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A PACKING PROCEDURE FOR SHIPMENT
OF PETN PELLETS

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DEVELOPMENT DIVISION

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FINAL REPORT

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ABSTRACT

Three "detonation tests" and one "burn test" were performed on an AN can, Type AN 8024 containing PETN pellets. Test procedures were discussed with a representative of the Department of Transportation. The can contained all reactions and did not rupture in any of the tests. The packing procedure and container were deemed acceptable for the pellets tested.

DISCUSSION

An AN can, Type AN 8024, normally used for shipment of 1E26 detonators was evaluated for shipment of PETN pellets. There are five styrofoam/aluminum/styrofoam platforms, each capable of holding twenty pellets, with each pellet inserted in a foam rubber "doughnut" and covered by a 2.54 cm diameter by 0.32 cm thick foam rubber wafer (see Fig. 1). The five platforms are stacked vertically with a 30.5 cm long by 0.64 cm diameter bolt passing through the center holes in each platform. Platforms were arbitrarily assigned numbers and letters for identification, with number 1T representing the top styrofoam layer and 1B the bottom styrofoam layer of the top platform in the can, 2T and 2B the next-to-top platform and so on with 5T and 5B representing the bottom platform in the can.

The platform assembly, covered with a 25.4 cm diameter by 1.91 cm thick piece of plywood and held together with suitable hardware, is placed inside the can atop a 25.4 cm OD by 17.8 cm ID by 4.45 cm thick layer of "hogshair" (see Fig. 2). Another layer of "hogshair" is placed atop the assembly and the ungasketed lid is attached to the can in the usual manner.

PETN pellets used in the tests were nominally 1.27 cm diameter by 0.635 cm thick and weighed 1.2 grams.

DETONATION TESTS

Three "detonation tests" were performed. In each of the tests a centrally located pellet in one of the platforms was initiated by an EX-12B detonator. Only the platform(s) adjacent to that containing the initiated pellet contained pellets. Fig. 3 shows an assembly ready to fire, with the detonator cable protruding through the hole which normally contains a humidity indicator.

In the first test, the initiated pellet was located in Platform 3T (the "middle" platform). The can did not rupture and the forty pellets in Platforms 2T and 4T (see Figs. 4 and 5) were undisturbed. The plywood cover was unmarked and styrofoam layers 2B and 3T were damaged (see Figs. 6, 7 and 8). Four pellets in Platform 3 were not found and several of the other sixteen pellets were displaced (but not damaged) from their shipping positions.

In the second test, the initiated pellet was located in Platform 1T (the "top" platform). Although the damage observed in this test was the most severe, the can did not rupture and relatively minor damage was observed inside the can. A hole was found in the plywood cover above the initiated pellet. Eight pellets in the top layer were not found. Styrofoam Layer 1T was damaged (similar to that shown in Fig. 7) but none of the other four platforms were damaged. All twenty pellets in the adjoining platform (number 2) were undisturbed.

In the third test, the initiated pellet was located in Platform 5T (the "bottom" platform). Again the can did not rupture and all platforms above 4 were found undisturbed. Styrofoam layer 4B exhibited damage similar to that shown in Fig. 6 and layer 5T was damaged similar to that shown in Fig. 7. Three pellets were missing from Platform 5T and several of the other seventeen were displaced and/or fractured. All twenty pellets in Platform 4T were undisturbed.

BURN TEST

A fully loaded (100 pellets) can was subjected to a fire fueled by 48 each 2.54 x 2.54 x 61 cm pine boards which had been soaked with toluene. The boards were arranged in six layers of eight boards spaced about 5 cm apart, with the can centered on the top layer (see Fig. 9).

About five minutes after ignition, smoke, followed almost immediately by flame, was observed around the lid-can interface. At about eight minutes, a flame typical of a high explosive fire was noted at the same location. At approximately twelve minutes the can toppled over due to damage to the wood pile (see Fig. 10). Shortly thereafter, "venting sounds" (like a rush of air) were heard from inside the firing chamber. Flames were visible at the lid-can interface until about twenty-five minutes after ignition. The fuel continued to burn another five minutes (thirty minutes total).

There were no explosions and the can did not rupture. A photograph taken after disassembly following the burn test is shown in Fig. 11. Motion picture coverage of the first twenty minutes after ignition is available for projection viewing.

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CONCLUSIONS

The AN can, Type AN 8024, was judged acceptable as tested as a safe shipping container for PETN pellets. It is concluded that this shipping container (as tested) would contain the explosion products of an accidental detonation.

FUTURE WORK

Other shipping containers and/or explosive materials will be tested as required. Other configurations, e.g., ways to ship more than 100 pellets per can, and/or modifications will also be investigated as required.

ACKNOWLEDGEMENTS

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Fig. 1. View of Platform No. 1 Showing Pellets
in "Doughnuts" and with Covers

Fig. 2. View Showing Container Before Attaching Lid

Fig. 3. Assembled Can Prior to a Detonation Test
(Note the detonator cable protruding from
the hole which is normally used for a
humidity indicator)

Fig. 4. View Showing Undisturbed Pellets in Platform No. 2

Fig. 5. View Showing Undisturbed Pellets in Platform No. 4

Fig. 6. View Showing Damage to Bottom Styrofoam Layer of Platform Number 2

Fig. 7. View Showing Damage to Top Styrofoam Layer of Platform Number 3

Fig. 8. Side View Showing Damage to Styrofoam Layer of Platform Numbers 2 and 3

Fig. 9. Pretest Photograph Showing Fuel and Shipping Container

Fig. 10. Post Test Photograph Showing Toppled Shipping Container and Remains of Fuel

Fig. 11. Disassembly of Shipping Container After Burn Test