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VOLUME XV, #1

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Fellow Horologists:

* This is the first issue of 1989 and is being sent to ALL EHS #78 members. If you have a dues reminder attached, your name will be removed from the roster unless the $10 dues payment is received.
* Please note the request for New York State Clocks for display at the Buffalo National Convention on the following page... This request includes ELECTRO-MECHANICALS, so let's all pitch-in.

We omitted a long overdue thank you due to Dave Lee for his generous contribution of material for the journals. Sorry, Dave, we'll try to stay on top of our "Thank you's" in the future. Bill Ellison is working on the updated Master Index of ALL journal material through 1988, and we're advised that it should be ready soon. Dr. George Feinstien has undertaken the job of Historian, and will provide reprints of older journals where available or copies of selected articles when requested. Cost will be approximately 25¢/page or $3.00 per issue, including domestic postage. This program is just getting off the ground, so be patient. Send requests to the editor with an SASE. (Harvey Schmidt)

* MEETING NOTICE: A meeting of all EHS members in the Long Island area is scheduled at the home of Dr & Mrs Bruce Levy on June 11th. RSVP by telephone, (516) 433-6836 for travel info and address.

* The annual meeting of the 3 Electrical Chapters; Midwest #125, Western #133, and EHS #78 took place during the Southern Ohio Regional on 4/7 and was attended by about 50 enthusiasts. A good interchange of information and promise of closer cooperation resulted. Thanks to Paul Heffner for making this annual event available.

Since most collectors are also historians, we felt that there is sufficient interest in the article on EXIDE Chloride cells to have justified its reprinting. We have additional material on other early types of batteries/cells used in older time systems which will follow in future journals. We have also included an early General Electric reprint on the WARREN models A & B Power Station monitors which offers a new insight on Warren's early work. Good Reading ahead....

Martin Swetsky, President, Harvey Schmidt &
Dr. George Feinstien, Co-Editors

1989 NATIONAL
NAWCC CONVENTION
JUNE 21-24 BUFFALO, NEW YORK

RUSS OECHSLE

220 East Lake Road, DeRuyter NY 13052

1989 NATIONAL CONVENTION - NEW YORK STATE CLOCK DISPLAY

The 1989 Buffalo National will feature a display on New York State Clocks. We need the participation of our NYS NAWCC members to allow us to have the widest and most complete variety of clocks. We urge you to assist us in this endeavor. The exhibit will be held in a large, well-lit room with 24-hour security. The exhibit opens at 10:00 a.m. on Thursday, June 22, 1989, and closes at 2:30 p.m. on Saturday, June 24, 1989.

Exhibit Item Information Form

Your Name:______________________________ Tel. #______________

Address:________________________ ____________________ Zip ______

I have the following New York State Clocks that would be available for display at the 1989 Buffalo National:

Maker Name	Type: Shelf, Wall, Tall	Description
1.		
2.		
3.		
4.		
5.		

Please attach additional sheets as necessary. If you have any questions regarding the display, feel free to call me at 315-662-7912 (evenings after 7 p.m.) Return this form to the above address. Thanks!

General Electric Company
Schenectady, N.Y.

May, 1919 *Bulletin No. 46037

WARREN MASTER CLOCK
FOR MAINTAINING CONSTANT AVERAGE FREQUENCY

The fundamental characteristic of a synchronous motor is that it runs "in step" with the generator from which it is taking energy. Any change in the speed of the generator results in a corresponding change in speed of the synchronous motor. Such a motor can, therefore, be used to determine the speed of the generator supplying it with power.

Until very recently synchronous motors were mostly used for power purposes. We now have, however, a very small synchronous motor, so small that it can be installed in a clock case and used to compare the speed of a generator with very exact time as obtained from a high-grade clock movement. This little motor is simple, reliable and, what is very important, self-starting and can be operated on a single-phase circuit.

A combination clock and synchronous motor equipment installed in a central station provides a very accurate means of maintaining constant average frequency. In addition the small motors can be used on the system in place of clock movements operating graphic instruments, demand meters, time switches, etc. All records from graphic instruments and demand meters will, therefore, be synchronized—a very desirable feature in many instances but heretofore difficult to accomplish.

Briefly, the method of maintaining constant average frequency is as follows: There is located near the switchboard within view of the operator a so-called master clock. This clock (Fig. 1) contains two independent movements, one a very accurate time-keeping device actuated by a pendulum, the other driven by a small synchronous motor.

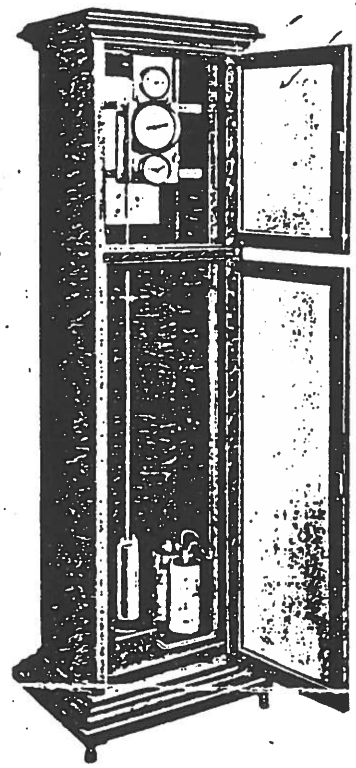


Fig. 1. TYPE "A" MASTER CLOCK

There are two large second hands or pointers rotating independently about the same center over a dial (Fig. 3) about 5 in. in diameter called the operating dial. One of these pointers (a black one) is connected to the pendulum clock so that it keeps accurate time, making one revolution in five minutes. The other (gold in color) is driven by the synchronous motor (Fig. 2) and so geared that when the frequency is correct it will rotate at exactly the same speed as the pendulum-driven pointer.

We have then a simple device for comparing at a glance the generator speed with standard time. It is the duty of the operator to hold the two pointers together, thus maintaining a fixed relation between generator speed and standard time, that is, cycles and time. This is done by occasionally adjusting the speed governors for the prime movers.

Any change in the relative position of the two pointers indicates a change in the frequency. However, in large steam-driven generator stations the frequency when once adjusted does not fluctuate enough to cause

NOTE.—Data subject to change without notice.

the pointers to deviate more than a few seconds in a period of fifteen minutes or even half an hour. Therefore, under ordinary conditions the operator will be required to

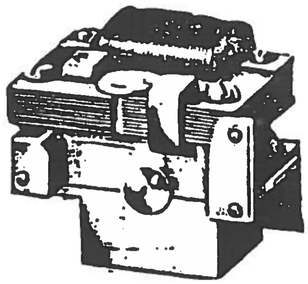


Fig. 2. WARREN SELF-STARTING, SINGLE-PHASE SYNCHRONOUS MOTOR

devote very little time to the actual observations of this device alone.

The installation of the master clock, however, does not render the use of a frequency meter unnecessary. Adjustments in the speed of the prime movers can be made to much better advantage when the operator

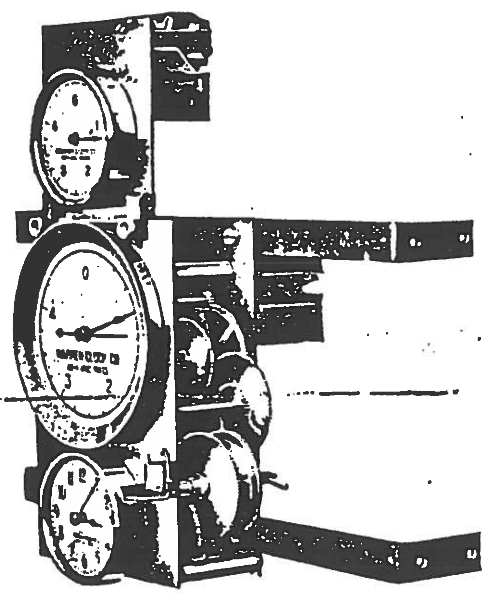


Fig. 3. DIALS OF THE TYPE "A" CLOCK

knows the instantaneous value of the speed at the particular moment the adjustment is made and also the amount of adjustment he has effected. The frequency meter shows these instantaneous values which are not apparent on the dial of the master clock. The latter shows only changes in average values.

Any uniform tendency of the motor-driven hand of the master clock to gain or lose with respect to the clock-driven hand, while the pointer of the frequency meter is held over the rated frequency, is an indication that the frequency meter is in error. Therefore, the master clock also acts as a constant check on the accuracy of the indicating meter and permits the operator to apply the necessary corrections.

A frequency meter giving a very wide deflection per cycle will permit very small corrections to be applied and consequently

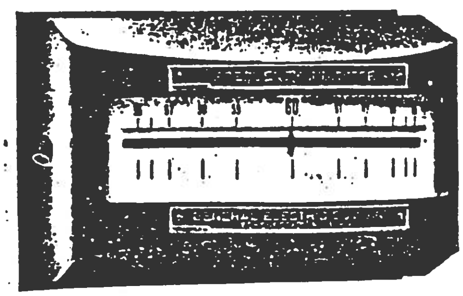


Fig. 4. 60-CYCLE TUNED CIRCUIT FREQUENCY INDICATOR

such an instrument is particularly well adapted for use with this equipment. The General Electric Company's tuned circuit type of frequency meter (Fig. 4) answers this requirement remarkably well and is, therefore, recommended for this service.

While the installation of the master clock will not eliminate those fluctuations always encountered to a greater or less degree dependent on load variations, speed governor response, steam pressure, etc., it does permit the maintenance of a more uniform frequency and at the same time a correct average frequency.

THE SYNCHRONOUS MOTOR

The little self-starting synchronous motor which forms the vital part of the master clock is also the means for utilizing the results accomplished by the master clock. This is effected by embodying the motor as a time-keeping element in graphic and demand meters, time switches, etc.

This little motor (Fig. 5) is only 2⅛ in. by 2⅝ in. by 2 $\frac{9}{16}$ in. in size and consumes less than 4 watts. It will start under load, reach synchronous speed in a second or two and continue to run at synchronous speed as long as the current is uninterrupted. It is very simple, containing few parts and should require little or no attention as the gearing is

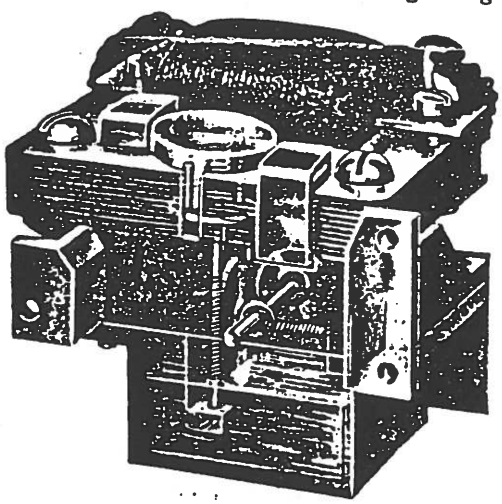


Fig. 5. PHANTOM VIEW OF THE SELF-STARTING SYNCHRONOUS MOTOR

permanently immersed in oil. These motors are wound for operation on a 110-volt circuit and can be furnished for any one of the standard commercial frequencies.

THE MASTER CLOCK

The General Electric Company is now prepared to furnish the master clock in two different styles, i.e., Type "A," which is an exceedingly accurate time-keeper, mounted in a case designed to stand upon the floor, and Type "B," which is a somewhat less accurate time-keeper in a smaller case to be mounted on the wall.

Type "A"

The Type "A" master clock (Fig. 1) is a carefully made time-keeping device having a 60-beat pendulum and an escapement of the Graham "dead beat" type. It is accurately compensated for temperature changes by the use of a pendulum rod of invar, a

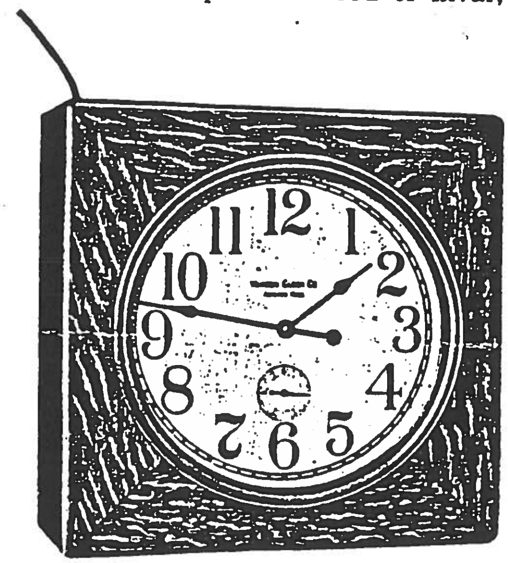


Fig. 6. SECONDARY CLOCK

metal having a negligible coefficient of linear expansion.

When properly located in a place free from vibration and extreme changes in tem-

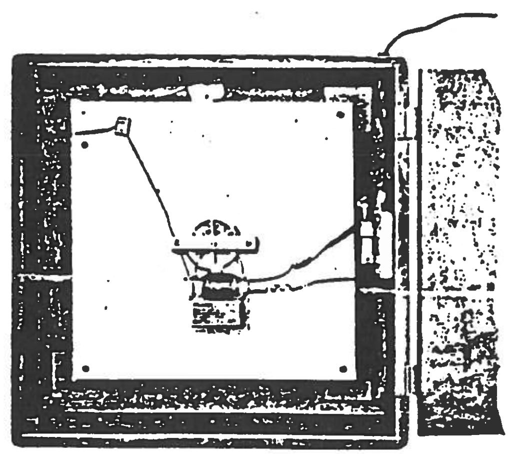


Fig. 7. BACK VIEW OF SECONDARY CLOCK SHOWING APPLICATION OF MOTOR TO REPLACE SPRING ESCAPEMENT

perature it is estimated that after being once carefully regulated it will run with an error not in excess of one second per day. Under favorable conditions it may do better than this.

The rate of the clock is regulated either by means of a set of weights which can be added to or removed from a small pan carried by the pendulum rod, or by adjusting an electrical attachment which influences the pendulum.

After once having been wound and started the clock does not require rewinding. This is accomplished by connecting the synchronous motor to the spring so that when in operation the motor continues to wind the spring at exactly the same rate as the escapement permits it to unwind. This results in a very uniform tension of the spring, which no doubt has considerable influence on the time-keeping qualities of the clock. The spring alone is able to drive the clock for a period of about three days.

The Type "A" clock is furnished in a quartered oak case, and is equipped with the usual clock dial, including hour and minute hands. This is the smallest dial seen at the bottom (Fig. 3). The operating or five-minute dial is located just above this and is about five inches in diameter. The small synchronous motor is mounted directly in back of this dial and is attached to the back plate of the clock.

As a precaution against the failure of the little synchronous motor, there is furnished a second motor and dial (Fig. 3) located just above the operating dial. This is entirely independent of the operating dial and master clock and acts not only as a sort of "stand by" motor in case of failure of the master motor, but being energized continually it can be used as a check on the performance of the other motor. It is advisable, of course, to connect the auxiliary motor through a different source of supply so that the chances of simultaneous failure of both motors from the same cause are reduced.

In addition to the master clock with its auxiliary motor and dial there is also furnished a standard secondary type of wall clock (Fig. 6) which is driven by one of the little motors and should be located near the master clock to be used as another check on its operation. If the pointers of the master clock are together the time shown by this secondary clock should agree exactly with that shown by the lower dial of the master clock.

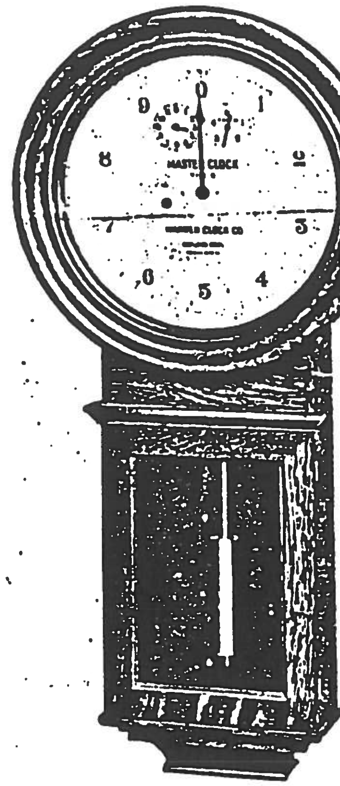


Fig. 8. TYPE "B" MASTER CLOCK

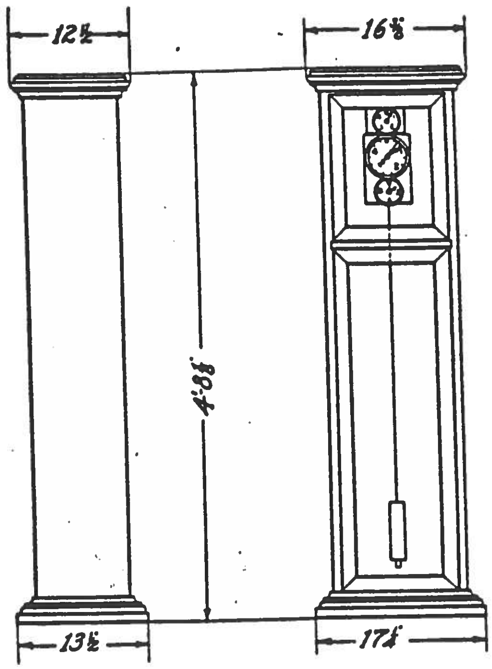
Type "B"

The operation of Type "B" device (Fig. 8) is based on the same general principles as the Type "A" but functions in a different manner.

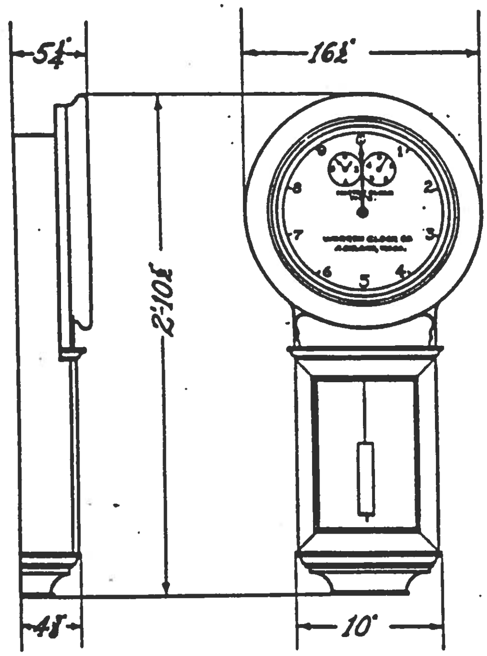
In this device both the motor and clock act on the same index hand through suitable gearing. The motor tends to drive the hand in one direction and the clock in the opposite direction. If the rate of clock and motor are the same the hand stays at rest. If the motor runs a trifle faster the hand is moved very slowly in a clockwise direction and vice versa, thus indicating variations in average frequency. In operation the pointer is supposed to be held on zero.

The escapement is the same as that in the Type "A" but the pendulum makes 80 instead of 60 beats per minute. The pendulum rod is of invar which permits accurate compensation for temperature and this may be adjusted by means of a graduated nut at the bottom of the pendulum bob. Like the Type "A," after once having been wound it does not require rewinding.

The dial of the Type "B" clock is approximately 12 in. in diameter and in addition to the large index hand has a five-minute and an hour hand. It is designed for wall mounting. It is recommended that with this clock there be installed a separate (Fig. 6) secondary motor-driven clock.



Type "A." SHIPPING WEIGHT 200 LB.



Type "B." SHIPPING WEIGHT 50 LB

UNITED STATES PATENT OFFICE.

DÉSIRÉ VANDE PLANCKE AND GUSTAVE VANDE PLANCKE, OF COURTRAI, BELGIUM.

ELECTRIC REGULATING-CLOCK.

SPECIFICATION forming part of Letters Patent No. 446,801, dated February 17, 1891.

Application filed May 21, 1889. Serial No. 311,588. (No model.) Patented in Belgium February 4, 1885, No. 67,750; in Germany April 13, 1885, No. 34,064; in France June 29, 1885, No. 169,834, and in England July 14, 1885, No. 8,538.

To all whom it may concern:

Be it known that we, DÉSIRÉ VANDE PLANCKE and GUSTAVE VANDE PLANCKE, subjects of the King of Belgium, and residents of Courtrai, Belgium, have invented certain new and useful Improvements in Electric Clocks, (which have been patented to us in Belgium by Letters Patent No. 67,750, dated February 4, 1885, and patent of Improvement No. 84,814, dated January 29, 1887; in Germany by Letters Patent No. 34,064, dated April 13, 1885; in France by Letters Patent No. 169,834, dated June 29, 1885, and certificate of addition dated February 20, 1889, and in Great Britain by Letters Patent No. 8,538, dated July 14, 1885,) of which the following is a full, clear, and exact specification.

Our invention consists in a new system of electric regulating-clocks in which the instantaneous closing and breaking of the electric circuit has the double effect of sending intermittent currents to different receiving-dials and at the same time winding the regulator itself. The circuit of the electro-magnet, which is periodically opened and closed by the movement of the clock, may include one or more electro-magnets belonging to one or more secondary clocks. The latter may be constructed in the usual manner, or like the clock described in English Patent No. 8,538, dated July 14, 1885. This latter result may be obtained with any kind of clock provided with our improvements, so that our invention may serve equally well for assuring the continuous and permanent running of ordinary clocks and for transmitting the time to distant points.

Our regulator is composed of an ordinary clock mechanism, with the addition of the following parts: first, the circuit of a galvanic battery including or controlling the coils of an electro-magnet, and an appliance connected with the seconds-motion shaft of the going-work and constructed in such a manner as to close the said circuit at short intervals—for instance, every minute or every half-minute; second, a fly-wheel mechanism, chiefly comprising a lever fixed to the armature of the said electro-magnet and an unequally-weighted fly-wheel adapted to receive at each contact impulses from the said lever sufficient to make an entire revolution every time, the whole serving, first, to wind the spring or the weight-motor of such a quantity as to enable the clock to work at least until the following contact takes place, and, secondly, to interrupt the said electric circuit almost immediately after it has been closed, thus avoiding polarization and insuring the long duration of the battery which feeds the circuit.

Our invention may therefore be divided into two distinct parts, as follows: first, the appliances for forming contacts, and, second, the appliances for breaking contacts and at the same time winding up the clock-work. In each of these classes we have been lead to adopt successively various arrangements of detail, which have been gradually simplified.

We will describe two varieties in order to show more clearly in what our invention essentially consists, and also in what manner the details of construction may vary without departing from the principle of our invention.

We will first describe what relates to the periodical formation of contacts or closing of circuits.

In the accompanying drawings, Figure 1 is a front elevation of mechanism embodying our invention and showing an appliance for breaking contact and for the automatic winding. Fig. 2 is a detail view showing parts of the mechanism seen in Fig. 1. Fig. 3 is a rear elevation representing the first means of making contacts or the first arrangement of detail. Fig. 4 is a side elevation. Fig. 5 is a front elevation showing another means for forming contacts. Fig. 6 is a rear elevation thereof. Fig. 7 is a plan view of the brake-spring.

Referring to Figs. 3 and 4, on the axle A of pinion B is fixed a cylinder C, of ivory or other insulating material, provided with steel pins *c*, the number of which depends upon the division of the wheels of the clock. These pins are in contact, one after the other, with two springs H and H′, extending beyond the cylinder and carrying at their ends contact-pieces *g*, of platinum, placed opposite corresponding platinum pieces secured in opposite sides of the terminal G, which is insulated from the metallic clock-frame and connected with the pole of a battery. The said springs H and H' are attached at the other end to a piece I, of insulating material, and communicate with two other springs J and J', which come in contact, one after the other, with the steel pins of a second cylinder K, likewise of insulating material, and armed with as many steel pins k as the cylinder C. These springs J and J' extend beyond the cylinder K and carry at their extremities contact-pieces o, of platinum, placed opposite two corresponding contact-pieces, which are fixed in the terminal O, insulated from the clock-frame, but connected with the coil of the electro-magnet P, the other extremity of the magnet-coil leading directly to the battery. In consequence of this arrangement the circuit is complete when a spring H or H' rests on the terminal G, and at the same time a corresponding spring J or J' rests on the terminal O. This coincidence depends on the division of the clock-wheels and may occur, for instance, at the beginning of every minute.

Fig. 6 is a rear elevation showing the second mode of forming contacts mentioned above. Here the circuit of the battery is closed through the terminal A' in contact with the metallic clock-frame, the contact-spring a', the lever b, the contact-faces c' c', the terminal B', and the coil of the electro-magnet P. As in the previous arrangement, the contact is made in two stages or periods. In the first stage a tooth of the wheel K', by coming in contact with the projection j, repels the lever h, so that the projection g' of this auxiliary lever, which supports the pin f of the contact-lever b, passes behind the said pin f and allows the lever b to drop until the projection b' of the lever b touches a tooth of the wheel K'. This first drop brings the two contact-faces c' c' close together. In the second period, while the ratchet-wheel K' continues to revolve, the projection b' reaches the edge of the tooth of the ratchet-wheel, and then drops again until lever b, pushed by the contact-spring a', has produced contact between the faces c' c'. The spring i tends to keep lever h in contact with ratchet-wheel K'.

We will now describe the appliances for breaking contact and for the automatic winding. Fig. 1 is a front elevation showing the first of the two modes of construction which we employ. Fig. 2 are detail views showing the principal parts of the same mechanism. The armature Q of the electro-magnet P is pivoted at its lower end q and has an upward extension R, provided with a plate R', between which and the part R is pivoted a lever S S'. The two arms of the latter are of unequal length and unequal weight. The shorter and lighter arm S has a recess s, into which projects a pin r, fixed to the lever R, for limiting the pivotal motion of the lever S. R^2 is the fulcrum of the lever S S'. The longer and heavier arm S' has at its extremity two teeth t' t', adapted to come in contact with a fixed stop-piece T. The motion of the lever R (away from the magnet) is limited by a buffer U, formed by an india-rubber ring surrounding a fixed stud. The fly-wheel V is fixed on a horizontal shaft a, Fig. 4, and carries a projecting pin v, which, owing to the unequal distribution of the weight of the fly-wheel, is always situated in front of the striking-lever R, as indicated by Fig. 1, when the fly-wheel is at rest. Consequently a sudden forward motion of the striking-lever R, produced by the attraction of the armature toward the electro-magnet, causes the lever to strike violently against the pin v and to turn the fly-wheel in the direction of the arrow. A second pin v' is attached to the fly-wheel, and a pawl or stop-lever W is suspended freely in such a position that during the revolution of the fly-wheel the pin v' passes underneath the lever W and lifts the same, but is afterward prevented from returning. To limit the pivotal motion of the pawl W, the latter is provided with a pin w, guided in a slot of the bracket Z, which supports the extremity of the axle a and also the pivot of the pawl W. With a sufficient impulse from the striking-lever R, aided by the unequal weight of the fly-wheel, the pin v will strike the short arm S of the lever S S', so as to turn on its fulcrum and allow the pin v to pass into its position in front of the striking-lever R. The energy absorbed in lifting the heavy arm S' from its support T is sufficient to prevent the fly-wheel from making more than one complete revolution. On the fly-wheel shaft a, Fig. 4, is fixed a pinion which gears into a spur-wheel X, mounted on the axle x of the small cylinder K, mentioned above. This axle also carries a pinion which gears into a spur-wheel Y, united by a copper tube y with the clock-spring situated in the spring-barrel y'. On the fly-wheel shaft a is a spur-wheel Y', meshing with the pinion B on the shaft A, which carries a spur-wheel 1, meshing with a pinion 2 on a shaft 3, which carries the escapement-wheel 4. In consequence of this arrangement the turning of the fly-wheel has the following effects: first, to turn the cylinder K so as to interrupt the circuit of the electro-magnet; second, to wind at each interval of time—for instance, every minute—the spiral spring in the barrel y' as much as it had been relaxed in producing the motion of the clock during the same interval of time. It is to be observed that the passage of the current in the electro-magnet is very short, because it requires the coincidence of position of the springs H' and J or H and J'. After each turning of the fly-wheel one of the springs J or J' is continuously in contact with the cylinder K; but the circuit is not closed, owing to the corresponding spring H' or H being insulated up to the moment that the going-work has caused the cylinder C to turn until the spring H' or H falls upon the binding-post G. In this moment the fly-wheel is set in motion, but the current is again interrupted after the wheel has made a quarter-turn. As the fly-wheel makes a whole turn in half a second, the contact lasts only one-eighth of a second. The contact-springs may press on the contact-faces with considerable force without interfering with the motion of the clock-work, because the pressure is applied neither to the escapement nor to the fly wheel, but only to the seconds-motion shaft. When the contact is broken, the lever R will easily fall back from the electro-magnet under the influence of its own weight and of a small leaf-spring *t* acting upon the lever; but if the armature should still adhere to the magnet when the pin *r* passes the upper end of the lever R the pin would press upon the inclined face of the latter and thereby detach the armature from the magnet. To prevent the lever R from falling back before the lever S S' has received the stroke from the pin *r* of the fly-wheel, (and thereby consumed the energy of the latter,) the extremity of the long arm S' has a pair of teeth *t' t'*, between which the upper end of the piece T rests, as shown in Fig. 2, until the arm S' is lifted. One Leclanché cell suffices to drive such a clock system. If a stronger current is used, the impulse given to the fly-wheel might be strong enough to turn it several times. It is to prevent this that the lever S S' has been applied so as to place an obstacle in the way of the fly-wheel.

Fig. 5 represents a modification of the fly-wheel mechanism just described. The striking-lever *q'*, extending upward from the armature Q', terminates at the top with an enlargement *r*, carrying a brake-spring *r'*. This spring *r'*, of which Fig. 7 shows a plan, has a projection r^2 sufficiently wide that, however slowly the lever *q'* may fall back into its position of rest, it will always interpose an obstacle to the motion of the fly-wheel, so as to prevent it from making more than one revolution by coming in contact either with the pin *s'* or with the pin s^2. To prevent the fly-wheel from turning back, we may employ a pawl W', as described above, or a spring pressing on a projection of the fly-wheel shaft, or any other suitable device. This mechanism works as follows: As soon as the circuit of the electro-magnet is closed the striking-lever *q'* is thrown forward and gives an impulse to the fly-wheel. The hub of the fly-wheel carries at the back a pin s^3, (shown in Fig. 6 by dotted lines,) adapted to come in contact during its revolution with a lever *d*, fixed on the axle *e'*, on which is fixed the lever *h*. Consequently the turning of the fly-wheel causes the pin s^3 to lift the lever *d*, and thereby also the lever *h*. The pin *f*, which is lifted with the lever *h*, allows the lever *h* to turn forward under the influence of the spring *i*, so as to place the projection *g* underneath the pin *f* and prevent the lever *h* from falling. The forward motion of the lever *h* is stopped by the projection *j* coming in contact with one of the teeth of the ratchet-wheel K.

What we claim is—

1. In an electric clock, the combination of an electro-magnet with an electric circuit adapted to excite the said magnet at regular intervals of time, an unequally-weighted fly-wheel mounted on a horizontal axle and adapted to act on the clock mechanism, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, and a brake device adapted to consume any excess of energy of the fly-wheel, substantially as described, and for the purpose specified.

2. In an electric clock, the combination of an electro-magnet with an electric circuit adapted to excite the said magnet at regular intervals of time, an unequally-weighted fly-wheel mounted on a horizontal axle and adapted to act on the clock mechanism, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, a brake device adapted to consume any excess of energy of the fly-wheel, and a check-lever or detent adapted to prevent the fly-wheel from turning back, substantially as described, and for the purpose specified.

3. In an electric clock, the combination of an electro-magnet with an electric circuit controlling the said magnet, a circuit-closer controlled by the going-work of the clock and adapted to close the circuit at constant intervals of time, an unequally-weighted fly-wheel connected with the clock-motor and adapted to wind the same between given limits at every turn of the fly-wheel, a striking-lever connected with the armature of the electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse sufficient for an entire revolution, a brake device adapted to consume any excess of energy of the fly-wheel, and a circuit-breaker adapted to be worked by the fly-wheel so as to interrupt the electric circuit after the fly-wheel has traveled a given distance, substantially as described, and for the purpose specified.

4. The combination, with a clock-work, of an electric circuit comprising an electro-magnet, a circuit-closer connected with the going-work of the clock and controlled by the same so as to close the said circuit at given intervals of time, an unequally-weighted fly-wheel connected with the clock-spring and adapted to wind the same within given limits during its forward motion, a lever connected with the armature of the said electro-magnet and adapted to give to the fly-wheel at every attraction of the armature an impulse at least sufficient for an entire revolution of the fly-wheel, a circuit-breaker adapted to be controlled by the fly-wheel so as to interrupt the circuit of the electro-magnet at every time when the fly-wheel has turned a given dis-

tance or angle from its starting position, a check-lever adapted to prevent the fly-wheel from turning back, and a brake device adapted to prevent the fly-wheel from turning too far, substantially as described, and for the purpose specified.

5. The combination of a clock-work with an electric circuit, an electro-magnet controlled by the said circuit, an armature-lever adapted to be attracted by the said magnet and carrying at its free end a brake-spring, an unequally-weighted fly-wheel connected with the going-work of the clock and adapted to wind the mainspring, the said fly-wheel being adapted to receive an impulse from the armature-lever sufficient at least for an entire revolution of the fly-wheel and to meet the said brake-spring after a given travel of the fly-wheel, so as to prevent the latter from making more than one revolution, substantially as described, and for the purpose specified.

6. The combination of a clock-work with an electric circuit, an electro-magnet controlled by the said circuit, an armature-lever adapted to be attracted by the said magnet and carrying at its free end a brake-spring, an unequally-weighted fly-wheel connected with the going-work of the clock and adapted to wind the mainspring within given limits, the said fly-wheel being adapted to receive an impulse from the armature-lever sufficient at least for an entire revolution of the fly-wheel and to meet the said brake-spring after a given travel of the fly-wheel, so as to prevent the latter from making more than one revolution, and a pawl or detent to prevent the fly-wheel from turning backward, substantially as described.

7. In an electric clock, the combination, with the electric circuit, of an electro-magnet and a pair of contacts included in the said circuit, a contact-lever carrying the movable contact and adapted to press the same against the fixed contact, an auxiliary lever adapted to keep the contact-lever away from the fixed contact, a ratchet-wheel connected with the going-work of the clock and controlling the position of the said levers, and a fly-wheel mechanism adapted to be worked by the said electro-magnet and to remove the contact-lever from the fixed contact after the fly-wheel has traveled a given distance, substantially as described, and for the purpose specified.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

DÉSIRÉ VANDE PLANCKE.
GUSTAVE VANDE PLANCKE.

Witnesses:
GEORGE BEDE,
AUG. GÉNARD.

(No Model.)

3 Sheets—Sheet 1.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

No. 446,801. Patented Feb. 17, 1891.

FIG.1.

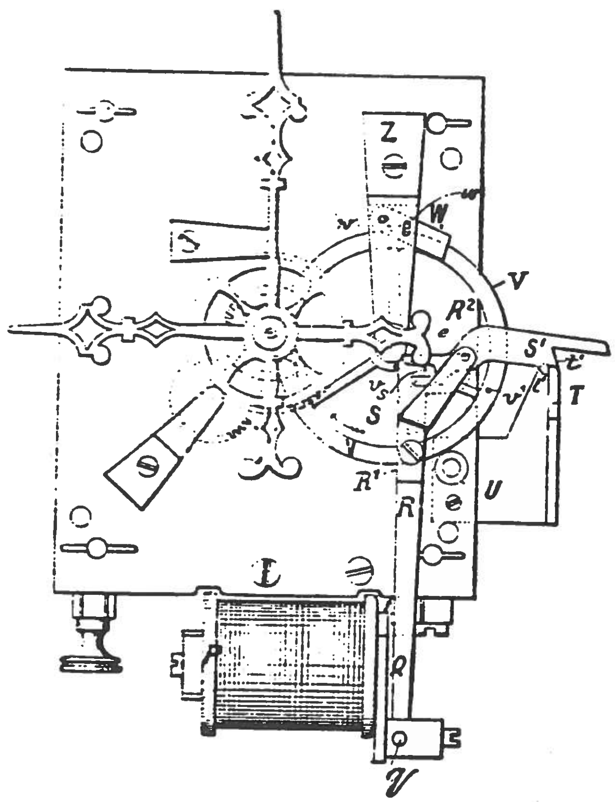
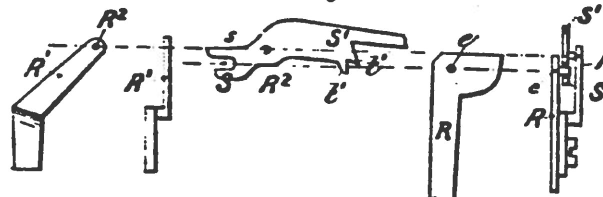


FIG.2.



Witnesses:
W. L. Carrington Jr.
G. K. Craig.

Inventors:
Désiré vande Plancke
Gustave vande Plancke
by Fairfax & Wetter
Attorneys

(No Model.) 3 Sheets—Sheet 2.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

No. 446,801. Patented Feb. 17, 1891.

FIG. 3.

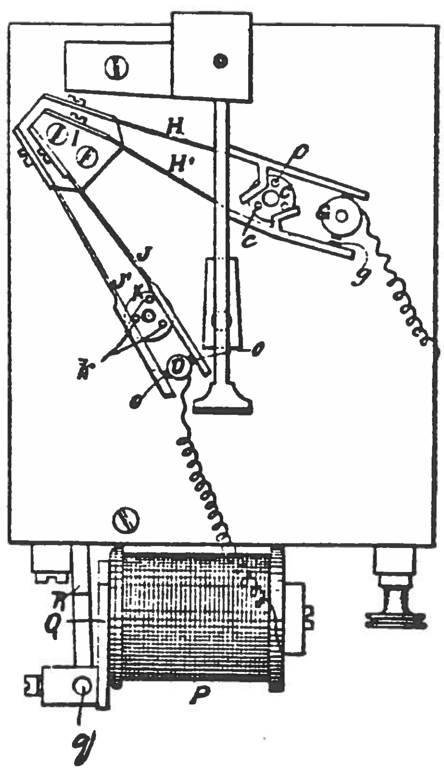
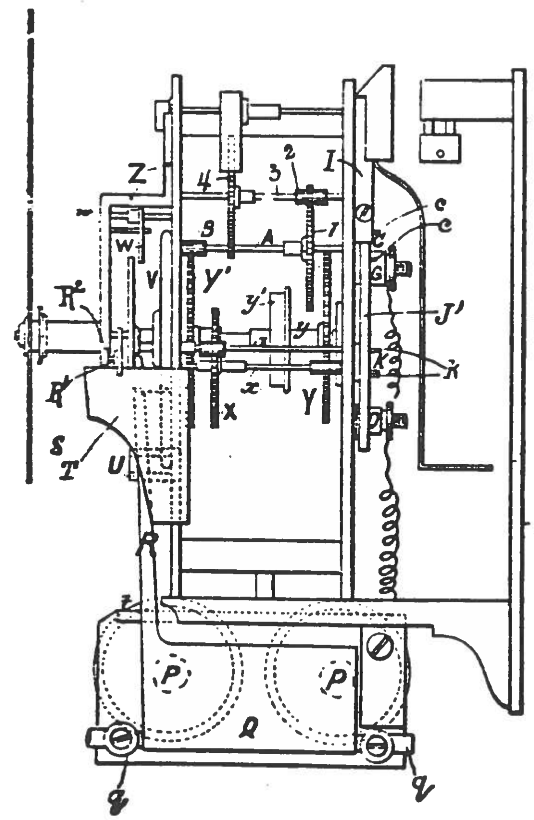


FIG. 4.



Witnesses:
M. L. Carrington
G. R. Craig

Inventors
Désiré vande Plancke
Gustave vande Plancke
by Fairfax Wetter
Attorneys

(No Model.) 3 Sheets—Sheet 3.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

No. 446,801. Patented Feb. 17, 1891.

FIG. 5.

FIG. 6.

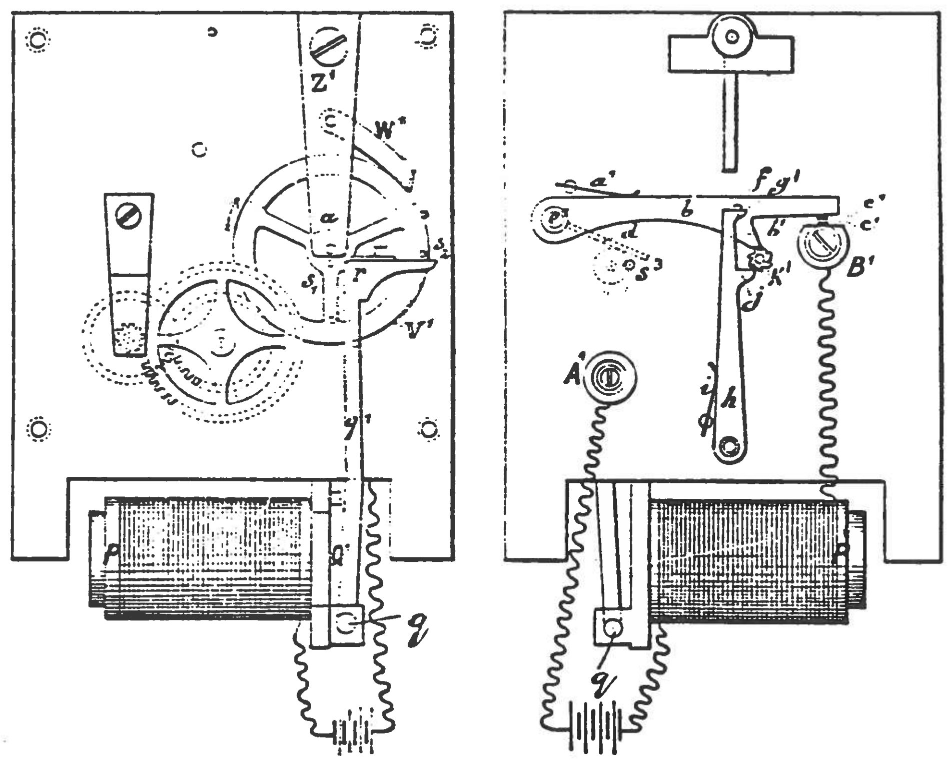


FIG. 7.

Witnesses:
W. Clearwater
G. R. Craig

Inventors:
Désiré vande Plancke
Gustave vande Plancke
by Fairfax Wetter
Attorney

INSTRUCTIONS

Installing *and* Operating

Exide

BATTERIES

In Open Glass Jars

TWO-PLATE CHLORIDE TYPES

THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA, U. S. A.

FORM 3473 Second Edition May, 1933

RATINGS

Based on electrolyte temperature of 77° F. at beginning of discharge and on full charge specific gravity of 1.210, corrected to 70° F. See Par. 23*a*.

TYPE OF CELL*	Plates Per Cell	CHARGE RATE (Par. 21)	DISCHARGE CAPACITY (Paragraphs 17 to 19)			
			8-Hour		72-Hour	
		Amperes	Ampere Hours	Approximate Points in Gravity	Ampere Hours	Approximate Points in Gravity
BTH 4" high 3" wide	2	3/4	6	35	7 1/2	47
CTH 5" high 5" wide	2	1 1/2	12	20	15	27
PTH 8 3/4" high 5" wide	2	3	24	25	30	32
ETH 7 3/4" high 7 3/4" wide	2	4 1/2	36	25	45	33
LT 3 1/8" high 1" wide	2	1/8	1 3/8			
BT 4" high 3" wide	2	3/4	6	36		
CT 5" high 5" wide	2	1 1/2	12	26		
PT 8 3/4" high 5" wide	2	3	24	23		
ET 7 3/4" high 7 3/4" wide	2	4 1/2	36	25		
Limiting Voltage per Cell (approximate)............			1.75		1.77	

*To identify type of cell, measure the plates in it, and the jar height.

The BT, CT, PT and ET have been superseded respectively by the BTH, CTH, PTH, ETH. These latter have higher jars, although the plates are the same, and a comparison of the jar height with those shown below will assist in determining the type of cell.

Approximate Height of Glass Jars

BTH— 7 3/8 inches	BT— 6 3/8 inches
CTH— 9 inches	CT— 8 inches
PTH—13 3/8 inches	PT—12 1/8 inches
ETH—13 1/2 inches	ET—11 3/8 inches

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INSTALLATION

1. Unpacking and Care of Material

a. Care should be taken in the unpacking and handling. Keep the packing boxes right side up. Examine packing to make sure that no parts have been overlooked.

b. If the material or battery is to be temporarily stored, choose a dry, clean location and keep the temperature above freezing and below 110° Fahrenheit.

2. Arranging for Initial Charge

a. Before starting to assemble cells, see that the proper current is available for charging the battery. Direct current only must be used, never alternating.

b. If the battery is shipped as part of a complete electric unit and is to be charged from the generator of the unit, the generator should first be properly set up and connected to give the necessary charging current.

3. Preparing Electrolyte for Filling

a. Have ready sufficient electrolyte so that the cells may be filled immediately after having been assembled. The amount of 1.215 specific gravity electrolyte to have ready for each cell is approximately as follows:

BTH—1	Pound	LT— 1/5	Pound
CTH—3¼	Pounds	BT— ¾	Pound
		CT—3	Pounds
PTH—4¼	Pounds	PT—4¾	Pounds
ETH—7¾	Pounds	ET—7	Pounds

b. The electrolyte to use with the battery is especially pure dilute sulphuric acid of 1.215 *specific gravity* (25½ degrees Baume), as shown on the hydrometer at a temperature of 60 degrees F. As it is essential that acid should be practically free from impurities, such as iron, nitrates or hydrochloric acid, it is recommended that electrolyte be purchased from The Electric Storage Battery Co. If sulphuric acid of higher specific gravity is purchased it should be reduced to 1.215 specific gravity by mixing it with water before adding it to the cells. Exceptional care must be taken to avoid personal injury in handling acid stronger than 1.400 gravity and extreme care when it is stronger than 1.600.

c. When mixing, use a glass, china, earthenware or lead vessel; never metallic other than lead. Rubber may be used except when mixing acid of 1.600 gravity or stronger. Carefully pour the acid into the water; *not* the water into the acid, as this may cause sputtering and therefore personal injury. Stir thoroughly with a wooden paddle. If acid of 1.835 gravity is used, the wooden paddle should be coated with sheet lead. The gravity of the mixture will rise as the mixture cools. Therefore, if the mixing is completed with the temperature between 75° and 90° F. the hydrometer should read 1.210 to 1.205; if temperature is between 90° and 105° F. the hydrometer should read 1.205 to 1.200; etc.

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4. Location of Battery

Battery compartment must be ventilated but in such a way as to keep out water, oil, dirt, etc. It should also be dry, and, if practicable, moderate in temperature. Locate and install the battery so that all cells are readily accessible for adding the water necessary to restore level lowered by charging and evaporation. All exposed metal work other than lead should be painted with at least two coats of white lead or asphaltum paint.

5. Racks or Stands

Before assembling the cells, suitable racks or stands should be provided and so located that each cell will be easily accessible. If sufficient floor space is not available for the single tier form of construction, two-tier racks will have to be provided. A clearance over the jars at least equal to the height of the jars should be allowed for each tier. If the racks are not purchased with the battery, drawings giving details of their construction will be furnished upon application.

6. Installing Plates and Jars

a. Fill the trays even with the top with fine, dry, bar sand and place them in position on the racks or stands, leaving a three inch air gap between wood trays. The trays rest on glass insulators, as shown in Fig. 6.

b. Clean the jars and then place them in position on the sand in the sand trays.

c. Plates of opposite polarity, except the terminal plates, are burned together by a connecting strap, forming a "couple" (Fig. 1), and are placed in adjoining jars; the positive plates are of brownish color, the negatives of a light gray. Before placing the couples in the jars, the straps should be bent over a piece of wood 7/8 inch thick, the top edge of which is rounded (Fig. 7). After removing from the form, the straps should be still further bent until the lower edges of the plates touch (Fig. 8); then by gently springing them apart when putting into the jars, the plates of adjacent couples will not have a tendency to get together and short circuit. In bending, care should be taken that only the connecting strap is bent, as the burned joints must not be subjected to undue strain. The plates must be so placed in the jars that each jar contains a positive plate of one couple and a negative plate of the next couple.

7. Connecting Cells Together and to System

a. Arrange the cells so that the positive terminal of one cell or section will be connected to the negative terminal of the next throughout the battery.

b. Arrange connections so that positive of charging source will connect with positive of battery, and negative of charging source with negative of battery. Test charging wires for positive and negative with a voltmeter, or dip the ends of the wires in a glass of water to which a few grains of salt have been added, but do not allow ends of wires to touch each other and do not use a strong solution of salt. In the water, fine, colorless bubbles will be given off from the negative wire.

c. All surfaces which are to be bolted together should first be scraped bright and then coated with a film of pure vaseline or No-ox-id grease,

which should also be applied to the bolt studs. Any surplus vaseline or No-ox-id grease that squeezes out should be wiped off. The nuts should be gone over and tightened several times after the first tightening, to insure thoroughly good connection.

d. After all connections are completed, check over each one to make sure the polarity is correct. Then see that any exposed metal in the connectors other than lead is protected by a film of vaseline or No-ox-id grease.

e. Number the cells, starting from the negative terminal of the battery. Lead numbers to be nailed to the rack beneath the cells are recommended.

8. Pilot Cell

Select a cell as a "pilot cell" to be used afterwards in checking the amount of charge and discharge given the entire battery during its operation. This cell should be readily accessible, but not at the end of a row. Where the plates in the battery are not all of the same age, the pilot cell should contain the oldest plates. If the battery has counter cells (Fig. 2). do not use one of these as the pilot cell.

9. Installing Separators

Type BTH or BT cells are the only ones in which separators are used. For this type, rubber separators are provided and one should now be placed in each jar between the two plates (Fig. 9).

10. Filling with Electrolyte

a. Before pouring into the cells, the electrolyte should be below 90° F. and its gravity should be above 1.205, the exact value depending upon its temperature (Par. 3*c*). Make certain of its gravity by means of one of the hydrometers furnished. If it is not correct it should be adjusted to the correct gravity before adding to the cells.

b. Slowly and carefully pour the electrolyte into the cells. Fill to the red line on the jar or 3/4 inch above the plates if there is no red line, and if level falls add more electrolyte to regain this height.

c. When the electrolyte is in all the cells, place the glass covers on them.

11. Giving Initial Charge

a. It is of the utmost importance that the initial charge be complete. If there is any doubt, it is better to continue the initial charge too long than to risk injuring plates by stopping before it is complete.

b. The charge should be started as soon as practicable (not over 4 days) after all the cells are filled with electrolyte, and continued *until both the specific gravity and voltage have reached a 10-hour maximum, that is, show no rise over a period of 10 hours*, and until gas (bubbles rising through the electrolyte) is being freely given off from all the *negative* plates. The negative plates will not start gassing until some time after the positives.

c. To meet these conditions, at least 35* hours' continuous charging will be required if the charge rate shown on page 2 is used.

*This applies when the negative plates are shipped charged and dried. If shipped otherwise, see Par. 30*b*.

d. Lower rates may be used, in which case the time required will be proportionately increased. If higher rates are used, the time will be decreased, but in this case it is important to keep a very close watch on the temperature of electrolyte.

e. During charge at any rate, the temperature of the electrolyte should be watched, and if it reaches 110° F., the charging rate must be reduced or the charge temporarily stopped until the temperature lowers.

f. If necessary, the charge can be interrupted, for instance over night, but the first interruption should not come until after at least 12 hours of charging. Interruptions should be made no longer than necessary, and if longer than 12 hours at a time will increase the time actually on charge beyond the 35 hours mentioned in Par. 11*c*. In any case, continue the charge until the 10-hour maximum gravity and voltage condition outlined in Par. 11*b* is obtained.

g. During charge keep the level of the electrolyte above the plates by adding water as necessary.

h. After about twenty hours' charge, ***readings of the current, specific gravity and voltage should be taken and recorded at regular intervals.*** The gassing should also be watched, and if any cells are not gassing, or are not gassing as much as the surrounding cells, they should be carefully examined for short circuits and the cause of the trouble removed.

i. The specific gravity will fall after the electrolyte is added to the cells, and will then gradually rise as the charge progresses until at the completion of the charge it will normally be between the limits shown in Par. 23*a*. In case the specific gravity is below, it should be adjusted to within these limits by adding electrolyte. If it is above, it should be adjusted by replacing some of the electrolyte with water.

j. The cell covers should be kept in place during charge.

12. Installing Counter Electromotive Force Cells

a. Counter Electromotive Force Cells or Counter Cells, as usually termed, contain plates without any active material. The negative plates are the same as the positives. They are used with some systems to prevent excessive voltage on the system while charging or to regulate the charging current.

b. The Counter Cells should be set up with electrolyte the same as the remainder of the battery, and should be connected preferably at the positive end of the battery.

c. No initial charge is required for the counter cells and a pilot cell is not desirable.

OPERATION

(Condensed Rules on Back Cover)

13. Cleanliness

a. Keep the battery, its connections and surrounding parts clean and dry. Keep the covers in place. If electrolyte is spilled or if any parts are damp with acid, apply a solution of ammonia or of baking soda and water (in the proportions of one pound of soda to one gallon of water). then rinse with water and dry; do not allow solution to get into cells.

b. If the terminals or connections show any tendency to corrode scrape the corroded surface clean, wash it with ammonia or soda solu-

tion, rinse with water and coat it thinly with vaseline or No-ox-id grease. No corrosion will be experienced unless electrolyte is spilled and allowed to remain.

c. Soda solution or ammonia will neutralize the effect of acid on clothing, cement, etc.

14. Adding Water

a. During operation water must be regularly added to each cell. *Do not allow the surface of the electrolyte to get below the top of the plates*; keep it above by removing the covers regularly from all the cells and adding sufficient approved water to each cell as often as necessary. Do not add higher then the red line on the jar or ¾ inch above the plates if there is no red line, as otherwise electrolyte will be lost by creepage over the top of the jars. There will be less harm result in allowing the level to get a little low than in adding water too high. After adding water be sure to replace the covers. The intervals at which water must be added depend largely on the operating schedule.

b. In cold weather the time to add water is just before or at the beginning of a charge, so that gassing (bubbling of the electrolyte resulting from floating or charging the battery) will insure thorough mixing and any danger of the water freezing be avoided.

c. Electrolyte loses some of its water by the charging of the battery and some by evaporation, but its acid is never lost in this manner; therefore, ***it will never be necessary to add new electrolyte,*** unless some should get outside the cell through carelessness or by adding water too high.

15. Battery Water

a. Only approved water should be used for restoring level lowered by charging and evaporation. Distilled (not merely boiled) water is approved. Other water is usually satisfactory but should not be used unless approved. If in doubt as to the suitability of the water, an analysis should be made or else distilled water used. The Electric Storage Battery Company, without charge, will analyze and report on ***quart*** samples received at its works (Allegheny Avenue and 19th Street, Philadelphia, Pa.), ***if transportation charges are prepaid*** and if sample is marked for identification.

b. Never transport or store water in any metallic vessel (lead excepted). Have receptacle clean and covered to keep out impurities. Glass, earthenware, rubber, lead or wooden receptacles that have not been used for any other purpose are satisfactory. If water is drawn from a tap, it should be allowed to run a few moments before using it.

16. Pilot Cell and Gravity Readings

a. The specific gravity of all cells in a battery falls on discharge and rises again on charge, so that the gravity reading of the electrolyte of one cell, known as the "pilot cell" (Par. 8), will indicate the state of discharge or charge of the battery as a whole.

b. Gravity readings are taken by means of the instrument shown in Fig. 3. This is known as a hydrometer and consists of a glass float. Be sure to get a good instrument, for cheap ones may be in error by as much as 25 to 35 points.

c. To take a reading, place the hydrometer in the electrolyte in the cell, making sure that it floats freely. The reading on the stem of the hydrometer at the surface of the liquid is the gravity reading of the electrolyte.

d. Both temperature and level of electrolyte affect the specific gravity reading and it is therefore desirable to record the temperature and level of the electrolyte of the pilot cell at the same time as its gravity reading.

e. After adding water a gravity reading should not be taken until the water added has been mixed with the electrolyte by gassing (bubbling) of the electrolyte resulting from charging or floating the battery.

17. Discharge Rates

a. High discharge rates (*amperes*) are often confused with overdischarge (too many *ampere hours* taken out).

b. An Exide Chloride Battery may, without injury to the plates, be discharged at any rate of current that it will deliver. The maximum permissible rate of discharge is limited only by the current-carrying ability of the wiring, motor or other apparatus to which the battery is connected or by the current-carrying ability of the cell terminals and connectors and not by the plates themselves.

18. Effect of Discharge Rate on Discharge Capacity

a. The *ampere hours* which may be obtained from a battery are greater for a long, low-rate or intermittent-rate discharge than for a short, high-rate discharge. This is because the voltage drops faster at the higher rates.

b. All batteries are given a "*normal*" capacity rating which is the ampere hours obtainable under certain working conditions. Therefore, this so-called normal capacity is not the capacity obtainable under all conditions. For example, a battery may be given a normal 8-hour capacity rating in ampere hours, but greater capacity can be obtained if the discharge current rate (amperes) is made lower. On the other hand, if the rates are above normal, the capacity for such a discharge will be less. Ratings are given in the table on Page 2.

19. Discharge Limits

a. In an emergency, little if any permanent harm will result if the battery is overdischarged to the full amount that it will give, provided that it is promptly recharged.

b. The specific gravity of the electrolyte falls on discharge and is therefore an indication of the amount of discharge. The difference between the full charge and discharge values of the gravity depends upon the type of cell and is given for certain ratings in the table on Page 2. The values shown in the table, however, are averages and may differ from that for a particular cell by as much as ten per cent. A point is considered equal to .001 specific gravity. For example, the differences between 1.200 and 1.150 specific gravity is 50 points. The specific gravity of the

electrolyte is readily determined as outlined in Paragraph 16.

c. Except in an emergency, the ***drop in specific gravity should not exceed*** **the number of points shown in the table on Page 2.**

20. Charging

a. Direct current only must be used, never alternating.

b. The positive terminal of the battery must connect with positive of charging circuit, and the negative of battery with negative of charging circuit. If connected reversed, serious injury will result.

c. When connecting a cell or battery to another in series with it, the positive of one must connect with the negative of the next.

d. Ventilate the battery compartment when charging, in order to dispose of gas generated by battery. Never bring a flame or spark, such as candle, lantern or lighted cigarette, cigar or pipe, near the battery when charging or shortly after.

e. If the cells flood electrolyte, the level is too high and should be lowered by withdrawing electrolyte.

f. Never add special solutions, powders or jellies to the battery. A great many are injurious, having a corrosive or rotting action on the battery plates, reducing the voltage and capacity of the cells.

21. Charging Methods, Rates and Lengths

Manually Cycled Batteries

a. By "manually cycled" batteries are meant those which are normally allowed to reach a certain state of discharge before being placed on charge, the charge being started manually.

b. The battery may be charged at any rate in amperes that will not produce gassing or bubbling of the electrolyte or a cell temperature in excess of 110 degrees Fahrenheit (43 degrees Centigrade). As soon as gassing starts, or before if the temperature reaches this limit, the rate should always be reduced, and the charge should be completed at not higher than the charging rate given on Page 2. *Do not charge at a higher rate than this while the cells are gassing.* If charging at constant current is more convenient, the entire charge may be given at the rate shown on Page 2 or at a lower rate.

c. The best method of charging will depend on the number of cells in the battery, the time available for charging and the voltage and capacity of the charging apparatus. Wherever possible the charging equipment should be permanently arranged so that the rate of charge is automatically (and not manually) tapered to the rate shown on Page 2, or to less, by the time the charge is completed. Usually, this is not only possible but very easy and simple to arrange.

d. Charge the battery at least frequently enough to keep the specific gravity of the electrolyte from falling below the discharge limits referred to in Paragraph 19.

e. *If the battery has been completely discharged*, it should be charged promptly and not allowed to stand completely discharged. Part of a charge is better than none, but it must be remembered that a charge longer than usual is required after an extra long discharge. Ordinarily

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too much charge is harmful, but in such a case it is better to give too much charge rather than too little.

f. The battery should be charged at least once every six months.

g. *If the battery has been idle,* it should be given a prolonged charge just before using it, continuing until the gravity stops rising.

h. *If the battery requires less than one charge a week,* make every charge an equalizing charge (Par. 22).

i. *If the battery requires more than one charge a week,* charge until the cells are gassing and until the specific gravity of the pilot cell is within 2 to 3 points of the maximum obtained on the last equalizing charge. *Then stop the charge.* Every sixth or seventh charge should be continued into an equalizing charge (Par. 22).

Floated Batteries

j. By "floated" batteries are meant those which are continuously connected to the electrical system with which they are used in such a manner that they are normally kept fully or nearly fully charged (except for momentary or emergency discharge) by being constantly maintained at a voltage that will result in a small net charge. The "*floating rate*" is the sum of the very low current (generally termed "*trickle rate*") required to counteract the small internal battery losses plus the average current requirements for the remainder of the circuit. If the latter is zero, the floating rate required becomes the trickle rate for the battery. The required floating or trickle current is automatically provided when the proper voltage is maintained across the battery.

k. For "floated" batteries of the types shown on Page 2, the voltage *directly at the battery terminals* should average very close to 2.15 volts per cell (for example, 12.9 volts for 6 cells in series) and should be kept between 2.10 and 2.20 volts per cell. If it is continually below 2.10, the charging is insufficient, in which case gravity readings taken from time to time will show a gradual falling off. If continually above 2.20, charging is excessive, in which case unusually frequent addition of water will be required and short life will result. Adjust as necessary until the voltage holds between these limits. Variations outside of these limits, if only of a few minutes' duration, are not harmful and may occur as incidental to normal good operation.

l. It is very necessary that the voltmeter used be kept in careful calibration as an error of five per cent or even less might have considerable effect upon the reliability and life of the battery.

m. With the proper voltage across its terminals, the actual current taken by the battery at any time depends on (1) the condition which the battery has had to meet prior to the time under consideration, (2) temperature of the battery, (3) age of the battery; but these variations are in all cases corrective; that is, the battery takes such current as is necessary to keep it in proper condition. This makes it impossible to assign definite values to the current which might be read on an ammeter in the battery circuit and therefore makes voltage operation of the battery much more satisfactory than current operation. However, it may be stated that at normal temperature the normal current flowing to a fully charged battery that has been under constant voltage of 2.15 volts for approximately an hour or more should be between one-quarter and one percent of the eight-hour rate of the battery. At higher temperatures or if a discharge has been recently taken (such as a circuit breaker movement), a current in excess of this will be observed. At lower temperatures, or if the battery has been subject to higher voltage, the observed current will be less or in the latter case may even be temporarily in a discharge direction. If the trickle rate (Par. *j* above) is consistently less than one-quarter of one percent or more than one percent of the eight-hour rate of the battery it is recommended that the meters be checked.

Attention is called to the fact that in some cases it is not practicable to permanently connect an ammeter in the battery circuit to indicate the amount of the floating current, as any high discharge currents required would, of course, pass through the meter in a reverse direction.

n. If the system is allowed to remain idle, the battery should be charged at least once every six months.

o. If the battery becomes discharged, as by its carrying the load for some time, or on account of abnormal operation, as soon as charging current is available, promptly recharge at the maximum safe rate (Par. *h*), raising the voltage above the floating values. The charge should be continued into an equalizing charge (Par. 22). After the battery is thus fully charged, the charge rate and voltage limits should be reduced in steps to the floating limits.

System-Governed Batteries

p. By "system-governed" batteries are meant those which are permanently connected to the electrical system with which they are used, in such a manner that their charging and discharging as well as their charge and discharge rates and state of charge are automatically governed by the schedule and adjustment of the system. They differ from "floated" batteries in that their normal state of charge is continually changing between rather wide limits.

q. For "system-governed" batteries of the types shown on Page 2, the adjustment which controls the amount of charge should normally keep the specific gravity of the electrolyte above the half charged value and without requiring unusually frequent additions of water. If the gravity is often found below this, the charging is insufficient and the system should be adjusted to give a trifle more charge. If it is often found near the full charge value (Par. 23*a*), especially if unusually frequent addition of water is required, the charging is excessive and should be adjusted to give a trifle less charge. Otherwise the life of the battery will be shortened.

r. If a battery is abnormally discharged, or if it has been operating for a long time in a half or less than half charged condition, it should be given a long charge (Par. 21*b*), continuing such a charge into an Equalizing Charge (Par. 22).

s. If the system is allowed to remain idle, the battery should be charged at least once every six months.

22. Equalizing Charge

a. An equalizing charge is a charge at a rate not higher than charge rate shown on Page 2 and lower, if practical, and continued until all the cells gas freely and until five consecutive readings of the specific gravity of the pilot cell (or of the lowest gravity cell) show no further increase over a period of time. This period of time and the interval between the consecutive readings are shown in the table following. The charge may be given by maintaining approximately constant either (1) the charge rate into the battery (constant current method) or (2) the voltage across the battery terminals (constant voltage method).

Interval between Readings	Period of Time for 5 Readings	Constant Current Method Charge Rate	Constant Voltage Method Average Volts per Cell
15 minutes	1 hour	Rate on Page 2	......
30 minutes	2 hours	½ of rate on Page 2	2.40 volts
1 hour	4 hours	¼ of rate on Page 2	2.35 volts
2 hour	8 hours	⅛ of rate on Page 2	2.30 volts
3 hour	12 hours	....	2.27 volts

b. In operation which includes frequent charges, the equalizing charge is simply an extension of one of the ordinary charges.

c. It is important to give the battery an equalizing charge when the operation is as described in—

Par. 21 (*o*) for Floated Batteries.
Par. 21 (*h*) and (*i*) for Manually Cycled Batteries.
Par. 21 (*r*) for System-Governed Batteries.

23. Specific Gravity of Electrolyte

a. The specific gravity of the electrolyte with the cells fully charged, and the electrolyte level at the red line on the jar or ¾ inch above the plates if there is no red line, should be as shown in the following table for the temperatures indicated:

Temperature	100° F.	70° F.	40° F.
Electrolyte Level at Red Line..........	1.190 to 1.210	**1.200 to 1.220**	1.210 to 1.230

b. If adjusted within these limits during initial charge, it will not require adjusting during the life of the battery unless electrolyte is lost from the battery.

c. A lowering in level (between additions of water) from the red line on the jar or from ¾ inch above the plates if there is no red line, to the top of the plates increases the full charge gravity from the preceding values to those shown for each type in the following table:

Temperature		100° F.	70° F.	40° F.
Electrolyte Level at Top of Plates	BTH....	1.240 to 1.260	1.250 to 1.270	1.260 to 1.280
	CTH....	1.225 to 1.245	1.235 to 1.255	1.245 to 1.265
	CT, PTH	1.215 to 1.235	1.225 to 1.245	1.235 to 1.255
	BT, ETH	1.220 to 1.240	1.230 to 1.250	1.240 to 1.260
	PT......	1.205 to 1.225	1.215 to 1.235	1.225 to 1.245
	ET.....	1.210 to 1.230	1.220 to 1.240	1.230 to 1.250

d. Both the above tables show the effect on gravity of changes in electrolyte temperatures. For example, a change of 30° F. changes the gravity 10 points (.010 sp. gr.).

e. The full charge specific gravity will normally decrease in value as the battery ages. No definite value can be given, but this decrease is very small, not over a few points per year at the most. This change is mentioned so that it will be understood.

f. Before adjusting low gravity, ***first make sure charging will not raise gravity.*** To do this, continue charge until specific gravity shows no rise, and then for three more hours. ***Never make a gravity adjustment on a cell which does not gas on charge.***

g. *To adjust low gravity,* first have ready sufficient electrolyte of any specific gravity between 1.200 and 1.300. Add this instead of water when restoring level until the gravity at the end of an equalizing charge is normal. Then stop adding electrolyte and return to the use of water. A quicker method, but one requiring more work and electrolyte is to withdraw some of the low gravity electrolyte and at once fill with the new electrolyte. Do not allow a cell to stand partly empty. The amount to withdraw will have to be determined by trial, as it depends upon the gravities of both the old and new electrolyte. Charge until all cells have been gassing for an hour. Then, if the gravity is not normal, repeat adjustment until it is.

h. *To adjust high gravity,* remove some of the electrolyte and replace with water until the gravity at the end of an equalizing charge is normal.

24. Readings

To facilitate following the operation of the battery, it is advisable to record, at least three or four times a year, the specific gravity of each cell.

25. Counter Electromotive Force Cells

Although not requiring the same attention that the cells in the main part of the battery do, Counter Cells (Par. 12) should be examined from time to time to see that they are not short-circuited. The height and gravity of the electrolyte should also be maintained the same as in the cells in the main part of the battery.

IMPORTANT POINTS

26. Impurities

Impurities in the electrolyte will cause a cell to work irregularly. Should it be known that any impurity has got into a cell, it ***should be removed at once.*** In case removal is delayed and any considerable amount of foreign matter becomes dissolved in the electrolyte, this solution should be replaced with new immediately, thoroughly flushing the cell with water before putting in the new electrolyte. If in doubt as to whether the electrolyte contains impurities, a ***pint*** sample should be submitted for test. The Electric Storage Battery Co., without charge, will analyze and report on, ***pint*** samples received at its works (Allegheny Ave. and 19th St., Philadelphia, Pa.), ***with transportation charges prepaid and sample marked for identification.***

27. Sediment

a. The sediment which collects underneath the plates need cause no alarm unless it deposits too rapidly, in which case there is something wrong with the way the battery is operated. In a new battery there is always a thin layer at the start. As the battery wears the sediment becomes higher, but for batteries which are floated (Par. 21*j*), the plates usually wear out before the sediment space is filled.

b. It sometimes happens that when the sediment space is nearly full, the condition of the plates will warrant the expense of leveling or removing sediment. In such a case.

c. When the sediment comes to within one-quarter inch of the plates it must be either leveled or removed. It usually accumulates in ridges, in which case the necessity of removal may be postponed by leveling down the sediment with a glass tube bent into an "L" shape or with an "L" shaped wooden stick having no metal in its construction.

d. When sediment is to be removed, first give the battery an equalizing charge and have on hand enough new electrolyte (Par. 3) of 1.215 specific gravity to fill several cells.

e. Starting at one end of the battery, remove not more than two or three couples; pour off the electrolyte, taking care to disturb the sediment as little as possible; clean the jars; put the couples back and fill with the new electrolyte of 1.215 specific gravity. Do this at once so the elements will not dry. The removal of sediment and addition of electrolyte should be completed for but two or three cells at a time before proceeding with the next. Enough high gravity acid may be added to the old electrolyte from the cell just cleaned to bring it to 1.215 specific gravity. This may be used for refilling the next two or three cells after they have been cleaned.

f. After all the work has been done give a long charge at the normal rate until the gravity and voltage have been at a maximum for three hours. If the charge rate used is considerably below the rate, shown on Page 2, this three-hour period should be increased in proportion. At the end of this charge read gravity of all cells and adjust where necessary. (Par. 23.)

28. Low Temperature

The capacity of any battery is temporarily reduced during periods of low temperature, but there is no danger of freezing if care is taken when adding water to add just before or during charging, so that it will be thoroughly mixed with the electrolyte by the charging.

29. Replacing Broken Jar

a. If a jar should become broken, do not allow the negative plates to dry. Lift the two affected couples out and immerse their negative plates only in a wooden bucket filled with water. Keep them covered with water until ready to reinstall them. The positives may be washed with water and let dry and stand dried. If it is necessary to use the battery in the meantime, move the sections of the battery together to fill the vacant space and replace one of the couples, using the battery temporarily with one cell less.

b. When replacing a jar, fill it with previously prepared electrolyte, so that the plates will not dry. The exact gravity of the electrolyte cannot be given, but it should usually be between 1.175 and 1.225.

c. If possible, put the couples back in circuit when the battery is discharged, so that they can be fully charged with least overcharge for the remainder of the battery. Be sure that the positive of one couple is in the same jar with the negative of the next.

d. Charge the battery until the repaired cell or cells gas freely and until three consecutive half-hourly readings of the specific gravity of repaired cell or cells show no increase. Then if the gravity of such cells differs from that of surrounding cells by more than 10 points, adjust as in Par. 23.

30. Installing New Couples

a. The sediment should be removed from the jars whenever new plates are installed. It is best to install new plates when the battery is discharged so that they will receive the benefit of the charge following. New couples (positive and negative plates) should be charged and the gravity adjusted as given under Initial Charge (Par. 11). New positive plates alone usually do not require as much charge as new negatives, but must be charged to the ten-hour maximum (Par. 11*b*). New negatives should be handled as follows:

b. If negative plates are shipped in a charged and dried condition, no special precautions against drying out are necessary. If shipped in a charged and wet condition, the packing case will be marked "charged and wet" and the negative plates will be individually wrapped in paraffined paper, and then the entire contents wrapped in paraffined paper, and should not be disturbed in the packing case until ready to install. Each cell should be assembled separately and filled with electrolyte as quickly as possible to prevent the plates drying out. Unless the negative plates are wet when installed, they may require as long an initial charge as if shipped in the standard charged and dried condition.

c. In any case, the initial charge for new negatives should be continued until a ten-hour maximum is reached. If the charge rate shown on Page 2 is used this will usually require a continuous charge of at least

—35 hours for negatives shipped charged and dried.

—10 to 15 hours for negatives shipped charged and wet, if they have not been allowed to dry, but it will generally be found that they will have dried to some extent and that a greater amount of charge will therefore be required.

d. For other charge rates see Par. 11*d*.

31. Putting Battery Into Storage

a. If the use of the battery is to be temporarily discontinued, give it a charge until *all* the cells gas and add water to the cells during this charge so that the gassing will insure thorough mixing and prevent its freezing in cold weather. Add enough water to raise the level of the electrolyte to the red line on the jars or to ¾ inch above the plates if there is no red line. After the charge is completed, remove all fuses to prevent the use of the battery during the idle period. Make sure all the covers are in place. Though not likely, the level of the electrolyte may, due to excessive evaporation during the idle period, fall below the top of the plates; if this should occur, add water to keep them covered; if in a place where freezing is apt to occur, charge the battery to mix in the water and prevent its freezing.

b. Repeat the procedure under Paragraph *a* at least once every nine months. If this cannot be done proceed as follows: Give a charge until *all* the cells gas, siphon off the electrolyte (which may be used again) into thoroughly cleaned glass receptacles and as each cell becomes empty immediately fill it with fresh water. When water is in all cells, allow the battery to stand twelve or fifteen hours. Next siphon the water out of each cell. The battery can then be allowed to stand indefinitely. If there is any considerable amount of sediment in the cells, it should be removed before it dries.

32. Putting Battery Into Commission Again

a. If the electrolyte has not been withdrawn, all that is necessary is to add water, if needed, to the cells and give a charge until the gravity of the electrolyte has ceased rising over a period of five hours.

b. If the battery has been standing without electrolyte, fill jars with either new electrolyte (Par. 3) of 1.215 gravity, or, if the old electrolyte has been saved, add enough new of 1.215 specific gravity to replace loss. Charge until both the specific gravity and the voltage have reached a ten-hour maximum as explained in Par. 11*b*. If the gravity after the first charge is low, it should be adjusted as in Par. 23.

33. Trouble

The chief indications of trouble in a cell are:

a. *Falling off in gravity or voltage* relative to the rest of the cells.

b. *Lack of gassing* on charge.

c. *Color of plates* markedly lighter or darker than the surrounding cells.

If a battery seems to be in trouble, the first thing to do is to give it an equalizing charge (Par. 22). Then take a gravity reading of each cell. If all the cells gas evenly on the charge and the gravity of all of them goes above 1.180, all the battery needed was the charge. Otherwise, record all gravities less than 1.180, resume charge and follow the directions of Pars. 23 *f* and *g*. If a cell will not gas on above charging, investigate for impurities (Par. 26) or inspect it for short circuits.

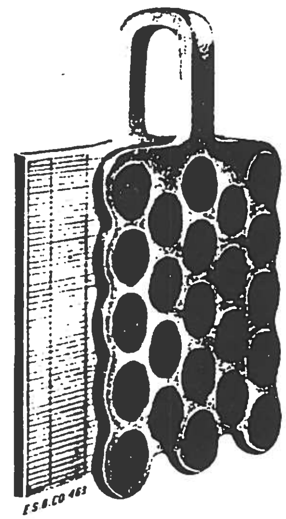

Fig. 1. Type CTH Couple

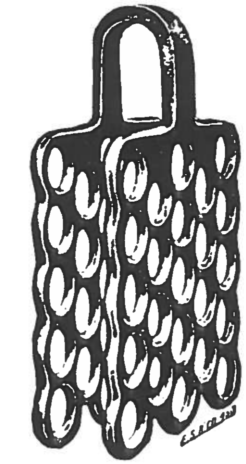
Fig. 2. Type CTH Counter Couple


Fig. 3 Hydrometer (Read Paragraphs 16*b*, *c* and *d*)

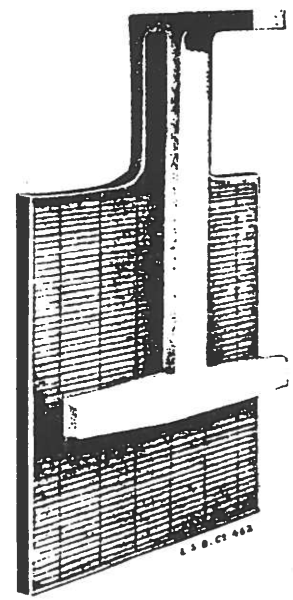
Fig. 4. Type CTH Negative Terminal Plate

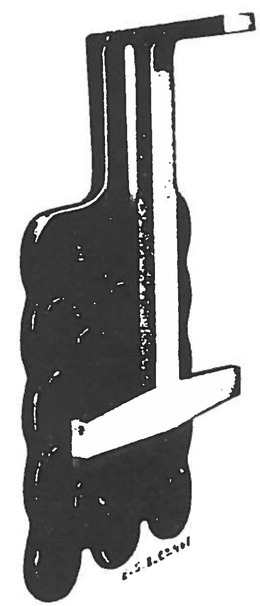
Fig. 5. Type CTH Positive Terminal Plate

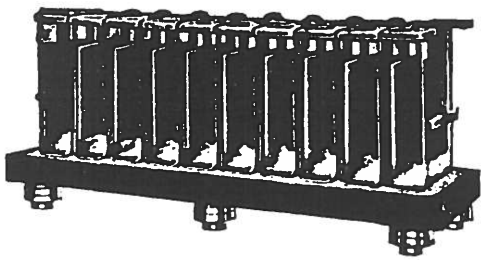

Fig. 6. 10 "CTH" Cells on Sand Tray

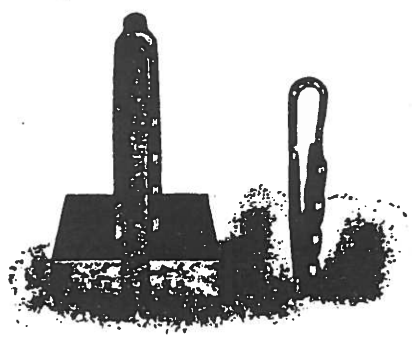

Fig. 7 Fig. 8
Method of Preparing Couple for Installation
(See Paragraph 6c)

Fig. 9. Type "BTH" Cells

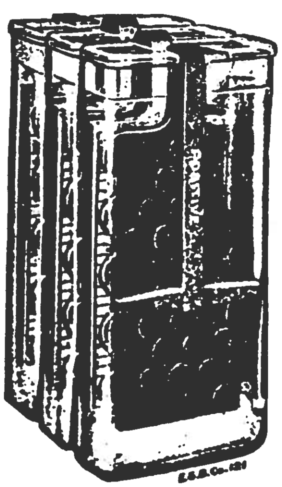

Fig. 10. Type "FTH" Cells

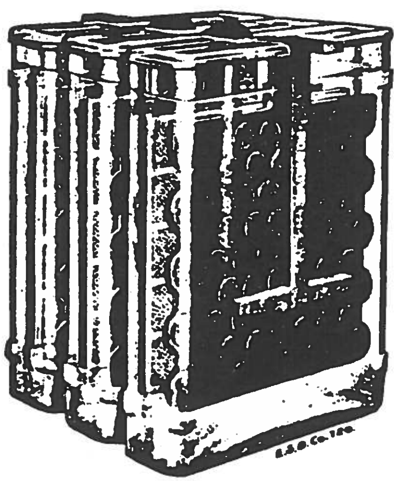

Fig. 11. Type "ETH" Cells

CONDENSED OPERATING RULES

For All Batteries

Keep the outside of the battery *clean and dry.*

Keep the *plates always covered with solution.* Do this by adding regularly *only approved water* (distilled, if necessary). Do not add higher than the red line on the jar.

Except in emergency, *stop discharge* before the voltage becomes too low for satisfactory service. The drop in specific gravity should not exceed the number of points shown on Page 2.

Always *charge at rates low enough* to keep the cell temperature below 110 degrees (Fahrenheit) and while the cells are gassing never charge at rates higher than the Charge Rate shown on Page 2.

Ventilate battery compartment freely when charging and never bring a lighted match or other *exposed flame* near the battery.

Never add electrolyte or acid, except under conditions explained in Paragraph 23. Never allow metals, special solutions, powders, jellies, or *impurities* of any kind to get into the cells.

Ammonia or soda solution will neutralize the effects of spilled acid if applied immediately.

For Manually Cycled Batteries (Par. 21a)

If the battery requires *charging only once a week* or less frequently, charge until *all* the cells gas freely and until half-hourly readings of the specific gravity of any certain cell and of the voltage for the battery *both* show no further increase over a period of one hour. This is termed an *Equalizing Charge.* (Par. 22)

If the battery requires *charging more often than once a week,* charge until the cells are gassing and until the specific gravity of the certain cell is within 2 to 3 points of the highest obtained on that cell during the Equalizing Charge last given. *Then stop the charge.* Every sixth or seventh charge should be continued into an Equalizing Charge.

For Floated Batteries (Par.21j)

Keep the voltage directly at the battery terminals so adjusted that it will average 2.15 volts per cell, although it may range from approximately 2.10 to 2.20.

For System-Governed Batteries (Par. 21p)

The adjustment which controls the amount of charge should normally keep the specific gravity of the electrolyte above the half charged value and without requiring unusually frequent additions of water.

Printed in U. S. A. Form 3473—5-'33—2M

All Mart ads are FREE... Send copy to the attention of the editor;
Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366

WANTED:

Information about the ELECTRO CLOCK CO., of Baltimore, MD. A.H. Redfield, 21 Kentbury Way, Bethesda, MD 20814, (301) 656-5562

Hamilton 500 & 505 watches, catalogs, repair info. Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366

Information on early Self-Winding Clocks, Long-Case, Wall clocks with one or two weights. Interested in research or purchase. Jack L. Clemes, 704 G Street, Crescent City, CA 95531.

Information, pictures, ad materials, for WALTHAM ELECTRIC CLOCK CO. wall clock having 90 beat pendulum and 10" dial without seconds bit.
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Junker early battery clocks, movements, parts, etc. Send details along with $ wanted.
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FOR SALE: KUNDO Replacement Coils, $25.00 each, postpaid. Also available, other clock movements, dials, parts, etc. NO lists. Leon O'Briant, 3516 Swift Drive, Raleigh, NC 27606. Call (919) 851-1706

FOR SALE: Large collection of SELF WINDING CLOCK CO. clocks, cases, movements, dials and parts. 30 year collection! Walter Spetrino, 1214 Cleveland Hts Blvd., Cleveland Hts., Ohio 44121. (216) 381-1197

WANTED: Information on the WARREN (TELECHRON) Clock Co., and in particular, Master Clocks. If you have clocks or information, please write to John M. Anderson, 17 Cedar Lane, Scotia, NY 12302.

AUCTION NOTICE:

Complete inventory of Driskill Clock Service, consisting of mostly Electro-Mechanicals. Sunday, Jan. 22, 1989, 1:30 PM at 1230 E. Mulberry St,(Hwy 35E) Angleton, TX 77515. Call Modie L. Driskill, (409) 849-5386

WANTED: Literature regarding Repair & Maintenance of INTERNATIONAL TIME RECORDING CO. Master Clock. Irwin A. Pogue, 212 N. William Dr., Chillicothe, IL 61523

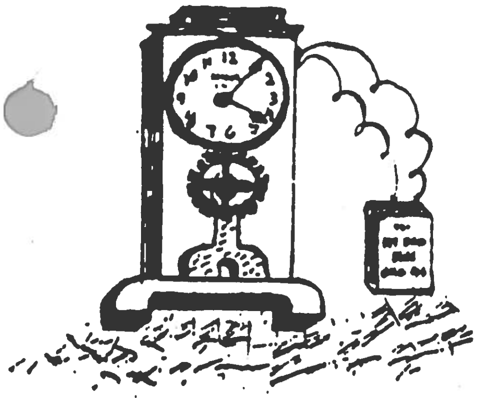
FOR SALE: Thinning Collection; S.T. #2 Tower Clock, Wt Driven Electrically Rewound, $1300. HOWARD #89, Electric Master with Tape Program, Limed Oak, $950. STANDARD ELECTRIC Master, Disc Program, Oak, $650. AMERICAN EVEREADY Wall Clock, Oak, $450. AEG ELECTRIC Wall Clock, Oak, $400. SELF WINDING GALLERY w/13" Dial, $175. ANSONIA STD ANT., Cherry, $6500. Also 3- WW LATHES; $75, $50, $50. Pix $1 each w/SASE. No Shipping. Harvey Schmidt, 49-20 108th St., Corona, NY 11368, 718-969-0847(eve)
718-592-7711(days)

INFORMATION FOR FUTURE JOURNAL ARTICLES, Requested by EHS members;
Warren early mystery clock with mercury switch.
Tiffany DOUBLE contact model.
Kennedy Electric Clock Co. (1867-69)

Information on these or other subjects of interest to the membership should be sent to the attention of the editor;
Harvey Schmidt; 75-80 179th Street, Flushing , NY 11366

ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



RENEWAL MEMBERSHIP or APPLICATION FORM

The Electrical Horology Society--Chapter 78 was formed in 1972 to provide a means whereby members of the NAWCC who have a primary and strong interest in early battery clocks as well as A.C. clocks would have a means to meet and communicate with other members having similar interests. Due to the geographic locations of the membership, our Chapter's cohesiveness depends upon two factors. One, we print the JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY six times per year with a yearly total of 72 pages of material. The JOURNAL includes technical information, original articles, reprints of important articles found in sources not generally available to the average collector, a question and answer section, a mart and other pertinent information. Secondly, we encourage groups of members to meet and form "Branches" of our Chapter. Local branch meetings include an educational program, a trouble-shooting discussion and often a small mart.

Any member in good standing of the NAWCC is eligible to join our Chapter. Our fiscal year begins in December and members joining after that date during the year will receive all the back issues for that year.

DETACH ALONG THIS LINE

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Please print all information:

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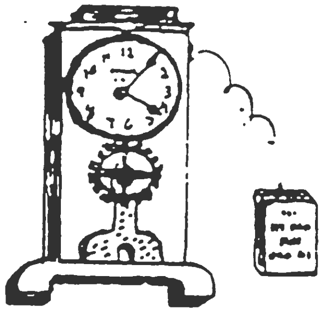
Send check to Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366, and make payable to EHS #78, % Harvey Schmidt, Secretary-Treasurer.

NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.



The

JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Chapter No 78

NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.

VOLUME XV, #2 April ~~1978~~ 1989

Fellow Horologists:

This issue is devoted entirely to a reprint of a SELF WINDING installation and maintenance manual originally published in the late 1800's. While there appears to be no shortage of material on Self Winding as relates to catalog reprints and very basic set-up instructions, this appears to be the only publication that offers repair and adjustment information on contact position, armature adjustment, synchronizer description, winding contact adjustment, etc. Additionally, the coverage includes the rotary motor model along with the C and F vibrating motor units. A very rare and useful reprint, supplied by EHS member Steve Berger, to whom we owe a debt of appreciation for his sharing of the information.

Member H.W. (Bill) Ellison has completed his research on an updated master index, and we should have it ready for publication soon. Bill, by the way, is the new owner of the Horolovar Company and we look forward to a constructive rebirth under his guidance.

Meeting reminder: June 11th, at the home of Dr. & Mrs. Levy, NY Long Island Area-RSVP for address and time: (516) 433-6836

National Convention Exhibit material request appears again... anyone planning to attend should cooperate in providing clocks by New York State makers for the display.

The Mart ads that appear in the Journal appear as a free service to EHS 78 members. We have no objection to their inclusion, but make one small request... Please advise us when you wish the copy discontinued. It makes very little sense to keep an ad in the Journal long after the need is no longer current. Thanks.

Good reading ahead...

Martin Swetsky, President,
Dr. George Feinstein & Harvey Schmidt,
Co-Editors

DIRECTIONS . . .

For Installation and Care of

Self Winding Synchronizing

Clocks

As furnished for Standard U. S. Observatory Time Signal
Service by Western Union Telegraph Co.

MANUFACTURED BY

Self Winding Clock Company

161-163-165 Grand Avenue

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.. DIRECTIONS ..

For Unpacking and Hanging Clock

First. In opening the packing box, be careful not to injure the clock. The strips that hold the case in position are fastened with screws; the cover is put on with screws or small nails, so that no damage need be done in getting the clock out of the box.

Second. Hang the clock on the wall where it is to be located by the hanger at the top of the case. The screw on which the clock hangs must be put in the wall firmly and with an upward slant; the clock will then settle against the wall solidly. If the pendulum is loose in the case while being hung up, and allowed to swing to one side, it is almost sure to put the clock "out of beat"; so do not remove the wood clamps that hold the pendulum ball until the clock is on the wall. When the clamps are fastened with bolts and the nuts are on the back of the case, take off the nuts and let the bolts remain; if the nuts are inside the case, take them off and change the bolts around to the front, then when the clock is hung up, carefully take out the bolts and let the clamps drop. When opening the case, before the bottom is secured to the wall, be careful that it does not swing to one side by the weight of the door.

Fig. 1

Third. THE CASE MUST BE PLUMB. Plumb it by the pendulum, the lower point of which must stand in front of the centre line of the degree scale, and the rod must be parallel with the back of the case.

Fourth. When plumb, secure the lower end of the case firmly to the wall with a screw, as provided.

Fifth. These clocks are regulated in the same manner as the ordinary clock, by raising and lowering the pendulum ball. If a little time is taken to regulate the clocks before connecting in synchronizing line, it will save much trouble and vexation. They can be easily regulated within two or three seconds per day.

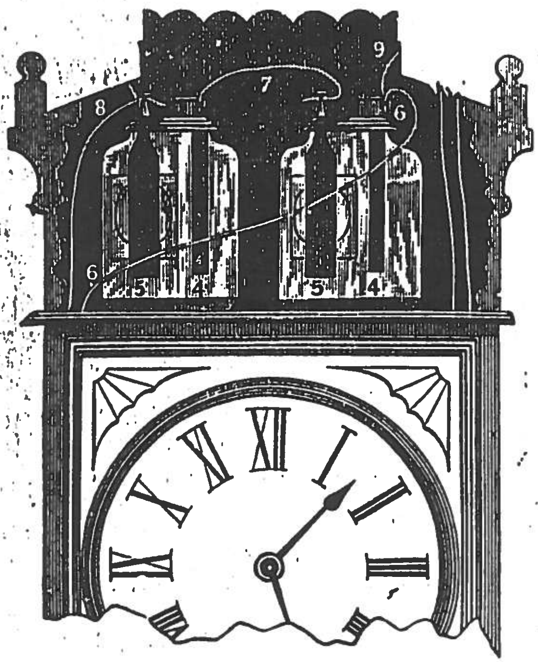

Fig. 2 shows the Battery in place

The wires shown are the clock-winding wires, and will always be brown; they are to be connected, one to Zinc of one cell, the other to Carbon of the other cell; the remaining Zinc and Carbon being connected by wire 7.

Clocks not lettered in bottom of case must be wound before starting the pendulum. To do this, press the key shown in Fig. 1, which is on the left side of the case and under the Dial.

Continue the pressure untill the winding ceases. Then set the hands and start the pendulum in the usual way.

If bell is not wanted to ring, bend back the hammer.

CARE OF CLOCK BATTERY

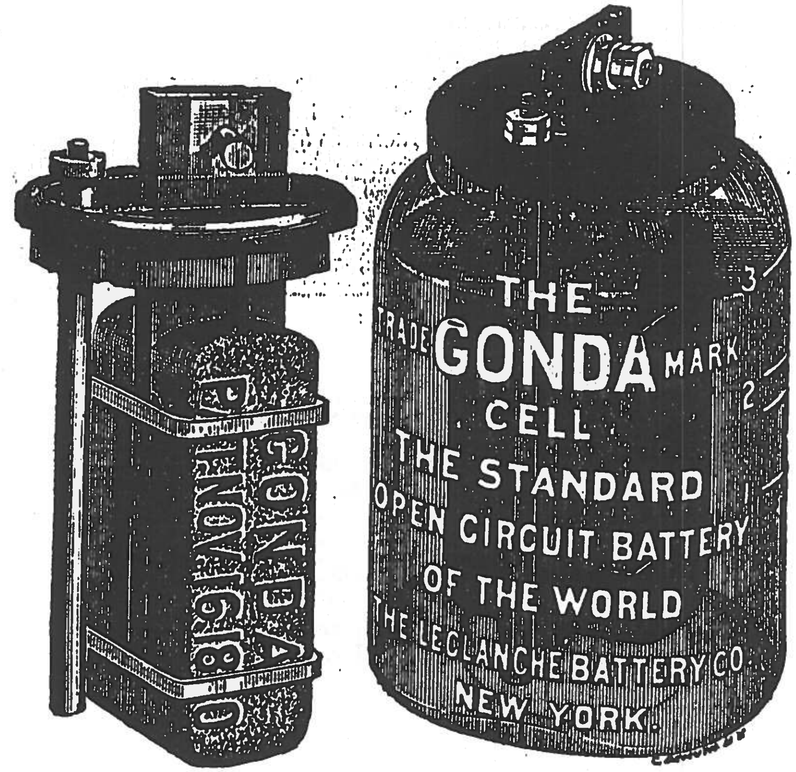

Fig. 3

Setting up Battery

First. Dust out the glass jar thoroughly, then place therein the contents of the paper bag (salammoniac).

Second. Fill to first water line with water (soft water if possible), then stir carefully until the solution is nearly dissolved.

Third. Insert the Carbon through slit in the Cover, then attach the Gondas to the Carbon, with the rubber bands around the top and bottom. Place the Gondas and Carbon in the solution, then insert the Zinc.

Fourth. See that the connections are clean and bright; connect the short wires sent with each clock, one end to the Zinc of *one cell,* the other end to the Carbon of the other cell.

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Fifth. Place cells in pocket in top of case, being careful not to slop the solution upon outside of jar; connect the clock wires, one to the Zinc of one cell, and the other to the carbon of the other cell, turning the nuts down hard.

Sixth. When all connections are made, and wires bent as they are to remain, press the cover down hard into the wax on the shoulder of the jar; this is to prevent evaporation and keep dirt out of cells.

For Renewing Battery

Before the battery is completely exhausted it should be recharged. A record should be kept in the clock, giving the date when the battery was set up or renewed.

One charging of the battery should wind the clock for eighteen months. One set of Gondas should do good work for at least ten years, and should not be changed unless they show that they have been ruined by a long-continued short circuit. When this has happened the Carbon and Gondas will be covered with crystals, the solution will be discolored and have a strong odor of ammonia. After the battery has been renewed it may be tested by noting the time it takes to wind the clock. If the winding is done in from eight to eleven seconds it is in good condition.

When renewing battery throw out all the old solution, rinse the jars thoroughly with clean water, wash the Gondas and Carbons, and scrape off the crystals if any have been collected on either. If possible dry them in the sun, then put in a new charge of Salammoniac and fresh water, as per directions for "Setting Up." A Zinc should last for two charges, but if much worn it is better to put in a new one. See that the wires are bright, and turn the nuts *down hard.*

Large Clocks

When clocks are large, and it is difficult to get to them, it is better to find a place for the battery where it may be easily reached. A shelf in any convenient place will answer the purpose.

A third wire can be run and the key for winding located in the same place. We are now putting on the large clocks devices

for regulating, setting the hands and starting the pendulum, all from the outside the case, which will not have to be opened except when the movement is cleaned.

Clocks with thirty-six and forty-eight inch dials must have a relay and local battery for synchronizing.

Circuits

The clock circuits should be clearly defined on a map or by streets from point to point, so that inspectors and linemen may be thoroughly familiar with each circuit, and know all danger points where line troubles may occur.

There should be a bell in the office, connected in the synchronizing line, as an audible signal showing when the line is in working order.

Clocks Stopped

When clocks are found stopped it is of the utmost importance to locate the cause of the trouble, and to do this, test as follows:

First. Set pendulum swinging to see if hands move; if not, see if dial is warped so as to touch hands.

Second. Turn hands to see if they bind in any way.

Third. If hands are free and yet do not move when pendulum swings, wind the clock by contact key.

Fourth. If clock winds slow in this way the battery is weak and the clock is run down.

Fifth. If clock winds strong it shows that the trouble is caused by the centre winding contact or motor brushes being out of adjustment.

Sixth. Take off hands and dial and examine all the parts closely.

Seventh. Touch contact key in case a number of times to see if the motor starts from every point.

Eighth. Take off front anchor lug, hold the escape wheel and raise anchor, then let the clock run down slowly until it makes on the centre contact. This will show whether that part is right.

Ninth. If the fault is found and cannot be easily and surely corrected, take the movement out and make a thorough job of it.

Back Stop Spring Broken or Bent

When this occurs it is usually from overwinding. It must be repaired by a new spring, or by straightening the old one by burnishing with a screwdriver. Set the spring so that it will catch about half way down the ratch tooth.

Cleaning and Oiling

At stated times—say once in eighteen months or two years—all clocks should be thoroughly cleaned and oiled, and at the same time inspected to be sure they are in good order.

Never let the clock run down backward, as the arm A will be carried back against the brush B and bend it out of adjustment.

To clean the movement, take it from the case, take out the anchor and allow it to run down gently, so as not to break the pins, then remove the motor. Take off front plate and separate all the parts. Wash the plates and all parts in good quality of benzine, letting them dry before assembling. The motor must not be taken apart, but may be washed in benzine, using a small brush freely about the bearings, commutator and brushes. Put oil in all the pivot holes, but not so much that it will run. The motor bearings and the pallets of the anchor should also be oiled.

Inspect carefully to see that the centre winding contact is right and the motor without dead points. Dust out the case and put the movement in place. Before putting on the dial try the winding to be sure that it is right, also see that the disc on cannon socket is in the right position to open the latch at the hour, and after the dial and hands are on, move the minute hand forward past the hour and then backward gently until it is stopped by the latch. This will prove that the hand is on the square correctly.

Dials Warped.

Dials, being made of zinc, warp if exposed to great heat. If they cannot be straightened a new one must be put in.

Hands Bent

When the hands are put on they must be carefully inspected, especially the hour. See that it is perfectly free and does not catch on the minute or second hands as it passes them.

Out of Synchronizing Range

This is usually caused by improper regulation of clock.

Fast: If the clock gains time turn the large regulating nut under the pendulum bob *slightly* to the *left.*

Slow: If the clock loses time turn the nut *slightly* to the *right.*

Loosen the small check nut under the regulating nut before turning the regulating nut, and be *sure to tighten* the check nut after moving the regulating nut.

Second Hand Friction Spring too Light

This friction is very carefully adjusted at the factory, being weighed by hanging a small standard weight on the point of the hand. If it becomes too light, and the hand drives or slips backward, losing time, it can be made stronger by laying it on a piece of wood and rubbing the inner sides of the points with a smooth screwdriver, and if too heavy, and the clock *will not set,* the points may be straightened a little.

If the second-hand sleeve does not hold on the second's socket, pinch it a little with pliers.

If the second hand is loose on the sleeve put on a new one or get a jeweler to solder it on the under side.

Wires Corroded

Examine the wires to see that they have not been spoiled by solution from battery being slopped on them. If they have, put in new wires.

Exchanging Movements

Great care should be exercised in having the number in the bottom of the case correspond to that of the movement.

When movements are exchanged the new number should be plainly written on a card and card tacked in bottom of case over the old number; managers and linemen should immediately report such changes to their superintendents and chiefs so that records can be properly corrected.

The old movements taken out of clocks and exchanged with new ones should be carefully packed and promptly sent to the Clock Co., 168 Grand avenue, Brooklyn, and a notice of such shipment, giving route, cause for removal and clock number of the new one installed in exchange, should be sent to the Clock Co. through the superintendent's office.

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Fig. 4 cut with centre broken out to show winding contacts

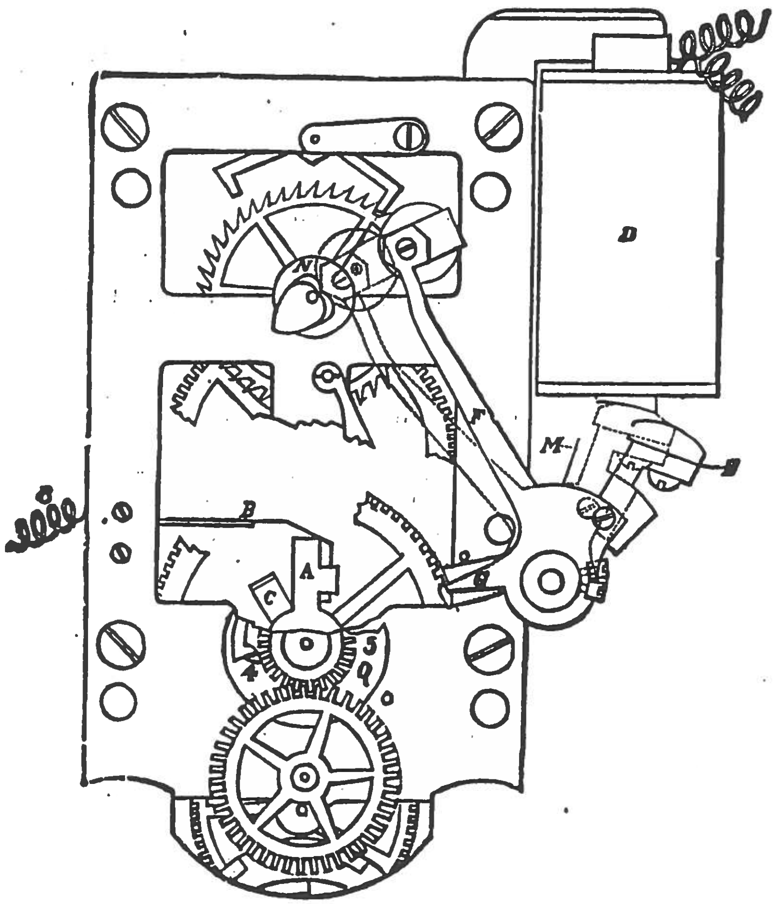

Fig. 4

Centre Winding Contact out of Adjustment

The clocks are wound by an electric motor, connected by gearing to the spring box, which it winds once around each hour.

To start the motor the circuit is closed by an arm A, loosely mounted on the centre arbor, and carried around by a pin in the centre wheel until it is upright, when it makes contact with the insulated brush B. This contact then remains closed until the spring box is turned a full revolution and brings up the "knockaway C," which moves the arm A forward from under the brush B and breaks the circuit.

The brush B should lie firmly on its banking piece, and should be so adjusted that when it leaves the arm A it will drop about one-thirty-second of an inch. Adjusted in this way it insures a good, firm contact.

The angle at the point of brush B must not be too abrupt, so as to retard the action of the clock while the contact is being made. Wire No. 8 connects spring contact B to one of the binding plates at the left-hand side of case; and wire No. 6 connects the motor M to the other. To these binding plates are attached brown wires that lead one to each end of the battery.

When the clock is quite run down it is wound by pressing key K, from which a wire runs to the plate. Key K should *not* be permanently connected to contact screw J. See that wires are in good condition and all connections tight. The main-spring is wound by a pinion on armature drum arbor, through an intermediate wheel and pinion to wheel on spring box.

Description of Synchronizer

At predetermined times a current is sent through synchronizer magnet D, which actuates the armature E, to which are attached the levers F and G, moving them down until the points on lever G engage with two projections, 4 and 5, on the minute disc; and lever F with the heart shapes or roll on seconds arbor causing both the minute and second hands to point to XII. (See cut No. 5, next page.)

On latch L is a pin I, arranged to drop under hook H and prevent any action of the synchronizing levers, except at the hour. A pin in disc on cannon socket unlocks the latch about two minutes before the hour and closes it again about two minutes after the signal.

This is to prevent any accidental cross on the synchronizing line from disturbing the hands during the hour.

M is a light spring attached to the synchronizing frame to help start the armature back after the hands are set.

The wires from the synchronizing magnet are connected to binding plates at the right-hand side of the clock, and from these binding plates the blue wires, Nos. 9 and 10 pass out at the top of the case to synchronizing line.

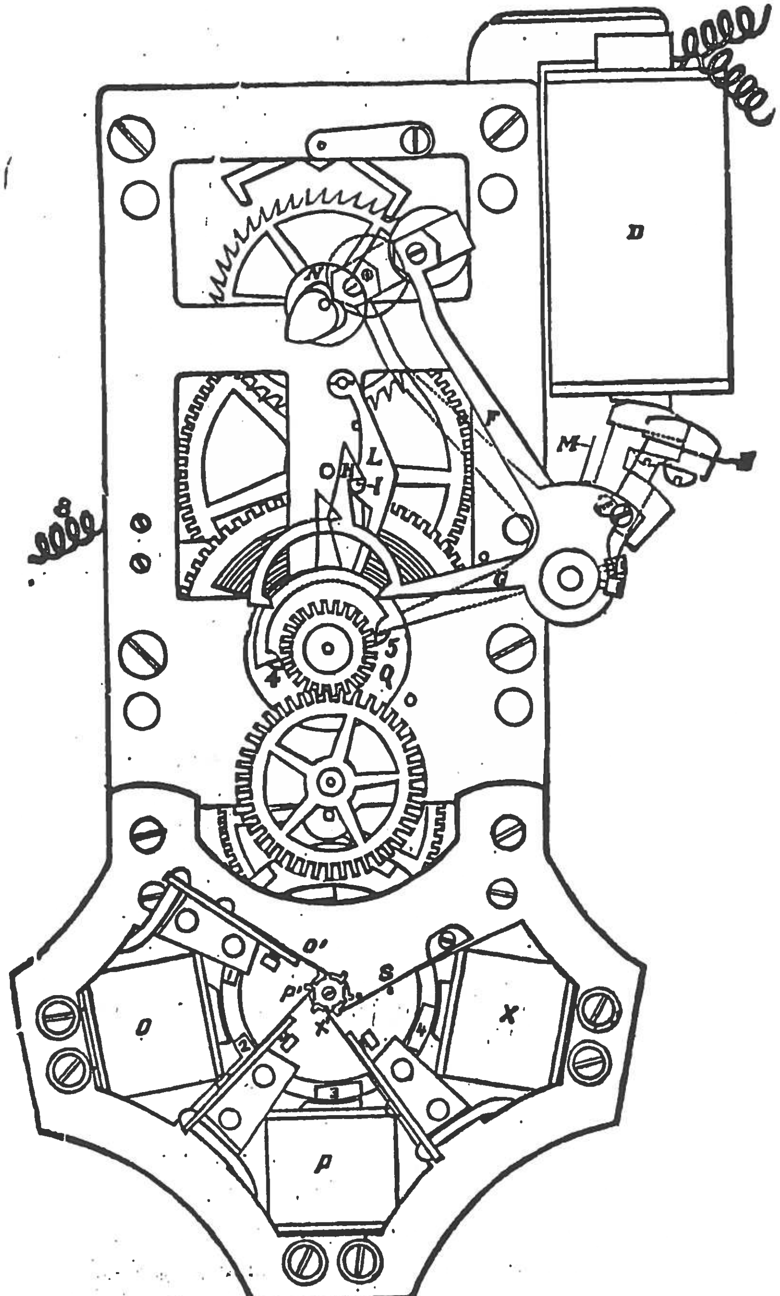

Fig. 5

Dead Point in Motor

On the front end of the armature drum arbor is a commutator having six points, corresponding to the six armatures in the drum. There are three magnets marked O. P. and X. Each magnet has its own brush marked O' P' and X'. When an armature approaches a magnet (see Fig. 5) the brush makes contact with a point of the commutator, and remains in contact until the magnet has done its work and the next magnet has come into action. When properly adjusted brush O' will make contact when armatures 1 and 2 are in position shown; with No. 2 a little nearer the core of the magnet than No. 1; and break when the armature has advanced into the position shown by armature No. 3, the front edge of armature being about one-sixteenth of an inch from corner of the core, armature No. 4 being entirely out of circuit as brush X' is not touching the commutator.

The back stop spring S must be abjusted so that brush O' is in full contact with a point of the commutator when the motor is at rest, with a tooth of the ratch touching the end of the spring.

MASTER CLOCK

Description

This is a finely finished movement with Mercurial Pendulum that beats seconds.

At the left and near the center of the movement is a device for closing the synchronizing circuit once each hour. The device consists of a stud on which is an insulator having two insulated spring fingers one above the other (see Fig. 6), except at the points where they are cut away to lie side by side on an insulated support. On these fingers, and near the Insulator, are two platinum pieces so adjusted as to be held apart, except at the time of synchronizing.

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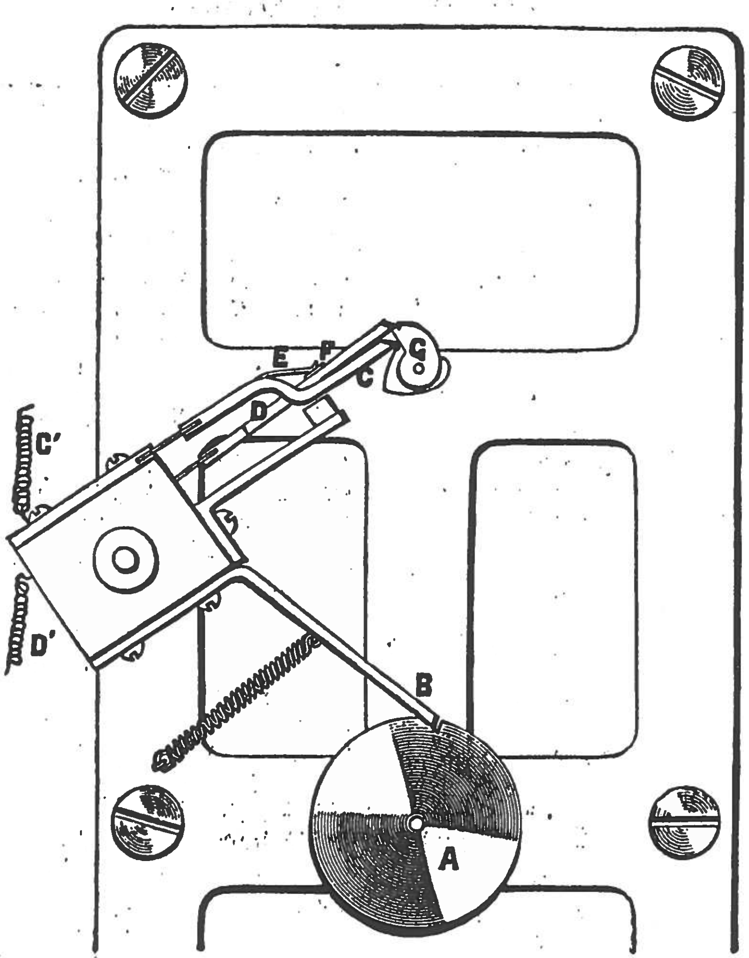

Fig. 6

A projection from the Insulator rests on the edge of a disc on the centre arbor. At ten seconds before the hour, a notch in this disc allows the retractile spring to draw the support downward, leaving the points of the fingers resting on the raised part of the rubber cam on the escape arbor.

The end of one of the fingers is made shorter than the other, and at the fifty-ninth second the shorther one drops and closes the circuit. At the next beat of the pendulum the long finger drops and opens it again.

The winding is the same as in the regular self-winding clocks; the motor wire and centre contact being connected to the binding plates at the left, from which brown wires lead up to the battery. Two wires from the synchronizing device are connected to the binding plates at the left, from which blue wires run out to the line.

. . DIRECTIONS . .

For Installing Master Clock

First. Remove the clock from the packing box and hang it on the wall by the hanger at the top of the case.

Second. Take off the dial and hands. Take the movement from the case, and hang the rod in its place.

Third. Roll the mercury jars gently, and end them up carefully to expel air bubbles; then set them in their places and see that the screws are set well down so as to hold the jars firmly, but not too tight.

Fourth. Plumb the case by the Pendulum, the lowest point of which must stand in front of the centre line of the degree scale, and the rod must be parallel with the back of the case. When plumb, secure the lower end of the case firmly to the wall. If the wall is of brick or stone, it is best to drill large holes and drive in wooden plugs, into which the screws may be driven through the back of the case.

Fifth. Return the movement to the case, being careful not to bend the crutch, and see that the fork is on the rod.

Sixth. Before putting on the dial it is best to see that contacts are working correctly. Wind the clock and start it going. Stop it when the long finger drops. Put on the second hand pointing directly up, and minute hand on the square, so that the notch in the disc is right for the synchronizing device to drop at the hour. Start the clock going and try it with sounder.

Seventh. When contacts are working correctly stop the clock again with the hands pointing to twelve. Put on dial and hands, and before connecting to the line, regulate to Observatory time.

.. DIRECTIONS ..

For Regulating Master Clock

First. Regulate at first by the nut at the bottom of the rod until it runs about one second slow in twenty-four hours. Two divisions on the nut will change the rate about one second per day. After the pendulum has been stopped to turn the nut, comparisons must not be made for several hours, giving time enough to be sure it has settled to its normal arc, otherwise an error will appear that would not if the arc was just right.

Second. We send with each clock a set of weights in pairs, the largest weighing one gramme each, the next size five, and the smallest two decagrammes each. When regulated to one second per day slow, make the fine regulation by placing small weights on the top of the jars.

Third. On the mercury pendulum two weights of one gramme each placed on the jars will make the clock gain about one second per day, and the smaller weights in proportion. Care must be taken when putting on or taking off weights not to disturb the swing of the pendulum, as any change of the arc changes the rate.

Fourth. To start the clock after it is regulated, stop it, with the second hand at the fiftieth second; move the hands forward to the hour at which the signal comes from the Observatory; then press the minute hand back gently until it is stopped by the extension on the hour contact, and beat the clock up to the hour. This ensures the hour contact being in position to send the synchronizing signal.

Fifth. A good way to start it with Observatory time is (with all the hands pointing to the "signal" hour;) hold the pendulum to one side and when the signal comes let it go. With a little practice it can be started very nearly correct.

Descriptions of Apparatus in Office

The relay for closing the synchronizing line and all the connections for actuating it will be inside the clock.

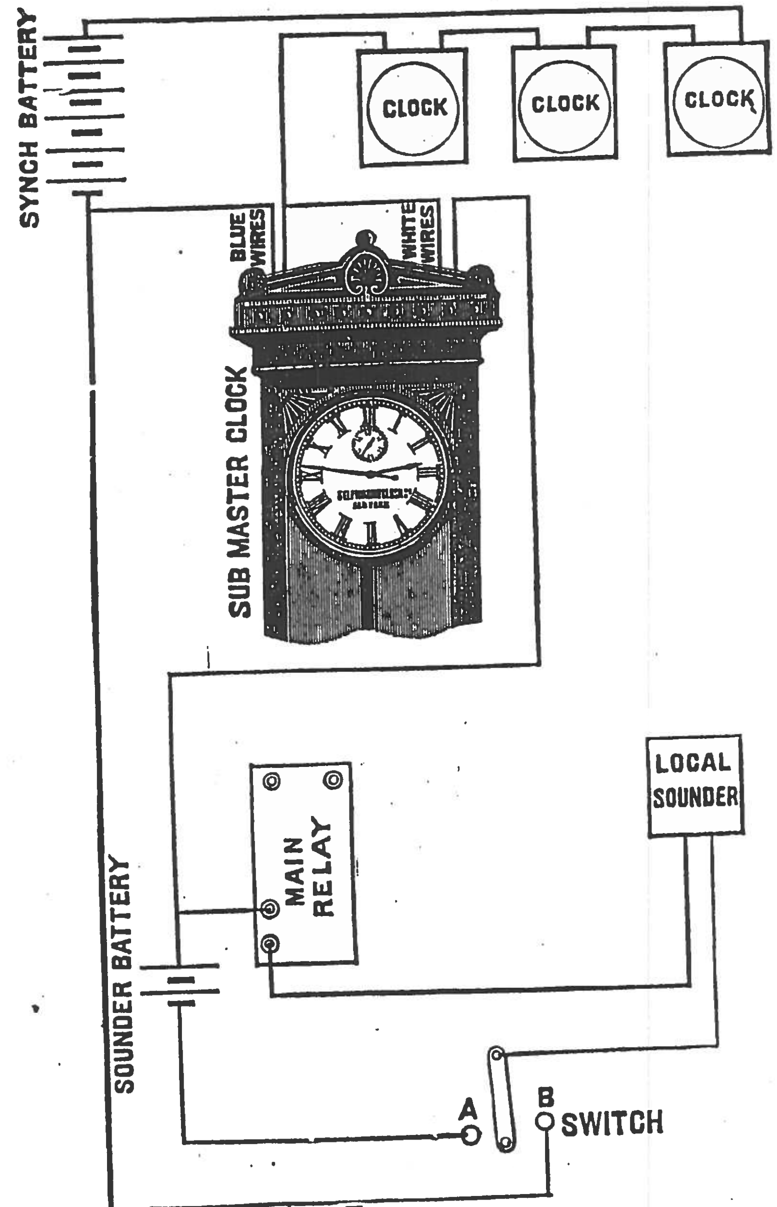

FIG 7
DIAGRAM SHOWING APPARATUS IN OFFICE.

The wires for this will be blue and white plaid and will run from the circuit-closing device through the incoming posts of the relay, to the binding posts to which the brown wires are fastened, thus using the clock battery. The two blue wires are run from the outgoing posts of this relay and must be connected to the synchronizing line direct.

The two white wires are for receiving the Washington signal, and must be connected one to a line wire direct, the other to an outgoing post of the main relay. (See cut.) From the other outgoing post of the main relay a wire is run through the local sounder and switch to the other line wire with the switch on the point A. The signals are received on the sounder only.

If the signal comes correctly, turn the switch to the point B, during the last pause before the hour, the circuit will then be established through the sounder, the Submaster and the synchronizing line so that the noon signal from Washington corrects the Submaster, synchronizes the clocks and operates the sounder. When the noon signal is complete turn the switch back to point A.

SUB MASTER CLOCK

Description

This is one of our regular synchronized movements, with the additional device for closing the circuit to correct all other clocks in the line each hour except at XII, at which time if the switch is turned it omits sending its own signal, and with all the clocks in line is synchronized by the signal direct from Washington.

For description of circuit closing device see pages 12 and 18, and instructions for connecting to synchronizing line, receiving "Washington," etc., see cut on page 16, and directions at top of this page.

. . . DIRECTIONS . .

For Installing Sub Master Clock

Remove the clock from the packing box and hang it on the wall by the hanger at the top of the case.

Plumb the case by the pendulum, the lower point of which must stand in front of the centre line of the degree scale, and the rod must be parallel with the back of the case. When plumb secure the lower end of the case firmly to the wall. If the wall is of brick or stone it is best to drill large holes and drive in wooden plugs, into which the screws may be driven through the back of the case.

. . DIRECTIONS . .

For Regulating Sub Master Clock

Before connecting the clock to the line it must be run until it is well regulated; and also to learn if the contacts are working correctly. Regulate at first by the nut at the bottom of the rod until it runs about one second slow in twenty-four hours (a full turn of the nut will change the rate about one-half minute per day.) We send with each clock a set of weights, the largest weighing one gramme, the next in size five and the smallest two decagrammes; these weights are to make the fine regulations by placing one or more of them on the little table that is fastened about the middle of the rod. The five decagramme weight will make the clock gain about one second per day, and the other weights in proportion. Care must be taken not to disturb the swing of the pendulum, as a change of the arc changes the rate.

To start the clock after it is regulated, stop it, with the second hand on the fiftieth second; move the hands forward to the hour at which the signal comes from the Observatory; then press the minute hand back gently until it is stopped by the extension on the hour contact, and beat the clock up to the hour. This ensures the hour contact being in position to send the synchronizing signal.

A good way to start it with Observatory time is (with all the hands pointing to the "signal" hour); hold the pendulum to one side, and when the signal comes let it go. With a little practice it can be started very nearly correct.

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CALENDAR CLOCKS

Directions. There will be three cells of battery sent with these clocks, and after the clock is secured to the wall as per Directions (page 2), connect the two *white wires* to the extra cell.

To prevent damage in transportation, the calendar movement is removed from its position on the door of the clock case and placed in a compartment at one end of packing case.

Open the package carefully and stand the calendar movement in the bottom of the clock case with the change wheels at the left-hand side, where they may be seen; this also brings the movement in such position that the date card may be put in place. Connect the two wires that are on the right-hand side of the calendar movement to the two spiral binding plates on the door of the clock case.

Inside the clock case at the right is a contact key, to be used when setting the calendar.

Press the key down firmly and release it, allow the calendar movement ensuing to complete itself before repeating the operation, ***continue this operation until the month cylinder is observed to turn into the next month,*** now take the Card No. 1 and suspend it (upright) to the two wire arms (resting in front) by inserting the ends of the arms into two holes found bored in the ends of the card (taking care not to strain the wires out of shape), so that the card will hang upright and against the brass guard, facing out.

See that the card hangs in easy yet firm suspension. Now close the key again, and when the next wire has come to rest, hang upon it Card No. 2. Continue this process until all the cards are hung, taking care to hang Nos. 6, 8 and 9 right side up, that is, so that the numbers on their reverse side are *wrong* side up.

Now run the calendar as before, until the number 26 faces front.

It will be noticed that this last operation has brought into an easy place for inspection the large toothed wheel on the left side of the calendar.

To simplify instructions we will call this large wheel No. 1.

The disc upon it with letters for the months, No. 2.

The smaller disc with four figures and four small arms, No. 3.

Wheel No. 2 is the month wheel, and will be numbered or lettered as follows:

J	January	1	L	July	7
F	February	2	A	August	8
R	March	3	S	September	9
P	April	4	O	October	10
M	May	5	N	November	11
U	June	6	Pin sleeve	December	12

Wheel No. 3 (the leap-year wheel) changes automatically in July of each year, being six months ahead of time, so to speak.

It is numbered 1, 2, 3, 4, Figure 4 is for leap year, Figure 1, the first; 2 the second, and 3 the third year after leap year.

To adjust these wheels: With 23 still in front, turn the month wheel No. 2 until the J (for January) is against the hollow below the blank tooth on wheel No. 1.

It setting for leap year, turn wheel No. 3 so that figure 4 is against the arrow mark. If setting for first year after leap year let figure 1 face the arrow. If setting for second year after leap year let figure 2 face the arrow. If setting for third year after leap year let figure 3 face the arrow.

Now turn wheel No. 2 by hand until the initial for the month preceding the month in which calendar is to run is opposite the hollow below blank tooth on wheel No. 1. (The wheel No. 3 will adjust itself, so do not disturb it.) Rotate the clock hands forward always until, in passing 12, the clock starts the calendar.

Hang the calendar movement in position on the door of the clock case.

Now by means of contact key run the calendar until the month cylinder is observed to turn, and run up the date required. Turn the month cylinder by hand to the proper month. Turn the day cylinder to proper day. The clock may now be set for any a. m. hour. If setting in p. m. hour rotate the hands (forward always) until 12 o'clock is passed then start clock and set to proper time.

Wind the Calendar

Calendars not in the same case with the clock, must be taken from their case to be adjusted; place them as near the clock as convenient, and use a pair of temporary wires, or you can use a single cell of battery, touching the binding plate by hand.
When adjusted, return the movement to the case.

. . DIRECTIONS . .

For Packing Clocks for Shipment

Never put the battery inside of the clock, but wrap it up in paper and excelsior, and pack it in the box at the head of the clock. Block down the pendulum ball as when received.

Never leave the pendulum in the clock loose. If the blocks are lost, then take the pendulum out of the clock, wrap it in an abundance of paper and slip it in beside the case.

Put a little straw or excelsior in the bottom of packing case before putting the clock in it, then crowd in wads of paper and excelsior at the four corners.

Remove broken glass, if any, and put loose ornaments and keys inside the packing case.

Place strips at top and bottom of the door to hold the clock in packing case, nailing through the sides of the packing case into the ends of the strips. Place thick pads of paper and excelsior under the strips at the edge of the clock, press strips down while nailing in, so the door cannot open.

Calendar Clocks

Disconnect the wires and take out the calendar movement.

Remove the date cards and wrap them in paper.

Roll the movement in an abundance of soft paper. Pack it in the separate compartment provided for it in the packing case. If you do not have the regular packing case, use another small box for the calendar and place it in the packing case with the clock. Never ship the calendar on the door of the clock.

Pack the clock as per directions for packing clocks.

. . . DIAGRAM . . .

Of connections for placing clocks in local circuit in despatcher's office to be synchronized by time signal

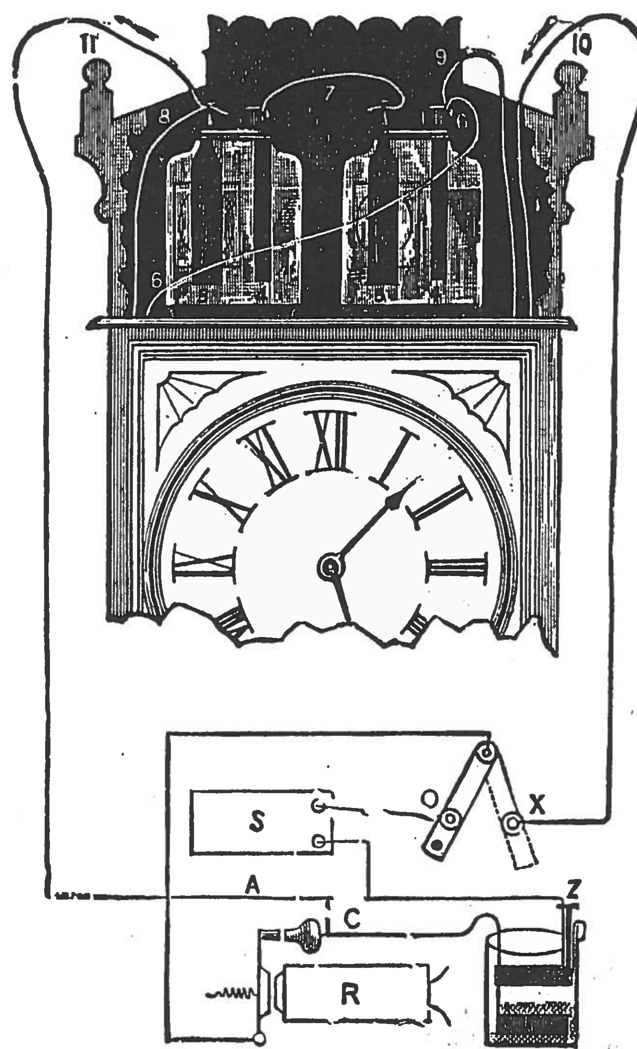

FIG. 8.

The clock is to be hung and regulated as per "Directions for hanging Clock," and connected with the Morse set according to diagram. When the switch is on point O the Morse set is in circuit to receive the seconds beats from Washington.

During the last pause before the hour, the switch must be thrown to the point X, which puts the clock in circuit to be synchronized by the meridian signal from Washington. The clock is usually synchronized by a local battery, and must be connected as per diagram, Fig. 8. Add another cell to the clock battery, using two for winding and three for synchronizing.

Description of

Style "C" Vibrating Motor Movement

The hourly contact for winding is the same as in the clock with the three-magnet motor. The vibrating motor is made with a single magnet and a vibrating armature. The mainspring is wound by the forward and backward motion of the armature, one end of the connecting rod 8 being attached to the lug of armature 2, and the other to the winding lever 10. As the winding lever is moved up and down the pawl 9 turns the ratch wheel 11, and a pinion on the ratch wheel arbor turns the spring barrel until the winding is completed.

Contact for operating the motor is made by the spring 3 which is attached to the insulated stud 4 and the platinum pin 5. As the armature moves forward the break pin A lifts the contact spring 3, breaking the circuit. The acquired momentum carries the armature forward until it strikes the upper banking 6, when it returns rapidly to its original position, by which time contact is again made and the vibration is repeated until the clock is fully wound and the circuit broken at the centre winding contact.

Adjustment of Armature

When the armature rests on the lower banking spring 7 its front edge must lap one-sixteenth of an inch on the core of the magnet. The upper banking 6 must be adjusted so that the front edge of the armature will be one-sixteenth of an inch from the corner of the core when it touches the spring.

Adjustment of Contact

When the contact spring 3 rests on the platinum pin 5 it should point to the centre of the magnet core, with the platinum pin at the middle of the platinum piece on the spring.

To adjust the tension of the contact spring take hold of the point with a light pair of tweezers and pull it gently forward, letting it drop under the pin. It should take the position shown by the dotted line, the top of the spring being one-thirty-second of an inch below the pin. If from any cause it has been put out of adjustment it can be corrected by carefully bending with the tweezers, or if necessary the nuts 4 may be loosened, the spring put in place and the nuts set down tight.

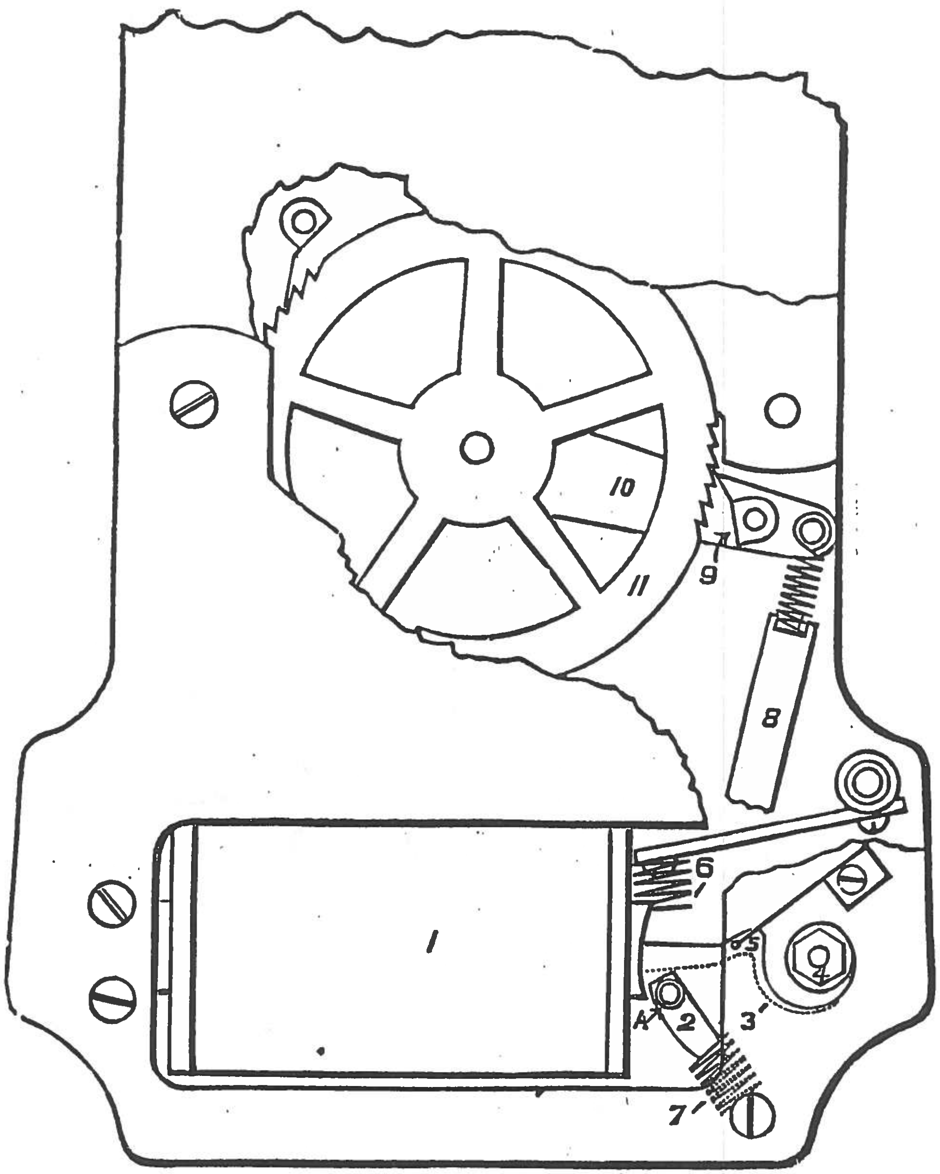

Fig. 9

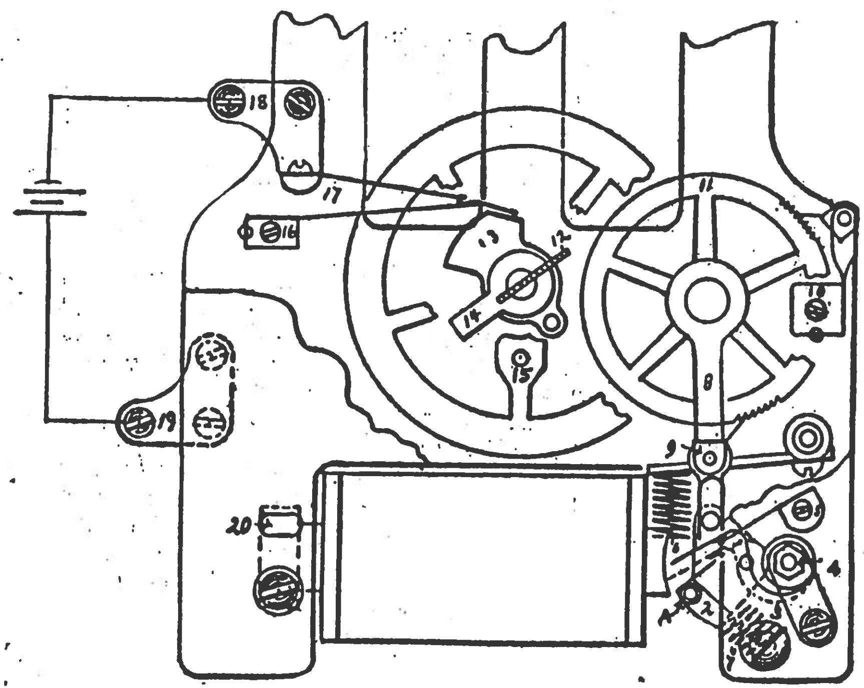

Fig. 10

Description of

Style "F" Vibrating Motor Movement

The Movement. This differs materially from our other styles. Referring to Fig. 10, it will be seen that train and motor winding mechanism are combined in one set of plates. The motor is of the oscillating type and its construction is such that all its parts may be removed without dissembling the clock train.

Construction of Motor. The construction of motor is very simple, having only one pair of magnets, but *two sets* of make and break contacts, one set of which is placed on front and the other on back plate of movement, thus ensuring a more reliable operation of the motor, and reducing by 50 per cent. the possibility of its failing to wind.

The centre winding contact also differs from those used in our three-magnet motors and former styles of vibrating motor movements. The centre winding contact piece (13) has no ivory and no platinum. The hourly circuit is not closed by the current passing through this piece, but merely acts in bringing the plate contact spring (16) in metallic connection with centre winding contact spring (17). It will thus be seen that no accumulation of dirt or gum around the centre arbor or the train pivots will have any effect in preventing the current passing from the motor to the hourly circuit closer.

Description of Operation. The operation is as follows: As the train revolves, pin (12) securely fastened to the centre arbor in its hourly revolution engages a pin on centre winding contact piece (13). This piece as it revolves pushes plate contact spring (16) upward, bringing it in metallic connection with centre winding contact spring (17), which is fastened to a stud on insulated binding post (18), thereby closing the hourly circuit. The current passes from binding post (18) through the battery (or any other source of current supply) to binding post (19), to which is connected one end of the motor magnet. The current passes through this magnet to insulated stud (4). To this stud the spiral contact spring (8) is fastened and the current passes from this spring to plate contact spring (5), thence through the movement frame to plate contact spring (16), and from there through spring (17) back to the battery.

The spring is wound by the forward and backward motion of the armature (2). To this armature is connected winding lever (8). As the winding lever is oscillated the pawl (9) turns ratchet wheel (11) and a pinion on the ratchet wheel arbor turns the winding wheel until pin (15) connected to it engages knockaway piece (14), revolving it until it strikes pin on centre winding contact piece (13) and pushes it from under the plate contact spring, thereby breaking the electric circuit and completing the hourly winding.

Adjustment of Hourly Circuit Closer

The position of the contact springs is clearly indicated in Fig. 10. The spring (16) should always assume the position shown thereon. When centre winding contact piece (13) comes in metallic connection with plate contact spring (16) the end of this spring should stand about one-thirty-second of an inch from the edge of the incline. The centre winding contact spring (17) should always clear plate contact spring one-thirty-second of an inch. When the two springs touch they should be perfectly parallel to each other.

Adjustment of Armature

When the armature (2) rests on banking spring (7) its front edge should be in line with the edge of the magnet core. The upper banking spring (6) must be adjusted so that the front edge of armature will be one-sixteenth of an inch from the corner of the magnet core when it touches the spring.

Adjustment of Motor Contacts

When contact spring (3) rests on the platinum pin (5) it should point to about the centre of the magnet core, with the platinum pin at the middle of the platinum piece of spring.

To adjust the tension of the spiral contact spring (3) take hold of the point with a light pair of tweezers and pull it gently forward, letting it drop under the pin. It should take the position shown by the dotted line, the top of the spring being about one-sixty-fourth of an inch below the platinum pin. If from any cause it has been put out of adjustment it can be corrected by carefully bending with the tweezers, or the nut (4) may be loosened and the spring removed. It may then be bent in its proper shape and replaced.

The hole in the brass hub to which the spring is fastened has a flat side to it, fitting a flat on the insulated contact stud. If the contact spring is bent to the right position it may be taken off and put back at any time without changing the adjustment, or a defective spring may readily be replaced with a new one. When the armature touches the upper banking spring the spiral contact spring (3) should clear platinum pin about one-sixteenth of an inch. Both contacts on front and back plates are adjusted alike. The circuit break pins "A" on armature should raise both spiral contact springs at the same instant. If for any reason the motor magnets have become displaced they may readily be adjusted by loosening the four yoke screws holding them to the movement plates. Hold the armature against the upper banking spring, move the magnets forward in the elongated slot (20) until the end of the magnet cores clear armature by one-sixty-fourth of an inch, then tighten down the four yoke screws. Connect motor to battery and see that the armature has a steady vibration and does not touch the magnet core. The adjustment should be such that the armature can swing past the magnet core one-eighth to three sixteenths of an inch before striking same.

Cleaning and Oiling Style "F" Movements.

The construction of this movement is such that nearly all parts needing periodical cleaning and oiling can be reached without dissembling it. Remove dial train, heart-shaped seconds socket and synchronizing lever, brush out all the bearings and pivot holes thoroughly with benzine, using a stiff marking brush. After applying the benzine let it soak for a minute or two, after which blow off all the benzine. Apply fresh benzine, and after another minute or two blow same off as before. This will force all the old oil and gum out of the holes on to the plates.

Take a piece of cheese cloth, wrap it around a small piece of flat wood and clean the dirty benzine and old oil from the plates and arbors. Then apply fresh oil to all the pivots and bearings. Replace the dial train, heart-shaped seconds socket and synchronizing lever, and see that motor and centre winding contact springs are clean and free from benzine or old oil.

If for any reason the movement must be taken apart do not start the screws in the back plate. Remove front plate only. When taking out centre arbor be careful the centre winding contact and knockaway pieces do not drop off the arbor. If they do, put them back with one and a half or two turns taken up on mainspring.

16

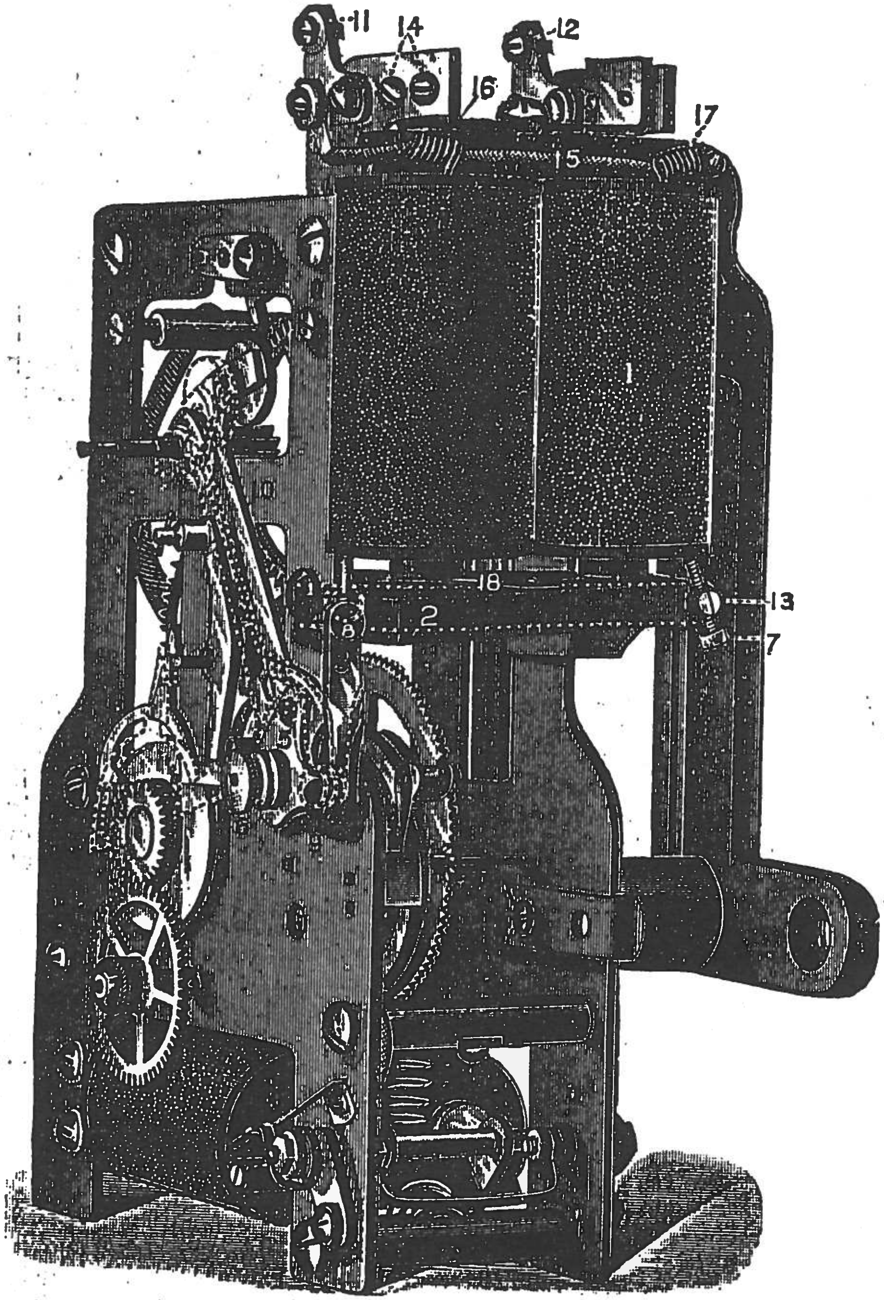

Fig. 11

Description of

Synchronizer on Style "F" Movement

In referring to Fig. 11 it will be seen that the synchronizing lever (10), heart-shaped seconds socket and cam on cannon socket are the same as in our older style movements. The difference is in the synchronizing magnets and the way they operate the synchronizing lever. The magnet (1) has a flat-ended core instead of being eccentric like our former ones. The armature (2) is also made of flat iron pivoted to a stud (13) fastened to synchronizing frame. The armature (2) is connected to the synchronizing lever (10) by a connecting rod (3) and the Pitman screws (8) and (9). Sector (5) has an oblong slot allowing the armature to be lowered or raised one-sixteenth of an inch. The synchronizing lever is placed on a steel stud (6) fastened to the front plate and held in position by a brass nut. The synchronizing magnets are fastened to yoke (4). This yoke is screwed to the synchronizing frame by four iron screws (14). The holes in synchronizing frame are made oblong, allowing the yoke and magnets to be raised or lowered one-sixteenth of an inch. The spring (18) on top of armature is used to throw it back quickly and also acts as a diamagnetic preventing armature from freezing to magnets. The screw (7) in stud (13) is used to screw up against magnet head, preventing any spring that might take place on armature stud (13). Binding posts (11) and (12) are screwed to synchronizing frame and the ends of the magnet coils are fastened thereto with metal clips.

The blue wires in clock case are coiled and have a metal clip soldered to them. They connect direct by these clips to the binding posts, thus making a firm connection and are not liable to oxidize. With the various points of adjustment a pair of magnets burned out or otherwise defective may readily be replaced in from five to ten minutes.

When replacing a pair of synchronizing magnets proceed as follows: Remove the old pair and then loosen all four screws in yoke (4), pushing same up against the top of oblong holes, then tighten down lightly. Fasten the new pair of magnets to yoke (4) with the inner ends (15) of the coils showing front. Press armature upward until synchronizing lever locks tightly on cans non socket and heart-shape cams, then loosen yoke screws (14), and press magnets down on spring (18) on top of the armature. Then tighten yoke screw on front plate and see that the back magnet clears armature by one-hundredth of an inch, when screws in back of yoke (4) can be set down firmly. The adjustment screw (7) may then be turned up until it presses lightly against magnet head. When current is passed through the magnets and held there the armature must clear the magnets without touching. Wire coils (16) and (17) must then be connected to their respective binding posts by slipping the metal clips soldered to them under the rubber bushing making metallic connection with the binding plates. Fasten screws down tight to insure good connections.

From the above description it will readily be seen that the synchronizing magnets do not need a file's stroke in fitting them. The magnets for this movement will always be shipped with the metal clips soldered to the wire coils.

WHEN EXCHANGING MOVEMENTS do not remove old bracket from clock case, as this movement will also fit the old style bracket. Fasten movement to the bracket with THREE screws only and omit the brass clamp such as is used on the "F" movement bracket.

WHEN ORDERING MATERIAL for this movement always mention STYLE "F."

1989 NATIONAL NAWCC CONVENTION JUNE 21-24 BUFFALO, NEW YORK

RUSS OECHSLE

220 East Lake Road, DeRuyter NY 13052

1989 NATIONAL CONVENTION - NEW YORK STATE CLOCK DISPLAY

The 1989 Buffalo National will feature a display on New York State Clocks. We need the participation of our NYS NAWCC members to allow us to have the widest and most complete variety of clocks. We urge you to assist us in this endeavor. The exhibit will be held in a large, well-lit room with 24-hour security. The exhibit opens at 10:00 a.m. on Thursday, June 22, 1989, and closes at 2:30 p.m. on Saturday, June 24, 1989.

Any EHS member attending the upcoming National Convention, TAKE NOTE...

Help by improving the variety of clocks to be displayed, and maintaining interest in Electro-mechanicals.

HELPFUL HINTS DEPARTMENT

When attempting to remove the enamel insulation from a coil lead, try this instead of emery or sandpaper. Use a product called "Strip-Ease" manufactured by GC and sold in Electronic Supply Houses. It's a thick liquid that's placed on the wire lead with a small brush, left for a few moments, and wiped off. Works like a charm! If unable to locate this item, paint remover will also do the job.

MS

---- MART ----

WANTED: Information about the MONARCH Master Clock made in Chicago, Illinois. Any information would be appreciated. Bill Ellison, 1635 Ford Court, Grosse Pointe Woods, Michigan 48236. Call (313) 881-2906

FOR SALE: KUNDO Replacement Coils, $25.00 each, postpaid. Also available, other clock movements, dials, parts, etc. NO lists. Leon O'Briant, 3516 Swift Drive, Raleigh, NC 27606. Call (919) 851-1706

FOR SALE: Large collection of SELF WINDING CLOCK CO. clocks, cases, movements, dials and parts. 30 year collection! Walter Spetrino, 1214 Cleveland Hts Blvd., Cleveland Hts., Ohio 44121. (216) 381-1197

WANTED: Information on the WARREN (TELECHRON) Clock Co., and in particular, Master Clocks. If you have clocks or information, please write to John M. Anderson, 17 Cedar Lane, Scotia, NY 12302.

WANTED: SYNCHRONOME CLOCK, Running condition or restorable, No junkers please. Quote price and include photo which will be returned. ELMER CRUM, 8510 Harms Rd., Skokie, Illinois 60077, (312)965-0188

WANTED: Literature regarding Repair & Maintenance of INTERNATIONAL TIME RECORDING CO. Master Clock. Irwin A. Pogue, 212 N. William Dr., Chillicothe, IL 61523

FOR SALE: Thinning Collection; S.T. #2 Tower Clock, Wt Driven Electrically Rewound, $1300. HOWARD #89, Electric Master with Tape Program, Limed Oak, $950. STANDARD ELECTRIC Master, Disc Program, Oak, $650. AMERICAN EVEREADY Wall Clock, Oak, $450. AEG ELECTRIC Wall Clock, Oak, $400. SELF WINDING GALLERY w/13" Dial, $175. ANSONIA STD ANT., Cherry, $6500. Also 3- WW LATHES; $75, $50, $50. Pix $1 each w/SASE. No Shipping. Harvey Schmidt, 49-20 108th St., Corona, NY 11368, 718-969-0847(eve)
718-592-7711(days)

INFORMATION FOR FUTURE JOURNAL ARTICLES, Requested by EHS members;

Warren early mystery clock with mercury switch.
Tiffany DOUBLE contact model.
Kennedy Electric Clock Co. (1867-69)

Information on these or other subjects of interest to the membership should be sent to the attention of the editor;
Harvey Schmidt; 75-80 179th Street, Flushing, NY 11366

---- MART ----

All Mart ads are FREE... Send copy to the attention of the editor;
Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366

WANTED:

Information about the ELECTRO CLOCK CO., of Baltimore, MD. A.H. Redfield, 21 Kentbury Way, Bethesda, MD 20814, (301) 656-5562

Hamilton 500 & 505 watches, catalogs, repair info. Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366

Information on early Self-Winding Clocks, Long-Case, Wall clocks with one or two weights. Interested in research or purchase. Jack L. Clemes, 704 G Street, Crescent City, CA 95531.

Information, pictures, ad materials, for WALTHAM ELECTRIC CLOCK CO. wall clock having 90 beat pendulum and 10" dial without seconds bit.
Anthony Prasil, 2179 titus Avenue, Rochester, NY 14622

Junker early battery clocks, movements, parts, etc. Send details along with $ wanted.
Martin C. Feldman, 6 Stewart Place, Spring Valley, NY 10977

Unusual Electric Clocks
A. Marx, 105 Bayeau Rd., New Rochelle, NY 10804

Remote Dials, Movements, Magnets or Entire Magneto for MAGNETA CLOCK. Write or phone;
Elmer Crum, 8510 Harms Rd., Skokie, IL 60077, 312-965-0188

SYNCHRONOME, or any Hope-Jones equipment or literature.
John Cammarata, 45 Murray Hill Terrace,
Marlboro, NJ 07746 (201) 972-7863

Horological literature, catalogs, anything of interest for future Journal issues.
Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366

FOR SALE:

Poole, Barr, Bulle, Self-Winding mantle clocks. All in restored running condition. call days, toll-free 800-221-0424
Martin Swetsky, 1910 Coney Island Ave., Brooklyn, NY 11230

REPAIRS:

All early battery clocks including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. Specializing in BULLE CLOCK REPAIRS using original parts. (One month maximum time for all repairs)
Martin C. Feldman, 6 Stewart Pl., Spring Valley, NY 10977

**** DUES PAYMENTS MAY BE MADE TO HARVEY SCHMIDT ****
75-80 179th Street, Flushing, NY 11366

The
JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY
Chapter No 78
NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.

VOLUME XV, #3, SEPT. 1989

Fellow Horologists:

This issue will probably prove to be one of the most valuable and useful in spite of the fact that it doesn't contain any technical or historical information! It is devoted entirely to a master index of all material published in the Journals of the Electrical Horology Society and the earlier Newsletters during its 17 year history. The entries include references to articles published as late as April 1989, and will be updated on an annual basis to retain a current status.

A debt of gratitude is due Martin C. Feldman, FNAWCC, the father of EHS #78, without whom we would not have become an NAWCC chapter. Marty worked tirelessly for 15 years as President and Editor of the chapter, and is responsible for the index that covered the first 10 years of publications. Bill Ellison, a newly created Fellow of NAWCC (and well deserved, too) followed up on Marty's work with his updated computerized version, designed for easy introduction of new material. His work follows, along with an explanation of the method used for referencing the material. Dr. George Feinstein, our chapter historian, assisted by proof-reading Bill's material prior to its completion, and has volunteered to supply copies of selected articles and journals at nominal (break-even) cost. It is anticipated that a 25¢ per page, or $3.00 per journal charge will cover the copying cost plus postage of 25¢ for each 5 pages, or 75¢ per journal issue. Please note that this is NOT an invitation to request all previous back-issues, but an attempt to provide material of special interest to members who do not have access to the previously published journals.

This journal issue is an invaluable reference... preserve it and use it often. Nothing else exists that offers so much in the field of Electrical Horology, and this is available ONLY to EHS #78 members!

Dues payments, correspondance, and requests for early journal information should be directed to the chapter Secretary-Treasurer & Co-Editor, Harvey Schmidt at 75-80 179th Street, Flushing, NY 11366.

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

The
JOURNAL
OF THE
ELECTRICAL HOROLOGY
SOCIETY
Chapter No 78

INDEX OF THE JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Introduction

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

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

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

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

For those who have back issues of the Journal available, two issues need to be dated in order to bring them into agreement with this Index. The first is the issue which was mailed out during the first part of 1987 and has no date nor volume identification. The first page of this issue begins as follows:

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

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

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

This Index is based on earlier indexes of "The Journal of the ELectrical Horology Society" prepared by Marty Feldman, the original editor of the Journal for 15 years.
Particular thanks are extended to Marty for all his efforts on behalf of electrical horology.

Bill Ellison July 1989

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--- MART ---

Please note: MART ADS ARE FREE, Send to attention of the Editor; HARVEY SCHMIDT, 75-80 179th St., Flushing, NY 11366

Some of the older ads have been eliminated. If repeat insertion is desired, please advise and they will appear in the next issue. Thanks for your cooperatio

REQUESTS: FUTURE ARTICLE MATERIAL; Warren "C" Mystery Clock Information, Kennedy Electric Clock Co., Tiffany DOUBLE Contact models.

The
JOURNAL
OF THE
ELECTRICAL HOROLOGY SOCIETY
Chapter No 78
NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.

VOLUME XV, #4 1989

Fellow Horologists:

This issue completes the publishing schedule for 1989, and now that we approach the year end, we reflect on our shortcomings and accomplishments, and consider the overall balance.

On the positive side, we've updated the index of all previously printed journals, we've increased our membership to a bit over 90 at present, and included in the journals, a wealth of new material with historical and technical interest, and of sufficient variety to provide a measure of interest to most of us.

On the debit side of the ledger, we find ourselves marginally getting by from one journal issue to the next with a continuing need for new material. Help by sending in those magazine articles, cartoons, or helpful hints... anything that may be of interest to our readership.

This issue contains an original article by one of our members, Dr. Wm F. Baker, reprinted from Broadcast Engineering Magazine, some additional material on Standard Electric on Cleaning, Oiling, Adjustment, and Hook-up, provided by Jeffrey R. Wood, a non-member of EHS, but an Answer Box Contributor who kindly offered this to us, and the first part of a catalog reprint covering the Hansen Clock & Signal Systems, supplied by David Lee.

Your Editorial team wishes to acknowledge the contributions of a few members whose efforts have contributed substantially to the journal production; Bill Ellison for his masterful job on the updated index, and Dave Lee, Marty Feldman, Steve Berger, and Leon O'Briant, among others for their frequent material offerings without which we'd have a very meager publication.

Let us all be thankful for the bounties bestowed upon us during this year and in this time of Holiday Joy and Pleasure, wish each other, Good Times, Good Health, and Good Friends.

A final note... 1990 Dues now due... please remit to our Sec'y-Treas., Harvey Schmidt at 75-80 179th St., Flushing, NY 11366. ($10 please)

Martin Swetsky, FNAWCC, President
Harvey Schmidt) Co-Editors

Timing is everything

By William F. Baker, Ph.D.

Does anybody really know what time it is?

An abiding interest of the author is precise time and timekeeping. Perhaps it stems from the many long hours spent at radio stations as a technician, backtiming records or meeting network cues. I vividly recall watching the huge Western Union clock on the wall as it strained to meet its pre-ordained hourly time sync with the Naval Observatory. Often, those old electromechanical clocks would drift seconds off time, creating real production problems for the people at the controls.

Those old clocks appeared at broadcast stations in 1935. They were connected to a master clock at the local Western Union office by telegraph lines feeding the hourly correcting pulse. Western Union ceased its clock operations on Dec. 31, 1973, principally because of the availability of lower-cost, reliable clocks synchronized to the 60Hz local power grid. Also, WWV, the National Bureau of Standards station, was providing precise time — coordinated to astronomical standards in the earlier years, and later to the current atomic standard.

Nevertheless, keeping accurate time at broadcast stations has continued to be a headache in an industry that measures its income in seconds sold. With the reliance on network/station synchronization and increased automation in the master-control area, the tiny station master clock remains the electronic "heart" of the station. Many broadcasters still are close to

Baker is president of WNET-TV, New York

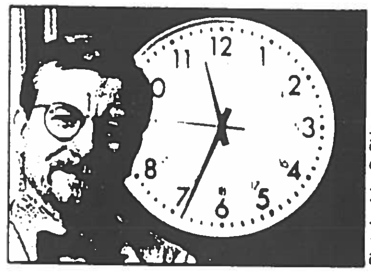


Photo by John C. Chiasson

the old Western Union days of clock operation, tuning in WWV on scratchy short-wave radios (unreliable in urban areas at certain times of the day). Others, although somewhat more sophisticated in appearance, have their clocks interfaced to a WWV receiver and are subject to all the attendant reception problems, remote antennas and other sources of grief.

A new advancement in horology, the science of timekeeping, is the use of a clock that contacts a master time source directly. It uses the reliable telephone network and measures time path delays in that network to assure local accuracy.

Telephone-based time dissemination

Telephone-based time-dissemination systems skirt the problems of radio-based systems. Time-dissemination networks employing standard asynchronous telecommunications signals (Bell 103-compatible at 300 baud) already are in place or are being implemented across the country. They use a public-domain protocol to transmit date and time information, and to measure the loop delay of the telephone link. This protocol, using ASCII characters, transmitted by shift-keying techniques, is designed for the transfer of correct time from a master to a submaster or slave clock. The submaster then can pass on this correct time to other clocks in a hierarchical system. Three hundred baud, although considered plodding to some, can travel through most phone systems. Because the average connect time to receive a time update is about 30s, little would be gained by going faster.

The originating, or in-house, clock calls the master clock, located in a precise time laboratory. The local clock emanates tones with frequencies of 1,070Hz and 1,270Hz. After a fixed delay, the master "echoes back" with tones of frequencies 2,025Hz and 2,225Hz. A software comparator in the originating clock looks at the information received to determine whether it falls within an acceptable window of time (see Figure 1).

If the information is valid, the clock accepts it and calculates the loop delay of the telephone line. The clock then requests a time or date feed. The master responds by sending a short string containing either "year-month-day" (such as 880203) or "hour-minute-second" once each second for three seconds. In the case of the date signal, the three strings are compared to test for transmission errors. In the case of the time signal, the string is loaded into the transmitting computer, and the carriage return occurs precisely on the second. The three words are compared to see whether the seconds are incrementing properly, and the carriage return's time of arrival is offset by the calculated delay of the line (from the echo signal) to synchronize the local clock with the master.

Try, try again

If the information falls outside the acceptable window of time, it is rejected by the originating clock, which can automatically redial the master unit. One manufacturer's equipment redials up to seven times, randomly, in a 1-hour period.

Calls aborted for other reasons, such as busy signals or poor connections, will initiate the same redialing sequence. If the originating clock fails to make contact with the master after multiple attempts, some prompt to the operator is issued. Typically, the front panel will flash, indicating that the clock has not been able to update its time information.

In some cases, the in-house master clock system can be programmed not to accept incoming calls. This obviates the need for a dedicated telephone line for the clock system and allows it to use shared lines, decreasing costs.

Some systems also include a password-protected "system mode" wherein a precise time laboratory can telephone a remote system and command it to have leap seconds or standard/daylight saving-time changes armed to occur at a particular time. This type of system mode normally allows full remote control of the in-house clock system, including time adjustments with millisecond resolution, and adjustments to its telephoning program.

Delay reciprocity

For any system attempting accurate time dissemination by telephone, a major concern is the reciprocity of telephone line delay. It is easy to measure the loop delay; it is the sum of the two line delays. If you could assume reciprocity, that is both of the line delays being equal, you could readily deduce from the loop delay the line delay from the master clock to the slave clock.

Strictly speaking, reciprocity is not always present. For short distances, telephone companies use "2-wire" connections, but for longer distances they generally will use a "4-wire" connection — a separate voice channel operating in

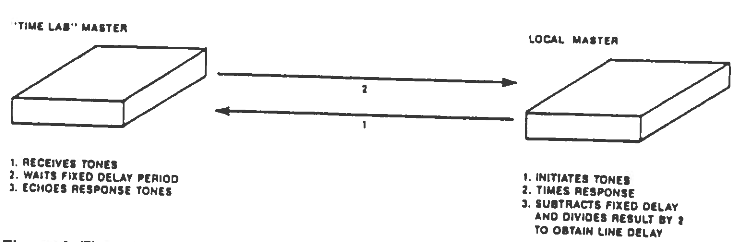


Figure 1. The delay of the telephone system can be calculated and compensated for by sending a test tone and monitoring the return tone. Algorithms can detect asymmetries in the transmit/receive loop.

each direction. Some degree of nonreciprocity also will be introduced by any dispersion (such as variation in group velocity with audio frequency), but because this dispersion degrades speech clarity, it is quite well-controlled by the telephone companies.

Experiments conducted by the National Research Council (NRC) of Canada about 10 years ago showed that the loop delay could be measured and corrected to permit millisecond accuracy in time transfer. Even in extreme cases, this type of time-dissemination system easily obtained accuracy within milliseconds, whether public access or leased lines were used. (See Figures 2 through 5.)

The latest generation of telephone-based time-dissemination systems appears to be capable of detecting cases of nonreciprocity, hence avoiding the associated problems. The worst possible situation for reciprocity is where there is a satellite link one way (approximately 0.25s delay), and a ground link the other way (with an uncertain line delay of tens of milliseconds). This condition occurs rarely and randomly on repeated calls between the same two points, and because it is identified easily by a range of loop delay times not otherwise encountered (approximately 200ms to 300ms), it is possible to consider any such call to be a failure, and to abort it.

Broadcast operation and applications

The present technology for telephone-based time-dissemination systems uses an ovenized crystal oscillator as its time base reference. This type of crystal oscillator may be used free-running for stand-alone operation or may be locked to an external 5MHz or 10MHz reference from a cesium or rubidium standard. The oscillator has a stability of ±3ms per day, based upon a unit starting out at 0°C and going up to 50°C. Because this situation does not normally occur in practice, the master oscillator is actually quite stable and does not require frequent telephone updates. Telephone calls can be programmed for any time of day, and at any date interval, as specified by the owner of the unit.

Some systems output time information in up to four different formats. Three of these formats (SMPTE time code, RS-232 and BCD — both serial and parallel time) already have proved their value in broadcast facilities. With these formats, the master-clock system can communicate with such external devices as computers, machine automation systems, automated radio stations and remote-production vans and trucks.

The fourth format, a 5MHz sine wave, is directly related to the crystal time base. twice a year.

This new telephone-based time-dissemination technology makes it convenient and economical to reliably maintain time accuracy within milliseconds. Precision timekeeping equipment at broadcast stations has come a long way from those Western Union electromechanical slaves to the present-day systems. In many ways, the modern version maintains the spirit of the old system, but it takes advantage of the latest electronic circuits and some reliable networking provided by telephone circuits to keep us all together and on time.

This output signal can be used as the master oscillator for a high-quality master sync generator system in any TV studio. With the aid of this output, sync pulse generation, video time code and real time can be directly related to one another to form a cohesive video system.

Advantages of telephone-based time dissemination

The new generation of master clocks is available in desk-, wall- and rack-mount analog and digital models. As an added bonus, you may not even have to change over your entire existing clock system. Some systems are capable of directly driving the existing impulse clocks in a building that has been so equipped. For these older building clock systems, the hands of each clock face must initially be set manually, but thereafter, the time would be controlled by the new clock-driver system. Leap seconds can be corrected for quickly, and changes back and forth from standard to daylight-saving time can be completed within an hour, eliminating the tedious and time-consuming chore of resetting all the clocks manually

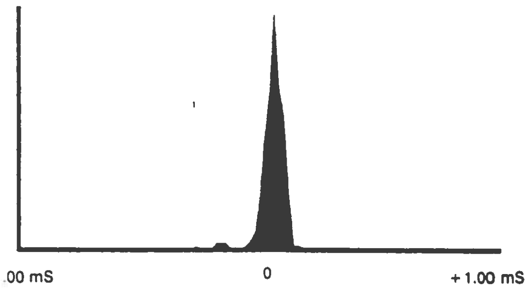


Figure 2. Histogram showing the precision of one slave clock setting its time from a remote master clock. Five hundred calls were made for each histogram. This one shows calls from the NRC time laboratory to NRC time laboratory (σ = 34µs).

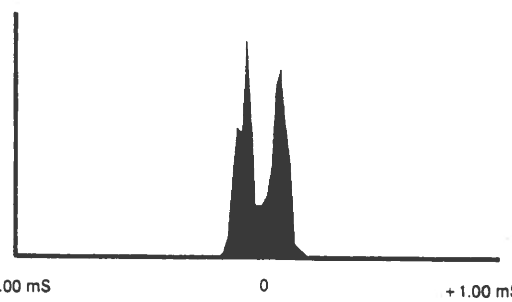


Figure 3. Calls from NRC time laboratory to a station 15km away (σ = 45µs).

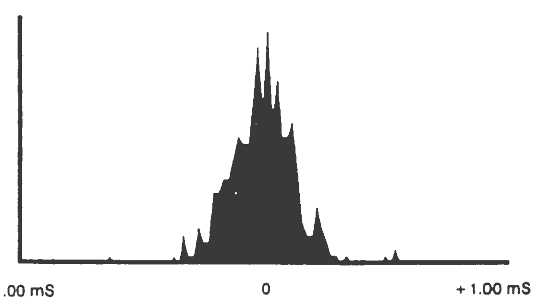


Figure 4. Calls from NRC time laboratory to a station 350km away by leased line (σ = 135µs).

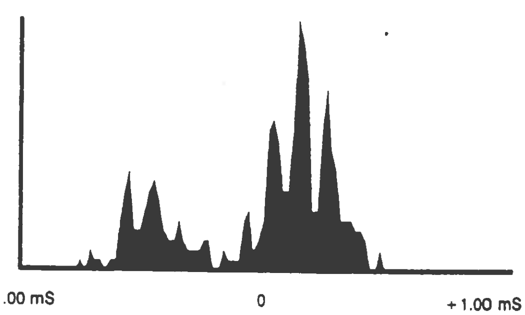


Figure 5. Calls from NRC time laboratory to a station 350km away by public access lines (σ=307µs).

The Standard Electric Time Co.

Springfield

ATTN.: ALL SALES AND FIELD TECHNICIANS

July 1, 1960

SUBJECT: INSTRUCTIONS FOR
CLEANING AND OILING 60 BEAT MASTER CLOCK MOVEMENTS

TI-1169

(NOTE: Refer to Figs. 6568-C and 6569-C.)

A. DISASSEMBLY.

1. Remove hands and dial. To remove the minute hand unscrew small thumb nut in front of hand, after which hand can be taken off. The hour hand and second hand are held in place by the friction of the sleeves on which they are mounted; to remove either hand, pull forward and twist back and forth and the hand will come off. Do not take hold of the hands near the ends as this would bend them.

2. Note positions of wires connected to movement before disconnecting. When not familiar with connections it is advisable to tag the wires and points of connection for identification when movement is replaced. Where wire curls are used, disconnect at connectors on back or top (inside) of case.

3. Remove four pins which hold movement to back frame and remove movement from case.

4. Remove thumb nut which holds gears on front of movement and remove gears and friction spring, noting the order in which they are assembled. This group of gears is known as the dial works.

5. Release tension on driving spring by turning ratchet wheel (H) forward with the right hand, and when tension is off pawls (E) and (J) raise pawls free of wheel and allow the wheel to turn back slowly until pin on ratchet wheel comes to rest on pin located on main driving wheel.

6. Where movement is equipped with magnet connector (A-2), be sure to disconnect the magnet wire which is connected to connector (A-2) on front plate.

7. Remove the four large screws that hold the front plate to the four pillar posts (Z-1). Remove the two smaller screws that hold the front plate to the magnet bridge (A-1). Note: It is not necessary to remove any more screws than the above six in the remaining operations of cleaning and oiling.

8. Hold movement in left hand with plates horizontal, and remove front plate; after which remove the various staffs (shafts), beginning at the top of the movement with the verge staff and removing them in the order of their position.

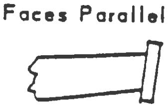
B. CLEANING.

1. Clean the parts, except magnet, thoroughly with standard safety solvent, using a brush except in pivot holes, and in these a piece of pointed pegwood or a round toothpick which will not splinter easily. Care should be used not to bend or distort springs or other flexible parts. After the parts are cleaned they should be dried with a soft brush and the use of dry, clean pegwood in pivot holes.

Faces Not Parallel

Wrong Way

Faces Parallel



Right Way

CONTACT (M)

(over)

2. Examine all contact points, and where burning or pitting has taken place points should be filed with a small, fine file until pit marks are eliminated, after which the points should be polished, preferably with a burnishing tool. When filing, shape the contact point or points to the original shape, using contact (M) as an illustration. If contacts are badly pitted, replace.

If the Program Circuit Closer (F) is burned or pitted, lower the phosphorous bronze spring on which this contact is fastened by elongating the screw hole which holds the contact spring (F) to the arm (F-2). This will cause the contact (F-1) to meet the contact (F) in a new place. A new point of contact on (F-1) can be obtained by loosening the nuts which hold it to the frame and turning it half way around, after which the nuts should be tightened again.

C. REASSEMBLING MOVEMENT.

1. Hold the back movement plate in the left hand in the same manner as when the parts were taken out, and replace the various staffs in just the reverse order to which they were taken out, starting with the winding lever (D-2), then the center staff (G-1), third wheel staff (G-2), escape wheel staff (X-1), and finally the verge staff (N-1).

2. Next the front plate can be replaced, being sure that all pivots have entered the front plate, that both winding pawl (J) and retaining pawl (E) are in proper position on the ratchet wheel (H), and the program contacts (F) and (F-1) are in proper relation to each other. Then replace the front plate screws.

3. After screws have been replaced, inspect each staff to see that it does not bind and has a little end play.

. After the movement has been assembled this far the oiling should be done.

D. OILING.

Care should be taken that the highest grade of clock oil is used in oiling the Regulator Movement.

1. Oil all pivots (N-1), (X-1), (G-2), (G-1), (D-2), pawl studs (J-2), (E-2), springs that hold pawls against the wheels (J-1), (E-1), pallets of verge (N-2) and (N-3), and kick-off spring (Z), using one small drop of standard clock oil at each point.

2. Apply 3 or 4 large drops of oil to the main spring (G).

Caution: Be careful that the oil does not run down the sides of the front and back plates. as this will cause the oil to siphon from the bearings, which will result in their running dry.

Care should be taken not to get any oil on the contacts or on the winding magnets (A).

continued page 3

E. ADJUSTMENTS.

1. MINUTE CIRCUIT CLOSER

This circuit closer is composed of two main parts: one that is mounted on the verge staff (N-1) with insulating blocks (R) and rocks with the motion of the verge (N); the other being mounted on the escape wheel staff (X-1) without insulation and revolving with the escape wheel (X). These two contacts are so proportioned and adjusted that the points (M) and (O) meet and make a wiping contact each revolution of the escape wheel (once a minute).

Before adjusting these contacts care should be taken that the oscillating contact bracket (K-1) is at right angles to the pendulum.

When these contact points meet, the arm which revolves with the escape wheel should be at right angles to the perpendicular center line of the clock movement. The proper time for the contact points (O) and (M) to meet is the exact instant the tooth of the escape wheel (Y) meets the pallet of the verge (N-2). If the points meet sooner, there is a tendency to retard the forward action of the escape wheel. If the points meet later, the duration of contact will be too short and uncertain. Contact points should meet with the center (lengthwise) of (O) meeting (M) near the top of (M) as shown in Fig. 6569-C. The pendulum has not completed its swing when the points meet, and the remainder of the swing causes point (O) to rub down the face of point (M). The points continue to rub as the pendulum swings back. The points (O) and (M) as indicated on Fig. 6568-C show the approximate position at the end of the swing of the pendulum. The minute circuit closer is located in front of the escapement.

2. WINDING CIRCUIT CLOSER.

This circuit closer is located back of the escapement; it is of the same construction and adjustment as the minute circuit closer, but is set to make contact thirty seconds later.

3. PROGRAM CIRCUIT CLOSER.

This circuit closer is composed of two parts. One (F-1) is fastened to the front movement plate but insulated from it. The point (F-1) is a short length of iridium platinum set in the end of a screw stud, and is clamped to the front plate by means of two nuts, one on either side of the plate. Mica tube and washers are used for insulation.

Contact point (F) is on a flat bronze spring which is mounted on an arm (F-2) which in turn is fastened to the winding lever staff (D-2) by means of insulating blocks (D-3).

The action of the winding lever staff once a minute causes the points (F) and (F-1) to meet, closing the program magnet circuit. (Program: Instrument for operating bells.)

The contact point (F) should be set a sufficient distance from (F-1) so that when the free action of the winding lever is taken up the two points will just meet. The free action of the winding lever is that portion of the motion that takes place before the winding pawl (E) engages the tooth of the ratchet wheel (H).

4. SIGNAL DURATION CONTACT

Points (I) and (L). Point (I) is a length of iridium platinum extending from the side of a flange (L-2) mounted on the escape wheel staff (X-1) and revolving with it.

Point (L) is two pieces of flat iridium platinum on a split bronze (flat) spring which is fastened at one end to a bracket (L-1) on the back of the front plate. The bracket is insulated from the front plate with mica bushings and washers.

The bracket should be set at such an angle that the flat contact points (L) rest in the line of travel of the contact (I) as it revolves with the escape wheel staff

The contact point (I) should be set to meet point (L) two seconds after the minute circuit closer has made contact.

Care should be used in positioning point (L) so that excessive friction is not caused. Too much friction will interfere with the free action of the escapement.

The duration of this contact is usually between three and five seconds.

The course of current through the "Minute", "Winding", and "Signal Duration" contacts is through the frame of the movement and the escape wheel staff to the various insulated portions of the contacts as the points meet. To insure good conductivity between movement frame and escape wheel staff, contact brush (V) is screwed to frame so that its point rubs gently on the staff, bridging around the oiled bearing of the staff.

5. WINDING MECHANISM

When not in action the winding lever (D) rests on stop pin (D-1) as in Fig. 6569-C. While in this position, winding pawl (E) rests with point halfway down tooth of ratchet wheel (H). The object in having the pawl such a distance below the ratchet tooth is to allow the magnet armature (B-1) to get well under way before taking up the load.

When the winding lever is actuated by the magnet it should turn the ratchet wheel a sufficient distance to allow the retaining pawl (J) to drop over one tooth and stop about one third of the length of a tooth beyond as shown in Fig. 6568-C. When magnet releases, the ratchet tooth should settle back engaging the retaining pawl while the winding lever drops back to its original position

The winding lever is aided in its return by the flat steel spring (Z) which is fastened to the end of the armature post (Z-2). Spring (Z) should be so formed that it will meet the movement post (Z-1) after the winding lever has started up and just at the instant the winding pawl meets the bottom of the tooth it is to lift against.

The length of travel of the winding lever (D) is determined by the distance between the armature (B-1) and magnet cores (B). The length of travel of the lever is controlled by the position of the armature on the lever and the elevation of the stop pin (D-1).

The travel of the armature (B-1) is not directly toward the cores (B) due to the position of the winding lever staff (D-2) The position of the winding lever staff permits locating the armature (B-1) quite close to the cores (B) as a good share of the travel is upward, thus getting the advantage of a stronger magnetic pull.

The armature (B-1) should not be allowed to touch the upper edges of the cores (B) before it does the lower edges, as this causes a wedging effect that does not release easily.

6. MAIN SPRING.

The main spring (G) is fastened at one end by means of a loop around a stud in the side of the main or driving wheel of the clock mechanism, and at the other end by a loop around a stud in the side of the winding ratchet wheel (H).

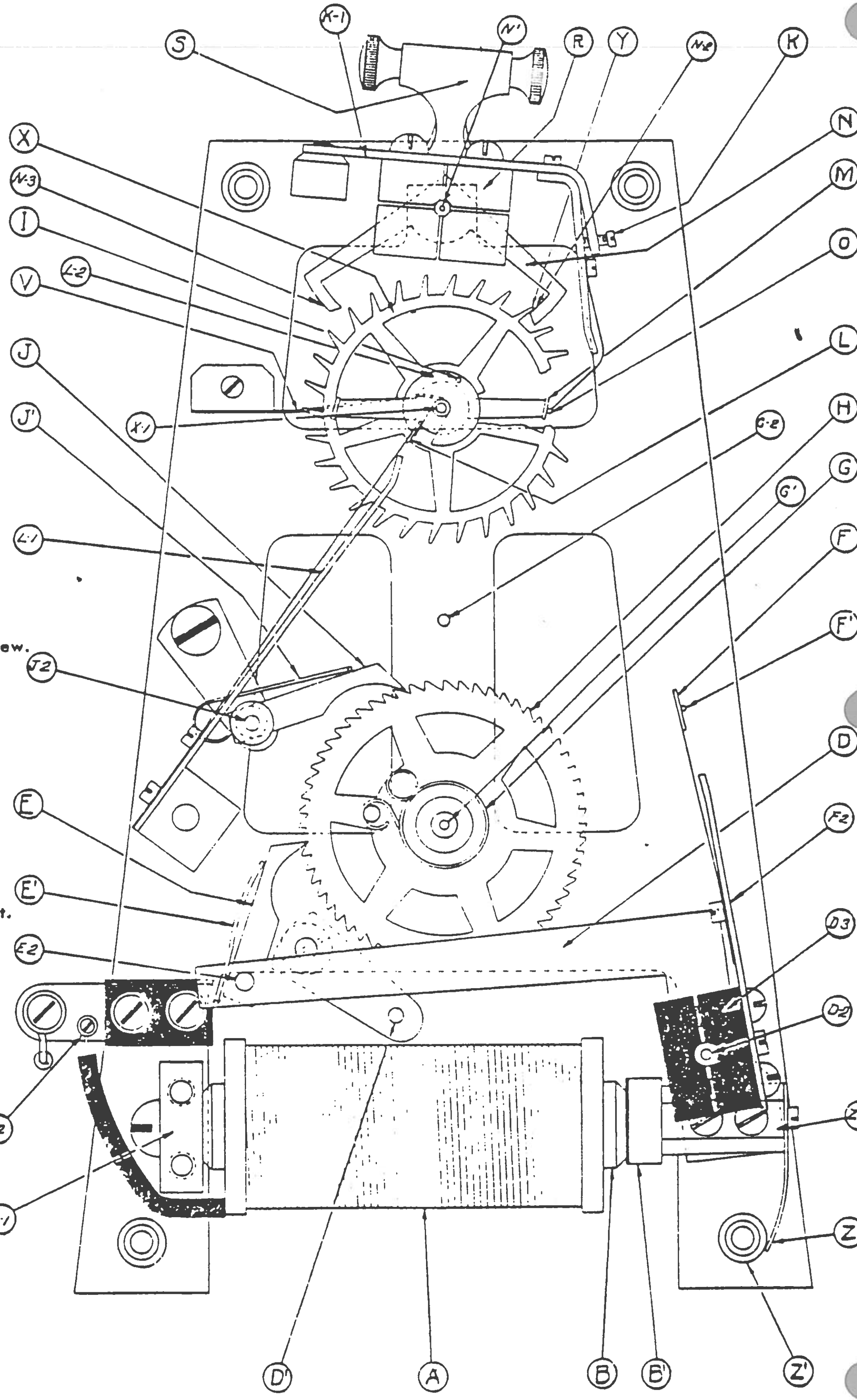
The main spring and wheels are assembled on the minute staff (G-1) and can be taken out as a unit when the movement is taken apart.

When it is necessary to take the spring assembly apart, be sure to count the number of turns in the spring (G) before taking the pin that holds the ratchet wheel in place out of the shaft. There should be three or four more turns in the spring (G) then when the spring (G) is out of the assembly and with the tension out three turns more for mercurial pendulum and four turns more for metal ball pendulum Let the tension out of the spring (G) slowly.

continued page 5.

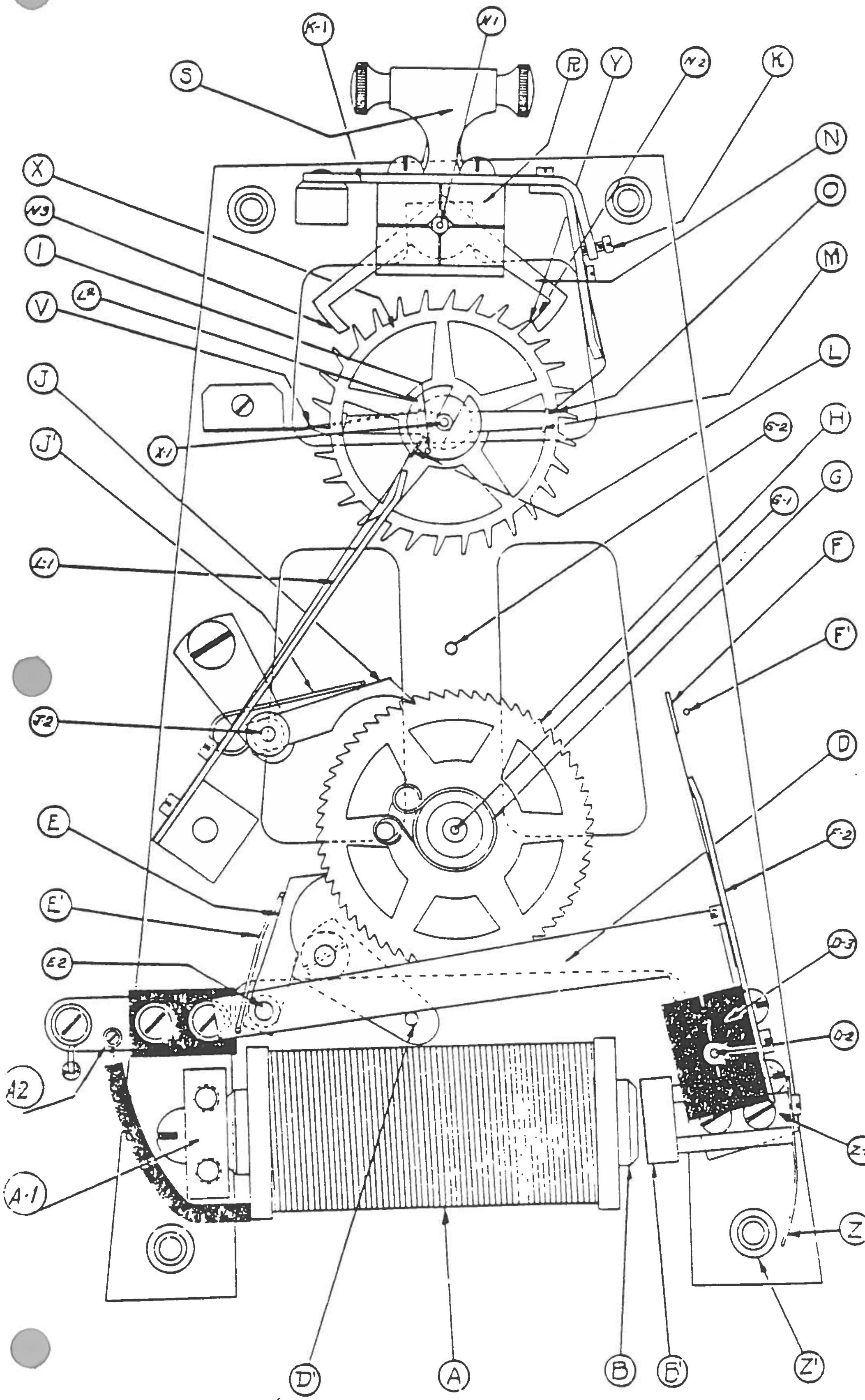
NUMBERS AND NAMES OF REGULATOR PARTS

A Wire of Winding Magnet.
A-1 Magnet Bridge.
A-2 Magnet Connector.
B Core of Winding Magnet.
B-1 Armature of Winding Magnet.
D Winding Lever
D-1 Stop Pin for Winding Lever.
D-2 Winding Lever Staff.
D-3 Winding Lever Insulating Blocks.
E Winding Lever Pawl.
E-1 Winding Lever Pawl Spring.
E-2 Winding Lever Pawl Stud.
F Program Contact Point. (flat iridium platinum).
F-1 Program Contact Point (round wire iridium platinum).
F-2 Program Contact Arm.
G Main Spring.
G-1 Center Staff
G-2 No.3 Staff
H. Winding Ratchet Wheel.
I Duration Contact (round wire iridium platinum).
J Retaining Pawl for Winding Ratchet Wheel.
J-1 Retaining Pawl Spring.
J-2 Retaining Pawl Stud.
K Oscillating Contact Adjusting Screw.
K-1 Oscillating Contact Bracket.
L Duration Contact (flat iridium platinum contact).
L-1 Duration Contact Bracket.
L-2 Duration Contact Flange.
M Rotary Circuit Closer Contact.
N Verge
N-1 Verge Staff.
N-2 Verge Pallet (wiping surface).
N-3 Verge Pallet (wiping surface).
O Oscillating Circuit Closer Contact.
R Circuit Closer Insulating Blocks.
S Beat Adjuster.
T Contact Brush
X Escape Wheel
X-1 Escape Wheel Staff.
Y Escape Wheel Tooth
Z Kick Off Spring
Z-1 Movement Post.
Z-2 Winding Armature Post.



6568-C

NUMBERS AND NAMES OF REGULATOR PARTS



6569-C

- A Wire of Winding Magnet.
- A-1 Magnet Bridge.
- A-2 Magnet Connector.
- B Core of Winding Magnet.
- B-1 Armature of Winding Magnet.
- D Winding Lever.
- D-1 Stop Pin for Winding Lever.
- D-2 Winding Lever Staff.
- D-3 Winding Lever Insulating Blocks.
- E Winding Lever Pawl.
- E-1 Winding Lever Pawl Spring.
- E-2 Winding Lever Pawl Stud.
- F Program Contact Point (flat iridium platinum)
- F-1 Program Contact Point (round wire iridium platinum)
- F-2 Program Contact Arm
- G Main Spring.
- G-1 Center Staff.
- G-2 No. 3 Staff
- H Winding Ratchet Wheel.
- I Duration Contact (round wire iridium platinum)
- J Retaining Pawl for Winding Ratchet Wheel
- J-1 Retaining Pawl Spring.
- J-2 Retaining Pawl Stud.
- K Oscillating Contact Adjusting Screw.
- K-1 Oscillating Contact Bracket.
- L Duration Contact (flat iridium platinum contact)
- L-1 Duration Contact Bracket.
- L-2 Duration Contact Flange
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- N-1 Verge Staff
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- R Circuit Closer Insulating Blocks.
- S Beat Adjuster
- V Contact Brush
- X Escape Wheel
- X-1 Escape Wheel Staff.
- Y Escape Wheel Tooth.
- Z Kick-Off Spring
- Z-1 Movement Post
- Z-2 Winding Armature Post.

(See other side for #6568-C)

10

The

Hansen Signal System

FOR

PUNCTUALITY
ORDER
SIMPLICITY
DISCIPLINE
ECONOMY

A Necessity in Every Modern School Building

CATALOG No. 10

Hansen Manufacturing Co.

Princeton, Indiana

The Hansen Manufacturing Company was first organized and started in business in 1908. The business started with the manufacture of Signal Systems for Schools and the desire to give the schools a good practical system for a reasonable sum. Hansen Signal Systems have been improved, new features added, new models introduced, until at this time we have a line of School Signal Systems to fill the need of every school from the little three room school to the million dollar structure.

This catalog lists only the hand wound systems. If a self-winding master and secondary system is desired write for our special catalog.

IMPORTANT FOREWORD

HOW TO ORDER

Give the model of the clock you want.

Give the type of the clock you want.

Give the number of programs you want.

Order prolonger if desired.

Send your programs so that they can be set here at the factory. This avoids mistakes in the type of clock required. There is a perforated page at the back of this catalog to be used in making out your programs.

NEVER FAIL TO GIVE THE KIND OF CURRENT AND THE VOLTAGE AND CYCLES OF SAME.

All equipment shipped F. O. B. Princeton, unless otherwise specified.

TERMS

To School Boards, to firms with an established credit rating and to parties known to this company, goods will be billed at thirty days net from date of shipment. Should a longer period of time be desired, special arrangements should be made at time of ordering.

SCHOOL WARRANTS

School warrants bearing the legal rate of interest will be accepted from Boards of Education, providing the warrant can be paid within six months.

CASH WITH ORDER

In remitting cash with order you should be sure to send an amount sufficient to cover the cost of article and the express charges, if prepaid shipment is desired.

We allow a discount of 2% for cash with order.

GUARANTEE

We handle only equipment of high quality. Everything listed in our catalog is guaranteed to be free from defects in workmanship and material. Our prices are guaranteed to be as low as it is possible for a reputable firm to make them, quality, of course taken into consideration. We guarantee these systems to operate perfectly for one year after they are properly installed and providing the complete system is purchased from us.

TIME AND PROGRESS

In the march of progress time is the most important factor. Success and time are inseparable, the former is dominated by the latter. How much can you do in a second, minute, hour? How quickly can you learn a foreign language, algebra, to fly an areoplane or build a machine? The factor of time has entered into everything and has brought many necessary and useful inventions, among the most prominent the Signal System for Schools and Colleges.

THE HANSEN SIGNAL SYSTEM AIDS EFFICIENCY

Among the various equipment which goes to make up efficiency in the modern school, perhaps nothing is more welcome to principals and teachers, nor does more to install habits of regularity and punctuality in the pupils, than a good automatic clock system. A good many of us are familiar with the old-time nuisance of gongs and manually-operated electric bells and, consequently, appreciate what a boon it is to be free from this. With the thorough installation of the HANSEN PROGRAM CLOCK AND BELL SYSTEM, the whole matter of class hours and program can practically be left to the system itself, and so satisfactorily have such systems been worked out that they are trouble proof and require only a moments time weekly, and that need not be at all of a skilled nature.

The application of modern electrical methods has accounted for what appears to be almost miracles in the operation of these clock systems. For instance, with the program clock installed in the principal's room of the school office, not only may the periods of the various classes be announced but play ground gongs, fire-alarm, and other special calls almost without limit may also be provided for. These systems are usually operated from the A. C. light current which does away with the purchase, filling and charging, as well as the early replacement of batteries.

The Signal System (sometimes called the Program Clock System) has been applied to eliminate the loss of time, irregularity of class signals, etc., and it has succeeded so well that today it is one of the most important feature of all modern Schools and Colleges. The apparent losses of time to the teachers and pupils through the irregularity of signals, when computed for months would be astonishing. How much time are you losing through the worrying over the program? How often do you look at the time piece?

THE HANSEN SIGNAL SYSTEM WILL RELIEVE YOU OF THE DAILY WORRIES AT A COMPARATIVELY SMALL COST

Our aim has been to eliminate cheap construction and to build a really scientific instrument that is both electrically and mechanically perfect; for instance, our clocks are equipped with platinum contacts and these contacts are of the "quick make and break" type. Slow opening and closing contacts form an electric arc and are therefore destructive to the contact points. This is an important point and should be borne in mind when purchasing a program clock system. Perfect contacts make it possible to use our clock on the alternating electric light current without the use of storage batteries and charging outfits. This one feature alone eliminates not only the first cost of the following apparatus, but also the trouble of maintaining the motor, generator, storage batteries, rectifier charger, volt meter and ammeter, etc.

The HANSEN SYSTEM requires only three things:

1. The Clock.
2. The switch-board.
3. The bells.

THE USE OF A CLOCK SYSTEM

Do not misconstrue the word "use"; but consider the service this Signal System will give. Every school day of the year, from the first bell in the morning until the final dismissal of the student body and final ring in the gymnasium at the end of practice. Do you use your electric lights that much? How about your heating plant; does it receive such constant service?

INSTALLATION

Making the installation of the HANSEN PROGRAM CLOCK AND BELL SYSTEM is a simple matter, and if you desire can be taken care of by men experienced along this line, from our factory. The wiring and conduit work can be done by your electrician according to our instructions and the final installation of the clock, switch-board and the bells made by our men. Should you desire the final installation made by our men then write for special instructions and quotation. Or should you desire the entire installation can be made by your electrician or possibly some one in your science department who is familiar with electricity. Of course plans and directions are furnished with each and every system. Along with the simplicity in installation comes the simplicity of operation. May we serve you in your efforts to put your school on a still higher plane of efficiency and discipline?

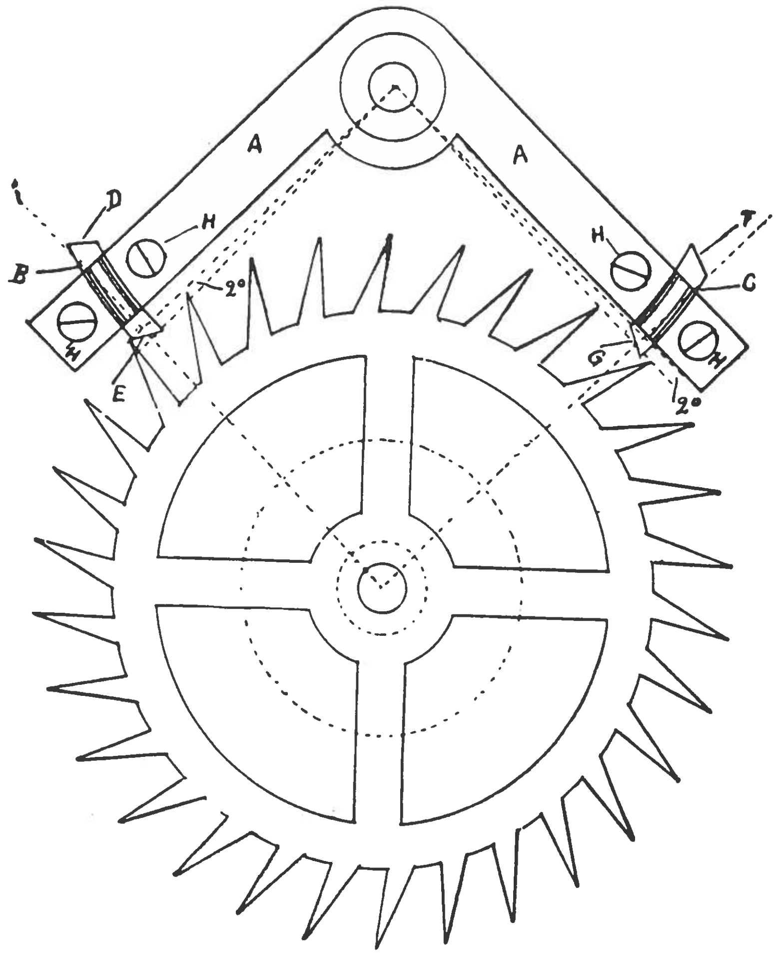


Fig. 1

THE TIME MOVEMENT

The clock movement is our own make and especially designed to drive the Program machine. It is equipped with the Graham "dead beat" escapement like all best grades of clocks, but has a feature of our own invention, which is found only on the Hansen Clock—the Reversible Pallets. Since the life of the clock depends on the lasting qualities of the escapement we shall give a few details concerning it. Referring to our drawing Fig. 1, B is the entry pallet and C is the exit pallet. The pendulum is kept in motion by the lifting of the escapement wheel teeth on the inclines E. and G. At this point the friction is the greatest and the power the least. It is apparent that the pallets should be made of hard steel and finely polished, but by the constant action of the escape wheel teeth, they gradually become pitted, which increases the friction until it finally becomes so great that it will stop the clock. With our reversible pallets it is only necessary to exchange the pallets B and C so that F becomes the entry incline and D the exit incline. With this simple operation the movement is made as good as new and we believe we are justified in our claim that our clock will wear twice as long as any other.

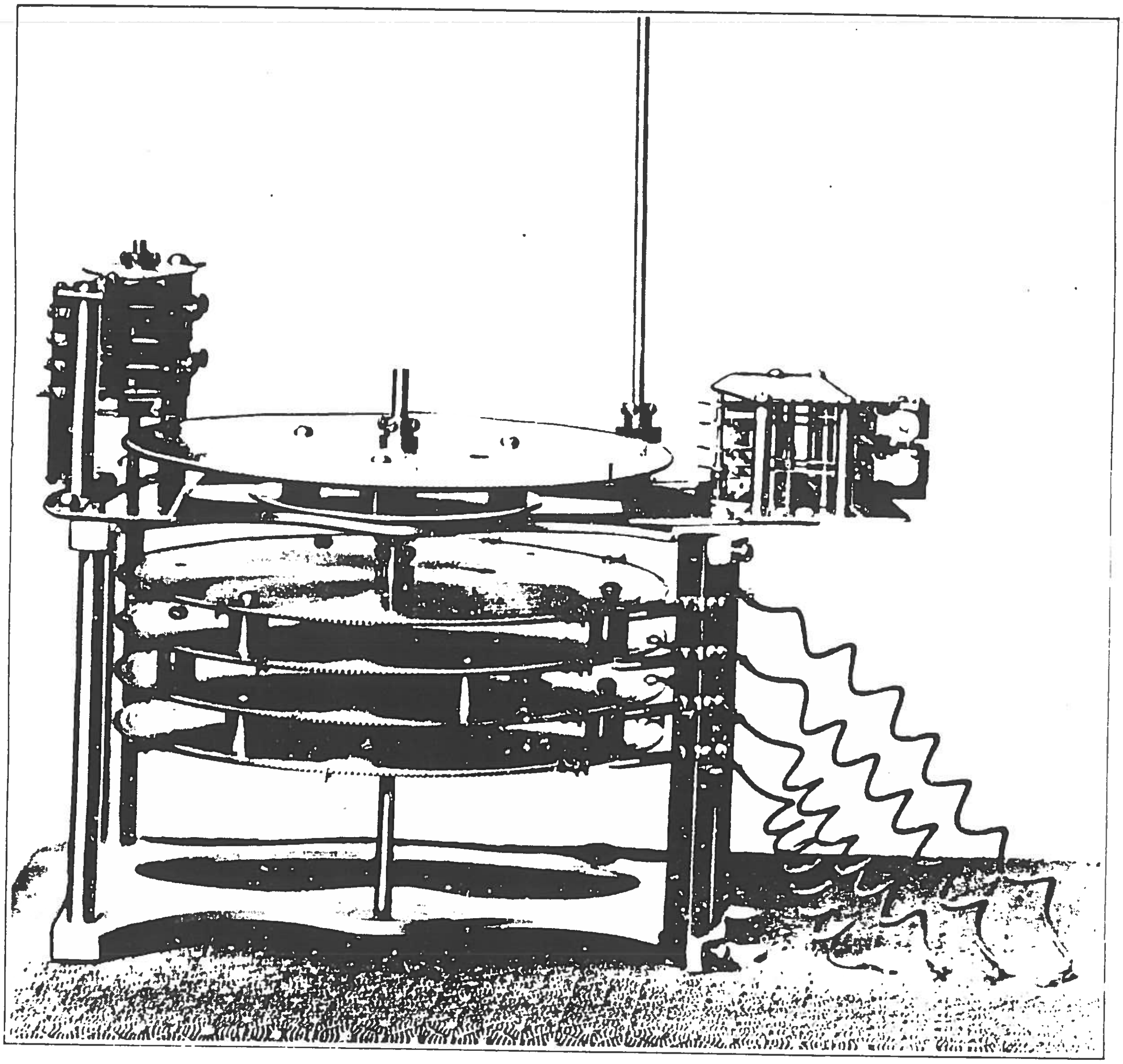


Fig. 2

Program Machine for 3 Programs with Automatic Switch and Prolonger

THE PROGRAM MACHINE

Our Program Machine is the simplest and most practical ever devised and is located at the bottom of the case where it is easily accessible. It consists of one or more discs, according to the number of programs it is designed to operate, which are mounted on a shaft. This shaft with the program discs is driven in a vertical position, thus reducing the friction to a minimum. There is enough surplus power in the clock movement to drive this Program drum directly and by this means we avoid a good deal of complicated mechanism. This in no way interferes with the running of the clock.

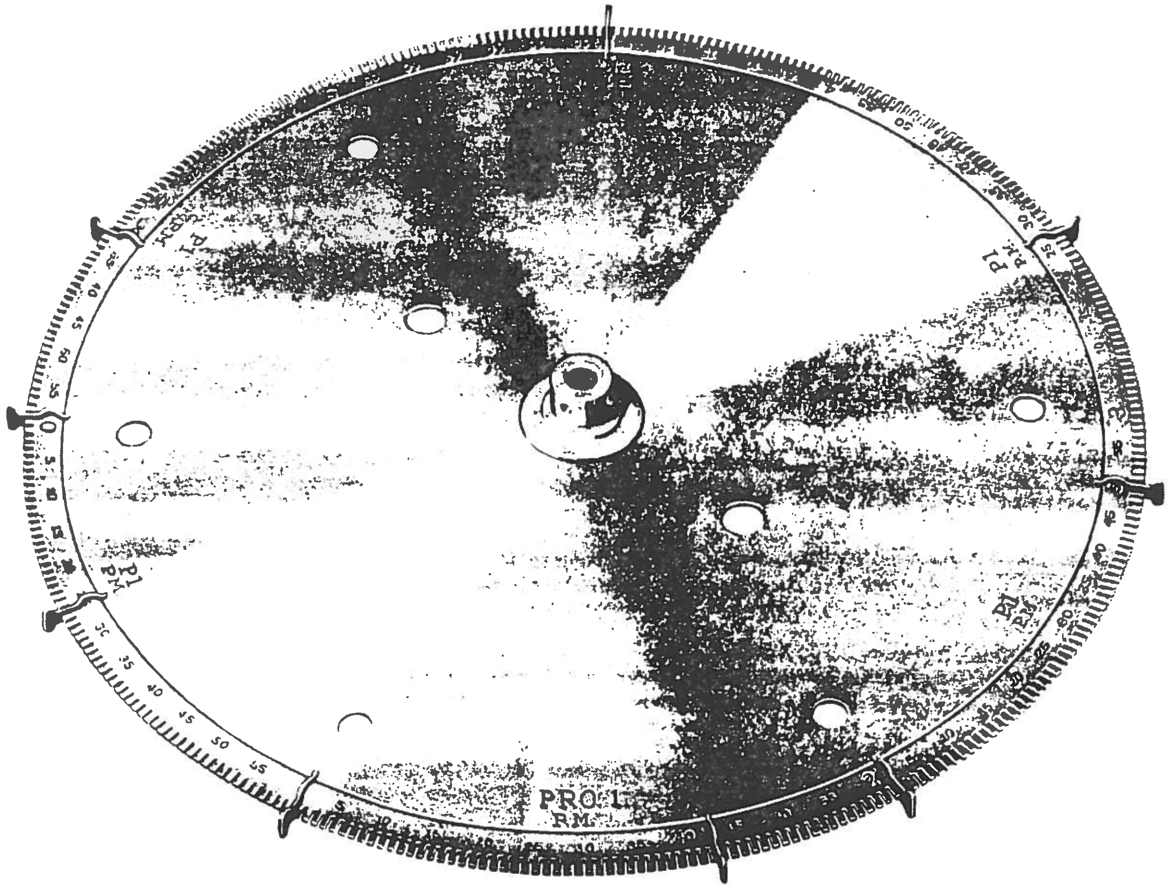


Fig. 3

In Fig. 3 we show a section of a Program disc illustrating the manner in which the contact pins are inserted.

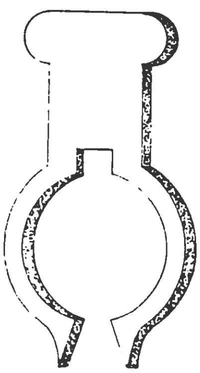


Fig. 4

Fig. 4 shows a contact pin enlarged. These have a small projection on each side by which the pin can be inserted or removed from the Program Disc with the fingers and without the use of tools. When a change of program is desired it is only necessary to move the contact pin to the desired slot. No tape and punches, pliers or tools of any kind are required.

If only one schedule or program is used in the school and only one disc is needed, this would be termed a one program clock. If two separate and distinct schedules are operated, two discs are needed, etc. Any number of bells may be operated on one disc and the number of bells has nothing to do with the number of discs. We make the 5-minute and the 2½-minute discs. The 5-minute discs have 144 slots, one slot for each 5 minutes during 12 hours, and the 2½-minute discs have 288 slots, one slot for every 2½ minutes during 12 hours. An example of a program that could be set on the 2½-minute interval clock is this: 10:07½, 10:10, 10:30, 10:32½. Now the nearest this program could be set on the 5-minute interval clock would be 10:05, 10:10, 10:30, 10:35. We give above to illustrate what is meant by 2½-minute and 5-minute interval clock.

THE CIRCUIT CLOSER

When the circuit is opened and closed in electric currents a spark occurs that burns and is very destructive to the contact points. Some materials will resist this spark much better than others. Of these materials platinum is far superior to any other. Our Circuit Closer, which is mounted at the right hand side of the Program Machine, has large platinum points, with 5 per cent iridium. The entire mechanism is made so fine and frictionless that it scarcely takes any power to move it. The shaft is pointed and runs on a steel plate; both are highly polished, to overcome friction. Our Circuit Closer is one of our finest electrical and mechanical inventions and is the result of 15 years of evolutionary progress. This is an exclusive Hansen feature far in advance of anything on the market. When any other metal is used for contact points on transformer alternating current it has been found to be very unsatisfactory as it soon "fogs" and will finally refuse to conduct the current.

THE AUTOMATIC SWITCH

This is a device for the purpose of cutting out the bells at night, Saturday, Sundays and other times they are not desired and is built in the clock. All Hansen Signal Clocks are equipped with automatic switches unless otherwise specified. We can also equip the Signal Clock with an automatic switch for switching different programs on different days if desired but this arrangement must be specified at the time the order is entered.

THE PROLONGER

We are the originators of the Prolonger and it has always been a Hansen feature. This is also built in the clock and will give a long ring on one circuit. This device is commonly used in connection with the circuit on which the yard gong operates but never on the class circuits as a long and a short ring cannot be had on the same circuit. The length of ring on the prolonger circuit is about 30 seconds and that of the class circuits about 5 seconds. If prolonger is desired it must be ordered with the clock, as it cannot be attached later. The prolonger requires a separate circuit and transformer or if battery current is used then a separate set of batteries is required for the prolonger. The prolonger consists of one extra circuit closing device and when ordering a prolonger bear in mind that this will be a separate program from all others.

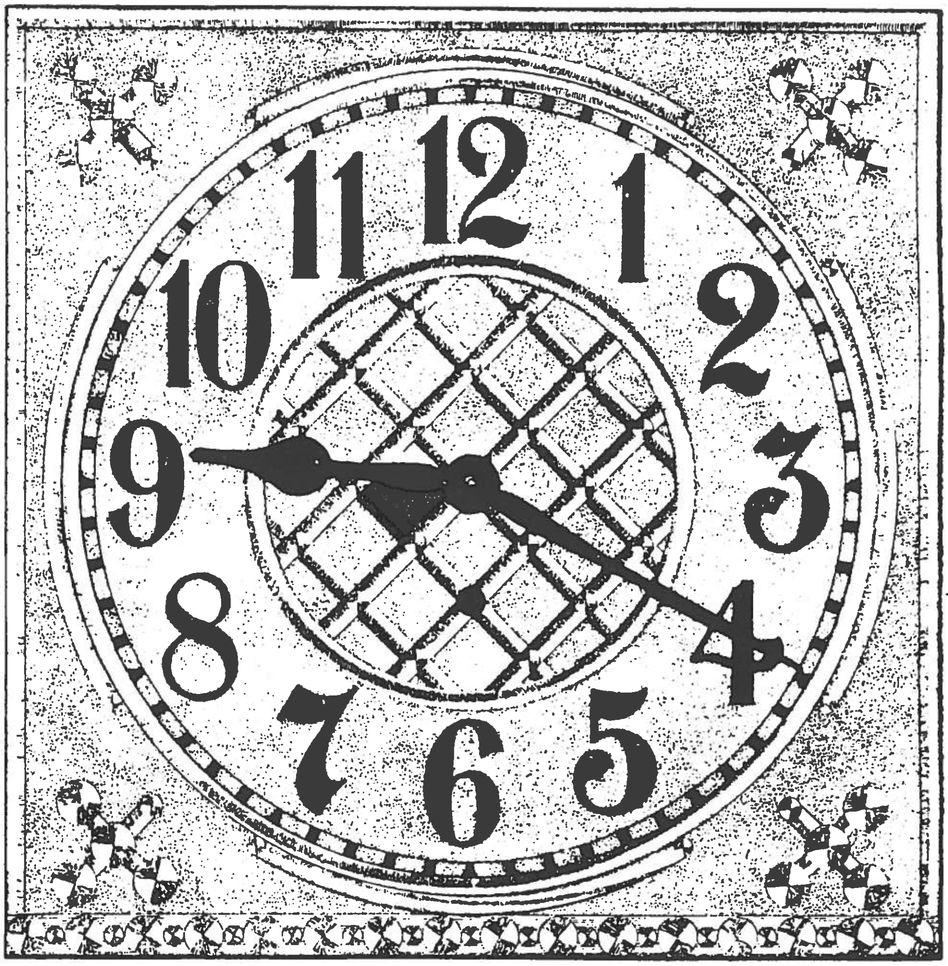


Fig. 5

DIAL

The time dial shown in Fig. 5, is made of aluminum, finely frosted and damascened, with black Arabic figures. This makes the dial as easily read but much more beautiful than the ordinary black and white dial. No cut can bring out the beauty of this dial.

The dials are all made in our own factory by our own special process and only the very best grade of aluminum can be used for these. The frosting gives a most wonderful background for the damascened decorations and jet black figures. The dull white frost and black figures are more clear at a greater distance than a porcelain black and white dial; this we have proved many times in our factory.

Many people who see our dial for the first time are highly enthusiastic over its beautiful and attractive appearance and never grow tired of it. We are the only manufacturers of Signal Clocks using such an expensive dial.

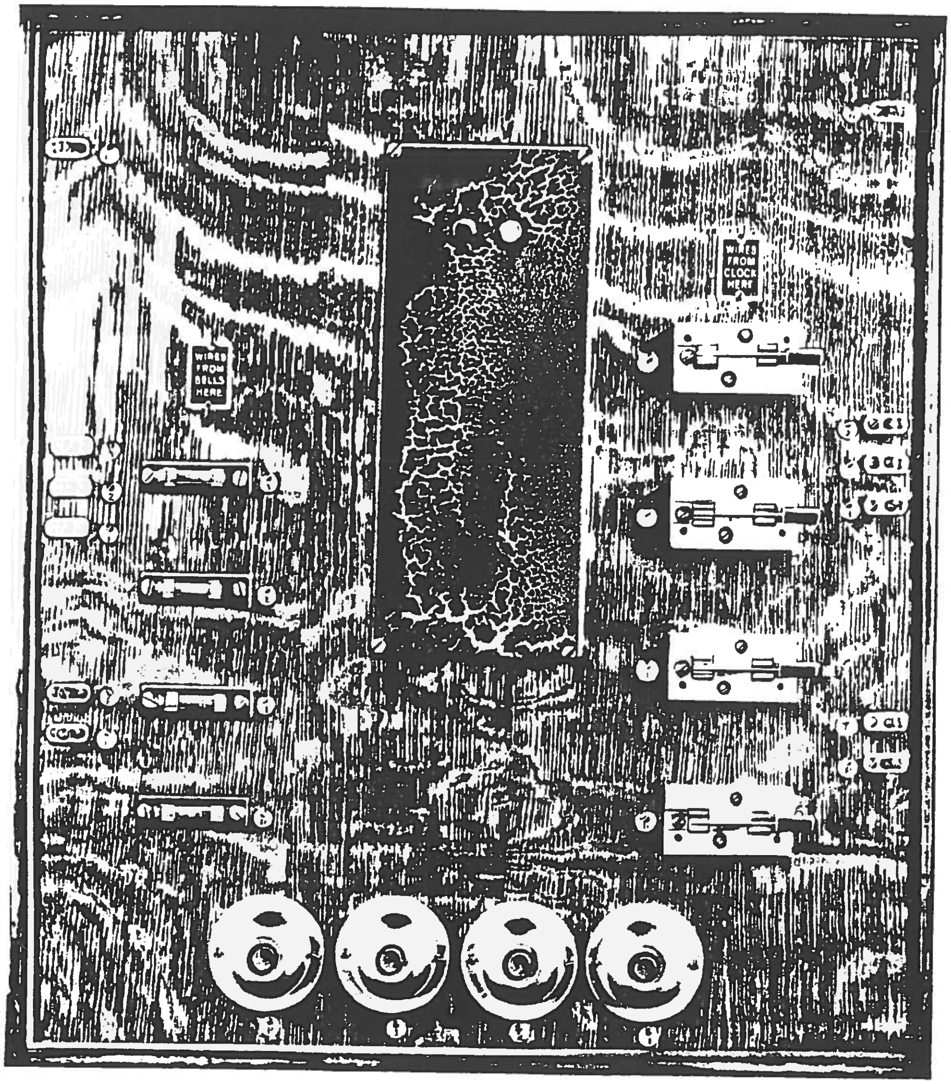


Fig. 6
Switchboard for three Program Clock without Prolonger

SWITCH-BOARDS

Each system listed includes the proper switch-board which is absolutely necessary when the system is to be operated from the electric light current. These switch-boards have the proper transformers of the proper capacity installed in an iron box and the 110 volt circuit to them is opened and closed by a double pole 120 volt 15 ampere switch.

Push buttons are arranged on the switch-boards for operating signals independent of the clock and independent of each other, everything is properly fused according to the rules of the underwriters. The switch-board saves time on installation as well as avoids numerous mistakes that are made in the wiring when no switch-board is used. When the wires are run for the bells they are merely attached to the proper binding post at the switch-board, wires then run from the clock to the switch-board and connected to the correct binding post and the system is ready for operation. Instructions sent with the switch-board shows exactly where each wire should be attached.

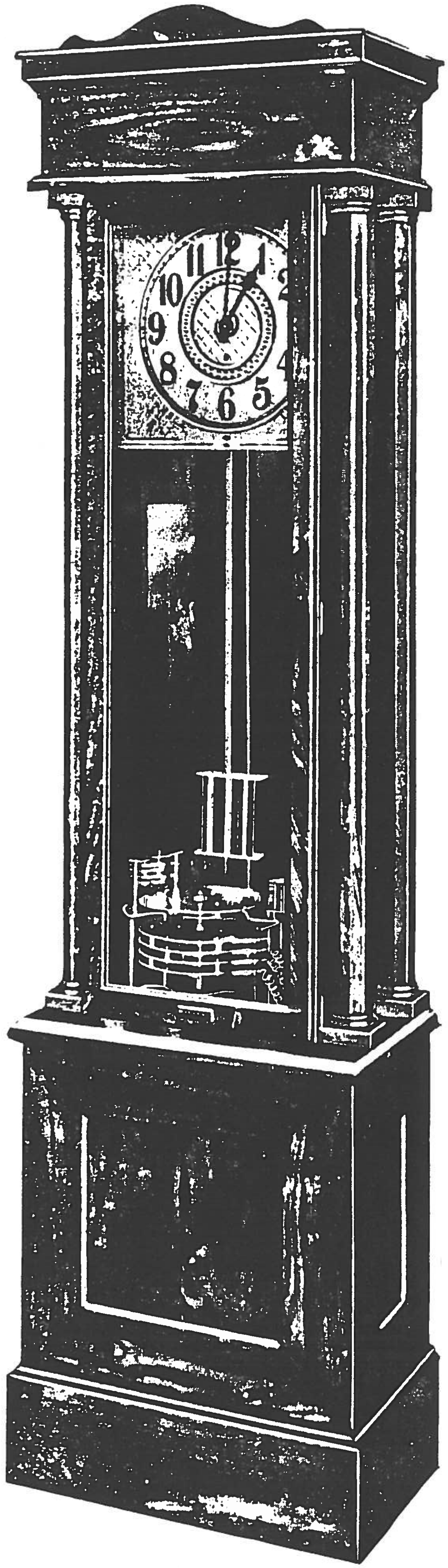


Fig. 7

THE MODEL "C"

The Model "C" is a floor clock of very handsome and massive appearance. The case is of American Walnut and finished in natural walnut. The movement has the long pendulum and has 72 beats to the minute instead of 86 as in the Model B. Size of case, 6 ft. 4 in. high, 22 in. wide, 12 in. deep.

This model is furnished only in the types two and three. The type two is a 24-hour five-minute interval and the type three is a 12-hour, 2½-minute interval clock. The type 2 will operate both day and night programs and the programs can be set to any schedule divisible by five. The type 3 will operate only a day program, but the program can be set to any schedule divisible by 2½. Prices are the same.

Fig. 7 shows the style of the Model "C" case in which only the best figured walnut is used. It is furnished with our beautiful damascened Aluminum Dial and compensated pendulum. These clocks will keep time within 30 seconds a month when properly regulated. This style of clock in addition to it's great usefulness, would be a distinctive ornament for the finest office.

PENDULUM

The Model "C" pendulum is constructed the same as the Model "B" but is much larger, having ⅞ inch pillars and is longer than the Model "B". This makes a very massive and beautiful pendulum that is as efficient as ornamental.

PRICES OF THE MODEL "C"

1 program	$235.00
2 programs	$250.00
3 programs	$265.00
4 programs	$280.00
5 programs	$295.00
6 programs	$310.00

These prices include the cost of the proper switch-board and the automatic switch. Should you desire your Program Clock equipped with a prolonger then add $30.00 to any of the above listed.

--- MART ---

Please note: MART ADS ARE FREE, Send to attention of the Editor;
HARVEY SCHMIDT, 75-80 179th St., Flushing, NY 11366

Some of the older ads have been eliminated. If repeat insertion is desired, please advise and they will appear in the next issue. Thanks for your cooperati

WANTED: To buy or borrow, ACROTYNE made by Seth Thomas, details in EHS Journal of April 1985. Bill Ellison, 1635 Ford Ct., Grosse Pointe Woods, MI 482 (313) 881-2906

ELECTRIC CLOCKS, Mark Gulbrandson, Box 1412, St. Charles, IL 60174 (312) 584-5134

CONVERSION INFORMATION to eliminate #6 Dry Cells, and replace with AC Adaptor; Also Parts Catalog or listings of replacements for Telechron Rotors. Joe Runtz, 5301 S. Broadway, St Louis, MO 63111 (314) 752-4273

MAGNETA movements, dials magnets, parts or complete Magneto. Elmer Crum, 8510 Harms Rd. Skokie, IL 60077, (312) 965-0188

SYNCHRONOME, or any Hope-Jones equipment or literature. John Cammarata, 45 Murray Hill Terrace, Marlboro, NJ 07746 (201) 972-7863

WALTHAM ELECTRIC CLOCK CO., Info, Pix, Ad materials for 90 beat, 10" Dial Wall Clock, Anthony Prasil, 2179 Titus Ave., Rochester, NY 1462

MONARCH Master Clock made in Chicago... Any information. Bill Ellison, 1635 Ford Ct., Grosse Pointe Woods, MI 48236 (313) 881-2906

ITR Master Clock, Repair & Maintenance info, literature. Irvin A. Pogue, 212 N. William Dr., Chillicothe, IL 61523

ELECTRO CLOCK CO. (Baltimore) Information. A.H. Redfield, 21 Kentbury Way, Bethesda, Md 20814 (301) 656-5562

Junker early battery clocks, Movements, Parts, etc., send details... Martin C. Feldman, 6 Stewart Pl., Spring Valley, NY 10977

HOROLOGICAL LITERATURE, Repair info, Catalogs, etc. for the Journal. Harvey Schmidt, Editor, 75-80 179th St., Flushing, NY 11366

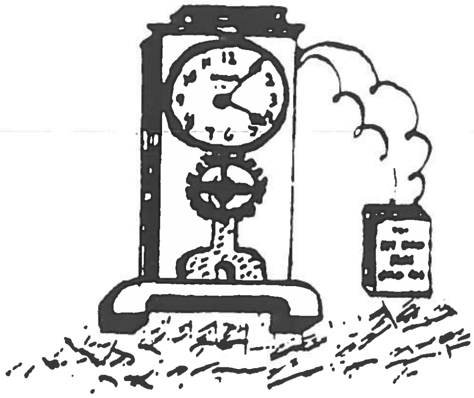
FOR SALE: KUNDO replacement Coils, $25 each, postpaid. Also Movements, Parts... Leon O'Briant, 3516 Swift Dr., Raleigh, NC 27606 (919) 851-1706

SELF-WINDING clocks, cases, parts, movements, 30 year collection! W. Spetrino, 1214 Cleveland Hts Blvd, Cleveland Hts, OH 44121 (216) 381-1197

ASSORTED ELECTRO-MECHANICALS, Thinning collection, Call or write, Harvey Schmidt, 49-20 108th St., Corona, NY 11368 (718) 969-0847 eves (718) 592-7711 days

REPAIRS: ALL EARLY BATTERY CLOCKS, including Poole, Barr, Bulle, Eureka, Tiffany Never-Wind etc. Specializing in BULLE using original parts. One month maximum time for all repairs. Martin C. Feldman, FNAWCC 6 Stewart Place, Spring Valley, NY 10977

REQUESTS: FUTURE ARTICLE MATERIAL; Warren "C" Mystery Clock Information, Kennedy Electric Clock Co., Tiffany DOUBLE Contact models.



ELECTRICAL HOROLOGY SOCIETY

Chapter No 78

RENEWAL MEMBERSHIP or APPLICATION FORM

The Electrical Horology Society--Chapter 78 was formed in 1972 to provide a means whereby members of the NAWCC who have a primary and strong interest in early battery clocks as well as A.C. clocks would have a means to meet and communicate with other members having similar interests. Due to the geographic locations of the membership, our Chapter's cohesiveness depends upon two factors. One, we print the JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY six times per year with a yearly total of 72 pages of material. The JOURNAL includes technical information, original articles, reprints of important articles found in sources not generally available to the average collector, a question and answer section, a mart and other pertinent information. Secondly, we encourage groups of members to meet and form "Branches" of our Chapter. Local branch meetings include an educational program, a trouble-shooting discussion and often a small mart.

Any member in good standing of the NAWCC is eligible to join our Chapter. Our fiscal year begins in December and members joining after that date during the year will receive all the back issues for that year.

DETACH ALONG THIS LINE

RENEWAL MEMBERSHIP or APPLICATION FORM

Please print all information:

NAME ______________________ NAWCC# ______________

ADDRESS ______________________________________

I wish to become a member of the Electrical Horology Society--#78 and enclose my $10.00 dues for the year 1990

______ check here

I wish to renew my current membership in the Electrical Horology Society--#78 and enclose my $10.00 dues for the year 1990

______ check here

SIGNED: ______________________ DATE: ______________

Send check to Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366, and make payable to EHS #78, % Harvey Schmidt, Secretary-Treasurer.