THE SWEDISH MARKER BUOY SYSTEM

by Dr. P. O. FAGERHOLM

IHB Note. — Although today radio-electronic-positioning systems are common tools for positioning hydrographic surveys, both inshore and offshore, there still remains a requirement for detailed investigations of shoals, obstructions, channels, etc., by so called conventional methods. This article describes one such method.

Due to shallow waters and uneven bottom topography the proportion of " development " in Swedish hydrographic surveys has always been rather high and showed during the 1950's a tendency to a further increase. Considerable attention was therefore paid to a system of fast working, convenient and economic selfanchoring marker buoys in a development block, which normally were placed as shown in fig. 1. (Large and small circles represent a total of 25 buoys.)

Without going into details about the survey techniques and the buoying operation I wish to emphasize as background information :

(1) that most of the buoys are dropped at full speed (8 knots) in accordance with a determined time interval,

(2) that only those buoys, marked A. B. C. and D. in fig. 1, are positioned later by sextant angles,

(3) that sounding lines are run as shown in fig. 1, averaging out minor divergencies in buoy positions from the ideal positions,

(4) when a reversing tidal current exists a block has to be finished before the tide reverses.

As the buoying technique and routine operation progressed, the procedure in areas where considerable development was foreseen, was to start directly with the development — no general sounding of the block was done — and cover the area with blocks (fig. 2.)

As the depth figures are plotted during the development survey — a sort of depth chart to scale of 1:2 500 (or 1:1 250) is available to the surveyor as the boat is proceeding along the sounding line at about 8 knots. The surveyor, who starts with the main sounding lines 50 metres apart can, immediately after these have been run, determine if intermediate lines (splits) 25 metres apart and very often 12.5 metres apart are needed.

Of course it is important that the buoys remain in position during the sounding of a block, which normally takes about 40 minutes, but may be longer for other reasons. This means that a block (where no tide

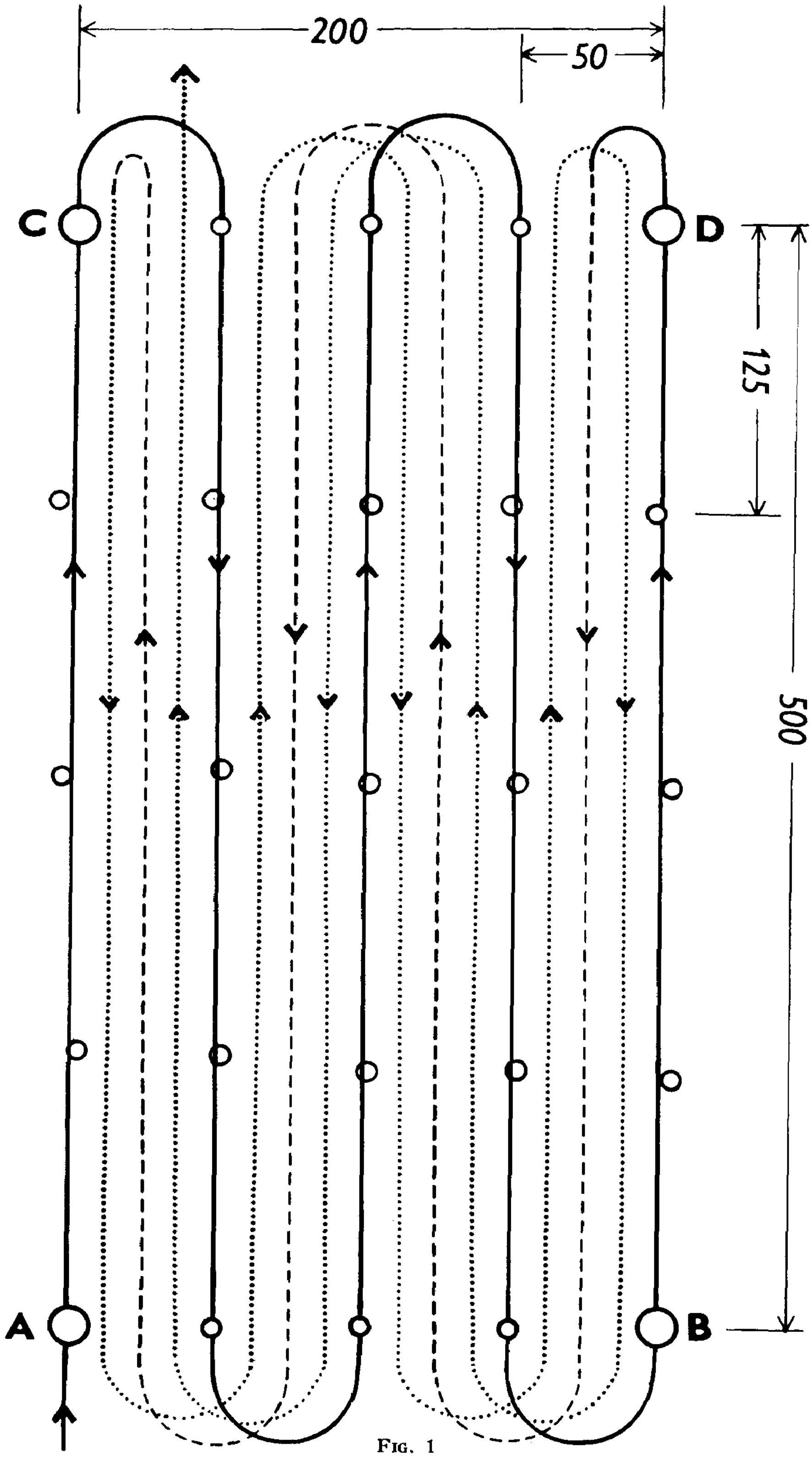

Fig. 1

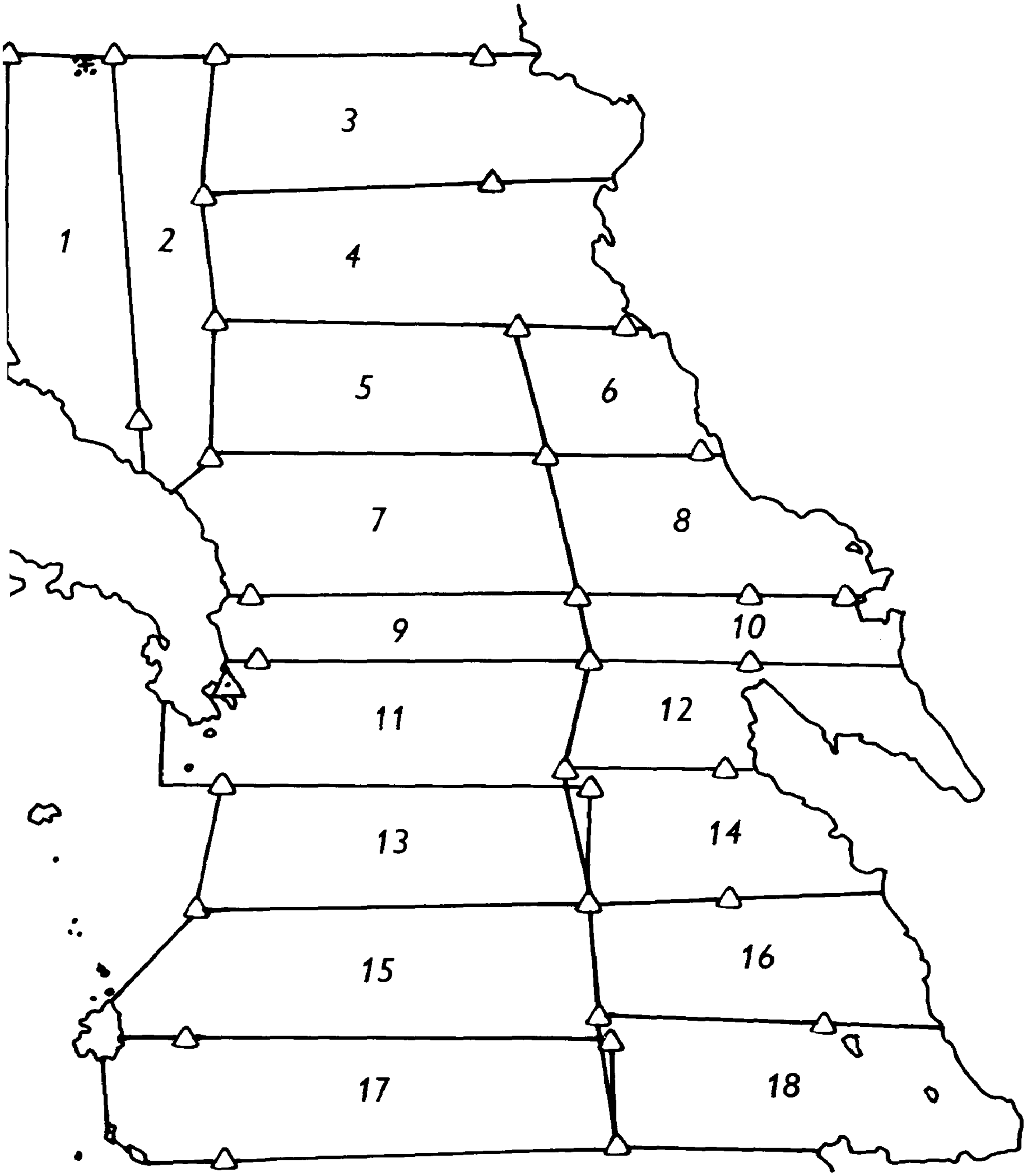

FIG. 2

reversal exists) might be buoyed out in the morning and sounded in the afternoon. Consequently much attention has been devoted to the development of self anchoring marker buoys which will remain fixed in position.

It is, however, indicative of the advancement in new techniques that after all this development we have now passed the peak use, as shown by the buoy-drop-curve. A rough estimate of the number of buoys dropped during the season of 1956 is 125 000. Today, thanks to new techniques (parallel-sounding, radio-positioning inshore and offshore, etc.) we estimate the number of " drops " to be about a tenth of the maximum figure shown above.

The Swedish marker buoy system uses the following six simple tools : anchors (3 types), rope, buoys (various sizes), rolling-off-stopper, the rail-roller, rolling-on-winch.

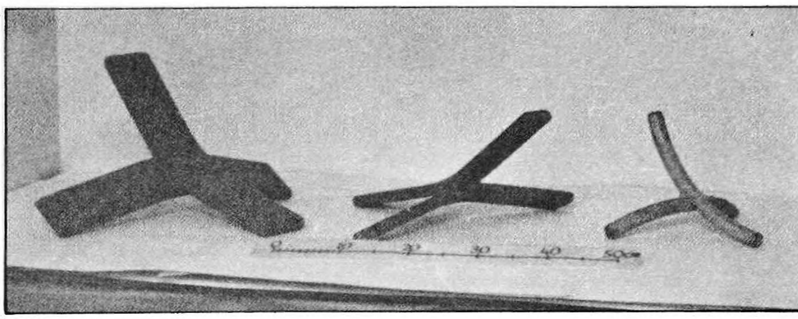

Fig. 3

The *anchor* (fig. 3) consists of two flat slightly bent pieces of iron welded together in the center where two holes are drilled for the rolling-on-winch. The edges of the irons are smoothed to avoid rapid destruction of the lines. The heaviest anchor weighs about 15 kg and the two flat irons have the dimensions 25 mm $\times$ 80 mm $\times$ 480 mm. This anchor is only used either offshore with a big buoy or inshore when a buoy has to stay in position for several days.

The medium anchor (the normal type) weighs about 8 kg and has the dimensions of the two flat irons 20 mm $\times$ 60 mm $\times$ 460 mm. Due to the above-mentioned change in survey techniques we have thousands of such anchors stored and are willing to sell minor quantities.

The smallest anchor is developed for extra small buoys which need to be maintained in position for only a short period. Instead of flat iron, ordinary round iron (used in concrete building technique) is used. The

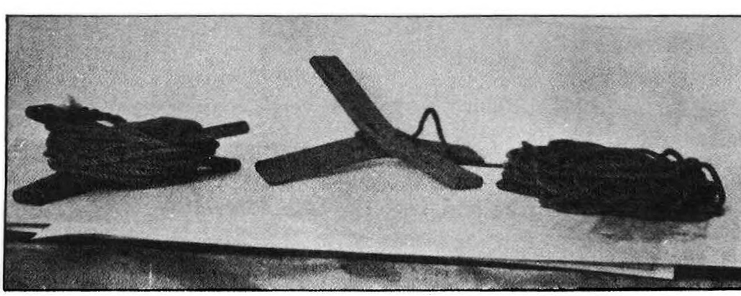

Fig. 4

dimensions of the two bars are 25 mm dia. × 300 mm. There are no holes drilled in these anchors.

The *rope* was originally of hemp and our yearly consumption amounted to about 50 kilometres. Every time a more or less weakened rope broke we lost an anchor ! We now use manila-line 8 mm in dia. for the heavy anchors, 7 mm dia. for the medium ones. For the light ones we use 7 mm in dia. strand polyeten-line. The rope (normally 30 metres long) is rolled around the anchor, as shown in fig. 4. This must be carefully done so that the rope does not become locked.

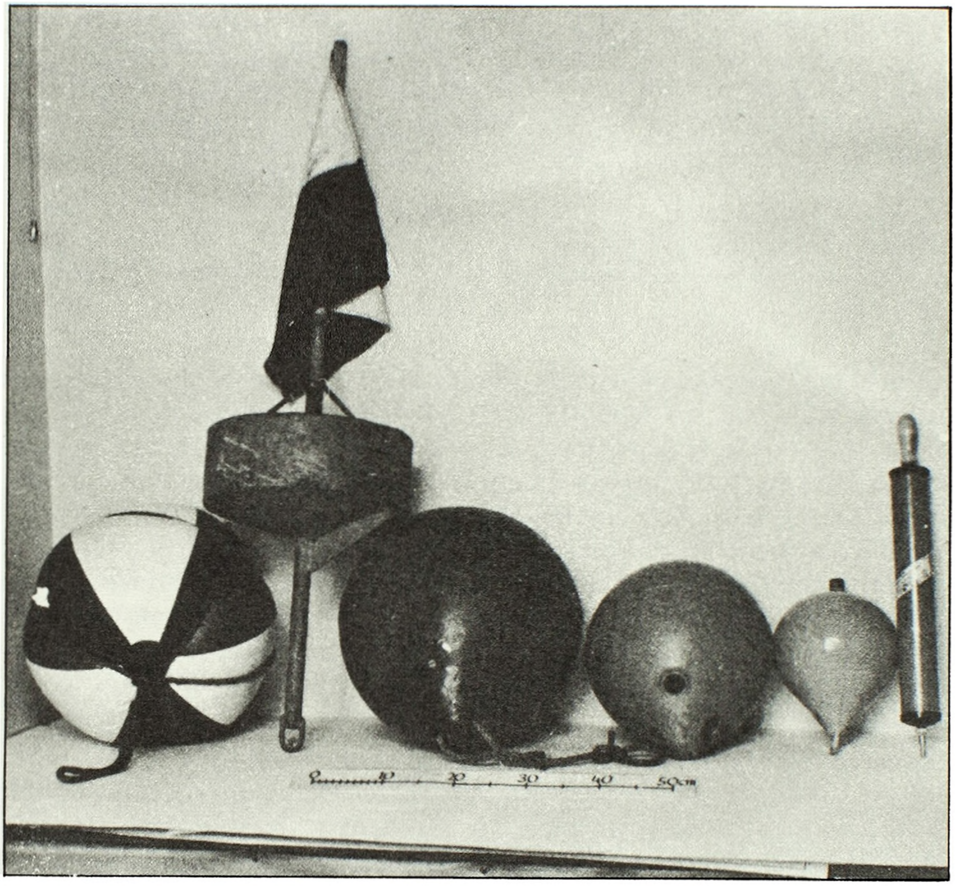

FIG. 5

The *buoy* (fig. 5) has propressively changed from iron buoys and wooden buoys and glass-spheres in 1948 to rope-wrapped thin beach-balls (plastic), to strong plastic buoys today (since 1960). The iron buoys often damaged the propellers as the helmsmen had to run straight lines. The beach-balls were not dangerous to propellers and they were normally thrown aside by the bow-wave but very often they were punctured and sunk, even without having been hit by the boat. Every sunken buoy represented a loss of anchor and rope and additionally loss of the *time* needed to re-establish it.

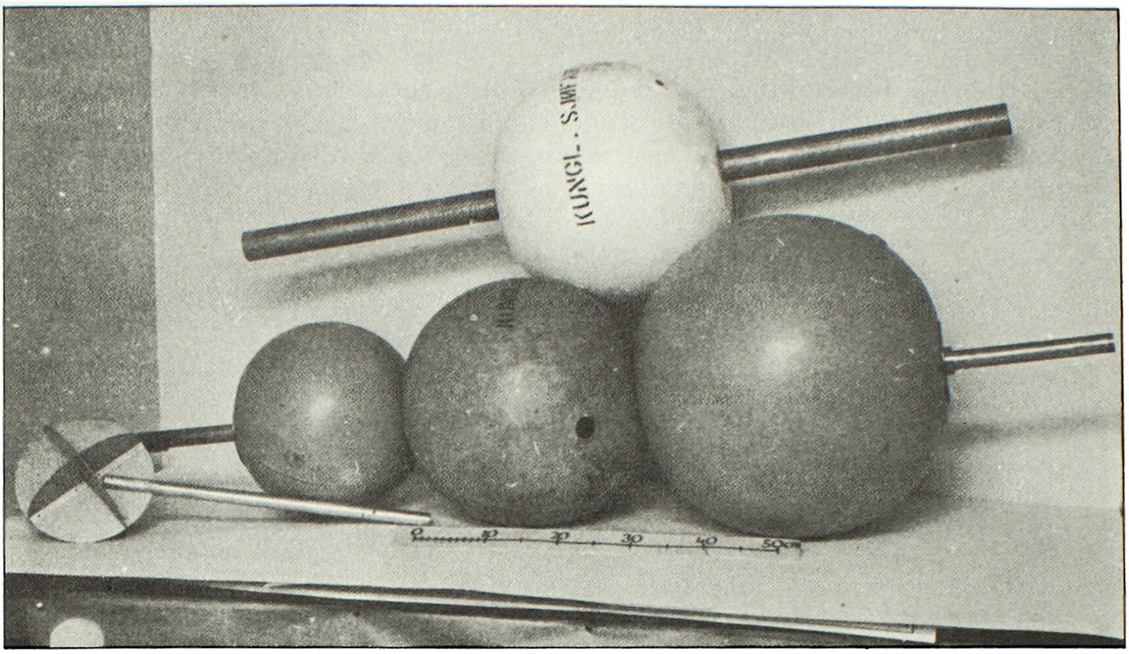

FIG. 6

When the Scandinavian hydrographers visited the Norwegian hydrographic operations on the Atlantic coast in 1959, I observed the buoys used by the Norwegian fishermen in their heavy work. A few samples, various sizes and shapes, were brought back. It has been found that no better buoy can be designed and manufactured. It fulfills every sensible requirement and as there are various sizes, shapes and colours there is always one covering the need. The size is given in inches of circumference when just filled with air. An overpressure is satisfactory and the circumference may normally be increased about 10 %. Even then it withstands hard treatment, e.g. in rough weather as fenders between the ship and a heavy launch !

Some buoy-types have a center hole for a bamboo flagpole with a weight on the lower end. When we add three such buoys of various diameters on to a brass tube we have an excellent inflatable wire-drag-buoy. (See fig. 6).

For inflating the buoys a simple all plastic air pump is used. (See fig. 5).

When dropping a buoy, which can be done from the boat or ship at full speed, the buoy must carry the weight of anchor and rope but not with too much margin. The anchor " rolls " down through the water until it hits the bottom. A wave or two helps to set the anchor and thereafter it stays, keeping the buoy with a fairly vertical line.

The *rolling-off-stopper* (fig. 7*a*) is the lazy man's blessing. If a buoy with e.g. 30 metres of rope is anchored in 10 metres depth the time and power required to haul the anchor would be the same as in 30 metres depth if it were not for a boatswain by the Christian name of Kalle (in English, Charlie) who invented this 15 mm dia. piece of iron bar bent into

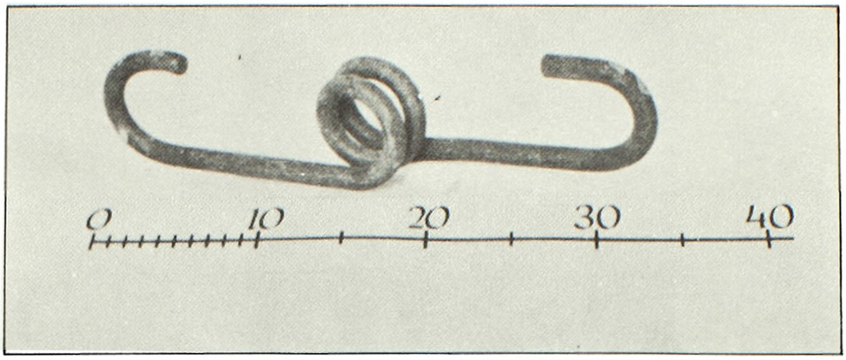

Fig. 7a

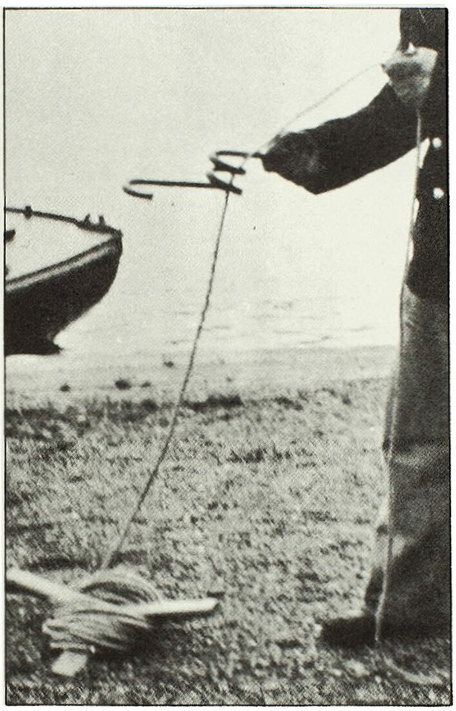

Fig. 7b

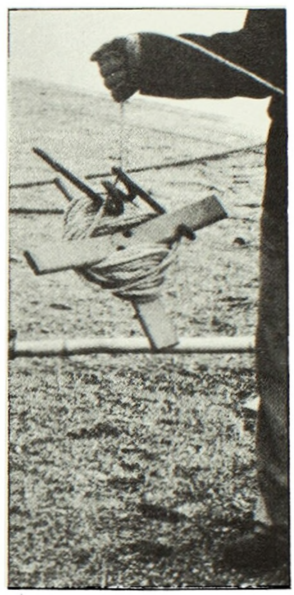

Fig. 7c

a spiral. Before hauling a buoy the " Kalle " is attached to the rope in a few seconds (fig. 7*b*), taking about 20 seconds to descend along the rope to the anchor and then in about 49 cases out of 50 the " Kalle " catches the anchor (fig. 7*c*), preventing any further rolling off of line. Before hauling, the short rope-tail of the buoy is disconnected from the anchor rope.

A *rail roller* (fig. 8) is attached to the boat's rail to reduce friction and to prevent wearing of the rope and rail. The line and the anchor are left on the floor plate until there is a pause in the hauling.

A *rolling-on-winch* (fig. 9) of simplest design requiring neither electricity nor automation eases the rolling-on-job and does it better. If not care-

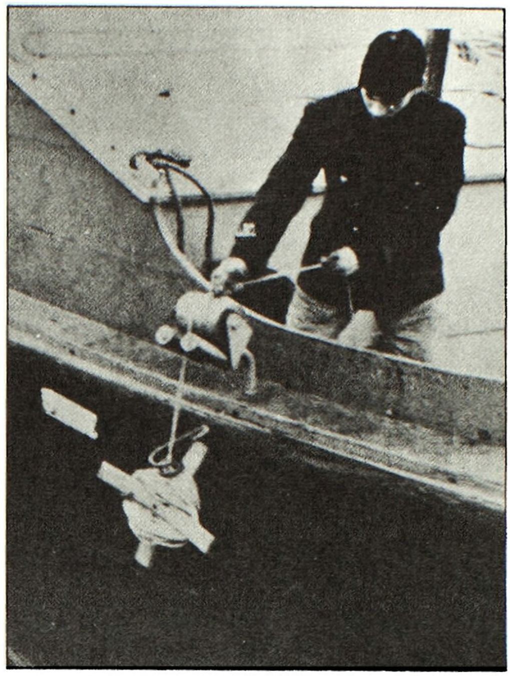

FIG. 8

FIG. 9

fully done, the rope may lock itself, but that can be immediately seen after the buoy is dropped. The buoy, in such a case, deeper in the water, sails away, sometimes commented upon by the surveyor in unprintable words. The normal reaction from a surveyor who has had bad luck during the day with several " sailing buoys " is to the effect that the men have done a bad rolling-on-job and they are ordered to roll off every rope — it might be a hundred — and roll them on correctly. The result is that the " sailing-buoy cases " are soon very few or possibly none at all.