Marconi's Wireless Pilot

BY COMMANDER E. C. SHANKLAND

DURING the last two decades, experiments have been made on wireless fog beacons, one of which is known as the revolving beam and another as the rotating loop. Navigators are not fully satisfied with these forms of fog signals, neither do the signals give a direct lead of sufficient reliability into a port. The Marchese Marconi's latest wireless invention recently demonstrated in Italy to a party of guests representing shipping and scientific interests of Britain and Italy definitely supplies this need.

The device consists of a beacon situated on the shore (a promontory 300 ft. above sea-level) and a receiver fitted to the ship. Its intrinsic reliability is also better than the direction-finding apparatus hitherto invented because it is simpler as regards both transmission and receiving. The wave-length used is 60 cm.

To envisage the application of the transmission, one may adopt the analogy of twin searchlights on a single mounting with a dark zone between them in the centre, covering an arc of horizon of 269° with their beams, each beam right and left having a

FIG. 1.

distinctive characteristic. The wireless transmitters send out signals at 500 and 1,500 vibrations per second in exactly opposite phases, producing a 1° zone of silence. This silent zone at 10 miles would subtend a band of silence of about 355 yards.

To have such a signal fixed in position would be unsatisfactory, as a navigator might assume he was in the silent zone when a breakdown had occurred and the transmitter was not functioning. To guide a ship safely therefore, and also to inspire the confidence produced by positive signals, the system is continuously swung from left to right of the centre line in a similar manner to a searchlight when looking for an object on the water. The amplitude of the swing is small, namely, 6° . When swinging to the left the beacon sounds a high note, when swinging towards the right it sounds a low note. The change of note takes place when the zone of silence coincides with the line of the entrance of the harbour. With this arrangement it is possible to ascertain immediately if the ship is either on the left or right side of the safety line or exactly at it. The rise and fall of the note gives a distinct cadence, to accustom the ear to which requires a certain amount of practice. A principal factor in the sound indication therefore lies in the change of note. If the ship is out of the correct course, the change becomes perceptible, one change of note becoming stronger than the other. It is claimed that this rate of change of tone is given to half a degree of the variation in the course by compass.

Experiments have shown that the apparatus is effective for a distance of 25 miles but the recent tests were conducted over a range of 10 miles, which is the distance between Santa Margarita and the beacon station at Sestri Levante. The strength of the signals varies approximately as the square of the distance from the source.

The transmission apparatus is about 6 ft. high and 4 ft. wide. Two small aerials and reflectors are mounted at right angles to each other on a platform forming the top of a cylindrical base. The platform and the aerial system swings left and right continuously about 2 inches from the centre line. The aerials and reflectors are set for horizontal polarisation of the waves. The small rotating transmitter and the mechanical gear swinging or rotating the beacon platform are both housed in the cylindrical base.

The transmitter is of recent development and has satisfied the conditions of working by operating for five months without attention. It uses two 100 watt special transmitting valves also of a recently perfected type. The remainder of the transmitting station

consists of a loud speaker, small motor generators to supply the low- and high-tension to the equipment and to the controlling panels. The latter are housed in the tower. The beacon itself on top of the tower is therefore under remote control.

The receiving equipment consist of two receivers installed on the roof of the navigating house of the *Eletra* at approximately 30 ft. above sea-level. The distance for reception depends considerably on the

height of the receivers. These are controlled from the wireless cabin. A repeater device is installed on the navigating bridge together with a microphone with its amplifier. The receivers are about 3 ft. high and only a few inches wide, and in their structure is incorporated an aerial, a small reflector, the tuning circuits and the receiving valves. They are mounted on two separate platforms which may be turned in any desired position. The angle of reception of these receivers is very wide (about 100°), so that it is only necessary to orientate them roughly on the beacon station. With these two receivers the beacon may be received in any position of the ship relative to that of the beacon. The repeater consists of a special milliamperemeter and a loud speaker. One side of the dial of the meter is painted green, the other side is red. In response to the radio signal, the needle oscillates continuously from left to right. When on the exact line of entrance, the change of tone occurs at the same time as the needle occupies its centre position and the deflection of the needle shows the same amplitude on either side. Any deviation from this normal condition indicates that the ship is either too much to the left or right of the line of entrance.

Attached to the system which guides the ship into harbour is a sound-ranging device which gives the distance of the ship from the entrance to the harbour at certain intervals if required. This is done by arranging the modulation of the beacon transmitter in such a way that one change of tone is missed every

15 sec., the next one being sent simultaneously as a radio signal and as an acoustic signal, the latter by means of a loud speaker oriented in the direction of the harbour. By measuring with a stop watch the time elapsing between the radio signals and the sound signal, the distance is known. To render this practical, the ship is equipped with a special microphone tuned to the note sent by the beacon and the

head telephones of the observer can be switched over automatically from the radio set to the microphone.

The apparatus is clearly capable of uses other than providing a 'bee' line course for a ship entering harbour in fog. The transmitter may be swung in azimuth to any bearing to provide a silent zone upon which a ship may navigate at right angles if necessary.

Researches on Glasshouse Plants

THE nineteenth annual report (1933) of the Experiment and Research Station established by the Nursery and Market Garden Industries' Development Society, Ltd., at Turner's Hill, Cheshunt, Herts, shows a gratifying co-operation between the glasshouse grower and the scientific worker. The director of the Station, Dr. W. F. Bewley, reports that manurial and variety trials of tomatoes have been prosecuted for some time, and various items of practice, such as planting in trenches, digging in spent hops, chrysanthemum roots and clean straw, have been investigated. A very important experiment relates to heating the soil. This was done by means of hot-water pipes buried in the ground. Circulation of water in the pipes was maintained by means of an electric pump controlled by a soil thermostat. The results show a considerable increase in yield due to the higher temperature of the soil. The use of oil fuel has been investigated through two seasons, and an increased financial return of more than £210 per acre was obtained as against the use of anthracite fuel. This was due to the uniformity of temperature which was maintained throughout the whole of the day and night. Experiments on cucumbers and lettuce find a place in the report, which also contains, within its 115 pages, detailed results of mycological, entomological and physiological investigations by members of the Station staff.

Many short descriptive and research papers of interest to mycologists and entomologists appear in the report. On p. 39, Mr. P. H. Williams writes on leafy gall of the chrysanthemum, discussing its etiology and methods for control. Dr. W. F. Bewley and Mr. O. B. Orchard have a short note on rose diseases, and Mr. H. G. White describes vegetable diseases, including grey mould (*Botrytis* rot or wilt) of lettuce, bean wilt, and a disease of rhubarb. The same author also writes on the sterilisation of lettuce

seeds. Messrs. O. B. Orchard and W. H. Read describe the control of leaf mould of tomatoes by fumigation with sulphur or quinone. Several virus diseases form the subject of a contribution by Dr. G. C. Ainsworth, and physiological investigations of mosaic disease of the tomato have been prosecuted by Mr. W. H. Read.

Mr. E. R. Speyer contributes articles on the red spider mite, the tomato-moth caterpillar, parasites of the tomato-moth, thrips and millepedes. Mr. O. B. Orchard writes on the control of wireworms and millepedes, and upon the joint destruction of tomato leaf mould and red spider mite, for which a combined insecticide and fungicide has been suggested. The Station continues to propagate and distribute a parasite of the greenhouse white fly.

The report also contains several contributions upon soil conditions and plant growth in glasshouses. Dr. O. Owen has investigated the leaching of nitrates and potash from soil used for growing tomatoes. Nitrates are not present in the drainage from heated soil in such large quantities as they occur in unheated soil, whilst the addition of spent hops has the effect of increasing the amount of nitrate in the leachings. The effect of manurial treatment on the nitrogen contents of some market garden crops has also been investigated by Dr. Owen. Mr. B. D. Bolas contributes a paper on the influence of light and temperature on the assimilation rate of seedling tomato plants, whilst Mr. R. Melville has studied the effect of water content of the plant upon assimilation. Some aspects of translocation in the seedling tomato plant are described by Mr. I. W. Selman. Messrs. W. H. Read and O. B. Orchard have a paper on plant injury following the burning of sulphur in glasshouses, and Dr. W. F. Bewley and Messrs. Read and Orchard report the results of numerous experiments on conditions which affect the quality of tomatoes.

Heavy Hydrogen and Heavy Water

A SURVEY of the applications of heavy hydrogen in research has been published by H. S. Taylor (*J. Franklin Inst.*, 218, 1; 1934). The method of preparation of pure deuterium oxide by electrolysis is described, with full experimental details, and the properties enumerated. The density is found to be $^{25}D^{25}$ 1.1079, in contrast to the value 1.1056 found by G. N. Lewis and Macdonald, whilst the freezing point, $+3.82^\circ$, is in good agreement with that found by the latter experimenters.

Pure heavy water is very hygroscopic, and readily absorbs moisture from the air and from containing vessels. Mass-spectrographic results show that the ratio of deuterium to hydrogen in ordinary rain water is 1 : 5000. The ratio of the isotope of mass 3 ($H^3 = T$)

to deuterium (D) in the gas from the electrolysis of the best samples of heavy water is less than 1 : 50,000, and in ordinary water less than $1 : 5 \times 10^8$.

The equilibrium $H_2 + D_2 \rightleftharpoons 2HD$ is of importance in the study of surface catalysis. Glass, mercury, charcoal, etc., are inactive in promoting the reaction, but active nickel and charcoal oxide induce the change even at the temperature of liquid air, the activities of the surfaces being quite specific. A summary of the results on the biochemistry of heavy water is given. The enzyme catalase is only half as active in 85 per cent deuterium oxide as in ordinary water. Bacteria, as contrasted with protozoa and rotifers, are not killed. Compounds of deuterium other than the oxide are known, and a detailed