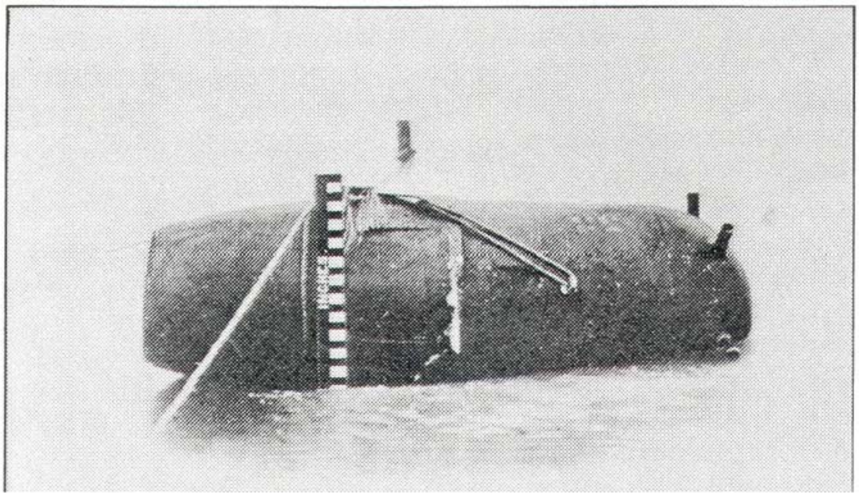
Chapter Eight

BOUYANT CAB LE

The Magnetic Mine - "Wheezes and Dodges"
Problems of Design - The Simple Solution

THE OUTBREAK of war in September 1939 brought about a radical change in the life of the Research Department at Wood Lane. At first it was believed that the Department as such could not continue to function under war-time conditions. The Company therefore decided to reduce the number of personnel at Wood Lane to the level of a skeleton staff, a move which was reluctantly accepted by Dr. Brazier who did his best to keep these dismissals to a minimum. Within months, however, this decision had to be reversed when the Company became involved in combating the menace of the magnetic mine.

Within weeks of the outbreak of war this most secret of Hitler's weapons had fallen into the hands of the Royal Navy when the first to be secured was recovered from the mud in the Thames Estuary at Shoeburyness, during the night of 22ndN ovember 1939. With the secret of the mechanism of the mine in their hands, the Office of the Admiral ty's "Inspector of Anti-Aircraft Weapons and Devices" (more commonly known as



First magnetic mine to be recovered (November 1939)

the "Instigator of Anti-Aircraft Wheezes and Dodges" - or Wheezers and Dodgers, for short), set about finding an antidote (21). Within a month, the Wheezers and Dodgers had established the principle of demagnetising or "degaussing" vessels by passing current through cable permanently fixed to their hulls. Devising a practical technique for sweeping the mines presented much greater difficulties.

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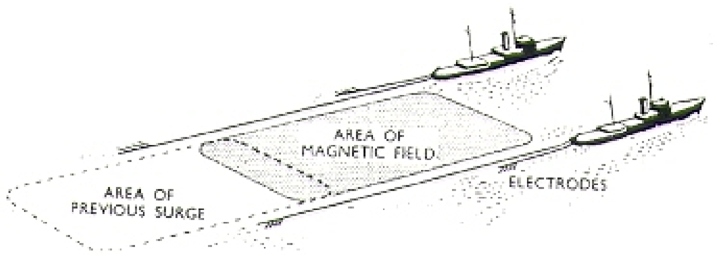
Professor B. P. Haigh, Professor of Mechanical Engineering at the Royal Naval College, was the first to suggest the idea of two mine-sweepers towing floating parallel cables through which violent pulses of electricity could be discharged to detonate the mines (later known as the Double-L sweep) but his scheme involved the use of so many thousand horse power of electricity that special power plants would have been needed. However, the Wheezers and Dodgers soon found a means of reducing very substantially the power needed for the Double-L sweep. The next stage was to give the apparatus they had designed a practical test.



First successful method of sweeping known as the Double-longitudinal or LL sweep

For the trial they needed a calm stretch of water where they could work undisturbed - and it had to be sea water. Right on the spot in Portsmouth was the ideal place - the Canoe Lake, where small boys sailed their model yachts - but security was the snag. The Canoe Lake was in full view of the public, and overlooked by nearby houses. Any attempt to screen it off would undoubtedly have attracted attention, and it was also important that the sailors helping with the trial should not realise what was happening. An ingenious cover plan was devised. In the strictest confidence the sailors and police were told that a new secret device for detecting enemy ships was being tried. A large number of models was launched on the waters of the lake, some floating as proudly as the schoolboys' yachts and some mounted on pieces of wood. it was a bitterly cold winter's day and ice had to be swept aside before the trial could start. Then the sailors began towing their model ships backwards and forwards across the lake, watched by an ever-growing crowd of housewives, small boys and policemen. Of all the gathering on the lakeside only three scientists knew what was afoot. They had brought with them, in a large box, the mechanism of the magnetic mine which had been salvaged from the Thames mudbank. This could not be placed on the bed of the lake as the water was too shallow. So it was decided to reverse the normal procedure and the Dou ble-L sweep wires were strung out along the bottom of the lake. The mine itself, hidden in its box, was lifted into one of the rowing boats, and as the sailors hauled their model ships to and fro the boat carrying the mine and three tense observers moved slowly among them.

When they had been afloat, ostensibly engrossed in the movements of the models, long enough to divert any interest on the part of the spectators, they pulled towards the head of the lake. At a signal from the boat, the current began flowing through the submerged cables. As they paddled slowly back down the lake a spasmodic flickering on the dial of one of the instruments announced the firing of the mechanism of the German mine at all corners of the sweep. It had worked! The magnetic mine on which Hitler had based high hopes of securing Britain's blockade could be destroyed just as certainly as the ordinary moored mine.

The solution had been found. The next problem was the production of the Double-L sweep cables in a practical form.

This problem resolved itself into the following requirements (11, 22):

The cable must

(a) be intrinsically buoyant;

(b) be able to carry an intermittent current of the order of 3,000 amperes (at a negligible voltage);

(c) be capacble of being towed at high speed; and

(d) be capable of being coiled up on deck when not in use.

By the middle of December the Admiralty had made contact with various cable manufacturers with a view to producing a suitable design for such a cable. The solution of such a problem by cable makers was a formidable task. Under existing conditions very few manufacturers were at that time in a position to undertake work of this nature, but Callender's and W. T. Henley's immediately mobilized their Research and Design Departments, who worked unceasingly in order to provide a satisfactory answer. It soon became clear that the problem was, in fact, impossible of solution by means of any normal method of cable construction.

Low density materials, such as would be required for the buoyancy medium, are, unfortunately, good thermal insulators. The main difficulty to be overcome thus resulted from the heating effect of the high current carried by the cable. In a conventional type of construction with the conductor at the centre, the size of the conductor required to carry even 1,500 amperes without undue heating would be five square inches; the buoyancy units required to enable such a cable to flat would result in the overall diameter of the cable exceeding nine inches. A cable to carry anything approaching the required current, even supposing a material with the buoyancy of cork and twice its thermal conductivity could have been developed, would have been of such dimensions that it could not have been manufactured, handled or operated.

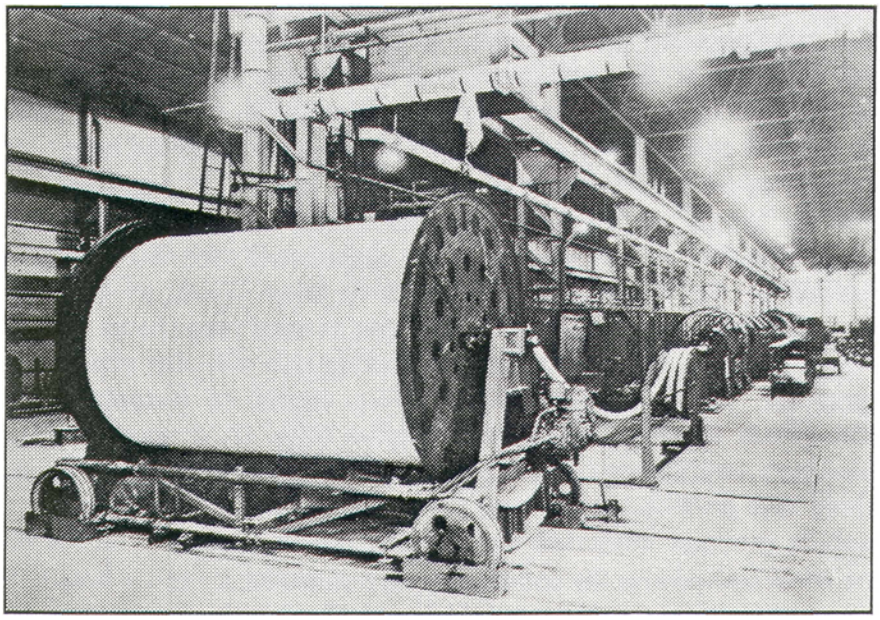
Ever since his "Asdic" days Mr. Hunter had maintained contact with the electrical branch of the Admiralty, and so was fairly well acquainted with this new problem and the shortcomings of the methods which had been tried. Thus, at a meeting at the Admiralty on the 23rd December 1939, he was able to confound the experts by putting forward an ingenious but beautifully simple solution and was also able to furnish the necessary practical proof of its validity as a result of extensive tests on a prototype carried out at Wood Lane in double quick time. (It is worth noting that such was the Company's confidence in the invention that a master patent application had been filed three days prior to the meeting!)

Mr. Hunter's proposal consisted virtually in turning the cable "inside out". That is to say, the wires comprising the conductor were stranded around a buoyant core and covered with a comparatively thin insulation and sheath. The latter was insufficient to insulate thermally the conductor and so the sea water could act as an efficient coolant.

The problems of the production of this strange new cable were severe, but rapid adaptation at Callender's Erith Works and also at the Wood Lane Research Laboratories enabled the cable and electrode tails to be produced quickly. In fact, the first buoyant cable to be made was delivered to the Admiralty on the 18th January 1940, within one month of the master patent application being filed, and a mere eight weeks after the recovery of the first magnetic mine from the Thames Estuary!

The nature of the buoyant material used presented some problems. Cork was originally proposed, but the use of this was frowned on by the Admiralty on the grounds that it all came from Spain, whose political affiliations were suspect at that time. They preferred the use of rubber which came from Malaya and for a time this was used in the form of expanded ebonite. Subsequently, it was found that the ebonite was inclined to be brittle and the cable was easily damaged, so later lengths were made using soft sponge rubber. Scrap rubber resulting from these processes was conveniently burnt in the far corner of the yard - until Malaya fell to the advancing Japanese, when it was ground and re-used. The ensuing rubber shortage caused second thoughts at the Admiralty and they were prepared once again to consider the use of cork. However, the development of expanded rubber continued at Wood Lane and all production of this material remained here throughout the war, several hundred tons being used during this period.

The expanded ebonite units, known as "hard-blocks", incorporated ferrous oxalate as the blowing agent and were given a pre-cure to expand them and set their shape before being finally cured in hot oil and then slid into a water bath to cool. The building where this was done became known, until it was demolished in 1958, as the "runway", from the runway used for the latter operation.



Buoyant cable for exploding magnetic mines being prepared for vulcanizing, Belvedere Works 1940

The sponge rubber units later developed, however, presented more hazards. They were expanded and cured in closed moulds, comprising lengths of pipe with threaded ends which were opened while still hot. The procedure was to clamp the mould in a vice and gingerly to unscrew one end with a wrench. Gingerly, because as the last thread was reached, the cap would depart down the shop at great speed, together with the wrench and hotly pursued by the rubber! A more insidious danger, however, was the risk of dermatitis due to the toxic nature of the blowing agent used for the sponge rubber units. This was the main reason for the installation of a first aid post with a qualified nurse on duty full-time, and the services of a visiting Harley Street specialist. Protective clothing, including underwear, was issued to the operatives and laundry facilities and shower baths were provided on the premises.

The buoyancy units were assembled at Erith Works into long lengths by means of tapes applied longitudinally, stranded with two layers each of 200 X 0.040 inch diameter copper wires, insulated with rubber tape and sheathed overall with tough rubber to a diameter of 3.45 inches. The cable was then returned to Wood Lane for the attachment of the electrode "tails". The markers (brass strips set into concrete) used to measure off the lengths could still be seen in the yard, one directly beneath the hoist outside No. 1 Boiler House and another about 10 yards to the east, until the roads were resurfaced.

In all, more than 11 million yards of buoyant cable was supplied by this Company up to V-E Day, this including some lengths of special purpose types of slightly different size or construction.

It should perhaps be mentioned that W. T. Henley's also manufactured a type of buoyant cable based on a buoyancy unit consisting of a hollow rubber cylinder made by the adaptation of their existing machinery which had been used pre-war for the production of tennis balls. Otherwise the construction was similar to the foregoing.