USE OF BILBY TOWERS IN TRIANGULATION OF SOUTHERN COAST OF SENEGAL

A number of Bilby towers belonging to the Geographic Service of French West Africa were used as triangulation signals by Lieutenant-Commander Bonnin, heading the mission for the triangulation of the southern coast of Senegal from October 1946 to August 1948, in connection with operations in a flat area covered by tall trees south of Cape Naze.

Towers 42 metres high were erected, with one 33-metre exception.

These triangulation beacons have already been described in the *Hydrographic Review*, Vol. X, No. 2, 1933, page 243.

An extract from Lt.-Cdr. Bonnin's report relating to his use of the towers and containing some useful pertinent information appears below.

I. ERECTING OF STRUCTURES.

General.

The towers were erected following the designer's instructions and plans.

However, the mudsills and crosspieces used as foundations and anchors for the tower legs were made of reinforced concrete instead of wood to avoid damage by termites.

The towers were moreover guyed, as they were expected to remain in one place for some time. The 42-metre towers were provided with guys at three different levels : half-way up and towards the top of the outer structure, and two-thirds of the way up the inner tower. The 33-metre tower was equipped with 6 guys : one set for each the inner and outer tower, two-thirds of the way up.

Setting-up of anchor posts.

The distance (D) from the centre of the tower at which the tower legs should be bolted to the anchor posts was deduced from indications appearing on the plans. The slope of the legs with reference to the vertical was also computed : 6° 32' for the outer tower and 6° 20' for the inner one.

A light metal frame template with an angle measurement of 96° 30' was made and used as shown in Figure 1.

The template (E) was bolted to a square wooden beam (C.) A hole was made in the beam so that it could be rigged on a central stake (A) with a nail in the top, and an automobile jack was placed under it. Horizontality was obtained by working the jack.

Distance d = Distance D $\times$ sin slope.

The anchor post (F) was shifted in the hole and slanted until it fitted perfectly along the template. Then the hole was partially filled to keep the post in position.

Guying.

Guying was done as shown in Figure 2.

U bolt D was clamped onto the tower-leg at the meeting point of two sections, that is at a point where the top of a lower section leg joined onto the lower end of an upper section, and where the legs were firmly kept in position by horizontal members and diagonal braces.

U bolts and turnbuckles were used to tighten the guys, which were set at a 45-degree slope.

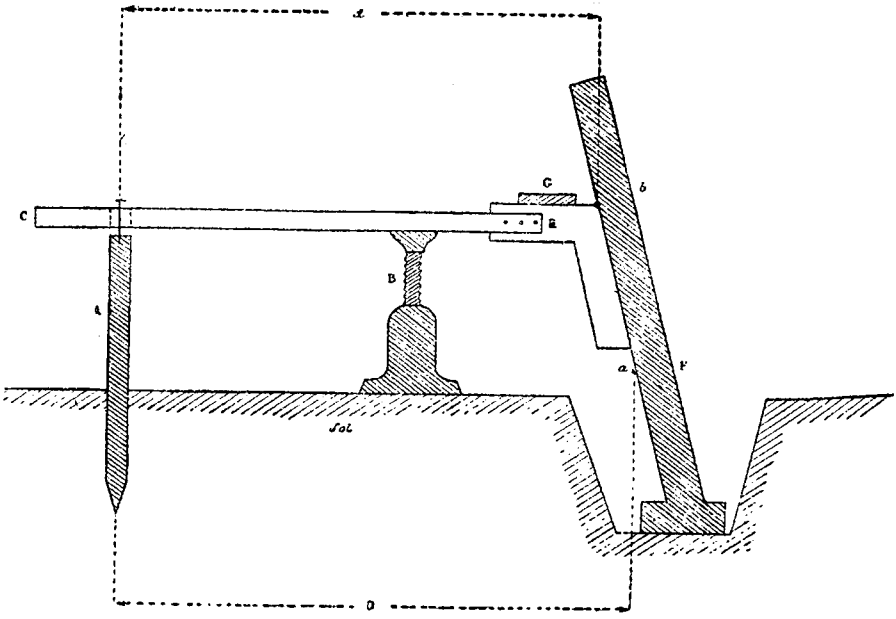

FIG. 1.

A) Stake at centre of tower with nail in top.

B) Automobile jack.

C) Wooden beam.

E) Template.

F) Anchor post.

G) Carpenter's level.

a) Point selected at convenient level for bolting legs.

b) Site of upper edge of template when carpenter's level (G) is in horizontal position.

2. PERSONNEL AND ORGANIZING OF OPERATIONS.

Ground crew : 1 petty-officer and a minimum of four natives.

This group placed at the base of the tower the various parts to be assembled and hoisted them as needed by the fitters. As the erection of the tower neared completion, they shared in guying operations.

Tower crew : 1 petty-officer and 6 fitters (consisting of 2 Europeans and 4 native workers).

The petty-officer supervised and regulated the work, helped out in case of trouble, and did such odd jobs as bolting the steps.

As long as the tower legs remained some distance apart and until the structure had reached a height about 8 metres below the level of the observer's platform, each leg was separately equipped with 2 fitters, a construction platform, a rope hoist and pulley.

The space between the legs decreased and the parts to be assembled became lighter as the work proceeded. A smaller crew was needed and only one or two hoists were used, releasing a number of fitters who were put to work on the guys.

Both the inner and outer structures were erected section by section and simultaneously ; at each level, the lighter parts of the inner section were assembled first.

3. LENGTH OF OPERATIONS.

It took from 6 to 7 days to erect the first 42-metre tower.

Once the crew had had some practice, however, the erecting of a 42-metre tower, including siting of the anchor posts and guying averaged three days, and that of a 33-metre tower two days and a half, reckoned from the time the foundation holes had been dug and the parts approximately sorted out.

Taking down the 42-metre towers required 2 days and a half, and the 33-metre towers one and a half, inclusive of the time required in removing the footplates from the foundations and the anchorings of the guys.

A) Pile of 4 50-kg. iron pigs, 1.50 metre underground.

B) 2 metres of scrap chain.

C) Turnbuckle or U bolt.

D) U bolt.

E) Steel wire, diameter 6 to 8 mm.

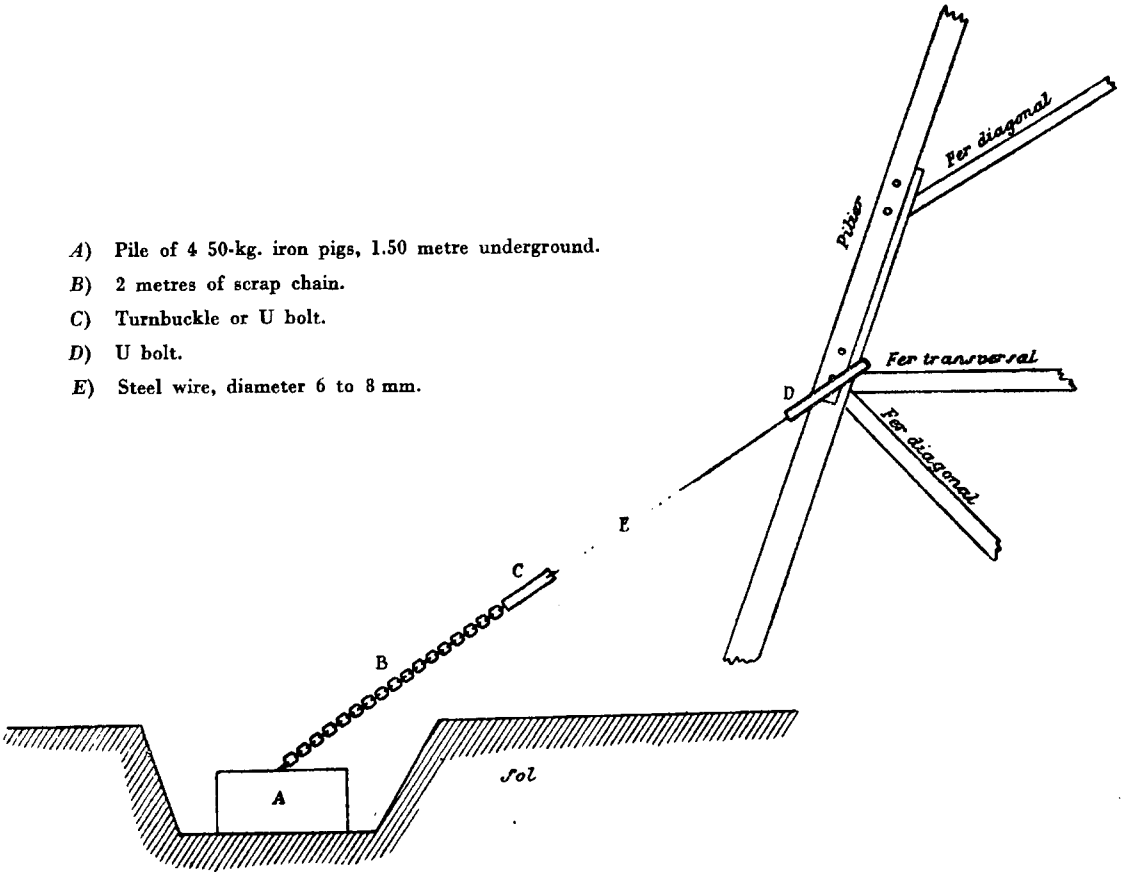

FIG. 2.

4. FOUNDATIONS.

Each of the three holes used as a base for the inner and outer tower legs were about 1.20 metre square and were dug to a depth of 1.50 metre.

They could not be made as deep on Point Jacksonsa, where at a depth of 1.50 metre the ground was damp and slimy and would not have adequately supported the tower. The posts were therefore sunk 50 centimetres down, and the base was buried in a mound of earth shored up by roughly cemented rubble.

The holes containing the guy anchors were one metre square and 1.50 metre deep.

5. TRANSPORTING EQUIPMENT.

The equipment needed in erecting a 42-metre tower weighs from 4 to 5 tons. The weight of the steel parts was estimated at 2 tons, and that of the concrete sills and crosspieces, together with the guying equipment, at over 2 tons. 2 medium or light trucks were adequate means of transport.

Whenever the equipment was carried by water and the harbour-launch was unable to come alongside the banks, a 1 by 4 or 5-metre raft made up of 3 small life-rafts secured together was used as a means of communication between the launch and the land.

6. VIBRATIONS.

The wind caused the towers to vibrate with a very slight rapid motion, but the guys proved to be not responsible.

A wind velocity of approximately 6 metres per second interfered with observations.