

The Goldwever System of Navigational Aid for U-Boats

The Goldwever system utilises a transmitter coupled to a Wullenwever type of aerial. A sharp beam is produced, and this is rotated at a certain speed. The transmission is keyed at a 70 c.p.s. rate with a modulation dependent upon the direction. The system, which was under development, was intended to be accurate within the limits of $\pm 0.5^\circ$, and capable of use at ranges of the order of 5000-6000 kms. It would thus be a supplementary navigational aid to the Electra-Sonne system, for U-boats.

Lichtkohle and Sumpfkohle U-boat D/F equipment

It was intended to produce a D/F equipment for U-boats having a visual presentation. The first attempt was known as Lichtkohle, and this employed the normal U-boat hand rotated loop, and D/F receiver, in conjunction with a visual presentation unit.

Development on this system was given up, however, since it was only possible to use the equipment when the U-boat was surfaced. This fact led to the development of the Sumpfkohle equipment, which could be used when the U-boat was submerged in the Schnorkel condition. The aerial system consisted of crossed loops mounted in the anti-radar camouflage material on the Schnorkel. A normal type of Telefunken goniometer was employed. The original development was intended to cover the Allied "Convoy wave band" (124 metres), but later, the coverage was to be extended from 50 to 200 metres. Visual indication was provided, the equipment necessary being produced by Siemens and Halske.

C. 2 D/F Equipment

The original development of this equipment was done by Electrofrequenz, for the German Army. The only outstanding feature of the equipment, which covers 50-200 metres, is its compact construction.

The Athos G.S.R. Equipment

It was appreciated that the D/F accuracy of the Athos G.S.R. equipment was poor, and it had been intended to improve the accuracy by making changes in the size of the pick-up loops, the relative spacing of the loops, and in the number of loops per sector. Dr. Kuhnhold and Dr. Kuepfmüller considered that the

sensitivity of the equipment could be improved by increasing the number of loops per sector.

It was suggested by the interrogators that the accuracy of Athos could, perhaps, have been considerably improved by applying the principles of the Spinning Naxos aerial, i.e. connect any two or three successive loops in parallel, with a contact strip rotating at high speed, and employ a visual presentation of intercepted transmissions using a circular time base running in synchronism with the aerial. This would provide a direct reading bearing indication relative to the ship's head. Dr. Kuhnhold stated that this idea had been thought of, but was discarded due to the possibility of a stroboscopic effect between the scanning rates of the radar and intercept receiver aerials, respectively. This would reduce the possibility of interception. The overall band covered by the Athos equipment was 2-20 cms. It was intended to extend the coverage from 0.5 to 2 cms. with an outfit known as the Athos M. This was to be mounted on top of the existing Athos aerial head. The Athos M uses the same principle as the existing Athos, although 12 detector elements were to be used per sector. The pick-up elements themselves consist of flared horns feeding a section of terminated waveguide, the crystal detectors being mounted across the guide in the normal way. The detectors are connected in parallel, on the output side, in each quadrant. The amplifier and presentation units are identical with those used in the normal Athos.

The Kuba IIIC G.S.R.

Some enquiries were made regarding the reported development of an earlier pressure tight G.S.R. equipment, covering the 9 cm. waveband, and known as Kuba III. It was stated that the aerial system consisted of four parabolic reflectors, placed together to cover each quadrant, a wide band dipole being placed at an angle of 45° in the focus of each reflector. Development was abandoned for two reasons. Firstly, it was found impossible to provide a 90° arc of coverage in the polar diagram of each reflector, so that it was impossible to provide 360° coverage with only four reflectors. Secondly, it was found exceedingly difficult to pressurise the dipole system satisfactorily.

The Leros G.S.R. Equipment

The German policy regarding G.S.R. equipment was stated to aim at providing coverage between the limits 0.5 cm. to 3 metres, with the crystal detector type of warning receiver. To this end, the Athos II and. Athos equipments provided coverage up to 20 cms. The Leros G.S.R. equipment was intended to complete the coverage between 20 cms. and 3 metres.

Development was undertaken by a Dr. Roche, of Siemens and Halske, in July 1944. The range 20 to 300 cms is divided into three ranges, 20 to 50 cms., 50 to 80 cms., and 80 to 300 cms., and each of these is covered by a separate aerial head.

The 20 to 50 cms, aerial head was intended to be of the same type as the Kuba III aerial described above i.e. a wideband dipole and reflector system covering each quadrant. The 50 to 80 cm. and 80 to 300 cm. aerial heads were both intended to be of the Rund-dipole type.

The three heads were to be mounted one above the other, on a common axis. Final stage of development is unknown.

Ship Borne V H/F Communication

At the beginning of the war, Siemens and Telefunken had started joint development of a ship-to-ship directive communication link, operating on a wavelength of 50 cms. The aerial systems were to be automatically trained between ships. This development was dropped, however, since presumably there was no very pressing requirement for the system.

One Pulse Radar System

Questioned as to German developments of one pulse radar systems, Dr. Kuhnhold stated that Dr. Spitzer had undertaken some work on this project. In practice, it was found that at least two pulses were required to obtain a sensible reflection from a target, and further, at least twenty times the peak power was required for the system, compared with a normal radar, to produce an equivalent response.

The German system operated on a wavelength of 2.4 metres, produced a peak power of 1,000 kW, and employed a 5 μ s pulse. Owing to the drawbacks with this system outlined above, and the belief that even a two-pulse radar could be intercepted, development work on the project was stopped.