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PERFORMANCE OF AN EXPERIMENTAL CABLE PAYOUT PACKAGE.(U)
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PERFORMANCE OF AN EXPERIMENTAL CABLE PAYOUT PACKAGE

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ABSTRACT

The experimental cable payout package was fabricated and laboratory tested to define any technical problems associated with the engineering development of a large capacity cable payout system. The test conducted to examine payout performance is briefly described. Since no technical problems were found from the test results, development of the proposed cable payout system is continuing as planned.

CONTENTS

		PAGE
I.	Introduction	1
II.	The Experimental Cable Payout Package	1
	A. Design Details	
	B. Fabrication	
III.	Test Methods and Results	2
IV.	Concluding Remarks	3

I. INTRODUCTION

The Ocean Technology Division of the Naval Ocean Research and Development Activity (NORDA) is developing a cable payout system which is capable of deploying cable at sea without the use of conventional winches, reels, and traction machinery. As a design goal, the system will pay out up to 64 km of 16 cm diameter cable by using discrete packages containing 8 to 16 km of cable arranged in series.

To define any technical problems that may occur with the overall system development, an experimental cable payout package was fabricated and tested in the laboratory. This report includes a description of the design and fabrication of the package, and the results of the test conducted.

II. THE EXPERIMENTAL CABLE PAYOUT PACKAGE

A. DESIGN DETAILS

The experimental cable payout package, fabricated by Whitehill Manufacturing Corporation of Lima, Pennsylvania, is shown in Figure 1. As shown, it has two flanges and a drum that contains about 1.5 km of electromechanical cable, bonded with polyurethane. The flanges are wood, and each is about 3.8 cm thick and 1.27 m in diameter. The drum is fiberglass, and is about 6 mm thick by 74 cm wide.

The cable is a spaced, double-armored construction that has four electrical conductors. Each conductor is #20 AWG-7, stranded, and copper-insulated with a polypropylene copolymer. The conductors are wrapped around a straight filler rod, and the resultant quad is covered with a black polyurethane jacket. The inner layer of armor has 14 wires wrapped in a right-hand lay, the outer layer of armor 16 wires wrapped in a left-hand lay. Each wire is galvanized, improved plow steel. The cable is jacketed with hytrel for corrosion and abrasion resistance, and has a diameter of about 1.3 cm and a minimum breaking strength of 36 kN.

The package is designed for paying out cable only. This is accomplished, not by rotating the package, but by applying a tension sufficient enough to break the bond of the polyurethane material (see Figure 2).

B. FABRICATION

The package was fabricated by using a standard, wooden shipping reel as a mold. This shipping reel was assembled with its own set of flanges and with an additional set (those of the cable payout package) that was specially machined to fit over the reel's wooden drum. Although they were free to move on the drum, each flange was secured to the inside of a shipping reel flange. After assembling, the cable was wound with one twist in the cable for each turn of the drum to insure a torque-free cable payout.

During winding, the cable layers were bonded with two types of polyurethane material that differ in strength and color. In particular, the first three cable layers were bonded with a lower strength material and the remaining layers with a higher strength material. These materials can be seen in Figure 2 where the lower strength material is green, and the higher strength material amber.

After winding all the cable on the wooden drum, the outer cable layer and the inside reel flanges were covered with fiberglass to form the drum shown in Figure 1. Next, the wooden shipping reel was disassembled by removing the flanges and slats which formed the reel drum. Finally, six steel spreader-rods and a cable rub-ring were attached as shown in Figure 1.

III. TEST METHODS AND RESULTS

The test designed for the cable payout package was simple and informative. The test was conducted in a towing tank at the National Space Technology Laboratories, and involved measuring the force needed to pull out cable, as well as visually inspecting the cable during and after payout. The method for paying out cable consisted of fixing the outboard-end of the cable and rectilinearly moving the cable package under water at a constant speed away from the outboard-end of the cable.

In particular, the outboard-end of the cable was rigidly attached to an end of the towing tank, and the cable package flexibly attached with slings to the tank's tow carriage. Since the towing tank is 137 m long, it was only possible to deploy about 120 m of cable during one run of the carriage down the tank. After the run, the cable lying on the bottom was hauled in by hand,

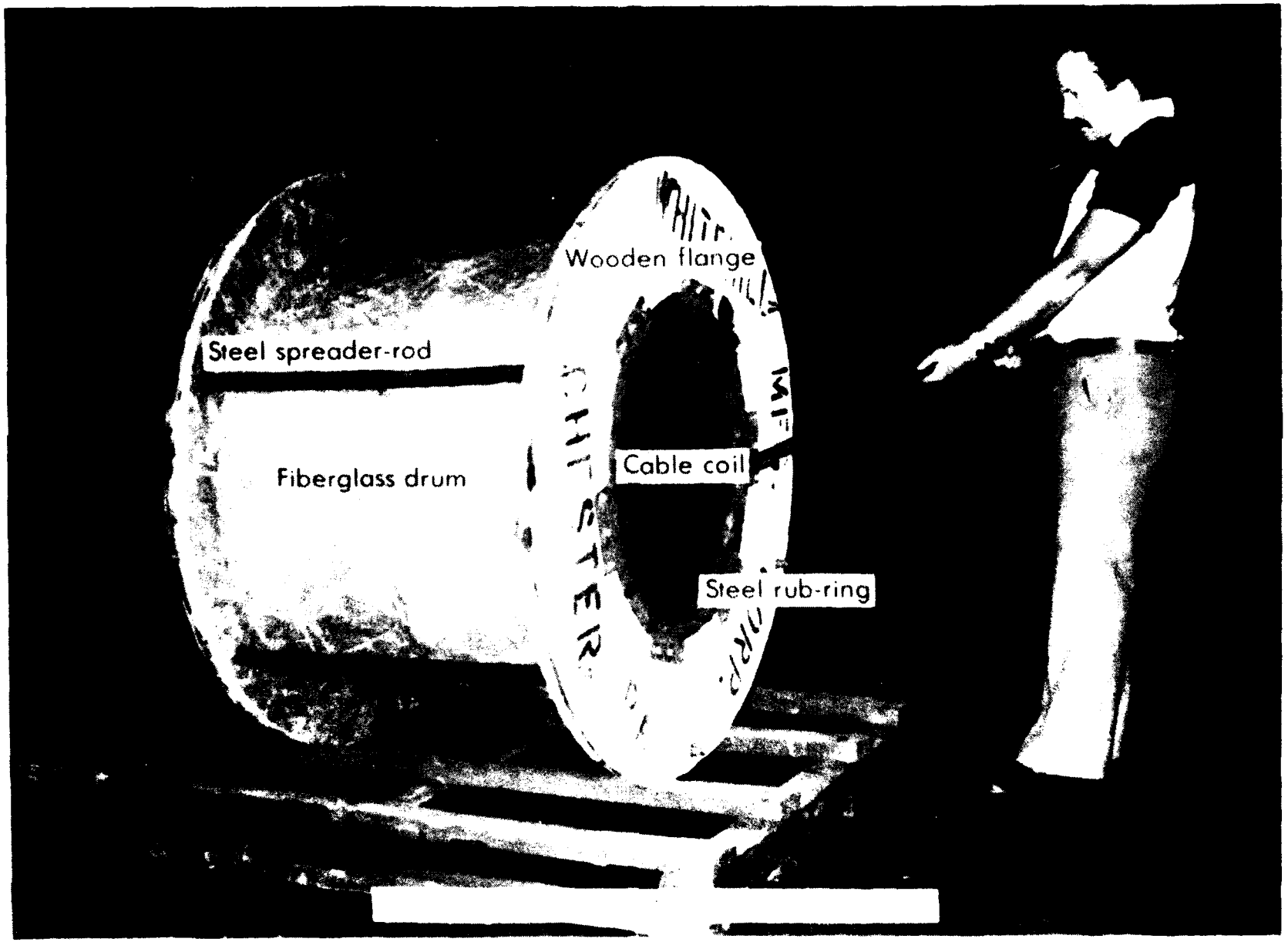
with the carriage moving back to prevent pulling cable out. This procedure was repeated until about three and a half cable layers were removed. For each run, a carriage speed of 0.5 m/s was used.

Data coverage for the test included tension observations (from a spring scale attached to the fixed-end of the cable) and photographs taken with an underwater movie camera. Typical tensions for cable layers bonded with the lower strength polyurethane were 150 to 180 newtons, with only small tension fluctuations. In contrast, the cable bonded with the higher strength polyurethane exhibited tension fluctuations varying from as low as 220 to as high as 900 newtons.

The configuration of the deployed cable was observed to be straight, indicating little or no torque present in the cable. As a result, the cable was easy to handle when it was hauled in by hand. In contrast, a cable with more torque present would not be as straight or as easily handled.

IV. CONCLUDING REMARKS

The test of the cable payout package has identified no technical problems associated with its overall design. Therefore, the development of the proposed cable payout system is continuing as planned.


Wooden flange
Steel spreader-rod
Fiberglass drum
Cable coil
Steel rub-ring


Cable coil
Steel rub ring

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