The Scripps Institution of Oceanography

MARINE TECHNICIAN'S HANDBOOK

THE SONAR PINGER

Frederick Dixon

Available from:
Institute of Marine Resources
P. O. Box 109
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IMR TR-21
Sea Grant Publication No. 13

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GENERAL INTRODUCTION

This publication is one of a series intended to provide explicit instructions for the collection of oceanographic data and samples at sea. Individual chapters are being issued separately so that they may be made available as they are prepared and may be replaced by updated versions without replacing the entire series. It can, therefore, be considered as an open-ended "marine technician's handbook".

For many years there have been such manuals in existence within various groups at the Scripps Institution of Oceanography for internal use. These manuals are being updated, and new ones are being prepared where no satisfactory ones existed; they will be issued as they are ready.

The instructions on physical, biological, and chemical oceanographic data collection and processing have been prepared by members of the Data Collection and Processing Group (DCPG), part of the Marine Life Research Group of Scripps. They cover procedures used by that group. Other chapters on geological and geophysical techniques are based on the "Marine Technician's Handbook" series originally prepared by Mr. Frederick S. Dixon, and issued by the Oceanic Research Division some years ago. It is expected that chapters on techniques used by other groups within Scripps will be added.

Since the sections will be published individually, there will undoubtedly be some repetition. This should not detract from the overall purpose of the manual, since it is expected that a single section will be the only one needed for a particular operation. We do not wish to suggest that the methods described are the only methods; we have merely attempted to describe the methods and procedures which we use and which we have found to be reliable and up-to-date. As new information becomes available, attempts are made to test techniques, incorporate them into routine procedures, and then revise the chapter concerned.

In the final analysis the reliability and quality of the data obtained is in your hands. It is imperative that meticulous attention be given to details to insure reliability and usefulness in the results you obtain.

Preparation of these chapters over the years has been supported by the University of California and by grants and contracts from the many federal agencies to the Scripps Institution of Oceanography and to the Institute of Marine Resources. Support for preparation of this more complete and revised manual has come from the National Sea Grant Program.

Much of the instruction material in this chapter on the Sonar Pinger was abstracted with permission from Edgerton, Germeshausen, and Grier, Incorporated from their Instruction Manual, E G & G Sonar Pinger Model 220, Report No. B-2348, 28 May 1962. We are grateful for their cooperation.

G. G. Shor, Jr.
Sea Grant Program Manager

The Sonar Pinger
August 23, 1971

THE SONAR PINGER

Frederick S. Dixon

The Edgerton, Germeshausen and Grier sonar pinger is a battery powered, automatic-cycling, submersible sound-generating unit for positioning oceanographic equipment within measured distances from the ocean floor. At Scripps it is used in a stainless steel frame (Figure 1). (See Figure 6 for blueprint specifications). It can be used in any operations requiring precise location of equipment on or above bottom. These include underwater photography, water sampling, coring, temperature measurement, and others. The pinger has been used in applications where cameras and light sources have been suspended a few feet off the ocean floor at a depth of more than 4,000 fathoms for over an hour.

With the sonar pinger, instrument placement is relatively simple. The pinger transmits a 0.5 millisecond burst of 12kHz sound at precisely timed ($\pm$ 0.002 sec) one-second intervals. As the pinger is lowered toward the bottom with the equipment to be positioned, the transmitted pings are received on an echo sounder recorder to produce a continuous visual record of the pinger-to-bottom distance. Since each sound pulse is transmitted to the ship directly and also by reflection from the bottom (Figure 2), the pinger-to-bottom distance can be read directly on a calibrated monitor by measuring the displacement of the direct and reflected pings.

Since $$D = \frac{VT}{2}$$

where D = pinger-to-bottom distance, in fathoms

V = velocity of sound in water, approximately 800 fathoms/second

T = time interval between direct and reflected signals, in seconds

the difference in the time of receipt of the direct and reflected pings is a direct indication of the pinger-to-bottom distance (Figure 3). For example, if the time between the direct and reflected ping is 1/2 second, the pinger-to-bottom distance is 200 fathoms; a 2-millisecond difference would indicate a distance of 8/10 fathom. Even if the pinger is more than 400 fathoms off the bottom (in which case the reflected ping would be received after a second direct ping), the strip chart record can be read without ambiguity. Provision is made in the instrument for blanking out every tenth ping, and direct and reflected pings can be matched by counting from the blank space. In all discussions here it is assumed that the recorder is operated on a one-second sweep, although slower sweeps can be used.

When the distance between the two recorded traces, as measured from the start of each, equals the distance between the traces which calculation has shown to represent the desired pinger-to-bottom distance, the correct position has been attained. If there is no relative motion between the pinger and the bottom, the chart record will appear as a pair of parallel lines. If a given distance must be maintained despite ship movement or changing bottom topography, the monitor operator and the winch operator must work in close cooperation. An intercom system usually serves this purpose.

The EG&G pinger frame has been replaced on Scripps ships by a smaller frame of stainless steel designed and built by F. S. Dixon of Scripps Institution of Oceanography. This has become standard equipment on all Scripps pingers. The pinger and frame are attached to the wire by four pieces of 3/16-in. galvanized chain shackled to the frame and two wire clamps which vary in size, depending on the diameter of the wire used (see Fig. 5 for blueprint specifications).

The silver-cell battery in the pinger is an expensive piece of equipment; care should be taken to insure that it is not overcharged. When changing batteries, use caution to insure that the "O" ring on the pinger end cap is seated correctly. An automatic battery charger which cuts off at the correct voltage should be used. Silver-cell batteries are rated at 20 ampere hours, 6.0 volts. When new they can be used for about 16 hours before being recharged; after six months, they should be recharged after 12 hours use. A year old battery will need recharging after every two lowerings (approximately 10 hours) and within another month or two will have to be recharged after each lowering.

The EG&G manual is sent on all expeditions, as well as a complete spare parts kit. Before the pinger is used, the manual should be read thoroughly so that the operator of the instrument will be familiar with its capabilities. It should also be consulted before any repairs are to be attempted. As spare parts are used, they should be noted so the kit may be properly and promptly replenished.

The pinger should be raised by at least two people to insure its safe ascent; in addition to the winch operator, a second person should continually watch the cable for the first appearance of the submerged gear. A number of instruments have been lost on oceanographic expeditions when equipment has been drawn up taut against the pulley sheaves and resultant tension has caused the cable to part. By having an observer watch the ascent of the instrument such accidents can be prevented.

The procedure for putting the pinger on the wire is as follows:

1. The winch is stopped at 185 meters; this is approximately 100 fathoms on the echo-sounder.

2. With the pinger in the hydro-bucket, the top clamp is securely attached to the hydro-wire. A 2-1/2 in. safety line, with a large snap hook, is snapped to the pinger frame as a precaution against running it up through the sheave. The other end is tied in the hydro-bucket. The winch operator should raise the pinger very slowly until it clears the hydro-bucket; then the bottom clamp is attached to the wire.

3. After the ground wire of the pinger is plugged into the end cap and the safety line is unhooked, the pinger may then be lowered.

4. In bringing the pinger up, the winch operator is informed at the sight and surfacing of the pinger, using the terms SIGHT and SURFACE. The winch is slowed down and, when the pinger is within reach of the hydro-bucket, the safety hook is snapped on. The winch should be stopped as soon as the bottom of the pinger clears the hydro-bucket. The pinger is then unplugged; caution should be observed since the pinger produces 8000 volts. The bottom clamp is removed from the wire; the pinger is pulled on board and lowered slowly into the hydro-bucket. The top clamp is removed and the pinger is tied in the lab.

When using the pinger on the dredge winch wire, the pinger clamps must be very tight, as this wire sets up extreme vibrations. If using 7000 meters or more of wire, it is a good precaution to attach one extra clamp at the top of the pinger. Bring the wire inboard by raising the "A" frame; attach the top clamp and have the winch operator raise the pinger about two feet off the deck; attach the lower clamp and lower the A-frame.

When the pinger is attached to the wire and on its way down, the echo sounder ping should be turned off and gain turned up on echo sounder receiver. Now the pinger trace will show on the echogram as a direct and a reflected ping. These traces will cross at multiples of 400 fm above bottom.

The crossings must be counted so that the watchstander can anticipate the "0 fm." reading. Since each crossing will represent 400 fathoms, the depth must be recorded before the operation is started. It is very important to have a record of the bottom topography at the spot where each core or picture is taken. Quite often the echo sounder ping can be kept on while the pinger is operating. If the ping cannot be kept on continuously to record depth throughout the station, the depth should be obtained (and recorded in the echo sounder log) at least every 15 minutes, and more often if the bottom depth is changing rapidly. This is to preserve a record of the topography over which the ship is drifting while on station. The pinger trace shows the distance from the bottom to the pinger only and NOT the bottom depth. For example if the bottom is 2250 fathoms, the first crossing will be 2000 fathoms, which means the pinger is 2000 fathoms from the bottom. The next crossing will be 1600 fathoms, etc. After the last crossing of 400 fathoms, the instrument will be closely approaching the bottom. When the traces are 100 fathoms apart, the instrument will be going into the bottom since the pinger is on the wire 185 meters, or 100 fathoms, above the instrument. At this point, if the instrument is to go into the bottom and come right out again (such as the gravity corer), the winch should be stopped when the traces on the echo sounder are 90 fathoms apart. If the instrument stays in the bottom any length of time (such as a heat probe), it is best to bring the traces to 80 fathoms apart to allow for ship's drift. As the instrument is raised from the bottom, the crossings will be reversed: 400, 800, 1200, etc. (Fig. 4).

When the bottom return is such that the pinger is not heard or recorded until nearing the 400 fm or 0 fm depth, an alternative method must be used to determine which 400 fm interval above bottom is being indicated in trace crossings. In this case, straightforward calculations are employed by ascertaining water depth from the echo sounder and computing the distance from the ship to the 800 fm and 400 fm crossings. The figures are converted to meters by Matthews tables and a chart made, as follows:

WATER DEPTH: 2600 fm

Crossing	Expected wire out (calculated wire out to reach crossing)	Observed wire out
2400 fm	378	
2000 fm	1123	
1600 fm	1867	
1200 fm	2618	
800 fm	3366	
400 fm	4129	
000 fm	4895	

When the first visible crossing is seen on the recorder, the wire out is recorded and entered in the proper slot, immediately identifying which crossing has just appeared. The actual wire out will always be a little greater than the calculated wire out because of wire angle and "snaking" of the wire. With a relatively light load such as a camera, this snaking can be considerable. Each successive crossing should appear more clearly and the observed wire out can be recorded for each. This data will give some idea of the overage.

The pinger returns are often masked by noise from the main engine and from auxiliary equipment on the ship. If high noise levels are observed, it may be necessary to locate and turn off the offending equipment.

At regular intervals during the station, usually every five minutes, the watchstander records the water depth and meters of wire out. The meters of wire out is also recorded whenever the winch starts in or out, stops, or changes speed.

When the operation is finished, the instruments are brought up at half speed to about half the total meters of wire out, then at full speed. The winch is slowed again at 300 meters and a technician should be in the hydro-bucket ready to sight the instruments and/or any tangles that may appear in the hydro-wire. When the instruments can be reached, the operator leans over in the hydro-bucket and snaps on the safety line. The pinger should be unplugged as soon as possible.

REFERENCES

Raymond, S. O., Instruction Manual, EG&G Sonar Pinger Model 220; Edgerton, Germeshausen & Grier, Inc., Report No. B-2348, 28 May 1962.

Matthews, D. J., Tables of the velocity of sound in pure water and sea water for use in echo-sounding and sound-ranging, Hydrographic Department, Admiralty, (London), H. D. 282, 52 pp., 1939.

LIST OF FIGURES

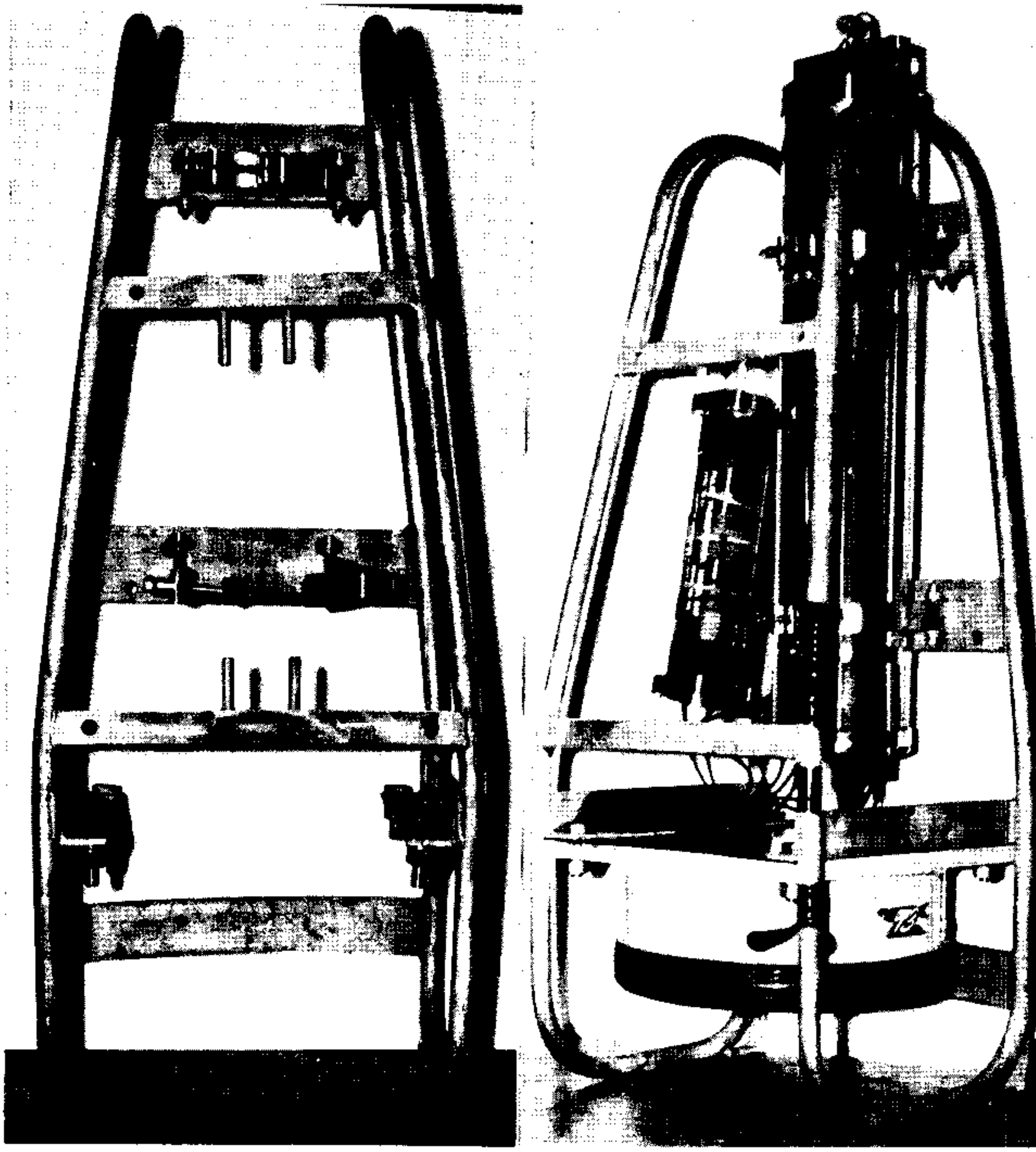

FIGURE 1 - Dixon Pinger Frame

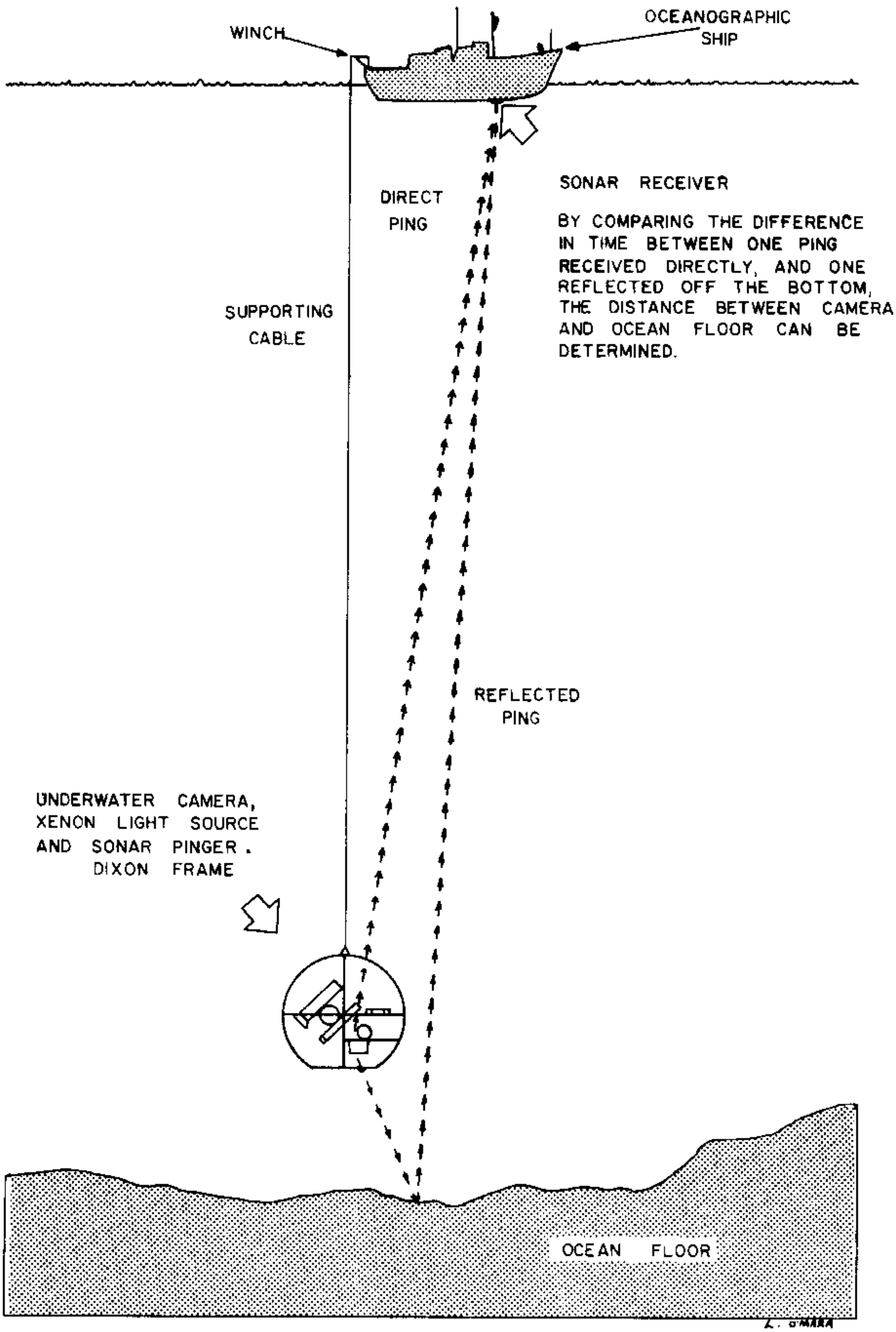

FIG. 2. PINGER OPERATION SKETCH

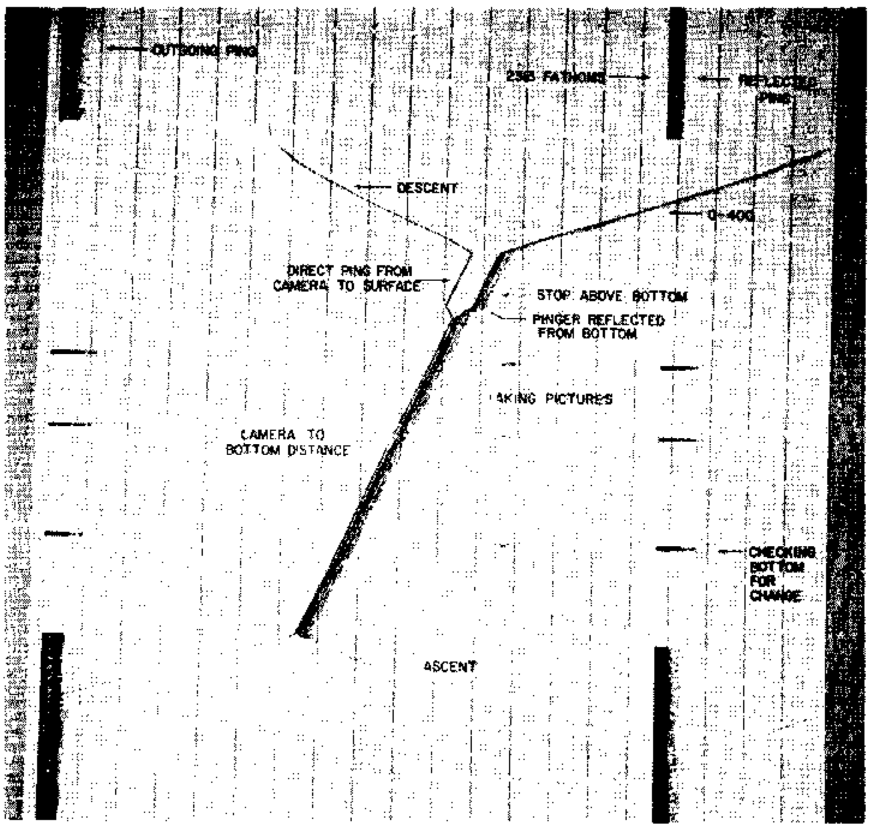

FIGURE 3 - Record showing pinger-to-bottom distance.

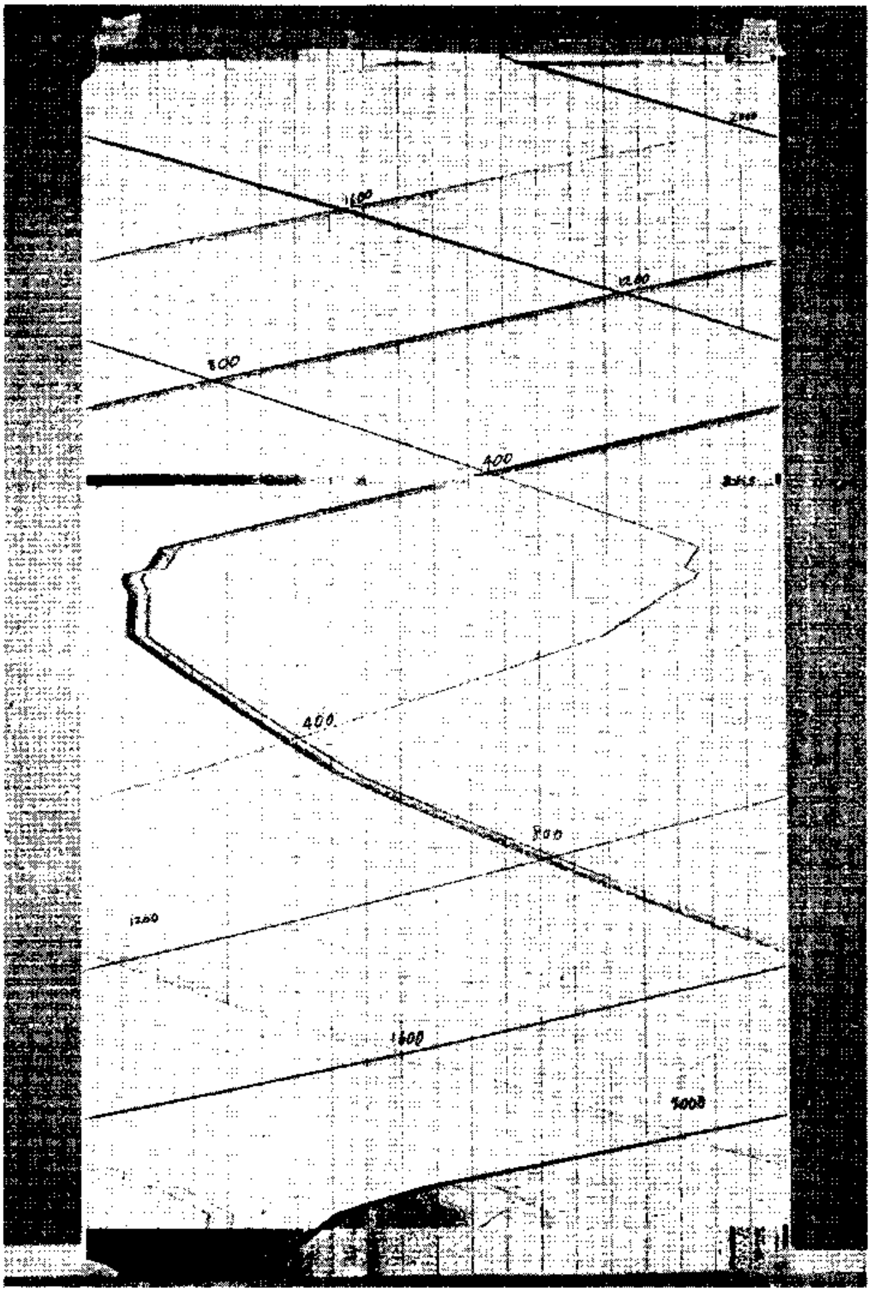

FIGURE 4 - Pinger crossings.

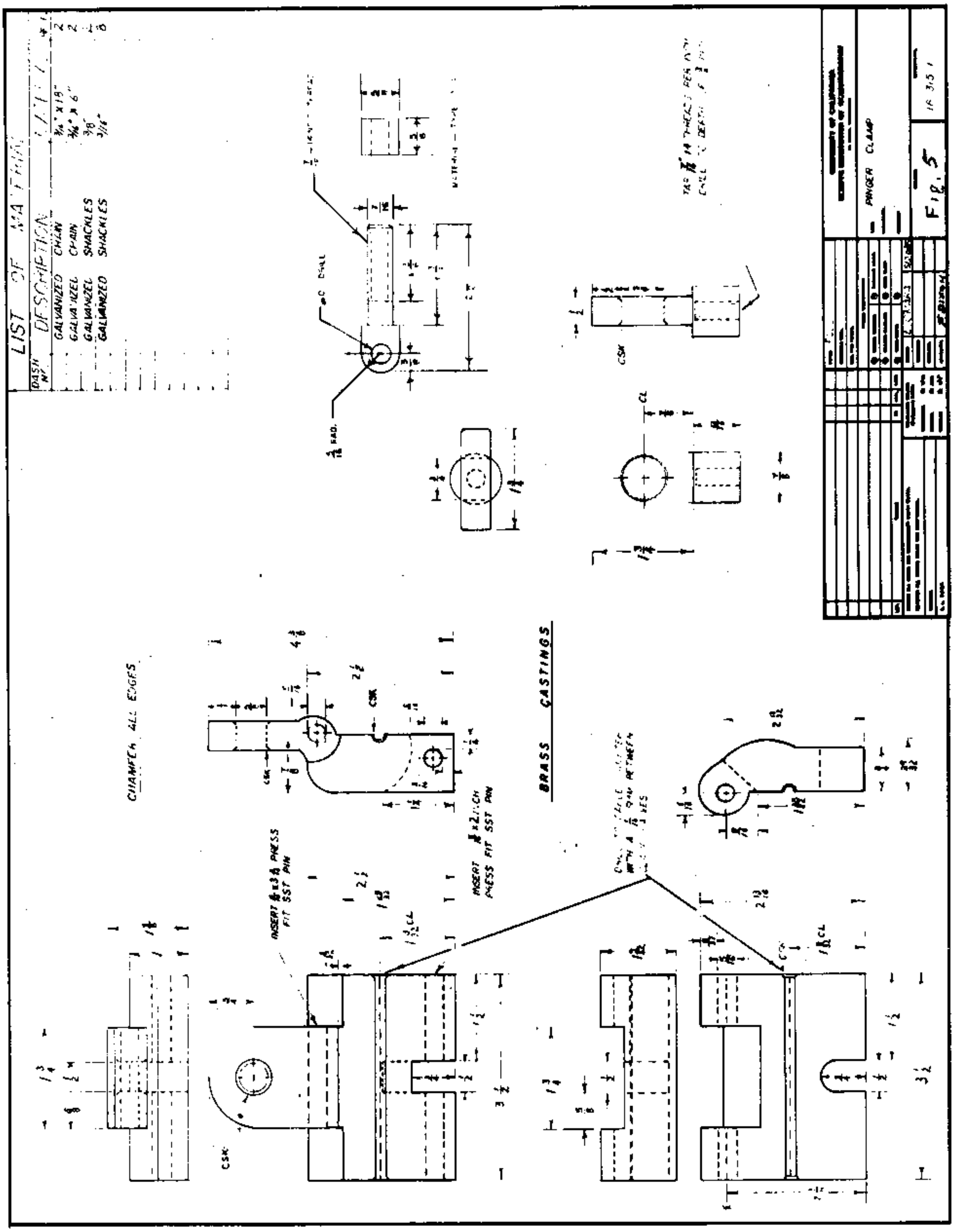
LIST OF MATERIAL
DESCRIPTION
GALVANIZED CHAIN
GALVANIZED CHAIN
GALVANIZED SHACKLES
GALVANIZED SHACKLES
BRASS CASTINGS
CSK
FINGER CLAMP
Fig. 5

FIGURE 5

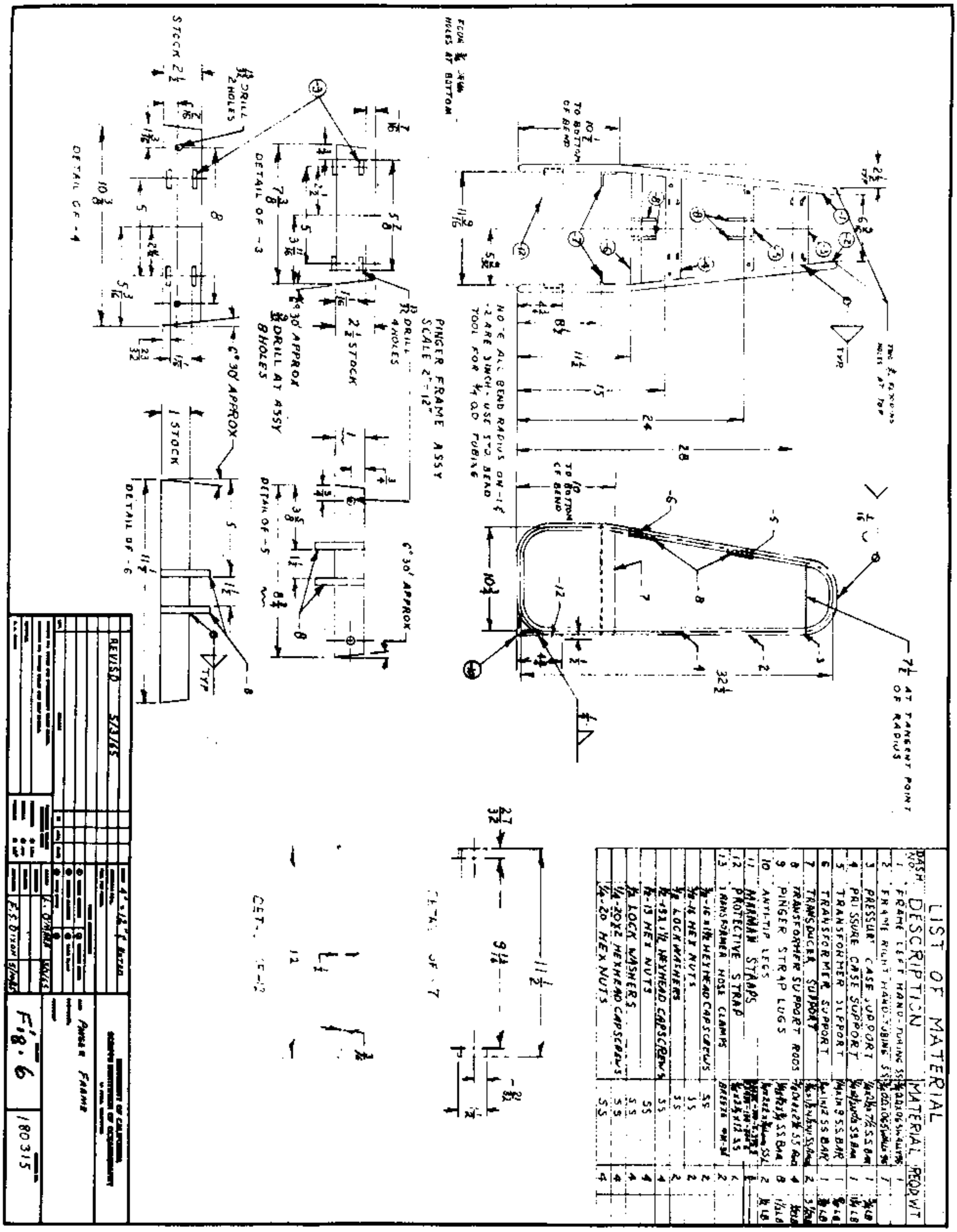

FIGURE 6