

Dec. 20, 1938.

D. D. HUYETT

2,140,746

METHOD OF AND MEANS FOR PACKAGING ELECTRIC BLASTING CAPS

Filed April 18, 1936

6 Sheets-Sheet 1

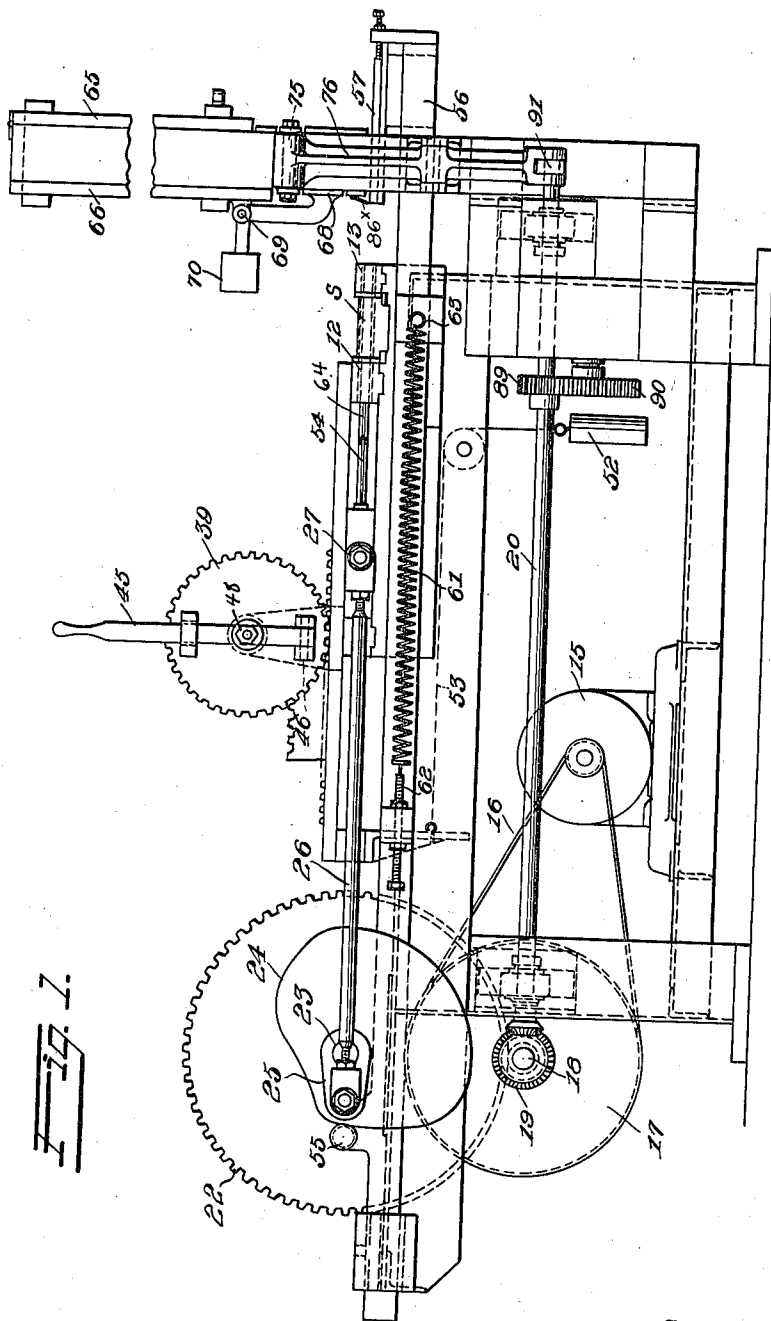


Fig. 1.

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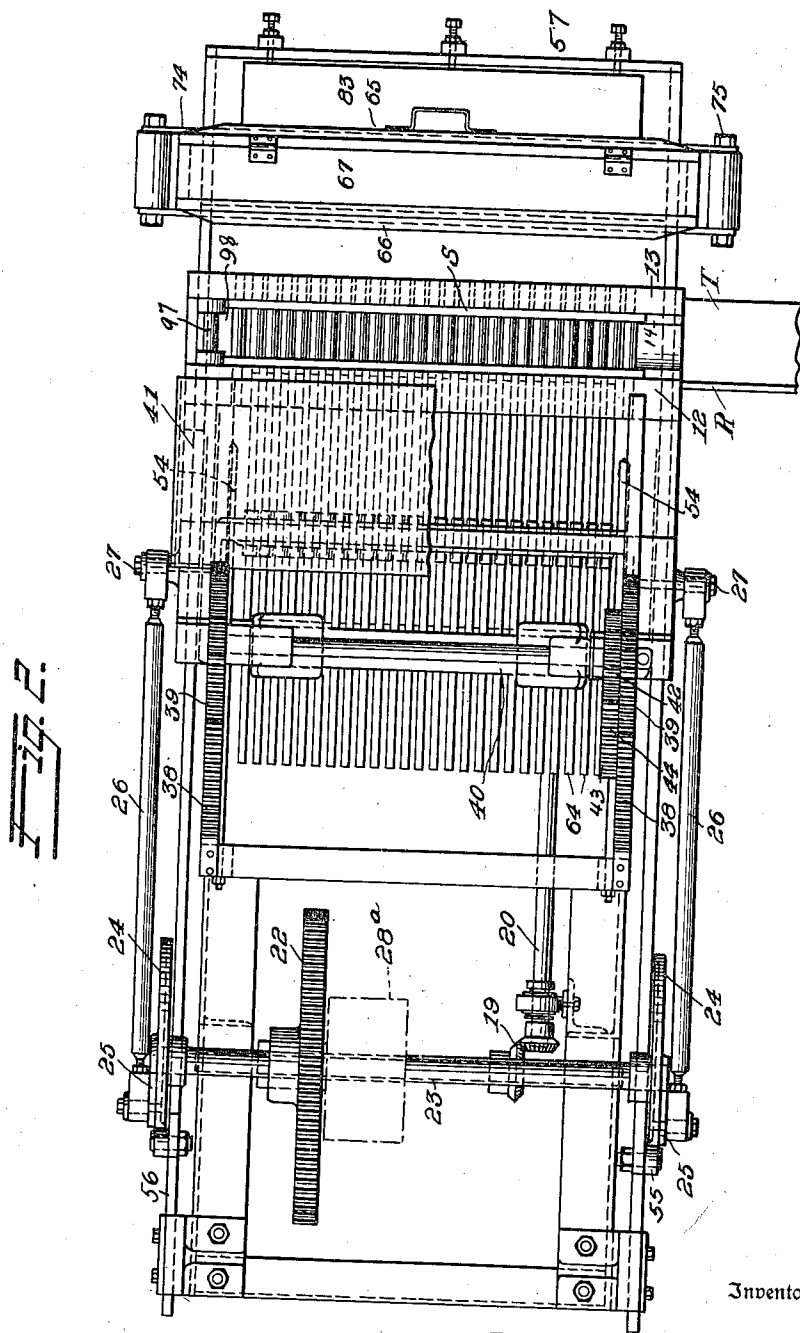
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6 Sheets-Sheet 2



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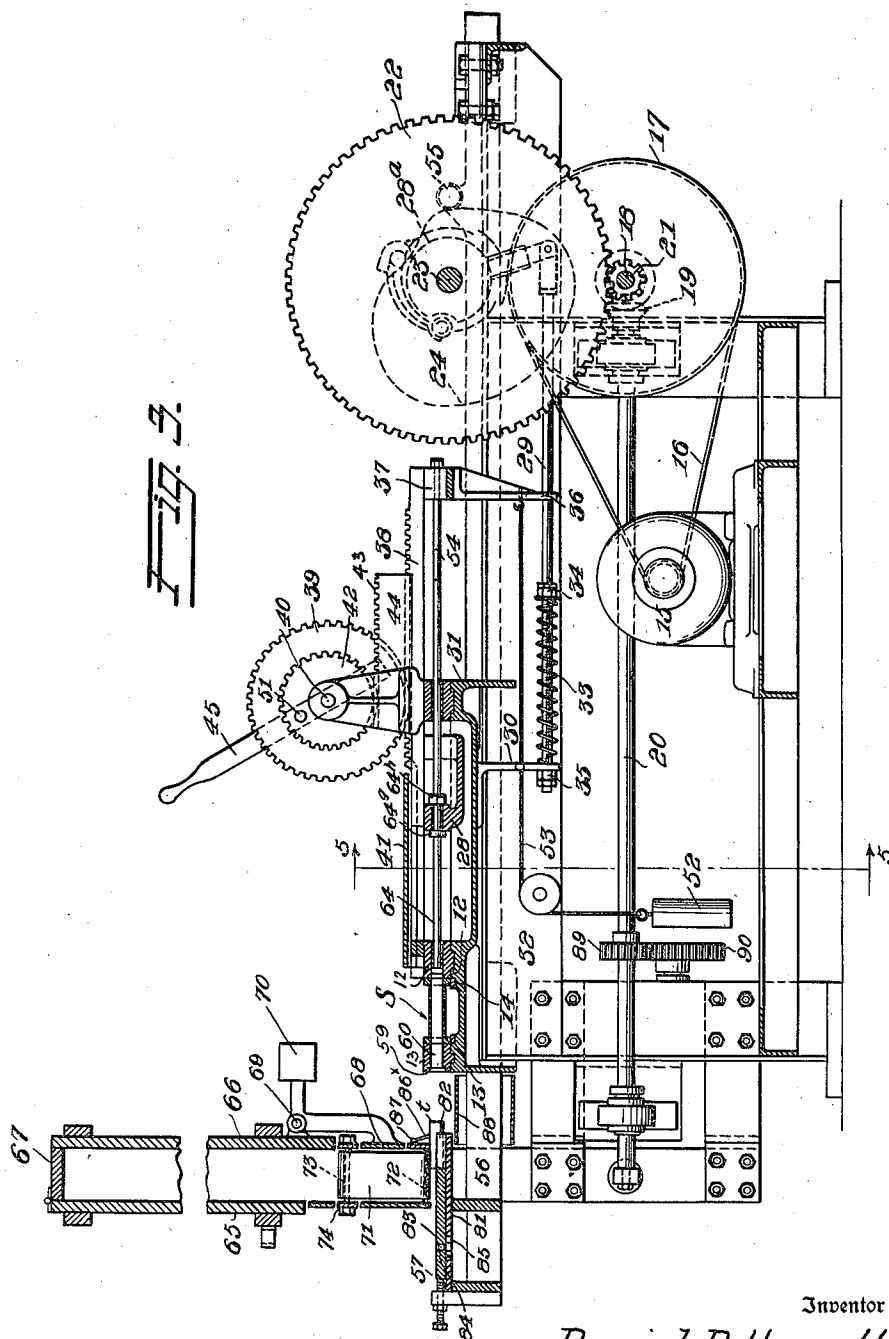
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METHOD OF AND MEANS FOR PACKAGING ELECTRIC BLASTING CAPS

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6 Sheets-Sheet 3



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6 Sheets-Sheet 4

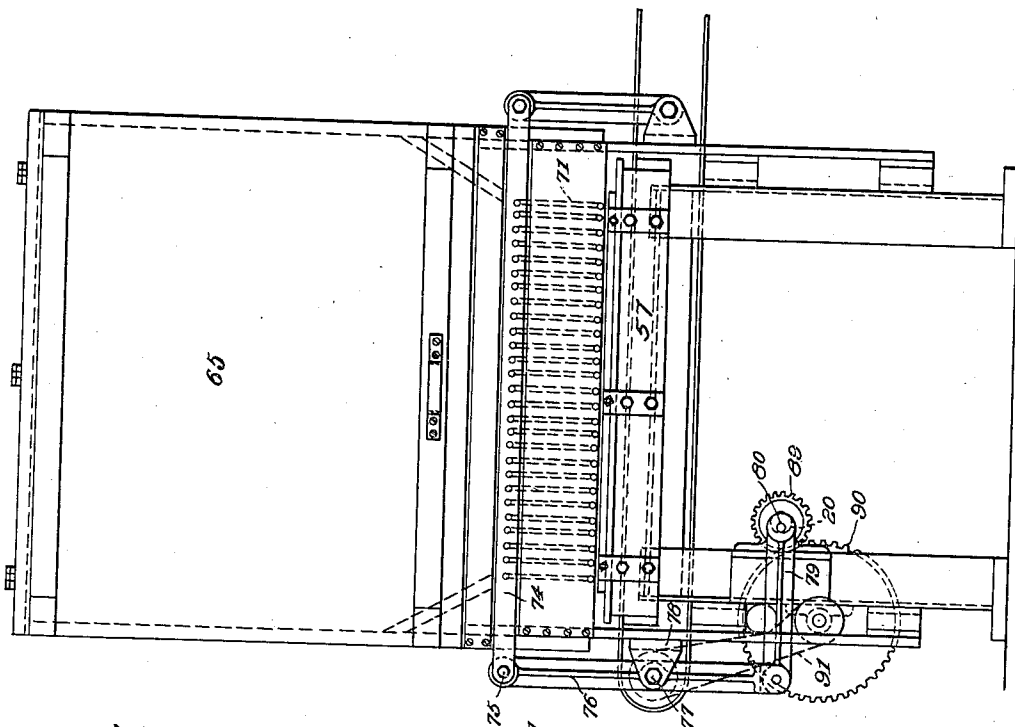
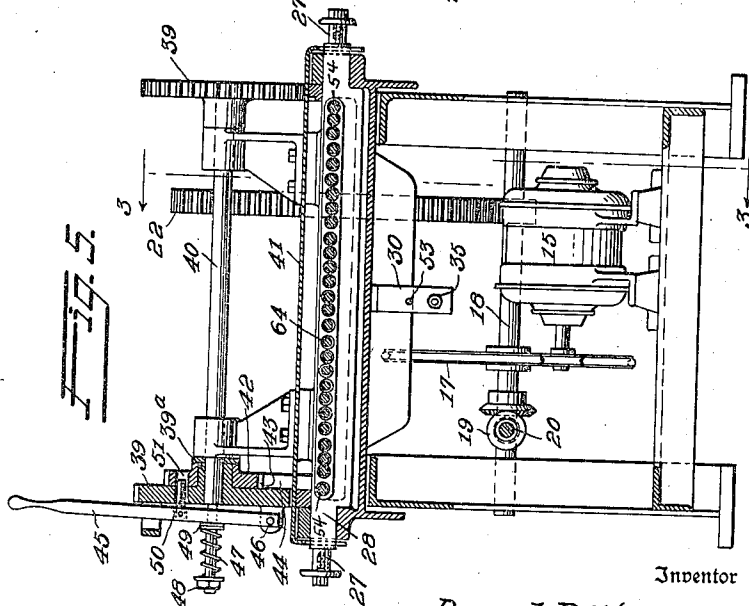


Fig. 4.



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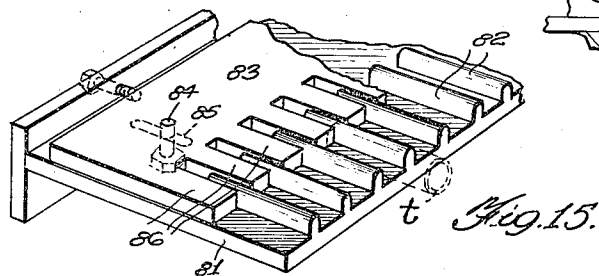
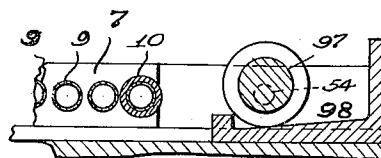
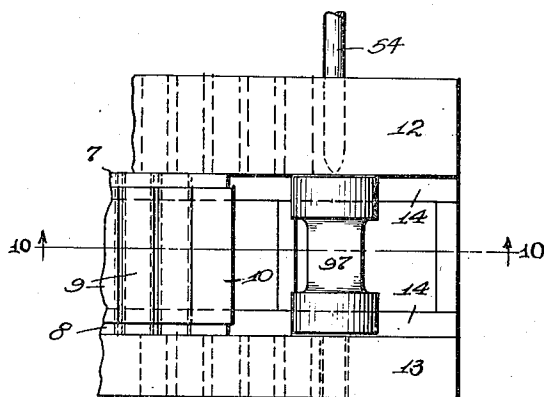
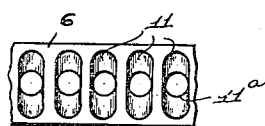
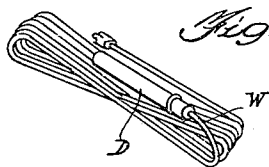
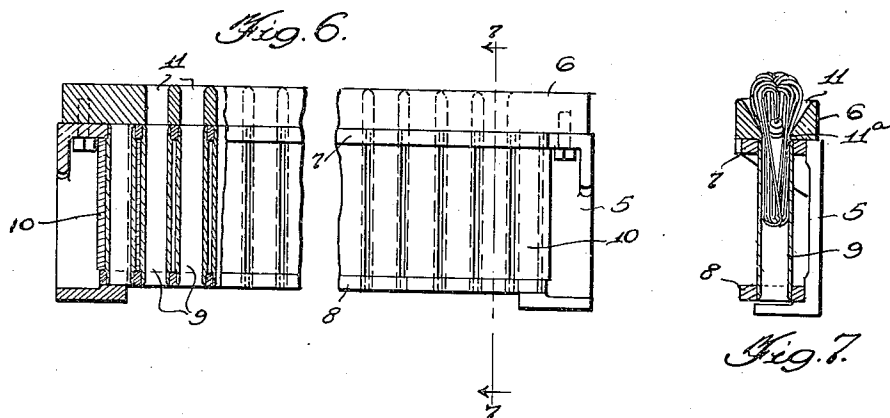
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METHOD OF AND MEANS FOR PACKAGING ELECTRIC BLASTING CAPS

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6 Sheets-Sheet 5



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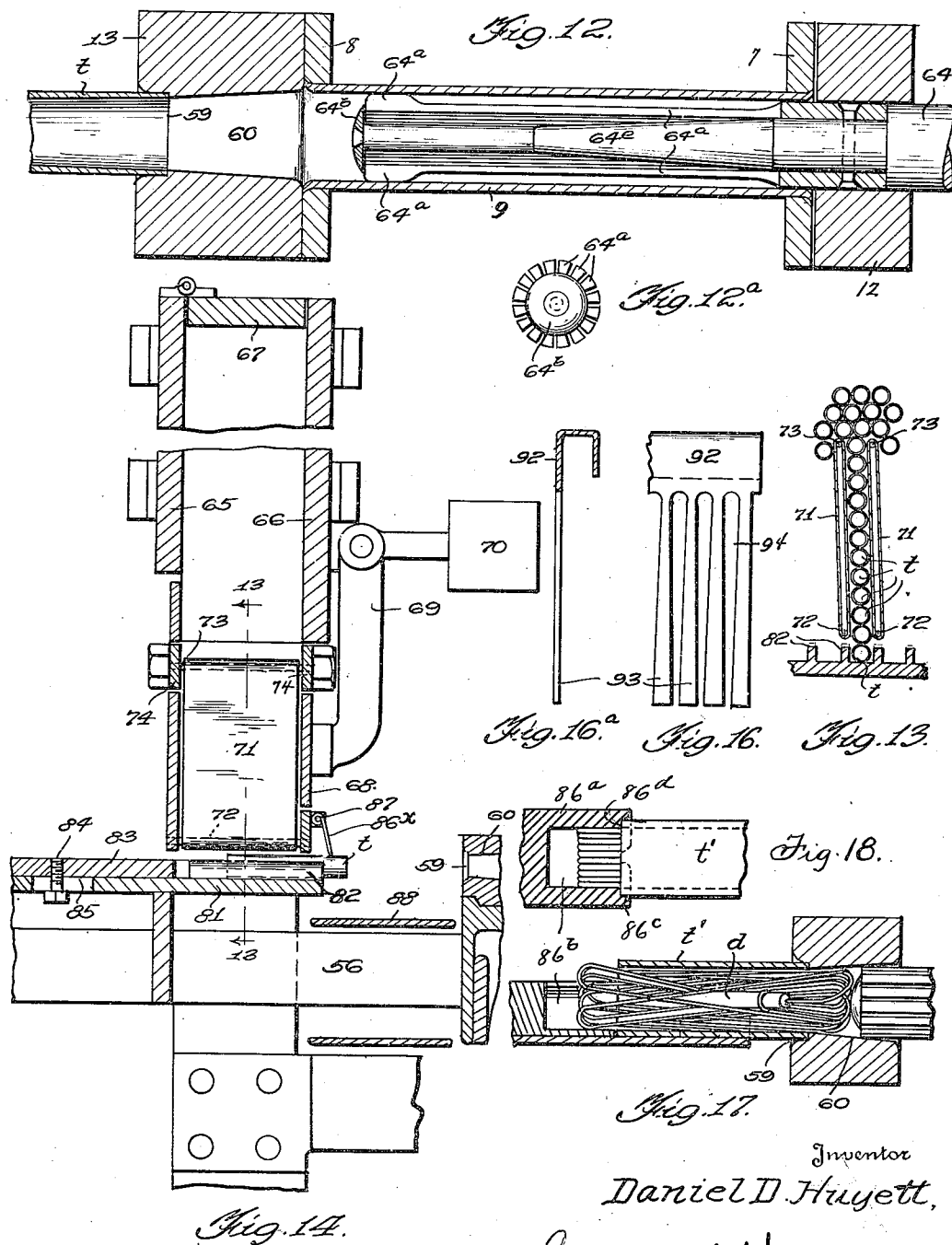
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METHOD OF AND MEANS FOR PACKAGING ELECTRIC BLASTING CAPS

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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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METHOD OF AND MEANS FOR PACKAGING
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Application April 18, 1936, Serial No. 75,170

19 Claims. (Cl. 86—1)

This invention relates to an improved method of and apparatus for packaging folded wires. While the invention is of general application in that many of its features may be employed in the packaging of folded wires in general, a very important field of usefulness for the same resides in its use in packaging electric blasting cap assemblies. These assemblies comprise a loaded detonator or blasting cap with the attached leg wires by which the detonator, when the time of use arrives, is, usually with a number of other detonators, attached to the firing cable of an electric blasting machine.

It is very well known that blasting caps are extremely sensitive; that they are easily exploded and that many persons have been killed and many others severely and painfully wounded by the accidental explosion of caps of this nature. Until comparatively recently these blasting cap assemblies were, when shipped to the trade, packaged in bulk. That is to say, a number of these assemblies were packed together in a single package, with the result that when the package was once opened the caps were likely to be scattered around more or less carelessly by the persons using them. Further, electric blasting caps are extremely sensitive with respect to their capability of being fired by electric currents of comparatively low strength, and many accidents have been caused by accidental setting off of these blasting caps by their leg wires coming in contact with a stray source of current and before they were attached to the firing cable.

To guard against the dangers indicated, the trade now demands the individual packaging of these blasting caps with their attached leg wires, and further, the industries, such as mining, quarrying, and the like, desire that in the packaging of the individual detonators the attached leg wires be so folded and maintained that when the time of use arrives the leg wires may be drawn out into straight line formation without any tendency for such wires to kink or tangle. One type of package adapted to accomplish the foregoing objects in a very simple and economical way is disclosed in United States Patent No. 1,983,141, issued to David M. McFarland, on December 4, 1934. The McFarland package comprises a cylindrical paper tube into which the detonator and its attached leg wires are slipped, the leg wires being folded back and forth in figure 8 formation, and the detonator being nested in the group of loops of wire in such fashion as to be at least partially covered thereby and be protected by the presence of said wires during shipment, storage, and up to

the time of use. It is desirable that the blasting cap assembly be inserted in its containing tube under at least a fair degree of compression because this not only reduces the packing volume, but insures that there will be such frictional engagement between the assembly and the tube that the wires and detonator will not accidentally slip out of the tube but must be designedly removed therefrom. Further, such arrangement holds the wire folds in such position as to insure against kinking when the leg wires are drawn out to straight line formation. While not being restricted in its use to that purpose, the present invention is admirably adapted to pack detonators in accordance with the McFarland disclosure in a rapid, economical and efficient manner and under such conditions as will insure the maximum of safety to the operatives employed about the packaging machine.

The detailed description may be followed with greater facility if it is first understood in a general way how the present machine operates.

A plurality of the blasting cap assemblies are placed by hand in the tubular compartments of a detonator bundle receiving and handling frame hereinafter called the carrier. This work is done before the carrier is placed in the machine of the present invention. This insures that the initial compression placed upon the detonator, up to the time it leaves human hands, will be relatively gentle and involve no danger to any human being. The filled carriers are brought to the machine along one flight of an endless conveyor while the empty carriers are returned for refilling along the other flight of the same conveyor. The filled carriers as they reach the machine are slipped into a suitably formed seat and an operator releases mechanism, operable under the influence of a relatively limited amount of power; such, for example, as the mere gravity action of a weight, which serves to locate the carrier firmly in place, to move a protecting barricade over the carrier to protect the operator in case of an accidental explosion, and finally to trip a single-revolution clutch to set in action positive, power-driven means for forcing the detonator assemblies out of the carrier and into the paper tubes in which they are to be packaged, the said assemblies being more forcibly constricted under the action of this power driven mechanism, during the operation of the single revolution clutch. As said clutch completes its revolution, the gravity actuated parts are restored to their original position, preparatory to repeating the operation.

While I have stated that the assemblies are

initially placed in the carriers by hand, I wish to make it clear that this initial filling of the carriers may be by machine without detracting from the efficiency of this machine in the charging of the assemblies into the packaging tubes and from the carriers.

Other details and advantages of the apparatus will be set forth in the description which follows.

In the accompanying drawings:

Figure 1 is a side elevation of one embodiment of the invention;

Fig. 2 is a plan view of the machine of Fig. 1;

Fig. 3 is a longitudinal sectional view through said machine, on line 3—3 of Fig. 5;

Fig. 4 is a rear end elevation of the machine;

Fig. 5 is a transverse vertical sectional view upon line 5—5 of Fig. 3;

Fig. 6 is a view partly in section and partly in front elevation of one of the carriers, showing the same associated with the elements employed at the filling station where the folded wires and detonators are initially placed in said carriers by hand;

Fig. 7 is a transverse vertical sectional view upon line 7—7 of Fig. 6;

Fig. 8 is a perspective view of one of the detonators and its associated leg wires before the leg wires are folded about the detonator and thrust into one of the compartments of the carrier;

Fig. 9 is a detail plan view of the carrier guide-ways of the machine, illustrating means for preventing the setting in operation of the machine until a carrier is in place;

Fig. 10 is a vertical sectional view on line 10—10 of Fig. 9;

Fig. 11 is a fragmentary plan view of the guide bar of Fig. 7;

Fig. 12 is an enlarged view of the die and one form of tamp which may be employed;

Fig. 12A is an end view of the tamp of Fig. 12;

Fig. 13 is a vertical sectional view through a pair of the vibrator plates on line 13—13 of Fig. 14;

Fig. 14 is an enlarged transverse sectional view through the magazine and feed plates as illustrated at the left-hand end of Fig. 3;

Fig. 15 is a detailed perspective view of a portion of the assembled feed table;

Fig. 16 is a detailed front view of a portion of a filler plate, hereinafter described;

Fig. 16A is a vertical sectional view of the filler plate;

Fig. 17 is a vertical sectional view through an assembly wherein the tube is shorter than the folded wires, showing the associated feed table, and

Fig. 18 is a partially horizontal sectional view of the tube of Fig. 17.

As previously stated, the first operation takes place at a station removed from the machine of Figs. 1 to 5. At this station, which may be termed the filling station, brackets 5 (Fig. 7), carrying guide bar 6, are arranged to receive and support the carriers to be filled. One of these carriers is clearly illustrated in Fig. 6, and by reference to that figure it will be seen that each carrier comprises a pair of plates 7 and 8 which are tied together by a row of tubes 9 which pass through said plates and have their ends spun out to hold them in place in said plates. These tubes constitute the receiving compartments for the detonator assemblies comprising the detonator D and leg wires W, see Fig. 8. In a machine which I have employed, there are twenty-seven tubes to each

carrier, twenty-five of which serve as detonator assembly receiving compartments while the pair of tubes at the ends are utilized for the reception of dowel pins, hereinafter described, by which the carriers are locked against accidental movement and properly aligned with other machine parts when the detonator assemblies are being forced out of these compartments and into their packaging tubes. These two end tubes are surrounded by tubular rubber bumpers 10 to prevent damage to other parts or any metal contact between the carriers while they are being handled or are traveling end to end on their transporting conveyors. In Fig. 7 I have illustrated one of the detonator assemblies partially thrust into the carrier and it will be seen that the guide bar 6 has a plurality of tapering guide recesses 11 (see Figs. 6, 7 and 11) which serve initially to constrict the wire loops about the detonator as said detonator and loops are thrust downwardly through the guide bar. It will be understood that there is one of these guide recesses 11 for each of the tubes 9 which constitute detonator assembly receiving compartments. I preferably elongate the recesses 11 toward their outer end portions so that these recesses do not present circular conical recesses at all points, but upon the contrary are of oval formation at their outer ends but taper to true circles 11^a, see Fig. 11, immediately above the bottom face of guide bar 6. However, true frusto-conical recesses may be employed, if desired. After a group of the detonator assemblies has been charged into a carrier, said carrier is placed upon one flight of a conveyor leading to the machine of Figs. 1, 2 and 3. In practice, one flight of the conveyor conducts the filled carriers to the machine while the other and return flight of the conveyor conducts the emptied carriers from the machine back to the filling station. The conveyor has not been shown since it constitutes no part of the present invention. It suffices to say that when a carrier reaches the machine it is removed by hand from the conveyor and placed upon a table, indicated at T in Fig. 2. This table is provided with a guide rail R by which the filled carrier, indicated as a whole by S, may be guided into place upon its seat in the machine, said machine comprising spaced bars 12 and 13 having depressed ways 14. The carriers slide upon these ways and lie between the bars 12 and 13.

The power for operating the machine is derived from any suitable prime mover, such as an electric motor 15. This motor drives through a belt or equivalent device 16 to a pulley 17 upon transverse shaft 18. This shaft in turn drives through the bevel gearing 19 to a longitudinally extending shaft 20. Shaft 18 also drives through spur pinion 21 and gear 22 to the main transverse drive shaft 23. Cams 24, mounted upon the outer end portions of shaft 23, carry integral crank portions 25. Longitudinally extending connecting rods 26 are engaged with these crank portions and with the bearing pins 27 of a reciprocatory crosshead 28. The gear 22 is not keyed upon the shaft 23, but upon the contrary is connected to said shaft from time to time through the medium of a conventional type of friction, single-revolution clutch indicated at 28^a. I prefer to employ a friction, single revolution clutch because of the smoothness of action of the same. This smooth action insures against shock or jar so objectionable about explosives. Single revolution clutches have acquired a distinct status in the art and any suitable type may be employed. It is sufficient to say that clutches of this type function to connect

a driving to a driven part in such manner that after the driven part has made one revolution under the influence of the driving part, the two parts are automatically disengaged.

The operating rod 29 of the clutch passes through a bracket 30 which depends from the fixed bed 31, said bed being in turn secured to the main frame 32 of the machine. A spring 33 bears between the bracket 30 and a washer and nut 34 upon rod 29. A second nut 35 on the rod limits its movement toward the right. The operating rod 29 also passes freely through a depending bracket 36, said bracket being carried by the transverse bar 39 of a carriage which comprises a pair of longitudinally extending racks 38. The teeth of this rack engage gear wheels 39 fixed to shaft 40. This shaft causes the gear wheels to move in unison and maintains the racks 38 in properly aligned relation. The carriage of which the racks 38 constitute a part, also comprises, at the forward ends of said racks, a metallic plate 41 which extends across the top of the machine and constitutes a barricade. This barricade overlies the carrier during the forcing of the detonator assemblies therefrom and consequently protects the operator of the machine from accidental injury if any of said detonators, through undue sensitivity or for any other reason, should be exploded during such forcing operation. Therefore, the term "blast-proof" is intended to distinguish the barricade 41 from a mere guard or grid such as is used in many types of automatic machines to prevent the operator from placing his hands in position to be injured by the mechanism. The blast-proof barricade of this invention is one which prevents the blowing out of explosive gases from the work being handled, beyond the confines of the machine. Loosely mounted upon the hub 39^a of one of the gears 39, see Fig. 5, is a smaller gear 42, the teeth of which mesh with rack teeth 43 of a rack bar 44, said rack bar being secured to and moving with cross head 28. A hand lever 45 is pivoted at 46 to one of the gears 39 and is thrust inwardly by the action of a spring 47, said spring acting between a stop nut and washer 48 upon the outer end of an extension of shaft 40 and a washer 49, the latter in turn bearing against lever 45. A lock pin 50, pivotally connected to lever 45, passes through an opening of the gear 39 and enters an opening 51 of gear 42. This is the position of the parts when the machine is at rest. After a carrier has been slipped laterally into the machine and properly positioned upon the ways 14, the machine is set in operation by the operator who grasps the hand lever 45 and withdraws the pin 50 from opening 51. Thereupon gears 39 start to rotate clockwise in Fig. 3, such rotation being under the influence of the rack bars 38 and said rack bars and their associated parts, in turn, being actuated by a weight 52 and cable 53, the latter being connected to the bracket 36 of the carriage, of which the rack bars 38 constitute a part. However, this movement of rack bars 38 and gears 39 is not partaken of by gear 42, which remains stationary. This gear remains stationary because it is meshed with rack bar 44, and this rack bar is in effect a part of the crosshead 28 which, at this time, is stationary. The initial movement of the parts described, under the influence of weight 52 projects a pair of dowel pins 54, (Figs. 2 and 3) through the outer end tubes of the carrier, thereby locking the carrier in place and properly aligning it with the remainder of the

mechanism. As soon as the gears 39 begin to move, as described, the pin 50 is carried out of alignment with the hole 51, so that even though the operator releases the handle, movement of said gears will continue to the proper degree. In addition to projecting the dowel pins through the carrier, forward movement of the rack bars 38 carries the barricade 41 forwardly and to protecting position over the carrier S. Forward movement of the rack bars 38 continues until the bracket 36 strikes the stop 34 and trips the single-revolution clutch. Thereupon, the cams 24 act through rollers 55 upon slidable side bars 56 to actuate a feed table 57, hereinafter described, to thrust a row of, preferably pasteboard, containing tubes *t* forwardly, so that their inner ends are seated in the mouths 59 of constricting dies 60, there being a row of the latter formed in the bar 13. The movement of the feed table 57 inwardly is against the tension of springs 61 which serve to hold the rollers 55 into engagement with the cams, said springs being adjustably connected to the side bars 56 by adjusting screw 62 and to a slide-bearing bracket at 63. When the crosshead 28 moves forward under the influence of the connecting rods 26, tamps or plungers 64 enter the rear ends of the tubular compartments of the carrier and forcibly thrust the detonator assemblies out of said tubes through the constricting dies 60 and into the tubular containers *t*.

By referring to Fig. 12, it will be seen that the dies taper from the carrier toward the tubes *t*, so that as the detonator assemblies are thrust therethrough, the wires are additionally constricted about the detonators. Therefore, when these assemblies are finally delivered into the pasteboard tubes *t*, they will, under their own tendency to spring back to their former condition, engage the interiors of the containers with sufficient friction to insure against the accidental slipping of the assemblies from these paper tubes. Further, this firm compression of the wires assures that they will maintain their position until the time of use arrives, it being understood that in the looping of these wires they are designedly folded so that they may be quickly drawn out to straight line formation without tangling. During the forward movement of rack bar 44 with the crosshead, gear 42 is caused to travel clockwise in Fig. 3 until its hole 51 again aligns with pin 50, at which time pin 50 is caused to snap into said opening under the influence of spring 47. In other words, gear 42 travels around and picks up gear 39 under the action of the pin 50 so that when the crosshead begins its return movement, rack bar 44 will move gear 42 counterclockwise and this will, in turn, carry the gears 39 back to their original position preparatory to repeating the operation. This return movement also returns rack 38, barricade 41 and dowels 64 to starting position. Movement of the crosshead to the right, and consequently movement of the gears 39, ceases when the single-revolution clutch throws out at the end of its cycle of operation.

The magazine or hopper in which the container tubes *t* are located comprises the rear and front walls 65 and 66. This magazine is preferably closed by a hinged cover 67. A gate 68, constituting part of the front wall of the hopper, is mounted upon hinges indicated at 69 and is kept closed by the action of a weight 70. By lifting this weight, the gate may be opened for purposes of inspection, loosening jammed tubes, etc. For

automatically ranking the tubes in a plurality of vertical rows, I provide a series of vibrating separating plates 71. These separator plates are hingedly mounted at their lower ends upon pivot rods 72, and at their upper ends they are connected, as indicated at 73, with longitudinally reciprocatory bars 74. These bars are pivotally connected at 75 to a vertical rock lever 76 the latter being pivoted intermediate its ends at 77 to a bracket 78. The lower end of the rock lever 76 is moved back and forth by a connecting rod 79. Connecting rod 79 is moved back and forth endwise by its engagement with an eccentric or crank 80 upon the rear end of shaft 20. As the plates 71 are vibrated back and forth, they work the tubes *t* downwardly in a plurality of vertical rows, and the lowermost tubes of the rows or ranks come to rest upon the feed table.

This feed table comprises a lower plate 81, the forward portion of which is provided with a series of upwardly projecting spaced strips 82 which form pockets between them for the tubes and which serve to space the tubes properly and to align them with the mouths 59 of the dies 60. A second plate 83 is engaged by bolts 84 which pass through slots 85 of plate 81. The forward edge of the plate 83 is provided with a series of fingers 86 which enter between the upstanding projections 82 and constitute stops for the rear ends of the tubes *t* to hold the tubes against the thrust of the tamps as the detonator assemblies are forced into said tubes. The adjustment provided by the bolts 84 and the slots 85 makes it possible to adjust the plate 83 to adapt the pockets between the projections 82 to receive paper tubes of varying lengths. The plate 83 is supported by the plate 81, and the plate 81 in turn is carried by and moves with the side bars 56.

The throw of the parts and the shape of the cams 24 is such that at the completion of any cycle of operation, the feed table has been moved forwardly to project a row of the tubes *t* a slight distance beyond the magazine and far enough to permit the operator to inspect the row of tubes to see that a complete row is in place and that none of the tubes are torn or bent out of circular formation. This is the position of the parts in Fig. 14. Then when the machine is again set in operation, the tubes are moved forward to engage the mouths 59 of the dies 60 in the manner hereinbefore described.

At the completion of the forward movement of the feed table, a swinging gate 86^a, which is pivoted at 87 to the front wall of the magazine, drops to vertical position, and its lower edge engages behind the ends of the row of tubes. When the feed table moves rearwardly, in the continued operation of the cams 24 and springs 61, this gate acts to thrust the filled tubes from the table, and they fall upon the upper flight 88 of a transversely disposed conveyor, by which the filled tubes are conducted transversely of the machine and to any desired point. The conveyor is driven from shaft 20 through the medium of pinion 89 (Fig. 4) which meshes with gear 90 and suitable belting or sprocket connections, indicated at 91.

The filler plate illustrated in Fig. 16 is, as its name indicates, a mere filling medium for reducing the effective width of the magazine when desired. The lower edge of this plate 92 is slotted to fit over the vibratory plates so that the legs 93 of the filler plate, which lie between the slots 94, project downwardly between the filler plates and

reduce the effective width of the magazine at the point occupied by the vibratory plates, the upper portion of the filler strip in like manner restricting the effective width of the magazine. The purpose of thus restricting the width of the magazine is to make it possible to adapt the machine of the present invention to handle tubes *t* of varying lengths.

Some users of the individually packaged detonators herein described desire the assemblies to be so packaged that while the detonators themselves lie within the tubes *t*, the wires are permitted to extend beyond the ends of the tubes.

In the structure of the McFarland patent, the tube was weakened at its center to permit it to be readily broken, so that the opposite halves of the tube could be easily pulled lengthwise from the detonator. However, it has been found that many miners, instead of breaking the tube, push the detonator assemblies endwise therefrom and throw the unbroken tubes on the ground. Where the wire loops are co-extensive in length with the tube and consequently the wires do not project beyond the tube, there is no way for a person to tell, at a glance, whether a tube lying on the ground is an empty and harmless tube or one accidentally dropped and containing a live detonator, dangerous to tread upon. The machine of the present invention is easily adaptable to the handling of shorter tubes and to the packaging of the detonator assemblies in these shorter tubes, with the wires projecting from the ends of said tubes.

Such an arrangement is illustrated in Figs. 17 and 18. Here the finger 86^a of the feed table engages the rear end of a tube *t'*, materially shorter than the wires of the detonator assembly, but preferably at least as long as the detonator indicated at *d*. When this arrangement is used, the movement of the parts is such that the tubes are moved into engagement with the mouths 59 of the dies 60, in the manner previously described, and the tamps force the assemblies into the tubes as they start forward.

However, when the assemblies have been forced into the tubes to about the position illustrated in Fig. 17, the table is quickly retracted from beneath the assemblies and tubes, leaving these assemblies held by those portions of the wires which are still in the dies. Then as the tamps continue to move forward, these portions are thrust out of the dies, and the filled tubes fall upon the conveyor 88, in the manner previously described. It will be apparent that the change necessary to effect the foregoing result is a very simple one, consisting merely of a change in the shape of the cams 24. The finger 86^a is recessed as indicated at 86^b for the reception of the projecting ends of the wire loops, and this finger is provided with a funnel mouth 86^c and a shoulder 86^d, the funnel mouth guiding the tube to its seating against the shoulder.

In actual practice, certain of the parts of the machine are made of brass and others are made of aluminum. No attempt has been made to indicate the particular materials employed, because it is manifest that this is merely a matter of choice upon the part of the engineer. It is common practice in explosives-packaging machines to utilize non-sparking materials in those places where a blow or friction might result in the creation of a spark such as would cause an explosion. It will therefore be understood that I contemplate employing non-sparking materials wherever good judgment dictates.

Referring now to Fig. 12, it will be seen that the tamps, which have heretofore been referred to in a general way by the reference character 64, comprise a plurality of resilient fingers 64^a, the free ends of which close in behind the head 64^b of a bolt-like ram 64^c, as the respective tamps move into the constricted portions of the dies 60. Since there are twenty-five of the tamps and twenty-five of the tubes of the carrier which receive detonator assemblies, it follows that each forward stroke of the crosshead results in packaging twenty-five of the detonators in their containing tubes *t*, and that this object is accomplished with no danger whatever to the operator.

It is desired to stress the fact that there would be considerable danger in manually placing the wires and detonators in a funnel and forcing them through a restricted opening by a plunger into a containing tube. Such action would involve the possibility of friction between the matchheads and the sulphur of the detonators should one of the matchheads be a little loose, and might result in a fatal explosion. Under my proposed method, the hand packing of the detonator and its leg wires into the carrier, as proposed in Fig. 7, is a safe and easy task, because this much of the operation can be carried out with the parts under so little constrictive pressure as to involve no danger, while the subsequent operation of forcing the detonator assemblies from the carrier into their packaging tubes takes place under such conditions that the operator is protected even if an explosion should occur. The term carrier as used in the appended claims is to be construed to mean an element within which the assemblies are temporarily placed and not the final packages in which they are delivered for use.

The shanks 64^d of the tamps carry collars 64^e and 64^f, which lie respectively in front of and behind the transverse member 28^a of the crosshead, so that the tamps are caused to partake of the movement of the crosshead. However, the collars 64^e are preferably secured upon the shanks 64^d by means of shear pins, so that if by reason of any binding or stoppage of a detonator assembly in its tube undue pressure should be created, the shear pin will shear off and permit additional forward movement of the crosshead without carrying that particular tamp with it.

It is desirable to provide means to prevent the machine from being set in operation until a carrier has been so positioned therein that no disastrous results would follow premature or unintentional starting of the machine. Such an arrangement is illustrated in Fig. 9, where it will be seen that I dispose upon the ways 14, along which the carrier slides to its position of rest, a spool-like roller 97. When the carrier is not in position, the roller 97 rolls down the inclined trackway 98 to a position where it lies in the path of one of the dowels 54.

Therefore, even though the operator might at this time move the operating handle to withdraw pin 50 from opening 51, the weight 52 could not move the racks 38 and the dowels 54 forwardly, because the dowels of Fig. 9 would merely come to a position of rest against roller 97. This in turn would prevent bracket 36 from moving far enough to trip the single-revolution clutch.

However, the act of sliding the carrier into place pushes the roller aside and permits the end tubes of the carrier to be brought into alignment with the dowels. After this, the machine may be operated as previously described.

While the elements shown and described are adapted to serve the purposes sought in a facile, economical and efficient way, it is to be understood that the invention is not limited to the precise arrangement shown, because it is apparent that the principles involved may, by skilled mechanics, be embodied in many different forms. Consequently, it is to be understood that the invention includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. A machine of the character described, comprising in combination a supporting frame which includes a fixed, horizontal frame member, a crosshead slidably mounted with respect to said frame member, a plurality of tamps carried by said crosshead, a row of dies tapered to compress blasting cap assemblies thrust through them, a carrier seat formed between said dies and the tamps upon the frame, a bodily removable carrier comprising a group of tubes shaped and dimensioned to receive detonator assemblies which align with said dies when the carrier is placed upon its seat and uniting means for said tubes, a magazine shaped and dimensioned to receive open ended container tubes and having an open bottom, a feed table upon which the lowermost tubes are received, means for moving the table to and from the dies, means upon the table for engaging the rear ends of the tubes to support them against the rear thrust of the tamps, and means engaging said tubes and holding them against rearward movement with the table whereby the tubes are discharged from the table upon rearward movement of the latter.

2. A structure as recited in claim 1, in combination with a blast-proof barricade, a reciprocatory part by which the barricade is carried, forward movement of said part moving the barricade to protective position with respect to the carrier, power means for actuating the crosshead and tamps, and means movable with the crosshead for restoring the barricade-carrying part to its original position upon movement of the crosshead away from the carrier.

3. A machine of the character described, comprising a row of dies extending transversely of the machine, a carrier seat rearwardly of said dies, a removable carrier comprising a plurality of compartments shaped and dimensioned to receive detonator assemblies which align with said dies when the carrier is properly positioned upon its seat, a feed table movable toward and from the dies and adapted to bring a row of container tubes into engagement with the mouths of said dies, a source of power, a main drive shaft, a single-revolution clutch constituting a connection between the source of power and the main drive shaft, means actuated from the main drive shaft for imparting movement to the feed table, a reciprocatory crosshead, a group of tamps carried thereby adapted to be projected by said crosshead through the compartments of the carrier to force blasting cap assemblies therefrom and through the said dies and into the container tubes, a reciprocatory carriage, a blast-proof barricade carried by said carriage and movable in the forward movement of said carriage to protective position over the carrier, said barricade being shaped and dimensioned to protect the operator from the effects of detonator explosions in the machine, means carried by said carriage for tripping the single-revolution clutch, and means

independent of the source of power for moving said carriage when the same is released.

4. A structure as recited in claim 3, wherein said independent means for actuating the carriage comprises a weight.

5. A machine of the character described comprising a fixed horizontal frame member, a carrier seat thereon, a row of dies extending across the forward side of the carrier seat and a row of
10 tamp guides extending across the rear side of the carrier seat, a carrier comprising a row of tubular members, a crosshead mounted to reciprocate toward and from the carrier, a group of tamps carried by the crosshead and operable by the
15 crosshead through the tubes of the carrier and through said dies, means for advancing container tubes in rows toward the mouths of said dies, a carriage mounted to reciprocate longitudinally with respect to the carrier and comprising a barricade shaped and dimensioned to protect the
20 operator from the effect of explosions in the machine, a rack along each of its sides and a connecting transverse part, a source of power, a main drive shaft, a single-revolution clutch constituting a connection between the source of
25 power and the main drive shaft, connections between the main drive shaft and the crosshead, a trip member for the single revolution clutch, and means carried by the barricade carrying carriage for engaging said member to trip the clutch
30 toward the completion of the movement of the barricade to protective position, means independent of the source of power tending to move the carriage toward the carrier, gear wheels engaged
35 with the racks of said carriage, a second gear wheel mounted in proximity to one of the first named gear wheels, a rack with which the last named gear wheel meshes, said rack being movable with the crosshead, and manually operable
40 interlocking means between the last named gear wheel and the gear wheel with which it is associated, release of said interlocking means by the operator permitting the carriage to move independently of the power means to move the
45 barricade to protective position and to trip the clutch, said interlocking means being so constructed that when the gear wheel which meshes with the rack of the crosshead is turned by the forward travel of the crosshead, said interlocking
50 means will again engage, so that upon the return travel of the crosshead, the carriage and barricade will be restored to their initial position.

6. A structure as recited in claim 5, in combination with dowels, carried by the said carriage, which traverse the said carrier to align the same
55 upon the forward movement of the barricade-carrying carriage.

7. In a machine of the character described, the combination with a barricade and dowel carrying carriage, of gravity means tending to move said
60 carriage in one direction, a power-driven crosshead and tamps carried thereby, juxtaposed rotative members, one of which is movable under the influence of the movement of the crosshead and the other of which is movable under the influence
65 of said carriage, and a manually-operable latch for connecting said rotative members.

8. A machine of the character described, comprising a source of power, a main drive shaft, a
70 countershaft driven by the source of power, connections between the countershaft and the main drive shaft including a single-revolution clutch, a longitudinally-extending shaft and gearing by which the latter shaft is driven from the countershaft, a conveyor driven from the longitudi-
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nally extending shaft and extending transversely of the machine, a plurality of fixed dies adapted to diametrically constrict detonator assemblies thrust through them, a magazine, a feed table
movable back and forth beneath the magazine
5 and over said conveyor, said feed table comprising means for engaging the rear ends of tubes delivered from the bottom of the magazine to thrust said tubes toward said dies, means for restraining said tubes upon reverse movement of the feed table to cause the tubes to be thrust from the feed table and deposited upon said conveyor, and members operable under the influence of the main drive shaft to thrust blasting cap assemblies through said dies and into said tubes.

9. A structure as recited in claim 8 wherein the means for thrusting the blasting cap assemblies through said dies includes a plurality of tamps, a crosshead by which the tamps are carried, connections between the crosshead and the main
20 drive shaft, a weight-operated carriage, and a blast-proof barricade carried by said carriage.

10. A structure as recited in claim 8 wherein the means for thrusting the blasting cap assemblies through said dies includes a plurality of
25 tamps, a crosshead by which the tamps are carried, connections between the crosshead and the main drive shaft, a weight operated carriage, a blast-proof barricade carried by said carriage, dowels carried by the weight operated carriage,
30 and a carrier adapted to be traversed by said dowels and comprising a plurality of assembly-receiving compartments aligned by said dowels with the said dies.

11. A machine of the character described comprising a carrier, a movable carriage, a blast-proof barricade carried by said carriage, a clutch controlled by the movement of said carriage, dowels for traversing the carrier, said dowels being carried by said carriage, a control element
40 for the machine, set in operation by movement of said carriage, and members movable out of the path of the dowels by the act of placing the carrier in the machine, which members, by preventing forward movement of the dowels, prevent
45 the setting of the machine into operation until a carrier has been properly seated in the machine, said carrier being provided with openings through which the dowels may pass to permit movement of the carriage after the carrier has been properly
50 positioned.

12. A machine of the character described comprising a carrier bodily removable from the machine and shaped to receive a blasting cap assembly comprising a bundle of longitudinally
55 folded wires and a blasting cap nested therein, a tamp operative through said carrier to thrust the blasting cap assembly endwise therefrom, a constricting die associated with said carrier, means for feeding a packaging tube to that side of the die opposite the carrier, the die exerting constricting action upon the blasting cap assembly as said assembly is thrust through the die and into said tube, a blast-proof barricade, a positioning means for the carrier, a control member, power means
65 for actuating the tamp, and means of restricted power independent of the power means, operable upon movement of the control member, for moving the barricade to protective position and for actuating the carrier positioning member.

13. A machine of the character described, comprising a row of dies extending transversely of the machine, a carrier seat rearwardly of said dies, a removable carrier comprising a plurality of compartments shaped and dimensioned to receive

detonator assemblies which align with said dies when the carrier is properly positioned upon its seat, a feed table movable toward and from the dies and adapted to bring a row of container tubes into engagement with the mouths of said dies, a source of power, a main drive shaft, a single revolution clutch constituting a connection between the source of power and the main drive shaft, means actuated from the main drive shaft for imparting movement to the feed table, a reciprocatory crosshead, a group of tamps carried thereby adapted to be projected by said crosshead through the compartments of the carrier to force blasting cap assemblies therefrom and through the said dies and into the container tubes, a reciprocatory carriage, a blast-proof barricade carried by said carriage and movable in the forward movement of said carriage to protective position over the carrier, said barricade being shaped and dimensioned to protect the operator from the effects of detonator explosions in the machine, means carried by said carriage for tripping the single revolution clutch, means independent of the source of power for moving said carriage when the same is released, interlocking means between the crosshead and the carriage, manually operable means for controlling said interlocking means, initial operation of said manually operable means releasing the carriage to permit it to move independently of the source of power to carry its barricade to protective position, movement of said carriage acting after the barricade has been so positioned in protective position to set the crosshead in operation under the influence of the power means.

14. A machine of the character described comprising a row of dies extending transversely of the machine, a carrier seat rearwardly of said dies, a removable carrier comprising a plurality of compartments, shaped and dimensioned to receive detonator assemblies, which align with said dies when the carrier is properly positioned upon its seat, a feed table movable toward and from the dies and adapted to bring a row of container tubes into engagement with the mouths of said dies, a source of power, a main drive shaft, a single revolution clutch constituting a connection between the source of power and the main drive shaft, means actuated from the main drive shaft for imparting movement to the feed table, a reciprocatory crosshead, a group of tamps carried thereby adapted to be projected by said crosshead through the compartments of the carrier to force blasting cap assemblies therefrom and through the said dies and into the container tubes, a reciprocatory carriage, a blast-proof barricade carried by said carriage and movable in the forward movement of said carriage to protective position over the carrier, said barricade being shaped and dimensioned to protect the operator from the effects of detonator explosions in the machine, means carried by said carriage for tripping the single revolution clutch, means independent of the source of power for moving said carriage when the same is released, interlocking means between the cross head and the carriage, manually operable means for controlling said interlocking means, initial operation of said manually operable means releasing the carriage to permit it to move independently of the source of power to carry its barricade to protective position, movement of said carriage acting after the barricade has been so positioned in protective position to set the crosshead in operation under the influence

of the power means, and carrier positioning and locking means carried by said carriage and movable to carrier engaging position as said carriage moves the barricade to protective position.

15. A machine of the character described comprising a magazine, a feed table reciprocable beneath said magazine, pockets upon said table adapted to receive tubes to be filled from said magazine, said pockets aligning with the magazine when the table is in retracted position, a filling means for said tubes associated with the magazine, said table moving the tubes toward filling position upon its forward movement, and means for imparting forward movement to said table in a two-step movement with an intermediate period of dwell, whereby said tubes are initially projected beyond the magazine and stopped for inspection and are then caused to resume forward movement toward filling position.

16. A machine of the character described comprising a frame having a seat and a bodily removable carrier, said carrier being shaped to fit upon said seat and including a row of open-ended compartments which, when the carrier is in place, extend across said machine, said compartments being so dimensioned that each is adapted to receive a detonator assembly consisting of a group of longitudinally folded leg wire loops and a detonator nested therein, said machine frame carrying a row of constricting dies aligned with the compartments of the carrier when the carrier is in position in the machine, said carrier being bodily removable from said machine for the charging of the detonator assemblies thereinto at another point, tube feeding means for moving a group of open-ended packaging tubes endwise against the discharge sides of said dies, a group of tamps movable through the compartments of the carrier for thrusting the detonator assemblies therefrom, power means for actuating said tamps in unison, a plate-like barricade movable horizontally along the machine frame and shaped when in projected position to overlie all of the dies, tamps and tubes, means for moving said barricade to its projected position over the carrier prior to the actuation of said tamps, and means movable in synchronism with the barricade and coming into operation only after said barricade has reached projecting position and near the termination of its projected movement, for setting the power means of the tamps in operation.

17. A machine for packaging blasting cap assemblies comprising a carrier bodily removable from the machine to adapt it to be filled at a separate station and consisting of a group of open-ended tubes, each of which is shaped and dimensioned to receive a detonator assembly comprising a bundle of longitudinally folded wire loops and a blasting cap associated therewith, a row of constricting dies and a seat for the carrier so located that when the carrier is seated thereon, the tubes of the carrier are aligned with the said dies, a group of tamps operable through the tubes of the carrier to force the detonator assemblies from said tubes and through said dies, a support for a row of packaging tubes, within which the assemblies are to be packed, and means for bringing about relative movement between said support and the dies, to thereby bring the packaging tubes into such juxtaposition to the dies that the blasting cap assemblies may be thrust by the tamps through the dies into said packaging tubes and be constricted by said dies in the action of passing therethrough, power

means for actuating said tamps, an imperforate barricade shaped and dimensioned to cover the constricting dies and tamps to protect the operator from the effects of an exploding detonator, a carrier positioning means movable with the barricade, and means for moving the barricade to protective position and thereby moving the carrier positioning means to engage and position said carrier, the movement of the carrier positioning means and the barricade being independent of the power means of the tamps on movement to protective position.

18. A machine for packaging blasting cap assemblies, comprising a carrier bodily removable from the machine to adapt it to be filled at a separate station and consisting of a group of open-ended tubes shaped and dimensioned to receive detonator assemblies, a row of constricting dies with which the tubes of the carrier are aligned when the carrier is seated in the machine, a group of tamps operable through the tubes of the carrier to force detonator assemblies from said tubes and through said dies, a support for a row of containing tubes within which the assemblies are to be packed, and means for bringing about relative movement between said tubes and the dies to bring said tubes into such juxtaposition to the dies that the assemblies may be thrust by the tamps through the dies into said tubes and constricted by said dies in the act of passing therethrough, said tubes of the carrier being shaped and dimensioned to receive blasting cap assemblies comprising a bundle of longitudinally folded wire and a blasting cap nested therein, the support for the containing tubes comprising a lower plate having a plurality of upstanding projections across its front portion, and an upper plate adjustably mounted upon the lower plate, in such

position that its forward edge constitutes stop portions against which the rear ends of said tubes abut.

19. A machine for packaging blasting cap assemblies, comprising a carrier bodily removable from the machine to adapt it to be filled at a separate station and consisting of a group of open-ended tubes shaped and dimensioned to receive detonator assemblies, a row of constricting dies with which the tubes of the carrier are aligned when the carrier is seated in the machine, a group of tamps operable through the tubes of the carrier to force detonator assemblies from said tubes and through said dies, a support for a row of containing tubes within which the assemblies are to be packed, and means for bringing about relative movement between said tubes and the dies to bring said tubes into such juxtaposition to the dies that the assemblies may be thrust by the tamps through the dies into said tubes and constricted by said dies in the act of passing therethrough, said tubes of the carrier being shaped and dimensioned to receive blasting cap assemblies comprising a bundle of longitudinally folded wire and a blasting cap nested therein, the supporting means for the containing tubes comprising a lower plate having a row of upstanding projections across its forward portion, between which said tubes are seated, and an upper plate adjustably mounted upon the lower plate and having a row of fingers, the forward ends of which fingers project between said projections and constitute abutments against which the rear ends of said tubes lie and by which rearward movement of said tubes is prevented during the thrusting of the blasting cap assemblies through the dies and into said tubes.

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