CHAPTER 29

MARINE LIFEBOAT EQUIPMENT

29.1 GENERAL

Lifeboat equipment falls into two categories, that which is fixed and that which is portable. Fixed equipment is transmitting and receiving equipment permanently installed in a motor-driven lifeboat and powered from a 24-volt battery, which can be charged from the lifeboat's generator.

The Merchant Shipping (Radio) Rules lay down the full specification for such equipment, and it is interesting to note that one requirement is that the equipment must be so designed that an unskilled person can readily cause it to transmit both alarm and distress signals. As an unskilled person would have little if any knowledge of the morse code this means that the alarm and distress signals must be generated automatically.

A piece of equipment designed to generate these signals is termed an *automatic keying device* and usually consists of a number of mechanically driven switches in the form of rotating cams which switch the transmitted carrier wave on and off according to the dots and dashes which make up the alarm and distress signals. The cams may be rotated electrically or by a clockwork motor.

Fixed lifeboat transmitters and receivers are very similar to the emergency transmitters and receivers described earlier in this book and for this reason it is not proposed to consider them separately as such, but to move on to a consideration of portable lifeboat equipment which differs considerably from equipments previously described.

By referring to the Merchant Shipping (Radio) Rules, the full specification for portable lifeboat equipment can be seen. However, for convenience, some of the requirements are listed below. The Rules state that the equipment shall be so designed and constructed that:

(1) It is contained in a single unit (with the exception of the aerial and aerial mast).

(2) An unskilled person can erect the aerial system and, without difficulty, by simple operation and automatic means, transmit the alarm and distress signals.

(3) It is readily portable by one person.

(4) It is watertight and capable of floating in water.

(5) It can radiate type A2 waves continuously (but not simultaneously) on the frequencies of 500 kc/s and 8,364 kc/s.

(6) The carrier wave shall be modulated to a depth of 100 per cent by a

wave of rectangular character, so that the carrier wave is switched on for not more than 50 per cent and not less than 30 per cent of a modulation cycle.

(7) The receiver shall be a fixed-tuned receiver which shall be capable of receiving type A2 waves in the band 490–510 kc/s when used with headphones.

Considering items 1, 3 and 4, it is evident that the equipment should be as small and lightweight as possible. The two equipments described later in this chapter meet the requirements by using the same valves for both transmitter and receiver, but similar equipment using transistors could be made both smaller and lighter. Most manufacturers of portable lifeboat equipment now have models employing transistors.

With respect to items 5 and 6, the type of transmission is A2 (m.c.w.), modulation being effected by an audio frequency signal of rectangular wave shape. As noted in an earlier chapter such a signal can be shown to consist of a number of sine and cosine waves of varying amplitudes, whose frequencies are multiples of the original signal frequency, that is harmonics. When a radio frequency carrier is modulated with such an audio frequency wave, side frequencies are produced which exist over a very wide band of frequencies either side of the carrier, due to the high harmonic content of the modulating signal. This is obviously an advantage, as it means that such a transmission has a better chance of being received than one employing a sinusoidal modulating signal, and having as a consequence only very narrow side bands. It should be noted in passing that the same modulation requirements also apply to fixed lifeboat transmitters.

Referring now to item 7, it should be clearly understood that although the transmitter must be capable of radiating on either 500 kc/s or 8,364 kc/s, the receiver can receive m.c.w. signals only in the band 490–510 kc/s, and furthermore must be a wide-band fixed-tuned receiver. This means that the only receiver control necessary is the volume control.

Bearing in mind the conditions under which the equipment is likely to be used and also that persons having little or no technical skill may be called upon to operate it, it follows that only the minimum number of controls should be incorporated. It should also be noted that operating instructions must be as simple as possible and should be fixed in clear and permanent form to the equipment.

When considering the lifeboat equipments now to be described the limitations in the design should always be kept in mind.

29.2 MARCONI SALVITA III LIFEBOAT EQUIPMENT

The Salvita III is housed in a cylindrical watertight case. The upper part of the case contains the medium-wave and short-wave transmitter and medium-wave receiver assembly together with the operating controls located on the top panel. The lower part of the case accommodates the hand-driven generator providing the requisite power supply to operate the equipment, the voltage regulator and filtering circuits. The generator handles protrude from the cylindrical casing

and are protected by detachable covers. The equipment is painted a brilliant yellow to facilitate recognition when floating in water.

A block diagram of the equipment is shown in Fig. 29.1.

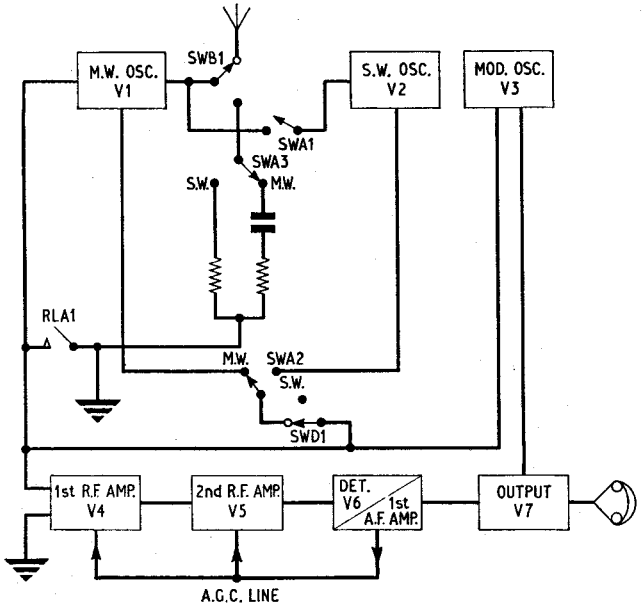

Fig. 29.1. Block diagram of the Marconi Salvita III lifeboat equipment.

Frequency range

m.w. transmitter	500 kc/s.
s.w. transmitter	8,364 kc/s.
m.w. receiver	500 kc/s.

Output power

Transmitter 1 to 3·5 watts.

Aerial systems

The equipment will operate with any aerial from 30 to 120 feet in length. A rod aerial with 30 feet of standard wire terminated with the necessary supporting insulators is provided with the installation.

Emission

A2 (m.c.w.).

Modulation

100 per cent by a substantially rectangular waveform of 800 c/s.

Signals

Automatic.

m.w. transmitter — Twelve four-second dashes separated by one-second spaces followed by distress signal three times and one long dash.

s.w. transmitter	Distress signal three times followed by a long dash of approximately 30 seconds.
Hand	By telegraph key on the front panel.

Power supply

From a hand-driven generator.

h.t. 420 volts d.c.
l.t. 6·3 volts d.c.

29.2.1 M.W. transmitter

The medium wave transmitter (Fig. 29.2) consists of a type 5B/255M valve, V_1, working as a crystal-controlled electron-coupled oscillator. Negative pulses from the modulator V_3 are integrated in a resistance capacitance network R_8 C_7 and applied as bias to the grid of V_1. As these pulses occur at approximately 800 c/s and the amplitude of the bias they produce is sufficient to cut off V_1, the medium-wave transmitter radiates A2 (m.c.w.) signals. The aerial circuit is series tuned by variometer L_2 and L_3; coil L_3 is short-circuited by switch SWC when working into a kite or balloon-supported aerial. For rod-aerial operation an additional coil, L_4, is switched in series with the variometer. Keying is in the cathode of V_1 by means of contact RLA1, relay RLA/2 being energized from the l.t. output of the generator, either by the hand key or by the automatic key.

29.2.2 S.W. transmitter

The short wave transmitter also consists of a type 5B/255M valve, V_2, operating as an inverted electron-coupled Pierce oscillator modulated in the same way as V_1 except that the anode circuit consists of a pre-tuned circuit L_{10} C_{34} C_{36} in parallel with a differential capacitor C_{39}, the output being taken from the rotor plates. By coupling the aerial in this manner, a form of capacitive tapping point is obtained which enables aerial matching to take place. A rejector circuit tuned to 500 kc/s, is formed by inductor L_{11} and capacitors C_{41} and C_{42}. It is included in series with the short-wave aerial circuit to prevent the output from the medium wave oscillator being by-passed to earth through C_{39} and the capacitance of the m.w./s.w. switch when operating on medium wave. Keying takes place in the cathode circuit by means of RLA1, as in the case of the medium wave oscillator.

29.2.3 Modulator

The modulator consists of a single type EL42 valve, V_3, operating as a blocking oscillator with a fundamental frequency of approximately 800 c/s. The negative pulses at the anode are integrated and fed to the grids of V_1 and V_2, interrupting their operation during one half of the modulator cycle. The modulator output is also fed via C_{43} to the secondary of the output transformer TR_3 thus providing monitoring facilities for the operator.

29.2.4 Receiver

The receiver is intended for break-in operation; that is, the receiver operates continually and is switched off only in the key-down condition. Contact RLA2

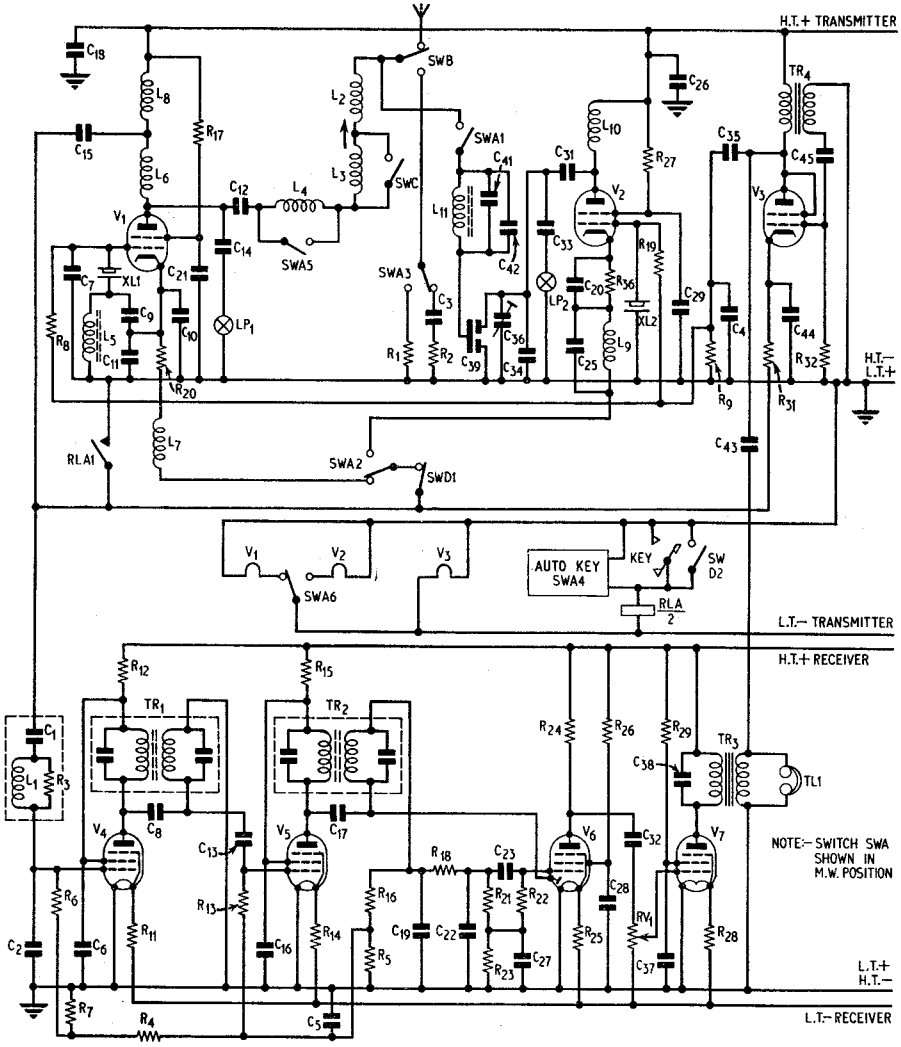

Fig. 29.2 (a). *Simplified diagram of the Marconi Salvita III transmitter and receiver circuits.*

opens when the key is pressed and removes h.t. from the receiver. The circuit is of the tuned-radio-frequency type and consists of two stages of radio-frequency amplification employing type W17 valves, V_4 and V_5, followed by a combined detector and audio frequency amplifier valve type ZD17, V_6, and an output power amplifier type N17, V_7. The input to the receiver is applied via the aerial circuit of the M.W. transmitter, and, in the key-down condition, is short-

circuited by contact RLA1. The receiver output is controlled by the potentiometer RV_1, connected in the grid circuit of V_7.

29.2.5 Power supply

The hand-driven generator has two armature windings generating h.t. voltage of the order of 400 volts and the l.t. voltage of 6·3 volts. The generator voltages

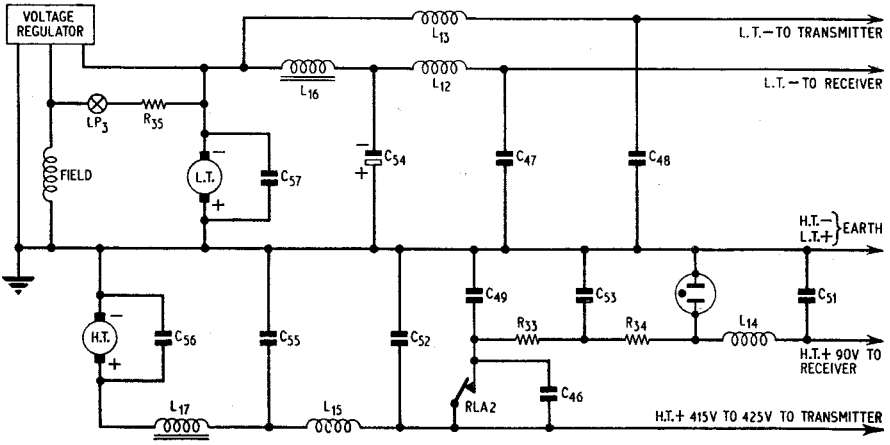

Fig. 29.2 (b). *Marconi Salvita III power supply circuits.*

are kept constant by a regulator of a type which consists of a bobbin with two windings, A and B, enclosed by a laminated iron core and armature to which is attached a contact, X_1, which is normally held closed. The coils, which give mutual assistance, are connected to the l.t. output of the generator as shown in Fig. 29.3.

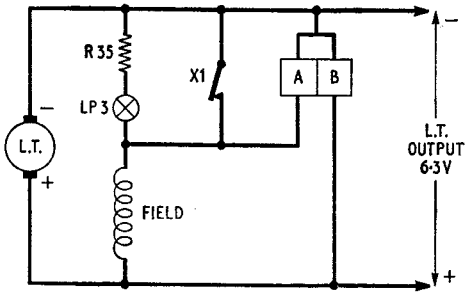

Fig. 29.3. Circuit diagram of the Marconi Salvita III voltage regulator.

Rotation of the generator above a certain speed causes the regulator armature to become attracted to the iron core thus breaking the contact X_1 and placing the lamp LP_3 and resistor R_{35} in parallel with coil A, which is itself now in series with the field winding of the generator. This causes the lamp to light, indicating

to the operator that the correct handle speed has been reached. Also, the inclusion of coil A in series with the field winding lowers the output from the machine. This lowering of the output voltage does not cause the regulator to de-energize, as coil A is now assisting the core magnetism due to coil B, and hence the regulator remains in the energized condition. The h.t. voltage is supplied directly to the transmitter and modulator and to the receiver after being reduced to 90 volts.

29.2.6 Testing D.AE/AK switch

This switch (SWB) is a three-position spring-loaded switch mechanically coupled to SWD_1 and SWD_2 for checking purposes only. For normal operation this switch is in the middle (neutral) position and does not affect the operation of the equipment. In the D.AE position the aerial is disconnected, the transmitter operates into an artificial aerial C_3, R_2 or R_1, and the keying circuit is closed by contact SWD_2. In the AK position, both oscillators are rendered inoperative by contact SWD_1; thus the automatic and hand keying operation can be checked without generation of radio frequency power.

29.3 I.M.R. SOLAS LIFEBOAT EQUIPMENT

The equipment comprises a transmitter and receiver with associated control and automatic transmission facilities on a single chassis housed in a cast light-alloy carrying-case. The hand generator, which supplies all power to the unit, is contained in the same metal case with two external handles for operation by one or two persons. Attached to the case is a container carrying a six-section portable mast 18 feet in height. Watertight lids cover the front control panel and rear panel; the former houses headphones, microphone and earth wire; and the latter, generator handles, aerial and signal lamp. Means are provided for lashing the equipment to a thwart or other parts of the lifeboat. Provision is made for the operation of a mast-head signal lamp from the hand generator.

By reference to the block diagrams of Fig. 29.4 it can be seen that a single set of three valves is employed for both transmitter and receiver.

Frequency range

Transmitter	Two fixed frequencies 500 kc/s and 8,364 kc/s.
Receiver	Wideband 490–510 kc/s.

Output power

Transmitter	2·5–4 watts.
Receiver	At least 1 milliwatt into headphones.

Aerial systems

Provision is made on m.f. for the use of aerial capacitances between 80 pF and 150 pF, and between 350 pF and 500 pF. These capacitances correspond to a mast-supported wire aerial or a balloon/kite-supported aerial about 200 feet in length.

Emission

A2 (m.c.w.) and A3 (telephony)