# THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78
NATIONAL ASSOCIATION OF WATCH & CLOCK COLLECTORS

## VOLUME XXIV #1, MARCH 1999

Fellow Horologists:

This issue, the first of 1999, contains the annual dues notice requesting $10 for domestic members and $15 for foreign members, unchanged for more than 25 years! Where else can you get such a bargain?

The good news is that the updated version of our master index of all previously published material is enclosed as part of this issue. Copies of any past issues or articles are available from Dr. George Feinstein, Chapter Historian, at a cost of $4 an issue or a quarter a page plus postage. George's address appears at the bottom of the Mart section. Please state clearly whether you want a specific article or a complete issue including the article.

We are indebted to H. William Ellison (Bill), one of our directors, for preparing the index. If any errors are discovered, they are deliberate, in an attempt to provide something for everyone, including the nitpickers.

Additionally, we have an interesting letter from Chris Brooks describing a Moser-Baer of Sumiswald master clock, and requesting any available additional information. Also we include a letter from 1921, provided by Steven Berger, describing the finances of The National Clock & Mfg. Co. of Chicago. Publication material for the Journal is still needed, please keep this request in mind.

Enjoy this issue, good reading ahead.

Martin Swetsky, FNAWCC, President
Harvey Schmidt, FNAWCC, Co-Editor
Dr. George Feinstein, Co-Editor

HARVEY SCHMIDT, FNAWCC, Secretary-Treasurer, 75-80 179th ST. FLUSHING NY 11366

Dear Fellow Members;

Enclosed find my check for $10.00 in payment of my dues for 1999.

Has anyone any information on a master clock made by Moser-Baer of Sumiswald? I believe it is Swiss. It uses a weight driven movement with dead beat escapement which has an electric rewind mechanism. It has a massive seconds pendulum of about 16 pounds. The hands are not driven directly by the movement, but are stepped ahead by a pair of magnet coils which are alternately energised as the pendulum swings, by contacts located above the suspension spring stud. These coils act on either of a pair of two bladed wheels located behind the dial. These wheels are out of step by a quarter turn. There is a center sweep hand.

The clock at this point consists of only a movement, dial, & pendulum. It is mounted on a large board, & is just as I bought it some years ago. The weight rewind system is run by a synchronous motor of the Telechron variety, at 120 VAC, while the hand stepping system operates on 24 VDC. Someone has constructed a small power supply to cover these requirements, & it will do for now. I'll come up with something better after I get the clock going.

There are a couple of things missing. Not the least of these is the suspension spring. I am of the opinion that this should be fairly substantial due to the weight of the pendulum. The stud slot & the pendulum slot both measure 0.085". Any suggestion as to spring thickness would be greatly appreciated. I can make the assembly without too much trouble.

Another difficulty is the lower limit switch. The upper limit switch is there, a slotted arm thru which the weight cable goes, & containing a mercury switch. When the weight gets to the top, the switch opens. I can't run it on just one switch because there would be excessive cycling. I can provide some kind of limit switch to sense the weight at a lower point, & wire it to a relay configured as a latch, but I'm not sure this is what was done originally. Any thoughts?

Located just above the pendulum, on the rod, is a moveable rectangular shelf perhaps just over an inch long by 3/8" wide, with a concave hole in it. Could this be some kind of weight shelf for spherical weights of different sizes?

I had an odd thought concerning the limit switches. The existing limit switch is mounted on the back frame of the clock below & to the left of the cable drum. The cable drum is mounted on what would usually be the center arbor. With 8 grooves in the drum, this would seem to give about 8 hours of power available. On the back frame, below & to the right of the cable drum are a pair of tapped holes where another limit switch assembly might be mounted. Consider 6 turns of cable & the free end not anchored in the existing slot in the drum, but leading down thru another slotted arm limit switch assembly & ending in a counterweight. As the driving weight is on the

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# THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78

NATIONAL ASSOCIATION OF WATCH & CLOCK COLLECTORS

## INDEX OF THE JOURNAL OF THE ELECTRICAL HOROLOGICAL SOCIETY

### INTRODUCTION

The following pages contain the Index of the Journal of the Electrical Society. This Index was developed primarily for use by the collector of electro-mechanical clocks and the intended purpose of the Index is to locate information concerning a particular clock. As a consequence, if a clock is commonly referred to using different names (i.e. "Gents Pul-Syn-Etic" and "Pul-Syn-Etic") articles will be indexed under both names. In instances where companies operated under different names such as is the case with I.T.R., IBM, and Simplex; the information contained in this Index is listed under the name which was in use when the information was produced.

In searching for information concerning a particular clock, users are encouraged to examine the information with the latest date first and to then work backward in time. This is not a criticism of earlier authors; it is just that, over the years, a great deal has been learned about electro-mechanical clocks. Also, many of the later articles used earlier articles as a source of information.

During the period of time from May 1976 until June 1981, Dr. George Feinstein edited a Question and Answer column entitled "The Electric Time Machine." Subjects covered in the Electric Time Machine are noted in the Index. However, information contained in the Electric Time Machine is usually relatively succinct.

Different numbering systems were applied to the Journal over the years. As a consequence, it was decided to use the month and year of the Journal as the means of identifying each Journal. Some issues of the Journal are originally identified as covering several months. Only the first month is listed in the Index. For example, the masthead for the issue originally identified as Volume XI, Issues #5-6 is dated October-December 1985. In this index, this issue is identified as the October 1985 issue.

For those who have back issues of the Journal available, two issues need to be dated in order to bring them into agreement with this Index. The first is the issue that was mailed out during the first part of 1987 and has no date or volume identification. The first page of this issue begins as follows:

> "Fellow Horologists:
>
> In this, our second issue of the EHS Journal....".

This issue of the Journal should be identified as "April 1987."

The second issue that needs to have a date added follows immediately and is identified as Volume XIV, #1. A date of "January 1988" should be added to this issue.

This Index is based on earlier indexes of the Journal of the Electrical Horology Society prepared by Marty Feldman, the original editor of the Journal who served for 15 years. Particular thanks are extended to Marty for all of his efforts on behalf of electrical horology. Special thanks are due to he editorial committee of Messrs. Martin Swetsky and Harvey Schmidt, and Dr. George Feinstein who have kept the technical and interest level of issues of the Journal consistently high. This was particularly evident as I updated the Index of the Journal and reviewed the articles of the past several years. Information regarding corrections and/or additions is always welcome.

Bill Ellison January 1999

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# THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78 National Association of Watch & Clock Collectors

## MEMBERSHIP (NEW & RENEWAL) FORM - 1999

Please print all information:

NAME_____ NAWCC#_____

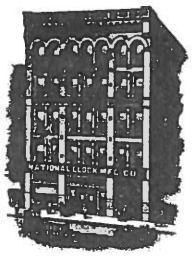
ADDRESS_____

PHONE NO._____E-MAIL_____

I wish to RENEW/ESTABLISH my membership in the Electrical Horology Society, NAWCC Chapter # 78 and enclose my $10 dues for the year 1999.

SIGNED:_____DATE:_____

HARVEY SCHMIDT, SECRETARY-TREASURER 75-80 179TH STREET, FLUSHING NY 11366



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20 WEST LAKE ST.

# The NATIONAL CLOCK & MFG CO.

CLOCK & HIGH GRADE SPECIALTIES

TELEPHONES CENTRAL 8860
CENTRAL 8861

W.E. HUNTER,
PRES. & GEN'L. MGR.
B.W. EVANS,
SECY & TREAS.

THE TIME TO STRIKE IS ALL THE TIME

October 29th., 1921

Mr. Carl P. Nachod,
4777 S Louisville Ave.,
Louisville, Ky.

10/29/21

Dear Mr. Nachod;

We have before us your inquiry of the 19th., and although you are not a stockholder of record on our books and it is not our policy to give out reports under similar circumstances, we are, nevertheless, answering your letter by reason of the fact that your business is with Marshall & Company official brokers handling our issue; Therefore the following are answers to your questions in numerical order to correspond with our letter of the above date;

1 -- The Company was incorporated in Illinois in 1901.

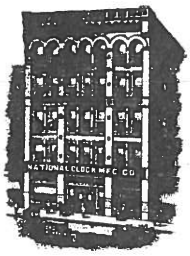
2 -- Authorized Capital Stock $500.000.00; The original capitalization however was $250.000.00 and increased to $500.000.00 in November 1912.

3 -- Pab value $10.00 Per Share.

4 -- Being all common stock, no preferred and no Bonds.

5 -- We cannot answer this question directly but will state that could could not be bought at this time at any such price as $30.00, same being held absolutely intact.

6 -- We do not list either patents nor good-will in our statement of assets for the reason that it is an impossibility to place a valuation on the same. We will say, however, that one of our assets of increasing value has been and is our property and leasehold at the above number; On April 15th., 1913 a very attractive proposition to the corporation was accepted and the Five Story Brick and Cement Building now occupied by the Corporation and a ninety nine year lease on the ground thereto was purchased by the Corporation and the developements since has greatly increased the value of the property and which proved the wisdom of the Directors in the completion of the deed, as we are located at State & Lake Sts which is now the heart of the loop district and we are now surrounded skyscrapers, the latest complete building is the new



OFFICE AND SALESROOMS
20 WEST LAKE ST.

TELEPHONES CENTRAL 8860
CENTRAL 8861

The NATIONAL CLOCK & MFG. CO.

CLOCK[illegible] SPECIALTIES

W. E. HUNTER,
PRES. & GEN'L. MGR.
B. W. EVANS,
SECY. & TREAS.

THE TIME TO STRIKE IS ALL THE TIME

Chicago Theater just opened this week and conceeded to be the largest in the World.

7 --Audits have been made periodically by Certified Accountants, the last audit having been made by the Banker's Audit & Appraisal Company.
The dividends have been materially in excess of 30% prior to the date of the necessary refinancing to handle the vast increase of business.

8 --We have estimated this year's earnings at $145.000.00

Io-Mr. Chas. A. Perry, Superintendent of the Retail Stores of Marshall Field & Co., is Chairman of the Board of Directors.

With regard to our assets and liabilities will state that our liabilities are $73.918.86 against assets of $370.304.42.

| | | |
|---|---|---|
| I— | Capital Stock Preferred | None |
| 2— | Capital Stock Common | |
| | Authorized | $500.000.00 |
| | Unissued | 196.140.00 |
| | Total Issued | $303.860.00 |
| | Treasury Stock | None |
| | Outstanding | $303.860.00 |

It must be understood of course that when the balance of the stock is issued, it will materially increase our assets for the reason that we have more orders on hand, and which by the way has always been the case, that we have facilities to handle and we are therefore forced to sublet contract every day of our performance on account of this condition.

Our business has increased 300% in the last three months and the indications are that this will more than double within the next sixty days.

Trusting the above information will serve you we are

Yours very truly,
NATIONAL CLOCK & MANUFACTURING COMPANY

WEH/H

President.

**TRAVEL:** If you come to **SWITZERLAND**, you are welcome to visit my collection. Michel Viredaz, Home +41 21 784 05 38, Work +41 21 924 23 31, Fax +41 21 924 45 29, E-mail michel.viredaz@nestle.com

**STOLEN: BULLE** wall clock. Very unusual light oak wooden case w/ front door. Approximately 16" tall. Painted round dial w/ rolled brass edge. Dial paint flaking off in various places. Stolen 11/3/98. If you see clock contact Detective Ken Woellert, Cincinnati Police Dept. At (513) 357-7529 or District 2 at (513) 352-3591. Or contact Jerry Hahn at (800) 733-3298. Cash reward for information leading to the recovery of clock and conviction of persons responsible.

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Requests for reprints of previously published material should be directed to the Chapter Historian:
Dr. George Feinstein 75-19 195th Street Flushing, NY 11366

Continued from pg. 2.

center arbor, the weight required won't be a lot, & the driving weight would only have to exceed the counterweight by that much. Consider the driving weight to be fully wound up.The upper & lower limit switches are wired in series. As the driving weight descends, the upper switch closes. As the counterweight rises & lifts the lower limit switch, it closes & a multi-pole relay is enabled. One normally open contact now closes, starting the rewind motor, & another normally open contact that is wired in parallel with the lower limit switch also closes. As the counterweight descends, the lower limit switch opens, but the parallel relay contact keeps the rewind motor running until the rising driving weight opens the upper limit switch, stopping the motor. Incidentally, there does not seem to be any maintaining power. I would guess that a pendulum of this weight would not lose too much arc in the time it takes to wind up the weight, even if the rewind occurred every hour. The cable drum is about 2" in diameter, which means that the weight fall for an hour will be on the order of 6 1/4" or so.

One other note. On the back plate of the weight driven movement is scratched "Simplex Time Recorder Co. Swiss". The only other marking is the stamped number 135.

It is an interesting mechanism that seems worthy of some time & effort. Any help that you could provide will be most appreciated.

Thank you.

Chris Brooks
P.O.Box 226
Seymour, CT. 06483

## — MART —

All MART Ads are FREE, Send copy to the attention of the Editor:
Harvey Schmidt, 75-80 179th St., Flushing, NY 11366. Limit 3 lines.

**WANTED: HOROLOGICAL LITERATURE**, Repair info, Catalogs, etc. for the Journal
**PORTESCAP** Secticon Clock or Movement. Antique Watch & Clockmaker's Tools & Machinery.
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Junker **EARLY BATTERY CLOCKS**, Movements, Parts, etc, send details.
Martin C. Feldman, 6 Stewart Pl., Spring Valley, NY 10977

Plastic Alarm Dial Plate for **SETH THOMAS** 120 v. el. alarm clock, Model POISE E-861-000.
Richard McCahan, P.O. Box 1296, Center Harbor, NH 03226. (603) 253-4110

Two **SWCC** dials, both having 11 1/4" chapt. ring One can be **WU** dial, & other dial w/ sec. bit opening for program clock. Also looking for program tapes for **Std. Elec.** program clck & 2 mag. relays that go behind dial. Larry Leiper, 3713 Boatman's Point, Belleville, IL, 62221 (618) 632 8135, E-mail @: parkerma@apci.net

**SYNCHRONOME MOVEMENT.** Henry Weiland, 8946 W. Grantosa Dr., Milwaukee, WI 53225

**Synchronome, PUL-SYN-ETIC,** or other master clock. Also Brillie wall clock. Need help finding following parts: rate adjustment potentiometer & a 1/2" dial for a Bulle.
Jerry Hahn (800) 733-3298 M-F 9am-5pm

Alarm parts for **HAMMOND** sync. electric clock. Need most of the parts.
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**REPAIR**: ALL EARLY BATTERY CLOCKS Specializing in **BULLE** using orig. parts.
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# THE JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78

NATIONAL ASSOCIATION OF WATCH & CLOCK COLLECTORS

## VOLUME XXIV #2, JUNE 1999


Fellow Horologists:

This issue starts a new series about the famous ELGIN Observatory and the RIEFLER clocks that were left there. When Elgin went out of business, they left the observatory to the school district. When the school needed a location for a gift planetarium, they rediscovered the observatory, which had been laying idle and completely neglected for some 40 years. Upon reopening the facility, they discovered three of the four original Riefler clocks, a chronograph and radio facilities used to transmit time signals, a Warner & Swazey telescope for the transit, and a temperature control system for the clock room!

All of the equipment was in restorable condition, truly remarkable, considering the natural changes occurring over the years. The Riefler manuals from the original installation, done by Riefler's son, were also there and will be reprinted in part, in future journals. Riefler, along with Shortt, and Leroy was noted for the extremely accurate observatory clocks, used extensively during the early twentieth century, world-wide.

Also included herein, is the beginning of a series on PORTESCAP SECTICON clocks, with the escapement covered in this journal, generously provided by the AWI for our publication.

We have been advised of a new edition of the book on EUREKA clocks, to be published shortly by Rita Shenton, the well known British bookseller and author. The book is priced at approximately $45 plus shipping. We have made arrangements for a pre-publication discount price of $35 postage paid, in quantities of 50 or more. The book will have a stitched binding, hard covers and many new photographs and line drawings that were not in the previous edition, now long out of print. Anyone interested send in the attached form with your check. If we fail to get the minimum order of fifty, we will return the checks. It sounds interesting and will certainly be a valuable addition to one's horological library. I have had many inquiries about my health, and am happy to report that I am still on the mend

(Continued on pg. 23)

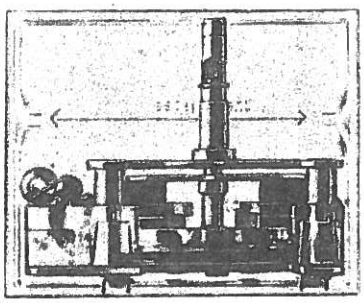
HARVEY SCHMIDT, FNAWCC, Secretary-Treasurer, 75-80 179th ST. FLUSHING NY 11366

# AWI TECHNICAL BULLETIN



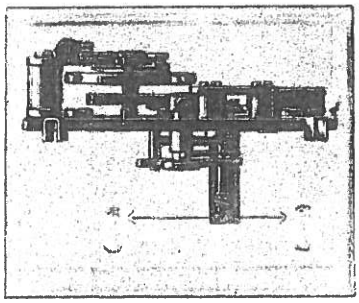
# portescap ®

## Exchange of the units



### Container for the shipment of the units

To simplify the shipment of the motor or regulating units, and to guarantee their protection, a special container is available. It is designed to hold either a motor unit, or a regulating unit. The container being made of transparent plexiglas, it is possible to see which unit is inside. A slightly bevelled edge helps in the stacking of several containers.



### Exchange of the motor unit

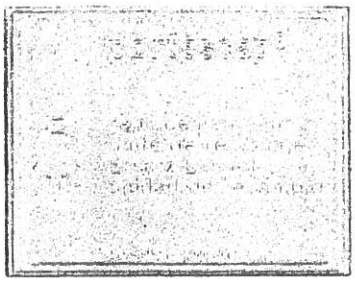
To remove the motor unit to be replaced:

1
remove the protecting cap after unscrewing the two holding screws

2
remove the contact plugs

3
spread the levers under the plate

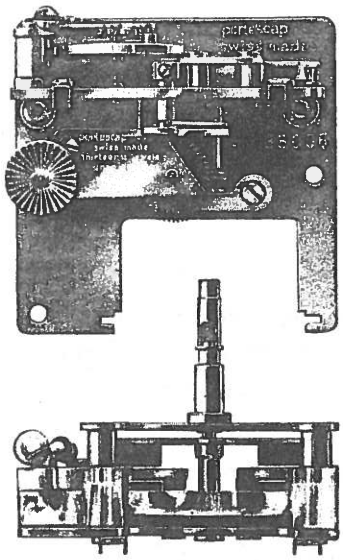
4
grasp the unit between the thumb and index, and pull it out in a parallel motion to the base plate



To replace the new motor unit:

5
spread the levers of the new unit

6
grasp the unit between the thumb and index, point the motor shaft toward the guide hole in the regulating unit; insert the unit completely into the space provided in the base plate and push in the unit completely



7
close the levers

8
replace the cap and tighten the holding screws (make certain that the screws are not too tight)

9
replace the contact plugs in their respective locations.

® registered trademark

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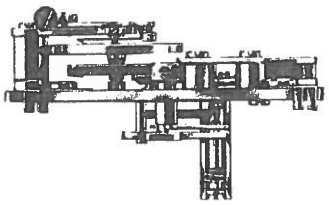
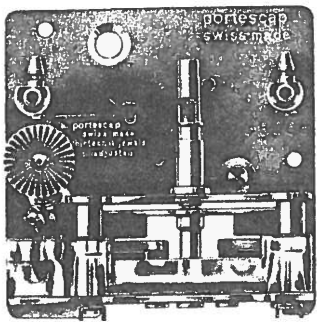
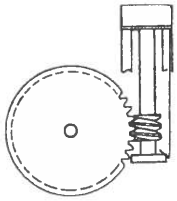




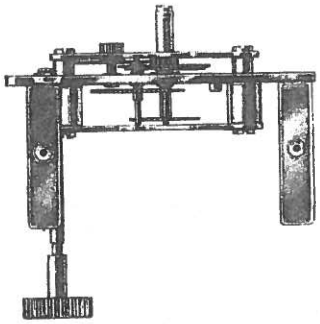
**Exchange of the regulating unit**

To remove the regulating unit to be replaced:
1
remove the protective cap after unscrewing the two holding screws
2
spread the levers as much as possible
3
grasp the plate between the thumb and index, and remove it from the two guiding posts without touching the micrometric regulating screw

To replace the new regulating unit:
4
spread the levers of the new unit
5
bring the unit in place by inserting it into the two guiding posts
6
tighten the levers completely

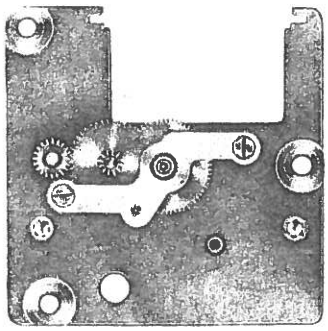
Checking:
7
check that the thin wire spring presses well against the movable bridge and make sure of the relative position of the endless screw and of the second wheel; there should be a little play between the endless screw and its tube when the movable bridge is displaced; if this play is not sufficient, remove the regulating unit and turn slightly the tube of the endless screw; the extreme position is reached when the millings are perpendicular to the plate (in any case, do not go beyond this last position)
8
see that the impulse spring is flat and that it touches neither the detent bridge, nor the motor tube
9
start the motor
10
with the motor running, make sure the seconds hand is properly set, this stopping exactly on 12 o'clock—this is not always the case as there are three positions of the winding wheel (see escapement functioning); if the seconds hand is not properly set, remove and replace the regulating unit until the hand is perfectly centered on 12 o'clock; another solution is to adjust the hand itself
11
replace the cap and tighten the holding screws (make sure the screws are not too tight).

**Base plate with train wheels**

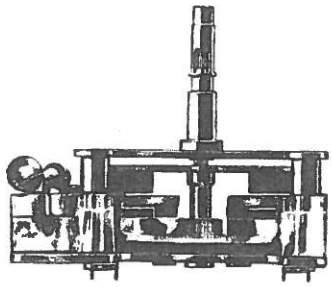


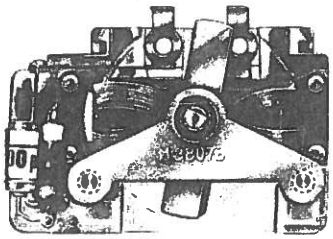
This unit is composed of a plate and two bridges holding the seconds, the minute and the hour-wheels, the third-wheel and pinion, and also the hand-setting stem. An adjusting ring holds the minute wheel.

The base plate has two supporting pillars with two conical posts used to guide and hold the regulating unit.



## Motor unit

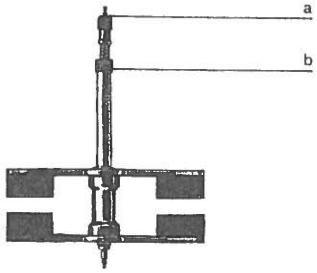




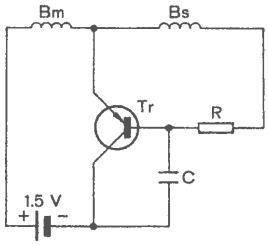
This unit has four elements:
1
a plastic frame with the electric circuits and the transistor, together with the pilot and drive coils
2
a bridge with a tube and bearing for the upper rotor shaft
3
a rotor carrying two thin plates which are parallel and similar; each one has at both ends a permanent and polarised magnet of very high quality; a starting pinion (b), an arming pinion (a) geared to the regulating unit
4
a lower plate for the assembling of the unit and with an Incabloc shock-absorber for the lower rotor shaft; this plate also carries the levers holding the motor unit to the base plate.

Functioning of the motor unit

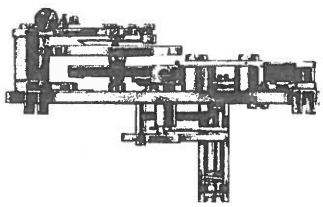
When the rotor is between the coils, the transistor does not let the current go through. In rotation, the rotor makes one of the pairs of magnets go over and under the pilot coil, inducing a tension which opens the transistor. The current from the battery can then go through the drive coil.

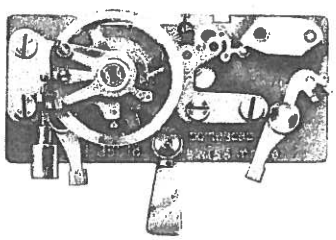



In going through the drive coil which, at that time, is in the magnetic field of the opposite pair of magnets, the current creates a rotation force making the rotor turn. The rotation speed can vary from 500 to 1000 revolutions per minute, depending on the voltage of the battery. However, this variation of speed has no influence on the functioning of the regulating unit, nor, therefore, on the precision of the movement.




## Regulating unit





This unit which is a magnetic escapement system with constant power of an entirely new type, has nine elements (see figures):
1
a plate which holds the pivots of the wheels, the pillars of the detent and balance bridges, the eccentric of the reverse block stop, and the levers holding the regulating unit to the base plate; this plate also has a guide hole for the tube of the motor unit
2
a tube riveted to the plate and having a movable bridge in which a bearing is pushed to serve as lower housing to an axle with endless screw; this movable bridge is under constant pressure from a spring wire working in the angle formed by the shape of the movable bridge and that of its pin
3
a plastic detent wheel, with three segments, a star with three points, in relation to the segments of the detent wheel and riveted to it; the system is fixed to an axle with endless screw and two pivots; the lower pivots in the bearing of the movable bridge and the upper in the bearing of the detent bridge
4
a detent with an edge where a detent spring and a protective blade are riveted; the detent has a stop pallet, a starting pallet, a jeweled pallet, and a magnetic attraction stem; the detent pivots with a staff between the plate and bridge

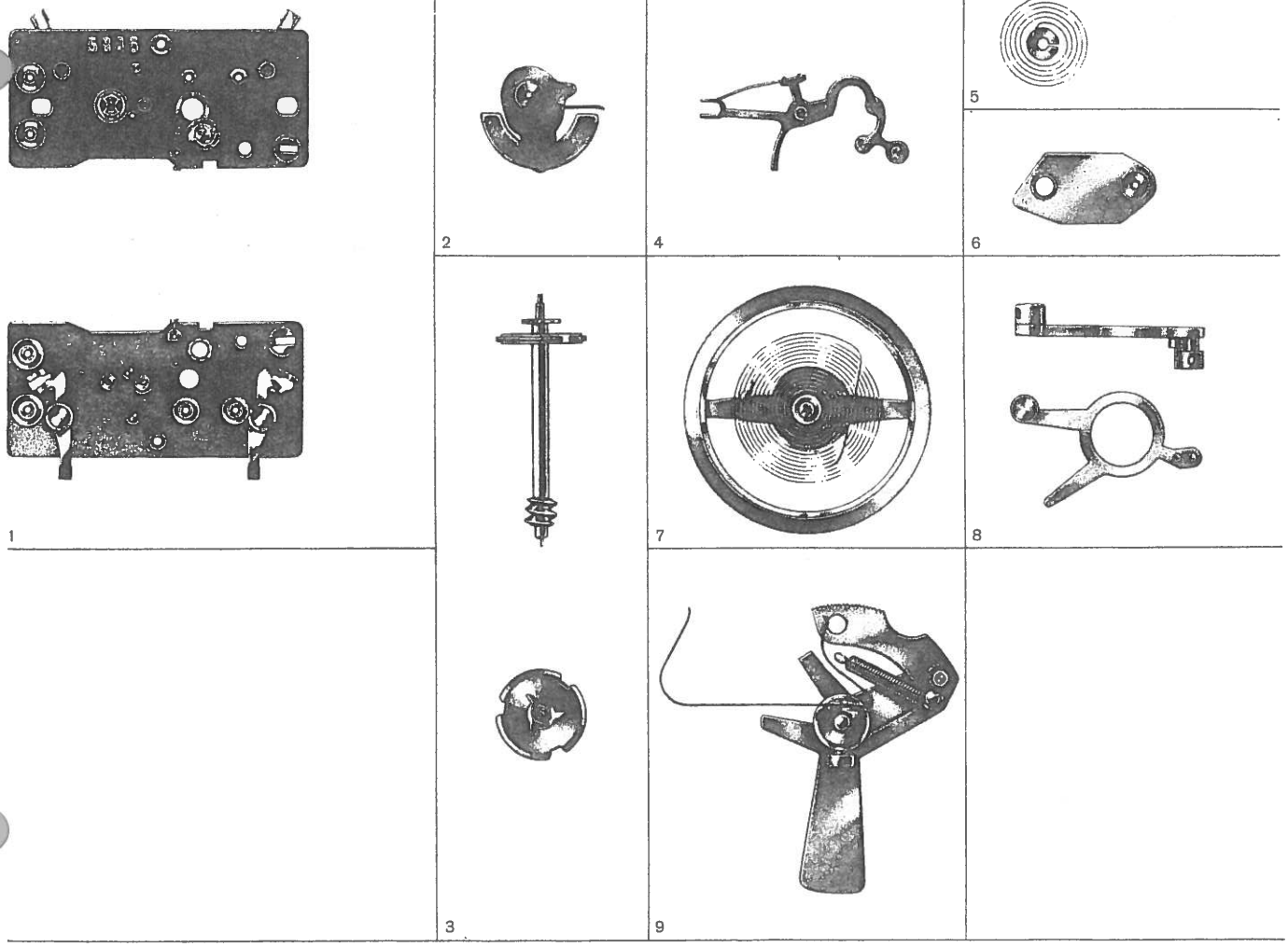
5
an impulse spring attached, on one side to a ring which is part of the detent staff, and on the other side to a stud held securely on the plate

6
a permanent magnet held by two small plates; this assembly is mounted on the plate with an eccentric, which permits true orientation (once the setting is made, a tightening screw prevents any shifting)

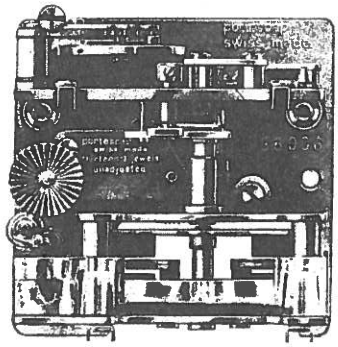
7
a very heavy nickel circular balance wheel attached to a Breguet self-compensating hairspring with a special thermoelastic coefficient of $\pm 0.2$ s/°C/24 h; the roller with jewel is on the staff of the balance wheel; the very fine pivots are protected with an Incabloc shock-absorber

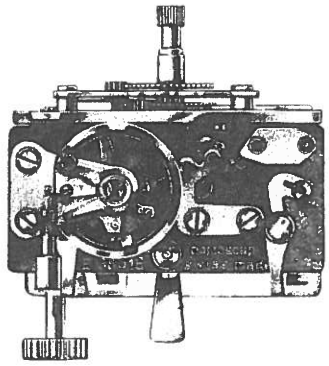
8
a regulator with a special key allows for the setting of the hairspring shake with great facility; the regulator is held only by a friction spring of light pressure; therefore, it turns very freely around the Incabloc shock-absorber; another spring blade attaching the regulator to the micrometric setting screw permits extremely delicate adjustments of fractions of a second per 24 hours

9
a stop lever, riveted to an axle under the plate, bears a starting rack with a return spring geared to the starting pinion of the rotor axle; above the plate, the axle with the stop lever operates a stop spring blade with the help of a collet which puts the detent back in its balanced position and pushes against the roller for the start or for the stop.



## Functioning of the Portescap movement





When the Portescap movement is stopped, the arming pinion is at the level of the detent wheel, and the endless screw interlocks with the second wheel. The hairspring balance wheel assembly is, in its balanced position, entirely free, while the detent is submitted to the tension of the impulse spring.

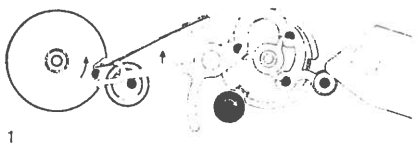
By moving the starting lever from its rest position, the rack gears with the starting pinion of the rotor. At the same time the stop blade has brought back the detent to its balanced position, that is to say against the reverse block stop, and has armed the impulse spring. The stem of the detent is now in the magnetic field of the permanent magnet which holds it back. This movement of the stop blade has moved the balance from its balanced position, while arming the regulating hairspring.

If the stop lever is released abruptly, it will immediately return to its rest position because of the return spring, and the movement will start. If, on the contrary, a restraining action is applied to the spring, the impulse is not sufficient to start the rotor and it will remain immobile; however it will free the balance wheel which will oscillate somehow, and make the detent return to its first position. The movement therefore does not run.

Figure 1
To make it easier to study the different steps, let us suppose that the balance wheel has been stopped without the use of the stop lever, so that the rotor is still turning. The winding pinion is found in one of the three segments of the detent wheel, because this latter is stopped by an arm of the star against the stop pallet. The detent being in its balanced position, these two movable parts will not interlock, due to the reciprocal position of the winding pinion and the detent wheel.

Figure 2
When the hairspring balance wheel assembly, by its roller jewel, moves the detent, it induces the detent with its detent blade, which presses on the protective blade. This rotation of the detent separates the gravity stem from the permanent magnet until its power is weaker than the torque of the impulse spring, which then acts on the motion of the detent and consequently transmits an impulse to the balance wheel through the roller jewel.

Figures 3 and 4
The impulse ended, the motion of the detent continues, while the stop pallet no longer holds back the star, nor the detent wheel to which it is attached. The starting pallet, at the time, pushes the back of one of the arms of the star. The star, in turning with the detent wheel, gears to the winding pinion, inducing through friction the segment of the wheel to the next slot, where it turns continuously. During the rotation of the detent wheel, one of the arms of the star pushes the jewel pallet of detent to bring it back to its balanced position where the permanent magnet will hold it. This rotation assures at the time the rearming of the impulse spring until one of the arms of the star stops the detent wheel by hitting against the stop pallet. During the return motion of the balance wheel, the detent blade will simply bend, without producing any other movement of the escapement.

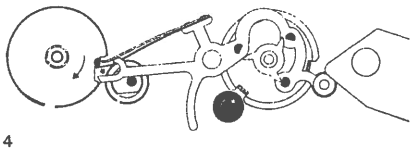


1

2

Each rotation of the detent wheel will push forward the seconds wheel a half second, under the direct but intermittent action of the motor.

3



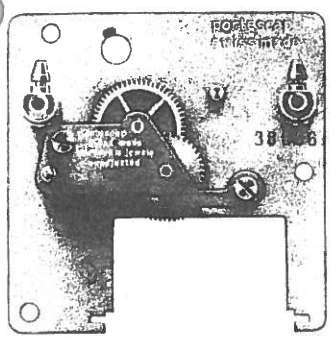
4

For better understanding,
the impulse spring is not indicated

In the usual watch movement, the motive force is transmitted to the escapement directly by the train, therefore all the factors which influence this motive force will have a repercussion on the running. In the Portescap movement, the motive power gives no impulse to the hairspring balance wheel assembly; it simply rearms the impulse spring and pushes the hands, independently of the regulating system.

We can see, therefore, that the speed of the rotation of the motor has no influence on the chronometric precision of the movement. As long as the battery has enough energy to give the motor a torque superior to that of the impulse spring and to push the hands, the Portescap movement functions without any changes in the quality of its adjustment. When this torque becomes too weak, the movement stops, and it is time to change the battery.

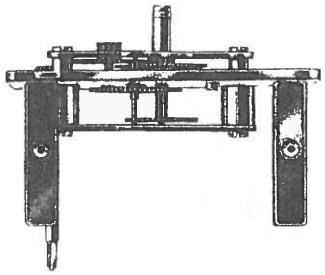
**Base plate with train wheels**



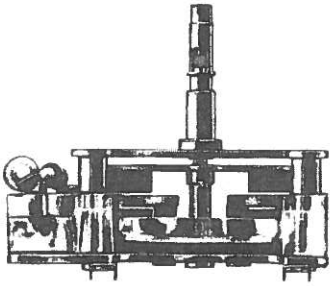
The unit with the train can be disassembled, cleaned and reassembled under usual procedure. Only the minute wheel should not be cleaned, since it works on greased friction.

For oiling, the manufacturers of the Portescap movement recommend the use of Synta-Visco-Lube oil for all pivots, and also for the minute stud.

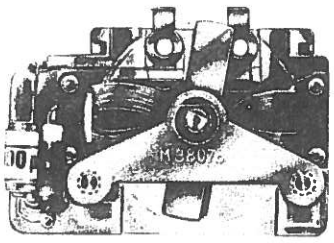
After pushing back the guard ring of the minute wheel, check the end shake of the minute wheel.



**Motor unit**



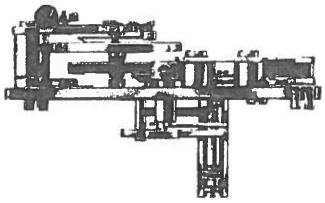
1
unscrew the two assembling screws to separate plate, frame, bridge and rotor
2
clean the Incabloc shock-absorber, using the method recommended by the manufacturers
3
clean the motor tube bearing
4
clean the rotor, making sure that no metal particles stick to the magnets
5
disassemble the winding pinion (this delicate operation should be done only by a watchmaker specially trained and with the proper tools)

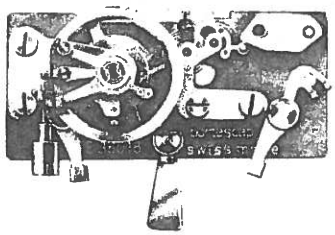


6
carefully clean the frame of the electrical assembly; do not use liquids
7
put a drop of Synta-Visco-Lube oil in one of the notches of the oscillating pinion, put pressure to the pinion to make it rotate, in order to spread the oil evenly
8
reassemble the motor without separating or scratching the coil threads
9
oil the pivots with Synta-Visco-Lube oil.

If a defect in the winding pinion, or in the electrical circuits is noticed, it is recommended that the complete unit be sent back to the factory.

**Regulating unit**





Normally, cleaning and oiling the Incabloc shock-absorber (upper and lower) is sufficient, and there is no need to disassemble anything else.

If a thorough cleaning is necessary, proceed as follows:
1
open the regulator key
2
unscrew the stud screw of the hairspring
3
remove the balance bridge, then the hairspring balance wheel assembly
4
loosen the impulse spring stud screw
5
remove the bridge, then the detent, and the detent wheel (the permanent magnet should not be unscrewed)
6
wash all parts in benzine (the Incabloc shock-absorber should be cleaned separately)
7
replace the detent wheel, the detent and the bridge controlling the end shake (detent staff 2/100 to 4/100 mm, detent wheel 1/100 to 3/100 mm when the movable bridge is pressed down); the end shake of the detent wheel should be very slight because it is responsible for the movement of the seconds hand; if it goes beyond the tolerance indicated above, the hand will vibrate and not move with precision
8
replace the impulse spring stud and tighten its fitting screw, without altering the strength of the spring (only a specially trained watchmaker can control this)
9
make sure that the detent blade is slightly detached
10
check the functioning of the wire spring of the movable bridge; its very weak tension should be exercised freely—if this tension is too weak, the gear of the endless screw and the seconds wheel will not work properly, and the seconds hand will vibrate; if, on the contrary, this tension is too great, the motor will increase its current consumption, the oil between the endless screw and the seconds wheel will disappear, and the movement could stop
11
the oiling will be done with Synta-Visco-Lube oil for
the jewels of the upper and lower Incabloc shock-absorber
upper and lower detent jewels
upper and lower detent wheel jewels
upper and lower pivots of the movable bridge
the flat of the detent jewel (without the oil touching the detent itself)
behind the arms of the star
the micrometric regulator screw notch
the endless screw (it is advisable to oil the endless screw sufficiently, as the use of the oil, at this point, is relatively high)

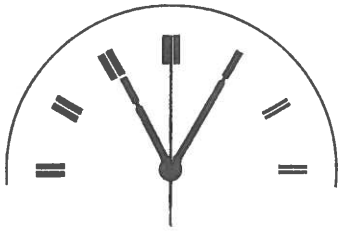
12
replace the hairspring balance wheel assembly and the balance wheel bridge, and tighten the hairspring stud screw

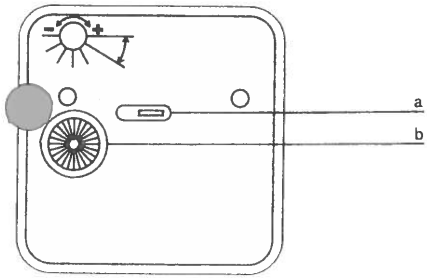
13
control the starting and the centering of the hairspring; turn the key leaving as little space as possible, without however impairing the free movement of the hairspring

14
place the movement in its final position and do not move it for at least 36 hours; this stabilization gives an opportunity for the oil to spread, the movable parts to reach their definite position, and the hairspring to balance its tensions, conditions indispensable to make any correction of a fraction of a second

15
check again the regulation without moving the movement, by using the Vibrograf (oscillations 7200/h); because of the exceptional conception of the Portescap movement, the instantaneous reading corresponds to the actual running condition.

**Time setting**





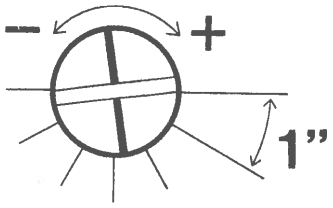

Once the hour hand and the minute hand are adjusted to each other, and the seconds hand is in place, proceed as follows for setting the time:

1
stop the seconds hand exactly on 12 o'clock by using the stop lever (a), then release the lever slowly

2
set the minute hand exactly on one of the dial indexes; the seconds hand will be correct in relation to the minute hand; to turn the minute and the hour hands, press lightly on the hand-setting knob (b) and turn it slowly until it is in gear, then press all the way and turn in the direction wanted

3
start the movement with the stop lever, by releasing it abruptly when the time signal is heard.

**Final adjustment**




Once the movement is cased and set in its final position, and after setting the time accurately, place the clock where it will normally be used, and let it run for about ten days.

Then, during the following eleven days, check each day, at the same time, its accuracy. This control will permit to calculate the slight differences which may occur.

The average daily error can be calculated and it will be easy to make the necessary adjustments, using the micrometric regulating screw. Simply remember that one quarter of a turn of the screw corresponds to a correction of three seconds per day, and that a turn to the right is a gain, and a turn to the left a loss.

For further information on the Portescap movement and its servicing, send inquiries to Incabloc Corp., Fifth Avenue, New York, New York 10019.

# HE ELGIN SERVICE BUREAU BULLETIN

*Subject:*

## *Receiving Time by Wireless*

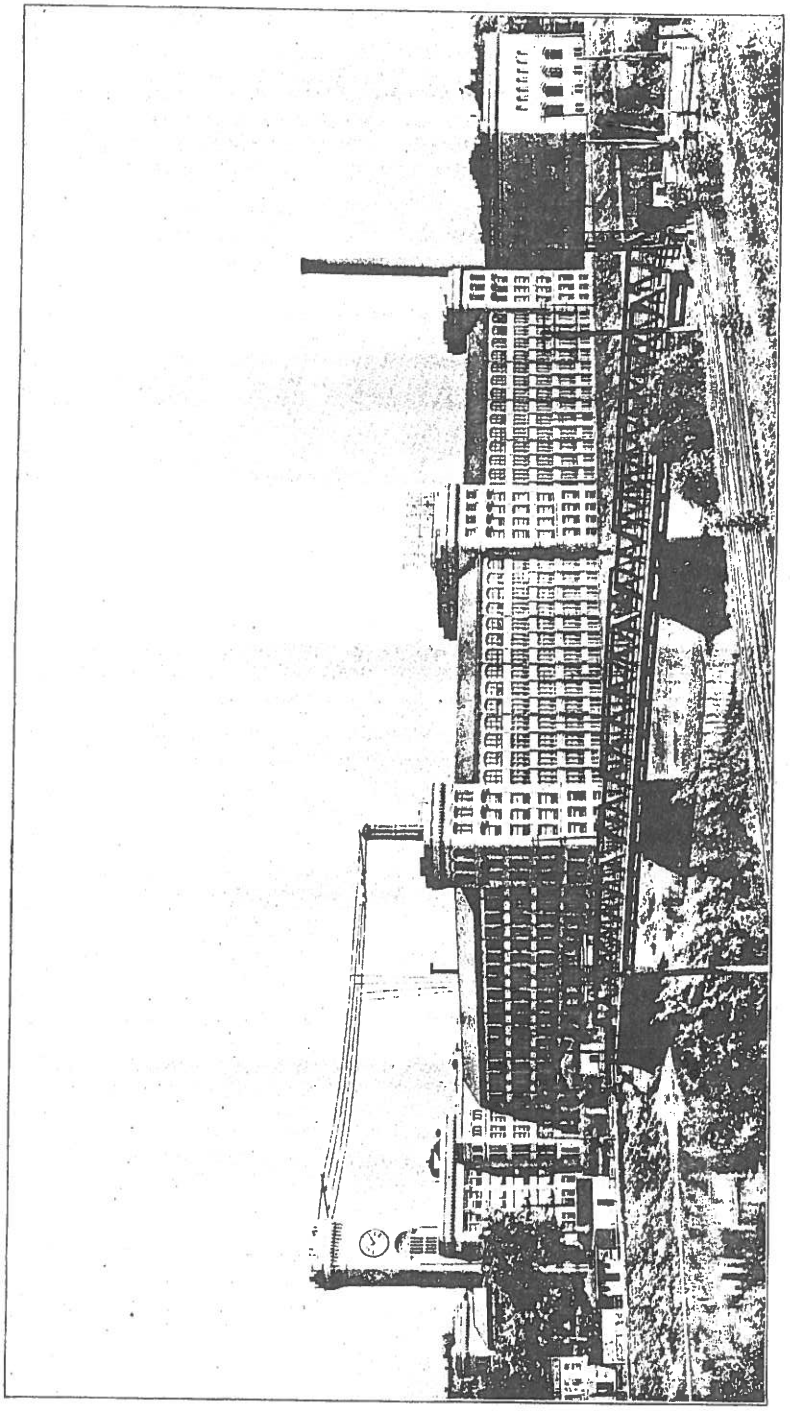
*Issued by the*
Elgin National Watch Company
Elgin, Illinois, U. S. A.

## *RECEIVING TIME BY WIRELESS*

ONE of the most interesting results of the discovery of wireless telegraphy has been its application to the distribution of Time.

Since the completion of the Arlington high-powered wireless station at Radio, Virginia, across the Potomac from Washington, D. C., the Navy Department has been sending broadcast wireless time-signals twice daily, from 11:55 A. M. to 12 noon and from 9:55 to 10 P. M., Eastern Standard Time. The beats of the clock at the United States Naval Observatory are transmitted by wire to Arlington, whence these signals are radiated in all directions by wireless at the incredible velocity of 186,300 miles per second. The Arlington signals can be heard at a distance of 1500 miles over land and at a much greater distance over sea—in fact, the Eiffel Tower Station, Paris, 3800 miles away, frequently hears them.

# *Elgin Service Bureau Bulletin*



ELGIN NATIONAL WATCH FACTORY
SHOWING ANTENNA

# *Elgin Service Bureau Bulletin*

The morning signals start at 11:55:00 (hr. min. sec.) and occur every second of the first four minutes, except the 29th, 55th, 56th, 57th, 58th and 59th seconds of each minute, which are omitted for reference points. During the last minute the signals occur every second, except the 29th, and 50th to 59th inclusive. At exactly 12 noon, Eastern Standard Time, one long dash is given. The evening schedule is identical to the above; it starts at 9:55:00 and ends with the long dash at 10:00:00 P. M., Eastern Standard Time.

Jewelers may now receive accurate time signals by erecting a small Receiving Station, which, when once installed and properly adjusted, occasions no further expense, as the Government makes no charge for its Wireless Time Service. A knowledge of the wireless code is not necessary in order to receive the time signals, and no Government license is required for a Receiving Station.

It is the purpose of this Bulletin to describe a *model* Receiving Station, designed to receive the Arlington Time Signals at a distance of 1000 to 1500 miles. Fig. 7 shows the general plan of the station, the *Antenna*, or overhead wires, (frequently called the *Aerial*) the *Lightning Switch*, the *Ground Connections*, and the *Receiver* Each part will now be considered in detail.

## *THE ANTENNA*

The exact form and size of the antenna will depend upon its location. It is desirable to have it as high and as long as possible; it should be at least 75 feet high and 100 feet long. If the antenna can be placed so as to point toward Arlington it should be made and connected as shown in Fig. 7. This is called the Flat Top Directive Antenna and receives signals best that radiate from stations located in the direction of the arrow.

If local conditions do not permit the antenna to be pointed toward Arlington we should advise either of the types shown in Fig. 1 and Fig. 2.

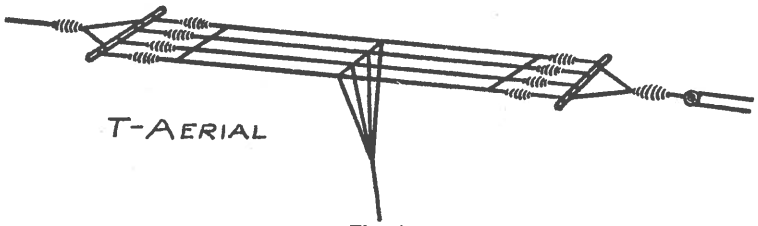



Fig. 1.

The antenna should consist of four wires, each of which should be brought down separately; the four should then be connected together just before reaching the central connection of the lightning switch.

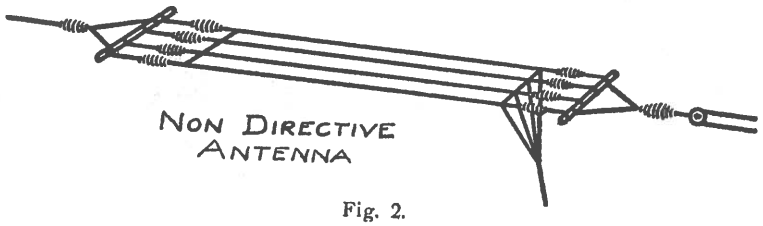



Fig. 2.

In constructing the antenna care should be used in selecting suitable wire. Experience has shown that stranded wire gives the best results. Silicon-bronze wire seven strands No. 22 is used in the U. S. Navy. This wire is manufactured by J. A. Roebling's Sons Co., Trenton, N. J. Phosphor-bronze wire seven strands No. 22 is also suitable for this purpose and can be procured from the Manhattan Electrical Supply Co., Chicago, at four cents a foot. Ordinary bare copper wire No. 14 will do, in fact, this kind of wire is used in the antenna of one of the large trans-Atlantic wireless stations. It is not, however, as desirable as stranded wire. *Never use aluminum wire.*

Electrose Insulators Fig. 3 are suitable for antennae. They are manufactured by the Electrose Manufacturing Company, Brooklyn, N. Y., and can be procured from any electrical supply house. Five and one-half inch insulators are ample for the receiving antenna; these are listed at 60 cents apiece.

Fig. 3.
Electrose Insulators.

The two spreaders can be made of wood. A very neat design for spreader and connections is given in Fig. 4, which is reproduced by permission from the *American Jeweler.*

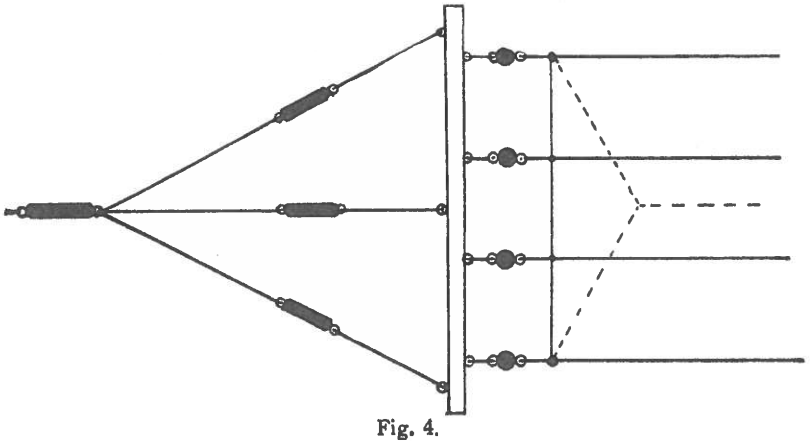


Fig. 4.

Fig. 4 shows the arrangements of wiring and dimensions on one end of the aerial; both ends are alike except for the lead-in wires. The oak spreader is two inches square, 6 feet 6 inches long with ½ inch eye bolt for all wires. Aerial is of 7-stranded No. 20 phosphor bronze. Ball insulators are No. 73 electrose attached to the spreader with No. 12 galvanized wire. The guys are of No. 8 galvanized wire with 8 inch electrose insulators in the guys. The middle insulator is not absolutely necessary, but is advisable on long spans to equalize the strain. All guy wires must be insulated from the ground.

It is desirable to have some convenient method of lowering the antenna in order to replace broken wires or insulators; this is usually accomplished by placing pulleys on the supports if it is not otherwise accessible. The antenna can then be raised or lowered by means of a rope.

## *LIGHTNING SWITCH*

During an electrical storm the antenna acts as a lightning conductor; hence means must be provided for grounding the antenna *outside of the building.* In order to comply with the rulings of the National Board of Fire Underwriters, the lightning switch should be installed as shown in Fig. 7. Fig. 5 shows the switch itself; it should be a standard 100 ampere single pole double-throw jack-knife switch which is listed at $4.20 and can be purchased from any electrical supply house.

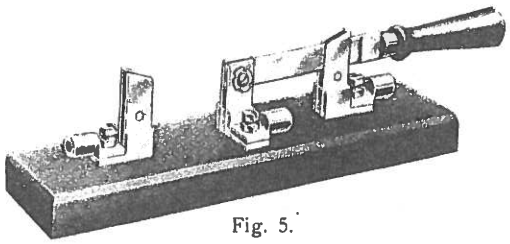
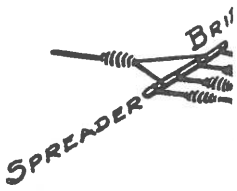


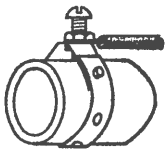
Fig. 5.

At all times when the set is not in actual use, the lightning switch should be left in the down position. *Never attempt to operate your set during an electrical storm.*

## *GROUND CONNECTIONS*




To comply with insurance requirements two separate ground connections are required, one outside the building leading to the lightning switch and one inside the building leading to the receiver. A water pipe makes an excellent ground. The ground wire should be soldered to the water pipe, or attached to it by a suitable ground clamp Fig. 6. A copper


GROUND CLAMP
Fig. 6.

or zinc plate, about 2½ feet square, buried about twelve feet under ground, constitutes a satisfactory ground for the lightning switch. The ground wire from the lightning switch must not be smaller than No. 4 B. & S. gauge and should be of copper. *The importance of good ground connections cannot be too strongly emphasized, as many installations fail in this respect.*

## *THE RECEIVER*

The following paragraphs quoted from a U. S. Naval Observatory communication describe all apparatus necessary for receiving the signals:

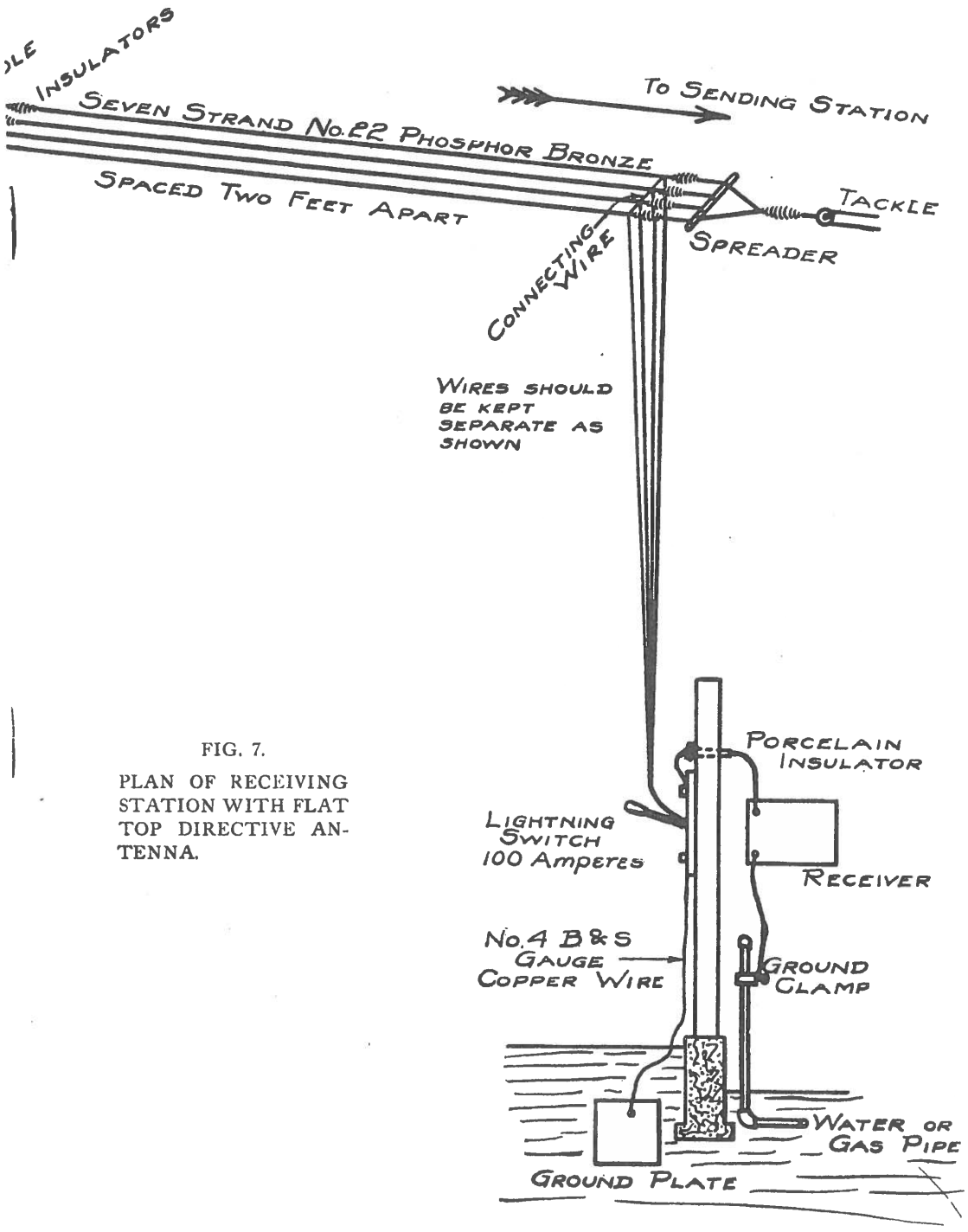



FIG. 7.

PLAN OF RECEIVING STATION WITH FLAT TOP DIRECTIVE ANTENNA.

"The receiving instruments themselves need not be elaborate or expensive; in fact, any one of three or four dealers in wireless specialties can furnish a complete set for $25 or $50 which will serve to receive Arlington at a distance of from 1000 to 1500 miles. The set should comprise the following instruments and should be connected as shown in Fig. 8.

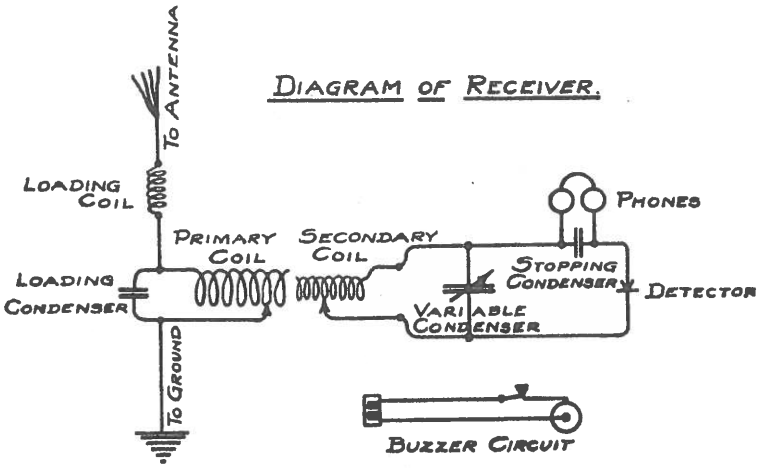



Fig. 8.

"Loose coupled tuning coil, with primary and secondary;

"Variable condenser, for secondary circuit;

"1 set of head phones, 2000 or 4000 ohms resistance;

"1 small stopping condenser for phones;

"1 loading coil, or small condenser for primary;

"1 or more detectors, of any reliable type; The *Perikon* detector, made by the Wireless Specialty Co., is very simple and satisfactory, but is rather expensive. A good galena crystal makes an excellent detector, but one that will not hold its point under heavy static as will one of silicon or iron pyrites. The *Audion* detector is very sensitive and is now being used very successfully.

"A small high-frequency buzzer, packed in a box with cotton and put in circuit with one or two dry cells, may be placed on the table with the other instruments and used to send out waves of sufficient intensity to adjust and get a point on the detector.

" Such, then, is the outfit which will be required to hear the [Arlington] radio signals."

Unless one has had considerable experience along electrical lines it is advisable to purchase a complete receiving set rather than to buy the separate parts and attempt to assemble them. With the following sets we have received the Arlington Time Signals day and night at our Radio Laboratory, Elgin, Illinois:

BLITZEN RECEIVING SET WITH DUPLEX LOADING COIL: Clapp Eastham Co., Cambridge, Mass. This set is illustrated in Fig. 9 and is listed at $39.00.

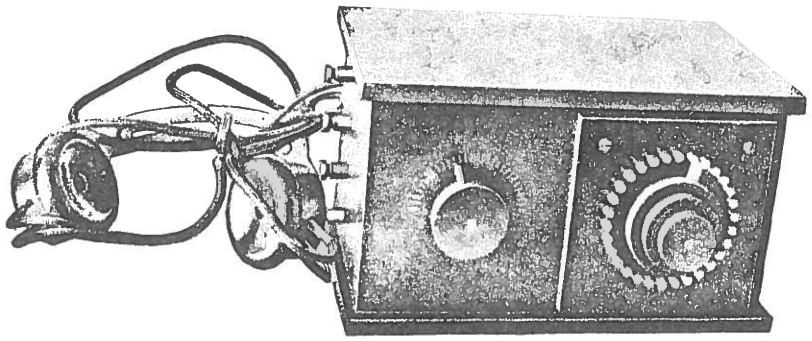


Fig. 9.

MURDOCK RECEIVING SET NO. 505: Wm. J. Murdock Co., Chelsea, Mass. This set is illustrated in Fig. 10 and is listed at $50.00.

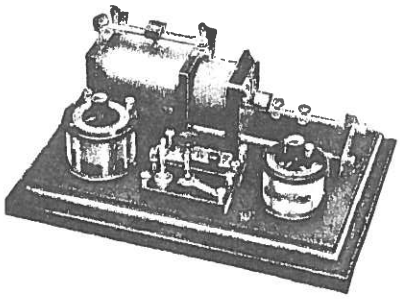


Fig. 10.

## *ADJUSTING THE RECEIVER*

After the receiving station has been installed, the next step is the proper adjustment of the Receiver in order to render the Arlington Signals audible.

Begin with the detector. Place the phones on the head, then start the buzzer (Fig. 7) going and move the needle-point of the detector slowly over the surface of the crystal until the buzzer signals are plainly heard in the head-phones. None of the other parts of the Receiver should be disturbed while effecting this adjustment. Not all parts of the crystal are equally sensitive, so it is a matter of trial to locate the most sensitive part. When the detector is once in accurate adjustment, do not disturb it while the other parts of the Receiver are being adjusted.

To be continued.

Glass Domes for the **Tiffany Never Wind** and other early electrical & battery clocks. If I don't have it in stock I'll try to get it. E-mail www.glassdomes.com
Ben Bowen, Rt. 3 Box 134C, Monticello FL 32344, (850) 997-3797 phone & fax.

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Wining's Clock Service, 2910 Farmdale Rd., Akron, OH 44312 (216) 628-1654

**TRAVEL:** If you come to **SWITZERLAND**, you are welcome to visit my collection. Michel Viredaz, Home +41 21 784 05 38, Work +41 21 924 23 31, Fax +41 21 924 45 29, E-mail michel.viredaz@nestle.com

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Requests for reprints of previously published material should be directed to the Chapter Historian: Dr. George Feinstein 75-19 195th Street Flushing, NY 11366

(Continued from front page)
and coming along, and would like to hear from my friends via e-Mail or Snail mail since my participation at meetings is still limited. I may be reached at the following; mswetsky@prodigy.net, or 15 Hummingbird Lane, Whiting, NJ 08759.
Good reading ahead...

Martin Swetsky, FNAWCC, President
Harvey Schmidt, FNAWCC, Secretary-Treasurer
Dr. George Feinstein, Historian, Co-Editor

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# THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78 National Association of Watch & Clock Collectors

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Please make checks out to: "Treasurer, EHS Chap. #78".

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# THE JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78
NATIONAL ASSOCIATION OF WATCH & CLOCK COLLECTORS

## VOLUME XXIV #3, SEPTEMBER 1999

Fellow Horologists:

As promised, we are continuing the ELGIN Observatory article and the series on the PORTESCAP SECTICON clocks, with the material covered in this journal reproduced by permission of the British Horological Institute.

We were advised by Mr. A.D. Harris, FBHI, Vice President and Past Chairman of the BHI, that they offered in the 1960's, a correspondence course (called Distance Learning) which covered this mechanism along with other battery electrics. The course has been re-written and updated many times since then and may still be available. The BHI is reproducing in booklet form all the movements which were covered in this course. Interested parties are advised to check with the BHI directly, at their address as follows:

British Horological Institute
Upton Hall, Upton, NG23 5TE
England
E-mail: clocks@BHI.co.uk
Web site: http://www.bhi.co.uk

As a reminder to those members who are delinquent in their dues, be advised that this is your **final journal issue**. It would be advisable to keep this in mind, the fact that dues reminders to delinquents cost the chapter money for envelopes & postage, notwithstanding the time and effort on the part of your officers to keep up with the membership status; to monitor which ones get reminders, and which must be removed from the computer's mailing list, often to be reinstated a short while later. If your chapter membership in any way displeases you, it would be to our mutual advantage to engage in a dialog with an eye to making changes, additions, or correcting omissions. Let's hear from you!

Good reading ahead, enjoy this issue.

Martin Swetsky, FNAWCC, President )
Harvey Schmidt, FNAWCC, Secretary-Treasurer ) Co-editors
Dr. George Feinstein, Chapter Historian )

## XV.—THE SELTICON BATTERY DRIVEN CLOCK

The **Selticon** electric clock is a complete breakaway from any other



type of battery powered clock so far in production (1962). It is made by Universal Escapements Ltd., of La Chaux de Fonds, Switzerland—the manufacturers of the Incabloc shock-resistant bearings.

There is no mainspring. The dry battery gives the power to drive a small electric motor, which runs continuously at a speed of about 1000 r.p.m. By an ingenious arrangement this motor then drives the escapement, which is a unique type of remontoire lever escapement controlled by a typical balance and spring, receiving impulse during one direction of its swing ; it beats half seconds. The escapement, in turn, drives the motion work, through worm gearing.

Fig. 7 is a photograph of two of the Selticon models, from which it will

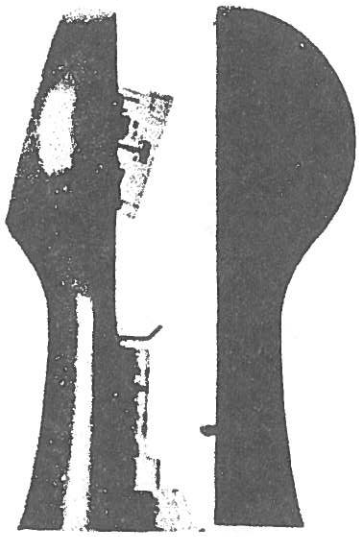


*Fig. 8.*

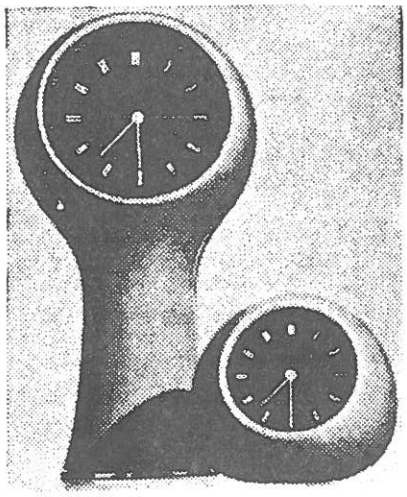


*Fig. 7.*

be seen that the design is somewhat unusual and very effective. Other models are made for hanging on the wall. It will be seen that the dial is set at an angle to the vertical, which makes for easy reading.

The case is made of plastic material. Fig. 8 shows how the case separates to give access to the movement. A wing nut is sunk in the bottom of the pedestal part of the case. On being given a part turn, this wing nut depresses a small plunger to release two spring clips at either

side of the back half of the case and to push the two halves of the case apart. When separated, it will be seen that the movement and battery are housed in the front half of the case.

The movement comprises three distinct units, each of which can be replaced by a new interchangeable unit. These units are :—

(1) Base plate upon which the other units are assembled. It carries the reduction gearing and motion work.

(2) Motor unit.

(3) Escapement unit.

## XVI.—DISMANTLING

Fig. 9 is a diagramatic representation of the movement. Before going on to a general description of the various units, we shall deal with dismantling. To dismantle the movement, proceed in the following sequence.

### BATTERY

First remove the battery. It is retained in position in a moulded battery holder, integral with the front half of the case, by a spring loaded clip, which carries one of the battery lead wires. It is pressed against the second battery lead. The other ends of the lead wires terminate in plugs, which fit into positive and negative sockets in the motor unit. Remove the plugs from their sockets. Release the spring loaded clip retaining the battery, when it can be lifted out, clear of the movement.

### PLASTIC COVER

The complete movement is protected by a transparent plastic cover, which is screwed on to the ends of two pillars, projecting rearwards from the base plate. The plastic cover is provided with :—

A large hole to permit the hand setting button to pass through which thus need not be removed ;

A slot for the motor starting lever to pass through ;

A hole to give access to the screw regulator, marked with a + and − sign to indicate which way to turn the regulator screw to give " fast " or " slow."

Two holes for the plug ends of the battery lead wires.

The correct position of the respective wires is marked by a + and − sign on the cover.

### ESCAPEMENT UNIT

Remove the escapement unit, which is mounted on a platform. It rests on the two pillars projecting rearwards from the base plate, to which the

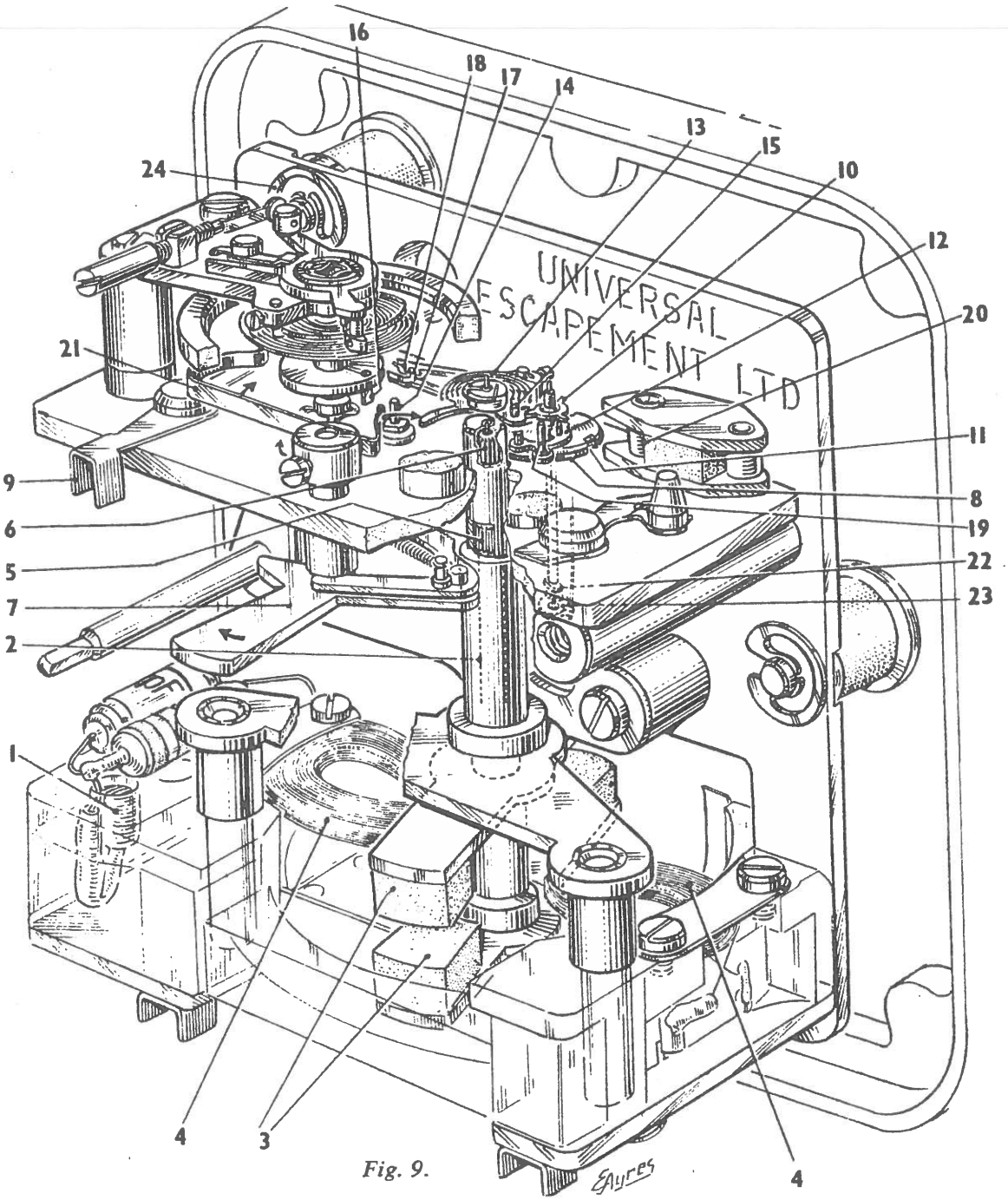



*Fig. 9.*

1. *Transistor.*
2. *Rotor arbor.*
3. *Permanent magnets on rotor arbor.*
4. *Horse-shoe coils.*
5. *Starting pinion.*
6. *Driving pinion.*
7. *Starting lever.*
8. *Plastic disc on escape wheel arbor.*
9. *Latch for escapement unit.*
9a. *Latch for motor unit.*
10. *Escape wheel.*
11. *Slots in plastic disc.*
12. *Tail of lever, carrying pallet pins.*
13. *Lever hairspring.*
14. *Stop pin.*
15. *Locking pin.*
16. *Impulse pin.*
17. *Fork of lever.*
18. *Passing spring.*
19. *Moving pin.*
20. *Permanent magnet.*
21. *Starting spring.*
22. *Worm.*
23. *Ruby rocking pin.*
24. *Spring clip.*

plastic cover is screwed. A short stud is secured at right angles to each of these pillars. These two studs enter locating holes in the escapement platform ; their upper ends are grooved and the escapement unit is held in position by two latches 9, secured to the platform by shouldered rivets. One end of each latch engages the groove in one of the studs ; the opposite end is bent downwards, clear of the platform, and on being moved in one direction **latches** the escapement unit firmly in position. Movement in the other direction unlatches the unit.

When unlatched, the escapement unit complete can be lifted upwards and clear of the rest of the movement. Fig. 10 is a photograph of the movement with the escapement unit removed.

Fig. 11 is another view of the escapement unit.

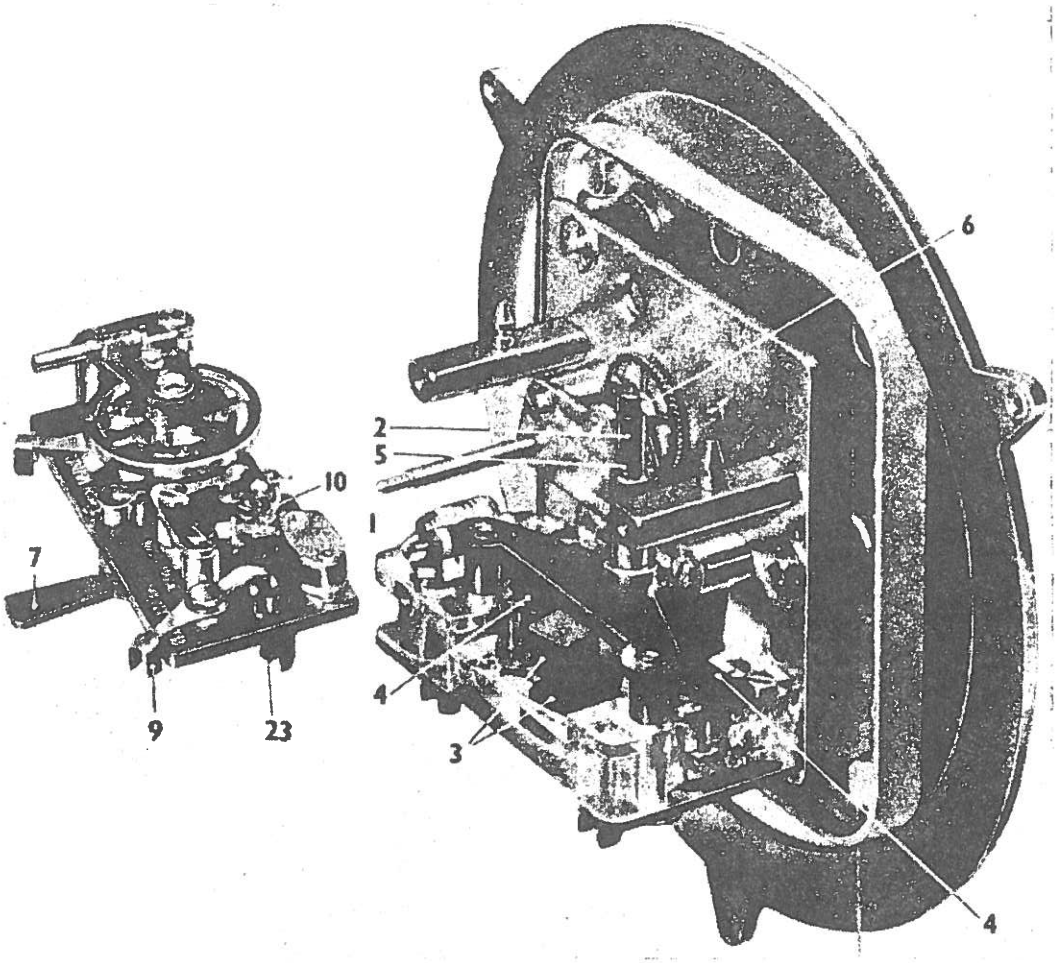



*Fig. 10.*

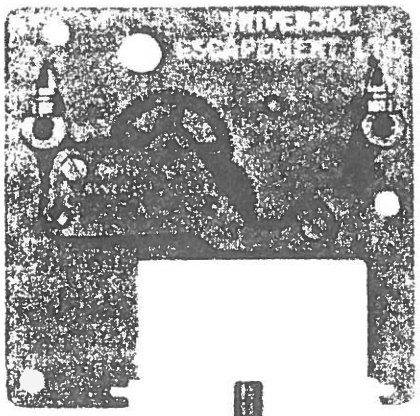


*Fig. 13.*

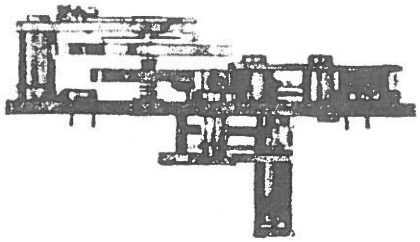


*Fig. 11.*

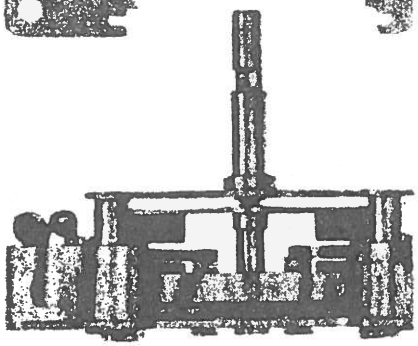


*Fig. 12.*

**MOTOR UNIT**

Fig. 12 is a photograph of the motor unit.

The motor unit is held in position by two latches 9a, each of which engages in a recess cut in the base plate of the movement, as shown at the bottom of Fig. 13. When these two latches are moved clear of their recesses, the motor unit can be lifted clear of the movement.

**HANDS**

In order to remove the base plate, which carries the reduction gearing and motion work, it is first necessary to remove the bezel and hands.

The solid type bezel, with solid inner ring and plastic glass, is secured by four screws which enter tapped holes in the case. With the bezel removed, the hands can be taken off.

The centre seconds hand is provided with an adequate brass pipe. The pipes for the minute and hour hands are formed as part of the stamping out process and are very efficient.

**BASE PLATE** (Fig. 13)

The dial is superimposed on a dial false plate, provided with three dial feet, to which the base plate is secured by three spring clips. When these spring clips are removed, the base plate can be lifted out.

The dial feet comprise short brass pillars, which are held in rubber mountings, secured to the dial false plate. The result is that the whole

movement is **cushioned,** giving a resilient effect should it receive a shock or jar.

## XVII.—GENERAL DESCRIPTION

For purposes of description it is convenient to deal with the motor unit first.

The motor unit is carried in a frame, the main members of which are a **bottom plate** and a **bridge,** carrying a pipe inside which the upper part of the rotor arbor turns. A bush is fitted at the upper end of the pipe for the upper pivot of the rotor arbor.

The motor is of special design and is controlled by a transistor 1. It comprises a double-armed rotor 3, mounted on a long arbor 2, and two horse-shoe shaped coils 4. The rotor takes the form of two pairs of radial arms mounted on the rotor arbor, one a short distance above the other. The tip of each of the four arms carries a small rectangular shaped permanent magnet, so placed that they face each other with a small gap between them and so arranged that each pair of magnets is of opposite polarity.

The coils are secured to the bottom plate of the motor unit in such a position that as the rotor revolves one pair of radial arms, with permanent magnet tips, is below and the other above the coils. The coils have no cores.

The coils are connected to the battery and the small transistor 1. The circuits are so arranged that when one pair of permanent magnets on the rotor moves past the first coil, the small current which is induced in the coil trips the transistor and so causes it to permit current from the battery to flow to the second coil. The field set up by the flow of current in this second coil repels the magnets on the rotor arm, which are passing the coil at the moment, and so maintains the rotation of the rotor.

As the rotor continues to turn, the permanent magnets move away from the coil and the transistor cuts off the current flowing from the battery to the second coil. The rotor continues to turn by momentum until the pair of magnets that have just been repelled have turned through 180°. At this point they pass the first coil, which trips the transistor again—and the cycle is repeated over and over again.

Thus, each pair of magnets on the rotor in turn induces current in the first coil to trip the transistor at one point of its rotation and is later repelled by the field set up by the current passing through the second coil.

All contacts of the normal type are eliminated and the whole construction and action is very simple.

The rotor turns in a horizontal plane ; hence its arbor is vertical. The lower bearing for the rotor arbor is in the bottom plate of the motor unit

and consists of an Incabloc resilient bearing assembly. The upper bearing is in a bush inserted in the tip of a long pipe carried on a bridge which spans the rotor and which is secured to the bottom plate.

The coils, transistor and other electrical components, including the two sockets for the battery leads, are accommodated in a transparent plastic housing secured to the bottom plate.

The pipe through which the rotor arbor passes is provided with two slots, one of which is in such a position that it lies below the platform of the escapement unit when fixed in position. The other slot lies above the escapement platform. A small pinion 5 is secured to the rotor arbor in position opposite the lower slot in this pipe ; it acts in conjunction with the starting lever 7, which is provided with a rack of mating teeth. Thus, when the starting lever is displaced, on being returned to its position of rest by a leaf spring 21, it gives an initial turn to the rotor arbor, thus starting up the motor.

The second slot is near the top of the pipe. Facing this slot, the rotor arbor carries a **driving pinion** 6, which is compliance coupled to the arbor by means of a sleeve and a small coil spring. This permits the pinion to move slightly in one direction or the other independent of the rotor arbor. The action of the driving pinion will be described presently.

The whole motor unit is extremely neat. It is retained in position by two latches 9a, or catch levers, which engage with slots in the base plate of the movement. To remove the motor unit, all that is necessary is to pull out the plugs on the two battery leads and swing the latches aside. The complete motor unit will then drop downwards and is free of the rest of the movement. Replacement is just as easy and rapid.

## XVIII.—ESCAPEMENT UNIT

The escapement unit, which has many novel features, is mounted on a platform. For description purposes it can conveniently be broken down thus :—

**Balance assembly**
**Escape wheel assembly**
**Lever assembly**

### BALANCE ASSEMBLY

There is nothing unusual about the balance assembly. The balance is plain, large and comparatively heavy. The balance spring is of the over-coil type. The impulse pin is of the usual " D " shape.

The balance, however, only receives impulse during one direction of swing.



To be continued.

Continued from June, 1999 issue.



# *Elgin Service Bureau Bulletin*

The next step is to tune the Receiver to the Arlington Signal. The variations of inductance in the primary and the secondary coils are usually accomplished by sliding contacts or multiple-point switches, and the secondary condenser is of the rotary type, with a pointer and a graduated scale. Further, the secondary coil generally slides in or out of the primary coil; this is technically known as "the coupling."

Place all pointers or sliding contacts on their respective zero-marks and have the set "close coupled," that is, the secondary coil close to the primary. Next, gradually add inductance to the primary coil. Unless your antenna is exceptionally large, a great deal of inductance will be required in order to tune to the Arlington signals, so it will be well to place the loading-coil in circuit at the start. As the inductance of the primary coil is increased, more inductance must be added to the secondary. Proceed in this manner until the Arlington signals are heard; after the signals are once heard they can generally be made somewhat louder by slightly varying the coupling of the primary and the secondary coils and by moving the variable condenser. From time to time

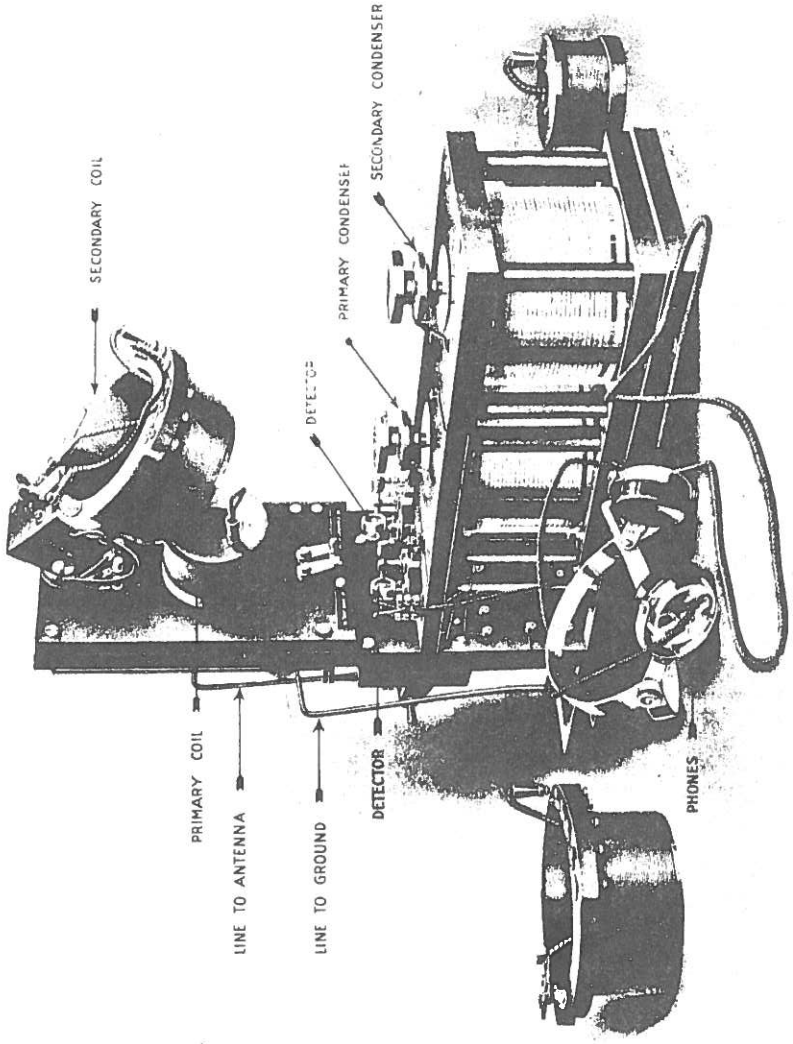



Fig 11.
WIRELESS RECEIVER OF THE ELGIN NATIONAL WATCH COMPANY.
A TELEFUNKEN SYSTEM COMMERCIAL SET OF THE HIGHEST GRADE.

test the detector with the buzzer, but always remember not to move any other part of the Receiver while making the detector adjustment.

If the above directions are followed implicitly no difficulty should be encountered in adjusting the Receiver to the Arlington Time Signals.

## *INSTALLATION*

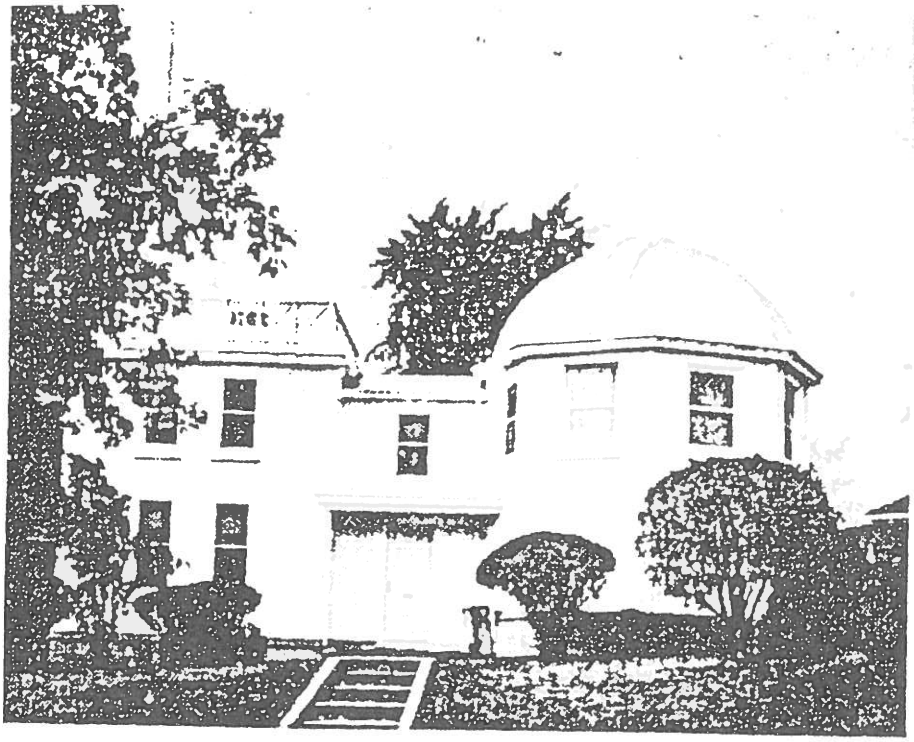
In case the jeweler decides to install a Receiving Station all wiring of any sort should be done by a first-class electrician, who should see to it that there is no possibility of power wires accidentally coming in contact with the antenna or with any other part of the wireless installation, in order to avoid possible destruction of apparatus and serious injury to operator.

## *THE ELGIN RADIO LABORATORY*

The Elgin National Watch Company has installed a Radio Laboratory for experimental purposes. The antenna is T-shaped and consists of four wires 280 feet long, 150 feet high, on 24 foot spreaders. To the antenna is connected a standard commercial receiving set of the highest grade Fig. 11. With this outfit,

at a distance of 800 miles, we are enabled to hear both the day and night time-signals from Arlington. It is a well-known fact that the range of any station is increased two to three fold at night, hence the Arlington signals are much louder at night than in the daytime. The day signals, however, are plain and distinct. Such distant stations as Key West, Florida (1250 miles), Sayville, N. Y. (900 miles), and South Wellfleet, Mass. (1000 miles), can be plainly heard at night.

The Elgin Radio Laboratory is maintained as an experimental station, and the Arlington signals are received only for purposes of comparison. As explained in our booklet, "Time Taking and Time Keeping," the time service used for the adjustment and regulation of all Elgin watches is furnished by the Elgin Observatory, whose equipment for the determination and maintenance of Correct Time is unexcelled by any observatory.



# THE ELGIN OBSERVATORY STORY

## 1909 - 1960

by

Ray S. Neidigh

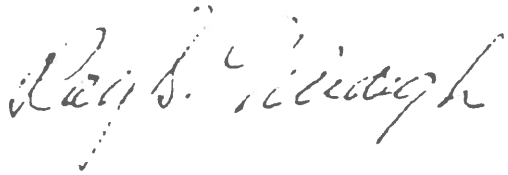
# DEDICATION

The writer respectfully dedicates this narrative of the Elgin Observatory, its functions and operations over the years 1909-1960 to the memory of:

MR. FRANK D. URIE, deceased,

who served as its Director from 1926-1960.

He and I enjoyed many years of co-operation in our duties with the Elgin National Watch Company. He was always kind, understanding and considerate where I was concerned.



Ray S. Neidigh
July 15, 1982

The February, March and April 1981 issues of the "Star Gazer" carried an article "Do You Know How Time is Determined" which incorporated a bit of the early history of the Elgin National Watch Co. Observatory located on corner of Watch and Raymond Street. After careful reading of this article, I came to the conclusion it would be a good idea to put down on paper the activities of this Observatory from the date of its inception until it was deeded over to the Elgin School Board District U-46 which will cover a span of slightly over fifty years 1909-1960. I feel that the history of such a unique building and what it meant to the city of Elgin should not be lost, therefore I will attempt to report the Observatory Operations, the individuals who were charged with its operation while owned by the Elgin National Watch Co. Quoting from the Seventy Fifth Anniversary (1939) issue of the "Watch Word" the inception of the Observatory is recorded. Quoting "Although the march of progress in time measurement had reached a stage of eminence by 1908, it was not until that year that the United States Government came to regard timing efficiency of such economic importance as to take a hand in its management. At that time President Theodore Roosevelt directed the United States Bureau of Standards to set up tests for watches. The resultant report disclosed that the time controls in America were inadequate and something should be done about it. The Elgin National Watch Co., to provide its own accurate time standards announced that it would build an astronomical unit to cover this necessity, and the Observatory was the result. In May 1909 Professor William W. Payne of Goodsell Observatory, at Carlton College, Northfield, Minnesota, was engaged to advise and assist in locating and equiping the Observatory. A permanent building was soon started according to designs made by

and supervised by Mr. George Hunter, consulting superintendent, to comply with the requirements outlined by Professor Payne. The Observatory was opened for business in February 1910, and Professor Payne's engagement as Director was extended indefinitely. Mr. Frank D. Urie was appointed as Assistant to Professor Payne". (End-quote). To utilize the time services of the Observatory in the factory where the watches were being regulated and timed it was necessary to lay underground cables from the Observatory switch board down Watch Street, passing under the Northwestern tracks (East side Northwestern) onto the factory property terminating in the Rating Room, which was located in a small building between the Power House and the river wing of the factory buildings. The Observatory was equipped with four Riefler clocks, made in Germany and were considered at that time the finest clocks available for accuracy and dependability. Two were Master Clocks kept within a temperature controlled vault, each mounted on a concrete pier which was separated from the building. The pier was so designed to prevent the pendulums from swinging in the same plane. One clock No. 220 was designated as the Sideral time keeper and the other No. 224 as the Mean time keeper. These clocks were sealed within glass jars and operated under a partial vacuum, which provided a means of regulating them by air pressure. A change of one m/m pressure would cause a change in rate of 0.018 of a second per day. To lower the pressure a hand operated vacuum pump was applied. The other two Riefler clocks were located upstairs, in the chronograph room. They too were mounted upon a concrete pier separated from the building. Again No. 240 was regulated to Sideral time and No. 237 was regulated to Mean time. These clocks were cased within a glass swinging door and operated at room temperature and pressure. They were used as slave clocks and kept in time with

the Master clocks in the vault. In latter years both clocks were regulated to Mean time and Sideral time reference in the chronograph room was shown by a Ships Watch regulated to Sideral time. All clocks were fitted with contacts whereby each could be recorded on the chronograph and the Mean time slave clock was fitted with additional contacts whereby the second impulses (ticks) could be transferred to a relay which in turn activated telegraph sounders in the various rooms in the factory where needed in the regulating and timing of watches in production. Hence the slogan "Timed to the Stars". At this point it perhaps would be in order to mention that the transit telescope located within the dome section of the building was also mounted on a pier separated from the building. Separate pier mountings for the clocks and the transit telescope was used for the prevention of vibration being transmitted to the instruments due to wind stresses against the building, street traffic, etc. The pier with transit is located in the center of the dome with horizontal axisis of the transit located on a true east and west line with the tube of the transit swinging from north horizon to south horizon at right angles to the horizontal axisis. The transit latitude was determined to be 42 degrees 2 minutes north and the longitude was measured as being 5 hours 53 minutes 5.477 seconds west. Also housed in the dome was an instrument for determining the value of a degree for a division indicated by the transit level. There was also an instrument for measuring the personal equation of the observer. About 125 feet north of the transit pier another pier housed in a separate building, carrying an optical system which transmitted a pin point of light (artifical star) towards the transit optical system. This reference mark was used for orientation purposes following any adjustments to the transit. The opening in the center of the dome was operated by a very ingenious mechanical

system designed and built by the factory machine department. Upstairs when leaving the dome you passed through the chronograph, secondary clock and switch board room into a fully furnished bedroom which provided the means for the astronomer to gain forty winks during a period of excended observations. In 1926, the bedbroom was deleted, the furnishings being transferred to the apartment of Mr. Shrine, the manager of the National House. The bedroom was converted into the radio laboratory. More about this follows. Downstairs beneath the bedroom was located the office with its desk, books, the Quad-weather recorder (the weather instruments were mounted on the roof of this part of the building) the mercurial barometer was mounted on the south wall and a flashing light on the west wall which indicated that the temperature control within the master clock vault was functioning in a satisfactory manner. The Master clock vault was located beneath the transit dome. A bulb type recording thermometer was located just outside the vault. The Observatory personnel also acted as co-operative observers for the Weather Bureau forwarding their reports to the Springfield Office of the U.S. Weather Bureau. A standardized "shelter house" was erected north of the building in which minimum and maximum indicating thermometers were housed along with a recording temperature instrument. Now that the building and its mysterious equipment has been recorded lets get on with the history of the Observatory operations and note the changes as time moves along. 1910-1915. With the Observatory well under way with its primary operation, the determination of accurate time and it being relayed to the factory, work was started on the building of temperature controlled vaults for the rating of watches in various temperature and positions. The United States government was in need of many precision time

pieces for its various military and naval forces; therefore Elgin became very serious in its attempt to supply some of these needs. Needless to say, with its excellent primary time service it was very successful in this endeavor. This rating service for these time pieces was placed in charge of Mr. Urie along with being Assistant to Professor Payne, the Observatory Director. The space devoted to the rating of the watches was soon outgrown and a special building was constructed on the factory grounds located just north of the Power House and the south end of the factory river wing and was known as the Rating Room. It was at this area the ticker lines from the Observatory were distributed to various parts of the factory. This was a two story building, the upstairs containing equipment for cooling the test vaults to low temperatures, also units for high temperatures along with normal temperatures. At a latter date part of this upstairs area became a long wave radio laboratory. Down stairs were two temperature controlled vaults equipped with racks accommodating one hundred watches each. A chronograph was used for all readings of the watches and the seconds beats of the Observatory clock could also be recorded during the readings of the watches on test. This building was completed in 1921. 1926-Professor Payne retired, was appointed Director Emeritus until his death which occured in 1928. Mr. Frank D. Urie was appointed Director of the Observatory, a title he retained throughout the remainder of his employment by the company. Mr. Urie was also appointed Superintendent of Research and Inspection this same year. This year also brought about additional services being performed by the Observatory along with its primary time determination, the ticker services to the factory and ticker services into our offices in Chicago which were located in the Pure Oil Building. Mr. Urie's petition, in behalf of the E.N.W. Co., for the issuance of a short wave radio experimental license for the transmission of time signals

was granted by the Federal Communications Commission. A contract was let to the Falkner Radio Engineering Co., of Chicago for the construction and installation of this transmitter to be crystal controlled on a frequency of 4797.5 kc, five hundred watts output, powered by a motor generator unit. This brought about "moving day" at the Observatory. The bedroom furniture was moved to the managers apartment located in the National House. This move provided space for the transmitter which was delivered the latter part of this year. A tall spruce pole was implanted just outside the northwest corner of the building to support the vertical antenna which was made of copper pipe one inch in diameter with a corresponding counterpoise the same length and same material mounted at right angles to the vertical element. It was attached to the north side of the building. The transmitter was known as a composite type, parts manufactured by various companies such as R.C.A., General Electric, Westinghouse, etc. One stage of frequency doubling from the crystal was employed driving a pair of R.C.A. 204 final output tubes. The motor generators supplied two thousand volts D.C. with a thirty volt exciter motor generator. The control panel was located above the operators desk which had the necessary relays, telegraph key, etc. located for the time signal transmissions. Following the completion of this installation, it was inspected by the Radio Supervisors office located in Chicago and was duly licensed and assigned the call letters of W.N.B.T. After the F.C.C. grant for the station, Mr. Urie studied and passed the Commercial Second Class Radio Operators License which was a requirement for the operation of this type station. I do not recall the exact date the station went on the air but it was early in the year 1927. During the life time operation of the station many equipment changes were required due to "improvements in the art" and a number of changes in the call letters were made by the F.C.C.

1927-Mr. Ray S. Neidigh was appointed Assistant to the Director Mr. Frank D. Urie. Along with learning the routine Observatory duties, it was necessary to study for Commercial Operators License and obtain the license necessary to operate the station. This license was granted in December 1927 and afforded a much needed relief of duties in this line for Mr. Urie who as Superintendent of Research and Inspection was very busy in the organization of this entirely new phase of factory operation. Also at this particular time, Mr. Urie and I were greatly involved with the rating of a group of railroad type pocket watches and a number of "ships watches" left over from those built for the Emergency Fleet Corporation during World War I. "The Conquest of Antarctica by Air" under the command of Rear Admiral Richard E. Byrd, U.S. Navy was scheduled to leave New York August 1928 and Elgin's contribution to this expedition was the donating of a number of Elgin railroad pocket watches along with five of the "Ships Watches". Three of the "Ships Watches" were with the Admiral during his long stay at the pole. One of these three "Ships Watches" was returned to E.N.W. Co., and as an advertising gimmick was sent to various jewelry stores selling Elgin Watches to use as a display. This "Ships Watch" finaliy returned to the Observatory where it was kept until the building was deeded over to the School Board. Neidigh was charged with keeping all of these type watches and were with him during his time with the Research Department in the factory building. Soon after Neidigh's retirement and moving to Fredericksburg, Texas, the Admiral Nimitz Museum was being organized. (Fredericksburg being the home of Admiral Chester Nimitz of World War Two Naval fame). I contacted the President of the E.N.W. Co., who at that time was Mr. Jerome Robbins, acquainted him with the Admiral Nimitz Museum and asked if he would permit me to present the "Byrd" watch to this museum.

He granted me this request and had Mr. Edward Freeman ship it to me and in turn I presented it to the Museum here. It now rests with many other Naval historic time pieces on display in this museum. It has always remained in exactly the same condition as it was in when the expedition returned it to Elgin. 1928-1929-1930 - We finaly completed the testing of the watches for the "Byrd" expedition and they were shipped to his supply depot. During this period the F.C.C. had changed the call letters of the radio station from W.N.B.T. to W.N.B. and then to W9XAM. By now the Naval Observatory started time signal transmissions via short wave and on more frequent intervals during the twenty-four hour periods which made it possible to record these signals at the Observatory and eliminated the trip to the Rating Room each day for these recordings. During this period of time the photo cell was just making its appearance and Mr. Urie started a project within the Observatory to investigate the feasability of measuring the amount of light emitted by stars by the use of a photo cell. Such cells were not available in the commercial market. Prof. Kuntz of the University of Illinois was making such cells on a very limited basis. Mr. Urie contacted him and he agreed to build the cell. Following several trips by Mr. Urie and I to Prof. Kuntz's workshop the cell was delivered. We were constructing the necessary electronic equipment to be used with this cell which had an envelop of quartz glass and was filled with selenium gas, the center bulb (ball) being about two inches in diameter, one half of it being the light window with three projections about six inches long each, two being the electrical connections and the third the envelop stem. This cell is now in the possession of the Elgin Historical Society (Mr. Clarence A. Reber). I shipped it to him about two weeks ago. The theory behind this idea was the resistance balancing method with a whetstone bridge being the measuring instrument. High value resistances were not available at

To be continued.

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# THE JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

CHAPTER #78

NATIONAL ASSOCIATION OF WATCH & CLOCK COLLECTORS

**VOLUME XXIV #4, DECEMBER 1999**

Fellow Horologists:

This issue contains the final segment of the PORTESCAP SECTICON clock material reproduced with the permission of the British Horological Institute, along with additional material from an old issue of the "Swiss Watch and Jewelry Journal".

The ELGIN OBSERVATORY series also continues, with a letter to the editor included that adds to the information being presented. We enjoy receiving your comments about the material in the journal... it shows that someone is really reading the stuff! (Kidding aside, we do get letters fairly often, some critical, and others with suggestions for future subjects to be included in the journal.)

For those who ordered the copies of the excellent new edition of "The Eureka Clock" by Dr. F. G. Alan Shenton, they have all been sent out.

We still need material for future journal issues, so look through your literature collections and share your information with other members. We are looking forward to greater participation in a "Question & Answer" column to become a regular part of the journal. So far, with the exception of a few queries with limited interest, the response has been disappointing. GET WITH THE PROGRAM... it's YOUR journal.

As the holiday season approaches, the officers and editorial staff join in wishing the membership, Healthy, Happy, Joyous and Fruitful holidays.

Good reading ahead...

Martin Swetsky, FNAWCC, President )
Harvey Schmidt, FNAWCC, Secretary-Treasurer ) Co-editors
Dr. George Feinstein, Chapter Historian )

Hi Marty

I have read with some intrrest the Elgin articles in the Journel. There is something that probably should be corrected in regards the number of clocks that were left in the obsevitory when U 57 took over.

The correct number was two they being the two in the first floor clock room. The other two had been removed much earlier one had been removed to the plant in Geogia and was used down there untill the plant was closed. At this time the clock was purchased by Shorty LaRose and until recently was in posesion of the LaRose family. The second was removed from the obsevitory and used in the plant accross the river untilit was repaced in an original container and moved to the Chicago plant it remained in the container during this time and may have been lost had it not been for one of the emoloyees wanting the container. Whwn the plant cklosed he obtained the container and the contents and not having a use for the clock stored it in his garage for some years using the container for whatever. During the time that Mark Gulbranson, John CONKLIN ? and myself were in the prossess of getting the observitory building on the National Register of Historic Places a newspaper article was written about our efforts and the missing clocks. The man happened to read it and called Gary Kutina whom was at the time in charge of the obserbitory. He told Gary that he had one of the missing clocks and if he wantedit he would be glad to get it out of the way. Mark whent with John and retreved it the next day. The case was in somewhat bad shape as it had been stored with no protection. John restored that case to near original status. This clock is now back in it's original position on the second floor.

At one time I had talked mr. LaRose into at least loaning the other with the stipulation that if the building fell into disuse the clock would then be removed to the National. Due to some resent information I do beleive the LaRose clock is being donated to National.
Elmer Crum FNAWCC #33463 Life # 84

that time. I made many resistances using India ink line on drawing paper attaching a fine wire lead to each end of the line sealing this combination in a glass tube. Mr. Urie performed the calibration of the resistors. Upon completion of the measuring unit and its battery requirements completed arrangements were made to have time using the thirty inch telescope (refractor) located in the Yerke Observatory at Lake Geneva Wisconsin. Due to the heavy research program being conducted at the Yerke Observatory, additional time to use this telescope was not available. We then started to use the sixteen inch refractor in the Dearborn Observatory, Northwestern University, Evanston, Illinois. I donot recall the Yerke Observatory Directors name, but Prof. Phillip Fox was Director at the Dearborn Observatory with Dr. Lee his assistant. Prof. Fox later became the first director of the Adler Planetarium, Chciago. Due to the increasing load of duties as Superintendent of Research and Inspection, Mr. Urie gave up further work on this project. We received word that the "Byrd" expedition had been receiving our time signal transmissions along with those from the Naval Observatory. 1931-Mr. Neidigh appointed Supervisor of Observatory Operations. Work was being conducted in the Radio Laboratory investigating the feasibility of a radio controlled clock and perhaps radio contolled watches. 1932-Mr. T. Albert Potter became President of the company. This signaled the beginning of drastic changes in factory policies (all for the better) and as we move along you will see the big movement placed into action by Mr. Potter to place the Observatory, its work etc. in the eyes of the public in various forms of advertising along with its primary time determination work. The Chicago Century of Progress, Worlds Fair was getting under motion and Mr. Urie was assigned the task of supervising the construction of the Elgin Exhibit. At this time the country was beginning to show recovery from the severe depression. The Chicago Century of Progress,

Worlds Fair played a large role in the improvement of conditions in the Great Lakes area and its impact was felt throughout the country. Before embarking upon the role played by the Observatory during these days of recovery I think it would be well to outline many of the established "ticker services" the Observatory was supplying. A leased telephone line was carrying the second impulses into Chicago terminating at our switchboard located in the basement of the Pure Oil Building. The Chicago Offices of the company were located in this building. A large bronze clock showing Elgin Observatory time was located on the street corner of the Pure Oil Building. Around the outside of the circular dial were mounted sixty electric lights, fifty-nine of them being white and one a red bulb at the sixtieth second. Each bulb was lighted from the Observatory ticker line therefore providing exact time on the street by the hour, minute and second. Whenever Mr. Urie or I would be in Chicago and pass this clock we knew that the ticker line was functioning satisfactorily and that the Observatory clock had not stopped. From our switchboard in the Pure Oil Building, ticker service was supplied to all clocks in the Palmer House Hotel, to the frequency control room of the Commonwealth Edison Electric Co., during the Century of Progress to the I.B.M. exhibit where it controlled the pendulums of two I.B.M. master clocks which in turn controlled all of the official clocks located on the Fair grounds. (This was a joint advertising gimmick of both companies and at each clock on the Fair grounds a plaque showed the correct time coming from the Elgin Observatory and distributed by I.B.M.), ticker service operated the drop of the Time Balls at the gates of the Fair grounds signaling the opening of the gate each day, ticker service was supplied to the C.D. Peacock Jewelry Store, to the Union Railroad Station for the starting of the first train of the New York Central Railroad when it reduced

its travel time between Chicago and New York from twenty hours to eighteen hours, the train was known as the Twenty Century Limited. Ticker service was supplied to various radio broadcasting studios so the correct Observatory time could be used at the close of a big band program sponsored by the company as an advertising gimmick. (Bennie Goodman, Kay Kayer-the Ink Spots and others) Mr. Floyd Gibbons was an outstanding rapid fire speaking news commentator during the radio days. He produced the Adventurers Club program for the advertising department which was a great success. Anyone could write to him outlining their great adventure (regardless of what it was) and he would produce this event as a short story on this program, which always ended with the time from the Elgin Observatory. The persons' story that was used received a bronze medallion from the company. Ticker service was supplied to the Museum of Science and Industry located in Chicago. This service was available to any place serviced by the Bell Telephone Service, and was used for many unusual events. In 1930 the company had made somewhat of a commitment to exhibit at the Century of Progress by reserving a section of floor space within General Exhibits Buiding No. 4 but actual plans as to what type of exhibit would be assembled lay dormant for some time due to the fact that the Fair could not meet its opening date of May 1932. Contracts had been made with a decorating group with Mandel Brothers Department Store to draw up preliminary plans consisting of a replica of the Observatory, some of its equipment, some automatic machine operation plus a display of all products made by Elgin. With Mr. Potters becoming President of the company, he fully approved the plans and from that moment on it was full steam ahead, the exhibit was completed and in operation the day the Fair opened - May 27, 1933. The floor space consisted of a circular area with a wide and quite long wing attached to it. The replica of the Observatory occupied the circular section with a

transit instrument in the center, one of the master clocks regulated to mean time on the south of transit and forward to the left was installed a chronograph. Over to the right was installed an automatic screw making machine in operation. The wing off the circular area was devoted to showcases displaying the Elgin Watch Line along with an operating model of a rectangular ladies wrist watch one hundred times natural size (by volume) on a turntable. Other items of interest were added from time to time in wall showcases. The Observatory replica was manned by personnel from the Observatory and the sales display by the traveling salesmen who were brought in assisted in groups of three to four for periods of a couple weeks at a time. They also helped out with the Observatory. The chronograph was kept running recording the beats from the master clock across the room. The exhibits drew throngs of visitors and received high praise. It was impossible to obtain a transit but our model wood-working shop built an exact replica of the transit, the machine shop made the metal attachments, etc. Upon completion, you could not distinguish the difference between the wood model and the real transit. (This model of the transit is now in the Time and Transportation section of the Museum of Science and Industry, Chicago). Now for the big play by the Elgin Observatory practically through its 1933 year of operation. The greatest single event on the Fair grounds was the turning on of all the outdoor lighting. The Fair was scheduled to open on May 27, 1932, but was delayed until the following year. 1932 would be forty years since the opening of the World Columbian Fair in 1892. The star Arcturus, an outstanding bright star is forty light years distance from the earth. Around this star revolved the lighting ceremony for the Fair on the first night of its operation. Light emmission from this star, Arcturus, forty years ago had just reached the earth at the time of the lighting ceremony. Three of the major companies in

the United States participated in this event along with four of the outstanding Obervatories. The Western Union Telegraph Co., supplied the transmission lines connecting the Observatories with the Fair grounds, the General Electric Manufacturing Co., supplied the photoelectric cell equipment and the Westinghouse Electric and Manufacturing Co., supplied electronic amplifying system. Likewise the equipment mounted upon the stage erected for this event in front of the Science Building was supplied by these companies. Prof. Phillip Fox, Director of the Adler Planetarium delivered the address leading up to the actual turning on of the outdoor lighting on the Fair grounds. This event was witnessed by thousands of people. This event was such a success that the public clamored for a repeat of it each night. Of course it was impossible to tie up the four major Observatories with a publicity stunt such as this. The Fair Commission contacted Mr. Potter hoping that the Elgin Observatory could help out in some way in the reenactment of this ceremony. Elgin agreed to take on this responsibility. Elgin had to have a telescope capable of picking up enough light from the star Arcturus to energize the photocell equipment, therefore a sixteen inch reflector was leased from a private owner and installed just east of the Elgin dome. A shelter house on wheels was constructed above the pier carrying the telescope; Western Union brought in their wires to the recording room switchboard (chronograph room) of the Observatory, General Electric and Westinghouse engineers, came in set up their equipment and Elgin was ready to intercept the light beam from Arcturus, providing a means of repeating the Arcturus ceremony every night throughout the operation of the Fair. The same speech, but with modifications explaining the part being played by the Elgin Observatory was included. The above outline of preparation work at Elgin appears to be somewhat simple but that was not the case. Working around the clock was not uncommon, the regular Observatory

services had to be maintained. A young man by the name of Hiland B. Filmore was hired, he having had experience with amateur radio transmitting. He was trained to help out with the routine Observatory duties, helping out at our Fair exhibit along with preparing for the Commercial Radio Operators License, which he obtained. Mr. Filmore remained with us throughout the year 1934, the second year of the Fair.
1934-The popularity of the Arcturus ceremony never seemed to abate and on the reopening of the Fair in 1934 saw Elgin with a theatre building located on the Fair grounds, with the sixteen inch reflector and its Arcturus equipment on the stage, accompanied by a lecturer giving a description of the Arcturus ceremony as it was presented the previous year. The lights in the theatre were turned on by light intercepted from Arcturus. Needless to say, this was a terrific advertising gimmick always drawing large crowds. The 1934 closing night of the Fair was greeted with mixed emotions by the Elgin exhibit and Arcturus staff. The Fair closing occurred at the time the eighteenth amendment was repealed, which served as a cushioning effect. I have copies of the speech delivered by Prof. Fox on the opening night of the Fair (1933) along with modifications used through the season after Elgin Observatory began supplying the Arcturus impulses. I have a copy of the lecture delivered in the Elgin Theatre during the 1934 Fair season.
1935-Mr. Robert C. Miller started his career with the E.N.W. Co., as Assistant Astronomer working with Mr. Neidigh. He also obtained his Commercial Radio Telegraph License. The three of us-Mr. Urie, Neidigh and Miller reached the old saying-the mail carrier goes for a walk on his day off - they built amateur radio stations and operated from their homes. Mr. Urie was the first to receive his station license and was assigned the call W9SI; with the station being located in the Observatory radio laboratory. Neidigh was next to receive an amateur station license license assigned the call letters W9BEP and Miller was the last to receive his amateur

station license and was assigned the call W9UZN. We all enjoyed carrying on communications with other "ham" stations and particularly foreign stations. These were "fun" however they did provide a means for the testing out of some facets of radio transmission. At that time, the amateurs were assigned rather narrow bands in which they were permitted to operate. Examples- the forty meter band, 7000 - 7300 kc., the twenty meter band 14000-14300 kc. to stray out of the assigned bands would cause interference to other services. It became necessary for the amateurs to police their operations. Mr. H.D. Hayes was Radio Inspector for the ninth district with offices in Chicago. He was well acquainted with the Elgin Observatory operations. He contacted the A.R.R.L. (Amateur Radio Relay League) the organization for amateur station owners, suggesting they contact the Elgin Observatory in an endeavor to find out if the Observatory would take on the task of transmitting standard frequency signals which in turn would give the amateur operators a means of calibrating their measuring equipment. The Inspector stated he would arrange for the licensing of such a station. The end result after officers of the A.R.R.L. contacted Mr. Urie and the approval of Mr. Potter, we soon became engaged in this service. A.R.R.L. supplied us with a 100 kc quartz crystal and multivibrators giving beat frequencies at every 100 kc., built by General Radio. The beat frequency method was used to monitor the continuous signal being transmitted on intervals of 100 kc., throughout the various bands. The 100 kc., crystal was contained within a temperature controlled chamber and we placed the generator and multivibrator assembly in the temperature controlled clock vault. We later built equipment in connection with this frequency standard whereby we could measure the frequency of our time signal transmitter W9XAM. After constructing the standard frequency transmitter, the Radio Inspector visited us and had the license assigned to the Observatory and was given the call letters W9XAN. These transmissions were discontinued in 1939. This service received

very favorable mention from the amateurs throughout the country and many radio publications carried stories concerning this service. Of course, no advertising was permitted via such channels but the publications were using the E.N.W. Co., name quite freely-that being the idea of supplying this service. 1939-1940 - Worlds Fair time again, this time in New York (Flushing). Elgin sponsored the construction of a fine building which housed a replica of the Elgin Observatory, a long hallway showing the evolution of Time-keeping devices along with paintings and models and facets of the work being performed in the Research and Inspection Department and of course, a large display of current model watches being manufactured. Again, Mr. Potter assigned Mr. Urie the task of procuring this building, equip it and control its operation. Mr. Elroy C. Reed was appointed Resident Manager of the building and exhibits. A meridian circle telescope was loaned to Elgin by the Dearborn Observatory to be used as the transit instrument in this Observatory. Both Riefler Master Clocks along with a chronograph comprised the Observatory replica. Mr. Reed and Neidigh set up the Observatory and several other exhibits within the building. Following Neidigh's return to Elgin, Mr. Miller was appointed Technical Manager of the exhibit and as such remained throughout the 1939 season of the Fair. The Fair operated through the following year (1940) with Mr. George Downey, Sales Department as Resident Manager and Mr. Miller as his assistant. At the close of the 1940 year of the Fair, Mr. Neidigh was sent to New York to assist in dismantling the Observatory, prepare exhibits for return to Elgin. Upon the return of the Meridian circle instrucment, it was returned to Dearborn Observatory and set it up in its former place. Early in the year of 1940, Mr. Robert L. Eberly entered the employ of E.N.W. Co., being assigned to the Observatory as an assistant to Mr. Neidigh. Mr. Eberly was with the Observatory until after the return of Mr. Miller from the New York Fair, at which time Mr. Eberly was

appointed to a position within the Chemical Laboratory, a division of the Research and Inspection. Also in 1940, the addition on the north side of the Observatory was built to house the timing functions of all Lady and Lord Elgin Watches being produced by the factory. Mr. Mert Doxey was in charge of this operation. The watches were trucked up to the Observatory in special type trunks daily and returned in the same manner. All of these watches carried a Certificate showing that they had been timed to the stars in the Observatory. Another advertising gimmick. With the advent of the short wave, time signal transmissions from the Naval Observatory and our ability to record the same on the Observatory chronograph started a long series of star observations by Miller and Neidigh to verify the longitude determination developed by Prof. Payne in 1910. Prof. Payne's observations coupled with those made by two co-operating observatories computed the Elgin Observatory longitude to be 5 hours 53 mins., 5.480 seconds west. Our long (Miller-Neidigh) series of alternate star set observations coupled with time signal transmissions from the Naval Observatory made during the course of our observations gave us a computed value of 5 hours 53 minutes 5.477 seconds which was adopted as the longitude for the Elgin Observatory. It was interesting to note that the difference amounted to just .003 of a second when all variable facts that entered are considered. 1945-Mr. Robert C. Miller was appointed Supervisor of the Observatory. Mr. Neidigh retained the position of Chief Radio Engineer but devoted the balance of his time to engineering projects. About this time Mr. Miller became involved with the aspects of Quality Control in the manufacture of watches. 1946-Mr. Nathaniel Warner started his career with E.N.W. Co., as Assistant to Mr. Miller. Along with making time determinations he also assisted Mr. Miller with watch testing, in the field of quality control. Miller and Warner developed a series of sun spots sketched on vellum, from projections produced by the four

inch refractor (portable tripod mounted) which was a part of the Observatory equipment. In 1944 several changes were made in personnel, some reorganization and duties. Mr. Urie was appointed Director of Post War Research, however he retained the title of Director of the Observatory. Mr. George G. Ensign was appointed Director of Research and Development. The functions of the Observatory and Rating Room remained under Research and Development. 1949-Mr. Bruce Rice replaced Mr. Warner, taking over his duties of time determinations. The F.C.C. again changed the call letters of the station from W9XAM to KS2XAT. Due to the increased scientific demands for accurate time intervals the U.S. Bureau of Standards with the co-operation of the Naval Observatory, the rapid development of time signal transmission, time signals became available through the twenty-four hour day. Continuous transmissions were now available via station W.W.V. Right now I have a small Time Cube receiver with which I can pick up W.W.V. from Boulder, Colorado on five, ten and fifteen megacycles with just a flick of a switch. What a tremendous development in the commodity "time" since President Theodore Roosevelt's order to the Bureau of Standards concerning this matter in 1908-09. Developments in equipment for rapid timing of watches during their manufacture plus a crystal controlled clock in the Research Department used in conjunction with timing devices practically eliminated the "Observatory Ticker Service". The need for primary time determinations had practically ceased. The Research work on the development of a radio controlled clock had ceased although the transmission of time signals were carried along in a manner of keeping the station license active. 1952-57. Past and present blend as OUR OBSERVATORY OBSERVES THE FUTURE. In 1947 semiconductors(diodes and transistors) were making their first appearance in the electronic field. The Bell Telephone Laboratories were very busy working on the production of these units. For several years Elgin was working on the develop-

To be continued.

# Electrical and Electronic Timepieces and Their Maintenance

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(See "Swiss Watch and Jewelry Journal" Nos. 5-6/1965 and 4-6/1966)

by Lothar M. Loske

## The movement Portescap

When examining the Portescap movement with which the Secticon clocks are fitted, the watchmaker of today may have the same impression as watchmakers once had when regarding a chronometer or a beautiful repeater watch. The previously described calibers of clock movements have opened the way to new horological techniques. In most cases the old fundamental rules for the construction of mechanical movements are no longer valid. The construction of the Portescap movement has many new and unusual aspects and yet the movement itself is very fine in its execution. Its outstanding execution sets limits to the production in series which is quite unusual in watchmaking.

The range of Secticon clocks **(Fig. 50)** proves that bold forms can fit in with the search for style.

The Portescap movement, because of its quality and particularly its excellent rating results, does not only appear on the market fitted into Secticon clocks but also in chronometers of other makes. Some of the Swiss watch-manufacturers use the Portescap movement in display-window chronometers to show the exact time to passers-by.

### Technical information

| | |
|---|---|
| Size (movement alone) | 44 × 44 × 29 mm (customs regulation) |
| Number of jewels | 13 jewels |
| Protection against shocks | Incabloc ® for the balance wheel and the rotor |
| Lubrication | Synta-Visco-Lube oil |
| Escapement | magnetic principle, with detent and constant power device |
| Oscillations | 7200/h |
| Balance wheel | nickel silver without screws |
| Hairspring | 1st quality Isoval for chronometers; thermo-elastic coefficient of ± 0.2 s/°C/24t |
| Motor | continuous rotation, with transistor and without contact |
| Source of power | standard 1.5 V leak proof battery |
| Annual consumption | 2.2 Ah |
| Life with same battery | 15 to 18 months with normal battery size D |
| Maximum length of hands | without seconds hand: 180 mm (width 6 mm) with seconds hand: 70 mm |
| Quality | the Portescap movement is produced by the manufacturers of Incabloc ® and Vibrograf ® |

### Rating results

| Test | Results of Observations (seconds) | | Limits for Obtaining Certificate with Mention (seconds) |
|---|---|---|---|
| Average daily rate | — 1,9 | — 1,5 | — 2,0 à 6,0 |
| Average variation | 0,66 | 0,36 | 1,5 |
| Greatest variation | 2,2 | 1,0 | 2,5 |
| Difference between 1st and 7th day at 20° C. | 2,6 | 1,4 | 5,0 |
| Variation per degree C. | + 0,01 | — 0,18 | ± 0,20 |
| Middle temperature error | + 0,4 | — 0,9 | ± 3,0 |
| Return to rate | + 0,2 | + 0,5 | ± 2,5 |

In practice these results are not always obtained. Here the position of the movement is very important. For the Portescap movement the best position is the vertical one in which the balance and the escapement are horizontal, and the arbor of the motor vertical. It is not always possible to achieve this position. Whether for every day use or as precious article the watch or clock demands, besides high precision, an elegant, modern design. This twofold purpose (technical and aesthetic) can only be respected by a compromise, of which the Secticon clocks give a good example **(Fig. 51).**

**General description (Fig. 52).**

The Portescap movement does not resemble any of the previously described mechanical and electrical movements. The entirely new concept of its regulating device, operated with a transistorised motor with a continuous rotation, makes it possible to obtain a precision of ± 2 seconds per day. Three major elements are responsible for this precision:

the detent escapement with its constant power, has an impulse hairspring which is rearmed with the same power at each oscillation, thus guaranteeing impulses to the balance wheel which are always constantly even;

the variations of the motor, namely the gradual running down of the battery will, in no way, have an influence on the accuracy from the escapement, this accuracy will remain constant as was set originally, until the complete exhaustion of the battery;

a specially designed regulator with a micrometric regulating screw, makes it very easy to make corrections up to a fraction of a second; therefore, the maximum precision performance of the movement can be obtained.

The Portescap movement is designed so that normal maintenance can be done without special tools or knowledge. Its three basic units, fixed to each other with simple levers, are interchangeable.

The Portescap movement comes in several adaptations which makes it very practical for use in clocks of different styles; with or without a seconds hand, with or without a central

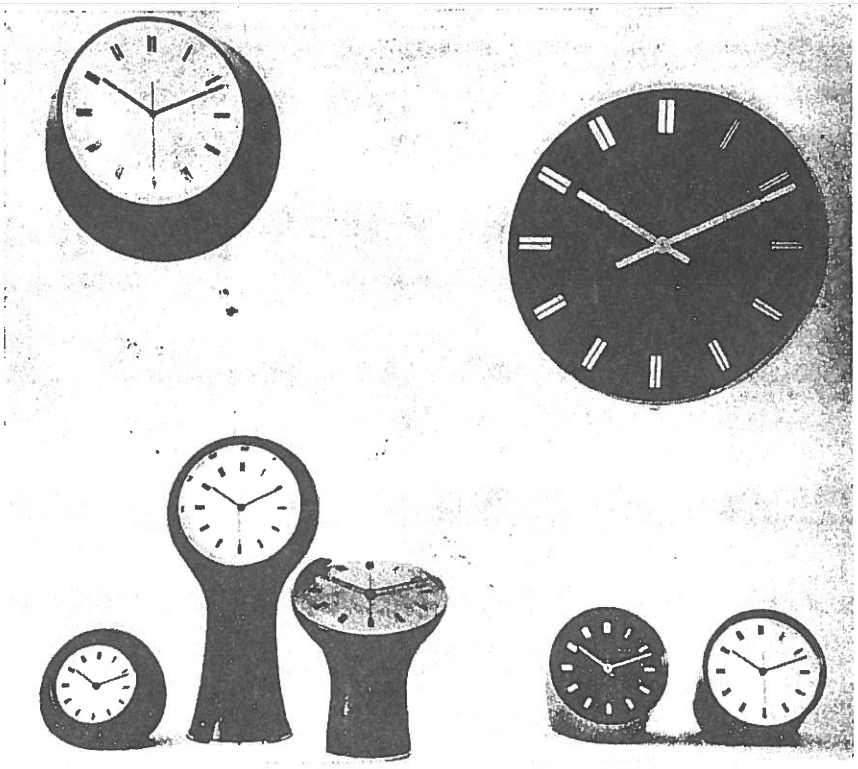

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**Fig. 50.** The Secticon models are differentiated according to their destination: the diameter and incline of the dial are adjusted to the line of vision and to distance. All are equipped with Portescap transistor movement.

**Fig. 51.** Position of movement in one of the Secticon clocks.

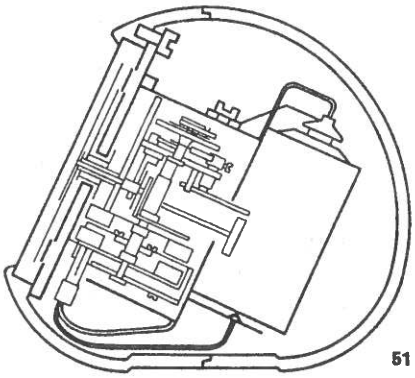

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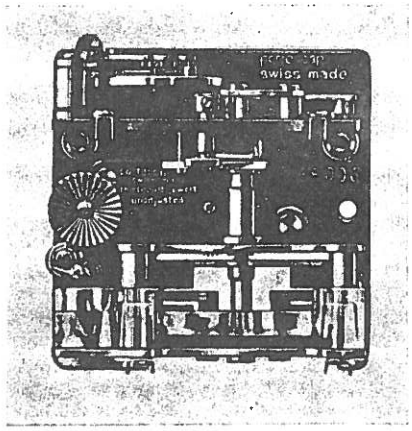
**Fig. 52.** The Portescap movement.

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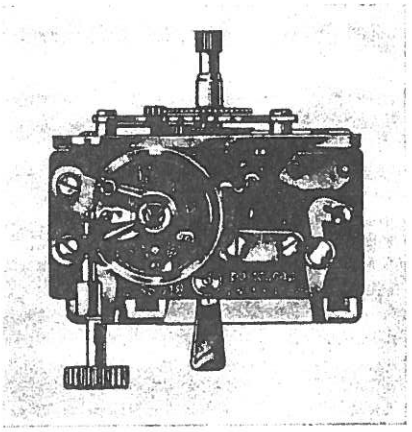


fitting, and with or without an exterior handsetting.

**The units.**

**1. Train wheels (Fig. 53).**

This unit is composed of a plate and two bridges holding the seconds, the minute and the hour-wheels, the third-wheel and pinion, and also the hand-setting stem. An adjusting ring holds the minute wheel. The base plate has two supporting pillars with two conical posts used to guide and hold the regulating unit.

**2. Motor unit (Fig. 54).**

This unit has four elements:

1 a plastic frame with the electric circuits and the transistor, together with the pilot and drive coils

2 a bridge with a tube and bearing for the upper rotor shaft

3 a rotor carrying two thin plates which are parallel and similar; each one has at both ends a permanent and polarised magnet of very high quality; a starting pinion (b), an arming pinion (a) geared to the regulating unit **(Fig. 55)**

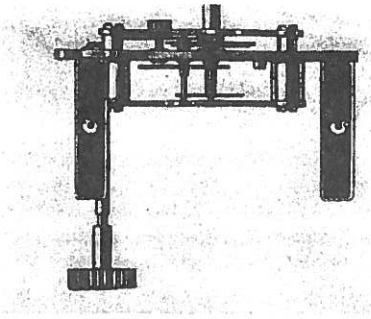
4 a lower plate for the assembling of the unit and with an Incabloc shock-absorber for the lower rotor shaft; this plate also carries the levers holding the motor unit to the base plate.

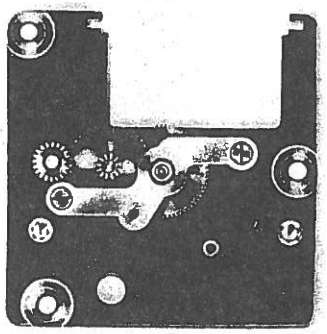
**Functioning of the motor unit.—** When the rotor is between the coils, the transistor does not let the current go through. In rotation, the rotor makes one of the pairs of magnets go over and under the pilot coil, inducing a tension which opens the transistor. The current from the battery can then go through the drive coil. In going through the drive coil which, at that time, is in the magnetic field of the opposite pair of magnets, the current creates a rotation force making the rotor turn. The rotation speed can vary from 500 to 1000 revolutions per minute, depending on the voltage of the battery.

**3. Regulating unit (Fig. 57).**

This unit is a magnetic escapement system with constant power of an entirely new type and consists of the following principal elements:

1 a plastic detent wheel, with three segments, a star with three points, in relation to the segments of the detent wheel and riveted to it; the system is





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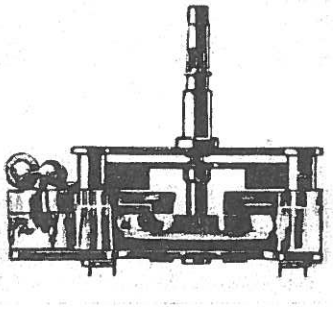

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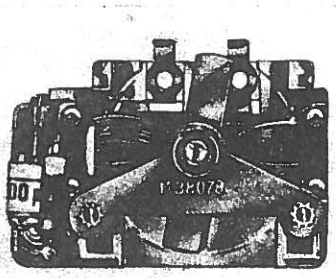

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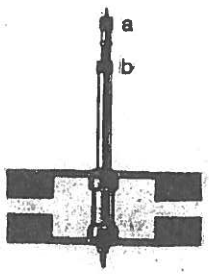



**Fig. 53.** Train wheels.

**Fig. 54.** Motor unit.

**Fig. 55.** Rotor ; a = arming pinion ; b = starting pinion.

fixed to an axle with endless screw and two pivots **(Fig. 58)**; the lower pivots in the bearing of the movable bridge and the upper in the bearing of the detent bridge

2 a detent with an edge where a detent spring and a protective blade are riveted; the detent has a stop pallet, a starting pallet, a jeweled pallet, and a magnetic attraction stem; the detent pivots with a staff between the plate and bridge **(Fig. 59)**

3 an impulse spring attached, on one side to a ring which is part of the detent staff, and on the other side to a stud held securely on the plate

4 a permanent magnet held by two small plates; this assembly is mounted on the plate with an eccentric, which permits true orientation (once the setting is made, a tightening screw prevents any shifting)

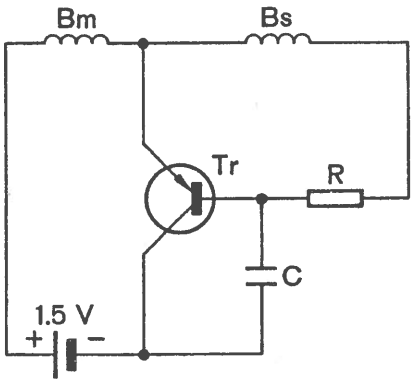
5 a very heavy nickel circular balance wheel attached to a Breguet self-compensating hairspring with a special thermo-elastic coefficient of ± 0.2 s/°C/ 24 h; the roller with jewel is on staff of the balance wheel; the very fine pivots are protected with an Incabloc shock-absorber

6 a regulator with a special key allows for the setting of the hairspring shake with great facility; the regulator is held only by a friction spring of light pressure; therefore, it turns very freely around the Incabloc shock-absorber; another spring blade attaching the regulator to the micrometric setting screw permits extremely delicate adjustments of fractions of a second per 24 hours

7 a stop lever, riveted to an axle under the plate, bears a starting rack with a return spring geared to the starting pinion of the rotor axle; above the plate, the axle with the stop lever operates a stop spring blade with the help of a collet which puts the detent back in its balanced position and pushes against the roller for the start or for the stop.

**The functioning.**

When the Portescap movement is stopped, the arming pinion is at the level of the detent wheel, and the endless screw interlocks with the second wheel. The hairspring balance wheel assembly is, in its balanced

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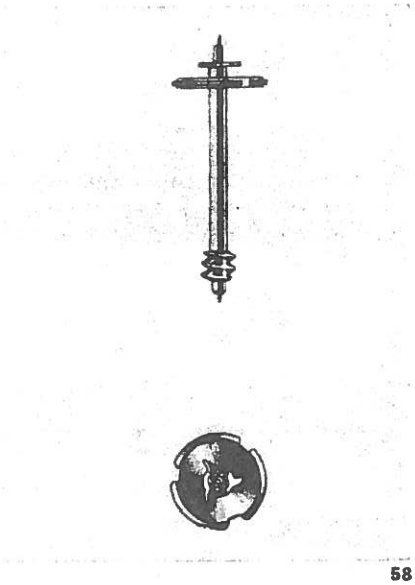

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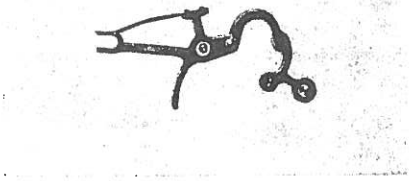

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**Fig. 56.** Electronic control circuit of motor.

**Fig. 57.** Regulating unit.

**Fig. 58.** Detent wheel.

**Fig. 59.** Detent.

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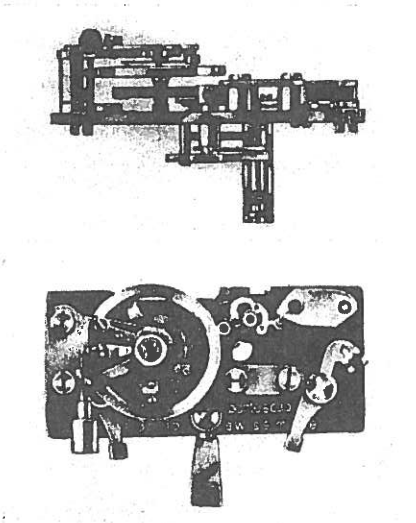


position, entirely free, while the detent is submitted to the tension of the impulse spring.

By moving the starting lever from its rest position, the rack gears with the starting pinion of the rotor. At the same time the stop blade has brought back the detent to its balanced position, that is to say against the reverse block stop, and has armed the impulse spring. The stem of the detent is now in the magnetic field of the permanent magnet which holds it back. This movement of the stop blade has moved the balance from its balanced position, while arming the regulating hairspring.

If the stop lever is released abruptly, it will immediately return to its rest position because of the return spring, and the movement will start. If, on the contrary, a restraining action is applied to the spring, the impulse is not sufficient to start the rotor and it will remain immobile; however it will free the balance wheel which will oscillate somehow, and make the detent return to its first position. The movement therefore does not run.

**Figure 60-1.**—To make it easier to study the different steps, let us suppose that the balance wheel has been stopped without the use of the stop lever, so that the rotor is still turning. The winding pinion is found in one of the three segments of the detent wheel, because this latter is stopped by an arm of the star against the stop pallet. The detent being in its balanced position, these two movable parts will not interlock, due to the reciprocal position of the winding pinion and the detent wheel.

**Figure 60-2.**—When the hairspring balance wheel assembly, by its roller jewel, moves the detent, it induces the detent with its detent blade, which presses on the protective blade. This rotation of the detent separates the gravity stem from the permanent magnet until its power is weaker than the torque of the impulse spring, which then acts on the motion of the detent and consequently transmits an impulse to the balance wheel through the roller jewel.

**Figures 60-3 and 60-4.**—The impulse ended, the motion of the detent continues, while the stop pallet no longer holds back the star, nor the detent wheel to which it is attached. The starting pallet, at the time, pushes the back of one of the arms of the star. The star, in turning with the detent wheel, gears to the winding pinion, inducing through friction the segment of the wheel to the next slot, where it turns continuously. During the rotation of the detent wheel, one of the arms of the star pushes the jewel pallet of detent to bring it back to its balanced position where the permanent magnet will hold it. This rotation assures at the time the rearming of the impulse spring until one of the arms of the star stops the detent wheel by hitting against the stop pallet. During the return motion of the balance wheel, the detent blade will simply bend, without producing any other movement of the escapement.

Each rotation of the detent wheel will push forward the seconds wheel a half second, under the direct but intermittent action of the motor. In the usual watch movement, the motive force is transmitted to the escapement directly by the train, therefore all the factors which influence this motive force will have a repercussion on the running. In the Portescap movement, the motive power gives no impulse to the hair-spring balance wheel assembly; it simply rearms the impulse spring and pushes the hands, independently of the regulating system.

We can see, therefore, that the speed of the rotation of the motor has no influence on the chronometric precision of the movement. As long as the battery has enough energy to give the motor a torque superior to that of the impulse spring and to push the hands, the Portescap movement functions without any changes in the quality of its adjustment. When this torque becomes too weak, the movement stops, and it is time to change the battery.

**Immediate service.**

The three units of the Portescap movement (train wheels, motor unit and regulating unit) are interchangeable.

The motor unit and the regulating unit are both held by the base plate with two levers. To replace either unit, just

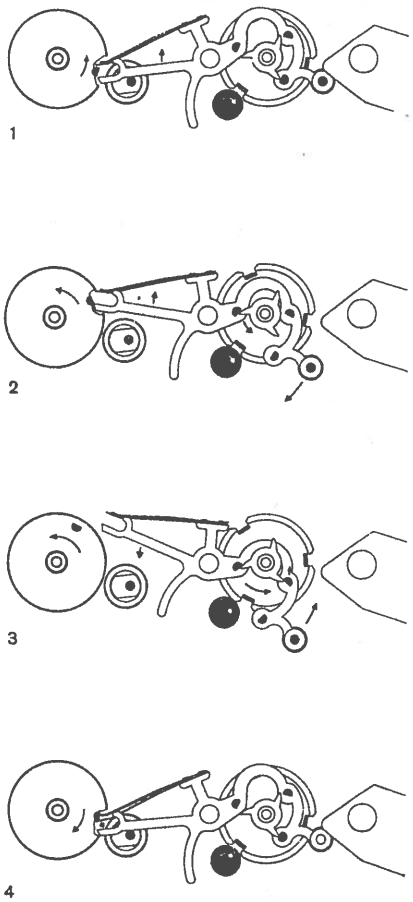



Fig. 60. For better understanding, the impulse spring is not indicated.

release the levers, take any unit out, put in the new unit and reset the levers.
This construction makes the maintenance and the repairs simple, fast and rational. As a matter of fact, the movement can be repaired without any delay ; just replace the damaged unit with a new, or even reconditioned one, either at the factory, or at a qualified repair center.
The actual repair of the damaged unit can be done later in a more economic way and with the best results.
To simplify the shipment of the motor or regulating units, and to guarantee their protection, a special container is available. It is designed to hold either a motor unit, or a regulating unit. The container being made of transparent plexiglas, it is possible to see which unit is inside. A slightly bevelled edge helps in the stacking of several containers.

**Controls to be effected after changing the regulating unit.**

1 check that the thin wire spring presses well against the movable bridge and make sure of the relative position of the endless screw and of the second wheel; there should be a little play between the endless screw and its tube when the movable bridge is displaced
2 see that the impulse spring is flat and that it touches neither the detent bridge, nor the motor tube
3 with the motor running, make sure the seconds hand is properly set.

**Maintenance.**

**1. Train wheels.**

The unit with the train can be disassembled, cleaned and reassembled under usual procedure. Only the minute wheel should not be cleaned, since it works on greased friction.
For oiling, the manufacturers of the Portescap movement recommend the use of Synta-Visco-Lube oil for all pivots, and also for the minute stud.
After pushing back the guard ring of the minute wheel, check the end shake of the minute wheel.

**2. Motor unit.**

1 unscrew the two assembling screws to separate plate, frame, bridge and rotor
2 clean the Incabloc shock-absorber, using the method recommended by the manufacturers
3 clean the motor tube bearing
4 clean the rotor, making sure that no metal particles stick to the magnets
5 disassemble the winding pinion (this delicate operation should be done only by a watchmaker specially trained and with the proper tools)
6 carefully clean the frame of the electrical assembly; do not use liquids
7 put a drop of Synta-Visco-Lube oil in one of the notches of the oscillating pinion, put pressure to the pinion to make it rotate, in order to spread the oil evenly
8 reassemble the motor without separating or scratching the coil threads
9 oil the pivots with Synta-Visco-Lube oil.
If a defect in the winding pinion, or in the electrical circuits is noticed, it is recommended that the complete unit be sent back to the factory.

**3. Regulating unit.**

Normally, cleaning and oiling the Incabloc shock-absorber (upper and lower) is sufficient, and there is no need to disassemble anything else.
If a thorough cleaning is necessary, proceed as follows:
1 open the regulator key
2 unscrew the stud screw of the hair-spring
3 remove the balance bridge, then the hairspring balance wheel assembly
4 loosen the impluse spring stud screw
5 remove the bridge, then the detent, and the detent wheel (the permanent magnet should not be unscrewed)
6 wash all parts in benzine (the Incabloc shock-absorber should be cleaned separately)
7 replace the detent wheel, the detent and the bridge controlling the end shake (detent staff 2/100 to 4/100 mm, detent wheel 1/100 to 3/100 mm when the movable bridge is pressed down); the end shake of the detent wheel should be very slight because it is responsible for the movement of the seconds hand; if it goes beyond the tolerance indicated above, the hand will vibrate and not move with precision
8 replace the impulse spring stud and tighten its fitting screw, without altering the strength of the spring (only a specially trained watchmaker can control this)
9 make sure that the detent blade is slightly detached
10 check the functioning of the wire spring of the movable bridge; its very weak tension should be exercised freely—if this tension is too weak, the gear of the endless screw and the seconds wheel will not work properly, and the seconds hand will vibrate; if, on the contrary, this tension is too great, the motor will increase its current consumption, the oil between the endless screw and the seconds wheel will disappear, and the movement could stop
11 the oiling will be done with Synta-Visco-Lube oil for
the jewels of the upper and lower Incabloc shock-absorber
upper and lower detent jewels
upper and lower detent wheel jewels
upper and lower pivots of the movable bridge
the flat of the detent jewel (without the oil touching the detent itself)
behind the arms of the star
the micrometric regulator screw notch
the endless screw (it is advisable to oil the endless screw sufficiently, as the use of the oil, at this point, is relatively high)
12 replace the hairspring balance wheel assembly and the balance wheel bridge, and tighten the hairspring stud screw
13 control the starting and the centering of the hairspring; turn the key leaving as little space as possible, without however impairing the free movement of the hairspring
14 place the movement in its final position and do not move it for at least 36 hours; this stabilization gives

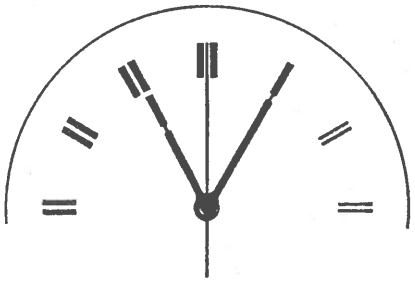


**Fig. 61.** Put in beat of the seconds hand.

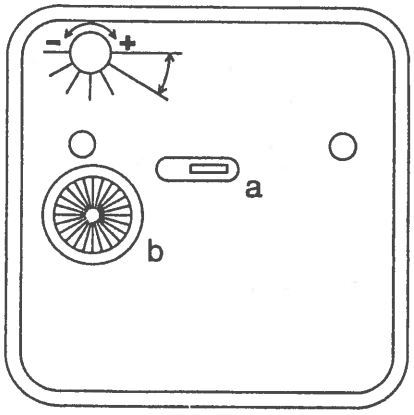



**Fig. 62.** **a** = stop lever; **b** = hand-setting knob.

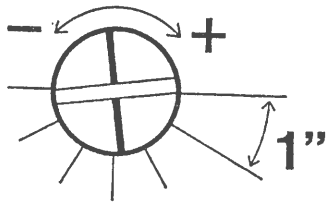



**Fig. 63.** Micrometric regulating screw.

an opportunity for the oil to spread, the movable parts to reach their definite position, and the hairspring to balance its tensions, conditions indispensable to make any correction of a fraction of a second

15 check again the regulation without moving the movement, by using the Vibrograf (oscillations 7200/h); because of the exceptional conception of the Portescap movement, the instantaneous reading corresponds to the actual running condition.

**Time setting.**

Once the hour hand and the minute hand are adjusted to each other, and the seconds hand is in place **(Fig. 61)** proceed as follows for setting the time:

1 stop the seconds hand exactly on 12 o'clock by using the stop lever **(Fig. 62-a),** then release the lever slowly

2 set the minute hand exactly on one of the dial indexes; the seconds hand will be correct in relation to the minute hand; to turn the minute and the hour hands, press lightly on the hand-setting knob **(Fig. 62-b)** and turn it slowly until it is in gear, then press all the way and turn in the direction wanted

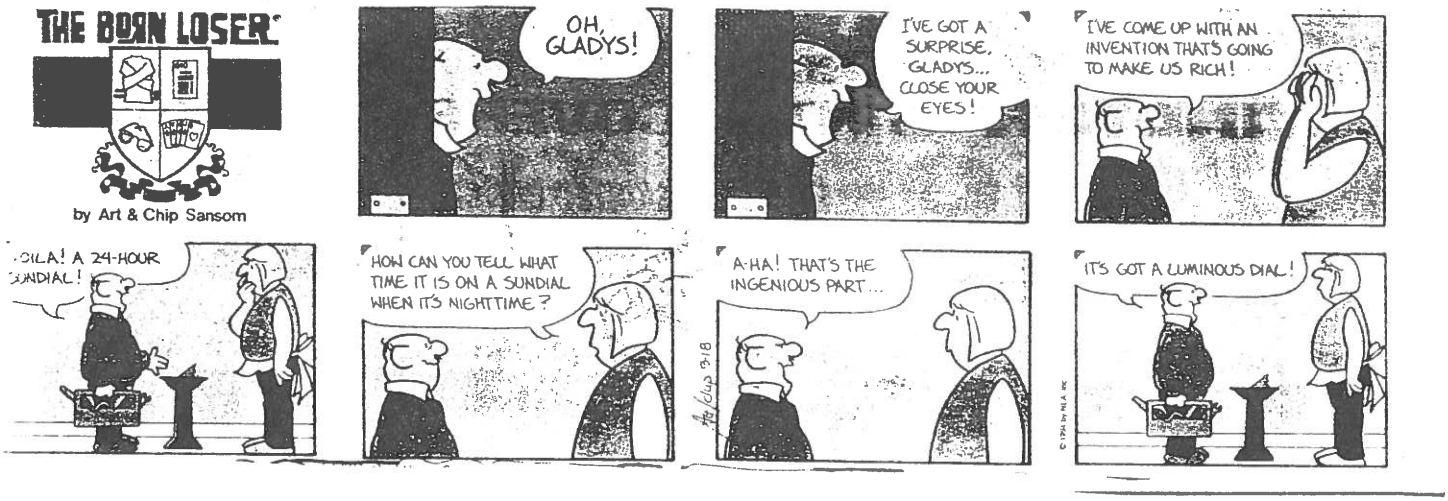
3 start the movement with the stop lever, by releasing it abruptly when the time signal is heard.

**Final adjustment.**

Once the movement is cased and set in its final position, and after setting the time accurately, place the clock where it will normally be used, and let it run for about ten days.

Then, during the following eleven days, check each day, at the same time, its accuracy. This control will permit to calculate the slight differences which may occur.

The average daily error can be calculated and it will be easy to make the necessary adjustments, using the micrometric regulating screw **(Fig. 63).** Simply remember that one quarter of a turn of the screw corresponds to a correction of three seconds per day, and that a turn to the right is a gain, and a turn to the left a loss.



Continued from September, 1999 issue.

ESCAPE WHEEL ASSEMBLY

The escape wheel 10, mounted on the escape wheel arbor, is cut with **three spur shaped teeth.** A **disc** 8 of plastic material, enclosed between two brass reinforcing discs of slightly smaller diameter, and cut with three equally spaced slots 11, is mounted on the arbor just below the escape wheel. The three slots are positioned in a certain exact relationship to the teeth of the escape wheel. The driving pinion on the rotor arbor can either turn idly inside these slots or, if the escape wheel is moved slightly forward, it can engage with the uncut part of the periphery of the disc, thus driving it round.

LEVER ASSEMBLY

The lever is of unusual construction. It is provided with a fork 17 of normal shape, but the solid part of one of its flanks is shorter than the other and its full length is achieved by the provision of a light **passing spring** 18, to enable the impulse pin to pass during the return swing of the balance, when no impulse is imparted. The opposite end of the lever 12, which would normally carry the pallets, is provided with three pins—two of which are of steel and one of ruby—which are placed so as to enable each of them to act on a different tooth of the escape wheel. We shall refer to this part as the **tail of the lever.**

These pins are :—

(1) **Locking pin** 15 of steel, the function of which is to lock and unlock the escape wheel ;

(2) **Moving pin 19** of steel, the function of which is to start the escape wheel moving afer it has been unlocked ;

(3) **Rocking pin** 23, of ruby, the function of which is to rock the lever on its axis and to cause it to move from one banking to the other. in an anti-clockwise direction (when looking at the drawing).

One end of a light hairspring 13 is colleted to the lever arbor ; the free end is anchored to the platform.

When the lever has been moved as far as it is permitted in an anti-clockwise direction, this hairspring is wound up, or put under tension, so that when the lever is released again, it will be moved in a clockwise direction until its movement is arrested by a stop pin in 14, set in the platform.

A small permanent magnet 20, is mounted in a frame of non-magnetic material, secured to the platform, which is thus insulated from the rest of the movement. When the lever is against the stop pin the permanent magnet attracts the moving pin on the tail of the lever and thus prevents the lever from moving away from the stop pin. It has the same effect as the **draw** in a conventional lever escapement. The attraction is not so strong, however, as to prevent the impulse pin from moving the lever when it enters the fork and strikes its flank.

## XIX.—ACTION OF THE ESCAPEMENT

Assume that the lever has been moved as far as possible in an anti-clockwise direction (when looking at the drawing) and is held against its stop pin 14 by the action of the permanent magnet 20 on the moving pin 19 of the tail of the lever 12. The balance will be completing its supplementary arc.

As the balance reverses its direction of swing and moves in an anti-clockwise direction, the impulse pin 16 enters the fork of the lever 17 and strikes the passing spring 18, which in this direction of travel is supported by the solid part of the flank of the fork. This causes the lever to move away from the stop pin and the moving pin 19 on the tail of the lever to move out of the field of the permanent magnet.

As soon as this happens, the lever hairspring 13, which is under tension, reasserts itself and forces the lever to move more rapidly in a clockwise direction, so that the opposite flank of the lever fork strikes the impulse pin and thus gives impulse to the balance in the normal way. The lever continues to move, under the action of the hairspring, until the fork clears the impulse pin. It moves on still further until it is completely out of the path of the impulse pin.

The escape wheel has been unlocked, but it does not start moving immediately, because there is no power on it. But, as the lever continues its movement in a clockwise direction, the moving pin on the tail of the lever engages with one of the three teeth of the escape wheel and causes it to move forward through a short distance. During this time, the rotor arbor has been turning idly, because the driving pinion has been in one of the slots 11, of the disc 8, on the escape wheel arbor. When the escape wheel is moved forward by the action of the moving pin, the driving pinion 6, engages an uninterrupted part of the periphery of the disc 8, and causes it to turn through the remainder of one-third of a revolution, until the driving pinion enters the next slot in the disc. This action causes the escape wheel also to move through one-third of a revolution. Meanwhile, another tooth of the escape wheel has engaged the ruby rocking pin 23, on the tail of the lever and as the escape wheel moves forward through one-third of a turn as a result of the action of the driving pinion on the disc, this pin causes the lever to rock on its axis and to move back to its original position against the stop pin.

During the return swing of the balance, when no impulse is imparted, the impulse pin strikes the passing spring 18, of the lever fork. In this direction of movement the passing spring is not supported by the fork ; hence the impulse pin can pass unimpeded.

From the above description, it will be seen that as the balance completes its supplementary arc in one direction, the escape wheel is locked by the

locking pin on the tail of the lever. The lever hairspring has been put under tension or, in other words, a remontoire has been wound up. When the balance moves in the opposite direction, first of all the action of the impulse pin on the lever fork unlocks the escape wheel. This frees the lever, whereupon the hairspring comes into action and causes the lever to move rapidly, thereby giving impulse to the balance. This movement of the lever is controlled by the hairspring ; accordingly, the impulse given to the balance will always be constant in amount. The escape wheel plays no part in the giving of impulse because as the lever moves over, although it has been unlocked, the escape wheel does not move immediately. After impulse has been given, the moving pin on the lever tail starts the movement of the escape wheel, which is completed by the driving pinion acting on the escape wheel disc. As the lever continues to move, the escape wheel engages the ruby rocking pin and re-sets the lever and at the same time re-winds the hairspring. This movement is performed by the constantly running motor, the power of which is adequate for the purpose. During the re-setting of the lever the balance is completely free of the escapement.

Thus, while the function of the motor is to move the escape wheel through one-third of a revolution each cycle, the escape wheel re-sets the lever and winds the hairspring. The hairspring, or remontoire, then gives constant impulse to the balance. Although the motor is rotating constantly, it drives the escape wheel only intermittently, because for part of the time the driving pinion is turning idly inside one of the slots in the plastic disc on the escape wheel arbor, and it is only when part of the uninterrupted periphery is presented to the driving pinion that it causes the wheel to turn—through one-third of a revolution at a time—or until the driving pinion enters the next slot of the escape wheel disc.

## XX.—TRAIN

The drive from the escapement to the centre seconds hand is by means of a worm pinion 22, fixed to the lower end of the escape wheel arbor and a worm wheel, fixed to the centrally placed arbor carrying the centre seconds hand.

The worm wheel is planted on the base plate of the movement (Fig. 13).

The ratio of the worm and wheel is such that one-third of a rotation of the escape wheel will advance the seconds hand by one half second. As the balance beats half seconds, this gives the correct drive to the seconds hand.

The rest of the reduction gearing required to operate the minute and hour hands is of the usual spur wheel and pinion type and is located partly behind and partly in front of the base plate of the movement.

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Dr. George Feinstein 75-19 195th Street Flushing, NY 11366

Hand setting is performed by a setting knob at the back of the movement. A pinion on the arbor of which this knob is mounted engages with the motion work when the knob is gently pushed in. A small coil spring keeps it out of engagement as the clock goes.

## XXI.—BATTERY

The current consumption of the electric motor is very small and is of the order of 0.3 milliwatts. It is claimed that an ordinary 1.5 volt dry cell, U 2 type, will operate the clock for some 18 months to two years.

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