Fig. 3

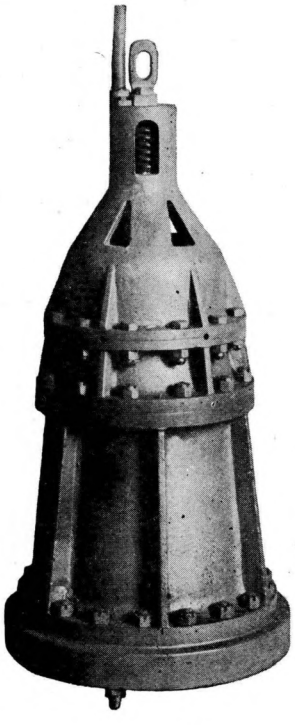

Fig. 2

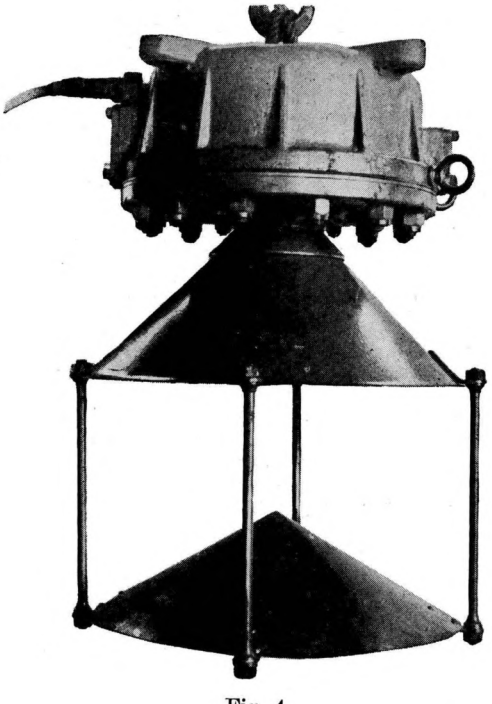

Fig. 4

DESCRIPTION OF THE FOG-SIGNALLING APPARATUS BY AERIAL AND SUBMARINE WAVES USED ON BOARD THE LIGHT-SHIP "FLADEN".

The Chief of the SWEDISH HYDROGRAPHIC SERVICE has sent the following particulars concerning the fog-signal apparatus of the light-ship "*Fladen*".

SUBMARINE WAVE-TRANSMITTING APPARATUS

The submarine wave-transmitting apparatus produces signals which, when they are given out with a certain cadence, can be used to transmit information under the water, either as distinguishing signals or as the Morse Alphabet.

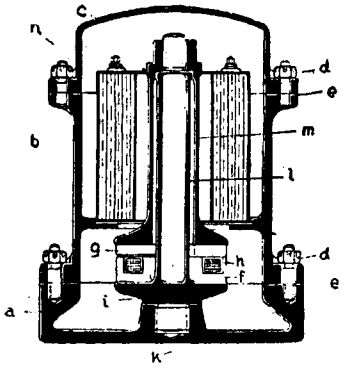

Fig. 1

Fig. 1 represents a model of the transmitter. The watertight casing is divided into three principal parts: the lower part (*a*), the barrel (*b*), the cover (*c*).

These three parts are fixed together by screw bolts (*d*) and india-rubber rings (*e*), which prevent the infiltration of water. The strength of the chamber, which contains the watertight conducting cable installation, is submitted to trials under pressure of 10 atmospheres. An electro-magnet is installed in the interior of the chamber. It is composed of a field (*f*), an armature (*g*) and an induction coil (*h*). The field (*f*) rests on the face-plate (*i*) which is screwed on to the vibrating diaphragm or acoustic disc (*k*) of the bottom (*a*).

The rod (*l*) passes through a large drilling in the middle of the electro-magnet (*f-g-h*) and its lower end is securely fixed to the plate (*i*). Above

the rod (*l*) is a tube (*m*) the top end of which is screwed to the upper end of the bar (*l*), while its lower end is fixed to the armature (*g*). The condenser (*n*) is fixed to a collar secured to the chamber. Fig. 1 shows transmitter closed.

The transmitter works as follows:—

The rod (*l*) and the tube (*m*), which together form the sleeve, generate, with the electro-magnet (*f - g - h*) and the acoustic disc (*k*), electro-magnetic vibrations, maintained by an alternating current sent out through the induction coil (*h*). According to the frequency of the alternating current, the armature (*g*) is attracted to the field (*h*) and then released. It follows that the acoustic disc (*k*) will vibrate through the intermediary of the resilient sleeve (*l - m*). If the period of mechanical vibration agrees with that of the electric excitation, or if the two are in resonance, the vibration of the diaphragm and the force of the sound given out are then at their maximum.

A transmitting apparatus giving 1050 vibrations per second has been found to be best for use with submarine signals. Its sound is higher than the majority of noises caused by water and ships, so that it can be easily distinguished from these. Moreover, it acts on the hearing in a more pronounced manner. Taking this frequency as basis, the totality of the mechanical vibrations, is tuned by the resiliency of the sleeve and the mass which is fixed to it.

The excitation of the electro-magnet and, consequently, the attraction of the field and of the armature, are produced twice during each period of electric current, *i. e.* once during the positive $\frac{1}{2}$ wave and once during the negative $\frac{1}{2}$ wave of the alternating current, in such a way that the system reacts with a frequency double that of the alternating current.

To produce a sound signal of 1050 periods, there must be an alternating electric current of 525 periods. The electric circuit of the stator winding of the generator and of the coil of the alternating current, also have themselves a number of vibrations. It is necessary to regulate the number of these vibrations according to the frequency of the motor power, in order to increase the flow of the alternating current. This regulating is done by means of the condenser (*n*) set in series on the coil of the alternating current (*h*).

Fig. 2 shows the entire watertight casing of the submarine transmitter.

AERIAL TRANSMITTER

Aerial signals are transmitted by a cadenced electro-magnetic siren, which is seen hoisted below the yard of the main mast in Fig. 3. Fig. 4 and Fig. 5 show the outside and the diagram of this transmitter.

To obtain the best transmission of sound, it is necessary to send out into the air oscillations of periodic alternating pressure, as strong as possible. In this transmitter they are obtained by means of the diaphragm (*H*) which is put in motion by its own vibration, that is to say in resonance. It is not placed in direct contact with the air, but an air compartment (*R*) which has been accurately determined and the funnel "*T*" are placed between it and the diaphragm. In this way, vibrations of the diaphragm (*E*) set up in the air

compartment (*R*) and so in the funnel (*T*) then in the free air which surrounds it — oscillations of very intense periodic pressure.

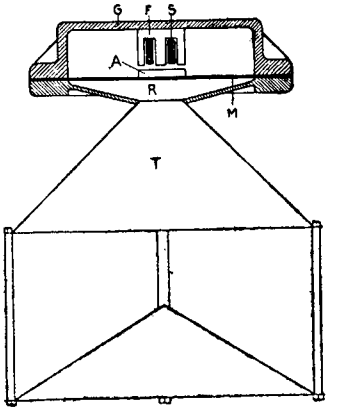

Fig. 5

The distributing and switch board carries the necessary apparatus to measure and regulate the frequency.

The two signals can be used either together or separately and Morse signals can be transmitted through one or the other by means of a key.

The lightship "Fladen" is also provided with a radiogoniometric telephone.

The apparatus installed on board has been provided by the various firms mentioned below, the approximate prices being given in Swedish crowns.

(1 Swedish crown is worth approximately 0.06 of a pound sterling or 6.80 French francs).

Firms.	*Instruments, etc...*	*Approximate Cost.*
Svenska Aktiebolaget Tradlos, Telegrafi, Stockholm	Radiogoniometric Telephone. Accumulator & Accessories.	14,655 kr.
Signal Gesellschaft, Kiel	Submarine wave transmitter (Wasserschallsender). Aerial wave transmitter (Luftschallsender). Antenna. Automatic fog-signal *r. g.*	22,600 kr.
Aktiebolaget Kockum, Malmo, Sweden	Vibrating diaphragm-compressed air transmitter-reserve. Ventilator ..... 550 kr. Regulating apparatus ..... 500 » Valve ..... 500 » Compresser ..... 1800 » Air Reservoir ..... 1000 »	4,350 kr.
Aktiebolaget Skandia-Verken, Lysekil, Sweden	Motor Generator (2 petrol engines).	60,00 kr.