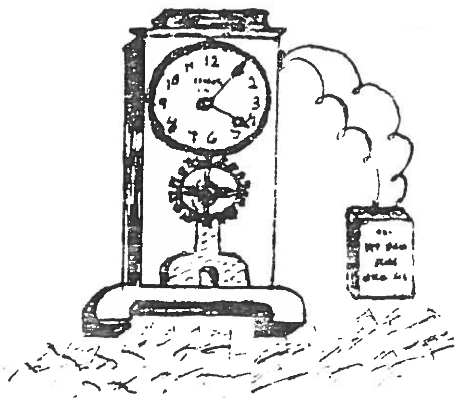
The
JOURNAL
OF THE
ELECTRICAL HOROLOGY SOCIETY
Chapter No 78



February, 1980
VOLUME VI---ISSUE #1
Martin C. Feldman, Editor

Hello fellow enthusiasts:

At the request of our treasurer I am opening this month's editorial with the request that all members who have not sent in their dues send it in immediately. We are a mail Society and as a nonprofit group your dues just about support us for the year bringing you the six Journals. For those members who have not paid, the February Journal will be the last one you receive. To the others who have conscientiously sent in their dues--we wish to thank you very much and hope that you shall continue to be pleased with our modest efforts. Also, many thanks for all the kind words of encouragement which we have received with many renewals.

Not surprisingly it appears that the problems of the 70's will follow us into the 80's. Without belaboring the economic, political and energy issues, we as electrical clock collectors have been caught up in the general swirl. The economic squeeze which affects us presents a paradoxical situation; on one hand some may find it advantageous or even necessary to part with a special electrical clock, while on the other hand the others will find it difficult to purchase said clock as there is just not enough free capital available. Of course there is always a small group of collectors who appear to remain unaffected no matter what happens. These people will always be able to add to their collections, be it in good times or bad. For the rest of us, we are faced with some painful decisions as to whether we should sell or buy. The end result of these ironic times is yet to be seen.

Our first Issue of the new decade opens with the return of Dr. Feinstein's column, The Electric Time Machine. George is willing to continue the column but it is dependent on questions from our membership. His address is included with his column, and he remains available for your questions. We are reprinting through the courtesy of O. R. Hagans, The Magnetic Escapement by A. Tremayne. His clock utilizing only magnetism to control and impulse a balance wheel is fascinating indeed. We now have more information on the Colin Walton clock kits, KI and K2, which have been built by David Chrestenson. His experiences and recommendations are well worth reading even if you are not thinking about purchasing these kits. We are also including the advertisements for those who were not EHS members at the time we first described them. Before concluding with our Mart we bring you the original advertisements for

cont. page 12

THE ELECTRIC TIME MACHINE

By: Dr. G. Feinstein
75-19 195 Street
Flushing, NY 11366

QUESTIONS AND ANSWERS

From: M. L. King, Rl Box 135B, Godley, Texas 76044

Question: In the article "Ideal Switch Contacts: A Matter of Metallurgy", in the August, 1979, Journal of the EHS, on page 8 is the following statement:

"...For example, sliding contacts break through some films and can increase contact area. But in d.c. circuits contact wiping may eventually cause mechanical hang up between the peaks and craters on the contact surfaces."

I have seen the peaks and craters on the "points" in ignition systems on cars. In the American Clock Co., Chicago, movement (described in Goodrich, The Modern Clock, page 396) the contacts are platinum; what I assume to be self cleaning, etc. However the contacts on the springs are gone. Similar metals have more friction than two different metals. Brass and steel wear well. Seems like the knife (dropping) contact has worn out the smaller contacts on the spring, as they are worn smooth.

Question: Should I replace the spring contacts with platinum, silver (hammer hardened) or say 10K gold (hammer hardened)? The "knife" shows no appreciable wear.

In your opinion, would a sealed mercury contact switch that tips (rocks) to close the circuit, be as good or better than the knife switch?

Answer: If the platinum contacts are completely worn away they should be replaced in kind if possible. A suitable substitute material is fine silver.

I have examined several of these clocks and the contacts were all in good condition. Maybe too high an operating voltage was used in your clock. You should operate this clock at 3 volts, D.C.

The usual cause of deterioration of electric clock contacts is arcing when the contacts open. This arcing is produced by the collapse of the magnetic field around the electromagnetic coils (inductive load). This collapse produces a back electromative force (E.N.F.) which can be 100 or more times as great as the original operating voltage.

To eliminate this arcing across the contacts, short out the coils with a high voltage diode. When installing the diode, make sure the polarity of the battery is correct or the diode will burn out. Even though the sealed mercury contact switch would probably work better than the knife switch, I would not use it on this clock since it would mean modifying the clock to a non-original design.

By the way, the peaks and craters on automotive "points" are not the ones described in the article since "points" are not sliding contacts.

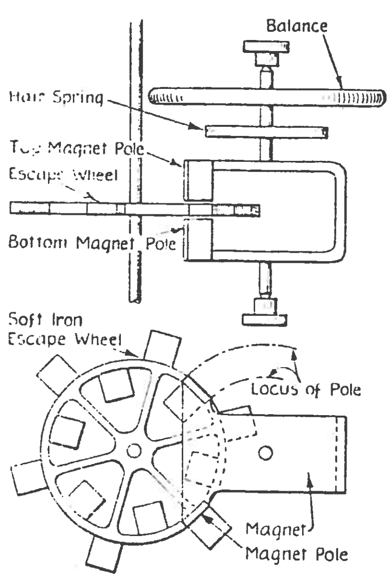
TECHNICAL BULLETIN FROM ENGLAND

THE MAGNETIC ESCAPEMENT

By ARTHUR TREMAYNE

ALTHOUGH the idea of using the flux from a permanent magnet to control and impulse a balance wheel was patented by H. S. Baker in the United States (1931) and a type of magnetic escapement was also patented by Reinhardt Straumann of Switzerland (1942), it has remained for a British inventor, C. F. Clifford, B.Sc., A.M.I.E.E., who has recently been awarded the Fellowship of the British Horological Institute, to put the idea into actual practice. It is claimed to be the most revolutionary advance in pendulum clock design since Graham invented the "dead beat" escapement. Mr. Clifford's experiments now extend to applying the principle to a drum time-piece, replacing the entire escapement assembly of lever, pallets, fork, balance wheel and balance spring by a magnetic escape wheel controlled by a vibrating reed.

The magnetic clock escapement designed by H. S. Baker.

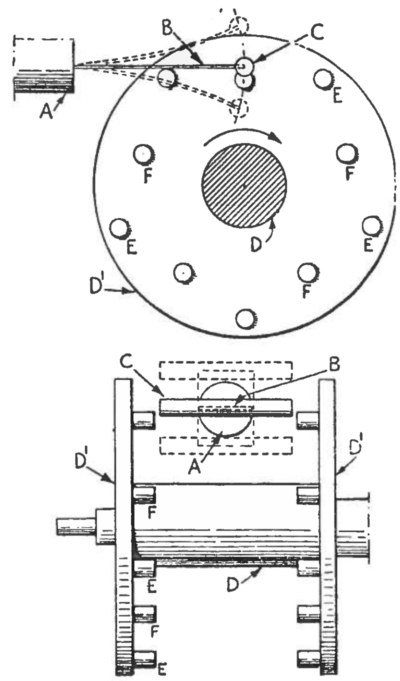


To go back to the first principles, in a lecture given before the members of the British Horological Institute, the inventor stated that the main object of designers of escapements in the past has been to keep friction and impact losses down to a minimum. The magnetic escapement eliminated these altogether. There is no mechanical contact between escape wheel and oscillator and hence no friction, no impact, no wear and no noise.

The banishment of friction due to lock, impulse and recoil makes an important difference to the work a clock can do. Mr. Clifford found that an ordinary eight-day timepiece when fitted with magnetic escapement had sufficient power to run for 30 days, meaning that 30-day clocks can be produced with magnetic escapements without undue complications other than a special train calculation, or that an eight-day clock can run with one-fourth the power. The eventual saving in wear and tear on the pivots and gear teeth means saving in costs of maintenance and replacement. Properly made and maintained, a magnetic escapement clock should have a useful life for an almost indefinite period, if one takes into account that well-made clocks with normal types of escapements, if reasonably well looked after, exist in good working order for some 200 years, giving good results all the time.

Mr. Clifford achieves his object by forming an escape wheel in which the teeth are replaced by a periphery shaped like a continuous sine wave or variation of it, and

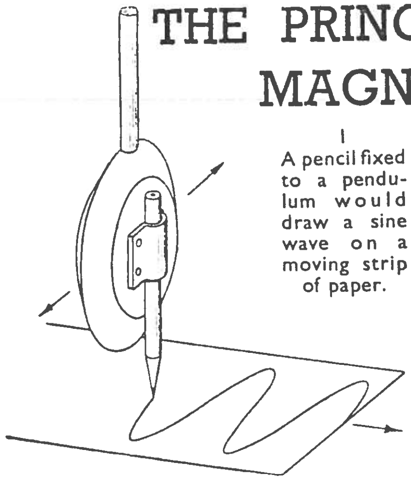
R. Straumann's magnetic escapement.



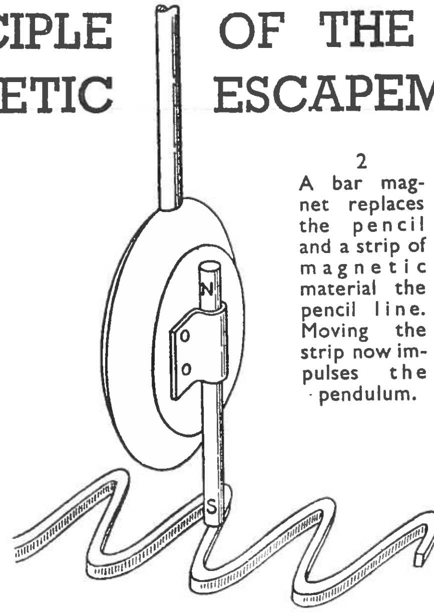
WITH THE COMPLIMENTS OF ORVILLE R. HAGANS

Issued by courtesy of N.A.G. Press, Ltd., 226 Latymer Court, Hammersmith, London, W.6., England, publishers of THE HOROLOGICAL JOURNAL

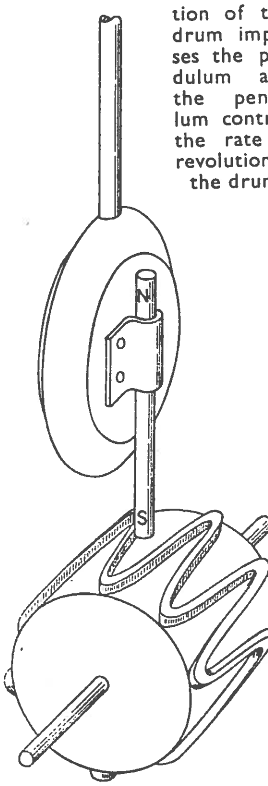
THE PRINCIPLE OF THE MAGNETIC ESCAPEMENT



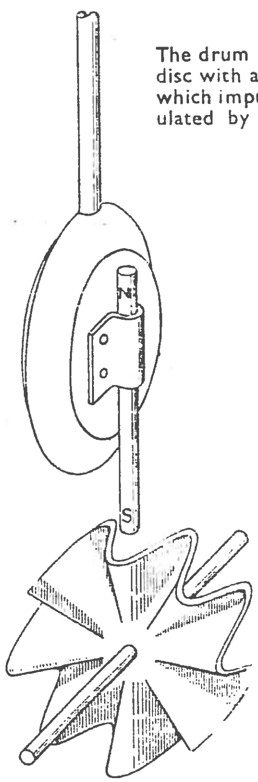
1
A pencil fixed to a pendulum would draw a sine wave on a moving strip of paper.



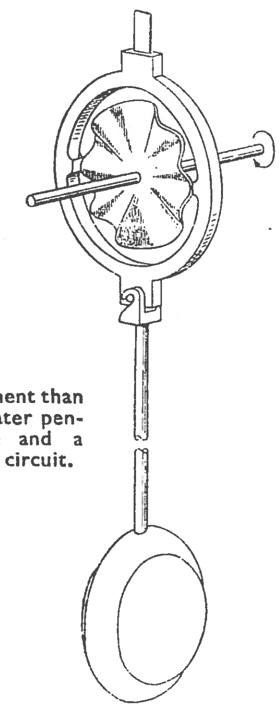
2
A bar magnet replaces the pencil and a strip of magnetic material the pencil line. Moving the strip now impulses the pendulum.



3
The sine wave strip of magnetic material is wrapped round a drum so that rotation of the drum impulses the pendulum and the pendulum controls the rate of revolution of the drum.



4
The drum is replaced by a disc with a crinkled edge, which impulses and is regulated by the pendulum.



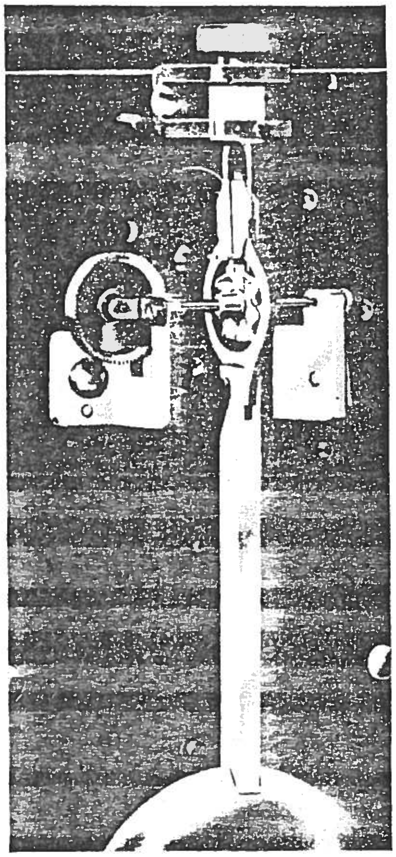
5
A better arrangement than in 4, allowing greater pendulum amplitude and a closed magnetic circuit.

made of magnetic material. If you could attach a pencil to the bottom of a pendulum in such a way that it would mark a strip of paper as it swings and arrange to draw the paper steadily under the pendulum at right-angles to its swing, the resulting pencil mark would form a sine wave. Therefore, if it is wished to place a rotating member close to any part of the pendulum rod so that the two pieces will maintain proximity whilst the one revolves and the other vibrates, the revolving member must take a sine wave form.

If, further, the one member is to control or impulse the other, then the sine wave escape wheel should be formed of magnetic material and the pendulum rod should bear magnetic poles. In practice the two parts, the escape wheel magnets and the pendulum magnets, may take various forms, and it has been the inventor's aim to discover the form which is the most economical to produce and the most effective in action.

The illustrations will give some idea of alternative designs which have been tried out. Let it be understood this is not an electric clock; it requires neither battery nor mains propulsion, nor is the pendulum used as a motor. The clock follows the normal practice of being gravity driven by a falling weight or spring driven.

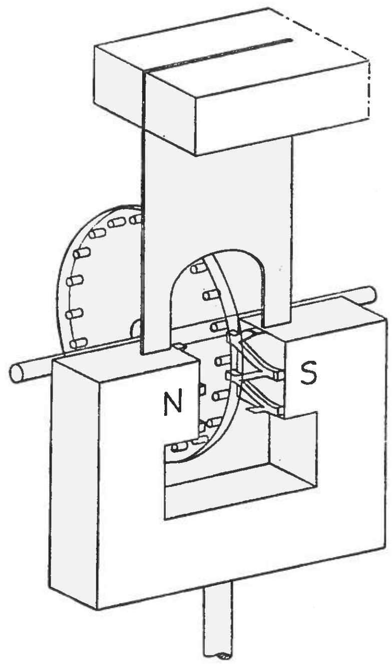
The magnetic escapement is applicable to pendulums of any normal length. It has been applied to a mantel clock with a 4¼ in. long (one-third seconds beat) pendulum, and also pendulums beating seconds. Mr. Clifford stated that his criterion of an escapement depended on what percentage of the escape wheel energy enters the pendulum. This is easily and quickly measured, and it will be found that the higher the efficiency of the escapement the better the timekeeping, as one would expect.



A magnetic escapement in use with a pendulum clock.

On the basis of a mathematical method of measuring the efficiency it was found that the highest efficiency calculated for a mechanical escapement was 18 per cent on a one-second pendulum clock made by Daniel Quare, the famous 18th century London clockmaker. Most one-second pendulum clocks have escapement efficiencies of approximately 10 per cent. The Clifford magnetic escapement on a one-second pendulum achieves 40-60 per cent. The efficiency of a mechanical escapement on short pendulums is very low, only 1 to 9 per cent, whereas the magnetic escapements achieve 15 to 20 per cent efficiency.

The vibrating reed magnetic escapement, on the improvement of which Mr. Clifford is very busily working now, appears to be the answer to many of the troubles of cheap alarm clock production. The main principle is the same as with the pendulum. The escape wheel is of magnetic material following a form of sine wave and the reed has magnetic poles. The wheel runs forward continuously or in pulses, but is held in step by the reed. Adjustment is given on the reed to bring the movement into time and although production models are not yet ready, many experimental examples seem to prove the inventor's theory. When perfected, this type of clock will provide a bedroom timepiece and alarm without any ticking noise and so lightly sprung in the timepiece train that performance and useful life will be far beyond those of the average spring-driven alarm —a piece of work which is usually very greatly over-powered and over-driven in order to overcome



A discontinuous sine wave can also be employed. Magnetic pins are embedded in a plastic escape wheel.

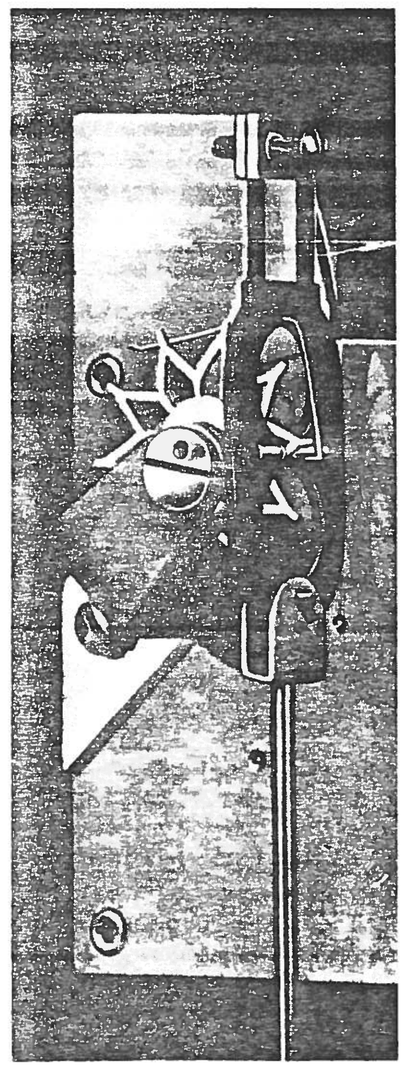
defects of design and manufacture attendant upon cheap mass-production articles.

Asked by one of the audience at the lecture concerning possible interference of proximity of powerful magnets, Mr. Clifford proved on his demonstration models by approaching the escapement with a magnet that the escapement was unaffected. Concerning the expectation of life of a magnetic escapement, the lecturer stated that the fluxes were still in the needles of magnetic compasses made in China about 2,000 B.C.

The most powerful magnetic alloys of which the sine waves can be made are roughly in the following order: Ticonal, Alcomax, Alnico, the 35 and 15 per cent cobalt alloys and the tungsten and chrome. The soft magnetic materials are Supermalloy, Nu-metal, Radiometal, silicon iron, Swedish iron and mild steel. Both permanent magnets and permeable materials can be used in compressed powder form, and in the case of permanent magnets the powder is sintered.

Development of the invention began in 1938 and, except for the war years, has been continuously proceeded with. Mr. Clifford is carrying out development work in the laboratories of Horstmann Clifford Magnetics, Ltd., of Newbridge Works, Bath, England, and it is hoped to issue licences for the manufacture of the device.

Another magnetic escapement applied to an actual clock.



BUILDING THE COLIN WALTON CLOCK KITS, K 1 and K 2

In the February 1979 EHS issue (Vol. V #1) you had an ad for two clock kits by Colin Walton and mentioned in the April issue that George Feinstein was going to make one. I have built both (the K-I and K-2) and briefly will give my experiences with them as follows: I ordered the K-I complete kit, not realizing there was an export version. I do not remember what the postage was, but it was very high. I would still recommend buying the complete kit however, unless one has access to a large stock of brass stock. Plans and prints are complete, instructions are minimal, though adequate. The quality of machined parts is good. All screws supplied are British sizes so unless one has a set of taps to match they cannot be used. Since nothing is predrilled for screws, the easiest way around this is to use standard American sizes. I used sizes 0-80 through 8-32 and this caused no problems if one plans in advance. Construction posed no great difficulty. The small parts (pivots, etc.) I made on my Levin jeweller's lathe. Most parts were too big for the small lathe and I did them on my 9" South Bend. I doubt everything could be made on a typical jeweller's lathe only, although I suspect someone will do it and prove me wrong!

The dial is a photograph to be cut out; not very attractive and I replaced it. Overall the job went fairly easily. I made each piece by the plans and set it aside; upon assembly everything fit with a minimum of handwork.

I don't know what size battery they use in Merry Old England, but I built the battery box according to their plans and then couldn't find batteries to fit. So I modified it. When I tried to get the clock to run I could not get it to go at all on the 2 "C" batteries I was using. I built another drawer in it and added 2 more "C" batteries. It then ran fine with almost no adjustments on my part. Getting the movement to drive the hands was another matter. I finally added a counter-weight to the operating lever and it worked. The clock has now been running for approximately a year without failure. It is still on its first set of batteries. Accuracy is poor! I have never checked it because it is too erratic. It appears very temperature sensitive, possibly due to the rod which is partially steel and partially brass. I suspect in a more controlled environment it may be more satisfactory.

Oh yes, the case. The case plans supplied was a Rube Goldberg concoction of angled brass. I skipped all of that and made it up of plexiglass. The clock is attractive and gets a lot of attention.

Upon completion of the K-I, I ordered the K-2 kit. Quality and plans were about the same as for the K-I. It was however simpler to construct with fewer parts. This might be possible to do on a "unimat" sized lathe. The plans for the case were a bit unusual as far as points, etc. go, so I redesigned it. One must have woodworking experience to build this case; it is not for the beginner! I made mine out of Koa wood and it is quite attractive. Remembering the problems with the K-I, I made two battery boxes instead of one, each to hold two "D" cells. The clock has now been more or less finished for about a month, however it still does not run correctly on flashlight batteries. I am, for testing purposes, using a large six volt lantern battery. It will run for 3 days to a week and then stop. I restart it and the procedure repeats itself. At this point, I have no idea what is wrong but I am still persevering and plan to succeed. Accuracy, when it is running, appears to be very good and I have hopes for it (if I can keep it running).

BY: David I. Chrestenson, 329 Seminary Ave. , Aurora, Ill.,60505

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(When writing to an author or to another clock enthusiast for advice, please have the courtesy to include a SASE for a reply!) Ed.

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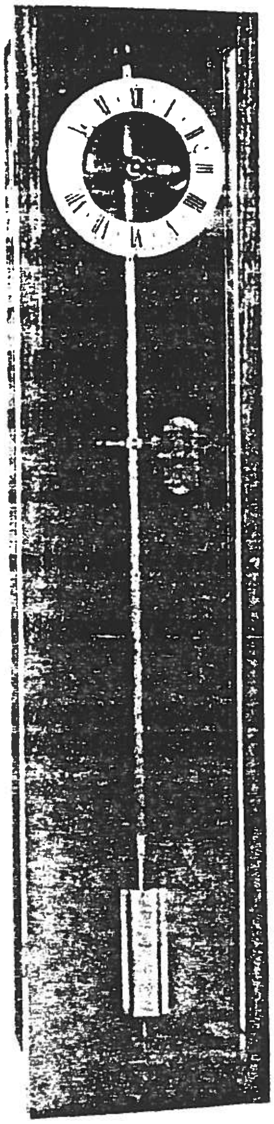
(For reference, we are reprinting the original adv.—Ed.)

COLIN WALTON CLOCKS
11 TYTHE CLOSE
GAZELEY, NEWMARKET
SUFFOLK

TEL. NEWMARKET 750125

THE K.2 1 SECOND PENDULUM WALL CLOCK



THE COMPLETED CLOCK

The K.2 is the second electrically driven clock to be offered as a kit, following the success of the half second electrically driven clock, the K.1., and the very popular clockmaker's depthing tool.

It is an imposing timepiece, having an overall length of 47" and width of 10½".

The K.2 was originally built in 1969, and has proved to be a most successful and reliable timepiece. It incorporates the Scott notched wheel principle in its design, which operates the impulsing for the one second pendulum, which is an intriguing feature of the clock.

This model is aimed at the constructor who wishes to incorporate more cabinet making skills and a little less clockmaking to obtain what is an elegant and accurate clock. To complete the clock you require a small lathe, drilling machine and the usual small tools.

The kit consists of the following items:-

All the materials including brass, screws, steel etc., to make the clock mechanism.
Silver plated chapter ring 8" diameter.
The wheels ready cut and crossed out, and the pinions complete ready for assembling.
The solenoid coils ready wound.
A full set of drawings and instructions.

The kit does not include the wood or glass for the case, as the constructor may wish to choose his own timber, although detailed dimensions and instructions are provided in the kit.

To: COLIN WALTON CLOCKS,
11, Tythe Close,
Gazeley, Suffolk,
CB8 8RS.

Please send me .... K.2 Wall Clock kit(s) at £31.00 each, p. + p. + VAT £3.00 extra.

I enclose a remittance of £ .... (Cheques should be crossed and made payable to Colin Walton Clocks)

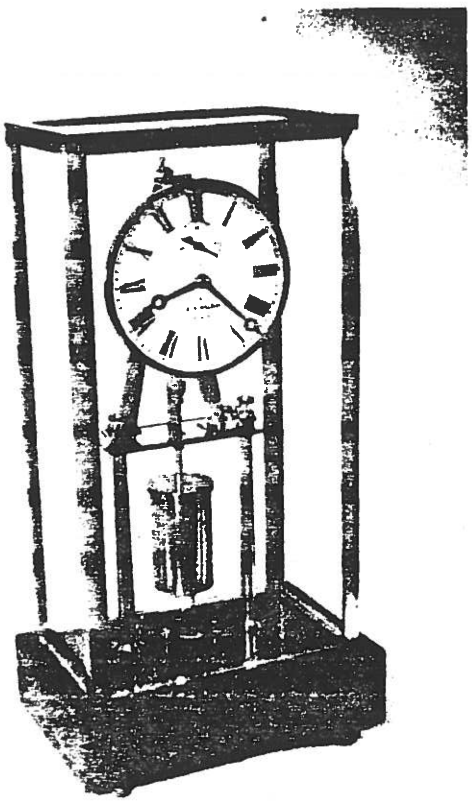
Name: ....

Address: ....

.... Date: ....

COLIN WALTON (CLOCKS)
11, Tythe Close,
Gazeley, Newmarket,
Suffolk. Tel. Newmarket 750125.

The K I 0·5 Second Pendulum Battery Driven Clock



The completed clock.

The K I Clock Kit is designed primarily for the Model Engineer who has an interest in horology or wishes to build something different.

The clock, when complete, stands 17″ high by 9″ wide by 6″ deep and looks an attractive feature in any room.

The basic requirements to build the clock are a small lathe, drilling machine, silver soldering facility, and the usual small tools, taps and dies etc. The kit is designed to take out the problems of wheel and pinion cutting, winding coils and depthing the train of wheels correctly. Thus leaving you the pleasant task of straight forward machining and hand work to complete the clock, in the knowledge of not having to search for the correct materials and that the end result will be a successful time piece, both pleasing to look at and accurate.

The clock is based on the well known Hipp principle, and is driven by a 3 volt flashlamp battery with a lifespan of about 9 months.

The kit shown in the photograph below consists of the following:

All the materials including brass, screws, steel, etc.

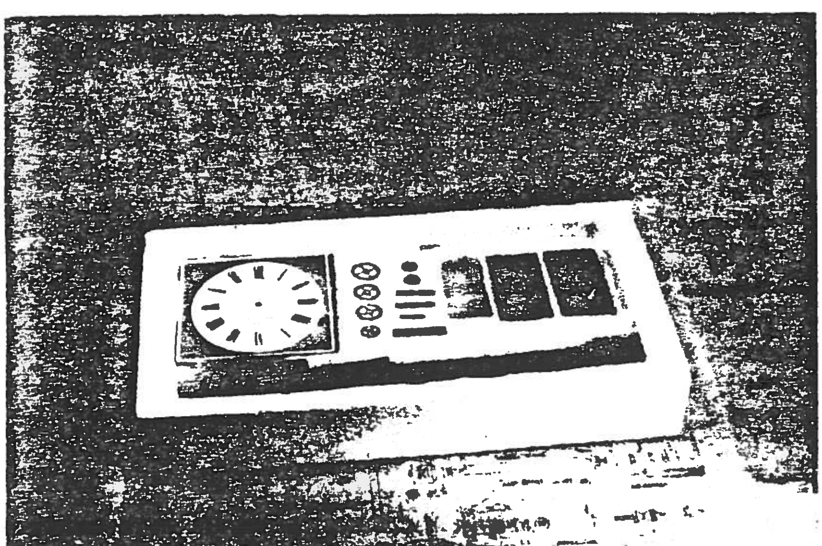
The wheels ready cut and crossed out, and the pinions complete ready for assembling.

The solenoid coils ready wound.

One engraved pendulum scale.

Two silver contacts.

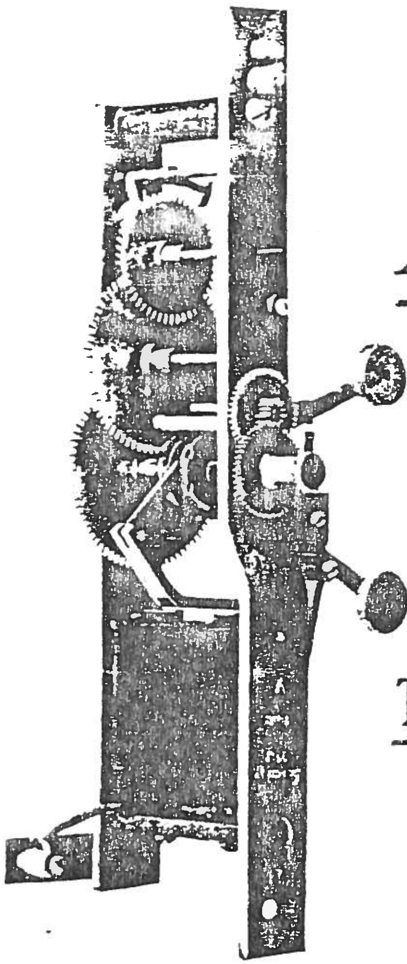
A full set of drawings and instructions.



The kit does not include the glass panels for the cover, the wood for the base or the battery.

The K I kit of parts.

SO SIMPLE   SO HANDSOME

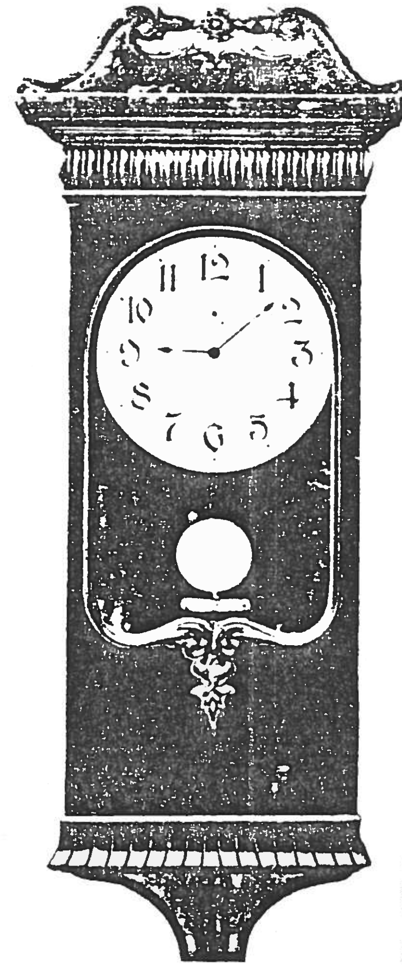


A Marvel
A Revolution

Three Wheels
Two Gravity Weights
One Set Magnets
One Set Electric Batteries

The Climax of American Ingenuity

Upsetting all preconceived principles
of clock construction



This clock was also marketed under the American Clock Co. brand.(Reprinted from the KEYSTONE, Nov.,1899)

No Winding
No Running Down
Regulated Scientifically

Once Started,
Runs Eternally.
Marvelously Accurate

TREASURY DEPARTMENT.
OFFICE OF SECRETARY.

WASHINGTON, D. C.
June 24, 1899.

AUTOMATIC ELECTRIC CLOCK CO.
231 S. Canal St., Chicago, Ill.

GENTLEMEN:-Your proposal dated June 9, 1899, received under advisement, to supply Electric Clocks as follows to United States buildings under the control of this department East of the Rocky Mountains, is hereby accepted, payable from the appropriation. "Furniture and repairs of same for public buildings for year 1900." Orders for clocks will be issued from time to time, as the requirements of the service may demand.

Please acknowledge the receipt of this letter. Respectfully yours,

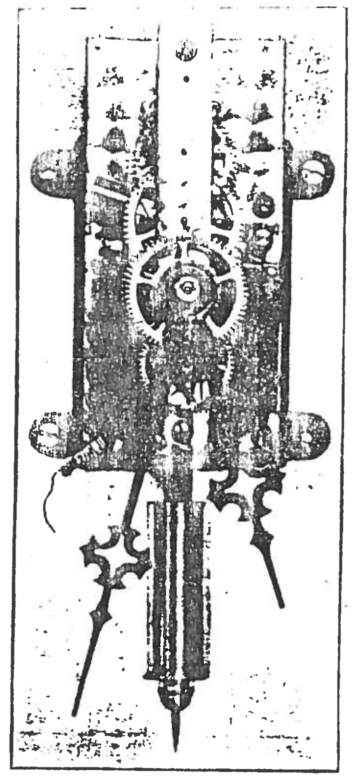
H.A. Taylor,
Assistant Secretary
U.S. Treasury

(Descriptive material of preceding page)

This is the MOVEMENT of the Marvelous NON-WINDING, LONG-RUNNING, PERFECT TIMEKEEPING

GRAV-ELEC CLOCK

It is absolutely and without qualification GUARANTEED to run continuously for TWO YEARS, on one set of DRY batteries, and keep PERFECT TIME, with no attention whatever other than ordinary regulation. We wish to impress the trade with the fact that this is not an Electric but a GRAVITY clock, gravity being the motive power that drives it, the electricity merely lifting the small driving weight to a gravitating position every two minutes, by a slight and instantaneous contact. There is NO WIRING from the outside everything pertaining to the clock being contained in the case. The movement,as shown,demonstrates its EXTREME SIMPLICITY. The GRAV-ELEC can be handled and put in place by any one. These clocks are listed from $15.00 up,and the same guarantee applies to our $15.00 article as to those of higher price. This clock is made in solid quartered oak,finely finished is 23 inches high and 20 inches wide. Why RENT time when you can buy a clock that will serve you better for the same money that it costs you for one year's rent? This is worthy of consideration to every one who rents time. Remember,we give you a WRITTEN GUARANTEE that every statement we make is correct, or money refunded. It will pay you to give this Clock a trial, as its simple construction and exactness in timekeeping makes the GRAV-ELEC its own greatest agent. These Clocks are not on an outside electric circuit,consequently they are thoroughly free from any danger of elementary disturbances,or of giving the person handling them the slightest shock,as the quantity of electricity used is infinitesimal, and could not be felt by the hand,were it brought in direct contact. The GRAV-ELEC is always running and always on time.



Correct Time

Non-Winding

Constant Running

Elegant Finish

Moderate Price

The above is the combination that makes the incomparable

GRAV-ELEC CLOCK

GRAV=ELEC CLOCK COMPANY, 177 & 170 Broadway, New York

AGENCIES WANTED THROUGHOUT THE COUNTRY.

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editorial continued from page 1

the American Clock Co. clock and the Grave-Elec clock from the Jeweller's Keystone of November 1899 sent to us by Stacy Wood. Our last page is the Mart which I again recommend to you at $2.00 per 4 lines as a means of buying, selling or trading electrical items.

Our Society continues to send electrical clock patents to the NAWCC Reference Library. During November we sent another twenty patents. We are still in need of original articles and/or material pertaining to early electrical horology. Your experiences in purchasing a clock, restoring one, or any other area of electrical clock collecting which interests you is well worth taking the time to write down. Please do not worry about spelling, grammar or syntax as any corrections which have to be made will be made by your editor very judiciously and discreetly with full credit being given to the author.

Enjoy this Issue!

Electromagnetically yours,

Martin C. Feldman
Editor

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MART

FOR SALE: Self-Winding Clock Publications. New clock book titles, Send for list. Dealer inquiry invited. Self-Winding Clock Publications, P.O. Box 7704, Long Beach, CA. 90807

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

ANNOUNCEMENT: I am trying to find out how much interest there is by our membership in the following item which I am going to produce: A continuous output variable power supply, 0 to 28 V D.C. (3 amps max), fully metered continuously for voltage and current, fused, on/off switch and pilot light--- projected price $44.95 ppd. If there is sufficient interest this excellent bench power supply will be produced within the next few months. Please let me know via postcard if you would like to have one. Martin Swetsky, 1910 Coney Island Avenue, Bklyn, NY 11230

WANTED: "Junker" early battery clocks, movements, parts, etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Marty Feldman, 620 Reiss Place, Bronx, NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

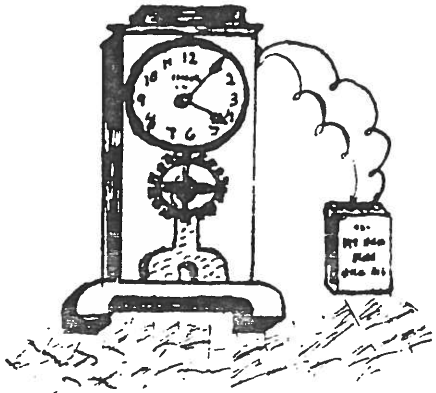
FOR SALE: Early modern Synchronome clock (pre WWII) in good condition and running-- $900 plus shipping (packing free).

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK REPAIRS USING ORIGINAL PARTS. One month maximum time for all repairs, Martin C. Feldman

FOR SALE: Poole, ATO, ITR Master, Rempe mvt.--see last MART for details. M. Feldman

FOR SALE: Master Clock With 3 Internal Pilot clocks, Double Door, Beveled glass, Oak Case, 8'x2'6"x 1'6" May be Self Winding. $750.00
S. Fischer 512 Albemarle Rd. Cedarhurst, N.Y. 11516
Eves: 516-295-4764

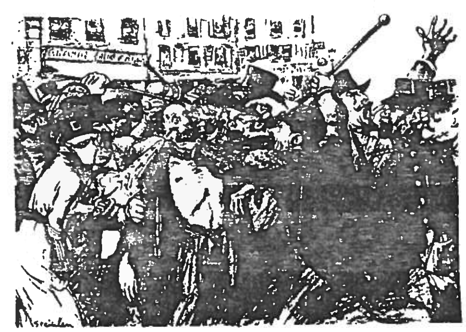
The JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY



Chapter No 78

April, 1980
VOLUME VI---ISSUE #2
Martin C. Feldman, Editor

Hello fellow enthusiasts:



Above: EHS members gently persuading a delinquent dues payer!!

As you know the life-blood of our chapter is the annual collection of dues. To bring you 96 pages of JOURNAL per annum is exhorbitantly expensive and increases every year. We hold no raffles, auctions, flea markets, turkey shoots or pie-throwing contests to increase Chapter revenues. I'm happy to report that most of our members have already renewed. Some have not for the usual reasons and others have simply forgotten--these members received their last Journals with the February, 1980 issue (along with a reminder)! If anyone knows of members who have not renewed as of yet, please nudge them along a bit. Also, and very importantly, we wish to encourage the signing up of new members. Any NAWCC member in good standing is eligible to join our Chapter by sending Sec-Treas. Charlie Roth, 2 Circle Lane, Roslyn,NY 11577, his/her NAWCC #, name and address and $10 for dues.

We are expecting to have a room set aside at the NAWCC Convention for our Chapter. Hopefully we all shall meet, talk and exchange views and ideas about our electrical clocks. If everyone brings an example, things will be lively indeed. In addition, we shall try to get a slide show together.

Since July, 1973 when Charles Aked's excellent article about the Synchronome Clock was first printed there has been a steady request for reprints of it. The Synchronome Co. has since gone completely out of business making these fine clocks even more desirable and collectible. We therefore thought it appropriate to reprint this article as it was originally seen in NEWSLETTER #6 (the precursor of our present JOURNAL).

We are indebted to R.L. O'Briant for making the Standard Electric Bulletin #22 available to us--a part of which is included in this issue. In the future we shall be seeing more of #22 as well as the ATO Repair Manual and the Magneta Clock Co. Repair

cont.page 12

THE SYNCHRONOME MASTER CLOCK

by Charles Aked

Many of these electric master clocks have been made available by the demolition of old buildings in towns all up and down the country. They are excellent timekeepers and economical in operation. Their value is gaining ground amonst discerning collectors, and in fact they have reached the distinction of being sold in Sotheby's salerooms. Whilst they do not have the aesthetic appeal of an antique clock, nevertheless the Synchronome master clock is one of the best looking of all the electric master clocks produced. As with most electric clocks using a gravity arm drive to the pendulum, the noise of the gravity arm being reset is not appreciated by the majority of people, especially at night. What is music to the enthusiast may be sheer unadulterated agony to the spouse and dependants of the owner. So a Synchronome master clock may have to be consigned to a part of the house where its uncompromising thuds can be properly attenuated. It is relatively undemanding in regard to surroundings as long as they are reasonably clean and dry, and there is a suitable firm vertical surface upon which the clock may be mounted. The ultimate performance of the clock depends very largely on the solidity of its mounting. As instructions for Synchronome clocks are not readily available, and those issued with the clock may have been lost, the following notes may be of some assistance.

Erection Notes

Having bought, or otherwise obtained, a Synchronome master clock, and assuming the clock to be in a sound mechanical and electrical condition, first clean the outside and inside of the case; the first to avoid soiling your hands and clothes, the second for the sake of the operating mechanism. Decide upon the fixing position of the clock and temporarily support the clock by the brass plate on the top of the case. A suitable height is with the centre of the dial at eye level. Hang the pendulum on its bracket, lightly screw down the retaining bar to prevent it slipping off, and use the pendulum as a guide to ensure that the case is truly vertical in both planes. As walls are nearly always out of plumb, it may be necessary to pack the clock case at the rear to ensure the required result. Mark the position of the fixing holes required for securing the clock case, remove the pendulum first, then the clock; and drill and plug the necessary holes. The clock may now be fixed in its permanent position on the wall.

If you are in a hurry to try out the clock, it may of course merely be stood on a firm level floor, and a battery of an output voltage approximately 4.5 - 6.0 volts connected. Most of the voltage is required for the gravity arm reset, and about 0.75 - 1.0 volt for the dial unit, the working current being approximately one third of an ampere. Do not expect good timekeeping with the case unsupported, and do not blame anyone else if the clock should get knocked over by accident.

In the course of its travels your Synchronome clock may have suffered many blows for which it was never designed. Demolition workers use primitive methods and tools, and your clock may have been removed from the wall by a shovel being placed behind it and yo-heave-ho! It will be well therefore to check the clock completely before putting into operation.

Commence the setting-up by slacking-off the wing nuts on the pendulum suspension bracket, release the clamp and turn to one side. Position the pendulum on the suspension bracket such that with the gravity arm released, the roller rests on the centre point of the slope of the impulse plane, the bottom of the pendulum being restrained so that it is not deflected from the vertical. The gathering pallet mounted on the pendulum must rest exactly with its mid-point in the plane of the count wheel, and at the centre of the space between two teeth tips. At the same time the pendulum must swing parallel to the back of the clock case. When all these adjustments are correct, tighten the wing nuts down on the clamp to secure the pendulum.

The impulse pallet on the pendulum rod must be positioned such that it just does not contact the gravity arm roller when the gravity arm is latched up. The drop of the roller on to the impulse plane must be minimal. Nor must the gathering pallet arm touch the normal, advance, and retard wire with the indicator set at normal (N). With the aid of the beat plate swing the pendulum by hand to cover an arc of $1^o - 0 - 1^o$. The gathering pallet should just turn the count wheel. It may be necessary to adjust the gathering pallet arm to ensure that the count wheel teeth are engaged with just enough depth to turn the count wheel tooth by tooth. All these adjustments are made to ensure that all the disturbing influences occur at the centre of the pendulum swing where they cause least interference with its motion, and hence the timekeeping.

The following notes apply to a clock that has been in use for some time, or has been interfered with, and will also be of use when setting up the master clock in a new position.

Service Notes

When the arc of the pendulum varies or decreases, it is generally a sign of increasing friction at some point of the mechanism for which the application of oil to the various working points may be sufficient remedy. Do not over-oil, and make absolutely certain that no oil reaches the electrical contacts. The voltage of the battery has no effect on the arc of the pendulum as long as it is sufficient to replace the gravity arm on its latch. In other words, the gravity arm is effectively a constant force remontoire.

Should the clock be found with the pendulum stopped, it will itself indicate the cause of stoppage. If the gravity arm is in the reset position with the pendulum stopped, then the cause is excessive friction, for the impulse energy has been dissipated before the count wheel has turned through one revolution, and the initiation of the succeeding impulse could not take place.

If the gravity arm is found resting on the pendulum pallet, it indicates an electrical fault. A battery at the end of its useful life will have given previous warning through the pendulum having to assist the gravity arm back into the latched position, and it is assumed that proper notice of this will have been taken. Assuming the battery to be correct, checking of the connections of the external circuits should speedily reveal where the fault lies.

Having ascertained the fault to be a mechanical one, commence by disconnecting the battery, or breaking the circuit at some convenient point. Brush out the case and clean as necessary before starting work on the mechanism. Leave the pendulum in situ as removing it will mean it will have to be set up again at the end of the work. Release the gravity arm from its catch, allowing the impulse roller to rest on the pendulum pallet. Take out the two bridge screws and remove the fifteen toothed count wheel, back stop, and catch. Clean these parts in the usual way, paying special attention to the acting surfaces of the count wheel teeth. Clean the bridge and backplate before pegging-out the pivot holes to remove old oil and dirt. Before reassembling, lightly oil the back pivots with good quality clock oil as they cannot be lubricated easily when the parts are assembled. Ensure the light catch spring rests in the notch on the right hand side of the catch, the catch must be on the right of the U-shaped catch piece on the gravity lever.

After disconnecting the flexible wire lead from the terminal, remove the screws from the pivot plate and take out the gravity arm. Unscrew the plate holding the steel roller and remove the roller. Clean all these parts carefully. Wipe the back plate and peg out all the pivot holes. If the contact is pitted, smooth down on a very fine carborundum stone until all traces of the damage is removed, taking very great care to preserve the correct plane and flatness of the contact. Place these parts on one side for the time being.

Next remove the gathering pallet from its pivot hole by lifting the jewelled end and then sliding the pallet assembly to the rear. Do not use excessive force on this delicate part. Clean the jewel, if it is coated with a hard deposit a little metal polish will speedily remove it.

Clean the pallet arm also. Peg out the associated pivot hole. Replace the pallet but do not oil the pivot. Oil at this point will only cause trouble.

The gravity arm may now be replaced, oiling the back pivot before doing so. Make sure the U-catch is on the left of the catch and reconnect the flexible wire lead to its terminal.

Unhook the tail spring from the armature, disconnect the flexible wire lead from the base-plate, and after unscrewing the top plate, remove the armature. Examine the platinum tipped screw, if pitted smooth the acting surface taking care to preserve its flatness and plane. Clean all parts and peg out the pivot holes. With a fluff-free cloth slightly smeared with vaseline, wipe the electromagnet poles clean. Replace the armature in the reverse order, first oiling the back pivot.

Oil all the front pivots, (five points) but do not oil the count wheel teeth, gathering pallet jewel, or the gathering pallet arm pivot. The catch may be lightly oiled, or preferably greased. Check that all the parts are correctly re-fitted.

In the course of the preceding work it is likely that the various adjustments have been disturbed. First measure the settings, and if they are near the following figures do not bother to adjust. The gap between the soft iron armature and the top pole of the electromagnet should be 0.01 inch (0.25m.m.) when the armature is pressed inwards as far as possible by hand. Reset by means of the left hand buffer stop screw if necessary. With the armature still pressed inwards check that the gap between the contacts with the gravity arm on the catch is 0.080 inch (1.8m.m.) Reset by means of the armature contact screw after first releasing the locknut. When the adjustment is correct, tighten the locknut taking care not to disturb the setting. Allow the armature to fall back and adjust the right hand buffer screw to give an air gap between the contacts of 0.210 inch (5.4m.m.), first releasing the locknut. When correct re-tighten the locknut, taking care not to disturb the setting. The locknuts must be perfectly tight and secure or trouble will eventually arise. Next check that the armature returns smartly, if not, slightly increase the tension in the return spring at the bottom of the armature by turning the screw anticlockwise after releasing the locknut. Do not over tension, a clean return is all that is necessary, and do not forget to lock the screw by its locknut.

Examine the pendulum suspension and ensure that it is correctly fitted and that the suspension spring is in good condition and free from rust. Check that the clock case is truly vertical and well secured to the wall.

Re-connect the battery and the pendulum should swing freely with only a very slight loss of amplitude from one impulse to the next. By displacing the pendulum just sufficient to operate the gravity arm release and observing that the amplitude gradually builds up to its normal value of approximately 3° - 0 - 3°, one can be certain the pendulum will continue to operate correctly. The gravity arm should be replaced on its catch with a quick action but not with excessive vigour which will result if too high a voltage is applied. A voltage of three to four volts for the clock plus about three quarters of a volt for each additional slave clock in the series circuit should be sufficient, but increase the voltage if the reset action is sluggish, and decrease it if the action is too lively. Excessive voltage will only damage the contacts by spark erosion.

It will be as well to examine the slave movement of the master clock indication but it is very unlikely that attention will be required or adjustment necessary. If in doubt leave well alone. When rating the clock, first give it a settling down period to obtain steady conditions, then adjust to have a slight losing rate of two or three seconds a day. Adjust to a closer rate by placing small weights on the bob rather than by the rating nut, this being calibrated to give a change of approximately thirty seconds per turn. It is neater, of course, to have a weight tray about half-way down the pendulum, and it is more effective. Stopping the pendulum to turn the rating nut causes a disturbance which may take some little time to settle before a steady rate again results, and the resulting change of rate may not even be in the correct direction. A rate of about a second or so a day is as much as one can expect from a clock whose pendulum is doing so much work in turning a count wheel and releasing the gravity arm. The weight of the massive gravity arm is some indication of the energy lost per half-minute by the pendulum as it performs these functions.

The Synchronome Company is now at Station Road, Westbury, Wiltshire. Some replacement parts may still be available, but the old service whereby one could obtain castings and parts for the construction of a Synchronome master clock was unfortunately discontinued long, long ago. Anyone considering acquiring a Synchronome master clock would be well advised to do so at the earliest opportunity as they are rising rapidly in price. The older type with the architectural design is much to be preferred from a collector's point of view as these are much rarer than the plain rectangular case. Some variants in mechanical design exist, and these are of great interest. One of the unusual features of some Synchronome clocks is the use of a fourteen pound shell from the first World War as the pendulum bob. They are unfilled of course, it is only the shell and not the case and charge. This was one of the ways in which the late Frank Hope-Jones turned swords into ploughshares, and it must be admitted that these bobs have a very attractive appearance.
A copy of a Synchronome blueprint is enclosed. Labeling of parts can be ascertained from second enclosure copy detailing functioning of mechanism.

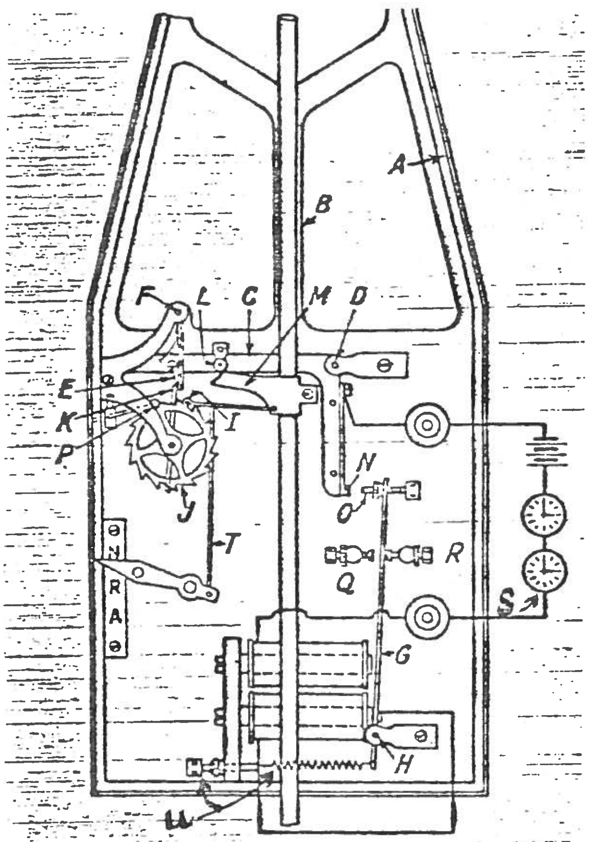


FIG. 21. MOVEMENT OF SYNCHRONOME MASTER CLOCK

Parts Description

A-frame
B-invar pendulum rod
C-gravity arm
D-gravity arm cock
E-gravity arm catch
F-main cock
G-armature
H-armature cock
I-gathering pallet
J-count wheel
K-gravity arm release
L-gravity arm roller
M-pendulum impulse pallet
N-gravity arm contact
O-armature contact
P-backstop pawl
Q-left armature buffer
R-right armature buffer
S-slave clocks
T-advance/retard switch
U-armature return spring & adjustment screw

AN OUTLINE OF THE STANDARD SYSTEM

THE "Standard" time system consists of an electric self-winding Master Clock or regulator, through which electrical energy is sent out at precise time intervals to the secondary apparatus which is driven thereby.

It is, therefore, an electric system, automatically operated, the energy for the operation of which is supplied from a primary or storage battery, the size and character of which depend on the requirements of the system to be installed.

The Master Clock has a pendulum escapement, and is so designed and made that it is capable of the closest regulation. From month to month it may be checked against observatory time and corrected if necessary. Every possible care is exercised in making the Master Clock an accurate timekeeper, since it controls all the other time-measuring devices in this system, so that their precision is equal to its own.

This is accomplished by operating all the secondary timekeeping instruments through the Master Clock, as will be described more in detail below.

Any number of secondary devices may be controlled by one Master Clock. These may be located wherever it is advantageous to have time indicated, or timing devices controlled, in one building, plant or community. Similarly, the Master Clock controls the Program clock, which is designed to automatically actuate signal bells or other apparatus.

Since only low voltage electric connections are necessary between the Master Clock and the other parts of a Standard Time System, it is elastic in its adaptability and presents no wiring difficulties not found in telephone or telegraph work.

On the sixtieth second the Master Clock closes the battery circuit to the Secondary apparatus directly or through relays, thus energizing their operating magnets for one-third of a second, or long enough for the secondary circuit devices to be brought into synchronism with the Master.

In the Standard Systems, therefore, the hands of the Master Clock move every second, but the secondary apparatus is actuated once a minute on the sixtieth second. Systems have also been designed in which the Secondary clocks move on the thirtieth and sixtieth seconds, or oftener per minute if necessary.

The bearing of this minute impulse system on precision may be illustrated by an application in testing work when simultaneous readings should be taken. The clocks from which the observers take their time are in synchronism, no matter how many nor how widely separated, provided they are controlled through the same Master. In even fine watches or independent clocks this uniformity is an impossibility.

Close attention and judgment must be exercised in observing the minute and second hands of the ordinary watches and clocks so as to take readings exactly on the minute. With the "Standard" System of Secondary Clocks the operator need only watch the clock as the time approaches for taking readings, and precisely on the minute the minute hand will move forward, thus giving a clean-cut time signal that cannot be mistaken, and requires no judgment for its interpretation.

THE MASTER CLOCK

SINCE the Master Clock is the distributor of time in the "Standard" System, its design has received the closest study, and the mechanical and electrical details that have been adopted are those approved by long experience.

The resulting Master Clock mechanism is extremely simple in its present form, and embodies the fewest working parts.

The base of the clock frame holds the winding magnet, the circuit to which is closed once per minute.

The clock spring is of helical form mounted on a sleeve concentric with the main arbor bearing the hands. One end is attached to the main wheel and the other to the ratchet winding wheel. This winding wheel is driven by a pawl from the winding magnet armature, one impulse of which winds the spring an amount which will drive the clock one minute, when it is again wound to its stop. This spring has a reserve power sufficient to run the movement for fifty-four minutes without any battery connection, thus assuring the operation even after the winding battery has given fifteen or eighteen months' service, and is in need of repair; that is, the movement would have to miss fifty-four times from weak battery before it would stop. A contact key in the Master Clock case permits a test of the battery from time to time if desirable.

In this design the spring is kept at a practically constant tension, assuring the closest regulation. It does not have to operate through an attendant train of reducing gears as in common practice.

Being pioneers in the development of electric clocks, twenty-five years' experience has taught that having a positive mechanical and electrical principle, success lies in the simplicity yet positiveness of the circuit-closing apparatus.

In the "Standard" Master Clock, therefore, there has been used for many years a contact device patented by the makers which is simple, durable and positive. An insulated arm is mounted on the verge staff and oscillates with each beat of the pendulum. This arm projects downward so that the path described by its end is tangent to the circle described by the end of a contact arm fixed to the escape arbor and rotating with same. Once per minute, therefore, the rotating arm comes in the path of the oscillating arm and a positive rubbing contact is effected for one-third of a second. This rubbing contact is in the same direction of motion as the clock movement, and is made at the end of the arc described by the pendulum, so as not to oppose the accelerating impulse. Consequently a self-cleaning friction contact is made without any retarding effect on the clock movement or driving power.

This contact is flexible and positive in operation. It insures the minimum current consumption with the sure operation of Secondary apparatus; resulting in reliable service, long life of battery and minimum maintenance expense. These contact pieces are iridium platinum tipped to make them durable. Provision is made for their renewal if it should be necessary.

The escapement of the "Standard" Master Clock is provided with screw adjustments. This is an important feature which permits the regulation of the beat, even if the clock is not exactly plumb.

The pendulum is usually of the seconds beat type. The metal compensating form of pendulum is capable of close regulation, but for the finest precision work a mercurial compensating pendulum having micrometer adjustment is employed.

The selection of the proper materials for the parts in the Master Clock affects its wearing qualities to such a degree that attention has been given to the smallest details so as to produce

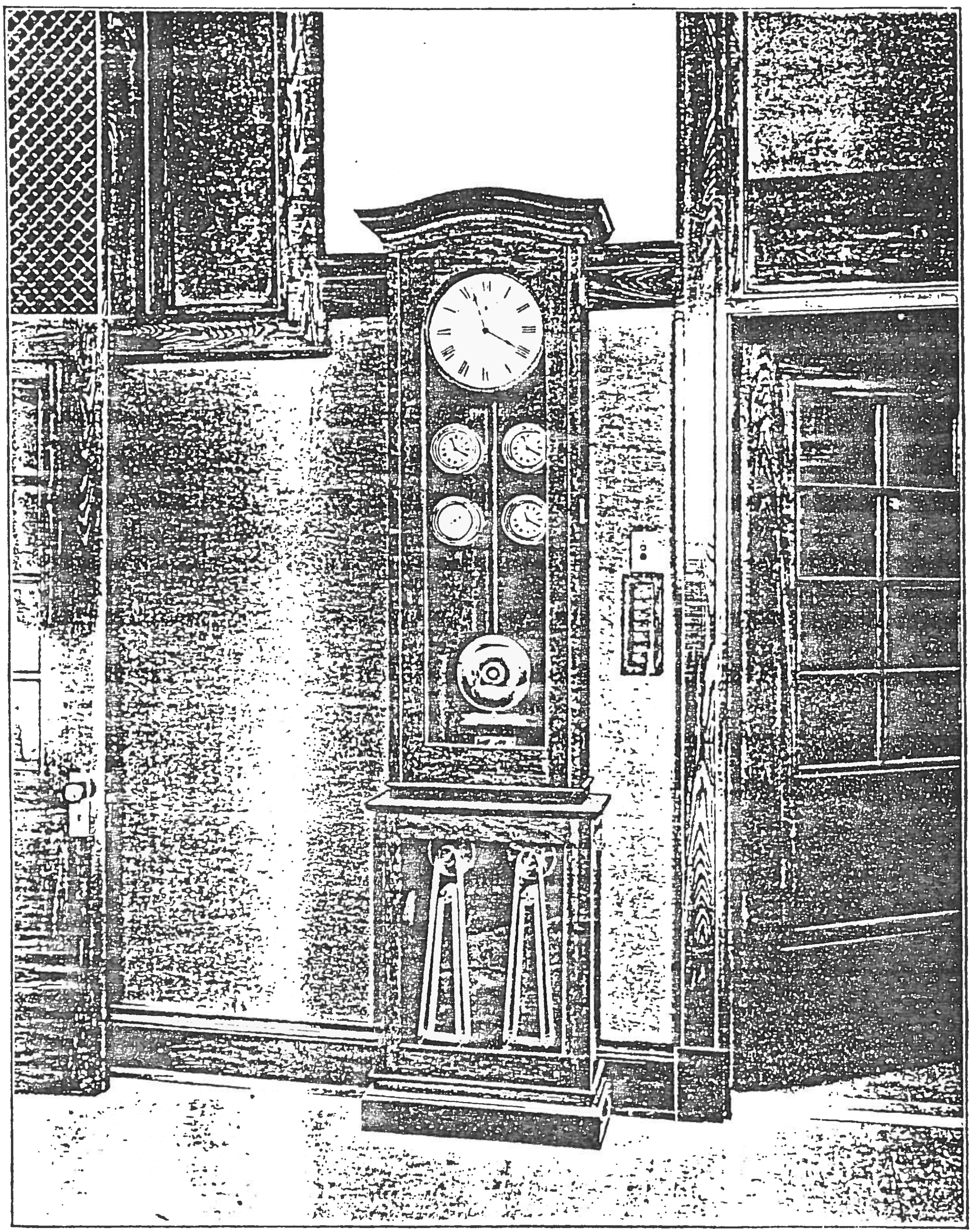


Fig. 447

THREE-CIRCUIT MASTER CLOCK

With two, four-circuit Program Clocks in base, controlling an equipment of

45 No. 1s Secondary Clocks	2 24-inch Outside Clocks
5 18-inch Double Dials	26 8-inch Gongs

a mechanism of component serviceable parts. The "Standard" Clock is a machine always in motion; hence the parts are made as durable as they can be devised.

The Master Clock case is usually made of selected quartered oak, though it may be of other wood, and will be finished to match standing woodwork, if sample is furnished. It is handsome in design and finish so as to be an ornament to any office in which it is located. Access to the clock and the necessary buttons and switches that may be located in the case is given by a door which is provided with lock and key.

Convenient connections for the clock circuits are placed in a space for this purpose at the top of the clock case where they are easily accessible.

Besides the dial of the Master Clock, which is usually twelve inches in diameter, the case contains a battery gauge which is automatically cut in once a minute, so that the battery strength can be noted. Also a pilot dial or small Secondary Clock for every Secondary Clock circuit controlled by the Master.

These pilot dials are in synchronism with the clocks on their particular circuits, and, therefore, show absolutely that these secondary circuits are in unison with the Master.

Switches in the Master Clock are used in starting or setting the Secondary clocks, the pilot dials indicating the Secondary circuit time facilitate this work.

For winding the Master Clock two cells of No. 3 Samson or battery equally efficient are employed. Other cells of similar type are used for the Secondary Clock circuits, bell circuits, etc. When more than three circuits are to be installed, especially in the industrial application of this system, a duplicate set of B. T. or C. T. Storage Battery should be used (size of battery depending on requirements of system). For further data see pages 34 to 38.

With such installations the best practice is to charge the battery and distribute its energy through a separate switchboard fitted with a "Standard" charging and automatic circuit breaker, voltmeter, etc. In this case all switches, keys, circuit indicators, etc., are located on this board.

Switches for the control of moderate-sized equipment may be located in the extension base of the Master Clock, or for a system of more than four circuits at some convenient location in the same room with the Master and Program clocks.

SECONDARY CLOCKS

SECONDARY Clocks are virtually so many dials to one Master Clock movement, and are limited only in size, distance and number by the strength of current supply and methods of distribution. They are actuated by current pulsations sent at exact periods, generally one minute, and transmitted on the first quarter of the first second of each period. There is no pendulum nor escapement and no springs to be wound, and excepting only the large tower movements, no bearings to be oiled. In all Secondary Clocks the movement is positively locked against vibration or shock.

It is a minute impulse movement of such construction and simplicity of operation as to make synchronism with the Master Clock positive.

The form, size and location of Secondary Clocks are, therefore, capable of varied modifications and can be adapted to all requirements. They may be located with reference to their appearance and utility rather than to their accessibility, since they do not have to be touched after installation. Their cases may be of any convenient or pleasing shape, and made of wood, marble or metal. Their action is not affected by vibration, thermal or barometric changes. Having no pendulum, expert care is not necessary in hanging these clocks. The matter of position and plumbness need be considered only as to appearance. When peculiar conditions require it, special adaptations of our movement can easily be made to meet them.

Secondary Clock dials can be furnished with tenths hour divisions instead of minutes, so as to facilitate keeping job time on the decimal system rather than in fractions. For convenience in calculations and simplicity this method has much in its favor. See page 16.

The Secondary Clocks shown in this bulletin are only a few of the great variety that have been made. It is requested, therefore, that any requirements as to size, form of dial, materials, finish and service be described so that they may be met.

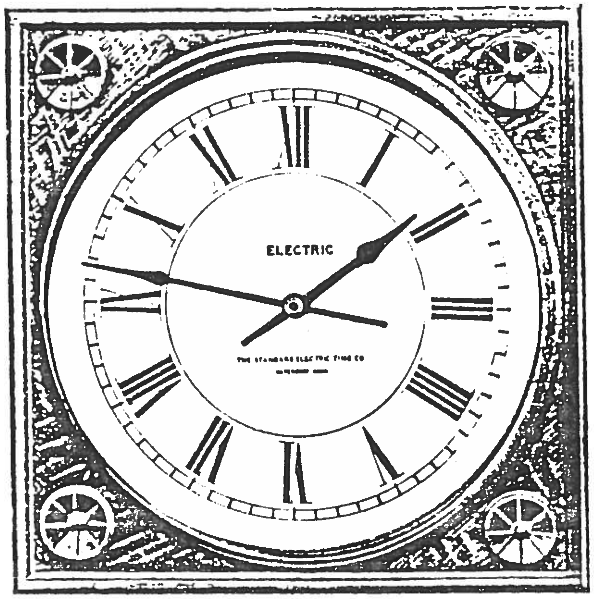


Fig. 23

No. 5. WOOD CASE SECONDARY CLOCK

PRICES

14 inch dial, $25.00 18 inch dial, $37.50 24 inch dial, $45.00

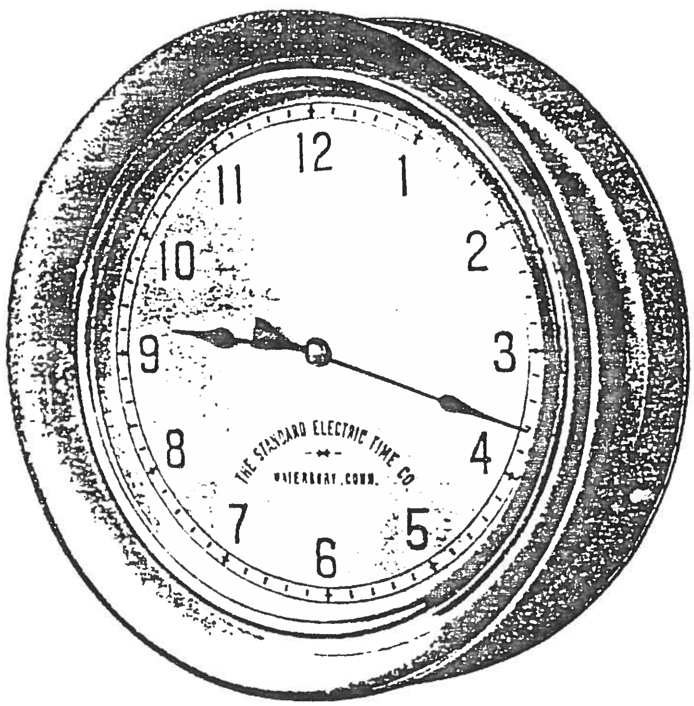


Fig. 457

METAL CASE SECONDARY CLOCK

These Cast Bronze or Iron Cases are designed to match other Switchboard Equipment and are dust-proof and durable

PRICES

	Bronze Case Nickel Plated	Iron Case Japanned	Bronze Case Polished
8 inch dial	$26.50	$23.00	$25.50
10 " "	31.50	26.00	29.50
12 " "	30.00	30.00	34.00
14 " "	43.00	35.00	41.00

Manual. Thus the JOURNAL is not only of interest for the many diverse electrical horological articles to be found therein, but also serves to become a part of your personal reference library. These manuals are unfortunately in a few private libraries, but through the generosity of their owners we shall try to continue to make them available to you.

Enjoy this Issue. See you in Boston!

Electromagnetically yours,

Martin C. Feldman, FNAWCC
Editor

* * * * * * * * * * * * * *

MART

FOR SALE: Self-Winding Clock Publications. New clock book titles, Send for list. Dealer inquiry invited. Self-Winding Clock Publications, P.O.Box 7704, Long Beach, CA. 90807

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

ANNOUNCEMENT: Production is starting on the 0-28 V D.C.(3 amps max) metered bench power supply as described in the last Journal Mart. This will be a short run production--so if you don't want to be left out, please let me know right away if you want one! Martin Swetsky, 1910 Coney Island Avenue, Bklyn, NY 11230

WANTED: "Junker" early battery clocks, movements, parts, etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Marty Feldman, 620 Reiss Place, Bronx, NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

FOR SALE: Early Synchronome clock (pre WW II) in fine restored oak case, 30 sec. contact for slave, one second invar rod plus 15 lb.bob pendulum; running--$1000 plus shipping (packing free). Charles Roth, 2 Circle Lane, Roslyn, NY 11577

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK REPAIRS USING ORIGINAL PARTS. One month maximum time for all repairs. Martin C. Feldman

FOR SALE: Poole, ATO, Rempe mvt.--see Dec.'79 MART for details. Martin C. Feldman

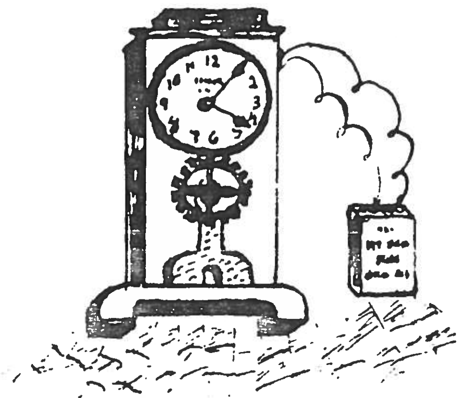
FOR SALE: Magneta floor model master clock with one slave. Oak case sweep second hand, wt. driven, 20"x88" $2200.00.
Blodgett Clock Co.-Boston master clock, 23"x72" oak case. $1800.00
Warren Telechron Co. Master Clock type B $600.00
Also other masters.
Irving E. Reinke, 426 S. Franklin St. Whitewater, Wis.
414-473-5194

WANTED: ZENITH-COLORA HOT WIRE CLOCK DATA. Drawings, photos, references and any other related data that will assist restoration. Wanted for purchase and/or trade for my data.
John Cammarata, 30 Lilac Drive, Syosset, N.Y. 11791
516 921-3919

WANTED: Would like to buy a nice Poole or Bulle
C. Georg Wiedmaier, 9207 Lawnview Lane
Laurel, Md. 20811

The JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



JUNE, 1980
VOLUME VI---ISSUE #3
Martin C. Feldman, Editor

Hello fellow enthusiasts:

As we once again approach the summer many of us look forward to some pleasant hours either at the shore or in the many cool mountainous areas of this beautiful land. I, for one, am very pleased to lie around doing nothing---just recharging my own biological batteries. With money being in tight supply and gasoline so expensive an increasing trend for horological collectors has been emerging. That is, many collectors now combine vacations with scouting trips. With the many clock meets held during the summer as well as flea markets, the collector stands a good chance of coming across a real "find". Best of luck to all!

This month we thank our good friend Orville R. Hagans for securing the permission to reprint, Basic Electricity As Applied To Horology. A rather interesting home-made power line frequency comparison device invented by Dick Warburton is described. Dick, as you know, runs The Rotor Exchange which has saved many an A.C. clock from the dump. A bargain page of electrics for sale is included---please don't all run out at once to order your clock (this is a 1903 ad). Finally a financial statement prepared by our Sec-Treas. Charlie Roth is included in this Issue.

May I take this opportunity on behalf of the Officers to wish you all a very happy and healthy summer.

Enjoy this Issue!

Electromagnetically yours,

Martin C. Feldman, FNAWCC

Vol. 2 No. 4
April, 1961

OF AND FOR THE WATCHMAKERS INDUSTRY

Because of the timeliness and evident interest in electric watches, the April issue of your NEWSLETTER is being devoted exclusively to the treatise on this subject by AWI National President John W. Farrell, Project Engineer, Research Laboratories, General Motors Corporation.

BASIC ELECTRICITY AS APPLIED TO HOROLOGY

Following the announcement a few years ago that an electric watch had been developed and a laboratory model was constructed and in operation, the watchmakers of the world expressed concern regarding the effect that a timepiece such as this would have on their livelihood. The old timers remember well the impact of the introduction of the synchronous motor household clock and its effect on the clock repairman. Inherent fear of something not understood is quite often responsible for the confusion which follows the unveiling of a so-called revolutionary development.

We should not look upon the synchronous motor clock as a true horological item but, rather as a motor and a gear train to drive the hands at the proper rate. In itself it cannot keep time, but is dependent for accuracy on the constant frequency of the electrical current supplied by the power company. Most power companies rely on a precision pendulum or the radio signals of WWV to maintain this accurate frequency. Unless these timepieces incorporate special features such as chimes, alarms and, etc., their repair does not call for the services of a professional horologist.

The types of electrical timepieces with which we are concerned will include the battery powered automobile clock and the battery or "energy cell" powered wrist watch. Each in itself is a true timepiece. Remove the battery and a complete timepiece, minus a source of power, remains. This is similar to a watch with a broken mainspring.

An understanding of a few fundamental laws of electricity and the simple circuitry involved will alleviate the fear that the watchmaker has of the electric timepiece.

Outside of the laboratories today we will find only the clocks having a simple electrical circuit. This circuit must be kept simple in the interest of a trouble free timepiece. The addition of an electrical circuit to a watch or clock will not increase the life expectancy of the lubricant. It will neither keep the crystal from breaking nor the case from leaking. The requirements of normal servicing remain plus the maintenance of a good electrical circuit. In trouble shooting or servicing each phase should be considered first separately and then in unison to minimize groping and bewilderment when the necessity for the servicing of electrical timepieces by the watchmaker becomes a reality.

As we progress from the simple to the more complicated electrical timepieces we become aware of the definite separation between the electrical and mechanical parts of the mechanism. Although the electrical components are interspersed throughout the movement this is usually to conserve space. The connecting link between the mechanical and the electrical units is magnetism - the same invisible force which causes the compass needle to point to the north. In a timepiece this magnetism may be derived from a permanent magnet, an electromagnet or combinations of both.

MAGNETISM

About the only time we think of the earth's magnetic field is when we use a compass. Why should the horologist be concerned with the invisible force acting between the compass needle and the North Pole? With the increased use of nonmagnetic materials in timepieces he can no longer depend on a compass to detect small amounts of magnetism. The usefullness of this invisible force lies in its obedience to the fundamental law of magnetism. This law states that, "Like poles repel one another and unlike poles attract one another." Figure 1.

The geographical North Pole of the earth is

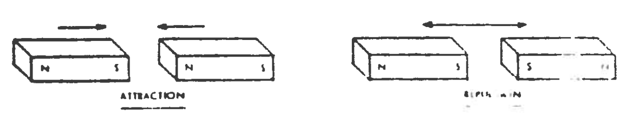


Figure 1

Reprinted with permission from Orville R. Hagans a South Pole magnetically speaking. So the North Pole of a compass will be attracted to the North geographic Pole of the earth. Figure 2.

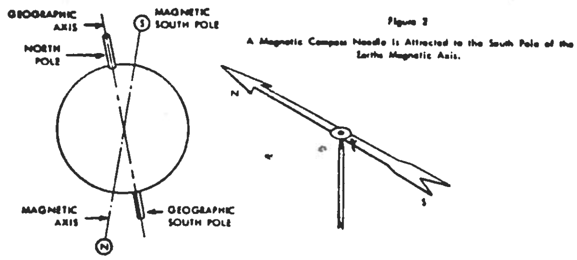


Figure 2

A Magnetic Compass Needle Is Attracted to the South Pole of the Earths Magnetic Axis.

You will notice that the magnetic axis of the earth is not the same as the geographic axis. There is an angle of about 15 degrees between them. This explains why the magnetic compass does not point to the true geographic North Pole.

We have the earth's magnetic field about us at all times. But, how about the magnet for the compass needle? A natural permanent magnet is the lodestone, a very inefficient magnet for practical purposes.

Electrically we are able to magnetize certain materials of a shape and size to best suit our needs. If we wind a coil of wire and attach its ends to the terminals of a battery the coil becomes a magnet - an electromagnet because it depends on the electromotive force from the battery. Wind this coil long and slender and suspend it midway between its ends on a piece of string and we have an electromagnet suitable for a crude compass pointer. Figure 3.

This is an air core magnet and its flux lines or lines of force are not as concentrated as in a permanent magnet. By inserting a piece of iron in the coil we can concentrate the lines of force at the ends of the coil. This results in a more responsive needle; one which is more noticeably north on one end and south on the other - or plus on one end and minus on the

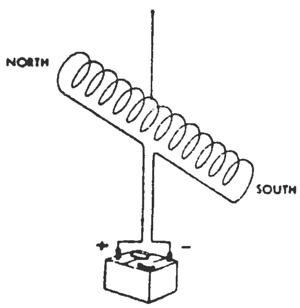


Figure 3

An Air Core Electromagnet Compass Pointer.

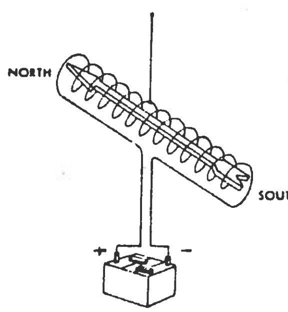


Figure 4

An Iron Core Electromagnet Compass Pointer.

other. These terms will be used later in describing the application of the magnet. Figure 4. The type of material that is inserted in the coil will determine whether or not we have an electromagnet that can be turned off by disconnecting the battery or source of e.m.f. If we use a piece of iron having a low magnetic retentivity (soft) it will become a magnet only when in the magnetic field of the coil that is energized by the battery. When the battery is disconnected or the piece of iron is removed from the magnetic field it retains none of the magnetism and is no longer a magnet. If we insert into the coil a piece of material alloyed to have a high magnetic retentivity (hard) it will retain a high percentage of its magnetism after the battery has been disconnected and the material removed from the coil. Using this material we will have a permanent magnet that will perform well as a compass needle and whose North Pole will point to the earth's magnetic South Pole. The direction that the coil is wound with respect to the polarity of the battery or source of e.m.f. will determine which end of the material is north and which end is southmagnetically. Either end will attract magnetic materials that are not charged magnetically.

From this it can be seen that if we want a magnet that can be controlled at will by merely interrupting the flow of current from a battery to a coil with a switch or contacts we select an electromagnet. If we desire a magnet that requires no external source of energy following its initial magnetism we select a permanent magnet, remembering of course, that we cannot turn off the permanent magnet unless we demagnetize it or counteract its effects with another magnet. Either the electromagnet or the permanent magnet may be shaped to suit a particular requirement. In the case of a timepiece, space limitations usually dictate the final form.

A magnet will always have a magnetic axis terminating in a North Pole at one end and a South Pole at the other. If a long bar magnet is cut into several pieces, each piece will be a magnet having a pair of poles. This same bar may be shaped like a horseshoe and the magnetic axis will still terminate at the ends of the bar. Figure 5.

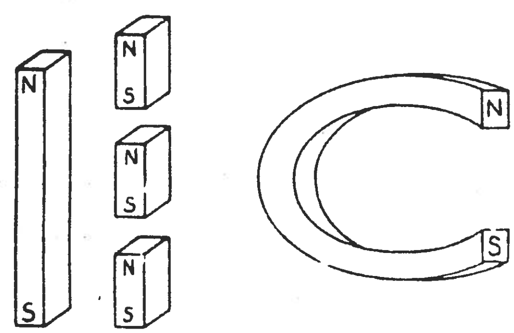


Figure 5

Permanent Magnets. Made From Material Having A High Magnetic Retentivity.

These same shapes may be used in electromagnets by the proper selection of core material and winding a coil around each as shown in Figure 6.

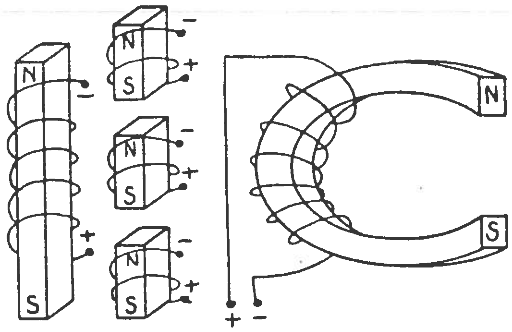


Figure 6

Electromagnets. Made From Material Having Little or No Magnetic Retentivity.

THE USE OF MAGNETS IN TIMEPIECES -

One of the simplest means of making an electrical timepiece would be to take a standard movement and use an electric motor to wind the mainspring. Unfortunately the cost of the motor and the necessary switching mechanism usually exceeds the cost of the timekeeping element, to say nothing of the size, weight and electrical power requirements. This method is used to raise the weights in tower clocks where the size of the motor and the cost of installation are not too important. It also allows the weights to be raised manually in the event of a power failure.

The electric motor is made up essentially of several electromagnets. So, if we take just one small electromagnet and reduce the running time of the clock mainspring we are able to electrify most clocks quite easily. Figure 7 is an in-line drawing of a conventional watch or clock movement. By using this type of drawing we are better able to show the distinct separation between the mechanical and the electrical sections of the various types of clocks with which we are concerned.

The installation of an electromagnet to wind a timepiece is shown in its simplest form in Figure 8. The mainspring has been removed from the barrel and replaced by a very short piece of spring that will allow the rachet wheel to turn only one or two teeth. This is the intermediate spring that will keep the clock running while the mainspring (which will be placed outside of the barrel) is being wound by the electromagnet. A lever is pivoted on the barrel arbor and extends out beyond the diameter of the barrel. Stop pins are placed in a position to limit the travel of the lever in either direction. A pawl is located on the lever to engage

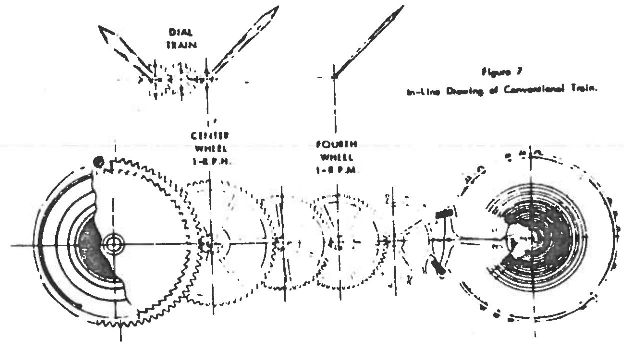


Figure 7
In-Line Drawing of Conventional Train.

the teeth of the ratchet wheel when the lever is moved in the direction that will drive the train. By attaching a short spring to pull the lever in the driving direction, we have converted the movement to one that must be wound every few minutes, but the winding is accomplished by moving the lever only a short distance to stretch the spring and engage a few additional teeth of the ratchet wheel. The short intermediate spring that was placed in the barrel will keep the balance wheel oscillating during the fraction of a second required to move the lever and rewind the mainspring.

All of the necessary mechanical modifications have now been made to the standard clock. All that remains to be done is the addition of an electromagnet to move the winding lever and a

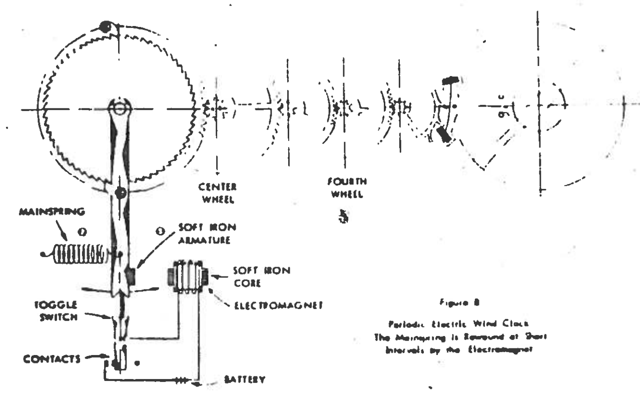


Figure 8
Periodic Electric Wind Clock
The Mainspring is Rewound at Short Intervals by the Electromagnet

means of switching the magnet on and off at the proper time. The strength of the magnet is inversely porportional to the distance we move from the magnet. For this reason we must keep the travel of the winding lever quite short to avoid moving the lever out of the strong field of the magnet.

We have selected a straight core electromagnet to wind this clock. By mounting it in line with the winding lever, on the side opposite to the mainspring, it will (when energized) attract the lever and wind the mainspring. A piece of the magnet core material is attached to the lever in line with the magnet. This increases the cross section of the lever and enhances the attraction between the lever and magnet.

The toggle switch operated from the end ...

the lever closes the contacts just prior to the time that the mainspring has pulled the lever against the stop pin. The coil is energized, attracting the lever, stretching the mainspring and moving the pawl around the ratchet wheel to engage additional teeth. Before the piece of core material or armature attached to the lever strikes the electromagnet core, the toggle switch opens the contacts and the timepiece is driven by the energy stored in the mainspring. This cycle is repeated each time that sufficient energy has been dissipated through the escapement to allow the lever to move and operate the toggle switch.

The above operating principle is used today in the majority of electric automobile clocks. The design of the electromagnet and switching device is much more efficient than that shown and will vary among manufacturers. One exception to this type of clock is the electric automobile clock that is driven by a direct current motor. The most notable difference will be found in the train. There is no first wheel or mainspring barrel. The train consists of the center wheel (or second wheel) the third, fourth and escape wheel. Energy to drive this clock is applied at the fourth wheel. Figure 9. The motor used in this clock may be referred to as a stalled torque type of motor. The armature turns at a very slow rate and is coupled to the

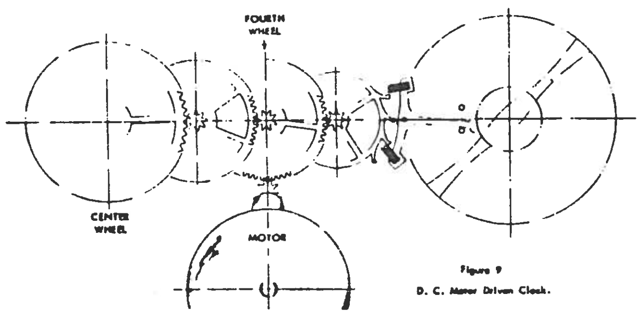


Figure 9
D. C. Motor Driven Clock.

train through a spring. The spring absorbs the shock of the escapement action and allows the motor torque to be applied to the train in a more linear form. Electrical contact is through the motor commutator.

It may be well to note at this time that although we have transformed a hand wound clock to an electric clock, little if any of the conventional clock has been modified. This means that the usual service requirements of an annual cleaning and oiling should not be overlooked. Because they do not require hand winding, we tend to allow them to run far beyond the time for servicing (with dry bearings) until an effective restoration is difficult and costly. Do not be surprised when the clocks that are supposed to run five years on one small battery fail prematurely. They also have bearings and pivots that require cleaning and fresh oil.

In the drawing of the clock which is wound by an electromagnet, we have titled it "The Periodic Electric Wind Clock". This name is more descriptive than "Electric Impulse Clock" as it is sometimes called. Two types of "Electromagnetic Impulse Clocks" will be described next. In these clocks the electromagnet is not used to wind a mainspring. The electromagnetic pulses act directly on the balance wheel. The outstanding difference between the following two clocks is in the method used to drive the train. In one of these clocks the balance assembly is mechanically coupled to the train and in the other clock of this type the balance assembly is coupled to the train through an electromagnet. Figure 10 illustrates the mechanical coupled type. The simple method of in-

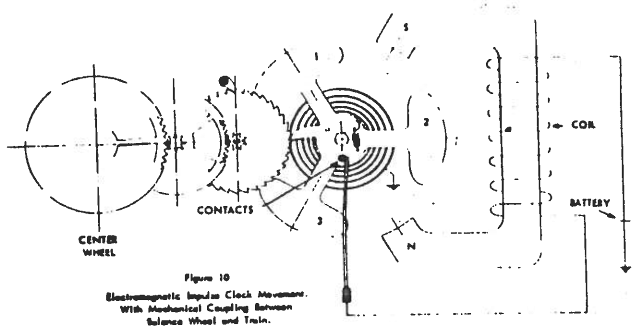


Figure 10
Electromagnetic Impulse Clock Movement. With Mechanical Coupling Between Balance Wheel and Train.

dexing used in this illustration is self explanatory and the electrical circuit will be described in detail. No mention of polarity was made in describing the periodic wound clock. Only one end of the electromagnet was used in the illustration, but either end can be used to attract the soft iron armature which was attached to the winding lever. Both ends or poles of the electromagnet are used in the impulse clock. These are marked "N" and "S" in Figure 10, The balance wheel is shown in the "at rest" position. One of the electrical contacts is part of the balance assembly and oscillates with the balance wheel. This is called the moving contact. The position of this contact on the balance wheel and its function in the operation of the clock is similar to a roller jewel. The stationary contact is positioned somewhat like a pallet fork, it is a soft flat spring made of contact material, anchored on one end and extending toward the balance staff. Each time the moving contact passes through center, when the balance is oscillating, it strikes the stationary contact and completes the electrical circuit.

The balance wheel is made of soft iron and shaped so that the mass is concentrated at three points equally spaced about its rim. The wheel is the armature of this electromagnetic circuit. It is extremely difficult to stop the wheel on dead center when the contacts are closed as shown in Figure 10. If the balance is in beat the stationary contact will keep the wheel from stopping on center. One cycle of operation is as follows:

> With the contacts closed as shown, the magnetic attraction is between the "S" pole of the electromagnet and lobes "1" and "2" of the wheel and between the "N" pole and lobes "2" and "3". If the wheel were on dead center the magnetic attraction would be equal and the wheel would remain stationary. The pressure of the contact spring holds the wheel off center and the major attraction is between the "S" pole and lobe "1" and between the "N" pole and lobe "2". This turns the wheel in a clockwise direction. Before the lobes align themselves with the magnet poles the contacts open. The inertia of the wheel carries it out on excursion. On its return in the counterclockwise direction the moving contact strikes the stationary contact and the energized electromagnet attracts the wheel in the counterclockwise direction. The major attraction now is between the "S" pole and lobe "2" and the "N" pole and lobe "3". Once the wheel is in motion inertia carries it past the neutral point of dead center.

The indexing pawl advances the train once each cycle, when the wheel is turning in the counterclockwise direction. Many variations of this simple indexing and contacting system will be found in clocks today. The number of lobes on the balance wheel may vary. In some cases the balance wheel may be round and an additional piece added to the balance staff to serve as an armature. The magnetic circuit in the majority of these clocks is quite similar.

Most watchmakers or horologists after reading the foregoing description of this clock will comment immediately on the use of the balance wheel inertia to drive the clock train. We are well aware of the detrimental effect a disturbance such as this can have on the natural frequency of the balance wheel. As mentioned previously the indexing mechanism designs that you will find in use today are much more efficient than the one we illustrated. A completely free clock and dial train are essential in this type of clock as loading at any point in the train will be reflected in the motion of the balance.

This same type of clock can be constructed as shown in Figure 11 and by using one of the pairs of poles to drive the balance wheel and

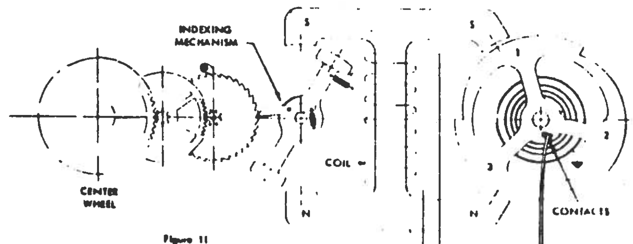


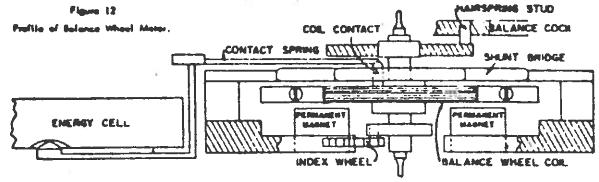
Figure 11
Electromagnetic Impulse Clock Movement. With Electromagnetic Coupling Between Balance Wheel and Train.

the other pair to index the counting mechanism, the balance will then oscillate with only the minor disturbance of making the electrical contact. The number of contacts per unit time can be reduced by a factor or two if one side of the stationary contact is insulated. The cam shaped balance wheel shown can then be used in the clock.

Electrical contact is made when the wheel is turning in a counterclockwise direction. The cam shape of the balance wheel rim gradually reduces the air gap in the flux path and a more uniform pulse is delivered to the balance wheel.

An excellent application of both a permanent and an electromagnet in the same timepiece driving mechanism is shown in Figure 12. This is a profile of the balance wheel motor used in the Hamilton Electric Watch. The complete Hamilton Service Bulletin from which this drawing was reproduced was published in the July 1957 issue of the H.I.A. Journal.

Figure 12
Profile of Balance Wheel Motor.



We have simulated only the magnetic circuit in Figure 13. The polarities are assumed for descriptive purposes. Before the battery is connected in the circuit we have a pancake coil of wire suspended in the field of two permanent magnets. When the coil is energized it becomes an electromagnet assuming the polarity shown. We now have three magnets - the two outer magnets are stationary and the center one which is attached to the balance wheel is free to move in compliance with the law of attraction and repulsion. The electromagnet attached to the balance wheel is attracted to the magnet on the right and repelled by the magnet on the left.

A description of the indexing mechanism used in this watch was published in the April 1957 issue of Product Engineering.

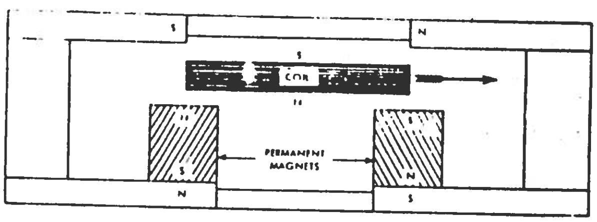


Figure 13
Magnetic Circuit. Unshaded Portion is the Shunt. Used for Increased Efficiency.

The timepieces that we have covered thus far have all used a balance wheel assembly as a frequency standard. This is no indication that the electrical circuits and magnetic principles do not apply to other types of clocks. There are pendulum clocks that use just the electromagnet, others that use both the permanent and electromagnet. Several variations of the principle that is used in the "Bulle" clock are used in battery operated pendulum clocks today.

TRANSISTOR CLOCK CIRCUITS -

The design and maintenance of the electrical contacts in clocks is always a problem. These contacts must operate one-quarter of a million times per year in the "Periodic Electric Wind Clock" and up to one hundred and fifty million times per year in the "Magnetic Impulse Clock".

Electrical arcing across the contacts is very destructive. A reduction in the amount of arcing is beneficial to clock life. The arcing is a function of the voltage, current and inductive load in the clock circuit. The use of a transistor reduces the value of the current and its effect on contact operation and life expectancy.

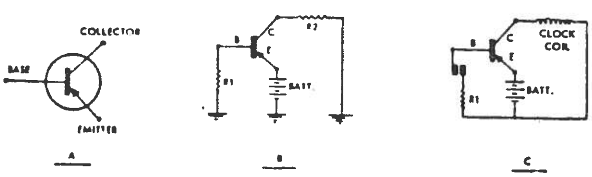


Figure 14
A - Transistor Symbol B - Transistor Circuit C - Transistor Relay Clock Circuit.

For a clear understanding of the function of a transistor when it is used as a relay in a clock circuit we can compare it with a common water faucet. With just a few pounds of pressure on the handle of the faucet we can control hundreds of pounds of water pressure. In a transistor relay circuit, with a very low voltage and small current through the contacts, we can control the higher voltage and large current in the clock circuit. Figure 14A is the conventional symbol of the transistor. The base lead to the transistor is like the faucet handle, the high pressure or voltage that we wish to control passes through the transistor between the emitter and the collector. With no voltage impressed upon the base the transistor will not conduct between the emitter and collector. In the circuit (Fig. 14B) the voltage to the base is limited to a small amount by the resistor R1. This low voltage to the base causes the transistor to conduct between the collector and emitter, this results in nearly full battery voltage at the resistor R2. If the resistor R2 is replaced with a clock coil and the clock contacts are put in series with R1, as shown in Figure 14C, the harmful current in the clock circuit does not pass through the contacts. The contacts now handle only the low voltage and current in the control circuit.

This "Transistor Relay Clock Circuit" is shown with the "Electromagnetic Impulse Clock" in Figure 15. Occasionally the indexing mechanism may cause the clock balance wheel to stop on dead center - a starting switch has been added to relieve this condition.

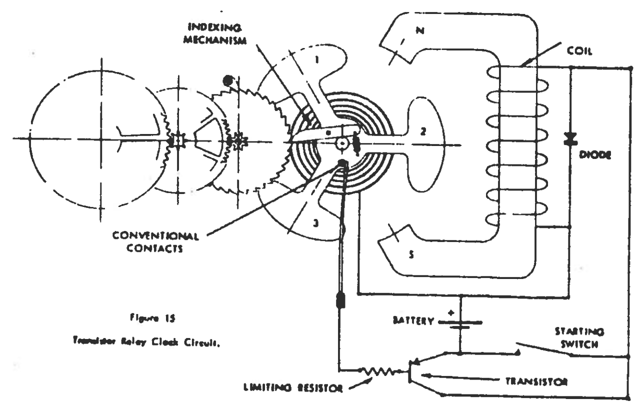


Figure 15
Transistor Relay Clock Circuit.

Another symbol has been added to this drawing, that of a diode. It is shown connected across the clock coil. The diode is placed there to protect the transistor from surge voltages which occur when the contacts open suddenly. This surge voltage which may rise very high due to the inductance of the clock coil is very harmful to the contacts in the regular clock circuit that does not use a transistor. For this reason it is beneficial to place a diode across the coil in most clock circuits.

The diode is a semiconductor; it allows electrical current to flow freely in the forward direction but offers a high resistance to current flowing in the reverse direction. The inductance of the coil in the clock circuit has the property which tends to oppose any change in the current passing through it. In an effort to maintain this current level as the contacts are opening, the voltage surges upward and an arc is drawn momentarily between the contacts. If a diode is placed across the coil in the proper direction it will offer little or no resistance to the normal flow of current when the contacts close, but when the contacts are opening the resistance of the diode in the reverse direction is less than the resistance of the air gap between the contacts, so the inductive surge will favor the path of least resistance and go through the diode. The current will dissipate itself flowing through the diode and the clock coil.

CONTACTLESS CLOCKS

If we wish to do away with the problem of mechanically interrupting the electrical circuit with contacts, and the cost of the timepiece is not too important, we can use a circuit similar to that shown in Figure 16. A magnetic pickup coil is used to generate a voltage to satisfy the requirements of the control side of the transistor circuit.

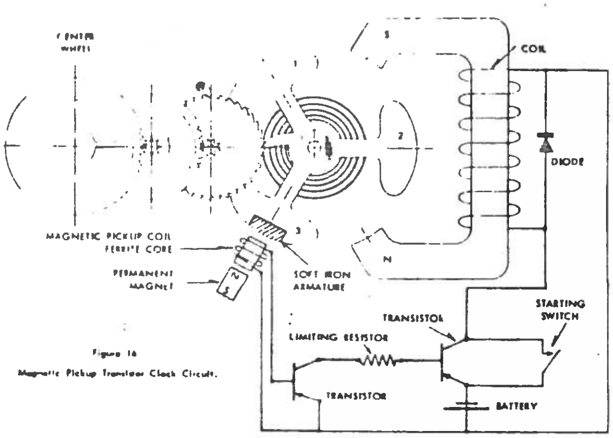


Figure 16
Magnetic Pickup Transistor Clock Circuit.

Michael Faraday's discovery in 1831 showed how mechanical energy could be converted to electrical energy by cutting the invisible magnetic lines of force (flux) with a moving coil. In Figure 4 we were able to make a permanent magnet by inserting the proper material in a coil and passing current through the coil. If we reverse the procedure and pass the field of a permanent magnet through a coil a voltage will be generated in the wire comprising the coil.

The pickup coil arrangement shown in Figure 16 was selected to move the balance wheel and armature away from the strong magnetic attraction of the permanent magnet.

If the current generated by the pickup coil is not sufficient, additional transistors may be added to the circuit as amplifiers to raise the current to a level compatible with the requirements of the relay transistor.

There is currently on the market a pendulum clock manufactured by Junghans-Schramberg, Eastern Germany, which employs a transistor feed-back. The circuit of this clock includes a permanent magnet, an electromagnet coil, pickup coil and a transistor. Attached to the lower end of the pendulum is a long slender permanent magnet, it is curved to correspond to the arc from the suspension in which it travels. Figure 17. At one end of its travel the permanent magnet enters the electromagnet driving coil. As it approaches the end of its swing in the opposite direction it enters the pickup coil. Both coils are connected to the transistor. The driving coil is connected to the side of the transistor that handles the heavy current and the pickup coil is on the control side. As mentioned previously, a small amount of current on the control side of the transistor will cause the transistor to conduct the heavy current necessary on the driving side. This small amount of control current is generated by passing the permanent magnet through the pickup coil. The pickup coil is connected so that the induced voltage is of the proper polarity to operate the transistor circuit only on the downswing of the magnet through the pickup coil. While current is flowing in the control side of the circuit the driving coil at the opposite end of the pendulum swing is energized and attracts the pendulum in that direction. This imparts the driving force to maintain the motion of the pendulum.

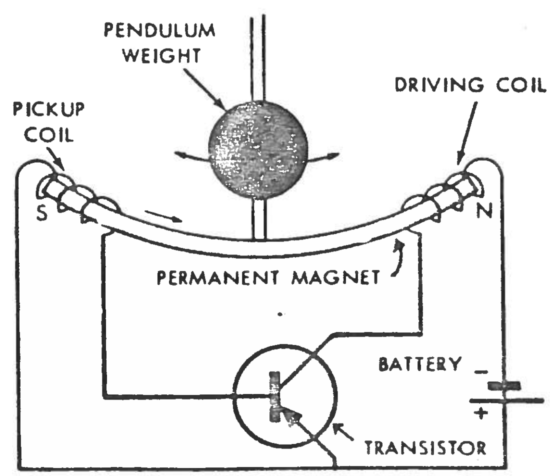


Figure 17
Transistor Circuit of a German Pendulum Clock.

Another illustration of how simple the circuit can be made in an electrically powered mechanical oscillator is shown in Figure 18. This is chronometer type of impulse mechanism and the electromagnet is used to raise the impulse lever to the cocked position in readiness for the next cycle of balance wheel motion. Transistors may be used in this circuit if it is desirable to reduce the amount of current through the contacts.

The use of capacitors or other electronic components that are sensitive to temperature variations should not be used in timepieces that are exposed to the elements. The use of these

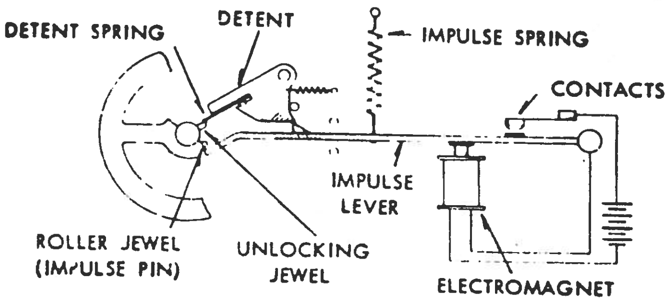


Figure 18

Chronometer Type Impulse Mechanism.
The Impulse Lever is Reset by the Electromagnet.

components will require a more complicated circuit to compensate for the effect they may have on the performance of the timepiece.

CONCLUSION -

The circuits that have been presented are quite basic. The horologist may find any one of these circuits disguised and apparently complicated by the addition of resistors, capacitors and rectifiers. These components may be added to change the current's characteristics and improve the circuitry. A careful analysis of each will show the connecting link between the mechanical and electrical portions of the timepiece is usually the magnetic field surrounding an electromagnet.

When servicing electrical timepieces, such as those described, the mechanical section can usually be serviced and tested independently of the electrical circuit. After this has been done the servicing of the electrical section becomes quite simple. A fresh battery, good clean contacts and continuity in the circuit are the usual requirements for good performance. Additional electromagnet coils can be added to these circuits for remote indicators such as slave dials, alarms or audible time signals.

Electronic frequency standards such as those used in timing machines, laboratories and observatories have not been included in this group of electrical timepieces. Their circuits are complicated and maintenance must be handled by an electronics technician.

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MART

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

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WANTED: "Junker" early battery clocks, movements, parts, etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Marty Feldman, 620 Reiss Place, Bronx, NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas,etc. SPECIALIZING IN BULLE CLOCK REPAIRS USING ORIGINAL PARTS. One month maximum time for all repairs. Martin C. Feldman

FOR SALE: Poole, ATO, Rempe mvt.---see Dec. "79 MART for details. Martin C. Feldman

FOR SALE: Slave Clocks $60.each, Standard Electric Time, eleven inch Roman numeral dial, round oak needs refinish. Have ten left. Arthur Sanders,The Musical Museum, Deansboro, NY 13328.

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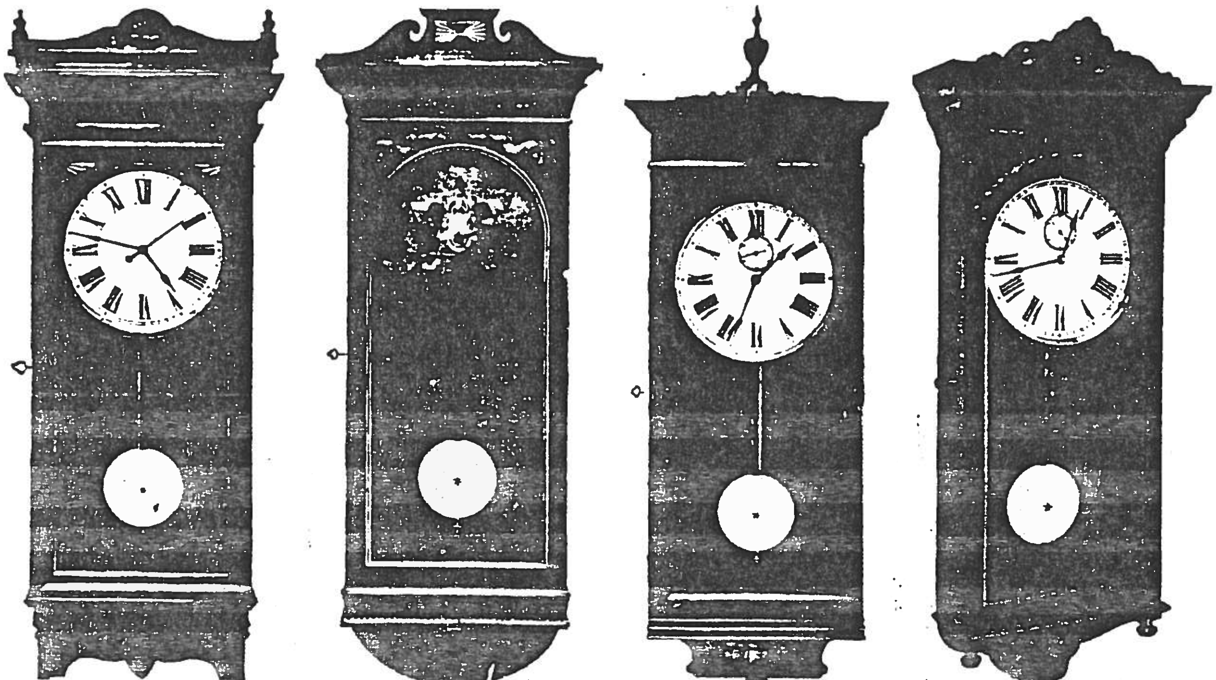
Mart Continued on Page 12

Checking on the Power Co. with a Home-made Frequency Device!

Most people who build things, once in a while like to build something that does little or nothing but is really a masterpiece of construction. This trend in the writer started while attending high school radio shop. A life-long friend and I built a device where one held two electrodes in one's hands and jumped off the floor when the current was applied. The device would then register how long you were off the floor! It was a complex device indeed and caused the teacher amazement at the silliness of it all. This trait in me has carried over to the latest project. The present device tells at a glance whether the Seattle City Light Co. is keeping up its generator speed as far as its 60 cycle current is concerned. While it is really of little importance whether they do or not, it gives me something to call a friend in order to complain as he happens to be a draftsman for the light company.

The project consists of two clock movements. The first is the usual Telechron M2377 rotor that turns 1 RPM. It is placed in its magnet backwards so it turns counter-clockwise. Attached to its arbor is a piece of sheet metal which is bent in a manner that allows it to receive a battery quartz movement. This is the type that doesn't step each second as in some models. This quartz movement has a six inch hand on its second arbor which sticks out through a 12-inch round face. The face is numbered in cycles clockwise from 1 to 3600 (cycles).

What happens is--the Telechron movement turns as a function of the city light current frequency and turns counter-clockwise. This means that the entire quartz movement turns counter-clockwise. Now the quartz movement in turn is turning its second hand clockwise at the rate of 1 RPM, therefore the two cancel each other out and the hand appears to stand still against the face. As the cycles of the city light current slows during the dinner hour and so on there is a marked movement of the hands. Then as it again speeds up it goes back to the "0" mark. It should be noted that power companies synchronize their equipment at 2 A.M. in the morning. I find that in this State they don't do it Friday or Saturday nights so by Sunday night they are off 600 to 700 cycles which is six or seven seconds. The device doesn't really accomplish anything but it does function and it is kind of like looking at the Barometer; you see what it has done and you know what to expect from its readings, but there is really very little you can do about it! (We would have liked a drawing or photos of Dick's device, but none were available at press time. For those wishing to construct this project, write to, Dick Warburton, 17043-8th N.E., Seattle, Wash. 98155. Please include a SASE. Ed.)



No. 10.
49 inches high, 12-inch dial.
Closing-out price,
$15.00, net.

No. 40.
(Dial off, to show movement.)
49 inches high, 12-inch dial.
Closing-out price,
$15.00, net.

No. 42.
50 inches high, 12-inch dial.
Closing-out price,
$15.00, net.

No. 46.
47½ inches high, 12-inch dial.
Closing-out price,
$15.00, net.

These are also furnished without Seconds Hand, or with either Independent or Sweep Seconds Hand.

Here's a Genuine Bargain!

In order to devote more factory room to the making of New York Standard Watches (the demand for which has overtaxed our present facilities), we are obliged to discontinue the manufacture of

"Standard" Electric Clocks,

and are closing out the stock on hand of these celebrated Clocks at a great reduction from the regular price, in order to move them quickly. The occasion presents an opportunity to secure a very great bargain.

The "Standard" Electric Clock

requires *no winding;* has *no springs* to break, *no weights* to fall; is so *simple* and *mechanically perfect* as to make repairs unnecessary (see cut of one with dial removed); requires *no outside connecting wires,* but is run by a dry battery (such as is used for door-bells, etc.), concealed within the clock-case, the average life of which is eight or ten months, and which can be renewed for eighteen cents by any local dealer in electrical supplies; is the *most accurate* of all clocks; and is beautifully cased in selected solid woods (oak, cherry and mahogany) with durable piano finish.

We sell these Clocks *direct to the Retailer.* The stock is moving rapidly in consequence of the attractive prices for such unusual values. *Order promptly,* to secure your share of this great bargain. Address,

NEW YORK STANDARD WATCH CO.,

JERSEY CITY, NEW JERSEY.

MART CONTINUED

WANTED: Case only for Warren Clock Co. Master Clock Type B, or will consider selling Mvt. for same.
H.R. Cramer, 1704 Hass Dr., South Bend, In.46635

WANTED: Nice Poole or Bulle- Please contact C. Georg Wiedmaier, 301-776-5925
9207 Lawnview Lane Laurel, MD 20811

FOR SALE: Standard Electric Time Master, rare mercury pend, ex. cond.,5'2" cherry case; also Sangamo Mantel exposed escapement, super case.
Craig Dinner, 516-872-6867
123 S. Terrace Place, Valley Stream, N.Y. 11580

FOR SALE: Early Synchronome clock (pre WW II) in fine restored oak case, 30 sec. contact for slave, one second invar rod plus 15 lb. pendulum bob; running--$1000 plus shipping (packing free). Also Rare Gents Pulsynetic English Master $1200.00
Charles Roth, 2 Circle Lane, Roslyn, N.Y. 11577

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A VERY BRIEF FINANCIAL STATEMENT FOR 1979

Bank Balance As Of 1/1/79	461.92
Receipts: 103 members and mart	796.50
Interest	23.92
	1282.34
Expenses:	
President's Expenses & Editorial-6 Issues	
Typing, photos, stamps, stationery, misc.	390.00
For Journal	
Printing, envelopes, stamps, labels,mailing,misc.	474.25
Bank Balance As Of 12/31/79	418.09

--Charles Roth

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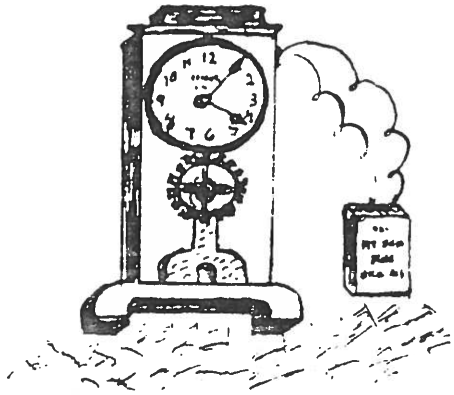
MEETING NOTICE

Next meeting will be held at Alan Marx's house on Sept. 14th, at 3:00 p.m. Call for reservations & directions. 914 632-5986

The JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



August, 19~~79~~80
VOLUME VI---ISSUE #4
Martin C. Feldman, Editor

Hello fellow enthusiasts:

As this absolutely weird (weather-wise) summer draws to a close many of us will be returning to our full time avocation of electrical clock collecting and restoring. For me it has been a relatively quiet summer as no new clocks have turned up either to be collected or restored! A quick check of the more avid collectors in the N.Y. area indicates their level of success is on a same par with mine. As the local Chapter meetings begin to take place once again, I am sure that the "electrics" will appear on various Mart tables.

This month we are reprinting two excellent articles. The first, <u>The 'ATO' Battery Electric Clock</u> by John D. I. Locke. This first appeared in 'Antique Collecting', the Journal of the Antique Collectors' Club (5 Church St., Woodbridge, Suffolk.).- Vol.14-No.11, April 1980. We wish to thank both the Journal and Mr. Locke, a British horologist, for their kind permission to reprint same. This article was brought to my attention by a good friend and member R. L. O'Briant who provides us with much information and leads for our Journal. The second article, <u>A Constant-Speed D. C. Motor Clock With Chronometric Governor</u> by Henry B. Fried originally published in the Jewelers' Circular-Keystone, June 1959, is being reprinted with kind permission from the author. Mr. Fried is probably the most eminent American horologist alive today and is the author of many articles and books dealing with all aspects of clocks and watches. I am privileged to have him as a very good personal friend as well as his being a member of our Chapter.

Enjoy this Issue.

Electromagnetically yours,

Marty Feldman

Martin C. Feldman, FNAWCC

A CONSTANT-SPEED D. C. MOTOR CLOCK WITH CHRONOMETRIC GOVERNOR

by Henry B. Fried
JC-K Horological Consultant

● SESSIONS CLOCK CO. recently added a new and most interesting timepiece to the growing field of electrical horology. It is a battery-driven direct current motor clock with a chronometric governor. Simply stated, this is a clock in which a battery operates a small D. C. motor which drives a set of hands. The speed of the motor is governed by a balance and hairspring, the purpose of which is to permit or deny power to the motor in order to synchronize the motor's speed (150 r.p.m.). The balance makes the usual 300 beats a minute. In turn, the motor brush springs act as a constant force impulse to the pallet fork which impels the balance. There is no escape wheel; only a pallet fork and lever arm.

This clock measures approximately 1¾″ x 2½″ and is powered by two pencil-type light batteries in parallel. The timekeeping qualities are unusually good. This is due to the constant force which impels the balance and controls the speed of the D. C. motor which drives the dial train. The balance has nothing to do but unlock the fork lever from its magneticc banking position. The action is fascinating to observe.

Figure I is a cut-away view of the movement side of the clock. Figure II is a schematic of the unit. The hairspring and balance (32 and 33) are conventionally clock-type, but with cylindrical pivots and running in jeweled bearings. In this

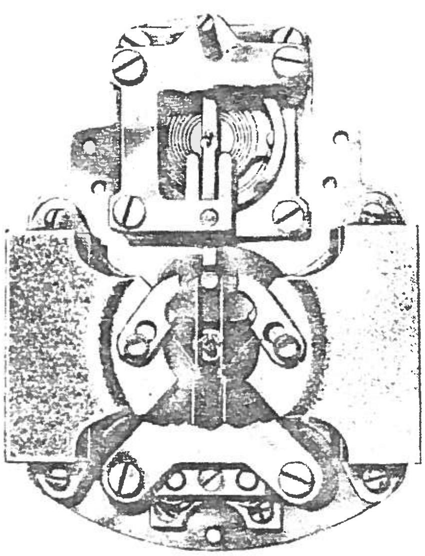


Figure I. Cut-away of Haydon's direct current motor with chronometric governor.

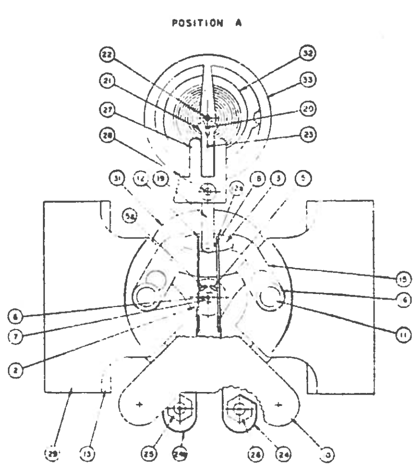


Figure II. Schematic of the chronometric-governed motor in neutral position.

The following numbers are used to identify parts in all illustrations accompanying this article:

1, Rotor pinion. 2, Coil support. 3, Coil mandrel. 4, Coil. 5, Commutator segment. 5a, Commutator segment. 6, Rotor arbor. 7, Commutator sleeve (concentric). 8, Epoxy resin binder (potting). 9, Jewel bearing. 10, Rotor bridge. 11, Rivet. 12, Brush contact (tension spring) to negative battery lead. 12a, Brush contact (tension spring) to positive battery lead. 13, Ceramic magnet (field). 14, Output potence bearing. 15, Magnetic detainer (horn). 16, Separating washer. 17, Commutator pin connecting concentric commutator sleeve. 18, Fork lever magnetic stud. 19, Fork lever. 20, Impulse pin (roller pin). 21, Lever fork. 22, Balance staff. 23, Banking pin. 24, Contact lead spring (negative). 24a, Contact lead spring (positive). 25, Contact post (positive). 26. Contact post (negative). 27, Banking pin stops. 28, Fork lever staff. 29, Upper pole piece. 30, Lower pole piece. 31, Rotor assembly. 32, Hairspring. 33, Balance wheel.

figure the balance impulse pin (20) rests in the fork (21). The fork and lever (19) are slightly different from the conventional type in that there are no pallets—pin or jewel. The fork lever has a banking pin (23) set upright near the fork. The banking pin comes to rest against the banking pin stops (27) which are fingers extending as part of the fork-lever bridge. The fork pivots in jeweled bearings (28). The lever continues beyond its pivotal point and terminates at a small cylindrical stud (18) composed of a magnetic ceramic material.

If we were to grasp the lever fork at its end (19) with a tweezer and move it back and forth, the balance would start to move—providing we could synchronize our moving the pallet with the natural period of vibration of the balance. To take the place of tweezers, the two long thin springs (12 and 12a) perform a somewhat similar service, except that they do not move in unison. Actually, these two springs are the brush contacts. The commutator segments (5 and 5a) are eccentric, set off a bit from the split commutator sleeve (7) so that the rotor assembly (31), as it turns, will alternately push one spring (12) and then the other (12a) aside and, as the commutator segments (5 and 5a) pass, will allow the contact springs (12 and 12a) to impulse the lever. The lever, of course, moves the balance.

However, as mentioned earlier, in order for the balance to receive the benefit of the impulses of these springs, they must be given at the natural speed period of the balance. Here is the way this is accomplished.

Synchronizing the Motor

In Figure II, the unit is shown in the neutral position. One contact spring (12) is connected to the terminal contact post (25) which leads to the positive terminal of the batteries; the other (12a) ends at the terminal (26) for the negative battery leads. Both springs have completed an electrical circuit upon two of the three commutator segments (5 and 5a). This starts the D. C. motor turning in a counter-clockwise direction and the commutator segment (5) permits the spring contact (12a) to push the lever (18) which starts the balance. This lever might ordinarily be stopped by the other spring (12), but by this time the commutator segment (5a) has pushed the spring (12) aside so that the fork lever is not stopped by it; nor does it have to push it aside.

Figure III illustrates the next sequence. As the segments (5 and 5a) turn to push the brush contact (12) aside, out of the way of the moving fork lever, the brush contact spring (12a in Figure II) makes contact with the commutator

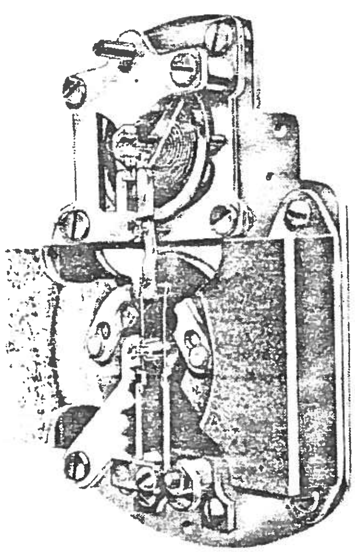


Figure III. The right contact spring has made contact with the small-radius concentric commutator sleeve, completing the electrical circuit.

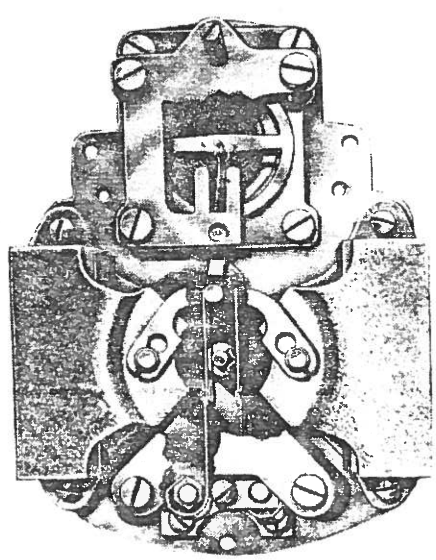


Figure IV. The balance is shown at the full extent of its motion and is now ready to return.

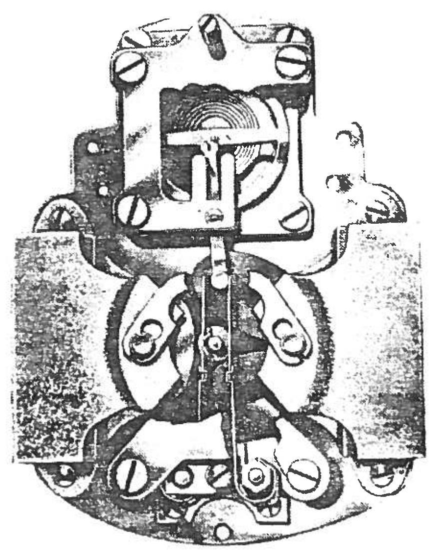


Figure V. The right contact spring is held in the poised position by the magnetic attraction of the ceramic stud and the field magnetic horn.

sleeve (7). This electrical circuit tends to keep the motor going.

The next sequence appears in Figure IV. As it continues turning, the commutator spring (12) wants to return and push upon the fork-lever stud (18). However, remember that the stud (18) is a ceramic magnet. The two horns (15) are "bleeder" magnets deriving their magnetic power from the strong ceramic pole pieces (13) situated on each side of the unit. When the fork lever was pushed to the left (as shown in Figure IV), it entered the magnetic field of the bleeder horn and, since the stud (18) is also magnetic, it was held there. It couldn't actually come in contact with the horn because the banking pin (23 in Figure II) prevented it, but the magnetic pull is strong enough to keep it there. This allows the balance's roller pin (20) to leave the fork without pushing its way out and, at the same time, keeps the fork clear of the balance staff so that the balance has freedom of motion. (This magnetic action takes the place of "draw" in the conventional mechanical escapement.)

Direct current motors tend to speed up or slow down with changes in voltage. However, as you can see in Figure IV, the commutator segments (5 and 5a) have come around and have pushed the contact spring aside where it too will be magnetically held. Notice, also, that since the contact spring (12) is retained outward by the magnetically banked fork lever, it does not make a contact with the sleeve commutator (7 in Figure II). This breaks the electrical circuit and the motor will slow down or stop. At this point the balance has reached the limit of its excursion.

On its return trip, the roller re-enters the fork and moves it over slightly. As it does, the other end of the fork lever, being held in the magnetic field of the bleeder horn tip, moves out a corresponding distance (enough to remove it from magnetic influence). As it is released, the tensed contact spring will also be released and will push the lever-end over. The lever-end, in turn, impels the moving balance in a counterclockwise direction. As the lever is pushed over by this spring it enters the magnetic field of the opposite bleeder horn tip. It does not have to push the right contact spring because this spring is being positioned by the commutator segments (as shown in Figure IV). Since the fork-lever does not have to push this spring with it as it moves towards the right, the balance is allowed ample motion. Remember that its movement to the right was caused by the tensed, left contact spring. Since the left spring's "strength" is exactly the same as the right spring's, it does not have the power to move both the lever and the right spring. Therefore, the unit is designed so that the tensing of the contact springs towards their bankings is always done by the rotor's eccentric commutator segments.

Completing the Circuit

Figure V shows the next sequence. The right contact spring is tensed and held captive by the fork-lever end which is in magnetic banking. While the commutator segments have now pushed

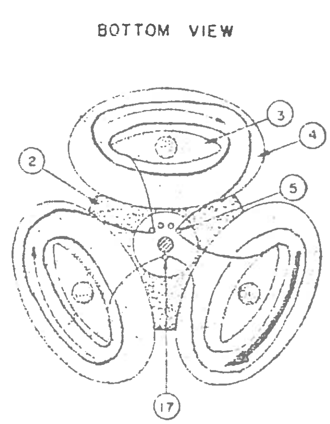


Figure VIa. A schematic of the three elliptical coils.

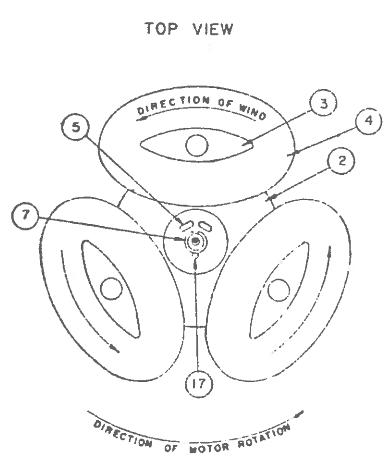


Figure VIb. Simplified top view of the rotor.

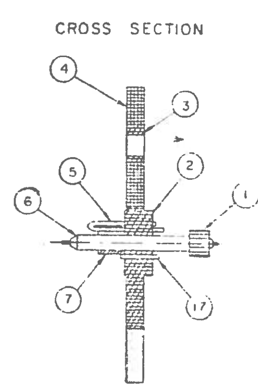


Figure VIc. Cross-section view of the rotor.

the left contact spring back again, the electrical circuit has been broken because the right spring is kept away from the small commutator sleeve. This causes the motor to idle by momentum until the balance releases the fork-lever and the contact spring. Thus the cycle is continually repeated, the motor moving the contact springs aside while the electrical circuit is completed.

The motor circuit is closed each time the balance wheel swings through center in either direction, first allowing one (brush) contact spring to drop on the small radius of the commutator (sleeve) and then the other (brush) contact spring to drop on the small radius of the commutator. The rotor circuit is opened each time the commutator segments rotate away from the contact spring which is simultaneously restrained by the lever; first one side, then the other as the fork-lever swings to and fro under control of the balance wheel.

Thus the motor circuit is constantly being pulsed or turned "on" or "off." It is always turned "on" when the balance wheel swings through center and it is always turned "off" when the rotor has rotated one-half turn (as in Figures IV or V). Since the start of each pulse is controlled by the balance wheel which oscillates at the standard 300 beats per minute, this results in a motor speed of 150 r.p.m. If the battery voltage is high, the rotor turns more quickly, but, in doing so, shuts its own current off more quickly, thus automatically compensating for voltage changes. The unit is self-starting because the (brush) springs have sufficient pressure to close the circuit regardless of the position in which the motor stops. This means that these springs can push the lever slightly aside and at the same time make contact with the small radius of the commutator when the motor has come to a stop.

In this unit, the balance always receives a uniform mechanical power from the contact springs, regardless of variations of electrical or mechanical conditions in the motor or the movement. This is because mechanical energy is stored in the contact spring when it is lifted by the motor commutator segments. This power is always uniform because these springs "travel" only until they contact the concentric radius of the commutator. It makes no difference whether the motor has coasted to one position or another.

The only mechanical work which the balance wheel and hairspring system does is to release (or unlock) the fork-lever from its magnetic detainer. This requires no more energy of the balance than in unlocking any precision escapement. Why not provide a transistor to do the unlocking? The release force required in the clock absorbs less energy from the balance than the energy required to generate a satisfactory signal to trigger a transistor. The manufacturer of this unit claims that transistors' characteristics vary individually over a temperature range. By comparison, Sessions says, their system provides much less disturbance to the simple harmonic motion of the balance unit than would any other.

(please turn page)

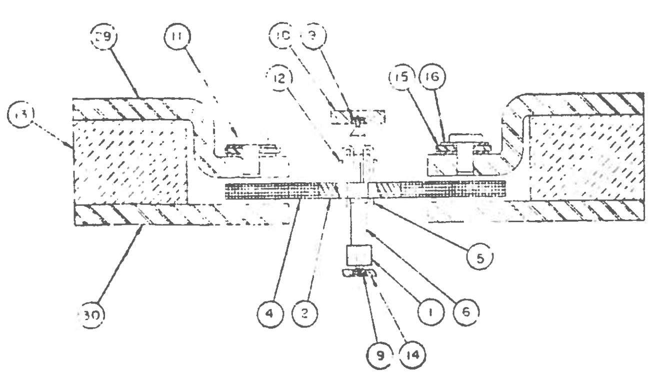


Figure VII. Detailed cross section of the motor unit.

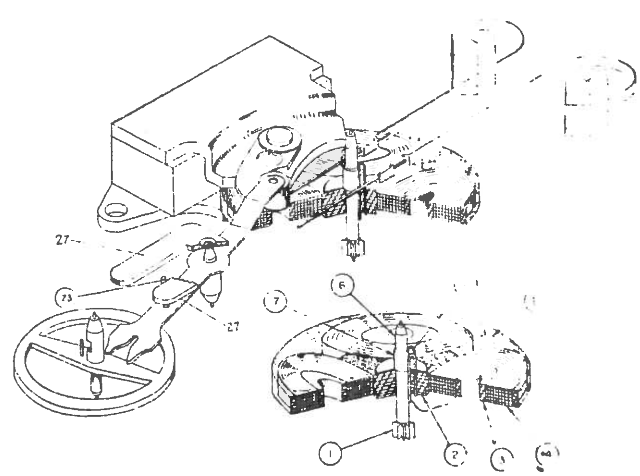


Figure VIII. Isometric view of the balance and rotor.

The patents for the unit are held by A. W. Haydon, its inventor. He is president of the company bearing his name. He is also head of the Sessions Clock Co.

Details of the Motor Unit

The electrical principle of the operation of the motor is the same as any small direct current motor having two permanent magnets in the field and three coils in the rotor. The rotor coils are connected in series, and the junction points are connected to the three commutator segments. Two of these segments are gold wire loops and the third is the small-radius concentric sleeve on the motor shaft. Figures VIa, VIb and VIc show a schematic of bottom view of the three ellipitical coils (4). Each of these coils have 3600 turns of wire. They are connected in series as indicated in Figure VIa. The outer coil end of one is connected to the inner core end of another. These in turn, are connected at the commutator segment-loops (5). The circuit is completed when the other (continuous) coil end is connected to the small-radius commutator sleeve pin (17). Each coil is wound around a mandrel (3). The three coils are held in place by a hard resin coil support (2). The arrows in each coil show the direction of the wind and the rotation of the unit.

A top view of this rotor is shown in Figure VIb. (As in all other figures, the numbers refer to the same units.) Notice that the pin (17) is the connector to the coil wire for the commutator sleeve (7). Figure VIc shows the cross section of the rotor. The rotor is mounted on a small pinion and arbor, pivoted and running in jeweled bearings. (1 is the pinion itself which drives the dial gear train; 2 is the coil support; 3 is the coil mandrel around which the coil, 4, is wound for 3600 turns on each of the three elliptical coils; 5 is one of the two gold wire loops which constitute the commutator segments; 6 is the pinion arbor, or rotor shaft as it is called; and 7 is the small-radius commutator sleeve and its coil connection, 17.)

Another cross-section view of the motor unit is shown in Figure VII. Here one can see the two gold wire loops (5) which act as the connecting points to the coil wire. The thin rotor coils run between two permanent magnets (13) which act as the field magnets. These magnets act upon the rotor coils through the upper pole pieces (29) and the lower pole pieces (30).

The magnetic banking of the fork lever is accomplished by the magnetic horns (15 in Figure II). In Figure VII they are shown in the cross section view. They receive their magnetism from the upper pole pieces to which they are attached. In this figure, the rotor bridge (10) is also shown in cross section, as is the lower bearing for the pinion (14) and the jewel bearings (9). The brush contact springs (12) appear as they would when the rotor is in the position shown in Figure II.

The Rotor Unit

Figure VIII shows an isometric of the unit and should serve as a summary of its components. Here the two battery leads (25 and 26) are shown with the long brush contact springs (12 and 12a) attached. The rotor is shown in a partially cutaway view. The positive lead and contact spring (12) is in contact with one of the gold wire loops (5), but the other brush contact spring is being held out of contact with the commutator sleeve (7) by the cylindrical magnetic stud at the end of the fork lever. In this figure the other spring is shown in the magnetic field of the pole-piece magnetic horn which acts as a detainer. The contact spring, being between the horn tip and the magnetic stud of the fork-lever, is thus held out of contact with the commutator sleeve. The rotor coils can be seen between the upper and lower pole pieces with the ceramic magnet in rectangular shape between the upper and lower pole pieces.

The fork and lever are held to one side. The lever is pivoted and held in the jeweled bearing in the lever bridge. Notice the banking pin of the lever: near the fork as it rests against one of the banking tabs which are part of the pallet bridge. The fork is free of the balance (the hairspring is not shown).

In the sectional view of the rotor, it can be seen that the three elliptical coils are held to the coil support (2). They are placed in relation to each other with an epoxy resin: a very hard, durable plastic which not only serves to keep these permanently in place but acts as a very efficient protective agent for the coil wires against accidental damage or parting. ■ ■ ■

The 'ATO' Battery Electric Clock

by John D. I. Locke

DESCRIPTION DU MÉCANISME

DES PENDULES "ATO"

Principe.

[illegible]

Entretien électrique.

[illegible]

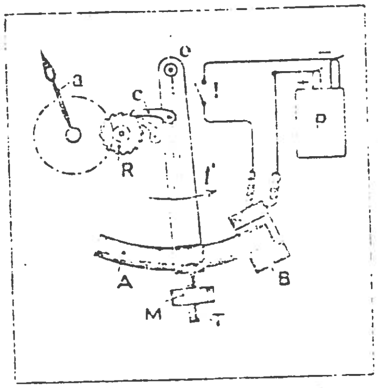


Fig. 1 — Schéma de la pendule "ATO"

Chaque fois que le balancier se déplace dans le sens f, la bobine B est parcourue par un courant électrique, fourni en temps utile par la pile P, grâce à l'interrupteur I, manœuvré automatiquement par le balancier.

On sait qu'une bobine de fil isolé parcourue par un courant électrique acquiert toutes les propriétés d'un véritable aimant, susceptible d'attirer ou de repousser un autre aimant.

Cette aimantation cesse dès l'interruption du courant.

Grâce à cette propriété, la bobine B exerce sur le balancier une série d'impulsions entretenant son mouvement.

Mécanisme des aiguilles.

[illegible]

Figure 1

Isochronisme.

[illegible]

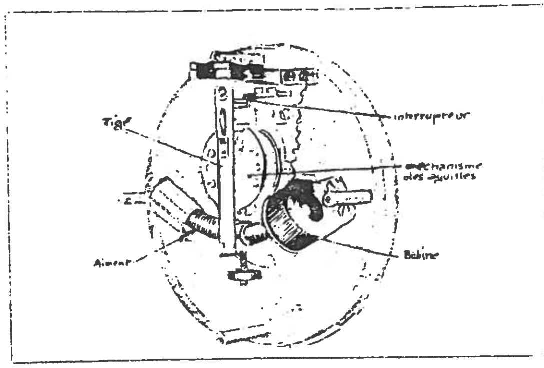


Fig. 2 — Vue du mécanisme intérieur

influant sur cette durée d'oscillation : longueur du balancier, malgré les écarts de température ; impulsions électro-magnétiques, malgré les variations accidentelles de la tension de la pile et de la durée des contacts. La constance de l'aimant est assurée par le courant d'entretien fourni par la pile.

Écarts de température.

La tige du pendule étant constituée par de l'acier au nickel à invar, les écarts de température n'influent pas sur la durée des oscillations.

Réglage électro-magnétique.

Ce réglage résulte des propriétés spéciales des organes électro-magnétiques moteurs.

La théorie du fonctionnement de ces organes sort du cadre de cette courte notice. Elle a été exposée au Congrès National de Chronométrie (Octobre 1923) ainsi que dans de nombreuses publications, notamment dans les principales revues horlogères.

Figure 2

While the best known marque of battery electric clock is that of BULLE, the ATO clock has had a similar history. Both were invented and constructed in France, production starting within a year or two of each other. They are also linked by the work of Marius Lavet who, as described in M. Belmont's book on the BULLE clock, was associated with M. Favre-Bulle in his studies immediately after the First World War. M. Lavet published his work on electrical horology in 1922 and, according to Tardy, his designs were adopted by the Etablissment Léon Hatot in the same year. The trade-mark ATO comes, of course, from the firm's name. It is perhaps of passing interest that Ets. Léon Hatot acquired the business of Paul Garnier in 1937 and displayed his name, as well as their own, on some models of their clocks in that year. Paul Garnier the elder had taken out a patent for electrically driving slave clocks in 1847 and exhibited an electric clock in 1849.

The first versions of the ATO battery clock were put on the market in 1923 and were based upon two movements: one beating half seconds and the other beating quarter seconds, although the latter was made in two sizes to suit differing case styles. Both versions operate on 1.5 volt batteries. The period of their production that will be covered in this article will be from their first introduction until 1954 when the firm made the first application of the transistor to electrical time-keeping; based once more upon a design of Marius Lavet who took out the patent in 1953.

The principal differences between BULLE and ATO clocks are firstly that the design of the latter is more compact, permitting the use of case heights as low as 4ins., although over the full range the case styles are remarkably similar, with BULLE the slightly more flamboyant. Secondly, while in the BULLE it is the coil which forms the pendulum bob, in the ATO it is the magnet. It is this fact which simplifies the design of the ATO as it avoids the complication of leading wires down the pendulum rod and therefore permits the more compact design. Thirdly, the pendulum suspension in the ATO is by double steel links, whereas in the BULLE it is by a silk ribbon.

A simple description of the action is given in figures 1 and 2, reprinted from the 1924 catalogue, a translation of which is given below:

"**Principle**

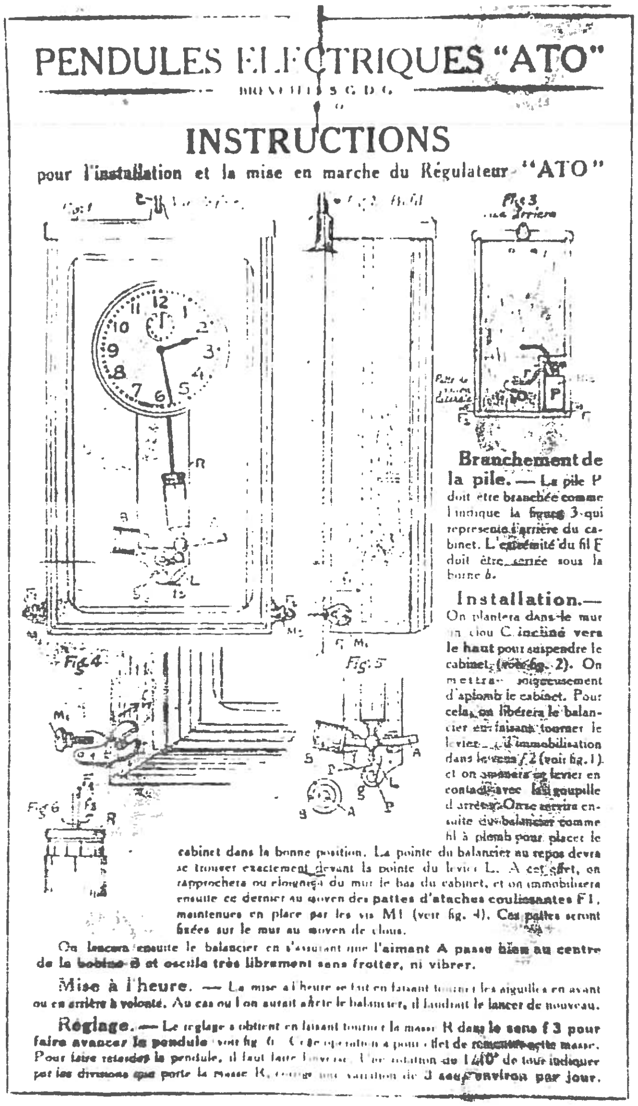
The regulator and motor is a pendulum whose oscillations are maintained electrically with the aid of a special dry battery.

Electrical Maintenance

As is illustrated by figure 1, the pendulum carries at its lower end a magnet A, formed in the arc of a circle, which at the extreme of its swing enters the coil B, (see also figure 2). Each time the pendulum swings in the direction f the coil is energised at the right time by an electric current, furnished by the battery P, through the switch I being automatically operated by the pendulum.

One knows that a coil of insulated wire through which a current flows acquires the properties of a true magnet, capable of attracting and repelling another magnet. This magnetisation ceases when the current is interrupted. Because of this property, the coil B exerts a series of impulses on the pendulum to maintain its movement."

I won't continue with the translation but will point out that the pendulum rod is of Invar to minimise the effect of temperature changes, and that a copper ring, opposite to the coil, reduces the effect of varying battery voltage. I have not yet experimented to find out how effective these measures are. The operation of the clock was described in: *Le Matin* of 27th October 1923, *Excelsior* of 15th November 1923, *La Nature* of 16th February 1924, *La France Horlogère* of 15th November 1923, *Le Moniteur belge de l'horlogèrie* of January and March 1924, *La Revue de l'horlogerie-bijouterie* of April 1924 and *Practical Electrics* of March 1924, amongst others. It was thus well



PENDULES ÉLECTRIQUES "ATO"

INSTRUCTIONS

pour l'installation et la mise en marche du Régulateur "ATO"

Branchement de la pile. — La pile P doit être branchée comme l'indique la figure 3 qui représente l'arrière du cabinet. L'extrémité du fil F doit être serrée sous la borne b.

Installation. — On plantera dans le mur un clou C incliné vers le haut pour suspendre le cabinet (voir fig. 2). On mettra soigneusement d'aplomb le cabinet. Pour cela, on libérera le balancier en faisant tourner le levier d'immobilisation dans le sens f 2 (voir fig. 1) et on amènera ce levier en contact avec la goupille d'arrêt. On se servira ensuite du balancier comme fil à plomb pour placer le cabinet dans la bonne position. La pointe du balancier au repos devra se trouver exactement devant la pointe du levier L. A cet effet, on rapprochera ou éloignera du mur le bas du cabinet, et on immobilisera ensuite ce dernier au moyen des pattes d'attaches coulissantes F1, maintenues en place par les vis M1 (voir fig. 4). Ces pattes seront fixées sur le mur au moyen de clous.

On lancera ensuite le balancier en s'assurant que l'aimant A passe bien au centre de la bobine B et oscille très librement sans frotter, ni vibrer.

Mise à l'heure. — La mise à l'heure se fait en faisant tourner les aiguilles en avant ou en arrière à volonté. Au cas où l'on aurait arrêté le balancier, il faudrait le lancer de nouveau.

Réglage. — Le réglage s'obtient en faisant tourner la masse R dans le sens f 3 pour faire avancer la pendule (voir fig. 6). Cette opération a pour effet de remonter cette masse. Pour faire retarder la pendule, il faut faire l'inverse. Une rotation de 1/40° de tour indiquée par les divisions que porte la masse R, corrige une variation de 3 secondes environ par jour.

Figure 3

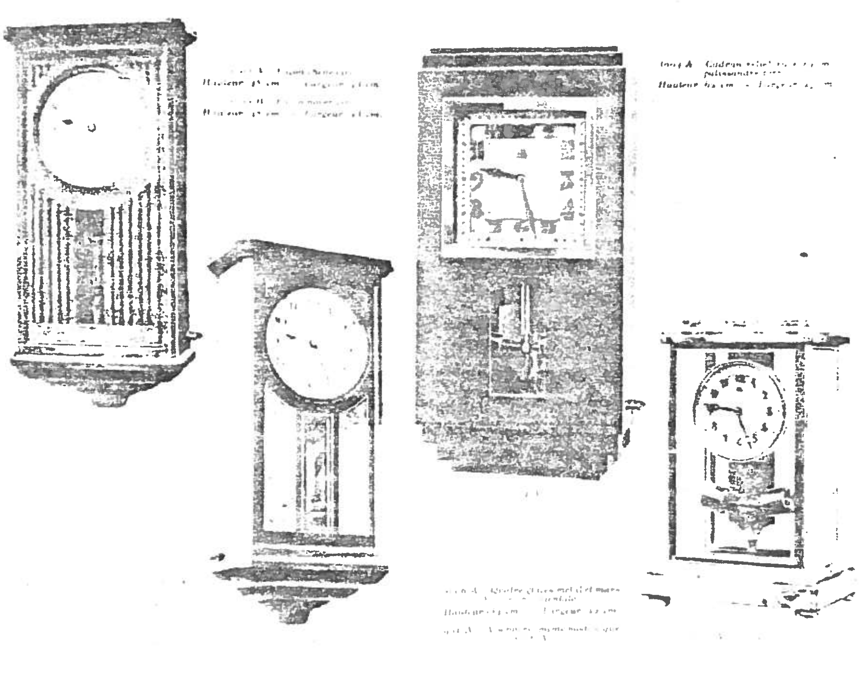


Figure 4

publicised both to the trade and to the public.

Having explained the operation using the quarter second movement as the example, the half second movement is used to illustrate the instructions as shown in figure 3 from a much folded and stained set that I found in one of my clocks. This half second version was frequently sold as a "regulator", having a second hand. Some examples of these are shown in figure 4, from the 1929 catalogue. I have not had the good fortune to find one of these yet and so I assume that they are scarce. I would value them between £100 and £150.

The number of models of all types increased rapidly; in 1924 four models were illustrated in the catalogue, thirteen in 1926, forty-nine in 1929, dropping to thirty-one in 1935. The two earlier catalogues state that they illustrate only some of the models available but I suspect that that was advertising licence. Figures 5 to 10 illustrate some examples from this period. Figure 5 shows a choice clock in a Lalique cast glass case. It is entitled "Les Mesanges" (the titmice) and was available in 1929 in two versions: with frosted glass dial or with white metal dial. The one illustrated is illuminated from within by two 6 watt, mains bulbs. It has a World War I commemorative sticker dated 1926 but I believe the clock dates from '28 or '29. Simply because of the origin of the case, a perfect example should fetch over £300. To my knowledge, five Lalique designs have been used for ATO clocks: "Les Coqs", "Les Moineaux" (the sparrows), "Aubépines" (hawthorn), "Dahlias", and "Les Mesanges". An attractive feature of many models of the late '20s and early '30s is the use of a silvered, figured dial with a beaten metal appearance. These can be seen in figures 6, 8 and 10. The octagonal cases of both models shown in figure 6 are of burr walnut with an inlaid pewter band. Both have silver plated bezels and dials but, whereas the smaller has gilt figures, the larger has silver figures in a blue enamel chapter ring. Both are c.1929, 6ins. and 7ins. high and should fetch £70 and £90 respectively. Figure 7 shows two small (5¾ins. and 4¾ins. high) models of burr maple veneer, the left-hand one with boxwood stringing. These I value at £50 and £40. Figure 8 shows an early use of celluloid as a case material. It is dark green with gilt painted lines. The dial is silvered with well gilt chapter square and numerals. It is 4ins. high and it can be seen that the case has warped slightly over the years (c.1930). Bakelite and Rhodoid were also used for case materials at that time. Because of the material it is worth between £50-£55. Figures 9 and 10 show two ugly examples of the ATO. The first is burr maple, boxwood and palisander marquetry, and the second is of marble, an inner square of an Indian red variety flanked by

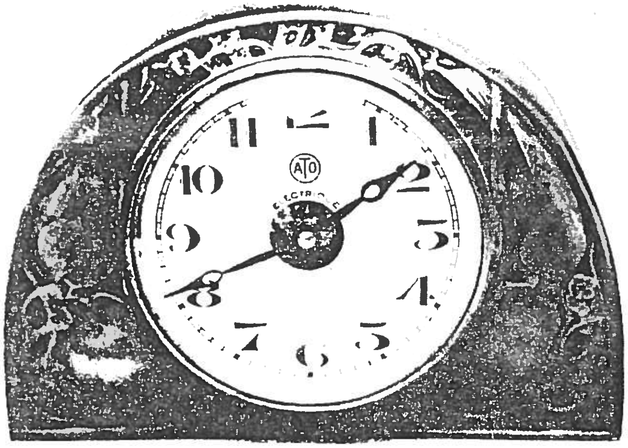


Figure 5

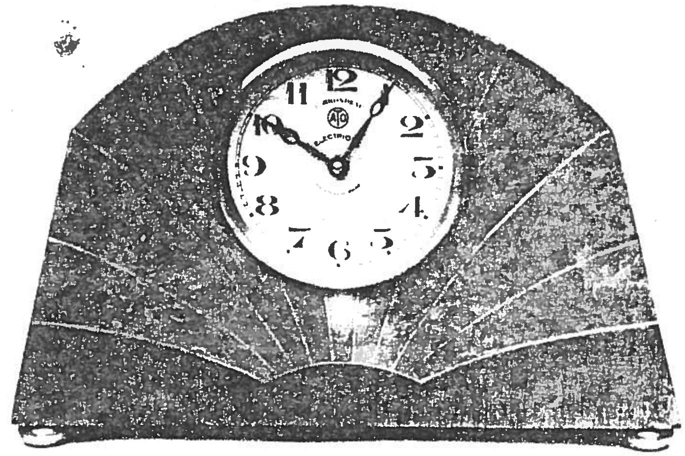


Figure 9

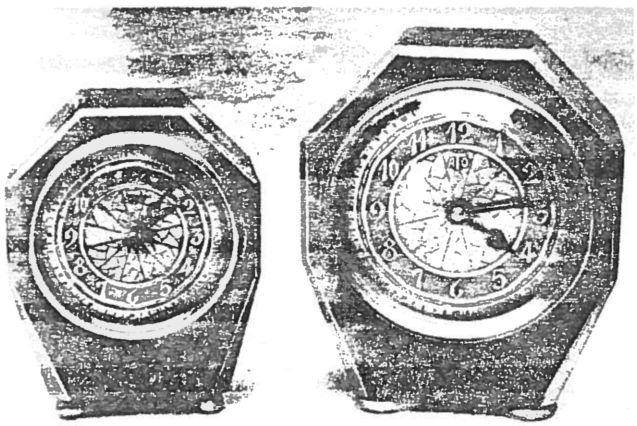


Figure 6

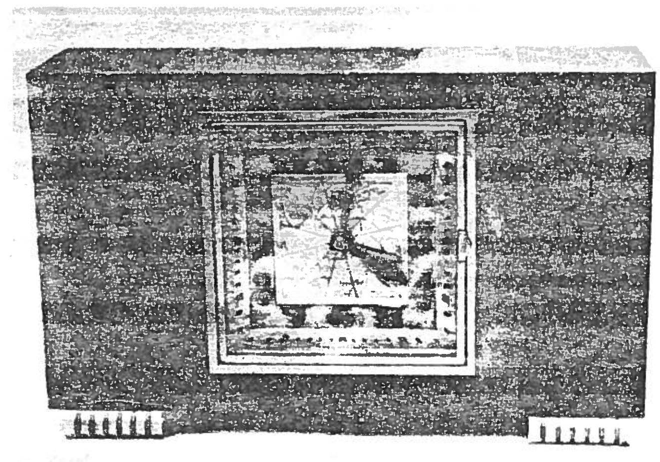


Figure 10

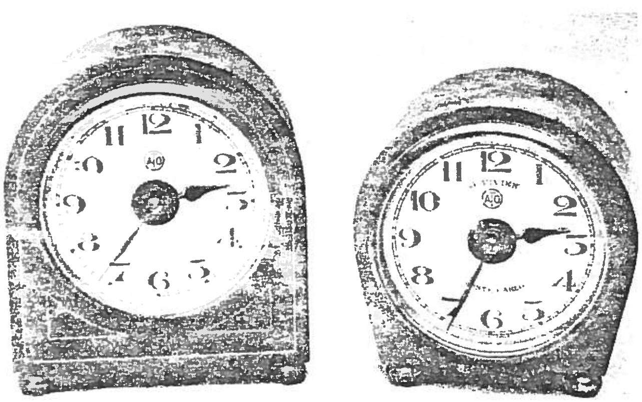
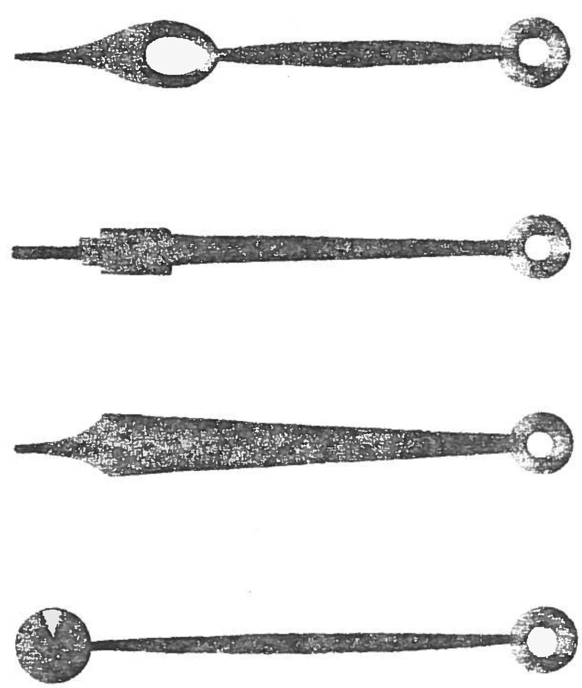


Figure 7



a

b

c

d

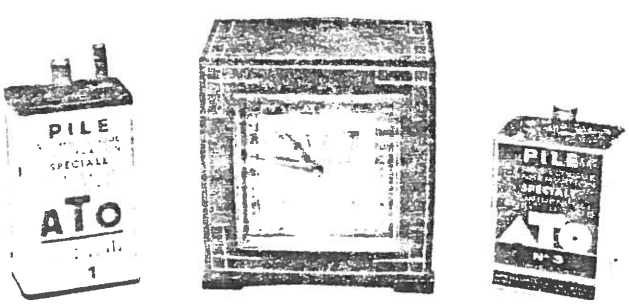


Figure 8

Figure 11

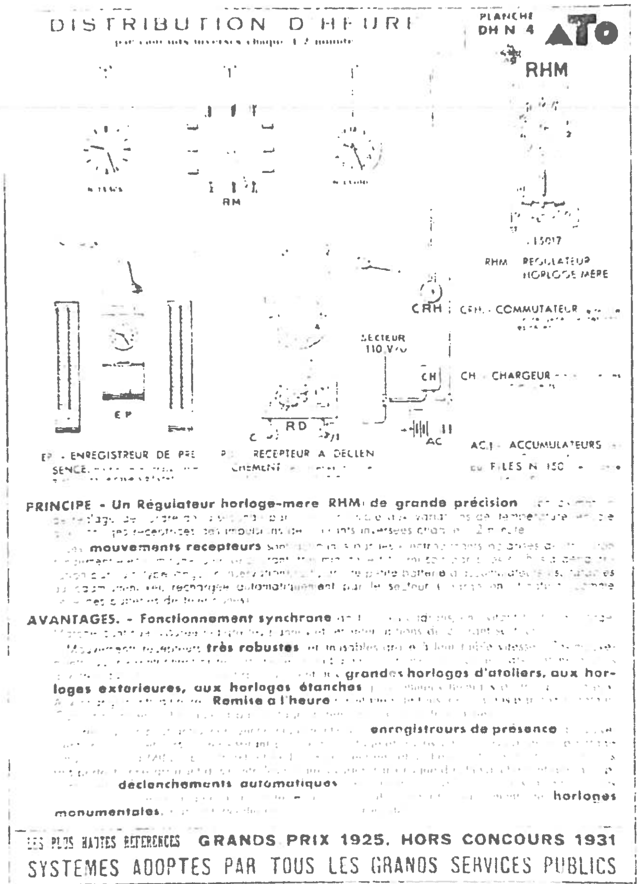


Figure 12

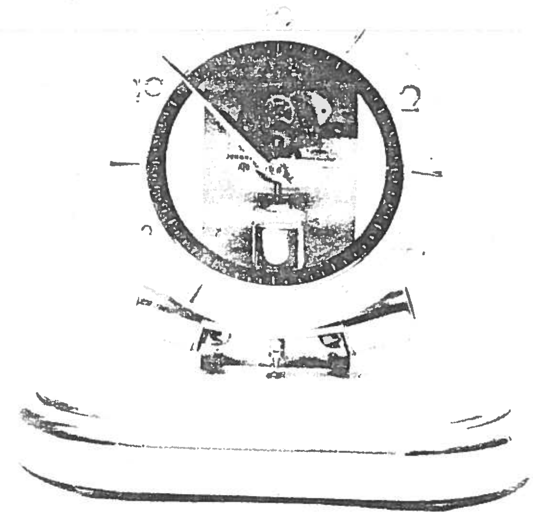


Figure 13

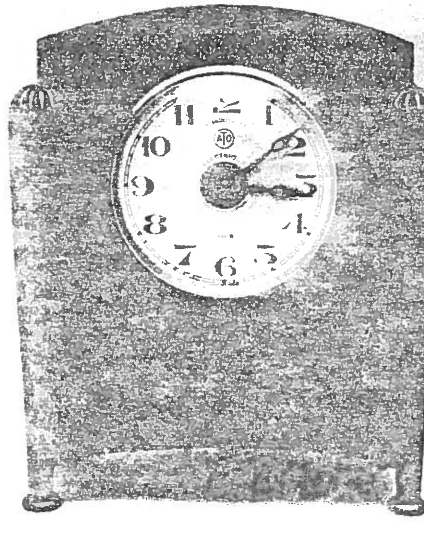


Figure 15

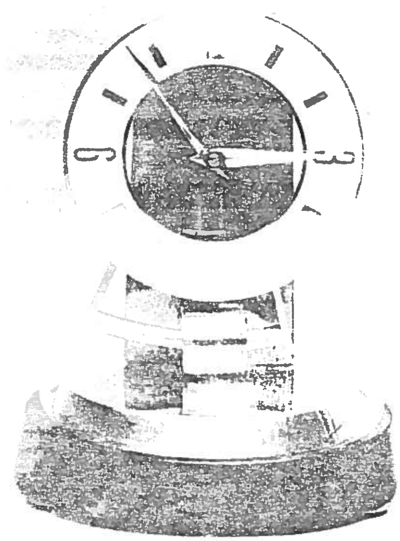


Figure 14

Belgian black edged with green cipollino. Both clocks are c.1929 and priced anywhere between £45 and £70, according to taste!

As might be expected, the style of the hands forms a useful guide to the age of the clock. I have illustrated some of these in figure 11. "Teardrop Breguet" (11a) were used on all the earliest models and on the quarter second ones until 1927. At that time, the half second models had the familiar spade hands. By 1929 the teardrop hands were only used on 12% of the models, being ousted by the stepped hand of 11b, with pointed baton (11c) running them a close second. By 1935, both of the earlier styles had virtually disappeared, to be replaced by parallel baton, pointed lozenge, and what I can only describe as "drumstick", or perhaps "dumbell" (11d). From 1937 onwards, baton and pointed baton have held sway.

Like BULLE, the mantel clocks have five feet. Three are functional and the other two, slightly smaller, are there only to make it look as if the clock has a foot at each corner.

The half-second clocks were used extensively as master clocks and were, in fact, adopted by SNCF Francais in 1928 which must have been a good advertisement for the marque. Figure 12 is from a 1948 document and gives a good idea of their adaptability for that purpose.

The design of ATO clocks changed little in the period covered by this article until the transistor was incorporated in 1954. This was the subject of world-wide patents and several firms in Europe and America made these clocks under licence. I do not have an Hatot made clock nor a good illustration of one of that year; however, figure 13 shows one made by Junghans which is very like the 1954 ATO model TR 3022. It has seven jewels which is a lot for an electric clock of this type, and has a one-third second pendulum with spring suspension. It is entitled "Junghans ATO, 7 jewels, Anticlimatic, Electronic". Its specially made battery was due for replacement in 1973 but is still going strong. A similar type is the Kundo illustrated in figure 14 which type was used in the 1977 "Electrifying Time" exhibition to illustrate the first application of transistors to clocks. As an early example it might be worth £40 to a collector. I make no apology for straying from the "antique" like this for it rounds off the ATO electric story and, I believe, illustrates some clocks that have already been ousted by quartz movements.

But for the final example I turn back to an earlier model in burr maple and ebonised wood c.1930. This is shown in figure 15 and should fetch about £100.

The story of Ets. Léon Hatot is far from finished as they are producing precision, domestic, and sports quartz clocks as well as monumental and floral clocks, amongst others. It is to them that I am indebted for much of the documentation on which this article is based.

MART

WANTED: Dome battery clocks in any condition. Send info., photo and price to, Thomas Hall, 404 Fourth Ave.N.,Mt. Vernon, Iowa, 52314. Photos will be returned.

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

WANTED: "Junker" early battery clocks, movements, parts, etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Marty Feldman, 620 Reiss Place, Bronx, NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

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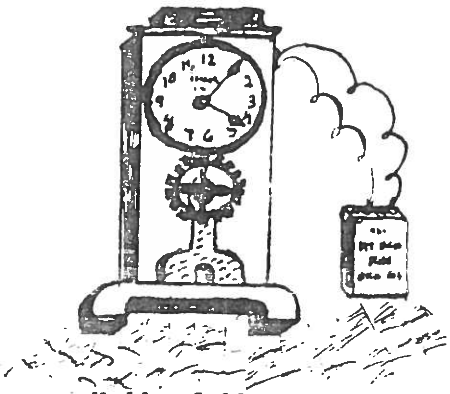

October, 1980
VOLUME VI---ISSUE #5
Martin C. Feldman, Editor

Hello fellow enthusiasts:

A new and very gratifying turn of events has come to pass in that what started as a local event here in the NY/NJ area has now been expanded considerably by the EHS members in the Chicago area; that is, local meetings of electrical clock people are taking place on a regular basis. The "Chicago Branch" of the EHS has now met a few times with the last meeting attended by approximately 40 people. The usual course of such meetings is a formal lecture and/or slide show followed by questions and answers and much socializing. It is during this time that problem clocks, swapping and other common activities of general Chapter meetings take place. However, the difference is that all the people at these meetings are particularly interested in our aspect of horology. The last New York meeting at Alan Marx's house was quite successful with 16 people attending (wives too!). A small business meeting was held since the officers of the organization were present with several conclusions: (a) material for the Chapter Section in the NAWCC Bulletin should be included in every Issue for interest and publicity, (b) more clocks should be brought to these meetings for discussion, (c) the Journal's content was supported and (d) enrollment of members must be continued if we are to survive financially. The "Chicago Branch" has been very active in signing up new members for which we are quite grateful. Our membership fluctuates between 95 and 120 people. The idea of Branches of our parent Chapter 78 is an excellent one indeed as opposed to forming new Chapters with the same purposes because of geographic distribution of members. If the latter were to occur it would surely destroy the parent organization as our present funding is just adequate to bring you the 96 pages of Journal per year. We are hoping to have local members in other areas of the country gather for meetings during the year as well. If other groups are meeting, please do let me know so that your work may be published. I have not mentioned names of the Chicago members responsible for these excellent meetings as I am sure to leave someone important out unintentionally. I would be very happy to include meeting notices, reports of meetings and/or any other pertinent material in future Journals if they are sent to me for this purpose.

This month I am very pleased to be able to offer you the complete ATO Repair Manual as published by Junghans. This will be printed in two parts and will hopefully become part of your permanent reference library. The manual was donated by David Vandor who is a partner in Antique Movements (see ad on MART page). We also have material for future Journals which has been donated by other members and will be printed as time and space permits.

cont.pg.12

JUNGHANS

ATO

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J U N G H A N S

A T O

Weak Current Clocks

Technical Description and
Servicing Instructions for
Single Clocks.

Revised Edition 1955

I n d e x

Illustrations are enclosed behind the last page.

P r e f a c e.

The present booklet contains important hints regarding the function, handling and repair of ATO Single Clocks.

A careful study of the following details will make it possible for everybody to understand the working and handling of ATO Clocks.

ATO Clocks of the type under discussion are technically very simple in respect of the clock as well as the switch mechanism.

The illustrations attached to these explanations will allow those people who are not or less conversant with electro-technical matters to adzquire the knowledge necessary for handling the clock parts important for the electrical functioning.

I General description of ATO SINGle Clocks.

ATO Wall and Bracket Clocks are weak-current clocks. Their pendulums are kept swinging by electrical impulses. The pendulum carries a permanent, bent rod-magnet (No. 1 of 1st illustration) of high-grade magnetic cobalt-steel. The

The north pole of this magnet is moving through the wire coil (No.3, also called Solenoid) which is fastened to the base plate (No.2). Such electric coils produce electro-magnetic fields when the electrical circuit is closed. This electro-magnetic field in turn attracts the rod magnet and the working of an ATO Clock is based on the simple principle that the electrical circuit of the coil (No.3) is closed every time the pendulum swings to the left. In this way the pendulum is given a little impulse which keeps it moving at the same time driving the motion work.

The main difference, therefore, between an ATO Clock and a mechnical spring-wound clock may be described as follows:-

An ATO Clock is driven by the pendulum, impulsed by the battery.
A mechanical clock drives the pendulum by means of the spring.

The movement of an ATO Clock may be divided into three components:

a) the pendulum receiving its power from an electro-magnetic coil

b) the wheel train and motion work transmitting the force from the pendulum to the hands

c) the switch mechanism effecting a short-time circuit every time the pendulum moves to the left.

II Description of the various components of an ATO Clock and their working.

a) The pendulum is suspended on a stud projecting from the mounting plate (No.2) by means of a flat suspension spring.
There are various lengths of these pendulums:-

1/3 second pendulum for small bracket clocks
2/5 second pendulum for larger bracket clocks
4/9 second pendulum for wall clocks
1/2 second pendulum for wall clocks.

The pendulum consists of: the suspension hook (to which is attached the pawl driving the motion work), the pendulum rod of a temperature resisting alloy, the pendulum weight (ensuring almost complete temperature compensating effects) and the bent rod magnet (No.1).

This magnet is moving through the two coils on the left and right-hand side of the mounting plate. The left-hand coil (No.3) contains the electro-magnetic coil whereas the right-hand coil (No.6) is a dummy.

When the pendulum moves to the left, the electrical circuit is closed and the pendulum is attracted. When it moves to the right, it is swinging through the dummy coil (No.6) thereby causing whirling currents (so-called Foucault currents) which are having a compensating effect on the pendulum swing.

The pawl fixed to the pendulum hook turns the star wheel by one tooth every time the pendulum moves to the left. Recoiling of this wheel is prevented by some sort of a click which at the same time acts as a switch lever, closing the electrical circuit.

b) <u>The wheel train and motion work</u> consist of the

- star wheel, complete with pinion (No.4),
- fourth wheel, complete with pinion (in some clocks this arbor carries the second hand),
- third wheel, complete with pinion,
- center wheel with cannon pinion,
- minute wheel with pinion,
- hour wheel.

The working of these parts is obvious, but it should be observed that the center wheel is actually the last wheel in the train and its position is not in the center of the plates. Looking at the movement from the source of power, i.e. the pendulum, the fourth wheel should be termed second wheel (second to the star wheel) etc. However, the common terms have been applied in order not to complicate matters.

c) <u>The switch mechanism</u> consists of the

- switch lever (No.10) with click or lifting roll (No.17), and platinum contact pin (No.9),
- hairspring (No.32) connecting switch lever with the back plate.
- gold contact springs (No.7),
- regulating piece (No.29),
- regulating screw (No25) running through a regulating counter piece with contact screw (No.8),
- metal piece carrying these parts and fixed to the back plate with insulating material.

The working of this mechanism is very simple once the principle has been detected:-

> As soon as the pendulum turns the star wheel, the switch lever is lifted to drop into the next tooth of the star wheel. This action effects contact between the platinum contact pin and the gold contact springs and the circuit is closed.
> This circuit runs from the plus pole of the battery to the gold contact springs (red insulated wire), from there to the platinum contact pin and through the hairspring to the metallic mass of the entire clock which is in turn connected with the leading-in wire of the coil. The leading-out wire of this coil runs directly to the minus pole of the battery (green or yellow insulated wire).

III The special Dry Battery.

The power behind every ATO Clock is a special dry battery of 1,5 volts. This battery is fixed either behind the mounting plate (No.2) or inside the base or at any other suitable place, and consequently these clocks are

<u>independent from the mains</u>

and therefore independent from failure of the general electric system and costly wiring etc.

The ATO Clock is also known by the name of "1000 Day Clock". In reality there have been many clocks with batteries lasting not only three years, but much longer without loss of its time-keeping qualities. Recent developments have made it possible to use batteries with a minimum of five years of useful service and such batteries will be supplied in future with all ATO Clocks.

Experience has shown that a premature exhaustion of the battery on account of inner deterioration does not occur, but careless short-circuit and faulty storage do damage it. Particularly any short-circuit does have harmful effects which should be avoided.

Therefore, when repairing ATO Clocks, please loosen the red insulated wire from the + pole of the battery before proceeding!

For the same reason all clocks leaving our factory are supplied without this wire being fastened. Please do the same when sending one of these clocks to your customers. And take care that the red insulated wire is connected to the + pole before setting the clock going. Otherwise, complaints that the clock is not working are unfounded!

New batteries can be supplied quickly upon request and other batteries should not be used. These cannot last as long as special ATO batteries as they are not made for highest storage capacity and smallest current consumption. We supply at short notice new batteries fresh from the factory to replace those run down.

The long life of ATO batteries is due to the very small current consumption and the adjustment of the inner battery-resistance to the coil-resistance of the ATO Clock. In fact the position is such that for driving the pendulum, the consumption of current remains below the loss of energy resulting of deterioration in storage. Consequently any battery will last as long as its storage life lasts no matter whether it is in use or stored away.

IV Checking of Voltage.

Very important!

It is necessary to check the voltage when repairing an ATO Clock to establish quickly a likely fault and, indeed, this is to be done first. In theory the battery has a voltage of 1.5 Volts, in reality the voltage of new batteries after storage of a few months is 1.46 - 1.4 Volts. The battery keeps this voltage practically for the remaining part of its life time. The drop in voltage will be eventually so rapid that the timekeeping of the clock will not be influenced before, but the clock will be stopping altogether.

Illustration No.2 demonstrates the drop of voltage graphically on the basis of observations carried through over a long period. Even if not every battery shows such a favourable curve, this is no exception either.

For checking the voltage no soft-iron but a turning-coil instrument should be used with an inner resistance of at least 500 Ohm/Volt to achieve correct results and to prevent any damage to the battery. On a Voltmeter the clips are marked + and -. The plus clip of the instrument is to be connected to the + pole of the battery and the minus clip to the - pole for measuring the voltage.

Measuring is best done when the circuit of the clock is closed, i.e. the battery is left in its position inside the clock, the switch lever being slightly lifted to establish the contact required. When contact is established and the battery has to supply current to the coil, then a further momentary drop of the voltage may occur on older batteries. For this reason measuring the battery in action will furnish the best information on the condition of the battery. On new or little used batteries a difference in measuring with or without contact being established is not recognizable.

It is essential that on measuring older batteries a voltage of 1.3 Volts is available. Only then it can be used any longer. The lowest limit for a realiable performance is 1.1 Volt. There are Voltmeters with several measuring ranges and Universal Volt and Milliamperemeters. These instruments have several clips, namely one common minus clip and diff. plus clips for the various measuring ranges for instance 6, 12, 30 Volts etc. and 6,60 Milliamperes etc.

For measuring ATO batteries the smallest measuring range has to be applied; as a rule 6 Volts.

Illustration No. 3 demonstrates how the voltage is measured. It also shoes how the wire of the instrument is applied to the clips of the battery. When measuring the voltage, the pendulum is to be moved by hand to and fro, so that contacts are not established too frequently and quickly. It should then be observed what v. difference of voltage is indicated on the instrument.

When results show that the battery is in order the fault must be somewhere else on the mechanical part of the clock or some contacts have to be cleaned. On very rare occasions the fault may be due to a defective coil.

If a suitable Volt or Milliamperemeter is at hand, the current can also be measured, and this not exclusively for ascertaining the current consumption, but to detect also a faulty working of the contacts or a defect on the coil etc. For this purpose the Milliamperemeter is switched in line on to the circuit of the clock as shown in illustration No. 4.

Then the pendulum is to be moved slowly by hand to close the circuit. At that moment the current consumption should be as follows:-

with 1/2 sec. pendulums about 0.6 Milliamp.
with 2/5 sec. pendulums about 0.8 Milliamp.
with 4/9 sec. pendulums about 0.7 Milliamp.
with 1/3 sec. pendulums about 1.0 Milliamp.

If this is not the case or if no current is being consumed at all, it can be concluded that either the contacts are bad or else the coil is defective. However, to make quite sure where the fault is, the contacts may be short-circuited by a piece of copper wire. If the instrument indicates a flow of current under these conditions, the contact that has been short-circuited is definitely faulty and should be cleaned or replaced (see also page 7).

In order to obtain a sufficiently large indication of the instrument the smallest possible measuring range has to be applied. In the example of illustration No. 3 the smallest range is 6 Milliamperes, but there are also Milliamperemeters with a range of 1.2 Milliampere, and this would be better still.

We repeat:

<u>For measuring voltage</u>:

Voltmeter to be switched parallel to the circuit connecting the wires of the instrument to the battery clips.
Measuring range = 3 Volts or 6 Volts (illustration No.3)

<u>For measuring current consumption</u>:

Switch Milliamperemeter in line or in series with circuit of the clock.
Measuring range = 1.2 or 6 Milliamperes (illustration No. 4)

V Insulation of the wires.

This is done correctly and checked at the factory. On repairing a clock it is to be watched that the insulation has not been damaged. The following connections and contacts are to be checked when there is no current consumption: Screws (No.8), (No.12) and (No.15), clip screws on the battery (illustration No.1) and fixing point of the current-carrying hairspring (No.32), also the tight fitting of this hairspring collet (illustration No.6).

VII Suspension spring and fastening of the pendulum during transport.

The suspension spring which directly influences the regulation has to be treated with special care. For this reason there has been added a protection against twisting. The pendulum of ATO Clocks is not packed separately as is usual with spring-driven clocks, but fixed with a special screw. This screw is used on some types of clocks not only for fixing the pendulum, but also for controlling purposes when the clock is being levelled out or hung up exaxtly vertically (illustration No.1). In such cases the screw (No.22) is put in the hole (No.24) of the pendulum point and screwed into the stud (No.23) of the base plate for transport whereas it is put as illustrated when the clock is to be set going. (Please refer to the instruction attached to every clock). The fastening of the pendulum is necessary on account of the pawl, the set position of which in relation to the star wheel must not be altered. The suspension spring has to be absolutely in a first-rate condition and the pendulum must not roll when swinging. If the suspension spring is cracked, it has to be exchanged against a new one. Damaged suspension springs cause a cracking noise; the accurate regulation of such clocks is practically impossible and the clock may stop altogether.

VII Oiling.

All ATO Clocks leaving the factory are well oiled and reoiling on arrival at destination is not recommended for the beginning. Later-on an oiling of the pivot holes in the movement must be carried out with the finest watch oil only. The pivots of the star wheel arbor must not be oiled heavily, otherwise the oil will run along the arbor and get to the star wheel (No.4). In course of time this would produce on the star wheel teeth - together with the fine brass dust rubbed of - a sticky mess, and the lifting roll (No.17) would no longer drop regularly.

A t t e n t i o n!

Not to be oiled are any of the contact parts (Nos.7,9), the pawl (No.5), the star wheel teeth (No.4) and the lifting roll (No.17).

The noise of an ATO Clock has naturally another rhythm than on mechanical clocks and is due to the co-ordination of pawl (No.5), star wheel (No.4) and lifting roll (No.17).

VIII Regulation of the ATO Clocks.

ATO Clocks are supplied with varying pendulum lengths, namely

a) 1/2 second pendulum (wall Clocks - long case form)
b) 4/9 second pendulum (Wall Clocks - modern case form)
c) 2/5 second pendulum (Wall Clocks - round and square shape and Bracket clocks)
d) 1/3 second pendulum (Bracket Clocks)

The ATO Clocks, when hung, installed and handled properly, achieve a time-keeping accuracy owing to its well-constructed technical system as cannot be obtained from any other electrical or mechanical single clock on an average of this price class. This applies in particular to the ATO Clocks with 1/2 second pendulum and this clock is being used by many clockmakers in place of a standard precision clock. Further, it is possible to supply ATO Clocks as Master and Signal Clocks with dependent Slave clocks for which please refer to the special catalogue.

The final regulation has to be done at the destination of every clock as various factors have to be considered such as for instance magnetism of the earth, ironmasses in the vicinity etc. which play an important part. Once the clock is definitely regulated on its final spot, timekeeping remains constant. Irregularities can arise only when in the neighbourhood large iron pieces such as steel safes, iron-concrete wall or strong magnetic fields like radios, ventilators etc. are to be found and especially when they are subject to changes in their position and strength. In the circumference of 1 m of a clock, there should thus be no large iron masses and no electrical apparatus with strong magnetic fields whatever. Irregularities in timekeeping naturally develop when the battery is nearly exhausted or after many years the contacts have become dirty.

********** TO BE CONTINUED **********

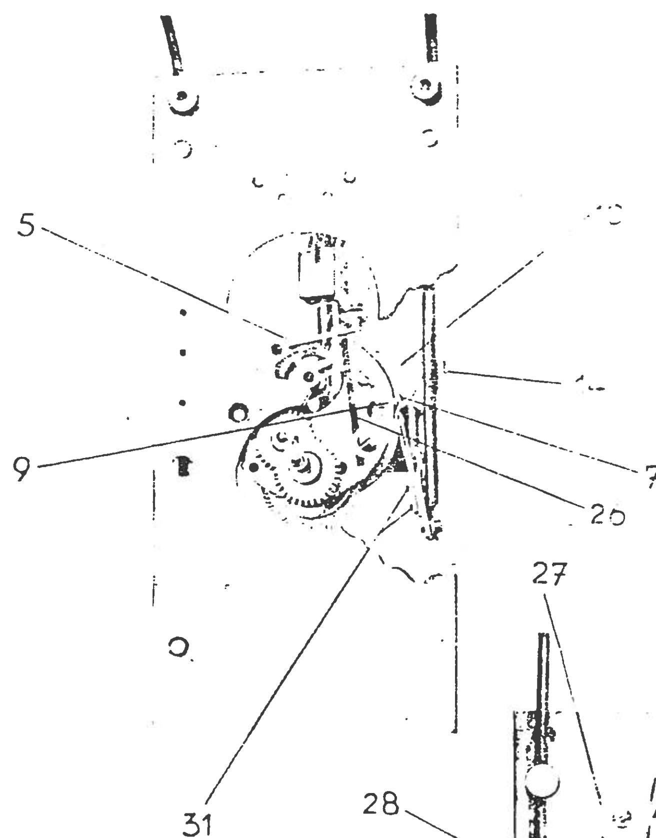

Fig. 5

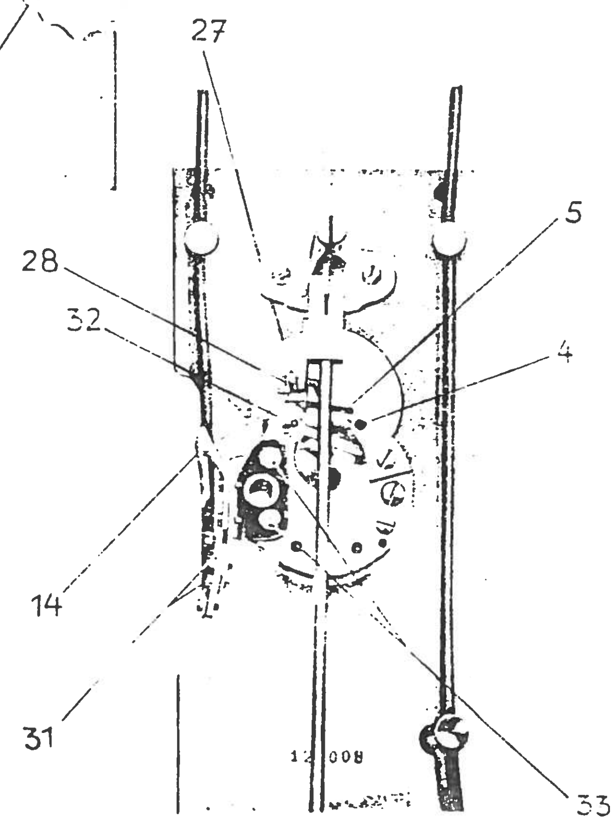

Fig. 6

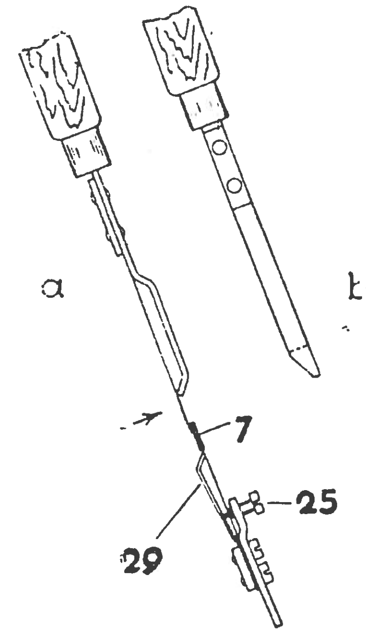

Fig. 7

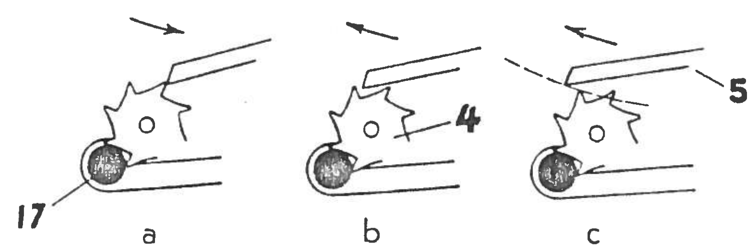

Fig. 8

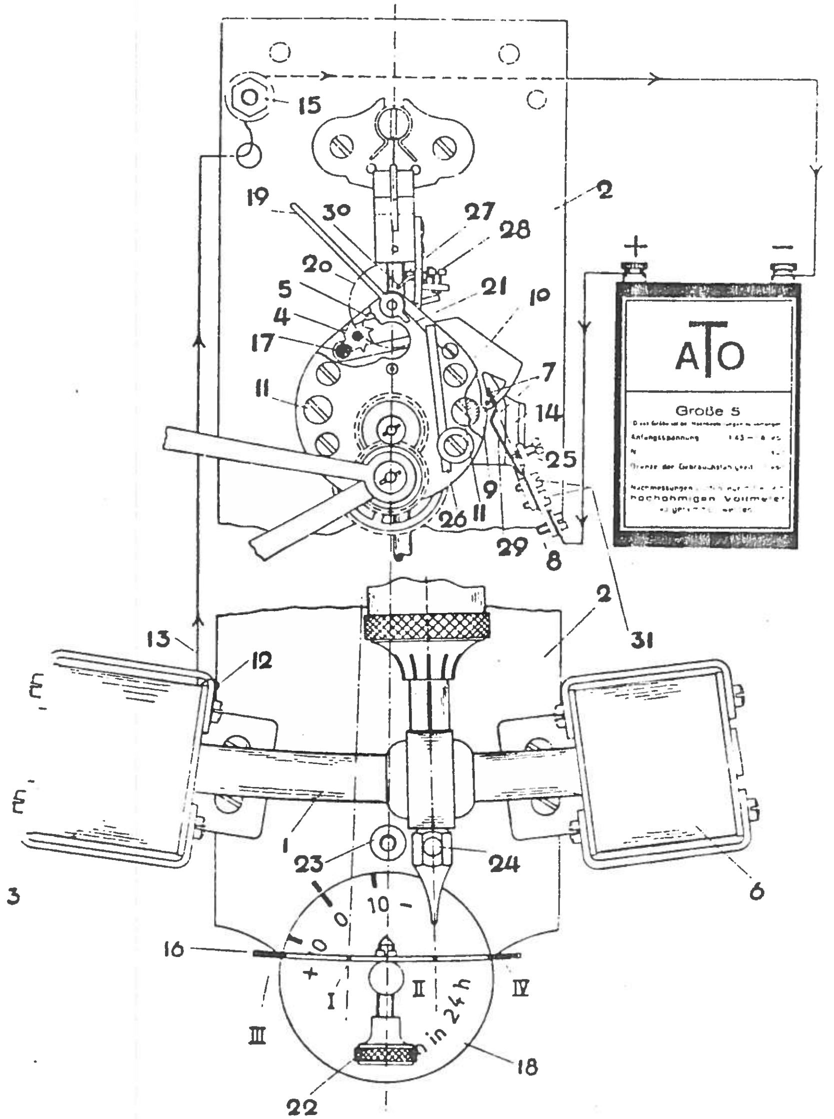

Fig. 1

Mittlere Partie der Grundplatte (2) nicht dargestellt. Ober- und Unterteil dieser schem. Darstellung zusammengerückt, um die Funktionsteile groß darstellen zu können.

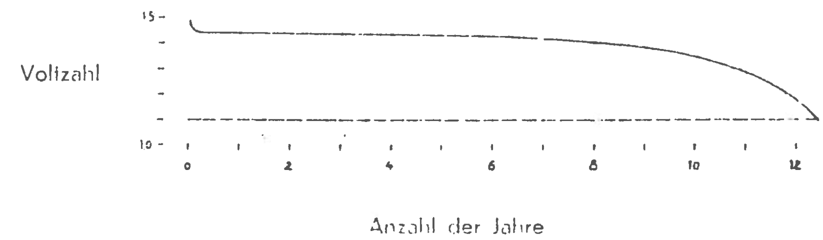

Fig. 2

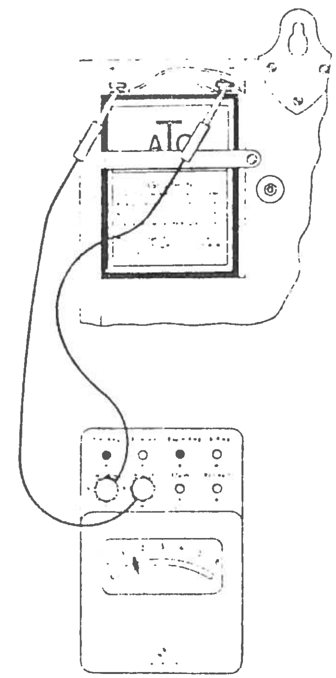

Fig. 3

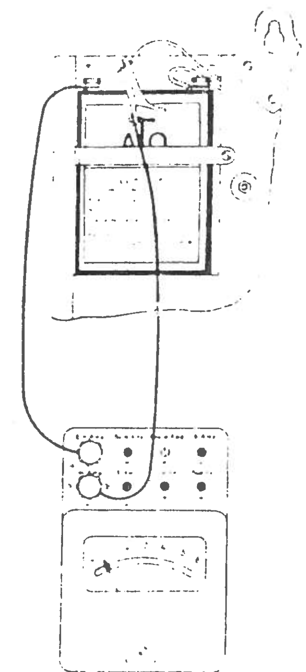

Fig. 4

MART

FOR SALE: N.Y. Standard 80 Beat Clock-$250, American Clock Co. 2 Arm missing parts--Cherry Case $200, Standard Electric Master Clock 7 Pilots & Separate Program, Invar Pend. $550.
Harvey Schmidt, 75-80 179 St.Flushing,NY 11366-(212) 969-0847

WANTED: Standard Elec.Master Clock the same as shown in Fig.447 of Std.Elec. Time Systems Bulletin #22 & EHS Journal April 1980 i.e. Master Clock with 4 pilot dials and two four circuit program clocks in base.
R.Stirnkorb,1670 Eolus Ave.Leucadia, CA.92024-(714)239-7251 or 753-1360, call collect.

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

WANTED: "Junker" early battery clocks, movements,parts,etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Marty Feldman,620 Reiss Place-7E.,Bronx,NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK REPAIRS USING ORIGINAL PARTS. One month maximum time for all repairs. Martin C. Feldman

ANNOUNCEMENT:
Power supplies to meet your needs will be custom built-upon request describing same. Please write your needs and enclose an SASE for reply.
Martin Swetsky,1910 Coney Island Ave.Bklyn,NY 11230

FOR SALE: "ANTIQUE MOVEMENT" Brooklyn's Finest Clock Shop. Always has a selection of electromechanicals for your viewing. Call David Vandor (212) 252-9032

* * * * * MART CONTINUES ON PAGE 13 * * * * *

cont.from Pg.1

All in all we look forward to the 1981 publication year as being another year where we shall be able to bring you much needed information in the form of repair manuals, diagrams, patents and original articles dealing with electrical horology. It is coming close to the end of our fiscal year which is December 1980 and membership renewals at $10 a member will become due. Our Treasurer, Charlie Roth, 2 Circle Lane, Roslyn,NY 11577, would not be overwhelmed and very pleased to receive renewals at this time rather than at the last minute. For reasons beyond our control our last Journal and this one has been and will be mailed later than usual--for which we apologize. We also regret the typographical error in the August Journal which stated "August 1979" as opposed to August 1980. If you care to, please make the appropriate date change on your copy.

Enjoy this Issue!

Electromagnetically yours,

Marty Feldman

Martin C. Feldman,FNAWCC

CHICAGO SECTION FORMED

We are pleased to hear that John Cammarata has formed the Chicago section of Chapter 78, EHS. There have already been three meetings. He himself has given a talk on Battery Operated Clocks, Joseph Borrell spoke on the StrombergTime System and John Harrison from England has given a presentation on the Eureka Electric Clock. These three meetings have been very well attended and I understand the meetings were very interesting and informative.

Mr. Cammarata was instrumental in picking up eight new members in the Chicago area. The well attended meetings that he organized showed that Chicago has a strong interest in Electrical Clocks as does New York. I am sure other areas could well follow John's example and could organize their own area meetings. Anyone interested in organizing a local section should let me know and we will put a notice in the next Journal.

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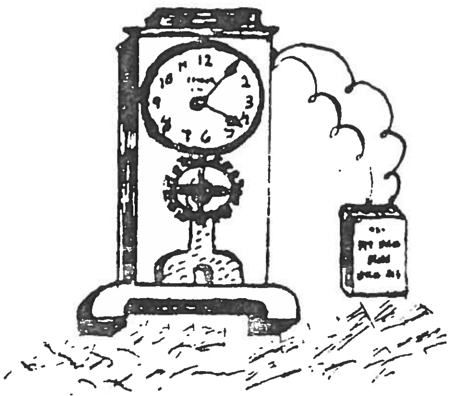
MART CONTINUED

The JOURNAL OF THE ELECTRICAL HOROLOGY SOCIETY

Chapter No 78



December, 1980
VOLUME VI---ISSUE #6
Martin C. Feldman, Editor

Hello fellow enthusiasts:

This Journal comes to you on the heels of the October Journal in our efforts to complete Volume VI by the end of 1980. As many of you know two people, Charlie Roth and myself, and a small staff bring you the Journal six times per year. Sometimes it is just not possible to coordinate all of our efforts in this regard.

This month we complete the ATO Manual lent to us by David Vandor. In addition we are beginning Part #1 of the IBM Manual which was kindly donated by Joseph J. Singer. For those of you who are interested in dating your IBM and Simplex clocks, the enclosed information will be invaluable. Parts and diagrams of same for the master clock movements will follow in subsequent Journal (s). Leon O'Briant has sent us a copy of the #2730 ST Burgess battery cover. This is enclosed for those of you who wish to make up a battery pack for your Tiffany Never-Wind clocks. Leon claims he found this in an old clock and perhaps this is what the original battery (or one almost original) looked like.

Our fiscal year draws to a close officially with this Issue!! In order for us to continue we must have dues sent to Charlie Roth, 2 Circle Lane, Roslyn,NY 11577 in the sum of $10 made out to EHS. We wish to thank those who have already renewed and encourage most strongly those who still have yet to send in their renewals.

On behalf of the Officers and myself may you all have a Happy and Healthy Holiday Season and New Year.

Enjoy this Issue!

Electromagnetically yours,

Marty Feldman

Martin C. Feldman, FNAWCC

Further, it is important for good time-keeping that the ATO Clock is hung up or installed in places that are free from vibration. Best are brick walls. Any walls made of wood or pressed plates as they are used in emergency for partitions or tables not standing firmly are to be avoided.

The regulation of ATO Clocks is effected as usual by means of the pendulum weight which can be screwed up or down. At the lower end of the pendulum weight of the 1/2 second pendulum 10 partition lines are marked; these correspond as follows:-

1 partition line = 6 sec. per 24 hours

1 complete turn of the pendulum weight = 60 seconds per 24 hours (this applies to all ATO Clocks)

On ATO Wall Clocks with 1/2 second pendulums there are fixed below the pendulum (Illustration No.1) on the base plate (No.2) magnetic regulating disks (No.18) for final regulation. These disks are used when the daily differences are below 10 seconds per 24 hours and they can be turned whilst the clock is going.
The effect of the regulating disk is about equal to adding or removing small weights on standard clocks with second pendulums. The regulating disk shows an inscription from which the amount of the necessary turn can be taken. The pendulum rod consists of a nickel-steel combination with small expansion capacity. In addition, the pendulum weight is almost completely temperature compensating so that practically differences in tim-keeping through variations in temperature are impossible.

The center or excentric second hand (on clocks with 1/2 second pendulums) can be turned while the clock is going without recoiling effects, but not too quickly and in clock-wise direction only. The minute hand of all Single Clocks can be turned backwards or forwards at will while the clock is going.

As is to be seen from illustration No. 1, on some clocks the excentric second hand (No.19) is not on the fourth wheel but on a separate second-hand wheel (No.20) meshing with the star wheel pinion. This arrangement has been developed for large dials in order to have a clear second-hand figure circle. A thin spring of steel wire eliminates a possible tooth-shake. The second-hand arbor is running between two jewels. A chamfering in the bushing of the front jewel makes it possible to take this out to clean the bearing.

IX Practical instructions for cleaning or exchanging contacts.

The contact arrangement has been ingeniously constructed. Suitable precious metal alloys are used to insure a minimum of wear and tear. The daily number of contact touches is very large as one contact touch per second means

60 x 60 x 24 = 86 400 contact touches per day
86 400 x 365 = 31,5 millions contact touches per year.

Considering the small current respectively the switch capacity of 1.5 Volt/ 0.6 Milliamp., it is clear that only the best metal contacts can guarantee a long-term working condition of these contacts. Even thin layers of oxidation, caused for instance by hand perspiration, may produce a transmission resistance large enough to interrupt the electrical circuit.

Experience has shown that the contact arrangement is adequate. After a service of many years it is likely that contacts get dirty or that there has been wear and tear, so that the clock may no longer function properly. In rooms which are damp and in which are acid vapours or air rich with ozone - for instance x-ray rooms of hospitals - contacts may become dirty more rapidly so that a repeated cleaning is required. For such rooms we also supply steamproof ATO Clocks for which please look up our special catalogue.

For explaining the contact cleaning we have to refer to 2 further illustrations in addition to illustration No. 1, namely No. 5 and 6. These show front and back of an ATO Clock movement and - in contrast to illustration No.1 - for 2/5 and 1/3 second pendulums without second hands.

In order to examine the contacts, it is essential first to unscrew the clock movement from the mounting plate to which it is connected by two pillars after hands and dial have been removed. The two gold contact springs on the movement are slightly raised with pincers and the contacts are looked at with a magnifier. If not much dirt or wear is to be seen, then cleaning can be done without unscrewing the contact pins. Take a fine hairbrush, dip it into cleaning fluid and clean several times the small platinum contact pipe (No.9) on the switch lever (No.10) and the gold contacts (No.7, illustration No.5).

Should there be considerable dirt or wear, it is better to unscrew the gold contact springs by loosening the two screws (No.31). If deep incisions in the contact surface can be seen after cleaning, then the contact springs have to be replaced by new ones, and if it is a clock that has been in service for more than 10 years, it is advisable to do this in any case.

The small platinum pipe (No.9) need not be replaced, it is to be turned only so that an unused part gets in touch with the gold contacts. This small platinum pipe is pressed onto a pin and for turning same lift the pipe slightly with a knife and after turning press it up to the lever again.

After cleaning the platinum and gold contacts these are polished with a fine clean leather or with eldermark. For unscrewed gold contact springs it is best to use a clean leather file.

After polishing the contacts they are on no account to be touched by hand so as to keep hand perspiration away.

X Special care is to be exercised on the following Points when the mechanical parts of an ATO Clock movement are checked.

1) When the lifting roll (No.17) is in its normal position and the two gold contact springs are resting against the regulating piece (No.29) the distance between the platinum pipe and the gold contacts must be 0.2 - 0.25 mm.

2) The gold contact springs (No.7) have to have a pressure of 0.5 to 0.6 g against the regulating piece (No.29). The pressure can be checked with a simple spring power controller which can be had from us or can be made by yourself. It is illustrated in No.7 a & b. This spring power controller is gauged so that the thin steel tongue (made of suspension spring steel or similar material) does not stand off the support when loaded with 0.5g at the very end. At a load of 0.6 g this tongue has to stand off from the support.

Illustration No.7a shows how the spring power controller is laid onto the gold contact spring for meauring. It is held on the small wooden shaft and pressed against the two gold contacts in direction of the arrow as indicated on the illustration. When the contact is set correctly, the gold contacts (No.7) and the steel tongue of the spring power controller have to stand off at the same time from their support. Illustration No.7b shows a view from the front.

3) The gold contacts (No.7) themselves must not lay directly on the regulating piece; only the spring on which the gold contacts are fixed are to rest against this support. Raising the platinum pipe with the switch lever, you have to see that both gold contacts touch the platinum pipe at the same time, i.e. the current must flow from the platinum pipe through both gold contacts at the same time. This is to be well observed and it is to be checked with a magnifier.

4) The small platinum pipe should not touch the gold contacts in their center but slightly below to prevent overbanking of the switch lever during transport.

5) The contacts, the lifting roll, the star wheel teeth and the pawl are on no account to be oiled.

6) The current-carrying hairspring (No.32) at the back of the movement (illustration No.6) must not be bent. There must not be any contact between the hairspring and the contact spring carrier (No.14) which is insulated against and fastened on the back plate as otherwise there will be a permanent circuit.

7) The current-carrying hairspring (No.32) must be well pinned and tightly fixed to the stud so that there is a good electrical connection. The hair-spring is not only to ensure a reliable electrical contact, but it also adds to the weight of the switch lever pressing the lifting roll (No.17) against the star wheel (No.4). The amplitude of the pendulum swing can be influenced by altering the tension of this hairspring.

8) The pawl (No.5) on the pendulum has to drop reaily and easily when it is raised up to the banking pin (No.30)

9) The little steel spring (No.26) fixed to the front plate serves to press the switch lever arbor slightly to one side to absorb any end-shake of this arbor which would be detrimental.

10) Damaged suspension springs are to be replaced. On clocks with such springs the pendulums do not show a proper swing or produce cracking noises at every swing.

11) The screw (No.27) serves to set the pawl (No.5) in such a way that the lifting roll (No.17) drops straight when the pendulum point on its swing to the left (illustration No.1) is on the partition line I of the scale (No.16), see also illustration 8b. With screw No.28 the depth of the pawl drop is regulated. On the advance of the pendulum the pawl (No.5) must hardly touch any more the tooth that is moved, it must be exactly beyond. All the teeth are to be tested so that onone is slightly out of shape (illustration 8c)

12) On the return swing of the pendulum to the right the pawl (No.5) has to drop on the highest tooth at the moment where the pendulum point passes partition line II of the scale. Illustration No.1 demonstrates this moment. (Please also refer to illustration 8a). The arrows in illustrations 8a and 8b and 8c show the direction of the pendulum swing.

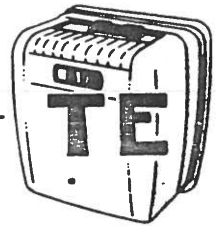
Instructions for installation of ATO Clocks are enclosed with every clock leaving the factory.

****
****

SEND YOUR DUES OF $ 10.00 IN CHECK FORM MADE OUT TO : EHS , c/o Charlie Roth, 2 Circle Lane, Roslyn, New York, 11577

IT'S THAT TIME OF YEAR AGAIN!! SENDING YOUR DUES IN NOW ASSURES YOU OF CONTINUING YOUR MEMBERSHIP IN CHAPTER 78- the ELECTRICAL HOROLOGY SOCIETY AND YOUR MEMBERSHIP MEANS THE SOCIETY WILL EXIST AND WILL BRING YOU ITS SIX JOURNALS PER YEAR.

Customer Engineering



PARTS CATALOG

TYPE 25

MASTER CLOCK

The following instructions are for the use of the reference letters and numbers in this catalog. Careful adherence to them will assure your receiving the parts you need.

All assemblies are indicated by an alphabetical character enclosed in a circle. The individual parts of the assembly are indicated by a reference number. These are listed in the index in alphabetical and numerical sequence by reference number for each figure.

When an assembly is listed, for example "B"; All parts that are listed between "B" and "C" are component parts of "B". This breakdown shows clearly just what component parts assembly "B" includes.

Therefore, care should be taken when ordering an individual part of an assembly to make sure it can be readily used. If a question exists as to whether this component part can be used, then the assembly should be ordered.

Parts listed under the heading, "Parts not shown on sub-assemblies", are individual parts that are used on the final assembly of the machine and are not shown in any sub-assembly drawing.

NOTE: Basic names are used exclusively in indexing.

Endicott, N. Y.
May 2, 1955

15. The alphabetic suffix shown on page 4 and which is included on the serial number plate for all equipment, is to be shown when reporting serial numbers on orders and other papers pertaining to exchange or trade-in allowances.

ALLOWANCES ON NON-SIMPLEX-IBM PRODUCTS

16. Allowances as shown herein will apply to a maximum of, and shall not exceed 30% of the total purchase price of new equipment.

MAXIMUM ALLOWANCE SCHEDULE ON NON-SIMPLEX IBM PRODUCTS

Age of Equipment Traded-In	Current Price of Equipment Traded-In				
	$101-$150	$151-$200	$201-$250	$251-$300	$300 Up
Less than —					
1 year	$ 35.00	$ 50.00	$ 75.00	$100.00	$125.00
2 years	25.00	35.00	50.00	75.00	100.00
4 years	20.00	25.00	35.00	50.00	75.00
6 years	15.00	20.00	25.00	35.00	50.00
8 years	11.00	15.00	20.00	25.00	35.00
10 years	10.00	11.00	15.00	20.00	25.00

On all Non-Simplex-IBM Equipment of the types described in Paragraph 1, ten years of age or over, or without serial numbers, the maximum allowance will be $10.00.

17. A token allowance of $10.00 including stations and keys on all competitive and obsolete Simplex Watchclocks is allowed.

TO DETERMINE AGE OF IBM RECORDERS

512,000	Shipped during December 1936
536,000	Shipped during December 1937
556,000	Shipped during December 1938
585,000	Shipped during December 1939
608,000	Shipped during December 1940
649,000	Shipped during December 1941
685,000	Shipped during December 1942
713,000	Shipped during December 1943
734,000	Shipped during December 1944
767,000	Shipped during December 1945
825,000	Shipped during December 1946
884,000	Shipped during December 1947
935,000	Shipped during December 1948
*999,000	Shipped during December 1949
90,000	Shipped during December 1950
164,000	Shipped during December 1951
251,000	Shipped during December 1952
344,000	Shipped during December 1953
440,000	Shipped during December 1954
535,000	Shipped during December 1955
610,000	Shipped during December 1956
655,700	Shipped during December 1957
680,000	Shipped during December 1958
730,000	Shipped during December 1959

GENERAL INFORMATION

Beginning with shipments for the year 1940, the following plan of adding alphabetical suffixes to the serial number was instituted to indicate the months of shipment:

A — January	D — April	J — July	M — October
B — February	E — May	K — August	P — November
C — March	H — June	L — September	S — December

In addition, the following alphabetical code is added to identify the year of shipment:

A—1940	F—1944	K—1948	P—1952	U—1956	Y—1960
B—1941	G—1945	L—1949	R—1953	V—1957	Z—1961
D—1942	H—1946	M—1950	S—1954	W—1958	
E—1943	J—1947	N—1951	T—1955	X—1959	

The following illustrates the use of the two codes for identifying the MONTH and YEAR shipped:

January, 1955	AT	March, 1956	CU
February, 1956	BU	April, 1957	DV

* (Machine Serial No. 999,999 shipped December 1949. New number started with 10,000 January 1950.)

TO DETERMINE AGE OF SIMPLEX RECORDERS

Starting in 1944, all units manufactured carry a month and year identification on the voltage or name plate. This states model, serial number with a dash line with digits to indicate month and year. i.e. BCG 49536 249 would mean February of 1949 was time of manufacture.

In 1954 the month and year code was changed from digits to letters. First letter is MONTH, second letter YEAR. i.e. Model 62JFA No. B-9781/FB; F denotes June; B year 1955.

A — January	D — April	G — July	J — October
B — February	E — May	H — August	K — November
C — March	F — June	I — September	L — December

A — 1954	E — 1958	I — 1962	M — 1966	Q — 1970
B — 1955	F — 1959	J — 1963	N — 1967	R — 1971
C — 1956	G — 1960	K — 1964	O — 1968	
D — 1957	H — 1961	L — 1965	P — 1969	

Starting in 1959, former IBM Type Equipment manufactured by Simplex has "S" preceding serial number.

REF. NO.	PART NO.	PART NAME
A	34757	LOCK ASSEMBLY
		FLUSH TYPE CABINET
B	59901	HINGE ASSEMBLY
		INCLUDES SCREWS
C	66531	POST ASM-BASE AND
D	72707	LOCK ASSEMBLY
		SURFACE TYPE CABINET

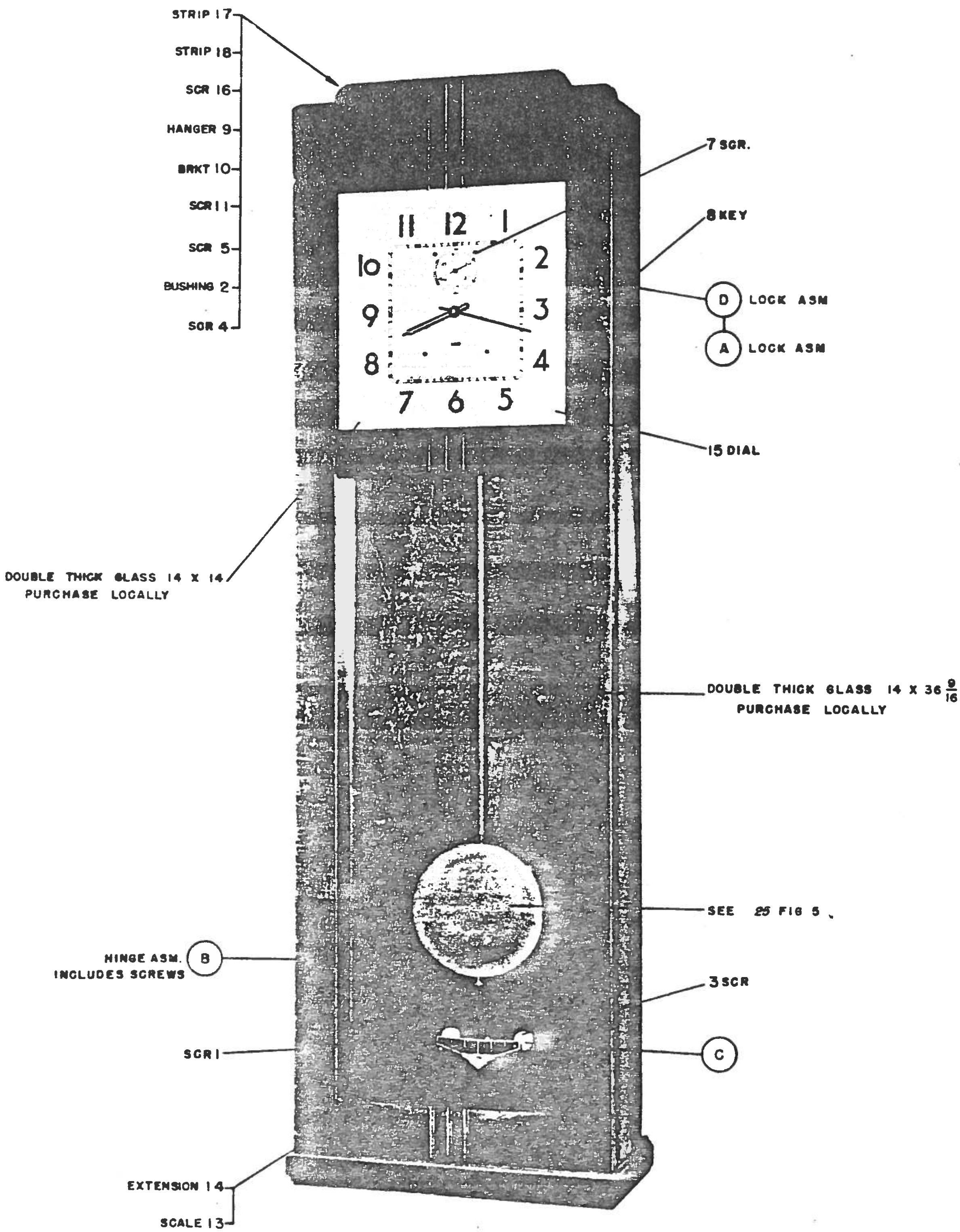
REF. NO.	PART NO.	PART NAME
		PARTS NOT SHOWN ON SUB ASSEMBLIES
1	2627	SCREW-3-48 1/8 FH
2	32678	BUSHING-PORCELAIN
3	38598	SCREW-#3 3/8 RWS
4	38616	SCREW-#6 3/4 RWS
5	38642	SCREW-#10 1 3/4 RWS
7	48594	SCREW-4-40 1/8 BH
8	55593	KEY
9	56257	HANGER

REF. NO.	PART NO.	PART NAME
		SURFACE TYPE CABINET
10	59309	BRACKET-ANGLE
		FLUSH TYPE CABINET
11	59746	SCREW-#14 2 1/2 RWS
13	66533	SCALE-PENDULUM
14	66534	EXTENSION-PEND SCALE
15	72829	DIAL
16	80257	SCREW-#1 1/4 RWS
17	91892	STRIP-TERMINAL
18	91893	STRIP-MARKER & INSUL

25 FIGURE I

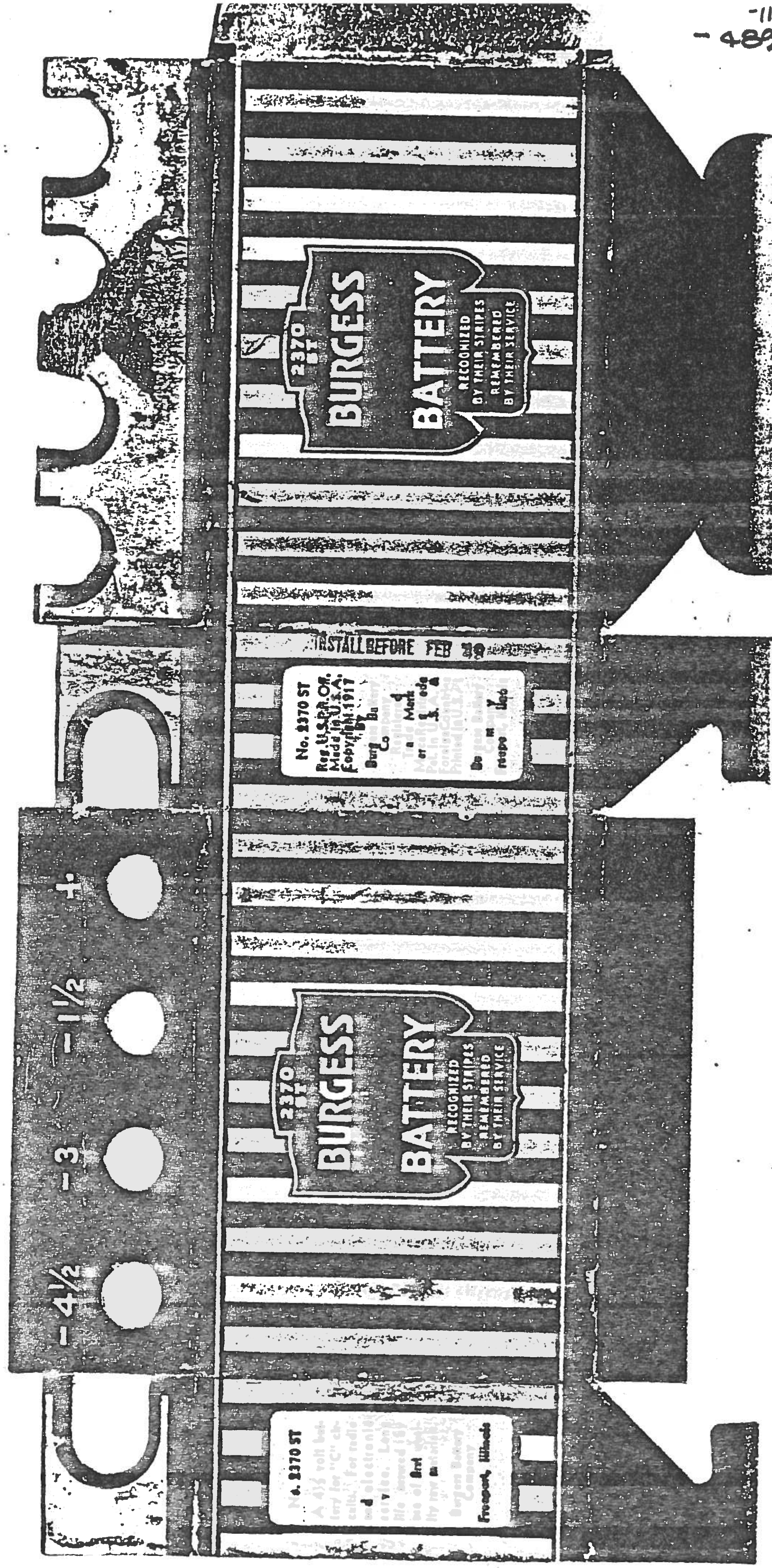
-9-

COVER VIEW



PRINTED IN U.S.A.

25 FIG. 1


2370 ST
BURGESS
BATTERY
RECOGNIZED BY THEIR STRIPES
REMEMBERED BY THEIR SERVICE
INSTALL BEFORE FEB
No. 2370 ST
-4½
-3
-1½
+
No. 2370 ST
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MART

FOR SALE: "ANTIQUE MOVEMENT" Brooklyn's Finest Clock Shop. Always has a selection of electromechanicals for your viewing. Call David Vandor (212)252-9032

WANTED: "Junker" early battery clocks, movements, parts,etc. Send details and $ wanted. ELECTRICAL CLOCK LITERATURE for possible reprinting in our Journal. Send to Martin Feldman, 620 Reiss Place-7E.,Bronx, NY 10467

WANTED: Electrical Horological Literature of any type. Martin C. Feldman

REPAIRS: ALL EARLY BATTERY CLOCKS including Pooles, Barrs, Tiffany Never-Winds, Eurekas, etc. SPECIALIZING IN BULLE CLOCK REPAIRS USING ORIGINAL PARTS. One month maximum time for all repairs. Martin C. Feldman

WANTED: Standard Elec.Master Clock the same as shown in Fig.447 of Std.Elec. Time Systems Bulletin #22 & EHS Journal April 1980 i.e. Master Clock with 4 pilot dials and two four circuit program clocks in base. R.Stirnkorb, 1670 Eolus Ave.Leucadia, CA. 92024-(714)239-7251 or 753-1360-call collect.

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

ANNOUNCEMENT:
Power supplies to meet your needs will be custom built-upon request describing same. Please write your needs and enclose an SASE for reply. Martin Swetsky, 1910 Coney Island Ave.,Bklyn,NY 11230

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FOR SALE: Early Synchronome clock (Pre WW II) in fine restored oak case, 30 Sec. contact for slave, one second invar rod plus 15 lb. pendulum bob; running--$1000 plus shipping (packing free). Also Rare Gents Pulsynetic English Master $1200.00 Both in G.R.O.
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FOR SALE: 28 P. instruction booklet for Gents' Pulsynetic, $10.00 postpaid. Several Pulsynetics, Synchronomes, and other foreign and domestic electrics for sale.
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