OPERATING SWITCHES.

Supply.

During the past year experiments have been carried out, and designs prepared, of a switch to replace the existing send-receive switch. The switches should become available early in 1910, and will be supplied to most ships having Mark II. or Mark I*. W.T. installations. They will also be fitted to short distance sets.

Principle.

The principle of the operating switch, and the difference between its arrangement and that of the send-receive switch, is shown in Figs. 1 and 2.

FIG. 1.

SEND-RECEIVE SWITCH.

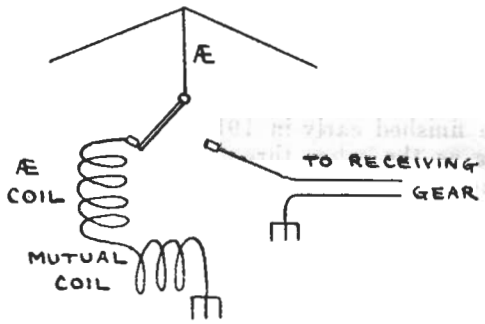
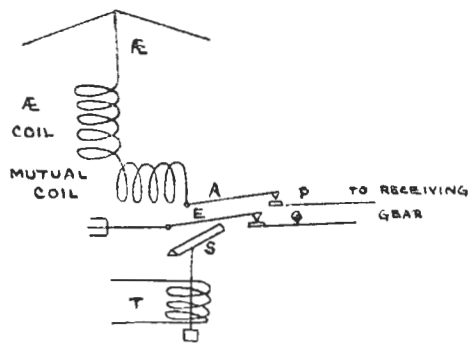


FIG 2.

OPERATING SWITCH.



The aerial is permanently connected through the aerial coil and mutual coil to a spring contact A. The spring of this contact keeps it connected with the contact P, which leads to the receiving gear.

The "earth" connection of the receiving instruments is joined to the contact Q, and this is in contact with the spring E, which is permanently connected to earth.

In this condition, therefore, the receiving gear is in circuit in the usual way, but the aerial and mutual coils are in circuit also. When the sending key is pressed, the primary circuit of the transmitting gear is completed, and, in addition, the solenoid T is energised, and the metal striker S is drawn up, so that it first short circuits the springs A and E, thus putting the mutual coil direct to earth, and then a further movement upward of the striker S lifts the springs A and E clear of the contacts P and Q, thus isolating the receiving gear.

Advantages over send-receive switch.

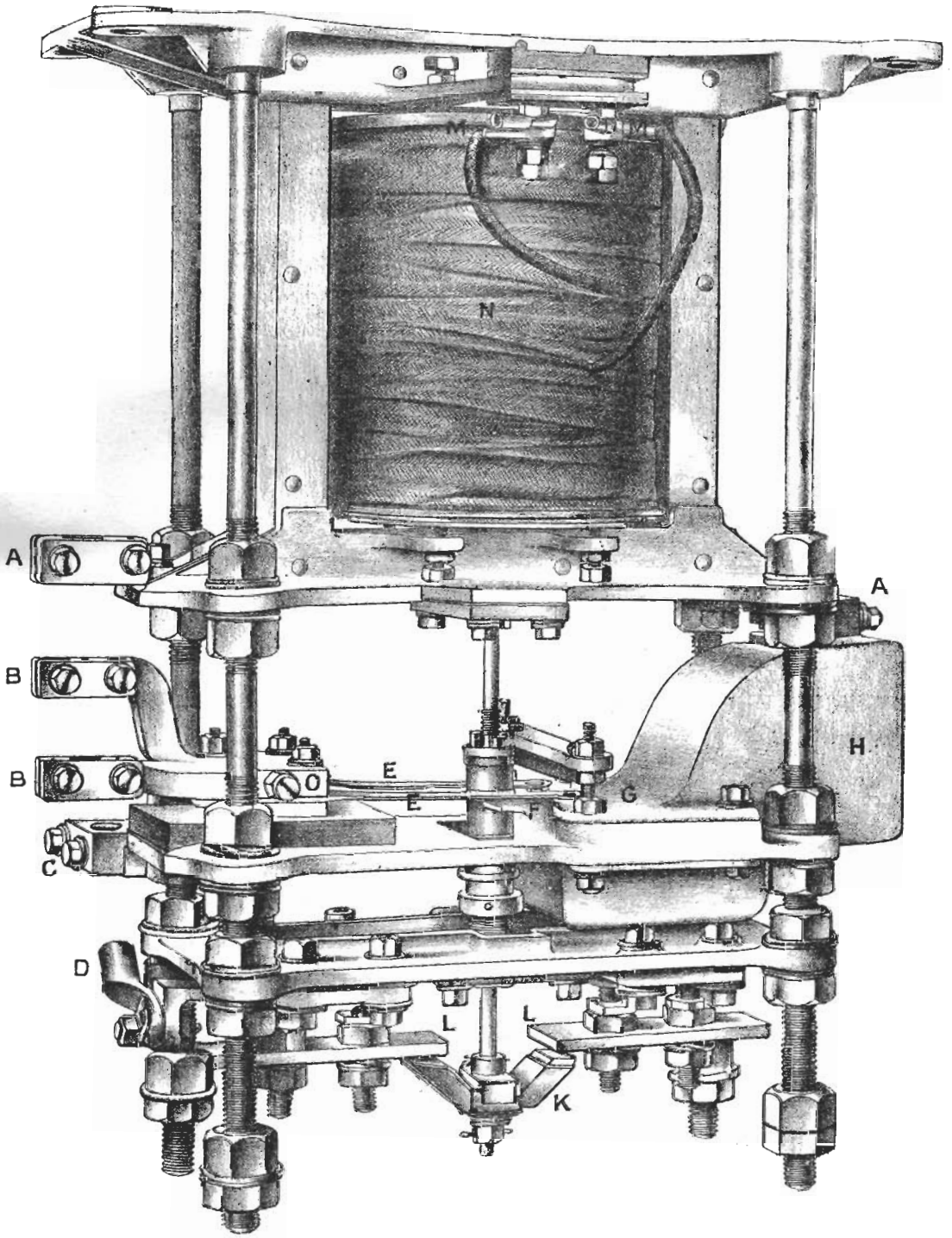
The advantages of the operating switch over the send-receive switch are :—

(1) The receiving gear is only out of action during the time the sending key is pressed. Hence, if two ships start sending at the same time, each will hear the other during the intervals between letters, &c., and interference should be very much lessened.

(2) In order to "send" after "receiving," no movement of the operator is necessary except pressing the morse key, hence signals can be answered and acknowledged more quickly.

(3) Since the switch is on the earth side of the mutual and aerial coils, the parts of the switch are at a comparatively small pressure above earth when sending, and the extra high tension insulation so necessary in the send-receive switch is not required in the case of the operating switch. High insulation is, however, still of great importance in the receiving position of the switch.

OPERATING SWITCH, MARK I.



REFERENCE.

A.A.	EARTH CLAMPS, FOR CONCENTRIC CABLES.	H	SCREEN OVER RECEIVING CONCENTRIC TERMINALS.
B.B.	LEFT HAND CONCENTRIC CABLE TERMINALS.	K	CONTACT BRUSH FOR A.C.
C	EARTH CLAMP FOR A.C. LEADS.	L.L.	CONTACTS FOR A.C.
D	CABLE EYE FOR A.C. LEADS.	M.M.	BOBBIN TERMINALS.
E.E.	CONTACT SPRINGS.	N	MAGNET BOBBIN.
F	STRIKER.	O	SAFETY SPARK POINT SCREW.
G	SCREEN OVER RECEIVING CONTACTS.		

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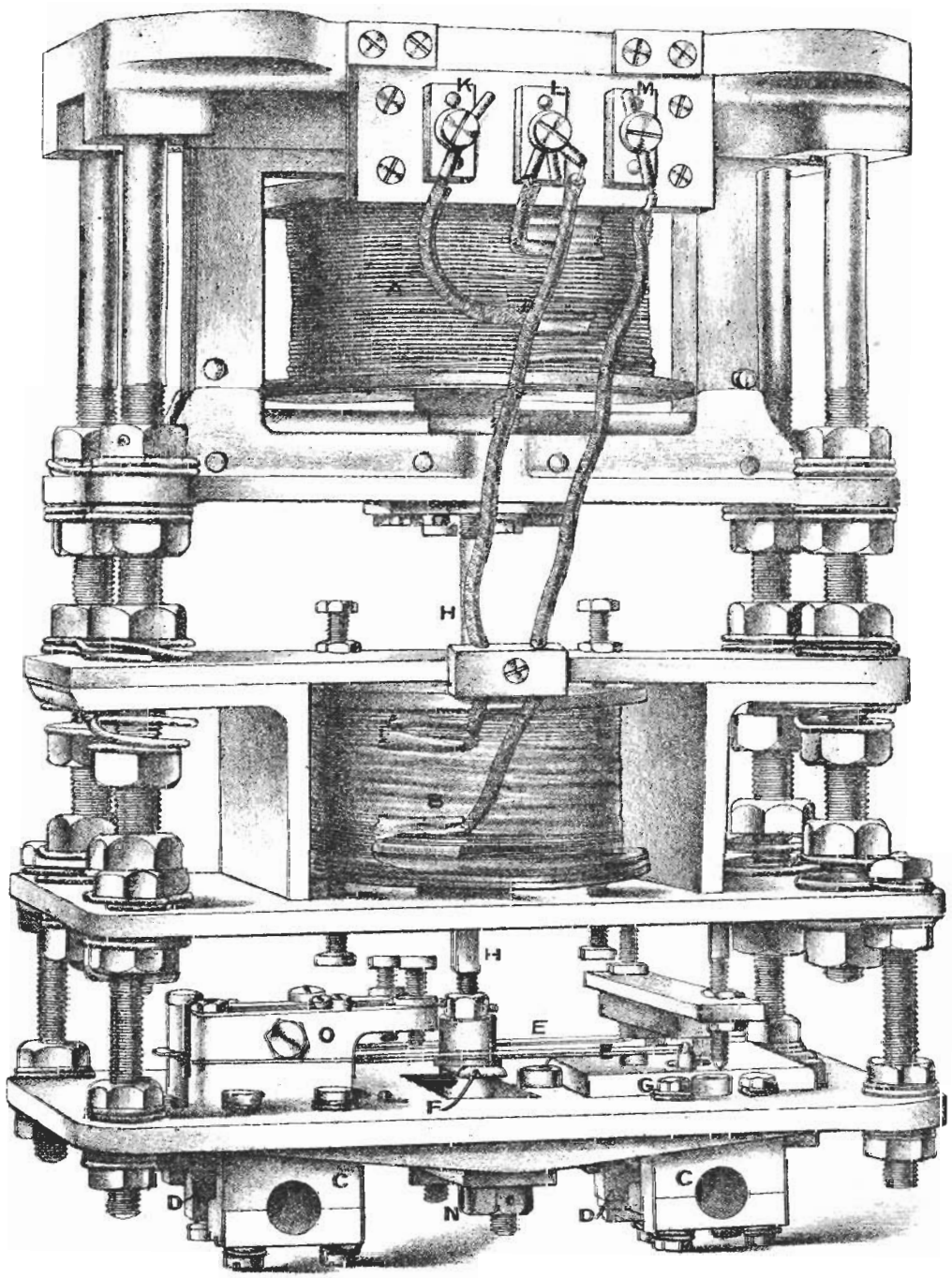
"OPERATING SWITCH" MARK II.



REFERENCE

LOWER SCREENS OVER TERMINALS REMOVED.

A.	MAIN BOBBIN	H	SPINDLE OF MOVING PART
B.	AUXILIARY BOBBIN	K	MAIN BOBBIN TERMINAL
C.C.	EARTH CLAMPS FOR CONCENTRIC CABLE	M	AUXILIARY BOBBIN TERMINAL
D.D.	CONCENTRIC CABLE TERMINALS	L	COMMON RETURN TERMINAL
E.E.	CONTACT SPRINGS	N	LOWER GUIDE
F.	STRIKER	O	SAFETY SPARK POINT SCREW.
G.	SCREEN OVER RECEIVING CONTACTS		

It will be noticed that the aerial and mutual coils are included in the receiving circuit, so no tuner is required except in the case of receiving waves longer than the wave to which the transmitting secondary is tuned. If a ship sending on a long wave desires to receive on a shorter one, the aerial condenser must be used, and may cause a slight loss of efficiency in receiving. Effect on receiving adjustments.

The additional moving contacts required in the receiving circuit may also impair the efficiency of reception unless carefully cleaned and adjusted. The leads from the operating switch to the receiving gear require careful screening from the effects of the sending oscillations. Concentric cable is used in conjunction with a special screened terminal fitting on the cabinet.

The necessity for careful screening of these leads has been demonstrated by trials which have been made with an operating switch extemporised from a "C" tune magnetic key. Screening.

It was found that careful screening of the leads to the cabinet and of the receiving contacts on the switch is essential, both to prevent the operator hearing his own signals as excessively loud and to protect the receiving instruments from damage. When these leads are properly screened other signals can be distinctly heard between the dots and dashes of one's own signal, and any interference is therefore noticed at once. The experimental switch has been working satisfactorily for some months and has required very little attention. No reduction of range, either sending or receiving, has resulted from the inclusion of the switch.

Two types of operating switch have been ordered. Types of switch.

The operating switch, Mark II., is for use in all ships and stations fitted with Service Mark II. Installation and in the large power stations at Horsea, Cleethorpes, and Gibraltar. The operating switch Mark I*. is for use in all ships and stations fitted with Mark I*., and is also for use with short distance sets. The same winding is used for all voltages in these switches, suitable resistances being placed in series with them.

The operating switch Mark II. is worked in parallel with the magnetic key, by the Morse key in the cabinet. The switch is designed to come to the "send" position slightly quicker than the magnetic key, and to come back to the "receive" position slightly slower. These conditions are necessary so as to ensure that the receiving gear can never be in circuit when the spark is occurring.

Plate II. shows the general arrangement of the Mark II. operating switch.

The moving part consists of a spindle carrying two armatures and the striker. The upper armature is for pulling up the switch to send, and the upper bobbin is in parallel with the magnetic key. The lower armature and bobbin are fitted to delay the return of the switch to the "receive" position.

Plate III. shows the general arrangement of Mark I*. operating switch.

In this case the switch is extended at the bottom to form a magnetic key in the primary circuit, and the Morse key in the cabinet supplies its bobbin with direct current as in the magnetic key. Details of both these switches will be found in the instructions issued for fitting them up.

The following accessories are supplied with the operating switch :— Supply of accessories.

Box of resistances.
Length of concentric cable.
Cabinet and earth ring fittings.
Spare parts.
Condenser for Morse key (*see* page 56).
Breakdown fuze (*see* page 56).

Only one type of "box of resistances" is supplied for the Mark I*. switch. It is suitable for use with either 80 or 100 volts, an adjusting piece being provided to adapt the series resistance to the voltage required. For the Mark II. switch two types of "box of resistances" are supplied, one for use with 80 or 100 volts, and one for use with 220 volts. Resistances.

BUZZER TRANSMITTER.

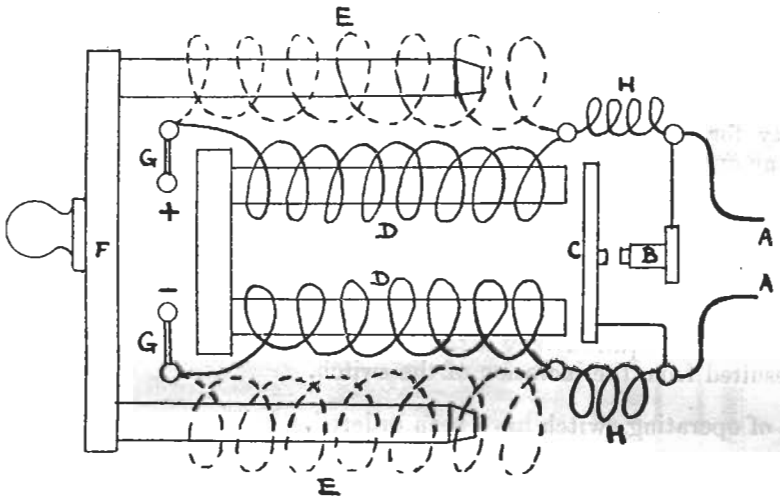
It has been decided to supply a buzzer transmitter to most ships fitted with Mark I*. and Mark II. installations, and to St. Angelo station at Malta, and Windmill Hill at Gibraltar. Spare buzzers will also be stored at depôts at home and abroad. Supply. N.S. 9217/13902 of 6th October 1909.

The buzzer is intended to be used for exercises and also for communication between ships up to 20 miles, using the main aerial. It is modelled on a buzzer used successfully in H.M.S. "Hampshire."

Fig. 1 shows the circuit of the buzzer.

FIG. 1.

BUZZER TRANSMITTER.



A, A. Leads to spark gap.
B. Contact screw.
C. Armature.
D, D. Buzzer coils on fixed iron core.
E, E. Shunt coils on sliding iron core (under).
F. Wooden yoke piece with handle.
G, G. Cut-outs.
H, H. Protecting coils.

Description of buzzer transmitter.

The protecting coils are fitted to protect the end turns of the buzzer and shunt windings from excessive pressure due to resonance effects. The shunt coils are fitted, one in parallel with each of the buzzer coils, because it is found that if these coils are fitted with a sliding iron core the correct adjustment of this core has a great effect on the note produced by the buzzer.

For every adjustment of the spring and of the buzzer contacts there is a best position for the iron core, the effect being most marked.

There will be two types of buzzer transmitter, one for use with 80–100 volts and one for 220 volts.

The buzzer is intended to be used direct on the lighting mains without a series resistance.

The shunt coils and buzzer coils are interchangeable, and each has a resistance of, approximately, 50 ohms in the 80–100-volt type, and 200 ohms in the 220-volt type.

Circuit.

When using the buzzer, the Morse key will supply current to the operating switch, magnetic key, and buzzer in parallel.

The magnetic key is not used, but it is left in circuit so that the protecting switch will work.

The connections to the spark gap must be arranged to be as non-inductive as possible, so as not to interfere with the tuning of the primary circuit.

The buzzer transmitters should be ready for distribution about May 1910.

Flexible leads for buzzer.

Special leads will be supplied for connecting the buzzer to the transmitting gear. They will be of different type for Mark II. and Mark I*. sets. In each case the leads consist of a flexible concentric cable. In Mark II. sets this terminates in a special clip designed to grip the large primary tubes leading to the spark gap and so make connection to them. In the case of the Mark I*. sets the leads terminate in special plugs designed to fit into the ends of the nuts securing the primary to the spark gap. For this purpose special nuts are supplied with the buzzer leads to replace the nuts at present in use. The new nuts have holes in them to receive the plugs.

In both cases holders are supplied to hang up the flexibles when they are disconnected from the spark gap.

The buzzer end of the leads is provided with cable eyes to connect to the buzzer, and is clamped by a cable clamp on the buzzer base.

INKER RECORDER.

The inker recorder for short distance sets will be fitted as described on page 4 of W.T. Appendix to Annual Report 1908. Those fitted in other sets will be joined up in parallel with a part of the series resistance of the operating switch. Two terminals are fitted in the resistance box for this purpose and are arranged to give a 15 to 20 volts supply for working the inker recorder. Inker recorders will be supplied to Mark II. sets, but not, at present, to Mark I*. sets.

SERVICE MARK II. INSTALLATION.

The fitting of all ships and shore stations, detailed for the Service Mark II. Installation, has been completed, and the "C" tune ships are now being fitted with Mark II. as they come in for large refit.

Generally speaking, the results have been most satisfactory, and experience has proved the value of the note for over-reading during interference.

The principal trouble has been the difficulty of keeping the magnetic key in adjustment, partly due to unavoidable delay in the issue of the spare fittings. It has been proposed that a second magnetic key shall be fitted as a stand-by, and it is hoped that, with this addition, no further difficulty will be experienced. Proposal to provide second magnetic key.

This auxiliary key is intended to act as a stand-by in case the main key fails. A change over switch will be fitted on the instrument board for switching from one key to the other. The details of the wiring are shown in Plates IV. and V.

In order to avoid the complication of duplicating the safety circuit, the second key will be fitted with its resistance in a convenient position inside the safety screen.

Silver contacts for Morse and side lever keys have also been issued in place of those made of copper, which were found to arc, and were a great source of trouble. Silver contacts for keys.

The transmitting condensers have proved to be most satisfactory. Three sections only have been returned for survey, and one of these had been damaged by water. Transmitting condensers.

A case having occurred in one ship, in which two transformers were found to have developed faults in the secondary windings, a careful investigation was made into the probable causes. Damage to transformers.

It is thought possible that the failure was due to resonance effects, allowing high frequency oscillations to reach the transformer through the protecting coils. Fittings for protecting coils, consisting of a carbon rod resistance of 4,500 ohms, shunted across each coil, are being provided to damp out any such oscillations. Fittings for protecting coils.

The first aerial coils were of insufficient strength, and a new and lighter design is being introduced, in which the central pillar and heavy porcelains have been abolished. Aerial coil.

The noise of the blower has been found to interfere with the reception of signals. A method of reducing the noise is given in Gunnery and Torpedo Orders, dated 1st October 1909, and a more silent type of blower will be provided for future ships. Blower.

The send-receive switch is being replaced by the operating switch. Send-receive arrangements.

Various methods of improving the note have been tried, both by altering the shape of the spark plugs and by introducing the air from the blower through one of the plugs. No appreciable improvement was obtained, and these trials have been discontinued. Musical note.

The purity of the note undoubtedly depends to a large extent on the cleanliness of the Spark Gap. It is impossible to obtain a good note with a dirty gap. The adjustment of the voltage for a given spark length is also essential.

Silver spark plugs are being supplied to certain ships for trial on account of the greater durability of this metal. Silver spark plugs.

RANGE REDUCTION.

Various methods of reducing the range of the Service Mark II. have been tried. These include (*a*) fitting an iron screen between primary and mutual coils, (*b*) reducing the voltage with an auto-transformer, and (*c*) the introduction of extra resistance or impedance into the primary circuit of transformer. The most satisfactory method is to fit an additional impedance coil, and instructions for this have been issued in the Gunnery and Torpedo Orders, dated 1st June 1909. In order to simplify the alteration from "Full" to "Reduced" power, all new impedance coils will be fitted with a single pole two-way switch and a terminal box. The auxiliary impedance coil is joined up to the terminals with a lead of pattern 546 cable. With the switch to "Reduced Power" the main and auxiliary impedance coils are in series, and when it is to "Full Power" the auxiliary impedance coil is short circuited.

REMARKS ON THE ERECTION AND INSTALLATION OF MOTOR ALTERNATORS FOR THE SERVICE MARK II. INSTALLATION.

Considerable trouble with certain of the motor alternators has been experienced. This has in general been traced to strain of the shaft or bearing standards during erection, more particularly in ships where it has been necessary to part the machines before striking them down below.

General Description.

The machines, being of special construction and high speed, are liable to the following defects, unless special precautions are taken during their erection and installation :— Possible defects.

(*a*) Straining of the shaft.

(*b*) Springing of the supports of the motor and bearing.

(*c*) Incorrect alignment of the bearings due to defective fittings of the machined surfaces when re-erecting the machines after stripping them for striking down below.

(*d*) Broken brasses.

Probable cause of defects.

In general these defects only occur if the machines are parted for striking down below, or if the strops, for lifting the machines, are placed so that undue strain comes on the support to a bearing—

(*a*) May be due to the armatures and shaft being lifted or transported by means other than the special slings supplied for the purpose, or one end of the shaft may have been allowed to rest on the deck during transport.

(*b*) May be due to the bearing supports being used for taking the weight of the bed-plate and lower halves of field magnet castings during transport. This portion of the machine should on no account be allowed to rest on the deck.

(*c*) The greatest care should be taken to clean all dirt from any of the machined surfaces and to examine closely these parts for any burrs or damage before re-erecting.

(*d*) Failure of the brasses can generally be traced to incorrect alignment due to (*b*) or (*c*), it is therefore essential that the alignment of the bearings should be very exact.

Mounting and support of bedplate.

All or any of the above defects may be due to the whole machine having been sprung when bolting down. It is important that the deck on which the motor alternator is to be placed should be level and as stiff as possible. The bed-plate must be mounted on a 1½-inch teak base, so placed that the shaft will be fore and aft to avoid the severe gyroscopic stresses to which the machine would be subjected in the athwartship position in a sea way.

Installing the motor alternators.

Owing to the great risk of damage, and the extreme care necessary when reassembling, the motor alternators should *never* be parted for striking below, unless the small size of the hatches makes this absolutely necessary.

To sling the complete machine horizontally, it is preferable that a strop should be passed round the machine and under the bed-plate, spans being secured to the lifting bolts to act as a preventer, and round the supports of the end bearings to steady and keep it central in the strop. Care must be taken that the weight is supported by the strop and not by the spans, otherwise the motor end bearing will probably be strained.

For striking the complete machine down hatches end on, if possible, it should not be unpacked from its case until placed in the compartment assigned to it. If the machine has to be unpacked and then struck down hatches end on, strops must be placed as most convenient round the various parts of the field magnet and bed-plate castings, but they must not be placed round the motor end bearing support, and this portion of the machine should not be allowed to rest on the deck during transport.

The canvas sling supplied for lifting the armatures and shaft must *not* be used for slinging the complete motor alternator, its strength being quite insufficient for this purpose.

Instructions for parting.

Where the size of the hatches makes the parting of the machines unavoidable, the following routine should be adhered to when parting, but only those portions should be removed which are absolutely essential to enable the machine to be struck below, and the instructions given in the coupling-up diagrams, supplied in outfit box for motor alternators, must be carefully observed :—

(*a*) Remove the upper halves of the end covers at commutator and slip ring ends.

(*b*) Break all electrical connections of the field windings on either side of the joint in the field magnet casting. Each connection broken should be carefully tallied to prevent error in connecting up.

(*c*) Remove the bearing caps and upper brasses from each bearing.

(*d*) Disconnect and remove the upper half of the direct current brush gear.

(*e*) Disconnect the leads to the alternating current brush gear, and remove the bolts holding it to the lower half of the end cover, leaving the brush ring free to lift with the armature.

(*f*) Remove the upper halves of both field magnet castings.

(*g*) Insert the special canvas slings, supplied for the purpose, between the armatures and the pole shoes.

(*h*) Lift both armatures carefully until the shafts are just clear of the bearings. Then raise the commutator end slightly, to clear the balancing ring from the middle bearing, when the armatures can be lifted clear of the field magnets.

(*i*) Break electrical connections between brush gear and field windings, and remove lower halves of both end covers.

(*j*) Unbolt and remove centre bearing standard. N.B.—This should be done before removing lower halves of field magnet castings to avoid possibility of damage to the standard when lifting the castings.

(*k*) Unbolt and remove lower halves of field magnet castings.

The various parts of the machine can now be conveyed below, but the greatest care is required in handling the armatures owing to the lightness of the shaft, which is very liable to be strained.

Should it be necessary to place the armatures on the deck, the direct current armature must be packed up until the shaft is horizontal, both armatures being placed on pieces of cloth or felt and, when lifting, both armatures must be lifted together. When it is required to get the armature and shaft into a vertical position, the direct current armature should be placed on a soft

support such as a bag of sawdust, which should be allowed to slide along the deck with the armature as it passes to the vertical position.

The alternator armature should be lifted by means of a sling passed round one of the spokes of the spider.

The lifting force should be applied steadily and without jerk.

It is important that no pressure be brought to bear on the windings of either of the armatures, and they should not be allowed to come in contact with any metal parts when being removed from the machine, or when passing through hatchways, &c. If there is any possibility of this happening, the armature windings should be completely covered with felt or other suitable material, and this precaution applies equally to the field windings.

Re-erecting the machine.

The process of re-erecting is the exact reverse of the above, and the machines must be built up before the bedplate is bolted down.

All bolts, nuts, dowell pins, &c. must be replaced in exactly the positions from which they were removed.

Special precautions.

When assembling the motor alternator the greatest care must be taken that no dirt has lodged on any of the machined surfaces on which the correct alignment of the bearings depends. It is evident that any dirt in the following places will be sufficient to throw one of the bearings out of line, and probably cause overheating :—

Between field magnet castings and bedplate.
Between two halves of motor field magnet casting.
Between end covers and field magnets.
Between two halves of end covers.
Between centre bearing standard and bedplate.

Turning by hand.

After re-erection the armatures should be revolved by hand to see that everything is free.

The clearances between the armature and the pole pieces should be measured, and should be approximately equal, the lower clearances being measured before placing the upper half of the field magnet castings.

Bolting down of bedplate.

Care must be taken before bolting down the machine that the teak bedplate is perfectly flat and the base plate of the machine is bearing evenly on it ; cases having occurred of the bedplate being strained due either to uneven bolting down or the unevenness of the teak bed.

Starting the machine for the first time.

The following precautions should be observed, and are particularly necessary if the machines have been parted before being struck below :—

(*a*) The bearings must be filled to the correct level with suitable lubricating oil.

(*b*) See that the oil rings are free, oil flingers fixed the correct way, and that none of the brasses are broken.

(*c*) See that motor brush rocker is in the correct position as shown by chisel marks, and is efficiently secured from movement. Also that all brushes are bearing correctly.

(*d*) Motor field regulator to be adjusted for slow speed.

(*e*) A responsible observer with a tachometer should be stationed to watch the behaviour of the machine, and an assistant to attend at the Direct Current Change Over Switch, which should be broken if speed rises unduly. This latter will probably be due to incorrectly connecting up the motor field winding.

Preliminary run.

The motor alternator should be given a preliminary run of not less than one hour with motor field regulator adjusted to give slowest speed.

Test run.

The test run should not be commenced until all bearings run perfectly cool and any excessive vibration has been eliminated during the preliminary run.

A run should be made for six consecutive hours at a speed of not less than 1910 r.p.m. with the alternator showing a terminal voltage of 500 volts R.M.S.

The machine should not be stopped during the six hours, but the commutator should be cleaned and the bearings replenished with oil at the discretion of the superintending officer. There should be no excessive vibration and the temperature of the bearings should not rise more than 100° Fahr. above the atmospheric temperature of the compartment in which the machine is installed.

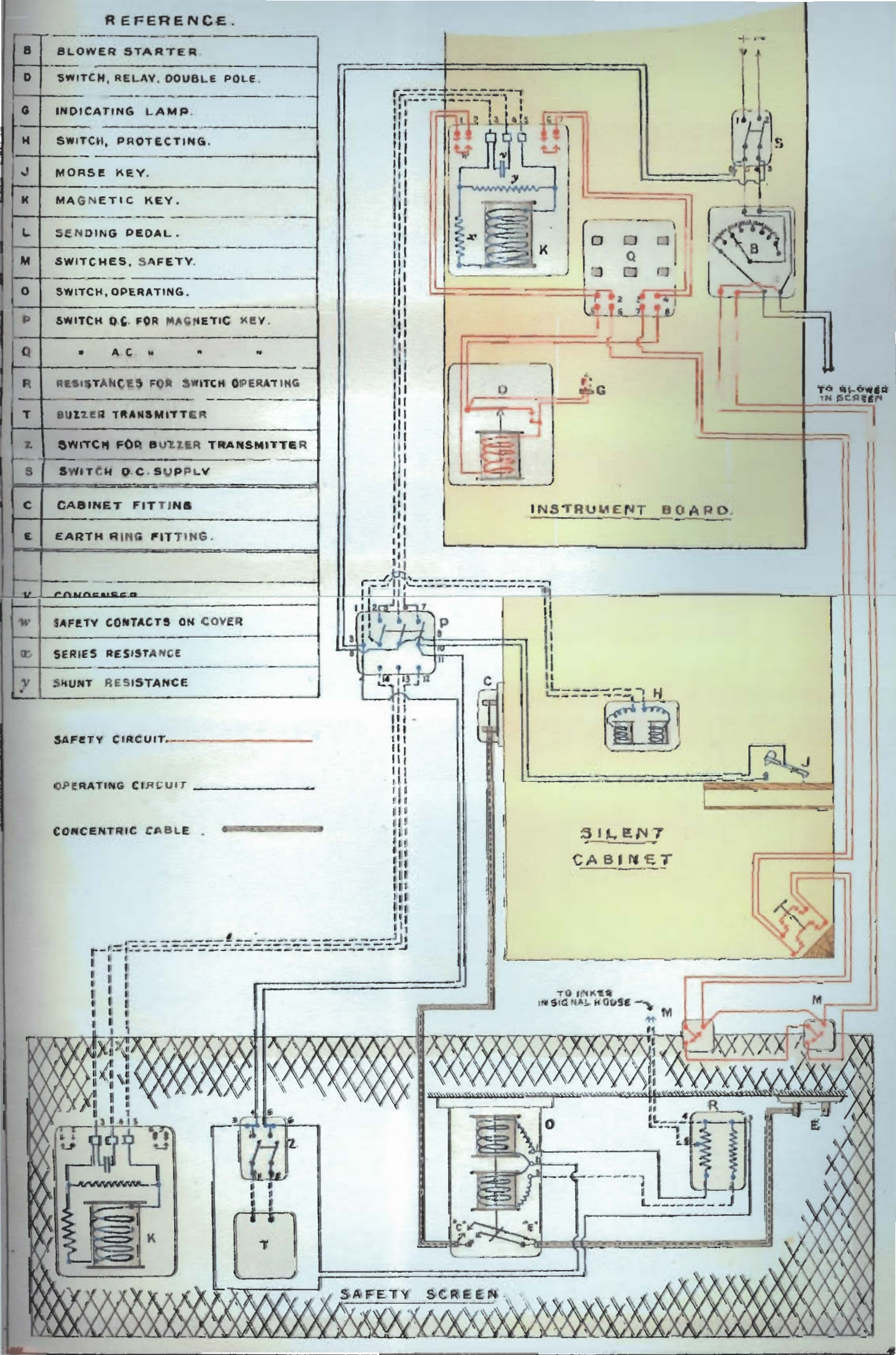
PROPOSED IMPROVEMENTS IN MOTOR ALTERNATORS.

For Mark II. Sets.

The original design of motor alternator is not completely satisfactory, and, although failures have generally been traced to strain during erection, there are certain points in which it is considered that the design could be improved.

"SERVICE MARK II." WIRELESS INSTALLATION.

DIAGRAM OF NEW "SAFETY" & "OPERATING" CIRCUITS.


REFERENCE.
B BLOWER STARTER.
D SWITCH, RELAY, DOUBLE POLE.
G INDICATING LAMP.
H SWITCH, PROTECTING.
J MORSE KEY.
K MAGNETIC KEY.
L SENDING PEDAL.
M SWITCHES, SAFETY.
O SWITCH, OPERATING.
P SWITCH D.C. FOR MAGNETIC KEY.
Q " A.C. " " "
R RESISTANCES FOR SWITCH OPERATING
T BUZZER TRANSMITTER
Z SWITCH FOR BUZZER TRANSMITTER
S SWITCH D.C. SUPPLY
C CABINET FITTING
E EARTH RING FITTING.
V CONDENSER
W SAFETY CONTACTS ON COVER
x SERIES RESISTANCE
y SHUNT RESISTANCE
SAFETY CIRCUIT
OPERATING CIRCUIT
CONCENTRIC CABLE
INSTRUMENT BOARD.
SILENT CABINET
SAFETY SCREEN
TO BLOWER IN SCREEN
TO INNER SIGNAL HOUSE

Defects in original design.

The principal defects are as follows:—

(*a*) The three bearing type is obviously liable to strain during transport and erection.
(*b*) The upper half of the bearing brasses were weak owing to the slots for the oil rings being cut too deep in order to allow for rolling of the ship.
(*c*) The direct current brush holders were weak and liable to fracture.
(*d*) The arrangements for slinging the motor alternators, more particularly when striking them down below, were inconvenient, with the result that the motor end bearing was frequently strained.
(*e*) The slings for lifting the armatures were too long to allow of the armatures being lifted clear of the lower field magnet casting in certain classes of ship.
(*f*) There were no means of draining the oil from the centre bearing when running.
(*g*) Certain of the dowell pins did not project far enough to be efficient.

With a view to the improvements of future motor alternators in these respects, the following action has been taken:—

Proposals for improved design.

(*a*) A new design of machine having four bearings and a flexible coupling is under consideration. It is proposed to order one of this type for trial in "Vernon" before finally approving the design. The overall length of the new four-bearing machine will be 5 feet 8½ inches. Thus the new type would be only 3½ inches longer than the old (the greater length required for the four bearings being partly balanced by a saving of 5 inches in the length of the commutator which can be effected in the 220-volt machines required for new ships), whilst the ease with which the motor and alternator can be separated for transport will much facilitate their installation.
(*b*) Stronger brasses are being supplied.
(*c*) A new design of brush holder is under consideration.
(*d*) Four lifting bolts, two at each end of the bedplate, are being fitted to all new machines.
(*e*) Shorter slings are being supplied.
(*f*) An oil drain is being fitted to all new machines.
(*g*) All dowell pins will project at least an inch into the lower bearing surface.

WIRING OF MARK II. SETS.

New instruments.

The addition of the operating switch to the Mark II. sets necessitates certain alterations and additions to the existing wiring, and renders three articles obsolete, viz.:—

(*a*) The Send-Receive Switch.
(*b*) The Pedal and Lever for Send-Receive Switch.
(*c*) The cut-outs for Concentric Cables which were formerly mounted on the instrument board.

The following new instruments will be supplied to Mark II. ships, and arrangements should be made when altering the wiring to insert these instruments in their correct positions:—

(*a*) Operating Switch (*see* page 10).
(*b*) Resistances for Operating Switches.
(*c*) Cabinet fitting for Operating Switch.
(*d*) Earth Ring fitting for Operating Switch.
(*e*) Pedal for Sending.
(*f*) Second Magnetic Key (to later ships only).
(*g*) Key Resistance for use with Second Magnetic Key.
(*h*) The Switch for Changing over the A.C. leads of the Magnetic Key from the key on the board to the key in the Cage.
(*i*) The Switch for changing over the D.C. leads of the Magnetic Key.
(*k*) The "Direct Current Supply Switch."
(*l*) The Protecting Switch (*see* page 37).
(*m*) The Buzzer Transmitter (*see* page 11).
(*n*) The Switch for Buzzer Transmitter.
(*o*) Connecting Box for Concentric Cable.

Position for new instruments within the cage.

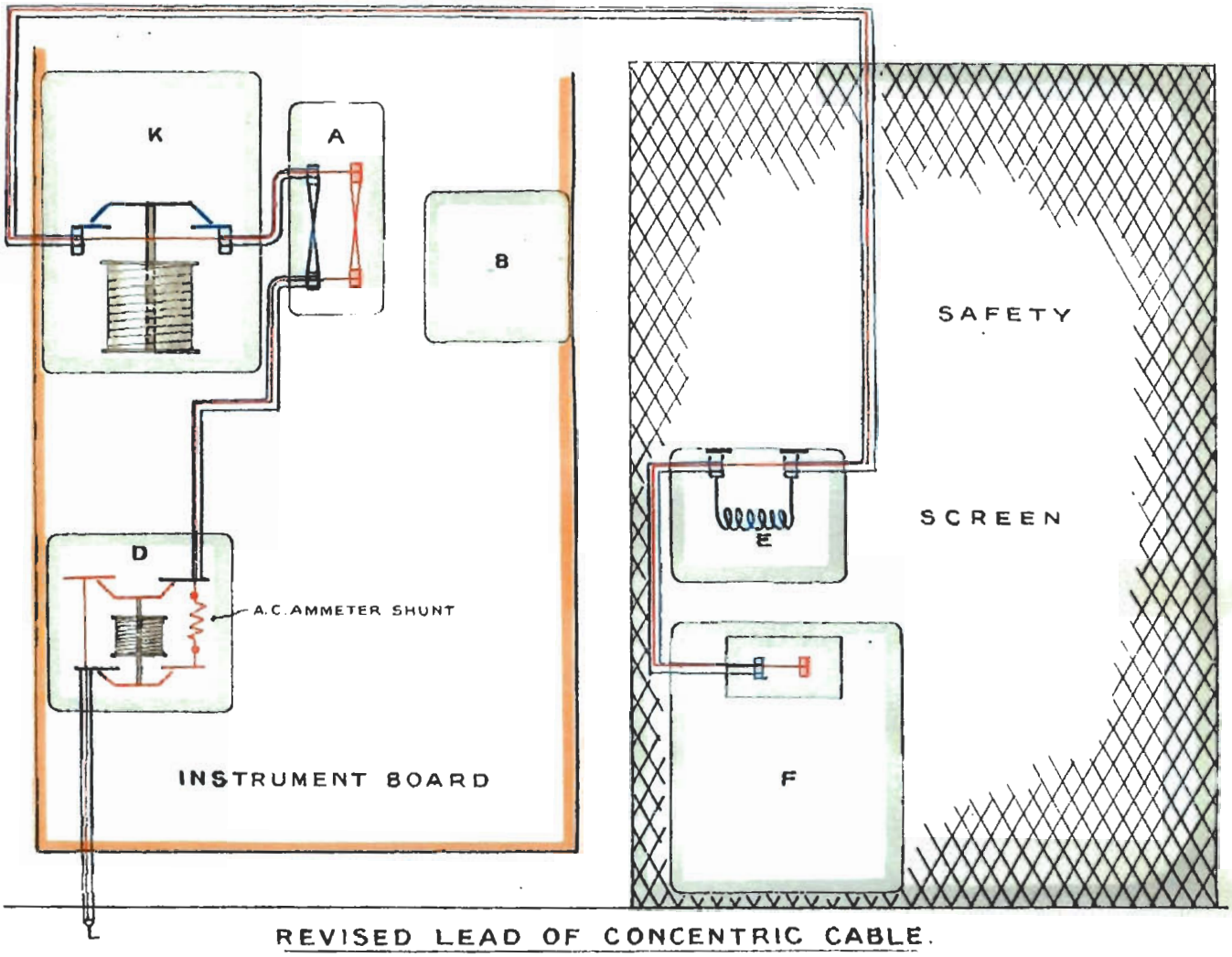
The following of the new instruments are to go within the safety cage:—

(*a*) Operating Switch.
(*b*) Resistances for Operating Switch.
(*c*) Second Magnetic Key.
(*d*) Buzzer Transmitter.
(*e*) Switch for Buzzer Transmitter.

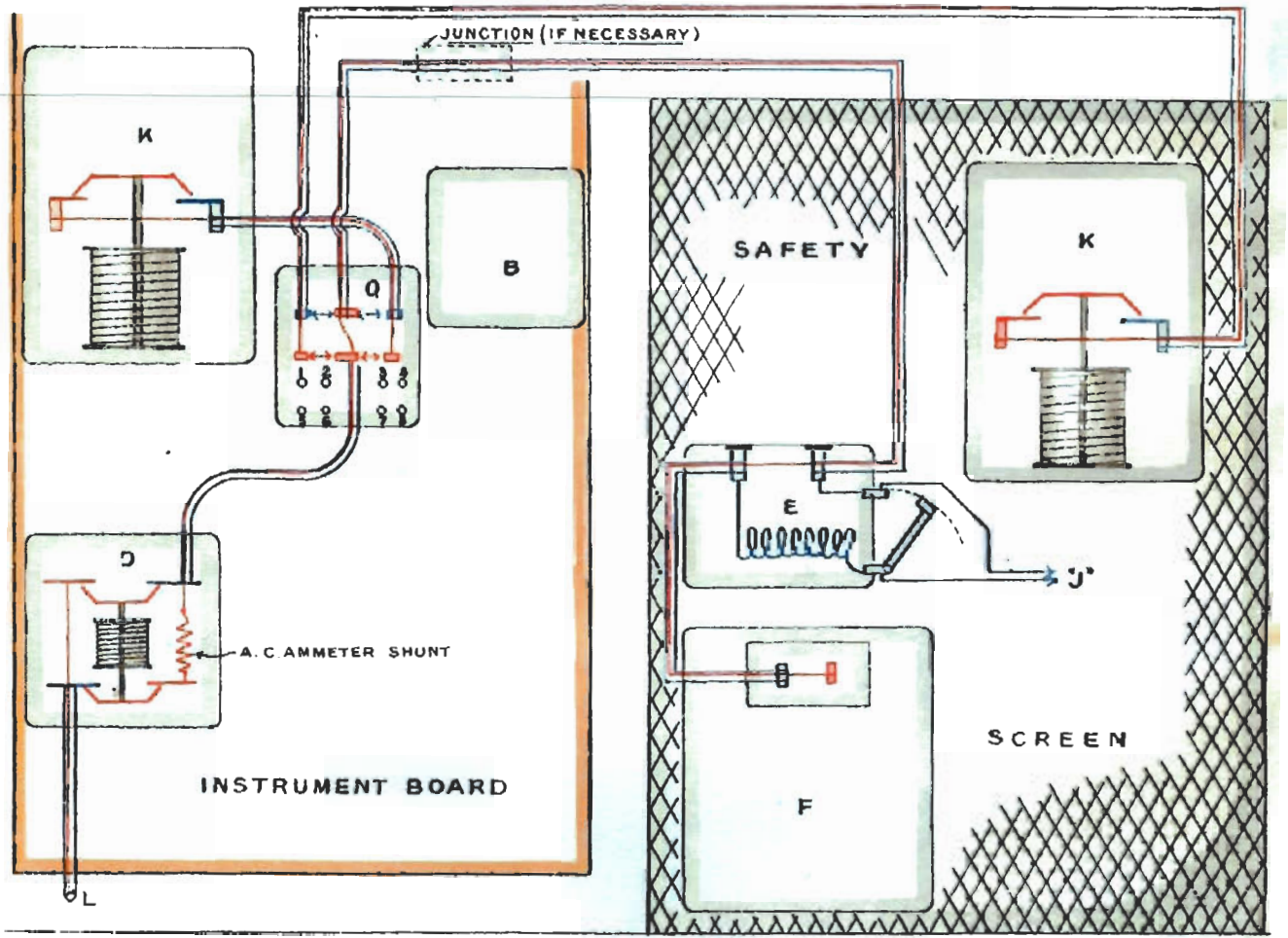
It is essential that the second magnetic key should be within the safety cage, as otherwise there would be no safety arrangement to prevent people from getting a 500-volt A.C. shock. The reason for putting the operating switch inside the cage is in order that the concentric cable between the earth-ring and the receiving instruments may be as short as possible. The most suitable position for the operating switch is obtained by having it suspended from the deck overhead just above the mutual coil. The position for the second magnetic key will of necessity

ALTERATIONS TO SERVICE MARK II WIRING

ORIGINAL LEAD OF CONCENTRIC CABLE



REVISED LEAD OF CONCENTRIC CABLE.



REFERENCE.

A	A.C. DOUBLE POLE CUT OUTS	E	IMPEDENCE COIL	Q	SWITCH A.C. FOR MAGNETIC KEY
B	BLOWER STARTER	F	TRANSFORMER	"J"	TO AUXILIARY IMPEDENCE
D	SWITCH, DOUBLE POLE, RELAY	K	MAGNETIC KEY	L	TO A.C. CHARGE-OVER SWITCH

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To face page 17.

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vary in different ships. If the spark gap is at the same side of the cage as the silent cabinet, it will probably be found most suitable to fit the second magnetic key over the impedance coil. In other ships this position may block up the window of the silent cabinet, and under these circumstances it may be more convenient to support the magnetic key with its back to the fixed part of the front of the screen. In any case care must be taken that the supports for the magnetic key do not prevent the doors of the screen from opening. Care must also be taken when deciding the positions for the new instruments within the screen that none of them come within sparking distance of the deck insulator or other high tension parts, and that sufficient room is left for running the necessary cables to the various instruments. A convenient arrangement for the buzzer transmitter is to secure the instrument on the safety screen close to the spark gap. The chief points to be noted in this respect are (1) that the buzzer should be readily accessible for purposes of adjustment, (2) that it should be in such a position that it can be permanently wired in the D.C. circuit, and (3) that the buzzer transmitter terminals should be as near to the spark gap as possible, so as to reduce the length of flexible necessary to a minimum. The buzzer switch should preferably be as near as possible to the buzzer itself.

Wiring of main concentric cable.

The new wiring of the concentric cable is shown in Plate IV. This wiring has been arranged in such a way as to make the alteration to the main concentric cable as small as possible. The "Cut-outs for concentric cable" require to be disconnected and removed from the board and the "Switch A.C. for magnetic key" to be mounted on the instrument board in lieu. When fitting this instrument it will be found necessary to select a position such that there will be sufficient clearance between it and adjacent instruments for running the cables as shown on Plates IV. and V.

In the majority of ships the wiring required will be as follows:—

(*a*) The concentric cable which runs to the magnetic key to be run in lieu through the "Switch A.C. for magnetic key" to the relay switch. If not long enough a connection to be made by means of the connecting box supplied for that purpose.

(*b*) Two new pieces of concentric cable to be run, viz., (1) a short piece to connect the magnetic key on the board to the A.C. switch, and (2) a long piece to connect the magnetic key in the cage to the A.C. switch on the board.

It is of the utmost importance that the two magnetic keys should be connected to their correct terminals as marked on the A.C. switch, as otherwise the safety contacts on the magnetic key will not be in circuit when the key is working.

It will be noticed that the magnetic key is now to be connected to one inner conductor and one outer conductor of the concentric cable, instead of making two connections to the outer conductor as formerly. It will be necessary to use a certain amount of packing when making connection to the inner core of the cable as otherwise the connecting piece would be too large.

Connecting box for concentric cable.

A small connecting box will be supplied to ships for the purpose of making a joint in the concentric cable. This box will have two uses, viz.: (1) To save a certain amount of re-wiring of the concentric cable when fitting up the new gear. (2) To enable repairs to be made to the concentric cable should it become seriously damaged at any time. The repairs would be made by inserting a new piece of concentric cable instead of the damaged piece, and connecting up by means of the new connecting box.

Wiring of safety circuit.

The safety circuit is shown in red on Plate V. The safety contacts on the magnetic key are to be disconnected from the main contacts and two separate leads are to be brought out of the instrument from each pair of safety contact terminals. This will entirely separate the safety circuit from the circuit which operates the magnetic key. It is important that the leads from the magnetic key safety contacts should be connected up to the correct contacts on the A.C. switch as shown in the plate. The safety contacts of the magnetic key in the cage are not to be wired at all, as the contacts on the screen door will provide sufficient protection.

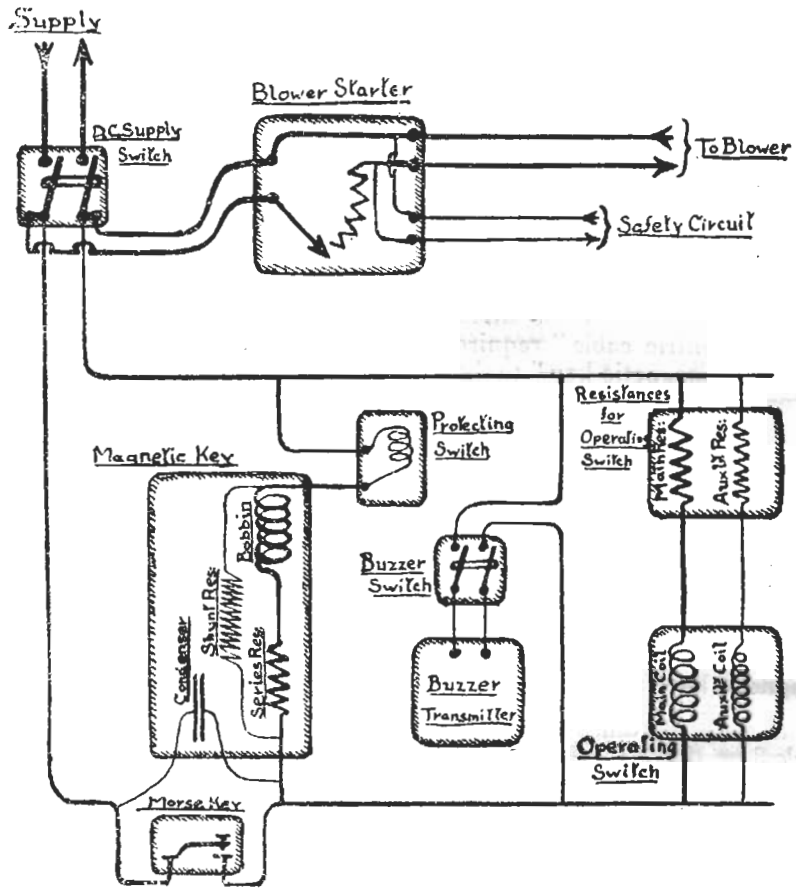
Wiring of operating circuit.

The circuits for operating the magnetic key and the buzzer transmitter are taken off in parallel with the circuit which supplies the blower, *see* Plate V. For this purpose the leads which supply the blower starter are to be disconnected from it and connected up to the "D.C. supply switch" instead. Double terminals are provided at the other side of this "D.C. supply switch" so that there will be no difficulty in connecting the blower circuit and the operating circuit in parallel.

A convenient place for the "D.C. supply switch" would be immediately above the blower starter on the instrument board. In Plate No. V. the circuits to the operating switch and to the buzzer transmitter are shown in full lines, while the parallel circuits to the two magnetic keys are shown dotted for clearness. The wiring on Plate No. V. is only diagrammatic, and does not show the instruments in their correct positions. A separate switch is provided for the buzzer transmitter so that this instrument may be inserted in parallel with the magnetic key and the operating switch when required. This switch will be identical with the D.C. Supply switch, and will be supplied under that name. When using the buzzer transmitter it will be necessary to have the magnetic key jumping up and down with each dot and dash sent, the reason being that the condenser which prevents the Morse key from arcing is permanently connected up inside the magnetic key. If, therefore, the buzzer were to be used without the magnetic key, the Morse key would arc at the contacts. This arcing might be avoided by fitting an additional condenser in the

cabinet across the terminals of the Morse key; and the advisability of supplying this additional condenser to ships is being considered. When all the switches are made and the various instruments are working, the circuit will be as shown in Fig. 1.

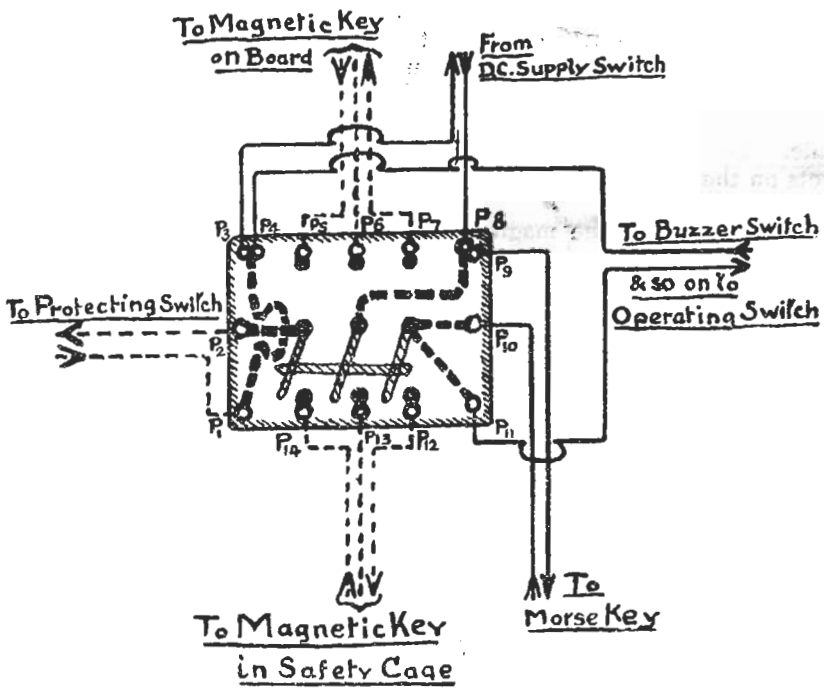
FIG. 1.



D.C. switch for magnetic key.

In Fig. 1 the "Switch D.C. for Magnetic Key" is not shown. This switch is shown diagrammatically in Plate V., the wires entering it being labelled as the terminals are on the actual switch. The correct arrangement and inter-connections of the switch are shown in Fig. 2.

FIG. 2.

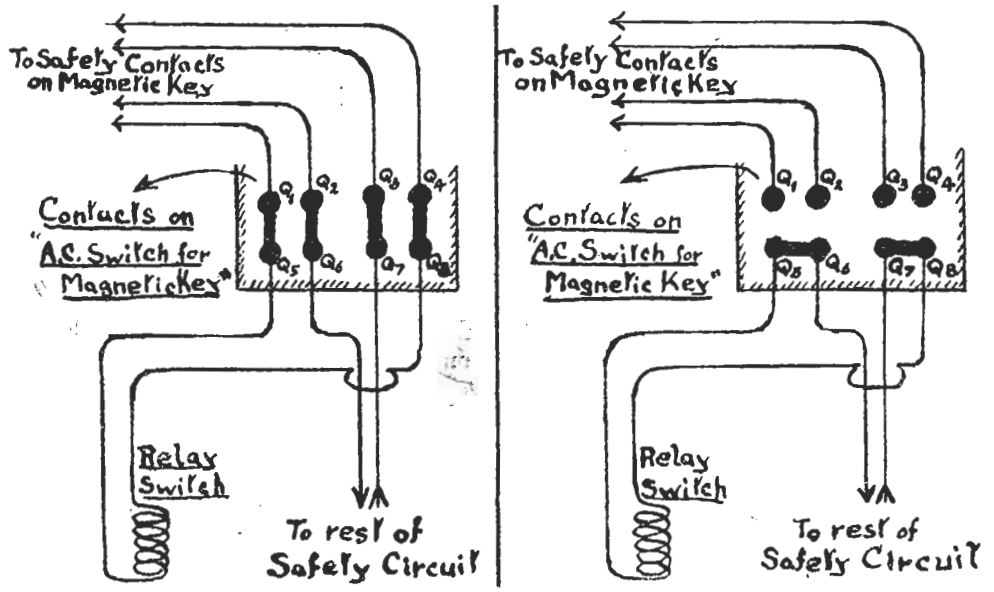


A good place for the switch would be on the outside of the silent cabinet above the field regulators. This switch is also used as a small junction box for connecting the various instruments in parallel, and it will be noticed that if it be placed in the "Off" position, both the "Protecting switch" and also the two magnetic keys will be put out of action. Care should therefore be taken not to use the buzzer transmitters with the D.C. switch for magnetic key open, as the result would be (1) that the "Crystalite detector" would be damaged, and (2) that the Morse key would arc at the contacts. If the "Protecting switch" is not connected, it will be necessary to short circuit terminals P_1 and P_2 of the "Switch D.C. for Magnetic Key."

A.C. switch for magnetic key.

The switch for changing over the alternating current from one magnetic key to the other is of a somewhat unusual design, as it is necessary to change over the safety circuit at the same time as the main A.C. circuit. In order to do this the cover of the switch has been made reversible, and automatically changes over the safety contacts. When switching over from the key on the board to the key in the cage it is necessary to remove the cover of the "Switch A.C. for Magnetic Key" and remove the two main contact blades to the other side of the switch, and then to replace the cover. When replacing the cover it will be found necessary to reverse it, and put it on upside down, as otherwise there is a projection inside the cover which would foul the main contact blades. This reversing of the cover will automatically cut the safety contacts of the key on the board out of the safety circuit (*see* Fig. 3).

FIG. 3.



WHEN USING MAGNETIC KEY ON BOARD.

WHEN USING MAGNETIC KEY IN CAGE.

Wiring of operating switch.

When wiring the operating switch it is important to note that the two "Resistances for operating switch" are not interchangeable, and that therefore the main resistance must be connected up to the main coil in the operating switch and correspondingly the auxiliary resistance to the auxiliary coil. Two additional terminals are provided on the resistances for operating switch, from which the "inker" in the signal house is to be operated. Two leads should therefore be run from these terminals to the signal house where the "inker" will automatically record all signals sent from the ship (*see* page 12).

Concentric cable for operating switch.

A special length of concentric cable (Pattern No. 751) will be supplied to each ship for the purpose of connecting the operating switch (1) to the "earth ring fitting," and (2) to the "cabinet fitting."

Earth ring fitting.

The earth ring fitting consists of a terminal block carrying suitable clamps for connecting up to the concentric cable. This fitting should be secured as near to the earth ring round the deck insulator as possible. The metal base of the fitting should be carefully earthed. With the earth ring fitting the following articles are supplied: (1) A piece of copper strip for connecting the outer conductor of the concentric cable to the earthing ring. This copper strip must be independent of the arrangement for connecting the metal base to earth. (2) A cable eye suitable for connecting to copper piping. This is to enable the inner conductor of the cable to be connected up to the correct terminal of the mutual coil.

Cabinet fitting.

The cabinet fitting consists of a terminal block carrying suitable clamps for connecting to the concentric cable. This fitting is designed to take the place of part of the "aerial and earth terminals" which are at present secured on the outside of the silent cabinet. The external plate of the old terminal block should therefore be unscrewed and the cabinet fitting secured up in its

place. The metal base should be earthed by means of the existing earth strip; and two leads of 611 cable should pass from the two terminals of the "cabinet fitting" through the two holes in the base of the fitting, into the silent cabinet and thus connect up the concentric cable with the receiving gear inside the cabinet. The two brass glands of the old aerial and earth terminals should still be used for bushing the holes through the cabinet walls.

Wiring of cabinet fitting and earth ring fitting.

The concentric cable between the operating switch, the cabinet fitting and the earth ring fitting should be run for the whole of its length as close to the deck and bulkhead as possible, and should be earthed at frequent intervals. It is important that there should be no inductive loops in the conductors which earth the bases of the fittings or in those which earth the lead casing of the cable, as otherwise currents might be induced in the lead casing of the concentric cable. The insulation in the concentric cable is also important, as this cable takes the sending current as well as the receiving current in the aerial. It should be noted that the cable from the "earth ring fitting" is connected to the terminal-clamps on the operating switch which support the two spring contact strips. These cable clamps are marked "E" and the cable clamps which are to be connected to the cabinet fitting are marked "C." It is important that the concentric cables should be connected up to their correct terminal clamps.

Sizes of cable

All the wiring shown on Plate V. in both safety circuit and operating circuit except the leads to the blower starter, is to be carried out with cable Pattern 798 A; or with its equivalent in the new cables, viz.:—Pattern No. 254.

Cable eyes.

It will be noticed that cable eyes are provided on each of the new switches; and much better results will be obtained by soldering the wires into the cable eyes than by simply forming a loop in the end of the wire and tightening up the terminal nut on that.

Earthing of lead casing of cables.

It is extremely important that the lead casing of all cables should be earthed at the following places:—

(*a*) Whenever a cable connects up to an instrument its lead casing should be electrically connected up to the metal base of that instrument.

(*b*) Whenever a cable enters the safety screen its lead casing should be earthed to the metal screen at the point of entering.

(*c*) Whenever a cable enters the silent cabinet, its lead casing should be earthed. The most convenient way of earthing these last-mentioned cables would be to run a metal strip along the side of the cabinet to connect up with the earth strip of the old "aerial and earth terminals."

When wiring cables which enter the silent cabinet, the cable outside the cabinet should be secured to the side of the cabinet, at intervals along its length, up to the point where the cable passes to some other fixed support. At this point an unsupported length of at least one foot should be left in the form of a loop or a coil between the last securing clip on the cabinet and the first securing clip on the next fixture. The reason for this is to prevent vibration being transmitted along the cable to the side of the silent cabinet, which under certain conditions might act as a "sounding board" and thus magnify the noise.

Remarks on new wiring.

Under the new system of wiring it is intended that in general the magnetic key on the board should be used. The circuit has been arranged so that if this key should break down, it will be possible to continue signalling by simply switching over (1) the "switch D.C. for magnetic key" and (2) the "switch A.C. for magnetic key" from the side marked "key on board" to the side marked "key in cage." When these switches are changed over, the magnetic key on the board will be quite dead in every part, and it will not interfere with the signalling if this key be opened out and parted for readjustment. The key in the cage may be rendered dead by switching back the two above-mentioned switches.

When the "pedal" is not pressed down the safety circuit between the pedal and the relay switch will be dead, but the safety contacts on the screen will be alive. To render the rest of the safety circuit dead, it will be necessary to open the "D.C. supply switch," and this will also make the whole of the operating circuit and the blower circuit dead. The D.C. supply switch should not be opened while the "blower" is running, as the switch is not designed to break such a large current. The only way of making the "operating switch" dead is to open the "D.C. supply switch."

When it is required to send with the "buzzer transmitter," it will be necessary (1) to open the "series parallel H.T. switch" for the transformer; (2) to connect up the "buzzer flexibles" to the two bars on the primary which make connection with the spark gap terminals; (3) to close the "buzzer switch."

It would be advisable to have the safety circuit broken by stopping the blower when using the buzzer transmitter, so as to prevent all possibility of the main A.C. circuit becoming completed.

Further information can be obtained about:—

Buzzer transmitter on page 11.
Operating switch on page 10.
Second magnetic key on pages 13 and 16.
Protecting switch on page 37.
Inker recorder on page 12.