Aug. 6, 1946. E. K. LEFREN 2,405,507

CHARGER FOR EXPLOSIVES

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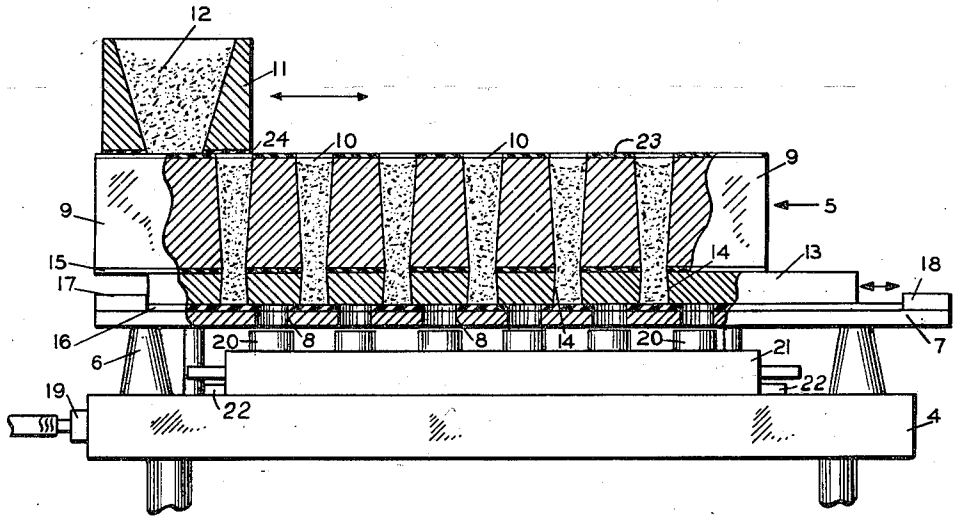

FIG. 1

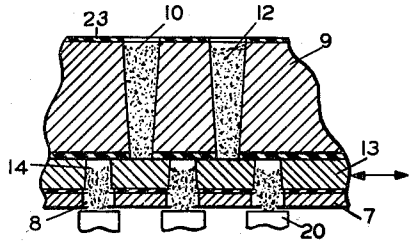

FIG. 2

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CHARGER FOR EXPLOSIVES

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3 Claims. (Cl. 222—197)

1

This invention relates to an improved machine for charging detonator shells and similar articles with explosives.

Heretofore equipment used for the charging of detonator shells with explosives has not been provided with means adapted to insure a uniform weight of charge of explosive. It is common practice in charging detonator shells to dump the explosive on the top side of a charging plate consisting of a plurality of explosive receiving bins or openings each having a fixed volume. The explosive is then moved across the face of the plate by means of a wiper thereby filling the openings. The excess explosive spills over the edges of the charging plate into a suitable catch means. The charging plate is then moved into shell loading position in order to dump the fixed volume of explosive into a detonator shell. This method of charging by spilling the explosive into the charging plate openings permits considerable variations in the weight of the charge of explosive delivered to each detonator or series of detonators, because variations occur in the volume of the charge (even though each opening in the charging plate is of the same volume) due to the tendency for the wiper or explosive moving means to carry a portion of the explosive out of the top of some holes and, in other cases, for the wiper to ride over the explosive leaving extra explosive on the charge plate opening. Furthermore, the weight of the explosive charge varies with the degree to which it is packed, which varies with the amount of explosive being moved across a particular charge plate opening. When varying weight charges of explosive are charged into a shell and the shell is subjected to a pressing operation, there is a tendency for the charge to be overpressed in the case where an excess of explosive is charged, and to be underpressed when an insufficient amount of explosive is charged. When the priming charge of a detonator is overpressed, a defective detonator results which detonator may fail to explode when put into use. Defective detonators are dangerous to work with and may result in loss of life.

Therefore, it is an object of this invention to provide a charging device for detonator shells and the like, whereby a fixed weight of explosive charge will always be delivered to the detonator, thereby insuring uniform pressing of the charge in the shell.

A further object is to provide means for charging a detonator with a fixed weight of explosive charge in an economical, efficient and safe manner.

2

Having now indicated in a general way the nature and purpose of this invention, there follows a more detailed description of the preferred embodiment thereof with reference to the accompanying drawing in which:

Fig. 1 is an elevational view, partly in section, showing the improved explosive charging device in charge receiving position.

Fig. 2 is a fragmentary view showing the device in charge releasing position.

Referring to the drawings, numeral 4 indicates a supporting means as, for example, a platform or a table supporting the explosive charger indicated generally at 5 through leg supports 6. An explosive releasing means or dump plate 7 is held in fixed position by means of said legs 6 in spaced relationship with said support 4. The dump plate 7 is provided with a plurality of openings 8 uniformly spaced throughout the plate. The number of openings depends upon the number of shells desired to be charged at a single operation and may be as many as 500.

Spaced from the dump plate 7 is an explosive storage means or plate 9 provided with a plurality of explosive receiving bins or openings 10. These bins may be conical in shape as shown and may have a capacity sufficient to receive enough explosive to charge five or more consecutive series of shells without the necessity of charging the bins with more explosive.

The bins are charged by means of an explosive storage means or hopper 11 adapted to be slidably moved across the face of the storage plate 9 and into registry with the openings 10. As each bin 10 comes into registry with the moving hopper the explosive 12, which may be mercury fulminate, diazodinitrophenol, pentaerythritol tetranitrate, etc., drops from the hopper into the bin. Movement of the hopper is regulated to permit complete filling of each bin.

An explosive charging means or fixed weight charge receiving plate or metering plate 13 is movably positioned between the storage plate 9 and the dump plate 7 and provided with explosive charge receiving openings or chambers 14. There are as many chambers 14 as there are bins 10 in the storage plate and openings 8 in the dump plate. In order to reduce to a minimum the possibilty of the sensitive explosive 12 being accidentally detonated through pinching which would occur should the explosive be caught between two hard surfaces, a soft rubber facing 15 and 16 is placed on the surface of the storage plate and dump plate, and soft rubber facing 23 and 24 is placed on the upper surface of storage plate 9

and on the lower surface of storage hopper 11 respectively. The charging plate 13 moves in sliding contact with and between the spaced rubber facings 15 and 16 between guides 17 and 18 which limit the movement of the charge plate and permit positive alignment of the chambers 14 with the bins 10 and with the openings 8, respectively. Other guides (not shown) prevent movement of the charging plate laterally to its normal movement.

A suitable vibrating means as, for example, the vibrating means 19 is attached to the table 4 and through its controlled operation the explosive 12 may be packed in the chambers 14 to a uniform density. Uniform density may be accomplished by other means as, for example, the bins 10 may be filled to the same level and in this way maintain a fixed static head of explosive which will exert a uniform packing effect on the explosive in the chambers 14, thereby resulting in an explosive charge having a uniform density. Since each chamber 14 is of the same volume and each chamber is uniformly packed, then each shell will receive a fixed weight charge of explosive.

Explosive receiving containers as, for example, detonator shells 20 are carried in a suitable support means as, for example, shell press block 21 which is slid on the top side of the table 4 beneath the charger 5. Each shell is moved into registry or axial alignment with a corresponding opening 8 in the dump plate 7 by reason of the fact that the shell press block 21 is guided into a predetermined position fixed by means of the guides 22 and other stop means (not shown) located on the far side of the table 4.

The charger is operated by first moving the chambers 14 out of registry with the bins 10 by moving the charging plate 13 to the right relative to Fig. 1. This movement closes the bottom of each bin. The hopper 11 is then moved across the face of the storage plate 9 slowly enough to fill each bin with the explosive 12. The charging plate is then moved to the left relative to Fig. 1 and the guide 17 stops the movement at a position where each chamber 14 is in registry with a corresponding bin 10. The explosive 12 drops from each bin into the chamber in registry therewith filling each chamber with a uniform amount of explosive. The charging plate is then moved to the right relative to Fig. 1 until each chamber is in registry with a corresponding opening 8 which movement is determined by means of the guide 18. The fixed weight charge of explosive drops through the opening 8 into corresponding detonator shells 20. The shell press block is then removed from the table and another series of shells are moved into position under the charger and the same procedure repeated.

Occasionally the density of a batch of explosive to be charged will vary in respect to the density of another batch of explosive. This density variation is a function of the grain size of the explosive. Thus, it may be readily seen that when the grain size of the explosive is unintentionally increased, a lesser number of grains are received in the chambers 10 and consequently the resulting density of the charge will be less under a given condition of packing than when the regular and desired grain size of explosive is charged under the same conditions of packing. Where the grain size is smaller than the desired grain size, a greater number of grains of explosive will be received in the chambers and consequently the resulting density of the charge will be greater than when a regular grain size is being charged. In order to compensate for these occasional density variations, it has been found that the vibrator 19 may be used to bring the density of the charge to a predetermined value regardless of the normal variation in grain size which may occasionally occur.

It is apparent that the objects of this invention have been attained by providing an improved machine for charging detonator shells; that the machine in accordance with the present invention permits uniform weight charging of detonator shells and the like, eliminates the spilling of explosive; all of which is accomplished in a more economical, efficient, and safe manner than heretofore realized.

What I claim and desire to protect by Letters Patent is:

1. In a device for charging explosive containers with a fixed weight of explosive, the combination of a storage plate having a plurality of explosive receiving bins therein; a storage hopper slidable over said storage plate; a dump plate with a plurality of openings displaced from axial alignment with said bins; and a metering plate in close fitting slidable relationship between said storage and dump plates and a plurality of chambers in said metering plate alignable in registry with the receiving bins and dump plate openings.

2. In a device for charging explosive containers with a fixed weight of explosive, the combination of a storage plate having a plurality of explosive receiving bins therein; a storage hopper slidable over said storage plate; a dump plate with a plurality of openings displaced from axial alignment with said bins; a metering plate in close fitting slidable relationship between said storage and dump plates and a plurality of chambers in said metering plate alignable in registry with the receiving bins and dump plate openings; and means for vibrating the aforesaid device.

3. In a device for charging explosive containers with a fixed weight of explosive, the combination of a storage plate having a plurality of explosive receiving bins therein; a storage hopper slidable over said storage plate; a resilient facing between the storage hopper and storage plate; a dump plate with a plurality of openings displaced from axial alignment with said bins; a resilient facing on the lower side of said storage plate; a resilient facing on the upper side of said dump plate; a metering plate in close fitting slidable relationship between resilient facings on said storage and dump plates and a plurality of chambers in said metering plate alignable in registry with the receiving bins and dump plate openings; and means for vibrating the aforesaid device.

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