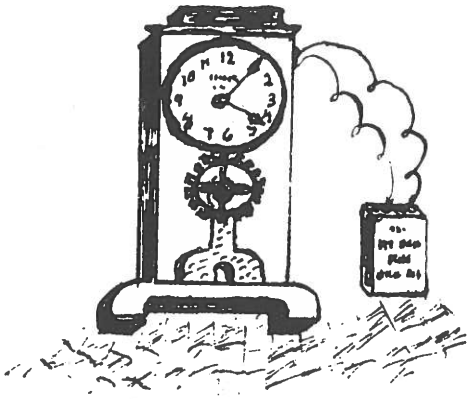
The
# JOURNAL
OF THE
# ELECTRICAL HOROLOGY SOCIETY
## Chapter No 78

February 1985
VOLUME XI--ISSUE #1
Martin C. Feldman, Editor



Hello fellow enthusiasts:

We have completed the administrative change-over for our Secretary/Treasurer. Marty Swetsky is also now able to have the Journal printed as well as mailing them out to you. We expect that our bi-monthly printing schedule will resume and the Journal of the EHS will come to you every even month--six times per year.

We are entering our 13th year of continuous publication with the February Journal which begins Volume XI. This issue contains the reprinting of the Sangamo Clock Co. Catalog and Manual. A few pages remain to be printed and they will appear in the April issue. To continue with our schedule we shall be sending you the April issue very shortly and then the June issue will be mailed on time.

We do have one major problem and that is membership. Marty Swetsky is doing a super job in writing to old members whose membership has lapsed in hopes of having them rejoin us. We must have at least 100 members to pay the expenses of printing six journals per year and regrettably we are short of this number. If you know of collectors who are interested in electrical horology the Society would welcome their support. I wish to personally thank you for your patience and support over the years and hope that we shall all be together for many more.

Enjoy this issue.

Electromagnetically yours,

Martin C. Feldman,FNAWCC

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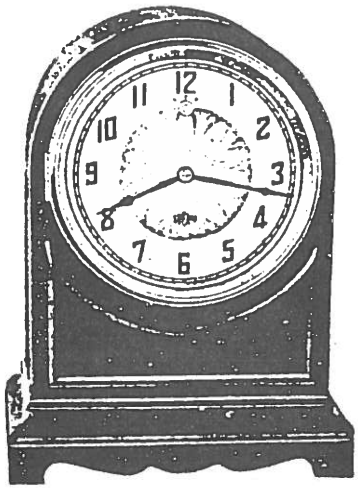
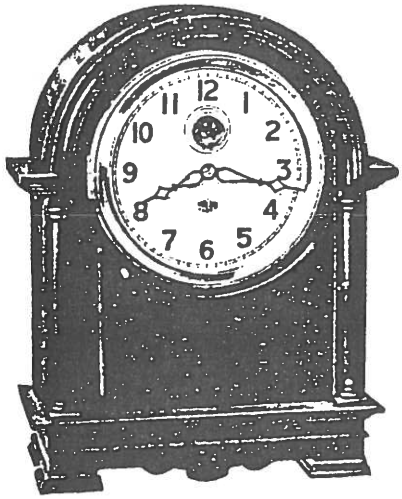


Style No. 5004

MANTEL CLOCK, MAHOGANY OR WALNUT CASE

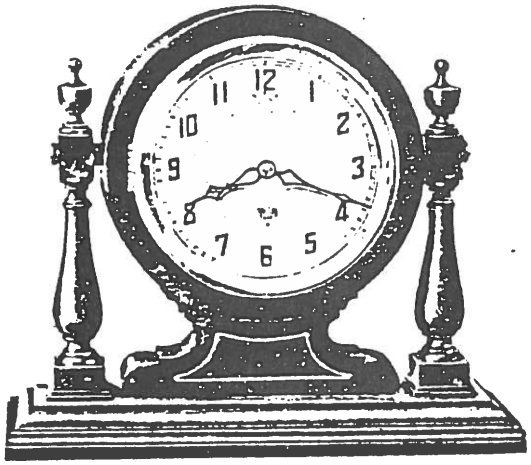
Illustrated with Dial No. 10—5¼-inch. Etched center, rich low brass on silver. Height, 10⅜ inches; width, 8⅜ inches; depth, 4¾ inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 5002

MANTEL CLOCK, MAHOGANY OR WALNUT CASE

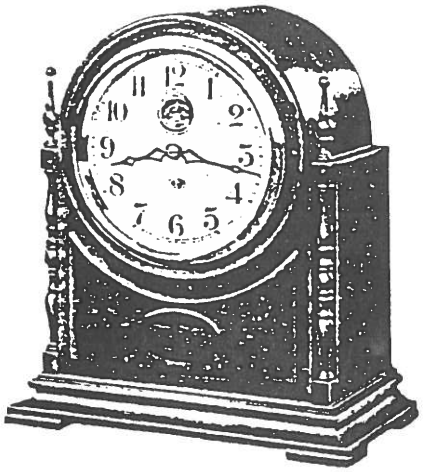
Illustrated with Dial No. 16—5¼-inch. Height, 12¾ inches; width, 9⅜ inches; depth, 5⅝ inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 5005

MANTEL CLOCK, MAHOGANY CASE

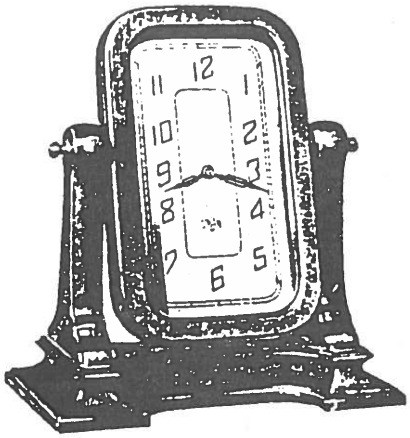
Illustrated with Dial No. 10—5¼-inch. Etched center, rich low brass on silver. Height, 10⅞ inches; width, 12⅛ inches; depth, 3¾ inches. Cannot be furnished with strike.



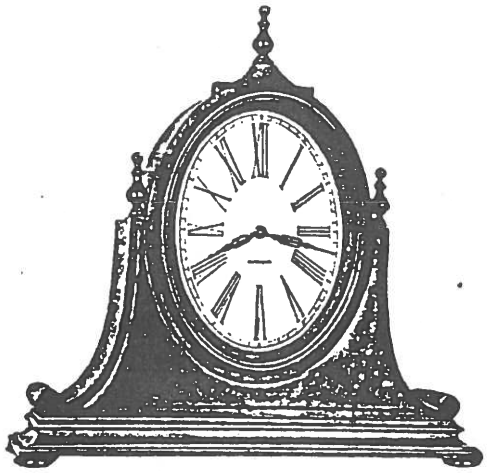
Style No. 5003

MANTEL CLOCK, MAHOGANY RAISED PANEL

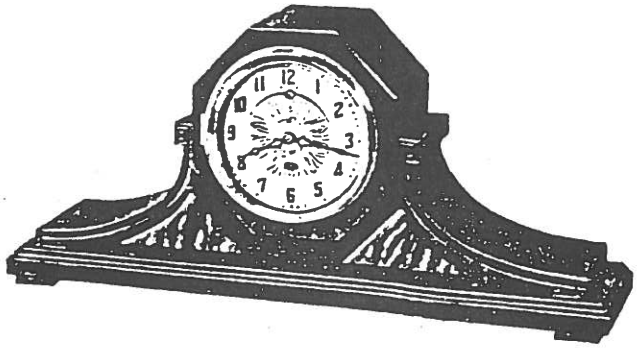
Illustrated with Dial No. 13—5¼-inch. Height, 10¾ inches; width, 10¼ inches; depth, 5¾ inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 4002
BOUDOIR CLOCK, MAHOGANY CASE
Dial No. 25—Rectangular, 4-inch. Height, 8½ inches; width, 8 inches; depth, 5½ inches.



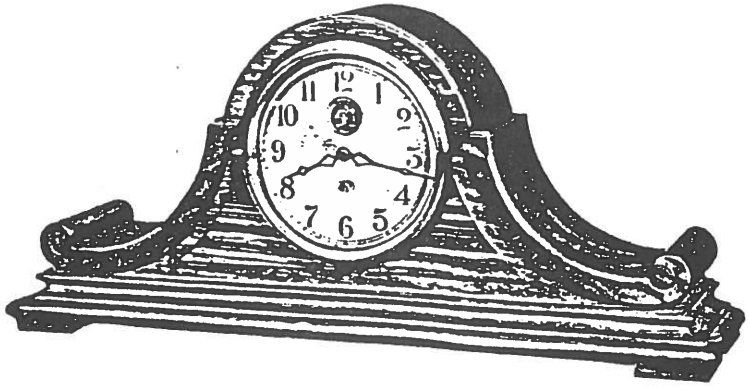
Style No. 4001
BOUDOIR CLOCK, MAHOGANY CASE
Dial No. 24—4-inch. Height, 10 inches; width, 10¼ inches; depth, 3¾ inches.



Style No. 5006

MANTEL CLOCK, MAHOGANY OR WALNUT CASE

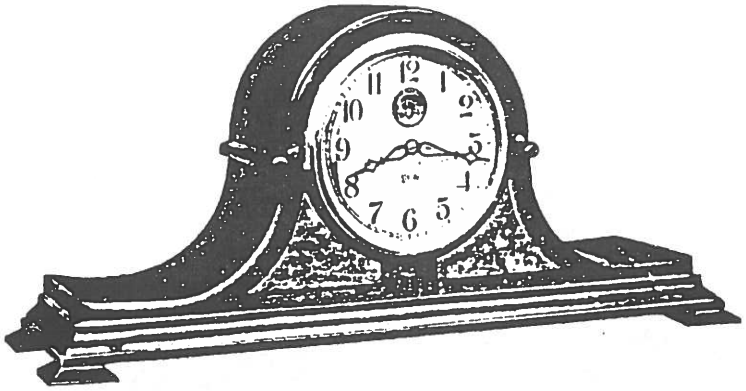
Illustrated with Dial No. 10—5¼-inch. Etched center, rich low brass on silver. Height, 8½ inches; width, 18½ inches; depth, 4⅞ inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 5008

MANTEL CLOCK, MAHOGANY OR WALNUT CASE

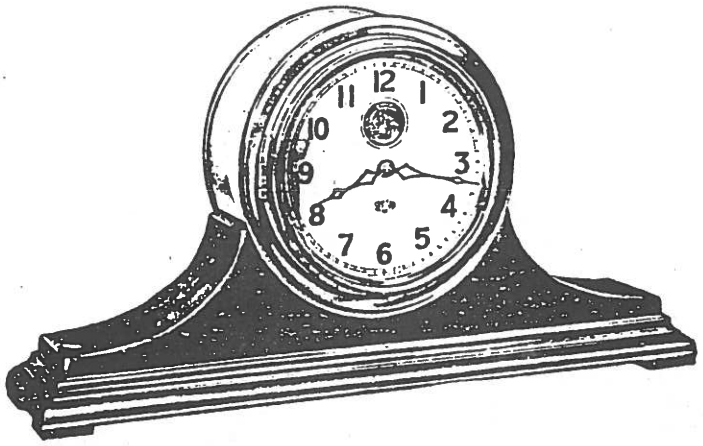
Illustrated with Dial No. 16—5¼-inch. Height, 9¼ inches; width, 21 inches; depth, 5¼ inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 5110

MANTEL CLOCK, MAHOGANY CASE

Illustrated with Dial No. 13—5¼-inch. Height, 9½ inches; width, 21 inches; depth, 6½ inches. Can be furnished with a two-tone hour and half hour strike if desired.

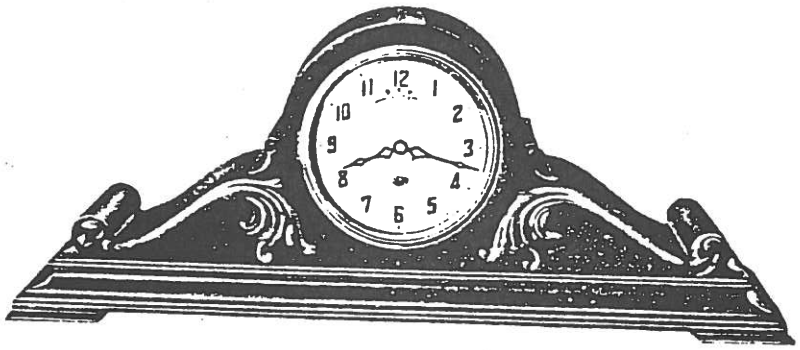


Style No. 5101

CRYSTAL CYLINDER CLOCK, MAHOGANY BASE

Illustrated with Dial No. 16—5¼-inch. Height, 9¼ inches; width, 17½ inches; depth, 5 inches.

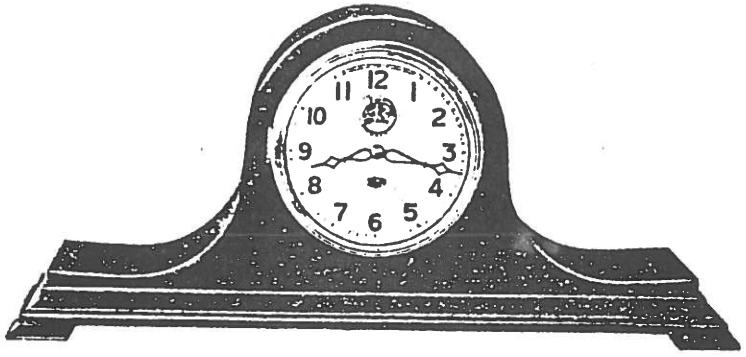
*Complete movement fully visible.*



Style No. 5014

MANTEL CLOCK, MAHOGANY OR WALNUT CASE

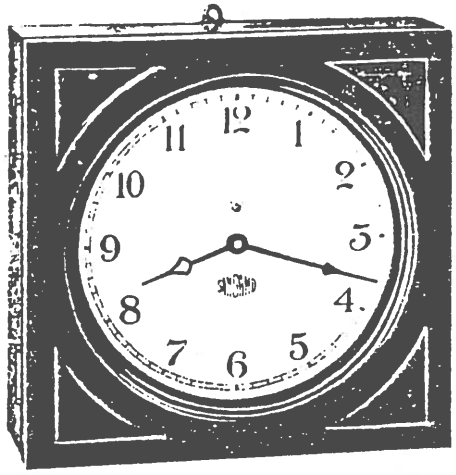
Illustrated with Dial No. 10—5¼-inch. Etched center, rich low brass on silver. Height, 9¼ inches; width, 24¼ inches; depth, 7 inches. Can be furnished with a two-tone hour and half hour strike if desired.



Style No. 5106

MANTEL CLOCK, MAHOGANY CASE

Illustrated with Dial No. 16—5¼-inch. Height, 9½ inches; width, 21 inches; depth, 5½ inches. Can be furnished with a two-tone hour and half hour strike if desired.



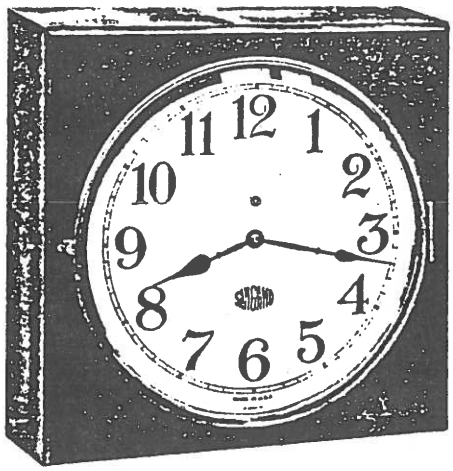
WALL CLOCK—SQUARE WOOD CASE *(Wood Door)*

Style No. 12003

Dial No. 37—12-inch, without second hand.
Dial No. 29—12-inch, with second hand.
Height, 16 inches; width, 16 inches; depth, 4½ inches.

Style No. 14003

Dial No. 30—14-inch, without second hand.
Dial No. 31—14-inch, with second hand.
Height, 19 inches; width, 19 inches; depth, 4½ inches.



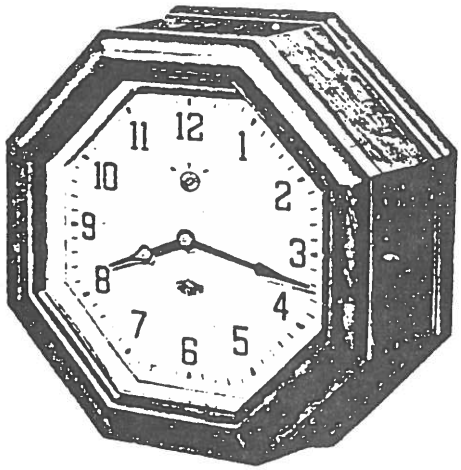
WALL CLOCK—SQUARE WOOD CASE *(Metal Bezel)*

Style No. 12002

Dial No. 37—12-inch, without second hand.
Dial No. 29—12-inch, with second hand.
Height, 16 inches; width, 16 inches; depth, 4½ inches.

Style No. 14002

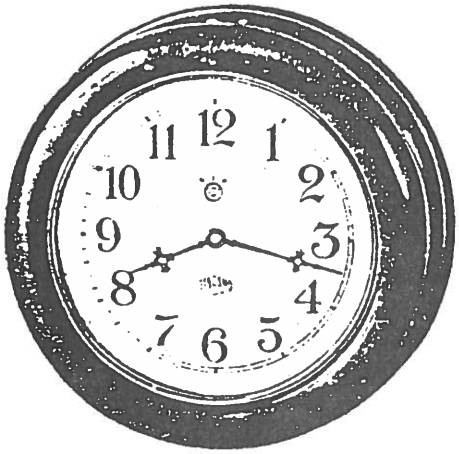
Dial No. 30—14-inch, without second hand.
Dial No. 31—14-inch, with second hand.
Height, 19 inches; width, 19 inches; depth, 4½ inches.



WALL CLOCK, CAST ALUMINUM CASE

Style No. 8100

Standard finishes—White, Black (plain or flock), Olive Green, Mahogany or Walnut. Diameter, 11½ inches; depth, 4 inches. Dial No. 22—7⅝-inch.



WALL CLOCK, CAST ALUMINUM CASE

Finishes—Same as 8100

Style No. 5001

Diameter, 8½ inches; depth, 3¼ inches. Dial No. 12—5 inches.

Style No. 10001

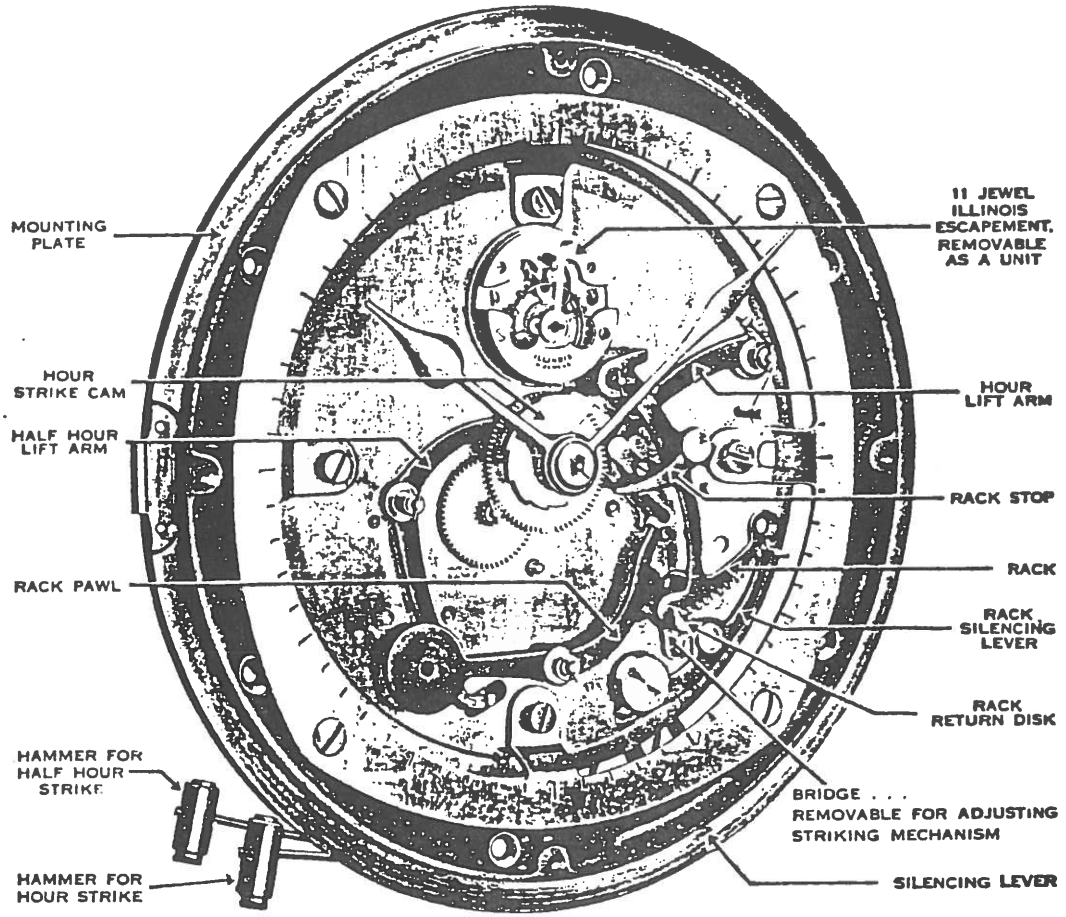
Diameter, 13½ inches; depth, 4¼ inches. Dial No. 19—9⅜ inches.

Style No. 8001

Diameter, 11½ inches; depth, 4 inches. Dial No. 18—7⅝ inches.

Style No. 12001

Diameter, 15½ inches; depth, 4½ inches. Dial No. 20—11½ inches.




FRONT VIEW OF SANGAMO STRIKING CLOCK MOVEMENT

The Sangamo Striking Clock combines the standard timepiece with a striking element. A second and separate motor is geared directly to the striking element, thus completely eliminating the striking spring and intermediate gearing. The motor, therefore, performs directly the operation of striking, with the result that the mechanism is greatly simplified and the reliability is increased.

The mounting of the motors is shown on page 9.

The front view of the striking movement (above) shows how the mechanism operates.

The mechanism is the standard rack and cam.

The Sangamo Striking Clock has these decided advantages:

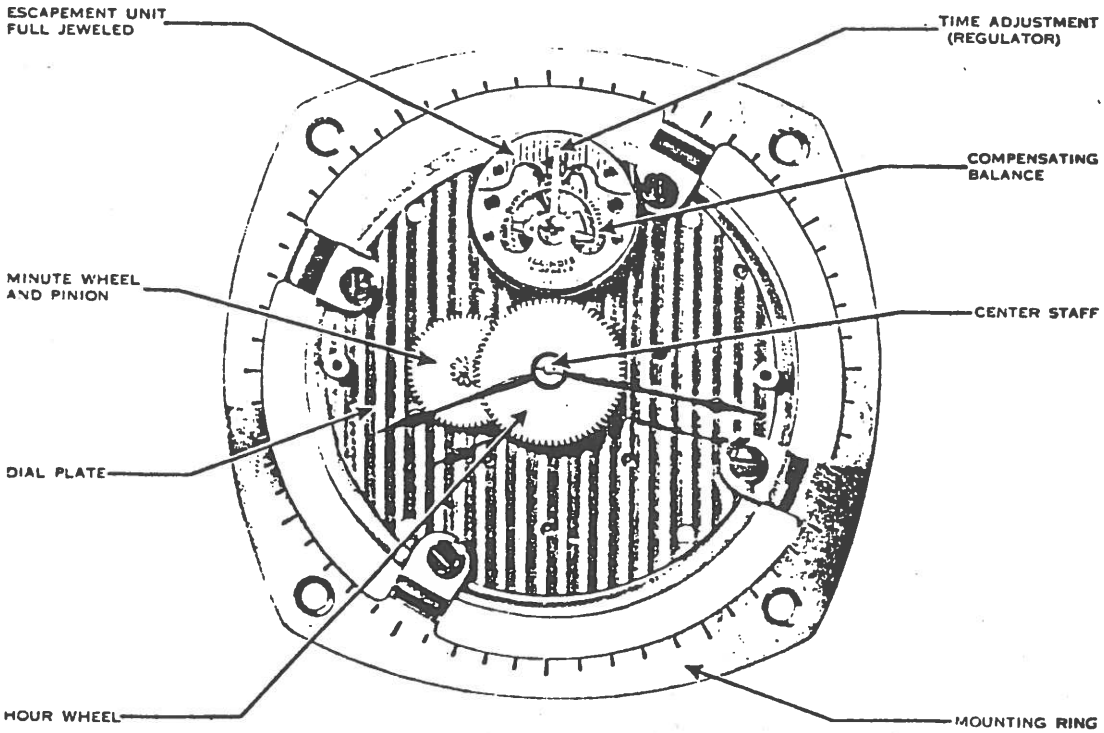
1 . . . The strike is absolutely even. No tendency to race.

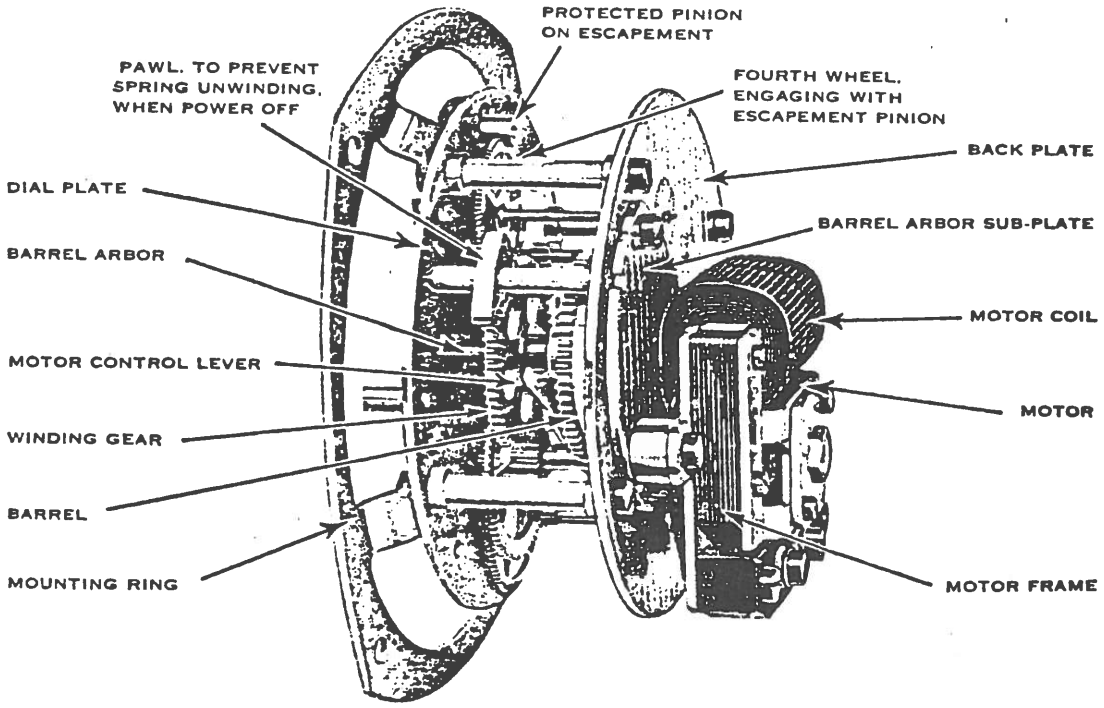
2 . . . It is impossible for the strike to get out of step, even should the electric current be cut off for hours.

3 . . . The construction makes it easy to see and adjust position of cams and striking levers.

4 . . . Simplicity plus highest precision in workmanship.

*On opposite page are front and back views of non-striking movement.*


ESCAPEMENT UNIT
FULL JEWELED
TIME ADJUSTMENT
(REGULATOR)
COMPENSATING
BALANCE
MINUTE WHEEL
AND PINION
CENTER STAFF
DIAL PLATE
HOUR WHEEL
MOUNTING RING


PROTECTED PINION
ON ESCAPEMENT
PAWL. TO PREVENT
SPRING UNWINDING,
WHEN POWER OFF
FOURTH WHEEL,
ENGAGING WITH
ESCAPEMENT PINION
BACK PLATE
DIAL PLATE
BARREL ARBOR SUB-PLATE
BARREL ARBOR
MOTOR COIL
MOTOR CONTROL LEVER
MOTOR
WINDING GEAR
BARREL
MOUNTING RING
MOTOR FRAME

# MART

NOTICE: ALL MART ANNOUNCEMENTS ARE PRINTED FREE! Send material to, M.Feldman, 620 Reiss Place-7e. Bronx, N.Y. 10467

FOR SALE: 30 to 40 electromechanical clocks, commercial electrical clocks and others. Call after 12 noon--George Zlobin,(212) 763-6124

FOR SALE: JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY-1975-1980 ORIGINAL COPIES 50¢ a copy--$4 minimum!--inquiries, SASE or send money payable to, EHS, % M. Swetsky,EWC,1910 Coney Island Ave.Bklyn,NY 11230

FOR SALE: VERY HIGH QUALITY EARLY BATTERY CLOCKS for the serious collector by Synchronome, Gents, Vaucanson, Leroy, Fully restored. C.Roth, 2 Circle Lane, Roslyn Heights, NY 11577

WANTED: "Junker" early battery clocks, movements, parts, etc. Send details & $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. M. Feldman, 620 Reiss Place-7e, Bronx, NY10467

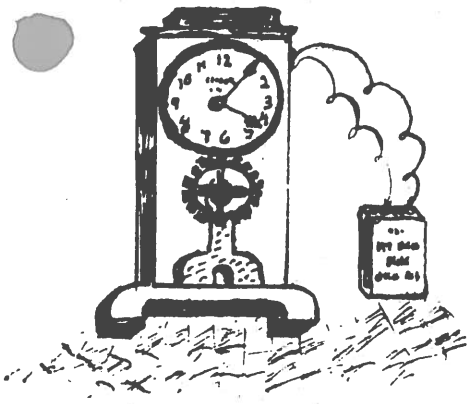
REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK USING ORIGINAL PARTS. One month maximum time for all repairs. M. Feldman, 620 Reiss Place-7e, Bronx, NY 10467

WANTED: Unusual Electrical Clocks, A. Marx, 105 Bayeau Rd. New Rochelle,NY10804

WANTED: Printed information concerning International Time Recording Co. of NY, Master Clock, Model 263, or similar regulator timepiece. Irvin A. Pogue,212 N.Wm.Dr., Chillicothe, IL 61523

WANTED: A Riefler Clock, E.C. Martt, 278 Bentleyville Rd. Chagrin Falls, Ohio 44022, (216) 247-6712

# ELECTRICAL HOROLOGY SOCIETY
# Chapter №78



April 1985
VOLUME XI--ISSUE #2
Martin C. Feldman, Editor

Hello fellow enthusiasts:

As I indicated in the February issue you are receiving April's Journal close on the heels of the first one in our effort to bring back our bi-monthly printing schedule.

We are completing the Sangamo Catalog and Manual. From Henry B. Fried, our good friend and one of the Society's strongest early supporters, comes the article, "Introducing the Acrotyne" which, although electronic in nature, uses principles developed by various inventors of early battery clocks. As with any invention principles are not terribly important until they are actually put to practical use and we see this quite clearly in the clock mechanism described. Many thanks go to good friend Leon O'Briant for his rather "bored rabbit" cartoon. I am sure we have all felt this way from time to time. Rounding out this issue are the instructions for replacement of the crystal and motor in the "Golden Hour" Jefferson Electric Clock which also is known as a "mystery clock". These are turning up at Marts and many battery clock "purists" are collecting them for their curiosity value--Marty Swetsky sent this in and thought it would be of interest.

Marty was quite successful in arranging for a local meeting of EHS people and non-members at the recent N.Y.Regional. We have some new members as a result and were able to interest people in our special brand of horology. A June meeting in the N.Y. area is planned and perhaps regular meetings will be scheduled as well. We expect to continue these little informal meetings at local as well as at regional clock meets.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman,FNAWCC

MCF:ms

# OUTLINE OF TIMEKEEPING DEVICES AND THEIR DEVELOPMENT

1. Clepsydra or water clock. About 4000 B.C., China, Egypt and Babylon.

2. Sun dial. Mentioned in the 38th Chapter of Isaiah. About 700 B. C., Eastern Countries.

3. Construction of first timepiece with moving hand, using falling weights. This invention claimed by many peoples, from the Chinese, 2000 B. C., to the Germans of the 11th century.

4. Scientific perfection of the sun dial by inclination of the gnomon. This probably took place about the time of the correction of the Babylonian calendar in 747 B. C.

5. Hour glass. Credited by some authorities to Alexandria. In a Greek bas-relief at the Mattei Palace in Rome, Morpheus is shown holding an hour glass. 3rd Century B. C., Greece. Legends also credit Luitprand, a Carthusian monk, with the invention of the hour glass, 8th Century A. D.

6. Candle clock. 12-inch candle marked at inch intervals. The burning of each interval denoted the passing of 20 minutes. Accredited to Alfred the Great. 872 A.D., England.

7. First mechanical clock. Believed to have been invented by Gerbert, the monk, later Pope Sylvester II. 990 or 996 A. D., Italy.

8. Westminster Cathedral Clock. 1288, England.

9. Henry de Vick's clock for King Charles V. 1364, France.

10. Peter Henlein made the first portable clock, called "The Egg of Nuremberg." This was round, was driven by a string and had small wheels of steel. About 1500 A. D., Germany.

11. Fusee. Invented by Jacob Zech of Prague. 1525 to 1540, Austria.

12. First clock applying pendulum principle. Made by Christian Huygens. 1657, Holland.

13. First watch to wind without a key. 1686 or 1688, Geneva.

14. Deadbeat escapement. Invented by Thomas Tompion and perfected by George Graham. About 1690, England.

15. Jewels in timepieces. Introduced by Nicolas Facio. About 1705, Switzerland.

16. Compensation balance. Originated by Pierre le Roy (1717-1785) and later perfected by Thomas Earnshaw. 1749-1829, England.

17. First electrically-driven clock. Constructed by Alexander Bain. 1840-1850, England.

18. Stem-winding watch. Perfected by Adrian Phillips. 1843, Switzerland.

19. Sangamo Clock. 1925, U. S. A.

# SANGAMO, MAKER OF PRECISION ELECTRICAL INSTRUMENTS SINCE 1899

THE foundation of the Sangamo Electric Company was laid in the nineties. Mr. Jacob Bunn, president of the Illinois Watch Company, bought a patent for an electric meter. He bought it at the right time. Electricity was still a very new thing; and the patent grew into the present world-wide business known by the name of Sangamo.

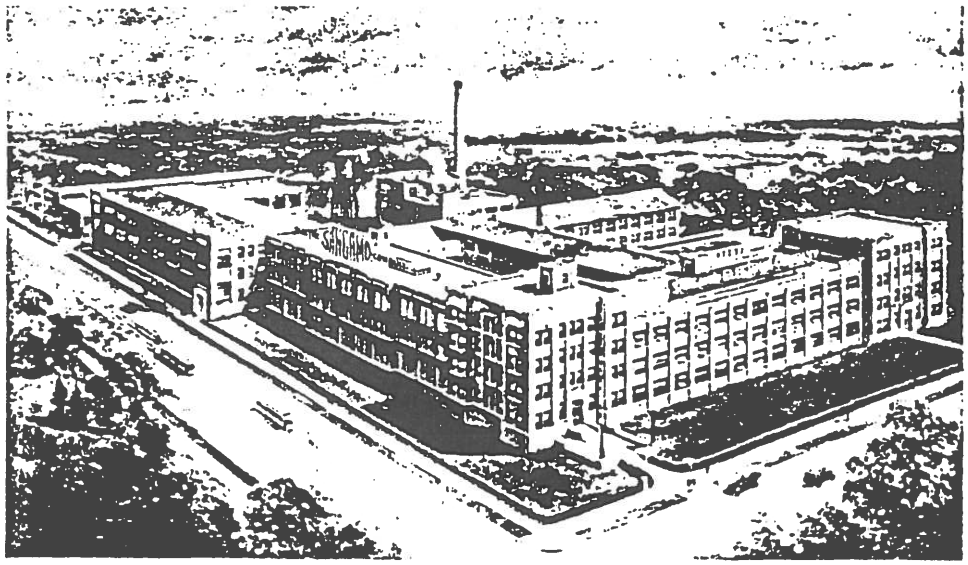
Sangamo's home plant in Springfield, Ill., covers five acres and employs over 1000 workmen. It has branch plants in Toronto, Canada; Ponders End, London, England; Osaka, Japan. Its laboratory is among the best equipped in the country. The requirements of different countries and different industries have been studied; meters have been produced that perform the best service under widely varying conditions.

More than 4,000,000 Sangamo meters are in use today. Battleships, submarines, farm-lighting plants, Pullman cars, street cars, mine locomotives, electric trucks, all are served by Sangamo meters. Millions of users of electric current who have meters in their homes are served by Sangamo. Thousands of switchboards in central stations, public buildings, manufacturing plants, etc., are equipped with Sangamo meters measuring millions of kilowatts. At the present time, a Sangamo meter is being installed somewhere in the world every twelve seconds of every working day.

The radio world connects the name "Sangamo" with "quality" through its familiarity with Sangamo Accurate Radio Parts.

The Sangamo Engineering Research Laboratory, which developed and perfected Sangamo meters, has also evolved the Sangamo Electrically Wound Clock. With every facility for investigating and testing, the Sangamo engineers have worked out with meticulous care the details of this superlatively accurate timepiece, checking and rechecking their work for over two years, before even the first Sangamo Electrically Wound Clock was given public sale.

In short, the history of the company since 1899 has been a history of original thinking, scientific development, and the most painstaking accuracy in every piece of work that bears its name. It seems reasonable to expect that the same policies which make the Sangamo meter a world-wide standard of accuracy in the measurement of electric energy will make the Sangamo Clock a world-wide standard of accuracy in the measurement of time.




THE MAIN OFFICE AND PLANT AT SPRINGFIELD, ILLINOIS

# SANGAMO ELECTRIC COMPANY

## Springfield, Illinois

NEW YORK—50 Church Street
CHICAGO—1590 Old Colony Building
BOSTON—19 Pearl Street
LOS ANGELES—750 Subway Terminal Bldg.
BIRMINGHAM, ALA.—8 South 18th Street
SAN FRANCISCO—1061 Howard Street
JACKSON, MICH.—Consumers Power Bldg.

*For Canada:*
SANGAMO ELECTRIC CO. OF CANADA, LTD.
183 George Street, Toronto, Ontario

*For Japan:*
ASHIDA ENGINEERING COMPANY
Osaka, Japan

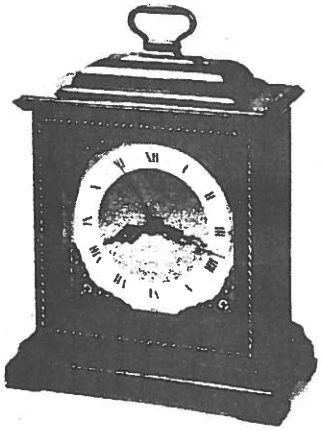
*For Great Britain:*
BRITISH SANGAMO CO., LTD.
Ponders End, Middlesex, England

Lillibridge 86-7819-1



Printed in U.S.A.

# INTRODUCING THE ACROTYNE



**Seth Thomas introduces a tuning fork clock and advances the art of electronic timekeeping. The Acrotyne improves upon the basic principle of the magnetic sine wave**

*BY HENRY B. FRIED*
*JC-K HOROLOGICAL EDITOR*

• "ACROTYNE," A NEW product from the Seth Thomas and Jeco (Japanese) factories, marks an advance in electronic timekeeping. The clock uses an electronically controlled tuning fork to turn a rotor-like device. Unlike the "Accutron," Bulova's electronic tuning fork watch, the Seth Thomas tuning fork has no mechanical connection with the train but moves the train magnetically like a synchronous clock motor.

## Horstmann-Clifford Patent

The Acrotyne mechanism is related to the magnetic escapement of the Horstmann-Clifford patent, which is presented in *Figure 1*. In the Horstmann-Clifford escapement, a broad-edged wheel is powered by a mainspring or a weight. A ferro-magnetic wire, called a magnetic track or a continuous sine-wave, is embedded in the edge of the wheel in the form of a zig-zag. A strong permanent magnet-nut, attached to a pendulum, hangs directly above the wheel, separated only by a narrow air-gap.

The wheel is magnetically locked in place by the magnet-nut. When the pendulum is set in motion, the magnetic zig-zag track follows the magnet-nut; and the wheel turns at the same speed as the rate of the pendulum swing. The motion itself is reciprocal because the turning of the wheel also influences the swing of the pendulum as the magnetic track pulls the magnet-nut from side to side.

The swinging of the pendulum allows the seconds hand to move in a manner similar to the movement in a synchronous electric clock without the usual spurts associated with mechanical escapement devices.

## Extending the Sine Wave

The same principle operates when the magnetic track is planted in the edge of a wheel like the one in *Figure 2*, a diagram of an extension of the Horstmann-Clifford patent. Here the zig-zag effect is produced by the teeth. This arrangement allows the use of a tuning fork in-prong-shaped magnet (*A*) is mounted on a flexible spring (*B*) which is attached to a firm base. The geared escape wheel (*C*) has curvatures (*E*) on its outer edge and holes situated below in a staggered pattern (*D*).

This escape wheel is made of a ferro-magnetic material which influences the movement of the magnetic prongs. The resiliency of the spring allows the prongs to move up and down as they follow the outer contour of the wheel. As the wheel turns, the prongs follow the magnetic strip of metal (*E*) downward until they reach the holes. The air-gap causes the prongs to move upward until they make contact with metal again. As the prongs move up, the wheel escapes through the air-gap of the outer curve and advances another space. The cycle is then repeated.

The turning speed of the wheel depends on the speed with which the prongs move up and down, which in turn depends on the natural frequency of the spring.

## The Acrotyne Improvement

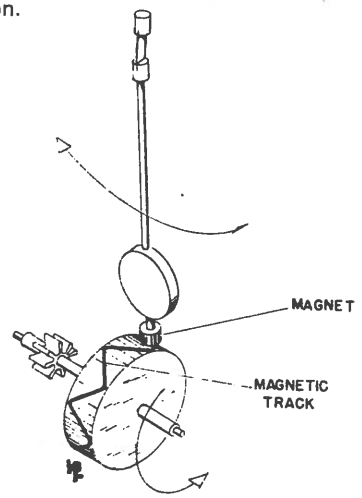
Acrotyne carries this mechanism further by substituting a tuning fork for the spring, as shown in *Figure 3*. A dry cell battery supplies the power to produce vibrations in the tuning fork. The escape wheel has 30 tooth-like protrusions with a hole directly below each one. The radial ribs and the narrow rim are more important in the operation of the system, however, than the holes.

The wheel is made of mumetal, a highly permeable material that is susceptible to magnetic influence.

*Figure 4* shows a segment of this wheel in six progressive stages. The outer teeth are numbered *1, 3, 5, 7*, and the inner teeth are numbered *2, 4, 6*. The shaded section (*A*) shows the position of the magnetic poles which, in the form of a horseshoe magnet on one of the tuning fork prongs, straddle the escape wheel.

As power is introduced through the circuit, the tuning fork begins

**FIGURE 1:** In the Horstmann-Clifford escapement, the embedded continuous sine wave causes the wheel to turn when the pendulum is set in motion.



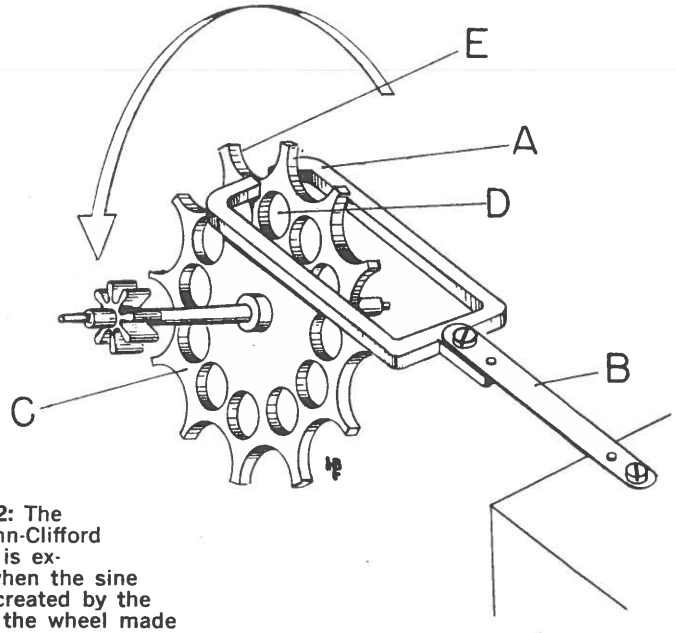
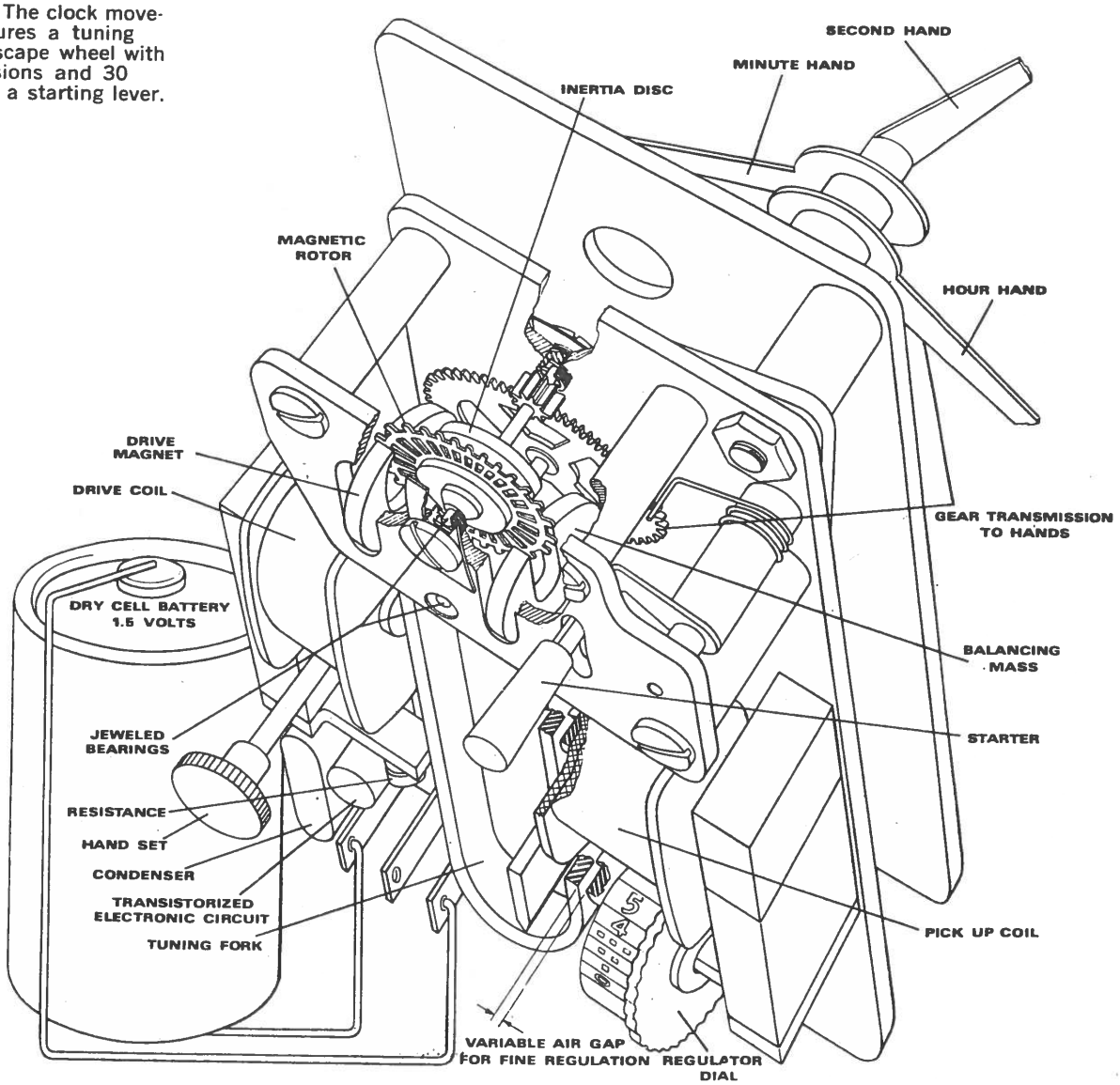




**FIGURE 2:** The Horstmann-Clifford principle is extended when the sine wave is created by the teeth on the wheel made of a magnetic material.

**FIGURE 3:** The clock movement features a tuning fork, an escape wheel with 30 protrusions and 30 holes, and a starting lever.



## INTRODUCING THE ACROTYNE

*continued*

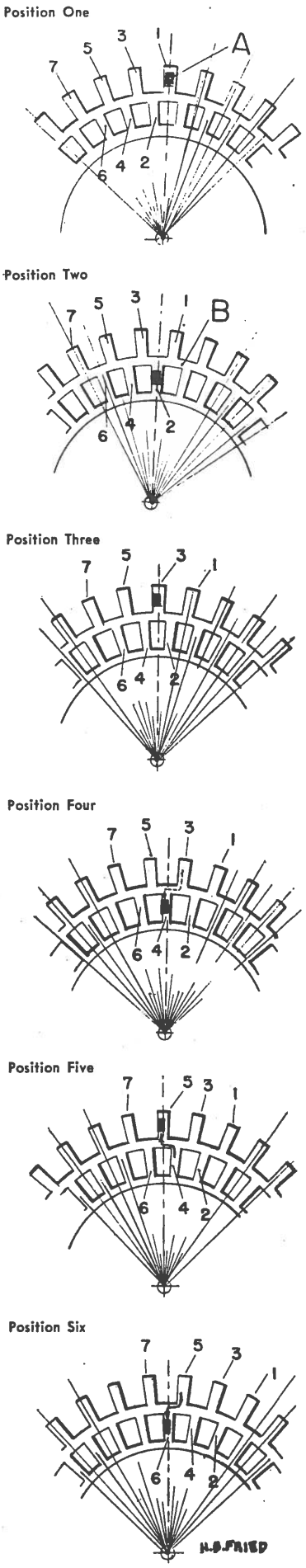



**FIGURE 4:** As the tuning fork moves up and down, the wheel turns clockwise. In position one the tuning fork is at rest and the wheel is motionless. In position 2 the tuning fork begins its downward path. In position three the off-center position of the tuning fork caused by the introduction of a starting lever is shown. Position four shows the same effect on the radial rib. Positions five and six repeat the cycle.

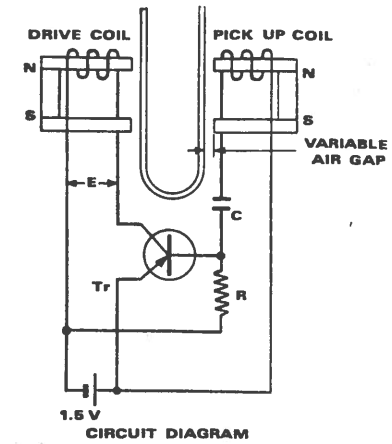



**FIGURE 5:** The circuitry of the clock includes a variable air gap which is used to regulate the frequency of tuning fork vibrations.

to vibrate in and out of the edge of the wheel. Because of its highly magnetic material, the wheel follows the movement of the tuning fork. In position one the tuning fork is at rest and the escape wheel remains motionless, held by the magnets on the tuning fork tine. As soon as the fork is activated, the magnetic action draws it downward to the spot shown in position two, so that tooth *1* is now clockwise of its former position. This happens because the wheel must follow the tuning fork's magnetic path. Therefore, when the magnet approaches the space under tooth *1*, the wheel turns so that the magnet can move along the rim (*B*). As it continues its downward path the magnet comes to rest on rib *2*.

While on this occasion the wheel moved clockwise, it could have as easily moved counterclockwise. To eliminate this chance factor, Seth Thomas introduced a starting lever (*Figure 3*) which is similar to the levers in the old, manual starting, synchronous electric clocks. In the Acrotyne when this lever is pushed, the rotor-escape wheel moves in a clockwise direction at a speed greater than the frequency of the tuning fork. As the wheel slows to a speed almost synchronous with that of the tuning fork, the magnetic tines take a slightly off-center position on each tooth. Since the wheel is moving ahead of the tuning fork, the position the tines assume is slightly left of center.

This is illustrated in position three of *Figure 4*. As the magnet moves downward, it takes the shorter path to rib *4*, rather than to rib *2*. Position four shows that the magnet again takes an off-center position which insures that it moves to tooth *5* next and continues in a clockwise direction. Positions five and six repeat the cycle.

### Acrotyne Circuitry

*Figure 5* gives a general idea of the circuitry of the clock. When the battery is connected with the circuit, a base current flows towards the resistance *R*, and a current passes into the drive coil. This causes the drive coil to attract the tines of the tuning fork towards the outer direction of their vibration. The pick-up coil uses this movement of the tuning fork to form a voltage and applies this voltage in a direction opposite to the emmitter of the transistor. This interrupts the base current, and the tuning fork is free to spring inward. The cycle is then ready to repeat itself.

The clock is regulated in split-second divisions by a magnetic device which moves in such a way as to intersect the flux leakage of

( [illegible] to page 164)

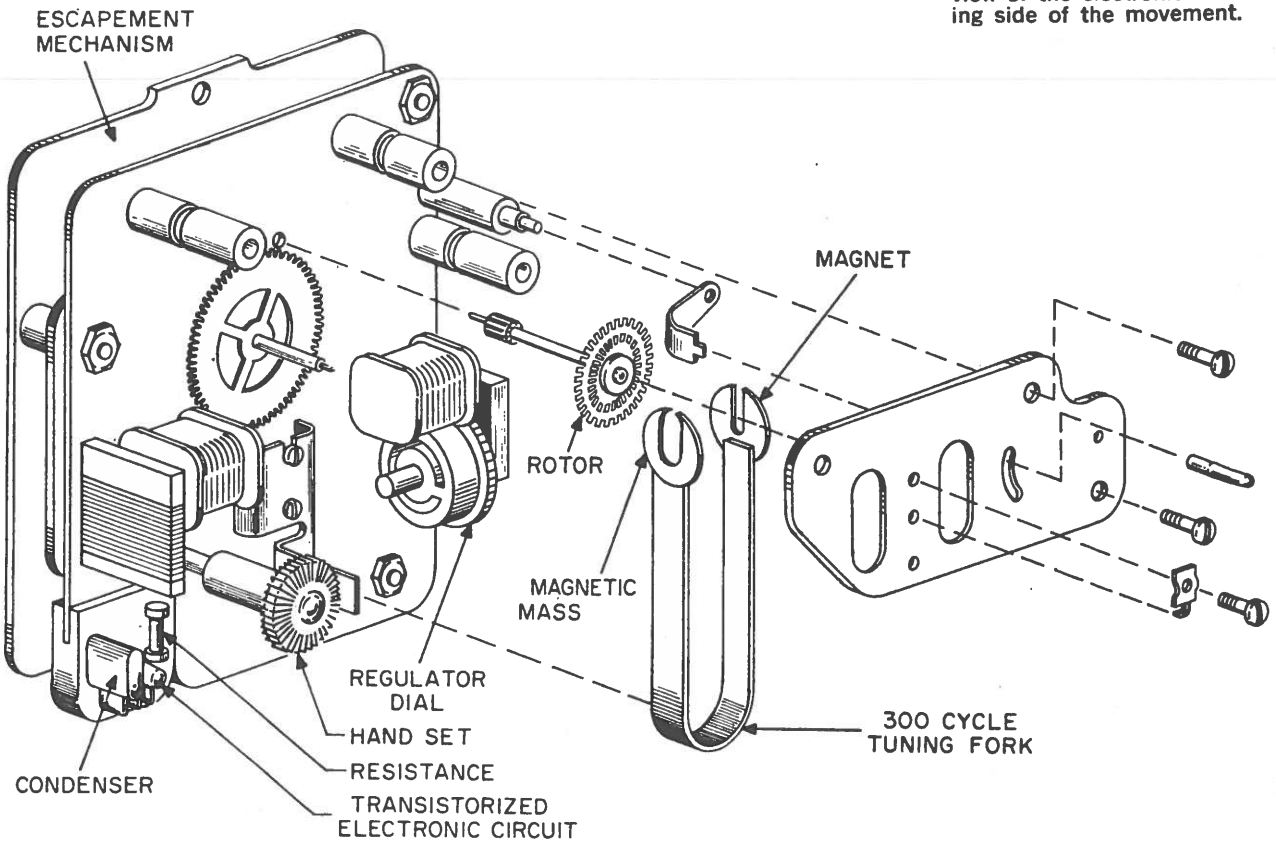



**FIGURE 6:** This is an exploded view of the electronic and driving side of the movement.

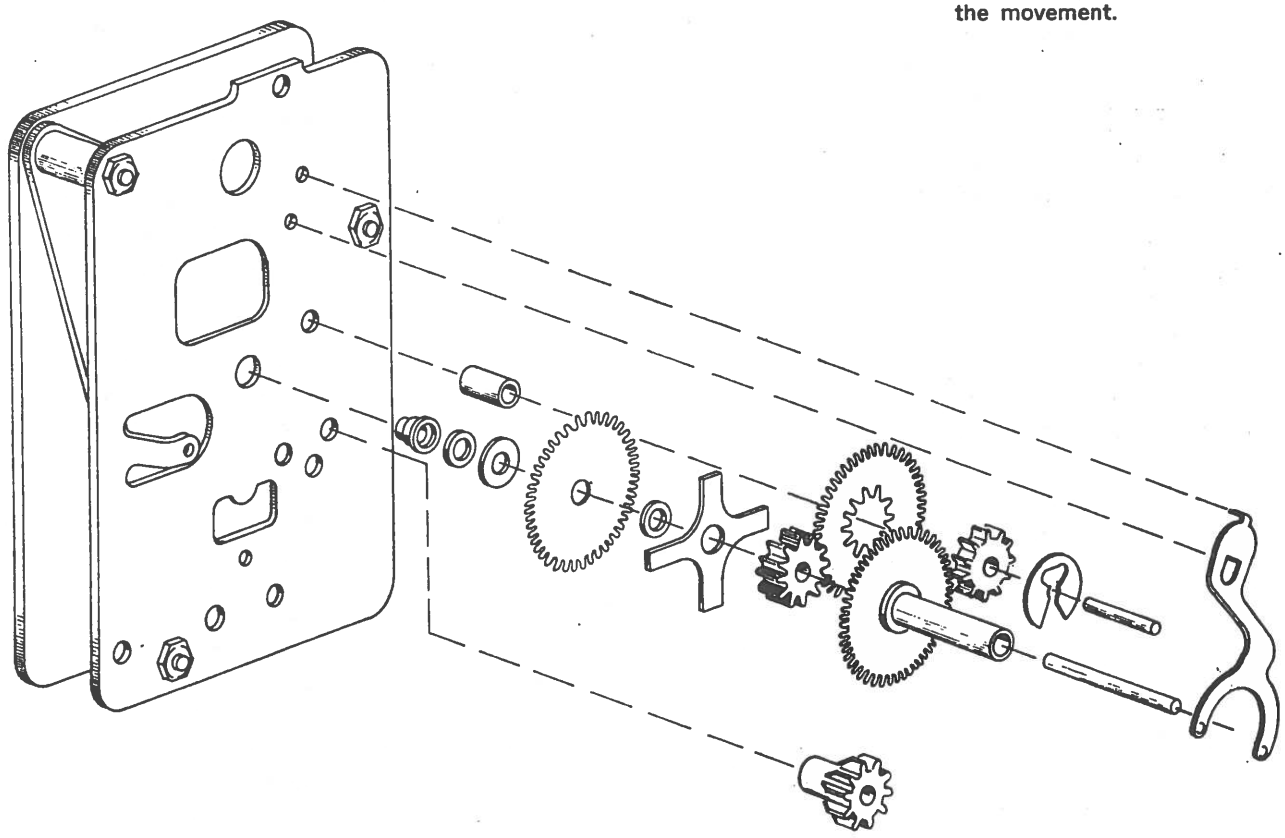


**FIGURE 7:** This is an exploded view of the dial train side of the movement.


*INTRODUCING THE ACROTYNE*

*continued from page* 161

the magnet. The adjustment back-and-forth of the device controls the frequency of tuning fork vibrations.

*Figure 6* shows an exploded view of the electronic and driving side of the movement. *Figure 7* is an exploded view of the dial train side of the movement. There are four jewels in the train and starting is quite smooth. Since there is no spring-loaded train, there is no undue pressure or torque on the gear train bearings.

The following list of specifications for the Acrotyne is given by the Japanese makers.

*Tuning fork frequency:* 300 cycles per second.

*Tuning fork composition:* Ni-Span-c. (Temperature control)

*Tuning fork temperature range:* −10°C to +50°C.

*Temperature error:* within + or −0.5 seconds per day per °C.

*Fork regulating range:* −60 to +20 seconds per day.

*Source voltage:* 1.5 V (D cell flashlight battery).

*Drive coil:* 5000 turns of wire rated at 0.06ø.

*Pick-up coil:* 11,000 turns of wire rated at 0.04ø.

*Capacitor:* rated at mF 0.05.

*Resistor:* rated at 100 K ohms.

*Current consumption:* less than 0.4 mA at 1.5 V.

*Minimum voltage:* just under 1.0 V.

*Isochronous error:* within + or −1 second per day between 1.3 and 1.6 V.

*Possible rates:* within + or −2 seconds per day. ■■■

# MOTOR REPLACEMENT INSTRUCTIONS

## Please read carefully before replacing Motor

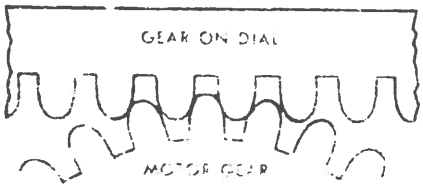



Fig A THIS

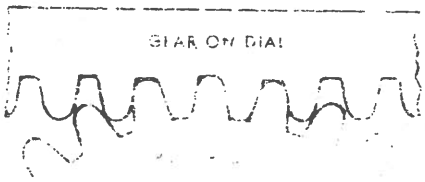



Fig B NOT THIS

The driving gear of the Motor and the gear of the glass dial should not mesh too tightly as this will place undue strain on the motor. It is recommended that they mesh only to the extent shown in Figure A. Incorrect assembly is illustrated in Figure B.

There is sufficient tolerance in the motor mounting flange holes for correct positioning this allows you to properly engage the gears. Removal of the gold retaining ring (See instructions) on the back of the glass dial will enable you to see if gears are meshing properly.

## Instructions for removing gold retaining ring

Place clock face down and remove ring by prying gently with a screw driver at top (See Figure C). Before replacing ring be certain the three small leaf springs between the glass and the dial frame are in the slots of the frame.

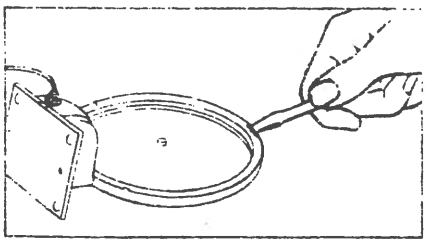
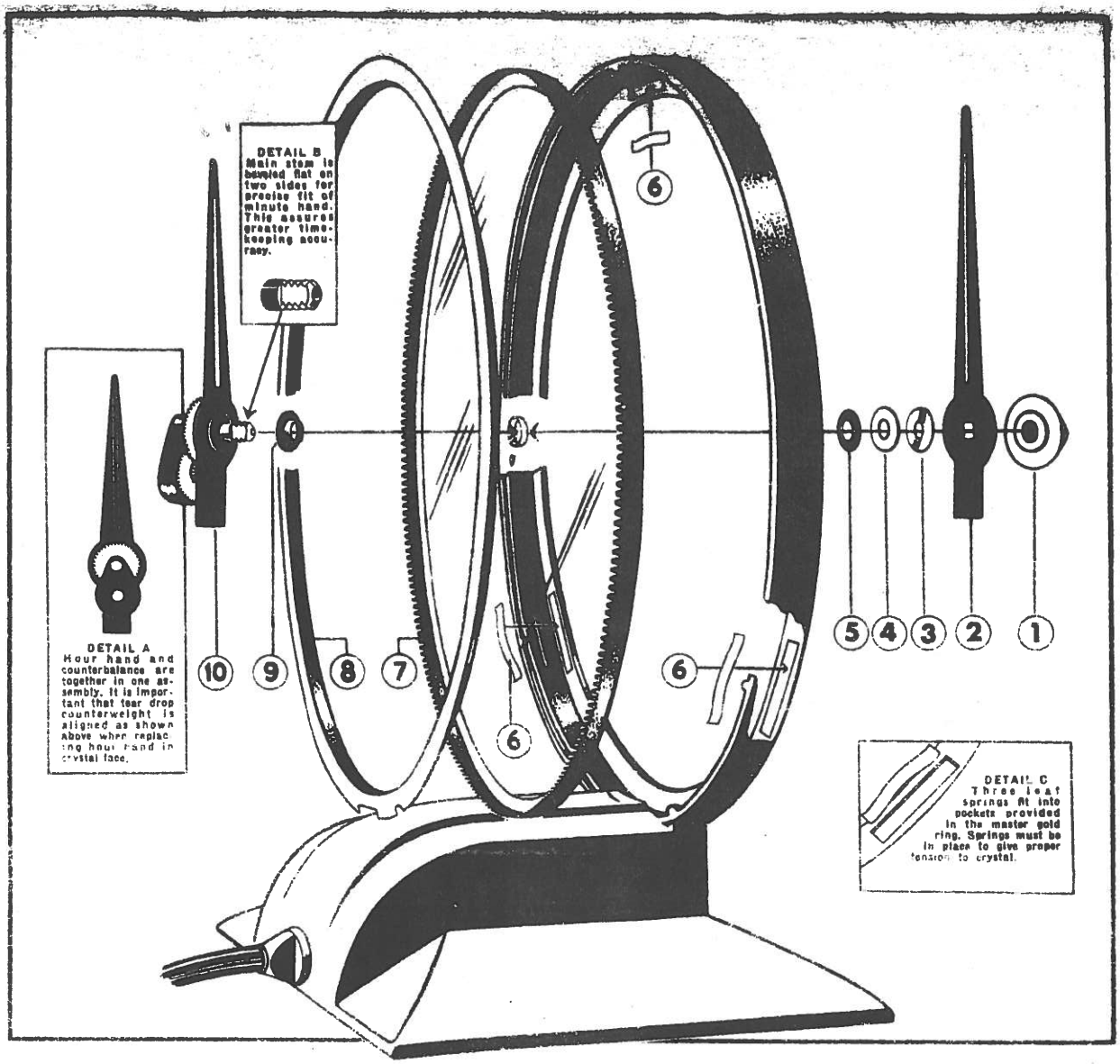


Fig. C

**JEFFERSON ELECTRIC COMPANY**
**Bellwood, Illinois**

FORM: 004.0235




## TO TAKE APART

1 Set both hands at 12 o'clock. Unscrew cone (1) at front. Minute hand (2), concave washer (3), flat gold washer (4), and flat fibre washer (5), will come off in that order.

2 All-in-one hour hand and counterbalance (10) removes from back. Then take out flared fibre washer (9). Turn clock down on face.

3 Remove gold retaining ring (8) from back by prying gently with screwdriver at top (see Figure D, at right below).

4 Entire crystal face (7) then comes out with ring gear attached. Remove the three small leaf springs (6) to prevent loss.

# It's *Quick* and *Easy* to replace a "Golden Hour" crystal!

The new Jefferson "Golden Hour" electric clock makes crystal replacement a profitable operation for you. Its fine precision construction makes the "Golden Hour" a foolproof item to service . . . and its fundamental construction minimizes costly bench time with your watchmakers. For repairs other than crystal replacement, it is strongly recommended that you send the clock to the Jefferson Electric Company, Clock Service Dept.

**To Set the Jefferson "Golden Hour."** Turn minute hand in *clockwise* direction to desired position. Then turn counterweight on back of clock until hour hand is in desired position. DO *NOT* TURN MINUTE HAND IN COUNTER-CLOCKWISE DIRECTION! The "Golden Hour" operates on AC current, 110-125 volts, 60 cycles only . . . its movement does not require oil.

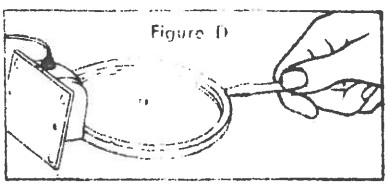


Figure D

## TO PUT TOGETHER

1 Make sure all three leaf springs (6) are in their pockets in proper position . . . see Detail C above. Then slip in new crystal face (7), meshing ring gear with main base gear. Snap (8) into place.

2 Put flared fibre washer (9) in center hole. Place hour hand assembly (10) back at 12 o'clock, making sure counterbalance is in position shown in Detail A.

3 Then put parts back in reverse order (5), (4), (3), (2) and (1). Line minute hand (2) up with hour hand (10) at 12 o'clock before tightening cone nut (1) on face.

4 Adjust hands to allow approximately ⅛" clearance from crystal face. To set clock, see instructions.

**JEFFERSON ELECTRIC COMPANY • BELLWOOD, ILLINOIS**

MART

NOTICE: ALL MART ANNOUNCEMENTS ARE PRINTED FREE! Send material to, M.Feldman, 620 Reiss Place-7e. Bronx, N.Y. 10467

FOR SALE: 30 to 40 electromechanical clocks, commercial electrical clocks and others. Call after 12 noon--George Zlobin,(212) 763-6124

FOR SALE: JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY-1975-1980 ORIGINAL COPIES 50¢ a copy--$4 minimum!--inquiries, SASE or send money payable to, EHS, % M. Swetsky,EWC,1910 Coney Island Ave.Bklyn,NY 11230

FOR SALE: VERY HIGH QUALITY EARLY BATTERY CLOCKS for the serious collector by Synchronome, Gents, Vaucanson, Leroy, Fully restored. C.Roth, 2 Circle Lane, Roslyn Heights, NY 11577

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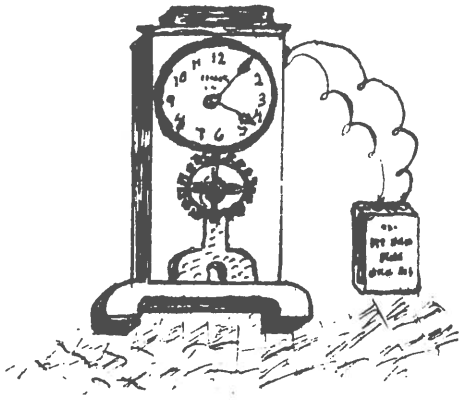
WANTED: Unusual Electrical Clocks, A. Marx, 105 Bayeau Rd. New Rochelle,NY10804

WANTED: Printed information concerning International Time Recording Co. of NY, Master Clock, Model 263, or similar regulator timepiece. Irvin A. Pogue,212 N.Wm.Dr., Chillicothe, IL 61523

WANTED: A Riefler Clock, E.C. Martt, 278 Bentleyville Rd. Chagrin Falls, Ohio 44022, (216) 247-6712

The
# JOURNAL
OF THE
# ELECTRICAL HOROLOGY SOCIETY
## Chapter No 78

June-August 1985
VOLUME XI--ISSUES #3-4
Martin C. Feldman, Editor



Hello fellow enthusiasts:

I hope you will all accept my apologies for the tardiness of the Journal. The number of inquiries received by Sec'y/Treas. Marty Swetsky has been gratifying only in the sense that you are concerned about the future of the Journal and the Society itself. At this time I would like to put questions and fears to rest in assuring you the Journal will continue to be published regularly. Our recent reorganization and my changing residence as well as having to attend to personal obligations caused the delay in publication. We also have decided to change the frequency in that you will be receiving four issues per year instead of six with 18 pages instead of 12 still giving you a total of 72 pages per year. The latter change in format will reduce our operating costs allowing us to continue to function.

We wish to send belated good wishes to Chapter 133---Western Electrics Chapter and wish President Art Bjornestad,the officers and members continued success. As the first electrical Chapter and the only Chapter with a continuous publication in its 13th year we will publish the Marts of Chapters 125 and 133. They in turn, when they publish their Newsletters, will reciprocate. If you wish to sell, trade or buy please make use of this free service.

This month we are printing,courtesy of Alan Marx, the first installment of the repair/user manual for the Gents' "Pul-syn-etic" Clock Systems. These clocks are still available, excellent timekeepers, collectors items and this particular manual is unavailable as it has long been out-of-print.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman,FNAWCC

Leaflet 246

INSTRUCTIONS FOR

# FIXING, OPERATION AND MAINTENANCE

also

# HINTS FOR USERS

## THE "PUL-SYN-ETIC" SYSTEM OF ELECTRIC IMPULSE CLOCKS

LONDON
Office and Showrooms
47, VICTORIA ST., S.W.1.

GENTS
OF LEICESTER
ESTAB. 1872.

NEWCASTLE-ON-TYNE
Office and Showrooms
Tangent House,
LEAZES PARK ROAD, 1.

GENT & CO., LTD., FARADAY WORKS, LEICESTER.

# "ONE ESTABLISHMENT —ONE TIME."

You can have [illegible] universal time through at your [illegible] establishment—not only on the inside Clocks but on your Outside Clocks.

MEAL BELLS AND "START AND CEASE WORK" SOUND SIGNALS will operate with automatic accuracy.

Your existing WORKMEN'S CHECK REGISTERS will keep the same absolutely accurate time if you fit "REFLEX" CONTROL to them.

Hundreds of Firms and thousands of workers one and all appreciate the "PUL-SYN-ETIC" Slogan—

# "ONE BUILDING —ONE UNIVERSALLY ACCURATE TIME."

## INDEX



PUL-SYN-ETIC

# THE "PUL-SYN-ETIC" SYSTEM OF ELECTRIC CLOCKS

## FIXING OPERATION AND MAINTENANCE.

### FOREWORD.

Do not imagine that there is anything difficult about fixing Electric Clocks. Anyone who can fix an electric Bell can fix and maintain the "PUL-SYN-ETIC" System—only, do not think you know more about Electric Clocks than we do.

These Instructions are quite simple and readily understood. In fact, the many points dealt with are only printed because some people think "any old thing" will do, and it won't. Our many cautions against carelessness are very necessary.

If Electric Bells cease to function, somebody puts them right, but if a Clock System stops, some people get annoyed, and rightly so, because there is no need for any such stoppage, if simple instructions are carried out with intelligence and particularly with care.

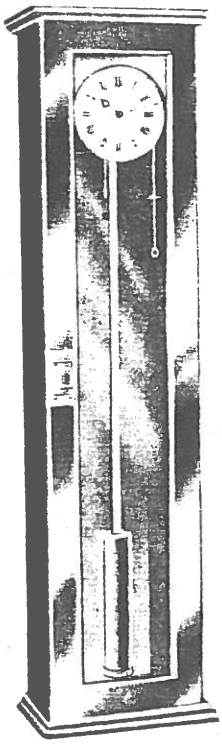


**FIG. C7. TRANSMITTER.**

### THE TRANSMITTER.

(1).—**POSITION OF TRANSMITTER.**

Some pains should be taken in selecting a suitable position for the Transmitter. Trouble in this respect will be amply repaid. The position should be such that the mechanism of the Transmitter is "face high," so that the condition of the mechanism can be readily seen. Much can be learnt by observing the action of this simple mechanism.

The wall should be firm and free from vibration. It should not be damp, nor the position subject to heat or rapid changes of temperature, a position where direct sunshine reaches for a part of the day is not a good one. Fixing on a wooden partition is fatal as regards time-keeping.

(2).—**FIXING THE TRANSMITTER.**

Too much emphasis cannot be placed on the importance of *securely* fixing the Transmitter. You are dealing with an oscillating pendulum bob weighing 10 lbs., and the slightest instability of the Case will result in indifferent time-keeping, or complete stoppage may occur. A central fixing lug is provided at the top of the Case, and the cast-iron pendulum support inside the Transmitter Case is provided with two fixing lugs, thus affording means of a firm fixing, and all must be used.

When fixed, it should not be possible by grasping the top of the Case with both hands, to obtain any movement of the Transmitter.

It will be found convenient to first fix by the central lug and plumb the Case as described below. Then mark off on the wall, the positions of the two plugs from the holes of the two inside fixing lugs.

A deal fixing board, two or three inches longer and wider than the Transmitter, to keep it off the actual brick and to provide a level backing, is desirable, especially when the wall is out of perpendicular or surface irregular.

An alternative is to fix two stout battens (about 2½ ins. wide) on the wall to take the top and bottom fixings.

## (3).—"PLUMBING" THE TRANSMITTER.

Two small brass studs will be seen on the front of the Transmitter Case and these must register vertically with the line of a plumb bob. See also that the wall or fixing board to which the Transmitter is secured is itself vertical. Two other studs will be seen at the left-hand side of the case to check the wall or board. When hanging the pendulum in position, see that the polished side of the rod is at the front.

## (4).—HOW THE TRANSMITTER OPERATES.

It must be first appreciated that the Pendulum of the Transmitter is kept in vibration by mechanical impulses imparted to it at half-minute intervals by a weighted lever termed the Gravity Lever (see Diagram C519).

The Gravity Lever is provided with a Roller which rolls down the Inclined Face of the Impulse Pallet, thus giving the Pendulum Crutch a gentle push.

This continues until the Contact pieces meet when the Electro-Magnet is energised by the flow of current through it.

The Armature is attracted and at once replaces the Gravity Lever on to the Stirrup Catch. Meanwhile the Clocks which are connected in circuit with the Battery are advanced half-a-minute.

The action is brought about in the following manner :

The Pendulum in vibrating, carries with it the Driving Pawl which pushes around the 'Scape Wheel tooth-by-tooth. The back Stop Click prevents its backward movement.

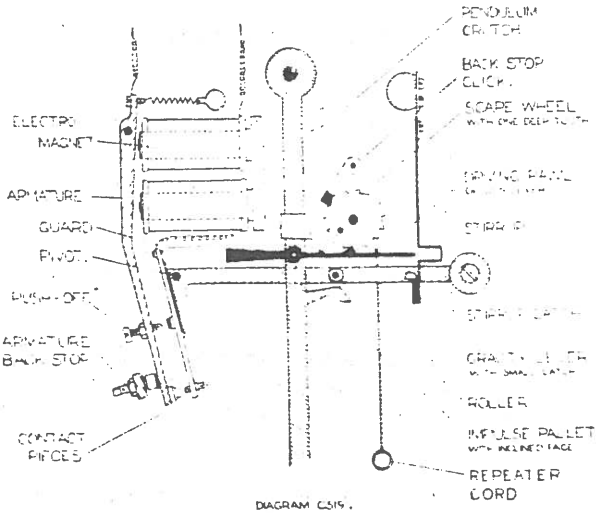


DIAGRAM C519.

At each complete revolution of the 'Scape Wheel (which occurs every half-minute), the Driving Pawl engages a Deep Tooth and its right hand extension instead of passing through the Stirrup, engages the Stirrup Catch just above the Stirrup, pushing the Stirrup catch and releasing the Gravity Lever.

The Roller drops on to the dead face of the Impulse Pallet, then runs down the Inclined Face, giving it an Impulse. Contact is then made as above described for the dual purpose of operating the Impulse Clocks and replacing the Gravity Lever.

The Guard shown just above the driving pawl prevents two teeth being taken by the driving pawl in case the Pendulum swing is exaggerated by any means.

While holding down the Repeater Cord, the Driving Pawl engages the Stirrup Catch below the Stirrup at each vibration of the Pendulum, thus the Gravity lever makes contact every two seconds instead of at each half-minute.

## (5).—AUTOMATIC WEAK BATTERY WARNING.

Attention is particularly drawn to the fact that, for the Transmitter to work correctly, the Gravity Lever must be lifted to its normal position by the current, the very instant the Contact pieces meet. If the Gravity Lever remains down in contact until the Inclined Face of the Pallet returns to the right and assists it, this assisting action is a positive indication that the current passing through the circuit is insufficient and must be increased either by adding more cells or by re-charging the Battery (or re-making a faulty joint if such exists). See paragraphs 11, 12, 13 and 20.

(6).—**ADJUSTMENT OF TRANSMITTER.**

No adjustment of parts or contacts is needed—the instruments are sent out perfectly adjusted—but it is necessary to regulate the pendulum after the Transmitter is permanently fixed (see paragraph 7).

In case the Transmitter has been thrown out of adjustment, for instructions how to adjust (see paragraph 23).

(7).—**REGULATION OF SYSTEM.**

It is necessary that the final regulation of the pendulum be accomplished after it is permanently fixed in position.

(*a*)—**To adjust the Time of the System.**—If the system gains time, correct the clocks by stopping the pendulum so long as necessary, and slow the pendulum by turning its graduated rating nut of the "bob" to the left.

If the system loses time regulate the pendulum to go faster by turning its graduated rating nut to the right.

The rating nut is clearly marked with degrees, each of which is approximately equal to one second per day.

The top of the pendulum "bob" is dished to receive small weights by which most minute regulations can be and should be effected. Drawing pins of different sizes make ideal weights. The Transmitter must be firmly fixed or it cannot be closely regulated.

(*b*)—**To advance the Time of the System.**—If the time of the system is slow, or if it is desired to advance all the clocks together—as when starting up for instance—this is done by means of the Repeater Cord found inside the Transmitter Case. To advance the time of Impulse Clocks singly, see paragraph 17.

(*c*)—**Where Reflexes are used** on the Pendulums of Sub-Transmitters, of Workmen's Recorders, or of other Clocks, the time of the Prime Transmitter must not be altered suddenly as by "stopping" for the few seconds necessary, or "advancing" by pulling the Repeater Cord (otherwise the "Reflex" Control will not function properly until reset). The regulation of the Prime Transmitter Pendulum must be made by an adjusting weight as is illustrated at Fig. C108.

To make the Pendulum go "fast," place the weight on the top of the Pendulum Bob in the space provided. To make the Pendulum go "slow," the weight should be placed on the rating nut below until the system is brought to time. Then hang the weight on the hook provided for its reception in the Transmitting Case.

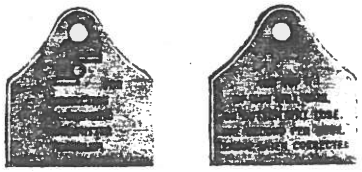


**FIG. C108.**

**OBSERVATORY CONTROL.** Weight may be added or deducted Automatically to the Pendulum by a local or other "Observatory Signal." For "See-Saw" Observatory Control, see Book 5, Section 4.

(8).—**SUMMER TIME ACT.**

To put a "Pul-syn-etic" Clock System forward to conform to Summer Time, advance the time of the system one hour by means of the Repeater Cord. When returning to normal or Greenwich time, stop the pendulum of the Transmitter for one hour.

## THE BATTERY.

(9).—The Transmitter coils and contacts are in series with the Impulse Clocks in a simple circuit. The current required to be sent round a circuit, whether long or short, or whether containing only one or two clocks or a large number, is 0.22 ampere. The working limits are between 0.17 ampere and 0.27 ampere. If an ammeter is put in the circuit for testing purposes, the contacts of the Transmitters must be held closed whilst the test is made, as the actual impulse sent when the Transmitter is working, is too short in duration to be measured by an ammeter. In order to ensure the requisite current being sent round the circuit, the voltage of the battery required will vary according to the length of the circuit and the number of Impulse Clocks therein.

(9a)—**ACCUMULATOR CELLS.**

These should consist of small sealed Cells as catalogued in Book 5, Section 1, Fig C6551, and Trickle Charge arrangements should be made. See also paragraphs 11a and 15 of this publication.

(10).—**DRY CELLS.**

Dry Cells may be used when desired, provided a reliable make is employed. We can offer a special high efficiency dry cell (Fig. C154) having a life of from 2 to 3 years on a normal "Pul-syn-etic" circuit.

(11).—**SIZE OF BATTERY.**

The number of Dry Cells required for driving Turret Clocks and Impulse Dials varies in accordance with the quantity and sizes of the Clocks, and full particulars will be given on enquiry, but :—To find the number of cells required for a simple installation having 12-in. dials (or smaller) the following rules should be observed :—

Allow Three cells for the Transmitter ; add One cell for every three clocks in the circuit ; the Warning Bell may be considered as one clock for this estimating purpose ; Two or Three extra cells to overcome line resistance (according to the length of the circuit), plus a third of this total to provide a working margin, for example :—

An installation of twenty 12-in. Clocks requires :

| | |
|---|---|
| For Transmitter ... ... ... ... | 3 Cells |
| One cell for every three clocks ... | 6 Cells |
| For overcoming line resistance, say ... | 3 Cells |
| Total | 12 Cells |
| Add for working margin, one-third above | 4 Cells |
| Total of necessary Cells | 16 |

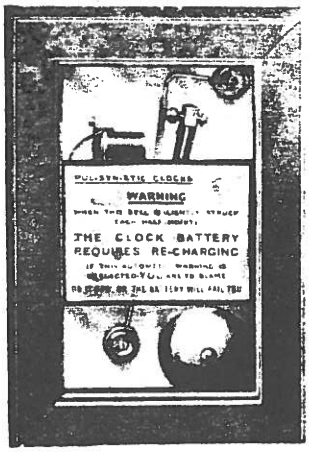



**FIG. C8 Warning Bell.**

Alternatively in formular form :—

$$\frac{\text{Sum of all Dial resistances} - \text{line resistance}}{7} \div \tfrac{1}{3} = \text{No. of dry cells required.}$$

(11a).—**SIZE OF BATTERY ACCUMULATOR.**

Sum of all Dial resistances - line resistance X 0.22 ampere = voltage of necessary accumulator. Where 10 volt accumulator units are being employed and it is found for example, that actually 14 volts are required by formula, them a 20 volt accumulator (2—10 volts units) must be used and the sliding resistance in the Transmitter must be adjusted until the correct working current—0.22 ampere—is obtained.

No Warning Bell is desirable where a trickle-charged Accumulator is employed.

(12).—**WEAK BATTERY WARNING BELL.** (Advisable when dry cells are employed).

With this device fitted, all anxiety regarding the condition of the battery is removed, and no other testing apparatus or periodical inspection is required. Immediately the battery begins to weaken the gong is struck at each half-minute impulse until the battery has been given the necessary attention. No extra battery is required to operate it. The Warning Bell should be fitted in some suitable position where it can be heard at once, being connected in the circuit exactly as an impulse clock.

The fact of the Transmitter automatically changing its action of working on the battery weakening, is the cause of the Warning Bell being brought into operation. When the strength of the current falls to a certain point, and while the bell is "warning," the lifting of the gravity lever of the Transmitter is delayed until the pendulum returns to the right and assists the operation, hence the longer contact which causes the bell to ring. This longer contact is noticeable as well as being visible in the Transmitter, but a Warning Bell, fixed in a definite position, makes it somebody's duty to have the battery attended to. Such attention must be carried out as early as possible, because during the "warning," the duration of the contact is a full second, instead of a normal duration of 1 30th second. See paragraph 5.

(13).—**CHECKING THE BATTERY POWER.**

After attending to the Battery and replacing run-down cell or cells, check up, with a milliameter preferably, that the correct current—0.22 ampere—is passing through the circuit.

If a meter is not available then reduce the current strength by removing one cell at a time until the Warning Bell commences to ring. Then re-insert cells until there is a margin of at least 25% above that number of cells which cause the Warning Bell to sound—this gives you a factor of safety and provides for any volt drop which may occur with new cells.

If 12 cells cause the Warning Bell to sound then add 25% (i.e., a quarter, namely 3 cells) making 15 cells in all.

(14).—**"WAITING-TRAIN" TURRET CLOCK BATTERIES.**

Dry cells for this purpose are not to be recommended. The modern practice is to employ a small bank of sealed Accumulators trickle charged from the A.C. or D.C. supply Mains, generally as described in paragraph 9a for ordinary Impulse Clock circuits. The only departure is that a slightly larger capacity Accumulator, (Fig. C6561, Book 5, Section 1), is employed. This same Accumulator is of course utilised if there are other Clocks in the same circuit, a variable resistance being employed to break down the voltage as required.

The following voltages are necessary for the four sizes of "Waiting-Train" Movements :—

| | | | | | |
|---|---|---|---|---|---|
| C40A | ... | 20 volts | C40B | ... | 30 volts |
| C40C | ... | 40 volts | C40D & E | ... | to requirements. |

The current taken by the power magnets of standard C40A is 0.4 amp., and by the C40B, 0.5 amp., but these magnets can be wound to instructions if voltage is given when ordering.

The frequency with which the Motor Pendulum takes current is dependent upon the load of the hands—i.e., weight, etc., and also upon weather conditions. In a high wind or in frost the Pendulum will take current more often.

Normally the Pendulum should swing not less than 15 times before taking current. It may, however, under favourable conditions, swing as many as 80 times.

Should the Pendulum drop to a low number of swings, then look for friction in the hand mechanism or motion work.

## SERVICE MAINS.

(15).—**"Pul-Syn-etic" Clock Circuits can be operated by A.C. or D.C. Service Mains.**

The modern practice as described in paragraph 9a, is to employ a small bank of sealed Accumulators and to trickle charge these from the A.C. or D.C. supply mains.

The system is thus virtually mains operated, with the advantage that on the mains fail it is not rendered inoperative.

Beyond an occasional topping up with distilled water about once per annum, these Accumulators need no attention whatsoever.

Full circuit diagrams are sent out with each Installation, but mention of this subject is made on page 14 & 15 of this publication.

## THE IMPULSE CLOCK.

(16). These may be of any type, size or pattern. Clocks with dials 6-in. or 6-ft. may be all in one circuit, only the voltage of the battery must be so that the standard 0.22 ampere passes through the circuit.

The fixing of the clocks is merely a matter for mechanics. Obviously wooden-case clocks must not be fixed in damp or steamy atmospheres, but metal-cased clocks or Bakelite cases are provided for these situations. Inaudible clocks are provided where the half-minute tick is objectionable.

### (17).—SETTING INDIVIDUAL IMPULSE CLOCK TO TIME.

In order to get all clocks to the same time when starting a system, if slow, advance the hands by making repeated contact to their terminals with one dry cell : if fast, short-circuit the terminals by connecting them together so long as necessary while the system is going. Two dry cells in series are required to advance Contact Clocks and clocks having dials 18-in. to 30-in. , three or more cells for larger clocks.

To advance all the clocks together, see paragraph 7.

When "setting" Contact Clocks and Contact Makers which control sound signals, note whether previously arranged for at a.m. or p.m. and set to time accordingly.

### (18).—REMOVING IMPULSE CLOCKS, OR INSERTING EXTRA CLOCKS IN A CIRCUIT.

When removing a clock, be sure to rejoin the wires so that they are in good connection with each other. A binding screw is best to a temporary connection, and a soldered joint is necessary if the connection is to be permanent.

It is necessary to disconnect a clock or break the circuit for the insertion of a new clock immediately after an impulse is made, and to quickly reconnect before the next impulse, otherwise the clocks in the system will become slow or be put out of step.

## THE CIRCUIT OR WIRING.

### (19).—LINE WIRES.

An ordinary 18 or 20 S.W.G. Electric Bell Wire, insulated with indiarubber and double cotton covered will suffice for the work, provided the walls are dry, but by reason of the extra mechanical strength which can be obtained without materially increasing the cost, we recommend, say, an 18 S.W.G. 300 or 600 megohm electric lighting wire being used. The insulated wire may be fixed by insulated saddle staples, hung on cleats, or carried in steel tubes or wooden casing as circumstances dictate. All that is required is a sound metallic circuit properly insulated.

When fixed on insulators as across yards or in the open, insulated wire is still recommended to prevent short circuits and interference by telephone and other workmen.

If stranded conductors are used, all the wires of the strands must be clipped under each terminal, or better still, the strands should be soldered together to ensure perfect contact to the terminal. If this cannot be ensured, we prefer the solid wire.

### (20).—JOINTS AND TERMINALS.

All joints in line wires must be soldered. After an installation is complete, it is desirable for the foreman to personally assure himself that all the joints have been soldered and go over all terminals to ensure all are tight, as a faulty joint will upset the most perfect system and may cause some of the clocks to lose and others to gain time. Joints in all wires, even if intended to be temporary (but often forgotten and left dry) become a source of trouble in time. All joints, therefore, should be soldered immediately they are made, so that, if forgotten, trouble is not likely to arise therefrom.

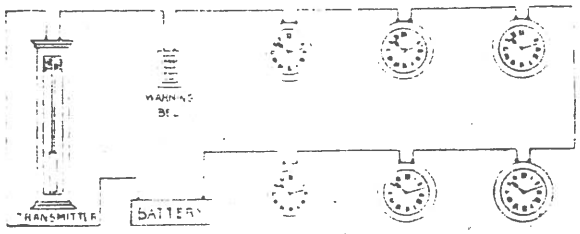



DIAGRAM No. 506.

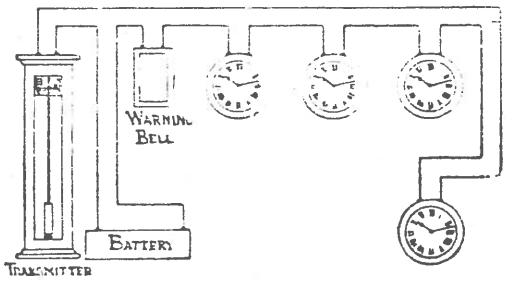



DIAGRAM No. 507.

### (21).—TESTING THE WIRING.

Before starting-up the Clock Installation, have the Circuit tested for insulation resistance. Any leakages to Earth and across lines will give considerable trouble, especially in a large installation.

### (22).—ALL CIRCUITS "SERIES".

Diagram No. 506 illustrates the principle of "Series Wiring", and shows clearly the circuit of wire and the Clocks, etc., included therein. In many cases, however, the layout of the building will not permit of the Clocks being arranged in a complete ring as shown in Diagram No. 506. The principle of "Series" wiring must, however, still be followed and it is then often advantageous to run the return wire from the last Clock back to the Transmitter alongside the wire connecting the Clocks, as shown in Diagram No. 507.

A "Pul-syn-etic" Transmitter will impulse any reasonable number of Impulse Clocks.

We have Installations where over 100 are on one circuit controlled by one Transmitter. It should be remembered that the voltage of such a circuit is high, and it is this voltage and the responsibility of having so many Clocks in one Circuit in case wires are carelessly cut, that is the controlling factor. (We supply Sub-Transmitting relays to overcome this difficulty).

## ADJUSTING TRANSMITTER.

### (23).—DON'T "MONKEY" WITH THE TRANSMITTER ADJUSTMENTS.

They were very carefully made prior to despatch, and it is most unlikely that any adjustment is required even after years of working.

For adjustment instructions after prolonged wear, reference should be made to "Hints for Users", incorporated from page 14 onwards in this publication.

### (24).—GENERAL—OIL.

Dirty oil should occasionally be wiped away from the Scape Wheel teeth and all frictional parts. For oiling instructions—which are most important—please see "Hints for Users", page 14 onwards of this publication.

## ADJUSTING IMPULSE CLOCKS.

(25)—If through interference, any Impulse Clock has to be re-adjusted, it must be set to work definitely on a minimum current of 0.12 ampere, and this current checked by an ammeter. Trial-and-error methods only end in disappointment. These remarks apply to "Pul-syn-etic" Clocks of all diameters, sizes and types, also to inaudible movements, and to "Waiting-Train" Turret Clock Relay Magnets.

The function of an Impulse Movement is to advance the hands one tooth only at each electrical impulse. Therefore, adjust the motion of the driving pawl and back-stop pawl so that this mechanical action takes place. Give that clearance to the adjustments to ensure definite and reliable operation.

The Magnet must operate as close to the armature as possible in order to obtain maximum efficiency. When the adjustments are properly set, the armature facing should just touch the Magnet at the same time as the top end of the driving lever touches the upper stop.

The driving spring of the Movement operates against the attraction of the Magnet, and the spring must be set by the adjusting lever provided, so that the armature operates with the minimum working current of 0.12 amp.

The Hands must be quite free of each other, and of the Glass and Dial. If there is any tendency to stick in any position after careful trial, the cause of the friction must be discovered.

All pivots must be oiled with clock-oil only. The pivot holes must first be cleaned.

The stud on which the driving pawl works must be oiled, but the ratchet wheel, the driving pawl and back-stop pawl must not be oiled and must be perfectly clean.

## "START AND CEASE WORK" SOUND SIGNALS, MEAL BELLS, Etc.

(26).—An Impulse Clock is often fitted with contacts which close for 30 seconds at certain fixed times to ring sound signals. These are light spring contacts suitable for passing a Battery current for one or two Bells. Diagram 609 shows such a Clock with Battery and Bells. The Push shown is put across the circuit so that the Bells can also be operated by hand, when desired. So that Bells shall not ring at night, a 24-hour wheel is added to the Impulse Movement. This cuts out the circuit during the "off" hours.

A limited number of such Contacts can be fitted to an Impulse Clock. A 12-in. wooden-cased Impulse Clock, as Fig. C10, lends itself best for the purpose and so is usually employed.

Such Clocks fitted with contacts are supplied by the Makers, and if adjustments are required by the user, great care is necessary, and careful test must be made after such adjustments to ensure contacts close only for the duration required and then only.

A general programme is 8 a.m., 1 p.m., 2 p.m., and 5-30 p.m. A contact will be found connected to the Hour-hand Wheel, and another in series with it to the Minute-hand Wheel, and when these contacts both "make," the circuit is established.

The 24-hour Wheel acts as a Cut-out breaking the circuit during the night. A weekly wheel is sometimes fitted for cutting out the week-end, but a manually operated switch is often employed. With complicated programmes, two Impulse Clocks are often brought into service, the contacts being distributed judiciously between them.

Another plan is to employ a Fig. C68 Contact Maker, as shown in "Book 5, Section 1." With this, a.m. and p.m. can readily be checked, and if the Mechanism is fitted with a 7-day wheel, set to the correct day.

When a programme contains a number of rings at those minute positions, during a said hour which do not occur at other hours, two or more Mechanisms are required, but if operating the same Bells, one 7-day wheel can cut out for both.

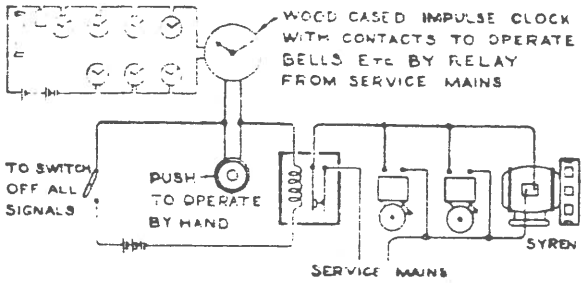



DIAGRAM No. 608.

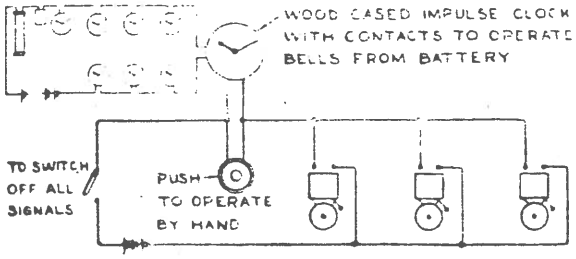



DIAGRAM No. 609.

(27).—With a large number of Bells, or when current is taken from the service mains, the clock contacts are employed to operate the coils of a Relay, and the heavy current used to operate large bells or a number of bells, and also to automatically operate, say a Syren, is passed by the Relay contacts. Diagram 608 shows such a Relay.

(28).—Contacts so added to an Impulse Clock are necessarily fixed by the Makers, but Adjustable Contact Makers or Programme Ringers, Fig. C69, are supplied, in which any intelligent operator can change pegs or pins so setting Bells to ring at any pre-arranged time at intervals of five minutes. The contact wheel or switch disc revolves once in 24 hours, so that a 24-hour programme is available. A weekly wheel is often added to cut out the week-end signals.

The connections of these programme ringers are the same as in the diagram shown at 608 and 609. In complicated programmes, sometimes both sides of the 24-hour Switch disc are employed, and such Programme Ringers are sometimes made to contain as many as three Switch discs, giving facility for very complicated programmes.

All classes of Contact Makers are simple Mechanisms, easily understood, and only require carefulness in making adjustments.

## "REFLEX" CONTROL.

(29).—This will be found fitted to many Workmen's Recorders and similar Clocks. It is essential, when fitting, however, that their Pendulums beat an even number of times per half-minute or per minute.

The principle on which the "Reflex" operates is that the Clockwork is wound as usual, but the Pendulum is set to go a little "slow", and it is cushioned against the saw teeth of the Stator at every half-minute or every minute, and so is "Hastened up" and held to time.

Operating correctly, the leaf spring of the Vibrator engages—at each impulse—the teeth of the rack of the stator at about the middle position. It must be seen, however, that the leaf spring supports the rack against gravity while the Pendulum completes its swing after engagement, and holds it supported until the return swing, because otherwise the "Reflex" action does not fully take place.

To ensure this action, the tip of the vibrator spring must reach the bottom of the teeth of the rack on engagement, otherwise the action will be imperfect and the rack damaged. Perfect results will be given when the proper reflex action is obtained.

(30).—Before fitting, see that the Recorder is standing square, or hanging perpendicularly, and that the clock-work "goes" in such a position.

Fit the Vibrator on to the Pendulum about two-thirds down, by the clips provided. Drop the Pendulum Bob approximately $\frac{3}{16}$-in. to compensate for its added weight, and to give the Pendulum that slightly losing rate, which is necessary.

The Stator, in many patterns of Recorders, may be screwed directly to the inside of the case. If the width of the case is such that the centre of the Pendulum Rod is more than five inches from the side of the case, pack out on a wooden block of a suitable thickness.

(31).—Diagram C601 shows the relative position of the two parts, and a gap must exist between the tip of the rack and the tip of the leaf spring, so that the tip of the leaf spring will travel over the rack not more than two teeth before the escapement of the clock movement gives a "tick". Move the Pendulum slowly and listen to check this adjustment. As a guide, the above-mentioned gap measures approximately $\frac{1}{32}$-in.

(32).—The rack of the Stator must not be fixed in a line with the centre of the path of the gravity of the Pendulum. An important point is that the Pendulum shall not be given a tendency to wobble by the leaf spring not meeting the rack squarely.

Normally, when swinging with the Pendulum, the tip of the leaf spring must clear the tops of the teeth of the rack an equal distance all along its length. The angle of the rack can be altered so that this condition obtains by means of an adjustable slot and screw provided at the back of rack.

When the Electro-Magnet is energised by an impulse on the Time Circuit, the rack will engage the leaf spring and so cushion the Pendulum.

(33).—See that the Leaf Spring does not foul the Magnet nor touch any part of the Stator except the rack and then only when this is lifted by the Magnet. When all is in order, the Vibrator may be more permanently secured by the small wood screws provided.

When the rack is put in its "down" position by the handle provided, the "Reflex" action is inoperative, but see that when it is in this position, its point does not foul any part of the Pendulum.

(34).—Put the rack "down" and regulate the Pendulum when operating on its own, to lose anything up to four minutes per day, and when this has been proved in a day or so, then the rack should be raised into its operative position and cushion the Pendulum at each half-minute when the Recorder will be held to time with the other Clocks of the System.

(35).—It will be seen if the Time Circuit is cut by accident, or the Transmitter stops for any reason, the rack becomes inoperative, and the Recorder will "Carry on" under its own power as if no "Reflex" had been fitted.

(36).—Dimensional working Drawings showing the "Reflex" fitted into most of the well-known Recorders, Card, Key, Radial, or Signature, are prepared, and will be sent on an intimation that such are required. Give the type and approximate year of manufacture when asking for Drawings.

*When regulating Pendulum (see page 5) use the correcting weight (Fig. C108) on Transmitter.*

*If any difficulty is found, it is well to write asking definite questions, so that concise answers can be, and will be readily given by the Makers.*

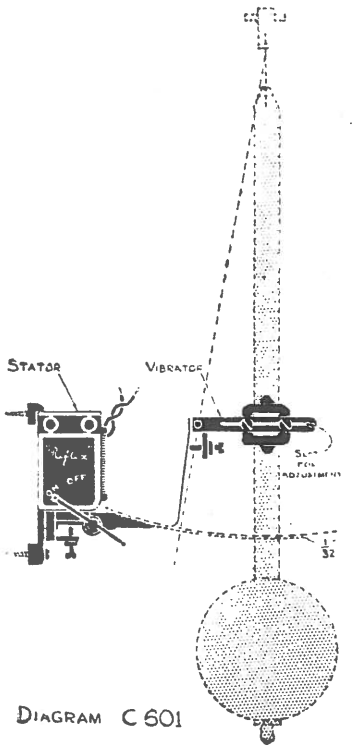


DIAGRAM C 601

(37).—If faults—how to locate them—please refer to paragraph 20 "Hints for Users", page 14 onwards of this publication.

Hints for USERS

# "PUL - SYN - ETIC"

## Electric Impulse Clock Systems

PENDULUM TYPE

# HINTS FOR USERS OF

## "PUL-SYN-ETIC"

# Electric Impulse Clock Systems,

## PENDULUM TYPE.

Do not imagine there is anything difficult about maintaining "Pul-syn-etic" Electric Clocks. Anyone who can fix an electric bell can maintain the "PUL-SYN-ETIC" System—only do not think you know more about Electric Clocks then the makers.

Some people think "any old thing" will do—it won't. If a Clock System stops some people get annoyed, and rightly so, because there is no need for any such stoppage if simple instructions are carried out with intelligence and particularly with care.

(1).—The outlines below give diagrammatically the arrangement of the Circuit, and it will be seen that all Clocks are connected in simple series. Incidentally it shows all the necessary apparatus that goes to make up a modern Impulse Clock System.

Whatever source of Power, whether Battery, Accumulator or Service Mains, be employed, it may be connected anywhere in the circuit. The number of Impulse clocks in the circuit is also immaterial.

All ordinary Impulse clocks whether large or small, whether near to or distant from the Transmitter, or the source of Supply, take the standard current of 0.22 ampere.

## SOURCE OF CURRENT SUPPLY.

## A.C. SERVICE MAINS.

**(1)—DIRECT.**

By putting in a Transformer to ensure the voltage being rendered suitable for the Clock Circuit and a Westinghouse All-metal Rectifier (full-wave). Should the Mains fail, then all Clocks will stop.

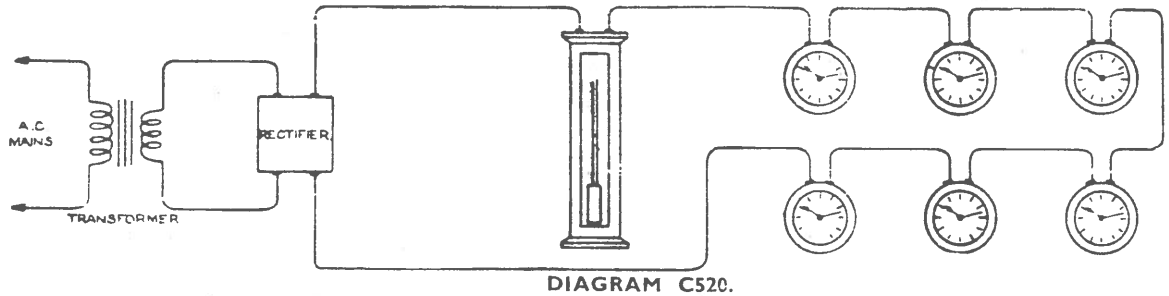



**DIAGRAM C520.**

*This Diagram shows a "Pul-syn-etic" Clock System driven off A.C. Mains (full wave).*

**(2)—BY TRICKLE CHARGED ACCUMULATOR.**

This method is strongly recommended in every way. Mains failure in no way interferes with the clock system.

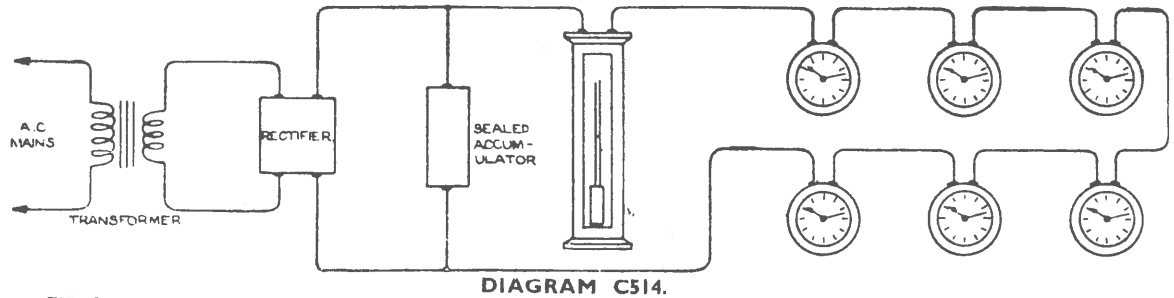



**DIAGRAM C514.**

*This Diagram shows the method of using the A.C. on "Pul-syn-etic" Clock Circuits with a Trickle-Charged Accumulator.*

# D.C. SERVICE MAINS.

**(1)—DIRECT.**
By inserting Carbon Lamps or other suitable resistances to limit Clock Circuit current to 0.25 amp.
Should the Mains fail, all Clocks stop.

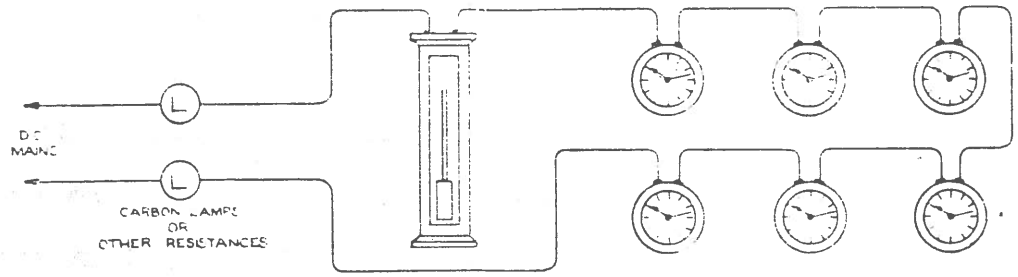



**DIAGRAM C515.**
*"Pul-syn-etic" Impulse Clocks driven off D.C. Service Mains*

**(2)—BY TRICKLE-CHARGED ACCUMULATORS.**
This method is strongly recommended. Mains failure or surges due to heavy loads in no way interferes with the Clock System. Duplicate batteries are advised in order to keep the D.C. Mains isolated from the Clock Circuit.

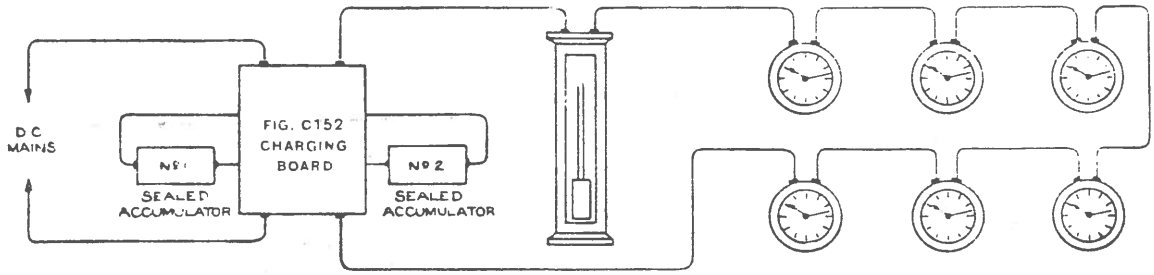



**DIAGRAM C516.**
*"Pul-syn-etic" Impulse Clocks driven off D.C. Service Mains with two batteries of Accumulators, one always in use, the second being charged as a stand-by.*

## BATTERY.

When using dry batteries as a source of Supply it is recommended that a Warning Bell be included in the circuit to afford audible warning when the battery is getting "low."

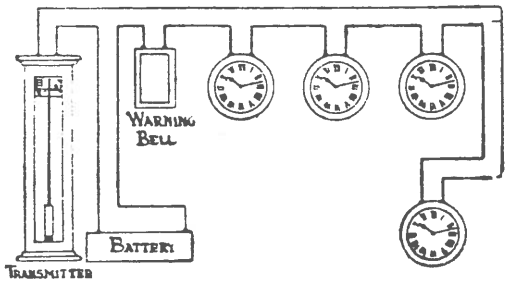



**Diagram No. 507.**

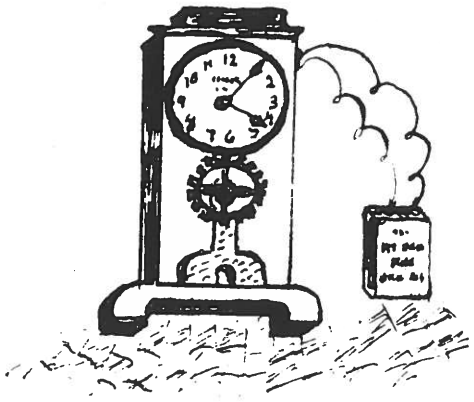
# THE CIRCUIT.

(2).—As all the clocks are in series, in case of trouble see that the circuit is complete and free from intermittent and other faults. A broken wire or a cut wire is sometimes, but seldom, the cause, although workmen have been known to cut wires, not appreciating they were the clock circuit.

(3).—*Loose Terminals are often the cause of any intermittent faults that do occur. This may be due to vibration. Test with a screw-driver and see that all Terminals are quite tight and contact good. Appearances are often deceptive. See that any joins in wire are soldered and not merely twisted together.*

The
# JOURNAL
OF THE
# ELECTRICAL HOROLOGY SOCIETY
## Chapter No 78

October-December 1985
VOLUME XI--ISSUES #5-6
Martin C. Feldman, Editor



Hello fellow enthusiasts:

The end of the 1985 year Journal comes to you late and we sincerely regret the delay.

From the volume of mail our Sec'y/Treas. Marty Swetsky has received it is gratifying to see that the Journal is awaited by the membership at large. Marty has asked me to extend his apology for not answering each letter as the volume and time involved are great--hopefully, this Journal will answer the question as to whether we still exist and continue publishing.

We continue and complete the Pul-syn-etic Manual and shall be publishing others in the future. From Mr. Tony Mercer of Thomas Mercer Ltd. England two flyers of their highest quality scientific chronometers are being reprinted. They are extremely rare and very collectible. We are very fortunate in having an original article from Bill Ellison entitled, Untapped Source of Electro-Mechanical Clocks Discovered. I am sure many of us have passed over automotive clocks with hardly a second thought but Bill's article puts this group of timepieces in an entirely new perspective.

The last issue of any year is one of membership renewal with dues being requested. The dues will remain the same for 1986 at $10. We expect to continue publishing 72 pages per year in our Journal as we have been doing regularly for the past 14 years.. Please send your dues as soon as possible to: M.Swetsky, 1910 Coney Island Avenue, Brooklyn, N.Y. 11230.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman,FNAWCC

(4).—See that the Battery or Accumulator is all in order and that current is "always there" and that at each half minute 0.22 ampere is supplied to the Transmitter, and that this current goes round the circuit.

(5).—*The Standard Current Impulse is of such short duration that an ordinary Ammeter is useless unless the contacts of the Transmitter are "made" for a definite time while the Ammeter is read. Remember this when testing.*

(6).—If the Circuit is suspected as faulty, test the wiring in the usual way with a Megger or with a Galvanometer

1. Test for continuity of the Circuit, from the Transmitter round and back to the other terminal of the Transmitter.
2. Further test all Conductors to earth. A leak often causes trouble.
3. Remove the wire from the most distant clock and test between Conductors.
   Remember if Auto Cut Outs are used in the installation precaution should be taken accordingly.

(7).—An intermittent fault will sometimes cause some Impulse Clocks to gain as well as some to lose, if present it may be most difficult to locate. See every joint is soldered. Look particularly to the Terminals of Battery. With Leclanche Cells the zinc terminal also is often carelessly left as a "Dry Joint."

(8).—Where Supply Mains are used without an Accumulator, the current may have been cut off temporarily, and if carbon lamps are used as a resistance, an intermittent fault is sometimes found in the lamp-holder plungers. Remember such contacts may carry a current for an electric lamp that will not pass the smaller Impulse Current used by the clocks.

(9).—*If all Clocks suddenly gain several minutes, it is not likely the Pendulum has altered its beat, so look to the Transmitter and read Paragraph* 28.

## Test of Circuit by the Transmitter.

(10).—Don't at once blame the Transmitter. See the Circuit is complete, and not till then, consider the Transmitter.
The Transmitter may be a great help in ascertaining the condition of the Clock Circuit. Therefore, scrutinise the Transmitter carefully without touching the Pendulum or interfering with the mechanism and note carefully.

(11).—See if the gravity-lever has been "thrown up" and is definitely on its catch. If it has been, then the trouble is probably not due to faulty circuit or lack of current, but to the pendulum not having sufficient energy to drive the simple half-minute 'Scape Wheel, perhaps owing to sticky oil.

(12).—Watch carefully the movement when the pendulum is swinging normally (and is not unduly actuated as by hand), and see that it is capable of so swinging that well over a tooth is taken at each swing. See also that the back-stop click falls easily and cleanly into its place. See that the slot is clean in the pendulum rod, and that the pin of the crutch that engages it is free and not sticky. If thick oil trouble is present—cleaning and re-oiling is the remedy. See paragraphs 30 and 32.

(13).—An intermittent fault in the clock circuit may be the cause of the trouble, the gravity-lever being "thrown up" but not regularly every half minute. Therefore, pull the repeater-cord and watch carefully with the pendulum swinging normally. Note the contact pieces but don't alter their adjustment.

(14).—If the gravity-lever is not "thrown up" back on to its catch and no current manifests itself, then the trouble is probably due to the battery being absolutely exhausted, or to a broken or faulty circuit. See paragraph No. 23.

# THE TRANSMITTER. How it operates.

(15).—It must be appreciated that the pendulum of the Transmitter is kept in vibration by mechanical impulses imparted to it at half-minute intervals by the gravity-lever.

This is provided with a Roller which rolls down the inclined face of the Impulse-pallet, thus giving the pendulum crutch a gentle push.

This push continues until the contact pieces meet when the electro-magnet is energised by the flow of current.

The armature is attracted and at once replaces the gravity-lever on to its catch. Meanwhile the Impulse Clocks which are connected in circuit with it and the battery, are advanced half a minute.

The action is brought about in the following manner :—

The pendulum-catch in vibrating with the Pendulum, carries with it the driving - pawl which pushes around the Scape-wheel tooth - by - tooth. The backstop click prevents its backward movement.

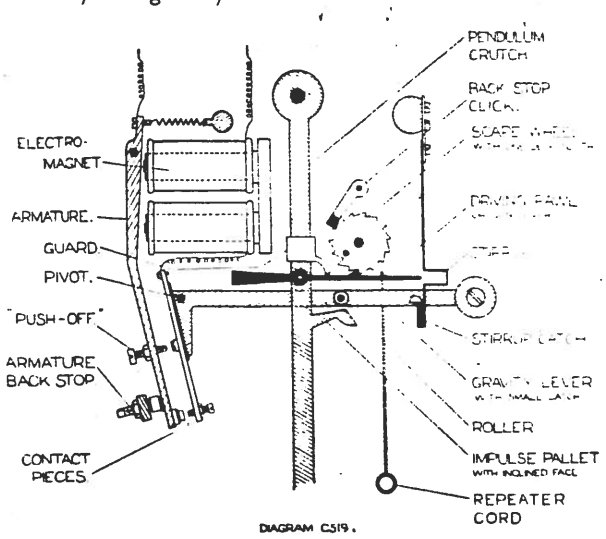


DIAGRAM C519.

At each complete revolution of the 'Scape-wheel (which occurs every half-minute), the driving pawl engages the deep tooth and its right hand extension, instead of passing through the stirrup, engages the stirrup lever catch just above the stirrup, pushing the catch to the right and releasing the gravity-lever.

The roller drops on to the dead face of the impulse-pallet, runs down the inclined-face, thus giving it an impulse. Contact is then made as above described for the dual purpose of operating the Impulse Clocks and replacing the gravity-lever.

(16).—*Don't attempt to adjust the contact pieces unless worn by very many years of operation, or unless they have been interfered with by someone.*

*Modern Transmitters are sent out with the adjustment screws treated with white enamel so that it is apparent if any attempt has been made to adjust them. Read carefully paragraph* 33.

(17).—**REGULATING THE PENDULUM.**

It is necessary that the regulation of the pendulum be accomplished when it is permanently fixed in position.

If the system gains time, stop the pendulum so long as necessary, and slow the pendulum by turning the graduated rating nut of the "bob" to the left.

If the system loses time regulate the pendulum to go faster by turning the graduated rating nut to the right.

The rating nut is clearly marked with degrees, each of which is approximately equal to one second per day.

In addition, the top of the pendulum "bob" is dished to receive weights by which most minute regulation can be and should be effected.

(18).—**ADVANCEMENT OF ALL IMPULSE CLOCKS.**

Hold down the repeater-cord provided in Transmitter. The extension of the driving pawl then engages the stirrup catch at each vibration of the pendulum.

(19).—**TRANSMITTER DIAL.**

*Remember that any dial fixed in the Transmitter case is, after all, merely an Impulse Clock, and is not worked directly by the Transmitter mechanism any more than other Impulse Clocks in the circuit, and as it is not sealed up, it may more easily have been interfered with.*

# THE TRANSMITTER. Examination.

(20).—In the event of a complete stoppage do not disturb anything until an examination has been made to ascertain—

(*a*) If the system has stopped for want of current, or—what is equivalent—through a temporary disconnection of the circuit, or

(*b*) If the Transmitter has stopped because of a mechanical fault, such as undue friction in the mechanism or a derangement or breakage.

If through (*a*) it will be seen that the gravity-lever has been disengaged from its stirrup-catch, and that the roller of the gravity-lever rests on the pallet—electrical contact not being made. This position of the gravity-lever shows that its release has been properly effected, but that the magnet has not been energised, and if it is found that the battery has not failed, an intermittent fault or a complete break must be looked for. An intermittent fault which would break the circuit for a minute or so would be quite sufficient to cause the vibration of the pendulum to fall below that minimum which will permit electrical contact to be made, and consequently cause the pendulum to stop.

(21).—If through (*b*), it will be seen that the gravity-lever will not have been disengaged from its catch, and incidentally, the deep tooth of the 'Scape-wheel will not have travelled to the disengaging position, and if no derangement is apparent, the Transmitter should be examined in relation to the following points :—

(22).—See the case is firmly fixed at the head, and, consequently, the pendulum is not liable to vibrate the case. The Transmitter must be so fixed that it is impossible to move the head of the case even by grasping same with both hands.

(23).—See that the battery power is sufficient and consequently the pendulum is not checked at each half-minute by having to assist in the action of lifting the gravity-lever. Proof of insufficient battery-power is shown when the gravity-lever is not replaced until the pendulum assists the lifting action. See paragraph 27.

This may be due to resistance in circuit through, say, a bad joint, insufficient battery power, or a bad state of the Battery.

(24).—Check that the case is fixed plumb. Two small studs are fixed on the front of the Transmitter Case, one at the top and one at the bottom, also two studs at the left-hand side of case, and these must register with a plumb line.

See that the pendulum is placed in "right way." The polished side must be towards the observer.

(25).—The end of driving pawl should fairly engage the supporting catch (when its click enteres the deep tooth of 'Scape wheel), and consequently should not "fail occasionally" to effect the half-minute release.

If obstructed by dirt in deep tooth, remedy is obvious. If no obstruction exists, bend up the end of the lever a trifle, but see that it is quite clear when it is in the shallow teeth.

(26).—*The dead face of the Pallet must normally swing under, but must not touch the roller. The pin at the bottom of the crutch must be quite free in the slot of the pendulum, and must be oiled only with clock oil.*

The driving-pawl (gun lever) must be quite free. It is sometimes found that is oscillates stiffly, and does not, therefore, engage the 'Scape-wheel.

The crutch must swing quite free, and must be bent forward a little if found to rub on the gravity lever.

(27).—**WARNING BELL.** (Not usually fitted where Trickle Charged Accumulators are installed).

A battery may have sufficient strength to operate the Transmitter and the Impulse Clocks, and yet not "throw up" the gravity-lever properly. The current may "come on" and the magnet still may not be able to do its duty until the pendulum swinging to the right aids it by means of the Impulse-pallet.

This fact is taken advantage of in sounding a Warning Bell. Normally the hammer in this tries at each impulse, but, has not time to strike the gong. With the longer interval caused by a weak battery, the hammer strikes the gong each half-minute until the battery is renovated or completely exhausted, which latter happens very soon if no attention is given.

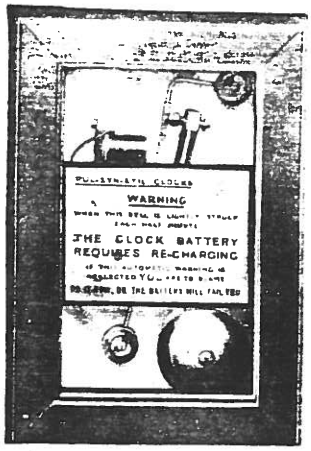



FIG. C8.

(28).—**ALL CLOCKS SUDDENLY GAIN.**

This is probably due to the gravity-lever being raised, but not held by the supporting catch. This may be due to :—

The battery being very weak, with the result that the gravity lever is not lifted sufficiently high, and it falls back again on the contact, thus causing a repetition at each swing of the pendulum, or

Through maladjustment, electrical contact may be broken far too soon, and before the catch is reached. See paragraph. 34.

Some slight mechanical adjustment of the catch may be necessary. Its spring may be weak, or the felt pad which cushions the upward movement of the gravity-lever may come into operation too soon ; some slight adjustment of the catch will generally obviate the trouble.

*Only when the Transmitter has been actually disarranged should the contact-pieces be adjusted as a remedy.*

# The Transmitter. OILING.

(29).—It must be remembered that this mechanism is really a clock and *only clock oil* must be used, and even this very sparingly. A piece of wire with a flattened end, about 18 gauge, forms the best oiler

(30).—*Use only finest clock-oil, obtained from a watchmaker, or use typewriter oil. Ordinary oil is fatal.*

All pivots of the mechanism must be oiled, one drop for each pivotted part or pin on which such parts turn. The oiling must be carried out methodically, otherwise pivots are missed. Reach through the frame from the front to oil the back pivots.

(31).—Before oiling anything, any dirt seen in teeth of 'Scape-wheel must be removed. Dirty oil must also be wiped away from the pivots and parts, and for this use a clean duster free from fluff.

(32).—See that the pin working in the slot in pendulum is oiled, also the tip of the stirrup-catch and the small catch on gravity-lever.

The pin on which the roller turns should be carefully oiled, but not the face of the roller or the Impulse-pallet on which it rolls, these surfaces must be *quite* clean.

# ADJUSTING TRANSMITTER.

(33).—**N.B.—Don't "monkey" with the Transmitter adjustments.**
They were carefully made before despatch, and it is most unlikely that any adjustment is required even after years of working.

*These instructions are only issued for use in cases where the adjustments are required through prolonged wear, or in cases of interference.*

(34).—All adjustments of the armature and the contacts commence from the correct position of the armature in relation to the magnet, therefore press the armature flat and square against the poles. Next unscrew the electrical contact screw and the push-off screw clear of everything, and while holding the armature in contact with the poles, screw up the push-off screw until its point lifts the gravity-lever catch on to the stirrup-catch. Next screw in the electrical contact screw to such a position that its point parts company with the armature contact, when the gravity-lever is within $\frac{1}{64}$-in. of engagement with the stirrup-catch.

This is best done with "the current on," and it will be convenient to control the upward movement of the gravity-lever by hand, to see in what position the gravity catch is when the "break" takes place.

Lastly, adjust the armature back stop screw against which the armature rests until there is exactly $\frac{3}{16}$-in. space between the contact points when the gravity-lever is at rest on the stirrup-catch and the armature is at rest against its back stop screw. The armature return spring should only be strong enough to return the armature to its position of rest with a "prompt" movement. If this spring is abnormally strong it is obviously acting unduly against the magnet.

(35).—The dimensions of $\frac{3}{16}$-in. applies to Transmitters in which the contacts are situated $2\frac{3}{4}$-in. below the pivot of the gravity-lever. In the case of Transmitters of an older pattern, in which the contacts are $1\frac{3}{4}$-in. below the pivot of the gravity-lever, the dimension in question must be $\frac{1}{8}$-in. only.

If a reliable open-scale ammeter shows that the gravity-lever is lifted (without assistance from the pendulum) at a lesser current value than 0.17 amp. an air gap must be given between the armature and the magnet when the armature is in the attracted position. This necessitates the screwing in of the electrical contact screw and the push-off screw and the unscrewing of the armature back stop screw, so as to get the adjustment results described.

Be sure and tighten all lock nuts.

(36).—The felt pad which checks the upward movement of the gravity-lever should come in operation just after the gravity-catch has engaged the stirrup-catch. In other words, there should be just a little shake between the felt pad and the gravity-catch.

(37).—When the "electric contact" adjustments have been made, the pendulum and escapement must be set in beat as follows :—Hang the pendulum in position and see that the crutch-pin is free in the slot of the pendulum and is oiled. Finally, the Scape-wheel must be set in beat, and this "set" must be such that both the driving pawl and back-stop click just drop equally in position with the minimum swing.

Adjust this by moving the suspension spring of pendulum along and re-tightening the hexagon gripping nuts.

The back-stop click is made adjustable also for this adjustment.

# THE IMPULSE CLOCK.

(38).—All Impulse Clocks contain a step-by-step mechanism similar to that illustrated at Fig. C9. When this is fixed without exposed terminals, two studs are provided at the bottom of the clock front so that individual clock can be "shorted" if fast, and advanced by means of a dry cell if slow. The studs are a precautionary arrangement to avoid the necessity of taking the clock down in case adjustment of the clock hands is found necessary. To advance all the clocks together, see paragraph 18.

(39).—The movement is set with an ammeter in circuit by the makers, and it is essential than an ammeter be used when any adjustment is made, and that the movement will operate with a current of 0.12 amp. This must be measured with care.

*Any re-adjustment made without the precaution of an ammeter will only end in future trouble. The re-adjusted Impulse clock may operate on the current as supplied by the Transmitter, but if for any reason this falls very slightly, then the misadjusted clock again fails.*

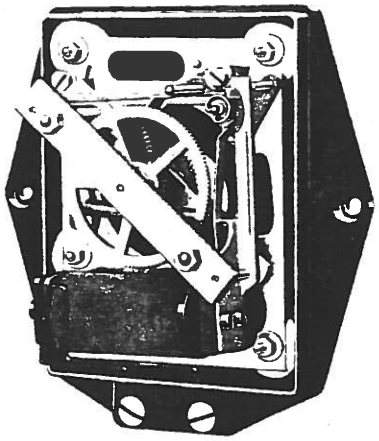


FIG. C9.

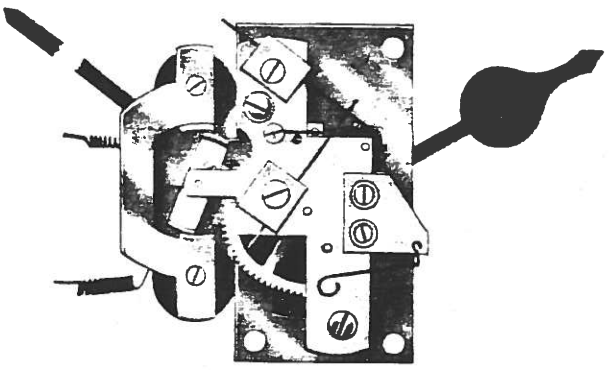


FIG C107.

(40).—*The remarks about oiling in paragraph 30 apply equally to the Impulse Movements, but the ratchet wheel and the driving ends of the pawls must not be oiled in any circumstance: they must however, be left perfectly clean, particularly the brass pin forming the forward stop of the driving pawl.*

Obviously wooden-cased clocks must not be fixed in damp or steamy atmosphere, but metal-cased clocks are provided for these situations. Inaudible clocks, as Fig. C107, are provided where the half-minute tick is objectionable.

(41).—Two dry cells in series are required to advance contact clocks and clocks having dials 18-in. to 30-in. ; three or more cells for larger clocks.

When "setting" contact clocks and contact makers which control sound signals, note whether previously arranged for at a.m. or p.m. and set to time accordingly.

(42).—**REMOVING IMPULSE CLOCKS, OR INSERTING EXTRA ONE.**

When removing a clock be sure to rejoin the wires so that they are in good connection with each other. A soldered joint is necessary if the connection is to be permanent.

If it is necessary to disconnect a clock or break the circuit for the insertion of a new one do so immediately after an impulse and quickly reconnect before the next impulse, otherwise the Impulse Clocks will become slow or be put out of step.

# BATTERY OR CURRENT SUPPLY.

(43).—If a dry cell battery is employed and is giving trouble, pick out the weak or faulty cells with a voltmeter and replace. If the weakness is general, fit a new battery.

(44).—If current is taken from Service Main D.C., see that metal filament lamps are not being used as a resistance, and examine the plungers of lamp holders for faulty contact.

(45).—If A.C., see that the rectifier is really giving the current required, and in either case, where no accumulators are used, see that the Supply is not being cut off momentarily and unknown perhaps to the Management. Where trickle charged accumulators are employed keep the cells "topped up" with distilled water.

(46).—If a Leclanche Battery is employed, read carefully the re-charging instructions.

(47).—**RECHARGING LECLANCHE CELLS.**

The zinc rods must be clean or they will not serve their purpose. Remove any crystals by scraping. When badly corroded they must be renewed. Zinc rods do not work nearly as well in an over-strong solution and require more frequent attention. When they are seen to be of a deep black colour, or to have crystals adhering which extend an appreciable distance from the surface of solution, the battery is being overworked—sometimes due to a leakage, locate it, and rectify or the battery will rapidly deteriorate.

(48).—If the solution develops a "milky" appearance, it indicates that it contains insufficient sal-ammoniac. The "milky" appearance will disappear when salammoniac is added. A deposit of undissolved salammoniac crystals at the bottom of the cells indicates that the solution is too strong.

(49).—When adding water to compensate for the loss due to evaporation, do not add more salammoniac. After eighteen months' to two years' working, a tablespoonful to each cell may be added, but not more. After approximately three years' normal working, the complete solution should be renewed—also new porous pots and zincs if necessary.

(50).—A Leclanche Battery properly housed and carefully erected will go for two years without attention, excepting for the addition of water to replace that lost by evaporation.

It is so easy just to be careful and not to spill water or solution on the tops of the battery.
It is so easy not to spill the grains on the battery tops and in the battery box.
It is so easy to do the thing properly, and obtain perfect results from the cells.

(51).—N.B. The careless workman just "bungs in" a handful of salammoniac, lets loose crystals fall about, splashes some water into the jars, and sticks the battery on a top shelf out of the way, and even then, the willing cells do their best to perform their duty.

(52).—If a good Leclanche Battery does not give permanent service, in 99 cases out of 100 it is due to it not being properly housed or other improper treatment.

# "TANGENT" ELECTRICAL PRODUCTS

INCLUDE

BELLS AND BUZZERS (Wood and Bakelite-Cased).

METAL-CLAD BELLS (Battery, A.C. or D.C. Mains).

RELAYS OF EVERY CLASS.

BELL INDICATORS (Wood-Cased and Metal-Clad).

LUMINOUS CALL SYSTEMS AND STAFF LOCATORS.

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ELECTRO-MOTOR SYRENS.

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PROCESS TIMERS.

SYNCHRONOUS ELECTRIC CLOCKS
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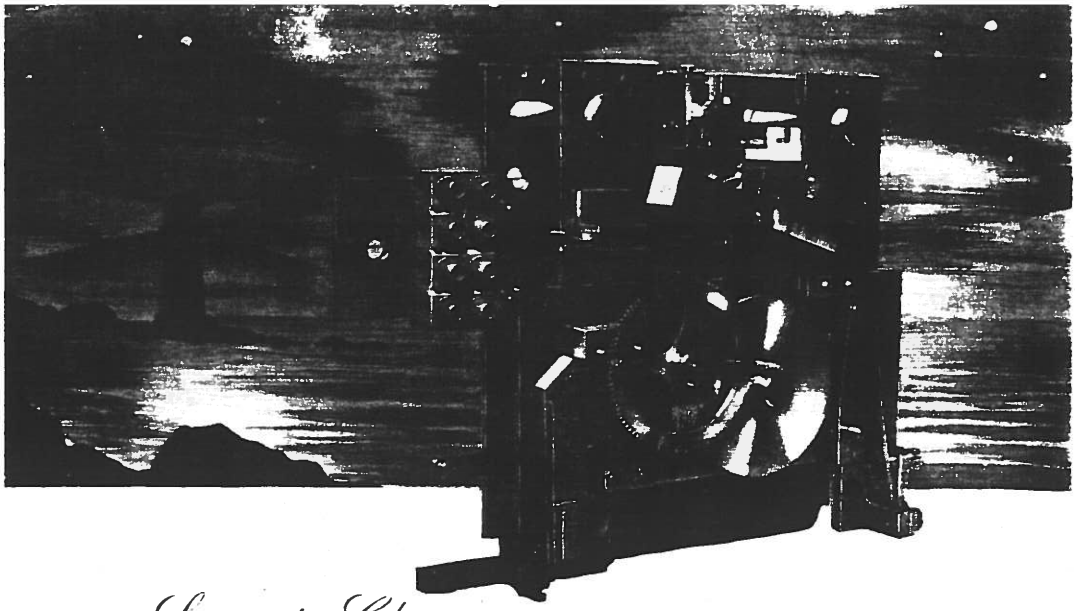

## *Scientific Chronometers* H.C.H.3 & H.C.H.4

These two Scientific Chronometers are mainly used as an automatic time base in situations where there is no personal supervision, and where a continuous sequence of contacts is essential, such as in Observatories, Laboratories, Factories, Lighthouses and Lightships. The electrically wound mechanism works from 12 volts D.C. and has six hours' reserve should the electric supply fail. These Chronometers are of the very highest quality workmanship and are reliable timekeepers in all adverse conditions. Seconds contacts of any variation during the minute can be supplied. *(For other details see reverse)*

These instruments are supplied either in teak cases with brass bezel with hand-cut and silvered dial, or in an alloy metal casing shown below.

Dimensions: Metal Case, 9 ins. x 11½ ins. x 4½ ins.
(228 mm. x 292 mm. x 114 mm.)

Wood Case, 10 ins. x 10½ ins. x 6 ins.
(254 mm x 267 mm. x 152 mm.)

**Code H.C.H. 3**—No contacts.

**Code H.C.H. 4**—Half-second contacts.

**THOMAS MERCER LIMITED**

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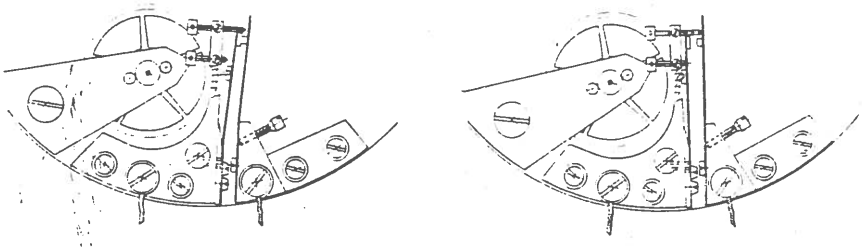

# *Electrical Contacts in Chronometers*

Electrical contacts have been fitted to Mercer Chronometers for over thirty years. These contacts have no adverse effect whatsoever on timekeeping and need only be cleaned when the Chronometer has a routine overhaul.

The contacts are of platinum, mounted on gold springs with allowance for adjustment. In general we advise a voltage of 3 volts to be carried which, in turn, actuates a heavier relay for subsequent instrument control. For example: The accuracy of any new Chronometer is approximately half-second per day, or at the maximum one second. Therefore, with this knowledge a pair of contacts was designed to work from the seconds spindle. A special tooth wheel was attached with sixty teeth giving a contact of half-second on and half-second off. This, of course, can be varied by us to give one contact per minute (or multiples up to sixty). The maximum number of contacts in twenty-four hours is, therefore, 86400, so the accuracy, if the Chronometer is slow or fast one half-second per day, is one part of 172800.

In short periods a Mercer Chronometer (No. 15421) was tested by the Royal Observatory. The Chronometer and a phonic motor contact were connected to batteries and the interval of time between the pulses from the Chronometer and those of the phonic motor were measured on an electronic decimal counter device. Readings were taken every second over a period of four minutes and the deviation from the mean value obtained from each minute was plotted. The four curves so obtained showed a strong correlation revealing the existence of a systematic error. As the errors were repeated with such constancy each minute, measures extending over a period of four minutes were considered to be sufficient.

The results shown below were for Mercer Chronometer No. 15421. The overall range of 6.5 milliseconds (+4.0 to −2.5) and the calculated value for the standard deviations was found to be 1.64 milliseconds. Another Mercer Chronometer (No 15032) showed an overall range of 5.0 milliseconds (+2.5 to −2.5) and the mean standard deviation was calculated to be 1.56 milliseconds.

With regard to contacts during an hourly period, extreme accuracy can be obtained, the shortest contact available being half-second. Contacts dividing the hour are also made extending still further the versatility of the Chronometer. These contacts fitted to all types of Mercer Chronometers have immense scientific value in Observatories, Laboratories and Research Establishments.

**THOMAS MERCER LIMITED**

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EHS#.D

## Untapped Source of Electro-Mechanical Clocks Discovered

Is it possible that there are several electro-mechanical clocks which are lying overlooked in your own neighborhood? Well, hopefully, not exactly in your immediate neighborhood but at least readily available. In the 1940's through the late 1970's a series of very interesting electro-mechanical clocks were produced and sold as automotive clocks. Although automobile clocks have a bad reputation with respect to both timekeeping ability and durability, in fact these clocks are technically interesting and capable of good performance under very demanding conditions. This article reviews these clocks with the hope that this interesting facet of electrical horology will be given a second look by clock collectors.

Early automotive clocks were essentially large watches. Prior to electrification, these clocks relied on manual winding, either through a large stem or by means of the bezel - the rim wind models. When electrification was adopted, the first system used was to periodically

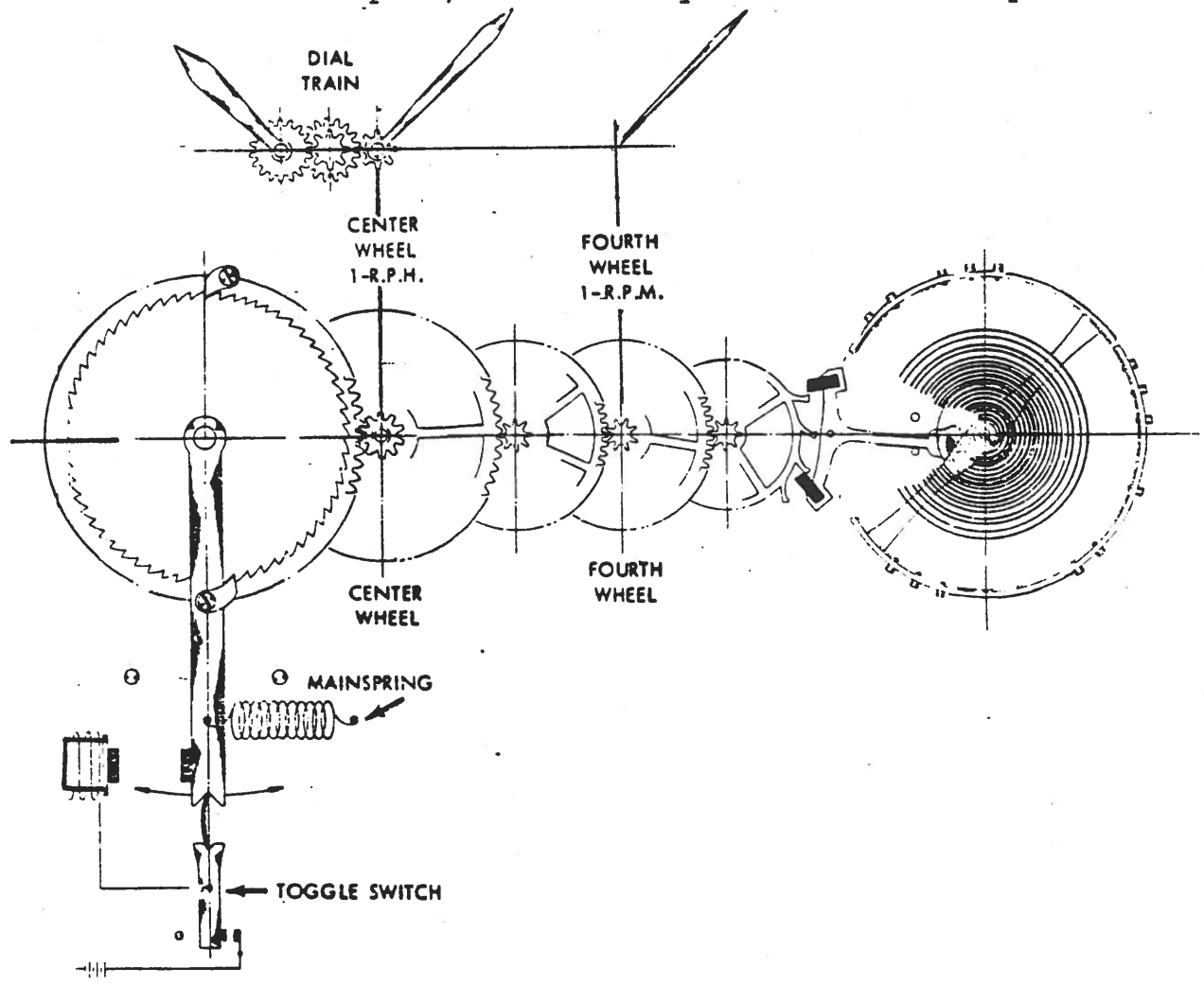



Figure 1. Periodic Electric Winding Automotive Clock Schematic

rewind the clock using an electromagnet. The large, heavy mainspring was replaced by a short coil spring which was capable of running the clock for a brief period of time; usually two to three minutes. A toggle switch sensed when rewinding was required. The effectiveness of this switch was increased by using the "mainspring" tension to close the contacts. This approach is shown schematically in Figure 1. (Figure 1 and all subsequent figures show the movement as though it is a straight line movement. This is done for clarity as, in reality, movements were not this simple.)

The companies producing automotive clocks using periodic electrical rewinding systems included the New Haven Clock Company (stopped production in 1956), the Westclox Division of the General Time Corporation, and the George W. Borg Corporation. These clocks suffered from contact problems due to the large current requirements, particularly when used in 6 volt systems. Some automotive clocks using this approach are still in production.

The second general type of automotive clock relied on electromagnetic impulses to maintain the balance wheel in motion. These clocks did not use mainspring and, indeed, had no provision for storing energy except for the restoring power of the hairspring. Figure 2 is a schematic of this type of clock.

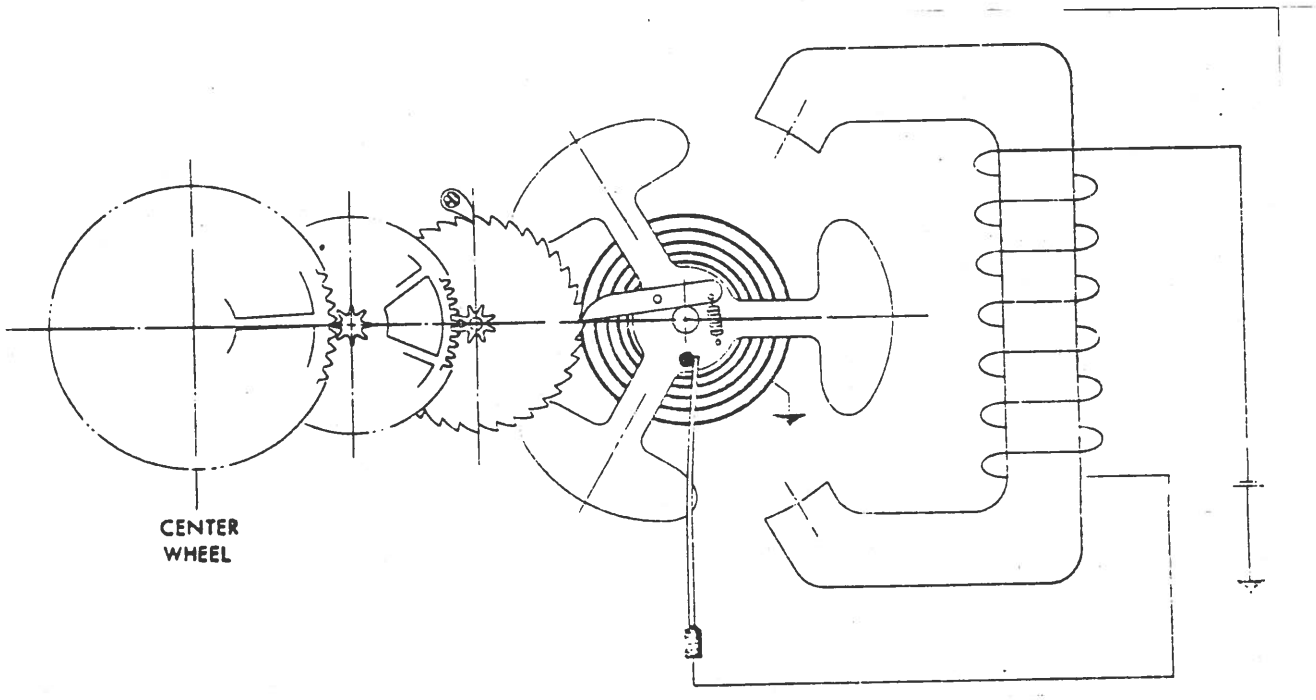



Figure 2. Electromagnetic Impulse Automotive Clock Schematic

In this type of clock, an escapement is not used. Instead, electromagnetic impulses are used to maintain the balance wheel in motion. These impulses are synchronized with the balance wheel by incorporating the electrical contacts on the balance wheel. Typically, impulses were provided two to five times per second. The balance wheel also incorporates an indexing mechanism to drive the train. The Jaeger Watch Company produced automotive

clocks which were based on this principle until approximately 1957 when they ceased production.

The Delco Appliance Division of General Motors also produced a form of electromagnetically impulsed automotive clocks although, perhaps, it is better to describe these clocks as being based on an electromagnetically coupled design. This approach is shown schematically in Figure 3. In this system, the electromagnet has dual pole pieces with one pair of poles driving the balance wheel and the second pair of poles indexing an armature. This armature drives the train. This approach relieved the balance wheel of the burden of driving the train although the balance wheel still was required to close the electrical contacts. The rim of the balance wheel is quite sophisticated and is designed to provide an optimum air gap. Delco ceased production of these clocks in 1955.

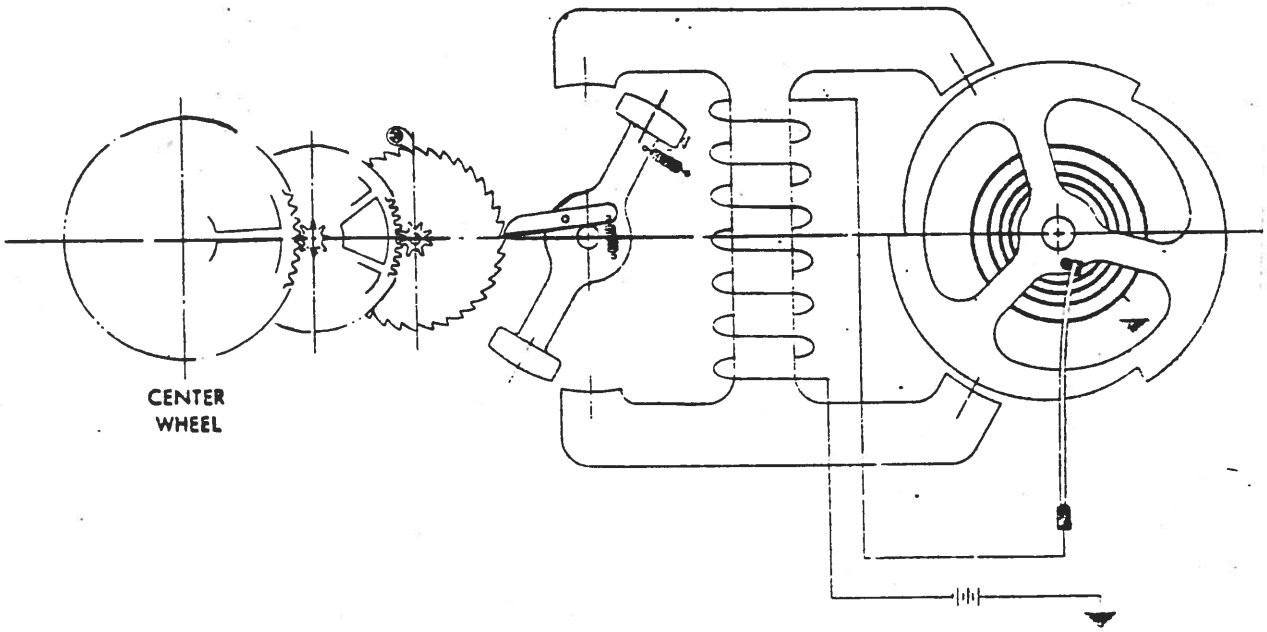



Figure 3. Electromagnetically Coupled Clock Schematic

The electrical contacts were still the main problem with the electromagnetic impulsed automotive clocks, particularly when the limited energy stored in the balance wheel and available to close electric contacts is taken into consideration.

One additional design of electric automotive clocks deserves mention although this design is not an "electro-mechanical" clock. During the mid 1950's, the General Electric Company entered the automotive clock market. The GE design involved a small, direct current motor designed to stall at a torque just necessary to maintain the balance wheel in motion. A spring coupling between the fourth wheel of the clock and the motor made it possible for the motor to rotate in a series of small, rapid steps which were intended to minimize arcing between the motor brushes and the commutator segments. This design is shown in Figure 4. Evidently, the GE automotive clocks were not readily accepted by the automotive companies as GE was no longer participating in the market in 1961.

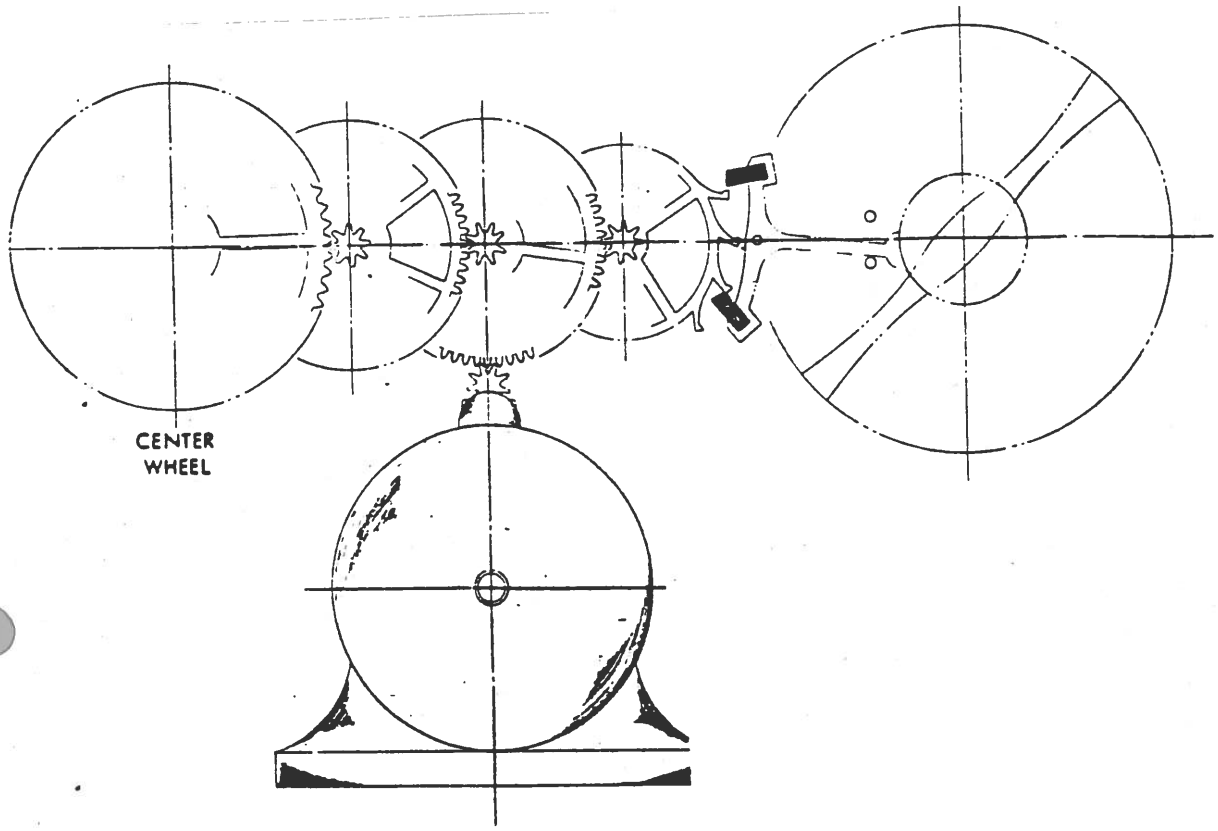



Figure 4. D.C. Motor Driven Clock Schematic

So ends this brief survey of automotive electro-mechanical clocks. The next generation of automotive clocks saw the introduction of quartz crystals as a means of controlling frequency followed in short order by the use of purely electrical (or electronic), digital clocks. These digital clocks are usually a part of the radio and are hardly recognizable as clocks at all. The next time you see an old automobile clock, stop and look again. These clocks are interesting, easy to work with, relatively inexpensive, and available.

H. W. Ellison 12/12/85

NOTICE: ALL MART ANNOUNCEMENTS ARE PRINTED FREE! Send material to, M. Feldman, 6 Stewart Place, Spring Valley, N.Y. 10977

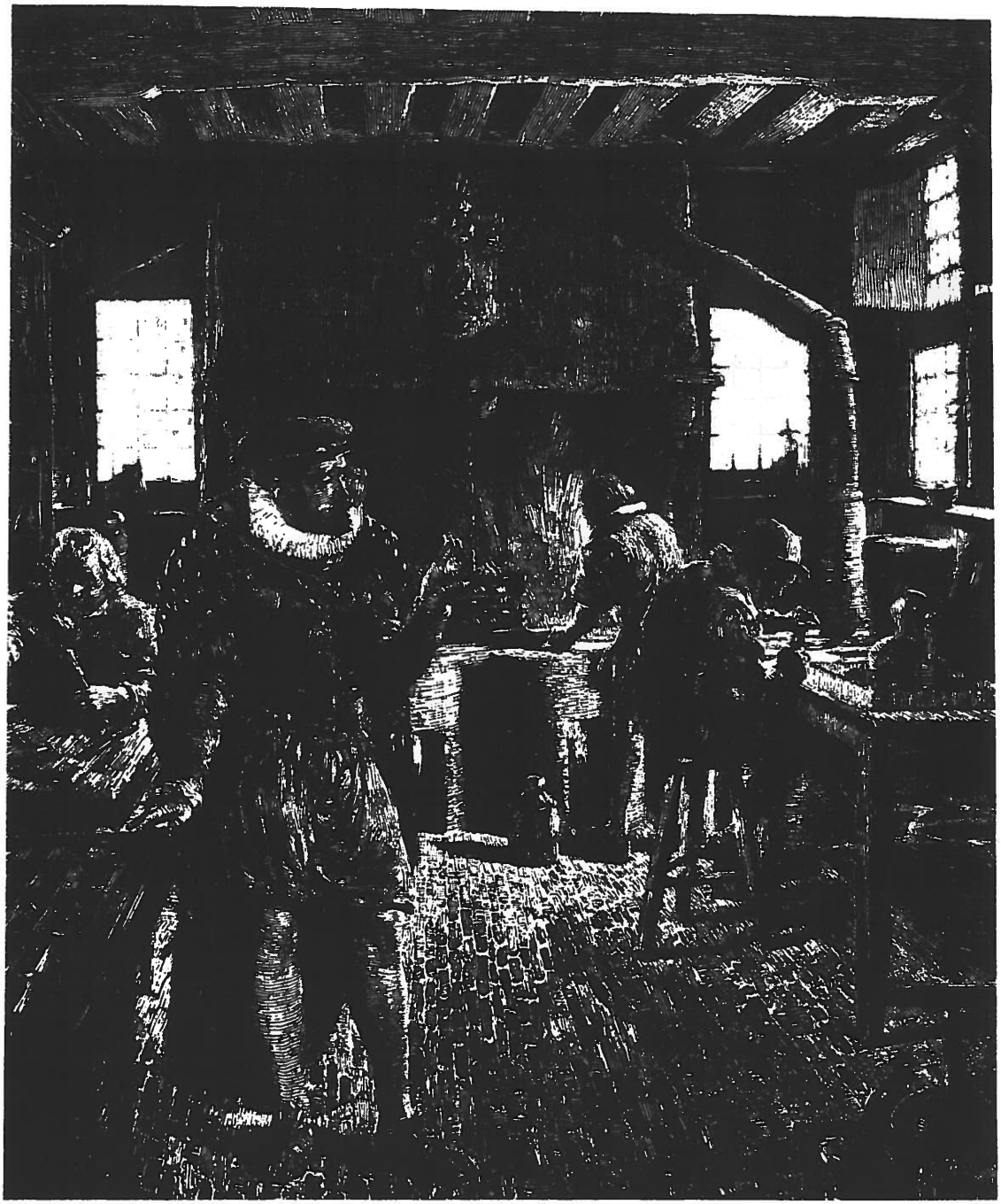
WANTED: Information, pictures, copies of ads for Waltham Electric Clock Co. wall clock having 90 beat pendulum, 10" dial with no seconds bit. Anthony Prasil, 2179 Titus Ave. Rochester, N.Y. 14622

FOR SALE: VERY HIGH QUALITY EARLY BATTERY CLOCKS for the serious collector by Synchronome, Gents, Vaucanson, Leroy, Fully restored. C. Roth, 2 Circle Lane, Roslyn Heights, N.Y. 11577

WANTED: "Junker" early battery clocks, movements, parts, etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. M. Feldman, 6 Stewart Place, Spring Valley, N.Y. 10977

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK USING ORIGINAL PARTS. One month maximum time for all repairs. M. Feldman, 6 Stewart Place,Spring Valley, N.Y. 10977

WANTED: Unusual Electrical Clocks, A. Marx, 105 Bayeau Rd. New Rochelle,N.Y. 10804



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