water may begin a series of swinging movements, each successive movement increasing in range in proportion with the shortening of the distance between lead and block.

French hydrographic parties frequently use the damping device shown in the accompanying figure.

It consists in passing the end of the sounding line through a ring, which will rest on top of the lead, before securing the latter to the line. Attached to the ring is a hemp lanyard the length of which is about equal to the height of the sounding chains above the water; if desired, a mop may be attached to the other end of this lanyard.

While the lead is being hauled forward along the jackstay, and also during the actul sounding, the ring is secured near the block used for heaving in or held in the leadsman's hand; as soon as the vertical sounding has been taken and the sounding line is travelling upwards under the action of the winch, the leadsman drops the lanyard into the sea, the ring meanwhile sliding along the sounding line.

When the lead leaves the water, the mop or lanyard which has been trailing in the sea behind the sounding line while the lead is coming up, acts as a damper to prevent the lead from swinging while being hauled on board.

H. B.

WATER SIGNALS FOR TRIANGULATION AND HYDROGRAPHY

(Extract from U. S. Coast and Geodetic Survey Special Publication No. 93 "*Reconnaissance and Signal Building*" by JASPER S. BILBY, Washington, 1923, pp. 69-72).

Along certain sections of the coast it is sometimes desirable to locate a station in the water some distance from the shore. In some cases the position of this station is determined by observations from land stations. In other cases it becomes necessary to occupy the water station itself with a theodolite. The signal must be built in such a way that it will not be shifted in position by wave action or wind pressure, and if it is to be occupied with an instrument it must be steady enough to permit accurate angle measurements.

The type of water signal described below is one that has been used successfully in depths as great as 13 feet. The elevation and plan of the tripod instrument support of this signal are shown in Fig. 1 and the different steps in its construction are shown in Fig. 2. The tripod has a large spread at the base to minimize the amount and effects of any unequal settling in soft bottom and has an extensive system of bracing for rigidity. A vertical stake attached to the foot of each leg of the tripod and weights in the form of bags of sand placed on platforms attached to each foot help to prevent any shift of position of the signal. The tripod is designed so that the center of bracing is well below the surface of the water where the greatest rigidity is required and to offer the least possible resistance to the waves at the surface of the water. The twisting motion caused by the waves acting unequally on different parts of the structure is by far the greatest factor to be considered in obtaining a rigid structure.

The tripod is built on shore, carried into the water and launched, towed to the desired location, and finally placed in position and weighted down. The scaffold for supporting the observer is then built independently of the tripod. The size of the structure depends, of course, upon the depth of water in which it is used.

Construction.

For building the tripod a level place on the beach is selected as near as possible to deep water and not too far from where the station is to be located. The bottom section of the center pole, consisting of two 2 by 4 inch pieces 8 and 16 feet long respectively, is placed in a vertical position and held by temporary supports. The three bottom members *B* are then placed on the ground in a level position at angles of about 120° with each other and nailed to the bottom of the center pole. Temporary braces are then nailed from each bottom member *B* to the center pole and the center pole extended by lapping on another 2 by 4 inch piece 16 feet long. The lower diagonal braces *C* (see *B*, Fig. 2.) are next nailed in place, and after the center pole has again been extended the upper diagonals or legs *D* are put on. The horizontal braces *E* are then

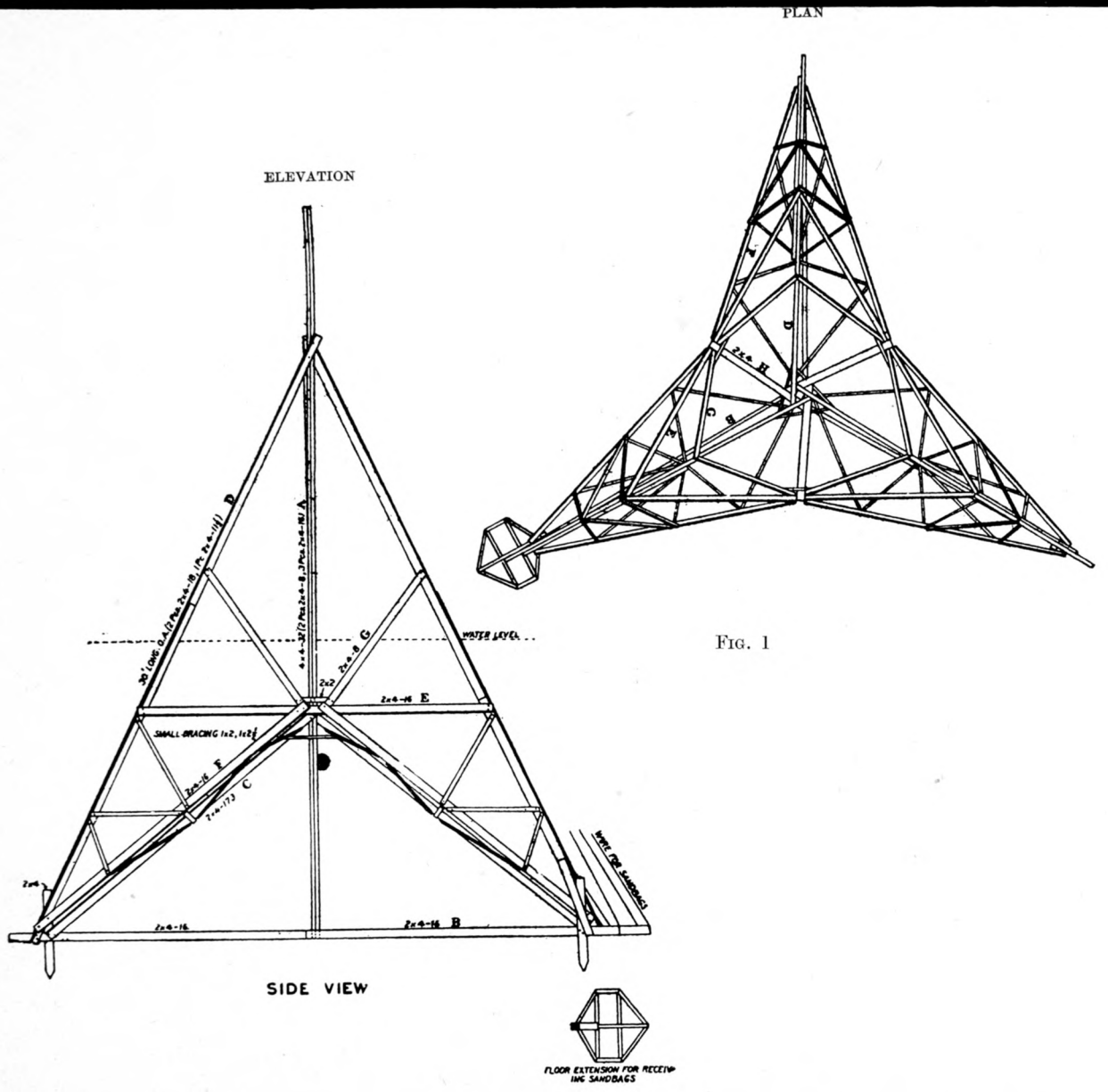
PLAN
ELEVATION
WATER LEVEL
SMALL BRACING 1x2, 1x2½
2x4-16 E
2x4-16 F
2x4-17½ C
2x4-16
2x4-16 B
SIDE VIEW
FLOOR EXTENSION FOR RECEIVING SANDBAGS

FIG. 1

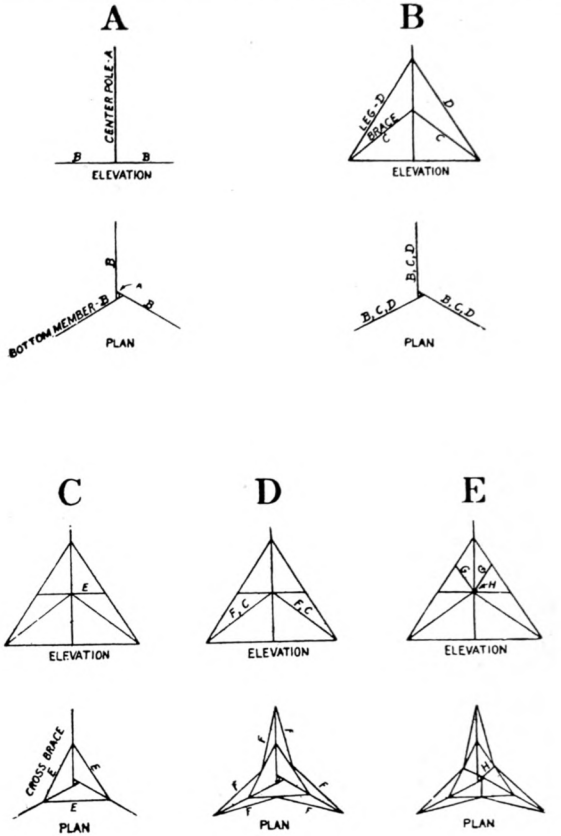
A
CENTER POLE-A
ELEVATION
BOTTOM MEMBER-B
PLAN
B
LEG-D
BRACE
ELEVATION
B,C,D
PLAN
C
ELEVATION
CROSS BRACE
PLAN
D
ELEVATION
PLAN
E
ELEVATION
PLAN

FIG. 2

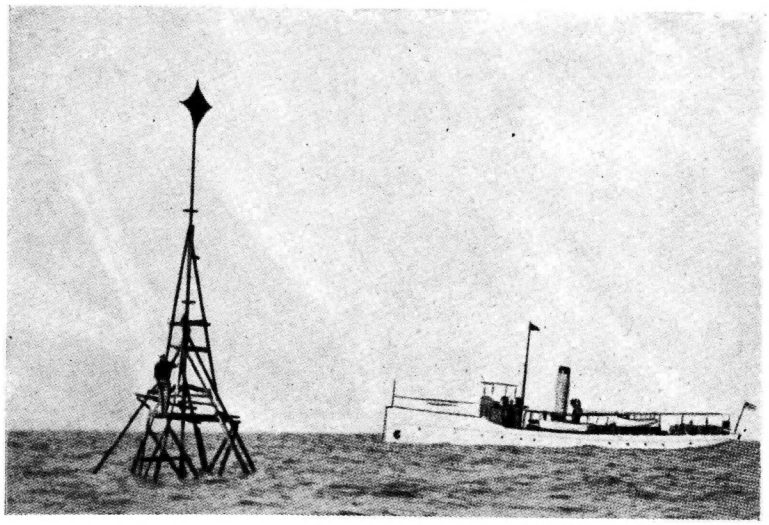

FIG. 3

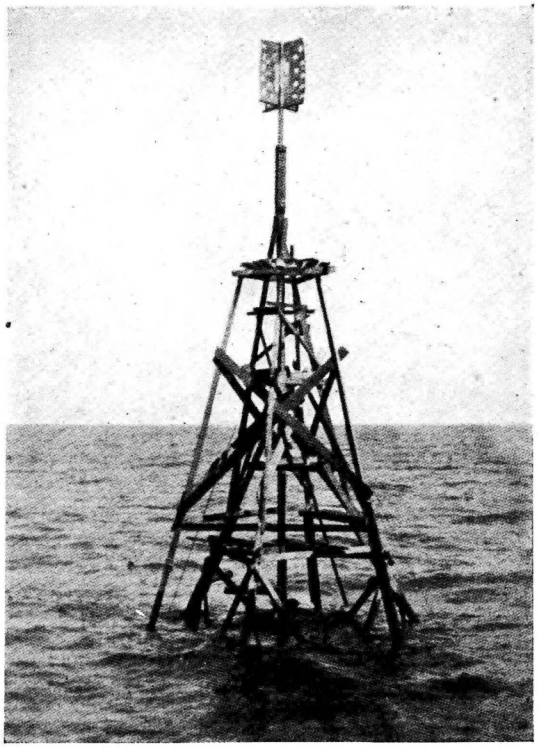

FIG. 4

nailed to the legs *D* at about the same height as the tops of the *C* diagonals. The members *F* (see *D*, Fig. 2.) which extend from the bottom of the legs *D* to the middle of the members *E*, are then attached, and the remainder of the construction, such as cross and diagonal bracing between the members *C*, *D*, and *F*, is done as indicated in Fig. 1 in order to insure a rigid structure.

The materials needed for the signal are given in the list below.

Launching and towing.

Twelve men are required to carry the tripod into the water. When a depth of about 3 feet has been reached, the tripod is put down and turned over on its side. The overturning movement is controlled by attaching a line to the leg being raised and keeping this line taut after the balancing point has been passed. The water also helps to retard the movement and prevent injury to the structure. The tripod is floated in the overturned position by means of lines from the two submerged legs to the bow and stern of a whaleboat and a line from the end of the center pole to a dinghy. After the tripod has been raised just enough to clear the bottom it is towed to the ship by a launch. Barrel buoys are then subtituted in place of the boats to float the signal, and the ship is used to tow it to the desired position, using care not to allow the barrel buoys to become submerged.

Uprighting tripod.

When the tripod is released from the buoys in 10 or 12 feet of water, it will tend to rest on the bottom on the ends of two of its legs. Temporary weights can be used to hold it in this position. The leg which projects out of the water can then be boarded by two men, who build the platform for holding the weights on the foot of the leg and attach four wires to different parts of the platform for use in guiding the weights when the tripod has been uprighted. The tripod is next rolled over to bring another leg up, and a similar platform with wires attached is built at the foot of this leg. After the third leg has been completed in the same way the tripod is uprighted by lifting the end of the center pole a few feet above the water, using a line to the ship if necessary.

About 60 cement bags filled with sand are needed to weight the tripod down They may be placed in position by attaching a wire loop to the neck of each bag and letting this loop slide down one of the wires attached to one of the three platforms while the wire is held vertical. The bags should be lowered carefully with a slip line. After all the bags have been lowered the guide wires should be attached securely to the tripod.

If necessary to add a superstructure to elevate the instrument, it should be built in the form of a slender tripod attached to the legs of the main tripod and properly braced (See Fig. 3). It should not be extended more than 12 feet above the apex of the main tripod. The target is attached to the top of the superstructure in such a way that it may be detached easily. When the station is occupied, the target is removed and the instrument, mounted on its own tripod, is lashed securely to the top of the superstructure.

The observer's stand is built independent of the instrument support by driving pipes into the bottom, to each of which a scantling is lashed with wire seizing. The necessary bracing and floor can then be attached to these legs. (See Fig. 4).

List of material for water signal.

Tripod instrument support.

Bags, cement, containers for sand ballast		60
Lumber, rough :		
2 by 4 inches by 18 feet	pieces	9
2 by 4 inches by 16 feet	do.	15
2 by 4 inches by 12 feet	do.	4
2 by 4 inches by 8 feet	do.	8
1 by 2 ½ inches	linear feet.	72
1 by 2 inches	do	112
Marline, for tying bags	feet	140
Nails :		
Forty-penny	pounds	10
Twenty-penny	do.	10
Ten-penny	do.	10

Wire :		
Telephone No. 5, for guide wires	feet..	240
Telephone No. 10, for attaching bags to guide wires	do.	200
Superstructure.		
Lumber, rough :		
2 by 4 inches by 16 feet	pieces	5
2 by 3 inches	board feet.	48
1 by 3 inches	do.	24
Observer's stand.		
Lumber :		
1 by 6 inches, for floor	board feet.	14
Rough :		
2 by 4 inches by 16 feet	pieces	6
2 by 4 inches by 10 feet	do.	3
2 by 3 inches by 16 feet	do.	7
Pipe, 2 ½ inches in diameter, 20 feet long	do.	3