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DEMILITARIZATION PLAN FOR XM767 INFRARED ILLUMINATING ROUND

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13. ABSTRACT

This report contains an evaluation of the current demilitarization plan of the XM767 infrared illuminating round and provides recommendations for implementing an alternate method that involves the adoption of a chemical recovery process to recycle the illuminating composition. Although the use of open burning/open detonation (OB/OD) is the primary methods for destroying obsolete pyrotechnic rounds because of its simplicity and low cost, the recommended chemical recovery method is more desirable. This is due to the fact that this method will provide royalties to the Army and at the same time substantially reduce the environmental emissions. It is anticipated that this step is in accordance with any new forthcoming limiting Environmental Protection Agency regulations, which will substantially reduce and possibly eliminate the use of OB/OD in the future.

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INTRODUCTION

Purpose

The purpose of the demil assessment for the 60-mm XM767 Infrared (IR) Illuminating Projectile is to provide the Project Manager (PM), Mortar System an assessment of the current demilitarization plan and offer alternative methods of demilitarization where applicable. The PM for Mortar Systems, being responsible for the life cycle of the XM767 IR projectile, is required to plan for the demilitarization of this item during its development. As such, the PM for Mortar Systems tasked the U.S. Army Armament Research, Development and Engineering Center's Armament Systems Process Division (ASPD) and the Logistics Systems Engineering Division (LSED) to conduct an evaluation of the current demilitarization procedures for the XM767 projectile. With the environmental regulations and laws associated with the demilitarization of munitions under a constant state of change in recent years, it is expected that the traditional demilitarization methods, i.e. open burning/open detonation, will eventually no longer be a viable process. The ASPD is responsible for the development of new demilitarization technology and also retains personnel with expertise and knowledge of the current laws and regulations, which govern these activities.

This report provides an evaluation of the current demilitarization plan and provides recommendations developed by ASPD and LSED for implementing an alternate method, which involves implementing a recovery process to recycle a portion of the pyrotechnic composition. As a result, the PM for Mortar Systems is provided a realistic strategy for achieving a process to demilitarize this munition in a safe, cost effective and environmentally acceptable manner.

Current Demilitarization of IR Illuminating Round

The structural design of the XM767 shown in figure 1 is modular in design. It consists of an M776 time fuze (fig. 2) that is screwed to a fuze adapter which is attached to the body tube by eight steel retaining pins that are equally spaced around the circumference of the tube every 45 deg. The body holds the IR illuminating canister and is attached to the tail cone assembly by four brass pins that are equally spaced 90 deg apart. The M27 aluminum fin assembly is screwed on the tail cone assembly, which holds the parachute expulsion spring. The M702 ignition cartridge is then screwed in place inside the M27 fin assembly. Four M204 propellant increments are fitted onto the outside of the fin assembly.

The current demilitarization plan for the cartridge calls for open burning of this round and transferring all the scrap metal to the Defense Reutilization Marketing Office (DRMO) for disposal. This demilitarization plan does not address the following concerns:

- The amount of air pollution generated from open burning of the IR illuminating composition. With EPA environmental limits becoming increasingly tighter, this is not expected to remain a viable demil option for an indefinite time.

- The Depot Maintenance Work Requirements (DMWR) require the removal of items containing precious metals prior to the demilitarization disposal operation, if economically feasible. Such an analysis was lacking in the current plan, and is the object of this report.

ECONOMIC ANALYSIS OF 60-mm XM767 COMPONENTS

M776 Time Fuze

Each M776 time fuze costs the Army $125.00* to procure. It contains approximately 0.18 g of detonator mixture and a maximum of 2.92 g of black powder. These compositions are usually sold at about $5.00 a pound or a maximum of 1.5 cents a gram. Salvaging this fuze is not economically feasible since the energetic materials have no significant recovery value and the fuze has no other end item application. The recovered metal from the fuze would weigh approximately 1 lb and is worth approximately 25 cents.

Infrared Chemically Filled Canister

The IR canister loading assembly shown in figure 3 consists of 12 g of first fire composition and 260 g of IR illuminating composition. Approximately 70% of this composition is cesium nitrate, which is procured by the government for about $20.00 a pound when purchased in large quantities of approximately 10,000 lb. Consequently each of the IR canisters contain chemicals that are worth a minimum of $8 to $10 and up depending on the quantity demiled and the purity of the recovered cesium nitrate. Open burning these canisters could eventually be environmentally undesirable and at the same time, an economic loss to the government. It is possible to chemically recover the cesium nitrate for reuse either by the government or sold for resale for other commercial applications. Based on the procurement projections within the next few years, it is feasible to develop and implement an economically profitable chemical recovery process for recovering cesium nitrate and other chemicals at a Flexible Chemical Recovery facility.

Tail Cone Structure

The tail cone structure shown in figure 4 is designed to carry the parachute pack and the parachute expulsion spring. Since the parachute assembly has no commercial value or use, it can only be salvaged as scrap. The total weight of the stainless steel in the entire round is close to 3.75 lb. Stainless steel scrap is sold for 25 cents per pound and consequently the recovery cost by DRMO of the entire scrap is almost $1.00 per round.

Tail Ignition Cartridge

The tail ignition cartridge shown in figure 5 is essentially composed of a 0.4 gr of percussion primer and 3 g of black powder. At $5.00 a pound the cost of these pyrotechnics will amount to only a few cents. Attached to the longitudinal axis of the ignition cartridge are four propelling charges (fig. 6). Each contains 125 gr or a total or 32.4 g of propellant charge, which sells for approximately $5.00 per pound and consequently is only worth a few cents.

*All money referred to in this report is from FY 98.

SHORT TERM PROCESS RECOMMENDATIONS

It is apparent from this evaluation, that the only valuable component of the M767 IR illuminating round is in the IR composition filled canister. Since the DMWRs call for removing all valuable materials prior to disposal of the item, it is recommended that the disposal strategy of this item be modified to adapt the following scenario:

- Prior to disposal of the item, drill the four brass pins at the bottom end of the tube cylinder to disassemble this round.
- Remove the canister that holds the IR composition and store it for future chemical recovery of the cesium nitrate.
- The only components left in this round that contain energetics are the fuze and the tail ignition cartridge both of which could either be detonated, open burned, or placed in an incinerator in order to dispose of the black powder, the primer, and the propellant charge.
- The scrap metals remaining after disposal of the pyrotechnics will be sent to DRMO for sale as scrap.

LONG TERM RECOMMENDATIONS

For the long term, it is recommended that a program be funded to determine the optimum process parameters needed to define the appropriate chemicals required by the hydrolysis reaction for the recovery of the cesium nitrate from the infrared illuminating compositions. Once an optimum recovery process has been established, it will be integrated into a flexible Chemical Recovery Facility. An effort to construct a flexible Chemical Recovery Facility has been proposed by Armaments Systems Process Division through the Demil Technology Office in FY 98.

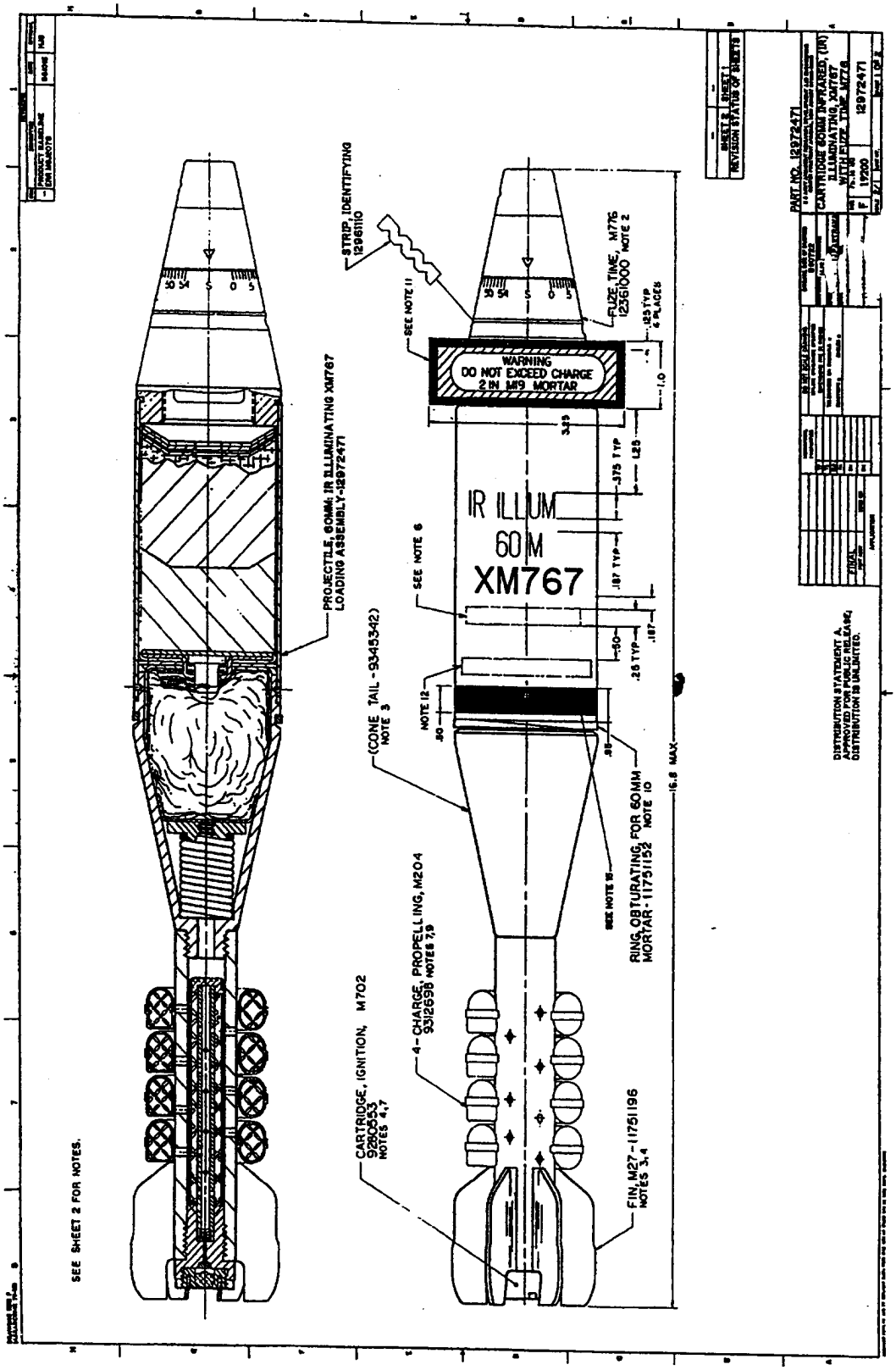

Figure 1
Structure of infrared illuminating round

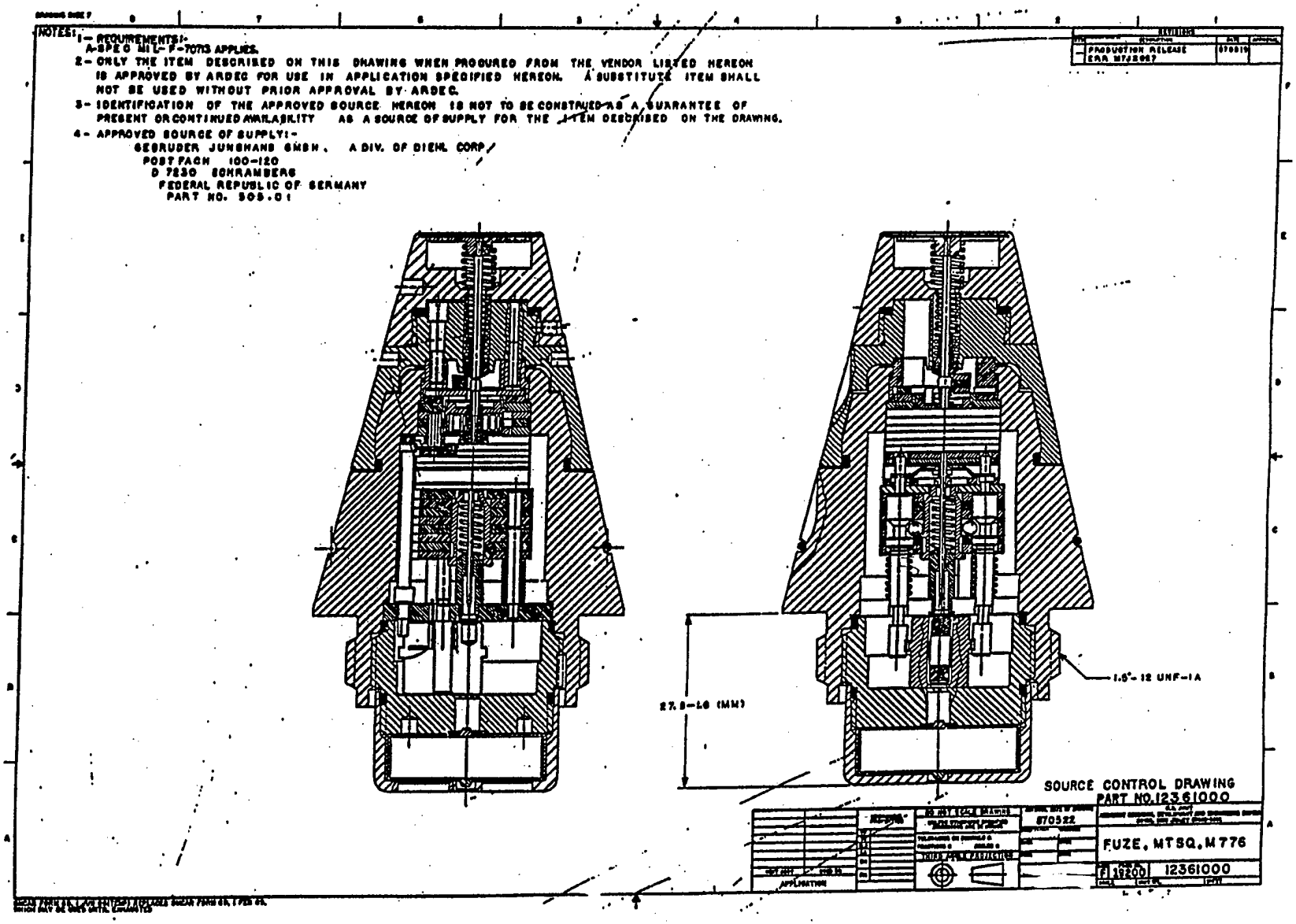

Figure 2
M776 time fuze

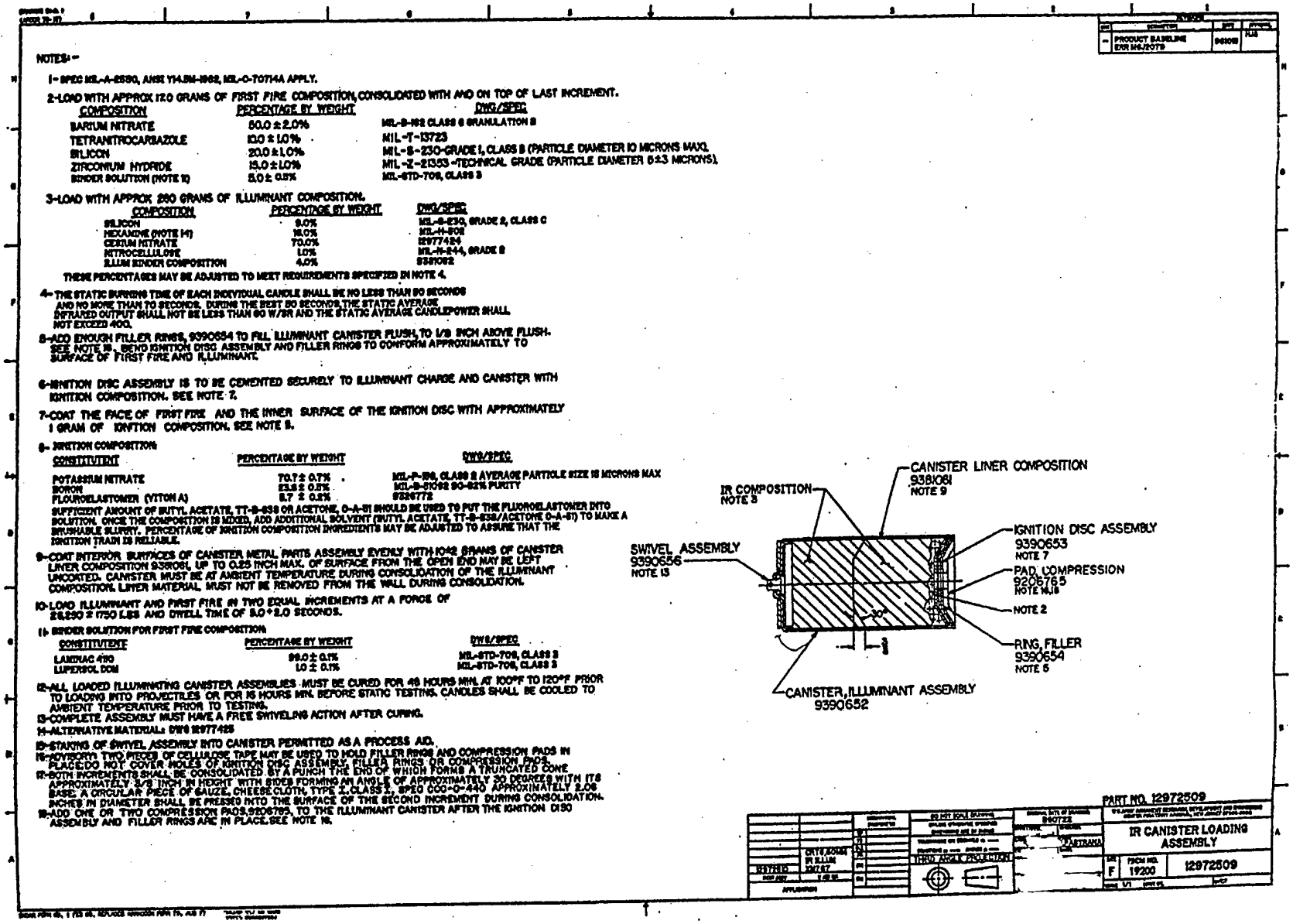

Figure 3
Infrared canister loading assembly

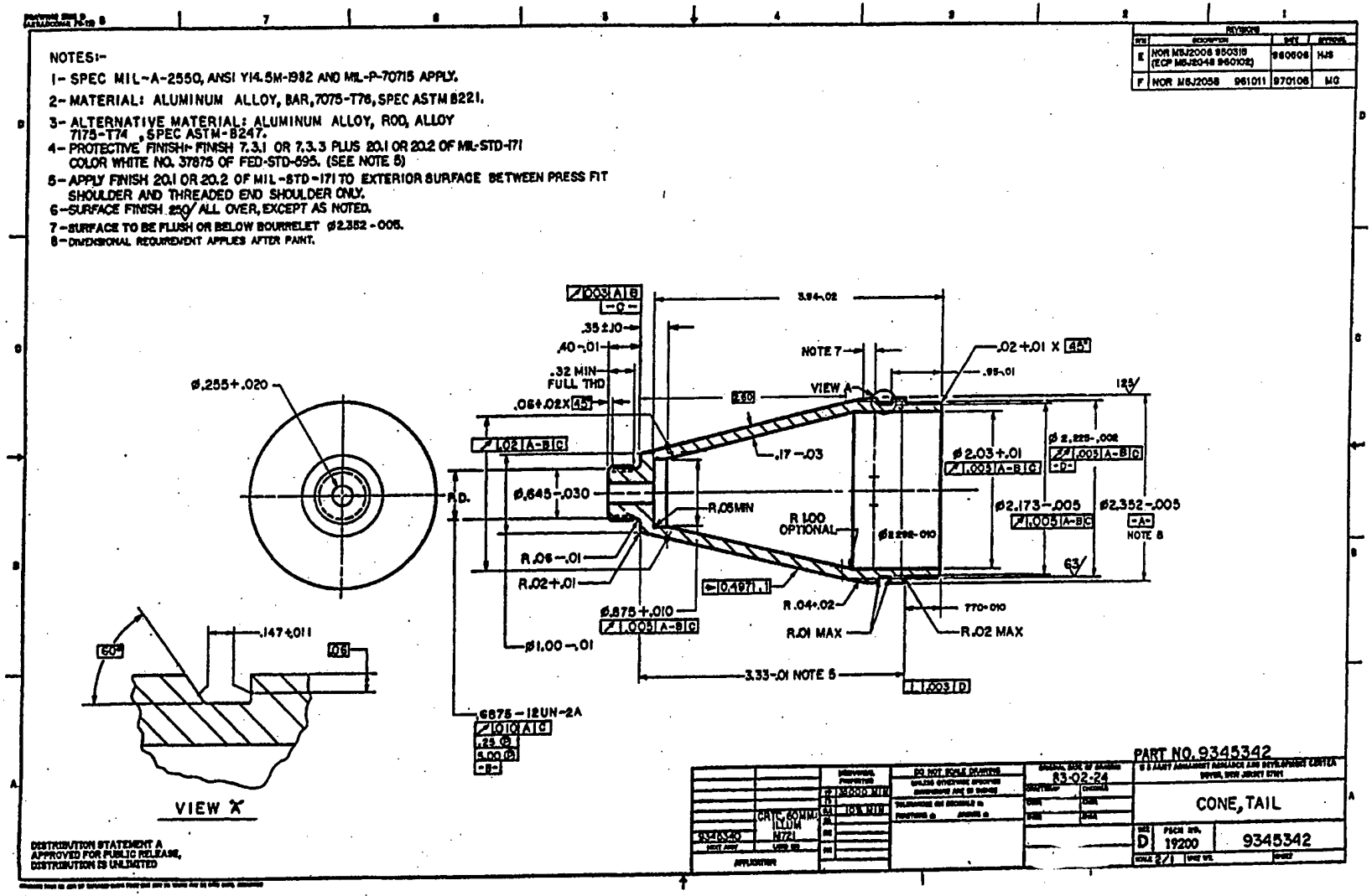

Figure 4
Structure of tail cone

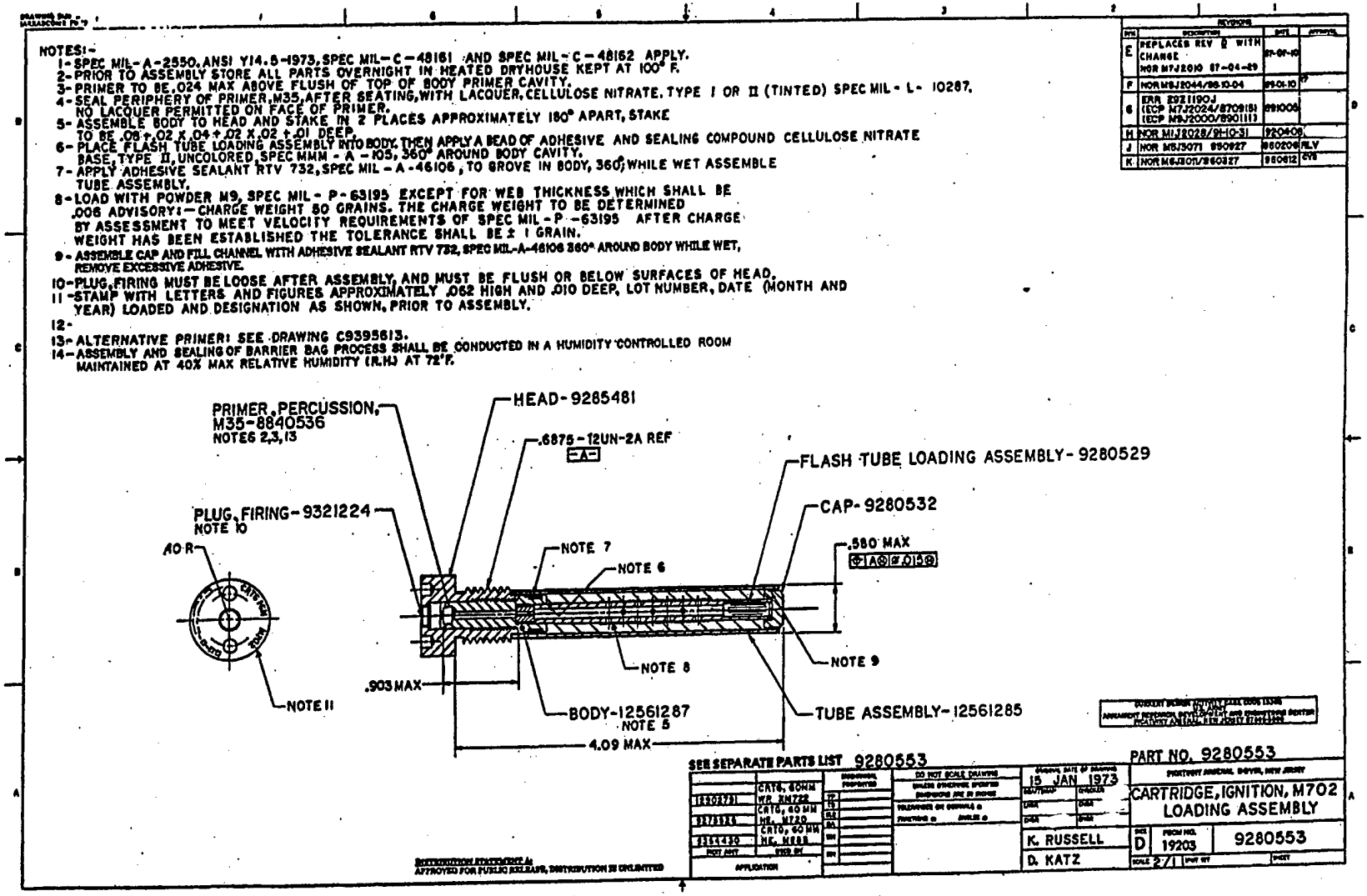

Figure 5
Ignition cartridge

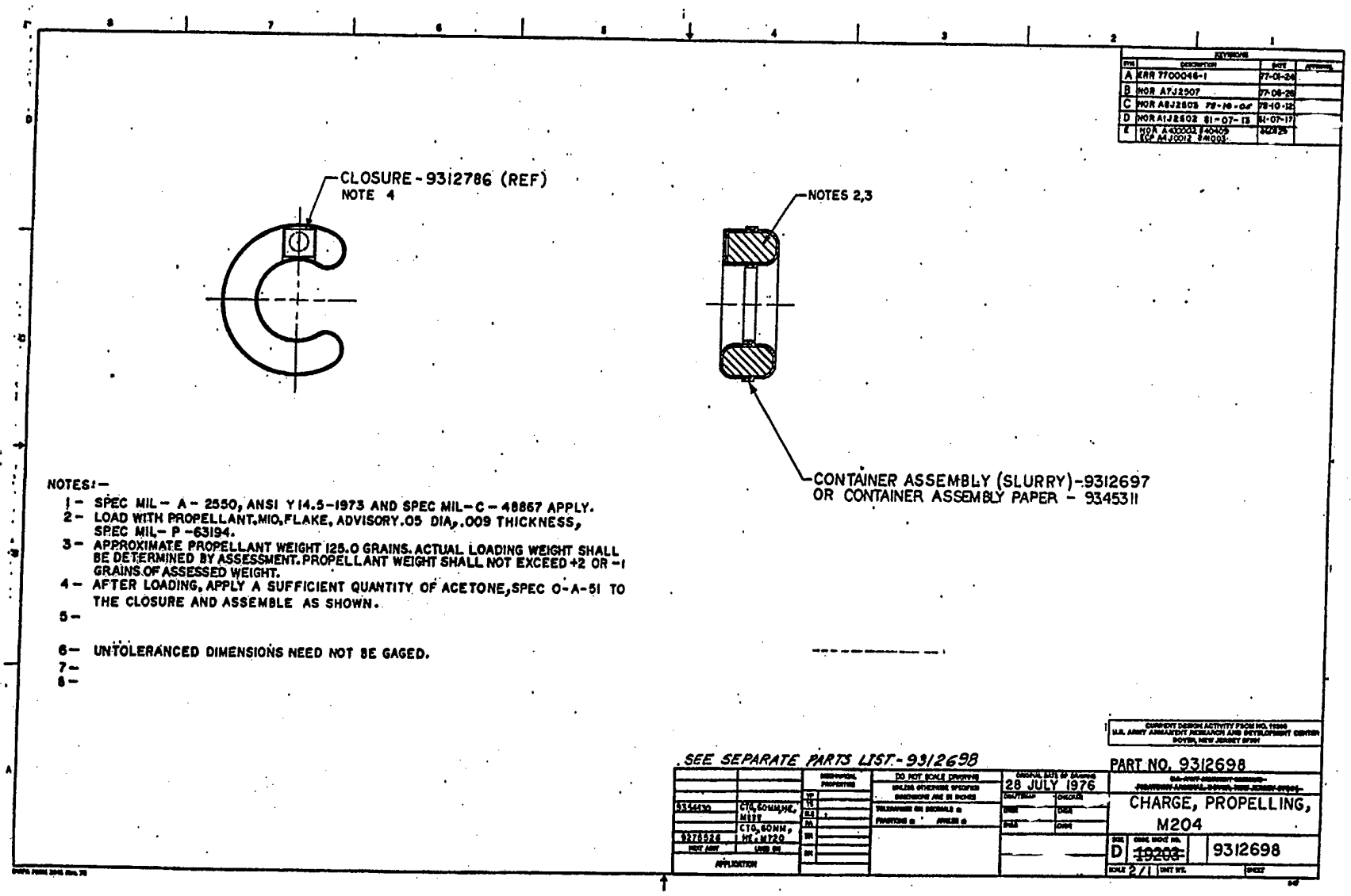

Figure 6
Propelling charge

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