

Dec. 11, 1923.

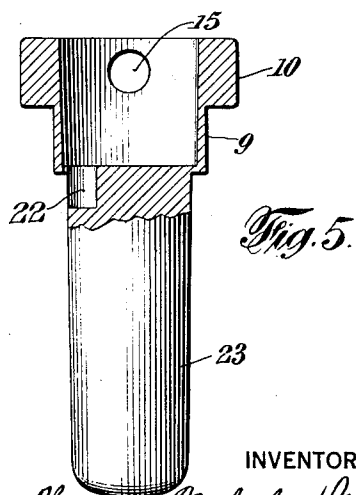
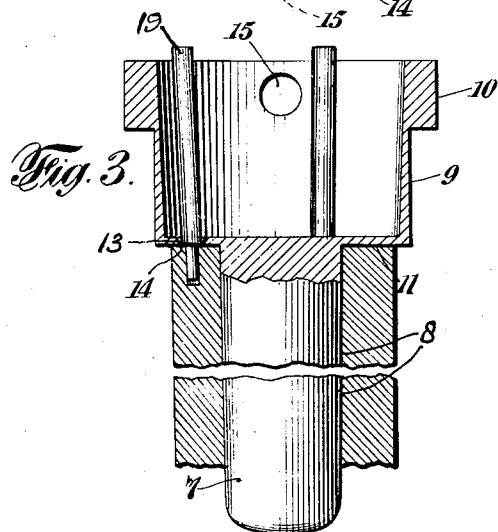
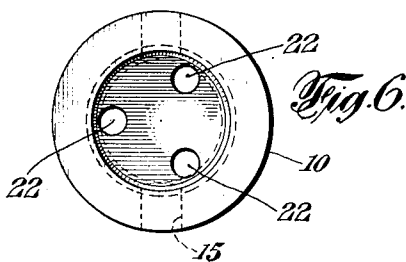
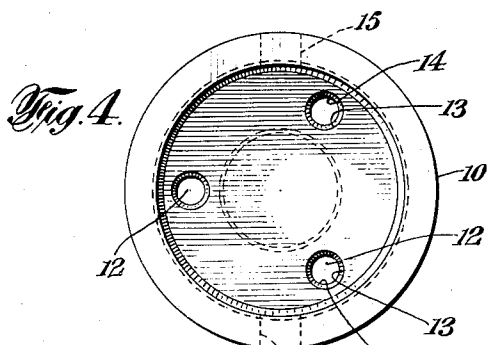
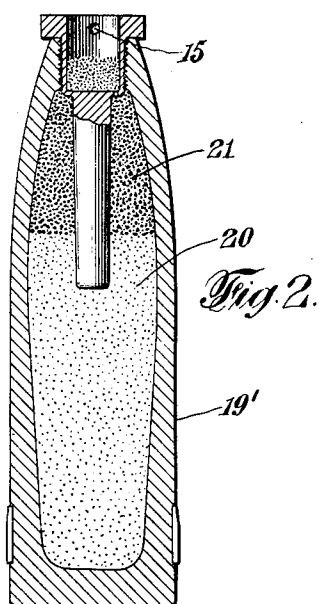
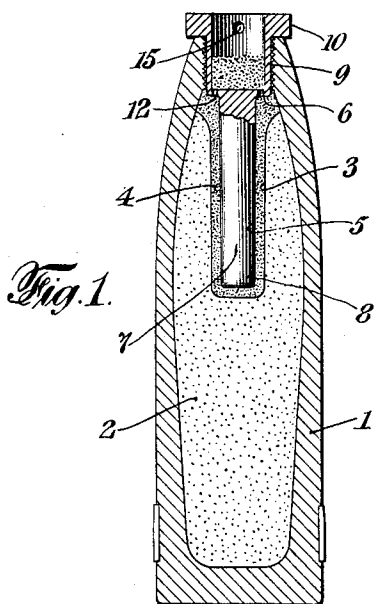
1,477,040

T. M. DAVIDSON

APPARATUS FOR FILLING CONTAINERS WITH EXPLOSIVES

Filed July 31, 1918

2 Sheets-Sheet 1



INVENTOR

Thomas Malcolm Davidson
BY
Pridle, Wright & Small
ATTORNEYS

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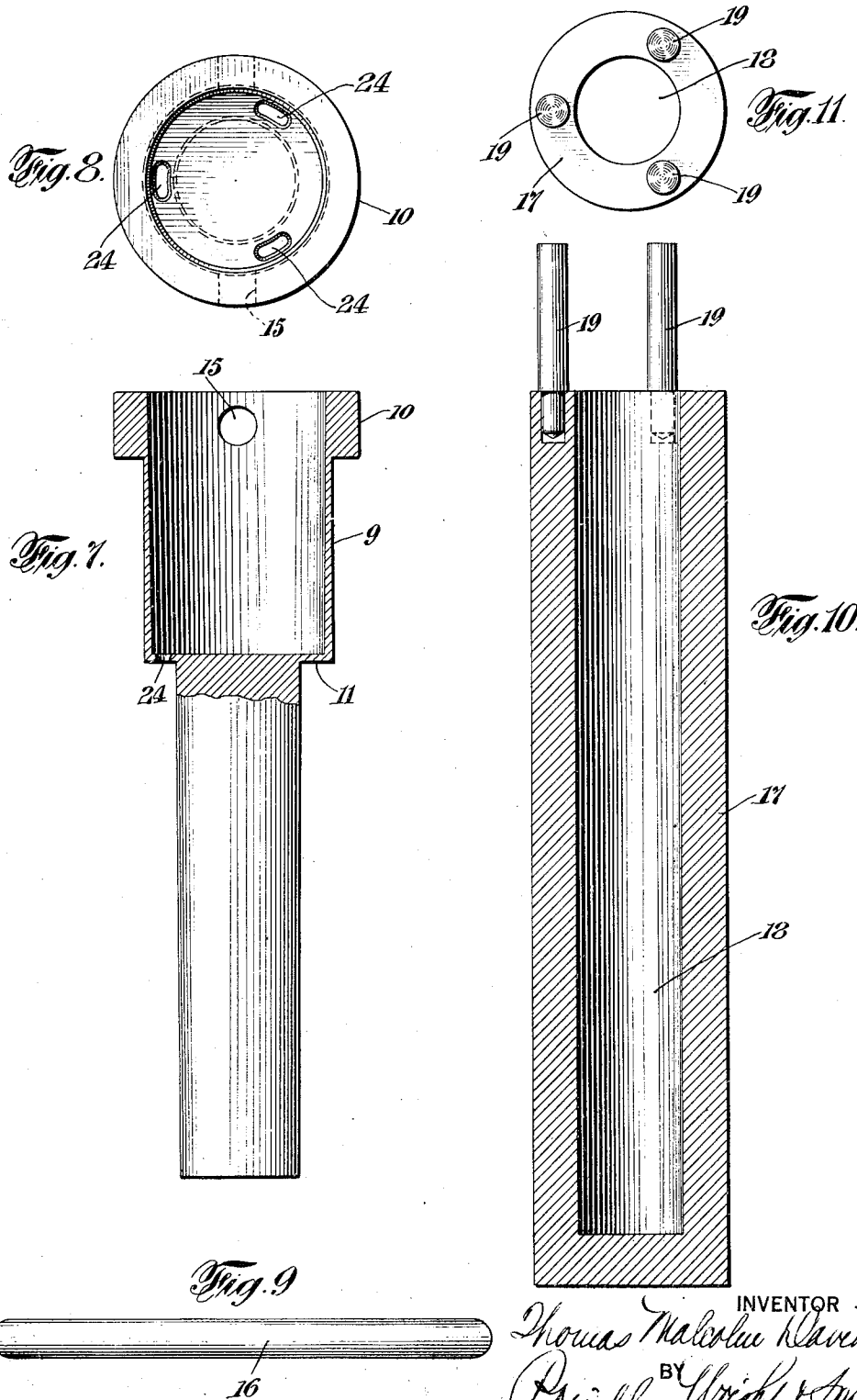
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APPARATUS FOR FILLING CONTAINERS WITH EXPLOSIVES

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2 Sheets-Sheet 2



INVENTOR
Thomas Malcolm Davidson
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UNITED STATES PATENT OFFICE.

THOMAS MALCOLM DAVIDSON, OF WILMINGTON, DELAWARE, ASSIGNOR TO E. I. DU PONT DE NEMOURS & COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

APPARATUS FOR FILLING CONTAINERS WITH EXPLOSIVES.

Application filed July 31, 1918. Serial No. 247,546.

To all whom it may concern:

Be it known that I, THOMAS MALCOLM DAVIDSON, a subject of the King of Great Britain, of Wilmington, in the county of New Castle and in the State of Delaware, have invented a certain new and useful Improvement in Apparatus for Filling Containers with Explosives, and do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates particularly to an apparatus designed for filling containers with explosives, but it has reference especially to the filling of explosive shells in this manner.

The object of my invention is to provide a device by means of which containers and particularly explosive shells may be filled with explosives in an expeditious and effective manner, and in such a way as to leave a cavity of the exact dimensions required for receiving a booster or other detonating agent. In the filling of explosives into containers of this character and particularly into shells, it is desired to pour the molten explosive into the container, but it is necessary to provide in the body of said explosive a cavity equipped with a shoulder, the same being of such dimensions as to accurately fit the booster or other detonating agent when inserted therein, and heretofore such cavity and shoulder have been made by drilling out the explosive after cooling. I have discovered that more advantageous results may be obtained by the use of a former and pouring the molten explosive into the container or shell around said former. By this means, the bodies of explosives with the desired cavities may be provided with a minimum amount of labor and time, as well as at a minimum cost. The object of my invention is, therefore, to accomplish these results while avoiding the disadvantages of previous apparatus used for this purpose.

Further objects of my invention will appear from the detailed description thereof hereinafter.

While my invention is capable of being carried out in many different ways, for the purpose of illustration I shall describe only one form of apparatus made in accordance

with my invention and shown in the accompanying drawings, in which:

Figs. 1 and 2 show an apparatus applied to the filling of shells.

Fig. 3 is a vertical section enlarged of the former used for the same with the punch shown in Fig. 10 inserted.

Fig. 4 is a plan view of the same.

Fig. 5 is a vertical section of a modified kind of former.

Fig. 6 is a plan view of the same.

Fig. 7 is a vertical section of another modified kind of former.

Fig. 8 is a plan view of the same.

Fig. 9 is a plan view of a rod used for detaching the former from the shell.

Fig. 10 is a vertical section of a punch used for removing the head of solid explosive from the former, and

Fig. 11 is a plan view of the same.

In the drawings, referring to Figs. 1, 3, 4, 9, 10 and 11 the apparatus is shown as applied to the filling of a shell 1 having a main body of pressed explosive 2 therein containing a cavity 3 which is to be filled with a molten explosive 4. In order to introduce the molten explosive 4 into the shell 1, and retain a cavity 5 with a shoulder 6 of such accurate dimensions as to exactly fit the booster or other detonator to be later inserted, a former 7 is introduced into the shell, the same comprising a downwardly directed tapered projection 8 having at its upper end a cup-shaped portion 9 provided with a flange 10 and a shoulder 11 adjacent to the projection 8, containing a plurality of holes 12 with bevelled edges 13 to provide cutting edges 14 for a purpose to be hereinafter described. The flange 10 has a plurality of oppositely arranged holes 15 to receive an operating lever 16, so as to detach the former 7 and the head of the body of explosive from the body of hardened explosive located in the interior of the shell 1, the rotation having the effect of cutting the body of explosive at the points where the holes 12 are located. After the former 7 carrying the head has been removed from the shell 1, the head may be removed from the former 7 by the use of a punch 17 comprising a hollow cylinder 18 adapted to fit over the extension 8, and a plurality of rods

or pins 19 to enter the holes 12, and push out the body of explosive. The parts shown in Fig. 2 are constructed the same as the parts shown in Fig. 1, but illustrated in this instance a different arrangement of the bodies of explosive in the shell from what is shown in Fig. 1. In Fig. 2 is shown a shell 19' having a main body of explosive 20, and an auxiliary body of explosive 21, which may be introduced in the shell while in a molten condition in the same manner as heretofore described.

The modification of my invention shown in Figs. 5 and 6 is the same as the form of my invention shown in Figs. 3 and 4, except that in this instance, the width of the parts is smaller, and feeding holes 22 are provided around the same, which extend for a short distance into a downward extending projection 23 located on this former.

The modification of my invention shown in Figs. 7 and 8 is constructed exactly the same as the form of my invention shown in Figs. 3 and 4, except for the proportions, and except for the use of elongated bevelled holes 24 which are made narrow to provide sufficient size for the feeding of the molten explosive without increasing the width of the former.

In the operation of my invention, referring first to Figs. 1, 3, 4, 9, 10 and 11, the shell 1 is filled with a body of explosive 2, such for example as amatol or T.N.T. (amatol=trinitrotoluol, $C_7H_5N_3O_6$, and ammonium nitrate, NH_4NO_3 . T.N.T.=trinitrotoluol as above) pressed into place in any suitable manner. Thereafter, the former 7 is inserted until the flange 10 rests upon the upper edge of said shell. A molten explosive, such for example as amatol or T.N.T. (amatol=trinitrotoluol, $C_7H_5N_3O_6$, and ammonium nitrate NH_4NO_3 . T.N.T.=trinitrotoluol) is now poured into the cup-shaped portion 9, and is fed through the openings 12 into the shell until all of the cavity below the openings 12 has been filled, and a quantity of the molten explosive extends above said openings. The molten explosive 4 is now allowed to cool and harden. While hardening, however, the shrinkage in the volume of the explosive is taken care of by the presence of the explosive in the cup-shaped portion 9, so that when said explosive has become entirely hardened the entire cavity below the cup-shaped portion 9 will be completely filled, thus providing a cavity with a shoulder of the exact shape and size required for receiving the booster or other detonating device to be inserted into the shell. The lever bar 16 is now inserted in one of the holes 15, and the former 7 is rotated, so as to cut the head of the explosive away from the body thereof located beneath the holes 12, by the aid of the cutting edges 14 provided around said holes 12. The

former 7 together with the head of explosive may now be readily removed, whereupon the shell 1 is ready to receive the booster or other detonating device, and finished in any desired manner. In order to remove the head of explosive from the former 7, the punch 17 is inserted over the projection 8 with the pins 19 opposite the openings 12, and the punch is now given a sharp blow which drives the head of explosive out of the former 7. The former is now in condition for use in filling the next shell in the same manner as above described, and the heads of explosive may be melted over again for filling succeeding shells. In this way shells may be filled with molten explosive in such a manner as to avoid the necessity of subsequently drilling out an accurately shaped and sized cavity for receiving the booster or other detonating device, while at the same time, the quantities of explosives left in the head are comparatively small, so that very little remelting of explosives is required.

The shell 19' shown in Fig. 2 is filled in the same manner, except that in this instance, the former 7 is inserted before any explosive is introduced into the shell, and then a quantity of molten explosive 20, as for example amatol or T.N.T. is poured into the shell. Thereafter, a quantity of molten explosive 21, as for example amatol or T.N.T. is also poured in in the same manner as the body of explosive 4 previously referred to.

The formers shown in Figs. 5, 6, 7 and 8 operate in the same manner as the former 7 previously referred to.

While I have described my invention above in detail, I wish it to be understood that within the scope of the claims many changes may be made therein without departing from the spirit thereof.

I claim:

1. A former designed to feed molten explosives through the base opening of a shell, said former comprising a depending extension, a cup-shaped portion for reception in said base opening and having its internal diameter approximating that of said opening, and an opening for feeding the explosive from the cup-shaped portion around the extension.

2. A former designed to feed molten explosives through the base opening of a shell, said former comprising a depending extension, a cup-shaped portion for reception in said base opening and having its internal diameter approximating that of said opening, and an opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located.

3. A former designed to feed molten ex-

plosives through the base opening of a shell, said former comprising a depending extension, a cup-shaped portion for reception in said base opening and having its internal diameter approximating that of said opening, an opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located, and the upper part of said former having means whereby an implement may be engaged for turning the former.

4. A former designed to feed molten explosives comprising a depending extension, a cup-shaped portion, a sharp edged opening for feeding the explosive from the cup-shaped portion around the extension.

5. A former designed to feed molten explosives comprising a depending extension, a cup-shaped portion, and a sharp edged opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located.

6. A former designed to feed molten explosives through the base opening of a shell, said former comprising a depending extension, a cup-shaped portion for reception in said base opening and having its internal diameter approximating that of said opening, a sharp edged opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located, and a hole at the upper edge for the insertion of a hand lever.

7. In combination, a former designed to feed molten explosives comprising a depending extension, a cup-shaped portion, an opening for feeding the explosive from the cup-shaped portion around the extension,

and a punch adapted to fit over the projection and provided with a pin to fit in the opening.

8. In combination, a former designed to feed molten explosives comprising a depending extension, a cup-shaped portion, an opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located, and a punch adapted to fit over the projection and provided with a pin to fit in the opening.

9. In combination, a former designed to feed molten explosives comprising a depending extension, a cup-shaped portion, an opening for feeding the explosive from the cup-shaped portion around the extension, said cup-shaped portion having a shoulder in which the opening is located, a hole for a hand lever provided at the upper edge, and a punch adapted to fit over the projection and provided with a pin to fit in the opening.

10. A punch for use with a former for cleaning the same, such former comprising a head portion and a depending extension, said head portion having an opening adjacent said extension; said punch comprising an extended member centrally recessed to be received upon and guided by said extension, and a pin extending forwardly from said recess said pin being spaced from said recess in correspondence with the spacing of said extension and said opening in said head portion.

In testimony that I claim the foregoing I have hereunto set my hand.

THOMAS MALCOLM DAVIDSON.

Witnesses:

C. LEON JOHNSON,

JAMES SHELTON BROWNE.