No. 119

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WIRELESS TELEGRAPHY.

1-534

INSTRUCTIONS

FOR

GUIDANCE OF OFFICERS

IN

FITTING UP LARGE POWER WIRELESS TELEGRAPHY INSTRUMENTS.

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CONTENTS.

NECESSARY PRECAUTIONS.

INSTRUCTIONS FOR FITTING UP LARGE POWER W.T. INSTRUMENTS.

(With special reference to "C" tune Mark II. Transmitting Instruments.)

ATTENTION IS CALLED TO THE FOLLOWING NECESSARY PRECAUTIONS.

Cage doors.

The cage doors are never to be closed when anyone is inside the cage. A shock from the high tension circuits inside the cage will be instantly fatal.

As long as the cage doors are open the Morse key circuit is broken.

Condensers.

The glass plate condensers must be filled brimful of clean vaseline oil before use.

The safety points are to be kept in position across the terminals of the condensers, and must be kept quite sharp, and exactly $\frac{7}{10}$ths of an inch apart.

The lid of a condenser should never be taken off except for the purpose of examination or repairs.

Transformer.

The transformer must be filled with vaseline oil before use.

A shock from the secondary winding will be instantly fatal.

When the primaries are in series, the connections through the switch should be—

$$\pm \; P_1 \text{~~~~~} P_2 \; - \; P_3 \text{~~~~~} P_4 \; \mp .$$

When in parallel, the connections through the switch should be—

$$\pm \left\{ \begin{matrix} P_1 \text{~~~~~} P_2 \\ P_3 \text{~~~~~} P_4 \end{matrix} \right\} \mp .$$

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Never attempt to increase the voltage at the primary terminals.

Choking coil.

The choking coil must be filled quite full of vaseline oil before use.

The terminals are inside the galvanised iron cap, which is supplied only for protection during transport.

Spark gap.

A spark is never to be made unless the safety spark points are in place across the spark gap, and the points *exactly* $1\frac{1}{4}$ *inches* apart. The points must be kept sharp.

If a spark takes place at the points under these conditions, the spark plugs are too far apart.

NOTE.—$1\frac{1}{4}$ inches across points is equivalent to just over 10 mm. spark between the spark plugs, and 10 mm. is the maximum spark to be used with "C" tune.

Men aloft.

No men are to be allowed aloft above the control platforms when sending.

CHAPTER I.

Instructions for Fitting up.

The wireless telegraphy office is built by the Dockyard. Inside, its principal feature is a safety cage for the transmitting instruments, 7 feet 3 inches long by 4 feet 6 inches wide, made of galvanised iron wire. Wireless telegraphy office.

It has two sliding doors, which allow an opening big enough to put the instruments in place.

The cage is earthed, and it, with the bulkheads, deck, and beams, must form a completely earthed structure.

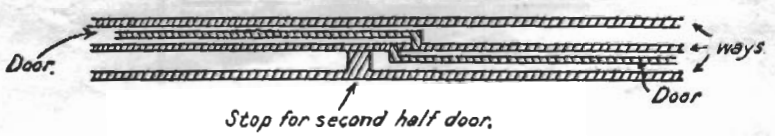
The Dockyard also wire the office and run the leads as laid down in their instructions. This only leaves the sweating on of end connections and joining up to be done. The Dockyard drill holes and bolt down instruments when they have been placed. The Dockyard also build and wire a silent cabinet.

They also cut a hole for the deck insulator, bore holes for securing the gunmetal deck fitting, and fix an iron guard screen round it on deck. Deck insulator.

They also drill holes and secure a zinc earthing ring round the deck insulator, and run two zinc strips from this ring along the bulkhead to two terminals for the sending and receiving earths to connect to. Earthing ring.

Points to be Attended to.

(*a*) See that the cage doors are properly interlocked, so that the second half cannot be opened unless the first half is already open. Cage doors.



Note.—Two safety bolts are supplied, one to each door.

Earthing ring.

(*b*) See that the upper surface of the zinc ring and the lower surface of the deck are scraped bright and the zinc ring screwed up taut.

The zinc ring should have two zinc strips running down the bulkheads to two terminals.

Guard screen.

(*c*) See that the deck insulator is approximately in the centre of its guard screen.

Wooden batten.

(*d*) See that a wooden batten, about 4 inches by 1 inch, is fixed round the inside of the cage about 3 feet 6 inches from the deck on the sides opposite the doors and silent cabinet to carry the safety chokers, &c.

Positions for electric lights.

(*e*) See that the two lamps inside the cage are placed at the two upper corners of the cage nearest the cage doors, and that they can be switched on or off from outside independently.

Aerial and earth terminals.

(*f*) See that the aerial and earth terminals are in place on the silent cabinet before it is erected, as they cannot be put in afterwards. A hole must be cut in the galvanised iron wire of the safety cage abreast them.

Condenser tanks to be bolted down to the deck.

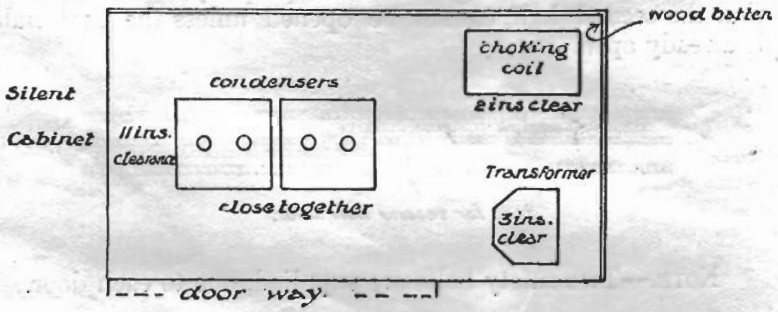
As soon as possible get the tanks properly placed so that the Dockyard can drill the holes for securing them.

At the same time measure off the positions for the holes for securing the secondary stand, and spark gap, to the ribs on the lids of the condensers.

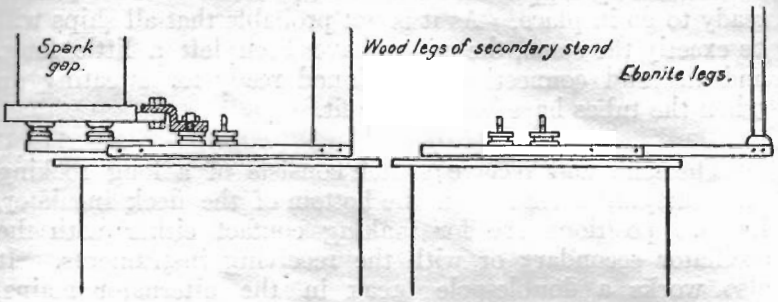
Do not take the lids off the condensers to make these holes.

Relative position of instruments.

The position of the tanks is as under—



Method of securing secondary stand and spark gap—



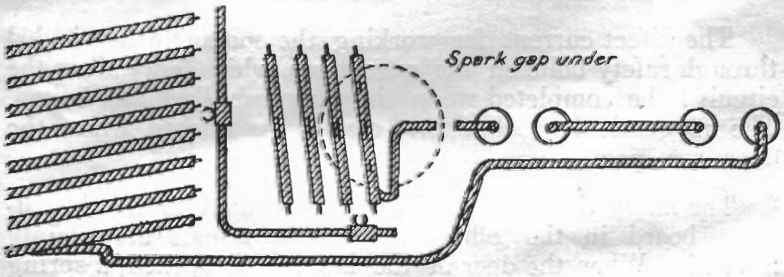
The spark gap has four ebonite legs, which must be secured to pieces of brass angle, which are in turn secured to the ribs on the lids of the condensers by screws.

Adjustable primary.

The adjustable primary is carried in a teak frame above the spark gap. One end of the frame is secured to a batten carried by the two steel brackets on the spark gap end of the cage, and the other to a batten fixed across the spark gap end of the secondary stand. There are four turns, mounted to rotate, parallel to the secondary. These form the coupling. The turn nearest the secondary has lugs on it, dividing it into eighths, and the others are divided into quarters; that is to say, the coupling can be adjusted from $\frac{1}{8}$ turn to 1 turn in steps of $\frac{1}{8}$ turn, and thence up to 4 turns in steps of $\frac{1}{4}$ turn. The remaining 8 turns are mounted rigidly, at right angles to the secondary. A revolving arm allows contact to be made to any point on the end turn, and a slider allows of contact being made to any other turn.

Arrangements are made to short-circuit all turns not required to prevent them from sparking. This is done by a straight bar fitted over three terminals at the back.

Diagram of Primary Leads.



The adjustable primary is connected to the spark gap and condensers by copper tubes, which are, as far as can be, fitted ready to go in place. As it is not probable that all ships will be exactly the same, the pipes have been left a little long, and the end connections are tinned ready for sweating on when the tubes have been cut to fit.

Send and receive switch.

The send and receive switch consists of a long rocking arm, carrying a lead from the bottom of the deck insulator, its two positions are for making contact either with the oscillator secondary or with the receiving instruments. It also works a double-pole break in the alternator mains, breaking them when in the receive position.

The switch is kept in the "receive" position by a spring.

A lever in the silent cabinet operates this switch by a Bowden wire, and this lever, and so the switch, are kept in the "send" position by a catch which is engaged by pressing a pedal. As soon as the pedal is released the catch disengages, and the switch flies back to "receive." An air buffer is fitted to the lever to prevent the spring recovering too fast. It can be adjusted by a milled headed screw at the bottom of the cylinder, which regulates the escape of air. The length of the Bowden wires is also adjustable.

The switch arm works horizontally, and the "send" contact must be at least 12 inches clear of the beams and all metal work. No screws for securing the switch are to be placed within 12 inches of the "send" contact.

Magnetic key.

The magnetic key is placed in the alternator mains. It is a single-pole surface contact switch, giving a double break, and is worked off the lighting mains on the sucking magnet principle, by a Morse key in the silent cabinet.

A resistance of 20 ohms for a 100-volt ship is fitted in the key box, in series with the bobbin, a condenser is fitted across the terminals of the Morse key to prevent sparking, and a resistance of 160 ohms is placed across the series resistance and bobbin to absorb the inductive kick.

The direct current for working the magnetic key is led through safety bolts on the cage doors, which only allow the circuit to be completed when the doors are shut and bolted. The magnetic key, therefore, cannot be worked when the doors are open.

The magnetic key box should be secured to the instrument board in the office. All its terminals are plainly marked. When the door of the key box is opened, a spring

contact short-circuits the "no volt" release in the starter and the rotary is thereby stopped.

Oil leakage.

An angle iron is to be worked round the floor of the cage, in the case of an iron deck, so as to form an oil-tight well; in the case of a wooden deck, a wooden beading is worked round, and the floor and beading covered with sheet lead.

Wire mats.

Spiral wire mats are provided to prevent oil which may leak on to the floor inside the cage from being carried over the ship.

Deck insulator.

The deck insulator is an ebonite rod, reinforced with anti-spark discs, rove through a large porcelain insulator, Place one sheet of $\frac{1}{2}$-inch rubber round the thinnest part of the porcelain and bolt the two halves of the gunmetal deck fitting together round it.

The india-rubber must be cut so as to just butt when wrapped tightly round the porcelain. It can be kept in place by a couple of turns of twine whilst getting on the deck fitting.

That end of the porcelain which has the most corrugations is the top.

The deck fitting is made watertight by a red lead joint between the flange and the deck, the flange being bolted hard down to the deck.

Guard screen.

Round the deck insulator an iron guard screen is fitted, and, if on a wooden deck, earthed to the zinc earthing ring.

The top rim of the guard screen has eyes fitted to take insulated guys to the feeder, if required, to keep the feeder central.

Earthing clip for aerial.

Two holes are drilled in the top rim to take the plate of the aerial earthing clip. The spring clip is clipped on to the nuts between the horns at the top of the deck insulator when it is required to earth the aerial.

When not in use the earthing lead is to be stopped up and down one of the vertical guard rails.

ÆRIAL AND RIGGING.

Top-gallant masts.

Top-gallant masts are fitted to each mast to give a vertical height of 180 feet truck to W.L., and all rigging leading to within 40 feet of wireless yards is insulated.

Insulation of stays.

The arrangement of the rigging and position of insulators laid down in Dockyard instructions have been thoroughly tried and found both necessary and sufficient.

Wireless telegraphy yards.

W.T. yards 18 feet long are fitted to the T.G. masts 4 feet below truck.

Arrangements are made for reeving a yard rope.

Nothing is to be left rove above the ærials.

Notes on rigging.

The following is a copy of the "Notes" on the rigging drawing:—

"The top-gallant masts are to be fitted for housing. The ærial yards on each top-gallant mast should be shackled, at the bunt, to a band 4 feet below the truck in order to take the weight of the yard, the principal object of the lifts being to keep the yards square. The lifts are to be of F.S. wire rope insulated top and bottom, with globe strain insulators two at each end.

"Each yard-arm is to be fitted with a galvanised iron band having two eyes. One of these eyes, in the case of both yards, will be fitted on the upper side to take the yard lifts; the other eye, in the case of the main W.T. yard, is to be fitted on the under side of the band, and in the case of the fore W.T. yard on the after side of the band. These eyes are to be fitted with M.C.I. swivel blocks to reeve 2-inch ærial halliards.

"At the bunt of each yard two galvanised iron bands are to be fixed, having eyes on their under sides. These eyes are to be fitted with swivel blocks, to form fair leads for the halliards.

"The halliards, after reeving through these blocks, are to be taken down close to the masts and set up in a convenient place, either in the tops, fire control platforms, or lead through to the upper or shelter decks.

"In the position selected for setting up the halliards, in the case of the main, belaying cleats should be fitted. In the case of the halliards on the foremast, eye-plates should be fitted on each side of the mast instead of cleats, and the springs to which the ærial hallards will be set up, are to be shackled to these eyes.

"The T.G. stays should be secured to a band on the T.G. masts just below the point at which the W.T. yard is shackled. The stays are to be insulated, with lignum vitæ deadeyes and hemp lanyards. Should the position of any of

these deadeyes come within 60 feet of the tops of the funnels in the direction that the smoke and funnel gas are likely to take, the insulators should be placed so as to be clear of this.

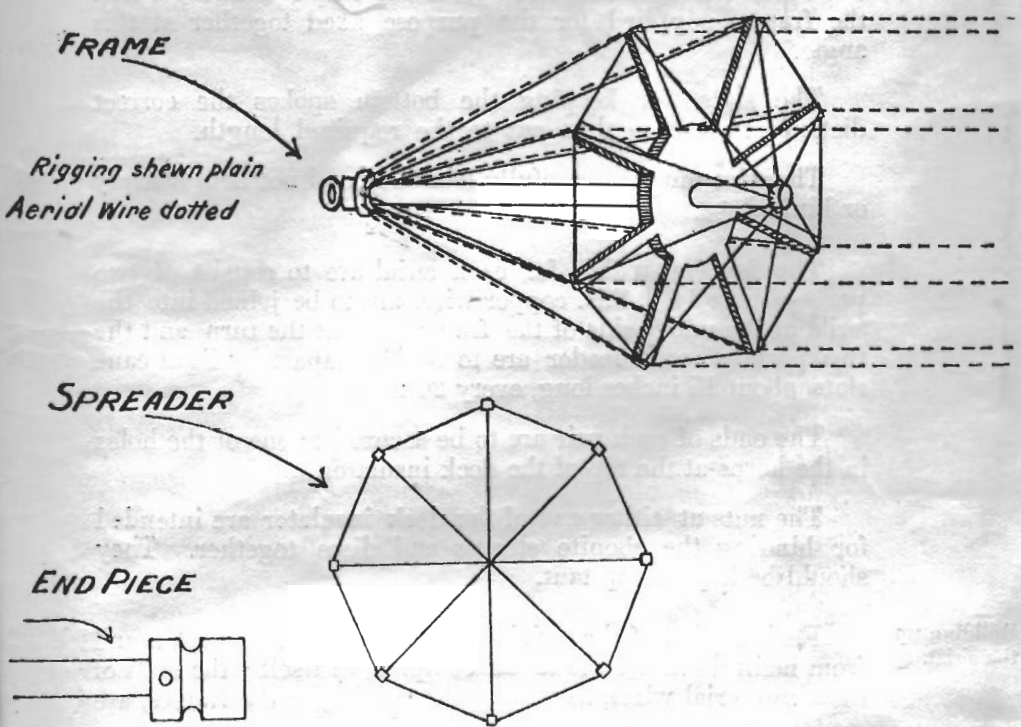
"The position of the ærial wire will be between the W.T. yards, brought aft, and stayed out to springs attached to eye-plates on the ship's sides not less than 20 feet apart in the athwartships direction, or more than 20 feet from the stern.

"A hemp Jacob's ladder is to be fitted to each top-gallant mast.

"Signal jackstay, if fitted, is to be of hemp. No signal halliards or hemp jackstay to be fitted higher up than at present, *i.e.*, no signal halliards to be taken to T.G. masts.

"Masthead semaphores to be removed, if not already done."

Each ærial consists of eight bare copper wires, 14 L.S.G., arranged axially on the surface of a cylinder 4 feet in diameter. At each end there is a wooden frame, and at the point where the ærial bends down, a special form of wooden frame-work is arranged to allow the wires to change their direction, and at the same time to keep the strains equally distributed between each of the eight wires. These special frames are triced up to the Main W.T. yard-arms. Ærial.



A spreader of four light canes is placed every 20 feet along the ærial, the canes having wooden end-pieces fitted with grooves to prevent the wire slipping.

The end-pieces are secured to the canes by the swifter being rove through a hole drilled through the end-piece and the cane.

The Æ. wires are to be given one round turn round these end-pieces and seized with waxed roping twine.

All swifters and stays for the frames and spreaders to be of bare copper wire.

Seizings to be of well-waxed roping twine, varnished over.

The frames with swivel eyes in the long member are for the foremost and aftermost ends, the others for the turn.

A twine seizing secures the centre.

The ærial wire is supplied in coils, and the turns must be carefully taken out of the wire whilst opening up the coils.

The angle at which the ærial bends at the Main W.T. Yard-arm must be measured from the ship's drawings, and the frames supplied for the purpose fixed together at this angle.

The slats, for keeping the bottom spokes the correct distance apart, are then cut to the required length.

The wire must be carefully handled, and not bent sharply or kinked.

Ærial feeders.

The feeders, which for each ærial are to consist of two parts of bare 14 L.S.G. copper wire, are to be joined into the ærial at the under side of the frame-work at the turn, and the two parts of each feeder are to be kept apart by light cane slats, about 15 inches long, every 20 feet.

The ends of each pair are to be secured to one of the holes in the horns at the top of the deck insulator.

The nuts at either end of the deck insulator are intended for binding the ebonite sleeves and discs together. They should be kept set up taut.

Building up the ærial.

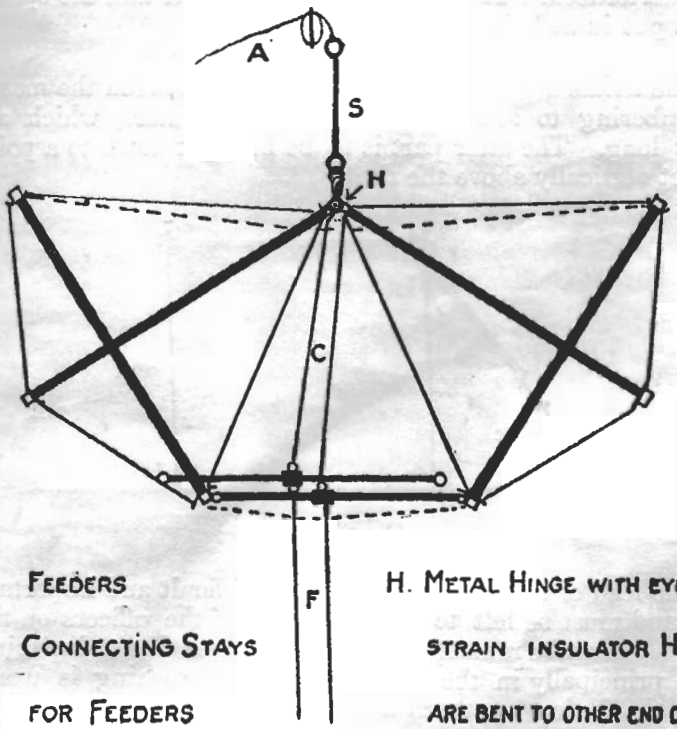
Each section of the ærial—that is, from fore to main and from main down aft—is to be complete in itself; the ends of the eight ærial wires, as well as the rigging of the frames, are

to be brought to the eye-plates on the long members of the frames.

At the turn, the parts of wire similar to the one shown dotted in figure below are to be put in after the frames are fixed in place, great care being taken with the connections.

No soldered connections to be used in the ærial.

One of the strain insulators is to be shackled to the hinge on the frames, and the halliards bent to it.



F. FEEDERS

C. CONNECTING STAYS FOR FEEDERS

A. ÆRIAL HALLIARDS

H. METAL HINGE WITH EYE FOR STRAIN INSULATOR HALLIARDS ARE BENT TO OTHER END OF INSULATOR

S. STRAIN INSULATOR

Hoisting the ærial.

It will probably be found easiest to trice the ærial up from before the mainmast and dip the after part and, if necessary, the feeders round the yard-arms.

Springs for automatically regulating the tension on the ærial.

Spring boxes, working from no extension at 100 lbs. to 2 feet extension at 300 lbs., are supplied for the ends of the ærial, and the secret of keeping the ærial standing in heavy weather lies in the proper use of these springs.

For the foremost ends a strain insulator is shackled to the swivel bolt in the end frame, and the foremost halliards bent to it.

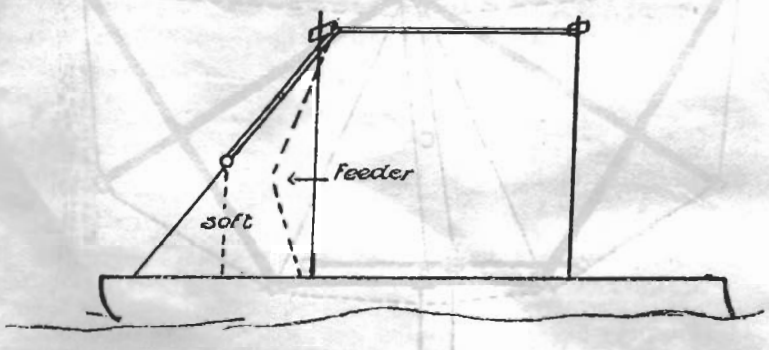
The foremast halliards are then hauled out taut, and a temporary eye turned in at a convenient place and the spring box put in vertical.

Both foremost ends must be hauled out together, as the yards have no braces.

The after ends must be shackled to strain insulators, and the out-hauls brought down conveniently to the eye-plates on the quarterdeck. They are to be hauled taut and the spring boxes put in as before.

Length of ærials.

The ærials are to be as long as possible between the masts, remembering to allow for the strain insulators, which are 5 feet long. The after part is to be brought down to a point 50 feet vertically above the deck.



Lead for feeders.

The lead of the feeders is the most difficult and important part, and must be left to the discretion of the officers on the spot. It must be remembered that the losses due to brushing occur principally in the feeders, and that brushing is worst where the feeders approach nearest to earthed iron.

The feeders for each ærial should be separated as far as convenient, and the lead should be fairly vertical. Sharp bends should be avoided, and the feeders kept as clear of smoke from the funnels as is practicable.

The feeders should be joined in to the ærial at the points on the slats of the cross-frames (which are hung from the main W.T. yard) as shown. The feeders may not divide the ærial into two equal parts, that is to say, there may be twice the length of ærial between the masts that there is leading aft, but still it is advisable to join the feeders in at this point as they are then well supported by the W.T. yard and will not

cause the ærial to sag, which would certainly be the case if they were forked in between the masts.

At the point where the feeders are joined in, all eight wires of the ærial are to be in good electrical contact with one another by means of the wire stays which secure the ends of the spokes to the hinge.

It is well to get the ærials up as soon as possible so as to get the stretch out of the gear before tuning.

It is advisable to get a plain spark into the ærials, from the coil supplied for tuning, as soon as possible, and this will form a fair test for insulation.

A coil will fail to spark when any other instrument will show perfect insulation.

It is necessary that the ærials be kept close up.

Filling the Instruments with Oil.

The condensers, choking coil, and transformer must be filled quite full of special vaseline oil, called Wakefield's patent insulating oil.

Too much stress cannot be laid on the necessity of absolutely clean oil, especially in the condensers. Clean oil necessary.

The least dirt or fluff in the oil will mean the failure of the condensers, and to remedy it the condensers will have to be parted, and every plate and contact carefully cleaned. This is a most ticklish and messy operation.

All oil must be poured into the tanks through a fine copper-wire gauze strainer. Straining the oil.

Condensers, choking coil, and transformer must have 24 hours to soak in the oil before they are used, in order to get rid of all air bubbles and allow the oil to get between the windings, &c. Time to be allowed for oil to soak in.

The greatest pains must be taken to see that the pump is kept perfectly clean inside. The slightest grit, fluff, or dirt in it will cause endless trouble. Oil pump.

Oil is supplied in 5-gallon drums, and about $4\frac{1}{2}$ drums are required for each condenser, $3\frac{1}{2}$ for the choker, and $2\frac{1}{2}$ for the transformer. Oil drums.

Safety oil tanks.

Safety oil tanks are supplied for each tank, consisting of a copper vessel holding about half a gallon, which should be secured to the bulkhead about 2 feet above the tank.

A thin spiral copper pipe connects this safety tank to the nearest filling nipple on the tanks.

The object of these safety tanks is to allow for the expansion of oil due to changes in temperature, and also to keep the instruments quite full when the ship is rolling. They must be cleaned out and all sediment removed periodically.

An additional reason for keeping all gear quite full is that if the oil sinks till sparking can take place on the surface, it will vaporise, and the vapour mixing with air in the tops of the tanks will form an explosive mixture, which will be ignited by the next spark. The resultant explosion cannot be serious, as there is no compression, but it is sufficient to bulge the tanks and ruin the instrument.

Adapter for transformer.

A special adapter is supplied to enable the nut on the end of the spiral pipe of safety oil tank to be connected to the hole in the cover of the transformer.

Filling and air escape holes.

In the condensers, the holes in the corners are for filling, the holes in the centre for air escapes. A small float is fitted for one of them to show when the tank is nearly full.