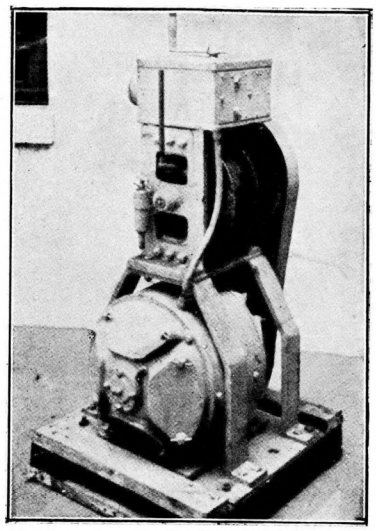

Fig. 2

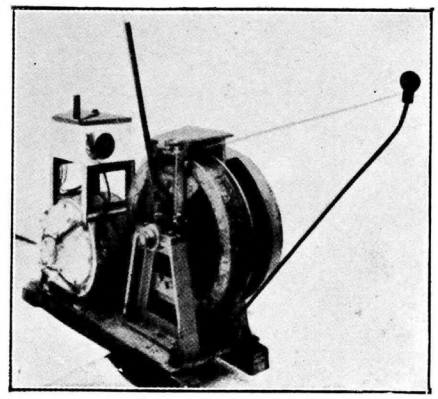

Fig. 3

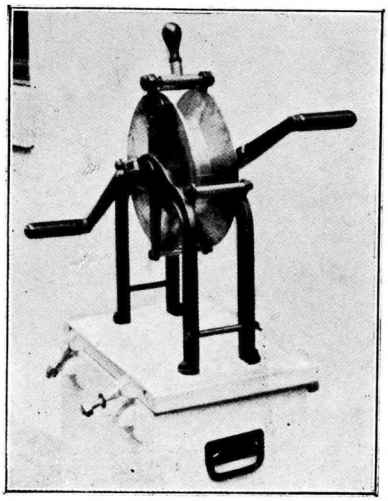

Fig. 4

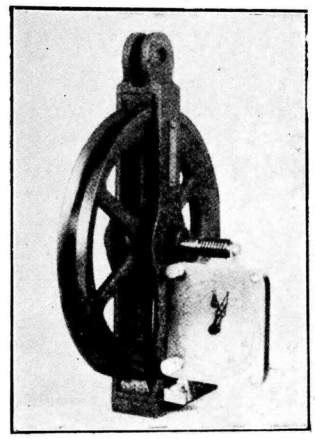

Fig. 5

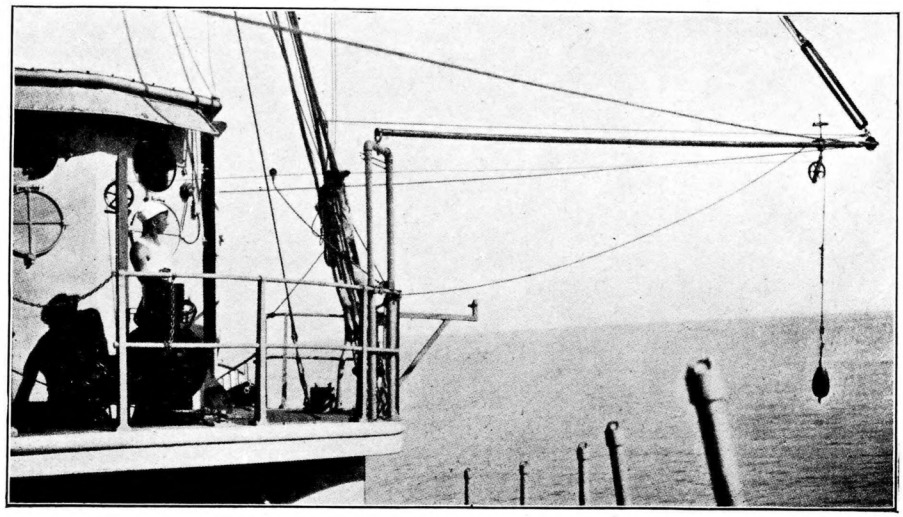

Fig. 6

SOUNDING MACHINES USED BY THE U. S. COAST AND GEODETIC SURVEY.

Extract from the *Hydrographic Manual*

U. S. Coast and Geodetic Survey, Special Publication N° 143 - 1928

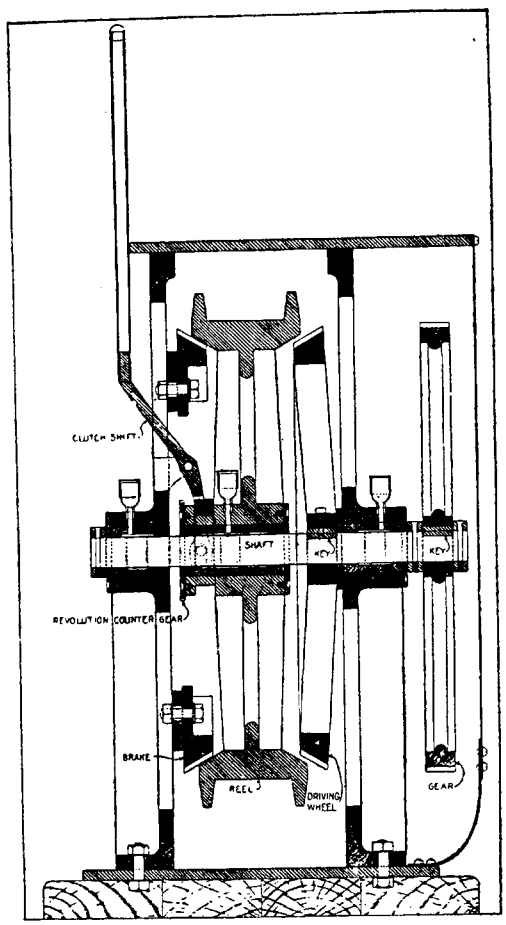

Fig. 1

A sounding machine may be briefly described as a reel or drum suitably mounted on standards so that it will turn freely, provided with a brake, and operated by hand or power. The depth-measuring equipment consists of stranded or piano wire wound on the reel, a lead attached to the end of the wire, and a registering sheave over which the wire passes and which measures the amount of wire run out. To obtain a sounding the vessel stops, the wire is allowed to run out until the lead reaches bottom, the depth is read from the counter on the sheave, and the wire is reeled in by hand or by means of a power unit connected with the machine.

Sounding machines are used by survey launches when working in depths too great for hand-lead sounding and by survey ships when not equipped with echo-sounding apparatus and working in depths beyond the capacity of pressure tubes; also for testing echo-sounding apparatus or pressure tubes, and for securing oceanographic data, such as bottom specimens and water samples and temperatures at various depths.

SHIP SOUNDING MACHINES. — The Coast and Geodetic Survey has designed a series of ship sounding machines that are superior in ease, smoothness, and speed of operation to those in previous use. These machines are now furnished as standard equipment. The general method of mounting is illustrated in Figure 1. A strong cast-metal reel is mounted so as to turn freely on the shaft. The inner side of the rim is beveled. On one side of the reel a driving wheel, with a beveled rim faced with brake lining, is securely keyed to the shaft. On the other side two segments of a similar beveled wheel are bolted to one of the standards. The entire arran-

gement is such that the reel, by means of a lever, can be held in a neutral position so that it turns freely, can be forced against the driving wheel so that it is connected with the power unit, or can be held against the segments bolted to the standard so that it is securely braked.

Three types of machine are in use. The *L*-type machine, illustrated in Figure 2. has a reel one-half fathom in circumference with a capacity of about 1,000 fathoms of stranded wire. It is driven by an electric motor, mounted below the reel, through a silent chain drive.

A similar machine, driven by a *Dake* steam engine, and known as the *SL*-type, is provided for ships that cannot furnish sufficient electric power to operate the *L*-type machine.

The deep-sea machine, shown in Figure 3, has a reel 1 fathom in circumference with a capacity of about 6,000 fathoms of piano wire. The motor is mounted at the rear of the reel.

The *L*-type machine can be used to the limit of its wire capacity, but ships equipped both with this type and the deep-sea machine generally use the former with stranded wire in depths up to from 200 to 500 fathoms and the latter with piano wire for greater depths. The deep-sea machine is equipped with a revolution counter.

LAUNCH SOUNDING MACHINES.— Various types of sounding machines have been used on survey launches. A hand sounding machine supplied by the Coast and Geodetic Survey to field parties is illustrated in Fig. 4. This machine has a bronze reel and brass standards. The brake is a clamp, lined with wood, forced against the reel or released by the small brake handle seen at the top of the apparatus.

The handles are hinged in such a way that they can be disconnected from the shaft when reeling out. The machine is secured to a wooden base provided with clamps, so that the box may be used as a cover for the machine or as a part of its base when in use.

When a sounding machine is used extensively, it is very desirable to supply power for reeling in. On account of the wide variation in the design and power plants of survey launches, no standard power machine for launch work has been provided. Hydrographers of the bureau, however, rig up power machines, usually by connecting a hand machine to a small steam engine, on steam launches, or to the engine of gasoline launches by a belt to the flywheel or by gears and shafting. In constructing small sounding machines the arrangement for mounting ship machines, described above, will be found satisfactory on account of the great flexibility of control.

SOUNDING WIRE. — Stranded wire is generally used for sounding in depths up to from 200 to 500 fathoms. This wire consists of seven tightly twisted strands of double-galvanized wire, each N° 24, *B.* and *S.* gauge, and has a breaking strength not less than 500 pounds. It is furnished in sealed tins containing 300 fathom lengths.

For greater depths, steel piano wire, N° 21, B. and *S.* gauge, is used. This wire will stand a strain of about 140 pounds but should not be subjected to a pull of over 100 pounds when reeling in. It is furnished in sealed tins containing 2,000 fathom lengths. To avoid kinks due to coiling on the bottom, from 20 to 30 fathoms of stranded wire or a few fathoms of cotton line should be inserted between the end of the piano wire and the lead.

PLACING WIRE ON SOUNDING MACHINE. — For winding piano wire on a sounding machine the coil of wire is generally placed on a wooden cone from 2 to 3 feet high and so proportioned that the coil rests about halfway between the apex and base of the cone. The latter is pivoted at top and bottom with the apex up. A supply of wire is generally carried on a storage reel from which it can be transferred to the sounding machine by power in a short time.

SOUNDING LEADS. — Leads of from 30 to 40 pounds in weight are used with stranded wire and also with piano wire in depths where the lead is recoverable; that is, depths from which the lead can be reeled in without great danger of parting the wire. One thousand fathoms is generally considered the approximate maximum depth for recovery of the lead. For greater depths a detachable, pear-shaped, cast-iron sinker, from 35 to 75 pounds in weight, is used with a Belknap Sigsbee specimen cylinder. The cylinder passes through a hole in the sinker, which is slung by a wire bale. Upon reaching the bottom the sinker is detached, thus decreasing the strain on the wire when the cylinder is reeled in.

REGISTERING SHEAVES. — A registering sheave, sometimes called a sounding sheave (see Fig. 5), consists of a grooved wheel of certain diameter, mounted in a yoke so that it will turn freely, and connected with a revolution counter which indicates the number of fathoms of wire that runs out over the wheel. A sheave differing in design from that illustrated, in that a numerical counter is used instead of a dial and pointer and that the bottom of the score of the wheel is formed by a removable steel ring, is being constructed for trial in the field.

The practice of furnishing two sizes of sheaves, one for stranded and the other for piano wire, which has been followed to some extent in the past, has been discontinued, and all sheaves secured hereafter will be designed for piano wire. The readings of such sheaves, when used with stranded wire, will be too short by 16 inches in 100 fathoms, an error that in most cases will be negligible.

A complete turn of wire is taken around the wheel of a registering sheave to prevent slipping.

TESTING SHEAVES — A registering sheave may be tested by running the wire over it for a measured distance along a wharf or other level space. Another method is to caliper the wheel carefully and calculate the length of one complete turn of wire, using the diameter of the wheel plus the diameter of the wire. The wheel can then be marked and turned a certain number of revolutions, the indicator being checked for different numbers of revolutions, multiplied by the length of a complete turn of wire.

If, after testing a sheave, it is found necessary to apply a correction to its readings, a correction factor should be computed both for piano and stranded wire.

USE OF SHEAVES. — The accuracy of a registering sheave is impaired as it becomes loose in its bearings through extensive use or is scored by the wire. After a sheave has been in use for some time the frequency of tests should be increased, and the sheave should be discarded and returned to the office when it becomes unreliable. Sheaves should be oiled properly and handled carefully. Every precaution should be taken to prevent the wheel from jamming in its yoke, as this will nearly always result in scoring by the wire.

Sheaves in use for some time will usually develop side play in the yoke, which may cause an error of as much as 1 fathom in the dial reading. Therefore, when special accuracy is required, as in comparative readings with tube or echo soundings, a fairly new and carefully tested sheave should be used if practicable. In such cases, if it is necessary to use a sheave with side play, the wheel should be held against one arm of the yoke to set the pointer and against the same arm to read the depth. In the new type of sheave a worm gear is not used, so that the error due to side play should be eliminated.

The design of registering sheaves suggests their use as fair-leads, for which they are well adapted. A sheave used for measuring depths, however, should never be used solely as a fair-lead. If it is desired to use a sheave as a fair-lead, one that has been discarded as a measuring device on account of wear may be retained for such use.

ARRANGEMENT OF APPARATUS. — A ship-sounding machine may be installed on the stern or on one side forward. In the latter case it is generally preferable to install it on the port side for vessels with a single, right-hand screw. A fair-lead should be carried on a davit or boom, so that the wire will lead clear of the side while the registering sheave is mounted near the machine.

A satisfactory installation is indicated in Figure 6. The fair-lead is carried at the outboard end of a boom of 2 1/2- inch galvanized pipe. It is attached to a pipe cross, which turns freely on the boom and is counterbalanced by an adjustable weight at the top. The registering sheave may be seen just above and to the left of the operator's head. A tension arm is hinged to the machine or rail and carries a small sheave at the other end, which rides on the wire. The weight of this arm takes up any slack and indicates clearly when the lead strikes bottom.

An accumulator spring between the end of the boom and the stay supporting it serves the double purpose of taking up sudden strains due to surging of the vessel and of indicating the tension when reeling in. The tie-rods of this spring are marked to show each 25 pounds of tension up to 150 pounds. A spring should be used for piano wire in depths over 200 or 300 fathoms, and the speed of reeling in should be so regulated that the tension does not exceed 100 pounds.