





SOUND RANGING

WITH REFERENCE TO ULTRA-SONIC PARASITIC NOISES.

In the April, 1927, number of the *Revue Maritime* there is an interesting account of the experiments made with the "ultra-sonic beacon" established for trials at Calais in 1926 (*).

The beacon emits under water signals by ultra-sonic waves for the guidance of ships entering the port. It is situated at the head of the East jetty (Fig. 1 - station), and consists essentially of a horizontal ultra-sonic transmitter directed as closely as possible in the line of the entrance channel. The transmitter is actuated by a high frequency emitting station and the ultra-sonic signals are sent out automatically.

The vessel is fitted with an ultra-sonic receiver which can be turned in all directions. The bearing of the beacon is obtained by finding the direction of maximum reception.

During the experiments, (which, incidentally, have given very satisfactory results), an unexpected and rather curious phenomenon was observed.

"The "*Champion*" (a tug provided with an ultra-sonic receiver), having stopped at the "point A (Fig. 1) approximately 6 kilometres (3.2 miles) from the beacon, reception was disturbed as soon as the projector was put under water by very violent parasitic noises which made it impossible to distinguish the ultra-sonic signals. The maximum intensity of these parasites was more or less in the sector indicated in Fig. 1. At another stopping-place of the tug, point B, it was observed that the parasites were still very violent in the sector indicated on the Figure, but that it was possible to distinguish the ultra-sonic signals when the projector was set towards the beacon. Finally, at a third stopping-place of the "*Champion*", point C, the reception of the ultra-sonic signals was again very clear when the projector was set towards the beacon but, nevertheless, there were still very violent parasites when the projector was set in the opposite direction, *i.e.* towards the sector indicated in Fig. 1. These observations showed that the parasites seemed to come from a definite region which happens to correspond with the position of a sand bank called the "*Ridens de Calais*", which is situated at about 4,000 metres (2.15 miles) from the jetties. When these observations were made, the ebb stream was at its maximum. The parasites disappeared at slack water of the ebbing and flowing streams. The hypothesis was put forward that the parasites were created by short series of damped elastic waves caused by displacement of shingle under the influence of the tidal currents which excited the receiver by the shocks."

The International Hydrographic Bureau considers that these details would be of particular interest to readers who are familiar with the methods of sound-ranging and acoustic sounding by ultra-sonic waves, of which mention has been made several times in the *Hydrographic Review* (See Vol. I, N^o 1,

(*) *Le phare ultra-sonore de Calais*, "Revue Maritime", April 1927, pages 481 et seq.

page 71 ; Vol. I, N^o 2, page 39 ; Vol. II, N^o 1, page 51 ; Vol. II, N^o 2, page 135 ; Vol. III, N^o 2, page 75) and it requested the " Société de Condensation et d'Application Mécaniques (S.C.A.M.), constructors of the LANGEVIN-CHILOWSKY appliances, to supply further information concerning these ultra-sonic parasitic noises the origin of which had so far never been discovered. The S.C.A.M. kindly sent the following reply :—

" The ultra-sonic projector used as a receiver on board the *Champion* (a projector identical with that which made the emission at the extremity of Calais East Jetty) had a natural mechanical frequency of resonance of 37,500. The oscillating circuit of the tuning-box which was connected with the terminals of the projector was itself tuned in to this frequency.

" The oscillating receiver equipment, constituted by connecting the projector and the oscillating circuits of the tuning-box was, therefore, a system of resonance tuned to a frequency of 37,500.

" The amplifier used was an apparatus with 8 valves having 5 stages of amplification with high frequency by resistance, a detector valve and 2 stages of low-frequency by transformer. This apparatus was very sensitive.

" Clear proof of the presence of the parasites was obtained by our engineers during the second series of experiments made at Calais between the 25th and 29th May 1926. Observation of the parasites was made on board the *Champion*, using the telephonic head-pieces, with and without heterodynation.

" The parasites heard, gave the characteristic sound of continuous, very intense frying. They were heard with the ultra-sonic projector turned in any direction when the tug was in the zone of parasites as indicated in Figure I. While the tug was leaving this zone of emission the intensity of the parasites decreased somewhat rapidly while the bearing of the submarine shoals, which were the cause of these phenomena, was observed. The parasites disappeared completely at the moments of slack of the tidal streams. They reappeared as soon as the tidal streams recommenced. It is interesting to note that the speed of these currents at Calais is about 3 knots.

" When the sea was calm it was noticed, during the period of emission of the parasites, that the zone of emission was marked by an agitation of the surface of the sea clearly localised above the shoals ; being rips caused by the currents deflected by the banks.

" Professor LANGEVIN himself came to observe the phenomena and immediately put forward the hypothesis that the parasites might be caused by the shocks due to the rattling of shingle stirred by tidal currents, shingle the dimensions of which would correspond generally to ultra-sonic elastic proper frequencies. The short series of high frequency elastic waves thus produced, acting on the surface of the ultra-sonic projector, may excite the latter.

" The phenomenon might be interpreted by stating that, in the development in Fourier series of these vibrations of special form, the terms whose frequency is close to 37,500 have still sufficient amplitude to be revealed by the ultra-sonic projector.

" If the large-scale chart of the entrance to Calais Harbour be exa-

“ mined, it will be seen that the bottom is composed principally of sand, sand and mud, and sand and broken shells ; but—by an interesting coincidence—in the zone of emission of parasites *gravel* is found in several spots, which would appear to confirm the hypothesis set forth above.

“ Another hypothesis was considered also, but it seems less probable ; the emissions of the small series of waves or groups of waves might be caused by the eddies and by the changes in the velocities of the thin streams of liquid in the rips which the shoals do not fail to create in the mass of water moving under the influence of the tidal currents.

“ Cavitation also was considered, but the low speed of the tidal currents hardly seems sufficient to produce such phenomena.

“ Unfortunately being hard pressed by a definite programme of experiments, we did not have time, while at Calais, to continue further the study of these new phenomena which, we think, it is of very great interest, from the general point of view of submarine acoustics, to note. (It is to be remarked that the bank which emits the parasites does not in any way interfere with the application of the ultra-sonic methods of guiding ships at Calais ; it is beyond the range of about 3,000 metres (1.6 miles) required from the station on the East Jetty.

“ It is probable that these phenomena of parasitic emissions by shoals, in regions where there are currents, must be very general. We consider that the sonic submarine listening appliances (ordinary microphonic or stethoscopic arrangements) must be sensitive to such parasites to a higher degree than is the ultra-sonic projector, which is very highly syntonised.

“ In submarine listening, with the aid of microphones placed at the bottom in places where there are currents, the existence has been observed, at certain moments, of noisy parasites which have hitherto been attributed to the striking of grains of sand, carried along by the moving water, on the microphone itself.

“ As a result of our experiments, it seems likely that this possible cause of parasites is not unique and that we are confronted with phenomena similar to those at Calais ; the fronts of these small series of incoherent waves without the slightest doubt excite submarine receiving instruments such as microphones or stethoscopes. This must be a cause of diminution of range of the instruments for ultra-sonic signalling under water in regions where depths are small and strong currents exist.

“ It would certainly be of the greatest interest from the general scientific point of view, and also from the point of view of submarine acoustics, if the various laboratories making submarine researches would kindly communicate to you their observations of any similar phenomena and that a comparison of the different observations which it has been possible to make should be drawn up and published by you.

“ Please note that in the course of the trials and experiments which follow in the wake of the development of the new ultra-sonic technique, the attention of our engineers is constantly directed to the observation of interesting or new phenomena which may occur ”.
