NON-DESTRUCTIVE METHOD TO ASSESS PHYSICAL CONDITION OF CHEMICAL FILL

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ABSTRACT
This invention relates to a method for assessment of the condition, and change of condition, of the liquid fill for chemical projectiles by analyzing the vibrational characteristics of the projectile and fill. It is a method by which the condition of the liquid fill in a projectile can be assessed without requiring cutting, drilling, and/or altering the structure of the shell or payload. This non-destructive technique can be used with projectiles filled with toxic or hazardous materials and can occur within the confines of storage buildings. The system for incorporating the method of the invention includes a projectile which is freely suspended and then struck with a device causing the projectile and the fill to vibrate. The natural vibrational characteristics of the projectile and fill are measured and recorded and can be compared to model data to ascertain any changes in the physical characteristics of the fill.

3 Claims, 2 Drawing Figures

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GOVERNMENT INTEREST

The invention described herein may be manufactured and licensed by or for the Government for Governmental purposes without the payment to me of any royalties thereon.

BACKGROUND AND SUMMARY OF THE INVENTION

Chemical projectiles often include a payload consisting of a liquid fill, for example, nerve agent, mustard, or white phosphorous. After long term storage, these fills may undergo a chemical or physical change in their physical properties such as density, viscosity, etc. which can affect their performance, functioning and military potential. The instant invention is a method by which the condition of the liquid fill in a projectile can be assessed without requiring cutting, drilling, and/or altering the structure of the shell or payload. This non-destructive technique can be used with projectiles filled with toxic or hazardous materials and can occur within the confines of storage buildings. It is an object of this invention, therefore, to provide a system for ascertaining the condition of the liquid fill in a projectile.

Another object of this invention is to provide a system which determines the condition of the liquid fill in a projectile without requiring alteration of the shell structure or payload. It is another object of this invention to provide a system for liquid fill assessment of a projectile which can take place within the projectile storage area without requiring the projectile to be removed from the storage building. Further objects and advantages of this invention will become more apparent in light of the following drawings and description of the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of an embodiment of a system incorporating a method for assessment of the condition of liquid fill in a projectile without alteration of the shell structure or payload; and

FIG. 2 is a perspective view in three dimensions of graphs of a typical test liquid fill indicating the relationship between wave amplitude, frequency, damping, viscosity and time for the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Referring to FIGS. 1 and 2 of the drawings, there is a testing system shown embodying the principles of this invention. The embodiment of the invention is based on measuring the frequency and damping characteristics of a projectile 10 and liquid fill (not shown) at their natural vibrational response conditions.

The test item and associated instrumentation are illustrated in FIG. 1. An actual projectile 10 is suspended in the air by an elastic cable 12 so that the projectile 10 is free to vibrate. An accelerometer 14 is placed on the outside surface of the projectile 10, either on the base or side. The projectile 10 is then struck with a mallet 16 or other heavy object to cause the projectile 10 and liquid fill (not shown) to vibrate at their natural frequencies. The accelerometer 14 and recording and storage oscil-