COPPER CRUSHER GAUGE HOLDER

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References Cited
U.S. PATENT DOCUMENTS
815,468 3/1956 Du Pont
2,620,652 12/1952 Hartman
2,870,631 1/1959 Musser et al. 73/167

A copper crusher gauge holder for testing internal pressures of cartridges during test firing is provided. The copper crusher gauge holder has a circular aluminum upper plate and a circular aluminum lower plate having a layer of urethane rubber approximately 1/8 inch thick sandwiched between the plates. The gauge holder is bored to hold copper crusher gauges and center-bored to fit over a cartridge centerline primer tube. A series of machine screws hold the plates together and allow for tightening the screws once the copper crusher gauge holder is in place in a cartridge to be tested. As the machine screws are tightened, the urethane rubber expands laterally gripping the inside of the cartridge and gripping the copper crusher gauges. A method to manufacture the gauge holder is provided.

ABSTRACT

1 Claim, 3 Drawing Sheets
1

COPPER CRUSHER GAUGE HOLDER

ORIGIN OF THE INVENTION

The invention described herein was made in the performance of official duties by an employee of the Department of the Navy and may be manufactured, used, licensed by or for the Government for any governmental purpose without payment of any royalties thereon.

1. Field of the Invention

The invention described herein relates to explosive pressure test devices and in particular to crusher gauges for measuring peak pressure within weapons and artillery shells during gun fire.

2. Background of the Invention

Crusher gauges have been known in the art for many years. Some earlier examples include a copper pellet crusher using a piston arrangement as depicted in U.S. Pat. No. 2,620,652 by Hartmann (1952). A later disclosure, U.S. Pat. No. 2,870,631 by Musser et al. (1959) depicts a device for positioning and housing of crusher gauges. In more recent years, it has been desired to measure peak pressures inside large caliber artillery shells. In order to accomplish these measurements, cylindrically-shaped crusher gauges have been used. As these crusher gauges must remain oriented and positioned within a shell during the firing of the shell, gauge holders within the shell are necessary. Typical of such prior art gauge holder is the neoprene holder device having a neoprene locking ring. The neoprene holder has a series of bore holders around the periphery for insertion of the crusher gauges. Additionally, a center bore is provided for the purpose of mounting the holder by sliding it over the shell’s primer tube. The locking ring is also centered and is slid down over the primer tube in a similar manner. As the locking ring’s outside diameter is slightly greater than the inside diameter of the edges of the peripheral holes on the holder, the locking ring wedges against the crusher gauges holding them in place.

Certain problems remain with these prior art holders. Typically, these gauge holders are inserted into the neoprene disk that is placed over the primer tube at the bottom of the cartridge case. Another neoprene disk, the locking ring, is placed over the gauge holder assembly. When the propelling charge with the gauge holder assembly is rammed to its seated position, the assembly slides forward on the primer tube as the propellant bed shifts forward (leaving a finite space). During ignition, the gauge assembly is forced into the base of the case damaging the gauges. During this process gauges may be dislodged from the holder and upon extraction and ejection of the spent case the gauges fall into the gun operating mechanism, foul the gun barrel, are propelled through the barrel forward of the gun mount and remain in the cartridge case. When the gauge holder is slammed into the base of the cartridge case the steel/copper holder is deformed and could be affecting the copper gauge readings.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide a crusher gauge holder which encapsulates and protects crusher gauges during the propellant ignition process.

It is another object of the invention to provide a crusher gauge holder having means for retaining gauges and holder in position and seated against the base of the cartridge case during the entire cycle of loading, firing, extracting and ejecting.
together. Likewise, copper crusher gauges 23 are also held in place by expansion of the pliant substrate material.

Referring now to FIG. 3, the configuration of the copper crusher gauge holder 10 is shown. Upper plate 25 has a series of four larger holes 33 sized to permit insertion of copper crusher gauges. Additionally, two smaller holes 37 are provided to allow the copper crusher gauge holder 10 to be filled with pliant or rubber material. In the preferred embodiment, a urethane rubber was used having a durometer hardness range between 60 and 90. A center bore hole 35 is provided to fit over the center primer tube of the cartridge case. The entire assembly is held together by three machine screws 31, threaded into the lower plate and friction fitted to the upper plate, which also function to compress the pliant material after installation in a cartridge case so as to hold the device in place and to hold the copper crusher gauges in place. Manufacture of the copper crusher gauge holder 10 is accomplished at the test site using the unassembled components, i.e., upper plate 25, three machine screws 31, four copper gauges, and a cut-off base of a cartridge which is used as a mold. The upper and lower plates are attached together using the machine screws leaving a gap between the plates of approximately ½ of an inch. Next, copper crusher gauges are inserted in the holes 33 and the entire assembly is placed over a primer tube and inside a cut-off portion of a cartridge on which a test is required. A liquid rubber or other pliant material is then added through one of the holes 37, the opposite hole 37 acting as a vent. Once the material has hardened, the copper crusher gauge holder is completed and may be removed from the mold cartridge. Test may then be conducted on the same size cartridge by inserting the preformed copper crusher gauge holder in the cartridge and tightening the machine screws to cause the urethane rubber to expand laterally, thereby gripping both the inside of the cartridge and the copper crusher gauges.

The features and advantages of the copper crusher gauge holder are numerous. The gauge holder encapsulates and protects the gauges during the propellant ignition process. The gauge holder and gauges are retained in the cartridge during the entire cycle of load, fire, extraction and ejection. The new features include gauge holder encapsulation, retention techniques for both the gauge holder to the cartridge case and gauge holder to the gauges.

Although the invention has been described relative to a specific embodiment thereof, there are numerous variations and modifications that will be readily apparent to those skilled in the art in the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced other than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A method for manufacturing a copper crusher gauge holder comprising the steps of:
   - cutting an upper plate to form a disc having an outside diameter slightly smaller than the inside diameter of a cartridge case to be tested;
   - boring a series of holes to said upper plate to receive copper crusher gauges;
   - boring a series of holes into said upper plate to receive machine screws;
   - boring a center hole into said upper plate for fitting over a cartridge center primer tube;
   - cutting filler and vent holes into said upper plates; cutting a lower plate to form a disc having an outside diameter slightly smaller than the inside diameter of the base of a cartridge core to be tested;
   - boring a series of holes into said lower plate to receive copper crusher gauges;
   - boring and threading a series of holes into said lower plate to receive machine screws;
   - boring a center hole into said lower plate for fitting over a center primer tube;
   - attaching said upper plate and lower plate together using machine screws and leaving a fillable gap between said plates;
   - inserting the attached upper and lower plates into a cut-off portion of a cartridge case, the case to form a mold;
   - inserting copper crusher gauges into each of the series of copper crusher gauge holders;
   - adding a liquid pliant material through the filler hole to fill the fillable gaps between said plates; and curing the liquid pliant material.

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