CONFIDENTIAL

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F I N A L R E P O R T

REDESIGN OF CLAM

1210-C-10

25X1

[redacted]

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F I N A L R E P O R T

REDESIGN OF CLAM

Since the present Clam was designed to be used with the Mark II Time Pencil, which never became available, it became necessary to develop a unit which could accommodate the Mark I Time Pencil.

In the process of redesigning the Clam, it seemed advisable to investigate other features which would improve the over-all functionability of the Clam. These improvements primarily consisted of improved plastics of higher tensile and impact strengths and flexible mounting brackets for the magnets in order to absorb shock better as well as increase the magnets' holding power on irregular surfaces.

Design studies were made on the "closure" to determine the feasibility of including the delay pencils adjacent to the body. This was accomplished, however, by incorporating a cavity in the body of the unit to permit the pencil to be snapped in place rather than in the cover as originally planned. The igniting flame from the pencil to the detonator could then be guided through tubes provided or molded-in during the manufacture of the unit.

In addition to the above investigations, studies were made to simplify the manufacture and assembly of the Clam.

The initial phases of the work involved design changes which would facilitate volume production. Two separate approaches were considered practical, and temporary molds were fabricated to produce prototypes for evaluation. Polyvinyl chloride resins were selected to make up the first prototypes for the purpose of obtaining dimensions and establishing the

feasibility of the proposed design. Polyethylene containers were also procured for evaluation in high and low temperature tests. The information gained from these tests aided in the final structural design of the Clam.

The first design featured a copper tube which was imbedded in the plastic case. This tube provided a channel for the igniting flame produced by the delay pencil. The flame was then transmitted through the tube to the detonator.

Consultations with various molders indicated that the channel used for the igniting flame could be molded directly into the plastic during manufacture, thus eliminating the need for the copper tube.

The proposed igniting channels, from the delay pencils to the detonator, were formed between two pieces of polyethylene sheet stock providing a half channel in each of the two halves. The two pre-formed halves were then cemented together, thus providing a channel similar to the channel formed by the copper tube. Several prototypes were made, and test firings proved very satisfactory. This feature is provided in the final design.

The next step in the redesign of the Clam consisted of an investigation of the maximum allowable wall thickness for the detonator well in order to insure proper and reliable initiation of the explosive. This was accomplished by fabricating several units having various thickness of polyethylene sheets between the detonator and the explosive. In order to establish maximum reliability limits, a number of polyethylene sheets, stretch-formed from stock of 1/32", 1/16", 3/32" and 1/8" thicknesses were cemented into polyvinylchloride prototypes for evaluation. Twelve units were

fabricated and test fired without failure on either of the 3/32" or 1/8" wall thicknesses. It was concluded from these results that further investigations were unnecessary since a sufficient margin of safety was obtained.

Further investigations resulted in a new mounting bracket design for the magnets which would give greater rigidity to the partition separating the payload and magnet cavities, and thereby eliminated binding of the magnets when the payload compartment is filled with explosive. Several prototypes were tested utilizing these modifications with success.

The second phase of the work involved an objective analysis of the Clam with respect to moldability and performance. Consultations with qualified injection molders resulted in a few changes to the design as it now stood. One of the changes involved a detonator adaptor, so that if the detonator size was ever changed, it would affect only the adaptor mold rather than the box mold. Another change involved the payload compartment closure. This change improved the moldability characteristics of the unit with no sacrifice to its functional use.

A prototype of the detonator adaptor was made and tested for leaks. One end of the adaptor was inserted in a detonator and the other end in a 3/16" diameter hole (simulating the detonator hole in the box). The unit was then submerged in 12 inches of water for 12 hours with no leakage of water noted.

After all of the Clam parts were finalized, drawings and specifications were submitted to the Engineering Department of [redacted] 25X1 for dimensional and molding verifications. One or two minor changes were suggested and the drawings were changed accordingly.

Several custom molders were contacted and their recommendations were included on the semi-final drawings. The [redacted] 25X1
[redacted] 25X1 was awarded the contract for the fabrication of molds and 1,000 complete Clam units.

The [redacted] 25X1 was awarded the contract for the fabrication of 4,000 Alnico III-B magnets for insertion into the finished Clam.

A prototype of the coil spring, used in the Clam assembly, was made and tested. The results proved satisfactory; however, it was felt that the pre-load of the spring should be increased by 25 per cent. This was accomplished by decreasing the coil diameter from 13/32" to 5/16" using the same 0.054" diameter wire. This spring was tested and passed all the required specifications.

The bracket which contains the spring when assembled was modified so that the pin originally used in the spring and bracket assembly was eliminated. This resulted in a much simpler assembly. The [redacted] 25X1
[redacted] 25X1 was contracted to furnish this simplified bracket assembly.

The first production samples were received and a thorough inspection was made. This inspection revealed that several modifications to the mold were necessary. These modifications were as follows:

1. The wall thickness of the box around the center cavity was increased to insure a better seal between the box and cover.
2. The outside edges were modified to provide a 1/8" radius to provide easier concealment and handling.

3. The outside surfaces of the box were sandblasted to lessen its reflective qualities.

4. A portion of the box edge was removed to permit easy removal of the time pencil's safety pin.

5. The two outside 3/16" diameter holes were increased to facilitate assembly of the time pencils.

6. All flash marks were removed at sealing points.

7. The adaptor was modified to facilitate its assembly to the box and the detonator.

8. The magnet coating mold was modified to improve mold safety aspect and decrease the molding time required.

Samples incorporating the above modifications were submitted and inspected. The seal between the box and cover was found to be watertight, a feature not expected initially.

The final phase of the program involved various assembly and packaging methods. Various methods of sealing, i.e., cementing, hot gas welding, and direct heat sealing, were investigated with the latter proving to be the best from the standpoint of sealing, appearance and time consumed. The direct sealing method was used to seal both the insert and the magnet bracket in place. A regular 300 watt soldering iron, modified to include a flat aluminum tip, in place of the regular tip, was used.

The following is the procedure recommended for the assembly of the insert, brackets and magnets:

1. Assembly of the Insert

Wipe silicone grease across exposed insert end and areas of the

box to be sealed (silicone prevents the gumming up of the soldering iron tip). Wipe soldering iron tip across insert and end of box. This provides a watertight seal between the box and cover.

2. Assembly of the Brackets

Assemble brackets in box at each end. Dip soldering iron into silicone and melt down the 3/16" diameter box pins. (Soldering iron should be dipped in silicone prior to melting each set of pins.) The melting of the pins seals the brackets into the box.

3. Assembly of the Magnets

Assemble the magnets to the torsion spring in such a way that the magnets are not positioned alike in respect to the north-south pole faces, rather, they should be assembled as shown in Drawing I. Snap the magnets into the already sealed-in bracket assembly. This can be accomplished by pulling the two tongues of the bracket together with a pair of needle-nose pliers. This secures the spring and magnet to the bracket.

Five units containing delay pencils, non-electric Corps of Engineers blasting caps and Composition C-4 explosive were test fired in order to obtain information as to their reliability and functionability. All units functioned properly; however, many more test firings are required to properly evaluate each feature of the Redesigned Clam.