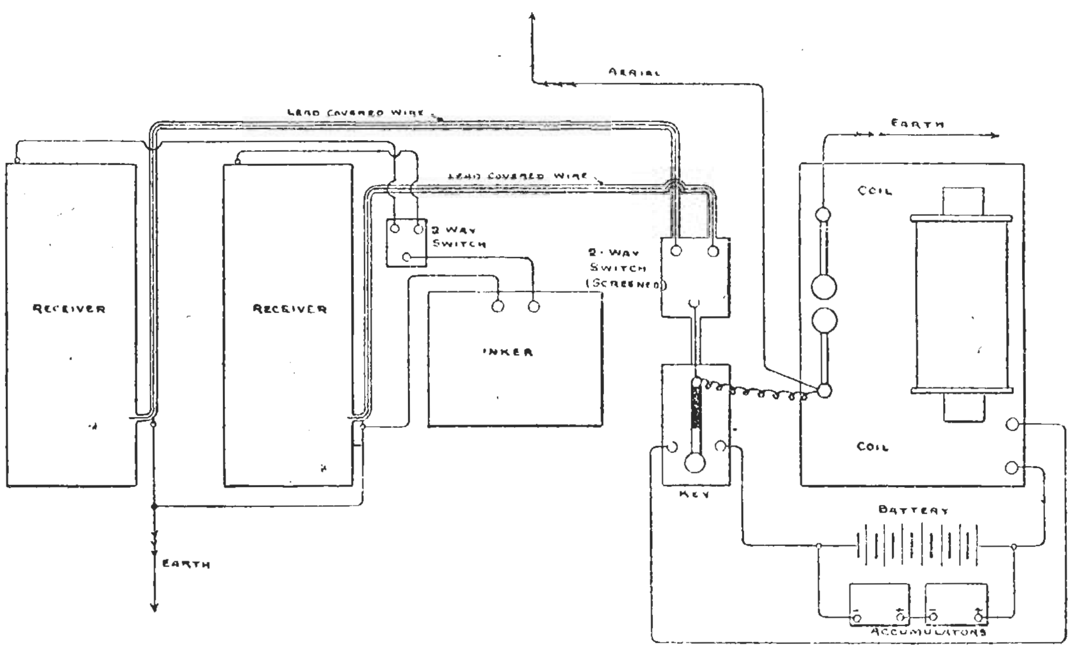
(B.) A Description of the Marconi System, the Conditions of the Contract between the Admiralty and the Company for the Supply of 32 Sets of Instruments, and an Account of Preliminary Trials made with the Apparatus.

As has been mentioned, the system of circuit employed is the same as in the Service sets, but there are many differences in detail.

Two receivers are supplied with each set. Figures 3 and 4, Plate 21, show the transmitter and receiver circuits.

Diagram of Connections for one Standard Installation of Wireless Telegraphy
All Leads to be as short as possible.



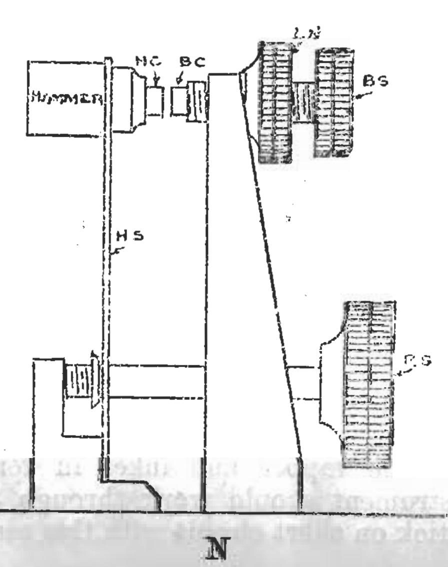
The Transmitter

Consists of a 10-inch coil and signalling key, actuated by two jelly-type accumulators. Each box of accumulators contains four cells, and the proper voltage when charged is 8·6.

The aerial wire is connected to one ball, the earth wire to the other.

The adjustments of the coil should be made in the following manner (a reference to the drawing will make this quite clear) :— Adjustment of the coil.

Induction Coil.—Break Adjustment.



Loosen regulating screw RS and back stop lock nut LN.

Unscrew back stop BS.

Examine back and hammer contacts BC and HC. See that the contact surfaces are clean and fit fair on one another. If not rub up with smooth file.

Press hammer H against coil with left hand and screw up back stop BS till back contact BC is within about $\frac{1}{20}$-inch of hammer contact HC.

Screw up lock nut LN.

Then regulate by screwing up regulating screw RS till a steady spark is obtained.

(Note.—Regulating screw turns to left to tighten hammer spring HS.)

From the aerial ball a lead is taken to the receiving terminal of the key.

Referring again to the figure, page 97 (diagram of connections) it will be seen that from the key the aerial wire is taken through a lead or brass covered wire to a two-way switch, also brass covered, and from this switch to the two receiving boxes, to which the lead covering is connected, the aerial wire itself being connected as shown in Fig. 4, Plate 21 (detail of receiver connections).

Jigger.

The jigger used is of the 140-foot type, and is wound on a rectangular framework of cardboard, the condenser being in the centre of the framework. The length of the primary winding is 14 feet. This jigger is unnumbered, and should be universally used; it is marked M. The Fig. 4, Plate 21 (detail of receiver connections) clearly shows the connections of jigger; the earth connection is taken to an "earth" terminal, this earth terminal being connected to the iron box, which is itself well earthed.

It will be seen that choking coils of iron wire are used each side of the jigger.

Siemens' relay.

The relay made by Messrs. Siemens Brothers is of the polarized type, wound to $10,000^{\omega}$, and is fitted with a balanced armature working between two stops contained in the top of an insulated vertical bar which is pivoted at the bottom.

The sensitiveness may be altered by means of a screw which works this vertical bar to and fro about the pivot as an axis. This screw is called the adjusting screw, and great care should be taken not to turn the adjusting screw too far back or the tongue of the armature will be bent.

Occasionally it may be found that the relay will not obey the motions of the adjusting screw; this is due to the pivot screw, mentioned, seizing, and it may be remedied by removing the base of the instrument and easing this screw.

The working stop and the tongue are shunted by a $1,000^{\omega}$ non-inductive resistance and a condenser in series, the coils are similarly shunted, and there is a $4,000^{\omega}$ non-inductive shunt between the working stop and the negative pole of the local battery, *i.e.*, across the tapper terminals.

The relay works the tapper and inker in fork, as in the Jackson instrument. The instrument should work through $50,000^{\omega}$, using one dry cell, and should not stick on short circuit with this same adjustment.

SIEMENS RELAY.—ADJUSTMENT OF.

(*See* the figure, page 100.)

These relays are passed into the Service in perfect adjustment.

Circumstances may, however, arise when, even with fair treatment, the relay becomes unreliable.

The instrument should work well through $50{,}000^{w}$, with one Obach cell. Also, without altering the adjusting screw, it should not stick when the $50{,}000^{w}$ is short-circuited.

This fineness of adjustment can be obtained by carefully following the instructions here laid down, although it is improbable that such sensitiveness is ever required in actual working.

Remove the watertight cover.

Take out both screws, retaining pole pieces P_1 P_2 and remove the pole pieces.

Ease back the working stop S_1, having first slacked its set screw.

By means of the big outside adjusting screw H_1 place the stop brackets B in the middle of their travel.

By means of the spring adjusting screw X place the armature (by eye) midway between the stop brackets.

Ship the pole pieces, placing them about $\frac{3}{16}''$ *apart* and equidistant from the centre line.

Should the armature A now be violently attracted over to either pole piece, disengage it by means of the fingers, and try if there is any position where it will remain at rest between the pole pieces.

This may be done by altering the spring adjusting screw X.

Thus, if armature sticks to pole piece P_1, disengage it; (*a*) it may balance between the pole pieces, (*b*) it may fly back again to P_1, (*c*) it may fly over to P_2.

In case (*a*), X need not be touched; in case (*b*), X must be altered to try and make the armature balance between the pole pieces; in case (*c*), *i.e.*, when the armature refuses to balance at all, the pole pieces are too close and must be shifted a little further apart.

In any case, the armature should be made to balance between the pole pieces, and on moving the big adjusting screw back and forth, the armature should follow the motions of the stop brackets for an appreciable distance before the pole pieces take charge of it altogether.

Now balance armature by means of the big adjusting screw H, and, also by means of this screw, get it into that position where the pole piece P_1 is just going to take charge of it.

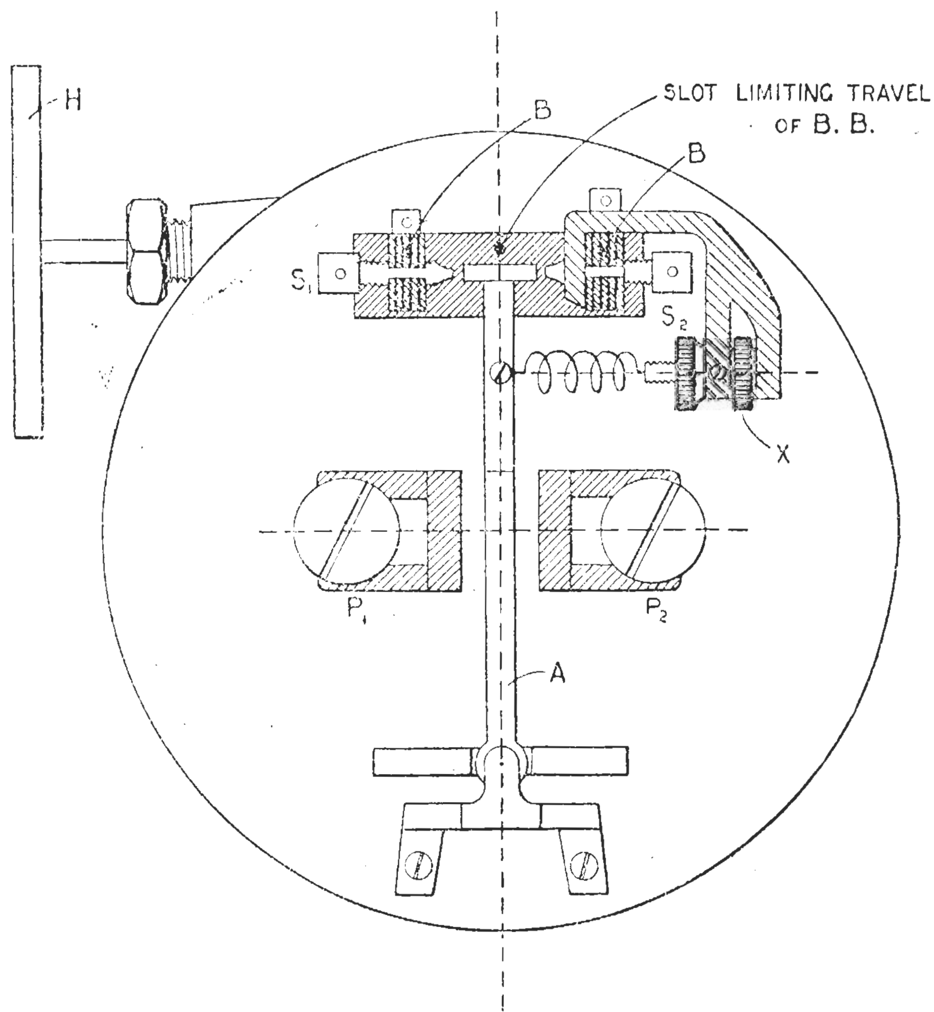
Screw up the working stop S_1 to just touch the tongue, and set up the set screws.

The position of S_2 is not very material, but it is as well to screw it up to within $\frac{1}{16}$th inch or so of the contact tongue.

The relay is now in adjustment, and will be found to fulfil the conditions mentioned.

This test is to be distinctly understood to be an instrumental one, to be applied to the instrument after repair or when it is certainly out of adjustment.

The test to be applied under working conditions is that laid down in the working instructions.

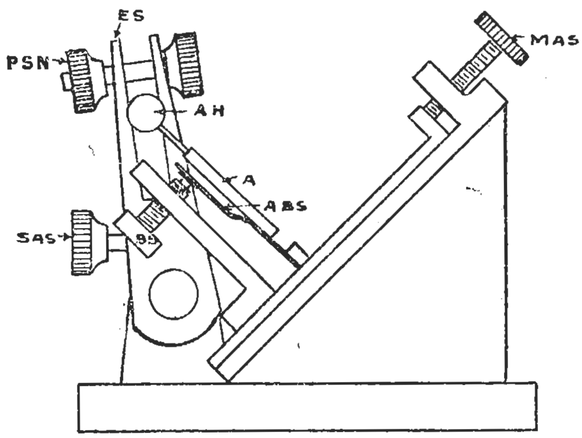


Tapper. The tapper is of the electro-magnetic type.

The strength of tap is regulated by moving the magnet towards or further from the armature by means of the magnet adjusting screw MAS. The following instructions will make this clear :—

(*The magnet coils are not shown in the figure.*)

TAPPER.—ADJUSTING GEAR.



To adjust the tapper unscrew back stop BS till the armature A is free and stands in its normal position. Adjustment of tapper.

Mount the coherer by placing the square end of the bone mount in the fork of the ebonite standard ES close up to the pinch screw PS, and in such a position that the armature hammer AH may hit the coherer fairly in the neighbourhood of the gap containing the filings. In the normal position the side tube or tag on the coherer should be parallel to the direction of the blow from the armature hammer. For greater sensitiveness it should be below this, and for less sensitiveness it should be above.

Tighten the pinch screw nut PSN.

Adjust the distance between the armature hammer AH and the coherer to $\frac{1}{16}$-inch by moving the ebonite standard ES by means of the standard adjusting screw SAS, that is, adjust the ebonite standard ES so that the stroke of the armature hammer AH between its normal position and the coherer is about $\frac{1}{16}$-inch.

Screw up the back stop BS to just touch the armature, back spring ABS, and give one quarter turn more and fix with lock stud.

When the back stop is thus adjusted the armature should be parallel to the plane of the faces of the pole pieces.

If it is not so, the spring should be bent to bring it into this position.

When adjusting the tapper screw with the object of strengthening the tap, great care should be taken not to screw it too hard down or the armature spring will be bent.

Bring magnets within $\frac{1}{16}$-inch of armature A by turning magnet adjusting screw MAS. This adjusts the strength of the tap: forward strengthens, back weakens. The final adjustment of this should be made while receiving.

Care should be taken that the magnets are not moved too far back, or they will be unable to actuate the armature.

The armature of a properly adjusted tapper will continue to vibrate against the back stop for some time after the local circuit has been broken, and this is a characteristic feature of a well adjusted instrument.

The tapper is shunted with $1{,}000^{w}$ across the terminals, and $1{,}000^{w}$ across make and break.

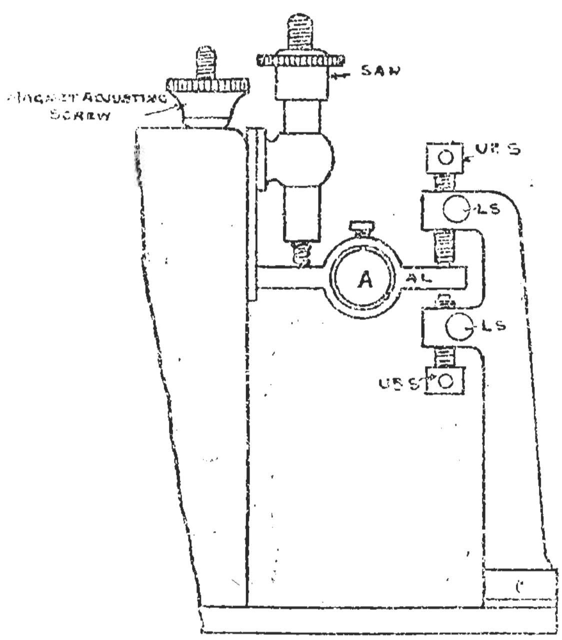
It will be seen that the lead to the inker is forked off from one tapper terminal and taken to the back of the box and passed through many choking coils, a condenser is attached to the far side of these coils, the other plates being earthed. The lead then passes to a two-way switch, and thence to the inker itself.

The inker is practically of the same type as that used in the Service gear, the armature is made to act as a relay to ring the call bell which is attached to the inker base with its single cell. The return lead from the inker is taken to the iron box, which we have seen is connected to the earth terminal of the receiver.

"Inker" adjustment.

The adjustments of this instrument have already been given in AR 1899, but the following are added here as the diagram renders them somewhat clearer than those mentioned.

MORSE INKER.—ADJUSTING GEAR.



Lower the magnet by unscrewing the magnet adjusting screw.

Loosen lock studs LS.

Unscrew the stops UP S—UR S so that both are clear of the armature lever AL.

Slack up the spring S by unscrewing the spring adjusting nut SAN till the inker wheel just touches the paper.

Then screw down the upper stop UP S to within $\frac{1}{20}$-inch of the armature lever AL. Screw up under stop UR S until it just touches armature lever. Tighten both lock studs LS.

Give spring adjusting nut SAN one turn so as just to lift armature lever AL clear of UR S (under stop), and bring it up against Up S (upper stop).

Then screw up magnet M by means of magnet adjusting nut MAN till magnet about $\frac{1}{16}$-inch from armature A. Make final adjustment with spring adjusting nut SAN while receiving, so as to get clear definition on paper.

Great care must be taken that the inking disc does not jamb the tape, or irregular signals will result.

The inker is shunted with $2{,}000^{w}$ N.I.

The Marconi system was tried during the Naval Manœuvres 1899, and a report of the results is given at p. 126. Annual Report for that year.

In July 1900, the Admiralty entered into agreement with the Marconi Company for the supply and use of 32 sets of their apparatus. The conditions are given in the following Admiralty letter C.P. $\frac{8254}{11450}$ of the 2nd July 1900, to the Company.

In the event of the Admiralty being of opinion that any installation is not in an efficient state they will give the Company the opportunity of making it efficient at their own expense. It is understood that they will not be held responsible to repair, nor suffer any loss of royalty, in any case where inefficiency can be proved to the satisfaction of the Admiralty to be due to negligence or gross carelessness on the part of Admiralty Officials, or to unusual and extraordinary atmospheric electrical perturbations.

The acceptance of the 32 installations to be contingent on their satisfying the following test, viz.:—

A ship at Portland, shall be fitted with the Marconi apparatus, and another ship in like manner at Portsmouth; the height of the masts for the purpose on both of these ships shall be 162 feet feet, measured above the netting; communication shall be made on these ships from Portsmouth to Portland, and from Portland to Portsmouth, and also to an intermediate ship, with a height of 100 feet, up to a distance of 30 miles. The Portland set will be maintained as a standard and all subsequent sets will be tested at Portsmouth by means of such standard. This standard will be one of the 32 installations herein referred to.

The above test to be carried out by Naval Signalmen under the Company's supervision, the Admiralty bearing the cost of fitting such ships for this purpose.

After the installations have been accepted, the necessary operators to start such installations when fitted in H.M. ships at home, or in Royal Naval Signal Station, or in Torpedo Schools in the United Kingdom, and to test them at starting, to be supplied by the Company free of charge.

The 32 sets were tested and passed without difficulty, the signals being made by Naval Signalmen (H.S.) who had previously received a short course of instruction in "Vernon"; the adjustment of the instruments in the first place being made by the Company's assistants.

The 32 sets were distributed as shown on the list given on page 131, and from reports received are giving general satisfaction.