TECHNICAL DESCRIPTION OF WASSERMANN (DATA CHIEFLY FROM UNTEROFFICER RIEKE - THE WASSERMANN MECHANIC)

1. The operating frequency is 136 Mc/s. and is not to be altered except on orders from German Ministry of Air. To alter it would involve moving two shorts on Lecher bars and tuning the output circuit.

Receiver tuning controls are set by the mechanic on a P.E. and are not altered during operations.

2. PRESENTATION

(a) The range operator has an 80 km. trace with lens viewing. A phasing control moves the time-bas along until the blip is on the cursor line on the tube face. Range is then read from a Veeder counter.

I.F.F. responses appear on a lower trace on the same tube.

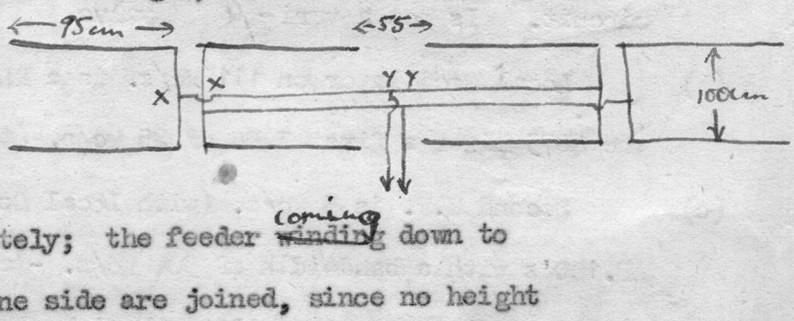
(b) The supervisor has two tubes, the first with a 200 km. horizontal trace, and the other with a 40 km. trace. A phasing control is available to adjust the position of the 40 km. within the 200 km. range.

(c) D.F. operator has two tubes also. The upper has a 200 km. vertical trace, which doubles when split is switched on to give left/right indications. This is the coarse D.F. tube. The lower tube is for fine D.F. and has a 200 km. horizontal trace, with downward deflection. Above this trace is a strobe trace about one cm. long on which the blip which is on the range operators cursor line appears. When split ~~oper~~ is applied, a second 1 cm. trace appears beside the first and the left and right echoes appear side by side on these two traces.

There is a knob to set the blip on the strobe when it is on the operators cursor line. This is only adjusted by the mechanic. With no split they are probably within ± 1° on their azimuth readings.

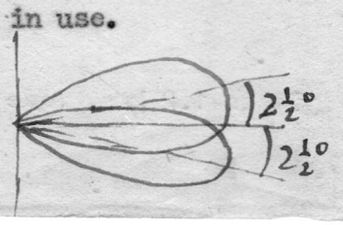
(d) AERIAL ARRAY

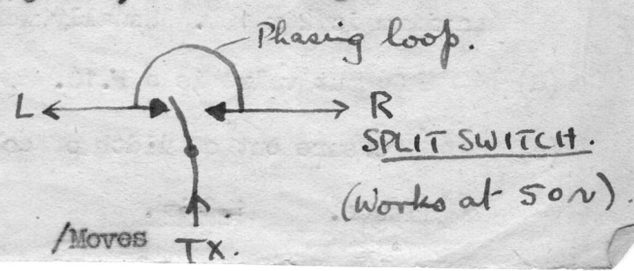
Horizontal beam width is 19° at transmitter half-power points whether on split or not. Each side (left or right) consists of 12 groups of ~~eith~~ eight half wave dipoles.



Each group is fed separately; the feeder ~~winding~~ coming down to the split switch. Here all one side are joined, since no height finding is in use.

(e) Split





Moves the lobe about ± 2½° from physical centre. The whole array is thus used on split, and when no split is used the beam is 2½° off centre so; this correction is added to each bearing by the D.F. operator. Lobe 2½° off target gives 20 - 15% less volts out.

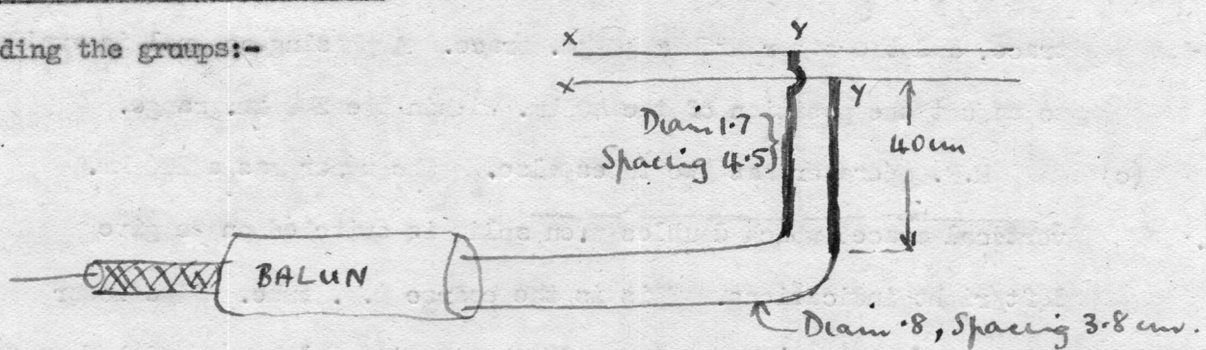
The aerial can use auto-scan to and fro (but not continuous rotation) but this is seldom used. Can scan almost 360° - but the usual arc of search for manual is from 230° - 320° - i.e. 90° sweep.

(i) Turning gear - Servo system

A Ferraris motor on the mast gives a feedback voltage into a valve amplifier which controls the field of the generator which provides the D.C. fiedl for the turning motor.

3. FURTHER AERIAL ARRAY DETAILS

Feeding the groups:-



The back netting (which is not soldered) is 25 m. tall and the bottom of it is 5 m. above.

4. MEASUREMENT ON MAIN LOBE (ON P.E.)

Echo amplitude down to half of maximum at ± 9½° off centre. This should be about transmitter half power point. Hence transmitter half power beamwidth is 19o approximately.

5. RECEIVER

S + N = 2N at signal of 10 micro-volts about (~~C/C~~ Kennel). Noise itself is 7 - 8 micro-volts.

(a) One R.F. stage using Phillips 4673 "built into" tuned circuit. Is not a vari-μ valve.

(b) Local Oscillator on 111 Mc/s. is a RL.12T1 giving from the 4673 mixer a first I.F. of 25 Mc/s. (two AF.110's ~~heere~~). here).

(c) Second I.F. is 5 Mc/s. (with Local Oscillator on 20 Mc/s.). Two AF.100's with a bandwidth of 500 Kc/s. -(as ~~in~~ the first I.F.). Gain maximum is 2×10^6. Usually work with about ½ cm. of noise.

(d) Output value is a P.10.

(e) Measurement of width of echo from Sylt is 1.2 kms. wide at half amplitude. ~~1.2 km.~~

6. MODULATOR AND TRANSMITTER

The 500 c/s. waveform goes into the modulator where it is squared. The square wave switches on a pair of CS.50's which have a ringing coil in their anodes. This produces a 2.4 kV., 2 micro-second pulse - all but the first half cycle being damped by a diode.

The transmitter has 2XTS.41 valves which are normally biassed off at - 2 kV. on their grids. The incoming pulse switches them on. Peak power is 40 kW.

Has lecher lines in anode and grid circuits which can only be adjusted with difficulty. The output coupling circuit is tunable by a condenser.

7. COMMON T AND R UNIT

Is not wide band, but can be set up on any frequency from 125 - 145 Mc/s. The TR switch in this equipment is a Nullode, i.e. it has no electrodes within the bulb, being simply a concentric glass tube containing a mixture of neon and hydrogen. The R.F. is fed to it by concentric tubes, one fitting inside the bulb and the other outside.

Its resistance when conducting is low, presumably far less than 70 ohms, since it is across a 70 ohm line. The maximum voltage rating is 7 kV. The life is estimated at several thousand working hours - this one has done 3 - 400 so far.

8. I.F.F.

The same type of transmitter is used for I.F.F., transmitting on 158 Mc/s. and receiving on 125 Mc/s. The I.F.F. response is displayed on a lower trace on the range operators tube.

In the waveform generator panel there are two phasing controls to adjust the phase of I.F.F. and main transmitters to compensate for the delay in the aircraft I.F.F. set.

Uses split if required. The aerial array consists of 4 wide band vertical dipoles per left or right side.

9. EXTRA UNITS

(a) Extra range unit

Switching this range unit increases the range by 200 kms. Can thus read up to (and actually beyond) the next transmitter pulse. Just add 200 kms. to the range reading - both range and D.F. operators traces being shifted the 200 kms.

(b) Wasserflau

Consists of a small C.W. oscillator with switch, tuning and output controls.

Its output is fed into the transmitter box by a probe about 10 cm. long running parallel to the grid lines. The box probably has two valves, being oscillator and buffer stage. The C.W. gets into the receiver via the common T and R unit.

The operators seldom use it, if they are interfered with they leave things to another station.

On 24th June (first exercise) when Window appeared they said "Here comes that growing grass again", and more or less packed up. With Wasserflau can sometimes see that there are aircraft present in Window sectors. the Window but still cannot count them, or follow a particular track.

(c) Height Finding Equipment

The height tube is already installed in this equipment.

There is also a compensator in the cabin at the base of the array.

The Wassermann mechanic says a compensator was tried but lost 40%

So they used a Wellenschieher (wave shifter) which consisted of lines with motor driven adjustments.

This is thought to lose only 10%. ~~May be shorts in concentric lines.~~

The above is installed and working on Sylt.

The Sylt set is also wide band,

125 - 145 Mc/s.

~~12 of these tubes for whole array.~~

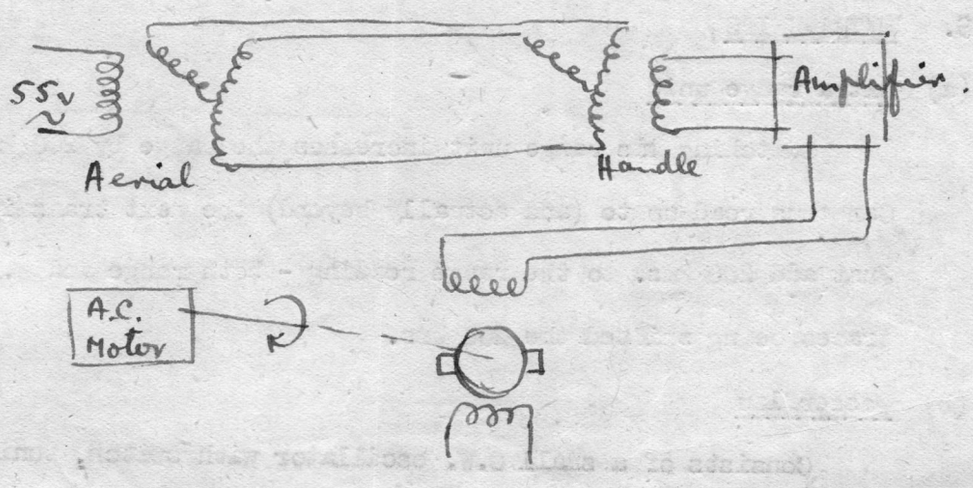
According to Kennel, they use a compensator just like the Mammut only smaller. Can theoretically shift the lobe 0 - 90°, but will probably only use about 15°. He says he can set up the compensator to lose only 20%.

Says cannot use split and height finding at once, but one after the other.

10. WASSERMANN TURNING GEAR

Bayley of RAE says the amplifier is all A.C. fed, the otput being the field supply of a DC. generator. The output of this generator supplies the (field)? of the turning motor.

Diagram from Kennel



/The

The amplifier has 2 thyratrons, one of which strikes when the aerial goes clockwise, the other when it goes anti-clockwise.

SYLT

1. WASSERMANN

(a) Frequency range 119½ to 156½ Mc/s. They usually work at high frequency end of band.

(b) I.F.F. trace is on the D/F operators upper tube - being another trace on the right.

(c) Height lobe may be swung 0 to 20°. There is a hand tuning control which makes the motor on the Wellenschieber turn, and its rotation is repeated back with Ferraris motors to a meter in the operations room. No split on height, just work on maximum. At the moment the hand turning is u/s. and they just have a two way switch for up and down and wait till the beam gets there. On 1st July followed an aircraft into 25 kms, where it was at 18,000 feet. Sometimes they tilt the beam to try to reduce jamming. Did not while we were there on 4th July exercise.

(d) For bearing can use auto-rotation at 3 r.p.m. There is the usual hearing meter by the handle, but there is also a Ferraris repeater from the aerial to the usual pair of bearing dials.

(e) Transmitter uses 2TS.41's but has high power anode modulation, with 22 kV. pulse. Has one knob (ganged) turning control with calibrated dial but you have to open the transmitter front panel to get at it. Also the D.F. operator (~~Sergeant~~ Feldwebel) who does the frequency changing has to walk round the back of the gear to do it.

(f) Receiver has one knob tuning - by Operator who is on height ~~(old supervisor)~~ tube.

(g) Frequency changing procedure is:

(i) D.F. operator goes round to transmitter and from a calibration chart, setsit on a suitable frequency (what he thinks fit).

(ii) Also from chart, sets two controls on the common T and R unit. ~~(Note it is larger than the usual Wassermann T and R box)~~.

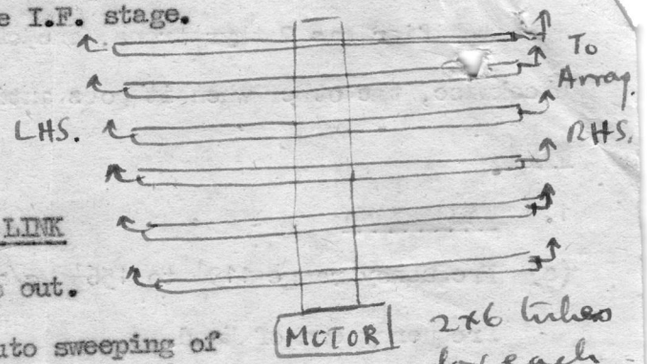
(iii) Returns to front and tunes the receiver on a P.E. This has now taken 80 seconds.

(Iv) Then trims the T and R unit on shorts from another operator, taking about a minute to do it.

(h) Has now Wasserfallau.

(i) Has a bandwidth switch which detunes one I.F. stage.

(j) Wellenschicher



OTHER EQUIPMENTS

ROMO "ROSE" DECIMETRE LINK

(a) Amplitude modulated megnetron giving 4 watts out.

(b) Frequency band 600 - 625 Mc/s., with auto sweeping of T and R together.

(c) Can handle 9 speech lines, being in the range 30 to 60 Kc/s. (of the side bands).

(d) Each speech channel can be divided into three teleprinter channels.

(e) Transmitter receiver separation should be more than $2\frac{1}{2}$ Mc/s.

SYLT DREH ANTENNA

P.P.I. Freya

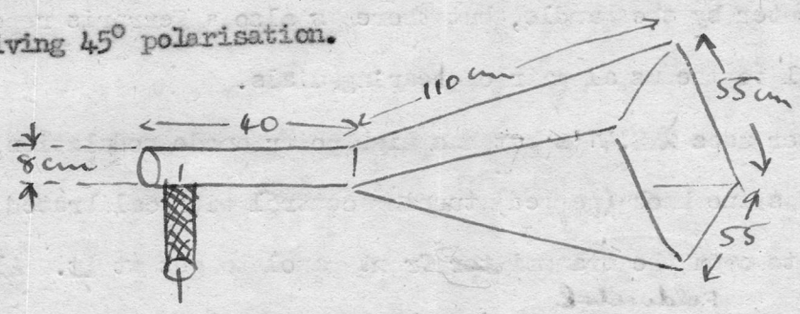
Normal frequency 146 Mc/s.

Range 125 - 155 Mc/s.

Rotates at 6 r.p.m., maximum being 10 r.p.m.

SYLT CORFU

Horn at 45° giving 45° polarisation.



The probe is a continuation of the feeder inner.

~~ROMO SQUARE ARRAY~~