Sea boring tower

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Sea boring tower

Bohrturm im Meer

Torre para sondagens marítimas

Tour pour sondages à la mer

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The first Sea Boring Tower for coal ever constructed was commissioned by the National Coal Board and designed by Messrs. Maunsell, Posford & Pavry, to prove new coal seams by test borings, first in the Firth of Forth and then around the coasts of Britain. The main Contractors were The Cleveland Bridge & Engineering Co. Ltd. of Darlington, who supplied and fabricated the structural steelwork, with the exception of the tubular portion, and carried out the whole of the erection of the Tower and also the marine operations, including towing it out and lowering it to the bed of the estuary. The tubular steelwork of the 125 ft. high tower was designed and supplied by Tubewrights Ltd.

The tower is built on a cruciform base consisting of two all-welded steel box girders each 7 ft. deep, 3 ft. wide and 165 ft. long. These girders are temporarily connected below two all-welded pontoons from which they can be lowered by means of electric winches when the tower has been floated out to its position for boring. During floating out operations the pontoons are locked in position on either side of the tower by tubular steel booms.

At the top of the tower there are two octagonally-shaped decks 86 ft. wide. The 54 ft. high drilling rig which is operated by the Foraky Boring and Shaft Sinking Co. stands on the upper working deck which is also equipped with a workshop, pumphouse, engine room and 2-ton mobile crane. Round the perimeter of the lower deck are located the cabins, mess rooms and bath rooms, in prefabricated hutments capable of accommodating 25 men; in the interior are housed the generators and pumping and distillation plants.

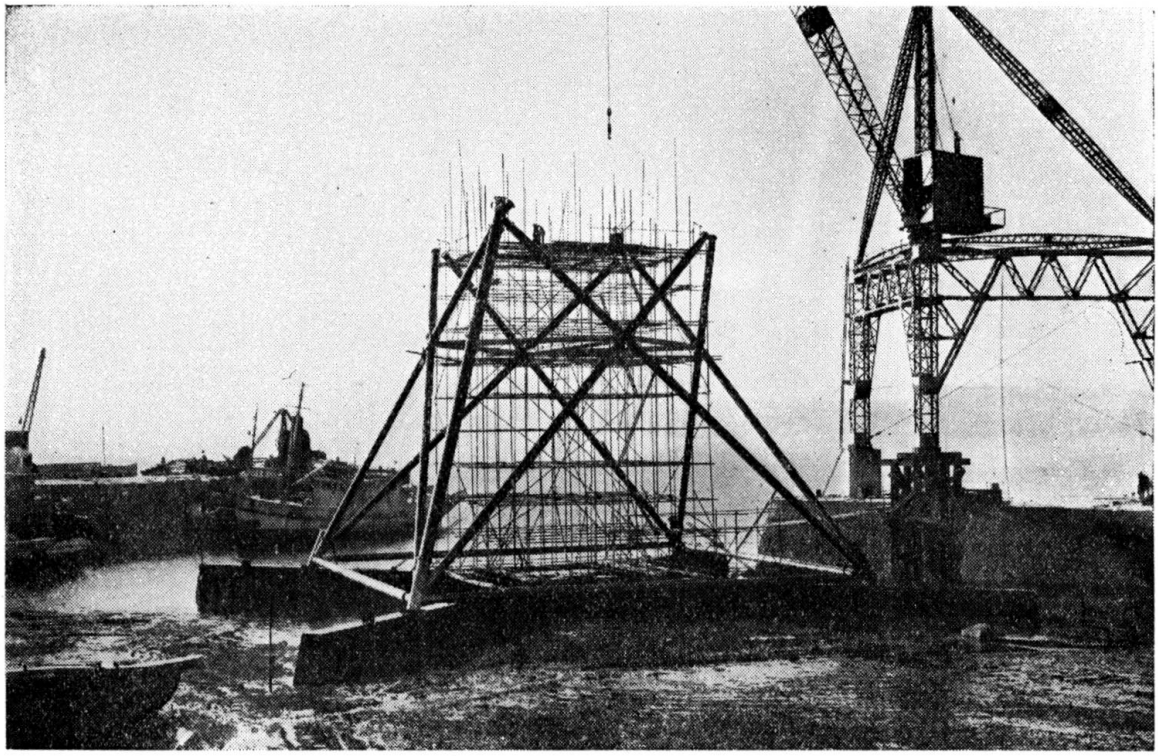

FIG. 1. Tubular steelwork being assembled, by 15–ton derrick, on cruciform base girders in St. David's Harbour

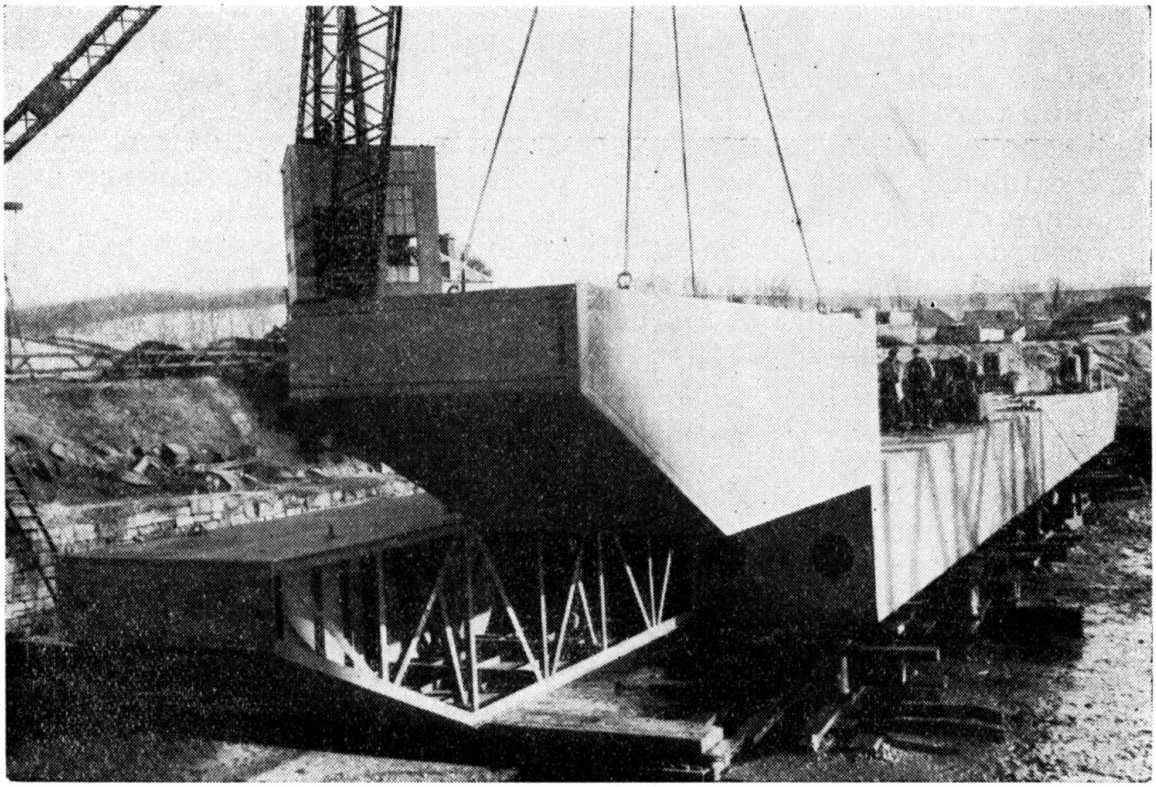

FIG. 2. Assembly of all-welded steel pontoons

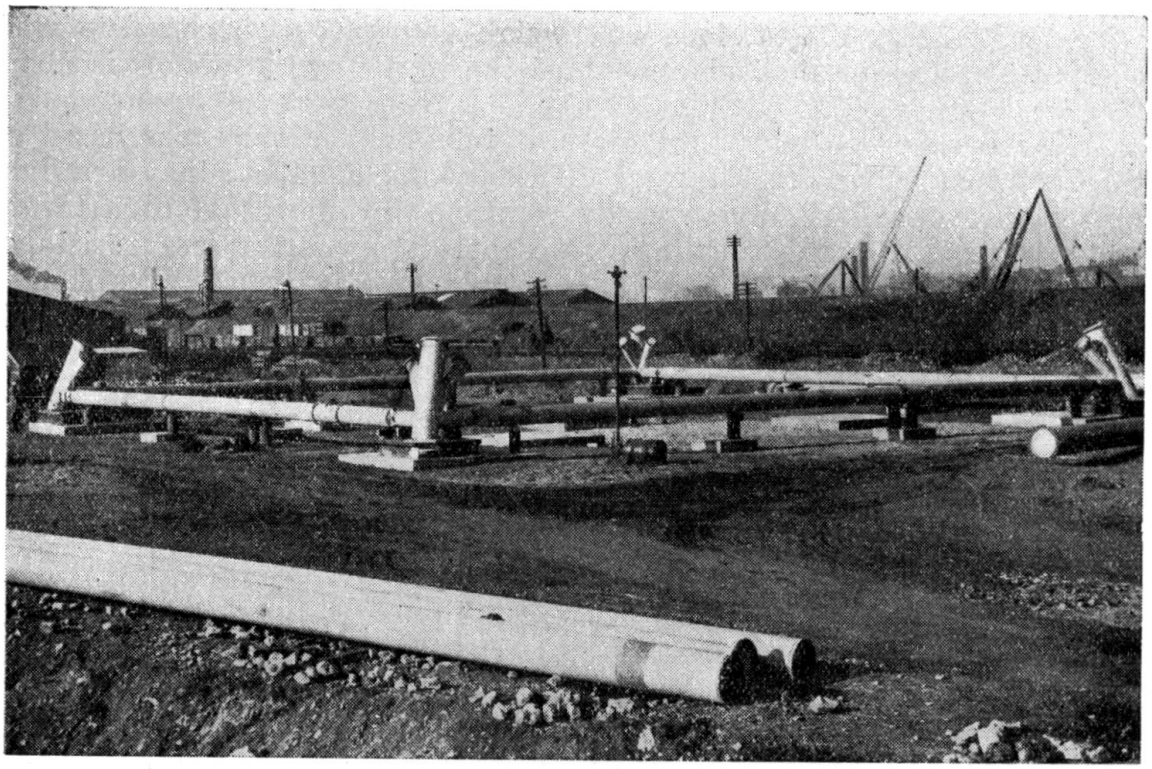

FIG. 3. Base unit of Tower erected at Messrs. Tubewrights' trial assembly site

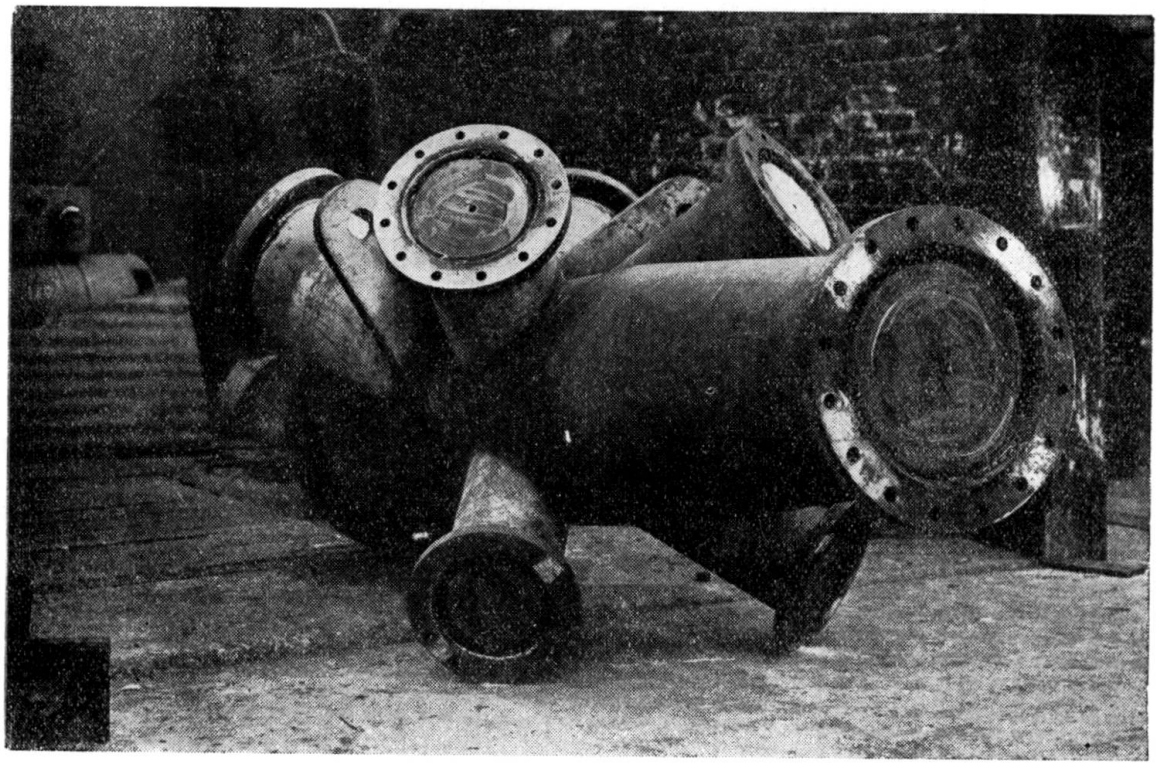

FIG. 4. Junction piece ready for completion of welding on blanking-off plates

The two all-welded pontoons used to transport the tower are 17 $\frac{1}{2}$ ft. wide, 7 ft. deep, 175 ft. long and weigh 180 tons each complete with equipment. The total displacement of the tower and pontoons is about 950 tons.

The decision to build the tower of tubular steelwork was based on the fact that tubes are the most efficient kind of strut; they are light in weight, strong, rigid and easily connected by means of high torque bolts through flanged couplings. Moreover, they offer less resistance than rolled steel sections to wave and wind forces; they can be blanked off for protection inside and the cylindrical outer surface lends itself

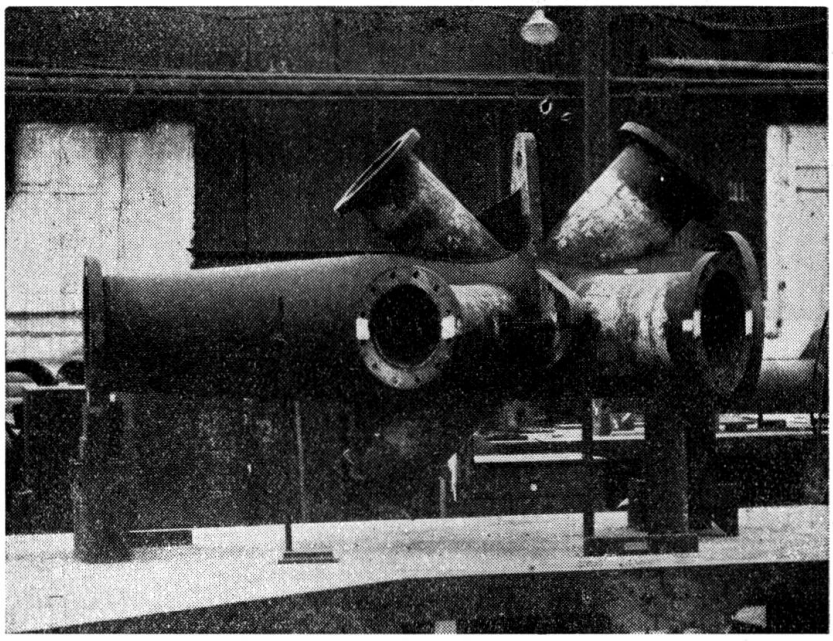

FIG. 5. Checking of heel plates after welding on junction piece

to easy maintenance. The main members are 24 ins. in diameter and the branch members 18 and 15 ins; where necessary short tapered sections are employed.

All the tubular members were fabricated and checked by shop assembly in Messrs. Tubewrights' Works. Although some connections had as many as ten tubes of varying diameter intersecting in different directions radially, the fabrication was so accurately carried out that all the 90 pieces fitted exactly and no adjustments whatever were needed during the site assembly. The tower was designed to withstand gales of 80 m. p. h. and waves 30 ft. high.

Work at St. David's Harbour, where the tower was erected, began in August 1954 and was completed in May 1955, when the tower was first floated, towed out and lowered on to its initial site. Before towing

the tower out, compressed air was pumped into the base girders to increase the buoyancy. The unit was towed by three Admiralty tugs with two more in attendance to provide restraint if necessary. At the end of their 12-mile journey the tugs were made fast to temporary

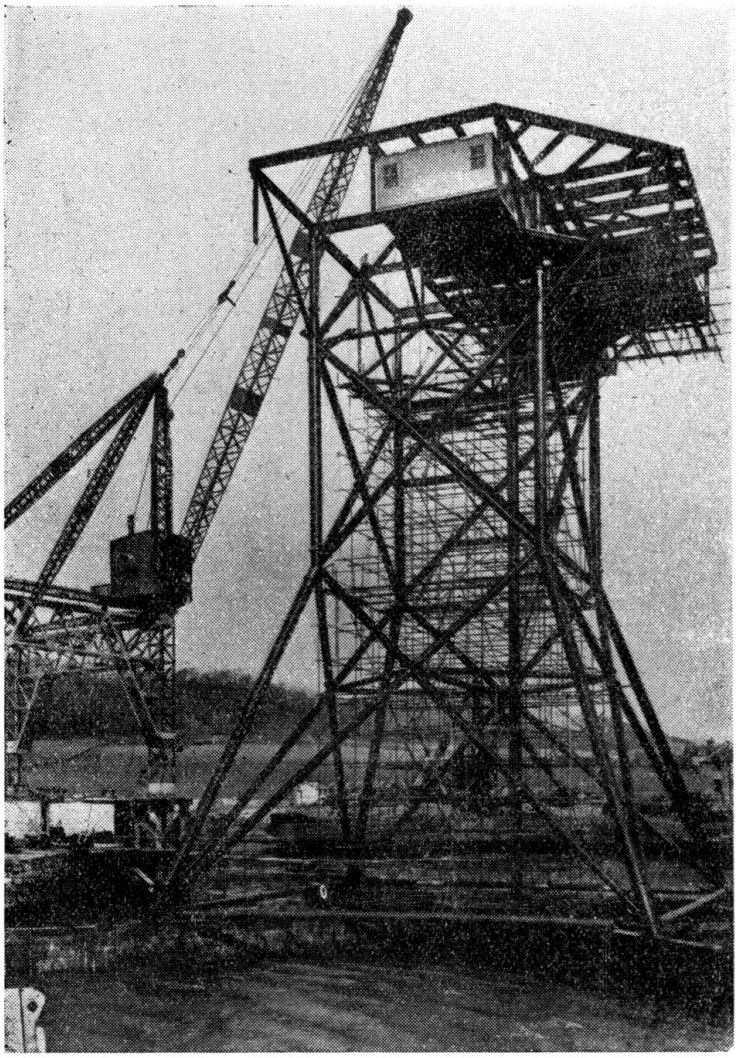

FIG. 6. Assembly of upper decks and accomodation units

moorings and the base girders of the tower were flooded and slowly lowered by means of four pairs of steel wire ropes of 8 inch circumference attached to the four lifting points. This operation was carried out by two 45-H. P. electrically driven winches on each pontoon. The tower was successfully lowered 12 fathoms to the bed of the estuary which had been checked for level in advance by means of echo soundings. The lowering ropes were disconnected and the pontoons returned to harbour.

The tower was then only three-quarters of a degree off vertical and drilling operations were commenced.

A year later, after completion of its first series of borings made to a depth of 3,000 ft. which disclosed the existence of five workable

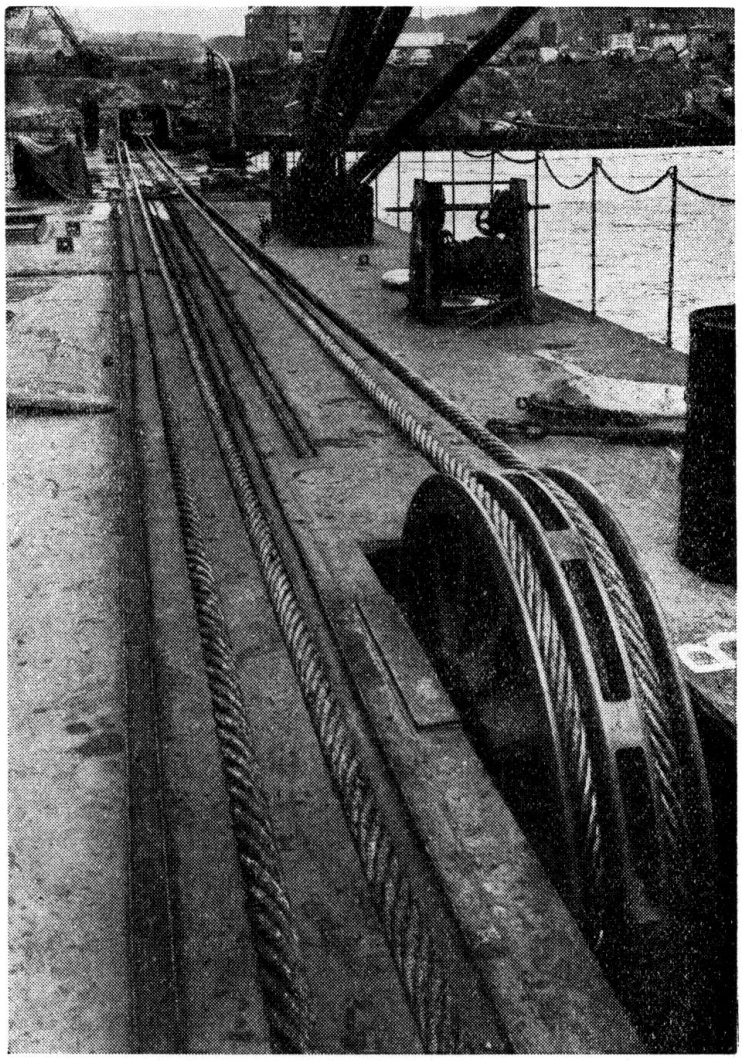

FIG. 7. 8-inch circumference lifting ropes and 5-ft. diameter sheaves on pontoon

seams, estimated to yield 40,000,000 tons of coal, the tower was uplifted by means of the same pontoons and winches which had been used to lower it. No difficulty was experienced in this operation and the tower was raised, moved to its new location and lowered again within a period of ten hours.

Apart from the drilling rig and the mobile crane, the whole of the power used for the services and operations is by electricity generated on

the tower. The three generators are driven by three 3-cylinder diesel engines which run at 500 r. p. m. and each develops 100 H. P. Connected in parallel, the generators give a total output of 150 kW. Fresh water for drinking and cooking is obtained by means of a vapour compressor

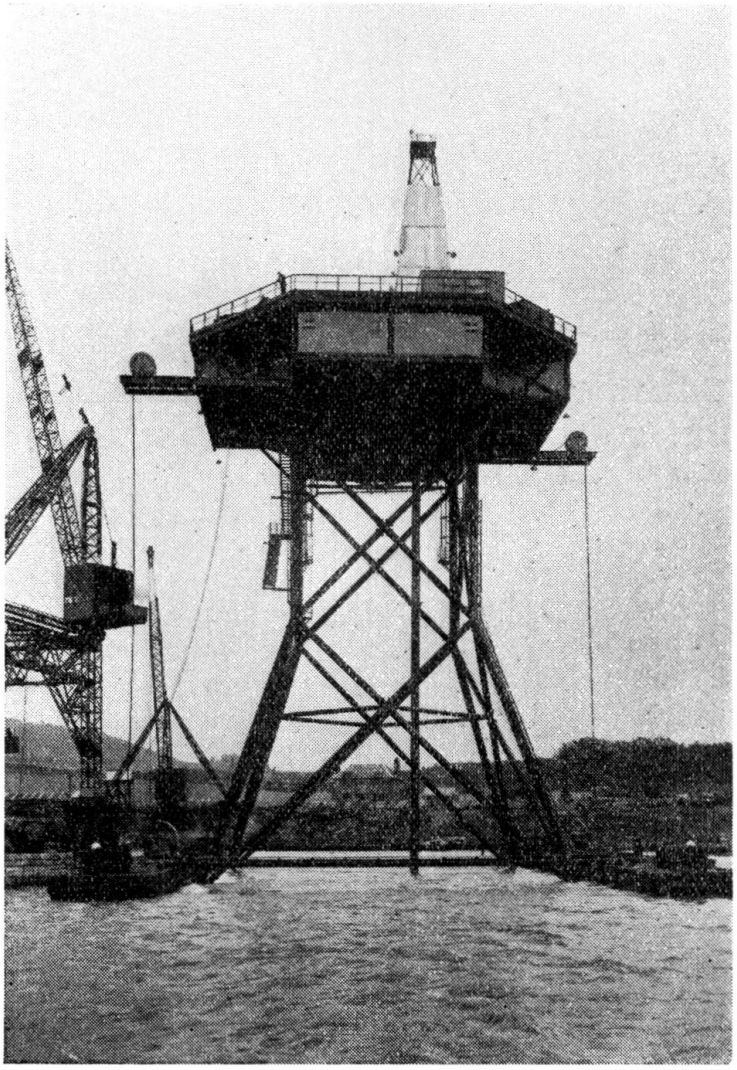

FIG. 8. Tower complete and ready for floating

unit which can produce 40 gallons of fresh water per hour from 70 gallons of salt water.

A radio telephone which operates at two frequencies and has a radius of ten miles is installed to maintain communication with the shore. The cost of the tower together with all its fittings, machinery and pontoons was of the order of £250,000 exclusive of the cost of boring.

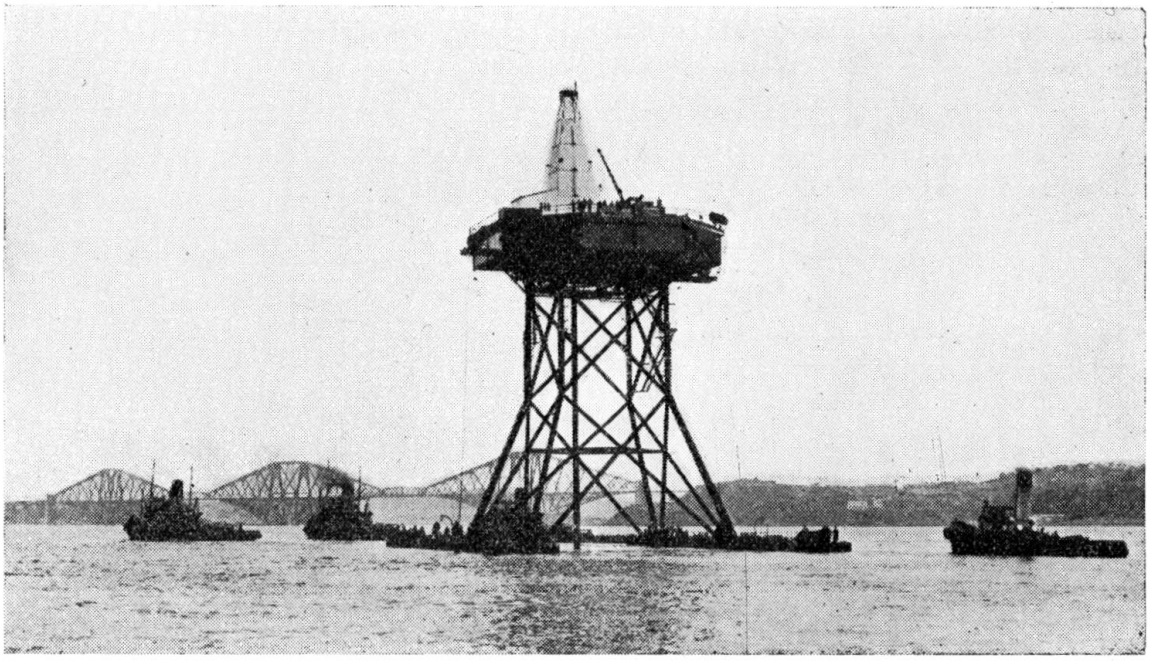

FIG. 9. Tower being towed out to its first drilling site

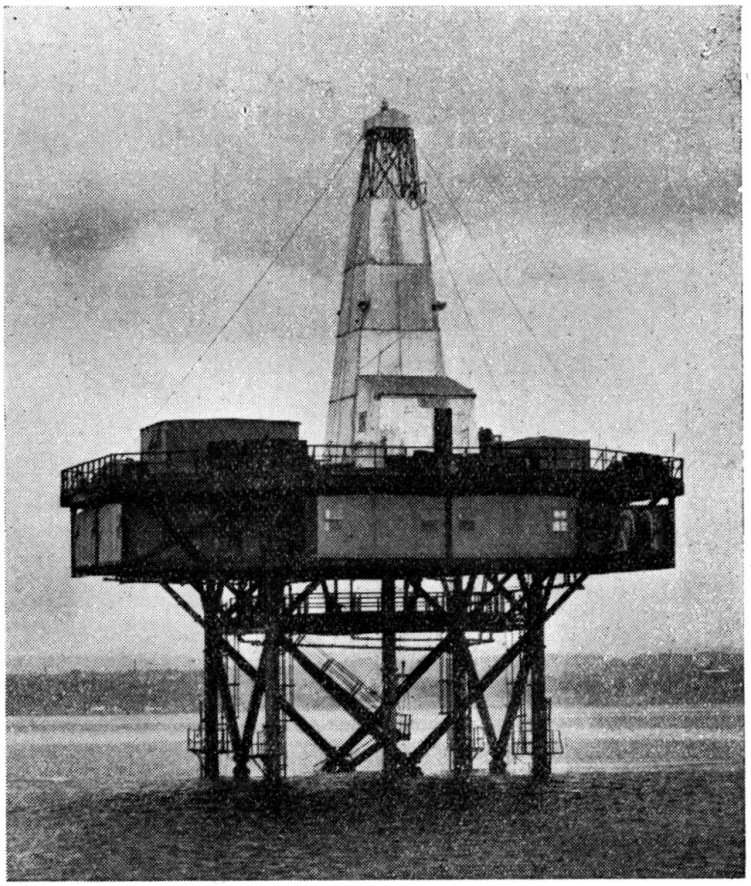

FIG. 10. Tower grounded in its first boring position in the Firth of Forth

SUMMARY

The authors describe the construction of the first sea boring tower ever built to prove new coal seams by test borings round the coasts of Britain. The tower was made of tubular steelwork connected by high torque bolts and was designed to be floated out and lowered to the sea bed for each series of borings.

ZUSAMMENFASSUNG

Die Verfasser beschreiben den Bau des ersten je gebauten Bohrturmes im Meer zur Erforschung neuer Kohlenflöze durch Probebohrungen an den Küsten Grossbritanniens. Der Turm wurde in Stahlrokonstruktion errichtet, wobei die Stahlrohre durch Drehzapfen miteinander verbunden wurden. Er wurde so entworfen, dass er auf einem Floss an Ort und Stelle gebracht und für jede Bohrung auf den Meeresgrund abgesetzt wurde.

RESUMO

Os autores descrevem a construção da primeira torre de sondagens marítimas destinada a prospectar jazigos de carvão por meio de furos de ensaio ao largo da costa britânica. A torre é constituída por uma estrutura tubular de aço, sendo as ligações asseguradas por parafusos especiais, sujeitos a um elevado binário à montagem, e foi projectada para ser rebocada até ao local e mergulhada até ao fundo para cada série de sondagens.

RÉSUMÉ

Les auteurs décrivent la construction de la première tour de sondages à la mer pour la prospection de gisements de charbon au moyen de forages d'essai, au large des côtes britanniques. Cette tour se compose essentiellement d'une structure en tubes d'acier liés au moyen de boulons à grand couple de serrage et a été étudiée pour être rémorquée sur place et descendue au fond pour chaque série de sondages.

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