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*Firing Device,
Clockwork,
~~30~~
24 Hour*

24 April 1956

MEMORANDUM FOR: THE RECORD

SUBJECT : Tests of 24-Hour Clockworks at Fort Belvoir

1. During the month of February 1956 fourteen 24-hour clockworks were tested at Fort Belvoir for leakage resistance, functioning and accuracy. The work was done at the Demolition Test Area of the Mine Warfare Branch by

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2. This testing was conducted as a result of discussions with TSS/WAD concerning the possibility of using the 24-hour clockwork with the Sea Pup. TSS/ED was advised that the depth requirement would approximate 200 feet of water. Hence, all testing was conducted under combined air and water pressure of 90 psi. This pressure is equivalent to 203 feet of sea water and 207 feet of fresh water.

3. To simulate an operational situation, the units were prepared for testing by utilizing a firing system comprised of the delay, special adapter, and live M-34 detonator. For safety reasons, the firing pins and springs were removed from the clockworks. It was found upon assembling the detonator-adapter combination bottoming of the adapter in the detonator well occurred. This was corrected by substituting a 7/64" gasket for the original one used on the adapter.

The adapters were hand-tightened into the clockworks with a 1" x 15/16" standard machinists open end wrench. Detonator - adapter connections were made by hand without the use of a wrench. The safety and start stop glands were tightened $\frac{1}{4}$ turn and the cover caps were tightened $\frac{1}{2}$ turn beyond finger tight.

Before the firing systems were immersed, the delays were wound and set for 23 hours 45 minutes with the firing arm outside the drum so that functioning could be verified,

After 24-hour immersion under pressure, clockworks were given time and functioning checks and detonators were fired using the adapter and pull-type firing device.

4. The results of the testing appear on the following pages:

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4. ACCURACY AND FUNCTIONING *

Unit #	True Elapsed Time	Clock Reading	Error
1	25 hr. 45 min.	25 hr. 43 min.	-2
2	"	25 hr. 44 min.	-1
3	"	25 hr. 44 min.	-1
4	"	25 hr. 30 min.	-15
5	"	25 hr. 41 min.	-4
6	"	25 hr. 44 min.	-1
7	"	25 hr. 42 min.	-3
8	"	25 hr. 45 min.	0
9	"	25 hr. 43 min.	-2
10	"	25 hr. 44 min.	-1
11	24 hr. 12 min.	24 hr. 9 min.	-3
12	24 hr. 13 min.	24 hr. 10 min.	-3
13	24 hr. 14 min.	24 hr. 3 min.	-11
14	24 hr. 15 min.	24 hr. 12 min.	-3
Average error slow			$\frac{50}{14} = 3.6 \text{ min.}$

* Each and every clockwork completed the test with no functioning failures.

5. SEAL AND FIRING FAILURES

Unit #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Detonator End or Detonator-Adapter			x			x		x					x	
Cover Cap							x		x				x	x
Adapter-Clock													x	x
Low Order Firing			x				*	*	*	*				

x - Failure

* - These detonators were fired successfully 3 days after ^{being} removed from the tank

It is interesting to note that even though leakage occurred, no clockworks failed to fire.

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6. The testing of detonator-adpater clockwork combinations revealed a high incidence of failures with moisture in the detonator well. It was reasoned by TSS representatives that this moisture entered through the gasket sealing the detonator adapter connection or clockwork. Subsequently however, it was thought that a possibility existed for moisture to enter through the detonator base. Testing is now underway to substantiate this theory.

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