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APPARATUS FOR METAL WORKING WITH EXPLOSIVES

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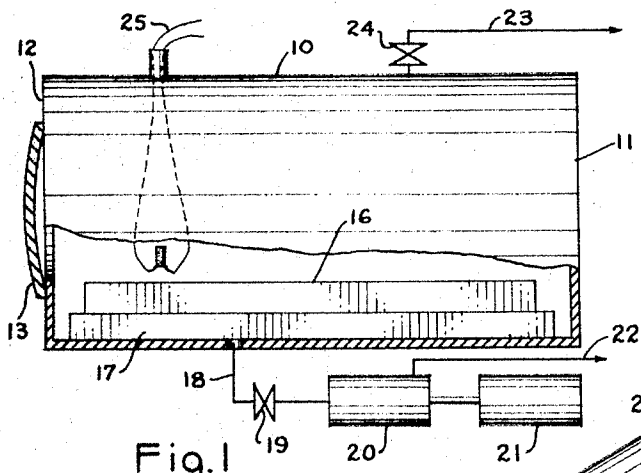


Fig. 1

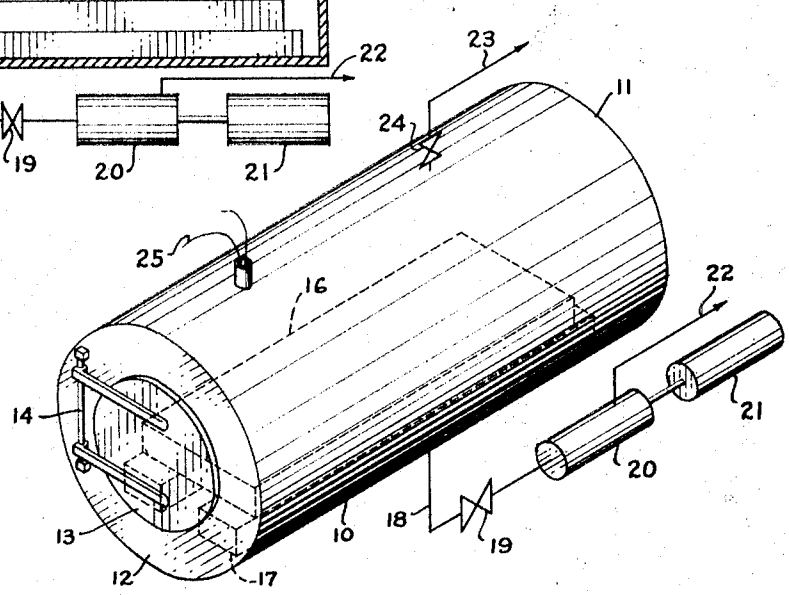


Fig. 2

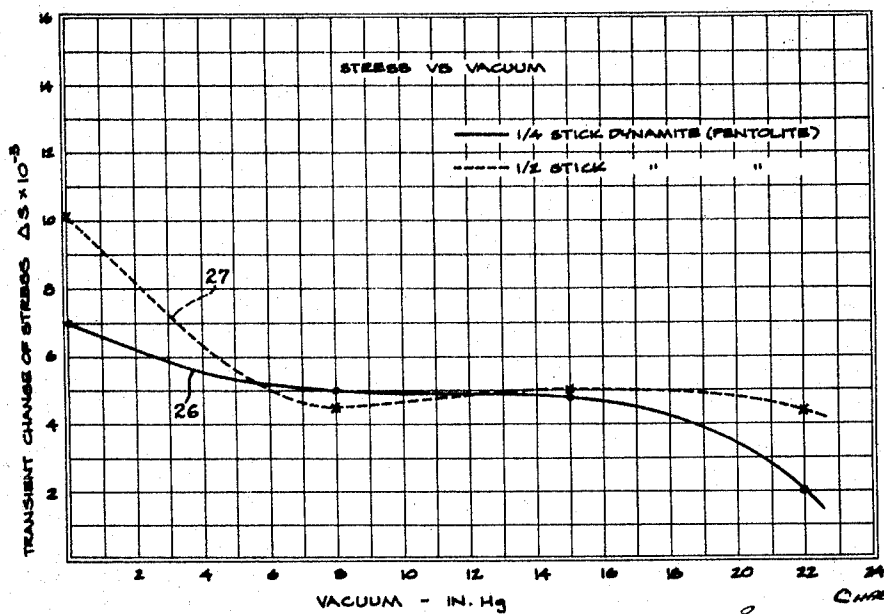


Fig. 3

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APPARATUS FOR METAL WORKING WITH EXPLOSIVES

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U.S. Cl. 72—56 1 Claim

ABSTRACT OF THE DISCLOSURE

Apparatus for metal working with explosives in a chamber and under conditions of vacuum or partial vacuum thus attenuating the shock wave and enabling the apparatus to be used indoors.

This invention relates to new and useful improvements in apparatus for metal working with explosives.

Well established metal working techniques using explosives have been in use for many years and such metal working being used for forming, welding cladding, embossing and compacting metal powders.

Due to the relatively large shock waves generated by the explosive, it is normal to practice such techniques in remote areas and out of doors.

I have found that the shock wave can be greatly attenuated if the explosion takes place in a vacuum or near vacuum.

This not only attenuates the shock wave but enables smaller charges to be used due to the fact that the shock wave is not dissipated externally so that the majority of the shock wave can be used for the metal working process.

The principal object and essence of the invention is therefore to provide apparatus for metal working with explosives under conditions of vacuum and within an enclosure such as a tank or the like.

Another object of the invention is to provide a device of the character herewithin described which enables metal working techniques by explosives to be undertaken indoors under controlled conditions of manufacture.

A yet further object of the invention is to provide a device of the character herewithin described which is simple in construction, economical in manufacture, and otherwise well suited to the purpose for which it is designed.

With the foregoing in view, and all those objects, purposes or advantages which may become apparent from consideration of this disclosure and specification, the present invention consists of the inventive concept embodied in the method, process, construction, arrangement of parts, or new use of the same, as herein particularly exemplified in one or more specific embodiments of such concept, reference being had to the accompanying figures in which:

FIGURE 1 is a schematic partially sectioned view of the apparatus used in the present invention.

FIGURE 2 is an isometric view of the tank.

FIGURE 3 is a graph showing the stress on the tank walls with the vacuum pressure therewithin and illustrating two charges at different levels of vacuum.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding therefore to describe the invention in detail, one embodiment of the apparatus utilized is shown in FIGURES 1 and 2. It consists of a cylindrical steel container or tank **10** having ends **11** and **12**. An access door **13** is provided in the end **12** of the tank and is mounted upon hinge mounting **14** and is secured by means of a suitable latch (not shown), it being understood that this access door is in sealable connection with the access aperture (not illustrated) in the end wall **12** of the tank so that the tank may be hermetically sealed.

A suitable work support **16**, substantially rectangular in configuration and approximately 2 inches thick, is provided inside the tank.

The support **16** is mounted upon supporting members **17** running in spaced and parallel relationship longitudinally along the base of the tank.

A conduit **18** connects with the interior of the tank and is connected via a control valve **19**, to a vacuum pump **20** which in turn is operated by motor **21** and the exhaust from the vacuum pump is shown schematically at **22**.

A vent **23** is also provided within the tank controlled by valve **24**, for the discharge of the explosive fumes after the explosion has taken place.

Electrical conduits **25** also lead into the tank and are connected externally to a conventional electrical power source, it being understood that these conduits are connected to the explosive (not illustrated) upon the steel floor and in conjunction with the metal to be worked. However, as the working of metal by explosives is well known it is not believed necessary to describe this further.

In operation, the vent **23** is closed by means of valve **24** and the metal to be worked is placed on the steel floor **16** together with the necessary explosive which is connected to the detonator wires **25**.

The access door **13** is then closed and locked and valve **19** is opened, whereupon motor **21** operates the vacuum pump to lower the pressure within the tank to the desired degree.

When this vacuum has been reached, the valve **19** is closed and the motor **21** is shut down whereupon the detonator is fired thus initiating the explosion.

Valve **24** is then opened allowing the fumes to vent whereupon the completed work piece may be removed.

The graph shown in FIGURE 3 is illustrative of the attenuation obtained by the explosion under the conditions of vacuum.

The solid line **26** shows the results of a quarter of a stick of dynamite (pentolite) exploded at atmospheric pressure, at 8 inches of mercury vacuum, at 15 inches of mercury vacuum, and at 22 inches of mercury vacuum.

It will be noted that at atmospheric pressure, the transient hoop stress recorded in the walls of the changer is approximately 7000 p.s.i.

This stress drops to 5000 p.s.i. with 8 inches of mercury, just below 5000 p.s.i. with 15 inches of mercury and to 2000 p.s.i. at 22 inches of mercury. This last figure represents an attenuation of 71%.

The dotted line **27** shows the results with a half stick of dynamite exploded at the same levels and indicates approximately 55% attenuation.

I have also exploded a complete stick of dynamite (⅓ of a pound) in a 6 ft. x 15 ft. chamber at 25 inches Hg vacuum without harmful effects being noted.

It should also be stressed that the same amount of deformation or useful work can be accomplished with a smaller charge due to the fact that more of the energy released at the work space is usefully employed rather than being dissipated in the surrounding medium by shock waves as is the usual case when this work is being done at atmospheric pressure.

What I claim as my invention is:

1. An apparatus for attenuating shock waves incident to deformation of metallic work by explosive action, said apparatus comprising a hermetically sealed cylindrical tank disposed in a horizontal position, a hinged access door provided in one end of said tank, an elongated work support extending longitudinally on the bottom of said tank, a valved suction conduit communicating the tank with an air pump whereby air pressure in the tank may be reduced to a predetermined degree of vacuum, electrical conductors extending into the tank for exploding an explosive charge therein, and a valved vent conduit for venting products of explosion from the tank to the atmosphere after the charge has been exploded.

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