intermediary wheel engages it, is very small due to the fine teeth on the seconds wheel. If the seconds wheel teeth were increased in size, this error would be increased.



OILING

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



15-A

PART NO. 16

A. DISASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

The seconds wheel tension spring is held in place by fillister head screw FS-7. After this screw is removed, the tension spring will be free on the plate and can be lifted out of place.

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

B. ASSEMBLY PROCEDURE OF SECONDS WHEEL TENSION SPRING:

Place seconds wheel tension spring in its proper position, with the hole in the tension spring over the proper hole in the plate. Now replace fillister head screw FS-7, but before tightening screw, make sure that the end "A" of spring is not over the hole in hollow center pinion. The end "A" of this spring should fit right along side of the center wheel pivot hole. It should not fit over it. Proper position of this spring is shown in the photograph. After screw is tightened, check to make sure that tension spring is still in its proper position, as shown in the photograph. This spring should also be checked to see that it is right side up. The only way to determine the side that should be up is to see that end "A" of spring is above the level of the plate and the polished side of the spring is facing up.

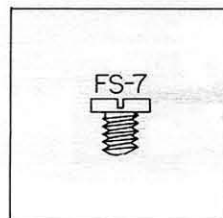
C. FUNCTION OF SECONDS WHEEL TENSION SPRING:

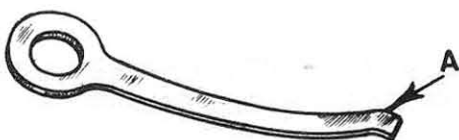
This spring holds a tension on the seconds wheel so that it turns with an even action with no irregular jumping or jerking.

REMARKS:

When replacing this spring, the end "A" of spring must be in its proper position. This is to prevent any contact of the spring with the seconds wheel staff. It is important to see that the end "A" of spring is in its proper position. If it is not, this end of spring may hold a tension on the seconds wheel staff, causing excess friction on this part, and may cause the watch to stop. The seconds wheel tension spring should only hold an upward tension on the seconds wheel.

REFERENCE: Seconds wheel is Assembly 15.

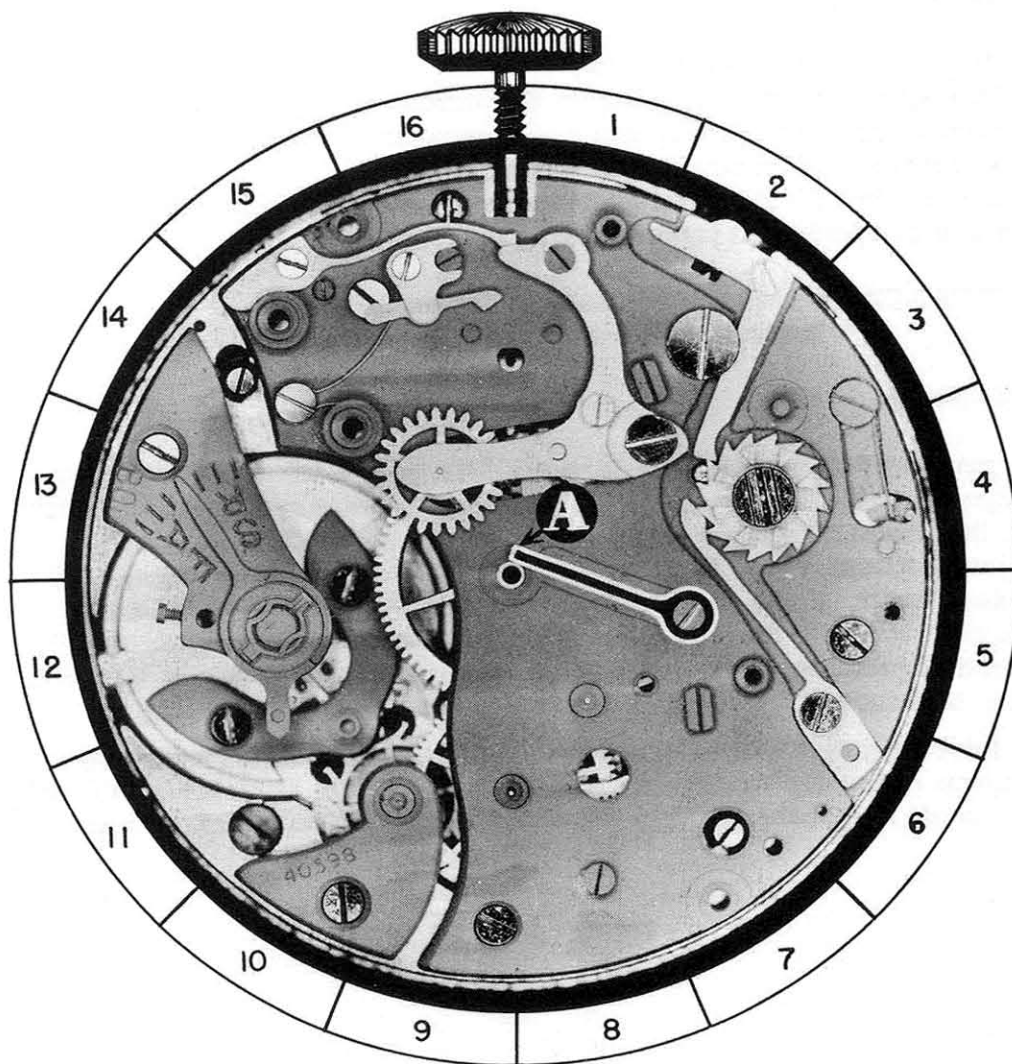




Seconds Wheel Tension Spring
Assembly No. 16

OILING

The seconds wheel tension spring should not be oiled.



16-A

PART NO. 17

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY SPRING:

This spring is held in place by fillister head screw FS-8. When this screw is removed, the spring will be free on the plate, and can 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 WHEEL ASSEMBLY SPRING:

Place spring on plate in position shown in photograph. The end "A" of spring should fit in slot "C" in the intermittent lever. The end "B" of spring should be contacting post on plate, as shown in photograph. Now place hole in spring over proper hole in plate, and replace fillister head screw FS-8 to hold spring in place.

REFERENCE: Intermittent lever is Assembly 18.

C. FUNCTION OF INTERMITTENT LEVER AND WHEEL ASSEMBLY SPRING:

The functions of this spring are:

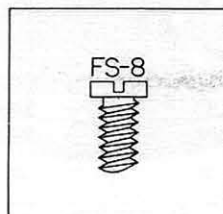
1. This spring holds a tension on the intermittent lever, which forces the intermittent lever to engage the intermittent wheel with the seconds wheel dart tooth.
2. It helps to hold the intermittent lever and wheel assembly down in place preventing it from working up.

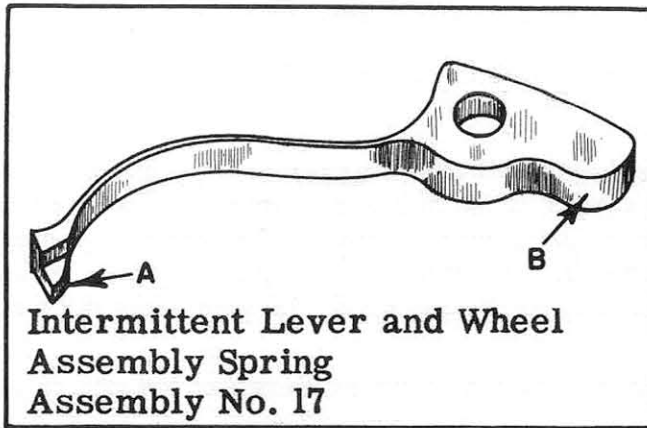
REFERENCE: Intermittent wheel is Assembly 18-B.
Seconds wheel dart tooth is Assembly 15-C.

REMARKS:

The intermittent wheel must turn slightly as the intermittent lever engages it with the dart tooth. The intermittent wheel teeth, meshing with the minute register wheel teeth which are stationary, cause the intermittent wheel to pivot on its axis as it moves to engage with the dart tooth. If the intermittent wheel is binding, when it is moved to engage with the dart tooth, it will turn the minute register wheel instead of pivoting on its axis and may result in an error in the register of minutes.

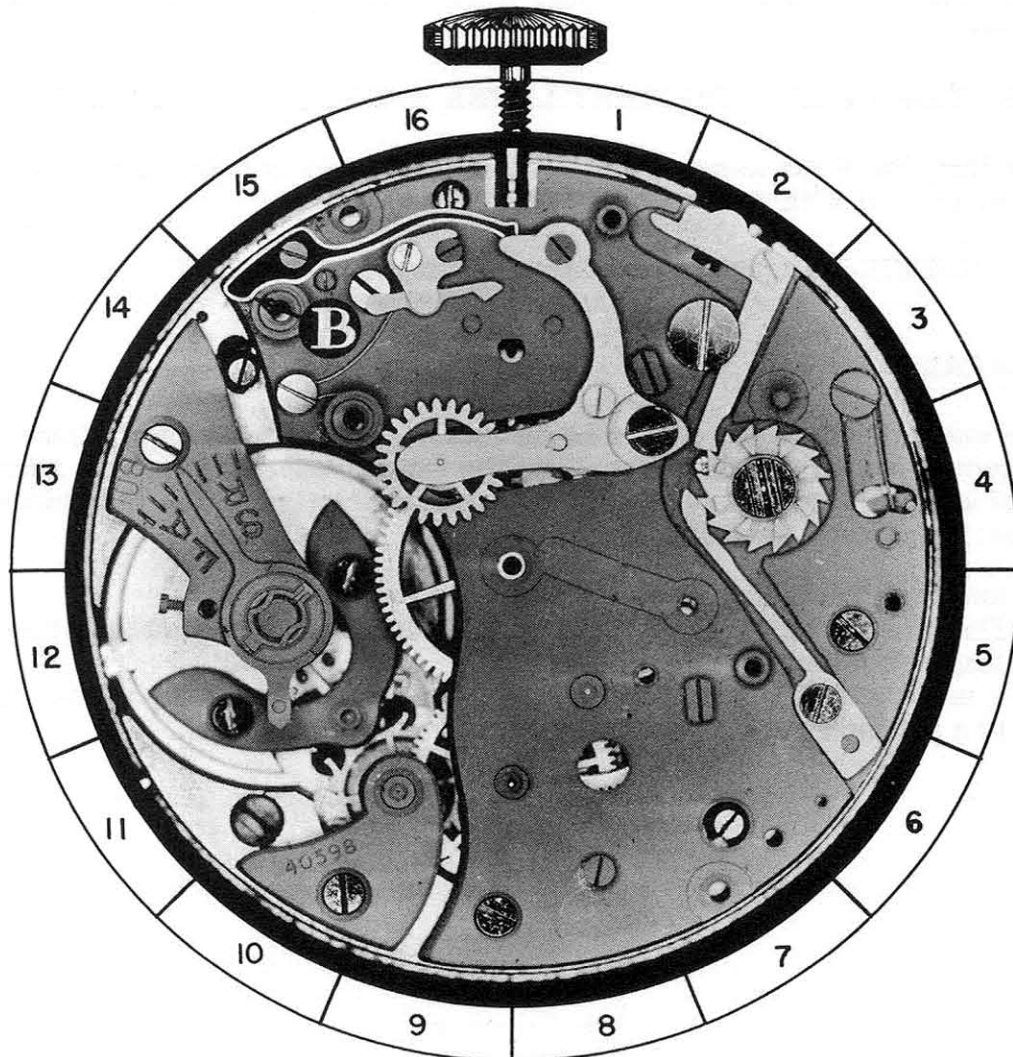
The intermittent wheel binding may cause the minute register pawl to be unable to correctly space the turning of the minute register wheel which may result in minute register hand setting at an incorrect position.





OILING

End "A" of this spring should be slightly moistened with oil at point of contact with intermittent lever.



PART NO. 18

A. DISASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

The intermittent lever and wheel assembly is held in place by shouldered screw SS-2 and pivots on an eccentric stud. Remove the screw and lift the assembly from the eccentric stud. The assembly should be lifted by the eccentric stud 'D' as shown in the photograph. When lifting the lever, tilt it slightly, so the part 'E' of assembly does not catch under the plate.

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

B. ASSEMBLY PROCEDURE OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

Place the hole "A" in the intermittent lever over the eccentric stud "F" on plate, as shown in the photograph. When placing lever down on stud, place the end "E" of this lever as shown in isometric drawing, so this part of lever will slide under plate. When lever is in proper position, replace shouldered screw SS-2 to hold assembly in position. Assembly should be checked to see that lever pivots freely under head of shouldered screw.

C. FUNCTION OF INTERMITTENT LEVER AND WHEEL ASSEMBLY:

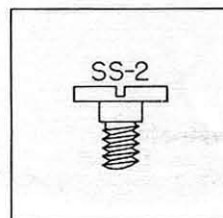
The function of the intermittent lever is to engage and disengage the intermittent wheel with the seconds wheel dart tooth.

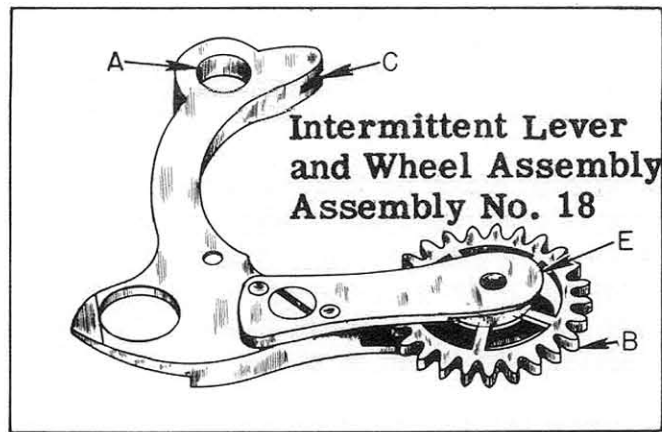
REFERENCE: Seconds wheel dart tooth is Assembly 15-C.
Intermittent wheel is Assembly 18-B.

REMARKS:

The intermittent wheel should be carefully checked to see that it has proper endshake and spins freely in the intermittent lever. This wheel must of necessity spin freely, as any excess friction on the intermittent wheel may cause the following errors:

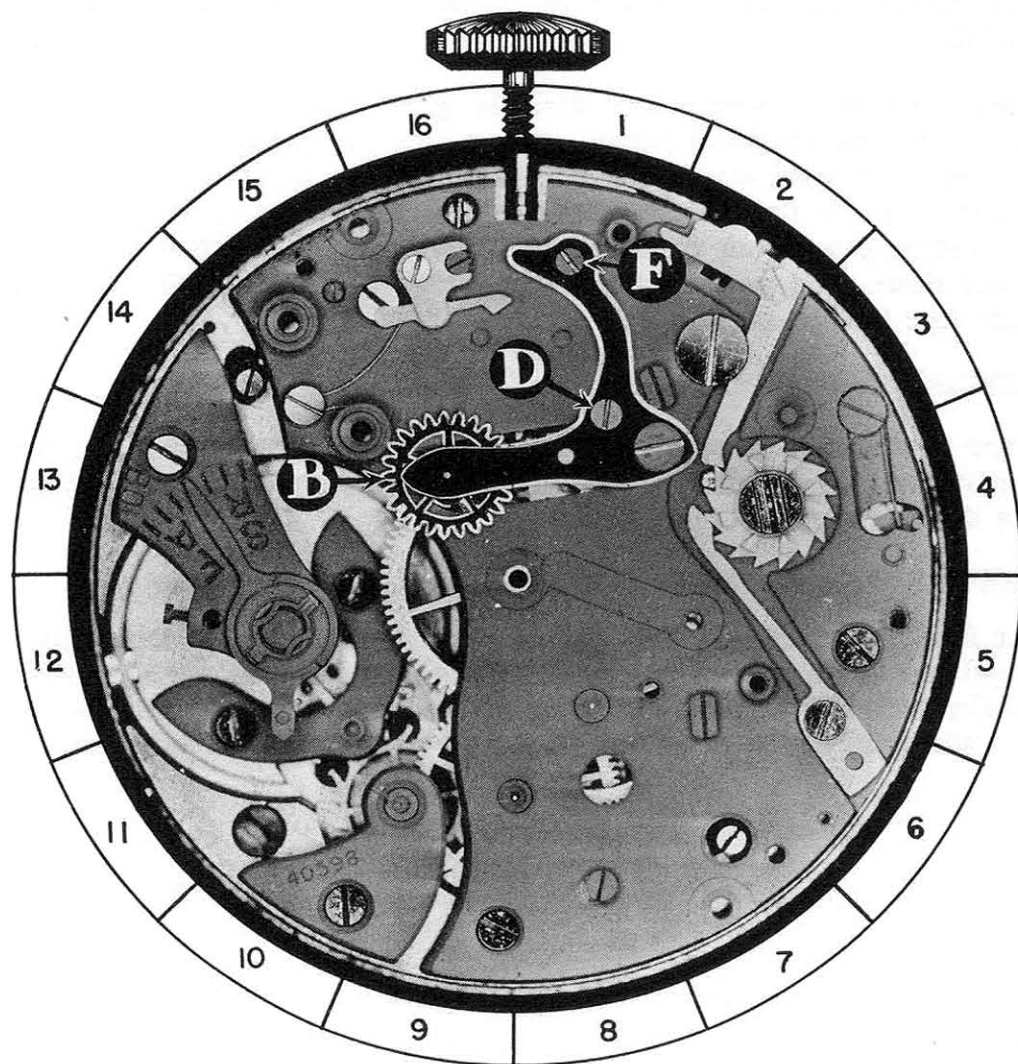
1. An error in the register of minutes on the dial.
2. The minute register pawl setting at an incorrect position on minute register wheel.
3. It may cause the watch to stop due to the dart tooth being unable to turn the intermittent wheel.





OILING

The eccentric stud on which the intermittent lever and wheel assembly pivots should be slightly moistened with oil.



18-A

PART NO. 18-B

A. DISASSEMBLY PROCEDURE OF INTERMITTENT WHEEL AND BRIDGE:

This bridge is held in place by beveled countersink screw BS-2. When this screw is removed, the bridge can be loosened from the intermittent lever by sliding a thin blade screw-driver under the bridge. After bridge is free of the steady pins on the intermittent lever, the bridge can be lifted out of place. To remove the intermittent wheel, simply lift it out of place.

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

B. HAZARDS IN DISASSEMBLY OF INTERMITTENT WHEEL AND BRIDGE:

When removing the intermittent wheel, lift the wheel straight up. Any tilting of wheel when removing may bend the pivot or burr the bushing in intermittent lever.

C. ASSEMBLY PROCEDURE OF INTERMITTENT WHEEL AND BRIDGE:

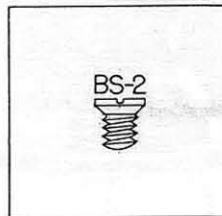
Place the intermittent wheel with the pivot "A" on wheel in pivot hole in the intermittent lever. Now place the bridge on the intermittent lever with steady pins on intermittent lever entering the proper holes in the bridge. Make sure the intermittent wheel pivot is entering pivot hole in intermittent lever bridge. Now press bridge down, and replace beveled countersink screw BS-2, which holds this bridge in place.

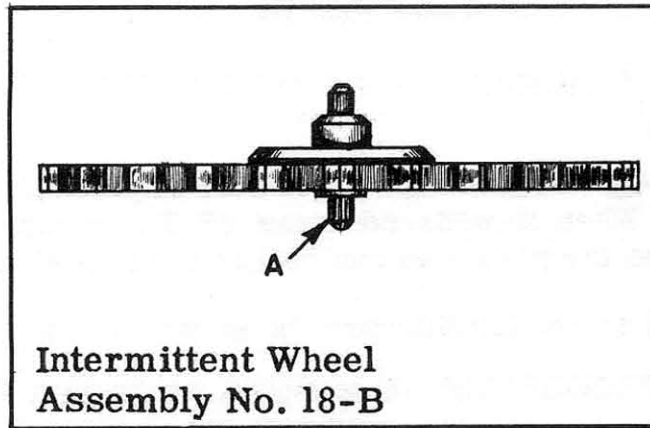
REMARKS:

After this bridge is replaced, check the intermittent wheel to see that it pivots freely and is not binding. Also check this wheel to see that it has proper endshake.

D. FUNCTION OF INTERMITTENT WHEEL AND BRIDGE:

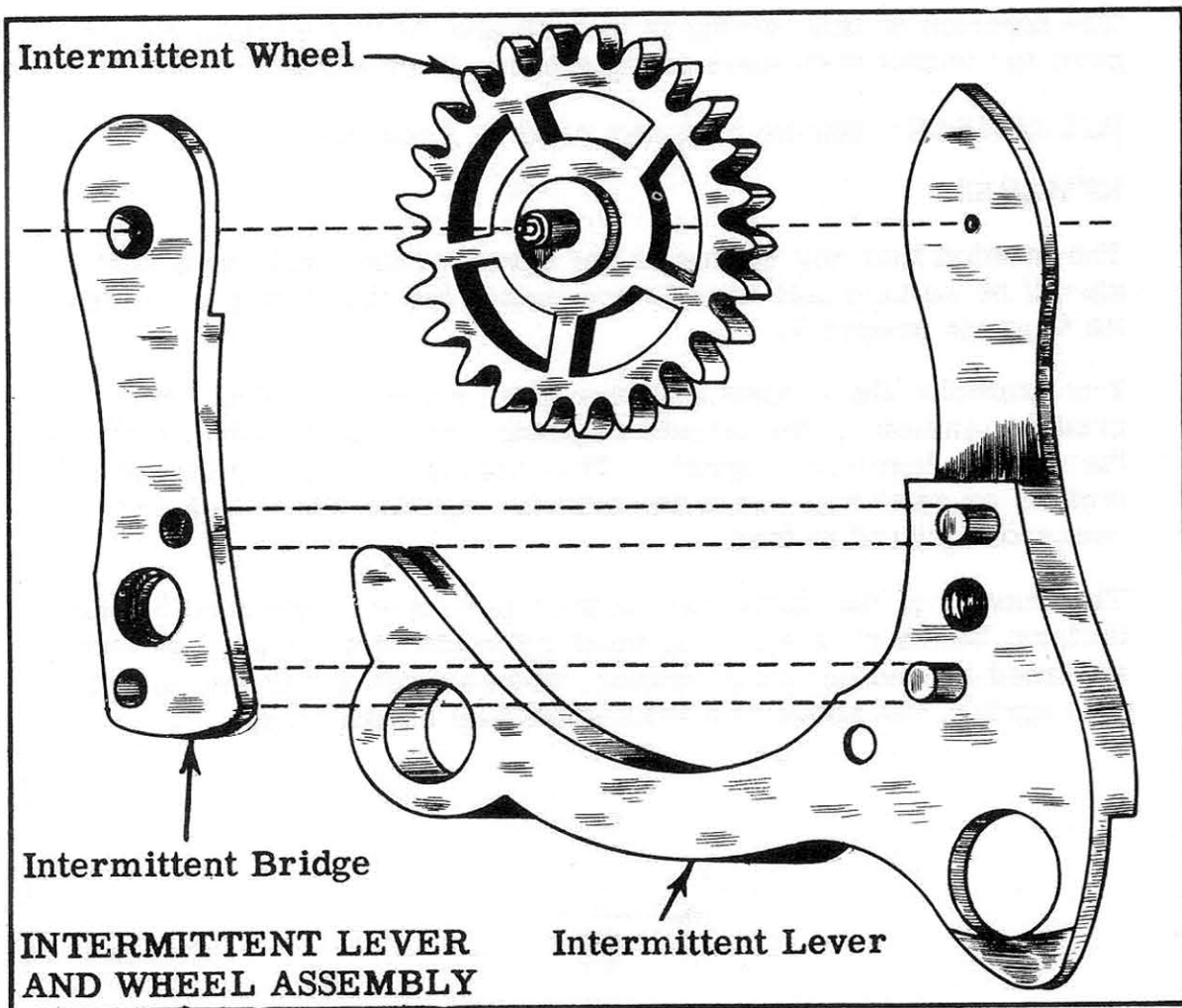
The function of intermittent wheel is to move the minute register wheel one tooth, each time the dart tooth on seconds wheel makes one revolution. The function of intermittent bridge is to hold intermittent wheel in position so that this wheel can function properly.





OILING

The intermittent wheel should not be oiled.



PART NO. 19

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL SPRING:

The minute register pawl spring is held in place by shouldered screw SS-3. When shouldered screw SS-3 is removed, this spring will be free on the plate and can be lifted out of place.

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

B. ASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL SPRING:

Place the minute register pawl spring on plate in position shown in photograph. The end "A" of spring should contact the minute register pawl. The end "B" should contact the post on plate. Now place the loop "C" in spring over screw hole in plate, and replace shouldered screw SS-3 to hold this spring in place. The spring should turn freely under head of screw.

C. FUNCTION OF MINUTE REGISTER PAWL SPRING:

The function of this spring is to hold end "A" of minute register pawl in contact with teeth on minute register wheel.

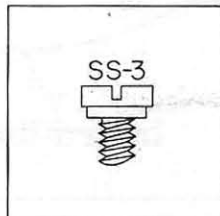
REFERENCE: Minute register pawl is Assembly 20-B.

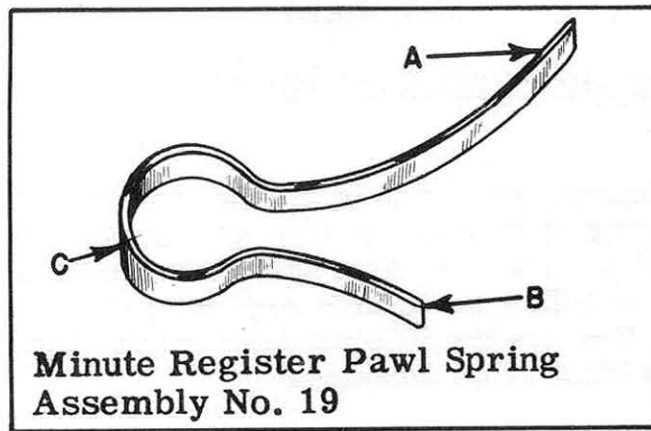
REMARKS:

The tension that any spring in the chronograph holds on a part should be no stronger than is necessary for the spring to perform its function properly.

For example, the minute register pawl spring should not hold any greater tension on the minute register pawl than is necessary for the pawl to function properly. This spring holding too strong a tension on pawl will cause the minute register wheel to be unnecessarily hard to turn.

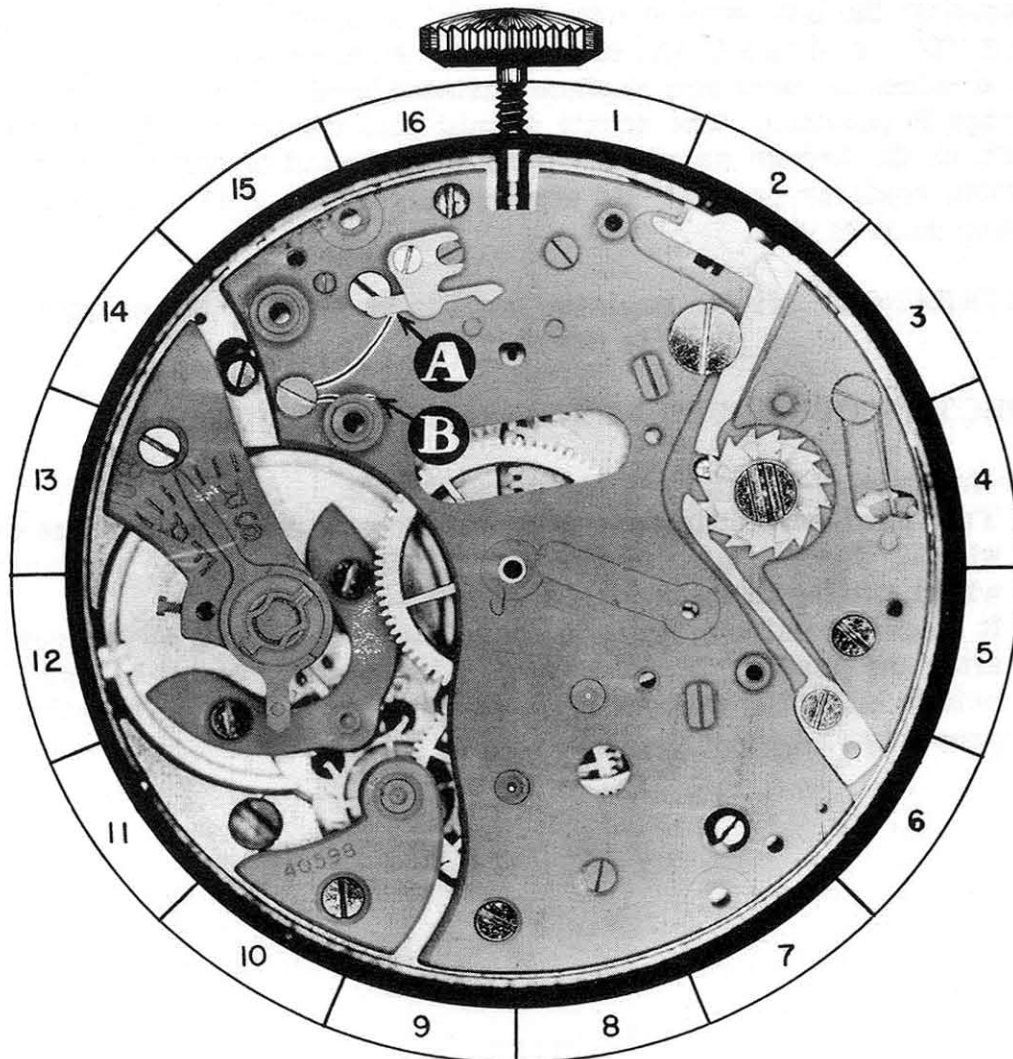
The tension of the spring to the part is properly adjusted by the factory, but in case a spring must be made or a spring has been replaced by another watchmaker, when adjusting the tension of this spring, the above remarks should be considered.





OILING

The minute register pawl spring should be slightly moistened with oil at point it contacts minute register pawl.



19-A

PART NO.20

A. DISASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL AND BRIDGE:

The minute register pawl is held in place by the minute register pawl bridge which is held to a hollow post on plate by fillister head screw FS-9. The eccentric stud "D" shown in the photograph is used to adjust the minute register pawl to the minute register wheel. Remove the fillister head screw, and the pawl and bridge may be lifted from movement.

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

B. ASSEMBLY PROCEDURE OF MINUTE REGISTER PAWL AND BRIDGE:

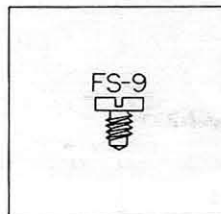
Place the bushing in minute register pawl on post on minute register pawl bridge, and place the minute register pawl and bridge in position shown in the photograph. The hole in bridge should be placed on the hollow post, with the "U" shaped slot over eccentric stud "D" as shown in the photograph. Now press the bridge down on shoulder on post, and replace fillister head screw FS-9 to hold bridge in position. The screw should hold the bridge tight to the post, as the bridge should not pivot under head of screw. The minute register pawl should pivot freely on the post of minute register pawl bridge.

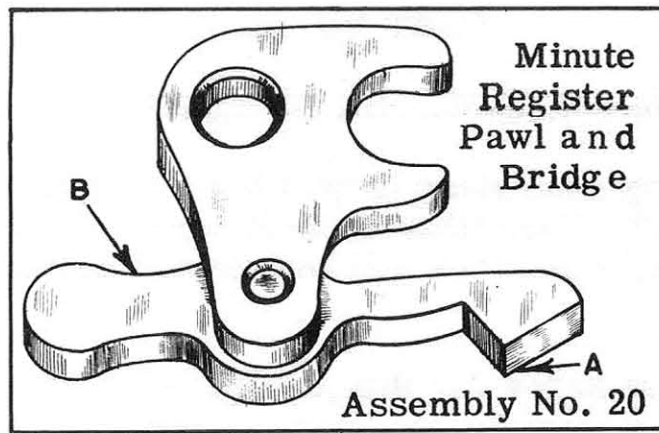
REFERENCE: Minute register pawl is shown as "B" on isometric drawing.

C. FUNCTION OF MINUTE REGISTER PAWL AND BRIDGE:

The function of the pawl is to do two things:

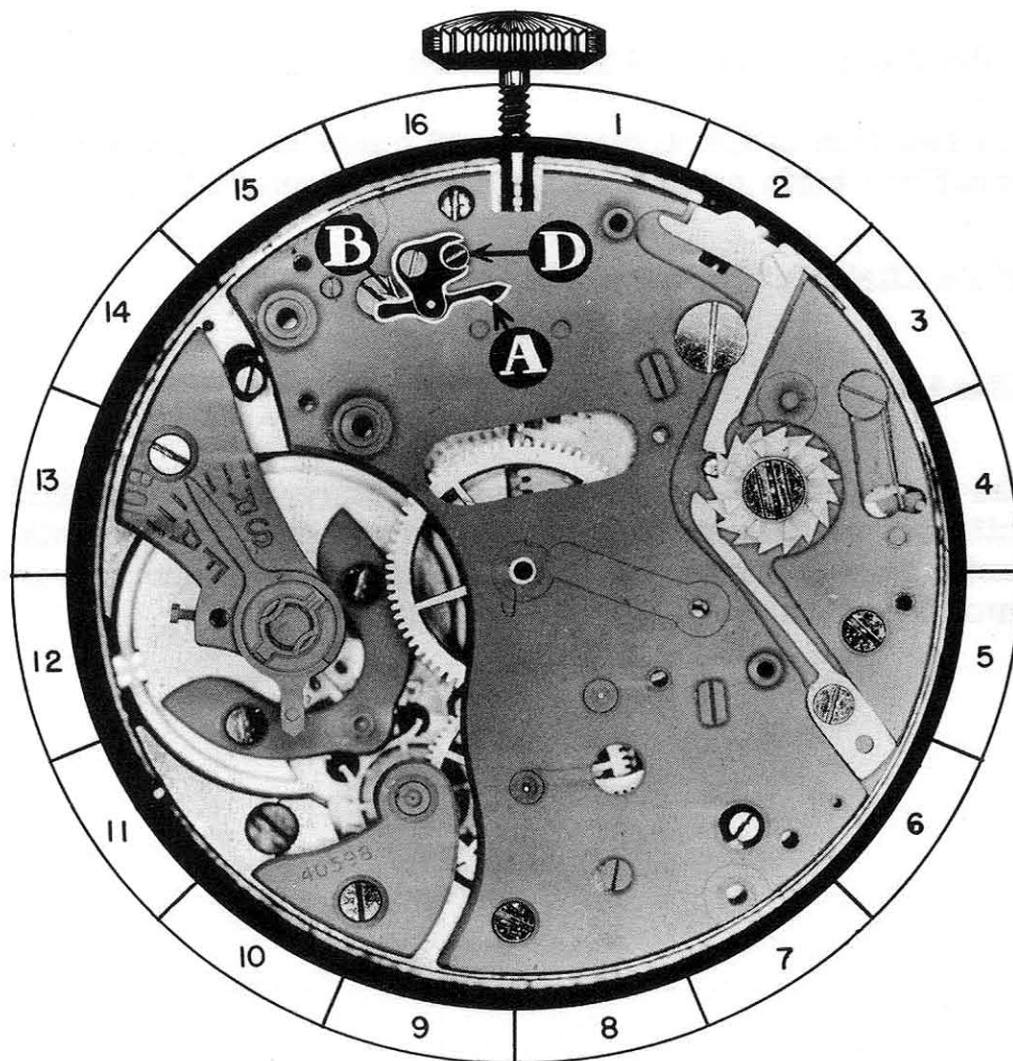
1. This pawl correctly spaces the turning of the minute register wheel. This eliminates the possibility of the minute register wheel setting at an incorrect position.
2. It holds the minute register wheel so that a bump or jar cannot alter the position of this wheel. The minute register pawl bridge holds the minute register pawl in position to function properly.





OILING

The minute register pawl and bridge should not be oiled.



20-A

PART NO. 21

A. DISASSEMBLY PROCEDURE OF ACTUATING PUSH PIECE:

The actuating push piece is held in place by fillister head screw FS-10. When fillister head screw FS-10 is removed, the actuating push piece will be free and can 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 the actuating push piece in position in the recess in the plate. Now replace fillister head screw FS-10 that holds the actuating push piece in place. After the screw is replaced, check to see that the actuating push piece moves freely under head of this screw and is not binding.

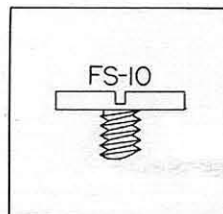
C. FUNCTION OF ACTUATING PUSH PIECE:

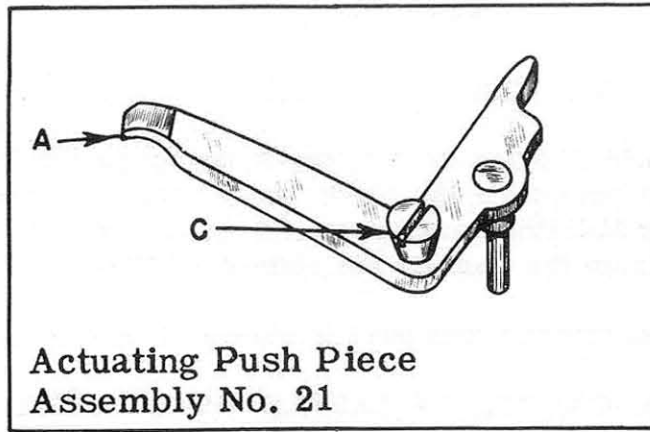
The function of the actuating push piece is to turn the castle wheel one tooth, each time the actuating push piece is pushed.

REFERENCE: Castle wheel is Assembly 23.

REMARKS:

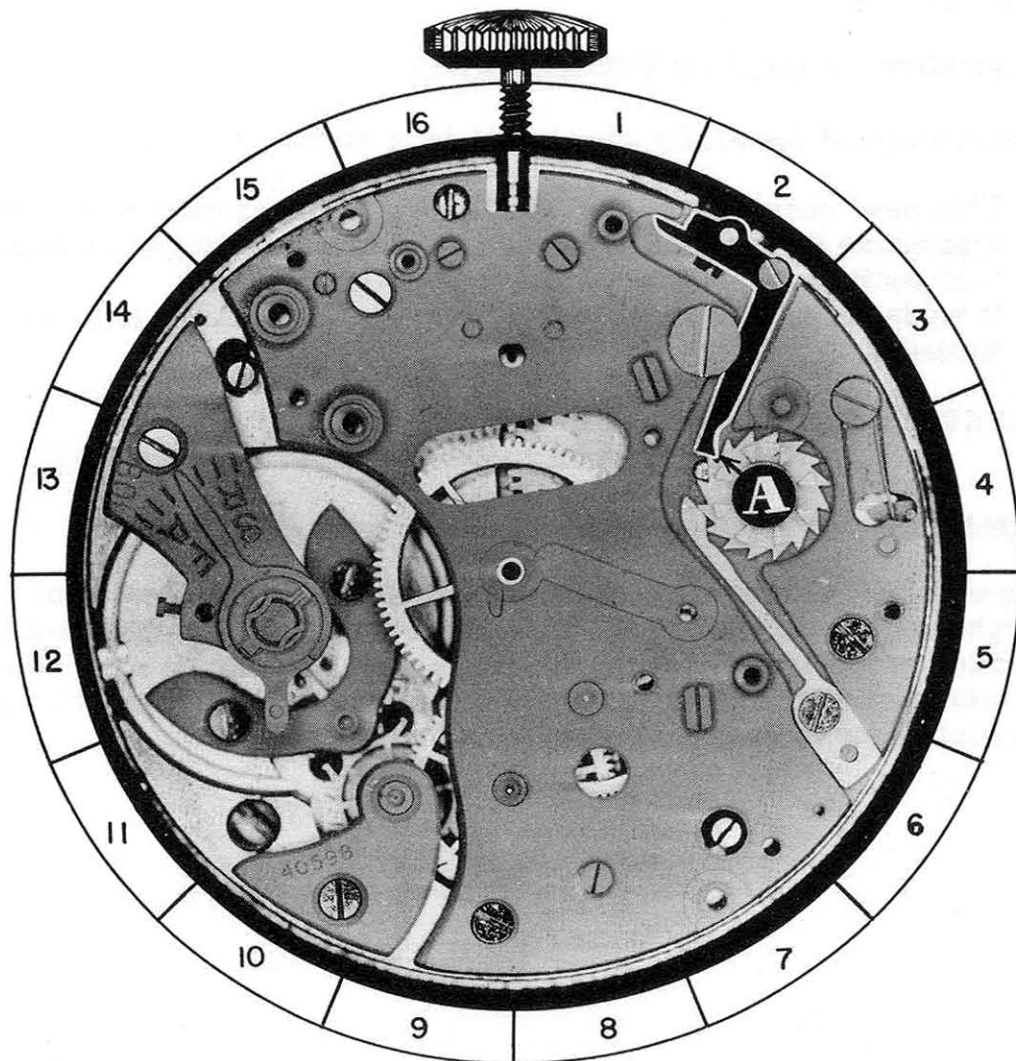
The surface "A" on actuating push piece should be highly polished, as this surface slides across the ratchet teeth on castle wheel. Thus, for this actuating push piece to work smoothly, this surface must be polished.





OILING

The actuating push piece should not be oiled.



21-A

PART NO. 22

A. DISASSEMBLY PROCEDURE OF CASTLE WHEEL PAWL:

This pawl is held in place by fillister head screw FS-11 and a stud on the plate. A recess in the plate helps hold this pawl in its proper position. After fillister head screw FS-11 is removed, this pawl can be lifted free from the stud on the plate and lifted out of place.

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

B. ASSEMBLY PROCEDURE OF CASTLE WHEEL PAWL:

Place castle wheel pawl in its proper position in recess in plate with the hole "B" in pawl over the stud on the plate. Now replace fillister head screw FS-11. Before tightening screw, make sure that end "A" of pawl is not on top of ratchet teeth on the castle wheel, but meshing in between two teeth on this wheel. To function properly, the end "A" of pawl must be engaged with the ratchet teeth on the castle wheel. Now tighten fillister head screw FS-11 that holds this pawl in place.

C. FUNCTION OF CASTLE WHEEL PAWL:

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

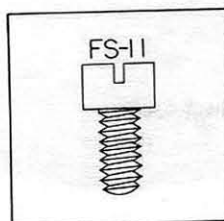
1. This pawl correctly spaces the turning of the castle wheel. This eliminates the possibility of the castle wheel setting at an incorrect position.
2. It holds the castle wheel in a correct position until it is moved manually.

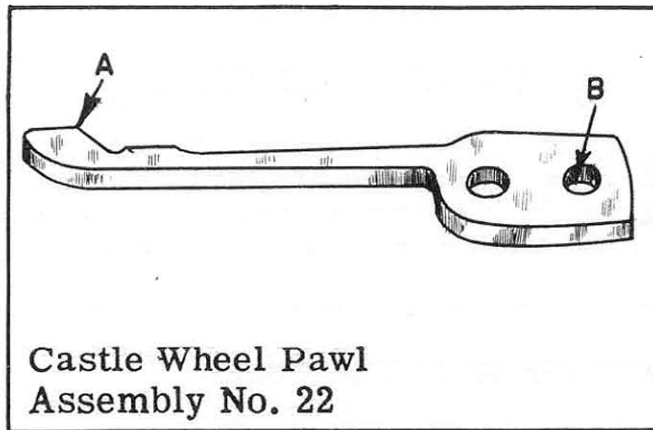
REFERENCE: Castle wheel is Assembly 23.

Ratchet teeth on castle wheel is Assembly 23-B.

REMARKS:

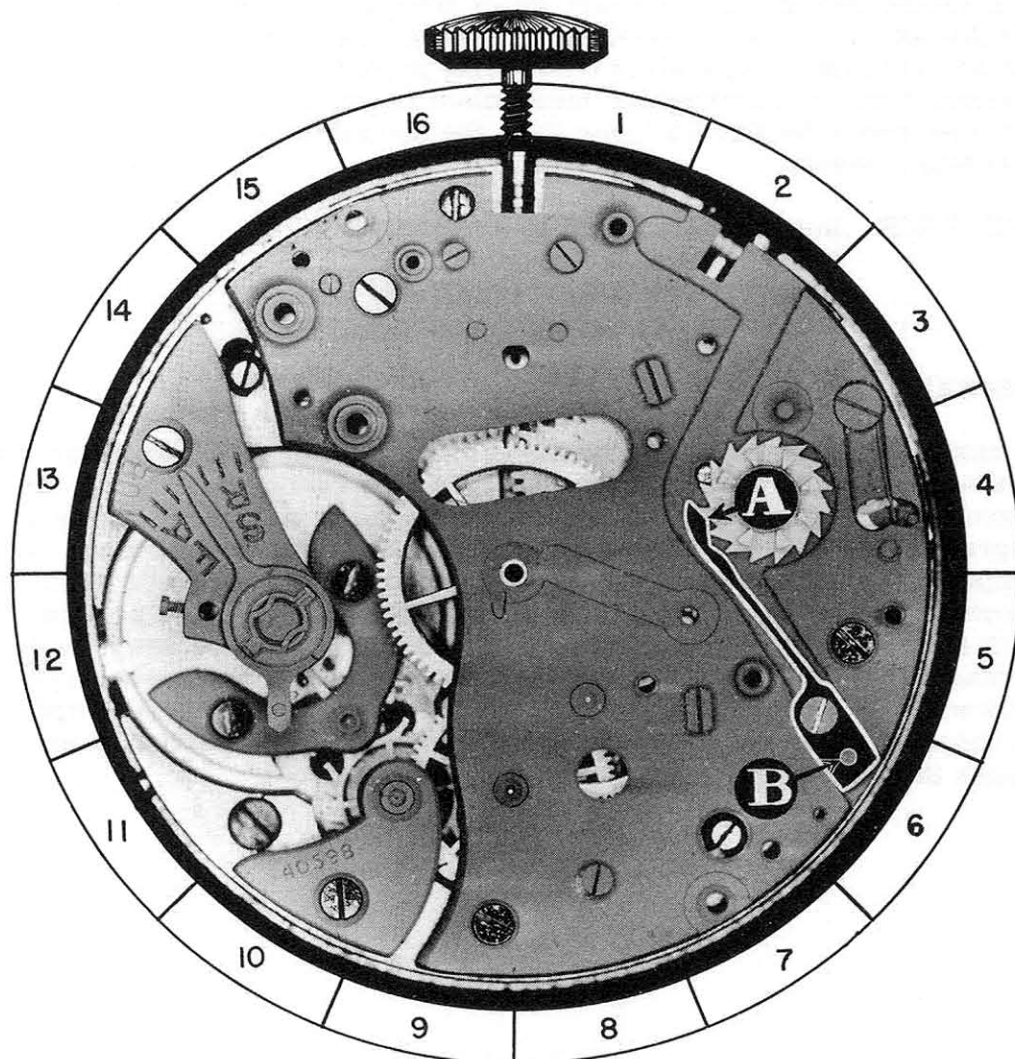
The end "A" of castle wheel pawl must be highly polished. Any roughness or pits of rust at this location may cause the pawl not to function properly. If it is necessary to polish this part, care should be taken not to change the shape of end "A" of pawl. It must be of correct shape to function properly as stated above.





OILING

The castle wheel pawl should not be oiled.



22-A

PART NO. 23

A. DISASSEMBLY PROCEDURE OF CASTLE WHEEL:

The castle wheel is held in place by fillister head screw FS-12. This screw is a left threaded screw. You can identify this left threaded screw by the two slots running parallel to the screw slot in the screw-head. After this screw is removed, the castle wheel may be lifted from post.

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

B. ASSEMBLY PROCEDURE OF CASTLE WHEEL:

Place the castle wheel in position with the hole in castle wheel over the hollow post on the plate. Now replace fillister head screw FS-12 that holds the castle wheel in place. After this screw is replaced, check to see that the castle wheel turns freely under the head of this screw. Of course, this wheel should not have excess freedom.

C. FUNCTION OF CASTLE WHEEL:

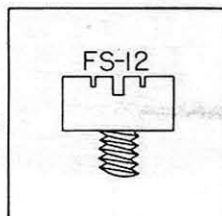
The functions of the castle wheel are:

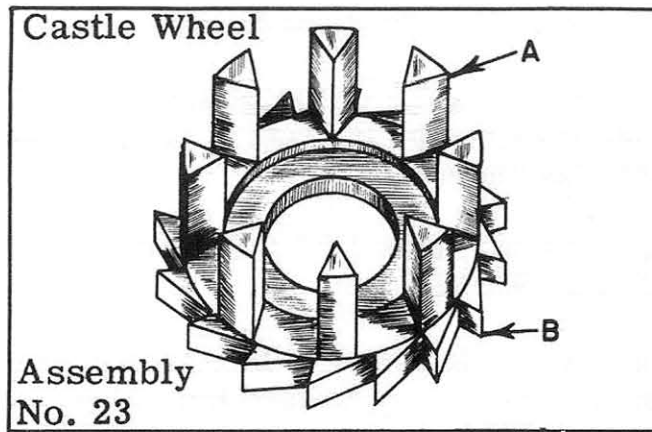
1. It disengages the intermediary wheel from the seconds wheel.
2. It disengages the brake lever from the seconds wheel.
3. It prevents the flyback lever from being moved toward the center of the watch, when the chronograph mechanism is engaged.
4. It disengages the flyback lever from the seconds wheel and minute register wheel hearts.

REFERENCE: Intermediary wheel is Assembly 11.
Seconds wheel is Assembly 15.
Flyback lever is Assembly 7.
Brake lever is Assembly 8.

REMARKS:

The castle wheel performs its functions by the columns "A" which are evenly spaced around the center of the wheel. As the castle wheel turns, the columns either force a part to move out from the center of the castle wheel or permit it to move into the empty spaces between the two columns. For example, the intermediary wheel is disengaged from the seconds wheel by the columns of the castle wheel forcing the end of chronograph pivoted detent from between the columns until the point of this lever rests on the columns. To engage the intermediary wheel with the seconds wheel, the castle wheel is turned one space. This permits the end of chronograph pivoted detent to enter the empty space between the columns, which in turn engages the intermediary wheel with the seconds wheel.

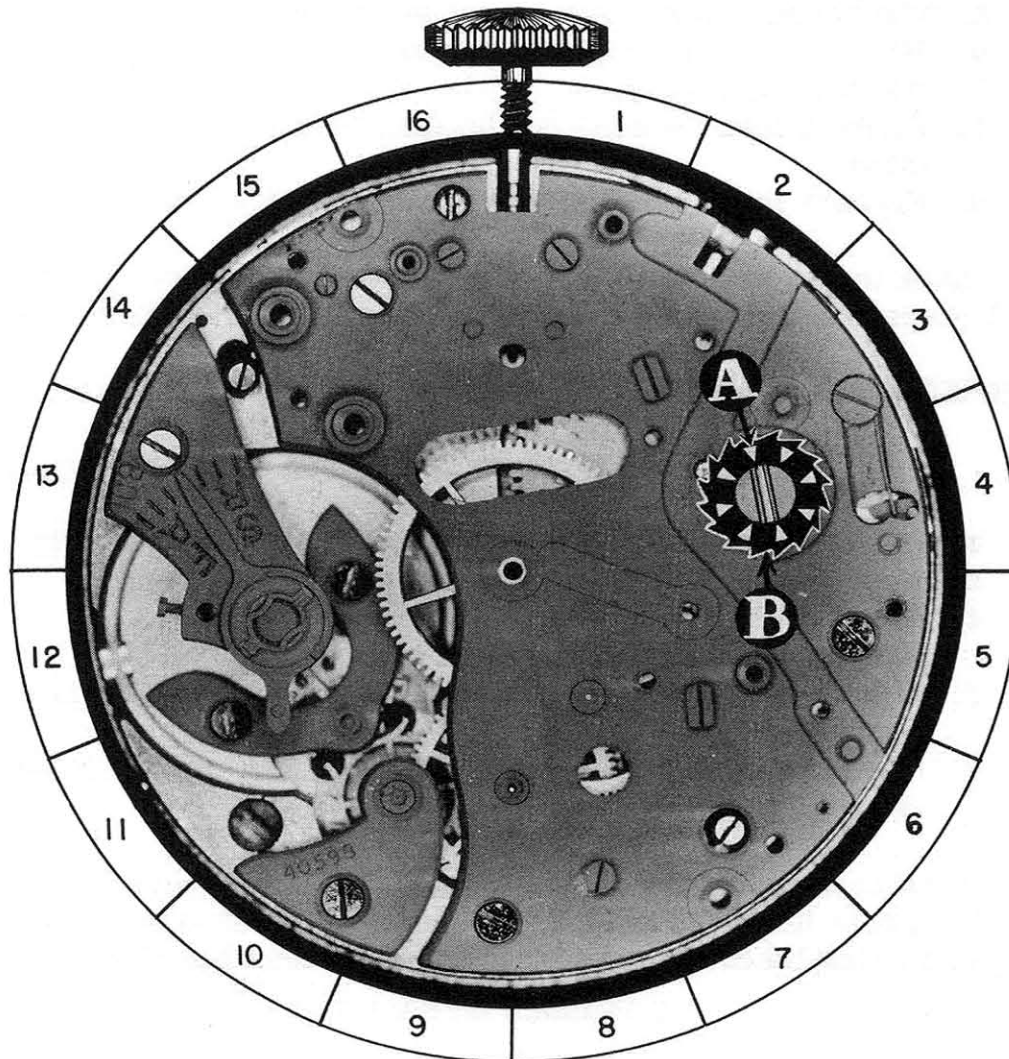




OILING

Slightly moisten with oil the castle wheel at these points:

1. The shoulder of post in plate on which castle wheel pivots.
2. The columns "A" that contact parts of this mechanism.
3. The ratchet teeth "B".



23-A

FUNCTIONAL RESULTS

After completely assembling the chronograph with the exception of back of case, place chronograph in front of you, pendant up, with back of chronograph facing you.

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

(Make sure that the castle wheel is in a position that permits the flyback lever to be moved toward the center of the watch.)

- 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 the sweep second hand and the minute register hand from returning to a zero position:

- a. The hands being loose or not set correctly.
- b. Minute register wheel or the seconds wheel binding and not turning freely.
- c. Flyback lever spring not holding proper tension on flyback lever.
- d. Flyback lever binding and not turning freely.

- B. Check to see that end "A" of minute register pawl is directly centered between two teeth on the minute register wheel.

CORRECTION: The following errors may prevent the minute register pawl from setting exactly centered between two teeth on the minute register wheel:

- a. Minute register wheel binding and not turning freely.
- b. Intermittent wheel binding and not turning freely.
- c. Improperly adjusted eccentric stud ES-1.
(See adjustment of eccentric studs.)
- d. Minute register pawl binding and not turning freely on post in bridge.
- e. Minute register pawl spring not holding proper tension on minute register pawl.

- C. Check to see that the ends "A" and "B" of flyback lever are of correct length to hold the seconds wheel stationary while permitting the minute register wheel to turn slightly.

(Continued on next page)

FUNCTIONAL RESULTS

(Continued)

CORRECTION: The flyback lever being bent or one branch of flyback lever being cut or filed too short may result in these wheels not being held correctly at a zero position by the flyback lever.

- D. Check to see that the intermittent wheel has moved away from the center of the watch, so that the teeth on this wheel are disengaged from the dart tooth.

CORRECTION: Failure of intermittent wheel to move away from seconds wheel dart tooth may be caused by improper adjustment of eccentric stud ES-4. (See adjustment of eccentric studs.)

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

- A. Check to see that intermediary wheel teeth are properly engaged with seconds wheel teeth.

CORRECTION: The following errors may prevent the proper engagement of these teeth:

- a. Chronograph pivoted detent binding and not turning freely.
- b. Improperly adjusted adjusting stud AS-5.
(See adjustment of eccentric studs.)
- c. Chronograph pivoted detent spring not holding proper tension on chronograph pivoted detent.

- B. Check the depth of the seconds wheel dart tooth with the intermittent wheel teeth.

CORRECTION: The following errors may prevent proper depth of these teeth:

- a. Intermittent lever binding and not turning freely.
- b. Intermittent lever spring not holding proper tension on intermittent lever.
- c. Improperly adjusted adjusting stud AS-3.
(See adjustment of eccentric studs.)

(continued on next page)

FUNCTIONAL RESULTS (Continued)

REMARKS:

If the depth 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 depth is shallow, it may result in the minute register wheel failing to move a full tooth and will not register the minutes on the dial.

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

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

- D. Check to see that the minute register hand completes the registration of one minute when the seconds hand passes 60 on this dial.

CORRECTION: The following errors may cause the minute register hand to register the passage of one minute either before or after the seconds hand passes 60 on the dial:

- a. Seconds wheel not being at zero position when the hand is replaced.
- b. Dart tooth incorrectly set on the seconds wheel.
- c. Minute register pawl not being correctly adjusted to the minute register wheel.

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

- A. Check to see that brake lever is contacting the seconds wheel.

CORRECTION: The following errors may prevent the brake lever from contacting seconds wheel:

- a. Brake lever binding and not turning freely under head of screw.
- b. The spring on the brake lever not having sufficient tension.

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

SPLIT SECOND SCALE

- B. This scale is divided into 300 divisions, each indicating $\frac{1}{5}$ 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.

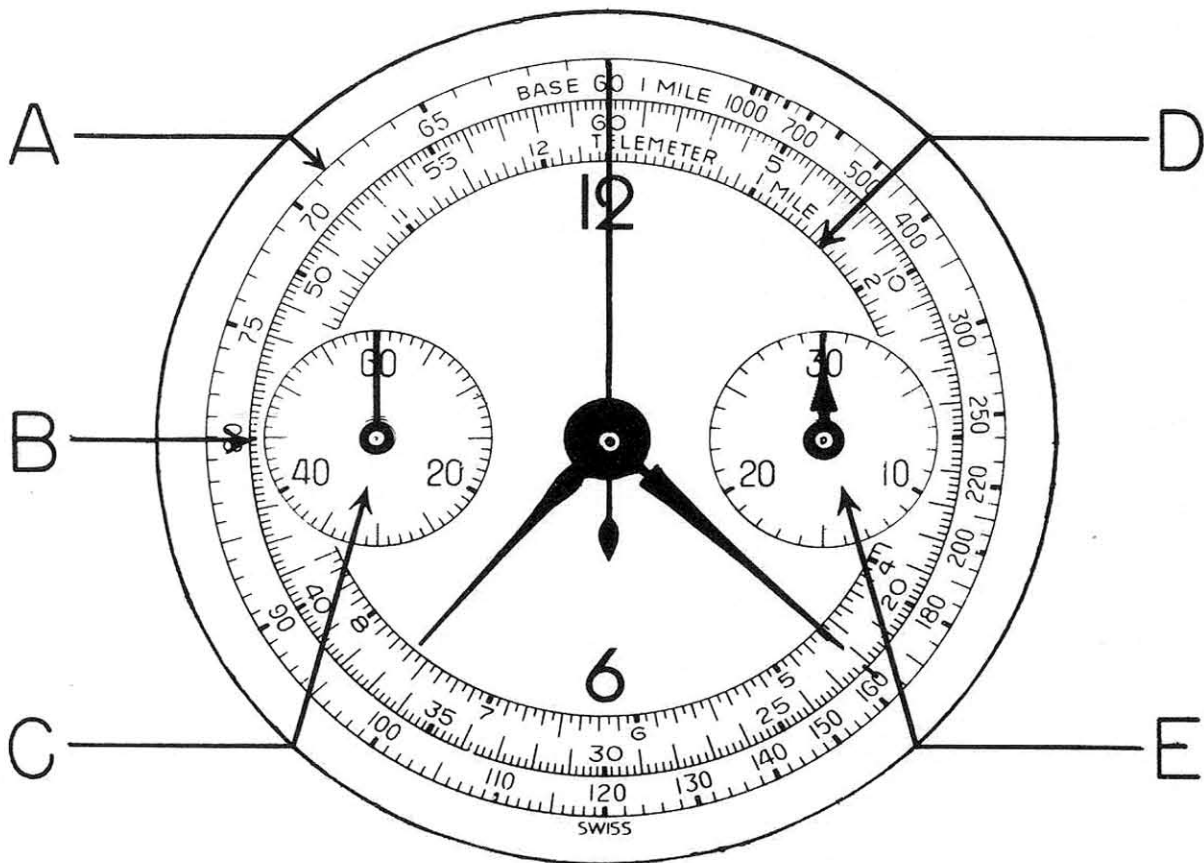
METHOD OF USING TELEMETER

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.