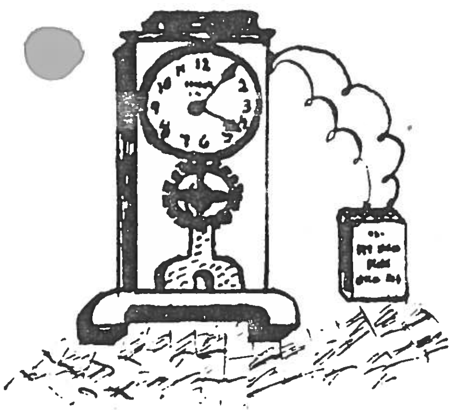
ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



February 1977

VOLUME III--ISSUE #1

Martin C. Feldman, Editor

Hello fellow enthusiasts:

This issue marks the beginning of a New Year as well as being the initial issue of Volume III. Our Journal will contain six issues printed every odd-numbered month. The Officers and Staff wish you a Very Happy and Healthy New Year, albeit late--but better-late-than-never. Highlighting this issue is a translation by our Technical Editor, Dr. George Feinstein, of a Russian article describing Fedchenko's Electronic-Mechanical clock. This particular type of clock is probably the last one of its kind to be made for precision time measurement. We have progressed so far with our quartz and atomic clocks that the standard of accuracy of an electronic-mechanical (i.e. Fedchenko's) clock is no match at all when absolute precision is mandatory. So, it is with this clock that we are marking the end of an era of extremely accurate and well-constructed precision mechanical clocks. This does not mean that the precision master clocks with which we are all familiar necessarily has lost its attractiveness and interest for us. On the contrary, those of us who are lucky to possess a Shortt Free Pendulum clock, Rieffler Master Clock and others of the same genre have in their possession clocks of extremely fine engineering and superb craftsmanship. Such clocks will not cease to lose interest in our eyes and they have, of course, entered the realm of antiquity as well. Dr. Feinstein's translation is the first of a two-part series. The April Journal will carry the second part dealing with a most unique pendulum suspension system. This suspension system contributes significantly to the accuracy of the Fedchenko's clock and, in addition, can be used on almost any pendulum master clock.

The other main section of particular interest in this issue is a copy of one of the Warren Clock patents to which Mr. Cramer alluded in his fine article in our last issue, Vol.II, #6.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman, FNAWCC

FEDCHENKO'S ELECTRONIC - MECHANICAL PENDULUM ASTRONOMICAL CLOCK

Translated by: Dr. G. Feinstein from V. A. Shpolianskii, & B. M. Cherniag, ELECTRICAL TIME DEVICES, Moscow, 1964.

The well known astronomical clock by the English scientist Shortt (10), (12), with a relative precision of the order of 10^{-8} has at present lost its importance as a standard clock, since the precision of a no more complicated quartz crystal astronomical clock is higher by 1 - 2 orders of magnitude.

One of the factors, limiting the further increase in the precision of the Shortt clock, is the electromechanical method of impulse transmission to the free-pendulum. As is well known, the slave pendulum of the Shortt clock releases the impulse mechanism of the free pendulum which receives as a result a force interaction component between this mechanism and the pendulum impulse maintaining its oscillation. Instability friction, arising by such impulse transmission, causes fluctuations in the pendulum amplitude, and consequently also impairs the clock's precision.

To Fedchenko's electronic-mechanical pendulum clock AChF-3 are applied the isochronous suspension and the electronic-mechanical escapement with magneto-electric drive, such as shown in Fig. 16, a.

Fedchenko's clock with its relative simplicity has a precision (2-3) 10^{-9}, i.e. an order of magnitude higher than the precision of the Shortt clock.

Fedchenko's clock is mounted in a steel pressure chamber within which the operating clock is maintained at a pressure of 8 -10 mm Hg. A two-second (i.e. 39 in.) compensated pendulum having an Invar rod of 10 mm. diameter and a copper cylindrical bob weighing 9 kg. is used. The total weight of the pendulum is 10 kg.

The magneto-electric drive has a moving portion fastened by means of the connector sleeve 5 to the bottom of the pendulum 8, which consists of a magnetic circuit 1 and two permanent magnets 2 and 3, which are of prismatic form and made out of Magnico (Alnico?). The stationary portion of the drive, in which are the coils 4 as well as the electronic circuit, is fastened by component 6 under the pendulum on the Invar bar 7, whose upper end is fastened to the same bracket as the pendulum, and goes down parallel with the pendulum rod. Securing the moving and stationary portions of the drive mechanism on rods of the same material, which have small and identical coefficients of thermal expansion, ensures in fluctuating temperatures a constancy in the clearance between these parts.

The discharge coil w_o and drive coil w_u are rectangular in shape and are wound one on top of the other. With the pendulum oscillating in the vicinity of its position of static equilibrium, the coils are in the gap between the magnets, and in the discharge coil arises the discharge signal current, while through the drive coil passes an impulse current from the direct current source E. The impulse forming circuit is transistorized. It transmits to the pendulum sufficient energy to sustain its oscillation.

The electronic cascade circuit formed represents a two-stage amplifier, built around junction germanium transistors P_1 and P_2 of type P5V. The use of

(10) Favager, A.; ELECTRICITY AND ITS APPLICATION TO CHRONOMETRY-Journal of Swiss Horology and Jewelry, Neuchatel, 1924.

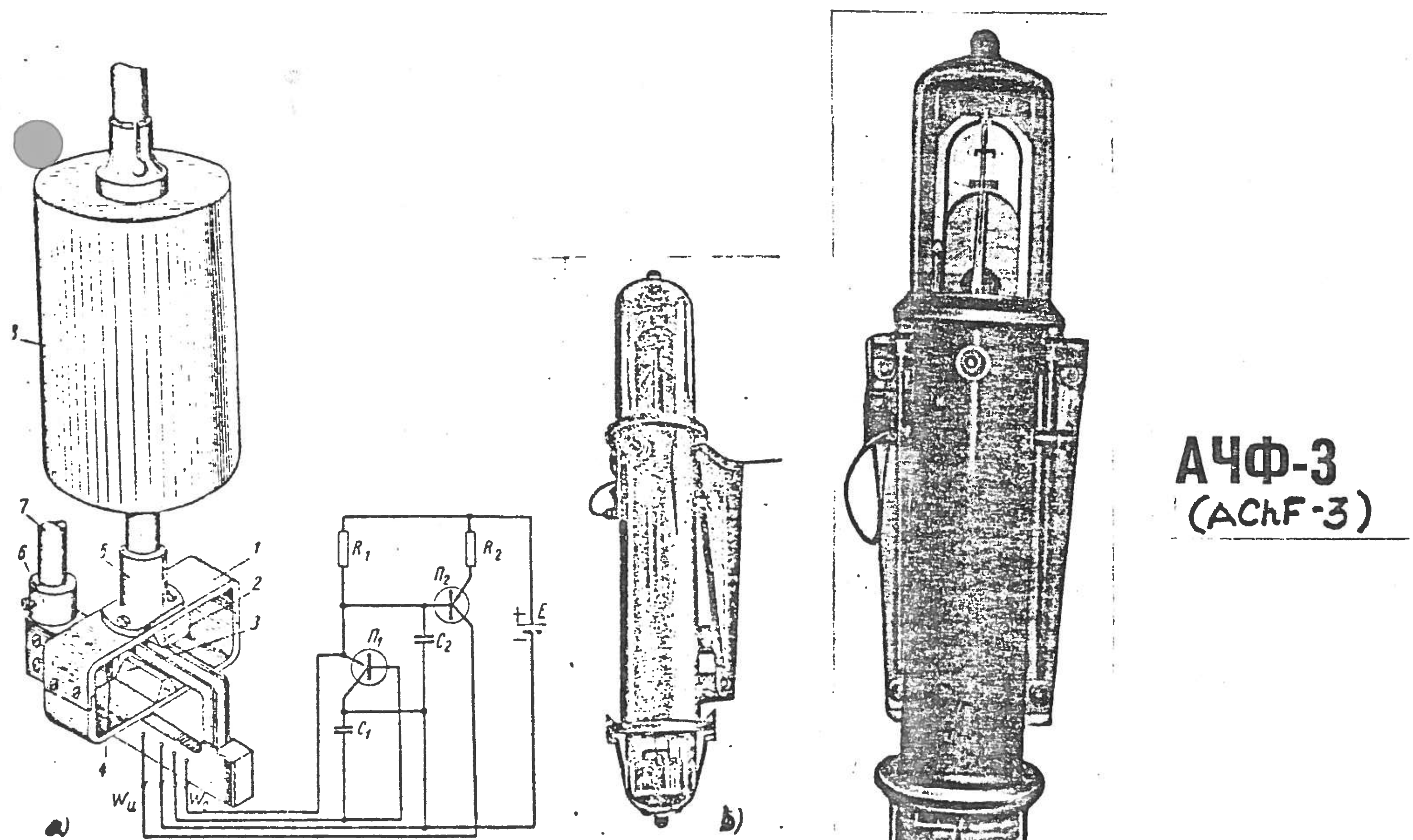
(12) Hope-Jones, F.; ELECTRICAL TIMEKEEPING - London, 1949

two-stage amplifier was called for, since the coil w_o produced too weak a discharge signal, which is insufficient to completely open the transistor P_1. Amplification of the discharge signal by increasing the magnetic induction in the working gap or the number of turns in coil w_o appears undesirable for such a high-precision clock, as Fedchenko's, because this causes an increase in the discharge time, and therefore, reduces the precision of the pendulum. Therefore the discharge signal is amplified in the preliminary stage, built around transistor P_1, and then the amplified signal, removed with the load resistance R_1 from the first stage, is fed in the input of the output amplifier stage (between the base and emitter of the transistor P_2). This signal completely opens transistor P_2, which in the switching mode forms the drive impulse current, as in the ordinary single-stage circuit. Drive coil w_u as usual is inserted in the collector circuit of the transistor P_2, resistors R_1 and R_2 define the operating conditions, condensers C_1 and C_2 serve to prevent the formation of spurious oscillations in the cascade circuit.

Clocks employing a direct current supply, require a potential of 1.5 v. The magnitude of the current drain is 0.2 - 0.3 milliamperes per pulse duration of 0.4 sec., which ensures the operation of the clock without change of current source for more than a year.

Discharge coil w_o has 2,000 turns of wire of 30 micron diameter. The drive coil w_u has 1,900 turns of 50 micron diameter.

Capacitance of the condensers C_1 and C_2 is 0.1 microfarad. An exterior view of the astronomical clock AChF-3 is given in Fig.16,b.



...с. 16. Регулятор электронно-механических астрономических часов Федченко АЧФ-3

а — схема; б — внешний вид.

Fig.16. Fedchenko's Electronic-mechanical astronomical regulator AChF-3

a) schematic b, b_1) Exterior View

THE JANUARY CALENDAR

1) New Year's Day. Congratulate yourself that you survived the holidays!
2) Count the Clocks in Your Clock Collection Day
3) Remind yourself to forget how many clocks you have in your collection.
4) Annual Day to Wind Your 400-Day Clock (s) (It's silly to wait another 35 days just to prove a point.)
5) Clean up a Dirty Old Clock Case Day
6) Some Old Clock Cases Look Better Dirty Day
7) Yearly Go Out and Buy Yourself an Expensive Antique Clock You Can't Afford Day
8) Traditional Day to Feel Guilty and Get It Over With
9) Celebrate National "I'm Glad to be a Clock Nut" Day!
10) Clear Off the Top of Your Clock Work Bench Day "How else will you know if it's still there?)
11) Be too uncomfortable with an orderly work bench to get anything done.
12) Semi-annual Wind All of Your 30-hour Clocks Day (It's the only way to find out if they still work.)
13) Bless Your Atmos Clock Which Never Needs to be Wound Day
14) Second Friday of the month. It's Clock Club Night in the San Fernando Valley. Join us if you can!
15) Go to a Garage Sale Day (You might find a cheapie old clock).
16) You can't Win 'Em All Day (Yesterday's bargain clock will be GREAT for parts.)
17) Pay Your Dues Better-Late-Than-Never Day (If you're not reading this column because you didn't receive your January Valley Regulator, you probably forgot to pay your 1977 dues.)
18) Buy your husband (or wife) a clock which you've been wanting for yourself. This is "It's All in the Family" Day.
19) You Got Away With (or You Did Not Get Away With) that Sneaky Trick Day
20) Really Try to Sell a Clock and Make a Profit Day
21) You Didn't Want to Part With That Clock Anyway Day
22) Black Saturday - also known as Clean Out Your Garage Day (or Week)
23) Have a Garage Sale Day (or week) - what else!
24) Be Good to Your Old Clocks Day (They appreciate an occasional friendly once-over with Windex and dust cloth.)
25) Participate in Rearrange Your Clock Collection Day (s) Don't procrastinate - RYCC Day won't come again for another five years!
26) Visit someone who has been collecting antique clocks for twenty years or longer
27) First day of "I Don't Know Why I'm So Depressed" Week
28) Resolve not to spend any more money on old clocks this month.
29) Nobody's Perfect Day
30) Contribute to the success of Clock Collecting is Contagious Day (Get a beginner hooked.)
31) Enjoy Your Old Clocks Day - which should be celebrated 365 days a year!

From: Valley Regulator, Volume 4-No.7, January 1977--CLOCKS 'N' STUFF - by Mary Wieland

UNITED STATES PATENT OFFICE.

HENRY E. WARREN, OF ASHLAND, MASSACHUSETTS.

CLOCK MECHANISM.

1,160,346. Specification of Letters Patent. Patented Nov. 16, 1915.

Application filed November 30, 1914. Serial No. 874,620.

To all whom it may concern:

Be it known that I, HENRY E. WARREN, a citizen of the United States, residing in Ashland, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Clock Mechanism, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to a clock mechanism of that class in which an oscillating pendulum is employed, and has for its object to provide the clock mechanism with means for directly transforming the oscillations of the pendulum into motion of continuous rotation, whereby the oscillating pendulum is employed as the driving member for the time train, yet is mechanically disconnected from the time train, which is especially advantageous in portable clocks, such for instance as the type commonly known as mantle clocks, as the pendulum or the works of the clock are capable of being removed from the clock when it is desired to move, ship or transport the clock and can be replaced by unskilled labor without danger of disarrangement of the clock which would interfere with its accuracy.

In the present instance I have shown the invention as embodied in a clock in which the pendulum is mechanically disconnected from the time train but is magnetically coupled thereto so as to produce rotation of the time train by reciprocation or oscillation of the pendulum.

These and other features of the invention will be pointed out in the claims at the end of this specification.

Figure 1 is a side elevation and Fig. 2, a front elevation of a clock embodying this invention. Fig. 3, a detail of the magnetic coupler shown in Fig. 1. Fig. 4, a diagrammatic view to illustrate the action of the magnetic coupler. Fig. 5, a modified form of magnetic coupler, and Fig. 6, a diagrammatic view to illustrate the action of the magnetic coupler shown in Fig. 5.

Referring to Figs. 1 to 4 inclusive, *a* represents a bent magnetized needle, which constitutes one member of the magnetic coupler and revolves about the axis *b*—*b*, see Fig. 3, so that the lower end of the needle describes a circle in a plane at right angles to the axis *b*—*b*.

The upper portion of the needle *a* is concentric with the axis *b*—*b* and has fast on it a small worm *c* or equivalent device, for transmitting continuous rotary motion to a gear *d* which forms part of the time train of the clock *e*, which time train may be such as now commonly employed in clocks. The needle *a* is magnetized by means of a permanent magnet 10, which also serves as a nearly frictionless bearing for the upper end of the needle *a*, by attracting the pointed upper end of said needle against its lower pole face. The needle *a* is maintained in its proper relation to the axis *b*—*b*, by means of a lower offset piece or crank 12, which is loosely mounted on a stationary pin or shaft 13, located in the axis *b*—*b* and supported by the bottom 14 of a casing 15 of non-magnetic material, in which the needle *a* and the gear *d* are located. The casing 15 is provided as shown in Fig. 2, with a partition wall 16, which separates the casing into a lower chamber 17 in which the needle *a* is located and an upper chamber 18 in which the permanent magnet 10 is located, and said wall is provided with an opening for the passage through it of the pointed upper end of the needle to make contact with the permanent magnet 10. The non-magnetic casing 15 is of sufficient size to enable the lower end of the needle *a* to be moved in a circular path.

It may be preferred to employ the permanent magnet 10 so as to inductively magnetize the needle *a*, but it is not desired to limit the invention in this respect, as the needle *a* may be made of hard steel and permanently magnetized, and mounted in suitable bearings to maintain it in the proper relation with respect to the axis of rotation *b*—*b*.

Rotation of the needle *a* is effected by two horseshoe magnets 20, 21, which are mounted upon the pendulum 22 to move therewith. In the present instance the permanent magnets 20, 21, are attached to a bracket 23, which is secured to the pendulum by screws 24 or otherwise, so that the said magnets are in a plane perpendicular to the axis *b*—*b* and in close proximity to the lower end of the needle *a*, and said magnets are arranged with relation to the circular path in which the lower end of the needle *a* is moved, so as to form around a circle alternate magnetic poles marked N. S. N[1] S[1]. The lines of force from the magnet poles pass across the four air gaps which are thus formed.

So long as the pendulum is at rest, the pole N of the needle *a* will be attracted by and will point toward one of the south poles S or S¹ of the magnets 20, 21. Assume that the pendulum 22 is at rest and that the needle *a* is attracted by the pole S of magnet 20 as represented in the position of the magnets marked No. 1 in Fig. 4. Also assume that the pendulum is put in motion. Just as soon as the pendulum begins to swing to the right, the N pole of the needle *a* will be deflected in a counter clockwise direction in the effort to continue pointing toward pole S and will be moved into the position No. 2. Very soon, however, the pendulum will reach a position when the repulsion from pole N¹ and the attraction of pole S¹ of magnet 21, will overpower the attraction of pole S and the repulsion of pole N of magnet 20 and the pole N of needle *a*, will continue its counter-clockwise rotation and reach the position No. 3. For any further motion of the pendulum toward the right, the pole N of the needle *a* will continue to point toward the pole S¹, but as the pendulum reverses its motion and begins to swing back again toward the left, the pole N of needle *a* will continue its counter-clockwise rotation, reaching successively the positions Nos. 4 and 5. Further left hand motion of the pendulum will bring about the strong repulsion of pole N of needle *a* by pole N and the attraction by pole S, so that the pole of the needle *a* will take the position No. 6, and as the left hand motion of the pendulum continues, the magnetic forces will continue the contra-clockwise motion of the needle *a* until it reaches the position No. 7 which is 180° from the position No. 3. The pendulum now swings back again toward the right, and the pole N of the needle *a* will continue rotary motion and will pass through the position No. 8 to position No. 1, the point of beginning. It will be observed, that a complete reciprocation or oscillation of the pendulum has brought about a single rotation in a counter clockwise direction of the needle *a*, and it therefore follows, that for any number of complete reciprocations or oscillations of the pendulum, there will be the same number of rotary turns of the needle in a single direction. By reversing the magnet poles of the needle *a*, the needle *a* would be rotated in the opposite direction, that is, clockwise.

It will thus be seen that the pendulum is not mechanically connected with the time train of the clock but is magnetically coupled therewith, consequently the pendulum or the clock movement can be removed for purposes of shipping, or moving from one place to another, and again placed in position or replaced by a substitute movement by unskilled labor without any danger of injuring or deranging the clock or getting it out of adjustment. In the present instance the pendulum 22 is shown as hung upon a pin 30, see Fig. 1, extended through a leaf spring 31 which is attached to the frame of the clock. By reference to Fig. 1, it will be seen, that the pendulum can be unhooked from the pin 30 and replaced thereon by unskilled hands, and that as there is no mechanical connection between the pendulum and the time train, there can not possibly be any injury done to the working of the clock by handling the pendulum or the clock movement.

The oscillations of the pendulum may be effected in a known manner, by means of current impulses passing through a coil 34 situated in the field of a permanent magnet 35, which forms part of the pendulum.

In the arrangement shown in Figs. 1 to 4, the permanent magnets 20, 21, both move with the pendulum, and while this arrangement may be preferred, it is not desired to limit the invention in this respect, as only one of the magnets may be secured to the pendulum to move therewith, after the manner shown in Fig. 5, wherein the magnet 20 is shown as movable with the pendulum and the magnet 21 is stationary, being secured to the clock casing or other support.

In the arrangement shown in Fig. 5, the magnet 20 is made larger than the magnet 21 and is located at a lower level, so that its poles can pass under the poles of the smaller magnet 21.

The needle *a* has its upper end attracted to the under side of the pole N¹ of the magnet 21, while its lower end is passed through a bracket 36 attached to the pole N¹ of said magnet, and is provided with a crank or arm 37 which constitutes the movable N pole of the needle. The needle *a* is provided with the worm *c* which is designed to engage the gear *d* of the time train. The needle *a* is rotated clockwise as represented in Fig. 6, wherein positions Nos. 1 to 8 of the movable magnet 20 are indicated.

The relation of the poles N, S, of the moving magnet 20 to the poles N¹, S¹ of the fixed magnet 21 is such that when the magnet 20 is in its extreme right hand position No. 3, in Fig. 6, the pole N of the needle *a* will be attracted strongly by the pole S¹ of magnet 21 and will take up the position shown in No. 3.

As the pendulum swings toward the left and reaches the position No. 4, the repulsion of pole N which is nearer the plane of the pole N of the needle *a* than is the pole S¹ of magnet 21, will move the needle slightly in a clockwise direction, and this repelling effect will continue to rotate the needle in the same direction, as the pendulum swings farther toward the left as shown by positions Nos. 5 and 6. Finally a position of the pole N of needle *a* will be reached, where the combined repulsion of pole N of magnet 20 and the attraction of pole S of said magnet, will completely overpower the attraction of pole S¹ of magnet 21 and will force the pole N of the needle to move into the position No. 7. As the pendulum swings back again toward the right, the pole N of the needle in its effort to follow the pole S, will continue its motion in a clockwise direction, passing successively through positions Nos. 8, 1 and 2, and finally the poles N S of magnet 20 will have moved far enough away from the pole N of the needle, so that the attraction of the pole S¹ of the fixed magnet 21, will exceed the combined attraction of the pole S and the repulsion of the pole N of the movable magnet 20, and the pole N of the needle will be turned into the position No. 3, having now completed one revolution while the pendulum has made one complete reciprocation or oscillation. Obviously this action will be repeated for every complete reciprocation or oscillation of the pendulum, so that the rotations of the needle will measure the reciprocations or oscillations of the pendulum.

In the arrangement shown in Figs. 1 to 4 both magnets 20, 21 are movable with the pendulum, whereas in Figs. 5 and 6, only one magnet as 20 is movable with the pendulum.

In both cases, it will be observed that the magnets 20, 21, coöperate with the magnetized needle to form a magnetic coupler for operatively connecting the oscillating or reciprocating driving member, herein shown as the pendulum 22, with a rotatable member herein shown as the gear *d* of the time train, and while this feature is especially serviceable for use in clocks, it is not desired to limit the invention in this respect.

It is preferred to inclose the magnetized needle *a* in a dust-tight casing of non-magnetic material to protect the same from dust and handling and also to inclose the gear *d* in said casing.

The casing does not interfere with the action of the magnets upon the needle, because the magnetic lines of force pass freely through the walls of the casing. The amount of energy taken from the pendulum to drive the clock movement by means of the magnetic coupler is very slight and is practically constant. It may be preferred to transmit the rotary movement of the needle to the clock movement by a worm and gear, but it is not desired to limit the invention to this particular transmitting means. The needle constitutes a rotatable member of the magnetic coupler and a rotatable armature for the reciprocating or oscillating member of the magnetic coupler, and while it may be preferred to make the rotatable member in the form of a needle, it is not desired to limit the invention in this respect.

Claims:

1. In a pendulum driven clock, in combination, a revoluble member connected with the gear train of the clock and carrying a magnetic pole outside of its axis of revolution, magnets coöperating with said revoluble member and one of which is mounted upon the pendulum of the clock to induce motion of complete rotation in said revoluble member by reciprocation of the permanent magnetic field across the axis of rotation of said pole.

2. In a clock, in combination, a time train, a pendulum mechanically disconnected from said time train, means for oscillating said pendulum, and means for magnetically coupling said pendulum with said time train to drive the latter by said oscillating pendulum.

3. In a clock, in combination, a time train, an oscillating pendulum for driving said time train mechanically disconnected therefrom, and means comprising mechanically disconnected members for directly transforming the oscillations of said pendulum into motion of continuous rotation in the time train, one of said members being connected with said pendulum and the other with the said time train.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY E. WARREN.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.

H. E. WARREN.
CLOCK MECHANISM.
APPLICATION FILED NOV. 30, 1914.

1,160,346. Patented Nov. 16, 1915.
3 SHEETS—SHEET 1.

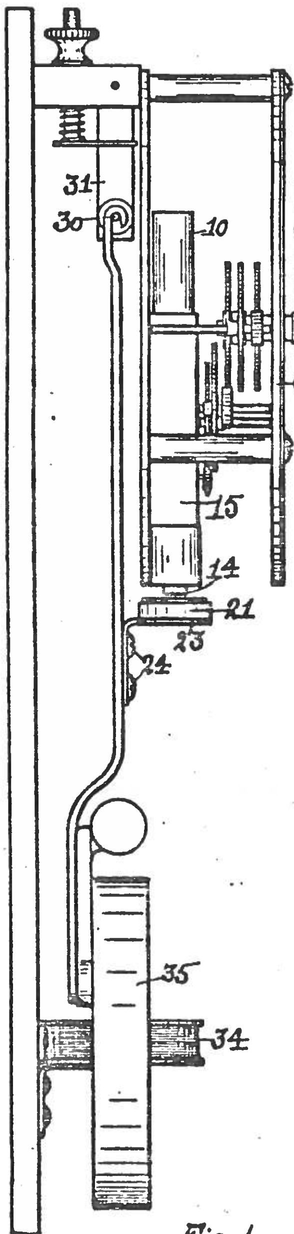


Fig. 1.

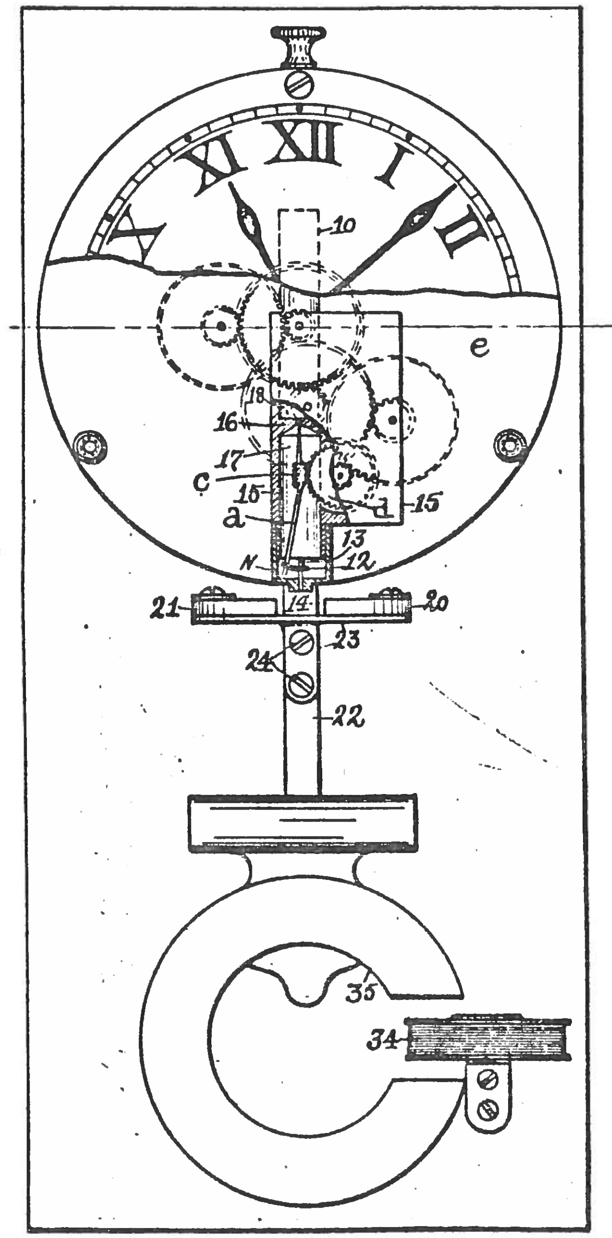


Fig. 2.

WITNESSES:
Harold L. Clark
Howard B. Lawrence

INVENTOR.
Henry E. Warren

H. E. WARREN.
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3 SHEETS—SHEET 2.

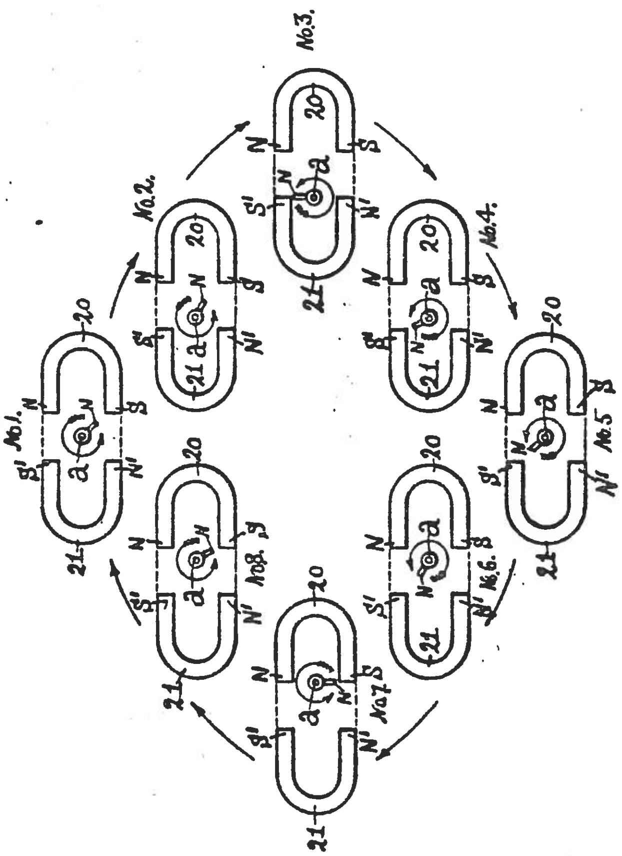

Fig. 4.

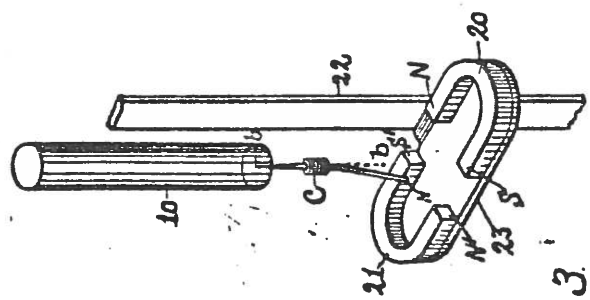

Fig. 3

WITNESSES:
Harold L. Clark
Howard B. Lawrence

INVENTOR.
Henry E. Warren

H. E. WARREN.

CLOCK MECHANISM.

APPLICATION FILED NOV. 30, 1914.

1,160,346. Patented Nov. 16, 1915.

3 SHEETS—SHEET 3.

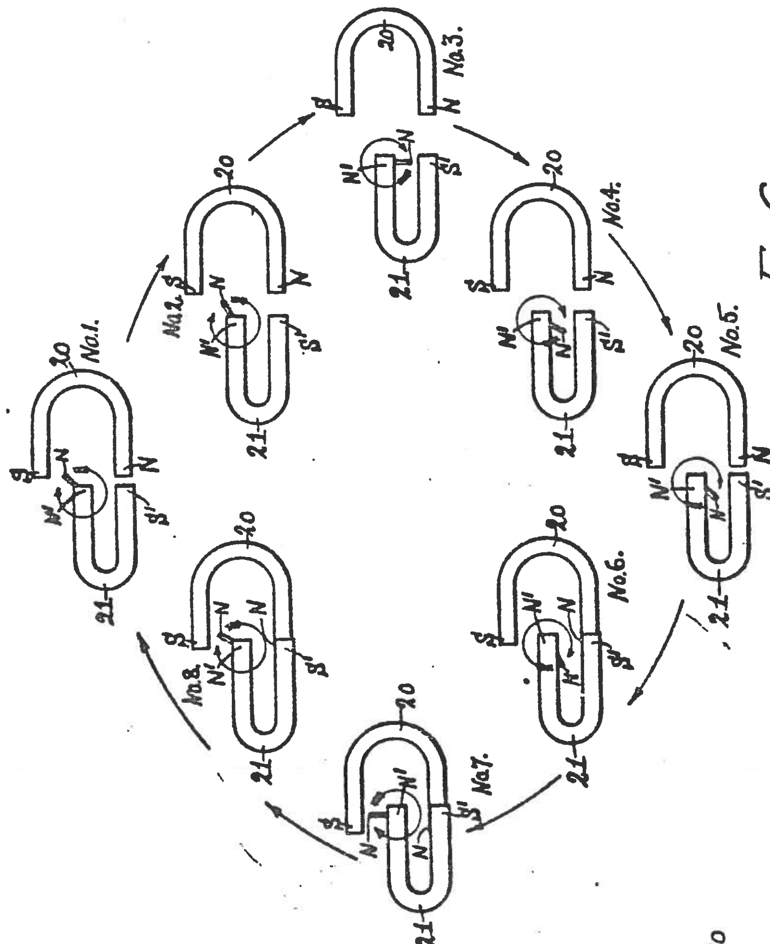

Fig. 6.

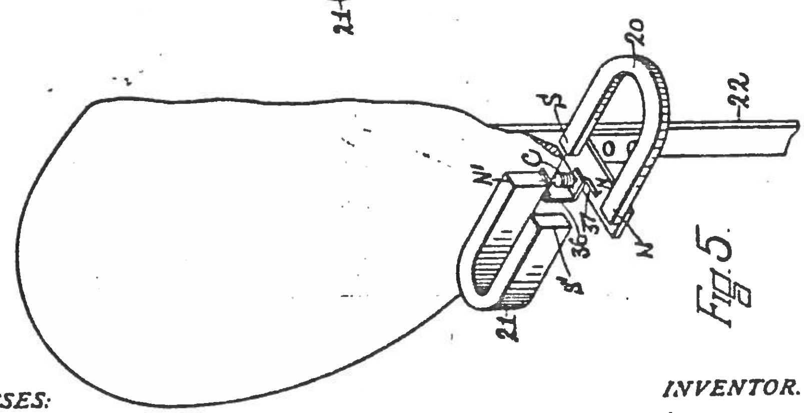

Fig. 5.

WITNESSES:

INVENTOR.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

***** MEETING ANNOUNCEMENT *****

Mr. Bob McGinnesshas kindly offered his home for any member of our Chapter wishing to attend a local meeting on Sunday, March 6, 1977 at 2:00 pm. Bob lives at 233-52 - 87th Ave. Queens Village, N.Y. A phone call to Bob as soon as possible is mandatory so that he knows how many people will be coming and you will know how to get to his home. His phone number is HO 4-0042. We suggest that each member bring one or more interesting electrical timepieces for exhibit and discussion.

It should be pointed out that since our Chapter is held together by the Journal and since our members are scattered throughout the U.S. and other parts of the world, we encourage groups to meet in different sections of the country as we have been doing here on the East coast. If anyone wishes to write an open letter to the membership offering his home for a meeting place, we shall be most pleased to print same.

****

***** WE HAVE PAST JOURNALS AVAILABLE *****

We have a limited number of past Journals available for those wishing them.
Volume No.I, Issues 2 through 6 for 1975 is available.
Volume No.II, Issues 1 through 6 for 1976 is available.
The supply is limited, so first come-first served! The cost is $4.00 per set each postpaid. Mail your order and remittance to Mr. Charles Roth, 2 Circle Lane, Roslyn,N.Y. 11577

****

***** MART *****

FOR SALE: 1. Standard Electric Master clock-24VDC-Oak case,Invar pend.Spring wound. $225.00
2. IBM Master clock, 24VDC, spring wound Model 25MC,complete with all attachments, and separate control box,Invar pend.,birch case. $225.00

Harvey Schmidt,49-20 108 St.Corona,N.Y. 11368

****

WANTED: 39" 10 lb. pendulum for Self-Winding Clock Co. clock

C. Griebell,354 Rodney Rd.Wyckoff, N.J. 07481

****

WANTED: Stromberg Masters--Write details.

Joseph Bourell,4213 No.Milwaukee Ave.Chicago,Ill. 60641

****

WANTED: Electrical Horological Literature--any type. Highest prices paid.
Hamilton-Sangamo clocks--write details.

Martin C.Feldman, 1545 Rhinelander Ave. Bronx,N.Y.10461

****

WANTED: Unusual Electrical Clocks (including Warren Mystery Battery Cl.).
Also unusual foreign pieces.

A.Marx, 105 Bayeau Rd. New Rochelle, N.Y. 10804

****

FOR SALE: Standard Electric Master Clock--wood pendulum(may not be original, but easily replaced),wood bezel, oak case clean and ready for finish or just wax, 24 volts D.C. with power supply.Sorry can't ship.-----ca 1920--$ 170.00
Martin Feldman, 1545 Rhinelander Ave. , Bronx,N.Y.10461---212-597-5913

****

FOR SALE: 3 Bulle Clocks- 1 wall all glass and brass-1 wall wood veneer and 1 marble and bronze table model- all in G.R.O.

C. Roth, 2 Circle Lane Roslyn Hts., N.Y.11577

****

WANTED: Suspension Springs for Tifany Never Wind-Long size. Warren Battery Clock. Top prices paid.

C. Roth, 2 Circle Lane Roslyn Hts., N.Y.11577

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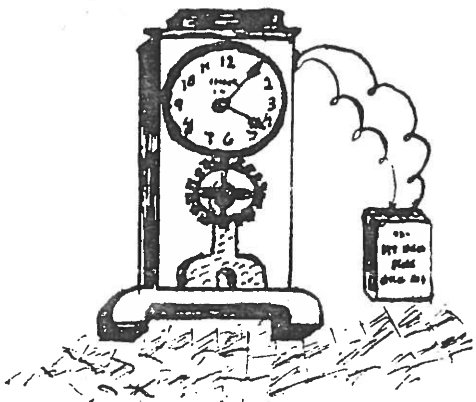
Chapter No 78



March 1977
VOLUME III--ISSUE #2
Martin C. Feldman, Editor

Hello fellow enthusiasts:

This month's issue of our Journal features a pictorial report of the March 6, 1977 local meeting at the home of fellow member Bob McGuiness. Also Dr. Feinstein's, ELECTRIC TIME MACHINE, features questions and answers of interest to all. Lastly, the Charles H. Pond patent of his invention which was later to become the first of a long series of clocks made by the Self-Winding Clock Company of N.Y. is reproduced in its entirety. Unfortunately, the copy received from the Patent Office was not of the best quality.

March 6, 1977 Meeting Report

On March 6th, 8 members of the EHS northeastern U.S. area met at the home of Mr. & Mrs. Bob McGuiness. A very active and interesting discussion of various clocks and movements immediately took place since each member brought timepieces of interest. Some of them are documented by the photo reproductions in this Journal. Coffee and cake were served by Mrs. McGuiness before Dr. Bruce Levy gave a most interesting slide-show and discussion of the recent British exhibit, ELECTRIFYING TIME, at the Science Museum which Dr. & Mrs. Levy attended in England. It was gratifying for some of the members to note that several of the clocks displayed in this exhibit were also in private collections here in the States. Following Dr. Levy's presentation a Business Meeting was held since the entire Executive Board was present as well as other members from the area. A discussion of whether or not the Chapter would send a donation to the National Museum Fund was undertaken. Due to the small size of our Chapter, as well as the present state of the treasury, it was decided by a majority vote not to send a Chapter donation at this time. However, it was also resolved to encourage all members to contribute what they can towards the Museum Fund! We are also printing in this issue a letter from the Museum Fund Chairman, Beth Zeibell, requesting funds. Our Chapter and mainly Dr. Levy is restoring the early battery-powered Kennedy Clock for the National Museum. In addition we are sending the Reference Library at National Headquarters, at our expense, each Journal as well as back Journals for their collection. Thus, we are not shirking our duty nor our responsibility to our mother organization; on the contrary, the opposite is true.

Near the end of the meeting a sumptious repast was served and was immensely enjoyed by all. We voted to have a $3.00 per person charge at future meetings to offset some of the cost of the extraordinarily delightful refreshments.

Once again I wish to encourage all members in different parts of the country to try and get together at local meetings. To further this goal we shall be printing the entire Roster of Members in the next issue of the Journal. If you wish your name to be deleted from this printing you must notify me as soon as possible, (M. Feldman, 1545 Rhinelander Avenue, Bronx, N.Y. 10461).

A vote of thanks was given to Mr. & Mrs. McGuiness for opening their home to us for our meeting. Our next local meeting will take place in May--the exact location of which has not been decided. All members wishing to attend, please send me a SASE. As soon as details are worked out, you will be notified.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman, FNAWCC

****

ELECTRIC TIME MACHINE

By: Dr. G. Feinstein
75-19 195th Street
Flushing, N.Y. 11366

QUESTIONS AND ANSWERS

From: John M. Perrigo, 5431 Crestview Drive, Hixson, Tenn. 37343

Q: I have several questions:

1. Name and address please of the manufacturer of the movement shown in photo's No. 1 and 2. The only markings are the patent date Feb.18,1895. The most distinctive feature of the lever wind (internal lever) is the inverted "Y" cast iron mounting bracket which measures 3" x 9".

2. Photo No.3 is of a Self-Winding (ST) movement. It's not a A-B-C etc. style--the two pole motor may have been an experimental model but if anyone has any information about it I would like to hear from them.

3. Newsletter #6, July 1973 mentioned Electrolube cleaning oil No.2CX and contact grease No.2CG as useful in lengthening contact life--Jack White was named as a supplier--however no address was given and I would like to know where to buy the product.

Sure enjoy the newsletter and Mart.

A: 1. The movement shown and described was made by the National Self-Winding Clock Co. originally of Bristol, Conn. and later Champagne, Illinois. It was invented by Charles M. Crook of Chicago, Illinois. For further information see the Newsletters of Feb.73, Sept. 74 and the Journal of Nov.74.

2. The movement with the two pole motor is an early model and not an experimental model. The two pole motor is shown in Pat. No.308,521 taken out by Chester Pond on Nov. 25,1884. The (ST) stands for Seth-Thomas, they produced the movements for the Self-Winding Clock Co.

3. Electrolube might (?) still be purchased from: Electrolube Corp., 155 Michael Drive, Syosset, N.Y., 11791.

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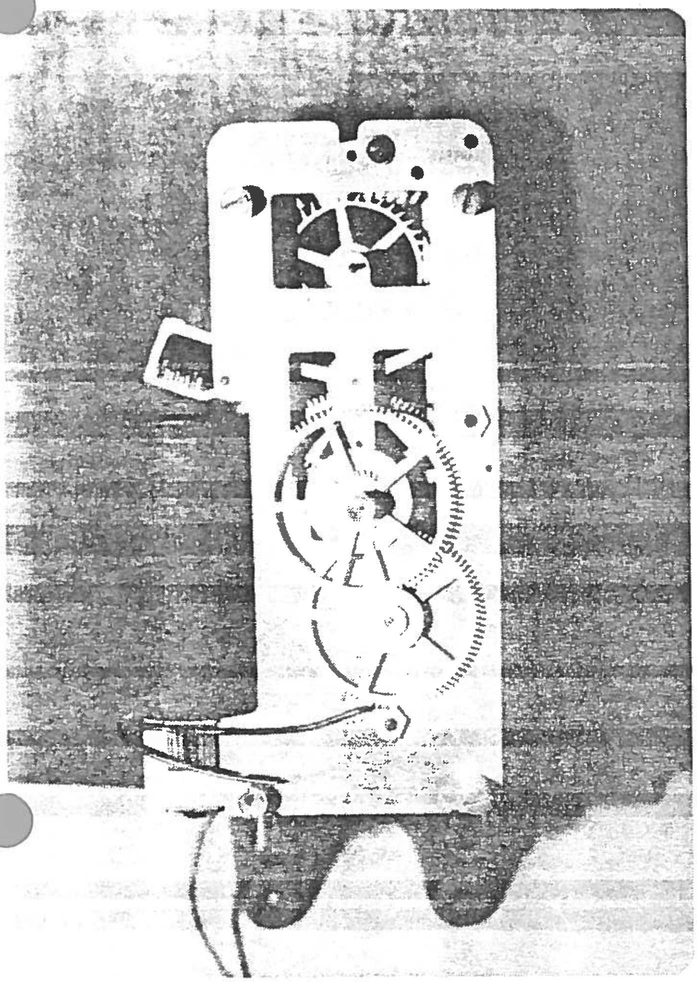

Photo #1-Self-Winding Clock Co. of Champagne, Ill.

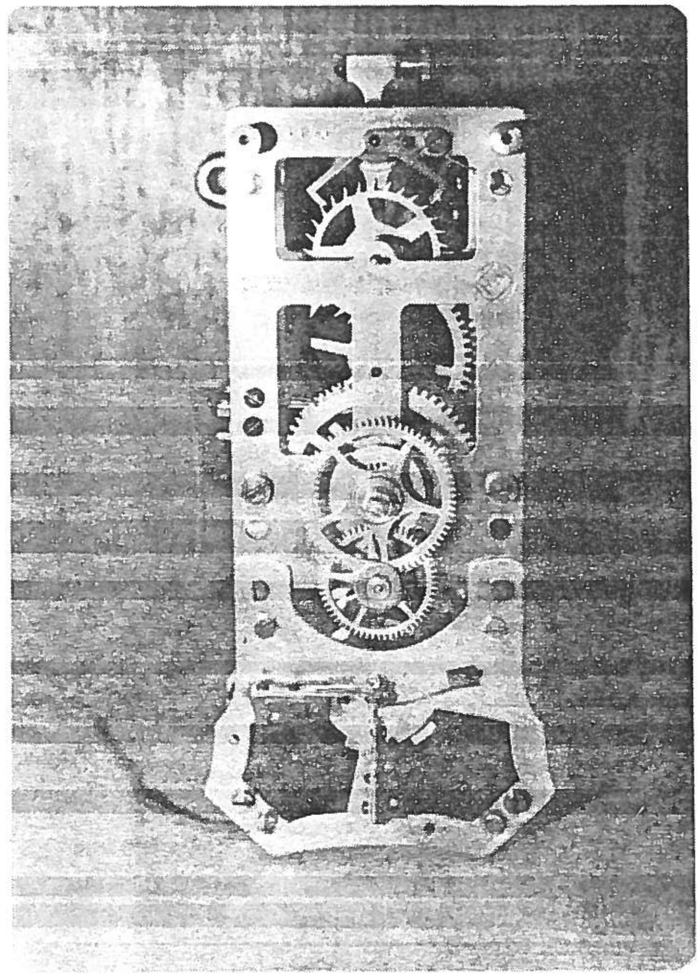

Photo #3-Self-Winding Clock Co. of New York

Photo #2 is a side view of #1, but is unreproducible.

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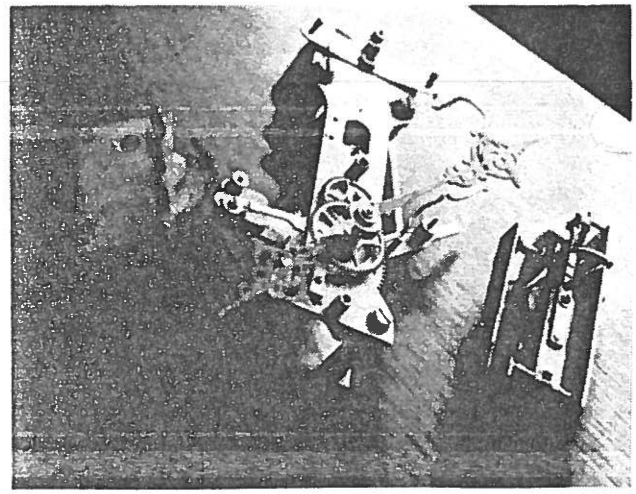
WE HAVE PAST JOURNALS AVAILABLE

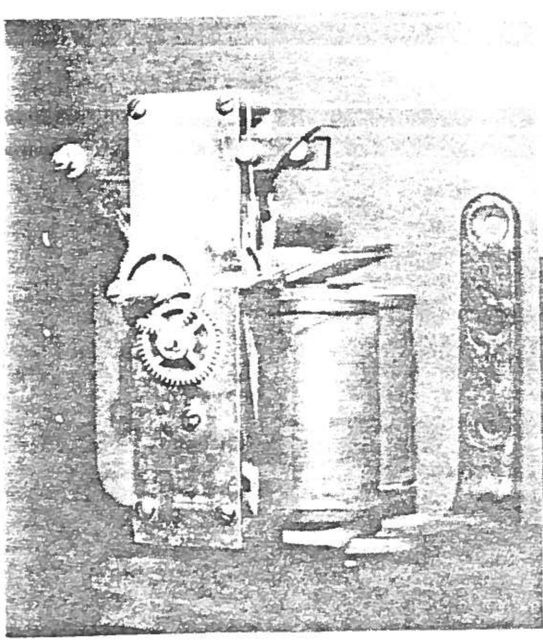
We have a limited number of past Journals available for those wishing them.
Volume No.1, Issues 2 through 6 for 1975 is available.
Volume No.11, Issues 1 through 6 for 1976 is available.
The supply is limited, so first come-first served! The cost is $4.00 per set each postpaid. Mail your order and remittance to Mr. Charles Roth, 2 Circle Lane, Roslyn, N. Y. 11577

LOCAL EHS MEETING ON MARCH 6, 1977

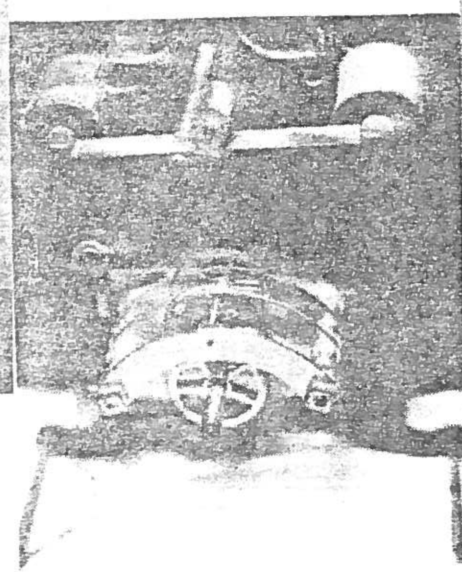
The boys at Bob McGuiness' home on March 6, 1977. (l. to r.)-Front-C. Roth, G.Zlobin, B.Levy, R. McGuiness; Back-M. Feldman, G. Feinstein, G.Cohen and A. Marx.



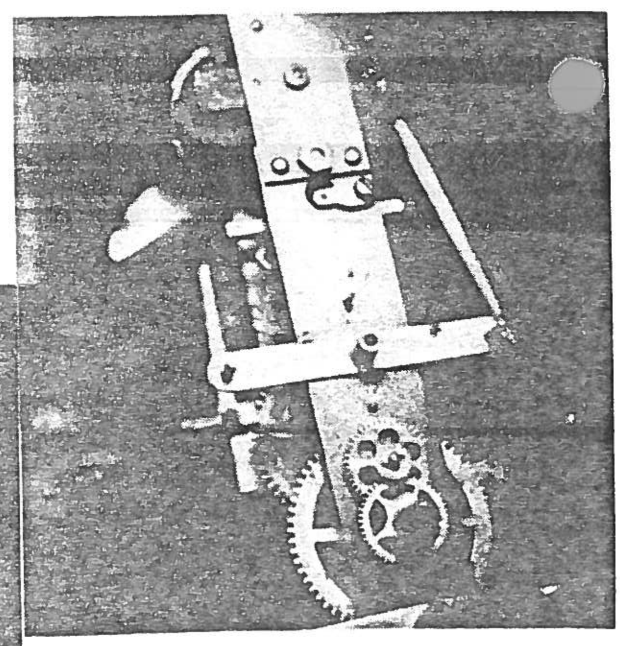
Fred Frick slave, unknown master, unknown slave at meeting exhibit table.(l.to r.)



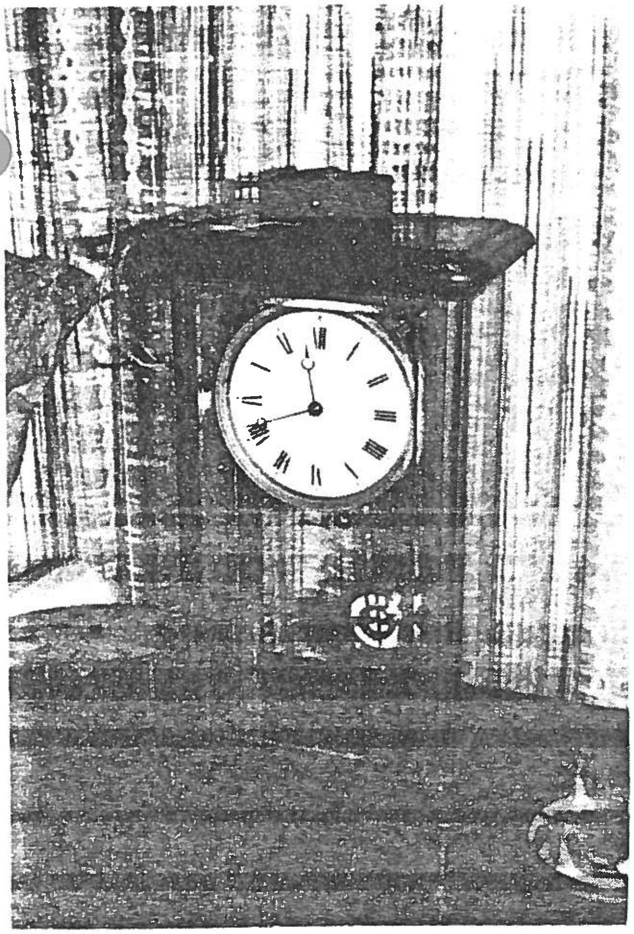
REMPE Movement



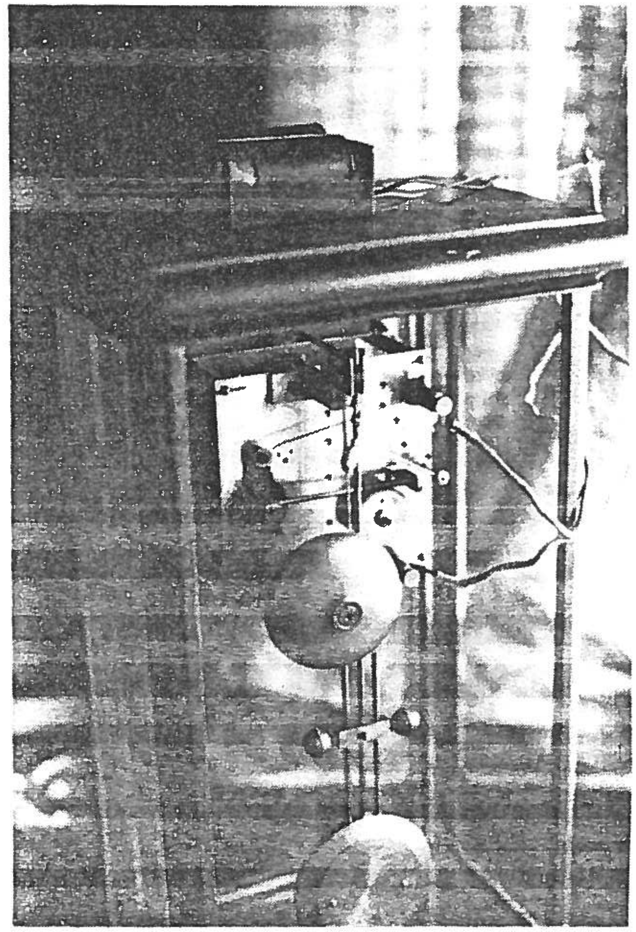
New York Standard Watch Co. master clock movement



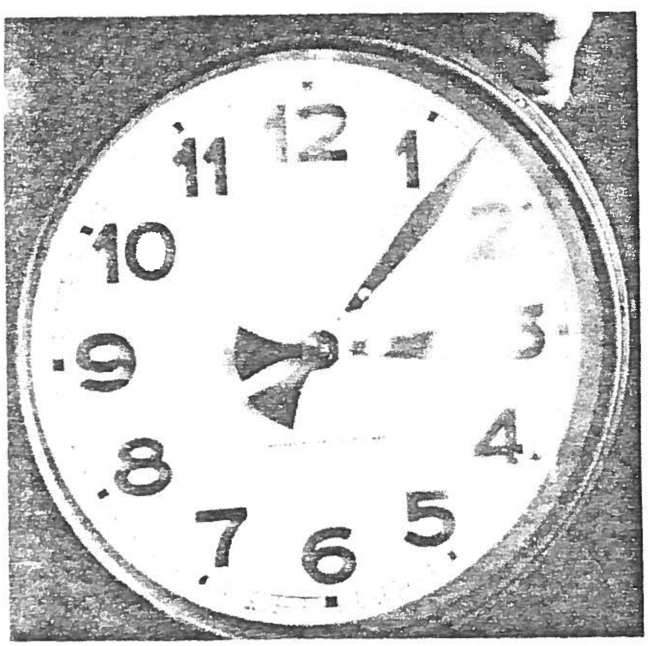
Master Clock Movement-maker unknown



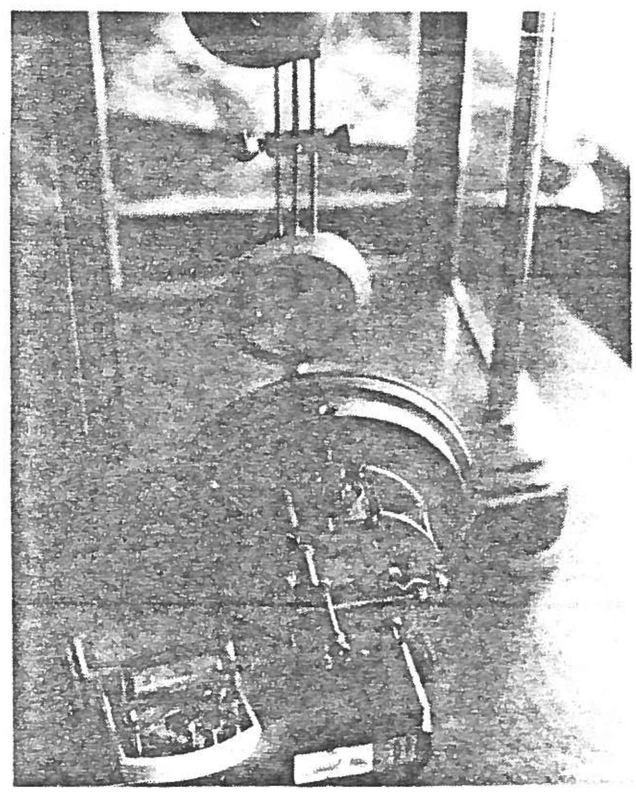
French battery rotary motor-wind with Ellicott pendulum,brass, glass and marble case. Maker unknown.(C.Roth Collection)



Same clock, but back open to show striking mechanism.



German-made TORK double-faced jewelled balance wheel movement. A.C. wound every 40 minutes. (M. Feldman Collection



Above clock. Balance wheel movement by same maker in foreground.Modern battery mvt.in lower left.

NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.

OFFICE — MUSEUM — LIBRARY
Phone (717) 684-8261
P.O. Box 33 514 Poplar Street Columbia, Pa. 17512

March 24, 1977

Dear Chapter President:

Our time has only the meaning we give to it.

What I'm doing these Spring days is building a time-piece which will tell us when our new Museum will be built and voluntarily paid for by the thriving membership of NAWCC.

To do this, I need all the assistance I can get from you and the fellow members in your Chapter.

Here's what you can do right now:

1. Choose to support this joint project with your own personal investment in the new Museum - for that's what your contribution is -- your investment in <u>your</u> Museum.

2. Resolve the matter of your chapter's Treasury Gift and Pledge.

3. Call or see 5 Key members and ask them to each make their own investments to the Museum - and then to call 5 others and do the same. (Keep a list of all names to make sure everybody gets called.) Let's try to have 100% participation.

Will you do these three things for your association? It will mean a great deal to all of us. Enclosed there is a copy of reprint from Columbia News and copy of March Mart insert.

<u>LOOK HOW NAWCC SERVES US!</u>

1. Bulletin (6 times a year)
2. Mart (6 times a year)
3. Slide presentations
4. Lending library
5. Research service on Horological items
6. National Museum!
7. Exposure to World Collectors with mutual interests.
8. The price of time is our rate of interest.

Thanks,

Beth Ziebell

Beth Ziebell, Museum Building Fund Chairman

(No Model.)

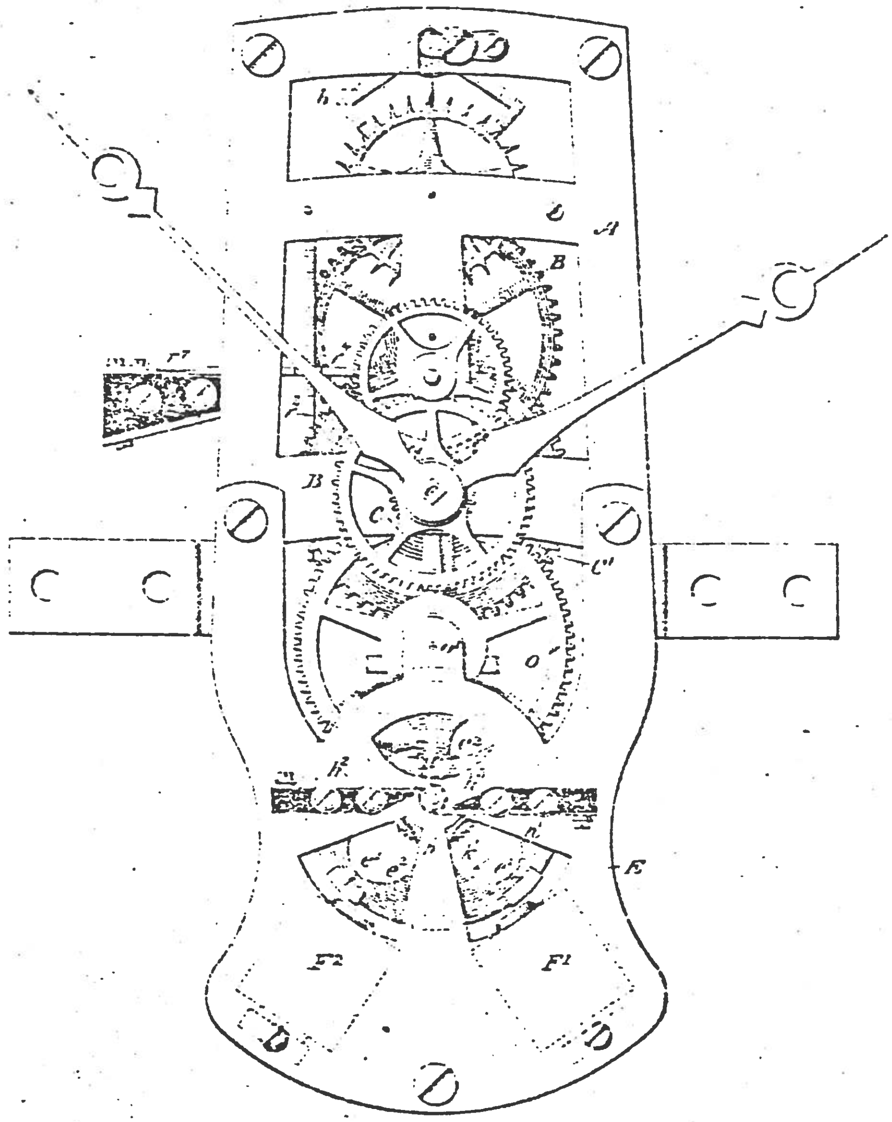
3 Sheets—Sheet 1.

C. H. POND.

ELECTRO MECHANICAL CLOCK.

No. 308,521. Patented Nov. 25, 1884.

Fig. 1



Witnesses

Wm A. Skinkle
Emma E. Ashley

Inventor
Chester H. Pond.
By his Attorneys
Pope & Edgecomb

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8

(No Model.) 3 Sheets—Sheet 2.

C. H. POND.

ELECTRO MECHANICAL CLOCK.

No. 308,521. Patented Nov. 25, 1884.

Fig. 2,

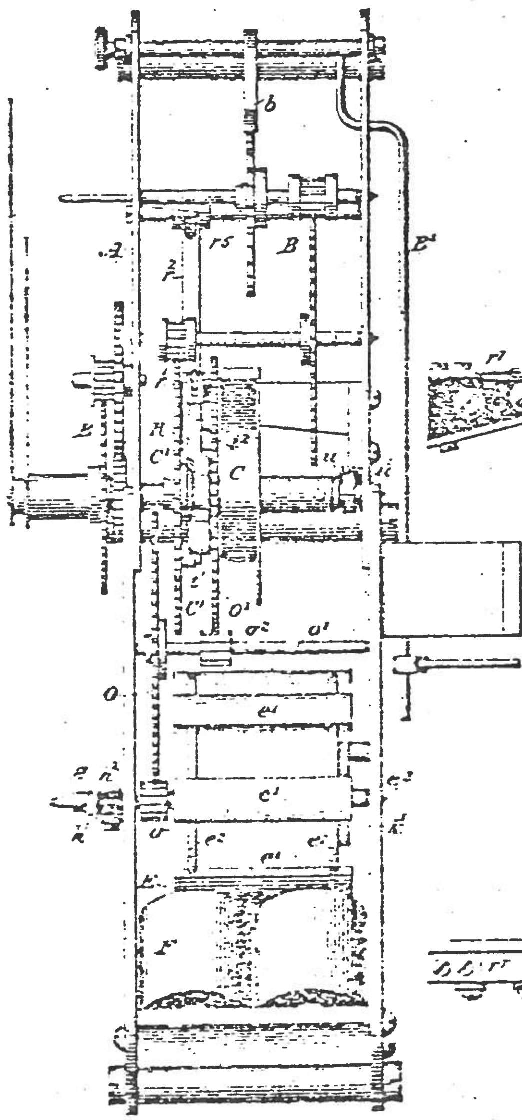


Fig. 3.

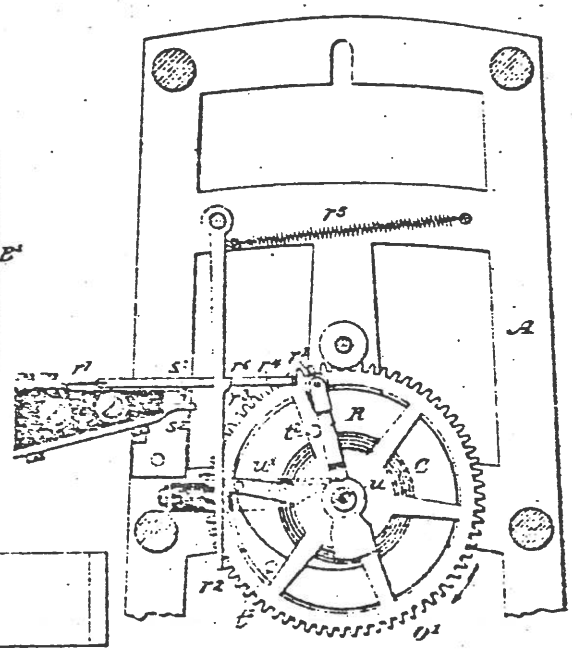
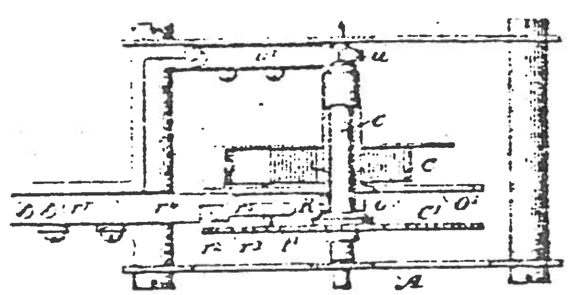


Fig. 4.



Witnesses

Wm A. Skinkle
Anne E. Ashley

Inventor

Chester H. Pond.

By his Attorneys

Pope & Edgecomb

(No Model.) 3 Sheets—Sheet 3.

C. H. POND.

ELECTRO MECHANICAL CLOCK.

No. 308,521. Patented Nov. 25, 1884.

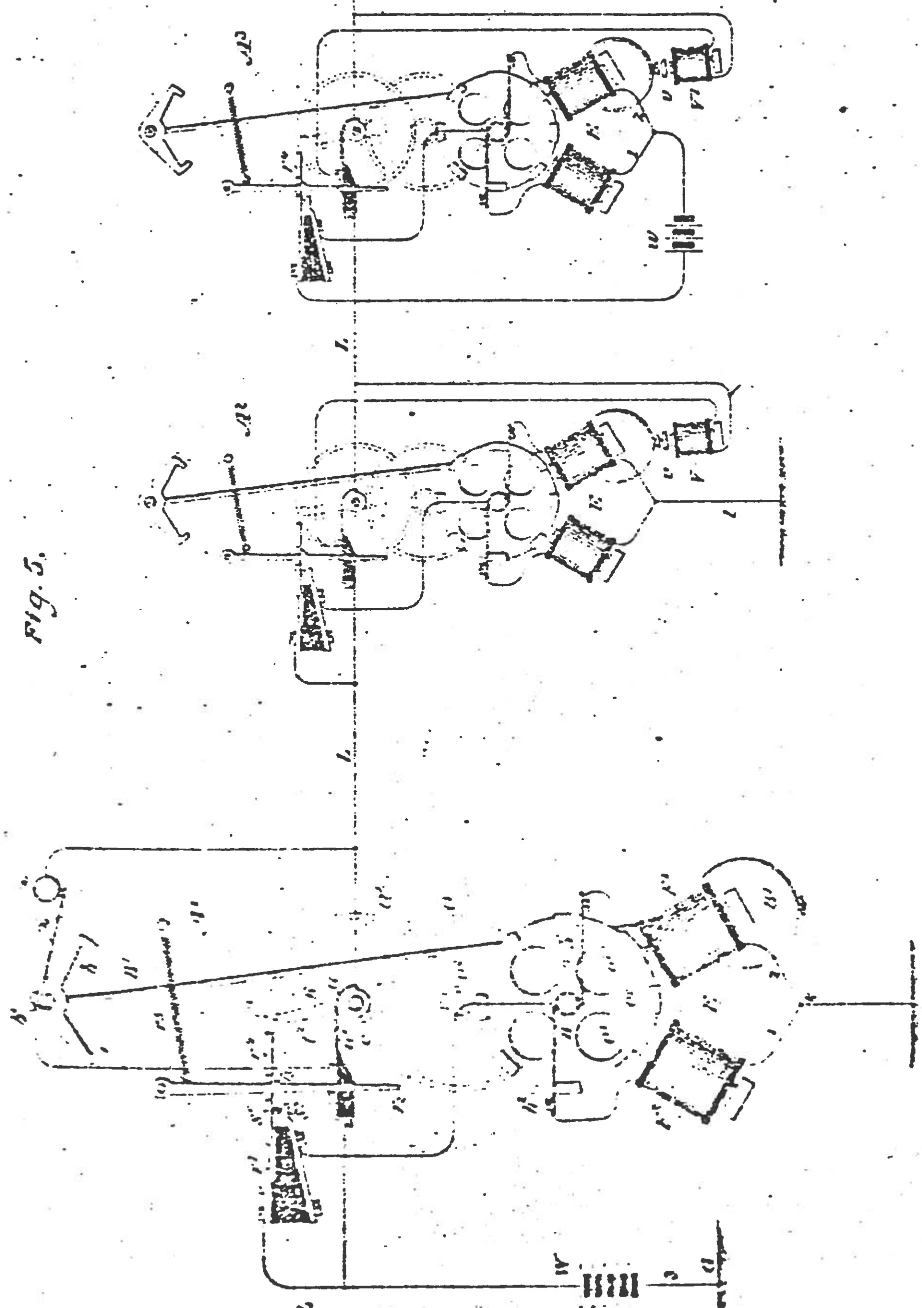


Fig. 5.

Witnesses

Wm A. Lind
Carrie E. Ashley

Inventor

Chester H. Pond.

By his Attorneys

Pope & Edgecomb

UNITED STATES PATENT OFFICE.

CHESTER H. POND, OF NEW YORK, N. Y.

ELECTRO-MECHANICAL CLOCK.

SPECIFICATION forming part of Letters Patent No. 308,521, dated November 25, 1884.

Application filed September 30, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHESTER H. POND, a citizen of the United States, residing in the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Electro-Mechanical Clocks, of which the following is a specification.

My invention relates to the class of electric clocks actuated directly by the force of a spring or a weight which is wound through the agency of electro-magnetism.

In organizing electric clocks and clock systems, it has usually been customary to propel each clock through the agency of a pawl or of an escapement, which in turn is actuated by an electro-magnet. Such an electro-magnet is caused to be periodically vitalized by the movements of the clock-train, or else by the operation of a primary regulator, which causes electric impulses to be transmitted to the several secondary clocks connected therewith at predetermined intervals—such, for instance, as once each second, or once each minute. When the clocks are thus actuated, the movements of the hands, instead of being constant and regular, as in the ordinary mechanical clock, are periodical. During the greater portion of the time, therefore, the hands of the clock are motionless or "dead." When a number of secondary clocks are driven or controlled by the movements of a primary clock, they are liable to be stopped or a portion of them to be thrown out of synchronism by any accident to the primary clock or to the main conductor of the system. Again, the uniform movements of the hands of such clocks as are operated by electro-magnets vitalized at frequent intervals, requires that the battery strength shall at all times be sufficient to drive the pawls and move the hands; otherwise one or more of the clocks of a system will fall behind the regulator.

To provide a clock and a clock system which shall be free from these and other incidental defects is the object of this invention.

It has been heretofore proposed to actuate clocks by a spring or a weight maintained under tension, or wound by means of an electro-magnet and a pawl actuated by the armature of the same at frequent intervals. The expenditure of energy in such organization is considerable, and owing to the frequent movements of the armatures the movement of the mechanism is more or less unreliable.

This invention is based upon the employment, in connection with an ordinary clock-movement which is driven by a spring or weight, of an electro-magnetic motor which periodically winds the spring or weight. Each clock is constructed in such a manner that it may operate independently of other clocks, or may be one of a series controlled by a central clock. The spring or weight is preferably of such capacity that it will serve to actuate the clock for several hours without rewinding. At the commencement of each hour, or at some other predetermined interval, the clocks, if there are several clocks in a system, are placed in such condition as to have their springs or weights successively wound without causing a cessation in the driving force which each spring exerts upon its train of wheels. After the springs or weights are wound to a predetermined tension or limit the normal conditions of each clock are re-established. The motor employed for winding each clock may be any suitable form of rotary electric motor, whether dynamo or magneto electric. It will be apparent that during the greater portion of each hour there will be no occasion for employing the battery force for winding the clocks. During such time it is designed that the main conductor of the system shall have its circuit connections through a series of synchronizing-magnets, which are respectively applied to the several clock-pendulums, or to some other suitable portion of the clock mechanism. Suitable means are provided in case the magnets are applied to the pendulums for sending an impulse from the battery through these magnets once during each complete or each semi-vibration of the pendulums. These impulses serve to maintain the several clocks synchronized in a manner well understood. It will be understood that the synchronizing-magnets may be applied to the hands of a clock, if it is desired.

In the accompanying drawings, which illustrate the invention, Figure 1 is a front elevation of the mechanism of the clock, the face being removed. Fig. 2 is a side elevation of

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the same. Fig. 3 is a vertical transverse section of a portion of the instrument. Fig. 4 is a plan section of the same portion of the mechanism. Fig. 5 is a diagram illustrating the organization of the clocks in a system.

Referring to the drawings, A represents the frame of the clock, and B the train of wheels commonly employed for actuating the hour, minute, and second hands in the usual manner. The train B is normally impelled by means of a spring, C, acting through a center wheel, C′, carried upon an arbor, c. The spring C is preferably of such length that it is capable of actuating the clock for several hours. An escapement-anchor, b, serves to control the movements of the train, and a vibrating pendulum, B′, controls the movements of the escapement in the usual manner.

The spring C is designed to be wound once each hour, or at some other convenient predetermined interval, by means of an electric motor, E. This motor is designed to be set in operation in a manner which will be hereinafter described, and to wind the spring quickly to a predetermined tension. The motor consists, preferably, of a series of armature-bars, e', of soft iron, which are mounted upon suitable non-magnetic disks or rings, e^2 e^2. These rings are supported from the axis e^3 of the motor. Two or more electro-magnets, F′ and F², are employed for propelling the armature in the direction of the arrow. These two electro-magnets are alternately placed in circuit with a battery, W, through the agency of a commutator, H, and its two brushes, h' and h^2. During the revolution of the shaft of the motor these brushes are alternately brought into contact with conducting and non-conducting segments h^3 and h^4 of the commutator. The battery W has one pole connected with the earth at G by a conductor, 3. Its other pole is connected with the conducting-segments of the commutator through a circuit-controlling device, which will be hereinafter described. The two brushes are respectively connected with one terminal of the coils of each of the two electro-magnets. The remaining terminals of these coils are connected with each other by conductors 1 and 2 at a point, 4, and this point is connected with the outgoing main conductor or with the earth. A ratchet-wheel, k', is carried upon the shaft e^3 of the armature of the motor, and a pawl resting against this wheel prevents the armature from turning backward.

Upon the shaft e^3 of the armature there is carried a pinion, o, which engages the teeth of a wheel, O. The shaft o' of the wheel O carries a pinion, o^2, and this pinion engages the teeth of a gear-wheel, O′. The collet or sleeve o^3 of wheel O′ loosely surrounds the arbor c of the center wheel, C′, of the train. The spring C has one end attached to the arbor c, and its other end is secured to the wheel O′. When, therefore, the motor is set in operation, the wheel O′ is driven in the direction of the arrow, and the spring is wound from its outer end. The spring is constantly unwound from its inner end by the action of the escapement of the clock, and it is evident that during the winding of the spring by the motor the clock will continue to be driven. It may be here remarked that a great advantage over the winding device operated by the to-and-fro movement of an armature is derived from the employment of the rotating armature of an electric motor, for the reason that the momentum acquired by such an armature is availed of in the winding, whereas in the case of a vibrating armature this factor is entirely lost.

The method of setting the motor in operation will now be described. Loosely mounted upon the arbor c is a balanced arm, R, which is designed to operate a circuit closing and opening device once each hour. The arm R carries at one end a small roller, r', which is designed to be carried against the lower end of a pendent arm, r^2, when the clock is to be wound. The pendent arm r^2 carries a hook or catch, r^3, which normally engages a circuit-closing arm, r^4. The pendent arm r^2 is normally held in the position to engage the arm r^4 by a spring, r^5. When, however, the roller r' at the end of the arm R is forced against the pendent arm r^2, the latter is forced backward against the tension of the spring r^5, and the catch r^3 is moved out of the path of the shoulder r^6 on circuit-closing arm r^4. The latter is then pressed downward by the action of a spring, r^7. When the circuit-closing arm r^4 is thus released, a contact-point, s', carried thereon, is brought against a corresponding insulated point, s^2, supported from the frame A. These two points are respectively connected with the main conductor L and with the conductor leading to the commutator-segments. The circuit of the motor will therefore be completed as soon as the arm R has caused the arm r^4 to be released, and its armature be thereby put in motion. For the purpose of thus operating the arm R a pin, t', is caused to project laterally from the face of the center wheel, C′, of the clock-train. This wheel revolves once an hour and the pin will therefore, by engaging the arm, cause it to be forced against the pendent arm r^2 once in each hour. The circuit will be completed thus at a predetermined moment; but it is evident that the slow movement of the center wheel, C′, cannot be relied upon for interrupting the circuit, for it is desirable that when the spring is wound the circuit through the motor should be interrupted immediately. For this reason there is placed upon the wheel O′ a pin, t^2, which, like the pin t', projects laterally from the face of the wheel toward the arm R.

As already described, the operation of the motor is to turn the wheel O′ in the direction of the arrow. The pin t^2 will therefore be caused to overtake the arm R and cause it to advance rapidly from the pin t' and the arm r^2 into engagement with the circuit-closing arm r^4. The latter is lifted, causing the contact-points to be separated, and the catch r^3 again passes into engagement with the circuit-closing arm r^4. The arm R then remains at rest until the pin t' is caused, by the revolution of the center wheel, C', to again overtake and to gradually advance it, thus causing the operation to be repeated. The operation of the motor is exceedingly rapid, and it usually requires about seven seconds only to wind the spring sufficiently to actuate the clock an hour. It will be understood that the spring is intended to be normally wound sufficiently to actuate the clock for several hours, even though the motor is not actuated.

When several clocks are connected in series, it is designed that the conductors 1 and 2 leading from the coils of the electro-magnets of the motors shall be connected with the earth. At the commencement of each hour the circuit connections of the main line will therefore be completed from the battery W, one pole of which is connected with the earth, as shown in the diagram Fig. 5, through the main conductor L, and with the earth through the several motors, E, and corresponding conductors, l. It is evident, however, that although the several motors are placed in circuit in multiple arc, yet, owing to the resistance of the main line, the motor nearest the battery will be first actuated. The ground-connection of this motor being then interrupted the next motor will be operated, and so on throughout the series. The time required for all the clocks in a system to be thus wound will usually be considerably less than a quarter of an hour, even in very extended systems. During the remaining three-quarters of an hour, therefore, the battery will not be required for the purpose of actuating the motors, and during such time it may be desired to employ the battery and main conductor for synchronizing the clocks. For this purpose there is placed upon the arbor c of each clock a cam, u, which extends over one quarter of the circumference of the arbor. A circuit-closing arm, u', is applied to this cam. When the cam is resting against the arm u', the main-line circuit is completed from the arm, which is connected with the main line through the cam which is in electrical connection with the succeeding section of the main line—that is to say, with the section leading to the next clock. The parts are so adjusted that the several clocks will thus place the main line in connection with the motor-controlling devices simultaneously. During three-quarters of each hour, therefore, the connections of the main line are through the synchronizing-magnets; but when the cams make contact with the respective arms the corresponding synchronizing-magnets will be shunted. The main-line connections are therefore at all times complete, either through the synchronizing-magnets or through the shunts of the magnets. The electro-magnets V are respectively applied to armatures v, carried upon the respective pendulums of the clocks. These electro-magnets are designed to be vitalized as the armatures pass above their poles for the purpose of synchronizing the pendulums in a manner well understood. The impulses which are required for thus vitalizing the electro-magnets may be derived from the battery W by the action of a circuit-closing device applied to one of the clocks of the series. Thus there may be applied to the trunnion b', carrying the escapement-anchor of one of the clocks, a circuit-closing arm, x. This arm is caused, by the movement of the anchor in one direction, to impinge against a contact-point, x', at the limit of its movement. The arm x is connected in this clock with the arm u', and the point x' is connected with the section of the main line leading to the line of clocks. In this manner synchronizing impulses will be sent to all the clocks in the series by the action of one of the clocks, which shall be maintained at standard time.

It remains to describe the method of actuating the motors of one or more clocks in the series independently of the other motors. This is illustrated in the diagram Fig. 5 in connection with the clock A^3. In this instance a small independent battery, w', is employed. The connections of this battery are completed at the proper intervals through the electric motor in the manner already described, one pole of the battery being connected with the circuit-closing arm r^4, and the other with the conductors 1 and 2. A synchronizing electro-magnet V', is applied to the pendulum of this clock for the purpose of causing it to maintain uniform time with the other clocks in the system. This magnet is included in the main line in the usual manner. It is desirable, however, that this magnet should be shunted during the time the other clocks are being wound. For this reason the section of the main conductor leading to this clock is connected directly with the contact-arm u', and this arm is also connected through the coils of the electro-magnet with the succeeding section of the main line in the usual manner. The cam u is also connected directly with the succeeding section of the main conductor, and when the cam makes contact with the arm the synchronizing magnet is shunted. It is evident that this clock A^3 may thus be actuated independently of the other clocks in the system while maintained in synchronism therewith. The same organization may be applied to other clocks in the system.

The clocks may, it is evident, be actuated at any other periods than once an hour, if it is so desired.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a mechanical clock-train, an electric motor having continuous movement, an intermediate train, and means, sub-

stantially such as described, for periodically setting said motor in operation and winding said mechanical clock.

2. The combination, substantially as hereinbefore set forth, of a mechanical clock mechanism, an electric motor having a rotating armature, and an intermediate train of wheels for causing the movements of said motor to wind the spring of said clock.

3. The combination, substantially as hereinbefore set forth, of a clock mechanism and an electric motor having a rotating armature for winding the spring or weight of said clock mechanism.

4. The combination, substantially as hereinbefore set forth, of a clock mechanism, an electric motor having continuous movement for periodically winding the same, and means, substantially such as described, for preventing a retrograde movement of said motor.

5. The combination, substantially as hereinbefore set forth, of a clock mechanism, a rotating electric motor, means, substantially such as described, for periodically actuating said motor and causing it to wind the spring or weight of said clock mechanism, a synchronizing-magnet applied to said clock mechanism, and means, substantially such as described, for v[illegible]alizing said magnet from the same source of electricity as is employed for actuating said motor.

6. The combination, substantially as hereinbefore set forth, of a clock mechanism, a main conductor, a rotating electric motor, a synchronizing electro-magnet, and circuit-controlling devices serving to normally complete the connections of said main conductor through said synchronizing-magnet, but at predetermined periods to connect the same with said motor.

7. The combination, substantially as hereinbefore set forth, with a time-train and a spring or weight for actuating the same, of a rotating electric motor for winding the same, a circuit-closing device for completing the connections of an electric circuit through said motor at predetermined intervals through the action of said time train, and means for interrupting said circuit through the action of said motor.

8. The combination, substantially as hereinbefore set forth, with a time-train and a spring or weight for actuating the same, of an electric-motor for winding said spring or weight, and a circuit-controlling device for periodically completing and interrupting the connections of an electric circuit through said motor, which device consists of an arm loosely surrounding one of the arbors of said train, a pin moving with said arbor, which pin engages said arm, a lever against which said arm is caused to impinge at one point in its revolution and to thereby cause said circuit to be completed, and a pin moving with said winding device, which pin engages said arm and advances it from engagement with said lever into engagement with a second lever or arm, thereby causing said circuit to be interrupted.

9. In an electric-clock-winding device, the combination, substantially as hereinbefore set forth, of the arm R, the wheels C′ and O′, the pins t' and t^2, for engaging said arm, the pendent arm r^3, and the circuit-closing arm r^4.

10. In an electric winding device for clocks, the combination, substantially as hereinbefore set forth, of the motor E, the wheels C′ and O′, arbor c, the arm R, mounted loosely upon said arbor, means, substantially such as described, for advancing said arm first through the movement of the wheel C′ and subsequently through the movement of the wheel O′, and the circuit-controlling device which is operated to close an electric circuit through said motor when said arm has been advanced by the wheel C′, and to interrupt the same when it is advanced by the wheel O′.

11. The combination, substantially as hereinbefore set forth, in an electrical device for winding clocks, of a motor, a circuit-controlling device, and means, substantially such as described, for causing said device to complete an electric circuit by the action of the clock, and to interrupt the same by the action of the winding device.

12. The combination, substantially as hereinbefore set forth, of a time-train, a rotating electric motor for winding the same periodically, a battery for actuating said motor, a circuit-controlling device actuated by said time-train, a synchronizing electro-magnet, a shunt-circuit around said magnet the connections of which are periodically completed by said circuit-controlling device, a circuit-controlling device for said motor, and means for operating the last-named device while said synchronizing magnet is shunted.

13. The combination, substantially as hereinbefore set forth, of the time-train, the synchronizing-magnet, the electric motor for winding said time-train periodically, the circuit-controlling device for the same, and means, substantially such as described, for shunting said synchronizing-magnet while said motor is actuated.

14. The combination, substantially as hereinbefore set forth, of a series of clocks, a battery, a conductor leading from said battery to said clocks, a motor in each of said clocks for winding the same, and means, substantially such as described, for completing a circuit through all of said motors from said main line, and causing said clocks to be successively wound by the action of the same.

15. The combination, substantially as hereinbefore set forth, of a series of clocks, a motor in each of said clocks, said motors being arranged in multiple arc, a battery, a conductor leading from said battery to said clocks, and means for simultaneously placing said motors in connection with said battery at predetermined times.

16. The combination, substantially as here-

inbefore set forth, of a battery, a main conductor, a series of clocks, a motor in each of said clocks for winding the same, a synchronizing electro-magnet applied to each of said clocks and included in said conductor, and a shunt-circuit around each of said magnets the connections of which are automatically completed at predetermined times.

17. The combination, substantially as hereinbefore set forth, of a source of electricity, a series of clocks, a rotating electric motor in each of said clocks for winding the same, and a conductor leading from said source to each of said motors.

In testimony whereof I have hereunto subscribed my name this 22d day of September, A. D. 1884.

CHESTER H. POND.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.

******* MART *******

WANTED: Stromberg Masters--Write details.
Joseph Bourell, 4213 No. Milwaukee Ave. Chicago,Ill. 60641

****

WANTED: Electrical Horological Literature--any type. Highest prices paid. Hamilton-Sangamo clocks--write details.
Martin C. Feldman,1545 Rhinelander Ave. Bronx,N.Y. 10461

****

WANTED: Unusual Electrical Clocks (including Warren Mystery Battery Cl.). Also unusual foreign pieces.
A. Marx, 105 Bayeau Rd. New Rochelle, N.Y. 10804

****

WANTED: Top dollar paid for Warren Mystery Battery Clock. Also still looking for suspension spring for large Tiffany Never Wind. Any information on French Rotary motor - wind as pictured on page 5 of this issue.
C. Roth 2 Circle Lane, Roslyn, N.Y. 11577

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WANTED: Tiffany Never Wind and London Eureaka---Top dollar paid.
Call George Zlobin evenings 212-763-6124

FOR SALE: 22" Square mahogany self winding clock G.R.O. Best offer over $175.00- - -Bulle Movements
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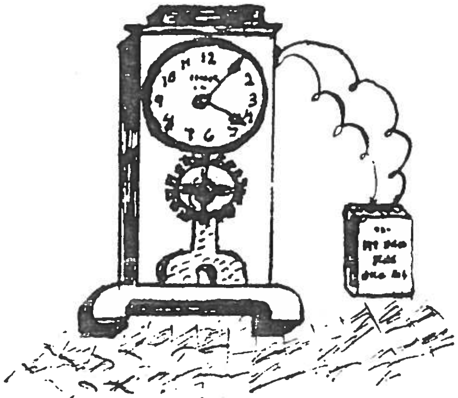
The JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



May 1977
VOLUME III---ISSUE #3
Martin C. Feldman, Editor

Hello fellow enthusiasts:

Once again we find ourselves approaching the happy time, at least for me, of the warm Spring and Summer months. This to me means vacations, and other excursions usually accompanied by small or large sorties hither and thither, for electric clocks, into the accompanying countryside wherever one may be at the time. Those of you taking excursions via ship should refrain from expropriating the ship's timekeeping system---as difficult as this task may seem! Let me wish you all the best horological hunting.

Of course, your Editorial Staff must keep functioning in order to send you the bi-monthly EHS Journal. In this regard I am once again requesting original articles, comments, questions, reprints or catalogs, etc. so that the rest of the membership will truly be benefited by this new information.

This month we are featuring the first installment of Dr. Feinstein's translation of an article by F. M. Fedchenko dealing with the special construction of an "isochronous" pendulum which is so important to accurate timekeeping. Dr. Feinstein's translation compliments his earlier translation in VOL. III--#1 of the February JEHS. Also included is R.E. Fenner's electric clock patent which appears to be quite interesting. If anyone has seen such a clock your Editor would be most appreciative in having this information forwarded to him. A Roster of the entire membership is being printed since there were no letters asking to be excluded (from any of the members) after the last Issue's announcement to this effect.

Lastly, the meeting tentatively scheduled by the local residents of the N.Y./N.J./Conn. area will be postponed until the fall. Notice will be given via the Journal prior to the meeting. Again, all members who find themselves within reach of each other should try to hold local meetings now that the Roster is available.

Unfortunately, my wife and I will not be attending this year's National Meeting and we regret that we will not have the opportunity to meet many of you there. However, if the EHS members could caucus at some time, I am sure everyone will be in for an enjoyable time.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman, FNAWCC

****

From "Measurement of Time", Moscow, 1958
edited by A. I. Konstantinov
published by the Committee on Standards
in 1958 as Preceedings of the All-Union
Scientific Research Institute of Physiotechnical and Radiotechnical Measurements

ABOUT THE ISOCHRONOUS OSCILLATION OF A PENDULUM

by: F. M. Fedchenko

Translated by: Dr. George Feinstein

Pendulum clocks, owing to their simplicity and reliability in operation, from Huygens (1629-1695) to our day remain one of the basic instruments of timekeeping. Over the prolonged period of their development, pendulum clocks have achieved great perfection. The well-known Shortt astronomical clocks have a root-mean-square daily variation in time of around 0.002 sec.per day.

The period of oscillation of a pendulum depends on the amplitude according to the formula:

$$T=2\pi\sqrt{\frac{J}{k}}\left[1+\frac{\Phi^2}{16}+\frac{11\Phi^4}{3072}+\ldots\right] \tag{1}$$

where: J - moment of inertia of the pendulum with respect to the axis of rotation;
k - restoring moment of the pendulum;
φ - amplitude of oscillation of the pendulum in radians. (semi-arc)

By reducing the amplitude, the period of oscillation of the pendulum decreases, and in the limit

$$T_{\Phi\to 0}=T_0=2\pi\sqrt{\frac{J}{k}} \tag{2}$$

The circular error is equal to

$$\frac{\Delta T}{T}=\frac{T-T_0}{T}=\frac{\Phi^2}{16}+\frac{11\Phi^4}{3072} \tag{3}$$

In calculating the daily period this introduces errors, tabulated below:

Φ Semi-Arc	30′	40′	50′	60′	70′	80′	90′	100′	110′
Lag in seconds per day	.41 0,[illegible]	0,73	1,14	1,65	2,24	2,93	3,71	4,56	5,54

A graphic presentation of the dependence of the period of oscillation of a pendulum to the amplitude appears in the curve of Fig. 1.

Contemporary astronomical clocks with amplitudes of oscill tion of the pendulum of 50' - 60' under constant phase impulse of constant magnitude can provide an accuracy of 0.002-0.003 sec. per day only under the maintenance of their amplitude with a precision of 2-3 seconds of arc, which in linear expression corresponds to $10\text{-}15 \times 10^{-6} \times L$ at the end of the pendulum, where L= length of pendulum.

Thus to increase the precision of motion of a clock it is necessary either to raise the precision of maintenance of the amplitude of oscillation of the pendulum clock or make the oscillations of a pendulum clock isochronous.

First of all there are bounds on all mechanical improvements due to the appearance of seismic and other disturbances which act on the pendulum, from which it is impossible to completely protect the clock even by placing it on a special pillar in a clock vault.

Second way--the path of isochronizing the oscillations of the pendulum attracted both the theoreticians and practitioners of clock making since the time of the introduction of pendulum clocks.

For isochronizing the oscillations of a pendulum it is necessary that its restoring moment be proportional to the angle of deflection of the pendulum.

In reality, however, the total restoring moment operating on a pendulum, consists of the gravitational force on the center of gravity, which is proportional to the sine of the angle of deflection of the pendulum $m = k \cdot \sin\varphi$, plus the elastic moments due to the suspension spring, proportinal to the angle of deflection of the pendulum $m_1 = k_1\varphi$.

The non-isochronous oscillations of a pendulum are based on the fact that one of the restoring moments (the principal one) acting on the pendulum is not proportional to the angle of deviation of the pendulum, but to its sine, $m = k \cdot \sin\varphi$.

Expanding $\sin\varphi$ in a power series and restricting it to the first two terms, we have:

$$m = k\varphi - \frac{k\varphi^3}{6} \qquad (4)$$

Therefore, the natural restoring moment is less than that required for the creation of complete isochronism by the quantity $k\varphi^3/16$, which is proportional to the cube of the amplitude.

Fig. 2 is a schematic presentation of the difference of the restoring moment $k\varphi - k\varphi^3/6$, represented by the curve Oa from that necessary for an isochronous moment $k\varphi$, represented by the straight line Oa_1. The region between these curves Oaa_1 gives a qualitative representation of the inadequacy of the natural restoring moment for an isochronous pendulum.

Solutions to the problem of the isochronous pendulum have been proposed at various times with many different arrangements that operate on the isolated pendulum or on the mechanism associated with the pendulum.

Huygens (1673) suggested cycloidal guides, that bend the pendulum suspension spring in its deflection [1].

Barth (1787) suggested rolling additional weights on a cylindrical surface, whose axis is located below the axis of rotation of the pendulum [1] .

There were also suggestions for additional springs, that the pendulum must expand in its deflection [1] . (See the Bulle Clock).

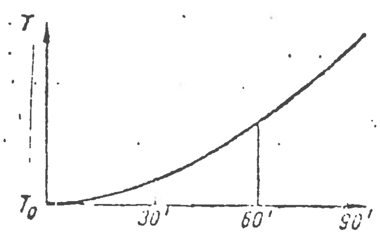


Fig. 1 Dependence of the period of oscillation of a pendulum to the amplitude.

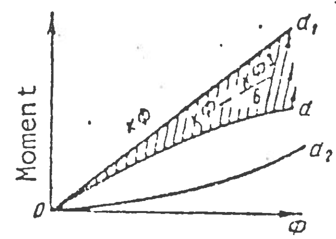


Fig. 2 Insufficiency of the natural restoring moment for isochronous pendulums.

These and other methods have not spread, because they introduce larger errors in working clocks than those that they attempted to reduce, or they were very complicated and inconvenient in operation.

L.D. Brzhev in ХГИМИП worked out a method of isochronizing the oscillations of a pendulum by means of a fixed magnet, but application of it is also restricted due to the complexity of initial tuning, recurring after every dismantling of the clock.

The period of oscillation of a free pendulum. depends on the amplitude of its oscillations. The period of oscillation of a pendulum is also dependent on the impulsing mechanism, and the phase of the driving impulse as well as its magnitude.

It is known, that positive impulses (i.e. in the direction of motion) after the position of equilibrium, and negative before the position of equilibrium of a pendulum increase the period of its oscillation, therefore the stronger the impulse is, the longer the period and conversely. the weaker it is, the shorter the period of its oscillations and this effect is independent of amplitude.

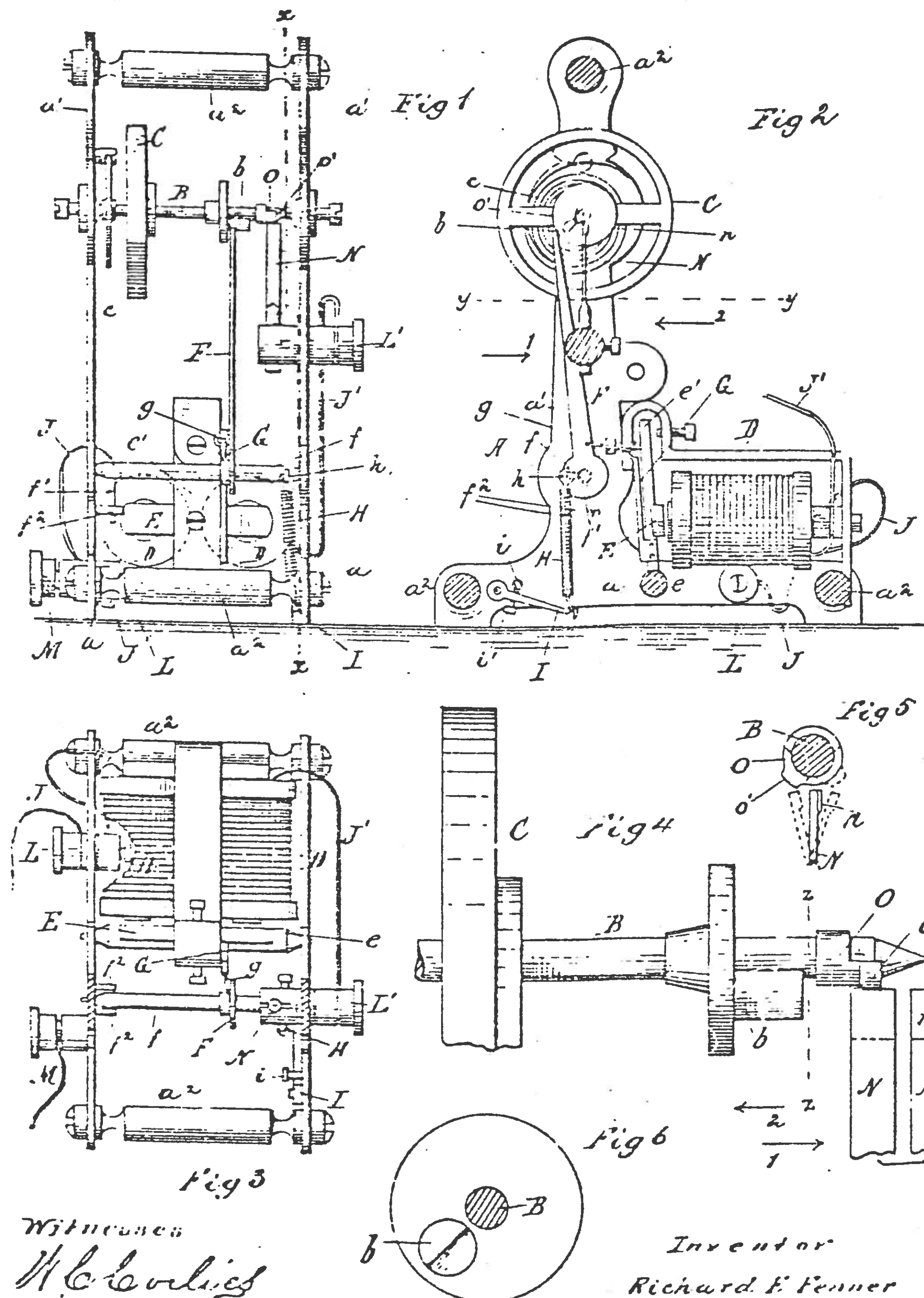
-to be continued-

(No Model.)

R. E. FENNER.

ELECTRIC CLOCK.

No. 345,292. Patented July 13, 1886.



Witnesses
W C Corlies
A M Best

Inventor
Richard E. Fenner
By Coburn & Thacher
Attorneys

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UNITED STATES PATENT OFFICE.

RICHARD E. FENNER, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO CHARLES K. GILES, OF SAME PLACE.

ELECTRIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 345,292, dated July 13, 1886.

Application filed September 21, 1885. Serial No. 177,765. (No model.)

To all whom it may concern:

Be it known that I, RICHARD E. FENNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Clocks, which are fully set forth and described in the annexed specification, reference being had to the accompanying drawings, in which—

Figure 1 represents an end elevation of a portion of a clock embodying my improvements; Fig. 2, a section of the same taken on the line *x x*, Fig. 1; Fig. 3, a plan section of the same, taken on the line *y y*, Fig. 2; Fig. 4, a detail elevation of the balance and its arbor, taken on an enlarged scale; Fig. 5, a cross-section of the same, taken on the line *z z*, Fig. 4, and looking in the direction of the arrow 1; and Fig. 6, a similar view on the same section, looking in the direction of the arrow 2.

My invention relates to clocks which are intended to be operated by electricity, instead of springs, weights, or other like devices. The usual mode of effecting this result is by means of an electro-magnet connected with a suitable battery to supply current thereto, and mechanism connected to the armature, which is operated by the vibrations of the latter to impart the necessary motion to the clock-movement, the vibrations of the armature being produced by the opening and closing of the circuit by a circuit-breaker operated in some way by the movement.

The object of the present invention is to apply this general principle of operation to balance-wheel clocks.

I will proceed to describe in detail one way in which I have carried out my invention in practical form, and will then point out definitely in the claims the special improvements which I believe to be new and wish to protect by Letters Patent.

In the drawings, A represents a supporting-frame, which consists of two side bars, *a*, at the base, from which rise two uprights, *a'*, preferably made in one piece therewith. These pieces are connected by suitable cross-bars, *a²*, two at the base and one at the top. The arbor B of the balance C is mounted in the uprights of the frame A, and is provided with the usual balance or hair spring *c*. These parts and their mounting do not differ materially from the ordinary construction of clocks of this type, and hence do not require specific description. A pallet-jewel, *b*, is attached to the arbor in any suitable manner some little distance from the balance, and is preferably plane on one face and convex on the other, and its location is such that when these parts stand normally at rest it will depend about vertically from the arbor. An electro-magnet, D, is mounted on the base of the frame, preferably with its cores horizontal. The armature E for this magnet is mounted on a rock-shaft, *e*, journaled in the base of the frame, being provided with an upright arm, *e'*, to which the armature is fastened. A lever, F, which may be called the "impulse-lever," is fastened at its lower end to a rock-shaft, *f*, mounted in the lower portion of the uprights of the frame A some distance below the arbor of the balance. This lever extends upward nearly to the arbor, and near its lower end is connected to a spring, G, by a link or rod, *g*, or any other suitable connection. The spring G is fastened at one end to the armature, or to the upright on which the latter is mounted, and is preferably a straight plate-spring, though the form is not an essential. A retractile spring, H, is fastened at one end to an arm, *h*, on the rock-shaft of the impulse-lever, and at the other end to the extremity of a pivoted lever, I, fastened to the frame. A stop-pin, *i*, is arranged over this lever I, to limit its upward vibration under the influence of the spring, and an adjusting-screw, *i'*, passes through the lever, and is arranged to work against the pin, whereby the relative position and vibration of the lever may be regulated, and so obviously the tension of the retractile spring adjusted. The retractile spring is arranged so that its action will be to vibrate the rock-shaft in a direction to pull the armature away from the magnet, and so, of course, when left to the influence of this spring, the impulse-lever will stand on the side of the pallet opposite to the magnet and its armature, as shown in Fig. 2 of the drawings, in which it will also be seen that the convex surface of the pallet is on the same side as the lever. An arm, *f'*, depends from the rock-shaft f near its other end and hangs between the two pins f^2 on the frame. The purpose of this device is to limit the oscillations of the shaft. Now, it is obvious that when the magnet is charged and the armature is drawn toward its poles the impulse-lever will also be vibrated toward the pallet on the balance-arbor, and, striking it, will give an impulse to the balance, producing an oscillatory movement; but the moment the circuit is broken, the armature being no longer attracted by the magnet, the retractile spring will at once vibrate the impulse-lever in the opposite direction. It is obvious, then, that a device for making and breaking circuit at the proper moments is necessary, and I will now proceed to describe the mechanism by which I accomplish this. One terminal wire, J, of the electro-magnet is connected to a binding-screw, L, on the base portion of the frame, and the other terminal, J', to a similar screw, L', on one of the uprights of the frame. Both of these binding-screws L and L' are insulated from the frame in any usual way. Another binding-screw, M, is attached to some portion of the frame, preferably, for convenience, to the base, and on the same side as the screw L, as shown in the drawings. The battery-wires are connected, respectively, to the two binding-screws L and M, as seen in Fig. 3 of the drawings, the battery, however, not being shown. It will be seen from this connection that the wire at the binding-screw M brings the frame into the circuit, and that the wire at the screw L brings the magnet into circuit, and that this portion of the circuit extends only to the binding-screw L', which is insulated from the main frame, so that to complete the circuit connection must be made between the binding-screw L' and the main frame. It is this connection which I have constructed so as to constitute a circuit-breaker, or rather a device for both breaking and making the circuit, as required in the operation of the clock. On the inner end of the binding-screw L' is mounted a spring, N, of any suitable metal—platinum, for instance—which is extended upward to the arbor of the balance, where it comes in contact with a cam projection or enlargement, O, on the arbor, extending part way around the latter. This projection may be provided in any suitable way. In the drawings I have shown it as a part of a collar fixed on the arbor, but cut away so as to leave the projection on the under side of the arbor when the latter stands in a normal position of rest, and preferably it is provided with a slight boss, o', with which the upper end of the spring is brought in contact when the arbor is at rest, as mentioned above. Now, it is evident that whenever this spring is in contact with the cam the circuit will be closed, for through the binding-screw M the current flows through the frame to the balance-arbor, and so to the cam projection thereon, and the spring which is connected to the binding-screw L', that in turn is connected with the other pole of the battery, whenever brought in contact with the cam on the arbor, will obviously complete the circuit, and the current will flow either in one direction or the other, it is immaterial which. So, too, whenever the spring is out of contact with the cam on the arbor, or insulated therefrom, the circuit will obviously be broken. It is plain that the oscillation of the balance-arbor will make and break contact between the spring and the cam on the arbor, and so a circuit breaker and maker is provided which is operated by the movement of the balance. Now, suppose the parts are at rest and connection be made with the battery. The circuit-breaking spring being in contact with the cam, the electro-magnet will at once be charged, the armature will be attracted to the magnet, and so the impulse-lever will be vibrated toward the pallet, which it strikes, thereby giving an oscillatory impulse to the arbor and balance in the direction indicated by the arrows 1 in Fig. 2 of the drawings. This movement of the arbor will carry the cam out of contact with the spring, as shown in Fig. 5 of the drawings, when, of course, the circuit will be broken, the magnetic force of the electro-magnet will be destroyed, and the armature released will at once be retracted by the retractile spring, the impulse-lever being carried with it. Under the ordinary action of the spring-balance the arbor will soon commence a return movement in the direction of the arrow 2 of Fig. 2 of the drawings, when, of course, contact between the spring and cam will soon be restored; but this would at once close the circuit, charge the magnet, and vibrate the impulse-lever again at an improper time, as the balance should have a free opportunity to complete its return oscillation. Now, in order to prevent this result, I insulate what may be called the "back" side or obverse face of the spring by applying thereto a thin strip, n, of ivory, rubber, or any other suitable insulating material. Now, when the cam O comes in contact with the spring on its return movement, it strikes this insulating material, so that the circuit is not closed, and this contact is continued as the cam carries the spring to one side, as shown in Fig. 5 of the drawings, finally sweeps past it, and is again free therefrom. The movement in the opposite or first direction of the balance will soon begin, and as soon as the cam is again brought into connection with the spring, when the parts are about in the relative position shown in Fig. 2 of the drawings, the circuit will be closed, the lever vibrated again, and another impulse given to the balance, and so the movement is kept up continuously by the successive impulses given by the vibrating lever.

The mechanism is compact, simple, and efficient, and I have found by practical test that it is satisfactory in its operation. It is obvious, however, that changes may be made without changing the general principle of operation which characterizes my invention; hence I do not wish to be understood as limiting myself to the particular devices and arrangement of devices which are here shown and described; nor do I wish to be understood as limiting my improvement to the particular circuit-breaker herein specified, for it is plain that some other device may be employed to effect the same result, while the other parts of the mechanism remain substantially the same as here shown. By a proper reversal of the relation of the impulse-lever, arbor, and circuit-breaker, the lever may be made to give its impulse on the other side of the pallet, instead of as described above, acting then under the influence of the retractile spring, while the magnet acts to bring it back on its inoperative stroke. In such an arrangement the force of the retractile spring should be nicely adjusted, so as to be always uniform. There is, however, no obstacle to the successful working of the mechanism arranged as described, and shown in the drawings, for any variation in battery force which might tend to make the movement of the impulse-lever more or less sudden or jerky is counteracted by the elastic connection between the lever and the armature effected by the spring on the latter, to which the connecting-link is attached.

It will of course be understood that the usual clock-work is combined with the balance in any ordinary way, which being well known and readily understood, I have not herein illustrated and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The spring-balance of a clock, in combination with an electro-magnet, a vibrating armature, a vibrating impulse-lever connected to the armature and arranged to act upon the arbor of the balance, a retractile spring connected with said lever, and an automatic circuit breaker and maker, substantially as and for the purposes set forth.

2. The spring-balance of a clock, in combination with an electro-magnet, a vibrating armature, a vibrating impulse-lever connected to the armature, and an automatic circuit breaker and maker consisting of a contact-point on the balance-arbor and a contact-spring constructed and arranged to be operated by the oscillation of the balance-arbor, substantially as and for the purposes set forth.

3. The spring-balance of a clock, in combination with an electro-magnet, a vibrating armature, a vibrating impulse-lever elastically connected to the armature, and an automatic circuit breaker and maker, substantially as and for the purposes set forth.

4. The electro-magnet, in combination with the spring-balance, the arbor of the balance provided with the cam O, and the spring N, provided with insulating material n on one side, at its contact end, substantially as and for the purposes set forth.

5. The clock-balance, in combination with the electro-magnet, the vibrating armature, the spring connected to the armature, and the vibrating impulse-lever connected to the spring, substantially as and for the purposes set forth.

6. The clock-balance, in combination with the electro-magnet, the vibrating armature, the vibrating impulse-lever F, mounted on the rock-shaft f, the retractile spring H, and the adjustable lever L, to which the spring is connected, substantially as and for the purposes set forth.

7. The electro-magnet, in combination with the vibrating armature, the vibrating impulse-lever F, mounted on the rock-shaft f, the arm f' on said rock-shaft, the limit-pins f^2, and the retractile spring G, substantially as and for the purposes set forth.

8. The electro-magnet, in combination with the insulated binding-screw L', the spring N, mounted on said binding-screw and provided with insulating material on one side, and the balance-arbor B, provided with the cam O, substantially as and for the purposes set forth.

9. The supporting-frame, in combination with the insulated binding-screws L and L', binding-screw M, the battery-wires connected, respectively, to the binding-screws L and M, the electro-magnet with its terminals connected, respectively, to the insulated binding-screws, the partially-insulated spring N on the binding-screw L', the arbor B, provided with cam O, the clock-balance C, the impulse-lever F, connected to the armature of the magnet, and the retractile spring G, substantially as and for the purposes set forth.

RICHARD E. FENNER.

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J. M. PARSHALL.

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WANTED: Stromberg Masters--Write details.
Joseph Bourell, 4213 No. Milwaukee Ave. Chicago, Ill. 60641

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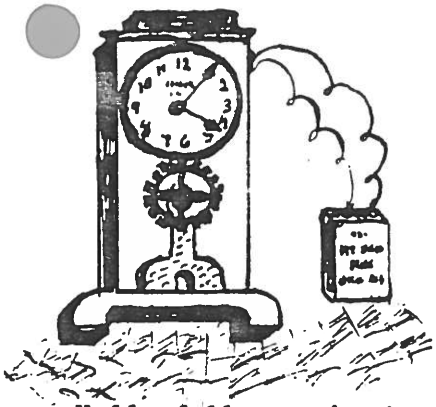
WANTED: Electrical Horological Literature--any type. Highest prices paid.
Hamilton-Sangamo clocks--write details.
Martin C. Feldman, 1545 Rhinelander Ave. Bronx,N.Y. 10461

****

WANTED: Unusual Electrical Clocks (including Warren Mystery Battery Cl.).
Also unusual foreign pieces.
A. Marx, 105 Bayeau Road, New Rochelle, N.Y. 10804

****

WANTED: Top dollar paid for Warren Mystery Battery Clock. Also still looking for suspension spring for large Tiffany Never-Wind.
Any information on French Rotary motor - wind as pictured on page 5 of last issue Vol.III-Issue #2.
C. Roth, 2 Circle Lane, Roslyn, N.Y. 11577



ELECTRICAL HOROLOGY SOCIETY
Chapter No 78

JULY 1977
VOLUME III---ISSUE #4
Martin C. Feldman, Editor

Hello fellow enthusiasts:

This Journal contains both patents of the clock constructed by Samuel A. Kennedy of Attleborough, Bucks County, Pa. The patent copies are being reprinted although it is regretable that the best available reproduction is so poor. The second patent #99,321 of February 1, 1870 illustrates the clock which was donated by Mrs. Slobin in memory of her late husband, Herman Slobin. The clock now belongs to the NAWCC Museum and is presently being restored by the Electrical Horology Society with the major part of the work being done by Dr. Bruce Levy. At present the clock is now running and the face and case restorations remain to be completed. Hopefully, all the work will be done before the new year and the clock will then reside at the NAWCC Museum in Columbia, Pa. We are hopeful that in the future, an article will be forthcoming describing the clock's history, the clock itself and its restoration.

Dr. Feinstein's article will be continued in the September Journal. It should also be noted that Dr. Feinstein's column, THE TIME MACHINE, has not been printed because of a lack of questions. All electrical horological queries should be sent to Dr. George Feinstein, 75-19 - 195 Street, Flushing, N.Y. 11366. If you can send photos, please send black-and-white photos as they reproduce best in our Journal. An SASE is also required and appreciated.

As always we are again faced with a lack of articles for future issues of the Journal. As Editor I can only print what original material is available to me. So, Gentlemen, let us dig out the pens and paper and dash an article off shortly. Many thanks.

We are now listed in the Encyclopedia of Associations. A copy of our listing is printed in this Journal.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman, FNAWCC

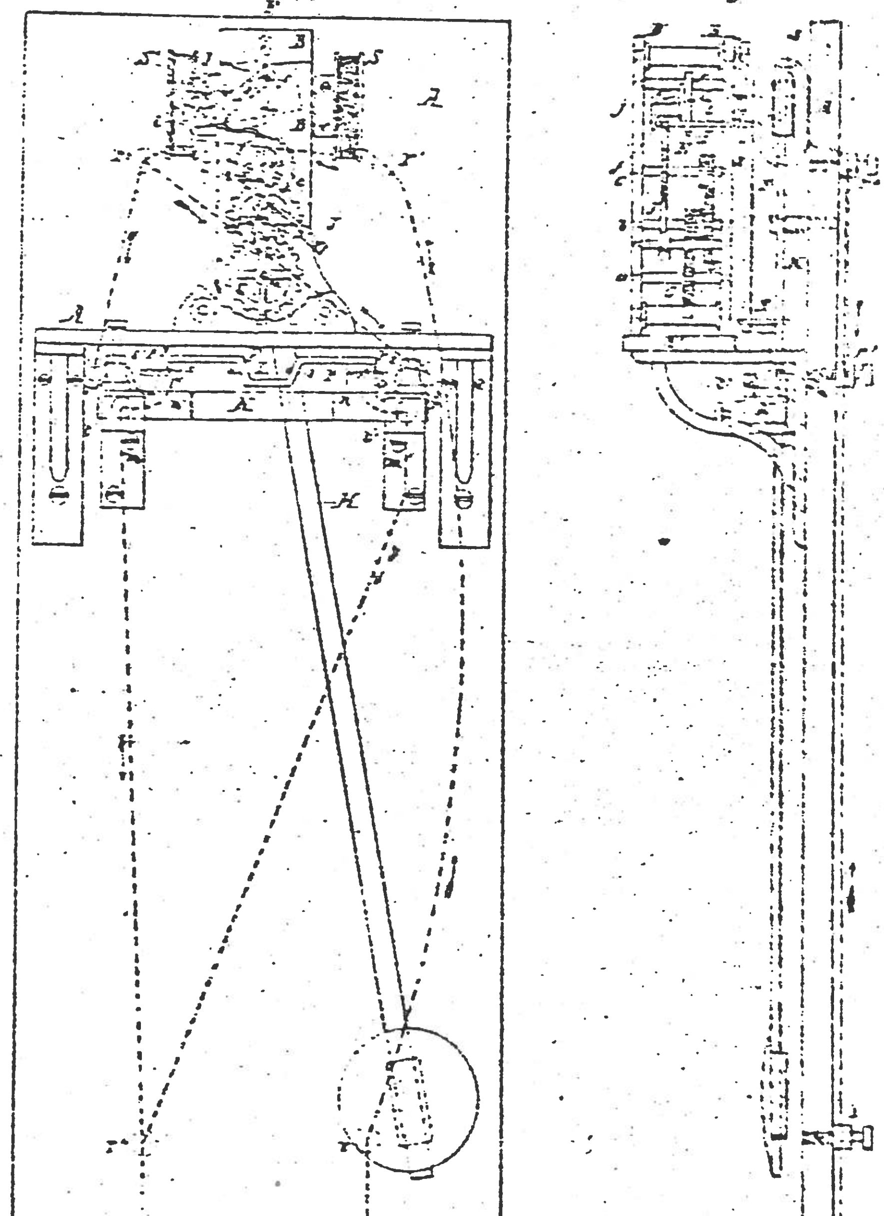
Sheet 1. 4 Sheets

S. A. Kennedy

Electric Clock.

No 71624 Patented Dec. 3, 1867.

Fig. 1 Fig. 2



Negative Pole Positive Pole

Witnesses

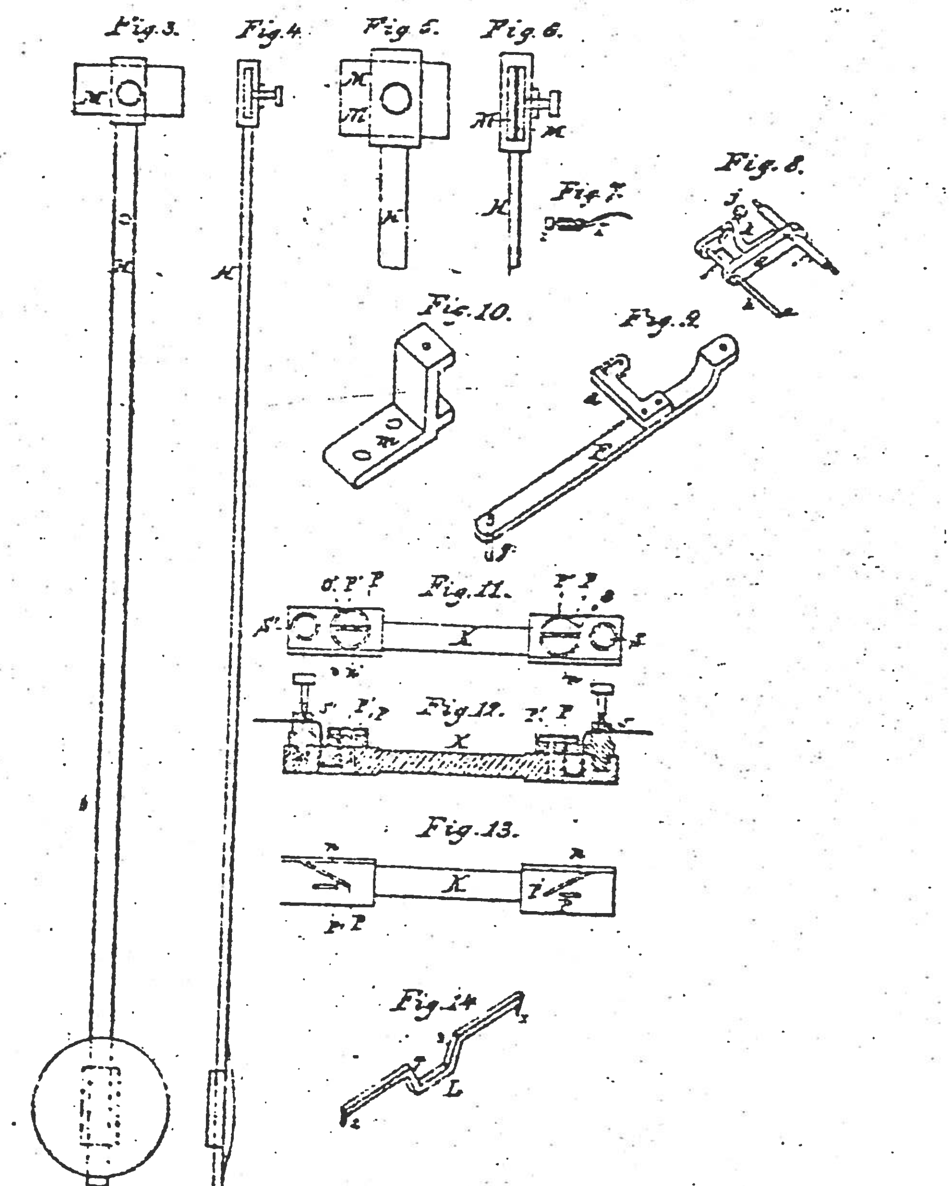
Inventors

Sheet 2. 2 Sheets.

S. A. Kennedy.

Electric Clock.

No. 71624 Patented Dec. 3, 1867.



Witnesses

Inventors

UNITED STATES PATENT OFFICE.

S. A. KENNEDY, OF ATTLEBOROUGH, AND S. W. HOLT AND J. GERLACH, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN ELECTRIC CLOCKS.

Specification forming part of Letters Patent No. 71,624, dated December 3, 1867.

To all whom it may concern:

Be it known that we, SAMUEL A. KENNEDY, of Attleborough, Bucks county, in the State of Pennsylvania, and S. W. HOLT and JOSEPH GERLACH, of the city and county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Electric Clocks; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of our invention mainly consists in forming and breaking the connection with the positive and negative poles of a battery by means of a vibrating bar operated by the pendulum, and arranged and operating as hereinafter described.

In the accompanying drawings, which make a part of this specification, Figure 1 is a front elevation of the improved clock. Fig. 2 is an edge view of the same. Fig. 3 is a front view of the pendulum H and magnetic bar M in connection. Fig. 4 is an edge view of the same. Fig. 5 is a front view of a modification of the said bar and pendulum. Fig. 6 is an edge view of the same. Fig. 7 is a vertical section of the pawl I. Fig. 8 is an isometrical view of the forked bar G and parts in connection therewith. Fig. 9 is a like view of the lever F. Fig. 10 is a like view of one of the brackets, *m*. Fig. 11 is a top view of the bridge K. Fig. 12 is a vertical section of the same. Fig. 13 is a bottom view of the said bridge. Fig. 14 is an isometrical view of the bar L.

A is a board to which the several parts of the clock are attached.

A' is a shelf which supports the vertical plates B B that support the journals of the shafts *a b c* of the center wheel, C, the second-wheel D, and the ratchet-wheel E.

F is a vertical lever, which is actuated by the pendulum H, for giving an automatic motion to the ratchet-wheel E, there being a slotted arm, *d*, of the lever, which receives the pin *e* of the forked bar G, in which the pawl I is hung by means of the horizontal rod *f*. The upper end of the said bar G is permanently connected to the rock-shaft *f'*. At each vibration of the pendulum from right to left the pawl is drawn outward from the ratchet-wheel by the pendulum bearing against the pin *g* of the said lever F, and when the pendulum swings back to the right the weight of the lever and the forked bar forces the pawl forward until the arm *h* of said bar bears against the edge of the contiguous vertical plate B.

There is a set-screw, *j*, in the lug *k* of the forked bar G, by which the heel end of the pawl is borne down more or less to give a longer or shorter catch of the pawl to regulate the motion of the ratchet-wheel; and there is a set-screw, *l*, in the heel of the pawl for equalizing the balance of do., so as to prevent its falling too hard upon the ratchet.

J is the click-lever.

K is an adjustable bridge, supported by the brackets *m* and *m'*. The bridge is provided with plates *n* and *n'*, that communicate with the magnetic wires, there being insulated projections *o o'*, which have wires *p p'* and *p p'* connected with the main-circuit wires.

L is a bar for changing the circuit, it having points 1 2, which communicate alternately at each motion of the pendulum with the wires *p* and *p'* in the projections *o* and *o'*, the pin *q* of the pendulum bearing alternately against the vertical parts 3 and 4 of the bar, and thus changing the points 1 and 2 with the wires *p p'* and *p p'*, so as to change the current.

The points 1 and 2 of the bar L, and the upper ends of the circuit-wires *p p'*, in the projections *o o'* of the bridge K, are of gold. The said projections *o* and *o'* have grooved facings, as seen in Figs. 11 and 12, to guide the points 1 and 2 of the bar L. The former facing is made of brass and the latter of agate.

The pendulum H is shown in detail, Figs. 3 and 4, Sheet No. 2, the forked bar G and parts attached in Fig. 8, the lever F in Fig. 9, one of the brackets, *m*, in Fig. 10, the bridge K in Figs. 11, 12, and 13, and the sliding bar L in Fig. 14. The arm *h* and pin *e* may be an extension of the rod *f* in the forked bar G, as represented in Fig. 8.

The pendulum H has a magnetized bar, M, which is actuated to produce the vibration of the pendulum by the galvanometers S and S', that are, in the drawings, placed above the center of motion. They may, however, be placed below the center, when desired, as the same result would be produced. We contemplate using four or more galvanometers when we want a powerful current, and also having a plurality of the magnetized bars M in the pendulum H. In Figs. 5 and 6 four are represented, which are insulated on their bearings by means of a thin coating of wax, or otherwise.

The circuit-wire, commencing with the platinum or positive pole of a battery, passes through the button r, and thence through the button r' to the galvanometer S, and from that to S′, as indicated by the arrows, and through the button r^2, and thence through the button r^3, and through the stud s on the bridge K; thence through the projection o, where it forms the point p. The wire passes from thence through the screw t, which communicates with the bracket m, to which is connected the wire leading to the negative pole of the battery through the button r^4. The current is formed when the pendulum is swung to the right, as represented in the drawings; but when it is swung to the left it moves the sliding-bar L so as to bring the points 1 and 2 into connection with the points p' p' of the projections o and o', thus changing the current as it passes from r^2 to r^3, thence through the stud s', and thence to the point p' in the projection o' on the bridge K, where it communicates with the sliding bar L, at the point 2, and passes through said bar to its point 1, where it communicates with the wire p in the projection o; thence to screw t' in the bracket m', communicating with the wire leading to the negative pole of the battery through button r^4. When the pendulum comes into the position as it now stands the polarized bar M is in connection with the galvanometer S′, and being repelled by the same the motion of the pendulum is changed from right to left, and when it reaches the galvanometer S the sliding bar L closes the circuit with the said galvanometer, and the pendulum is again repelled back to the right, and thus the movement is continuously kept up.

What we claim as new, and desire to secure by Letters Patent, is—

1. The combination and arrangement of two or more galvanometers with one or more polarized steel bars, combined with the pendulum, and arranged either above or below the center of motion, substantially as described, and for the purpose set forth.

2. Producing a double automatic circuit by means of the combination of the pendulum H with the sliding bar L arranged and operating in relation to the electric wires p and p', which project to the surface of the projections o and o' of the bridge K, substantially as described, and for the purpose specified.

3. The combination and arrangement of the electric wires with the batteries, the galvanometers S and S′, the sliding bar or circuit-changer L, and the bridge K, so as to produce a double-acting circuit by means of the motions of the pendulum, substantially as described.

4. The combination of the ratchet-wheel E with the pendulum H, by means of the lever F, forked bar G, and pawl I, arranged and operating in relation to each other substantially as described, and for the purpose specified.

5. The combination of the ratchet-wheel shaft e with the shaft a, by means of the wheels C and D, and pinions V and V′, substantially as represented.

6. The combination of the set-screw j with the forked bar G and pawl I, substantially as and for the purpose set forth.

In testimony that the above is our invention we have hereunto set our hands and affixed our seals this 29th day of March, 1867.

SAML. A. KENNEDY. [L. S.]
S. W. HOLT. [L. S.]
JOS. GERLACH. [L. S.]

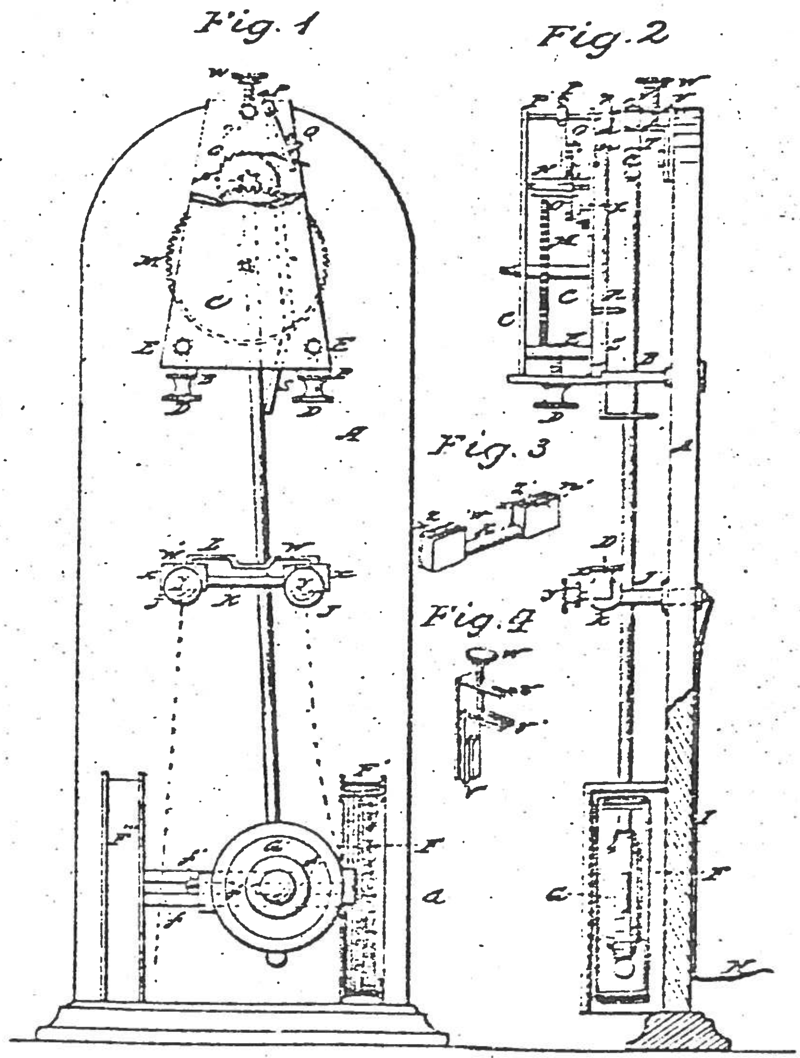
Witnesses:
JOHN WHITE,
STEPHEN USTICK.

S. A. KENNEDY.

Electric Clock.

No. 99,321.

Patented Feb. 1, 1870.



Witnesses:

Gustave Dieterich

Wm. F. Clark

Inventor:

S. A. Kennedy

per Munn & Co

Attorneys

United States Patent Office.

SAMUEL A. KENNEDY, OF ATTLEBOROUGH, PENNSYLVANIA, ASSIGNOR TO THE KENNEDY ELECTRIC-CLOCK COMPANY, OF NEW YORK CITY.

Letters Patent No. 99,7[illegible], dated February 1, 1870.

IMPROVEMENT IN ELECTRIC CLOCKS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, SAMUEL A. KENNEDY, of Attleborough, in the county of Bucks, and State of Pennsylvania, have invented a new and useful Improvement in Electric Clocks; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The nature of the present invention consists principally in the employment of a single wheel in the clock-train to carry the dial-movement, which wheel is driven directly by the pinion of the ratchet-wheel, thus diminishing the resistance in the clock-train, so that the motive-power which is applied through the pendulum, may also be decreased, and the clock rendered more simple in construction, and more accurate in operation, as will be fully understood from the following description, in which—

Figure 1 represents a front elevation of my improved electric clock, parts being broken away in order to show its construction more fully.

Figure 2 is a side view of the same.

Figure 3 is a perspective view of the bridge.

Figure 4, is a perspective view of the adjustable holder for the pendulum.

Similar letters of reference indicate corresponding parts.

A represents a board or tablet, corresponding to the back of the clock-case, to which the several parts of the clock are attached, and from which project arms B B, on which the upright plates C C are supported.

The arms B B are flattened and slotted on that portion on which the plates C C rest, which plates are held secure to the arms B B, by means of screws D D, which run into the pillars E E, which extend between plates C C, as shown.

The electric coil F, enclosed within an ornamental case, F', is a hollow oblong, adapted in form and position to receive the end of a permanent magnet, G, which is carried by or forms part of the pendulum G'; but I also propose, in some cases, to reverse the position of the coil and magnet, using the electric coil on the pendulum, and making the magnet stationary. In either case, the joint repulsion between the coil and magnet, keeps up the oscillations of the pendulum.

Upon the side of the pendulum, opposite the case F', is placed a similar case, F'', merely for ornamental purposes, and containing no coil.

The position of the cases F' and F'', is adjusted by the slotted arm *f*, and the screw *f'*, whereby they are also attached to the back of the case A.

The terminals of the electric coil F, extend through the board or tablet A, one connecting directly with the battery, the other extending up to the pillar or support J of the bridge K, which latter is composed of some suitable non-conducting material, and over the top of which, at *z z'*, and front at *z z'*, extend metallic strips to connect with the screws *y y'* of the arms *j j'*.

The two supports J J' always remain electrically insulated from each other, except when connected by the metallic slide L, the points of which move in a guiding-groove, *w w'*, which extends across the upper face of the plates *z z'*, and the bridge K, substantially as shown.

The slide L is formed of a single bar of metal having a depression in its centre, and a shoulder at each side of the depression, as shown, against which shoulders the pin *l*, projecting from the front of the pendulum, strikes, and thus, by the oscillations of the pendulum, the slide L is moved alternately right and left, and thus the points of the slide L alternately travel upon and beyond the metallic strips *z z'*.

When these points rest upon the strips *z z'*, the battery-circuit is complete through the coil, via the supports J J'. The direction of the current must be such that both the coil F' and the magnet *m* must present like polarities toward each other.

The circuit is closed at *z z'*, after the magnet *m* has passed into the coil F', and just before the pendulum arrives at the point of rest, when, by the natural repulsion of coil and magnet, the pendulum is driven back to the other end of its arc of oscillation, but just before arriving there, the pin *l* takes the slide L back, and the circuit is again interrupted, and remains broken, until the pendulum has returned, and the magnet re-entered the coil, as before described.

The lever S, suspended from the rock-shaft P', is moved aside by the pendulum, but returning by its own gravity, drives the clock-train.

The arm in which the pawl *p* is pivoted, is also attached to the rock-shaft P' by the screw P, which serves to clamp and hold the said arm at any desired angle, and by adjusting screw P, the extent of the catch for the pawl may be regulated.

The adjustment of the pawl is also assisted by means of the set-screw Q, which operates on the heel of the pawl.

N is a pinion on the shaft of the ratchet-wheel O, which pinion meshes in the teeth of the train-wheel M, and imparts motion thereto.

By this arrangement of a single train-wheel with the ratchet-wheel, the resistance is diminished, and less driving-power is required.

In order to render the resistance to the pendulum constant, the spaces through which the weight or lever S is carried, must be always equal. To secure this equality of distance, I employ the stop-pin R, or other suitable device, to arrest the descent of the lever S at a fixed point, where the pendulum, by passing on, leaves it, and returning, receives it again.

The pendulum-rod is constructed of wood, kiln-dried, and filled in with paraffine, glycerine, or other like substance, so as to prevent absorption of moisture.

T is a spring, on which the pendulum hangs. This spring is inserted in slits in the adjustable slides U U'. The portion marked U', is provided with a slot V, so that it may be moved up or down on the spring T, by turning the thumb-screw W for the purpose of regulating the oscillations of the pendulum.

X is a spring, which bears on the shaft of pinion K, to prevent any retrograde motion thereof.

Having thus described my invention,

What I claim as new, and desire to secure by Letters Patent, is—

1. The method of vibrating a pendulum having a magnet attached thereto, by the repulsion of a single electric coil, always having the same polarity at the end of the magnet opposite thereto, and whose connection with the battery is intermittently broken.

2. For the use and purposes of an electric clock, the employment of a clock-train, consisting of a single wheel, M, driven directly by the pinion of the ratchet, which is in turn driven by the pendulum-lever.

3. Regulating the angle and extent of catch of the driving-pawl of a clock, by means of the rock-shaft P and screw P', arranged and operated in the manner described.

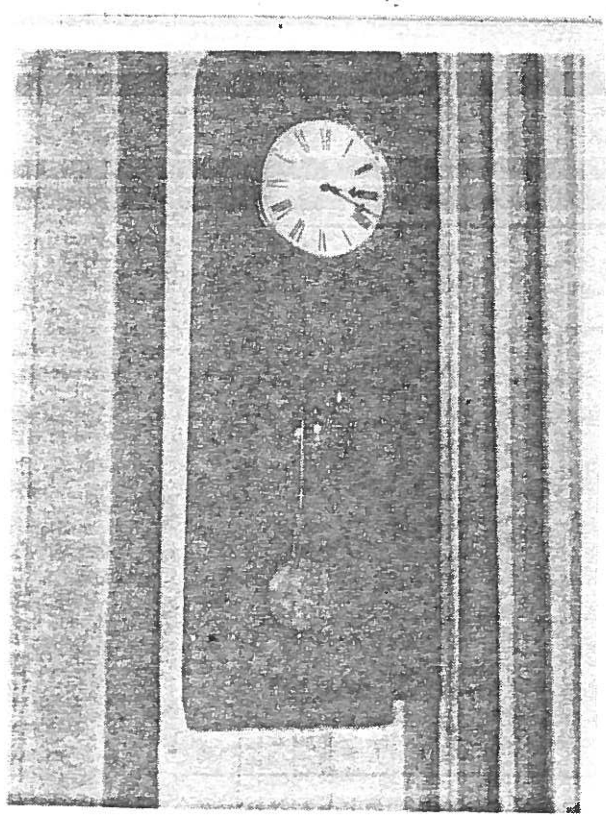
4. The combination of the set-screw W, slide U', and its parts, and the spring T at the top of the pendulum, to adjust the length of the latter, substantially as herein shown and described.

5. Rendering the resistance of the lever S to the pendulum uniform, by always arresting the gravitating movement of said lever at a fixed point, in the manner described.

6. Also, the manner of adjusting the position of the electric coil F, by having a slotted bar, Y, with set-screw extending through it into the board or tablet A, substantially as shown.

SAMUEL A. KENNEDY.

Witnesses:
WM. MARTINDELL,
JOE. J. MARTINDELL.



THE NAWCC KENNEDY CLOCK

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1: Original articles.
2: More Mart participation.
3: Technical questions.
4: New members (for the Society).

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1545 Rhinelander Avenue
Bronx, N.Y. 10461

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ELECTRICAL HOROLOGY SOCIETY
C/O Martin C. Feldman, 1545
Rhinelander Ave.
Bronx, NY 10461

ACRONYM:

OFFICERS TITLE: Pres.

PHONE NO.: ( )

Founded: 1972. Chapter No. 78 of the National Association of Watch and Clock Collectors. Formed to provide a means whereby members of the NAWCC who have a primary and strong interest in early battery clocks as well as AC clocks would have a means to meet and communicate with other members having similar interests. Seeks to collect, explore and disseminate information regarding such time pieces. Is establishing library. Publications: Journal, 6/year. Affiliated with: National Association of Watch and Clock Collectors. Convention/ Meeting: annual , in conjunction with NAWCC.

TIME AND PROGRAM CLOCK CIRCUITS

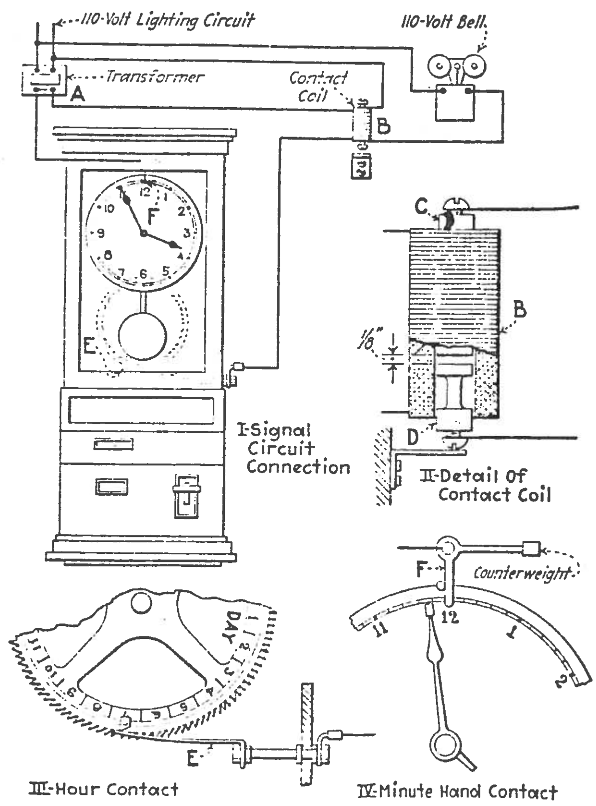

FIG. 154.—An improvised automatic time signal. A 50-watt potential transformer, *A*, was connected to the lighting service in the plant. A 110-volt bell and also the contacts of a solenoid coil *B* were connected across the lighting circuit. The secondary voltage of the transformer, which was about 10 volts, was connected across the solenoid coil *B*. The time clock, which was equipped with a brass wheel (Fig. *III*) about 10 in. in diameter, was provided with lugs which closed an electric circuit through a second contact making device (Fig. *IV*) attached to the minute hand of the clock. With this arrangement, when the circuit to the coil *B* is closed, by the contacts *E* and *F* on the clock, the core *D* is drawn up against the stationary core, *C*, thus closing the signal circuit and sounding the gong.

FOR SALE: Mahogany-cased master clock, 15½ x 10 x 45, VG cond'n. Layman's description: ST(?) 2-train pend. mvt. with circ. merc. switch in ew position, makes 60-sec. contacts. Below, a vertical key-wind strike train, relay released. On case bottom, heavy mvt. with 2 crank-wind spgs., top plate containing 40 contacts. Rotating brush controlled by relay. Inspection slips by Diebold for 1930s, 40s, 50s. 19 connectors at top. Inside, "Secondaries Ahead" button, "Off-on Chime" push switch, 3 knife switches. Someone has made rough drawing of circuits. All original keys. $280. Must pick up. C. Terwilliger, Box 171, Bronxville NY 10708

****

WANTED: Stromberg Masters--Write details.
Joseph Bourell, 4213 No.Milwaukee Ave. Chicago,Ill. 60641

****

WANTED: Electrical Horological Literature--any type. Highest prices paid.
Hamilton-Sangamo clocks--write details
Martin C. Feldman, 1545 Rhinelander Ave. Bronx, N.Y. 10461

****

WANTED: Unusual Electrical Clocks (including Warren Mystery Batter Cl.).
Also unusual foreign pieces.
A. Marx, 105 Bayeau Road, New Rochelle, N.Y. 10804

****

WANTED: Top dollar paid for Warren Mystery Battery Clock. Also still looking for suspension spring for large Tiffany Never-Wind.
Any information on French Rotary motor-wind as pictured on page 5 of last issue Vol.III--Issue #2.
C. Roth, 2 Circle Lane, Roslyn, N.Y. 11577

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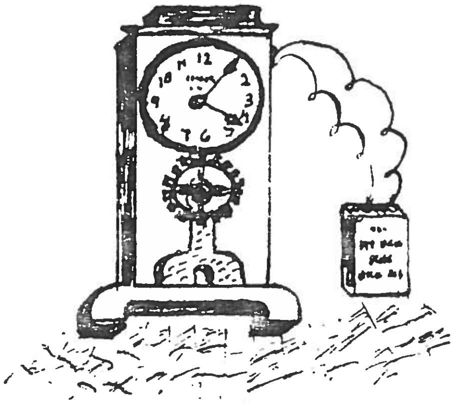


October 1977
VOLUME III---ISSUE #5
Martin C. Feldman, Editor

Hello fellow enthusiasts:

This month we are concluding the translation by Dr. George Feinstein of the article, Measurement of Time. We also have a large Mart for this issue. We would like to print an even larger Mart so that more electrical horological items get spread around to as many collectors as possible. The rates are very reasonable at $2.00 per 4 lines and all copies should be sent to me at least 3 to 4 weeks prior to each odd-numbered month. We also, in order to bring you as much original work as possible, request individual articles from our members. They can describe a clock you have restored, an experience you had in purchasing an electrical clock, or any other information you wish to share with the membership. Please do not worry about your ability to write as your editor will polish all articles before they are printed.

As you know, the beginning of the year will be approaching us and our annual dues of $7.00 should be sent to our treasurer, Mr. Charles Roth, 2 Circle Lane, Roslyn, N. Y. 11577. It would be appreciated if you send your dues as soon as possible as this facilitates bookkeeping considerably. Our membership continues to increase at a steady rate and we are most pleased that more and more collectors are finding early electrical clocks of interest.

Enjoy this issue!

Electromagnetically yours,

Martin C. Feldman,FNAWCC

continued from--VOLUME III, ISSUE #3, Page 2
"Measurement of Time" ed: A. I. Konstantinov
Trans. by: Dr. George Feinstein

For elimination of the harmful effects of the mechanism of the clock on the period of oscillation of the pendulum it follows that we go along the path of maximizing the freedom of the pendulum in the clock, and supply to it impulses once every 15-30 periods, or less frequently, which reduces to a minimum its connection with the mechanism. Impulses must be short and supplied in the position of equilibrium of the pendulum, then all the variations in the mechanism supplying the impulses are reduced to a variation of amplitude of oscillation of the pendulum, and the influence of the phase of the impulse will be minimal. Consequently, the problem of isochronizing the oscillations of a pendulum must for a solution free the pendulum beyond its connections with the mechanism.

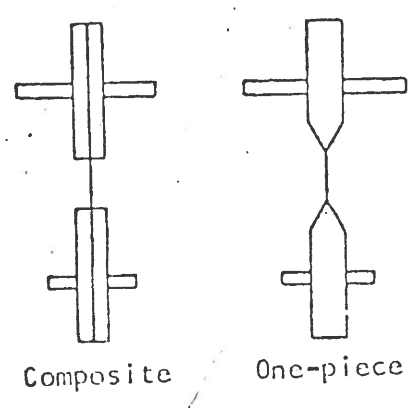
At the present time, pendulums of astronomical clocks are hung on a spring suspension (pendulum spring). The quality of the suspension to a considerable measure determines the quality of the clock. The spring suspensions are made composite and one-piece (Fig.3).

In the literature (1,2) it is indicated that by means of experiment it is always possible to determine such dimensions of the spring suspension, that an oscillating pendulum attached to it will have the desired degree of isochronism.

For an astronomical clock recently created by the author it was necessary to have an isochronous spring suspension, this is what induced his start along the indicated way of experimental selection of suitable dimensions and shape for a spring, as the best way of solving the question of the isochronous oscillations of a free pendulum.

For clearing up the influence of the "spring constant" of the suspension on its isochronous characteristics there were conducted a series of tests, they were repeated with various suspensions, the results of these tests is on the graphs of Fig.4. Undergoing investigatinn were "knife edge", inelastic (made of silk tape), and various thickness steel suspensions.

Fig. 3 Hangers



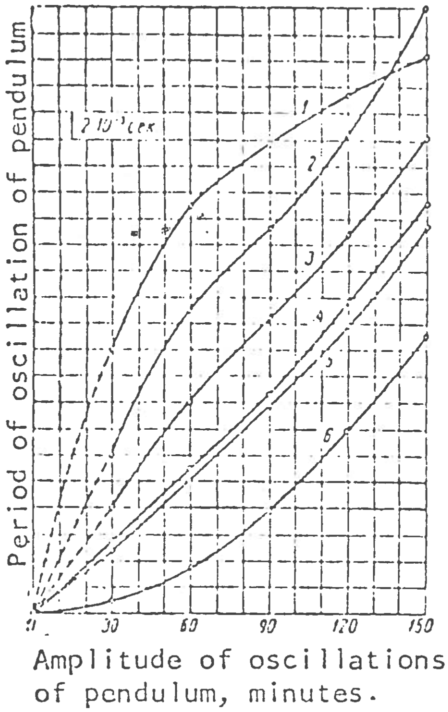


Fig. 4 Relationship of the period to amplitude for freely decaying oscillations of a pendulum on suspensions of various elasticity but equal length.

1. thickness of spring 0.3 mm.;
2. thickness of spring 0.08 mm.;
3. thickness of spring 0.05 mm.;
4. inelastic suspension (silk tape);
5. "knife edge"
6. theoretical curve.

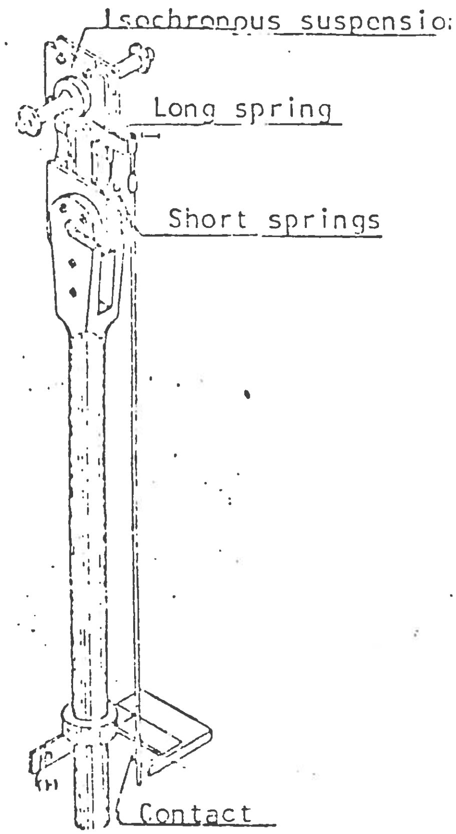


Fig. 5 Mechanical contact of pendulum.

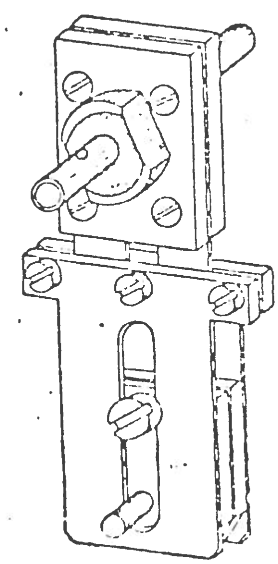


Fig. 6 Suspension with variable length springs.

As we can see from the graph, all curves, obtained empirically, independently of suspension take on slopes steeper than the theoretical curve, constructed to the same scale. The closest to the theoretical curve proved to be the curve of the "knife edge" and inelastic suspensions made of silk tape. The remaining curves were in the order of thickness of suspension: the greater the stiffness of the suspension, the steeper is its corresponding curve in the needed interval of amplitudes, the farther its characteristics from isochronous. Curves, represented on the graph (Fig. 4), were obtained by means of a mechanical contact (Fig. 5), therefore, terminating at an amplitude of 30', since below this they diverge from a curve obtained by means of a photocontact. The curve for the inelastic suspension (third from the bottom) does not produce such a divergence, therefore, it was carried out down to an amplitude of 5'.

For the experimental verification of the possibility of improving the isochronous oscillations of a pendulum at the expense of moving its axis of rotation in the deflected pendulum, a special suspension with a variable length spring (Fig.6) was designed and made. The spring thickness is 0.1 mm. and width 5 mm. The lower portion of the suspension has a movable cover plate, which permits a change in the effective length of the spring, the total length is not changed, therefore, the length of the pendulum is not changed.

It is possible to change the length of the spring, without removing the pendulum from the suspension, within the limits of 9.5 mm to nothing. The results of the test are shown on the graph of (Fig.7).

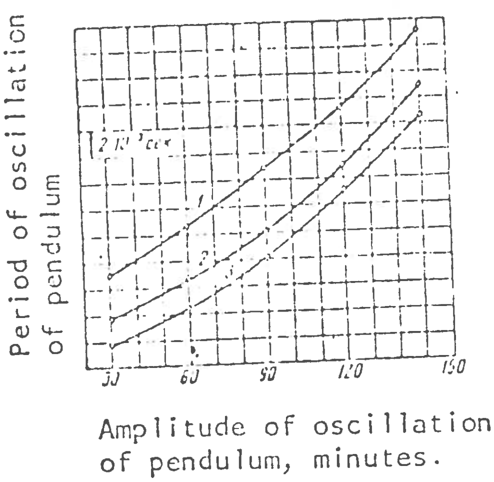


Fig. 7 Relation of period to emplitude of the freely decaying oscillations of a pendulum with suspension springs of various lengths. (Width of suspension spring 5 mm., thickness 0.1 mm.)

1-length of spring 1 mm.;
2-length of spring 3 mm.;
3.length of spring 0.5 mm.

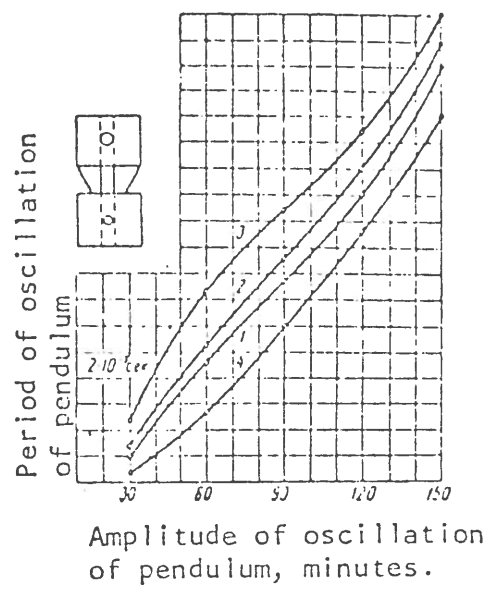


Fig.8 Relation of period to amplitude of the freely decaying oscillations with suspension springs of varying width.

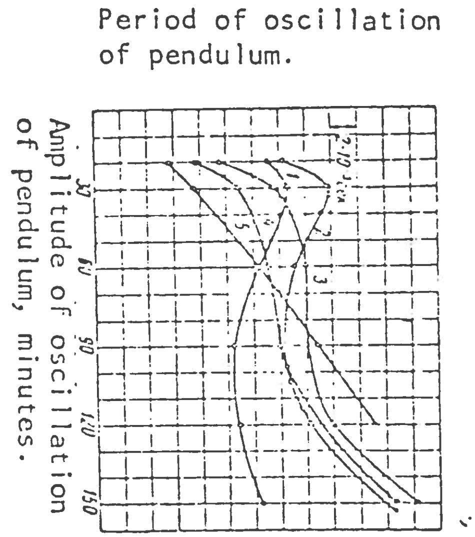


Fig. 9 Relation of period of oscillation of pendulum to amplitude under various tightening of the cover plates of the suspension of a Riefler clock.

Changing the length of the spring between 9.5 to 1 mm. does not show any change in the slope of the corresponding curves.

The only change is in the period of oscillation of the pendulum, that is by shortening the spring, its stiffness is increased, correspondingly decreasing the period of oscillation of the pendulum.

L.P. Shishelov (3, p. 186) indicated that it is possible to obtain the desired degree of isochronism by using a spring suspension of variable width, that is a spring of appropriate shape. For clearing up this possibility, there was produced a suspension, consisting of two one-piece suspensions, the dimensions of the springs were 7 x 7 x 0.12 mm. The results of the trials with this suspension are shown in a graph (Fig. 8).

Curve 1 corresponds to a suspension of standard springs, curve 2--suspension, of springs with a taper cut a quarter into the width, curve 3--suspension, of springs with a cut one half into the width, curve 4--corresponds to a suspension inverted such that the top pin became the bottom. Furthermore, one suspension was produced with springs of variable thickness. Characterizing its nature in turning over around a horizontal axis by 180° it was found that its curve was similar to the ones in the graph (Fig. 8).

After conducting all these tests it became evident, that the isochronous oscillations of a free pendulum cannot be obtained by either a choice of dimensions for suspension springs, or their shape.

Why was there such a disparity in the results of the experiments and the existing ideas? To clear up this problem the author attempted to repeat Hayne's experiment. Hayne experimented with two composite Riefler suspensions and Riefler pendulums and obtained good results. Of two suspensions one with springs of thickness 0.05 mm., far overcompensated the period--amplitude relation for the freely decaying oscillations of the pendulum. The suspension with 0.1 mm. thick springs far undercompensated.

To repeat the experiment, there was used, as was by Hayne, a Riefler pendulum and suspension with a spring of 0.1 mm. thickness. A spring of 0.05 mm. thickness was specially prepared. Many repetitions of this experiment with both springs did not produce Hayne's overcompensation.

To our aid came the following case. Once, after a regular substitution in suspensions, thick spring to thin, unexpectedly produced overcompensation, which was not previously observed. After careful inspection of the suspension, which gave overcompensation, it was found, that its springs were insufficiently compressed in the top cover plates. Elimination of this defect again eliminated the isochronous properties of the suspension. After this case it was easy to produce any degree of isochronism, which is evident from the graphs of (Fig.9). Curve 5 corresponds to the suspension with tightly compressed cover plates. The other curves correspond to various degrees of compression of the spring suspensions top cover plates.

Evidently, such cases occurred in Hayne's experiments. His suspension far overcompensated because of poor quality, especially as a sufficiently small gap between the upper cover plates of the suspension will produce any degree of isochronism. But such isochronism has no real value, as it changes with variations in the degree of compression of the suspension springs in the cover plates, and also with variations in the friction between the springs and the cover plates.

The idea of the possibility of obtaining isochronous oscillations of a free pendulum by the selection of the proper dimensions and shape of the suspension spring arose probably, as a result of investigations with poor quality composite suspensions. In reality even the usually employed one-piece and quality composite suspensions are by no means isochronous.

To produce isochronous oscillations of a free pendulum the author, in 1952, proposed a design for an isochronous pendulum suspension (pendulum spring). Unlike the ordinary, two-spring non-isochronous suspension, the isochronous suspension consisted of three springs, arranged in one plane, symmetrically with respect to the longitudinal axis of suspension. The middle spring is longer than the side springs and is displaced upward (Fig. 10). All three springs represent in themselves individual suspensions, side springs having the dimensions 3 x 4 x 0.1 mm., and the middle spring 15 x 6 x 0.15 mm. All three springs are interconnected at the thick parts by means of cover plates screwed and in addition dowel pinned. The middle spring is only screwed and therefore has longitudinal free movement for regulation to produce the necessary degree of isochronization of the oscillations of a pendulum. Moving the middle spring up increases the isochronizing characteristics of the suspension, moving it down decreases them. If all the springs are arranged with their top part at one height, the result is an ordinary non-isochronous suspension.

For a qualitative presentation on the operation of the isochronous suspension let us examine the scheme represented in Fig. 11., AC--long suspension spring, BC--short suspension spring. The springs have their ends firmly clamped, and no relative displacement is possible.

Cross-section at A-A

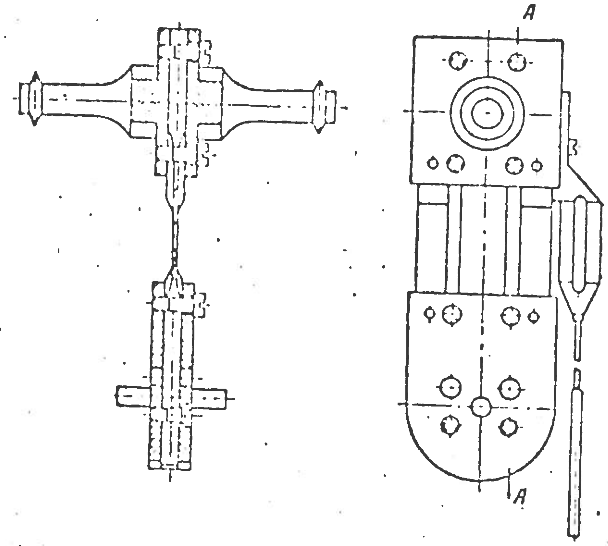


Fig. 10 Isochronous suspension for a pendulum.

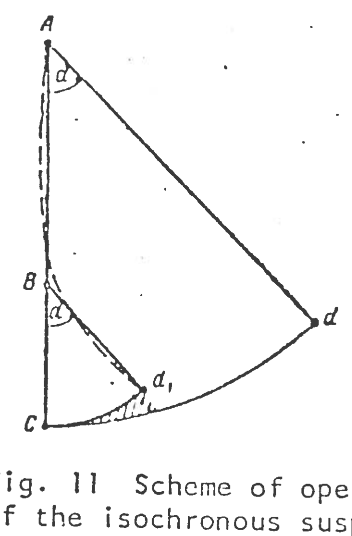


Fig. 11 Scheme of operation of the isochronous suspension.

Let us assume, that point A is a projection of the axis of rotation of the pendulum suspended only on the long spring with the side springs eliminated. Point B is a projection of the axis of rotation of the pendulum suspended only on the short springs with the long spring eliminated. If the pendulum were suspended by the long spring, then the springs lower end (point C) due to the deflection of the pendulum to the right by the angle α is transferred to the point d along the arc Cd. If the pendulum were suspended by the short springs, then their lower ends (point C) due to the deflection of the pendulum to the same angle α, will be transferred to point d_1 along the arc Cd_1. In reality the pendulum is suspended by all three springs, and the springs are rigidly interconnected, therefore, the end of the long spring due to the deflection of the pendulum is constrained to proceed along the curve Cd_1 of the short springs, while the long spring is forced to bend, as shown by the dashed line Ad_1. Consequently, the middle spring, besides deforming, because of the deflection of the pendulum, which is common for all three springs, undergoes some additional deformation, due to the different lengths of the springs and non-coincidence of their points of fastening. This deformation increased with increasing amplitude not proportionally to the angle of deflection of the pendulum, but faster,--hence the total restoring moment of the isochronous suspension will increase as well not proportionally to the angle of deflection of the pendulum, but faster, i.e., along the curve Oa_2 in a definite interval of amplitudes on symmetric curve $k\varphi - k\varphi^3/6$ (see Fig.2).

Resultant effect of the natural restoring moment and the restoring moment of the isochronous suspension in a definite interval of amplitude will be expressed directly in terms of $k\varphi$, causing isochronous oscillations of the pendulum. Thus, the isochronism of this suspension depends on the existence in the third, longer, spring, of additional deformation which introduces extra elastic moment in a definite, reasonably wide interval of amplitudes, compensating for the inadequacy of the natural restoring moment. The period of oscillation of a pendulum, hanging by the isochronous suspension in the requisite interval of amplitude, has slight dependence on amplitude, which is evident from the curves in Fig. 12. Curve 1 shows the relation of the period of oscillation of a pendulum to the amplutude by free decay on an ordinary suspension, curve 2-for the isochronous suspension.

The isochronous character of the suspension is completely dependent on the elastic properties of the suspension springs, therefore the production of proper springs requires that the right alloy steel be subjected to proper heat treatment. Experiments have shown that the best steel alloy, for this purpose, is 50 XΦA X-chromium, Φ -vanadium, A-aluminum) hardened at a temperature of 860°C with subsequent annealing at a temperature of 680°C with slow cooling.

In Fig.13 are presented curves showing the relation of the elastic properties of the suspension to variations in temperature, from which, it is evident, that the elastic properties of the isochronous suspension are affected by the variation in temperature in the same way as the elastic properties of the ordinary suspension.

The character of the curves is independent of the temperature variations.

At present the isochronous suspension developed by the author is running in a simple, single-pendulum astronomical clock, the oscillations of the pendulum are maintained by short impulses, supplied in the position of equilibrium of the pendulum once every 60 sec. The precision of the rate of this clock is greater than the precision of the rate of the Shortt clocks. The root-mean-square of the variation in its daily rate is less than 0.001 sec. per day (3).

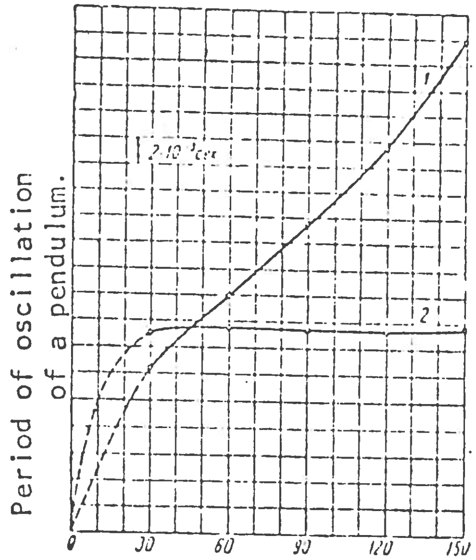


Fig. 12 Relation of the period of oscillation of a pendulum to the amplitude for isochronous and ordinary suspensions.

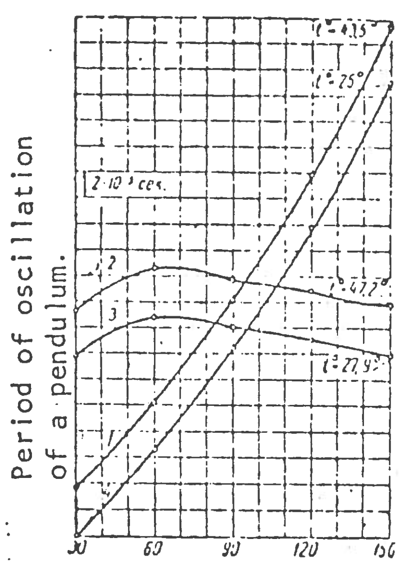


Fig. 13 Relation of the period of oscillation of a pendulum to the amplitude under various temperatures

1-ordinary elastic suspension t^o=45.5°C,
2-isochronous suspension t_o=47.2°C
3-isochronous suspension t^o=27.9°C
4-ordinary elastic suspension t^o=25°C

CONCLUSIONS

1. The idea of the possibility of improving on the isochronous oscillations of a pendulum by the trial and error selection of the dimensions and shape for the springs in an ordinary suspension is erroneous and originated, as a result of the investigation of a composite suspension, which permitted the flexing of the suspension springs between its upper cover plates. All usually employed one-piece and high-quality composite suspensions are in no way isochronous.

2. It is possible to obtain satisfactorily isochronous oscillations of a free pendulum due to the suspension, if we use the isochronous suspension proposed by the author.

3. Use of the isochronous suspension improves the performance of clocks and creates conditions for simplifications in their design.

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Translated by G. Feinstein

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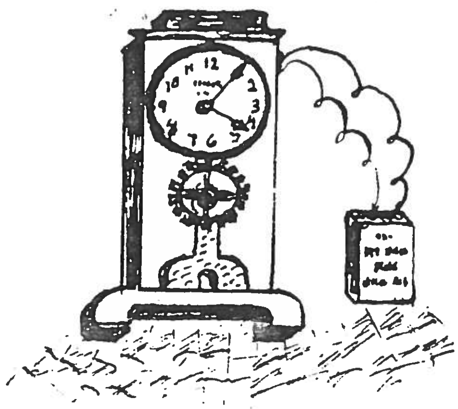


December 1977
VOLUME III---ISSUE #6
Martin C. Feldman, Editor

Hello fellow enthusiasts:

This Issue marks the last Journal for 1977, and in February 1978 we shall publish the first issue of VOLUME IV. As I indicated in the last Journal our yearly Chapter dues of $7.00 are to be paid to our Treasurer, Mr. Charles Roth, 2 Circle Lane, Roslyn, N.Y. 11577. As we are a small organization we unfortunately cannot afford the luxury of sustaining non-paying members. Therefore, if the dues are not in before the printing of the next Journal you will not receive it. For those members paying late, we cannot guarantee that back Journals will be available. So please send Mr. Roth your dues.

In the coming year we expect to be publishing original articles dealing with electronic swing counting and actuating of a pendulum, construction of the Matlock-Collins Clock kit, M. Hipp and his work, an index of all former Journals, translations of old books, patents, etc. Of course, our regular features including questions and answers, the Mart, meeting notices and the like will continue in the next volume as well. It appears we shall have a very interesting year of Journals.

All electrical clock inquiries and problems should be sent to me. They have been sent to Mr. Roth and to others. This only increases the time between the question and the answer. My address is, 1545 Rhinelander Avenue, Bronx, N.Y. 10461.

As you will note from the increased activity of the Mart, more and more of you are taking advantage of the opportunity to reach the very select readership of our Journal. This means that you will be able to trade, sell or purchase electrical horological items with greater ease. The Mart rules are quite simple. All material must reach me during the first ten days of every odd numbered month. There is a minimal charge of $2.00 per 4 lines (greenbacks--please). To those not advertising, please respond early to the advertisers to ensure maximal success of your ventures.

A meeting of the Electrical Horology Society in the New York-New Jersey-Conn. area will take place at 2:00 P.M. on Sunday, November 27, 1977 at the home of Dr. and Mrs. Bruce Levy. Of course all members are welcome no matter where you come from and if you are not from the geographic meeting area but plan to be in New York on the 27th, by all means try and make this meeting. A telephone call to the Levy's is mandatory as they must know how many people will be coming so that they can adequately prepare for us. Please call them at, (516) WE 5-2994 for address and travel directions. We expect that all participating members will bring an horological item of interest for discussion. Please make every effort to attend!

This Issue is devoted to a translation of a section from an early French electrical book written by A. Favarger. This particular clock is in the collection of one of our members (not me) and is running beautifully. The translation in two parts will be continued in a future Journal.

Although it is still early, I wish to take the opportunity on behalf of the Electrical Horological Society's Officers, Journal Staff and myself to wish you a Very Happy Holiday Season and a Healthy and Happy New Year.

Electromagnetically yours,

Martin C. Feldman, FNAWCC

ELECTRIC MASTER CLOCKS USING THE HIPP CONTACT SYSTEM

From: A. Favarger, L'ÉLECTRICITÉ ET SES APPLICATIONS À LA CHRONOMÉTRIE, Neuchatel, 1924, pp. 354-360.
Translated by: Martin C. Feldman, FNAWCC

Exteriorly this type has the same form as the two independent clocks which are represented in Figures 163 and 164, and where one is fitted with a pendulum beating half-seconds and the other with a balance beating seconds. The interior mechanisms of these two devices are the same. Figure 251 gives a front view of this clock. The escape wheel r which makes one turn each minute is directly controlled, as we have already seen on pages 237, etc., by the mechanical impulses of the pendulum. It carries an insulated curved spring k of which the free portion is split and lined with platinum and which, at each turn of r, in other words at each minute, comes in contact successively with the insulated contact points 1, 2, 3, 4, etc. distributed in a circular crown about the periphery at r. But, at the same time, the platinum projection of k touches the platinum arc equally (or covers the silver plate) l; k thus connects this arc successively with the insulated points. Each of these control one group of slave clocks, to which it is connected by the intermediary terminal contacts Nos. 1', 2', 3', etc., placed on the top of the clock case backboard which carries the entire mechanism. The current return wires are common to all the groups and all lead to an exterior terminal marked C; of which two exterior terminals are marked + and -. They receive the two wires coming from the source of current P which at the same time furnishes the current to the slave clocks, and which maintains the oscillatory movement of the pendulum of the master clock (one sees at e the contact-interrupter of the electric Hipp escapement and at d the electromagnet motor respectively).

The current reverser consists of two springs A and B (Fig.252 and 253) along with a lever f which moves around an axis g and is continued on the other side of this axis by an anchor h. Six pins are placed regularly on the toothed wheel r, which makes one turn in 12 minutes, activates a pinion l staked on to the axis of the escape wheel r. The two arms of the anchor h are formed in such a fashion that the passage of two pins placed on a same diameter of the wheel r' give little by little and successively, two different positions to the springs A and B during the interval of two consecutive minutes. In one of these positions, these springs are in contact with the two fixed contact points a and b (Fig.252); in the other, they touch the two fixed contact points b and c (Fig.253), (furthermore, A and C are connected in series, but are only activated on an individual basis alternately). In the first case (Fig.252), the positive current of the source P arrives at point a by the spring A, enters successively the different groups of slaves, then closes (at two second intervals) the interruptors of the groups, returning by the common return wire C through the spring B of the reverser and finally to the negative pole P. In the second case (Fig.253), the same positive current enters in the contact point b through the spring A, arrives at the slaves by the common return wire C and reenters through the group interruptors, at the contact point a and via the spring B. When a minute has elapsed between the two changes of position of springs A and B, the flow of current received by the slaves in the first minute is in a sense the inverse of that received by them during the second minute. The

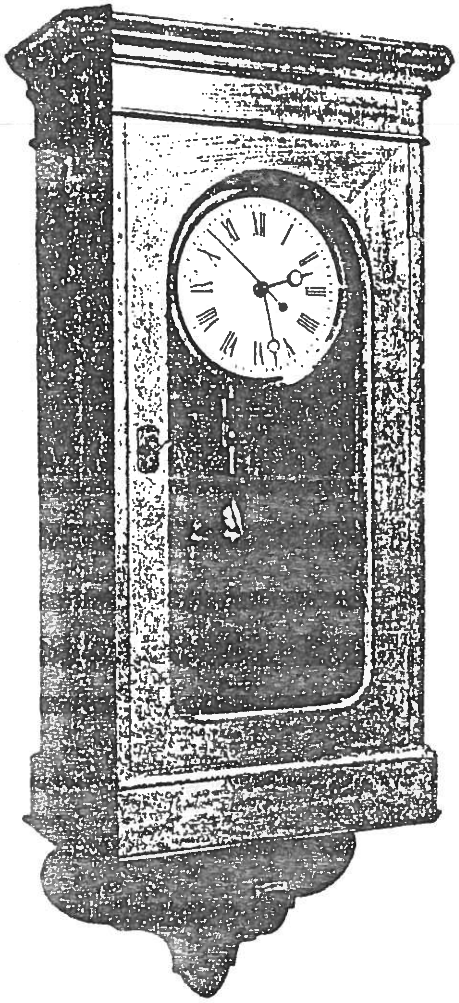


Fig. 163

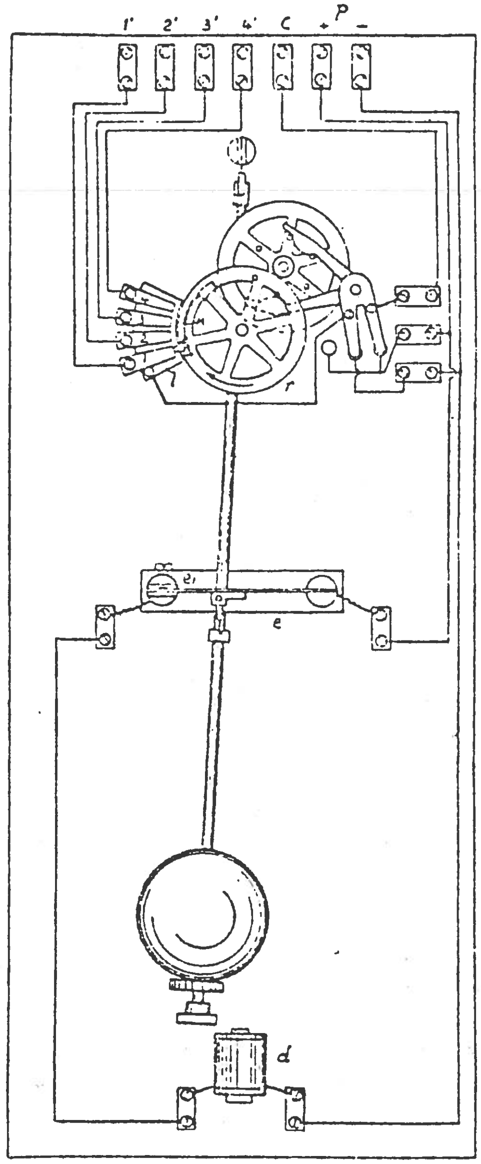


Fig. 251

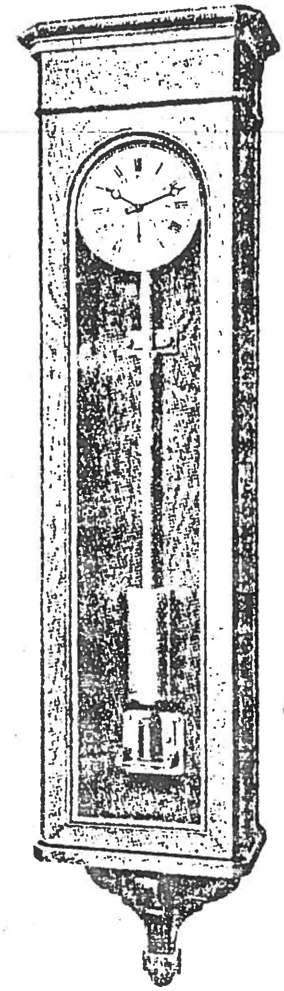


Fig. 164

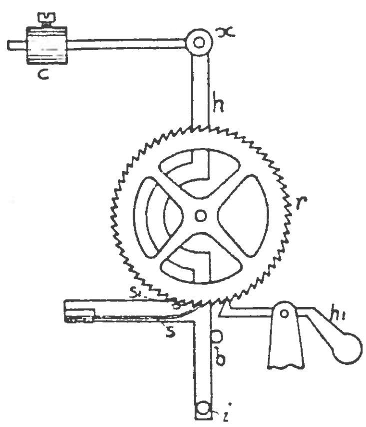


Fig. 165 (p.237)

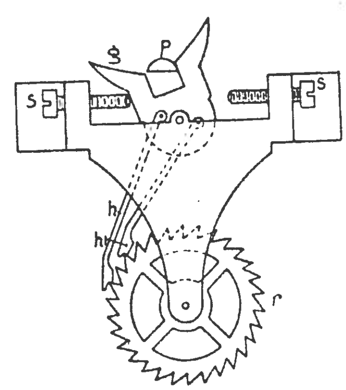


Fig. 166 (p.237)

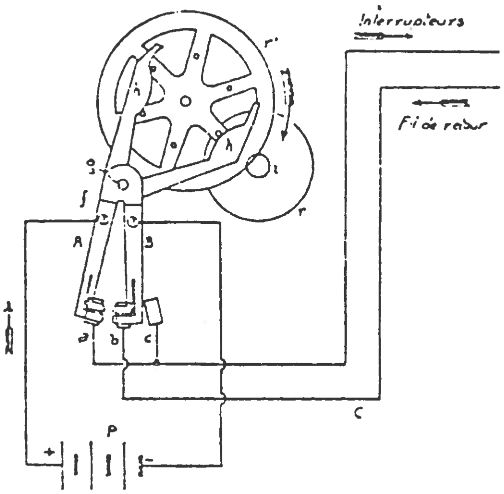


Fig. 252

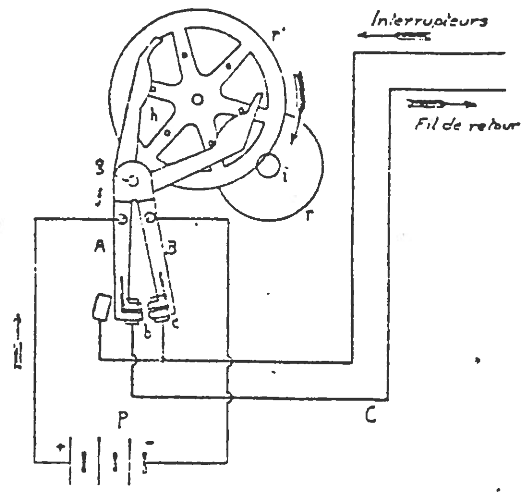


Fig. 253

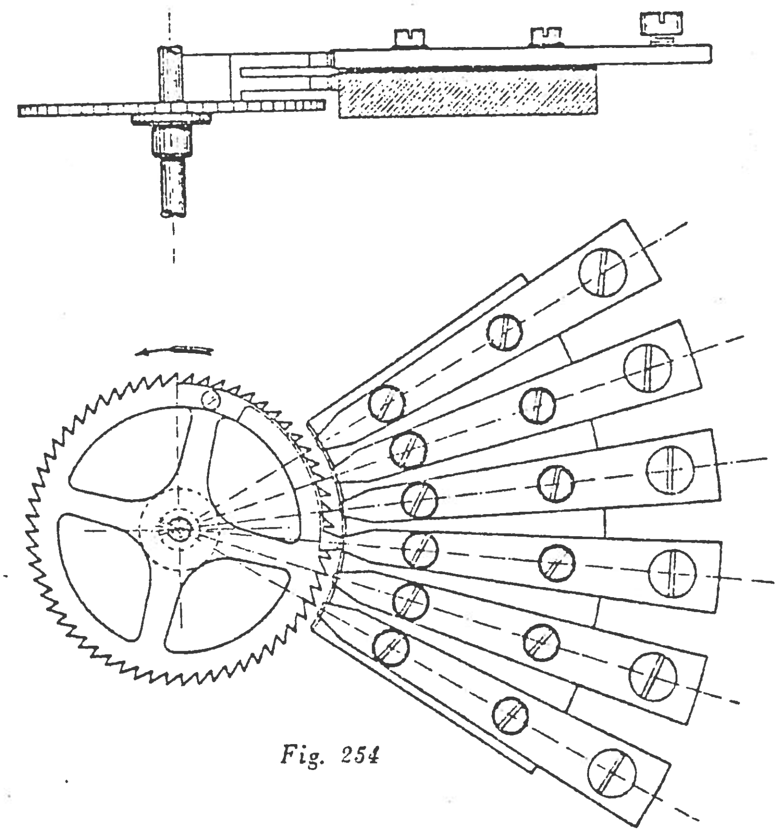


Fig. 254

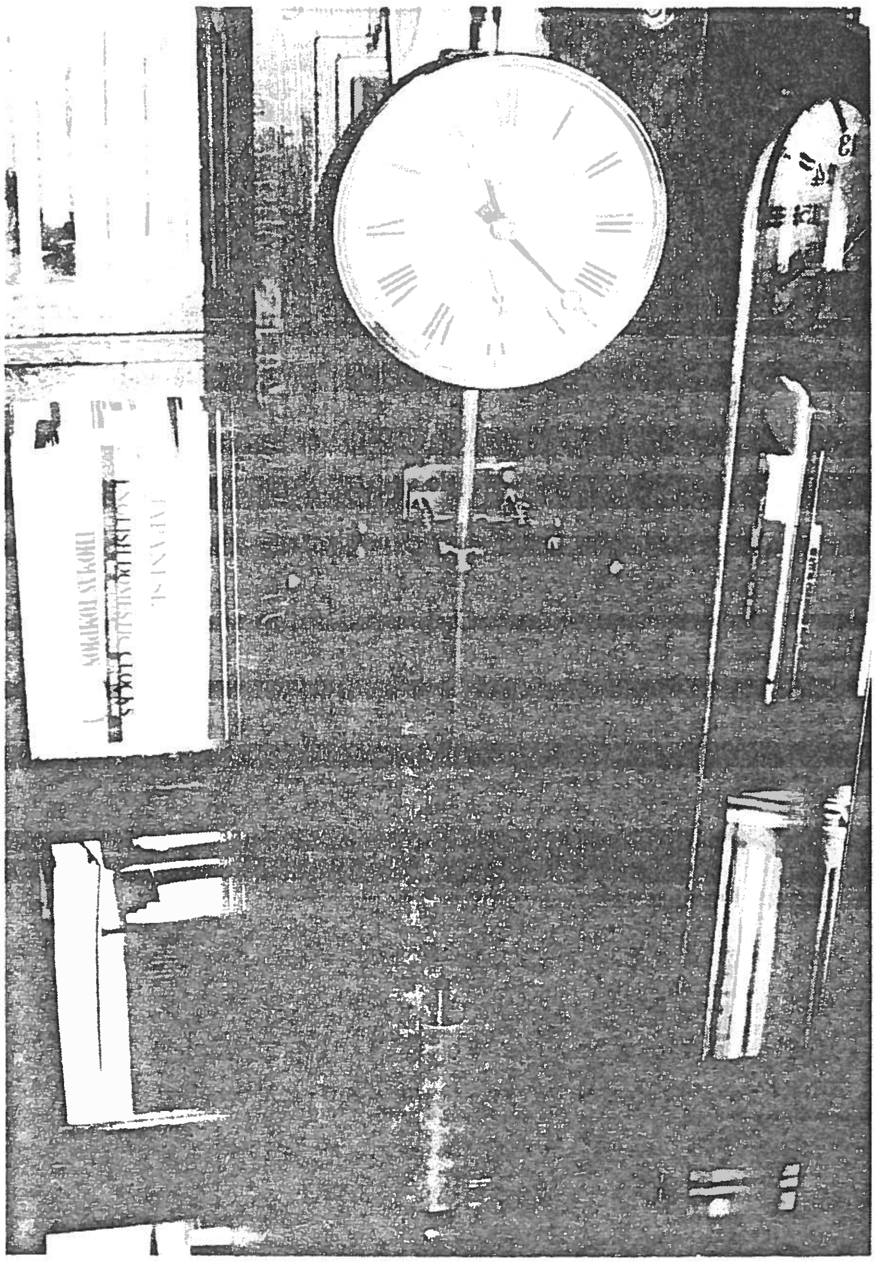


Figure 1

Front view of Favarger Master Clock showing front top to bottom--face, Hipp contact switch, pendulum bob, and part of the actuating electro-magnet.

The current reverser consists of two springs A and B (Fig.252 and 253) along with a lever f which moves around an axis g and is continued on the other side of this axis by an anchor h. Six pins are placed regularly on the toothed wheel r, which makes one turn in 12 minutes, activates a pinion l staked on to the axis of the escape wheel r. The two arms of the anchor h are formed in such a fashion that the passage of two pins placed on a same diameter of the wheel r' give little by little and successively, two different positions to the springs A and B during the interval of two consecutive minutes. In one of these positions, these springs are in contact with the two fixed contact points a and b (Fig.252); in the other, they touch the two fixed contact points b and c (Fig.253), (furthermore, A and C are connected in series, but are only activated on an individual basis alternately). In the first case (Fig.252), the positive current of the source P arrives at point a by the spring A, enters successively the different groups of slaves, then closes (at two second intervals) the interruptors of the groups, returning by the common return wire C through the spring B of the reverser and finally to the negative pole P. In the second case (Fig.253), the same positive current enters in the contact point b through the spring A, arrives at the slaves by the common return wire C and reenters through the group interruptors, at the contact point a and via the spring B. When a minute has elapsed between the two changes of position of springs A and B, the flow of current received by the slaves in the first minute is in a sense the inverse of that received by them during the second minute. The double-wired coils, in order to avoid the harmful effects of stray currents produced by the opening and closing of the group interruptors, are placed in such a fashion as is seen in Fig.191, namely in shunt fashion or in parallel.

Fig.254 shows a section of a master clock utilizing the Hipp principle and indicates the six contacts in this particular unit which control the groups of slave clocks. This illustration is, compared to that in Fig.81 of the 2nd French Edition of this present work which represented the analogus primitive Hipp contact system, considerably more simple, more robust and more reliable than this last one. It therefore gives much better results. Each interruptor or slave clock contact is able to control 20 or 25 secondary clocks, and thus for a master clock with six interruptors it represents a capacity of 120 to 150 clocks each having a coil resistance of 150 ohms. By raising this resistance to 500 or 1000 ohms one increases this capacity considerably.

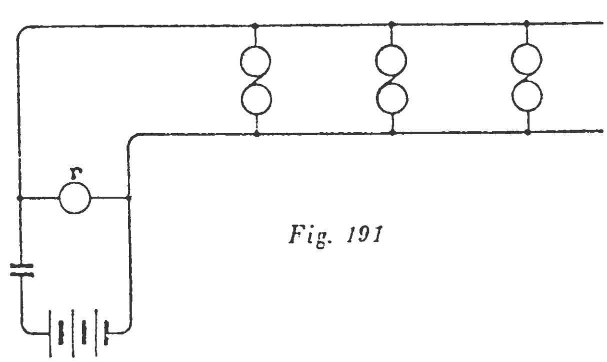


Fig. 191

-to be continued-

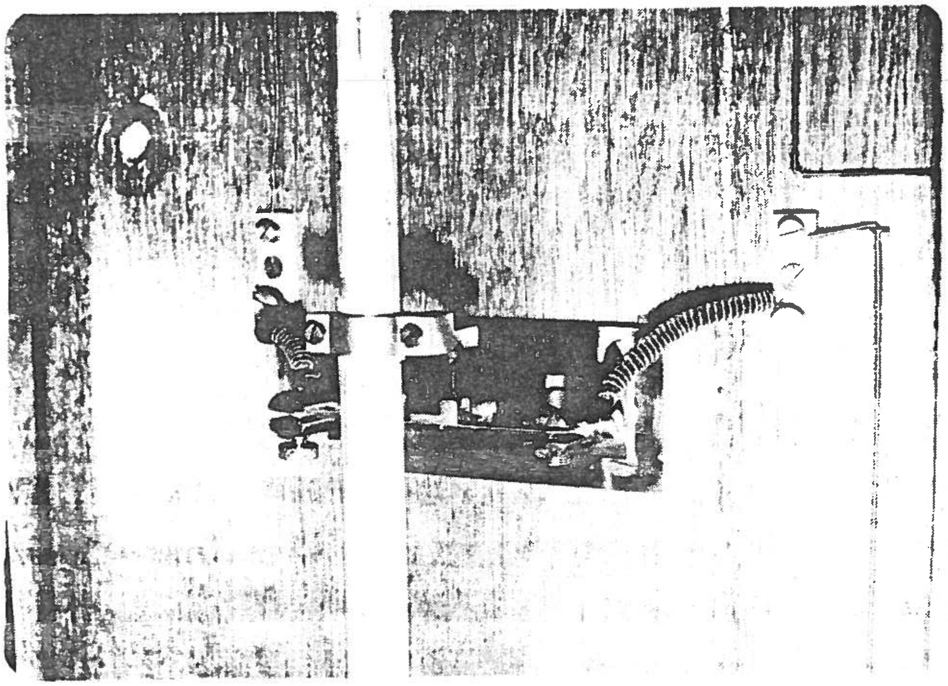


Figure II

Close up of the Hipp contact switch

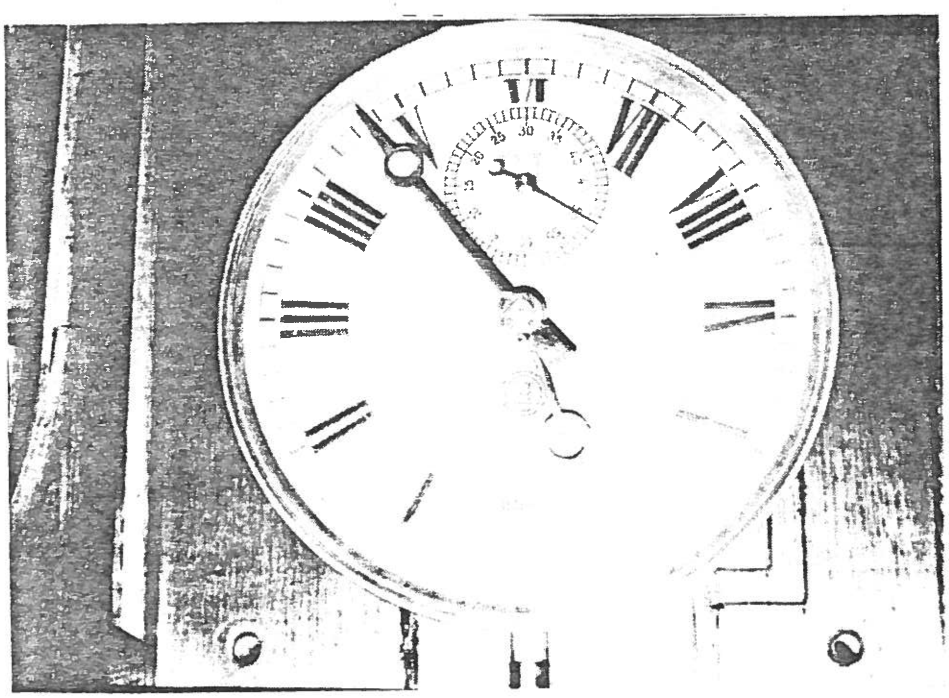


Figure III

Close up of the clock face. Note glass tip at aft of minute hand to show second hand when the former is over the latter.

Figure IV

Back of the movement showing the slave contacts at the lower right. Anchor and escape wheel visible at lower center.

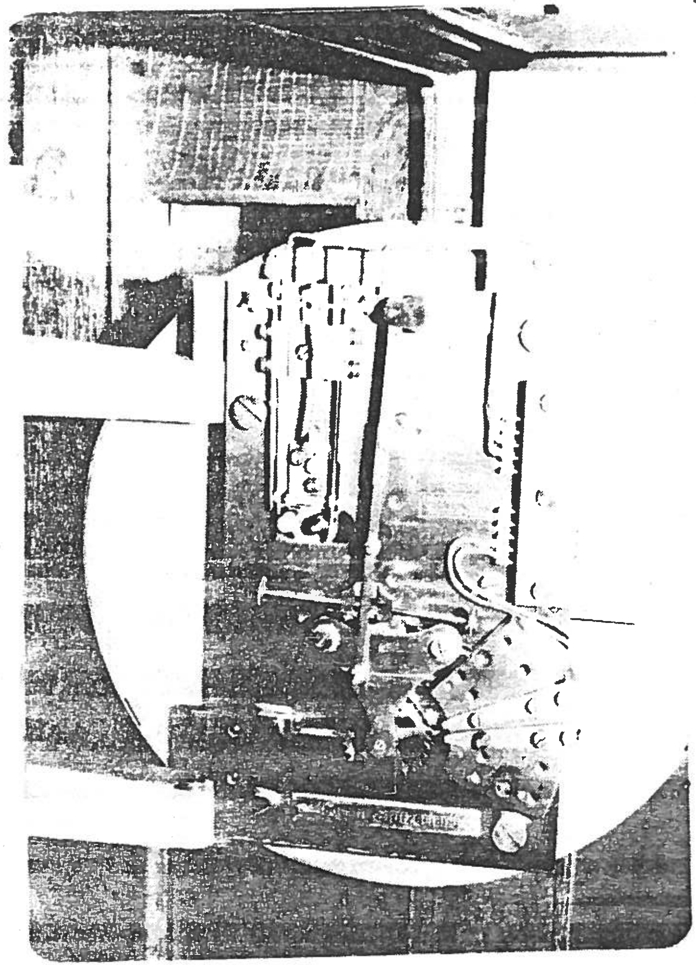
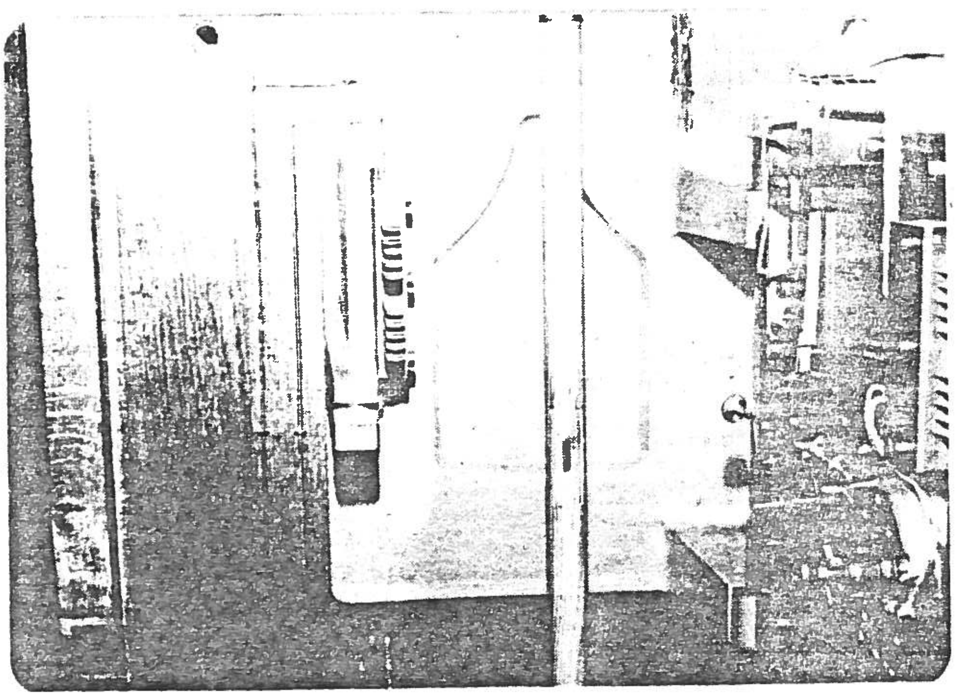


Figure V

Movement swung away from backboard showing pendulum and connecting female mechanism (on backboard). Connecting device enables movement to be swung away on two hinges.



ATO SETUP INSTRUCTIONS

NOTICE N° 1 — FÉVRIER 1930

PENDULES ÉLECTRIQUES ATO

BREVETÉES S.G.D.G.

INSTRUCTIONS

pour la mise en marche des PENDULES & PENDULETTES A COURTS BALANCIERS

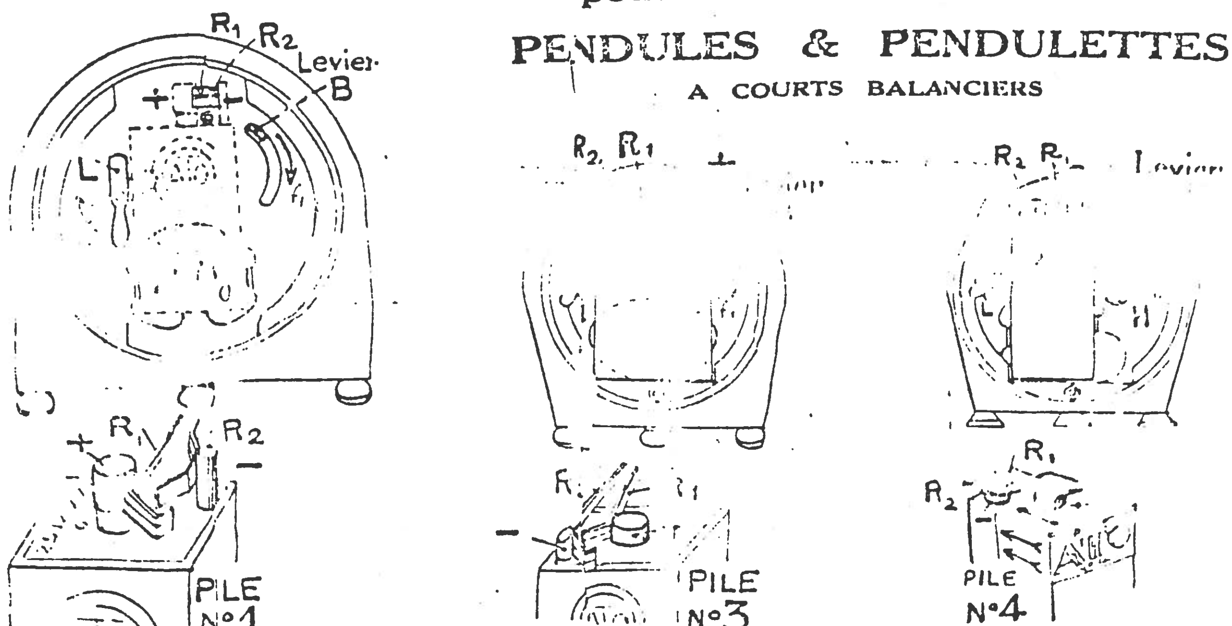


Fig. 1

Lunette ouvrante (fig. 1)

Lunette ouvrante (fig. 2)

Remise à l'heure [illegible]

1° MONTAGE DE LA PILE. — Placer la pile à l'arrière de la pendule comme l'indiquent les gravures ci-dessus. Les bornes + et — de la pile doivent appuyer respectivement sur les lames de contact R^1 et R^2. Ces lames doivent être bien isolées l'une de l'autre.

2° MISE EN MARCHE. — Pour le transport, le balancier est immobilisé au moyen du levier *B*. Ce levier doit être abaissé *complètement* (sens f^1), pour libérer le balancier.

3° MISE A L'HEURE. — Se fait en faisant tourner les aiguilles en avant ou en arrière à volonté. Dans le petit modèle (fig. 3), faire tourner le bouton *H* se trouvant à droite de la pile.

4° RÉGLAGE DE L'AVANCE OU [illegible]. — Se fait comme [illegible] toutes les pendules en allongeant ou en raccourcissant le balancier, c'est-à-dire en faisant descendre ou remonter l'écrou *M* (Fig. 4). Pour cela :

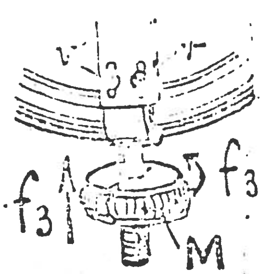


Fig. 4 (Pour faire avancer)

1° Enlever la pile ;

2° Bloquer le balancier en remontant le levier *B* ;

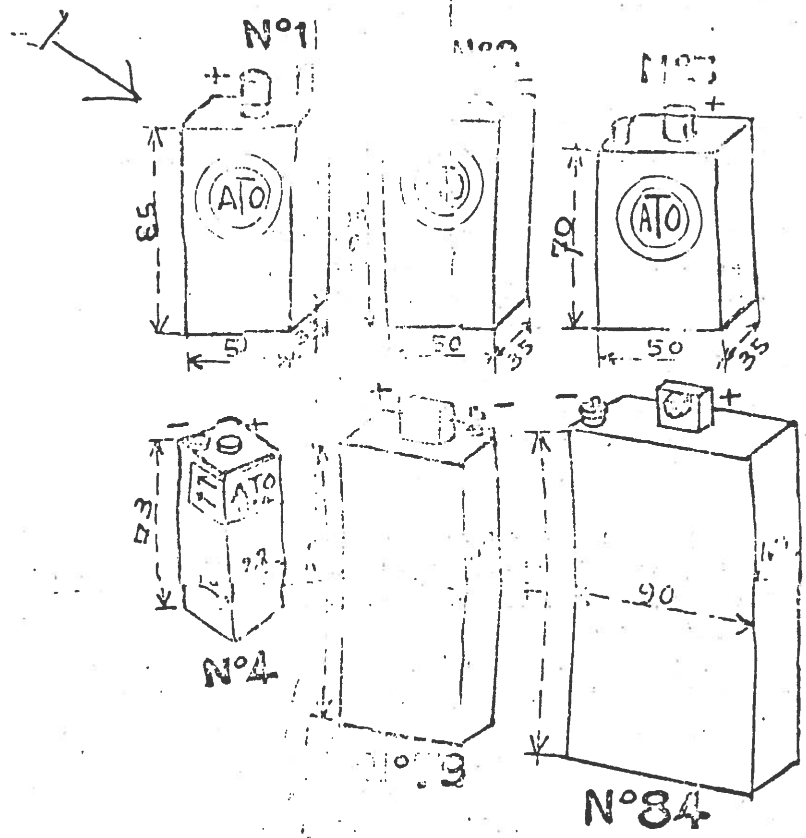
3° Pour faire avancer la pendule : Visser l'écrou *M* (sens f^3), en poussant avec un doigt. Agir en sens contraire pour faire retarder. (Un tour de l'écrou *M* produit une variation d'une minute environ par jour ;

4° Rabaisser complètement le levier *B* et remettre la pile.

ATO SETUP INSTRUCTIONS CONTINUED

DÉSIGNATION DES PILES POUR PENDULES ÉLECTRIQUES "ATO"

Pour faciliter à nos Clients les demandes de remplacement de piles, garanties deux ans, voici leurs caractéristiques :



Pile N° 1. – (85 m/m × 50 m/m × 35 m/m) avec deux bornes, suivant fig. 1 ci-dessus, pour pendules à cadran rond de 120 m/m, à petit balancier et pendules à grand cadran de forme ... (Même ... avec deux bornes à écrous pour ...)

Pile N° 3. – (70 m/m × 50 m/m × 35 m/m) avec deux bornes, suivant fig. 2 ci-dessus, pour pendulettes à cadran rond de 91 m/m, à lunette de cadran ouvrante.

Pile N° 4. – (73 m/m × 28 m/m × 28 m/m) avec deux petites bornes suivant fig. 3 ci-dessus, pour petites pendulettes à cadran carré 60 m/m × 60 m/m et à cadran rond de 90 m/m, mais avec remise à l'heure par bouton ... placé à l'arrière.

Pile N° 79. – Pour modèle S ... sonnerie (130 m/m × 70 m/m × 40 m/m).

Pile N° 84. – Pour modèles muraux à sonnerie (150 m/m × 90 m/m × 45 m/m).

6.000 - 2-30

WANTED: Invar Pendulum, or invar to make pendulum, seconds beat.
Paul Hopkins,2717 Millwood Rd. B'ham, Ala. 35243

****

WANTED: Literature concerning maintenance and repair for International Time Recording Co. Master Regulator, Model No.263.
Irvin A. Pogue, 212 N. Wm.Dr., Chillicothe, Illinois 61523

****

WANTED: Suspension spring and pendulum for Western Union Self-Winding secondary clock. Or will trade for anything of similar value ($60.00) Packing and shipping included.
A. Engel, P.O. Box 493, Aberdeen, South Dakota 57401

****

WANTED: Movement, Program tape mechanism, and bell relays for Standard Electric Time Master. 24 volts DC CA 1920. Write details and price.
Don W. Cassel, Rt.1-Box 17, Salisbury, Md. 21801

****

WANTED: Stromberg Masters--Write details.
Joseph Bourell, 4213 No. Milwaukee Ave. Chicago, Ill. 60641

****

WANTED: Electrical Horological Literature--any type. Highest prices paid. Hamilton-Sangamo clocks--write details.
Martin C. Feldman, 1545 Rhinelander Ave. Bronx,N.Y.10461

****

WANTED: Unusual Electrical Clocks (including Warren Mystery Battery Cl.). Also unusual foreign pieces.
A. Marx, 105 Bayeau Road, New Rochelle, N.Y. 10804

****

FOR SALE: Master clock, platinum contact one minute signal, jeweled Waltham mvt., approximately 5" case, excellent timekeeper---------$60.00
Sangamo electric, time only, center seconds disc, beehive case,GRO--$57.00
Firehouse receiving unit with 1" tape (full roll including), take-up reel with spring motor. Main unit is glass enclosed with heavy brass and steel precision machining of all components. Electrically activated to punch a series of triangular holes as per signals received. This unit was used by the N.Y.C. Fire Dept. approximately during the early 1900's. A fine collector's piece in working order----$130.00 plus shipping, packing free!
Martin C. Feldman, 1545 Rhinelander Ave. Bronx,N.Y.10461

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