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PHASE 1 REPORT NO. 506

WORK UNIT 794105/015

SEWAGE PLANT GRINDER PUMP

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FIELD TESTING AND DEVELOPMENT CENTER

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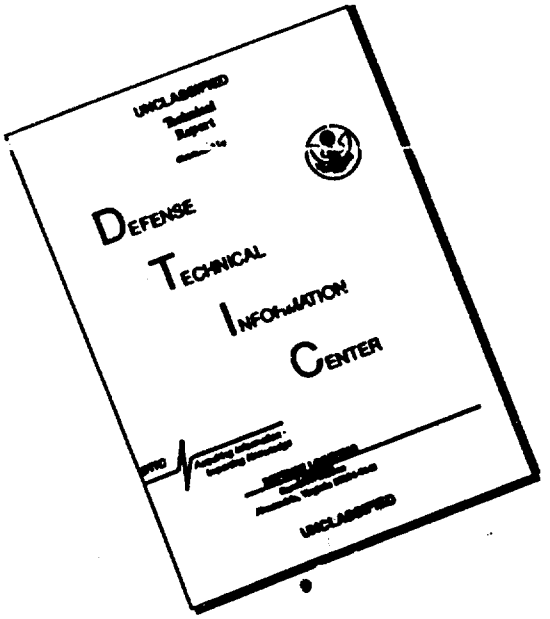

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UNITED STATES COAST GUARD

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SEWAGE PLANT GRINDER PUMP

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Date: 12 March 1970

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GRINDER PUMP

I INTRODUCTION

Ideas for the grinder pump to be used on the Valdespino sewage plant to replace the communitor came from experience gained on a FT&DC built version of the plant, and was further substantiated upon disassembly of the sewage plants on the CGC SASSAFRAS and the CGC ALERT.

The first obvious fault found with the communitor was its size and the difficulty involved in preforming any type of inspection or maintance. In observing the FT&DC plant while operating under simulated conditions the communitor appeared to clog and not break up paper products, cigarettes, etc. as had been expected. When the units on the ALERT and SASSAFRAS were opened it was noted that most of the screen had either clogged or been eroded away. The erosion was in the area of the torque line entrance into the communitor. This was an additional reason for using another method of breaking up the raw sewage as it enters the plant.

II DESCRIPTION OF GRINDER PUMP

The grinder pump (Figure 1) presently being used consists of a 2 hp, 1725 RPM motor driving a centrifugal pump. The suction end of the pump was modified to allow for a shaft extension and a grinder or chopper housing. The chopper shaft is 5/8" in diameter keyed with threads on each end. One end is threaded into the end of the pump shaft, the threads on the other end are for tightening the blades on the shaft. There are five blades mounted at 90° from one another and separated by a 3/4" spacers. All blades are sharpened and the trailing edge is tipped to cause a flow toward the impeller on the pump (Figures 2 & 3). The last or outside end knife is tipped (bent) more than the others to give a bit more thrust. Raw sewage enters the grinder through the housing side vertical to the shaft and comes in contact with the spinning knives. The pump suction was enlarged to allow for the area taken by the shaft.

Future plans call for the replacement of the communitor on the modified Valdespino plant with a grinder pump for extensive comparison testing.

Operation of the grinder pump requires approximately 20 gallons of water in a surge or circulating tank mounted over the pump (Figures 4 & 5). The raw sewage enters a stand pipe leading into the grinder section of the machine. The stand pipe has an orifice near the bottom of the tank for constant recirculating into the grinder and then into the pump.

The top of the stand pipe is larger than the raw sewage line entering it and acts as a skimmer during periods when no new sewage enters the machine. The discharge of the pump passes through a venturi which will pull the column in the vacuum tower. Discharge from the surge tank is so arranged as to keep a constant level of sewage in the tank.

III TESTS OF GRINDER PUMP

The effectiveness of the grinder pump was tested in the laboratory by comparing its performance to that obtained with an expanded metal (Valdespino type) comminutor. A small model of a sewage plant with an expanded metal comminator was built for this purpose (Figure 6). Human wastes themselves have never been a great problem with the expanded metal comminuter. Such things as paper, cigarette filters, etc., on the other hand, are not shredded effectively by the expanded metal screen and tend to clog it over a period of time. When the model plant shown in Figure 6 was fed a given quantity of water and toilet paper, soggy paper rapidly collected on the screen. When the same mixture was passed through the grinder pump, the paper was finely shredded, and its presence in the effluent was scarcely detectable by visual inspection. While this test produced no quantitative comparison of the grinder pump and the expanded metal comminuter, it did demonstrate quite dramatically the superior shredding action obtained with the former.

The grinder pump was taken to Cape May, N.J. with the intention that it be installed temporarily in series with the Valdespino plant on CGC ALERT to determine its effect upon the overall operation of the treatment system. The desired tests could not be performed at that time, however, because of problems with the ALERT's treatment plant.

A completely definitive evaluation of the grinder pump requires that it be tested as a component of a complete sewage treatment plant, operating normally with natural sewage influent. At this writing a modified Valdespino plant (R&D work unit 794105/016) is being installed at the C.G. Group, Baltimore barracks in the Coast Guard Yard. Initially this plant will be tested in the designed configuration. Later the comminuter section of the machine will be replaced temporarily by the grinder pump (with an appropriate surge tank). This test will provide a direct comparison of the performances of the vacuum-aeration treatment plant with the two types of comminutor.

IV SUMMARY

Preliminary tests indicate that the grinder pump does a more rapid and positive job of putting all the raw sewage into a liquid state. It has other advantages besides the working application. Access to the grinder section is much easier than access to the comminutor screen in the Valdespino plant. The cost of repairs, overall size and possibly even the initial cost could be less than with the Valdespino plant.

FIGURE 1 - GRINDER-PUMP

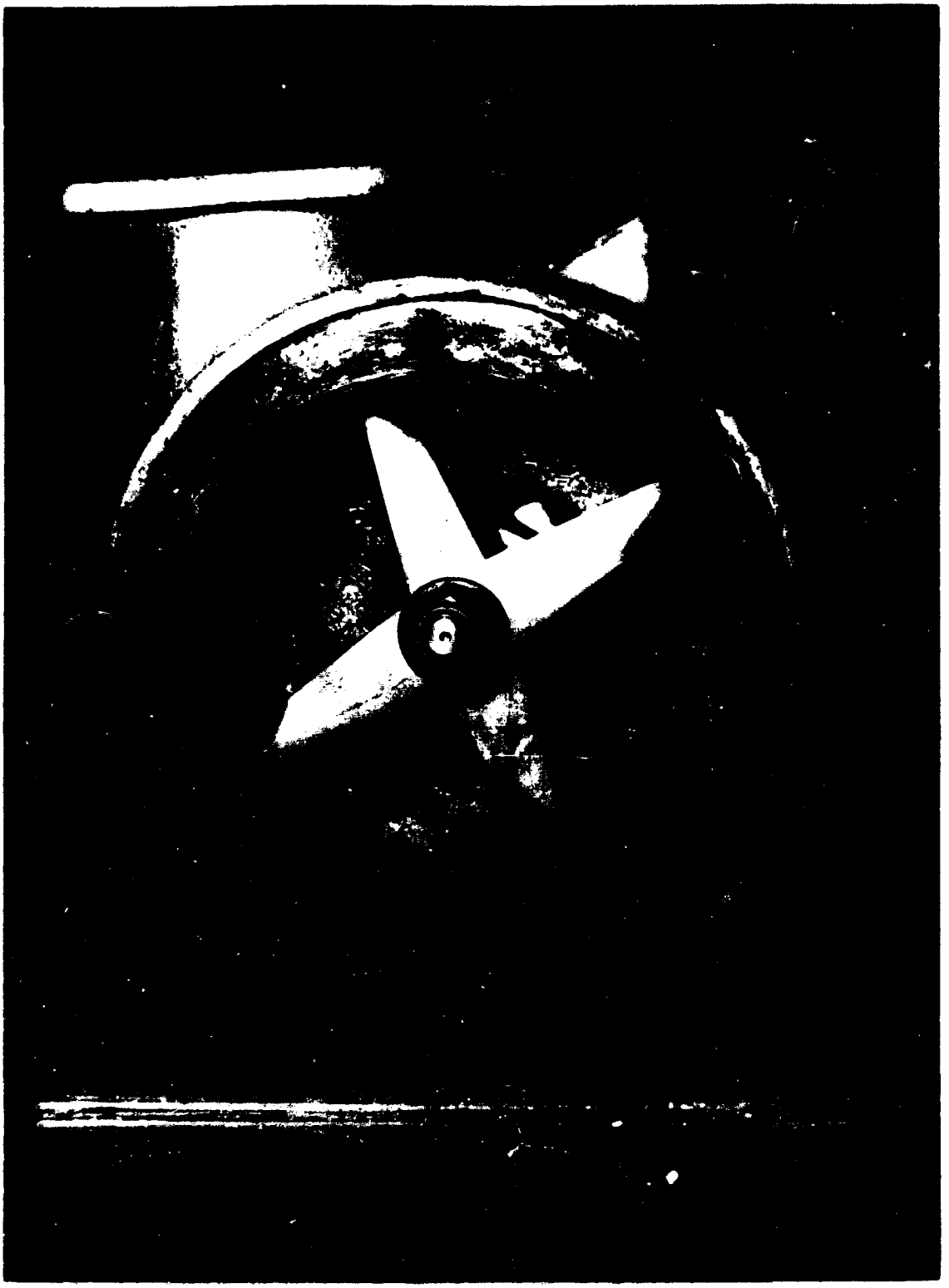

FIGURE 2
END VIEW OF GRINDER-PUMP SHOWING GRINDER BLADES

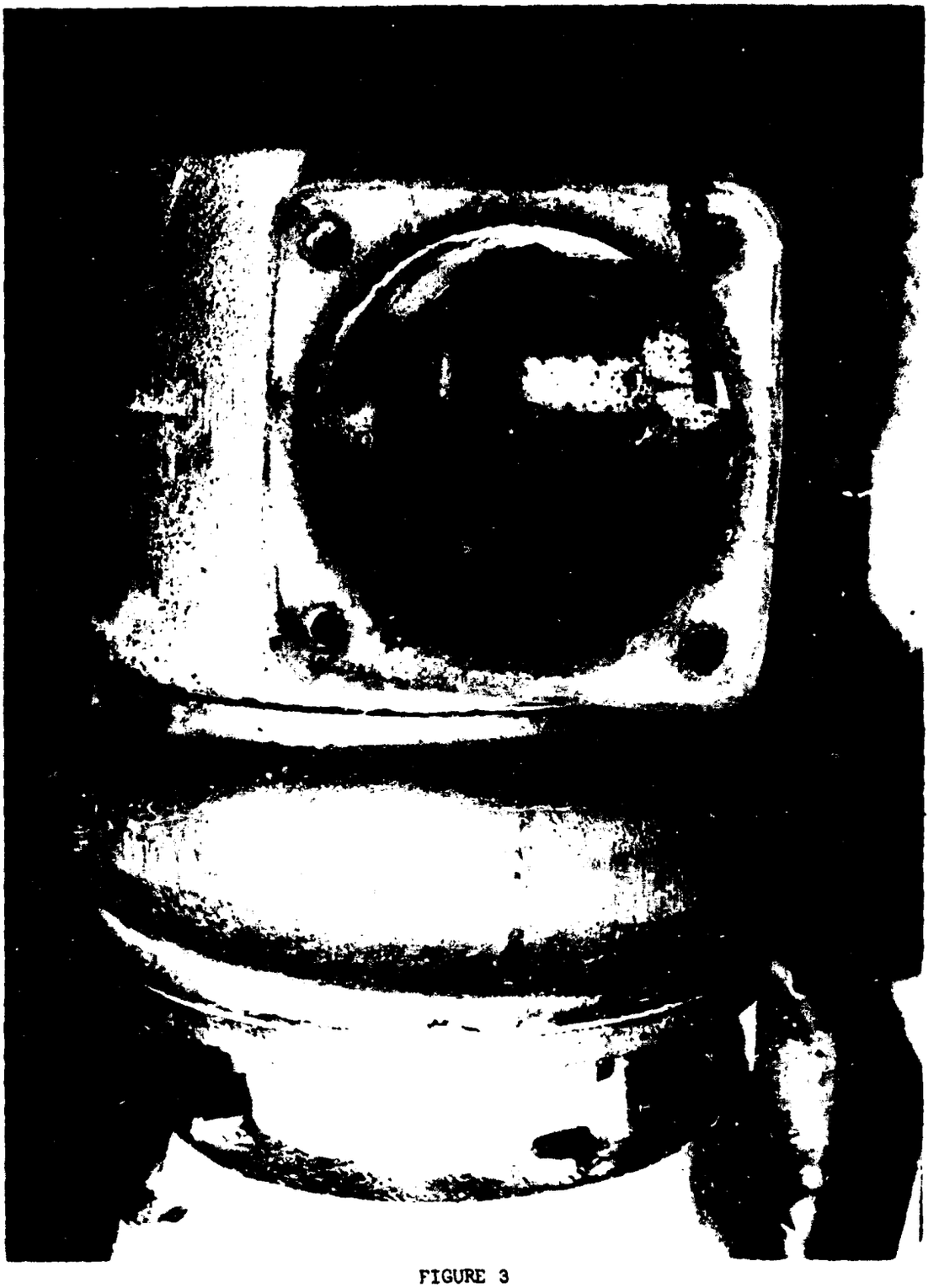

FIGURE 3
GRINDER BLADES AS SEEN THROUGH INLET TO GRINDER-PUMP

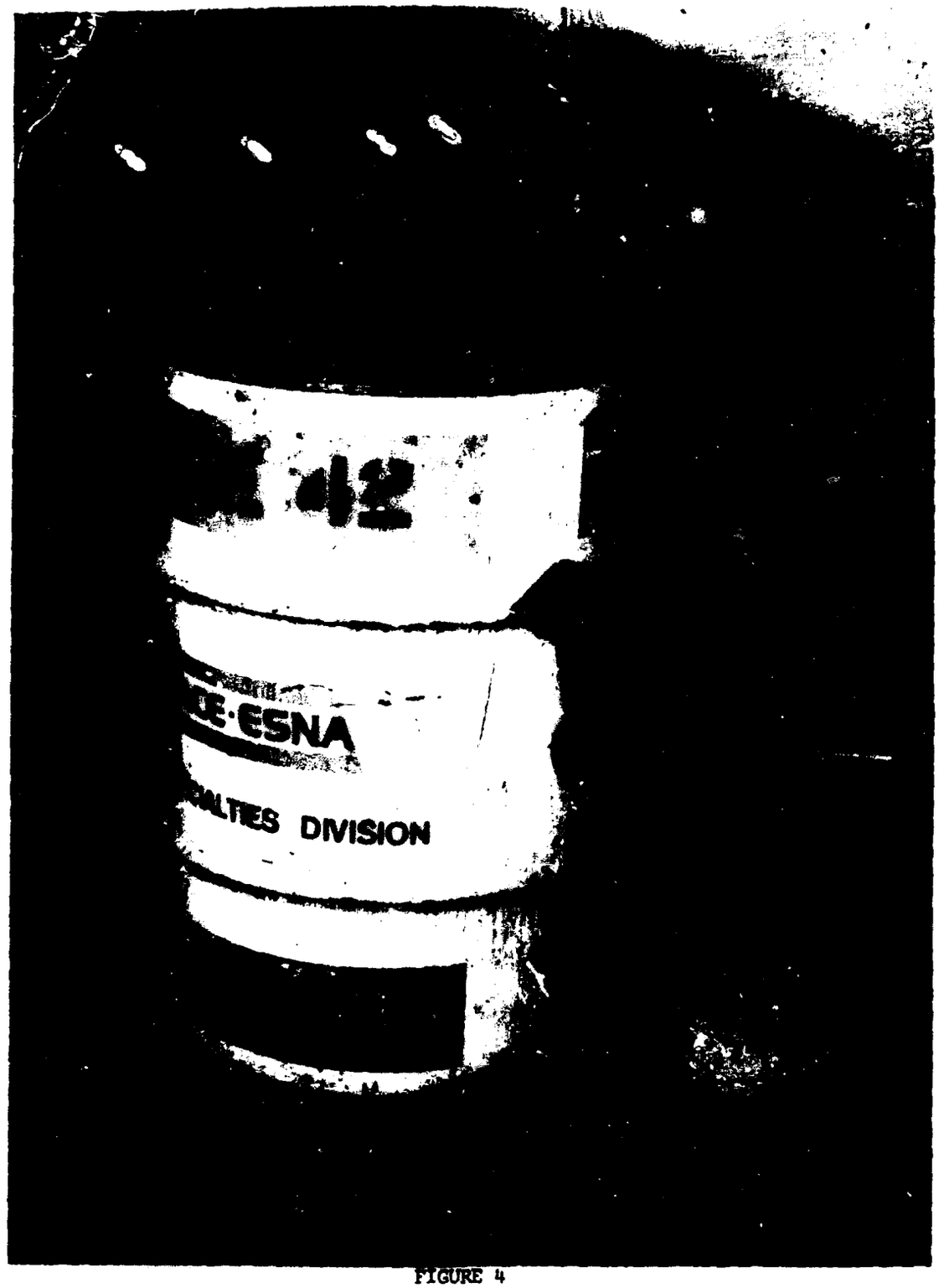

FIGURE 4
GRINDER PUMP INSTALLED UNDER DRUM USED AS SURGE TANK IN LABORATORY TESTS

FIGURE 5
SURGE TANK AND PIPING AS USED FOR LABORATORY TEST OF GRINDER PUMP

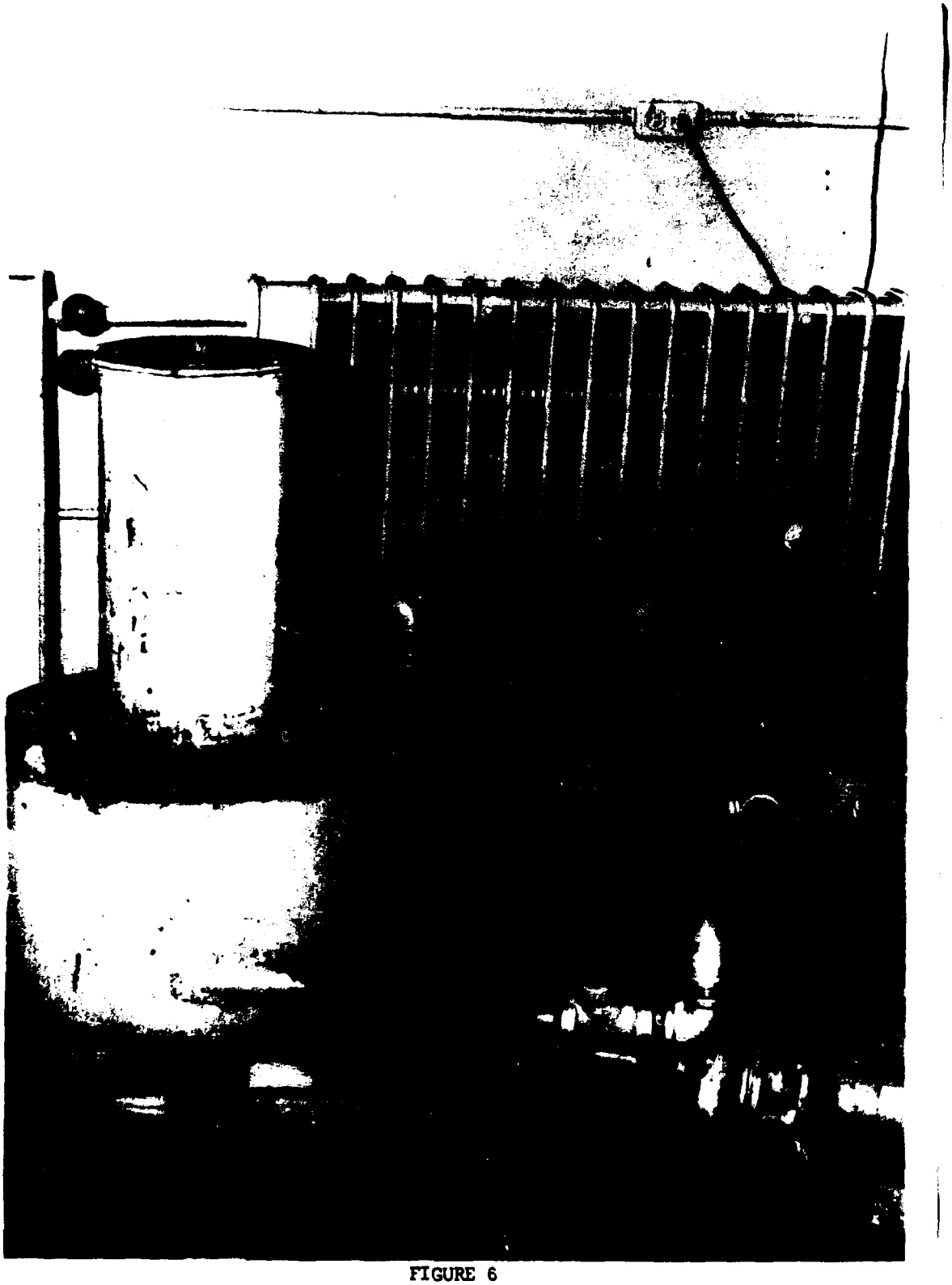

FIGURE 6
MODEL SEWAGE PLANT WITH EXPANDED METAL COMMINUTOR, USED IN COMPARISON TESTS OF GRINDER PUMP

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Report includes pictures of the grinder pump installation.	COMMANDANT(DAT) U.S. Coast Guard Washington, D.C.

13. ABSTRACT

Evaluation of a grinder pump as an improved means of waste solids comminution. Performance of the grinder pump compared to expanded metal screen hydraulic comminutor in its ability to break up waste solids. Efficiency of the grinder pump shown to be superior to expanded metal screen hydraulic comminutor.

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