June 1, 1943. W. S. PILCHER 2,320,465

SHELL-FEEDING DEVICE

Filed Nov. 8, 1940 2 Sheets-Sheet 1

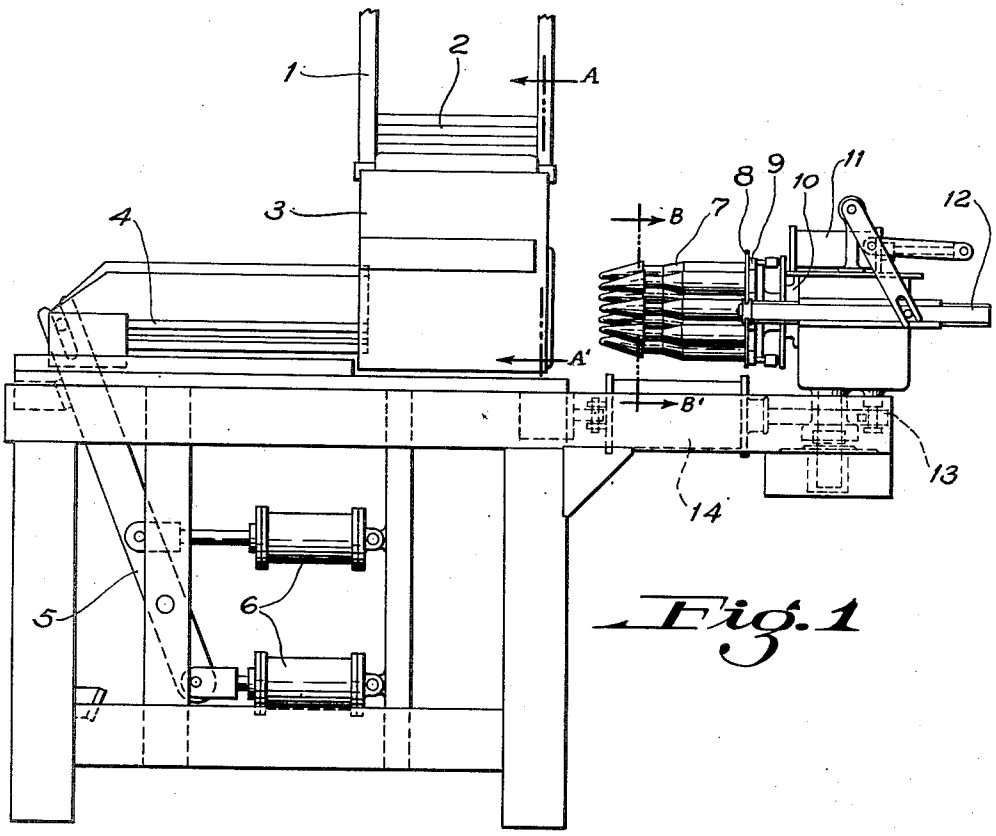


Fig. 1

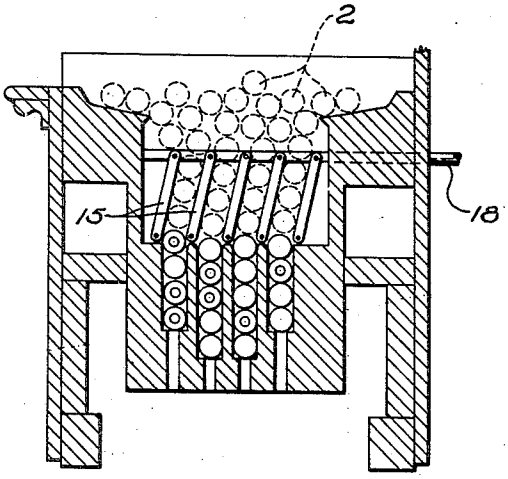


Fig. 2

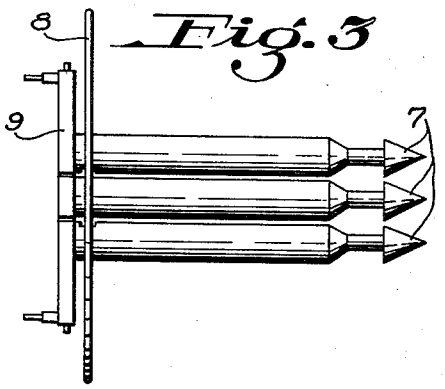


Fig. 3

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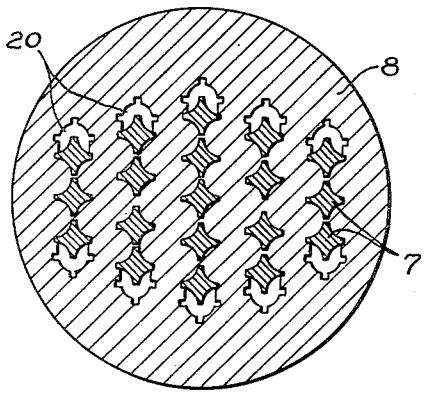


Fig. 4

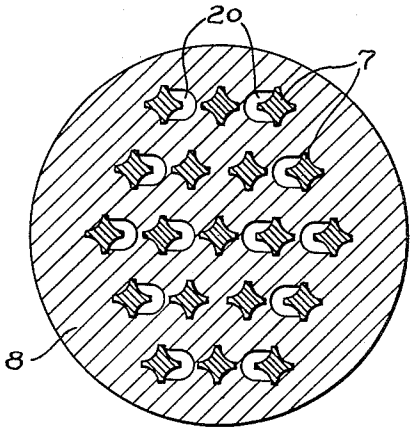


Fig. 5

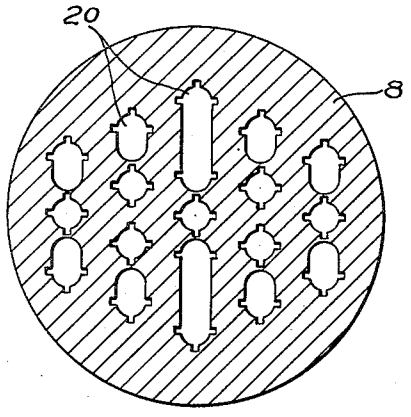


Fig. 6

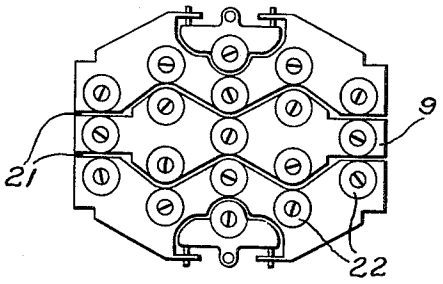


Fig. 7

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2,320,465

SHELL-FEEDING DEVICE

William S. Pilcher, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

Application November 8, 1940, Serial No. 364,768

8 Claims. (Cl. 86—46)

This invention pertains to an improved method and apparatus for feeding shells, particularly those employed in conjunction with explosives, such as dynamite.

Heretofore, empty shells have been fed automatically to the filling positions or stations, by loading the shells in a hopper from which they descend into a receiver adapted to align said shells in vertical tiers, each shell resting in a horizontal position. When in this position, a predetermined number of the shells at the bottom of the receiver are forced by plungers or fingers into a shell holder possessing a number of compartments equal to the number of shells forced from the receiver. Because of the fact that the shells are desirably spaced further apart at the time of loading with the explosive charge than they are when in the receiver, the compartments of the shell holder are tapered. Thus, the compartments or channels at one terminus afford openings in alignment with the shells as presented in the receiver; at the other terminus, due to tapering of the channels, they afford openings which correspond to those of the shuttle that retains the shells in fixed positions during the charging operation. The shell holder generally has pivoting means so that once the empty shells have been charged thereinto, it can be pivoted and swung around over the shuttle, so that the shells can be dropped into said shuttle by gravity, upon loosening the components constituting the shell holder. However, because of the tapering of the channels of the shell holder, the shells do not lie in a truly vertical position, but instead are somewhat inclined therefrom. Consequently, when they are released and permitted to drop into the vertical compartments of the shuttle, it is necessary for the shells, in effect, to change their direction somewhat. This difference in alignment between the channels of the shell holder and those of the shuttles prevents a truly smooth operation and necessitates frequent handling of the equipment before the shells attain the filling positions.

The object of the present invention is a novel method and apparatus for automatically feeding shells to their loading positions. Another object is an improved method and apparatus for feeding simultaneously a plurality of shells to positions wherein they can be loaded with explosive compositions, without necessitating manual handling. A further object is a novel device for receiving, supporting and spacing shells. Other objects will become apparent as the invention is described hereinafter.

The foregoing objects are attained by means of the apparatus shown in the accompanying drawings. Figure 1 is a general side elevation of the apparatus. Figure 2 is a detailed view in cross-section along the line AA', Figure 1. Figure 3 is a side view showing part of the projections and the base plate together with the stripper plate. Figure 4 is a cross-sectional view of the projections and stripper plate along the line BB', Figure 1. Figure 5 is the same view of the projections and plate as shown in Figure 4, except that it shows a different spacing of said projections. Figure 6 is a cross-sectional view of the stripper plate. Figure 7 is a view from the bottom of the base plate.

Similar numerals refer to similar parts throughout the different views.

The numeral 1 denotes a cage adapted to receive the shells 2 in the horizontal position in which they are shown. The cage rests upon the receiver 3, the construction of which is shown more in detail in Figure 2. As shown in this figure, the shells drop into the receiver, which is provided with inclined slopes adapted to feed the shells to the pivoted divisions 15 which, when activated via 18, serve to align the shells in vertical tiers and as such drop down into the open slots. Although only four slots are shown in Figure 2, it will be understood that any convenient number may be employed, and that such number influences the design of the device which serves to receive the shells therefrom. The shells are ejected from the receiver by means of the plungers 4, which are in alignment with the vertical tiers of shells and are designed to eject a predetermined number of the shells. Activation of the plungers is accomplished by motivation of the arm 5, which is effected by means of the air cylinders 6.

Ejection of the shells from the receiver causes them to become engaged with the pointed ends of the fingers on projections 7, the tip of each of these fingers or projections being in alignment with the center of a shell as it lies in the receiver. Each shell as it moves forward slips over a corresponding projection, which is adapted to receive said shell and to support the same. The stripper plate 8 is adapted to remove the shells after they have been properly spaced, whereas the base plate 9 serves not only as anchoring means for said projections, but likewise is capable of extension for proper spacing

of the projections. Pivoting of the shell feeding structure is effected by means of the air cylinder 11 through gears (not shown) in the gear box 10, and the stripper plate 8 is activated by the levers 12. The numeral 14 denotes an air cylinder in communication with 13 which shows linkage adapted to rotate the shell feeding device.

One species of projections shown in position to receive the shells from the receiver is shown in Figure 4, which likewise shows a cross-section of the stripper plate with the unoccupied portions of the apertures 20. As stated hereinbefore, the tips of the projections are in alignment with the center of the shells as they lie in the receiver. When employing the device shown in Figure 4, nineteen shells will be propelled simultaneously from the receiver and thus into contact with the corresponding number of projections. It will be noted that the projections are in vertical alignment and thus correspond substantially to the vertical tiers of shells in the receiver. However, the projections in vertical alignment need not be equally spaced from each other, but instead, for convenience of design, may be spaced at different intervals. Thus, the members in the second and fourth rows, as shown, are not equally spaced from each other. This inequality of spacing is adjusted by altering the shape of the contact end of the projection so that it is offset. However, in each case, the very tip of the projection must be in substantial alignment with the center of the shell as it comes from the receiver.

After the shells have slipped over the projections, the base plate 9 is extended to the open position by the means disclosed above. Figure 7 refers to one specific embodiment whereby the base plate can be made extensible. In that case, the plate in effect is composed of three sections, the middle section being separated from the outer as indicated by the separation 21. This construction permits various degrees of extension on the part of the various sections and consequently means that the projections may be moved varying distances.

When the shells engage the projections, they slip over the end thereof. As shown in Figure 3, the ends of said projections or fingers are conical in shape. In those cases where, for some reason or other, it is desirable to offset the body of the projection, it will be necessary for the shell to change direction as determined by the particular position of the projection over which the shell is moving. In such case the projection is characterized by a reduced cross-section, which affords the space necessary to take up the shell and thereby prevents ripping or tearing thereof. The shell then moves along to the main body of the finger which possesses a maximum cross-section only slightly less than the inside diameter of the shell being handled, so that said shell fits rather snugly thereover. A rather snug fit is important, in view of the fact that it is desirable not only to give adequate support to the shell so that proper spacing is assured but also to retain the shell while the distributor device is moved so that the shells can be fed to the shuttle.

Various methods and means can be employed for effecting spacing of the shells so that they will be in alignment with the holes of the shuttle employed for retaining said shells while they are being loaded with the explosive material. It is preferred, however, to employ an air cylinder as the source of energy because such source is conducive to safety, particularly when the compositions being handled are explosive in nature. The air cylinder communicates with known means for the transmission of energy, said means preferably being adapted simultaneously to pivot and rotate the distributor device while extending the base plate to cause spacing of the fingers. Thus, the distributor is pivoted about a horizontal plane a distance of 90 degrees, or such other distance as is necessary to align it with the shuttle which is held in the open position with the chambers thereof lying in a horizontal plane. At the same time that the distributor is pivoted, it is rotated through, say, a 90° angle in a vertical plane, extension of the device being effected during said rotation.

The position of the various components of the distributor, after rotation thereof, through 90 degrees, is shown in Figure 5. It will be noted that the fingers now occupy the sections of the apertures in the stripper plate which are toward the periphery of the same, thereby assuming a space relationship differing materially from that shown in Figure 4. The fingers are now in the open position and correspond to the chambers of the shuttle.

Once this position has been attained, the stripper plate is moved forward along the fingers and, since the apertures of said plate are sufficient to clear the fingers even in the presently spaced position (Figure 6), but are not sufficiently great to clear the shells fitted over said fingers, this movement causes the shells to be pushed forward. This motion of the stripper plate causes the shells to be ejected from the fingers and into the chambers of the shuttle with which they are aligned. The shuttle is then pivoted to the loading position wherein the chambers are in a vertical position, while closing said shuttle by means of a cam or the like.

It will be understood that the projections or fingers need not possess the form shown in the drawings. Instead, it is essential that they possess a design which is adapted to receive the shell and to support the same. Preferably, they should be capable of imparting some change in the spacing of the shells over the spacing arrangement obtaining when the shells are in the receiver, because it facilitates the design of the base plate to which the fingers are attached. Nor is it essential that the stripper plate be characterized by the apertures shown herein, since these are designed to permit movement of the fingers to both the open and closed positions, and yet permit contact of the plate with the shells supported by the fingers so that the shells can be suitably removed. Indeed, it is not absolutely essential that the shells be removed by means of a stripper plate, it being possible to effect their removal by the adoption of a finger provided with a channel through the body thereof and an aperture at the tip thereof so that air can be passed through the finger at the appropriate time. Removal of the shell in such case is effected by means of an air jet.

The fingers or projections of the distributor may be composed of almost any material which can be reduced to the desired shape. It is preferred, however, to employ wood, plastic or materials which are relatively soft. Metals which yield sparks upon impact are considered hazardous and thus are not attractive.

The adoption of the present invention provides a device and operation having distinct advantages over those known to the art. The device is relatively simple in construction and may

be activated by known means. When shells are fed by means of this apparatus and method, the operation is automatic and requires a minimum of attention.

Although the invention has been described in detail in the foregoing, it is evident that it permits of variations without departing from the spirit or scope thereof. As an example, the distributor is not limited to one capable of receiving shells when they are in alignment and in contact with each other as in the receiver shown in the accompanying drawings. Instead, it can be designed to receive shells from a receiver regardless of the manner in which said shells are distributed, provided said shells can be ejected from said receiver. I intend, therefore, only to be limited in accordance with the following claims.

I claim:

1. In a shell-feeding apparatus, a shell container, a distributor device provided with projections disposed in parallel relation and adapted to receive and support shells, means for pushing the shells from said container onto each of said projections, and means for extending said distributor and moving said projections into predetermined changed parallel positions.

2. In a shell-feeding apparatus, a shell container, a distributor device provided with projections disposed in parallel relation at all times and adapted to receive and support shells, means for pushing shells from said container onto each of said projections, and means for extending said distributor and maintaining the shells on said projections in alignment at all times.

3. In a shell-feeding apparatus, a shell container, an extendible distributor device provided with projections adapted to receive and support shells, said projections being disposed in parallel relation at all times, means for pushing shells from said container onto each of said projections, and a stripping plate in conjunction with said distributor having apertures for accommodating said projections in both constricted and extended positions and adapted to remove the shells from said projections when said projections are in extended position.

4. In a shell-feeding apparatus, a shell container, a distributor device capable of extension and provided with projections disposed in parallel relation at all times and adapted to receive and support shells, means for pushing shells from said container onto each of said projections when the distributor is in constricted position, means for extending said distributor, and a stripping plate in conjunction with said distributor adapted upon activation to remove the shells supported by said projections when said distributor is in extended position.

5. In a shell-feeding apparatus, a shell container, a distributor device capable of extension and capable of rotation away from the shell container, said distributor device being provided with projections disposed in parallel relation at all times and adapted to receive and support shells, means for pushing shells from said container onto each of said projections, a stripping plate in conjunction with said distributor permitting extension and contraction of said distributor and capable of removing the shells supported by said projections when said distributor has been extended and rotated, and means for extending and contracting said distributor during rotation.

6. In a shell-feeding apparatus, a distributor capable of expansion to a predetermined extended position, said distributor comprising a plurality of projections which are disposed in parallel relation at all times, one end of said projections being fixed, the other end being adapted to receive a shell from a vertical tier of shells in contact with each other and to support and retain said shell when the distributor is extended.

7. A method of feeding hollow shells, which comprises forcing shells lying in a horizontal plane with their open ends foremost into contact with a plurality of projections disposed in parallel relation and adapted to receive and support said shells, rotating said projections through a horizontal plane while spacing them to predetermined loci, and then contacting simultaneously the end surfaces of the open end of each shell and forcing them from the projections.

8. A method of feeding hollow shells disposed in parallel relation at predetermined spaced loci, which comprises forcing shells lying in a horizontal plane with their open ends foremost into contact with and about a similar number of projections in alignment with said shells, rotating said projections while spacing them in parallel relation to predetermined loci, and then contacting simultaneously the end surfaces of the open end of each shell by a member moving in a direction parallel to the longitudinal axes of said projections, and continuing the motion of this member until the shells have been removed from the projections.

WILLIAM S. PILCHER.

CERTIFICATE OF CORRECTION.

Patent No. 2,320,465. June 1, 1943.

WILLIAM S. PILCHER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 43, for "shuttles" read --shuttle--; and page 2, second column, line 42, after "essential" insert --only--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of July, A. D. 1943.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.

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(Seal)