

ELECTRIC CLOCK

KS-8155

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers the KS-8155 electric clock.
- 1.02 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

2. REQUIREMENTS

- 2.01 Cleaning: Contacts and other parts shall be cleaned when necessary in accordance with approved procedures.
- 2.02 Lubrication
 - (a) The commutator (Fig. 1 (A)), and slip rings (Fig. 1 (B)) shall be adequately coated with a light coat of W.E. Co. 57997 petrolatum.

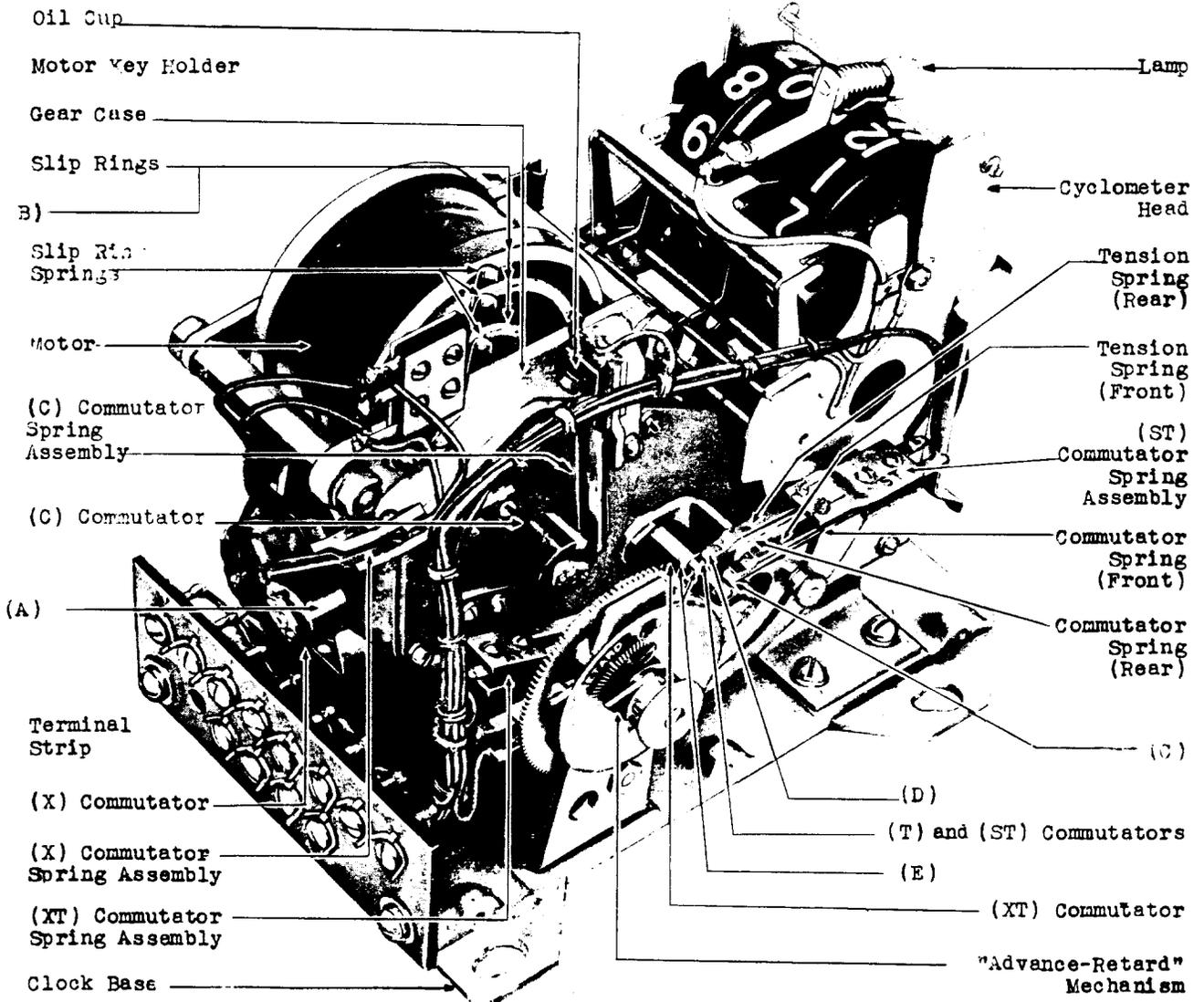


Fig. 1 - Illustrating Commutators and Commutator Spring Assemblies

2.02 (Continued)

(b) Fig. 2 (A) - With the motor stopped, the gear case shall be filled to approximately the centerline of the oil sight with KS-6232 oil.

(c) Recommended Lubrication Intervals: After turnover it is recommended that the parts listed in requirement (a) above be cleaned and lubricated at intervals of six months. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure requirement (a) will be met during the extended interval. Periodic inspections shall be made to insure that the oil level specified in requirement (b) is maintained.

2.03 Record of Lubrication: During the period of installation a record shall be kept, by date, of lubrication and this record shall be turned over to the Telephone Company with the equipment. If no lubrication has been done, it shall be so stated.

2.04 Accuracy of Clock Movement: The clock movement shall not gain or lose any time over a period of 48 hours when connected to a power supply regulated for time service.

2.05 Alignment of Commutator Springs and Tension Springs

(a) Fig. 1 (C) - The commutator springs shall be so aligned that the contacting surfaces are wholly within the edges of the commutators. Gauge by eye.

(b) Fig. 1 (D) - The tension springs and their associated commutator springs shall be in approximate alignment with each other (within the thickness of the tension spring) across the width of the springs. Gauge by eye.

2.06 Tightness of Screws

(a) The screws shall be sufficiently tight to hold the commutators and springs in their adjusted positions. Gauge by feel.

(b) The cover shall be securely fastened to the clock base by means of the screws. Gauge by feel.

2.07 Freedom of Movement of "Advance-Retard" Mechanism: The "Advance-Retard" mechanism shall move freely when manually operated. Gauge by feel.

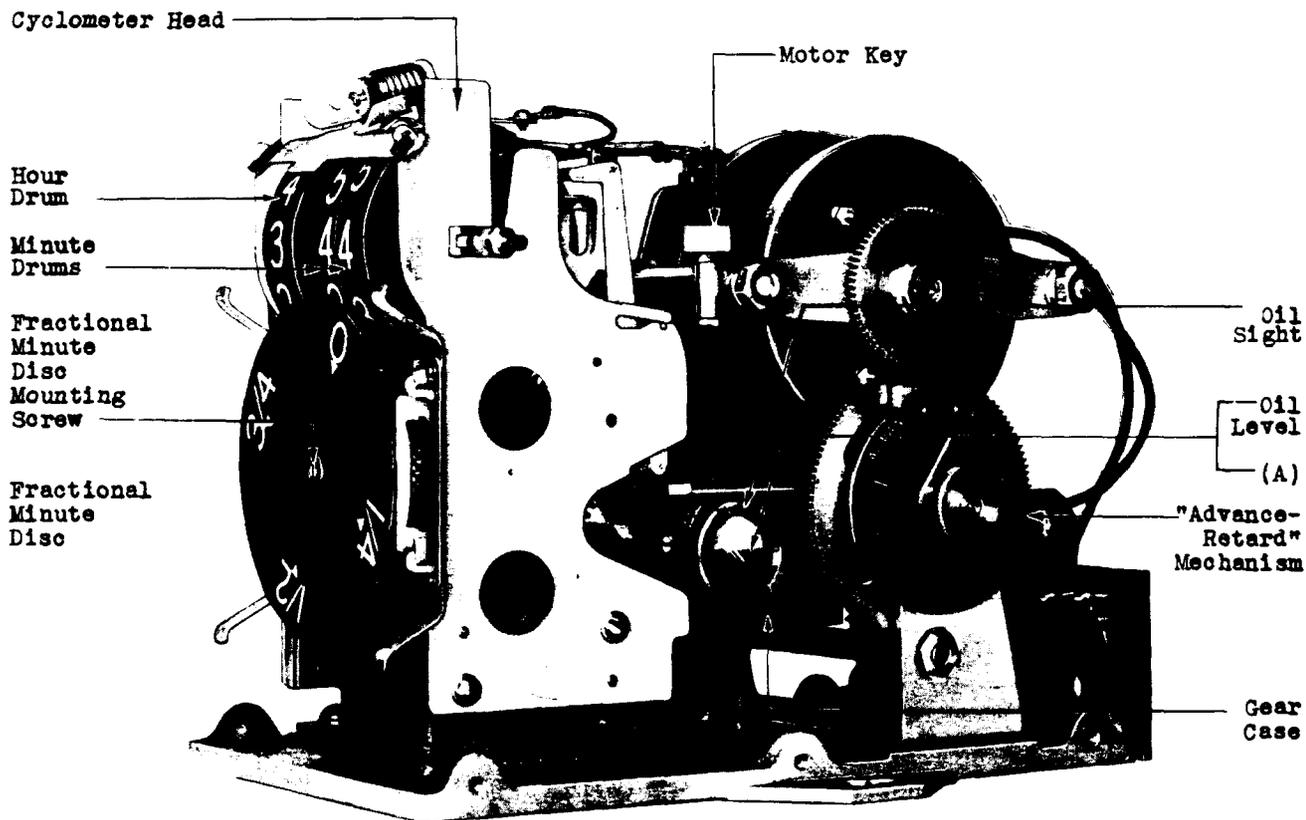


Fig. 2 - Illustrating Gear Case and Cyclometer Head

2.08 Alignment of Figures on Minute and Hour Drums and Fractional Minute Disc - Fig. 3 (A): With the clock electrically operated, the top of any figure shall not be above the top edge of the openings in the clock case or the bottom of any figure shall not be below the bottom edge of the openings in the clock case. Gauge by eye.

2.09 Alignment of Fractional Minute Disc and Minute Drum - Fig. 3 (B): The minute drum shall complete its advance to the next minute, when the indicator at 0 on the fractional minute disc is approximately in alignment with the right hand spacing line on the clock case. Gauge by eye.

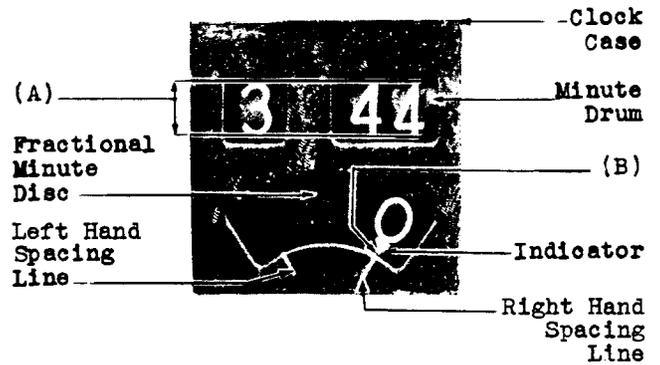


Fig. 3 - Illustrating Relationship Between Clock and Clock Case

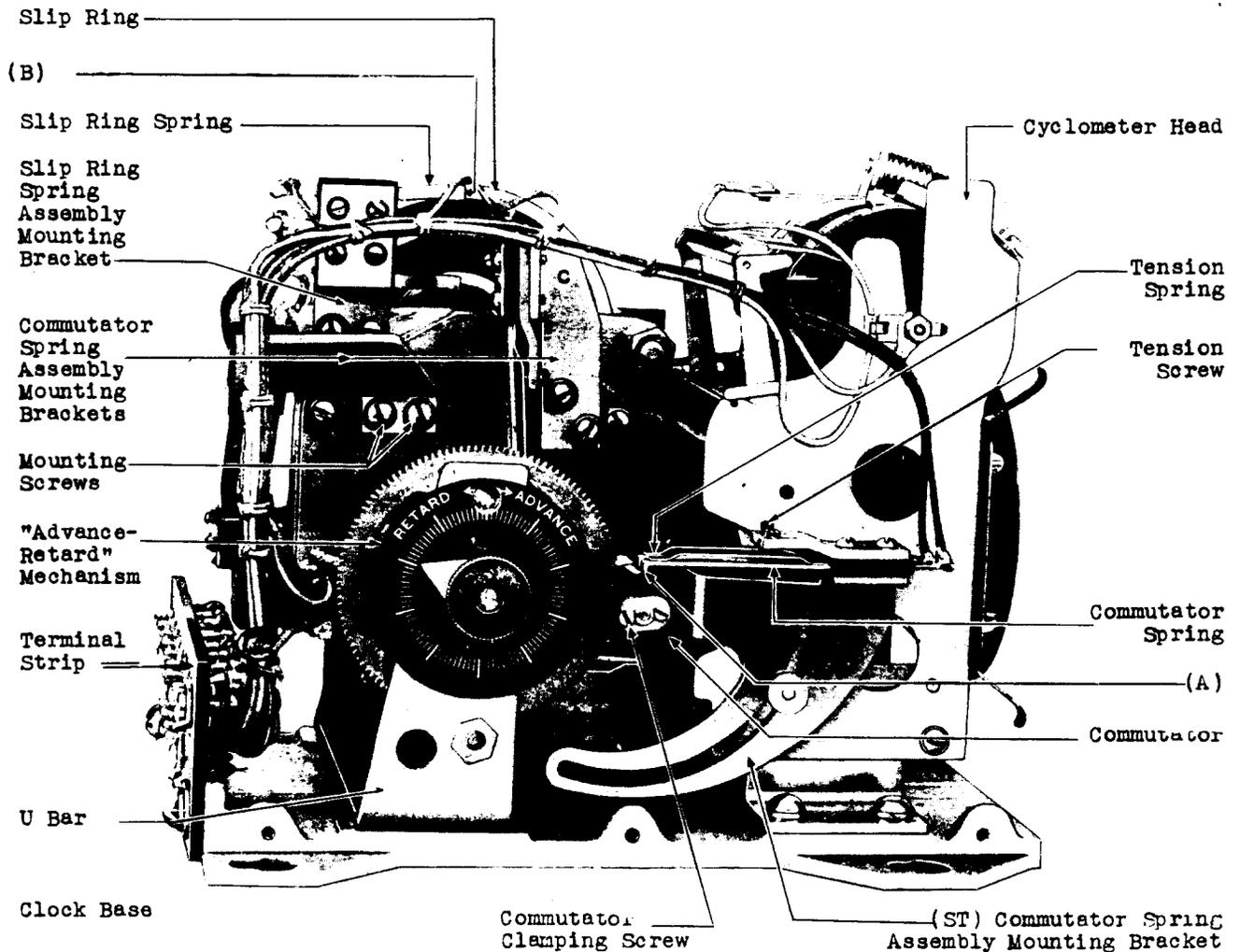


Fig. 4 - Illustrating Mounting Bracket Arrangements For Commutator Spring Assemblies

2.10 Commutator Spring Pressure - Fig. 4 (A):

The combined tension of the commutator spring and its associated tension spring against the commutator shall be

Test - Min. 120 grams
Max. 200 grams

Readjust - Min. 130 grams
Max. 180 grams

This tension shall be measured at a point approximately 1/4" back of the bend near the free end of the commutator spring. Use the No. 79C gauge.

2.11 Slip Ring Spring Pressure - Fig. 4 (B):

The pressure of the slip ring spring against its associated slip ring shall be:
Min. 200 grams

This tension shall be measured as close as practical to the bend near the free end of the slip ring spring. Use the No. 79C gauge.

2.12 Alignment of (ST) and (XT) Commutator Segments - Fig. 1 (E):

The centerline of the (ST) commutator segment shall be in alignment (within the thickness of the tension spring) with the centerline of the (XT) commutator segment. Gauge by eye.

2.13 Relation Between (C) and (T) Commutator Springs and Their Associated Commutators:

The commutator springs shall close a circuit through their associated commutator segments 7.5 seconds (within approximately $\pm .10$ second) after the minute drum has completed its advance to the next minute.

2.14 Position of (ST) Commutator Springs:

Unless otherwise specified the (ST) commutator springs shall close a circuit through the commutator segment 7.5 seconds (within approximately $\pm .10$ second) after the (T) commutator springs have closed a circuit through the same segment. Gauge by "Advance-Retard" mechanism.

2.15 Closed Period of (C), (T) and (ST) Commutator Springs and Their Associated Commutators:

The circuits through the (C), (T) and (ST) commutator springs shall be closed .50 second (within approximately $\pm .10$ second). Gauge by "Advance-Retard" mechanism.

2.16 Synchronization of (XT) and (X) Commutator Springs and Time of Day:

The (XT) and (X) commutator springs shall close a circuit through their associated commutators once during every quarter hour period and this closure shall occur 1 second (within approximately $\pm .10$ second) before each specified period. Gauge by time of day and "Advance-Retard" mechanism.

2.17 Closed Period of (XT) and (X) Commutator Springs and Their Associated Commutators:

The circuit through the (XT) and (X) commutator springs shall be closed 1.0 second (within approximately $\pm .10$ second). Gauge by "Advance-Retard" mechanism.

3. ADJUSTING PROCEDURES**3.001 List of Tools, Gauges and Materials**

<u>Code No.</u>	<u>Description</u>
<u>Tools</u>	
206	30° Offset Screw-driver
207	90° Offset Screw-driver
417A	1/4" and 3/8" Hex. Open Double End Flat Wrench
485A	Long Nose Pliers
-	Medicine Dropper
-	KS-6320 Orange Stick
-	KS-6854 3-1/2" Screw-driver
-	3-1/2" Cabinet Screw-driver
-	4" Regular Screw-driver
<u>Gauges</u>	
79C	0-200 Gram Push-Pull Tension Gauge
<u>Materials</u>	
-	KS-2423 Cloth
-	KS-6232 Oil
W.E.Co. 57997	Petrolatum (Unmedicated White Vaseline may be used)

3.002 Removal of Clock from Service and Preparation for Adjustment:

Before making any adjustments on the clock, disconnect all leads from the terminal strip, remove the clock from the turret and remove the clock case mounting screws with the 3-1/2" cabinet screw-driver and remove the clock case. Whenever any adjustments are to be made on the clock that require the "Advance-Retard" mechanism to be operated when the source of power is disconnected, insert the motor key in the keyway in the motor. This locks the stator and rotor together and prevents slippage of the rotor. Whenever it is necessary to remount the clock case to check a requirement, remove the motor key as the clock case cannot be mounted in place with the key inserted in the motor.

3.003 Restoring Clock to Service:

To restore a clock to service, proceed as follows: With the source of power disconnected, check the time from some standard source. Advance the hour drum to the correct hour or if the time is near the end of an hour advance the drum to the next hour. Advance the minute drums in steps of 15 minutes until the time indicated by the drums is in advance of the correct time by approximately 15 minutes. This is done in order to main-

3.003 (Continued)

tain the proper relationship between the correct time and the circuit through the (XT) and (X) contacts.

For example: The time indicated by the clock is 10:35 and 0 on the fractional minute disc is at the left hand spacing line, the correct time is 3:08 and the clock is ready to be restored to service. First make sure that the 15 minute commutator is in synchronism with the time as covered in requirement 2.16. Then rotate the hour drum to 3, rotate the minute drums to 20. After setting the drums, mount the clock case on the base and insert and securely tighten the mounting screws. Mount the clock in the turret. Connect all leads except the power leads to their proper terminals on the strip. When the actual time is approximately 3:20 $1/4$ connect the power leads. Then by advancing the "Advance-Retard" mechanism, correct for the differences in time that exists between the time shown on the clock when the 0 on the fractional minute disc is at the left hand spacing line and the correct time. Be sure to remount the same clock case that was removed.

3.01 Cleaning (Rq.2.01)

- (1) Clock Case, Clock Base, Gear Case, Motor, Cyclometer Head and "Advance-Retard" Mechanism: Remove dust from these parts with a clean dry KS-2423 cloth.

Caution: When cleaning the parts of the cyclometer head, hold the hour and minute drums lightly against their respective back stops so as to prevent changing the settings of the drums.

- (2) Commutators, Commutator Segments, Slip Rings and Slip Ring Springs: Clean these parts as follows: Connect the source of power. Wrap a clean dry KS-2423 cloth tightly around a KS-6320 orange stick and apply the cloth across the width of the commutator. On the high speed commutators the entire commutator may be cleaned by holding the cloth firmly in one position against the commutator while the commutator revolves but on the slow speed commutators it will be necessary to clean the commutators by working the covered orange stick back and forth around the entire surface of the commutator. After the commutators and commutator segments are cleaned lubricate them as outlined in 3.02.

- (3) Commutator Springs: To clean commutator springs, proceed as follows: Wrap a clean KS-2423 cloth around a KS-6320 orange stick, raise the spring to be cleaned from its associated cam and clean the contacting surfaces with the cloth by inserting the covered orange stick between the cam and the spring. Work the orange stick back and forth several times. Check the spring pressure.

3.02 Lubrication (Rq.2.02)

- (1) Commutator and Commutator Segments: Before lubricating these parts, clean them as outlined in 3.01 and then apply a very light film of petrolatum to the commutators with a finger. Take care not to get an excessive amount of petrolatum on the commutator. Remove any excess that may collect on the commutator spring with a clean dry KS-2423 cloth.

- (2) Slip Rings: Before lubricating the slip rings, clean them as outlined in 3.01 and then apply a very light film of petrolatum on the rings with a finger. Take care not to get an excessive amount of petrolatum on the rings. Remove any excess that may collect on the slip ring springs with a clean dry KS-2423 cloth.

- (3) Gear Case: If upon inspection through the oil sight glass it is found necessary to replenish the oil in the gear case, raise the oil cup cover and fill the gear case to the specified level with KS-6232 oil applied with a medicine dropper. Exercise care when replenishing the oil to prevent the oil level being above the specified level when it has had time to reach its true level as an excessive amount of oil may result in creepage along the commutator shafts.

- 3.03 Record of Lubrication (Rq.2.03)
(No procedure.)

3.04 Accuracy of Clock Movement (Rq.2.04)

- (1) If the clock fails to keep satisfactory time, refer the matter to the supervisor.

3.05 Alignment of Commutator Springs and Tension Springs (Rq.2.05)

- (1) To reposition the commutator springs or tension springs, loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and shift the position of the springs as required. Take care in doing this not to change the relationship between the commutator springs and the commutator segments. Securely tighten the spring assembly screws.

3.06 Tightness of Screws (Rq.2.06)

- (1) Tighten all loose screws making sure that the requirements covering the relationship and alignments of the commutator springs to their associated commutator are satisfactory.

3.07 Freedom of Movement of "Advance-Retard" Mechanism (Rq.2.07)

- (1) If the "Advance-Retard" mechanism does not move freely, hold all three

3.07 (Continued)

slip ring springs at one time away from the slip rings with a KS-6320 orange stick and rotate the "Advance-Retard" mechanism. If this believes the condition, it is an indication that the tension of the springs is too great. Reduce this tension as outlined in 3.11. If the mechanism binds with the tension of the springs removed, refer the matter to the supervisor.

3.08 Alignment of Figures on Minute and Hour Drums and Fractional Minute Disc (Rq.2.08)

(1) If the position of the figures on the minute and hour drums or fractional minute disc is not satisfactory, the trouble may be due to defective or deformed parts or to an unsatisfactory adjustment of the pawl. If the retaining latch spring or retaining latch pawl is broken or deformed, replace the cyclometer head. Before making any adjustment note whether the retaining pawls rest in the notches of their associated ratchets when the clock is electrically operated. If the retaining pawls do not rest in their notches, refer the matter to the supervisor before attempting any adjustment. With the supervisor's approval proceed as follows.

(2) Compare the included angle between the pawl tip and pawl arm at fault with the angles of similar pawls. Examine the pawl at the extreme right as viewed from the front. The position of this pawl controls the advance of the drum at the extreme right and also the center and left drums. Too small an angle will prevent the drum at the right from advancing far enough. If the angle is too great, it may result in the right hand drum advancing too far. It may also cause the center pawl to advance its associated drum at periods other than when the right hand drum is advancing from 9 to 0. Likewise if the center or left pawl forms too small an angle it may prevent their respective drums from being advanced far enough. If the angle formed at the center pawl is too great, it may result in the center drum being advanced too far and may also cause the left hand pawl to advance its associated drum at periods other than on the hours. Improper angles of the pawl at the left will result in conditions similar to those already explained for the drum at the left. To correct, grasp the pawl above the bend with a pair of No. 485A pliers and grasp the free end of the pawl near the bend with another pair of No. 485A pliers. Adjust the pawl very slightly and carefully as required to increase or decrease the

angle. If the figures on the fractional minute disc are not satisfactory, replace the disc.

3.09 Alignment of Fractional Minute Disc and Minute Drum (Rq.2.09)

(1) Turn the "Advance-Retard" mechanism in the advance direction until the minute drum just advances to the next minute. Remove the motor key and mount the clock case in position. If the position of the indicator at 0 is not satisfactory, note the direction and amount of misalignment. Remove the clock case. Loosen the fractional minute disc mounting screw with the KS-6854 screw-driver and draw the disc away from the cyclometer head far enough to permit unmeshing of the gears on the disc and head. Shift the disc in a clockwise or counter-clockwise direction enough to compensate for the misalignment between the disc and drum. Mesh the gears and securely tighten the mounting screw in place. Recheck the alignment of parts.

3.10 Commutator Spring Pressure (Rq.2.10)

(1) To increase or decrease the tension of any commutator spring against its associated commutator, adjust the tension screw as required with the KS-6854 screw-driver or the Nos. 206 and 207 offset screw-drivers. Turning the screw in a clockwise direction increases the tension and in a counter-clockwise direction decreases the tension. Holes have been drilled in the clock base to facilitate the adjusting of the screws associated with the (T) and (XT) commutators. In the case of the screws associated with these commutators, the KS-6854 screw-driver is inserted through the holes bored in the clock base. Also in the case of the (XT) commutator, it will be necessary to remove the pinion bearing located beneath the "Advance-Retard" dial with the No. 417A wrench and remove the pinion. After making the necessary adjustments, remount the pinion and pinion bearing.

3.11 Slip Ring Spring Pressure (Rq.2.11)

(1) Place the No. 485A pliers on the spring just below the bend near the insulators and adjust the spring toward or away from the slip ring as required.

3.12 Alignment of (ST) and (XT) Commutator Segments (Rq.2.12)

(1) To realign the (ST) and (XT) commutator segments, it will be necessary to shift the position of the U bar that supports the "Advance-Retard" mechanism. To do this, remove the mounting screws located on the under surface

3.12 (Continued)

of the clock base with the 4" regular screw-driver, and shift the position of the U bar. Loosen the commutator clamping screw with the KS-6854 screw-driver. Remove the commutators turning them in a clockwise direction as the commutator clamp has a left hand thread. Loosen the clamping nut with the No. 417A wrench and locate the commutator segments as required. Then while holding the segments in their adjusted positions, tighten the clamping nut securely. Remount the commutators in place on the shaft turning them in a counter-clockwise direction. Locate the position of the commutator segments with relation to the commutator springs as outlined in 3.15. Tighten the commutator clamping screw securely and remount the U bar securely in place.

that makes with the commutator segment first is meant and the leading edge of this spring has a bevelled edge; when a reference is made to the trailing spring of a commutator spring assembly, the spring that makes with the commutator segment last is meant and the trailing edge of this spring has a bevelled edge. In making any of the following adjustments, take care when changing the position of any commutator spring that a corresponding change is made in the position of the associated tension spring. After making these adjustments, recheck the commutator spring pressure as outlined in 3.10. The chart shown in Fig. 5 may be used as a guide in positioning the commutator and commutator springs with respect to the minute drum. When using the "Advance-Retard" mechanism to check the adjustments one revolution of the pointer is equal to advancing the clock one second. Do not turn the "Advance-Retard" mechanism in the retard direction.

- 3.13 Relation Between (C) and (T) Commutator Springs and Their Associated Commutators (Rq.2.13)
- 3.14 Position of (ST) Commutator Springs (Rq.2.14)
- 3.15 Closed Period of (C), (T) and (ST) Commutator Springs and Their Associated Commutators (Rq.2.15)
- 3.16 Synchronization of (XT) and (X) Commutator Springs and Time of Day (Rq.2.16)
- 3.17 Closed Period of (XT) and (X) Commutator Springs and Their Associated Commutators (Rq.2.17)

(2) (C) Commutator Springs and Associated Commutator: Turn the "Advance-Retard" mechanism until the minute drum just completes its advance to the next minute. Then turn the "Advance-Retard" mechanism 7-1/2 turns in the advance direction. Loosen the commutator clamping screw with the KS-6854 screw-driver. Rotate the commutator until the leading edge of the segment is approximately on the horizontal centerline through the commutator. Remove the backlash in the commutator by turning the commutator in a counter-clockwise direction a slight amount and then tighten the clamping screw securely. Loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and slide the trailing commutator spring up or down until the con-

(1) General: To check or adjust for these requirements, use a test set consisting either of a lamp and battery or a buzzer and battery and connect these parts in a circuit across the terminals of the commutator springs. When a reference is made to the leading spring of a commutator spring assembly, the spring

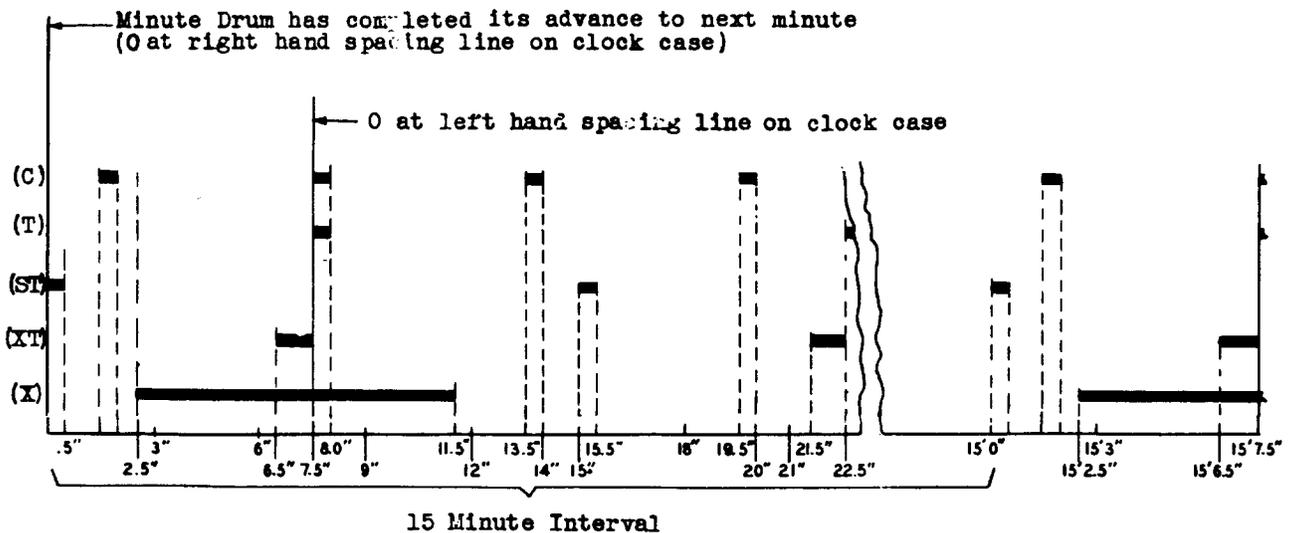


Fig. 5 - Illustrating Relation of Circuit Operation to Time Indicated by Minute Drum

3.13-3.17 (Continued)

tacting edge is approximately in the center of the segment. Adjust the leading commutator spring in the same manner until it just makes with the leading edge of the segment. Turn the "Advance-Retard" mechanism in the advance direction 1/2 turn and adjust the trailing commutator spring until the circuit is just made on the trailing edge of the segment. Tighten the screws securely.

(3) (T) Commutator Springs and Associated Commutators: Turn the "Advance-Retard" mechanism until the minute drum just completes its advance to the next minute. Then turn the "Advance-Retard" mechanism 7-1/2 turns in the advance direction. Loosen the commutator clamping screw with the KS-6854 screw-driver. Rotate the commutator until the leading edge of the segment is approximately on the vertical centerline of the commutator shaft. Tighten the screw securely. Loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and slide the trailing commutator spring back and forth until the contacting edge is approximately in the center of the segment. Adjust the leading commutator spring in the same manner until it just makes with the leading edge of the segment. Turn the "Advance-Retard" mechanism 1/2 turn in the advance direction and adjust the trailing commutator spring until the circuit is just made on the trailing edge. Tighten the screws securely.

(4) Position and Closure of (ST) Commutator Springs: After adjusting the (T) commutator springs as outlined above check the position of the (ST) commutator springs. Normally these springs should be parallel to the clock base. However, if a period longer or shorter than 7-1/2 seconds is required between the time the operator starts the time announcement and the time the tone is transmitted to the subscriber, the position of the (ST) commutator springs may be changed by loosening the bracket lock nut and shifting the position of the springs as required to compensate for the difference in time. To change the period of closure of the commutator springs, loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and shift the position of the springs as outlined in (3). Do not reposition the commutator.

(5) (X) Commutator and Associated Commutator Springs: Turn the "Advance-Retard" mechanism until the minute drum just completes its advance to the next minute. Then turn the "Advance-Retard" mechanism in the advance direction 2-1/2

turns. Loosen the commutator clamping screw with the KS-6854 screw-driver. Rotate the commutator until the leading edge of the segment is approximately 45° to the left of a vertical line through the center of the commutator shaft. Tighten the clamping screw securely. Apply a light pressure on the commutator in a counter-clockwise direction to take up any backlash in the gears before adjusting the springs. Loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and slide the trailing commutator spring back and forth until the contacting edge is approximately in the center of the segment. Adjust the leading commutator spring in the same manner until it just makes with the leading edge of the segment. Turn the "Advance-Retard" mechanism in the advance direction 9 turns and adjust the trailing commutator spring until the circuit is just closed on the trailing edge of the commutator. Tighten the screws securely. Then rotate the hour and minute drums until an hour and no minutes or an hour and any quarter hour period is indicated.

(6) (XT) Commutator and Associated Commutator Springs: Turn the "Advance-Retard" mechanism until the minute drum just completes its advance to the next minute. Then turn the "Advance-Retard" mechanism in the advance direction 6-1/2 turns. With the commutator in this position the commutator spring should be made or about to make. Do not relocate the commutator since it should have been located at the same time the (T) commutator was located. Loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and slide the trailing commutator spring back and forth until the contacting edge is approximately in the center of the segment. Adjust the leading commutator spring in the same manner until it just makes with the leading edge of the segment. Turn the "Advance-Retard" mechanism in the advance direction one turn and adjust the trailing commutator spring until the circuit is just made on the trailing edge of the commutator segment. Tighten the screws securely.

(7) After locating the (XT) and (X) commutators and commutator springs and before returning the clock to service, connect the test set across the proper terminals on the terminal strip and with the motor running, check that the requirement for synchronization of the (XT) and (X) commutator and commutator springs is being met. If it is not being met, recheck the closures of the individual commutator and commutator springs and make the necessary adjustment.