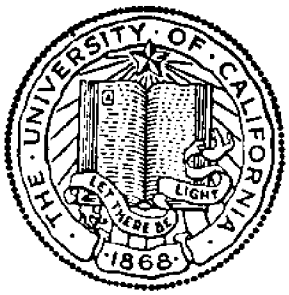
MARINE TECHNICIAN'S HANDBOOK

Gravity Coring

F. Dixon



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The Institute of Marine Resources
P. O. Box 109
La Jolla, California 92037

When completed the Marine Technician's Handbook will include sections on most of the techniques used in scientific exploration of the sea.

The price of each section, at present printing costs, will be $1.25. Each section may be ordered individually.

Available May 1, 1971:

"Oxygen Analysis" - IMR TR18 (Sea Grant Ref. No. 9)
"Gravity Coring" - IMR TR19 (Sea Grant Ref. No. 10)
"Phosphate Analysis" - IMR TR20 (Sea Grant Ref. No. 11)

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.

While we have attempted to be thorough in descriptions of techniques, this cannot be considered to be a complete "cookbook" for the novice. It is in most cases assumed that the reader has some prior knowledge and training in the field concerned. We hope, however, that these instructions can serve as a training aid for the novice marine technician, a "cookbook" for the scientist who is taking his own observations, and a reference manual for the experienced technician.

Preparation of these chapters over the years has been supported by the University of California and by grants and contracts from 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.

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

Gravity Coring
May 1, 1971

GRAVITY CORING

Frederick S. Dixon

Gravity coring is among the cheapest and easiest means of obtaining samples of ocean-bottom sediment. The gravity corer consists of a valve, weight stand, barrel, plastic liner, cathcher, and cutter (Figure 1). The weight stand has thread protectors on each end when it is not in use. The core liner is clear butyrate tubing, 2 inches o.d. by 1 7/8 inch i.d. by six feet.

PROCEDURE FOR TAKING GRAVITY CORE

1. Screw the valve on the top end of the weight stand, with the axis of the valve in line with the bail of the stand; the bail helps to protect the valve from slack wire.

2. To prevent the regular liner from traveling upon impact up into the weight stand, insert a piece of liner cut off even with the bottom of the weight stand to serve as a "dummy liner".

3. Insert the regular liner into the core barrel, cutting it one-half inch shorter than the barrel length so that it will not jam against the threads on the weight stand. With the liner pushed out of the end of the barrel, insert the catcher; the liner will now be pushed flush with the end of the barrel and the cutter is attached. Tighten the three Allen screws evenly. If only one screw is tightened, the barrel will jam against the side of the cutter, leaving the other two screws no holding power.

4. Place the weight stand in horizontal position in the hydro-bucket with a hydro-wire securely attached. Screw the barrel hand tight, then back off one-quarter turn.

5. Have the winch operator standing by with power on the winch ready to go. The ship should be in position so that wind and sea are to the side over which the corer is to be lowered to allow the ship to drift away from the wire and instrument rather than over them. In case it should be necessary to steam on station, one engine is maintained "on the line". If the wire angle is greater than 20 degrees, the bridge should steam on station and should do so before 1000 meters of wire are out in order to steam around the wire and to reach a near vertical angle before the unit goes into the bottom.

6. The technician stands in the hydro-bucket and, holding the core barrel, signals the winch operator UP SLOW. As soon as the weight stand has cleared the hydro-bucket and is on a horizontal plane, push the barrel out and swing it over the side. Check the valve to be sure it works freely, then lower the corer until the top of the bail is just below water. Stop the winch and zero both the winch operator's meter and the digital repeater in the laboratory. Lower the corer at 90 to 125 meters per minute, depending on the sea and the roll of the ship to keep slack out of the wire.

7. A pinger will not be needed if the sea is calm and the depth is no more than 2500 meters; when the corer hits bottom

(a) the wire sheave will jump or slack momentarily;

(b) the hydro-winch will momentarily slow down;

(c) the tensiometer needle will drop slightly; and

(d) the wire tension will increase at pull out from the bottom.

If the pinger is not used, someone must stand by the winch as the meter reading approaches the bottom depth as computed on the coring log sheets, using the Matthews correction tables (Matthews, 1939).

8. When the core is in the bottom, record the time and number of meters on the log sheet.

9. Have the winch operator bring the corer up slowly for the pull out from the bottom and log the meters at the time of pull out. Bring the corer up slowly for another 100 meters, then at full speed. If coring is being done in rough seas with the ship rolling and pitching, take great care during pull out to bring the corer up very slowly for 100 meters; at half-speed until 3500 meters; at full speed until reaching 400 meters, and then slow to half speed again. During this procedure someone should stand in the hydro-bucket to watch the wire in case of any tangles or meter-wheel slippage. Have the winch slowed as the corer gets closer to the surface; at sight and surfacing of the instrument, inform the winch operator using the terms SIGHT and SURFACE.

10. Have the winch stopped when the corer reaches a height from which the barrel can be unscrewed. The core MUST be kept VERTICAL at all times so that the sediments do not mix. Tie the barrel in a convenient place nearby until the weight stand is in the hydro-bucket with the thread protector on it.

11. A two-man operation follows: One holds the barrel while the other loosens the Allen screws. The Allen wrench must be all the way in to protect against stripping the screw socket. When the screws are loose, he holds the cutter and liner while the man holding the barrel pushes down on the liner and pulls up on the barrel. As soon as the barrel is off, place a cap plug on top of the liner immediately to hold the suction so that the core will not fall out of the bottom. Using pliers, quickly remove the catcher and cap the bottom of the core. Hold the bottom of the core with one hand and, carefully keeping it vertical, move it to the lab, tying it in a convenient place. Remove the top cap and prick a small hole in the liner at the top of the sediment to drain off water. Cut the liner off even with the sediment and replace the cap and tape both top and bottom caps with Scotch #33. Mark the core with felt pen and electric etcher as follows:

> TOP with arrow, abbreviation for the name of the expedition, G for type of core, number, length of cores in meters, and date.

Tie the core securely in the scientific refrigerator. CAUTION: The core must be held in vertical position at all times. Finally, clean the mud from the catcher and put the mud in a separate container labeled with the core number and other data, as indicated above.

12. If the depth exceeds 2500 meters, or if the sea is breaking white caps, a pinger may be necessary. The procedure is as follows:

(a) The winch is stopped at 185 meters (100 fathoms on the PDR)

(b) With the pinger in the hydro-bucket, attach the top clamp securely to the wire. A stout safety line with a hook attached to the bucket is also snapped to the pinger frame. The operator raises the pinger slowly until it clears the hydro-bucket and the bottom clamp is attached.

(c) After the pinger is plugged in and the safety line is unhooked, lower the pinger according to specific directions given under Sonar Pinger section.

(d) In bringing the instruments up, follow the same procedure as without the pinger except that the winch is slowed well in advance of surfacing. When the pinger is sighted, inform the winch operator to "slow winch"; when the pinger is within reach of the hydro-bucket, snap on the safety hook. Have the winch stopped as soon as the bottom of the pinger just clears the hydro-bucket. Unplug the pinger, exercising extreme caution; the pinger produces 8000 volts. Remove the bottom clamp from the wire and pull the pinger on board, lowering it slowly into the hydro-bucket. Remove the top clamp and tie the pinger in the lab.

REFERENCES

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.

SUPPLY SOURCES

Butyrate tubing:

Jet Plastics
941 N. Eastern Avenue
Los Angeles, California 90063

Cap plugs for core liner:

Protective Closures Co., Inc.
705 N. Lamos Street
Inglewood, California 90302

LIST OF FIGURES

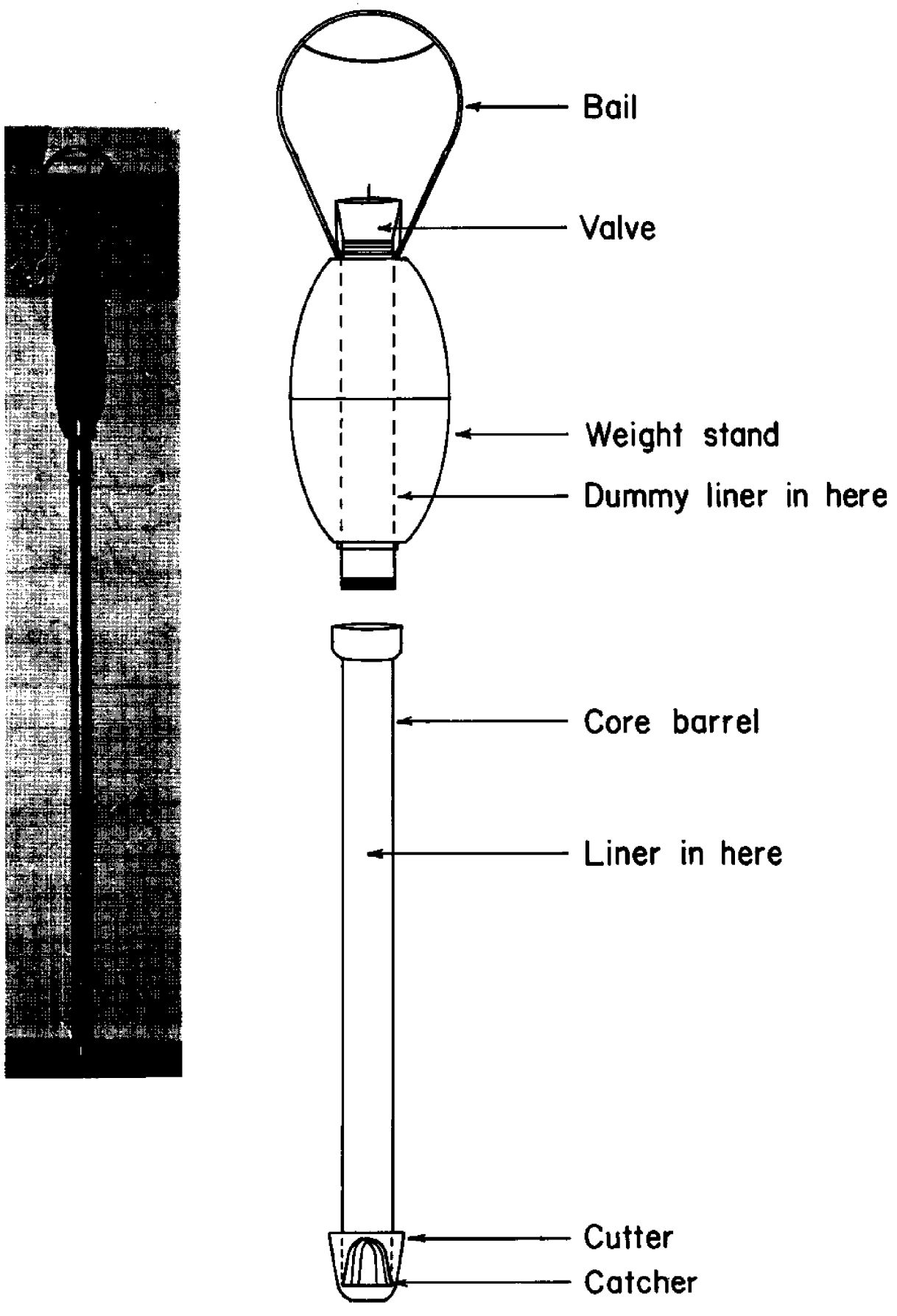

FIGURE 1 - Gravity Corer

1.0

CORE LOG

Expedition LUSIAD

Ship ARGO

Lat. _____

Long. _____

Bathymetry WEST SLOPE MID-ATLANTIC RIDGE GENTLY ROLLING HILLS

Sample No. LSD - G281

Date 5-15-63

DEPTH

Echo 2000 Fm _____ M

Correction 44 Corrected Echo 2044 Fm 3741 M

Total wire out _____ Fm 3827 M

Pull Out _____ Fm 3787 M

TIME: Start down 1410

On bottom 1446

On deck 1526

TYPE OF SAMPLE

Piston _____

Trip Gravity _____

Gravity ✓

Dredge _____

Other _____

Description of sample BUFF CALCAREOUS OOZE

Length or size of sample 48 CM

NO CATCHER SAMPLE

Preservation GOOD

Remarks: (where appropriate--weather, accidents, defective equipment, recovery of equipment, other operations at station, etc.)

FIGURE 2

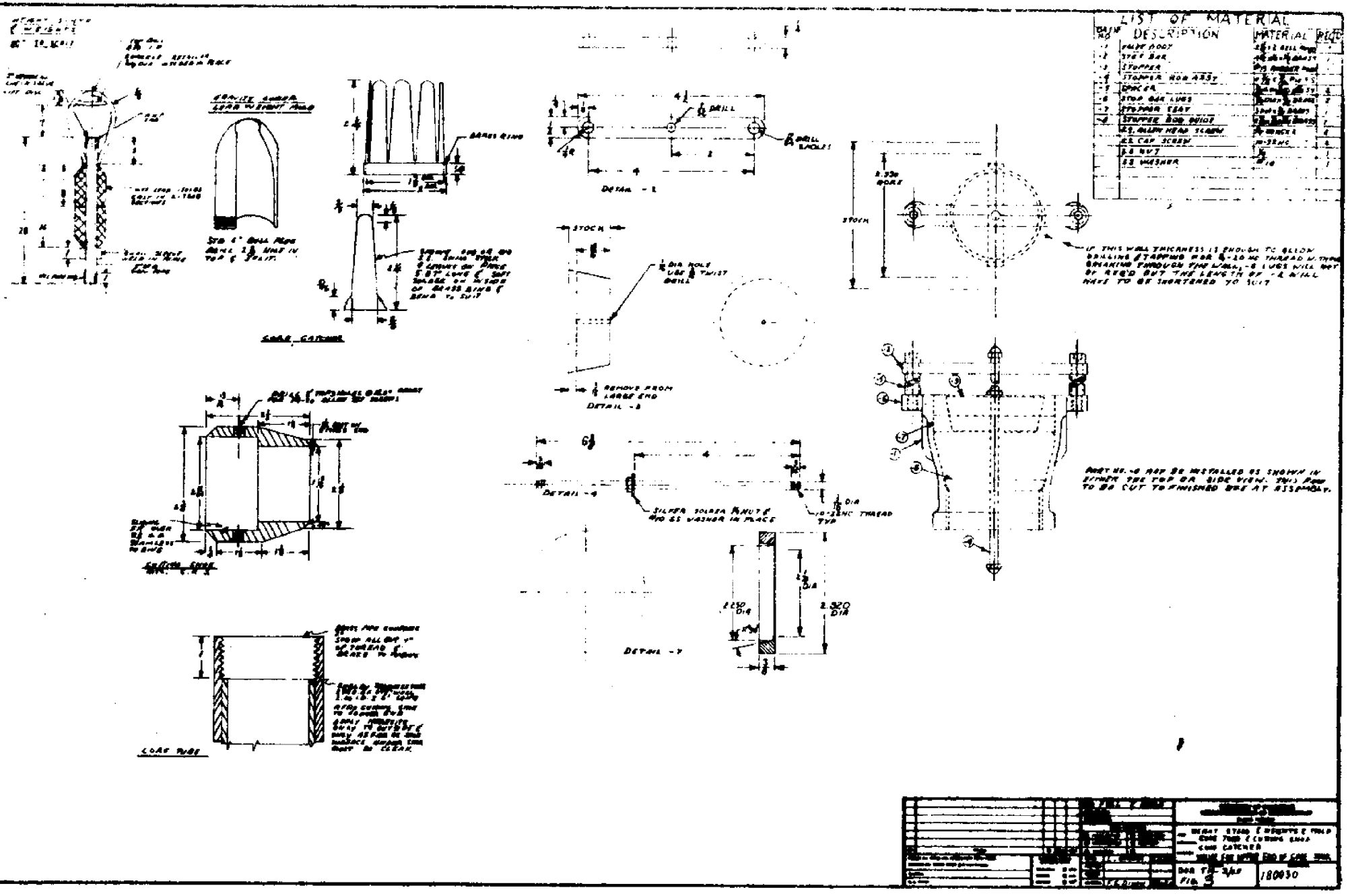
LIST OF MATERIAL
DESCRIPTION
MATERIAL REQ'D
CORE CATCHER
CORE TUBE
DETAIL - 1
DETAIL - 2
DETAIL - 3
DETAIL - 4
DETAIL - 5
CORE TUBE
180030

FIGURE 3