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

VOLUME XVI, #1, MARCH 1990

Fellow Horologists:

This issue completes the HANSEN SIGNAL SYSTEM catalog reprint which was started in our issue #4 of 1989. It is interesting to observe that the Hansen Manufacturing Co. is still very much in business, having begun operations in 1904! They presently manufacture a wide variety of synchronous timing motors, custom made for speed, shaft direction, torque, etc., as well as standard catalog models. An example of a company with the foresight to see the future needs, and manage to keep pace with the market.

Also included is a HOWARD ELECTRIC MASTER CLOCK catalog reprint, which to our knowledge, has not been available prior to this printing. An interesting and informative publication...

If a "PAST DUE" notice is attached to this Journal issue, it serves to act as a reminder that your dues has NOT been received for 1990, and it will be assumed that no further interest in membership in Chapter 78 is intended. It is both costly and time consuming to continue to send Journals to those folks who have no intention of maintaining membership in the chapter, just as well as to those members who are habitually late in paying their dues. This requires a deletion from the roster and then a reinstatement into the computer file. Please keep in mind the fact that all of the work in managing the chapter business and publishing the journal is performed by a handful of volunteers who give up 3 full days for each issue printed!

We still need material for future issues of the journal, so assist by sending in any material that might be of interest... We'll doctor it up, so don't be ashamed if it's less than professional to begin with.

Dues payments, Mart ads, correspondance, and requests for previous journal reprints, all go to our Secretary-Treasurer, Harvey Schmidt, at 75-80 179th Street, Flushing, NY 11366.

Good reading ahead...

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

v

The

Hansen Signal System

FOR

PUNCTUALITY
O R D E R
SIMPLICITY
DISCIPLINE
E C O N O M Y

A Necessity in Every Modern School Building

CATALOG No. 10

Hansen Manufacturing Co.

Princeton, Indiana

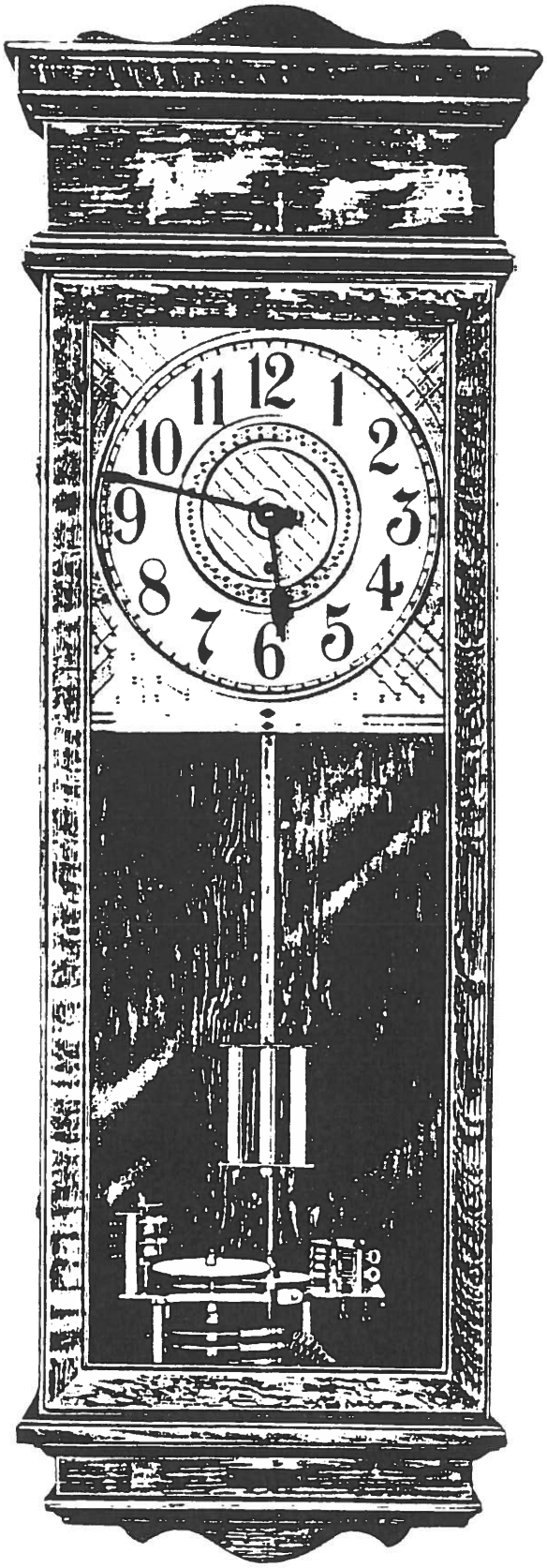


Fig. 8

MODEL "B," TYPE 1

This is a 5-minute interval 12-hour Program Clock in which the program or programs are the same on every school day. By 5-minute interval is meant that this clock will only ring programs divisible by 5. Example: 8:40, 8:45, 10:20, 10:30, etc., but will NOT ring a program as follows: 8:42, 8:46, 10:31, 11:58. By 12-hour program is meant that the program must not be over 12 hours duration. When a day and night program is used the type 2 should be ordered. The type 1 is used very extensively and is bought on account of the lower price by a great many of the smaller schools. If shorter periods than 5-minute is wanted, the Type 3 should be ordered.

We can furnish this to ring any number of different programs or schedules.

The movement is our regular type which we use on all clocks except that the pendulum has 86 beats and movement used in Model C has 72 beats.

The regular Dial and Pendulum described elsewhere are furnished with this clock. The case is 45x17½ inches, quarter-sawed Oak, finished in Golden Oak with clear lacquer.

PENDULUM

The same size pendulum is used in all Model B, types 1, 2 and 3 clocks. This is a highly compensating construction having three ⅝ inch finely finished brass rods held together by a thick brass strip on each end with a wood pendulum rod. Regulation is by a small brass nut at the bottom of the pendulum. It is possible to regulate these clocks very closely because of the high compensation.

PRICES OF MODEL "B" TYPE 1

1 program	$135.00
2 programs	$145.00
3 programs	$155.00
4 programs	$165.00
5 programs	$175.00
6 programs	$185.00

These prices include the cost of the proper switchboard and the automatic switch. Should you desire your program clock equipped with a prolonger then add $30.00 to any of the above listed.

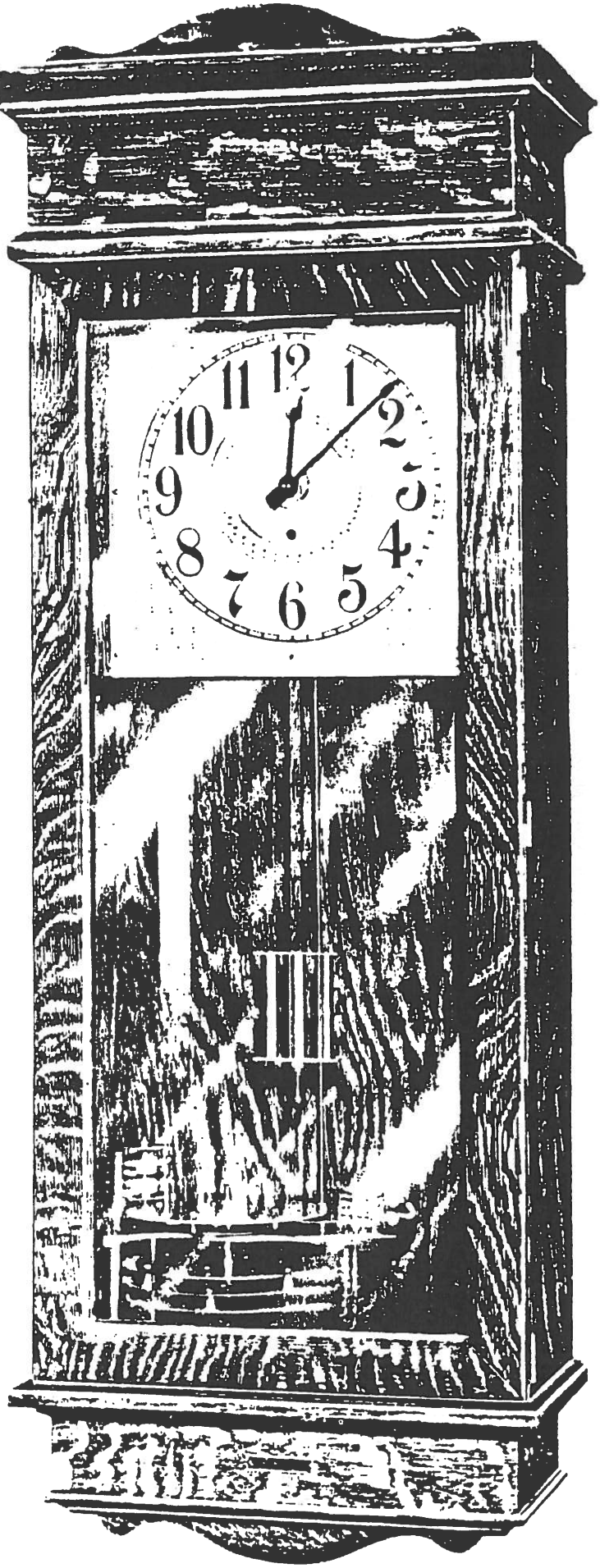


Fig. 9
Model B, Type 2 or 3

MODEL "B" TYPE 2

This is a 5-minute interval 24-hour clock and is adapted for colleges, academies and boarding schools. It will ring on the 5-minute points of the dial the same as the type 1, but has twice the capacity, so that it can be used for both day and night programs. The program machine is twice as large as the Type 1, and the case is also much larger, being 52x20x8 in. It is equipped with our Movement, Dial and Pendulum described elsewhere.

This type is particularly adapted for schools having different programs on different days. This, however, requires a special automatic switch, varying in price with the number of programs. Prices on application.

MODEL "B" TYPE 3

The two and one-half minute interval clock covers the requirements of most all schools since it can be set to either two and one-half minute intervals or five minute intervals, for instance; 1:05, 1:07½, 2:22½, 2:25 etc. This clock is much larger than the type 1, the case being 52x20x8 inches and the program machine twice the size of that of the type 1. The finish on all Hansen clocks is Lacquer, unexcelled for beauty, brilliance and service.

PRICES OF MODEL "B" TYPE 2 AND 3

1 program	$155.00
2 programs	$170.00
3 programs	$185.00
4 programs	$200.00
5 programs	$215.00
6 programs	$230.00

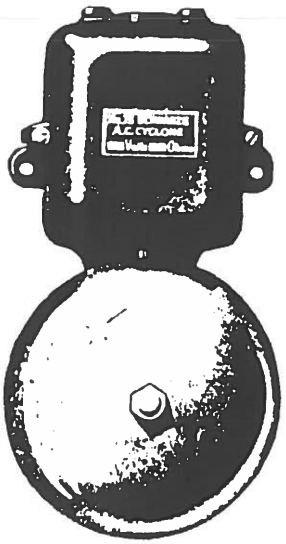
These prices include the cost of the proper switch-board and the automatic switch. Should the prolonger be desired then add $30.00 to any of the above listed.

A CLASS GIFT

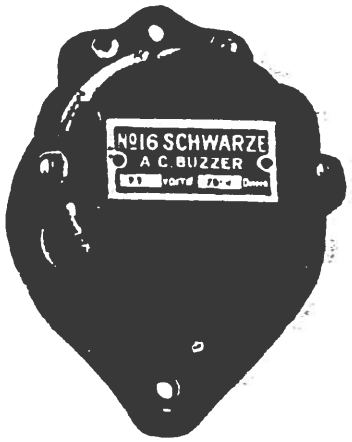
The gift of a Signal System to the school will remain as a practical incentive, something that will be a daily reminder that the students of that class had the continued welfare and interests of the school at heart.

There are many ways that the cost of the Signal System may be divided without any noticeable expense to any one, for instance; the class may purchase the Signal System and the Board of Education provide for the installation and purchase of suitable bells or the Parent-Teachers Association may purchase the Signal System and the class purchase the bells and provide for the installation.

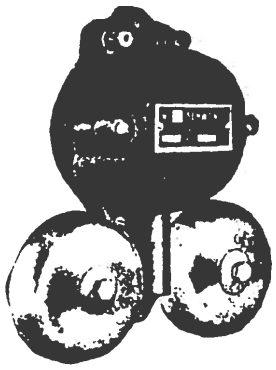
For classes purchasing a Signal System we do lettering on the glass door of the clock, however this lettering should be as simple as possible. Just the word "CLASS" and the year. For this work we make a small charge of $1.50.



No. 75



A. C. Buzzer



No. 9 or 11

BELLS

We carry both Edwards and Schwarze polarized bells which are considered the best bells on the market today, having no contact points, therefore no spark is produced in the operation of these bells from the alternating current. Hundreds of thousands of these bells are in use throughout the country. They assure additional safety and will stand up under the most exacting service, cost less to operate, cost less to install and will outwear contact point bells.

We recommend to use one 8 in. or possibly one 6 in. gong in the corridors where all rooms on that corridor are operating under the same program. If this is not practical then groups of rooms operating under the same program can be operated by one gong or even buzzers can be used in each room. Some superintendents prefer a double gong bell for the corridors in which case we recommend No. 11 or No. 9.

SCHWARZE SINGLE BELLS NO. 700

Buzzer (No. 16)	$ 5.00
3-in. Bell, Interior	$ 6.75
4-in. Bell, Interior	$ 7.25
5-in. Bell, Interior	$ 8.25
6-in. Bell, Interior	$12.00
8-in. Bell, Weather-proof	$15.00
10-in. Bell, Weather-proof	$23.40
12-in. Bell, Weather-proof	$28.00

SCHWARZE DOUBLE BELLS NO. 9

3-in. Bell, Interior, Bell Metal	$ 7.00
4-in. Bell, Interior, Special Steel	$ 8.75
5-in. Bell, Interior, Special Steel	$ 9.60
6-in. Bell, Interior, Special Steel	$16.90
8-in. Bell, Interior, Special Steel	$19.90
10-in. Bell, Interior, Special Steel	$24.00

Special prices on Bell Metal Bells

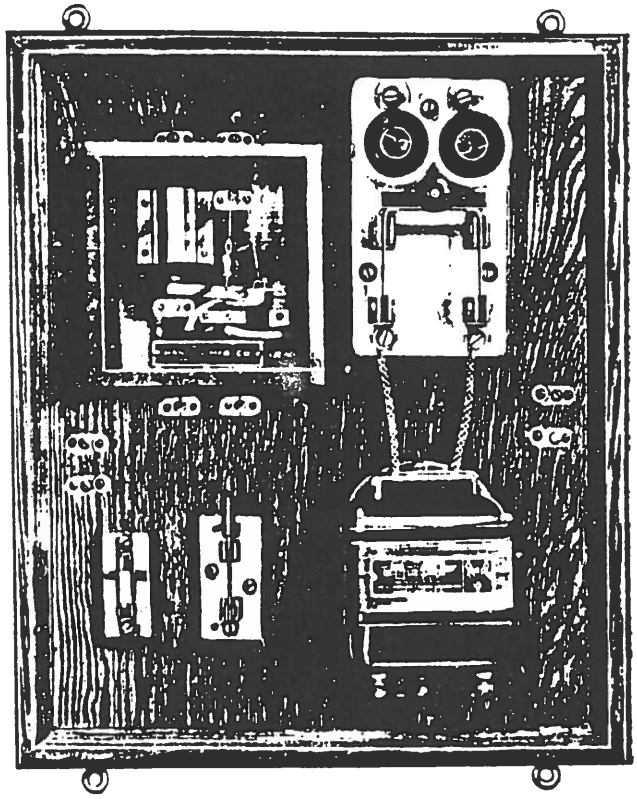


Fig. 10

Relay Switch-board for Transfering the Service to Other Buildings

Price $20.00

When other buildings are to be operated with the one clock this can be done very successfully by the use of our relay switch-board, illustrated. This board contains one A. C. relay and transformer, fuses, switches, etc.

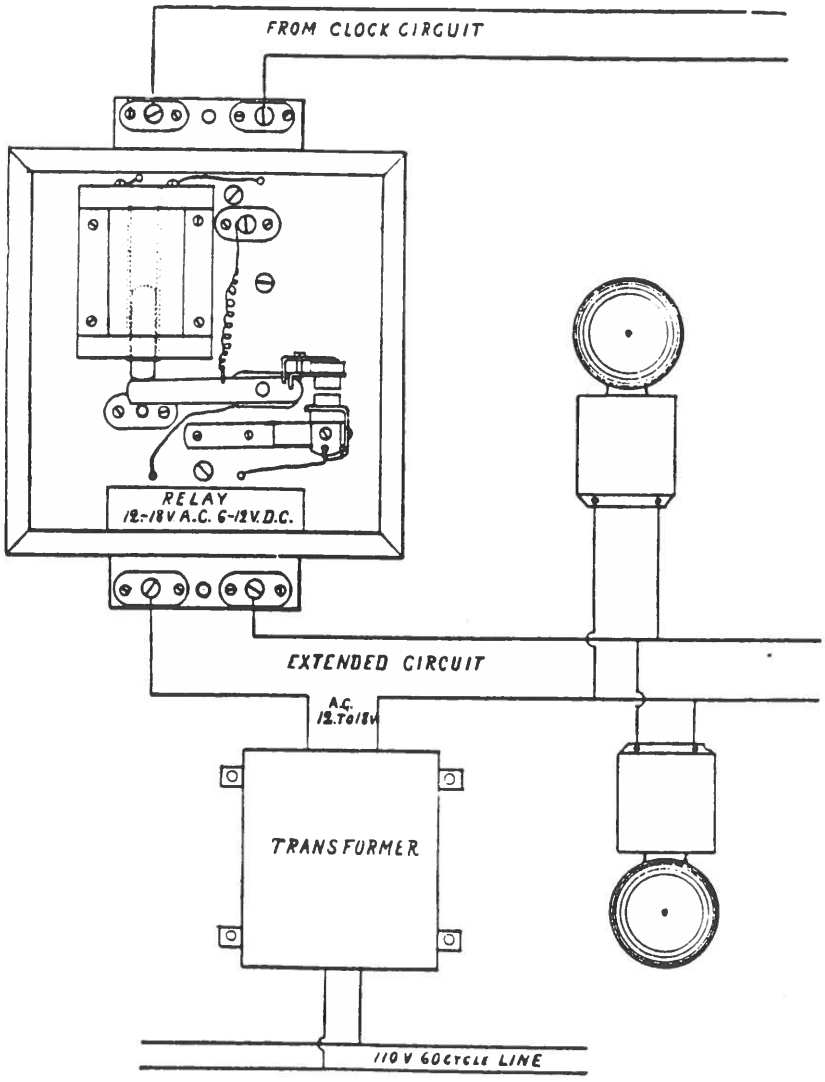

FROM CLOCK CIRCUIT
RELAY
12-18V A.C. 6-12V.D.C.
EXTENDED CIRCUIT
A.C.
12.To18V
TRANSFORMER
110 V 60CYCLE LINE

Fig. 11

HOWARD CLOCKS ARE WORTH THE PRICE

HOWARD ELECTRIC MASTER CLOCK

MANUFACTURED BY

E. HOWARD CLOCK COMPANY

NEW YORK	BOSTON	CHICAGO
305 Broadway	387 Washington Street	31 N. State Street

Makers of

TOWER and STREET CLOCKS
WATCHMAN CLOCKS
ELECTRIC CLOCK SYSTEMS
MARINE CLOCKS
BANK, OFFICE, RAILROAD
and SCHOOL CLOCKS
CLOCKS of SPECIAL DESIGN
REGULATORS, HALL CLOCKS

E. HOWARD & CO.
BOSTON
Trade Mark
ESTABLISHED 1842
All Genuine Howard Clocks Have the Mark

QUALITY, NOT QUANTITY, OUR WATCHWORD

Electrical World Readers

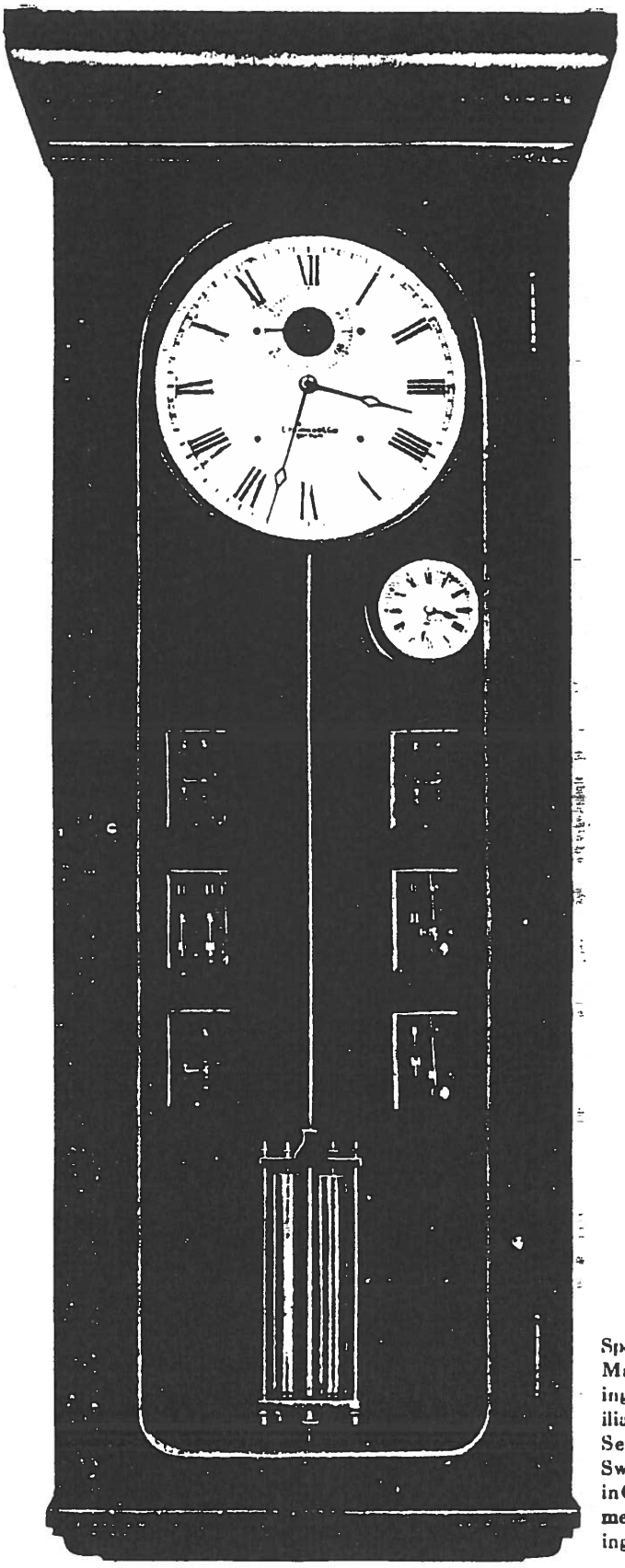
WE HAVE RECEIVED so many inquiries from our advertisement in the Fiftieth Anniversary number of the *Electrical World* that we have concluded to get up a special circular describing the outfit which we had in mind for Central Stations when preparing our advertisement for that issue.

The Congressional Library at Washington is equipped with our No. 89 Regulator with cherry rod, case 5 ft. long, 20 in. wide and 7 in. deep, as shown on page 2. That Regulator is equipped with a minute interval circuit-closer, or, as we call it, an electrical contact for closing a circuit each minute. The purpose of this contact is to drive forward the hands of Secondary Clocks, located in different rooms or departments of the Central Station or its customers.

Of course, it is necessary to run a pair of wires from the Master Clock to the Secondary Clock locations, and it is also necessary to have a sufficient amount of battery continuously available for the operation of the Secondary Clocks. A minimum of 16 volts is sufficient, and we do not care to have more than 24 volts, as a greater amount is apt to burn the delicate contact on the Master Clock. Where direct current is available we recommend reducing it to a voltage of from 16 to 24 volts, and depositing it in a storage battery, but when alternating current only is available it is necessary to have a rectifier or motor generator set for converting the current from alternating to direct, and, of course, the storage battery for from 16 to 24 volts is needed also.

The cost of maintenance of such a system is not large, the only necessity being continuous current, by means of the storage battery. We have sometimes stepped down the generating current, if direct, to a smaller voltage, by means of resistance, but it is not the best thing to do, as occasionally in the night repairs or alterations are made in the lighting or power circuit, and unless the clock battery is stored the clocks have to lose time when the current is interrupted.

We can supply a key-winding Regulator Master Clock for as low as $125.00, and a self-winding Master Clock for $150.00. The Secondary Clocks with 12″ dials are priced at $20.00 each in the square pattern and $22.50 each in the circular pattern.



Specially Designed Master Clock, showing Pilot Clock, Auxiliary Master Relay, Setting Key and Switch. All installed in Chamber of Commerce (new building), Boston, Mass.

We also frequently supply what is known as a Program Clock movement and 2-circuit tape, which we fit into a Master Clock case, furnishing a side door as well as a front door to the case, which enables the program tape to be easily reached without interfering with the pendulum. The tape is printed for a 24-hour period and, by means of it, bells may be rung any minute of the 24 hours.

The Montaup Electric Co. is having built at Somerset, Mass., by Stone & Webster, a large Central Station, and we have an order to furnish it with an electric clock system.

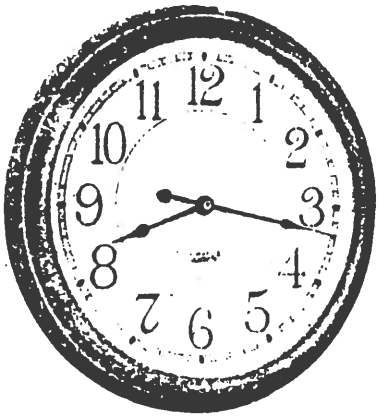
We supplied the Edison Electric Illuminating Co. with a fine Master Regulator a few years ago, and we have orders from the Brooklyn Edison Co., and some years ago we furnished the Mississippi River Power Co., at Keokuk, Iowa, with an electric clock system.

These installations are representative, but we have many others in various parts of the country, which we could refer to.

We solicit inquiries and hope you will tell us when you write about what your desires are, so that we can quote the first time on an equipment adapted to your requirements.

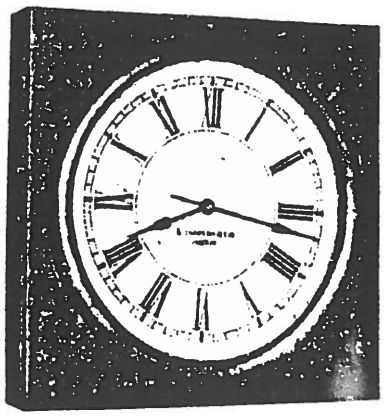
SECONDARY CLOCKS

No. 226



Semi-flush Metal Case
Arabic Dial

No. 66



Surface Type Wood Case
Roman Dial

Also other types and various sizes of dials in stock and made up to order.

CLOCKS
SECONDARY CLOCK SYSTEMS, Etc.
TOWER CLOCKS.

THE E. HOWARD CLOCK CO.

373 WASHINGTON STREET
BOSTON, Mass.

NEW YORK CHICAGO

Referendex Catalogue Sheet No. T-2
Dated September, 1918

PRODUCTS.

Makers of Clocks—Tower Clocks; Magneto Watchman Clocks; Electric Clock Systems for public buildings; Program Clocks for ringing bells at stated intervals; Post and Bracket Clocks; Astronomical Clocks for Observatories; Westminster Chiming Clocks for private estates; Library, Church and Banking room Clocks; Hall, School and Office Clocks, etc.

TOWER CLOCKS.

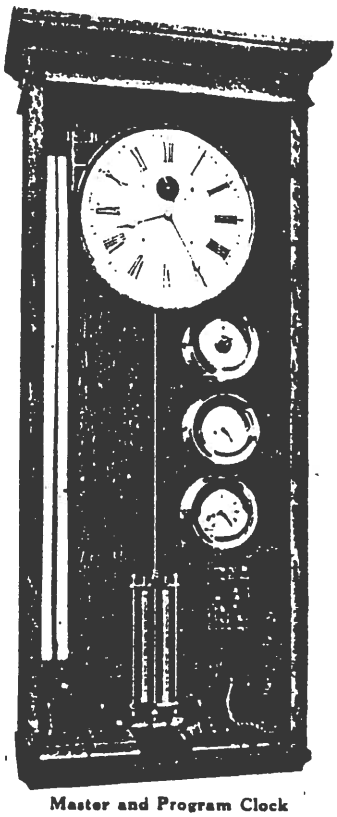
Our Clocks are made of the highest grade materials and are warranted to be first class in every respect and free from all original defects for 5 years. The Striking part of a Howard Clock is a repeater, making it impossible for the clock to strike wrong. Howard Clocks do not vary more than 20 to 30 seconds in a month.

SECONDARY CLOCK SYSTEMS

MASTER CLOCK.

The Master Clock can be any of our seconds beating regulators, 8-day, weight driven or self winding. The movement is constructed of the best materials and is of the finest workmanship throughout. The movement is equipped with specially designed minute or half-minute platinum tipped contacts consisting of an oscillating arm and a rotary arm with gold contact surface. This rotary arm is mounted on the seconds arbor of the movement, and once each minute forms a contact, for about one-third of a second, with the oscillating arm. This operates a relay which in turn operates any number of secondary clock circuits. In the event that half-minute impulses are desired, two rotary arms are mounted on the seconds arbor, one of which comes in contact with the oscillating arm at the 59th second and the other at the 30th second.

This System consists of a Master Clock, Secondary Movements and a source of Current Supply



Master and Program Clock

RELAY.

The function of the relay is to close the secondary circuits once each minute or half minute. One relay will operate any number of secondary circuits. The relay is especially designed for clock system service, and is so made with double set of platinum tipped contact finger working on carbon and platinum surfaces that burning and corrosion are eliminated. The relay is usually mounted in the Master Clock Case, but on large systems it may be located on the switchboard, with the pilot dials and charging apparatus.

SECONDARY CLOCKS.

The Secondary Clocks consist of a mechanism for moving the hands forward each minute or half minute. They are positive in operation, and are made with the same care and of the same high grade of material and workmanship as our other clocks. The magnets are wound to six and a half ohms resistance and operate on one volt. The usual current discharge per circuit is about one-tenth of an ampere. Secondary clocks may be grouped into circuits of from 10 to 20 clocks, depending upon the conditions at the building. The clocks are operated on a series circuit, all circuits being brought to a bus-bar, which in turn is connected with the relay. Each secondary circuit should have about the same resistance. No. 14 or No. 16 R.C. wire should be used.

PROGRAM CLOCKS.

Our No. 89 Program Clock is used extensively in Colleges, Schools and Factories, to automatically operate a system of bells or buzzers, or whistle blowing devices. It is usually located in the same case as the Master Clock, but can if desired, be cased separately.

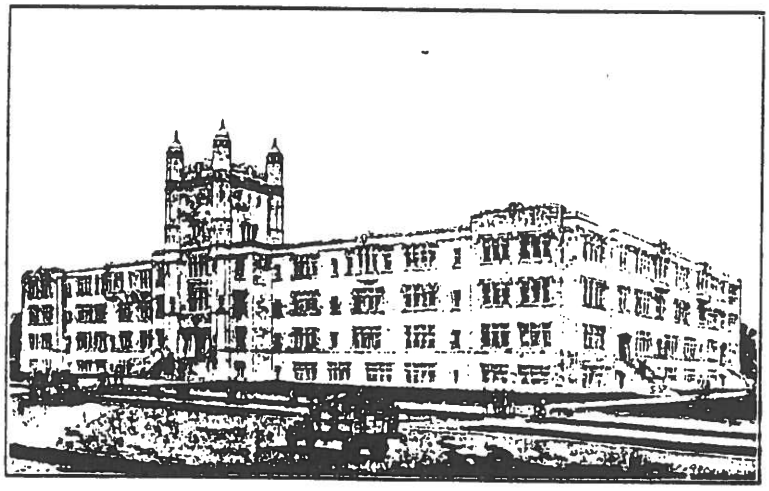
The program device is operated by the Master Clock in the same manner as the Secondary Clocks. The mechanism of a large secondary movement is used, operating a 24 hour tape, in which a perforation can be made for any minute of the 24 hours that it is desired to ring the bells.

The advantage of having a twenty-four hour program is apparent. In many schools and colleges, evening as well as day sessions are held. With our 24 hour program, signals may be given for the evening session entirely different from the day session without changing the tape, as would be necessary on a 12 hour program. The paper tapes are printed on special paper and are not easily torn. One tape may be used for years without changing, providing the program is a fixed one.

An automatic cut-out attachment is fitted to our program clocks so that any day's signal may be dispensed with, also for silencing bells on Saturday or Sunday.

OPERATING CURRENT.

The operating current for large systems should be preferably taken from a storage battery. For small installations, however, a high grade primary battery may be used.



Technical High School, Toronto, Ont.—Howard Electric Clock System Installed

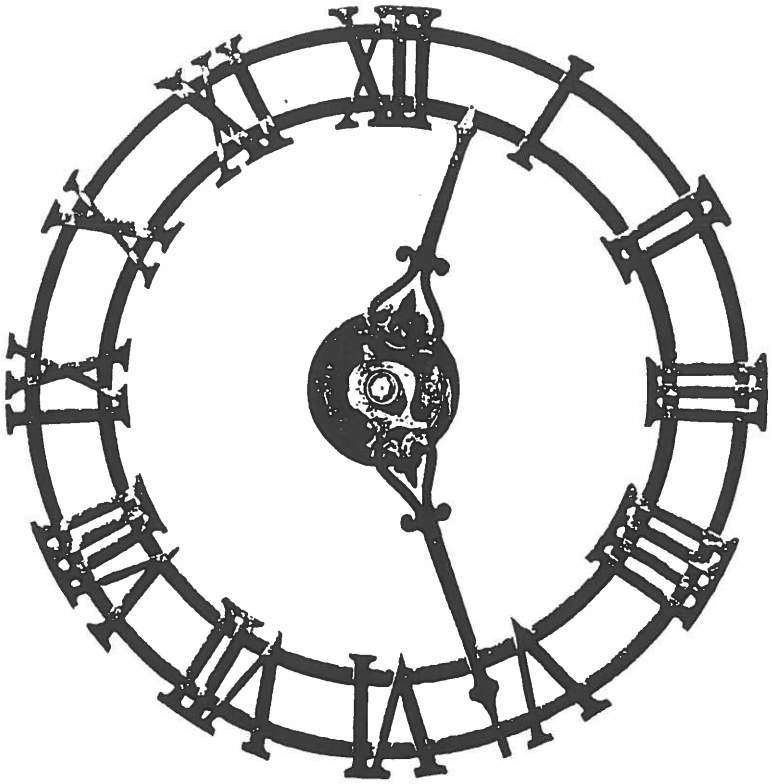
REFERENCES.

Thousands of Howard Clocks are in use all over the United States and Canada in municipal, public and private buildings. Among others we supplied :—

Library of Congress, United States National Museum and Smithsonian Institute, and Scottish Rites Temple at Washington, Trinity Church, St. Patrick's Cathedral, J. P. Morgan & Co. Bankers Trust Co., McAlpin Hotel, Yale Club, Metropolitan Life Ins. Co., at New York. United States Custom House, City Hall and Wentworth Institute at Boston; Technical High School at Toronto, Royal Victoria College at Montreal, American College for Girls at Constantinople, Turkey; Hotel Statler and Henry Ford Hospital at Detroit, Mayo Clinic at Rochester, Minn., and Royal Connaught Hotel at Hamilton, Ont.

Electric Secondary Clocks

THE E. HOWARD CLOCK COMPANY. BOSTON-NEW YORK-CHICAGO



Bronze Skeleton Dial

SKELETON BRONZE SECONDARY CLOCK

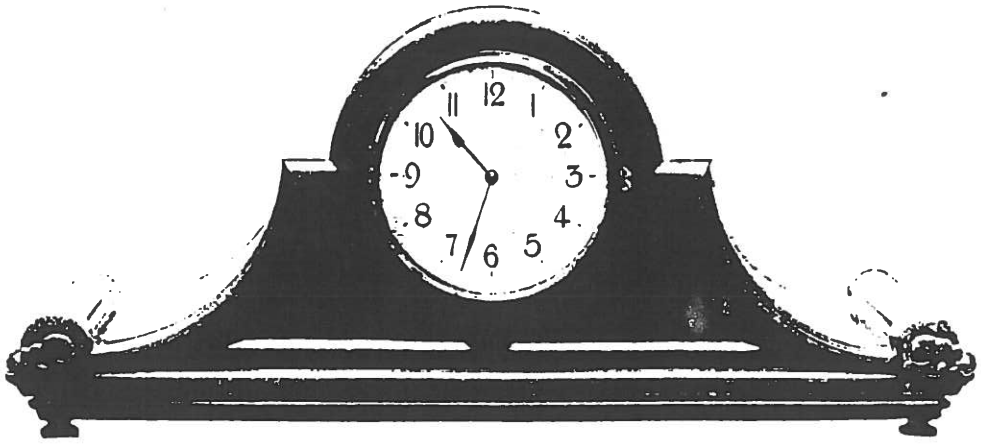
Dials 14, 18, 24, 30, 36, and 48 inches diameter

SECONDARY MOVEMENTS

Recessed in wall and covered with bronze center plate.

Other designs of hands may be substituted.

Cast-iron wall boxes supplied.



No. 200. Tambour Pattern Mantel Clock

CASES OF MAHOGANY OR OAK. DIAL SASH OF WOOD OR METAL
DIALS SILVER FINISH, BLUED STEEL HANDS

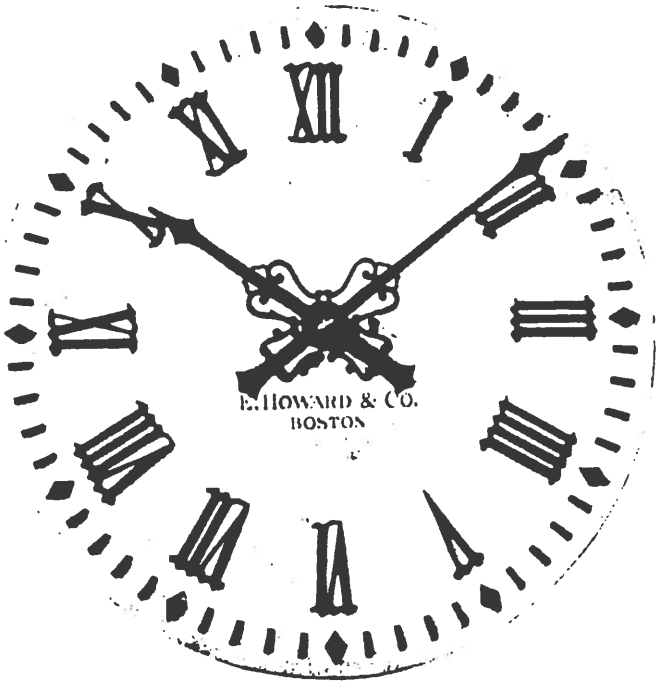
Dial sizes: 4, 6, and 8 inches

Other designs of Mantel Cases can be supplied.

Electric Secondary Clocks

THE E. HOWARD CLOCK COMPANY. BOSTON–NEW YORK–CHICAGO

THESE CLOCKS ARE ALSO MADE UP AS INDEPENDENT EIGHT-DAY WIND ACCURATE TIME-PIECES

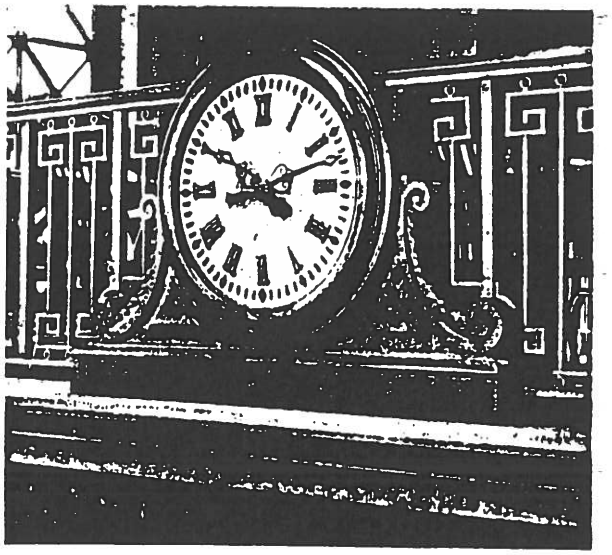


CLOCKS FOR PUBLIC SPACES IN BANKS AND OFFICE BUILDINGS

No. 21. Special

Dials of White Marble, with enameled figures and marks, or with bronze metal numerals and marks applied and pinned to the marble

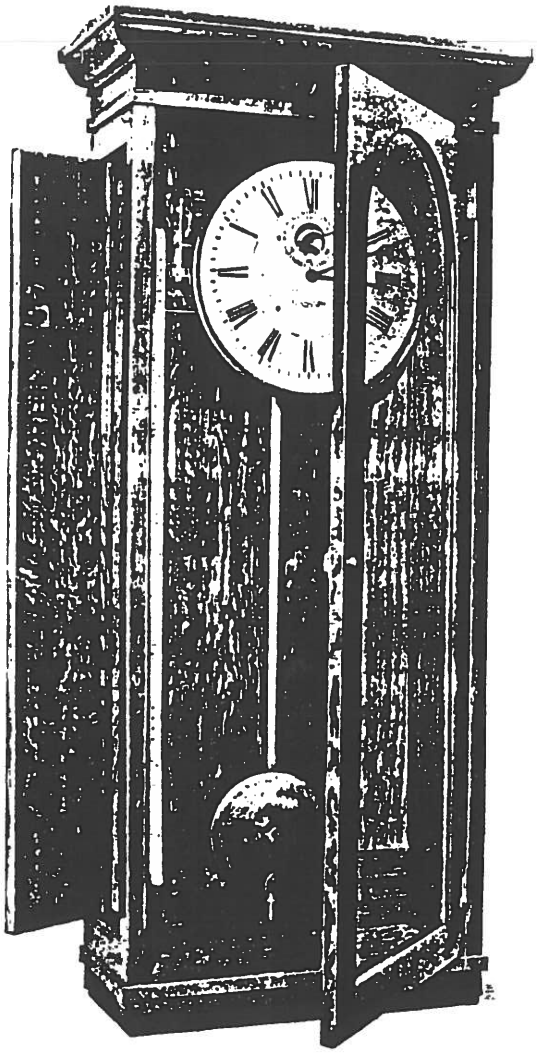
Dial sizes: 14, 18, 24, or 30 inches



CLOCKS FOR GALLERIES PARTITIONS OR OVER ENTRANCES ALSO OUTDOOR BRACKET CLOCKS

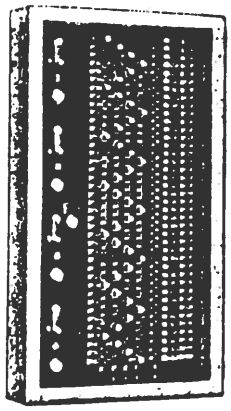
No. 290

This type of case made in wood or of metal.



No. 89 Master Clock
WITH TWO-CIRCUIT PROGRAM

RELAYS, CUT OUTS, SWITCHES AND STEP-UP KEYS ACCORDING TO NUMBER OF CIRCUITS ARE USUALLY PLACED IN MASTER CLOCKS



BELL CONNECTOR PANEL

PROGRAM MASTER CLOCKS AND PROGRAM INSTRUMENTS

The Program Instruments can be placed in the Master Clock cases or can be supplied in separate casings.

The Program Device is operated by the Master Clock in the same manner as the secondary clocks. A mechanism similar to a large secondary is used, moving a 24-hour tape, in which a perforation can be made for any minute of the 24 hours that it is desired to ring bells, and as many different circuits can be handled as may be required, there being two circuits controlled by each tape.

Automatically the ringing may be cut out for stated periods, or change made to another ringing program.

Provision is also made to manually cut out the ringing, or to ring by hand in emergencies.

It is also arranged so that the duration of the actual ringing is adjustable at the duration contact on the Master Clock or by using Time Element Relays for individual circuits.

BELL CONNECTOR PANELS IN CABINETS

These panel boards are supplied when specified so that the entire number of bells used can be connected one by one to any program circuit, or changed from one circuit to another. They can be arranged so that each bell can be rung by hand from the panel, and it can be so wired that all the bells can be rung at one time by throwing down a manually operated contactor.

OPERATING CURRENT

Systems are operated by battery and any regular open-circuit type battery can be used; or storage battery, in varying voltages, preferably 12, 16, or 24, but lower or higher as required or specified.

Regular open-circuit battery must be watched, and upon becoming exhausted replacement must be made.

Storage Batteries have a charging outfit, by which they can be kept up to full charged condition practically all the time at little expense.

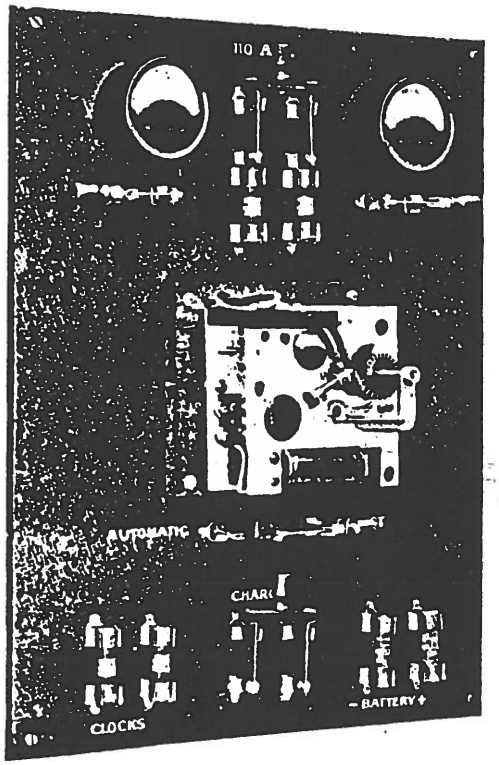
BATTERY CHARGERS

If Alternating current is available the charging of the Storage Batteries is accomplished by using Rectifiers, or with Motor Generators.

If Direct current is at the location, the charging can be done through resistance units, with but little trouble.

AUTOMATIC BATTERY CHARGING

A refinement of storage battery use is the addition of an Automatic Charger. This is operated in circuit with the secondary clocks and can be set to charge at any time and for any length of time each day.



Automatic Charging Device

CONTACT CLOCKS
of All Kinds are Our Specialty

SECONDS CONTACTS
For Laboratory Work, Electric Power Stations and Testing Units
Fitted to Regulator Clocks or to Fine Marine Movements

Master Clocks and Electric Secondary Clocks for Ships and Boats

---

FOG SIGNAL CONTROL CLOCKS

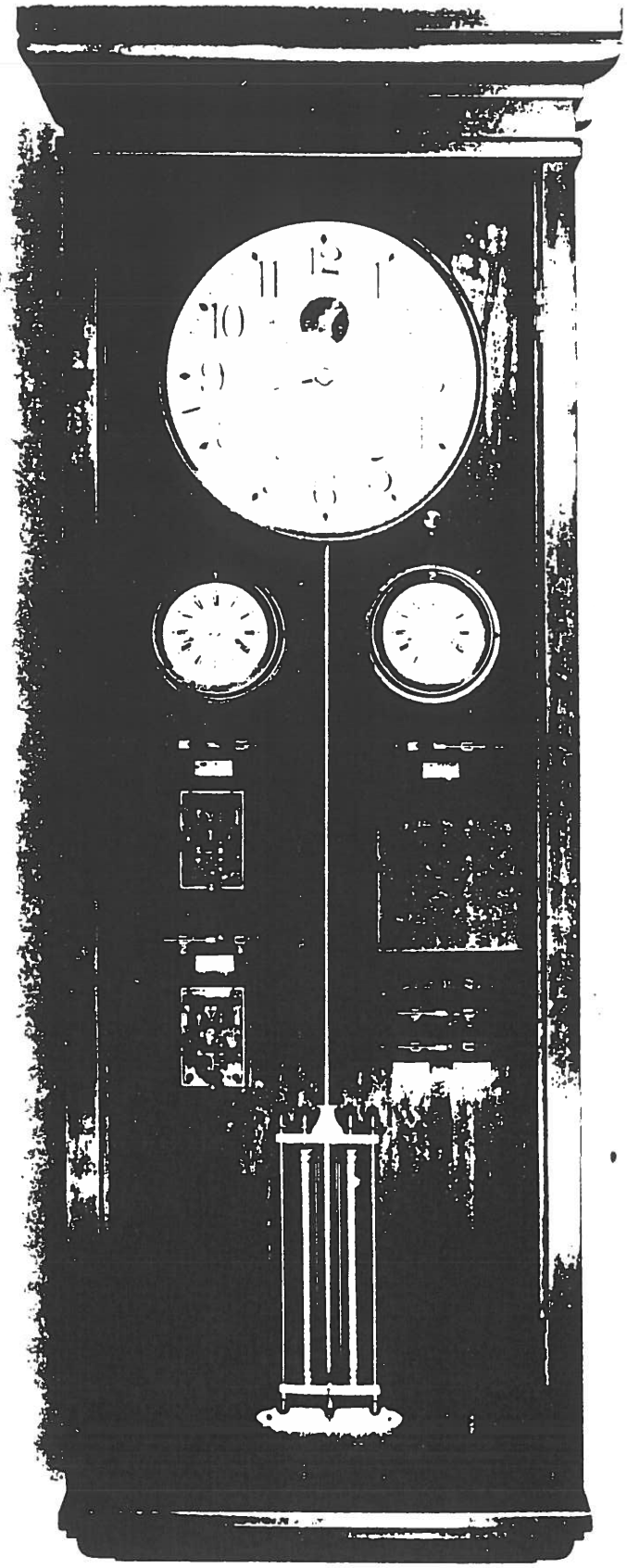
TOWER CLOCKS
Always fine timekeepers. Can be fitted as Master Clocks, making Inside and Outside Time Correct and in Agreement

ADDITIONAL PARTS APPLIED TO SYSTEMS

There are many other parts that can be furnished when systems are to be very complete, that are not supplied unless specially called for, such as Mercurial Pendulums, Pilot Clocks, Auxiliary Master Clocks, Battery Gauges, Duplicate Relays, Time Element Relays, Resistance Units, Circuit Breakers, etc., all depending upon the type of building being equipped and the care it is going to have after the installation has been made.

TRANSFORMERS

Bells may be rung by transformers operating from Alternating current, but a special bell is needed for this purpose. Classroom Bells, Buzzers, Corridor Bells and Yard Gongs as regularly supplied operate on Direct current.



--- MART ---

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

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 48236 (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

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. Irwin 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

Information on STRIKING SELF-WINDING CLOCK MOVEMENT. Need Rack. A. Redfield, 21 Kentbury Way, Bethesda, MD 20814, 301-656-5562

Information, Patents, Patent #'s, Ads, ANYTHING on SOHM ELECTRIC CO., Chicago. David Lee, RD #1, Box 187, Delanson, NY 12053

Information on SELF-WINDING clocks with movement marked BETTS & BETTS CORP. NYC, USA, OBERMILLERS PATENT. Anthony Prasil, 2179 Titus Ave., Rochester, NY 14622

Information about pneumatic master clocks by BUCHBINDER CLOCK SYSTEMS, Detroit, MI. George E Norkus, 18358 Red Oaks, Utica, MI 48087

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

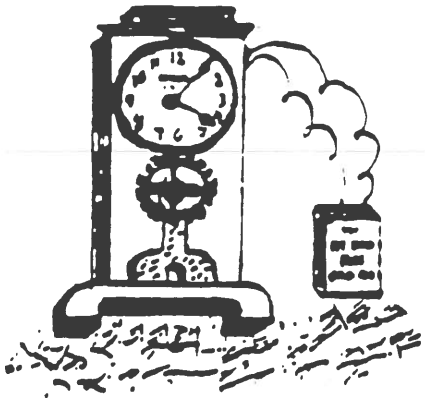
SELF-WINDING clocks, cases, parts, movements, 30 year collection! W. Spetrino, 1214 Cleveland Hts Blvd, Cleveland Hts, OH 44121 (216) 381-1197

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. Speciallizing in BULLE using original parts. One month maximum time for all repairs. Martin C. Feldman, FNAWCC 6 Stewart Place, Spring Valley, NY 10977

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_____

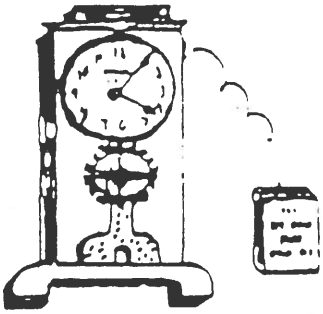
I wish to become a member of the Electrical Horology Society--#78 and enclos my $10.00 dues for the year 1990 _____ check here

I wish to renew my current membership in the Electrical Horology Society--#7 and enclose my $10.00 dues for the year 1990 _____ check here

SIGNED:_____ DATE:_____

Send check to Harvey Schmidt, 75-80 179th Street, Flusning, 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 XVI, #2, MAY 1990

Fellow Horologists:

This issue contains an original article by Chapter 78 member, Dr Bruce Levy, in which he describes the construction of an inexpensive and very useful VARIABLE VOLTAGE PORTABLE POWER SUPPLY. Modifications to convert to a bench type, AC powered supply are offered, courtesy of the editorial committee.

Also included, is a reprint of an article by Charles Aked which appeared in the March 1983 issue of CLOCKS magazine, which discusses in detail, the adjustments and repair procedures for the EUREKA CLOCK. We are indebted to the author for his kind permission to reprint the material. Additionally, an interesting patent is included by D & G Vande Plancke of Belgium, which details their "Electric Regulating Clock" with its unique contact system. The patent was issued in 1891 by the US Patent Office, and in 1885 in France, Germany and Great Britain, yet in spite of all of this protection, it seems that no-one has seen one of these clocks. An interesting research project; were any made?

MEETING NOTICE:
Chapter member, Alan Marx, has offered to host a meeting of the members at his home on Sunday, June 22nd, at 11:30 AM. All EHS Chapter 78 members are welcome, but it is essential to RSVP in order that Mr & Mrs Marx may know how many of us will be in attendance. 105 Bayeau Rd., New Rochelle, NY, phone 1-914-632-5986.

Our appreciation to those members that responded to our requests for Journal material... At last we are prepared for the next 2 issues without the hand-to-mouth existance that we had experienced in the recent past. Many thanks, all.

Good reading ahead...

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

A Power Supply For All Seasons Or a Variable Voltage Battery

Electrical clocks need energy to run. With the arrival of quartz clocks a voltage of 1½ is fairly standard, but there exists tremendous variability in current and voltage needs of earlier clocks. Many require only very short impulses of 1 to 2 milliamperes or less of current, while others may require close to 1 ampere. Most will operate somewheres between 1½ and 15 volts, a few require 24 volts.

Wouldn't it be "wonderful" (although I realize it might not be that wonderful) if one could easily carry in your pocket an independent portable power supply that could satisfy the energy needs of practically all battery clocks? With no formal education in electronics or electrical engineering, but with over 50 years of tinkering in my hobby of ham radio, I realized this would now be a rather simple project.

In order to "create" (I have no artistic, musical or literary ability but I am hoping this makes me a little creative) this power supply one requires - -

1) An interest and need for such a "machine".
2) Soldering iron, solder and a little bit of wire.
3) Screwdriver and pliers.
4) A small drill.
5) About $8.00 for parts ($3.50 more for batteries).
6) About 1 to 3 hours of free time (this does not include the time to buy some of the parts from Radio Shack or elsewhere).
7) A voltmeter - but this you might borrow from a friend.
8) Only a very limited electronic knowledge and some ability to work with ones hands.

RADIO SHACK PARTS REQUIRED (could be bought elsewhere)

1) Voltage regulator integrated circuit (IC) LM317T
   Part # 276 -1778 cost $1.99
2) Heat sink for voltage regulator (probably not really needed and it takes up space, but I used it to help carry off heat)
   Part # 276-1363 cost $0.79
3) Resistor 270 ohms (2 in a package but you only need one)
   Part # 271-016 cost $0.19)
4) Potentiometer (variable resistor) 5K (5000 ohm linear taper)
   Part # 271-1714 cost $1.09

5) Knob for potentiometer (see page 128 in 1990 catalog you can pick what you like about $0.50 each.

6) Small switch (big choice page 133 about 50 cents and up depending on what you choose)

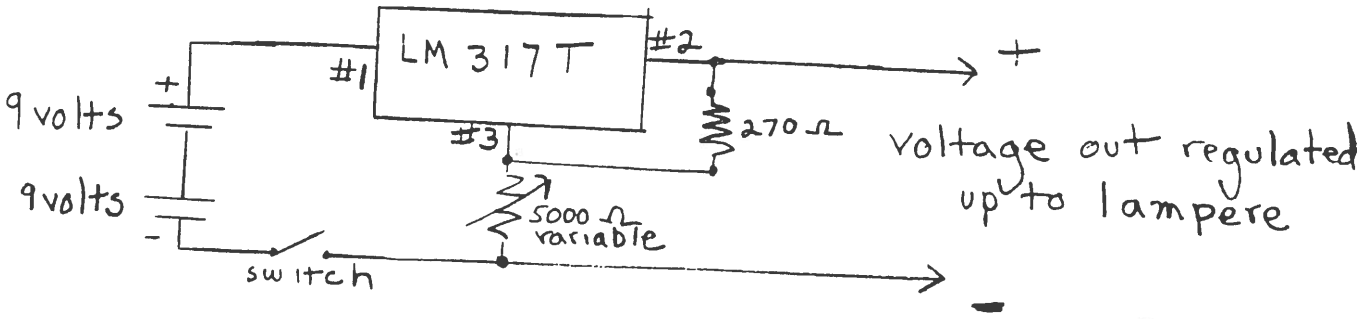
7) Two 9 volt battery connectors.
   Part # 270-326 cost about $0.25 each but must buy five in a packet (share with a friend and save money!)

8) Box or enclosure for all these parts.
   Part # 270-231 cost $1.89 size 4" x 2 / x 1 / (This is a tight fit for batteries and parts but it can be done. You might want to chose a larger box. I doubt very much that you could fit batteries and parts in a smaller one.)

9) Two alligator clips (your choice see page 131)
   about 20¢ each - pick small ones for tight spots and different colors to indicate polarity.

10) Two 9 volt alkaline batteries
   Part # 23-553 cost $1.89 but can get anywhere (Price not included in cost of power supply. You know " batteries not included").

Below is a simple schematic. The power supply I built has an extra switch to change from internal battery power to external power e.g. larger batteries, solar cells, small A,C. to D.C. adapter. However I do not feel most people would think this is worthwhile or necessary so it is not included here.



The back of the blister pack which contains the LM 317T shows 2 capacitors in the circuit - I found them not necessary. Be sure you connect the leads correctly to the LM317T and observe proper battery polarity. Carefully note the diagram on the back of the package.

276-1778

TO-220
CASE

LM317T—POSITIVE

The LM317T is an adjustable, 3-terminal positive voltage regulator. Internal current limiting makes the device virtually free from accidental blowout. Output voltage adjustable +1.2V to +37V. Output current limited to 1.5A.

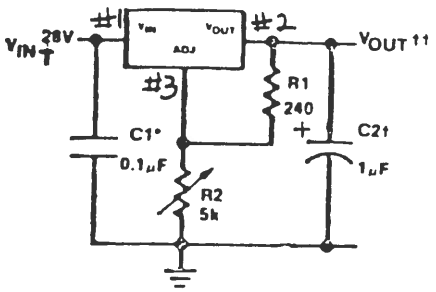
absolute maximum ratings

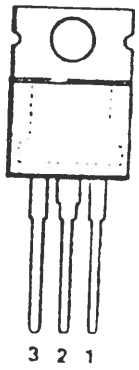
Power Dissipation: 15W
Input-Output
Voltage Differential: 40V
Load Regulation (Typ.): 0.1%
Line Regulation (Typ.): 0.01%/V
Ripple Rejection (Typ.): 80 dB

All Ratings Assume Proper Heatsinking

typical application

1.2-25V Adjustable Regulator





† Optional — improves transient response

* Needed if device is far from filter capacitors

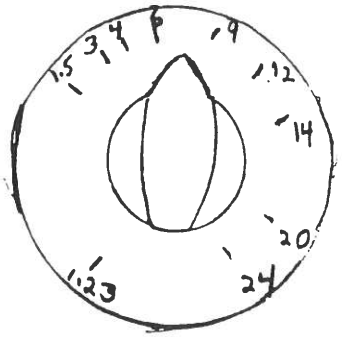
1. V_{IN}
2. V_{OUT} (Tied to Tab)
3. ADJ

$$\dagger\dagger V_{OUT} = 1.25V\left(1 + \frac{R2}{R1}\right)$$

For Further Information See Radio Shack Data Books

I suggest that one uses alkaline batteries because of their high current capacity (you really can get 1 ampere of current for short periods of time) their longer in use life and better shelf life. 9 volt lithium batteries will have an even longer in use life and shelf life, but they will not deliver as high a short term current - they are also more than double the cost.

After the power supply is constructed one must calibrate different positions of the potentiometer for different output voltages. I used a digital voltmeter for best accuracy but this is certainly not necessary, and a cheap (at least moderately reliable) analog voltmeter would be fine. I cut out a circular piece of paper and placed it under the mounting nut of the potentiometer on the surface of the box. Then I made marks for different voltage points. The nut holding the potentiometer and paper to the case should be very tight so there will be no slippage and therefore no change in calibration.



Using two 9 volt batteries (= 18 volts when in series) will only give a maximum regulated voltage of about 15.5 volts, but this will be adequate for most clocks.

There must be a switch to turn off the battery power when not in use. The voltage regulator draws a <u>small</u> amount of current even when not supplying any output. I measured about 4.5 milliamperes. Therefore the battery switch <u>must</u> be turned off or after several days the batteries would be exhausted.

When testing and running an electric clock one of course could confirm the calibrated voltage with a voltmeter, but I have found the calibration remains very accurate. One might also use a milliammeter or micrammeter in series with one of the output leads to measure the current drawn by a clock. Very often however the current drawn is only over a period of milliseconds and the inertia of the meter prevents accurate readings. Using an oscilloscope to measure current flow would be most accurate and will give an interesting determination of contact closure time with patterns of current rise and fall - perhaps the possibility of another article.

Not only have I used this power supply for clocks but also for testing and operating transistor radios (even a small hand held radio transmitter). It can also be used to adjust the output from solar

cells. You could run a clock on solar energy alone, at least on a sunny day!

My philosophy about gadgets like this (and other things in life) is that even though you may not need it very often, just knowing it is available to use is a happy reassuring thought.

I hope you enjoyed reading this article. If you have any questions or problems please write or phone =

Bruce Levy
3 Saul Place
Plainview, N.Y. 11803

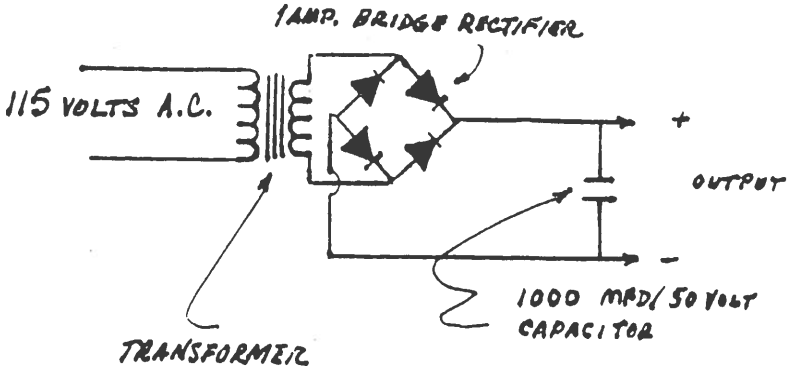
Phone (516) 433-6836

Editor's Note:

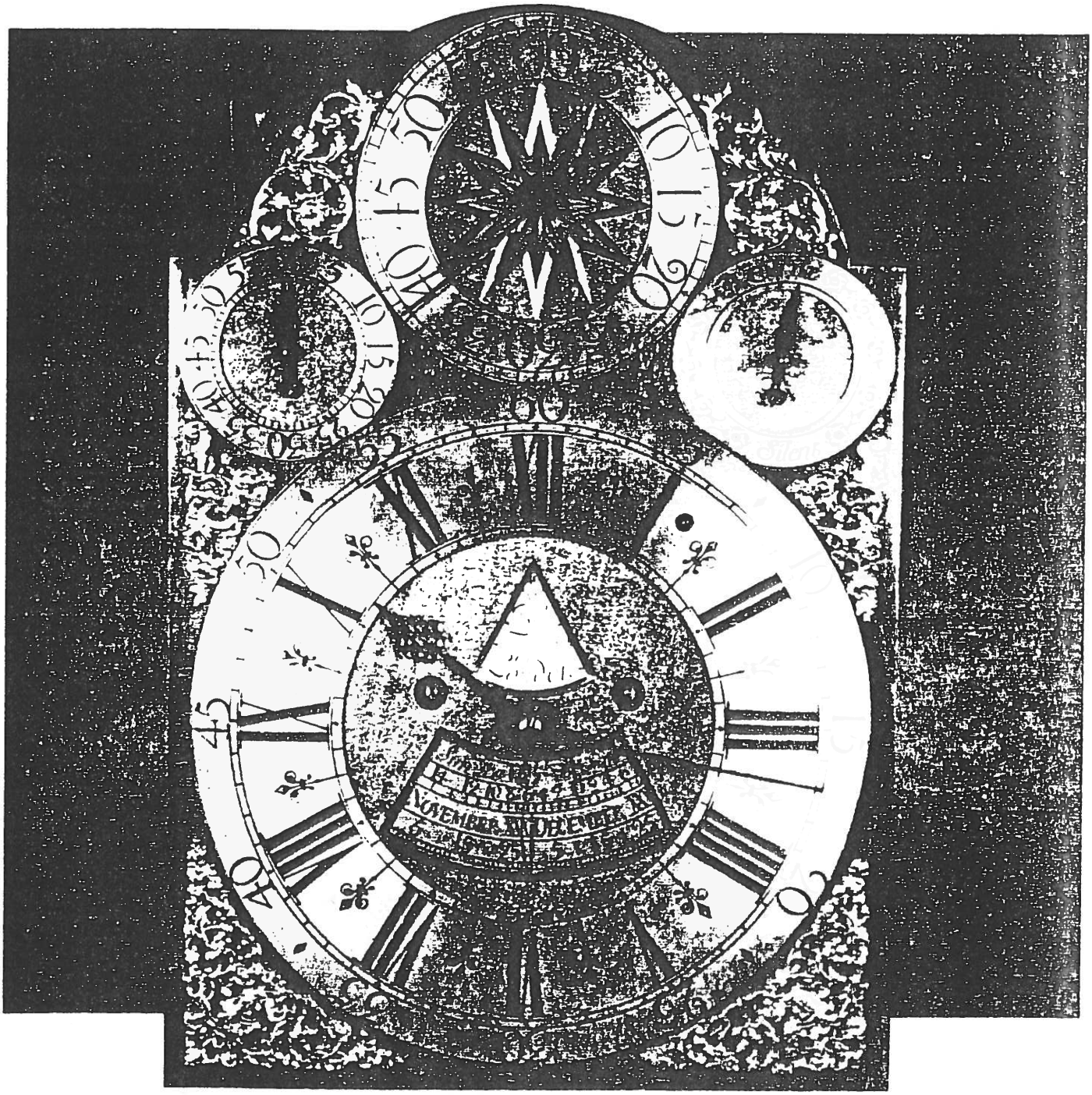
For those folks that want a line operated power supply, with higher output voltages than the 15.5 volts available from the battery unit, you may use the circuit below, replacing only the battery portion of Dr. Levy's schematic representation.

The voltage would only be limited by the output of the transformer.... Use of a 28 volt unit could supply up to 24 volts for powering a Standard Electric or Stromberg for example, and may also be used while a clock may be on test for extended periods that would otherwise cause the early demise of batteries.

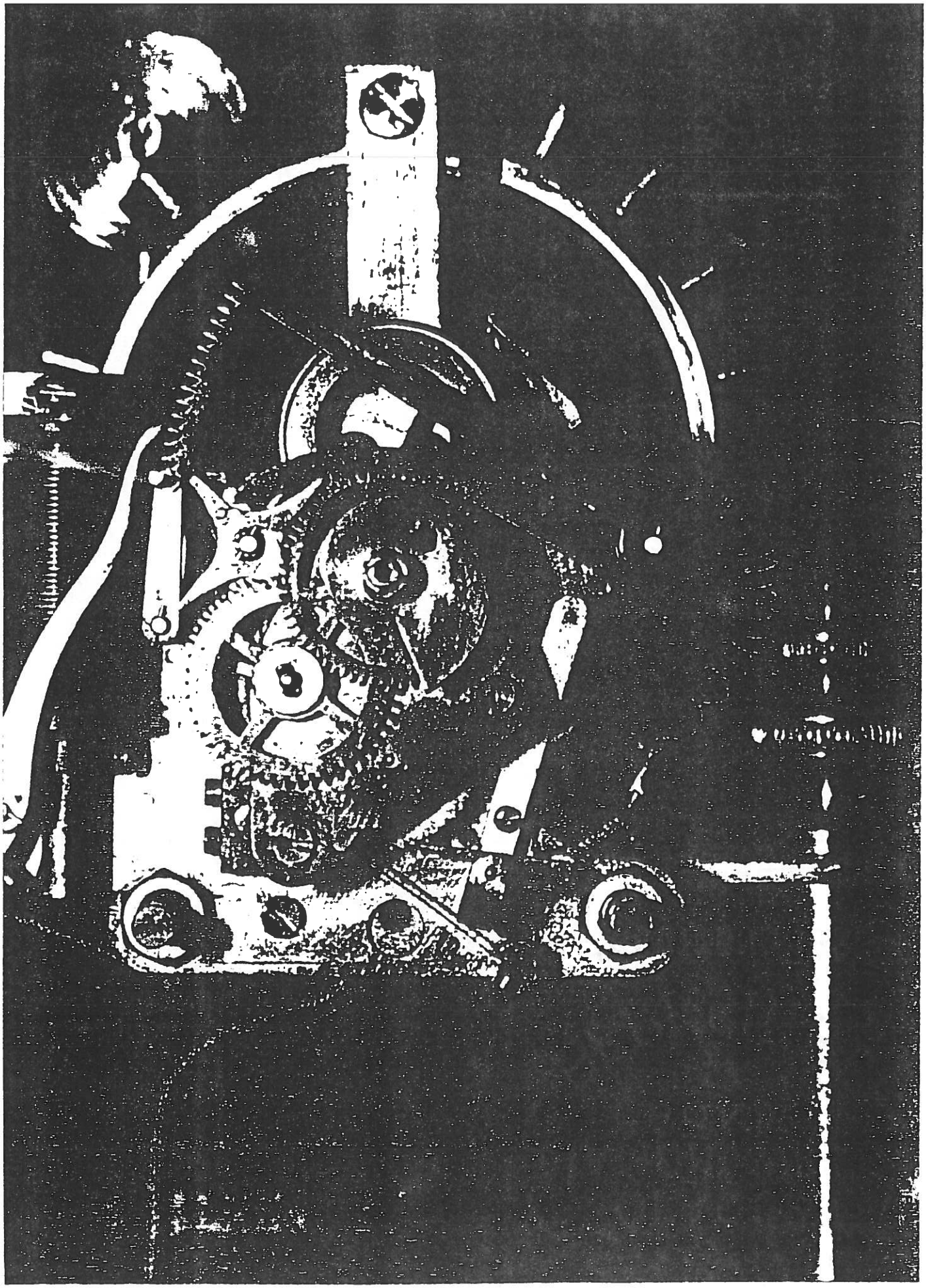
Many thanks to Dr. Levy for his useful, clear, and concise presentation. Dr. Levy is an occasional contributor of original material to the Journal, and we are looking into incentives that might encourage more frequent contributions...



CLOCKS



SPECIAL FEATURE~LONGCASE CLOCKS: A Topping longcase; Clock from the Cape; An astronomical 'prentice piece; ALSO: John



Eureka clocks

From time to time queries arrive at *Clocks* which require longer and more detailed answers than are normally possible on the 'Interface' pages. For this reason we have initiated an occasional series of Interface Special Reports which will, where appropriate, make a fuller reply to a reader's letter. The first of these starts below:

Sir,
After considerable time and effort I have just acquired a Eureka mantel clock, dated 1906, numbered 7373 and sold through Lyons and Sons, Exeter.

The mahogany case is in beautiful condition, the movement appears to be simply long neglected. In order that it may do the job properly, would you be so kind as to advise me of any suitable publications detailing the operation and maintenance of the movement.

I have been all through my back copies of *Clocks* and have only found generalised descriptions. This particular clock has what appears to be a home-made transformer and simple rectifier in the base. As the clock was originally dry cell battery driven (was this 1.5 volts?) how important is it to supply the clock with a DC supply – fully smoothed – or would a slight ripple not affect the operation?

Your help would be gratefully received.
Yours etc,
WW
Wigan

MANY Eureka clocks have been damaged through a lack of understanding of the principles of operation. All genuine Eureka clocks were made between 1909 and 1914, the date on the clock referring to the date of the granting of the patent, and so it follows that the examples found today are approximately of equal age. The main difference in the clocks is that caused by the difference in treatment, some being almost as good as new, others having been reduced to scrap by incompetent repairers unable to understand their *modus operandi*.

The usual error is to increase the driving voltage in an effort to compensate for the loss of balance amplitude from some fault; another is to meddle with the adjustments of the clock without discovering what the original fault is. For the record, the correct driving voltage is 1.5 volts from a Leclanche type cell. Originally a bell battery was used, lasting about three years, hence the 1000 days one often sees printed on the dial of a Eureka clock. However a SP11 cell will do the job for about six months and is cheaper. Never increase the applied voltage, the use of a mains transformer and rectifier is not recommended, unless any resulting damage is not important to the owner. These clocks fetch high prices at auction, £350 upwards, and must be treated accordingly.

Careful examination of a Eureka clock will reveal that the various parts of the operating mechanism are fixed geometrically and no adjustments are therefore possible. The points of contact closure and opening are determined by the fixed contact and, except in a few early models, this fixed contact cannot be moved up or down; the only adjustment is by filing the top and bottom edges of the fixed silver contact. When first made this was done once and for all by the manufacturer when making the final running adjustments. The moving contact on the balance, the driving cam on the balance arbor, and the magnet poles are all fixed immovably with respect to each other.

One adjustment remains to the repairer, that of the angular position of the balance spring collet on the balance arbor. This enables the length of the balance spring to be adjusted in conjunction with the outer fastening stud. But this should never be necessary if the balance spring is not rusty or damaged, or the balance screws have not been tampered with. There is one other use of the balance spring adjustment, and that is the positioning of the balance arms with the balance at rest. In the original setting the balance arm was about 30 degrees to the vertical and the contacts were just made at rest in order that the clock would start itself when the battery was connected, an unusual feature at the time. But the balance action is then asymmetrical, and for a Eureka clock with an exposed balance it looks much better with the balance arms vertical at rest. Theoretically the impulse to the balance should take place at the centre of the swing, however, the change merely removes it from one side to an equal amount on the other, and the cam driving the clock train is still operated as the balance is

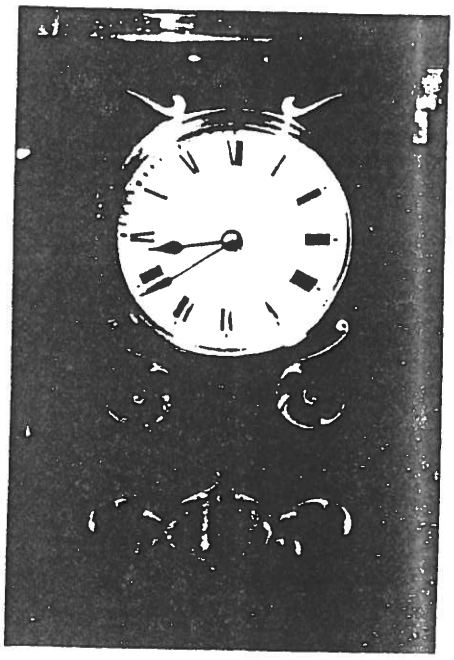


Figure 1: A Eureka clock in a wooden case.

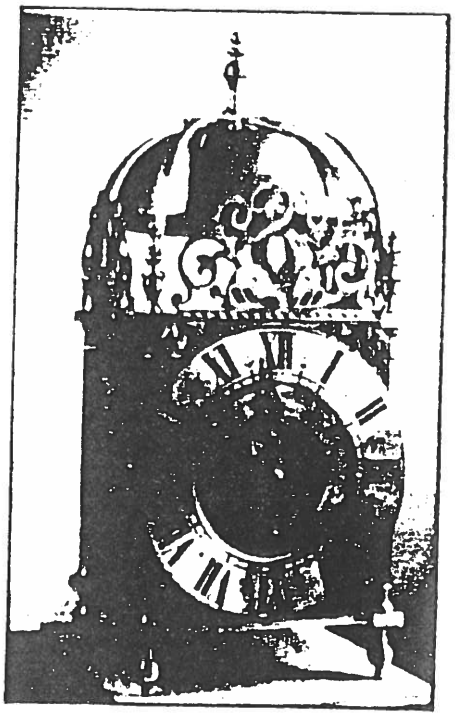


Figure 2: The lantern clock version was a very popular anachronism.

Opposite: The striking mechanism of the Eureka clock is directly under the dial.

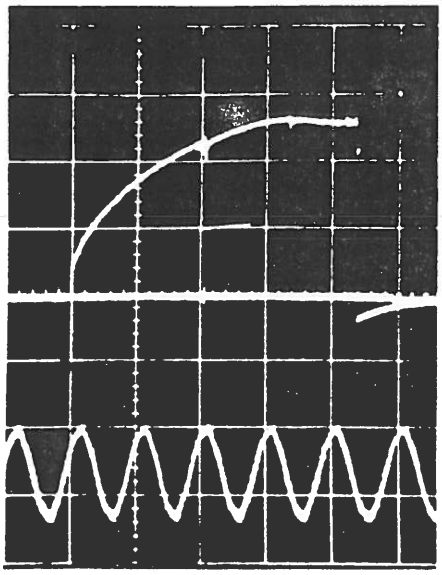


Figure 3: Oscillogram of the current as the contacts close then open. Lower wave is 50Hz timing wave.

impulsed. If it is decided to alter the balance collet, be extremely careful with the delicate screw, it is only 14 BA, use a drop of penetrating oil if it is rusty or stiff.

If the clock has been treated with reasonable care during its working life, the most likely defect is wear of the silver contacts. After some 70 years of use and approximately 840 *million* contact operations later, it will be surprising if some wear has not resulted! The wear will be mainly confined to the top edge of the fixed contact, and it results from spark erosion and metal transfer caused by the high voltage generated when the contacts open to interrupt the current flow through the magnet winding: the magnetic flux collapses rapidly and generates several hundred volts across the opening metal surfaces.

Figure 4 illustrates the sequence of events. To prevent the high induced EMF at the instant of contact opening, the writer has found it useful to connect a small silicon diode across the magnet winding – the Texas 1S113 is a suitable device – as this allows the current in the coil to find an alternative path when current from the driving cell is turned off, thus preventing the generated high voltage. The diode is connected as in figure 5, and draws no current from the cell; its physical size is so small that the effect on the balance poise may be neglected. It is preferable to connect the negative pole of the cell to the fixed contact and the positive pole to the metal frame, the diode being connected with the wire near the diode markings to the balance arm, the other to the moving contact. Once this is done, the cell must not be reversed or the diode will be destroyed.

The use of the diode gives the following advantages:

- Contact erosion from sparking is eliminated;
- Interference to nearby UHF radios and televisions is eliminated;
- The amplitude of the balance swing is increased some 20-30 degrees for the same battery voltage;
- Because the current flows longer in the magnet winding, a slight loss of the top of the fixed contact can be tolerated;
- The amplitude of the balance swing is maintained more nearly constant, as minor changes in the contact resistance in operation do not alter the operating current through the magnet coil significantly;
- The delicate moving contact assembly is protected from insulation breakdown and metal deposition;
- The magnet coil insulation is protected from breakdown by the high voltage.

It is important that the contacts are 100 per cent correct. If the fixed contact is worn, there may be enough material to allow punching out the rivets and drilling holes in the worn portion and re-riveting as shown in figure 6, so that the part originally fixed to the spring blade becomes the new working surface. The old rivet holes need not be filled in, but the operating faces must be made absolutely smooth, and the edges relieved as shown.

The moving contact is a much more subtle arrangement if, as fitted originally, it consists of a sterling silver 18 SWG wire pin passing through a phosphor bronze tube, a fibre tube insulating the pin from the phosphor bronze which also has an insulating tube on the exterior, the whole being secured by a screw closing a slit cut in the brass mount holding the balance arm. At the operating point, half the circumferential sheath of phosphor bronze and fibre is cut away to expose the silver pin to the fixed contact as it passes over the inner surface of the fixed contact; on the return swing the phosphor bronze tube engages the other side of the fixed contact (see figure 6). Thus current can pass through the contacts when the balance swings clockwise, and not on the reverse swing. Usually the moving contact assembly is damaged, however it was made long enough to allow being drawn through enough to give a fresh working portion for the silver pin, cutting off the damaged part and filing the end smooth. Do not attempt to alter the phosphor bronze tube, it may be that enough remains to work correctly, and while the fibre tube may have disappeared between the silver pin and outer tube, if there is a gap all round the silver at the operating part and the fibre is intact lower down, all is well.

There is also a sleeve insulating the moving contact assembly from the brass of the balance; if this is missing or defective the battery is shorted out and soon discharges completely. Even if the moving contact appears perfect, it should be cleaned by a non-toxic degreasing agent because the slightest flow of current on the reverse swing will reduce the amplitude. It is not an easy matter to make a moving contact assembly as originally fitted. A solution is to cover the outer surface of the fixed contact with a thin smooth layer of epoxy resin or stick a very thin piece of PTFE tape in place. The aim is to prevent a circuit being made on the reverse swing. Be careful in handling the various parts as age will have made the insulation brittle. Check that the lead connected to the fixed contact is in reasonable condition and not shorting to the frame of the clock, otherwise the battery is shorted out.

If the contacts seem to be correct, or have been restored, the operation of the clock can be checked. With a 1½ volt cell the amplitude of the balance swing should be 360 degrees; if not there is some fault. If the top edge of the fixed contact is worn down, the current is switched off too soon and the impulse to the balance is reduced, thus the swing falls off. Oil on the contacts is fatal since it increases the contact resistance and reduces the current; it must be removed completely.

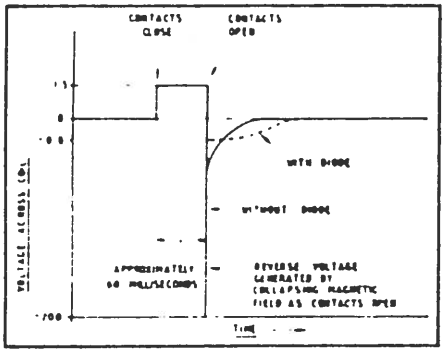


Figure 4: Graph of voltage across coil in operation, with and without suppression.

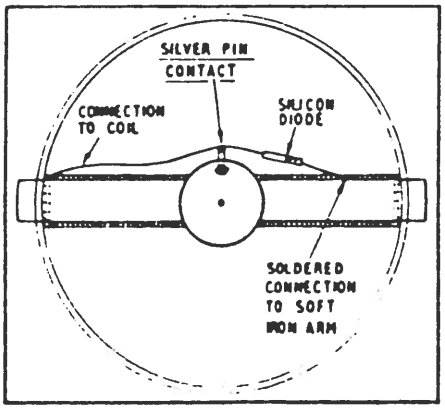


Figure 5: A silicon diode is connected across the magnet coil as shown.

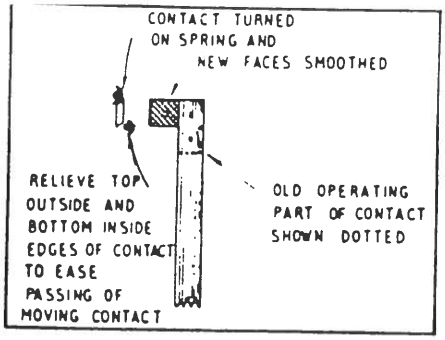


Figure 6: Repair of the fixed contact by turning through 90 degrees.

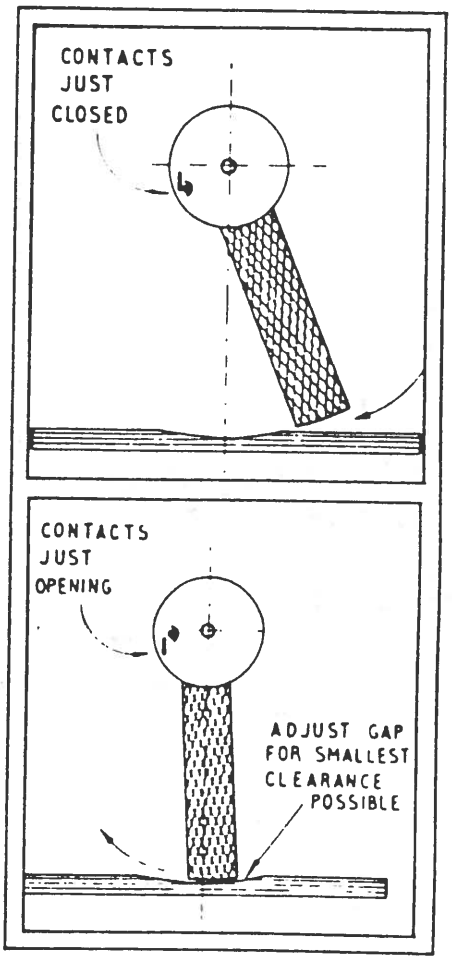


Figure 7a: Impulse to the balance just commencing (top) and, 7b, impulse ending approximately 60 milliseconds later.

Turn the balance through 180 degrees and release it; it will run for about one minute before the amplitude falls to half a turn if the clock is in good condition. If it does not, repeat the same test with the arm carrying the roller bearing on the cam pulled away from the balance arbor. The balance should swing for at least one and a half minutes before reducing to half amplitude. If it does not, the bearings of the balance must be checked, the races may be rusted or the balls pitted, it is better to strip the bearings down and thoroughly clean these, turning the races to an uninjured portion if possible (the ball bearings operate over a small arc only). If the balls are pitted it is better to obtain new ones, however these too can be turned to a new acting surface since the movement is not great.

After cleaning, new clock oil should be used, enough to touch the bottom of the balls; some will be conveyed to the balance pivots, but a drop on the pivots is helpful. It is rare for the pivots to show signs of wear.

Should the bearings have to be dismantled, it is a good time to clean the clock itself, do not be tempted to dismantle the balance; it is best left alone if possible. It is possible to remove the balance screws, noting the position and amount screwed in, in order to polish the brass rim and remove rust from the steel, and to polish the screw heads, followed by lacquering. It is also a good time to clean rust from the balance spring and give it a thin coat of oil to prevent further rusting. Cleaning the clock train is a simple matter; preserve the original lacquer wherever possible.

Before assembling the clock completely it is better to check the action of the balance. The fixed iron armature should be truly concentric with the balance arbor and in action the balance magnet poles will seek the centre part because this is the position of minimum magnetic reluctance. The Eureka clock is designed so that at this point the contacts have just opened.

Reference to figures 7a and 7b will clarify the correct sequence of events. As the balance swings clockwise, the moving contact meets the fixed contact and current from the battery commences to flow through the magnet coil. The winding has considerable inductance and it takes time for the current to rise to its full value (see figure 3), so that contact is made just before the balance magnet poles enter the curved part of the fixed iron armature.

The magnetic flux created by the soft iron poles on the balance pulls the magnet round until the position in 7b is reached, at which point the contacts open, the current ceases and the electromagnet reverts to an unmagnetised state once more. As this also takes time, the contacts open slightly before the central position: the electromagnet on the balance must be completely demagnetised before leaving the soft iron armature or it will exert an opposing force to the balance motion. The current only flows for about 60 milliseconds with the balance swinging through 360 degrees, and the power consumption is neglible.

One of the most important points for efficient operation is that the gap between the moving poles of the balance and the fixed soft iron armature must be as small as possible without actual contact occurring when the magnet is energised: the thickness of a cigarette paper is about right. The gap is adjusted by placing *brass* shims under the iron armature – do not use steel or the action will be impaired. The pull on the balance is considerable, therefore it is essential that the bearings are in good condition to prevent physical contact of the various parts.

Do not expect perfect timekeepig from a Eureka clock. Sometimes these clocks will go for long periods quite well, followed by the most erratic behaviour when adjustment of the balance spring regulator from one end to the other will not rectify the rate. The first requirement is a constant amplitude of the balance swing, if it varies then the timekeeping will vary too. Most owners accept this behaviour and are content with the attractive appearance of the clock in motion.

The highest serial number for a Eureka clock I have discovered is 9950, so the generally accepted production of 10,000 clocks may be correct. On the other hand it is definitely known that the serial numbers are not in chronological order and there are large gaps in these. Again, certain serial numbers were reserved for overseas orders and examples of Eureka clocks

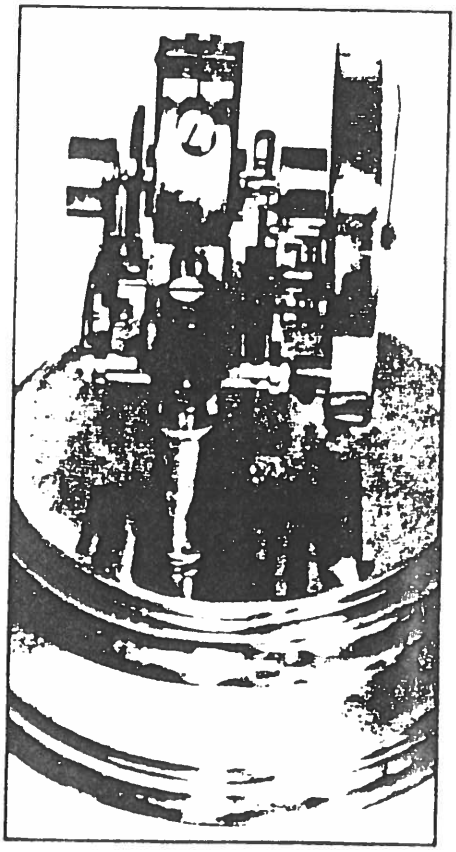


Figure 8: Early Eureka clock, usually found missing the glass dome cover.

are to be found over the whole world. Many were sent to America by the late Malcolm Gardner in the middle part of the present century.

No repair or technical literature was ever published by the Eureka firm; they merely published a catalogue of their clocks. There was a one-column article in *Electrical Engineering*, published in London, page 943 of the issue of 17th June 1909. Another description was given in the *Horological Journal*, pages 172-3 of the July 1909 issue. In the *Model Engineer* from 3 February to 31 March 1949, there was a series of instalments on how to make a Eureka clock by 'Artificer'. Some of his instructions do not lead to an exact duplication of the component parts, for example the contact arrangements – particularly the moving contact arrangement – and he recommended a gold-silver alloy for the fixed contact.

Another, and most useful source of information, was compiled by B S T Wallace for the *Watchmaker, Jeweller and Silvermith* of August 1955. Mr Wallace was a grand old man who retired to Bognor Regis. He had studied the Eureka clock from when it first appeared and had a large collection. He was famous for his long-range weather forecasts in the *Daily Mirror*, basing his forecasts on the simplest of meteorological equipment. He was always correct, and it is curious but his recording barometer stopped shortly before his death after being in use for over 50 years without ever being attended to for the cleaning and so on of the clock mechanism.

For the history of the Eureka clock one must refer to *The Eureka Clock* by Dr F G Alan Shenton.

One of the most common enquiries is about poising the balance. This is not necessary if the balance runs at constant amplitude, unlike a watch which would have a change in rate with change of position. Any slight out-of-balance will not impair the action of the Eureka clock. Another common query is about the compensation balance, however this is more for appearance than practical use, although the balance rim is of brass and steel and correctly cut. Again enquiries have been made whether the orientation of the clock in the earth's magnetic field is important, the effect is about as much as lining yourself up with the magnetic field before going to sleep. The cost of acquiring a Eureka clock will have vastly greater effect. If you see one going cheap, take it whatever the condition. □

(No Model.)

3 Sheets—Sheet 1.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

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

FIG. 1.

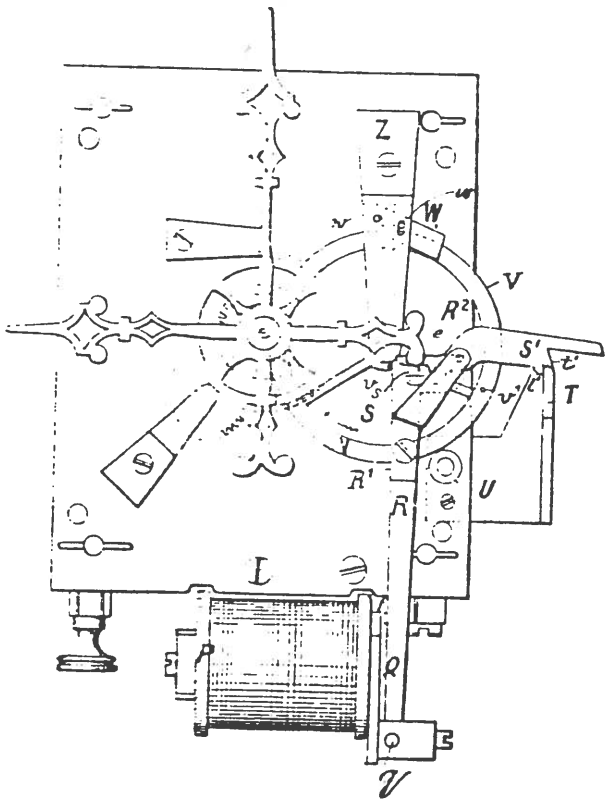
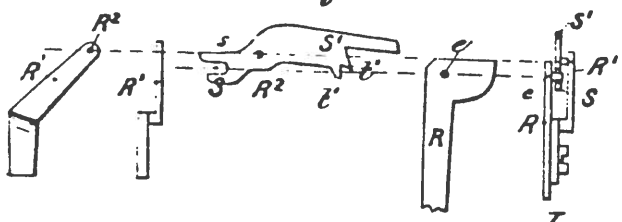


FIG. 2.



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

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

(No Model.)

3 Sheets—Sheet 2.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

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

FIG. 3.

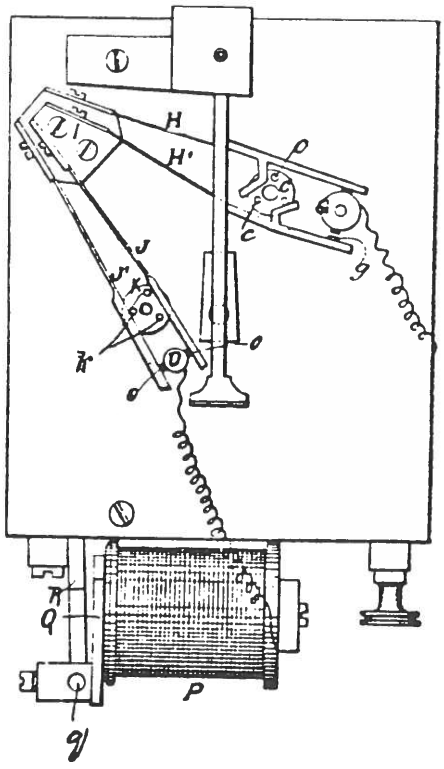
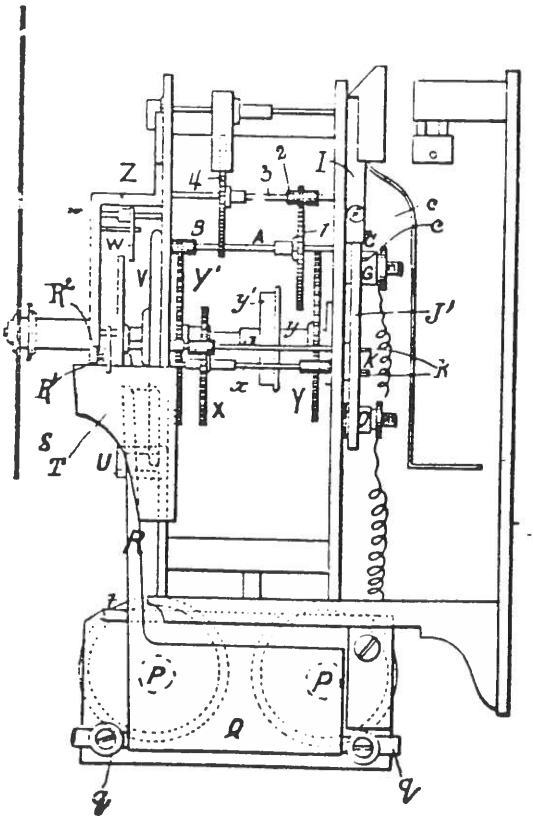


FIG. 4.



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

Inventors
Désiré vande Plancke
Gustave vande Plancke
by Fairfax & Hotter
Attorneys

(No Model.) 3 Sheets—Sheet 3.

D. & G. VANDE PLANCKE.

ELECTRIC REGULATING CLOCK.

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

FIG. 5.

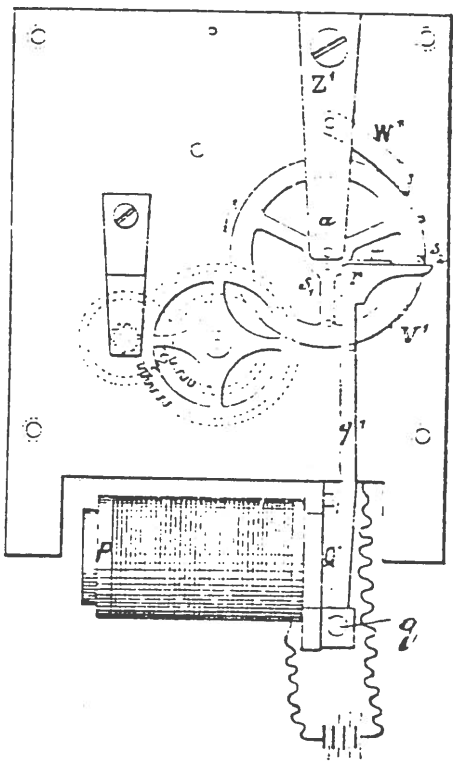


FIG. 6.

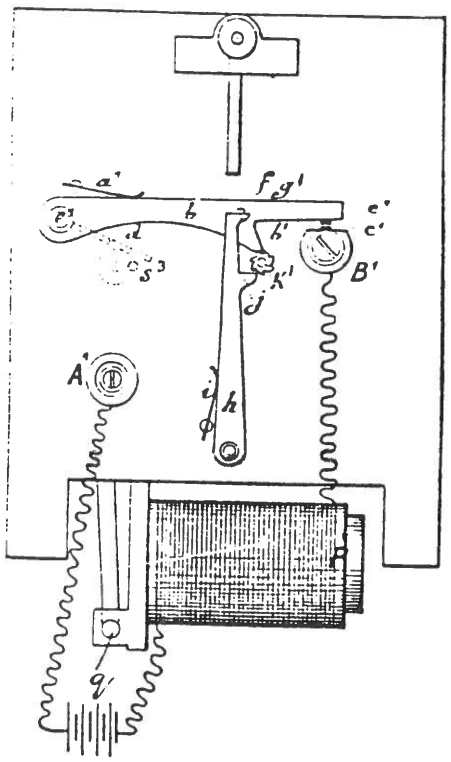


FIG. 7.

Witnesses:
M. Learning
G. R. Craig

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

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 20, 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 *l′ l′*, 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 *e*, 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 *r* and to turn the fly-wheel in the direction of the arrow. A second pin *e′* 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 *e′* 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 *e* will strike the short arm S of the lever S S′, so as to turn on its fulcrum and allow the pin *e* 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 cur-

rent 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 *b*. Consequently the turning of the fly-wheel causes the pin s^3 to lift the lever *d*, and thereby also the lever *b*. The pin *f*, which is lifted with the lever *b*, 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 *b* 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.

The Ancient Timekeeper

Sundial at Christ College, England

"Time Passes Silently Away
By minutes, hours, and then the day."

The Sundial is still used for its Beauty, but most of us require a more accurate means of timekeeping.

--- MART ---

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

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 48236 (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

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. Irwin 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

Information on STRIKING SELF-WINDING CLOCK MOVEMENT. Need Rack. A. Redfield, 21 Kentbury Way, Bethesda, MD 20814, 301-656-5562

Information, Patents, Patent #'s, Ads, ANYTHING on SOHM ELECTRIC CO., Chicago. David Lee, RD #1, Box 187, Delanson, NY 12053

Information on SELF-WINDING clocks with movement marked BETTS & BETTS CORP. NYC, USA, OBERMILLERS PATENT. Anthony Prasil, 2179 Titus Ave., Rochester, NY 14622

Information about pneumatic master clocks by BUCHBINDER CLOCK SYSTEMS, Detroit, MI. George E Norkus, 18358 Red Oaks, Utica, MI 48087

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! Joseph J. Singer, 6404 Woodhawk Dr., Mayfield Hts, Ohio 44124

WANTED & FOR SALE: STANDARD ELECTRIC Clocks & Wiring Diagrams/Service Bulletins. Will trade, sell, or buy. Call or write for available material & wants. Jeffrey R Wood, P.O. Box 5, Wilbraham, MA 01095. (413) 596-8250

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

The
JOURNAL
OF THE
ELECTRICAL HOROLOGY SOCIETY
Chapter No 78
NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.
VOLUME XVI, #3, OCTOBER 1990

Fellow Horologists:

"I am compelled to regard the post office, next to Christianity, as the right arm of our civilization," Spoken by the famous American orator, Edward Everett, many years ago. I wonder about Mr. Everett's opinion of the postal system if he were available for comment today. How does this relate to Horology, you may ask? The relationship is clear when one considers the undue delay between the mailing of the Journal, and the actual receipt... Some members are blessed with delivery within a few days while others wait as much as a few weeks, so a little tongue-in-cheek criticism seemed in order as an explanation.

This is the 3rd issue of 1990, with the final issue to be released by the year's end. The final issue will contain, in addition to the usual dues notice, a ballot for the election of officers, and it seemed appropriate to advise the membership in advance, to offer enough time for consideration of candidates for the various offices.

Charles Aked, the noted British authority on all phases of horology has sent us a number of interesting items for publication, and we included 2 in this issue with more to follow. It is especiaaly interesting to note that one of them deals with the installation of a Time Ball in the city of Boston, some little distance from his home in England!

Another item, one of a group supplied by David Lee, describes the striking version of the Gregory-patented Sempire clock. You may recall the original article detailing the contact system provided by Bill Ellison recently, and this addition adds interest to the clocks by this maker since none of the strikers seem to exist. Does anyone know if any were actually made?

Additional material on early batteries, or cells, is included as an add-on to the information previously published on this subject. One of the items describes how you can rebuild dry batteries ... Do you want to try your hand at doing one? Interesting bit of nostalgia intended to be both informative and amusing.

Enjoy this issue... Good reading ahead.

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

EPHEMERA OF ELECTRICAL HOROLOGY

No. 1

Thanks to Ms. Carlene E. Stephens who provided a copy of the rare pamphlet containing the communication from Professor E. N. Horsford to the Mayor of Boston dated 27th November 1853, it is possible to place this information before those who are interested in these matters. On the cover is the following:

CITY DOCUMENT - No. 75

CITY OF BOSTON.

PROFESSOR E. N. HORSFORD

RESPECTING THE REGULATION

OF

TIMEPIECES IN THE CITY.

In Board of Mayor and Aldermen,

November 28, 1853.

Referred to the Committee on Fire Alarms, and ordered to be printed.

Sent down for concurrence.

BENJAMIN SEAVER, Mayor.

In Common Council, December 1, 1853.

Concurred.

Henry J. Gardner, President.

His Honor the Mayor of Boston,

Sir, The accompanying communication presents the Plan for the Regulation of Timepieces in and about Boston, which you were pleased to request at my hands.

I am, very respectfully,

Your obed't Servant,

Cambridge, Nov. 27th, 1853. E.N. HORSFORD.

A PLAN FOR THE REGULATION OF TIMEPIECES IN AND ABOUT BOSTON.

The cupola of the State House is fortunately so high, that a signal made at its top with a properly colored object of moderate magnitude, may be seen from many points in town, from the steamers and sailing vessels entering and leaving the harbor, from some points along the wharves, from railway trains approaching and leaving the city, from public institutions and schools in the suburbs and neighboring towns, and with the aid of a small spyglass, from all points where the dome of the capital is visible, embracing an area of some ten miles radius.

It is proposed to take advantage of this elevation, and erect upon the top of the cupola, fixtures for dropping, at precisely twelve o'clock, mid-day, a dark colored spherical ball.

To this end the ball may be run upon a hollow iron shaft, by a chain passing over a pulley at the summit of the shaft, and descending along its interior to a convenient place in the dome. At five minutes before twelve o'clock the ball will be run to the top of the shaft, and so secured that by electro-magnetic apparatus it may be released precisely when the hands of the fire-alarm clock shall indicate the instant of twelve.

Page 6: The necessary fixtures for carrying out the above plan, according to such an estimate, as with the aid of several experienced persons, I have been enabled to make, will cost as follows:-

A hollow wrought iron shaft, of three inches inner diameter, and twelve feet long, .	$ 15.00
A copper globe, securely braced within, three feet in diameter, .	$ 60.00
Staging and labor for establishing the shaft and ball in their places, .	$100.00
Pulleys and chain, .	$ 15.00
Fixtures for dropping the ball, .	$ 25.00
Spring for the ball to strike upon, .	$ 3.00
Permanent battery, at the State House, .	$ 10.00
Wire communicating with the fire-alarm office,	$ 50.00
Fixtures for closing the circuit, including an electric clock at the State House .	$ 75.00
Compensation to Messrs. Farmer and Batchelder, for professional service, .	$ 47.00
Total, .	$500.00

It is conceived that no expense will attend the uniform service of the ball. The person in charge at the State House, will, as part of his daily duty, run up the ball at five minutes before twelve as indicated by the electric clock connected with the fire-alarm office. The dropping mechanism will adjust itself at the moment the ball attains its place at the top of the shaft. The release of the ball will take place of itself, the second hand of the clock being made to close a galvanic circuit, for this purpose, at the required instant.

Page 7: Accurate time is sent in from the Cambridge Observatory to Boston, twice a week, and, with the correction due to difference in longitude, can be employed to regulate the dropping of the ball.

The advantages of such an arrangement are so obvious as scarcely to require enumeration. There are a few if any similar points from which the communication of accurate time once in twenty-four hours, would be a convenience to so large a number. Within the sweep of a three mile radius from the State House as centre, there cannot be less than two hundred and ten thousand inhabitants, who would directly or indirectly be benefitted by such an arrangement. Within a

circle of ten miles radius there cannot be less than two hundred and sixty thousand who could profit by it.

It is of no small moment in the conduct of industrial enterprises, that the time-pieces which are to regulate duties and engagements be coincident and reliable. With the arrangement above proposed, it will be easy for all in and about Boston to be governed by the same time, and to have that correct. It will be as if all watches and clocks within a certain circle were moved by common and connected machinery.

Besides the various officials at the State House who will have standard time indicated on the electro-magnetic clock in the capitol, and those to whom the ball will be visible with the unaided eye, and those who will see it with a glass, railway passengers will take the time to every part of New England, and thus enable time-keepers knowing their difference of longitude to adjust their clocks and watches more accurately than they could by individual observation; while ship-masters will regulate their chronometers on the day before sailing, and take with them true Boston time, (page 8) with the trouble of a few moments' attention at noon.

The general plan of the above was naturally suggested by the similar contrivances at Greenwich and in the Strand, London. Shipmasters in the Thames have found it a great convenience to procure accurate time from the Observatory at Greenwich, without leaving their vessels; and those doing business in the city proper have experienced like advantage from the time-indicator in the Strand. It cannot be doubted that an equal if not a greater benefit will follow to residents of Boston and its vicinity, if the above measure be carried out.

Finally, it will be a fitting accompaniment to the scientific fire-alarm system, which we owe to the conception of Channing, united to the fertile invention of Farmer.

Respectfully submitted.

E. N. HORSFORD.

Cambridge, November 23rd, 1853.

: ———— :

Notes: Although this is only a proposal, it contains information which is quite interesting. First of all it indicates that not only was an electric clock in use in the city of Boston, but that it was used to give the standard time and sufficiently accurate to require checking twice a week with the regulator at Cambridge Observatory only. Furthermore it was judged sufficiently accurate for use in the setting of chronometers used on board ships, and to govern all industrial enterprises and govern all civil activities. Surely this is a vindication that some of the early electric clocks were not as unreliable as some authors have made out.

Another interesting aspect is the speed in which various events spread across the Atlantic from England, even taking into account that Boston is a seaport and was having direct trade with Bristol and London. Professor Horsford wrote in November 1853 about the time ball in the Strand, and this was erected on the buildings of the Electric Telegraph Company at 448 Strand and used for the first time in August 1853, the ball being dropped by a galvanic current from Greenwich Observatory. The time ball at Greenwich itself is, of course, very much earlier and dates from 1833 when it was mounted on the top of Flamstead House.

At the moment nothing is known as to the result of the proposal, but from about 1866 the standard timekeeper in Boston was an astronomical regulator made by William Bond, this was synchronized from a similar regulator at the Harvard College Observatory, Cambridge, Massachusetts. Bond's regulator was in the window of his shop and marked on the square plinth was "Bond's Standard Time".

Charles K. Aked. 4.8.1984.

EPHEMERA OF ELECTRICAL HOROLOGY

No. 2

The Scientific Proceedings of the ROYAL DUBLIN SOCIETY, Volume XI.(N.S.), No. 4, September 1905, pages 34-36.

A MODIFIED FORM OF ELECTRICAL CONTROL FOR DRIVING CLOCKS by Sir Howard Grubb, F.R.S., Vice-President, Royal Dublin Society.

This paper was read to the Society 17 January 1905, received for publication April 1905 and published September 1905.

The system of electrical control for clocks described in my paper read before the Institution of Mechanical Engineers, Dublin, in July 1888, and adopted for the various instruments employed in the international photographic survey of the heavens at Greenwich, Capetown, Oxford, Mexico, Melbourne, Perth (West Australia), &c., has been found to be capable of driving these large equatorial instruments with the necessary accuracy, and to be reliable in its action so long as the electrical contacts are in good order.

Within the last few years I have been able to simplify the system, and, by reducing the number of contacts, have eliminated many sources of possible error and failure. This modified form of electrical control has been applied to several instruments with success.

The principle may be thus explained:- On the counter-spindle which works the driving-screw of the equatorial, and which generally revolves once in twenty seconds, is fixed an insulated disc d (see fig. p.35), shod on its periphery with with a discontinuous metallic band b b.

By a simple system of rubbing contacts (not shown in the design in order to avoid complication), these bands are connected severally to one end of the magnet-coils which actuate the retarding and accelerating apparatus.

The circuits are so arranged that if "earth" (in this case any metallic part of the apparatus) be connected to one of these brass bands, the accelerator is brought into action; while, if the other be connected to "earth", the retarder is brought into action.

Close beside this insulated disc, and strung loosely on the same spindle, is an un-insulated wheel, a a with twenty V nicks or cuts on its edge.

There is an arrangement by which a small amount of friction can be introduced in the revolution of this wheel on the spindle; and this can be regulated with great nicety.

Two spring contacts s s, are so arranged on this toothed wheel that, under ordinary conditions, neither of the springs forms contact with the metal bands on the insulated disc; but a very slight motion of the toothed wheel on its spindle, in either direction, will cause contact to be made between one or the other of the springs and one or the other of the metal bands, and, in doing so, will bring either the accelerator or retarder into action.

Over this wheel is mounted a lever with a V cuts which happens to be exactly under it.

This lever is actuated by an electro-magnet, through which an instantaneous current passes once a second from the regulating clock, which may be any distance away.

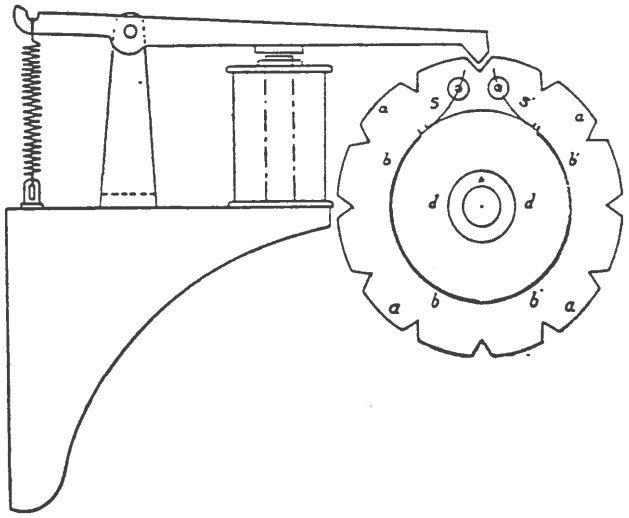
The action is as follows:-

Every second the lever with the V tooth is brought sharply down on the wheel a a. If all be right, this should occur just as the V cut is directly under the tooth, and the spring contacts s s, are in such a position that they do not make contact with either of the brass bands b b, b' b'.

So long as the clock is going correctly, the lever with its V tooth will hit accurately into each V groove; and no connection will take place. If, however, the clock has gained or lost so much as the thirtieth part of a second, the V tooth will not strike accurately into the V cut, but will hit one side before the other, and consequently will displace this wheel on the shaft (it being only carried by friction); and this will immediately bring into action the accelerator or retarder as may be required, and the correction will be repeated at the next stroke, if the error be not completely wiped out.

When the correction is perfectly made, the wheel will be brought back to its n normal position by the action of the V tooth.

This arrangement has been found to give as great accuracy as the original form; and it has the advantage of greater simplicity.

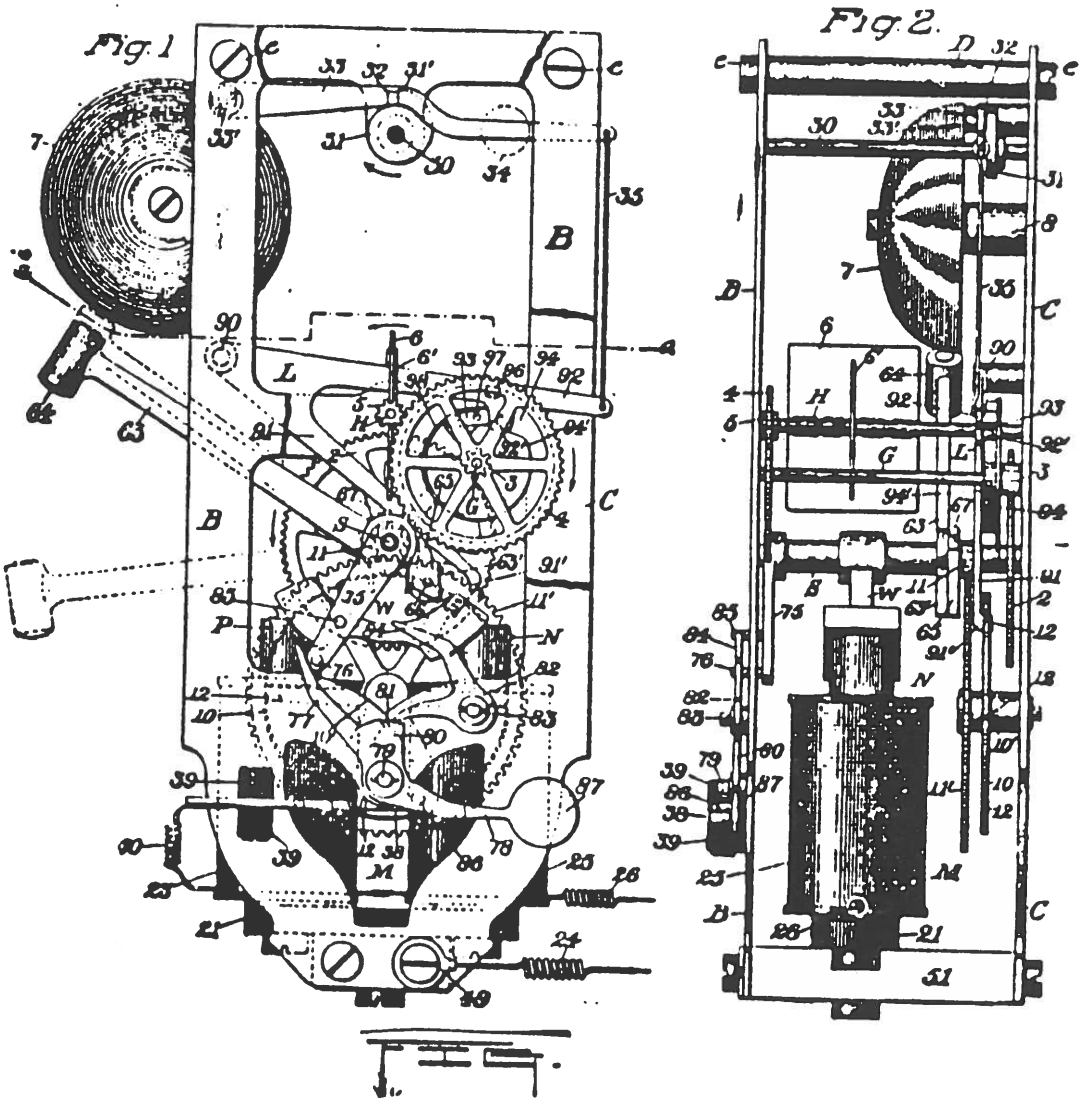


Notes: The band b'b'is always connected to one side of the accelerator electro-magnet coil and the band b b to one side of the retarding electro-magnet coil, the connections not being shown or described but probably through two slip rings and contact strips. When the electro-magnet is energised by the master regulator at each second and the V notch is slightly out of position, the contacts at the end of the band and the spring contacts are pressed together with considerable pressure, but on the current ceasing, the contacts are held only by the friction force applied between the metal disc a a unless the lever with the V tooth is released with the two systems are in absolute synchronization and contact with both bands is broken. The two systems must be in step within plus or minus one-fifth of a second approximately or one second will be lost or gained before the two get into step again and the error would be maintained. In the sketch there are only twelve notches shown; this being the Irish twenty, but the principle is clear; and the notched wheel is assumed to be turning clockwise, if not, the connections to the accelerating and retarding circuits would have to be interchanged. Obviously the mechanism driving the telescope must be reasonably constant in motion, although the error could be up to about ten minutes in an hour before control was lost completely.

Mention is made that the original system had been adopted from 1888 onwards, therefore its reliability must have been within acceptable limits to have continued and to justify bringing up to date after nearly twenty years of service

Charles K. Aked. 6 August 1984

535,370. ELECTRIC CLOCK STRIKING MECHANISM. FRED. L. GREGORY, Chicago, Ill. Filed January 30, 1894. Serial No. 498,521. (No model.) Issued March 12, 1895.



In a striking-mechanism, the combination with a stop-wheel and a resistance-train in operative connection therewith, of a combined stop-wheel-actuator and striker in operative connection with the stop-wheel and adapted for periodically rotating said stop-wheel, means for imparting a reciprocatory movement to said striker, an independently operable hold-back device in position and adapted for periodically engaging and arresting the movement of the stop-wheel, and means in position and adapted for operating said hold-back device at predetermined intervals to release the mechanism and permit the actuation thereof by the striker, substantially as described.

THE CLOCK CRAZE

By Thomas Reed

(From "The Electrical Experimenter" - June, 1917, pg. 114-115)

Being cooped up in a flat, late years, I've had to give up experimenting. Mine's a fine flat, as flats go--all modern conveniences, two kinds of cold water as the fellow says, and a fire-escape with a sparrow's nest on it; even a little safe let into the wall, big enough to hold most of the Wiff's diamond tiaras if you pack 'em tight. Yes, it has all the conveniences but one, and that's the only one worth having--a workshop.

The nearest I can get to it now is reading the good old "Electrical Experimenter". When she blows in, I sop her up from front cover to back--every word. Advertisements and all. Well, I'll say so; and I'm not the only one that does it, eh, Bugs?

One place I always stop and smile, and that's the heading "How-to-Make-It Department." I guess my department is the "How-Not-to-Make-It." Usually everything I started went wrong the first time: but the finding out why it wouldn't work, and making it over till it would, wasn't the worst fun in the world. In fact, I think it was the best. No fun simply copying.

When it came to the electric clock, though, that nearly beat me. There's a thing that looks easy, and isn't; yet it's simple enough once you're wised up.

I was sort of forced into the clock craze. You see, our kitchen clock was on the blink. Father didn't blame it--good old clock, he said, it had served him faithfully twenty-five years, and was worn out. Worn out nothing! I'll bet old Jerome turned over in his grave at that libel, for one of his excellent brass clocks ought to go for 1ØØ years, and only be talking baby-talk then. I knew what ailed it all right; it was so full of my contact-springs, wires, magnets and other junk, that its regular works had become discouraged. But that was a secret between me and the clock, and there were good reasons why the secret was safe with me.

Anyhow, when the clock took to stopping, something had to be done, and done quick, because mother would figure wrong with her Saturday baking, and Mrs. Skillings would get her hot pies out on the window-sill first, which was an awful catastrophe to mother, and made her feel as peevish as the Standard Oil does when a competitor sells a quart or so of gasoline right under its nose.

I had pondered a little on electric clocks, and as I say they looked easy, so I made the family a proposition: for half the price of a new clock I would turn the old one into an electric clock that would go all the time without winding. Father liked the idea because his back got twisted climbing up on a chair to wind the thing and any clock at all looked good to mother provided it was a going institution. I said this one you

couldn't stop if you wanted to; and it would be so accurate that Mrs. Skillings would be running over to ask humbly what the really correct time was. This is known as promoters' language, and is powerful. It clinched the deal. Father handed over the kale with a feeling which if magnified a few diameters would have been enthusiasm.

Everybody (including myself) expected it would be not over two weeks at the outside before I had the clock rigged up and was after Mrs. Skillings' goat with it. I took the old clock to pieces for the last time, pulled out a few superfluous wheels and springs, and inserted a pawl and ratchet-wheel where they would do the most good. Then I started gaily on the electric pendulum that was to drive it. I wished afterward I'd made the pendulum first.

It was a grand pendulum I made--a seconds-pendulum of the due length of 39.1 inches, with wooden rod and a fine heavy bob. I was so cocksure that I polished up all parts as I went along. But when it was done, it wouldn't work.

There were two or three main reasons why. To begin with, it was hung on pivots, like a telegraph key; and the heavy bob set up so much friction there that it would have taken about a kilowatt to drive it. Of course it should have been hung on a suspension spring which lets the pendulum oscillate while supporting its weight without friction. Bonehead play number one.

Well, I discarded my pivots--tho I hated to, they looked so pretty--and with my pendulum swinging easily from a spring, I looked to see her go. But nix. Good strong magnet, clean contacts, and all that, but nothing doing. Could anything be wrong with my arrangement? Answer, oui, oui.

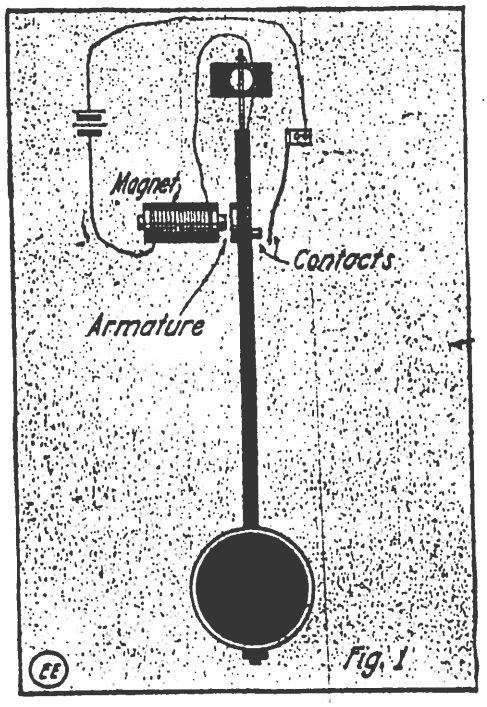


Fig. 1. Attempt No. 1 In Electric Clock Research as Tried Out by the Author--Did it Work? Read the Accompanying Text if You Think So, Bugs.

You see I had it rigged as in Fig. 1, following the idea of the electric bell. When the pendulum swung over far enough to make contact, the magnet gave a vigorous pull; but unfortunately it checked the pendulum just as much as it pulled it, and the result was nil. The slow, free-swinging pendulum acted differently from the rapid, springy bell-hammer.

The two weeks were already up, and mother was beginning to peeve, because meanwhile Mrs. Skillings had put it over her again on the pies; so I hid my chagrin under what I hoped looked like a confident smile and attacked the problem anew.

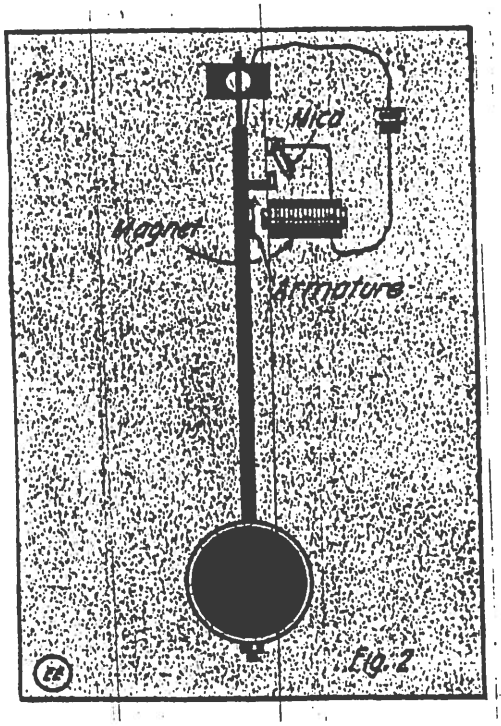


Fig. 2. Attempt No. 2 In Electric Clock Design. This Arrangement "Worked Too Well." But the Magnet's Successive Pulls on the Pendulum Accumulated till it Banged Against the Magnet Like Jess Willard Administering a K. O.

The next attempt is shown in Fig. 2. I made a flapping contact, metal on one side and insulating mica on the other. This arrangement worked too well, if you get me. The magnet gave a nice pull, and on the back-stroke it let go, all as per intention. But now the pulls accumulated till the pendulum ended by hanging against the magnet like Jess Willard administering a K. O. This pendulum thing began to seem decidedly not as easy as it used.

Anyhow, to have it go at all was some consolation. All that was needed now was some arrangement to cut the current off as soon as the pendulum had all the impulse it needed, and switch it on again when more was required. Now I began to appreciate Hipp's pendulum, described in the text-books. In Hipp's device (Fig. 3) the electric contact is made by means of a notched post attached to the pendulum, which normally pushes past a little swinging trigger attached to the contact-spring. As the pendulum loses its amplitude, there comes a moment when the notch in the post just catches the trigger, and then when it starts the other way the trigger is raised and the contact made, the magnet is

energized, and gives the pendulum a push. The notch now brushes by the trigger again, until the narrowing swings allow it to catch once more, and the process is repeated. As the battery runs down, the push is weaker and the contact has to be made oftener; but the mechanism does this automatically until the battery is exhausted.

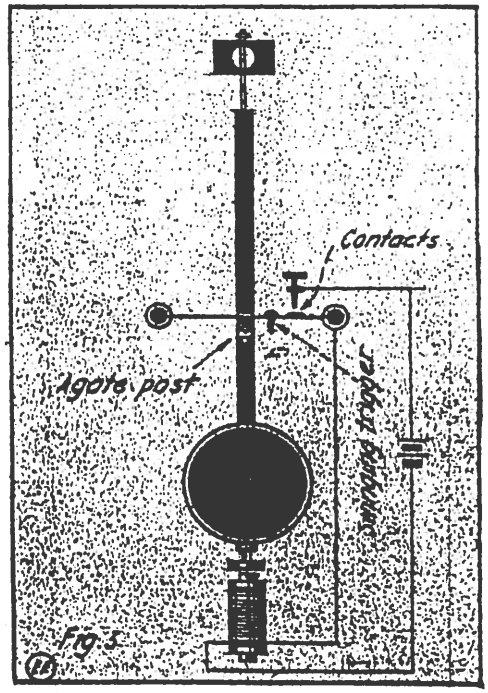


Fig. 3. Finally the Electric Clock Problem Settled Down to a Resurrection of Hipp's Famous Pendulum. But Oh! that "Agate" Post !X? Likewise Zowie.

Hipp's rinktum looked effective, if one could only make it; but being a clockmaker, old Hipp had specified agate as the material for his notched post. Agate, he says, just like that: "Take a piece of agate, you know, and put a notch in it." Oh, yes. The only agate I had ever heard of was an agate marble; and it didn't look exactly like easy stuff to make anything of.

Four weeks had now gone by, and the family had lost all their peevishness; that, is, they had exchanged it for black looks and language not calculated to please. I was reaping the usual reward of the sanguine promoter. My stockholders, ignorant of the exactions of science, were clamoring for quick returns on their investment. Stockholders in this mood fall naturally into sarcasm. They say, "Oh, you were just as sure as anything when you were after our money, and now you admit you didn't know what you were doing. Of course you're right on the track of it this time--pooh, pooh! Have it all ready tomorrow morning at breakfast, I suppose. Well, a fool and his money---" all that encouraging stuff. I know just how to treat impatient investors now; but at that time the situation, coming on top of my defeat at the hands of Nature, got my goat, and I'm ashamed to say I declared bankruptcy and quit. Father bought a new kitchen clock, and issued a manifesto (having got an inkling of what ailed its predecessor) that if I monkeyed with its insides to the 1ØØth part of a monk, he would monkey with my outside; and, in the

vigorous language of the day, I was not to forget it.

I knew why a prophet is without honor in his own country. Believe me, my home reputation as a budding scientific and business man was badly damaged; to be more exact, it looked like the place where a 42 cm. shell has recently landed. But the clock craze had struck in; and oblivious of everything, in cloistered seclusion behind the barn I pondered upon Hipp and his exasperating agate.

I pondered long before, in a burst of enlightenment, the great truth of Bugdom burst upon me--use some other material, even if it isn't as good, anything at all for a starter. Couldn't I use steel, brass even? it would last long enough to try it anyhow. It makes me laugh now, my great discovery; but do you know that sometimes the getting rid of a fixt idea is the hardest part of an undertaking? Why, could have used pewter, paper, I guess even cheese if you took it near the rind.

Don't let anyone discourage you, Bugs, by specifying costly and unusual materials. The inventor's describing his rinktum the way it looks after he's got it all babied up in its final Easter dress; but just for a trial you don't need the platinum. Bakelite, Empire cloth, and "S.C." wire--no sir, you'll find all you really require in the good old junk-box as usual. Me, I grew so independent finally in the matter of materials that I hardly recognized more than two kinds--conductors and insulators.

So, having got the agate out of my head--"solid agate" I guess my old bean was--I used steel for the post and brass for the trigger; and as to durability, let me tell you that after nearly twenty years use I can't with the naked eye detect any wear.

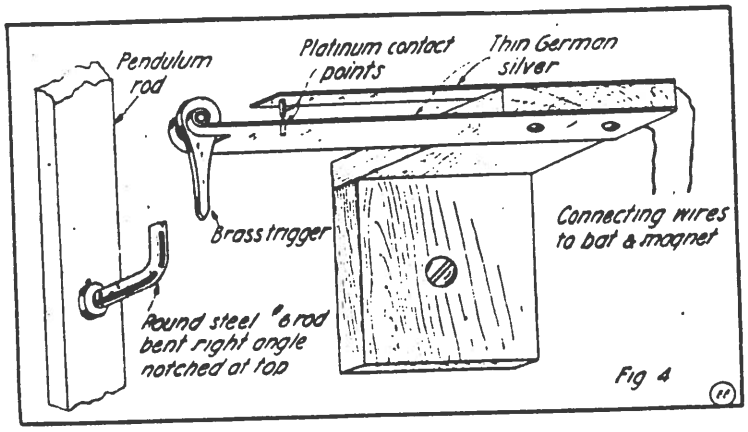


Fig. 4. Finally I Contrived a Substitute for that "Agate" Post on the Clock Pendulum, Relates the Author, and Decided that the Thing to do Was to "Substitute." Steel Proved Excellent--but I Guess a Piece of Cheese Would Have Sufficed.

Oh, yes, I made the clock, but I had a long hunt for something on Hipp's principle in a form which the amateur workshop might turn out. After many trials I evolved the form shown in Fig. 4; and I make you free of my invention, Bugs, hoping someone will be interested enough make himself an electric clock. There's lots of enjoyment in listening to its sedate

13

tick-tock as it breaks up infinite time into the small units we need to make our good or bad use of. Maybe, now that the war will debar us from wireless work for a while, you'll feel inclined to take up this fascinating subject of clocks; and if so, I have many valuable "wrinkles" which I should be delighted to share with you. Only, avoid my experience, and don't make a business proposition of it at first. C-U-L-O-M. .-.-. -.-

---

While the Eagles Battery gives invariably superior satisfaction in all the ordinary uses of gravity or other sulphate of copper batteries, for local and main batteries of telegraphs, etc., it proves to be the *only* one capable of producing the results desired where *both power and steady, enduring action* are required, and wherever tried for such purposes as for printers' motors, electrical machinery, etc. has made itself indispensable

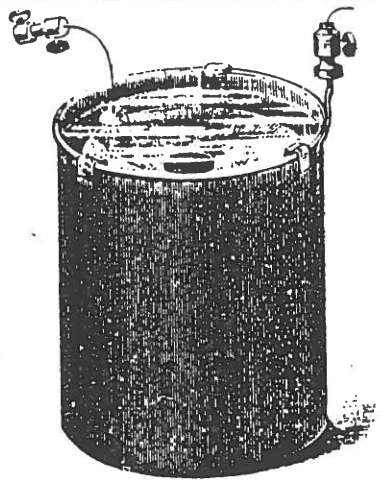


Fig. 2.

The containing cell is of lead, which is indestructible by any action of the chemicals used, and has great advantage over glass battery cells in its non-liability to fracture by heat, cold or abrasion. No "copper" is used, the lead cell itself constituting the negative pole.

Two sizes are furnished. No. 1, fig. 1, rectangular cell, size 6 x 8 inches, for all purposes where greatest power or quantity are required. No. 2, round cell, fig. 2. 6 inches diameter, 8 inches deep, for telegraph purposes, main and local batteries, etc.

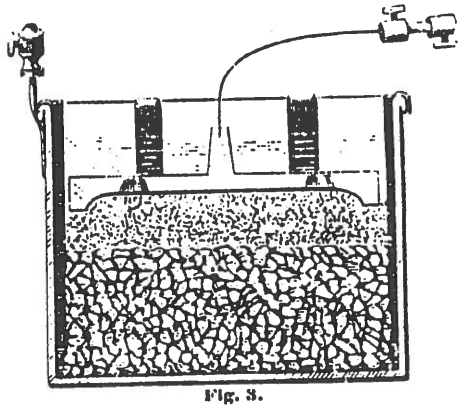


Fig. 3.

Fig. 3 shows the arrangement of the zinc, sawdust, sulphate, &c., in the No. 1 cell, which is the same as that of the round one. Suspended from the rim at the sides, and extending downward to near the bottom of the jar, are several wooden fenders or sticks of prepared wood, for the purpose of preventing a contact between the zinc and the sides of the jar.

The action of the Eagles Battery is unlike that of any others, in which a large charge of sulphate of copper is placed for the purpose of producing long-continued action. By this arrangement *the zinc is allowed to fall with the sawdust diaphragm as*

fast as the sulphate of copper beneath it is consumed. Thus the internal resistance of the Battery, and therefore its action and current produced, is always the same, until the consumption of the sulphate of copper charge is entirely completed.

In practice, this peculiarity meets and completely remedies one of the most prominent and troublesome defective features of Gravity Batteries. The use of the sawdust diaphragm in this combination, effects practically a *more perfect separation of the "blue and white solutions" than is possible by any other means.*

DIRECTIONS FOR SETTING-UP AND MANAGING

THE EAGLES METALLIC GALVANIC BATTERY.

Suspend the wooden fenders from the rim on each side of the jar, so that the zinc when placed in position cannot touch the lead at any point.

Place in the jar the charge of sulphate of copper, about five pounds, broken into small pieces. Upon the sulphate of copper put a layer of clean pine sawdust, about one inch thick. Place the zinc upon the sawdust, and fill the jar with water up to within about one inch of the rim. Connect the wire from the zinc to the binding-post on the side of the cell ("short circuit") for a few hours, and the Battery will then have developed its strength and be ready for use.

To prevent the accumulation of masses of sulphate of zinc on the rim and outside of the jar, and also to prevent drying-up or evaporation of the liquids, put in an ounce or so of clean oil, which spreads upon the surface and forms an air-tight film over all. The cell will then remain *always clean, and will not require further attention for months,* or until the charge is entirely exhausted, when it can be renewed in the same way.

PRICES.

No. 1, Square Cell, complete,	**$2.25**
" 2, " " "	**2.00**
" 1, Lead Jars,	**1.50**
" 1, Zincs, with wires fastened in,	**70**
" 2, Lead Jars,	**1.30**
" 2, Zincs, with wires fastened in,	**65**
Insulating Fenders, each,	**3**

Other sizes than the above, for special work, furnished promptly to order.

TAKE NOTICE.

New York, August 1, 1874.

Notice is hereby given, that I have appointed Messrs. PARTRICK & CARTER, of New York and Philadelphia, as Sole Agents for the manufacture and sale of **The Eagles Metallic Galvanic Battery,** *for which I have applied for Letters Patent of the United States.*

I hereby enjoin all other parties against attempting the manufacture of said Battery, or the sale of the same, except through my authorized Agents, Messrs. PARTRICK & CARTER.

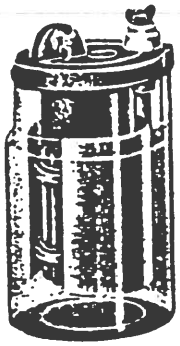
EDWIN EAGLES,

Inventor of "The Eagles Metallic Galvanic Battery,"

22 Dey Street, New York.

BATTERIES AND SUPPLIES

No. 2 NATIONAL CARBON BATTERY



Description	Price Each
Cell complete	$1.90
Element complete	1.10
Empty carbon cup	.40
Cover and bushing	.40
Zinc	.40
Depolarizer, per charge	.15
Sal ammoniac, per charge	.15
No. 1 round glass jars	.25
Cup rubbers (2)	.15

IMPROVED No. 2 SAMSON BATTERY

4½x4½x8 in.

Samson No. 2—
"Shipped Set Up"

	Std. Pkg.	Price Each
Complete	50	$2.00
Carbon	50	1.15
Cover	100	.25
Jar	50	.40
Sal ammoniac	200	.15
Zinc	100	.55
Star fenders	100	.10

PENCIL ZINCS

	Price Each
Pencil Zincs	$0.10

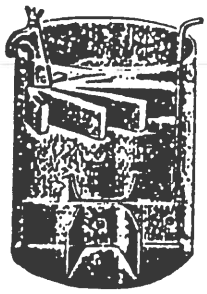
CYLINDER ZINCS

No.		Price Each
21	Thumb nut connection	$0.20
22	National	.22
23	Thumb screw connection	.22

IMPORTED SAL AMMONIAC

In Bulk, per pound	$0.40
4 oz. Pkgs., per package	.30

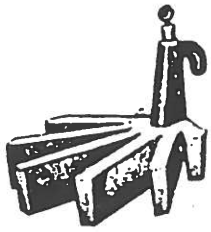
GRAVITY BATTERY



6x8 Inches

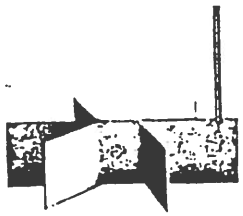
Cell complete, less blue vitriol	$1.20
Glass jar	.50
Zinc	.80
Copper	.17

ZINC CROWFEET



Std. No.	Size of Jar Inches	Price Each
1	6x8	$0.80

BATTERY COPPERS



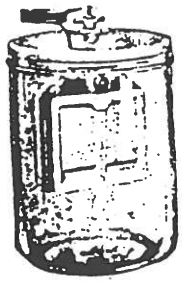
Brush copper, No. 32 B. & S. gauge, 13 in. of No. 14 rubber covered wire for connections.

16 2x6 in... 6x8 $0.17

BLUE VITRIOL

In Bulk, per pound	$0.15

EDISON PRIMARY BATTERY



Type M403—Porcelain (old Type RR)

Capacity, Amp. Hrs.	$4.00
Complete cell	5.40
Complete renewal	3.00

Renewal Parts

1	charge Zinc-Oxide, assembled	2.85
1	charge caustic soda	.36
1	charge special battery oil	.09

Permanent Posts

Porcelain jar	$2.00
Porcelain cover	.60
Terminal Nuts & Washers, per cell	.25

LUTHY NON-BREAKABLE HYDROMETER SYRINGE

Complete	$1.25

How to Rebuild Dry Batteries

The old pitch plug is broken out of the original battery and the pieces saved, to be remelted. The material inside of the cell is then shaken out and the inside of the zinc cup given a thorough cleaning. Then the carbon is washed and cleaned of any hard sediment that may have collected thereon and the contact of the binding posts cleaned and brightened.

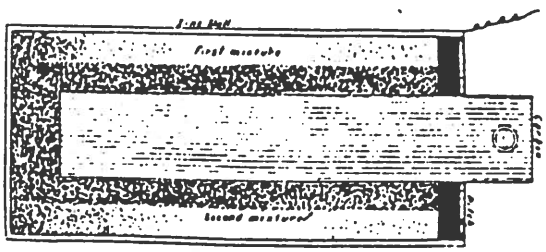
A paste is then made up according to the following formula:

Sal ammoniac	1 part
Chloride of zinc	1 part
Plaster-of-paris	3 parts
Wheat flour	87 parts
Water	2 parts

A wooden plug or cylinder, somewhat larger in diameter than the width of the carbon, is then inserted in the center of the zinc shell, and the above paste firmly packed in about it. While the above solution can be poured in readily, it sets very quickly, becoming stiff enough to stand while the plunger is being withdrawn. This leaves a space inside of the dry cell a little larger in diameter than the carbon. The carbon is now inserted in this hole, and the surrounding space is filled with another mixture composed of the following:

Sal ammoniac	1 part
Chloride of zinc	1 part
Plaster-of-paris	3 parts
Granular carbon	1 part
Flour	1 part
Water	2 parts

These are thoroughly mixed and poured into the space about the carbon. The pitch which was



taken off of the original cell is then melted and poured back over the top, thoroughly sealing it and preventing evaporation.

A very small piece of rye straw may be inserted in the top of the mixture before the pitch is poured in. This straw could then be withdrawn, leaving a very small vent for the escape of gases, which are generated within the cell during action. This will give a new battery with an e. m. f. of about 1.4 volts and an internal resistance of .3 of an ohm.

The granular carbon spoken of may be had by crushing up some old electric light or battery carbons. The pieces should be about the size of kernels of corn, so that they will lie as closely together as possible. Dry batteries made according to this formula will give the very best of service, and they may be recharged from time to time, until the zinc shell is completely worn away.—*Electrician and Mechanic.*

July 1895

THE KEYSTONE

HELPFUL HINTS

1. When attempting to clean the end of enamel-insulated magnet wire preparatory to soldering, try a little paste type paint remover. In just a few seconds, the enamel may be wiped off, avoiding the irritating and delicate alternative of using sandpaper or emery cloth. Keep a small supply in a bottle at your bench and use a Q-tip or small brush as the applicator.

2. A Beat Amplifier commonly used to aid in setting clocks in beat may be used as a diagnostic device to check contact make, break, and cleanliness. Use a Telephone type pick-up coil, the ring type that normally snaps around the earphone end of a telephone handset, and by locating the coil at different positions, near the contact or near the electromagnet, you can, in many cases, actually hear the contacts being activated, and with a little practice, determine their effiency. It is always the objective to hear a sharp, quick click as opposed to a lingering, dragging sound, which would indicate the presence of a faulty or dirty contact. A sensitive milliammeter is also of value in contact evaluation. Placed in series with the battery and the clock, the meter needle action clearly shows contact quality, but a movement with minimum damping and rapid response is required.

--- MART ---

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

WANTED: To buy or borrow, ACROTYNE made by Seth Thomas, details in EHS Journa. of April 1985. Bill Ellison, 1635 Ford Ct., Grosse Pointe Woods, MI 48236 (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

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. Irwin 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

Information on STRIKING SELF-WINDING CLOCK MOVEMENT. Need Rack. A. Redfield, 21 Kentbury Way, Bethesda, MD 20814, 301-656-5562

Information, Patents, Patent #'s, Ads, ANYTHING on SOHM ELECTRIC CO., Chicago. David Lee, RD #1, Box 187, Delanson, NY 12053

Information on SELF-WINDING clocks with movement marked BETTS & BETTS CORP. NYC, USA, OBERMILLERS PATENT. Anthony Prasil, 2179 Titus Ave., Rochester, NY 14622

Information on REMPE movement... Need one with second hand capability, Have non-second hand movement. Will trade or sell. Art Redfield, 21 Kentbury Way, Bethesda, MD 20814

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

REVERE Electric Clock Service Manual, $3.50 each PPD. Also 2- 12 page Booklets from Self Winding Clock Co., Schedule of Parts, Style F, and Style A & C Movements, $2.45 each, PPD. Tom Welch, Box 23753, Eugene, OR 97404

WANTED & FOR SALE: STANDARD ELECTRIC Clocks & Wiring Diagrams/Service Bulletins. Will trade, sell, or buy. Call or write for available material & wants. Jeffrey R Wood, P.O. Box 5, Wilbraham, MA 01095. (413) 596-8250

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

The
JOURNAL
OF THE
ELECTRICAL HOROLOGY SOCIETY
Chapter No 78
NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.
VOLUME XVI, #4, DECEMBER 1990

Fellow Horologists:

This is the final issue of 1990, and your editorial staff has attempted to put together a variety of material to insure that there will be something for each of us. In this regard, we include an article covering the addition of a striking mechanism to an electric clock, written in a most amusing manner. A joy to read even if you don't build his attachment. In addition, a fascinating reprint of a TESLA clock that anyone (almost anyone) can build rounds out the construction material.

In a more serious vein, we are pleased to have an original treatise by Charles Aked documenting the published literature of the 19th century about Electro-mechanical clocks. Included in this material are charts and graphs which detail the number of books per annum, and the number of clock patents issued per annum, covering the entire century. Mr. Aked, the noted British horological authority has recently been reactivated as a member of EHS, and we are honored to have his friendship and enjoy his writings. His material reads very much like a review of the writings discussed, as opposed to a dry factual reference.

And now to the business of the chapter... Membership dues for 1991 is now due. Some of the members paid their previous dues twice, and they were credited for the following year as opposed to returning their check. These folks will have a note attached to this issue advising that dues have been paid. Everyone else... Get it up!

Elections... It is 2 years since the last election and a ballot is included at the end of this journal for nominations and elections. The present officers are listed along with a space for write-in candidates for each office. If a write-in gets 5 or more votes, we will have a run-off election which will be detailed in our next journal.

The chapter is financially sound, enjoys a membership of close to 100 paid up Electro-mechanical enthusiasts, and has a supply of material for 2 to 3 future fournal issues on hand. Our pleas for the submission of material for our journal has fortunately met with a positive response and we regularly receive fresh material from a handful of frequent contributors. Thanks to David Lee, Bill Ellison, Marty Feldman, Steve Berger, Charles Aked, and all those that we may have missed.

Enjoy this issue... Good reading ahead.

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

ELECTROMAGNETIC CLOCK LITERATURE

of the 19th Century

By Charles K Aked

There was no systematic approach in the apparent revolution in timekeeping offered by electromagnetic means in the first few decades of its introduction, and the writings of the nineteenth century reveal very strongly polarized attitudes in Britain. It was mostly antagonistic from clockmakers, in keeping with the constant opposition to innovation; highly favoured by a few in the scientific world and the many interested in electrical matters.

The first writings on the subject of electromagnetism applied to clocks, as might be expected, came from those anxious to claim priority of invention. On 20 September 1839, Professor C A Steinheil applied for a privilege in respect of his invention of an electric clock system - *Privelegium für den K Akademiker, Conservator und Professor Dr Steinheil zu München auf seine Erfingdungen von Uhren, welche dur galvanische Kräfte bewegt und reguliert werden.* He was granted this on 2 October 1839, thus he has the undisputed honour of being the first to record his work in the application of electromagnetism to clockwork. Alexander Bain could quite easily have forestalled Steinheil since he was devising an electric clock system in 1837, alas the cost of a patent in those days was beyond the reach of an ordinary man working for a living; the basic protection cost about £100, almost a year's wages; plus the cost of preparing the patent itself and the drawings accompanying it. Bain approached John Barwise of St Martin's Lane, London, for financial support, so Bain's first patent also bears Barwise's name as co-patentee.

Steinheil described his galvanic clock system in the publication *Kunst-und Gwerwerbsblätter* in 1843, it was an ordinary mechanical clock with the pendulum fitted with electrical contacts to switch currents to operate clock dials some distance away, in other words, telegraphing time intervals from an accurate master clock. It did not use a true electrically-driven clock, only slave dials.

The vicissitudes which Bain experienced prior to, and following when his first patent was granted, are described in the writer's *A Conspectus of Electrical Timekeeping*, published in 1976. Briefly, Charles Wheatstone attempted to pilfer the inventions of Bain and pass them off as his own. To reinforce his bogus claim he showed a similar electric clock, supposedly of his own invention, to the Royal Society, 26 November 1840; having deposited a description of his "invention" prior to this. He was, of course, unaware of Bain's application for a patent, which in fact was not granted until 11 June 1841 although applied for on 10 October 1840. From the many exchanges resulting between the two antagonists, published in various journals, we learn something of the ideas then held on electrical clocks. Much of this is included in *A Conspectus of Electrical Timekeeping.*

Fortunately for Alexander Bain, a fellow-countryman of his, John Finlaison, saw Bain's clock and printing telegraph at the Polytechnic, London, in the year 1841. He was so impressed by these that though an important figure in the Government service, namely Government Actuary, he took up the cudgels on Bain's behalf and wrote a rather long-winded book in his defence. Part of the title goes: *An Account of Some Remarkable Applications of the Electric Fluid ... by A Bain; with a vindication of his claim to be the first inventor of the Electro-Magnetic Clock, &c. &c ...*, by John Finlaison, published London, 1843. It rather overstated the case, being Bain's thoughts and attitudes expressed in English by his

far more educated amanuensis, who however, had little grasp of the technicalities of the subject. At the time this also applied to everyone else save one or two. Again the attempt to bury Wheatstone reveals much of the contemporary thinking on the subject of electric horology, demonstrating the tenuous grasp of what was required by most of the people involved, with the sole exception of Bain. Bain had, of course, received his early training as a clockmaker, and was applying his further self-acquired knowledge of electricity and magnetism to time measurement and transmission. In contrast, Wheatstone knew little or nothing about mechanical horology, his lack of understanding persisted to the end of his days, being quite apparent in all his later attempts to produce electric clocks. Nevertheless the book is a mine of information and there is a chronological list of the events and achievements in Bain's early career.

Charles Shepherd, of Leadenhall Street, London, wrote a brief pamphlet of three pages in 1851, entitled "Shepherd's Electric Clock at the Great Exhibition Building", and also a booklet of 24 pages in the same year - *Applications of Electromagnetism as a Motor for Clocks*". There is also an article "On Improvements in Electric Clocks and the means of working the Greenwich Time Signals" in the *Journal of the Society of Arts*, Vol 1, pages 85-88, contributed by him in 1853. The treatment shows that Shepherd had a very good grasp of electricity applied to timekeeping, however the opposition to his electric clocks eventually drove him out of the field in spite of being favoured by the Astronomer-Royal, G B Airy. The finest vindication of Shepherd's principles is that his electric clock served as the mean solar timekeeping standard at Greenwich for many years, and it still functions perfectly today. Fifty years ago Hope-Jones thought Shepherd's clocks should be pensioned off, however it is Hope-Jones' clocks that have been retired instead. Both Shepherd and Bain exemplify the superiority of the clockmaker with knowledge of electricity, to those who were electricians turned clockmakers, typified by Charles Wheatstone.

Alexander Bain wrote a small treatise, with the promising title of *A Short History of the Electric Clocks, with Explanations of their Principles and Mechanism and Instructions for their Management and Regulation*, London, in 1852. The expectations engendered by this optimistic title are quickly dashed upon reading the introduction, the little treatise of 31 pages only deals with Bain's approaches and inventions, not a word of Steinheil, whom he knew by this time had anticipated him in several of the discoveries he claimed. The book was either sold from Bain's business address, 43 Old Bond Street, it cost one shilling and sixpence, or was given to potential customers calling to inspect the large and varied stock of electric clocks kept in the showrooms and manufactory at this address. What money Bain made from his inventions, as a result of a legal award, was quickly swallowed up by his constant litigation; especially in America in respect of his telegraphic patents against Samuel Morse in particular. Bain is thought to have made no profit at all from his electric clock manufacturing.

The list of literature in connection with Bain may be found in the writer's publication *Electrifying Time*, produced for the exhibition of electric clocks at the Science Museum, London, which opened on 15th December 1976. It was arranged to commemmorate the death of Alexander Bain on 2 January 1877. Both this catalogue and the earlier *Conspectus* ... contain a long list of electrical horology literature; the reader must be warned that it is almost impossible today to find copies of the reference material listed. Bain fully intended to produce a book on electric clocks late in his life, illness and lack of money prevented it from being published. For many years the papers of Bain and his manuscript for the book were preserved, their whereabouts today being unknown.

PATENT SOURCES:

The annual submissions of electrical clock patents are shown in Fig 1, for 1840 to 1900 inclusive, these numbers are accurate but only for British applications, there are many more in America, France, Germany, Switzerland and elsewhere. For an insight into the mental approach by the various inventors, one can do no better than study the patent abridgements, or the writer's *A Parergon of Electrical Horology - Electric Clock Patents for the Period 1840-1900*, published in 1984. This work contains all the electric clock patents sieved from the other applications, but includes no diagrams, whereas the abridgements do. Some of the ideas put forward are very naïve, and the patent system was not sufficiently discriminatory to prevent what were almost identical proposals receiving patent protection. In any case a succesful innovation was soon applied by others, with a few changes to circumvent the patent, the most notable instance being the interchange between Parsons and Ball of Leicester, and Hope-Jones, where the patents provided little real protection in practice unless backed up by expensive legal measures which consumed all the possible potential profit.

Hope-Jones' early use of the Patent Office facilities in order to monitor the progress of his rivals in the electric clock developments led him to use the same procedure to prepare the manuscript for his series on electric clocks in *The Practical Watch and Clock Maker* in the late 1920's, this was later turned into book form as *Electric Clocks* in 1931. Because of this approach, the earliest developments in electrical horology were either unknown to, or ignored by Hope-Jones, namely the electrostatically driven clocks of the early nineteenth century which proved totally unsuccessful.

From this point on it is proposed to look at extracts from works, some not exclusively devoted to electrical clocks, in order to derive some understanding of the contemporary attitudes towards electrical horology. Many of these references may be difficult to procure for the majority of those interested, and too expensive to purchase for the electrical clock content. In the past some of the rare pamphlets have cost the present writer several pounds per page. Figure 2 shows the number of references for the years 1843 to 1900 inclusive, it is only a comparative illustration since it is based on material known to the writer, they may be many more references he has not uncovered. The main reason for many items not being listed is that electricity was regarded as a branch of natural philosophy or physics for many decades, therefore many articles on the subject may be found in the proceedings of the many august bodies not readily accessible to most of us. Very many of the French contributions, for example, are to be found in the *Comptes Rendus de l'Académie des Sciences*, and have never been available in the English language. The standard of writing on electrical horology in this period was very much better in France than in England.

We commence with a little-known treatise, *Mécanique Appliquée, Horloges, Montres, Chronomètres* by Charles Gaumont, Paris, 1860. (Applied Mechanics, Clocks, Watches and Chronometers). This has a short section on electric clocks of seven pages which plunges into the subject without even the benefit of a heading as an introduction. As an illustration of the impracticality of collecting this sort of material, the information works out at £5 per page of foxed French text. Most of the text is translated here for the benefit of readers.

We must however detail a new system of time measurers, which, if they have not met the hopes with which they were born, nevertheless occupy an important part in chronometric history. This system is that of the application of electricity to clocks.

The mechanical movement produced by electricity is by reason of the property of a body carrying an electric current attracting a bar of iron as a natural magnet does, but in proportion to the strength of the battery; when the current is interrupted, the attraction

ceases and the bar resumes its first position, either through its own weight or by a spring.

This to and fro movement, determined at will, becomes a force easily transformed into a circular movement. In the electric telegraph, a ratchet wheel carries the receiver needle and is moved by a fork which is furnished with an armature of soft iron which is attracted when the current passes; when it ceases, a spring returns the anchor. There is, therefore, a parallel between the mechanism of modern telegraph instruments and that of clocks.

Also, just as one can, by the simple sending of a voltaic current, cause the needle on a distant telegraphic dial to move, it is natural to think of applying this mode of transmission to hands arranged to give the time on a dial distant from the principal clock. In this case, the alternating movement of the pendulum of the clock, in interrupting and re-establishing the electric current, replaces the action of a man on the telegraph key, and, at each oscillation the hands advance one step. They act instantly, for the electricity of the battery, in the metallic wires, travels, according to the physicists, forty-three thousand leagues per second, (This *lieu*, or league, was equal to 2½ English miles; the velocity was therefore 107,500 miles a second - just over half of the true velocity), a speed which makes the time of the current to propagate to the dial inappreciable. In this way the hands of a large number of dials may be activated. This instantaneous transmission of the time of a clock to another dial, was realised for the first time in Munich, in 1839, by M Steinheil, who was the first to apply the electric telegraph to this use.

The idea of clocks taking advantage of the electrical transmission was almost amends for the new telegraph having used the anchor and escape wheel. But the propagators of electromagnets did not stop there, they wished to replace the old weights and springs by electricity. This new agent was to replace gravity and elasticity at one stroke in their function as motive power, the train itself was disposed of, in its place was substituted a vase filled with acid in which metallic discs were placed, connected by wire to the clock. M Bain is the author of this revolution in the chronometric art, which dates from 1840 and had Edinburgh as its stage. We hasten to say that it was not crowned with success, the direct action of the variable electromagnet on the pendulum was soon abandoned. Clockmakers not only did not restrain their rancour at those who claimed the right of measuring time by electricity; they did better, they employed the new agent to rewind, as a slave, a constantly falling weight. M Verité, clever clockmaker of Beauvais, is the inventor of this system. Already, in 1839 and 1844, he had exhibited a small clock with a constant force escapement of his own invention. At each oscillation, a small ball suspended by a thread, rested on the arm of a pendulum and maintained the movement by a constant action in its fall. He naturally applied the same procedure to his electric clocks. Two metallic balls, by virtue of the electromagnetic action, were applied alternatively to the arms of the pendulum and maintained its oscillations without having to undergo variable resistance in disengagement.

In spite of its apparent simplicity, electrical horology lost ground each day to the more rational system of transmitting the time of a regulator clock. M Breguet, in a note published in *Revue Chronométrique*, has pointed out the faults of this combination, in which the regularity is dependendent on the constancy of three elements, namely; 1, the battery, the source of the electricity; 2, the conductor or insulated metal wire; 3, the regulator, intended to send, at regular intervals, the electrical current in the conductor and the various dials. Experience shows that these conditions cannot be maintained over a long period. For a month, six weeks, or two months, everything works well, then all at once derangements arise, the cause of which are always easily found, sometimes the battery has not been maintained with sufficient care, sometimes the contacts in the regulator which initiate the current are faulty; again sometimes the conductor suffers an accident. Also the clocks can be irreproachable without being able to guarantee perfect regularity of performance.

With the aim of avoiding the numerous causes of perturbation which occur, M Breguet has devised a system in which electricity is always used, but in a way to avoid the inconveniences inherent in the procedures known up to now. This system consists of ordinary clocks going without the help of an exterior force; the role of electricity is then limited to periodical

regulation of these clocks. A subsidiary mechanism, arranged for this, supplies a special motive force, it is performed by an electromagnet, when the current energizes the electro-magnet, the magnetism attracts the armature, the train of the mechanism is set in motion, and if, at a designed moment, the hands present a difference early or late, the hands are set to time. This operation takes place at midday or midnight. The greatest advantage of this combination is the simultaneous setting of all the dials, when those placed in a transmission system may, by some cause, failed to be moved by the electricity.

One preserves also, concludes M L Breguet, the advantage sought for a long time of giving precise time at a distance, without any chance of derangement. In the old system, real difficulties were experienced, since at every moment, the clocks could be deranged by atmospheric electricity, moreover it was necessary to reduce the size of the hands, which was not convenient for dials such as those placed on the facades of large buildings.

Without prejudging the approach, one must be aware that the role of electricity in horology is actually very limited. The problem of the synchronism of time is almost resolved. In spite of premature hopes, the moment has not yet come when time is carried underground, side by side with gas and water, to be distributed to domestic subscribers. Clockmakers have dethroned the sun, convinced of its error, but they have not yet subdued electricity; the slave in revolt, often breaking its chain and bringing lightning to the wings of time.

This classical image may be pardoned at the sight of the astonishment and awe which shows in a peaceful citizen on seeing the hands of his electric dial madly registering movements under the influence of atmospheric electricity, of which telegraphic lines have given previous examples, or graver still, have served to lead the lightning to his chimney! This is no exaggeration, "When the atmosphere is charged with electricity" states M Becquerel in his *Traite d'électricité et de magnetisme*. "It can, in acting on an insulated wire, communicate to apparatus and impair the the messages, and likewise, if it is in a sufficient quantity, melt the wires of the electro-magnets, and give shocks to the operators. These circumstances are fortunately rare and of short duration". Many arrangements, amongst others a special lightning conductor, can prevent these accidents, but the causes of the disturbances exist nevertheless, and this alone has prevented the general adoption of telegraphic communication of time for a long period.

THE MECHANIC'S FRIEND:

This pleasant book was edited by W E A Axon, the contents being taken from the *English Mechanic* which was popular in the nineteenth century with amateurs. One of the features was the resolving of problems, sent in by readers on a huge variety of subjects. Electric clocks are covered on pages 160-163 and 309-310.

The first account is of Bright's perpetual motion electric clock modelled on the lines of Bain's electric clock with a bob coil moving over permanent magnets with consequent poles, the contacting arrangement is by a weight biased toggle at the top of the pendulum, moved by the pendulum rod. On one side of the pendulum is a contact so that the circuit is completed with a contact on the toggle for almost the whole of one swing, as it nears the end the weight flips over the vertical and opens the contacts. The pendulum rod picks up the other toggle arm on its return but there is no electrical contact fitted on this side. The arrangement takes the place of Bain's break, but has no compensatory action in its operation, hence the amplitude would vary with the battery voltage.

It states that a piece of zinc and one piece of coke are sufficient to drive eight or ten such clocks for a lifetime. A later section is of sufficient interest to repeat in full:

A set of four clocks, worked from one piece of zinc 2 ft square and one piece of coke, have been at work in Leamington for two years; and though they were only a trial set, not over

well made, they have never deviated from mean time more than a few seconds per week, and have never deviated from each other at all. The said piece of zinc and coke have been in use during the twenty years in which Mr Bright has been engaged in perfecting his invention, and on the occasion of a visit from a gentleman from Greenwich Observatory for the purpose of inspecting these clocks, the zinc and coke were dug up and found to be apparently as servicable as ever.

An interesting fact, in connection with this part of the subject is that a set of three clocks are at work with no other battery than one wire attached to a gas-pipe and the other to a piece of coke. A set of five clocks may be seen at work at the Gun Cotton Office, 173 Fenchurch Street, London.

It is thus evident that these clocks require very little power to keep them in motion, and have very little friction, and it may be expected that the liability to error will be proportionally diminished; and therefore much may be hoped from them in the direction of good timekeeping, as well as uniformity, both great desiderata for railway and commercial purposes.

H Bright's electric clock is described in his patent application no 549 of 1866, granted on 22 February. It is fairly clear that he had taken his ideas from Bain, including the use of a double contact maker with turret clocks, intended to give an imnpulse to the pendulum in both directions to provide more driving power. This appears to be his only patent in connection with electric clocks. Many amateur clockmakers produced clocks to this design.

On page 309 commences a description of an Electro-Magnetic clock, but this is another of Bain's designs, with a platinum ball at the top of the pendulum to switch the current to the pendulum bob solenoid. After explaining the action of the platinum ball, which is on a pivoted arm so that it rests on an electrical contact on one side and allows current to pass; the reader is put firmly in his place by the final sentence, "No explanation is needed of the remaining portion of the clock". No reader who had not made an electric clock previously, would have been able to construct one from these instructions, since no practical details were included.

HET ELECTRO-MAGNETISMUS . . .

This is a Dutch book with the title of "Electro-magnetism applied to the manufacturing of timepieces or clocks", written by Jonkheer A Everts in 1872 for his friends. He was a Captain in the regiment 'Grenadiers en Jagers' and actively interested in electrical timekeeping. Two years later he issued another edition which was sold publicly. After many years of owning a copy of this work, the writer was fortunate enough to have it translated into English by Mr. S Huisman of Holland. This work is the subject of another article and it is a fascinating insight into Continental electrical horology in 1872.

EXPOSÉ DES APPLICATIONS DE L'ÉLECTRICITÉ:

This is a monumental work by Count Th Du Moncel in four volumes, first issued in 1876, (Account of the applications of electricity). There are several parts, of which Volume III in the first edition, and Volume IV in the third edition, contain the applications of electricity to clocks, chronographs and other similar devices. Several editions were published, the third in 1885 (Tardy quotes 1883), and another in 1903. This work goes into great detail and describes all the contemporary arrangements on the Continent, but it is rather weak when dealing with the British effort, for example it does not include a single diagram with the text relating to Bain and Wheatstone. It also does not relate the clocks and systems to the people who attempted to improve them, nor take a man-in-the-street opinion of their performances.

For those only interested in the electrical horology section, the acquisition of the full set of volumes is expensive, but Du Moncel's treatment is by far the most detailed of the devices themselves published in the nineteenth century.

BRITISH MANUFACTURING INDUSTRIES

This work was edited by G Phillips Bevan, the first edition of it appearing in 1876, and is of interest as containing the first article writen by F J Britten, the noted writer on antiquarian horology. Within the 37 pages of his text on clocks and watches is a short section on the use of electricity in timekeeping:

Countless experiments have been made with a view to the employment of electricity as a motive force for clocks. It is difficult to see what is to be gained by substituting electricity for the winding up of a weight, which seems to have been the sole aim of many inventors. Mr R L Jones, the station-master at Chester, in 1857, turned electricity to good account for controlling clocks, but not for driving them. At no very remote day, a method by which clocks may be controlled will no doubt be considered a *sine qua non*, so the subject is therefore one of interest and not out of place.

In all systems for distributing time, one clock - the distributor, we may call it - must be watched and corrected from observations. A clock in the Royal Observatory, Greenwich, distributes the time to a clock at the Post Office, Lombard Street, and to one at the factory of Messrs. De La Rue and Co, in Bunhill Row, by Jones' plan, which is simply this: The pendulum rod of the Observatory clock, in its vibrationns, presses together two very weak springs, thus completing a galvanic circuit and allowing a galvanic current of opposite kinds to be transmitted at successive seconds to the clocks to be controlled, each of which has its pendulum bob composed of a hollow coil of wire. The wires from the coil pass up the pendulum bob and are led away to the controlling or distributing clock, however distant it may be. Two permanent bar magnets, having similar poles in proximity, are fixed inside the case of each controlled clock, so that the hollow coil forming the pendulum bob in its vibration passes over andencircles each magnet alternately. The action of the currents will be to retard the vibrations of the controlled clocks, if they are going too fast, and to accelerate them, if going too slow. The controlling clock is of the ordinary kind, and the others differ only in having the pendulum composed of the wire coil. The clocks being reasonably good themselves, it matters not if the current fail occasionally. As long as the accumulated error is less than one beat of the pendulum, when the current is resumed it will again correct the error.

There is a system of magnetic clocks with many advantages, the invention of the late Sir Charles Wheatstone, made at the British Telegraph Manufactory, and at work in the London University, the Royal Institution, and other places. A single motor clock upon this principle will actuate sixty or seventy indicating clocks, the maintaining power being supplied by magneto-electric currents developed in a coil of wire forming the pendulum bob of the motor clock, which is made to oscillate over the poles of permanent magnets. Each indicating clock is actuated by an astatic system of magnetic needles, kept in continued rotation by these currents. In this way the whole circuit remains unbroken, and the currents are alternately inverted without breaking and re-making of contacts, which is the chief source of failure in the many attempts to drive clocks by electricity.

Mr Ritchie, of Edinburgh, has lately introduced an electric system of clocks, in which the pendulum is made to actuate the escapement. It seems to answer well, but it would be premature to pass a decided opinion on its merits.

Not a single word on the endeavours of Alexander Bain, no mention of the work of the Continental workers such as Mätthaus Hipp or Breguet; and all in all a rather damning view of the infant art. The fact that an electric clock was

governing the time of Britain and its great maritime navies, escaped Britten's notice, as did the Great Westminster clock rate, so greatly praised elsewhere, which was reported daily to this standard so it could be corrected. So there was no need to report the sudden jumps of the Westminster clock of two or four seconds, although it was supposed to sound the first stroke of the hour correct to within one second of true time. Britten was merely reflecting the attitude of the British watch and clockmakers, and since he had only recently become the Secretary of the British Horological Institute, he had no alternative but to be partisan. He evidently knew little of Ritchie's system, which was a precursor of the "waiting train" arrangement, clocks with a gaining rate stopped on reaching the hour early, and then released exactly on time on the hour.

DIE ELEKTRISCHEN UHREN ...

First issued in 1883, and written by Dr A Tobler, this little book covers both electric clocks and electric telegraphs. The various electric clocks of the period are well described. It was also translated into the French language and further editions produced by Johannes Zacharias, the last in 1920. It is one of the most enduring publications in electrical horology in the nineteenth century, but inaccessible to most English-speaking readers because of the German text.

WATCH AND CLOCK MAKING.

This was written by David Glasgow in 1885 when he was the Vice-President of the British Horological Institute. It ran to two further editions. Its main interest is the view of a clockmaker of good repute in respect of electric clocks, pages 312-319. This is the outline of Alexander Bain:

ELECTRICAL CLOCKS - In 1840, Mr Alexander Bain, of Edinburgh, invented a clock to go without springs or weights as the motive power, by the application of electricity to the pendulum; he reversed the order of things in the old clocks, and made the pendulum drive what wheels were in the train and the hands.

The pendulum bob was composed of a hollow cylinder, containing a large coil of insulated wire, the ends of which ran up the rod, terminating in two springs, upon which the pendulum was suspended, and attached to which were wires which communicated with a small galvanic battery. Two groups of four or five permanent magnets having opposite poles were fastened together, each magnet being close to, but separated from, the next, and fixed to the case, the like poles of each group being next to and slightly separated from those of the other. Over these magnets, but without touching them, the bob passed in the oscillations of the pendulum, and the galvanic circuit was completed by a sliding bar, which rested on the battery terminals; this bar being pushed backwards and forwards by the pendulum in its oscillations, made and broke contact with the different poles, thus reversing the current at each beat, and rendering the pendulum automatic in its action ...

Bain's system was much thought of at the time, and he carried on a large clock factory at Edinburgh for some years, afterwards removing to London; but his clocks were a failure scientifically and commercially. Being directly controlled by the current from the battery, any irregularity in that caused a corresponding irregularity in the rate of the clock, the friction of the sliding bar proving a source of failure, and they are now things of the past. But his system was modified and improved by others, and clocks kept going, controlled, and set by electricity came into common use.

Mr Shepherd also spent a great deal of his time in improving electric clocks, his system being approved and adopted by the late Astronomer Royal, as it gave

a kind of gravity impulse to the pendulum. However, all electric clocks that are entirely dependent on the constant action of the current will fail sometimes if provision is not made to enable the clock to go for a time independent of it.

Glasgow goes on to discuss R L Jones' system of controlling clocks, Ritchie's electrically driven secondary clocks, and Barraud and Lund's system of setting clocks, ending with "... it is questionable whether in merchants' offices, and such places a good clock, that can be procured at a moderate price, and that will keep time without setting for weeks and months together, would not be less expensive and a good deal more trustworthy than common dials set by any automatic system".

Glasgow evidently knew little of electric clocks since the preceding is based upon Denison's remarks in his *Clocks, Watches and Bells*; or else he takes his explanations from F J Ritchie's account of the Jones's system. It was precisely because common mechanical clocks could not keep time without constant setting, that electrical time systems were envisaged in the first place. He also did not understand Bain's system since it included a compensatory action in the contacting system to maintain the amplitude constant irrespective of the state of the battery, and the earth battery adopted by Bain was of a very steady voltage anyway.

LES MERVEILLES DE L'HORLOGERIE

This is a splendid book (The Marvels of Clockwork) by Camille Portal, a former pupil of the National School of Horology, and H de Graffigny, former editor-in-chief of the journal *La Science Universelle*, published in 1888. The whole of the text dealing with electric clocks was given in *Clocks*, Volume 9, No 11, pp 37-43; to which reference must be made for further details.

WORKSHOP RECEIPTS

Edited by C G Warnford Lock, the third series published 1889 contained much information on the current ideas in practical electricity, for example giving full details of the different cells which are often well-known by name without any idea of the arrangements adopted. The text is extracted from the various works published by well known authors.

Strangely enough the electrical notes commencing on page 69 deal with electric alarms, or rather ordinary mechanical clocks fitted with contacts to cause electric bells to ring at any required time, and a watchman's tell-tale clock with electrical actions. As no electric clock as such is described, the chief interest is in the descriptions of the cells.

THE BASHFORTH CHRONOGRAPH

Written by Professor Francis Bashworth in 1890, this deals with the author's instrument for determining the very short intervals of time when a projectile is in motion; and the results of gun trials at Shoeburyness. It is a rare book today, interesting mainly because of the electrical means used to determine the time of flight of shells from guns. An example of Bashforth's instrument, invented about 1865, is in the Science Museum, London, and is the one he actually used to obtain his results. The study of chronographs has largely been neglected by electrical horologists, yet these instruments were responsible for elucidating events far too quick for the unaided eye to follow.

Briefly it consists of a flywheel turning a cylinder which carries a prepared paper wrapped round it. Two electromagnets are arranged to mark the paper, one

controlled by a clock beating half-seconds, the other actuated by a circuit connected to ten screens placed 150 feet apart. As the projectile passes through each screen, it actuates the electromagnetically operated marker. Simultaneously with the turning of the drum, a spiral screw moved a slide carrying the marking devices, so a continuous record was spaced out on the paper for later measurements to be taken.

Bashforth's tables of velocities of projectiles were adopted by armies and navies throughout the world, they are, of course, of little use today since many missiles contain their own guidance and propulsion systems, for which the science of ballistics is no longer of importance.

The subject of chronographs has received little attention from electrical horologists, for whilst it has a wide field of application, it is a very specialized aspect. This is an application which was pioneered by Charles Wheatstone and involved him in dispute with Breguet. Wheatstone contributed an article "Note sur le Chronoscope électromagnétique" (Note on the electromagnetic Chronoscope) to the *Comptes Rendus de l'Académie ds Sciences*, it was published in Volume XX, pages 1554-1561, 1845. The events leading up to this from Wheatstone's experiments to measure the velocity of electricity in solid conductors, are very interesting, and in 1840 Wheatstone was telling the Bishop of Landorff he had contrived to measure time to a sub-division of one-millionth of a second; a most remarkable achievement. However it is the intention of the writer to detail these events in a separate article so we will leave the matter here. Wheatstone's contributions were all brought together in one book, many of the articles in this are in French, for he was fluent in both written and spoken French, and many of his contributions were published in the French equivalent of the Royal Society's *Transactions* - the *Comptes Rendus* ... .

Another interesting facet, which again has not had a great deal of attention from modern enthusiasts, is that of the multitude of Time Balls erected in the latter half of the nineteenth century. The literature for these is often in the form of pamphlets and brief descriptions in journals such as *The Horological Journal*. This valuable source of information was not founded until 1858, so the beginnings of electrical horology were not recorded in it. Another difficulty is that it has never been systematically indexed to enable the information to be extracted easily, often items are found only when the journal is searched page by page. Thus there is a very interesting article "Time Signals at Greenwich Observatory" in Volume XXII, pages 114-124 (May 1880), not indexed under time signals at all. In this we find mention of Shepherd's master clock which by then had been at work for thirty years as the mean solar time clock, it was corrected at 10 am each day before the time signals were sent out to the various parts of the country. The operation of the Greenwich Time Ball is also described, with mention of the Deal Time Ball, recently restored after decades of neglect.

Thus it will be seen that there is much research necessary if an adequate recovery of the written records of electromagnetic clocks is to be made, and it requires a number of people to join in the project to make it a real practical proposition even for the nineteenth century alone. The writer has found over one thousand references so far, and of course, many more of such references remain to be uncovered. These were incorporated in his *A Millenary of Electrical Horology References* published in a limited issue of 50 copies, one of which was deposited in the NAWCC library and may be copied without requesting permission from the author. The electrical horology patents issued in Britain for the nineteenth century were listed in his *A Parergon of Electrical Horology - Electric Clock Patents* for the period 1840-1900; there are hundreds more for the Continent and the U.S.A.

REFERENCE MATERIAL:

A Conspectus of Electrical Timekeeping. Charles K Aked. AHS Monograph No 12, 1976. Reprint of six articles on electrical horology published in *Antiquarian Horology*, three of which contain fundamental information on Alexander Bain.

Electrifying Time. Charles K Aked. Catalogue of the exhibition of electric clocks at the Science Museum, December 1975 to May 1977. AHS Monograph No 10, 1976. The exhibition was visited by over 100,000 members of the public. In spite of initiating the exhibition, the writer did not choose this title.

A Parergon of Electrical Horology - Electric Clock Patents for the period 1840-1900. Charles K Aked. 1984. Privately published.

A Millenary of Electrical Horology References. Charles K Aked. 1987. Privately published.

Die gesammte Literatur über Uhrmacherei und Zeitmesskunde. M Loeske. Berlin. 1897. (The complete literature on Clocks and Watches and the Measurement of Time). This gives the complete listing of electrical works in the 19th century, a separate classification index separates these from the general horological literature.

Bibliographique Générale de la Mesure du Temps. Tardy. First edition, Paris, 1947; second, Paris 1980. (General Biography of Time Measurement). This gives many of the references in the *Comptes Rendus de l'Académie des Sciences*, the electrical references are found under the heading of *Horlogerie électrique*, about 60 entries before 1900.

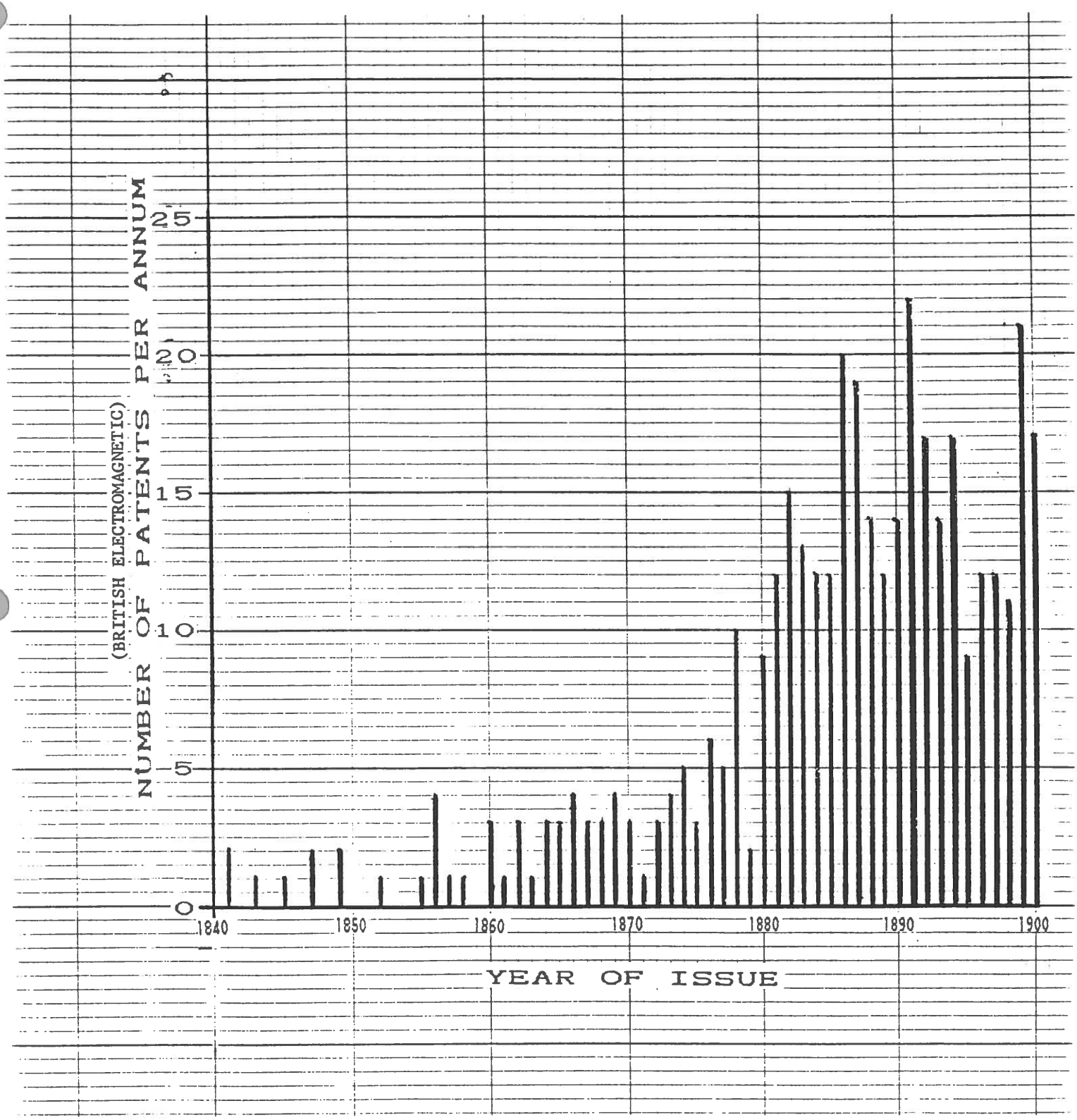
Patent Abridgements - Horology 1855-1900. Volume I. Facsimile edition published by Albert L Odmark in 1979. This is an essential work for anyone interested in electrical clocks of the nineteenth century. It is the most inclusive source of information on mainly English electric clocks of all, but it is necessary to obtain copies of the actual patents themselves to be able to read the full specifications of the proposals.

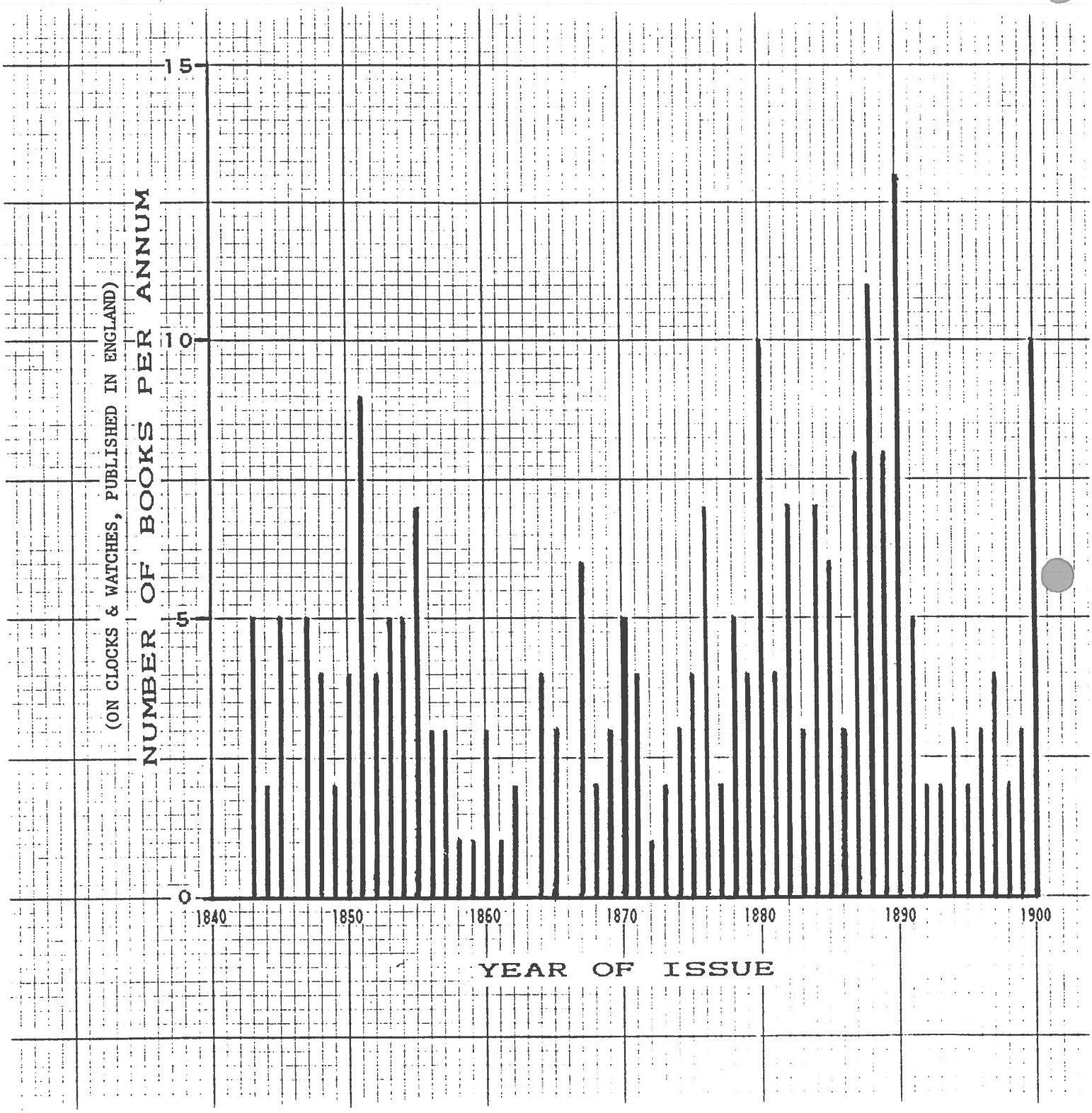
Horological Books and Pamphlets in the Library of the Franklin Institute. Walter A R Pertuch. Philadelphia. 1956. This includes many American references not included in this article, such as "Facts about Spellier's electric clock", Philadelphia, 1884; or "A Plan for the regulation of time-pieces in and about Boston" by E N Horsford in 1853, published only a few weeks after the installation of a Time Ball in the Strand, London. The works listed here were transferred to the NAWCC library, now the most comprehensive horological library in the world, in spite of what the British Horological Institute says.

Clocks and Watches - An Historical Bibliography. G H Baillie. Volume II covering 1800-1900. This is only available in a manuscript form at the Guildhall Library, Aldermanbury, London. In general most of his information for the 19th century was extracted from Tardy's *Bibliographie* ... There are no illustrations accompanying the manuscript, one of the main reasons why it has not been published up to the present time. No reader's ticket is required to consult this or any other horological material, simply ask at the desk.

-.-.-.-.-.-.-.-.-.-.-.-

Text completed 7 February 1988, checked 11 October 1988, reset into single line spacing 16 March 1990. Charles K Aked.


NUMBER OF PATENTS PER ANNUM
(BRITISH ELECTROMAGNETIC)
0
5
10
15
20
25
1840
1850
1860
1870
1880
1890
1900
YEAR OF ISSUE


NUMBER OF BOOKS PER ANNUM
(ON CLOCKS & WATCHES, PUBLISHED IN ENGLAND)
15
10
5
0
1840
1850
1860
1870
1880
1890
1900
YEAR OF ISSUE

AN ELECTRIC HOUR-STRIKING MECHANISM.

By Thomas Reed

(From "Electrical Experimenter" - July, 1918, pg. 182 & 210)

An earnest "Bug" who had evidently just completed an electric clock according to specifications, wrote me asking how to make a striking-mechanism to go with it.

I had to reply sadly that I didn't know. I said I'd devoted, first and last, a large part of a misspent life to that very problem, and hadn't solved it yet, nor heard of anyone who had. It's a thing that looks as simple as fixing the back gate, till you come to tackle it, when you find some goblin of mechanical perversity lurking at every turn, with a kibosh in his hand, ready to put it on you.

Lots of people have thought they had a successful electric striker, but their rinktums weren't reliable. A few years ago, an inventor was so sure of his, that he approached our firm for $50,000 capital to put it on the market. It was my job to interview him.

He set his clock up on my desk, and started it going. It was nicely made, with a beautiful mahogany case, and he eyed it with the same glance a mother gives her newborn baby boy. He took half an hour to describe its perfections, and by that time it was three o'clock.

"Now," said he, "it's going to strike." It did; Ye Gods, it did. It struck the three, and then went on to get all it's striking done up for the day. The inventor, his face a beautiful pink, thumped on the case to remind the mechanism of its duty, but nothing doing. At the twenty-seventh stroke, his endurance gave way, and he stopt it by poking a finger in the works.

It was a dirty trick for baby to play, just when papa's $50,000 depended on his speaking his piece right. Sometimes clocks are almost human.

Well now, to return to that "Bug," his letter seemed to bring a sort of inspiration with it; and after telling him dolefully to save the problem, with perpetual motion, to think over at night as a cure for insomnia, an answer to it happened along just as casually and naturally as a fellow dropping in to cut off your gas meter for arrears. So as the "Bug" (whose name was Walter Franseen) furnished the inspiration, he is hereby declared joint inventor of the apparatus, which is shown in Fig. 1.

To begin with, while this mechanism could be incorporated with the time-works, it's better to drop it down below, and connect it with the hour-hand arbor by chain and chain-wheels, or even pulleys and a rubber band, as there is almost no power to be transmitted. In that way, you can have the pleasure of seeing it

go; and if it cuts up any shines, as the baby boy did, you can get at it handily with a half brick or a hammer.

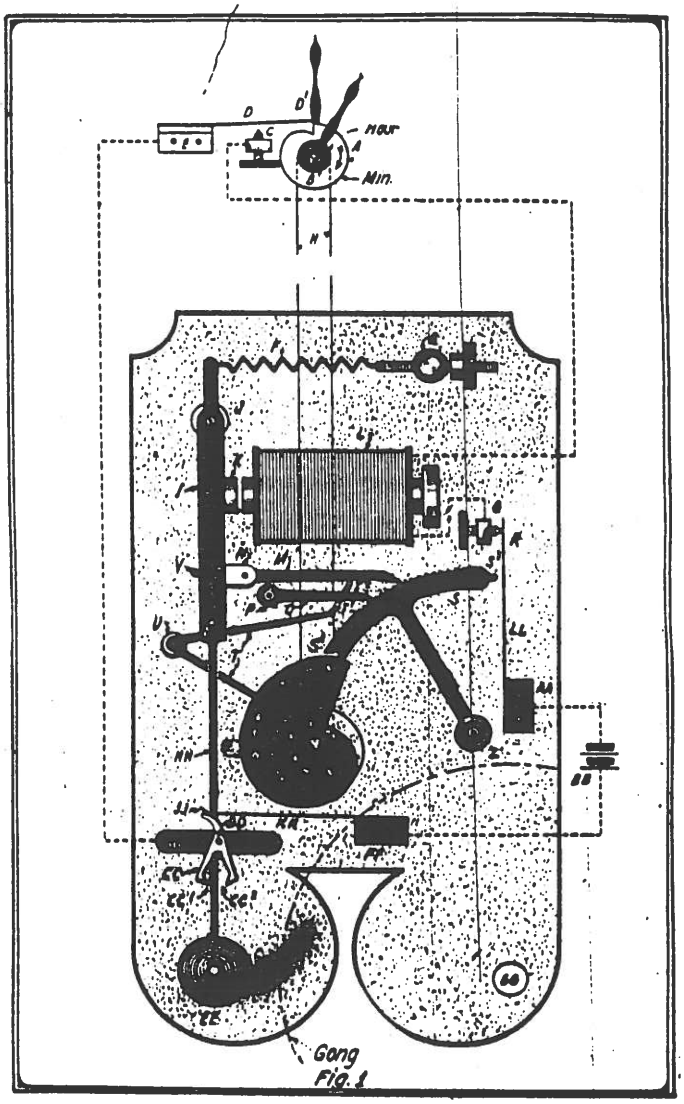


Fig. 1. Well, Clock Fiends, Did You Ever Attempt to Make an Electric Hour-Striking Mechanism to Attach on That Hall Clock? At Any Rate, Mr. Reed Assures Us, It's No Cinch to Solve the Problem RIGHT, But the Scheme Suggested Here is Said to Do That Little Job, and Do it O.K. Here's Wishing You Luck.

As the picture is drawn, the clock is just ready to strike one. The cam A, attached to the minute-hand arbor of the clock, and moving in the direction indicated, is about to let drop the flat spring D, which rests on the cam at D'.

When the spring does drop, the point on it where the D is marked strikes on the contact point C and completes the entire electrical circuit. Follow it around. It first enters the little forked trigger CC. The bent top of this trigger forms a contact with the flat spring KK at the point JJ. On goes the circuit, thru the battery BB, support AA, spring LL, across to contact Q at point R, thru the magnet L, and so back to C, where we began.

Now, what happens? The magnet L, of course, is energized and pulls toward itself the armature K, attached to the lever I, pivoted at J, which carries the heavy hammer EE by its stem HH.

Righto! But also attached to the lever I is the stud N, carrying the pawl M. As this pawl is pushed to the right, it pushes along the circular rack S, till just as the hammer strikes the gong, it has pushed it to the extent of exactly one tooth; and the click O is holding that gain of one tooth, and will hold it till we get ready to make it let go.

Now, having struck our one o'clock on the gong, we want to stop things. Up above, in the clock-works, of course the contact D, C, is still closed; it won't be separated for 1Ø or 15 minutes yet, as the cam A goes around with the minute-hand. But look at our excellent nubbin S", protruding like a sore thumb from the end of the rack S. The nubbin has now reached the spring LL, pushed against it, and separated the contacts Q and R. The magnet L is "killed," the armature-lever I is drawn back to the stop V by the spring F, and our mechanism goes to sleep till it's time to make preparations for striking "two."

Next, we introduce the volute-shaped piece W, well known in the clock-making art as a "snail." This snail is constantly moving in the direction of the arrow, at the same rate as the hour-hand of the clock above. Attached to the same arbor, and moving similarly, is the wheel X, with twelve projecting pins, X', X", etc.

Fifteen or twenty minutes after we have so brilliantly struck "one," the pin X" strikes the end of the forked lever T, pivoted at U; and X", continuing further, raises T. The top fork of T, which is naturally raised also, carries the two pins T' and T", which bear on both the click O and the pawl M.

We left Mr. Click holding up the rack S, and resolved to continue holding it or know the reason why. Well, the reason is here. On a little further raising of T, the click is lifted out of the tooth, and the rack S falls till the pin S" hits somewhere on the edge of the snail. The snail, however, has been moving to the right, and the pin falls at the point W", where the diameter has lessened by just the amount of one rack-tooth. Two teeth in all, then, are ready for our next hour-strike.

A few minutes more, and the pin X" drops the lever T, and the latter "passes the buck" by dropping the click and pawl into the rack, ready for operation. It must be remembered that when the rack S fell, it released the spring LL, and closed the contact Q, R; but long before this, the contact D, C, back in the clock was opened, so we don't start yet. But we are all set again, and the instant DC is closed, the striking operation is repeated; only now the rack S has two teeth to go before the nubbin strikes LL and ends the game. The process continues for the succeeding hours, till at 12 o'clock the rack S falls thru its widest arc, the pin S' striking the snail at its lowest point W".

The layout of the snail is shown in Fig. 2. The distance

from W' to W" is just equal to twelve teeth on the rack, so make your rack first. Use for the rack a section of any old big clock gear wheel, filing the teeth over into the new shape required; then make your snail to correspond. In Fig. 1 the teeth are supposed to be 1/16 in. apart.

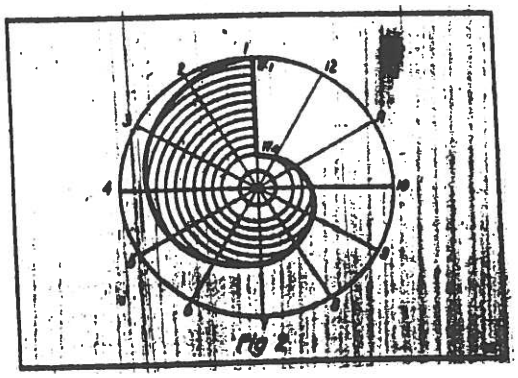


Fig. 2. How the Volute-Shaped Disc, or "Snail" as Clockmakers Call It, Is Laid Out With the Aid of a Drawing Compass.

A word in regard to the forked trigger CC. The object of this is to give the magnet the longest pulling-time, and yet break the circuit at the end of the stroke. The contact holds on until the hammer-stem strikes the point CC", when the curved top and the spring KK are separated at JJ: and they remain apart until the returning stem strikes CC', when they are wedged together for another pull of the magnet. Of course the pivot DD must be muffled slightly, so that C will stay where it's put, and not swing freely.

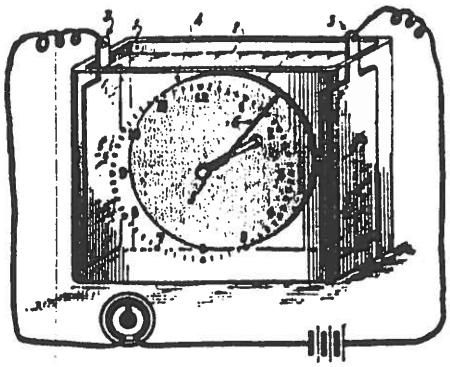
This rinktum may look complicated at first sight, but if you'll analyze it you'll find it's very simple and not hard to make. It's more work to describe it than to make it. So go to it, "Bugs," with my blessing.

THE TESLA CLOCK

(From "Science & Invention" - August, 1920, pg. 396)

There is always something extremely novel and interesting in the duplication of Dr. Tesla's experiments, but it seems that at times such attempt is rather difficult. However, that may be due to the particular care exercised by Dr. Tesla in having his experiments exact to the minutest point, a feature which amateurs generally glide over. In the case given here, however, there will be no such difficulty in the making of a clock of this nature.

Not only is the clock unique in design, but rather serviceable if a constant E.M.F. is available. It makes an adorable clock for the amateur, even tho it varies slightly from correct time. This, of course, depends entirely on the regulation of the resistance in the controlling circuit.



1-glass tank 6"*2"*3". 2-copper sulphate solution. 3-metal plates. 4-balanced copper disc. 5-jewel bearings. 6-glass thread pointer.

Dr. Tesla Has Given to the Amateur Construction "Bug," a Simple Idea Which He Used Some Years Ago, In Building an Electric Clock. The Clock Is Simplicity Itself and Comprises a Well-Balanced Copper or Silver Disc, Mounted So as to Rotate in Two Jewel Bearings. Two Metal Electrodes are Placed on Either Side of the Revolvable Disc and When Current is Applied, the Disc Rotates Very Slowly.

A clear walled glass jar or celluloid jar is employed, a well balanced metal disc of copper or silver mounted in such a way that it is free to rotate in the centers of two jewelled bearings. These may be obtained from a clock and easily inserted by drilling a hole thru the glass or celluloid jar and securely mounting them therein with a copper washer on each side to prevent any escape of liquid.

On each side and equi-distant from the periphery of this metal disc are placed two metal electrodes similar in nature to the metal disc, i.e., either silver or copper. On the disc itself is fastened a thin glass thread pointer or a thin annealed iron wire, the latter being preferred.

The jar now is filled with a solution of silver nitrate if a

silver disc has been used, or copper sulfate if a copper disc and copper electrodes have been used. (Electrodes can be copper strips.) If a magnet is now placed in front of the dial so that its action will take place upon the thin annealed iron wire, the disc inside can be rotated to any desired position. Current from several storage cells is now turned on.

The result is that an electrolytic action takes place, metal being deposited on one side of the movable disc while it is taken off on the other side slowly and with remarkable regularity. This causes the disc to rotate slowly, due to a gravitational action, and if carefully regulated a clever timepiece is the result.

The bluish color of the copper sulfate solution makes a very pleasing aspect in a home or library, the experiment itself being one of the least difficult to reproduce. The disc is about three inches in diameter and the electrodes at each end about 1/2 inch wide and 4 inches long. About three volts E.M.F. will be sufficient if the amperage is quite constant.

According to Dr. Tesla, a slow deposit is more desirable and for this reason a very narrow plate will answer the purpose. If a wider plate should have been used and the disc rotate too rapidly when current is applied to the terminals, the electrodes of both sides may be coated with paraffin so that but a thin space which is cleaned of this paraffin will be effective.

The plate should be slightly wider than the thickness of the disc itself. The disc could likewise be used as one electrode and instead of the two end strips only one would be employed.

Another essential is that the bearings should be made non-corrosive and at the same time it would be better to lubricate them with a small drop of watch oil. Then when the jar is filled with the electrolyte, the oil will be retained in the bearing zone preventing a deposition of metal upon this zone and corrosion to a great extent.

----- MART -----

All Mart Ads are FREE... Send copy to the attention of the editor; Harvey Schmidt, 75-80 179th St., Flushing, NY 11366. (limit 3 lines)

FOR SALE: ROYAL Electric Beehive Clock, also LACKNER Electric Clock. $50 each or make offer. For details; Al Engel, 634 South Front St., #2, Mankato, MN 56001. (507) 388-2305

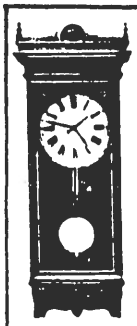
WARREN Type-A Power Station Monitor Clock, Good condition and GRO. $2,000. (plus shipping if applicable) Martin Swetsky, 1910 Coney Island Ave., Brooklyn, NY 11230 (800) 221-0424

WANTED: PORTESCAP Secticon Clock or Movement. Harvey Schmidt, 75-80 179th St., Flushing, NY 11366, (718) 969-0847

A BIT OF NOSTALGIA ....

The young or middle-aged man who desires to learn **ENGRAVING**, to grasp the finer points of **WATCHMAKING** and **OPTICS**, finds it necessary to spend at least five years in a store before he has attained a thorough knowledge of the business. In less than a year's time this complete knowledge can be gained at our college, each student receives individual and practical instructions. We get telegrams and letters every day, offering positions to our graduates, which shows what practical storekeepers think of our course. **Send for Prospectus NOW.** A position awaits you.

THE PHILADELPHIA COLLEGE OF HOROLOGY
F. W. SCHULER, Principal **Broad and Somerset Sts., PHILADELPHIA, PA.**
See our large advertisement, page 254



You are not too busy
to hear a suggestion concerning
"a good thing"
and to submit it to your customers as
an ideal Christmas Gift
which will return to you
an unusual profit

Here is the suggestion:

Order *at once* one or more of the

No. 10 "Standard" Electric Clocks

Hang it conspicuously in your store and direct attention to it as *the fit Gift* from

Wife to Husband, for Office or Store
Husband to Wife, for Hall or Library
Children to Parents, for Hall or Library
Member to Church, for Meeting Room
Brother to Order, for Meeting Room
Pupils to Teacher, for School Room
Class to Sunday School
etc., etc.

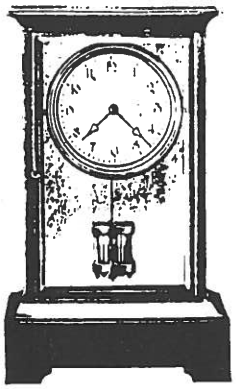
The substantial reason for your urging this Gift upon buyers is for the *profit* that is in it—for what are left of them can be had at

the extra-special price of **$12.50**

We sell these *direct* to the Retailer.

New York Standard Watch Co.
Jersey City, New Jersey

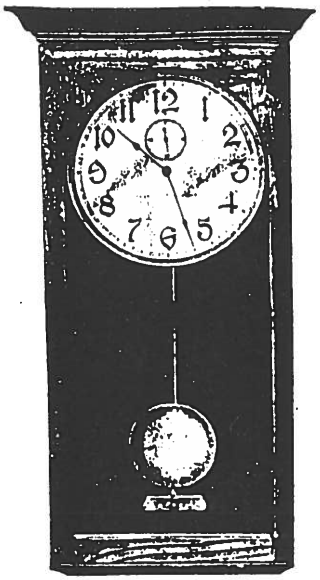
ELECTRIC CLOCKS



Our beautiful line of Wall and Mantel Clocks are unsurpassed.

There are none "**just as good,**" they are in a class by themselves.

Our Secondary Clock System for large buildings where numerous clocks are necessary, all operated by our master clock, is a generation ahead of all others. Our Electric Time Stamp can be operated in connection with this system and no business office is complete without our time stamp.



SEND FOR CATALOGUE

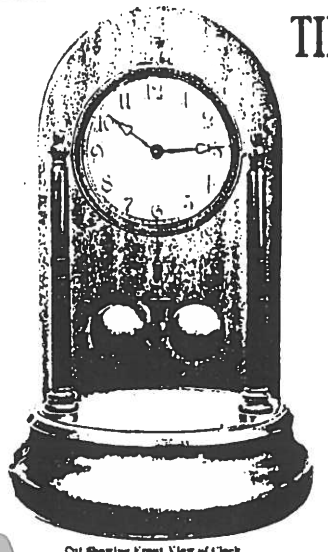
AMERICAN CLOCK COMPANY

Wabash Avenue and 20th St., CHICAGO

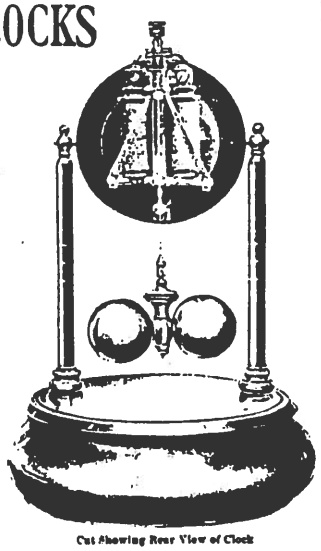
TIFFANY ELECTRIC CLOCKS

PURELY ELECTRIC

NO SPRINGS
NO WEIGHTS
NO CLEANING
NO OILING
MOST ACCURATE TIMEKEEPERS



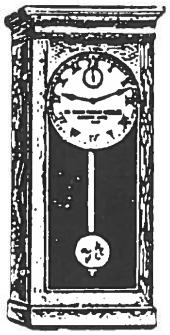
Cut Showing Front View of Clock



Cut Showing Rear View of Clock

For prices and other information write

TIFFANY. ELECTRIC MANUFACTURING COMPANY
MANUFACTURERS OF TIFFANY ELECTRIC CLOCKS
General Offices and Factory, 437-453 Eleventh Avenue NEW YORK, N. Y., U.S.A.



No Winding

required yet they keep perfect time. ¶ Has Graham Escapement. 80 beats to the minute.

Ideal Time Keeper

Made by

The Imperial Electric Clock Co.
Makers of the Simplest Electric Clocks
GRANITE CITY, ILL.

--- MART ---

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

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 48236 (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

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. Irwin 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

Information on STRIKING SELF-WINDING CLOCK MOVEMENT. Need Rack. A. Redfield, 21 Kentbury Way, Bethesda, MD 20814, 301-656-5562

Information, Patents, Patent #'s, Ads, ANYTHING on SOHM ELECTRIC CO., Chicago. David Lee, RD #1, Box 187, Delanson, NY 12053

Information on SELF-WINDING clocks with movement marked BETTS & BETTS CORP. NYC, USA, OBERMILLERS PATENT. Anthony Prasil, 2179 Titus Ave., Rochester, NY 14622

Information on REMPE movement... Need one with second hand capability, Have non-second hand movement. Will trade or sell. Art Redfield, 21 Kentbury Way, Bethesda, MD 20814

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

REVERE Electric Clock Service Manual, $3.50 each PPD. Also 2- 12 page Booklets from Self Winding Clock Co., Schedule of Parts, Style F, and Style A & C Movements, $2.45 each, PPD. Tom Welch, Box 23753, Eugene, OR 97404

WANTED & FOR SALE: STANDARD ELECTRIC Clocks & Wiring Diagrams/Service Bulletins. Will trade, sell, or buy. Call or write for available material & wants. Jeffrey R Wood, P.O. Box 5, Wilbraham, MA 01095. (413) 596-8250

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

BALLOT

At a meeting of the EHS Chapter 78 nominating committee, chaired by Alan Marx, the recommendation to the general membership was to re-elect the present officers for an additional 2 year term, unless a write-in candidate received a minimum of 5 votes. In this event, a run-off election would take place for that office, with the details to be outlined in the next issue of the journal. In the absence of a write-in candidate for office receiving the 5 vote minimum, the current slate of officers shall be deemed re-elected.

President..... Martin Swetsky
Vice-President..... Dr. George Feinstein
Secretary-Treasurer. Harvey Schmidt

Additionally, Harvey Schmidt has agreed to act as chairman of the Editorial Committee, with the future Journals prepared by a committee and compiled and edited by the Editor. This plan should provide a number of advantages in that the burden of journal preparation will be divided, and a more varied and diverse assortment of material should be made available.

OFFICIAL BALLOT: I wish to exercise my voting priviledge as follows:

_____ I am in favor of the nominating committee recommendation.

_____ I am not in favor of the nominating committee's recommendations and wish to vote for the following for the offices indicated:

President_____

Vice President_____

Sec'y Treasurer_____

My Name _____

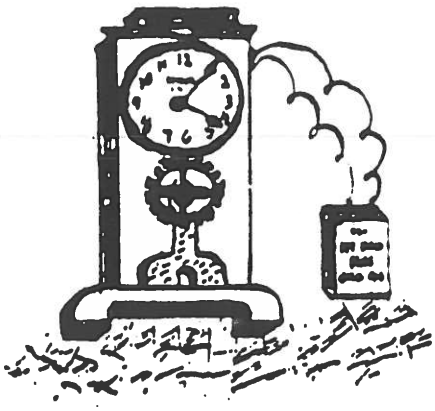
NAWCC # _____

IMPORTANT... Please mail your dues and ballot to the attention of the secretary-treasurer, Harvey Schmidt, 75-80 179th Street, Flushing, NY 11366.

Ballots MUST be received no later than January 15th to be eligible for consideration in the election.

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.

ATTENTION MEMBERSHIP: DUES... ARE DUE

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 enclos my $10.00 dues for the year 1991 _____ check here

I wish to renew my current membership in the Electrical Horology Society--#7 and enclose my $10.00 dues for the year 1991 _____ 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.

NATIONAL ASSOCIATION of WATCH and CLOCK COLLECTORS, Inc.