Leaflet 185a.

HINTS FOR USERS.

PUL-SYN-ETIC

IMPULSE CLOCK SYSTEMS

PENDULUM TYPE

GENT & CO. Ltd., Faraday Works, LEICESTER

PUL-SYN-ETIC ELECTRIC

HINTS FOR USERS OF

PUL-SYN-ETIC

Electric Impulse Clock Systems,

Pendulum Type.

Do not imagine there is anything difficult about maintaining Electric Clocks. Anyone who can fix an electric Bell can maintain the " PUL-SYN-ETIC " System—only, do not think you know more about Electric Clocks than the makers.

Some people think " Any old thing " will do, and it won't. If a Clock System stops some people get annoyed, and rightly so, because there is no need for any such stoppage, if simple instructions are carried out with intelligence and particularly with care.

(1).—The outlines below give diagrammatically the arrangement of the Circuit, and it will be seen that all Clocks are connected in simple series. Incidentally it shows all the necessary Apparatus that goes to make up a Modern Impulse Clock System. Transmitter, Clocks, Warning Bell, Battery and Circuit Wiring.

Whatever the source of Power, whether Battery, Accumulator or Service Mains be employed, it may be found connected anywhere in the Circuit. A large number of Clocks may be also in the Circuit.

All ordinary Impulse Clocks, whether large or small, whether near to or distant from the Transmitter, or the source of Supply, take the Standard Current of 0.22 ampere.

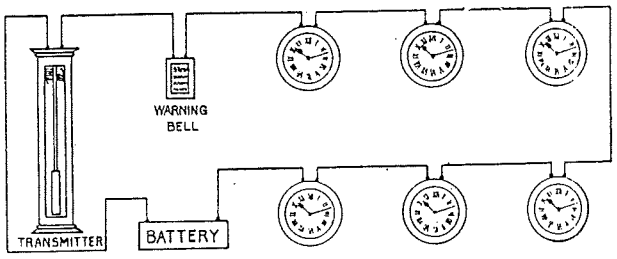


Diagram No. 506.

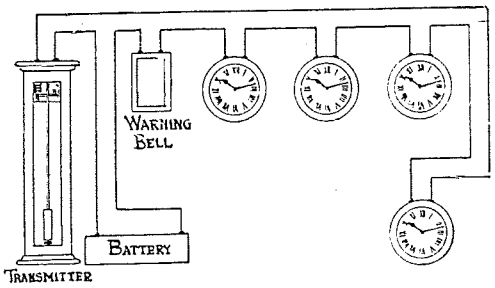


Diagram No. 507.

THE CIRCUIT.

(2).—As all the Clocks are in series, in case of trouble see that the Circuit is complete and free from intermittent and other faults. A broken wire or a cut wire is sometimes but seldom the cause, although workmen have been known to cut wires, not appreciating they were the Clock Circuit.

(3).—*Loose Terminals are often the cause of any intermittent faults that do occur. This may be due to vibration. Test with a screw-driver and see all Terminals are quite tight and contact good. Appearances are often deceptive.*

(4).—See that the Battery is all in order and that a current is " always there " and that at each half minute 0.22 ampere is supplied to the Transmitter, and that this current goes round the Circuit.

(5).—*The Standard Current Impulse is of such short duration that an ordinary Ammeter is useless unless the Contacts of the Transmitter are " made " for a definite time while the Ammeter is read. Remember this when testing.*

TANGENT

(6).—If the Circuit is suspected as faulty, test the wiring in the usual way with a Megger or with a Galvanometer.

1. Test for continuity of the Circuit, from the Transmitter round and back to the other Terminal of the Transmitter.
2. Further test all Conductors to earth. A leak often causes trouble.
3. Remove the wire from the most distant Clock and test between Conductors. Remember if Auto Cut Outs are used in the Installation precaution should be taken accordingly.

(7).—An intermittent fault will sometimes cause some Impulse Clocks to gain as well as some to lose, if present it may be most difficult to locate. See every joint is soldered. Look particularly to the Terminals of Battery. The Zinc Terminal also is often carelessly left as a " Dry Joint."

(8).—Where Power Mains are used without an Accumulator, the Current may have been cut off temporarily, and if Carbon Lamps are used as a Resistance, an intermittent fault is sometimes found in the Lamp-holder Plungers. Remember such Contacts may carry a current for an Electric Lamp that will not pass the smaller Impulse Current used by the Clocks.

(9).—*If all Clocks suddenly gain several minutes, it is not likely the Pendulum has altered its beat, so look to the Transmitter and read Paragraph 28.*

Test of Circuit by the Transmitter.

(10).—Don't at once blame the Transmitter. See the Circuit is complete ; when so proved, and not till then, consider the Transmitter.

The Transmitter may be a great help in ascertaining the condition of the Clock Circuit. Therefore, scrutinise the Transmitter carefully without touching the Pendulum or interfering with the Machanism and note carefully.

(11).—See if the Gravity-lever has been " thrown up " and is definitely on its Catch. If it has been, then the trouble is probably not due to faulty circuit or lack of current, but to the Pendulum not having sufficient energy to drive the simple Half-minute 'Scape Wheel, perhaps owing to sticky oil.

(12).—Watch carefully the movement when the Pendulum is swinging normally (and is not unduly actuated as by hand), and see that it is capable of so swinging that well over a tooth is taken at each swing. See also that the Back-stop Click falls easily and cleanly into its place. See that the Slot is clean in the Pendulum Rod, and that the pin of the Crutch that engages it is free and not sticky. If thick oil trouble is present—Cleaning and re-oiling is the remedy. See paragraphs 30 and 32.

(13).—An intermittent fault in the Clock Circuit may be the cause of the trouble, the Gravity-lever being " thrown up " but not regularly every half minute. Therefore, pull the Repeater-cord and watch carefully with the Pendulum swinging normally. Note the Contact pieces but don't alter their adjustment.

(14).—If the Gravity-lever is not " thrown up " back on to its Catch and no current manifests itself, then the trouble is probably due to the Battery being absolutely exhausted, or to a broken or faulty Circuit. See paragraph No. 23.

THE TRANSMITTER. How it operates.

(15).—It must be appreciated that the Pendulum of the Transmitter is kept in vibration by mechanical impulses imparted to it at half-minute intervals by the Gravity-lever.

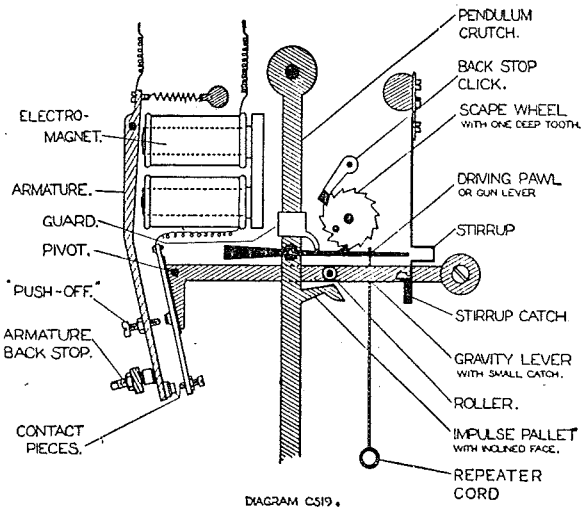
This is provided with a Roller which rolls down the Inclined Face of the Impulse-pallet, thus giving the Pendulum-crutch a gentle push.

This push continues until the Contact pieces meet when the Electro-Magnet is energised by the flow of current.

The Armature is attracted and at once replaces the Gravity-lever on to its Catch. Meanwhile the Impulse Clocks which are connected in circuit with it and the Battery, are advanced half a minute.

The action is brought about in the following manner:

The Pendulum-crutch in vibrating with the Pendulum carries with it the Driving-pawl which pushes around the 'Scape-wheel tooth-by-tooth. The Back-stop Click prevents its backward movement.



At each complete revolution of the 'Scape-wheel (which occurs every half-minute), the Driving-pawl engages the Deep Tooth and its right hand extension, instead of passing through the Stirrup, engages the Stirrup-lever Catch just above the Stirrup, pushing the Catch to the right and releasing the Gravity-lever.

The Roller drops on to the Dead Face of the Impulse-pallet, then runs down the Inclined-face, giving it an impulse. Contact is then made as above described for the dual purpose of operating the Impulse Clocks and replacing the Gravity-lever.

(16).—*Don't attempt to adjust the Contact-pieces unless worn by very many years of operation, or unless they have been interfered by someone.*

Modern Transmitters are sent out with the adjustment screws treated with white enamel so that it is apparent if any attempt has been made to adjust them. Read carefully paragraph 33.

(17).—**REGULATING THE PENDULUM.** It is necessary that the regulation of the Pendulum be accomplished when it is permanently fixed in position.

If the system gains time, stop the Pendulum so long as necessary, and slow the Pendulum by turning the graduated rating nut of the " bob " to the left.

If the system loses time regulate the Pendulum to go faster by turning the graduated rating nut to the right.

The rating nut is clearly marked with degrees, each of which is approximately equal to one second per day.

In addition, the top of the Pendulum " bob " is dished to receive weights by which most minute regulation can be and should be effected.

(18).—**ADVANCEMENT OF ALL IMPULSE CLOCKS.** Hold down the Repeater-cord provided in Transmitter. The extension of the Driving-pawl then engages the Stirrup-catch at each vibration of the Pendulum.

(19).—**TRANSMITTER DIAL.** *Remember that any dial fixed in the Transmitter Case is, after all, merely an Impulse Clock, and is not worked directly by the Transmitter mechanism any more than other Impulse Clocks in the circuit, and as it is not sealed up, it may more easily have been interfered with.*

PUL-SYN-ETIC ELECTRIC.

THE TRANSMITTER. Examination

(20).—In the event of a complete stoppage do not disturb anything until an examination has been made to ascertain—

(*a*) If the system has stopped for want of current, or—what is equivalent—through a temporary disconnection of the circuit, or

(*b*) If the Transmitter has stopped because of a mechanical fault, such as undue friction in the mechanism or a derangement or breakage.

If through (*a*), it will be seen that the Gravity-lever has been disengaged from its Stirrup-catch, and that the roller of the Gravity-lever rests on the Pallet—Electrical contact not being made. This position of the Gravity-lever shows that its release has been properly effected, but that the Magnet has not been energised, and if it is found that the Battery has not failed, an intermittent fault or a complete break must be looked for. An intermittent fault which would break the Circuit for a minute or so would be quite sufficient to cause the vibration of the Pendulum to fall below that minimum which will permit Electrical contact to be made, and consequently cause the Pendulum to stop.

(21).—If through (*b*), it will be seen that the Gravity-lever will not have been disengaged from its Catch, and, incidentally, the deep tooth of the 'Scape-wheel will not have travelled to the disengaging position, and if no derangement is apparent, the Transmitter should be examined in relation to the following points :—

(22).—See the case is firmly fixed at the head, and, consequently, the Pendulum is not liable to vibrate the case. The Transmitter must be so fixed that it is impossible to rock the head of the case by grasping same with both hands.

(23).—See that the Battery power is sufficient, and consequently the Pendulum is not checked at each half-minute by having to assist in the action of lifting the Gravity-lever. Proof of insufficient Battery power is shown when the Gravity-lever is not replaced until the Pendulum assists the lifting action. See paragraph 27.

This may be due to resistance in Circuit through, say, a bad joint, insufficient Battery power, or a bad state of the Battery.

(24).—Check that the Case is fixed plumb. Two small studs are fixed on the front of the Transmitter Case, one at the top and one at the bottom, also two studs at the left-hand side of case, and these must register with a plumb line.

See that the Pendulum is placed in " right way." The polished side must be towards the observer.

(25).—The end of Driving-pawl should fairly engage the supporting catch (when its Click enters the deep tooth of 'Scape-wheel), and consequently should not " fail occasionally " to effect the half-minute release.

If obstructed by dirt in deep tooth, remedy is obvious. If no obstruction exists, bend up the end of the Lever a trifle, but see that it is quite clear when it is in the shallow teeth.

(26).—*The dead face of the Pallet must normally swing under, but must not touch the roller. The pin at the bottom of the Crutch must be quite free in the slot of the Pendulum, and must be oiled only with clock oil.*

The Driving-pawl (gun lever) must be quite free. It is sometimes found that it oscillates stiffly, and does not, therefore, engage the 'Scape-wheel.

The Crutch must swing quite free, and must be bent forward a little if found to rub on the Gravity-lever.

(27).—**WARNING BELL.** A Battery may have sufficient strength to operate the Transmitter and the Impulse Clocks, and yet not "throw up" the Gravity-lever properly. The current may "come on" and the Magnet still may not be able to do its duty until the Pendulum swinging to the right aids it by means of the Impulse-pallet.

Fig. C8.

This fact is taken advantage of in sounding a Warning Bell. Normally the Hammer in this tries at each impulse, but, has not time to strike the Gong. With the longer interval caused by a weak Battery, the Hammer strikes the Gong each half minute until the Battery is renovated or completely exhausted, which latter happens very soon if no attention is given.

(28).—**ALL CLOCKS SUDDENLY GAIN.** This is probably due to the Gravity-lever being raised, but not held by the supporting catch. This may be due to :—

The Battery being very weak, with the result that the Gravity-lever is not lifted sufficiently high, and it falls back again on the Contact, thus causing a repetition at each swing of the pendulum, or

Through maladjustment, electrical contact may be broken far too soon, and before the Catch is reached. See paragraph 34.

Some slight mechanical adjustment of the Catch may be necessary. Its spring may be weak, or the felt pad which cushions the upward movement of the Gravity-lever may come into operation too soon. some slight adjustment of the Catch will generally obviate the trouble.

Only when the Transmitter has been actually disarranged should the Contact-pieces be adjusted as a remedy.

The Transmitter. OILING.

(29).—It must be remembered that this Mechanism is really a Clock and only Clock Oil may be used under any circumstances, and even this very sparingly. A piece of wire with a flattened end, about 18 Gauge, forms the best oiler.

(30).—*Use only finest clock-oil, obtained from a watchmaker, or use typewriter oil. Ordinary oil is fatal.*

All Pivots of the Mechanism must be oiled, one drop only for each pivotted part or pin on which such parts turn. The oiling must be carried out methodically, otherwise pivots are missed. Reach through the frame from the front to oil the back pivots.

(31).—Before oiling anything, any dirt seen in teeth of Scape-wheel must be removed. Dirty oil must also be wiped away from the pivots and parts, and for this use a clean duster free from fluff.

(32).—See that the pin working in the slot in Pendulum is oiled, also the tip of the Stirrup-catch and the small catch on Gravity-lever.

The pin on which the roller turns should be carefully oiled, but not the face of the roller or the Impulse-pallet on which it rolls, these surfaces must be *quite* clean.

PUL-SYN-ETIC ELECTRIC.

ADJUSTING TRANSMITTER.

(33).—**N.B.—Don't " monkey " with the Transmitter adjustments.** They were carefully made before despatch, and it is most unlikely any adjustment is required even after years of working.

These instructions are only issued for use in cases where the adjustments are required through prolonged wear, or in cases of interference.

(34).—All adjustments of the Armature and the contacts commence from the correct position of the Armature in relation to the Magnet, therefore press the Armature flat and square against the poles. Next unscrew the Electrical Contact Screw and the Push-off Screw clear of everything, and while holding the Armature in contact with the poles, screw up the Push-off Screw until its point lifts the Gravity-lever Catch on to the Stirrup-catch. Next screw in the Electrical Contact Screw to such a position that its point parts company with the Armature Contact, when the Gravity Catch is within $\frac{1}{16}$-in. of engagement with the Stirrup-catch.

This is best done with " the current on," and it will be convenient to control the upward movement of the Gravity-lever by hand to see in what position the Gravity Catch is when the " break " takes place.

Lastly, adjust the Armature Back-stop Screw against which the Armature rests until there is exactly $\frac{3}{16}$-in. space between the contact points when the Gravity-lever is at rest on the Stirrup-catch and the Armature is at rest against its Back-stop Screw. The Armature return spring should only be strong enough to return the Armature to its position of rest with a " prompt " movement. If this spring is abnormally strong it is obviously acting unduly against the Magnet.

(35).—The dimension of $\frac{3}{16}$-in. applies to Transmitters in which the Contacts are situated $2\frac{3}{4}$-in. below the pivot of the Gravity-lever. In the case of Transmitters of an older pattern, in which the Contacts are $1\text{-}\frac{3}{4}$in. below the pivot of the Gravity-lever, the dimension in question must be $\frac{1}{8}$-in. only.

If a reliable open-scale ammeter shows that the Gravity-lever is lifted (without assistance from the Pendulum) at a lesser current value than 0.17 amp. an air gap must be given between the Armature and the Magnet when the Armature is in the attracted position. This necessitates the screwing in of the Electrical Contact Screw and the Push-off Screw and the unscrewing of the Armature Back-stop Screw, so as to get the adjustment results described.

Be sure and tighten all lock nuts.

(36).—The felt pad which checks the upward movement of the Gravity-lever should come in operation just after the Gravity-catch has engaged the Stirrup-catch. In other words, there should be just a little shake between the felt pad and the Gravity-catch.

(37).—When the " electric contact " adjustments have been made, the Pendulum and escapement must be set in beat as follows :—Hang the Pendulum in position and see that the Crutch-pin is free in the slot of the Pendulum and is oiled. The meeting of the Electrical Contact Screw and the Armature Contact when the Pendulum is swinging to the left, and the release of the Gravity-lever when swinging to the right, must take place at equal positions of Pendulum respectively on each side of zero. Reduce the arc of vibration to the point at which test can be made. Finally, the Scape-wheel must be set in beat, and this " set " must be such that both the Driving-pawl and Back-stop Click, just drop equally in position with the miminum swing.

Adjust this by moving the suspension spring of Pendulum along and re-tightening the hexagon gripping nuts.

The Back-stop Click is made adjustable also for this adjustment.

THE IMPULSE CLOCK.

(38).—All Impulse Clocks contain a Step-by-Step Mechanism similar to that illustrated at Fig. C9. When this is fixed in a case without exposed Terminals, two studs are provided at the bottom of the Clock front so that individual Clock can be " shorted " if fast, and advanced by means of a Dry Cell if slow. The studs are a precautionary arrangement to avoid the necessity of taking the Clock down in case adjustment of the clock hands is found necessary. To advance all the Clocks together, see paragraph 18.

(39).—The Movement is set with an Ammeter in Circuit by the Makers, and it is essential that an Ammeter be used when any adjustment is made, and that the Movement will operate with a current of 0.12 amp. This must be measured with care.

Any re-adjustment made without the precaution of an Ammeter will only end in future trouble. The Re-adjusted Impulse Clock may operate on the Current as supplied by the Transmitter, but if for any reason this falls very slightly, then the misadjusted Clock again fails.

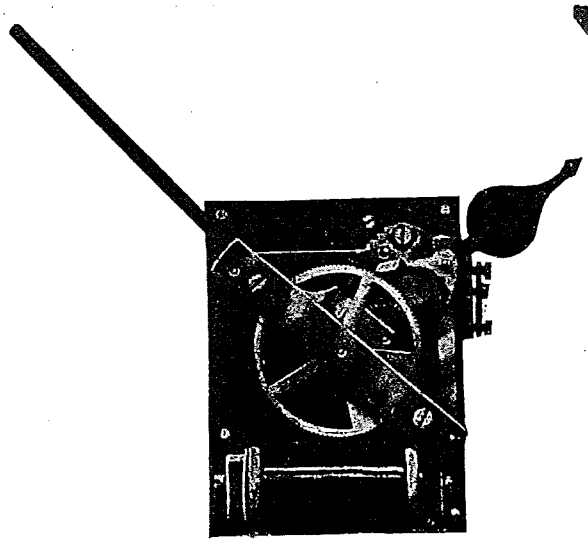


Fig. C9.

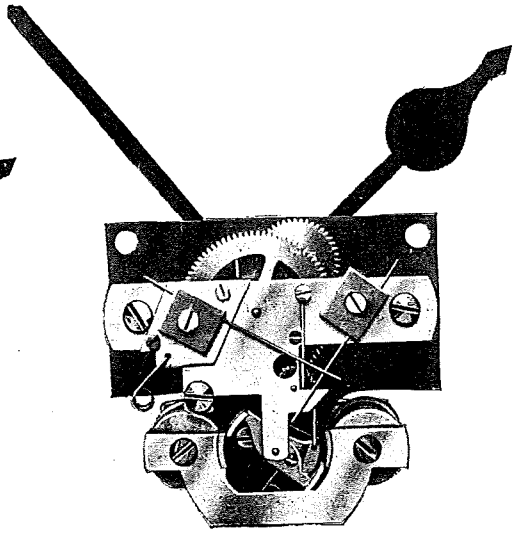


Fig. C107.

(40).—*The remarks about oiling in paragraph 30 apply equally to the Impulse Movements, but the Ratchet Wheel and the driving ends of the Pawls must not be oiled in any circumstance; they must however be left perfectly clean, particularly the brass pin forming the forward stop of the Driving Pawl.*

Obviously wooden-case clocks must not be fixed in damp or steamy atmospheres, but metal-cased clocks are provided for these situations. Inaudible clcoks, as Fig. C107, are provided where the half-minute tick is objectionable.

(41).—Two dry cells in series are required to advance Contact Clocks and Clocks having dials 18-in. to 30-in ; three or more cells for larger Clocks.

When " setting " Contact Clocks and Contact Makers which control sound signals, note whether previously arranged for at a.m. or p.m. and set to time accordingly.

(42).—**REMOVING IMPULSE CLOCKS, OR INSERTING EXTRA ONE.** When removing a Clock be sure to rejoin the wires so that they are in good connection with each other. A soldered joint is necessary if the connection is to be permanent.

If it is necessary to disconnect a Clock or break the Circuit for the insertion of a new one do so immediately after an impulse and quickly reconnect before the next impulse, otherwise the Impulse Clocks will become slow or be put out of step.

BATTERY OR CURRENT SUPPLY.

(43).—If a Dry Cell Battery is employed and is giving trouble, pick out the weak or faulty Cells with a Voltmeter and replace. If the weakness is general, fit a new Battery.

(44).—If current is taken from Service Mains D.C., see that Metal Filament Lamps are not being used as a resistance, and look to the plungers of Lamp Holders for faulty contact.

(45).—If A.C., see that the Rectifier is really giving the current required, and in either case, where no Accumulators are used, see that the Supply is not being cut off momentarily and unknown perhaps to the Management.

(46).—If a Leclanche Battery is employed, read carefully the Re-charging Instructions.

(47).—**RE-CHARGING LECLANCHE CELLS.** The zinc rods must be clean or they will not serve their purpose. Remove any crystals by scraping. When badly corroded they must be renewed. Zinc rods do not work nearly as well in an over-strong solution and require more frequent attention. When they are seen to be of a deep black colour, or to have crystals adhering which extend a good distance from the surface of solution the Battery is being overworked—sometimes due to a leakage, locate it, and rectify or the Battery will rapidly deteriorate.

(48).—If the solution develops a " milky " appearance, it indicates that it contains insufficient salammoniac. The " milky " appearance will disappear when salammoniac is added. A deposit of undissolved salammoniac crystals at the bottom of the cells indicates that the solution is too strong.

(49).—When adding water to compensate for the loss due to evaporation, do not add more salammoniac. After eighteen months' to two years' working, a tablespoonful to each cell may be added, but not more. After approximately three years' normal working, the complete solution should be renewed—also new porous pots and zincs if necessary.

(50).—A Leclanche Battery properly housed and carefully erected will go for two years without attention, excepting for the addition of water to replace that lost by evaporation.
It is so easy just to be careful and not to spill water or solution on the tops of the Battery.
It is so easy not to spill the grains on the battery tops and in the battery box.
It is so easy to do the thing properly, and obtain perfect results from the cells.

(51).—N.B. The careless workman just " bungs in " a handful of salammoniac, lets loose crystals fall about, splashes some water into the jars, and sticks the Battery on a top shelf out of the way, and even then, the willing cells do their best to perform their duty.

(52).—If a good Leclanche Battery does not give permanent service, in 99 cases out of 100 it is due to it not being properly housed or other improper treatment.

PUL-SYN-ETIC

GENT & LEICESTER

Book 5.
Section 5d

INSTRUCTIONS

FOR

Fixing, Operation and Maintenance

THE "PUL-SYN-ETIC" SYSTEM OF ELECTRIC IMPULSE CLOCKS.

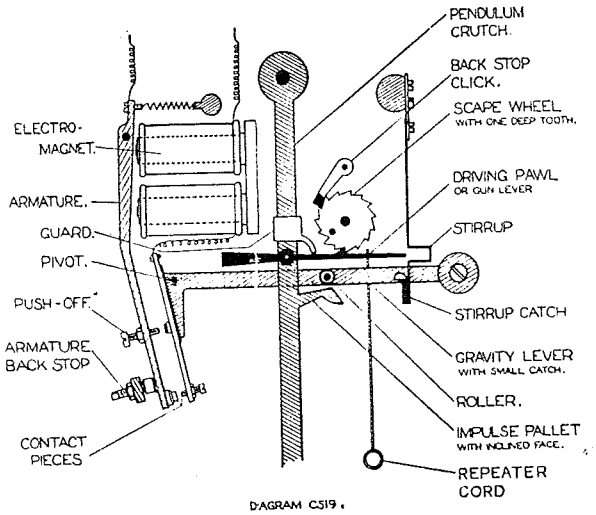


DIAGRAM C519.

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TANGENT

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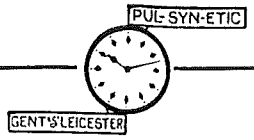

"ONE ESTABLISHMENT—ONE TIME."

You can have one universal time through all your Establishment—not only on the inside Clocks but on your outside Clocks.

MEAL BELLS AND "START AND CEASE WORK" SOUND SIGNALS will operate with automatic accuracy.

Your existing WORKMEN'S CHECK REGISTERS will keep the same absolutely accurate time if you fit "REFLEX" CONTROL to them.

Hundreds of Firms, and thousands of workers one and all appreciate The "PUL-SYN-ETIC" Slogan—

"ONE FACTORY———ONE TIME."

PUL-SYN-ETIC ELECTRIC

Book 5.
Section 5d

INSTRUCTIONS
FOR
Fixing, Operation and Maintenance

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PUL-SYN-ETIC ELECTRIC.

THE "PUL-SYN-ETIC" SYSTEM
ELECTRIC IMPULSE CLOCKS.
FIXING, OPERATION AND MAINTENANCE.

FOREWORD.

Do not imagine there is anything difficult about fixing Electric Clocks. Anyone who can fix an electric Bell can fix and maintain the " PUL-SYN-ETIC " System—only, do not think you know more about Electric Clocks than we do.

These Instructions are quite simple and easily understood. In fact, the many points dealt with are only printed because some people think " any old thing " will do, and it won't. Our many cautions against carelessness are very necessary.

If Electric Bells cease to function, somebody puts them right, but if a Clock System stops, some people get annoyed, and rightly so, because there is no need for any such stoppage, if simple instructions are carried out with intelligence and particularly with care.

THE TRANSMITTER.

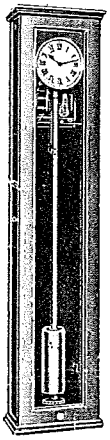


FIG. C7
Transmitter

(1)—POSITION OF TRANSMITTER. Some pains should be taken in selecting a suitable position for the Transmitter. Trouble in this respect will be amply repaid. The position should be such that the mechanism of the Transmitter is " face high," so that the condition of the mechanism can be readily seen. Much can be learnt by observing the action of the simple mechanism.

The wall should be firm and free from vibration. It should not be damp, nor the position subject to heat or rapid changes of temperature. A position where direct sunshine reaches for a part of the day is not a good one. Fixing on a wooden partition is fatal as regards time-keeping.

(2)—FIXING THE TRANSMITTER. Too much emphasis cannot be placed on the importance of *securely* fixing the Transmitter. You are dealing with an oscillating pendulum bob weighing 10 lbs., and the slightest instability of the Case will result in indifferent time-keeping, or complete stoppage may occur. A central fixing lug is provided at the top of the Case, and the cast-iron pendulum support inside the Transmitter Case is provided with two fixing lugs, thus affording means of a firm fixing, and all must be used.

When fixed, it should not be possible by grasping the top of the Case with both hands, to obtain any movement of the Transmitter.

It will be found convenient to first fix by the central lug and plumb the Case as described below. Then mark-off on the wall, the positions of the two plugs from the holes of the two inside fixing lugs.

A deal fixing board, two or three inches longer and wider than the Transmitter, to keep it off the actual brick and to provide a level backing, is desirable, especially when the wall is out of perpendicular or surface irregular.

An alternative is to fix two stout battens (about 2½ ins. wide) on the wall to take the top and bottom fixings.

(3)—"PLUMBING" THE TRANSMITTER. Two small brass studs will be seen on the front of the Transmitter Case and these must register vertical with the line of a plumb bob. See also that the wall or fixing board to which the Transmitter is secured is itself vertical. Two other studs will be seen at the left-hand side of the case to check the wall or board. When hanging the pendulum in position, see that the polished side of the rod is at the front.

(4)—HOW THE TRANSMITTER OPERATES. It must be first appreciated that the Pendulum of the Transmitter is kept in vibration by mechanical impulses imparted to it at half-minute intervals by a weighted lever termed the Gravity Lever (see Diagram C519).

The Gravity Lever is provided with a Roller which rolls down the Inclined Face of the Impulse Pallet, thus giving the Pendulum Crutch a gentle push.

This continues until the Contact Pieces meet when the Electro-Magnet is energised by the flow of current through it.

The Armature is attracted and at once replaces the Gravity Lever on to the Stirrup Catch. Meanwhile the Clocks which are connected in circuit with the Battery are advanced half-a-minute.

The action is brought about in the following manner:

The Pendulum Crutch in vibrating carries with it the Driving Pawl which pushes around the 'Scape Wheel tooth-by-tooth. The Back Stop Click prevents its backward movement.

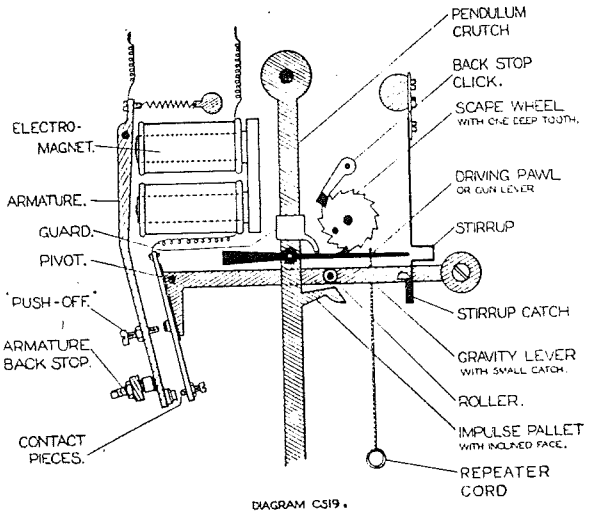


DIAGRAM C519.

At each complete revolution of the 'Scape Wheel (which occurs every half-minute), the Driving Pawl engages a Deep Tooth and its right hand extension instead of passing through the Stirrup, engages the Stirrup Catch just above the Stirrup, pushing the Stirrup Catch and releasing the Gravity Lever.

The Roller drops on to the dead face of the Impulse Pallet, then runs down the Inclined Face, giving it an Impulse. Contact is then made as above described for the dual purpose of operating the Impulse Clocks and replacing the Gravity Lever.

The Guard shown just above the Driving Pawl prevents two teeth being taken by the Driving Pawl in case the Pendulum swing is exaggerated by any means.

While holding down the Repeater Cord, the Driving Pawl engages the Stirrup Catch below the Stirrup at each vibration of the Pendulum, thus the Gravity Lever makes contact every two seconds instead of at each half-minute.

(6)—AUTOMATIC WEAK BATTERY WARNING. Attention is particularly drawn to the fact, for the Transmitter to work correctly, the Gravity Lever must be lifted to its normal position by the current, the very instant the Contact Pieces meet. If the Gravity Lever remains down in contact until the Inclined Face of the Pallet returns to the right and assists it, this assisting action is a positive indication that the current passing through the circuit is insufficient and must be increased either by adding more cells or by re-charging the Battery (or re-making a faulty joint if such exists). See paragraphs 14, 16 and 24.

(7)—ADJUSTMENT OF TRANSMITTER. No adjustment of parts or contacts is needed—the instruments are sent out perfectly adjusted—but it is necessary to regulate the pendulum after the Transmitter is permanently fixed.

In case the Transmitter has been thrown out of adjustment, for instructions how to adjust, see paragraph 27.

(8)—**REGULATION OF SYSTEM.** It is necessary that the final regulation of the pendulum be accomplished after it is permanently fixed in position.

(*a*)—**To adjust the Time of the System.**—If the system gains time, correct the clocks by stopping the pendulum so long as necessary, and slow the pendulum by turning its graduated rating nut of the " bob " to the left.

If the system loses time, regulate the pendulum to go faster by turning its graduated rating nut to the right.

The rating nut is clearly marked with degrees, each of which is approximately equal to one second per day.

The top of the pendulum " bob " is dished to receive small weights by which most minute regulations can be and should be effected. Drawing pins of different sizes make ideal weights. The Transmitter must be firmly fixed or it cannot be closely regulated.

(*b*)—**To Advance the Time of the System.**—If the time of the system is slow, or if it is desired to advance all the clocks together—as when starting up for instance—this is done by means of the Repeater Cord found inside the Transmitter Case. To advance the time of Impulse Clocks singly, see paragraph 21.

(*c*)—**Where Reflexes are used** on the Pendulums of Sub-Transmitters, of Workmen's Recorders, or of other Clocks, the time of the Prime Transmitter must not be altered suddenly as by " stopping " for the few seconds necessary, or " advancing " by pulling the Repeater Cord (otherwise the " Reflex " Control will not function properly until reset). The regulation of the Prime Transmitter Pendulum must be made by an adjusting-weight as is illustrated at Fig. C108.

To make the Pendulum go " fast," place the weight on the top of the Pendulum Bob in the space provided. To make the Pendulum go " slow," the weight should be placed on the rating nut below until the system is brought to time. Then hang the weight on the hook provided for its reception in the Transmitter Case.

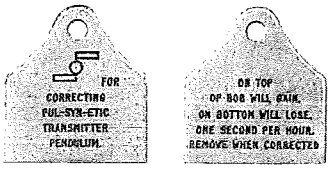


FIG. C108.

OBSERVATORY CONTROL. Weight may be added or deducted Automatically to the Pendulum by a local or other " Observatory Signal." For " See-Saw " Observatory Control, see Book 5, Section 4.

(9)—**SUMMER TIME ACT.** To put a " Pul-syn-etic " Clock System forward to conform to Summer Time, advance the time of the system one hour by means of the Repeating Cord. When returning to normal or Greenwich time, stop the pendulum of the Transmitter for one hour.

THE BATTERY.

(10)—The Transmitter coils and contacts are in series with the Impulse Clocks in a simple circuit. The current required to be sent round a circuit, whether long or short, or whether containing only one or two clocks or a large number, is 0·22 ampere. The working limits are betweem 0·17 ampere and 0·27 ampere. If an ammeter is put in the circuit for testing purposes, the contacts of the Transmitter must be held closed whilst the test is made, as the actual impulse sent when Transmitter is working is too short in duration to be measured by an ammeter. In order to ensure the requisite current being sent round the circuit, the voltage of the battery required will vary according to the length of the circuit and the number of Impulse Clocks therein.

LECLANCHE CELLS. These are eminently desirable for energising the circuit, owing to the small current required, which is less than any other system. One advantage of the employment of Leclanche cells is that their visible condition is often a useful indication of their general condition—and incidentally of the circuit.

(11)—**DRY CELLS.** Dry Cells may be used when desired, provided a reliable make is employed. The make used should have a long life. A cell 8-in. high × 3½-in. diameter is a suitable size to employ, such as our " Cogent " Dry Cell, which is fitted with special security terminals.

(12)—SIZE OF BATTERY. The number of Leclanche Cells required for driving Turret Clocks and Impulse Dials varies in accordance with the quantity and sizes of the Clocks, and full particulars will be given on enquiry, but :—To find the number of cells required for a simple installation having 12-in. dials (or smaller) the following rules should be observed :—

Allow Three cells for the Transmitter ; add One cell for every three clocks in the circuit ; the Warning Bell may be considered as one clock for this estimating purpose : Two or Three extra cells to overcome line resistance (according to the length of the circuit), plus a third of this total to provide a working margin, for example :—

An installation of twenty 12-in. Clocks requires :

For Transmitter	3	Cells
One cell for every three clocks ...	6	Cells
For overcoming line resistance, say ...	3	Cells
Total	12	Cells
Add for working margin, one-third above	4	Cells
Total of necessary Cells	16	

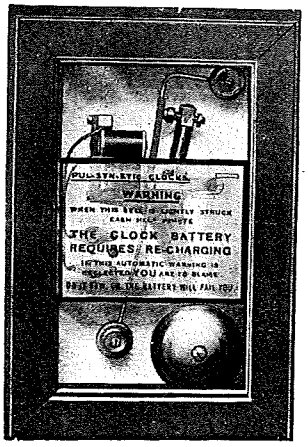


FIG. C8. Warning Bell.

(13)—WEAK BATTERY WARNING BELL. With this device fitted, all anxiety regarding the condition of the battery is removed, and no other testing apparatus or periodical inspection is required. Immediately the battery begins to weaken, the gong is struck at each half-minute impulse until the battery has been given the necessary attention. No extra battery is required to operate it. The Warning Bell should be fitted in some suitable position where it can be heard at once, being connected in the circuit exactly as an impulse clock.

The fact of the Transmitter automatically changing its action of working on the battery weakening, is the cause of the Warning Bell being brought into operation. When the strength of the current falls to a certain point, and while the bell is " warning," the lifting of the gravity lever of the Transmitter is delayed until the pendulum returns to the right and assists the operation, hence the longer contact which causes the bell to ring. This longer contact is noticeable as well as being visible in the Transmitter, but a Warning Bell, fixed in a definite position, makes it somebody's duty to have the battery re-charged. Re-charging must be carried out as early as possible, because, during the " warning," the duration of the contact is a full second, instead of a normal duration of 1/30th second. See paragraph 6.

(14)—CHECKING BATTERY POWER. After charging the estimated number of cells, in accordance with the instructions and starting the clock system, reduce the current strength by taking off one cell at a time until the Warning Bell commences to ring, and so see the exact margin of battery power available. See that there is a margin of at least 25 per cent. above that number of cells which cause the Warning Bell to sound. Have a good working margin of battery power, because with it attention is only required after long intervals.

(15)—CHARGING LECLANCHE CELLS. In all cases where primary batteries are used for " Pul-syn-etic " Electric Impulse Clocks, three-pint " Heavy-Duty " type Leclanche cells supplied by us should be used.

(*a*)—Great care must be taken to keep the terminals of the porous pots, and wires of zinc rods and battery leads, free from solution, because of its corrosive effect. Spilled crystals should also be removed from boxes or shelves.

(*b*)—The tops of the glass jars and the tops of the porous pots must not be splashed with solution or even water, because after once being moistened, " creeping " of the solution is very liable to occur. When filling jars with solution or water, always use a vessel having a spout (a tea-pot or jug for instance, as the spout can be placed between the porous pot and glass jar). Never fill to the brim of the glass jar—within two inches of the top is sufficient. Never use a metal vessel even for a moment for holding the solution.

(*c*)—Four-and-a-half ounces of salammoniac is sufficient for charging each three-pint Leclanche cell. Over-saturating the solution does not increase the efficiency. For " Pul-syn-etic " Impulse Clock driving do not use a fully saturated solution—a solution which is half-saturated works much better.

(16)—RE-CHARGING LECLANCHE CELLS. The zinc rods must be clean or they will not serve their purpose. Any crystals adhering to them must be removed by scraping. When much reduced in diameter, or badly corroded, or pitted, renew. Zinc rods do not work nearly so well in over-strong solution and require more frequent attention.

(*a*)—When Zinc rods are seen to be of a deep black colour, or to have crystals adhering which extend a good distance from the surface of solution, it is an indication that the battery is being overworked from some cause or other—sometimes due to a leakage in the wiring. This leakage should be rectified immediately, or the battery will rapidly deteriorate.

(*b*)—If the solution develops a " milky " appearance, it is an indication that it contains insufficient salammoniac and more should be added. The " milky " appearance will disappear on added salammoniac being dissolved. A deposit of undissolved salammoniac crystals at the bottom of the cells is an indication that the solution is saturated and is too strong.

(*c*)—When adding water to compensate for the loss due to evaporation, do not add more salammoniac. After eighteen months' to two years' working, however, a tablespoonful to each cell may be added, but not more. After approximately three years' normal working, the complete solution should be renewed—also the porous pots and zincs if necessary. It is a good plan to pencil the date on each porous pot.

A Leclanche Battery properly housed and carefully erected will go for two years without attention, excepting for the addition of water to replace that lost by evaporation, and for a similar period after careful cleaning and after perhaps, new Zinc Rods are fitted.

It is so easy { just to be careful and not to spill liquid on the tops of the battery.
to measure the right quantity of salammoniac, and not to spill the grains.
to do the thing properly, and obtain perfect results.

N.B.—The careless workman just " bungs in " a handful of salammoniac, lets loose crystals fall about, splashes some water into the jars, and sticks the battery on a top shelf out of the way, and even then, the willing cells do their best to perform their duty, till the terminals corrode, jars crystallise and dry up, sometimes in a few months.

If a good Leclanche Battery does not give permanent service, in 99 cases out of 100, it is due to slovenly or careless handling or improper treatment.

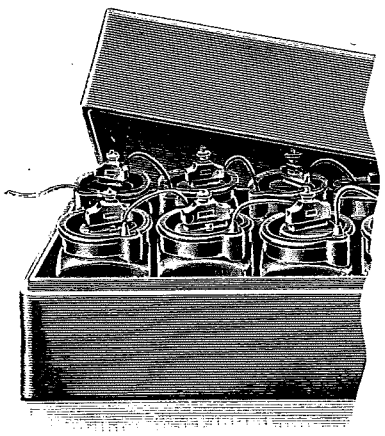
(17)—HOUSING LECLANCHE CELLS. The psoition chosen for the battery must be cool and not excessively damp ; a shelf in a cellar is often an ideal situation. On no account fix a battery in a hot and dry situation, or frequent attention will be needed because of water lost by evaporation. Near a ceiling is a very bad position, often chosen in spite of all warnings.

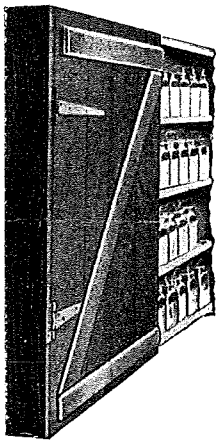
The illustrations show our two approved methods of housing Leclanche Batteries for Clock Driving.

The Battery Box is recommended where a comparatively small battery is used, and the Cupboard for larger installations. In either case, the cells are protected from damage and accumulations of dust, etc., while the loss due to evaporation is reduced to a minimum and the life of the battery at least doubled.

The shelves for the Battery Cupboard should be 6-ins. wide and 12-ins. should be allowed between shelves to give easy access. The cells must be in single rows for easy and efficient inspection.

Whether battery boxes or cupboard be employed, always let the location be both accessible and available to light. Cells pushed away in a dark corner never can maintain good service.





(18)—"**WAITING-TRAIN**" **TURRET CLOCK BATTERIES.** The remarks regarding attention, cleanliness and general treatment of cells for impulse clocks apply equally. One notable difference, however, is that as the work thrown on the battery is somewhat variable owing to the changeable weather conditions occasionally calling for more frequent impulses to the motor pendulum, a slightly stronger solution must be used. The quantity of salammoniac recommended for a "Waiting-Train" battery is five-and-a-half ounces for each three-pint "heavy-duty" cell. This battery should be tested for margin of battery power. The current taken by the power magnets of standard C40A is 0·4 amp., and by the C40B 0·5 amp., but these magnets can be wound to instructions if voltage is given when ordering.

The normal impulse to the motor pendulum should not be more frequent than every half minute—once every 45 seconds is the usual frequency, and under favourable conditions, once per minute should be attained. If it is not, look for friction somewhere in the hand mechanism, which should be quite free, when moved slowly round.

SERVICE MAINS.

(19)—"**Pul-syn-etic**" **Clock Circuits can be operated by A.C. or D.C. Service Mains.** With D.C., it is desirable to use Impulse Clocks with Incombustible Cases, and where metal is used to connect to earth by means of an earthing screw, and the Voltage of these D.C. Mains must be so reduced that only the necessary 0·22 ampere gets through the Circuit.

It is customary, therefore, to pass the current through a Carbon Incandescent Lamp or other resistance to reduce the current to 0·22 ampere only. Metallic Filament Lamps are useless for this purpose.

On receipt of details of Voltage and number of Clocks, we shall be pleased to advise.

With A.C., an Accumulator Battery is employed with a Trickle Charger. The voltage of the mains is suitably reduced by a Transformer and a Rectifier employed, so that only uni-directional current reaches the Clocks, and this from the Accumulator.

Full particulars are shown in Section 1 of this Book 5.

THE IMPULSE CLOCK.

(20)—These may be of any type, size or pattern. Clocks with dials 6-in. or 6-ft. may be all in one circuit, only the voltage of the battery must be so that the standard 0·22 ampere passes through the circuit.

The fixing of the clocks is merely a matter of mechanics. Obviously wooden-case clocks must not be fixed in damp or steamy atmospheres, but metal-cased clocks or Bakelite cases are provided for these situations. Inaudible clocks are provided where the half-minute tick is objectionable.

(21)—**SETTING INDIVIDUAL IMPULSE CLOCKS TO TIME.** In order to get all clocks to the same time when starting a system, if slow, advance the hands by making repeated contact to its terminals with one dry cell; if fast, short-circuit the terminals by connecting them together so long as necessary while the system is going. Two dry cells in series are required to advance Contact Clocks and clocks having dials 18-in. to 30-in.; three or more cells for larger clocks.

To advance all the clocks together, see paragraph 8.

When "setting" Contact Clocks and Contact Makers which control sound signals, note whether previously arranged for at a.m. or p.m. and set to time accordingly.

(22)—**REMOVING IMPULSE CLOCKS, OR INSERTING EXTRA CLOCKS IN A CIRCUIT.** When removing a clock, be sure to rejoin the wires so that they are in good connection with each other. A binding screw is best for a temporary connection, and a soldered joint is necessary if the connection is to be permanent.

It is necessary to disconnect a clock or break the circuit for the insertion of a new clock immediately after an impulse is made, and to quickly reconnect before the next impulse, otherwise the clocks in the system will become slow or be put out of step.

THE CIRCUIT OR WIRING.

(23)—**LINE WIRES.** An ordinary 18 or 20 S.W.G. Electric Bell Wire, insulated with indiarubber and double cotton covered will suffice for the work, provided the walls are dry, but by reason of the extra mechanical strength which can be obtained without materially increasing the cost, we recommend, say, an 18 S.W.G. 300 or 600 megohm electric lighting wire being used. The insulated wire may be fixed by insulated saddle staples, hung on cleats, or carried in steel tube or wooden casing as circumstances dictate. All that is required is a sound metallic circuit properly insulated.

When fixed on insulators as across yards or in the open, insulated wire is still recommended to prevent short circuits and interference by telephone and other workmen.

If stranded conductors are used, all the wires of the strands must be clipped under each terminal, or better still, the strands should be soldered together to ensure perfect contact to the terminal. If this cannot be ensured, we prefer the solid wire.

(24)—**JOINTS AND TERMINALS.** All joints in line wires must be soldered as well as the connection to the zinc pole of the battery. The latter precaution is often not taken by otherwise careful workmen. After an installation is complete, it is desirable for the foreman to personally assure himself that all the joints have been soldered and go over all terminals to ensure all are tight, as a faulty joint will upset the most perfect system and may cause some of the clocks to lose and others to gain time. Joints in all wires, even if intended to be temporary (but often forgotten and left dry) become a source of trouble in time. All joints, therefore, should be soldered immediately they are made, so that, if forgotten, trouble is not likely to arise therefrom.

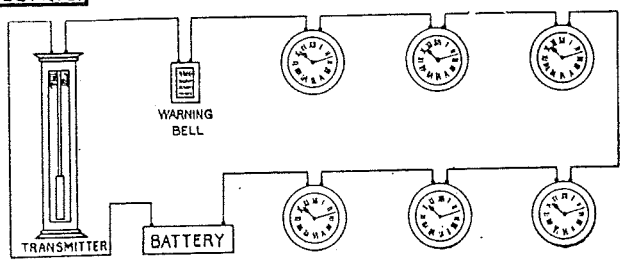


Diagram No. 506.

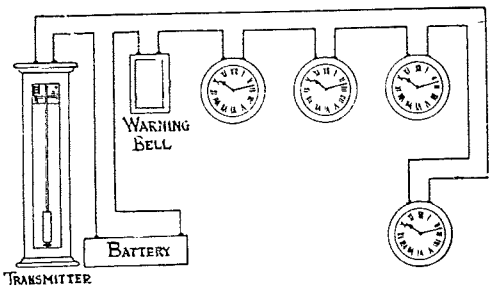


Diagram No. 507.

(25)—**TESTING THE WIRING.** Before starting-up the Clock Installation, have the Circuit tested for insulation resistance. Any leakages to Earth and across lines will give considerable trouble, especially in a large installation.

(26)—**ALL CIRCUITS "SERIES."** Diagram No. 506 illustrates the principle of "Series Wiring," and shows clearly the circuit of wire and the Clocks, etc., included therein. In many cases, however, the layout of the building will not permit of the Clocks being arranged in a complete ring as shown in Diagram No. 506. The principle of "Series" wiring must, however, still be followed and it is then often advantageous to run the return wire from the last Clock back to the Transmitter alongside the wire connecting the Clocks, as shown in Diagram No. 507.

A "Pul-syn-etic" Transmitter will impulse any reasonable number of Impulse Clocks.

We have Installations where over 100 are on one circuit controlled by one Transmitter. It should be remembered that the voltage of such a circuit is high, and it is this voltage and the responsibility of having so many Clocks in one Circuit in case wires are carelessly cut, that is the controlling factor.

ADJUSTING TRANSMITTER.

(27)—**N.B.—Don't "monkey" with the Transmitter adjustments.** They were carefully made before despatch, and it is most unlikely any adjustment is required even after years of working.

These instructions are only issued for use in cases where the adjustments require re-setting through prolonged wear, or in cases of interference. It must not be thought that adjustments are frequently necessary.

All adjustments of the Armature and the contacts commence from the correct position of the Armature in relation to the Magnet, therefore press the Armature flat and square against the poles. Next unscrew the Electrical Contact Screw and the Push-off Screw clear of everything, and while holding the Armature in contact with the poles, screw up the Push-off Screw until its point lifts the Gravity-lever Catch on to the Stirrup-catch. Next screw up the Electrical Contact Screw to such a position that its point parts company with the Armature Contact, when Gravity Catch is within $\frac{1}{16}$-in. of engagement with the Stirrup-catch.

This is best done with "the current on," and it will be convenient to control the upward movement of the Gravity-lever by hand to see in what position the Gravity Catch is when the "break" takes place.

Lastly, adjust the Armature Back-stop Screw against which the Armature rests until there is exactly $\frac{3}{16}$-in. space between the contact points when the Gravity-lever is at rest on the Stirrup-catch and the Armature is at rest against its Back-stop Screw. The Armature return spring should only be strong enough to return the Armature to its position of rest with a "prompt" movement. If this spring is abnormally strong it is obviously acting unduly against the Magnet.

The dimension of $\frac{3}{16}$-in. applies to Transmitters in which the Contacts are situated $2\frac{3}{4}$-in. below the pivot of the Gravity-lever. In the case of Transmitters of an older pattern, in which the contacts are $1\frac{3}{4}$-in. below the pivot of the Gravity-lever, the dimension in question must be $\frac{1}{8}$-in. only.

If a reliable open-scale ammeter shows that the Gravity-lever is lifted (without assistance from the Pendulum) at a lesser current value than 0·17 amp. an air gap must be given between the Armature and the Magnet when the Armature is in the attracted position. This necessitates the screwing in of the Electrical Contact Screw and the Push-off Screw and the unscrewing of the Armature Back-stop Screw, so as to get the adjustment results described.

Be sure and tighten all lock nuts.

The felt pad which checks the upward movement of the Gravity-lever should come in operation just after the Gravity-catch has engaged the Stirrup-catch. In other words, there should be just a little shake between the felt pad and the Gravity-catch.

When the " electric contact " adjustments have been made, the Pendulum and escapement must be set in beat as follows :—Hang the Pendulum in position and see that the Crutch-pin is free in the slot of the Pendulum and is oiled. The meeting of the Contact pieces when the Pendulum is swinging to the left, and the release of the Gravity-lever when swinging to the right, must take place at equal position of Pendulum respectively on each side of zero. Reduce the arc of vibration to the point at which test can be made. Finally, the Scape-wheel must be set in beat, and this " set " must be such that both the Driving-pawl and Back-stop Click, just drop equally in position with the minimum swing.

Adjust this by moving the suspension spring of Pendulum along and re-tightening the hexagon gripping nuts.

The Back-stop Click is made adjustable also for this adjustment.

(28)—General.—Oil. Dirty oil should occasionally be wiped away from the scape wheel teeth and all frictional parts, and a little good clock oil or good typewriter oil should be applied. The pin on which the roller is pivoted should be oiled, but the face of the roller or the pallet on which it rolls must not have the slightest trace of oil.

It is of the utmost importance that everything connected with the supporting of the pendulum should be quite rigid. For instance, the two washers which grip the upper part of the suspension spring should be always screwed firmly by the two nuts provided, the movement should be screwed firmly in the case, and the case must be screwed firmly to the wall.

ADJUSTING IMPULSE CLOCKS.

(29)—If through interference, any Impulse Clock has to be re-adjusted, it must be set to work definitely on a minimum current of 0·12 ampere, and this current checked by an ammeter. Trial-and-error methods only end in disappointment. These remarks apply to " Pul-syn-etic " Clocks of all diameters, sizes and types, also to inaudible movements, and to " Waiting-Train " Turret Clock Relay Magnets.

The function of an Impulse Movement is to advance the hands one tooth only at each electrical impulse. Therefore, adjust the motion of the driving pawl and back-stop pawl so that this mechanical action takes place. Give that clearance to the adjustments to ensure definite and reliable operation.

The Magnet must operate as close to the armature as possible in order to obtain maximum efficiency. When the adjustments are properly set, the armature facing should just touch the Magnet at the same time as the top end of the driving lever touches the top spring.

The driving spring of the Movement operates against the attraction of the Magnet, and the spring must be set by the adjusting screw provided, so that the armature operates with the minimum working current of 0·12 amp.

The Hands must be quite free of each other, and of the Glass and Dial. If there is any tendency to stick in any position after careful trial, the cause of the friction must be discovered.

All pivots must be oiled with clock-oil only. The pivot holes must first be cleaned.

The acting end of the driving spring, and the stud on which the driving pawl works must be oiled, but the ratchet wheel, the driving pawl and back-stop pawl must not be oiled and must be perfectly clean.

"START AND CEASE WORK" SOUND SIGNALS, MEAL BELLS, Etc.

(30)—An Impulse Clock is often fitted with contacts which close for 30 seconds at certain fixed times to ring sound signals. These are light spring contacts suitable for passing a Battery current for one or two Bells. Diagram 609 shows such a Clock with Battery and Bells. The Push shown is put across the circuit so that the Bells can be also operated by hand, when desired. So that Bells shall not ring at night, a 24-hour wheel is added to the Impulse Movement. This cuts out the circuit during the "off" hours.

A limited number of such Contacts can be fitted to an Impulse Clock. A 12-in. wooden-cased Impulse Clock, as Fig. C10, lends itself best for the purpose and so is usually employed.

Such Clocks fitted with contacts are supplied by the Makers, and if adjustments are required by the user, great care is necessary, and careful test must be made after such adjustments to ensure contacts close only for the duration required, and then only.

A general programme is 8 a.m., 1 p.m., 2 p.m., and 5-30 p.m. A contact will be found connected to the Hour Hand Wheel, and another in series with it to the Minute Hand Wheel, and when these contacts both "make," the circuit is established.

The 24-hour Wheel acts as a Cut-Out breaking the circuit during the night. A weekly wheel is sometimes fitted for cutting out the week-end, but a manually operated switch is often employed. With complicated programmes, two Impulse Clocks are often brought into service, the contacts being distributed judiciously between them.

Another plan is to employ a Fig. C68 Contact Maker, as shown in "Book 5, Section 1." With this, a.m. and p.m. can readily be checked, and if the Mechanism is fitted with a 7-day wheel, set to the correct day.

When a programme contains a number of rings at those minute positions, during a said hour which do not occur at other hours, two or more Mechanisms are required, but if operating the same Bells, one 7-day wheel can cut out for both.

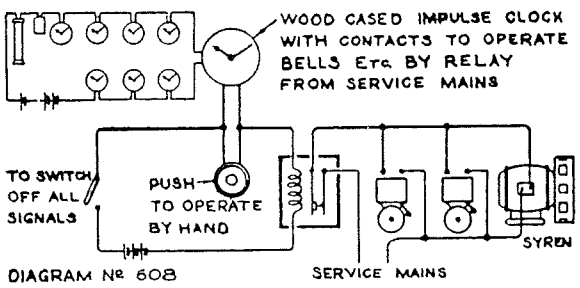


DIAGRAM Nº 608

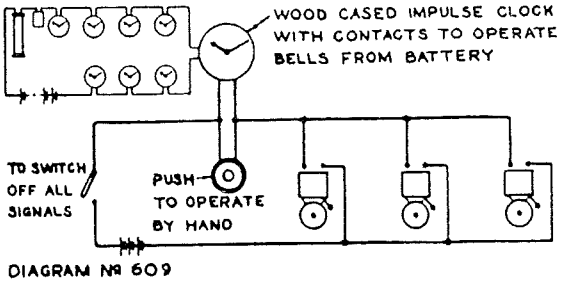


DIAGRAM Nº 609

(31)—With a large number of Bells, or when current is taken from the service mains, the clock contacts are employed to operate the coils of a Relay, and the heavy current used to operate large bells or a number of bells, and also to automatically operate, say a Syren, is passed by the Relay contacts. Diagram 608 shows such a Relay.

(32)—Contacts so added to an Impulse Clock are necessarily fixed by the Makers, but Adjustable Contact Makers or Programme Ringers, Fig. C69, are supplied, in which any intelligent operator can change pegs or pins so setting Bells to ring at any pre-arranged time at intervals of five minutes. The contact wheel or switch disc revolves once in 24 hours, so that a 24-hour programme is available. A weekly wheel is often added to cut out the week-end signals.

The connections of these programme ringers are the same as in the diagrams shown at 608 and 609.

In complicated programmes, sometimes both sides of the 24-hour Switch disc are employed, and such Programme Ringers are sometimes made to contain as many as three Switch discs, giving facility for very complicated programmes.

All classes of Contact Makers are simple Mechanisms, easily understood, and only require carefulness in making adjustments.

"REFLEX" CONTROL.

(33)—This will be found fitted to many Workmen's Recorders and similar Clocks. It is essential, when fitting, however, that their Pendulums beat an even number of times per half-minute or per minute.

The principle on which the "Reflex" operates is that the Clockwork is wound as usual, but the Pendulum is set to go a little "slow," and it is cushioned against the saw teeth of the Stator at every half-minute or every minute, and so is "Hastened up" and held to time.

Operating exactly, the leaf spring of the Vibrator cushions on engaging the middle tooth of the stator saw blade, but so long as the leaf spring does not cushion against the tip on the saw or hit the stator itself, or in other words is caught and cushioned somewhere near the middle of the saw blade, perfect results will be obtained.

(34)—Before fitting, see that the Recorder is standing square, or hanging perpendicularly, and that it operates in such a position.

Fit the Vibrator on to the Pendulum about two-thirds down the clips provided. Drop the Pendulum Bob approximately $\frac{3}{16}$-in. to compensate for this added weight, and to give the Pendulum that slightly losing rate, which is necessary.

The Stator, in many patterns of Recorders may be screwed directly to the inside of the case. If the width of the case is such that the centre of the Pendulum Rod is more than five inches from the side of the case, pack out on a wooden block of a suitable thickness.

(35)—Diagram C601 shows the relative position of the two parts, and a gap must exist between the tip of the saw blade and the edge of the leaf spring, so that the edge of the leaf spring will travel over the rack not more than two teeth before the escapement of the clock movement gives a "tick" on its left-hand stroke. Move the Pendulum slowly to the left and listen to check this adjustment. As a guide the above-mentioned gap measures approximately $\frac{3}{8}$-in. more or less.

(36)—The saw blade of the Stator must be fixed in a line with the centre of the path of the gravity of the Pendulum. An important point is that the Pendulum shall not be given a tendency to wobble by the leaf spring not meeting the saw edge fairly and squarely.

Normally when swinging with the Pendulum, the edge of the leaf spring must clear the tops of the teeth of the saw blade an equal distance all along its length, so that the angle of the saw blade can be altered so that this condition obtains.

An adjustable slot and screw are provided at the back of saw blade.

When the Electro-Magnet is energised by an impulse on the Time Circuit, it will trip the leaf spring and so cushion the Pendulum on its left-hand swing.

(37)—See that the Leaf Spring does not foul the Magnet nor touch any part of the Stator except the saw blade, and then only when this is lifted by the Magnet. When all is in order, the Vibrator may be more permanently secured by the small wood screws provided.

When the saw blade is put in its " down " position by the handle provided, the " Reflex " action is inoperative, but see that when it is in this position, its point does not foul any part of the Pendulum.

(38)—Put the saw blade " down " and regulate the Pendulum when operating on its own, to lose anything up to four minutes per day, and when this has been proved in a day or so, then the saw blade should be raised into its operative position and cushion the Pendulum at each half-minute when the Recorder will be held to time with the other Clocks of the System.

(39)—It will be seen if the Time Circuit is cut by accident, or the Transmitter stops for any reason, the saw blade becomes inoperative, and the Recorder will " Carry on " under its own power as if no " Reflex " had been fitted.

(40)—Dimensioned working Drawings showing the "Reflex" fitted into most of the well-known Recorders, Card, Key, Radial, or Signature, are prepared, and will be sent on an intimation that such are required. Give the type and approximate year of manufacture when asking for Drawings.

If any difficulty is found, it is well to write to us asking definite questions, so that concise answers can be, and will be readily given by the Makers.

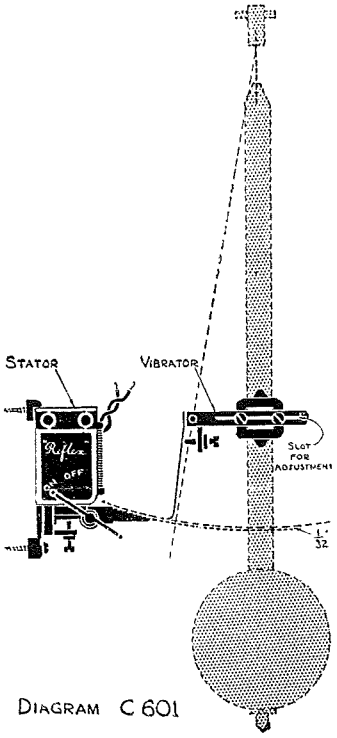


DIAGRAM C 601

IF FAULTS—HOW TO LOCATE THEM.

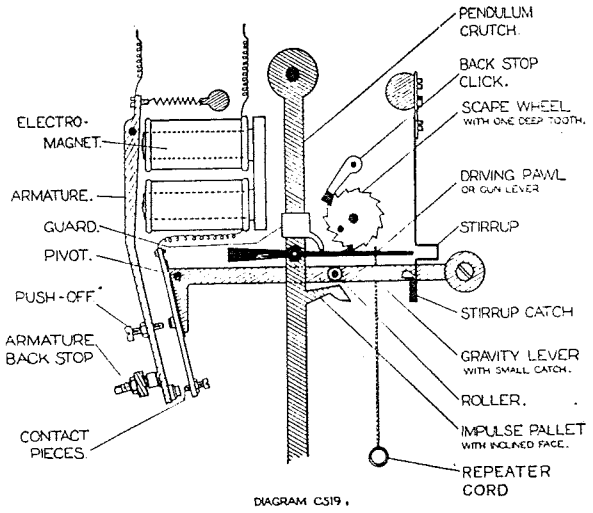


DIAGRAM CS19.

(41)—COMPLETE STOPPAGE. In the event of a complete stoppage of a " Pul-syn-etic " System occurring, do not disturb anything until an investigation has been made as follows :—

The first thing to decide is :

(*a*) If the system has stopped for want of current, or—what is equivalent—through a temporary disconnection of the circuit, or

(*b*) If the Transmitter has stopped because of a mechanical fault, such as undue friction in the mechanism or a derangement or breakage.

If through (*a*), it will be seen that the Gravity Lever has been disengaged from its supporting catch, and that the roller of the Gravity Lever rests on the impulse pallet—contact not being made. This position of the Gravity Lever shows that its release has been properly effected, but that the Magnet has not been energised, due to absence of current, and if it is found that the battery has not failed, an intermittent fault or a complete break must be looked for. An intermittent fault which would break the circuit for a minute or so would be quite sufficient to cause the arc of vibration of the pendulum to fall below that minimum which will permit contact to be made, and consequently cause the pendulum to stop.

If through (*b*), it will be seen that the Gravity Lever will not have been disengaged from its supporting catch, and, incidentally, the deep tooth of the scape wheel will not have travelled

to the disengaging position, and if no derangement is apparent on a visual inspection, the Transmitter should be examined in relation to the following points :—

(*c*) Transmitter case not firmly fixed at the head, and, consequently, pendulum is able to vibrate the case. The Transmitter must be so fixed that it is impossible to rock the case by grasping same with both hands.

(*d*) Battery power insufficient, consequently the pendulum is checked at each half-minute by having to assist in the action of lifting the Gravity Lever. Proof of insufficient battery power is shown when the Gravity Lever is not replaced until the pendulum assists the lifting action.

The remedy is of course obvious, look for undue resistance in circuit through, say, a bad joint, insufficient battery power, or a bad state of the battery.

(*e*) Case not fixed plumb. Studs are fixed on the Transmitter Case, one at the top and one at the bottom, also studs at the left-hand side of case, and these must register with a plumb line.

(*f*) Pendulum placed in wrong way. The polished side must be towards the observer.

(*g*) Wall not perpendicular, the top of the wall leaning from the observer, with the result that the pendulum fouls the stud of driving pawl and sets up friction.

(*h*) End of driving pawl does not fairly engage the supporting catch and consequently fails occasionally.

If obstructed by dirt in deep tooth, remedy is obvious. If no obstruction exists, bend up the end of the Lever a trifle, so that it engages fairly, but see that it is quite clear when the stud is in the shallow teeth.

(*j*) The oil in the pivot holes and on the scape wheel teeth has become thick or dirty. If so, it must be wiped off with a clean cloth, and fresh oil supplied. It is important that the Impulse Roller be quite free on its stud and properly oiled, but the rolling surface of the roller and the pallet on which it works must be quite dry and free from oil. Use only the finest clock-oil obtained from a watchmaker's sundryman, or use typewriter oil. Ordinary oil is fatal.

(*k*) The pallet must normally swing under, but must not touch the roller.

(*l*) The stud at the bottom of the crutch must be quite free in the slot of the pendulum, and must be oiled with clock-oil.

(*m*) The suspension spring of the pendulum must be locked firmly between the two washers provided.

(*n*) The driving pawl must be quite free. If this is tight, it is sometimes found that it does not engage the scape wheel.

(*o*) The crutch must swing quite free and must be bent forward a little if found to rub on Gravity Lever.

(*p*) An intermittent fault such as was mentioned under (*a*), may be a loose joint in the System, which occasionally keeps the circuit broken long enough for the vibration of the pendulum to die down. Under such conditions, it is possible to start the pendulum up at some time later, and for the system to work, due to the fact that in the meantime the intermittent contact has by chance become " made."

(*q*) All clocks suddenly gaining. This is probably due to the gravity lever not being caught up and held, by the supporting catch. This may be due to :

1. The Battery being very weak, with the result that the Gravity Lever is not lifted sufficiently high, and it falls back again on the Contact, thus causing a repetition of the contacts, or
2. Through maladjustment, contact is broken far too soon, and before the catch is reached. Paragraph 27.
3. That some slight mechanical adjustment of the catch may be necessary. The spring may be weak, or the felt pad which cushions the upward movement of the gravity lever may come into operation too soon. Some slight adjustment of the catch will generally obviate the trouble.

Only when the Transmitter has been actually disarranged should the Contact Lever or Armature Contact be adjusted as a remedy.

REPLACE THIS IN THE RECEPTACLE PROVIDED IN TRANSMITTER CASE SO THAT THE WORD "HINTS" IS VISIBLE.

HINTS FOR USERS

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