June 4, 1946. D. W. MOLINS ET AL 2,401,654

AMMUNITION HOPPER FOR USE ON AUTOMATIC GUNS

Filed Jan. 6, 1944 5 Sheets-Sheet 1

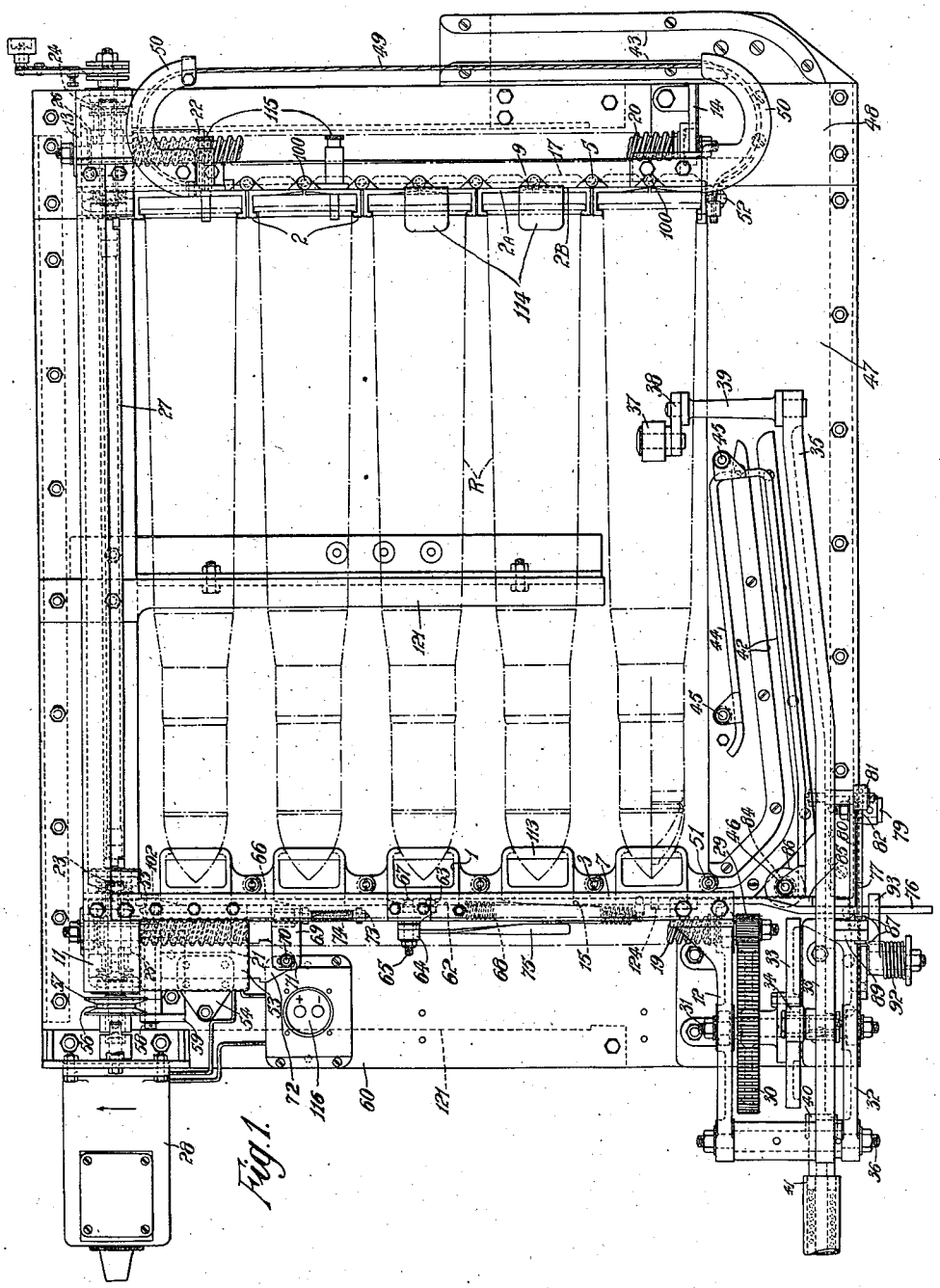


Fig. 1.

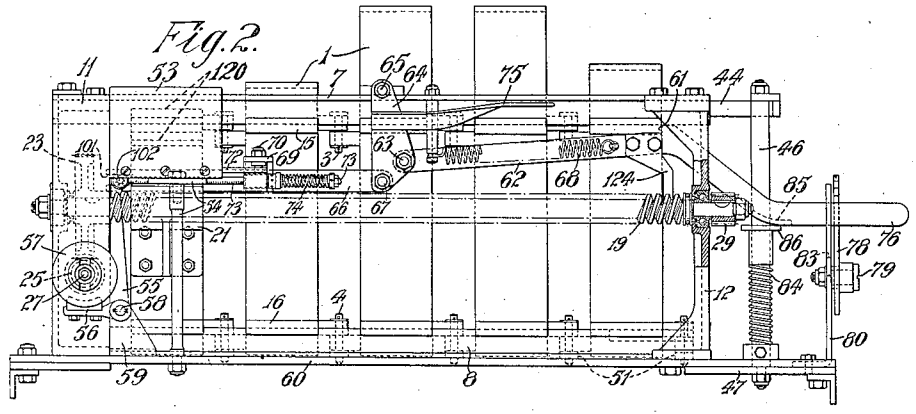
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Fig. 2.



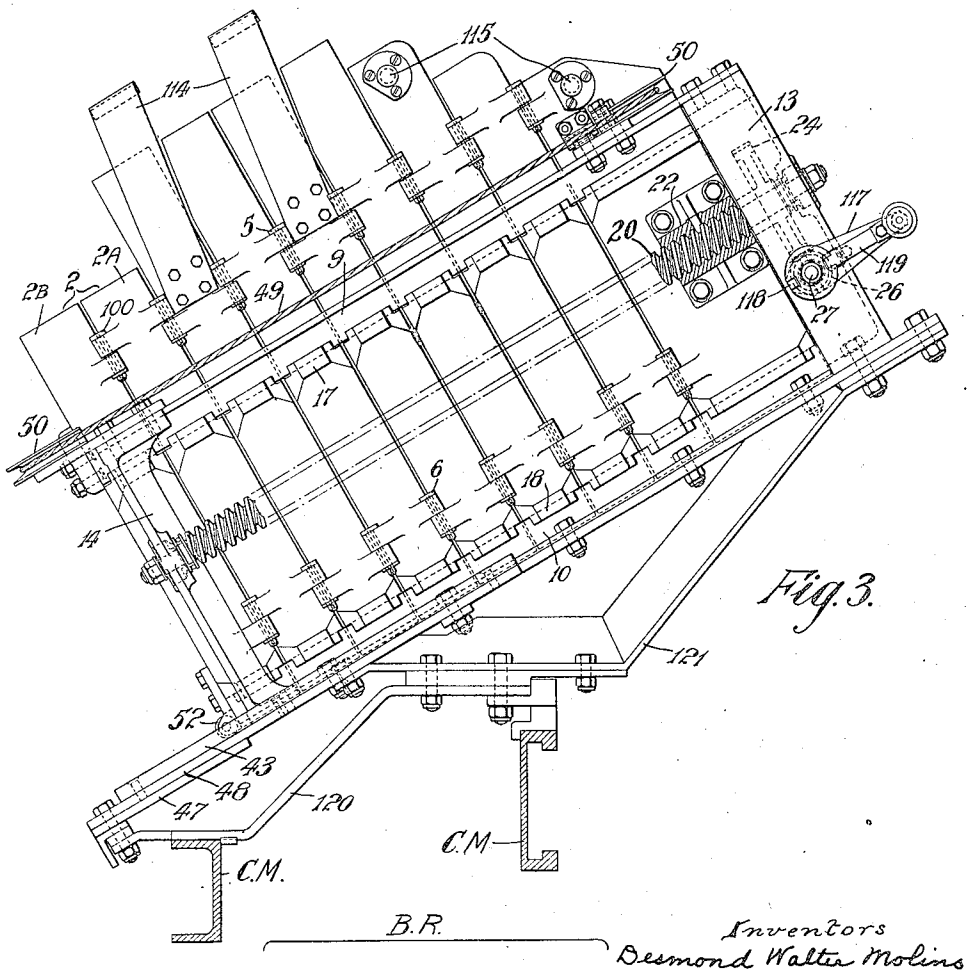


Fig. 3.

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AMMUNITION HOPPER FOR USE ON AUTOMATIC GUNS

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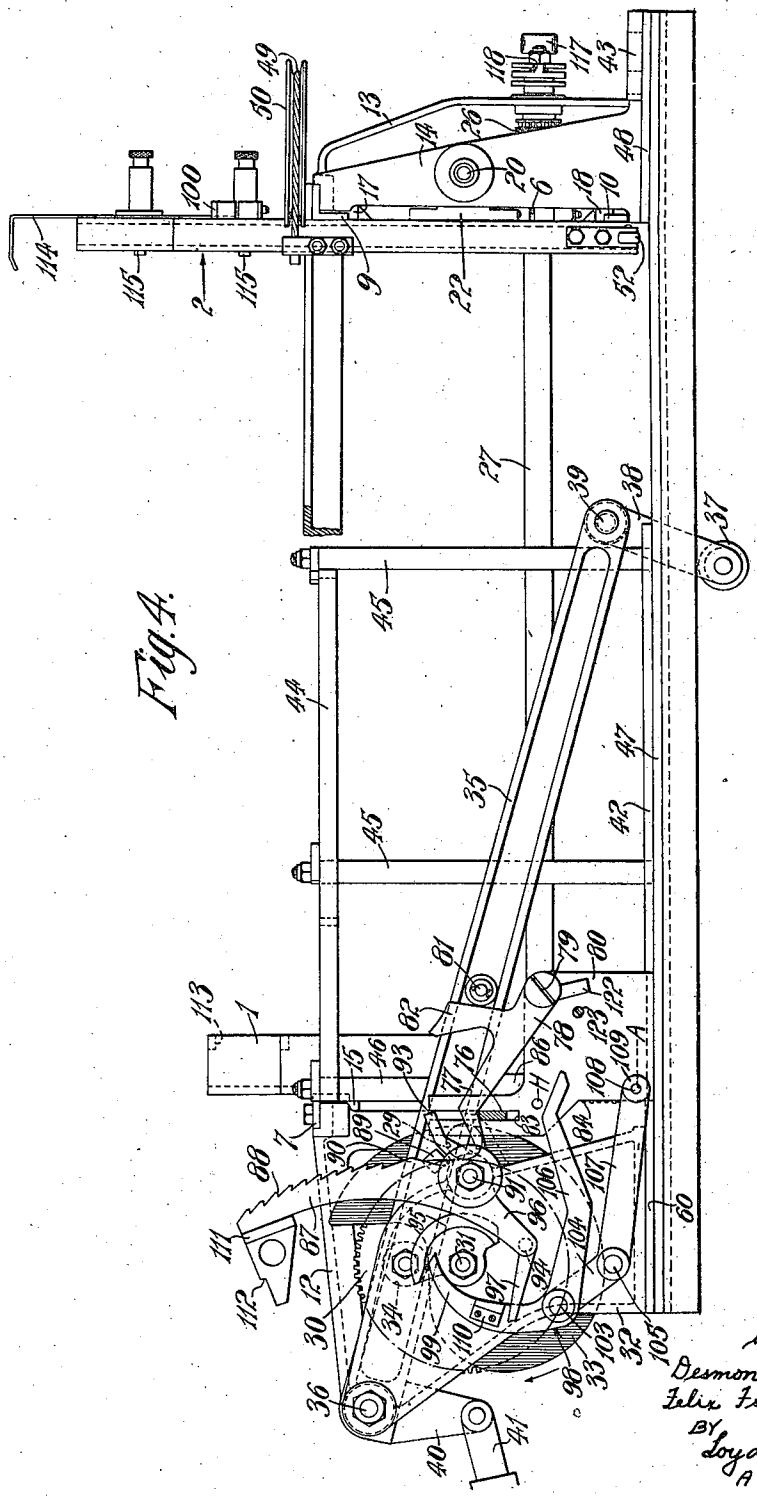


Fig. 4.

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AMMUNITION HOPPER FOR USE ON AUTOMATIC GUNS

Filed Jan. 6, 1944 5 Sheets-Sheet 4

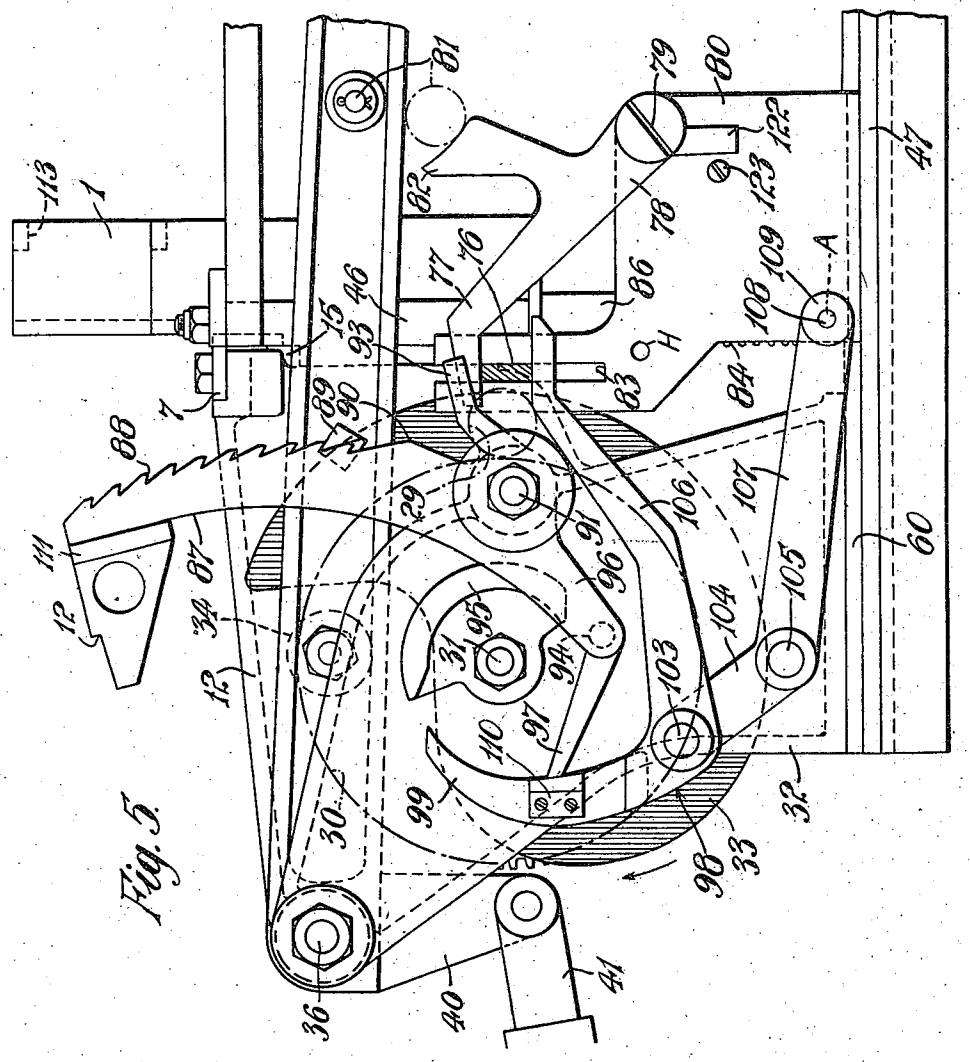


Fig. 5.

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Fig. 7.

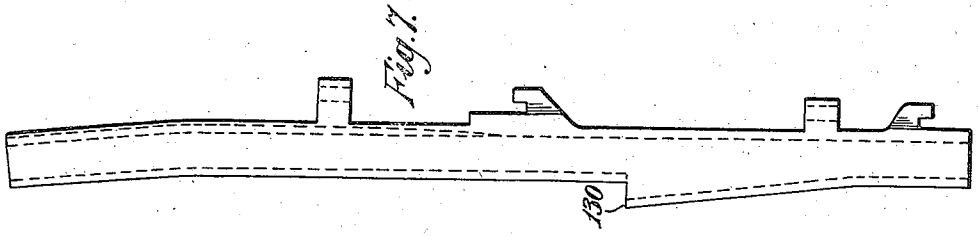
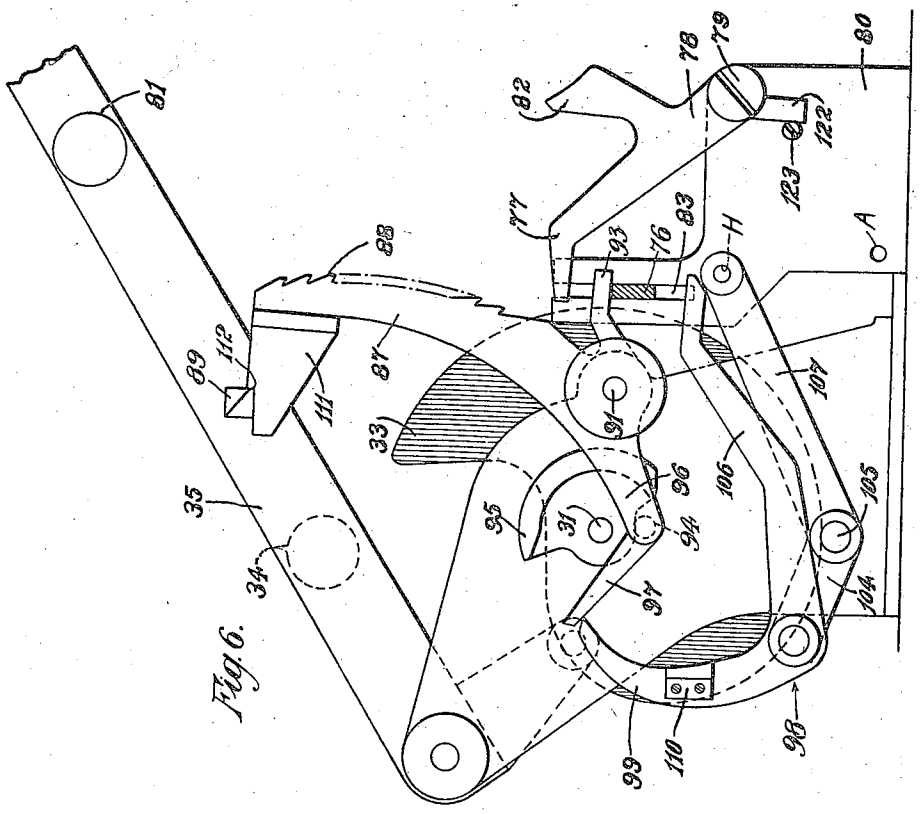


Fig. 6.



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Patented June 4, 1946 2,401,654

UNITED STATES PATENT OFFICE

2,401,654

AMMUNITION HOPPER FOR USE ON AUTOMATIC GUNS

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Application January 6, 1944, Serial No. 517,270
In Great Britain January 7, 1943

15 Claims. (Cl. 89—34)

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This invention concerns improvements in or relating to ammunition-hoppers for use on automatic guns.

In feeding cartridges or rounds to an automatic gun, it is often desirable to employ an ammunition-hopper which takes up relatively little space and from which cartridges or rounds can be fed automatically to the gun without the use of links, which in the case of large calibre rounds are difficult and costly to produce. It is particularly desirable in the case of an automatic gun for use in aircraft that the ammunition-hopper should be light in weight and should take up as small space as possible. It is an object of the invention to provide an ammunition hopper having these characteristics.

The term "charger" when used herein means a set of guide-members to accommodate the bases and noses of a row of cartridges or rounds of ammunition, and along which the cartridges or rounds can move transversely to their axes.

According to the present invention there is provided an ammunition-hopper for use on an automatic gun, comprising in combination, a plurality of sets of guide-members, the guide-members of each set being adapted to accommodate respectively the base-ends and nose-ends of rounds of a row of rounds, a support to accommodate side by side the sets of guide-members and to retain each set in position to hold a row of rounds, a round-discharging station, means to feed in succession to said round-discharging station the sets so arranged, and means operable on each set after it has been removed from the discharging station to displace the guide-members of each set independently of one another and to move said members transversely of their direction of feeding movement so that they are collocated alongside the hopper. The guide-members of each set may be displaceable along guide-tracks located beyond the discharging station. The guide-track for the base-guide-members may comprise a curved portion, and some at least of the guide-members may be constructed so as to be flexible whereby they can accommodate themselves to the curved portion. Some at least of the guide-members may be formed from parts hinged together so as to swing about axes lengthwise of said guide-members so that the latter can accommodate themselves to the curved portion.

Further according to the present invention there is provided an ammunition-hopper for use on an automatic gun as set forth in the preceding paragraph, wherein the means to feed the sets

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of guide-members in succession to the round-discharging station comprises an electrical circuit, electrical driving-means in said circuit for driving said feeding means, a switch in said circuit, an element adapted to engage the last round in a row of rounds at the discharging position and operably coupled to said switch to close the switch when the last round in said charger has been discharged, means operably connected to the feeding-means for lifting said element after it has closed said switch, a control-means adapted to be engaged by a guide-member of the succeeding set and operable to open said switch when said succeeding set reaches the discharging station.

The said control-means may comprise a brake-member adapted to be applied to said driving-means when the said succeeding set reaches the discharging station.

Like guide-members may be hingedly interconnected to form a flexible row for facilitating the collocation.

One form of ammunition-hopper made in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which—

Figure 1 is a plan view of the hopper looking in a direction normal to the base thereof.

Figure 2 is a side elevation looking at the left hand end of Figure 1, some parts being omitted.

Figure 3 is a side elevation looking at the right hand end of Figure 1, showing the hopper tilted with respect to the horizontal, as it is in practice, some parts being omitted.

Figure 4 is a front elevation of Figure 1.

Figure 5 is a view of part of Figure 4 showing parts in a different position.

Figure 6 is a view of diagrammatic nature similar to Figure 5 and showing parts in a still further position.

Figure 7 shows a modified form of base guide.

Referring to the drawings, the hopper is constructed to accommodate a number of chargers side by side. A charger is made in two separate parts, 1 and 2 respectively, each part comprising a vertical guide-member having back and side walls, and the two parts of a charger are oppositely disposed one at each side of the hopper, with their open sides facing one another, and spaced apart a distance sufficient to accommodate a round lengthwise between them. Rounds are indicated in Figure 1 by chain lines and bear the reference R. The round at the bottom of Figure 1 shows several different kinds of noses to the projectile, all such shapes being suitable for use

in this hopper. The part 2 of a charger is of a suitable size to accommodate the bases of a row of rounds and will be called for convenience a "base-guide," while the other part 1, which is disposed on the other side of the hopper, is of a size to accommodate the noses of a row of rounds, and will be called for convenience a "nose-guide." It will be noticed from the figures that the base-guides of a charger are each sub-divided into two pieces marked 2A and 2B. The pieces are hinged together by pins 100 and the construction is merely to obtain greater flexibility as will be better understood later.

Five chargers having base and nose-guides are arranged side by side in the hopper, and thus the guide-members which constitute the chargers are arranged side by side along each side of the hopper. The leading charger (i. e. the one at the bottom of Figure 1) is at a position where it can supply rounds to the gun. This position is called herein "the discharging position."

The nose-guides are hingedly connected to each other, and the base-guides, at the other side of the hopper, are similarly attached to each other. The connections are made by hinge pins 3 and 4 in lugs in the nose-guides and hinge pins 5 and 6 in similar lugs in the base-guides.

The chargers are supported by two pairs of guide rails, one pair at each side of the hopper, which extend along the width of the hopper behind the base-guides and nose-guides respectively. The rails for the nose-guides bear the references 7 and 8 and those for the base-guides are marked 9 and 10. The guide-rails are fixed at their ends to brackets 11, 12, 13 and 14 on the framework of the hopper. Slide members 15, 16, 17 and 18 respectively are formed on the back of each guide-member and fit over the guide-rails in such a manner that a guide-member is capable of sliding along the guide-rails. The arrangements are clear from the end elevations.

Two driving worms 19 and 20 respectively are provided, one at each side of the hopper behind the guide-members. These driving worms are supported as shown in bearings formed in the brackets 11, 12, 13 and 14 to which the guide-rails are fixed.

The base-guide and the nose-guide forming the two parts of the last charger at the rear end of the hopper have secured to them nuts 21 and 22 respectively through which the appropriate driving worms extend in such a manner that on rotation of the worms these two guide-members will be moved across the hopper towards the discharging position, and on being moved in this direction by rotation of the driving worms they will cause the other chargers in the hopper to slide along the guide-rails in the same direction, and an empty charger will be pushed past the discharging position by the next full charger.

Wormwheels 23 and 24 respectively are fixed at one end of these two worms, and these two wormwheels are arranged to engage with further worms 25 and 26 carried by a cross-shaft 27 which is driven by an electric motor 28, Figure 1. Both of the driving worms are by this means arranged to rotate at the same speed and to move the base-guides and nose-guides in the same direction.

At the discharging end of the hopper, one of the driving worms has attached to its end a gear pinion 29, which meshes with a gear wheel 30 fixed to a shaft 31 which is mounted in bearings in the bracket 12 and a further bracket 32 on the framework of the hopper. This shaft also has fixed to it a cam 33, whose edge engages a roller

34 mounted on one arm 35 of a bellcrank lever, see Figures 1 and 4. This lever arm, which for convenience will be called the "depressor-arm," extends transversely to the direction of movement of the chargers across the hopper and is disposed just outside the hopper at the discharging position and is spring urged so that its free end is urged downwardly. The bellcrank lever is pivoted at 36 on the bracket 32. Attached to the free end of the depressor-arm at right angles to it is a roller 37 which extends into the hopper between the base-guide and nose-guide of a charger at the discharging position. The roller is pivoted on a short arm 38 fixed to a stud 39 fixed in the free end of the depressor arm, the arrangement permitting adjustment of the location of the roller 37.

The other arm 40, Figure 4, of the bellcrank lever is attached to a spring-barrel device 41 which provides the force urging the free end of the depressor-arm downwardly about the pivot.

The cam 33 is so shaped that in one revolution of the camshaft the depressor-arm will first be raised against its spring above the level of the hopper and then be released so that it can move downwards under the influence of the spring 41.

Guides 42 and 43 respectively, suitably curved as shown in Figure 1, are provided at the discharging end of the hopper in such a position that nose-guides and base-guides removed from the discharging position will engage the curved guides. The nose-guides will be swung out of their forward path into a position at right-angles to the rows of guides still in the hopper.

Nose-guides moved out of the hopper in this manner move along the curved track 42 and come to rest in front of the hopper. The upper ends of such guides are controlled by a guide frame 44 supported on three studs fixed in a plate 47 which forms part of the hopper framework. Two of these studs are marked 45 while the other, which differs in some respects, is marked 46.

Base-guides moved out of the hopper, move at first through a semi-circular path, running over a plate 48 which forms part of the hopper framework and then engage the guides 43 by which they are guided into a path parallel to their original disposition. To control the leading base-guide of the set during this movement there is provided a wire cable 49 which passes round semi-circular grooved members 50 fixed to the guide rail 9. The ends of the cable are attached to the first and last base-guides, see Figures 3 and 4. The nose-guides are provided at their bases with rollers 51 which run in the guide track 42 and the leading base-guide has a roller 52 to ease the movement over the plate 48.

The driving motor 28 is started and stopped by a switch 120 (Fig. 2) contained in a box 53' which is supported on a bracket 54. A brake is provided to assist in rapidly stopping the motor. The brake consists of a bellcrank lever 55 having a brake shoe 56 on its short arm which engages with a grooved wheel 57 fixed on the cross-shaft 27. The bellcrank lever is pivoted at 58 to a small bracket 59 fixed to a plate 60 which forms part of the hopper framework. The brake is applied by a catch 61 which is arranged to engage the leading edge of a nose-guide at the discharging position.

The catch 61 is formed on a bar 62 pivoted at 63 to a lever 64 which is pivoted at 65 on the guide rail 7. The bar 62 is also provided with a hook member 124 whose function will be explained when the operation of the hopper is de-

scribed. Another bar 66 is also pivoted at 67 to the lever 64 and the other end of this bar is slotted at 101 and slides on a pivot 102 referred to below. A bracket 69 on the bar 66 surrounds a circular rod 73 provided with an adjustable compression spring 74. The other end of the rod 73 is pivoted by a pin 102 to the bellcrank lever 55. There is some lost-motion between the bracket 69 and the co-operating part of 73 and also between rod 73 and lever 55 so that when a pull is imparted to the bar 66 the brake is pulled on towards the end of the movement by the rod 73 but the pressure is elastic through the spring 74. A spring 68 tends to hold the bar 62 to the left, Figure 2, and keep the brake shoe off the wheel. The bracket 69 is also provided with a pin 70 at its end which can be adjustably fixed in a short slot 71 therein and engages in the end of a switch-operating member 72 for operating the switch 120. This adjustment is for the purpose of timing the operation of the switch 120. On the lever 64 there is fixed a hand lever 75 best seen in Figure 2 and termed hereafter the "cocking-lever."

The free end of the bar 62 is bent down to form a tail piece 76, which can also be used as a handle when inspecting or manipulating the mechanism. The tail piece can be depressed at times by an arm 77 of a double-armed lever 78 which is pivoted at 79 on a bracket 80 fixed to the plate 47 of the hopper frame. The double-armed lever is moved to depress the tailpiece at certain times by a roller 81 mounted on the depressor arm which engages the other arm 82 of the lever. A weak torsion spring (not shown) surrounds the pivot 79 and a tail 122 on the lever 78 is urged by the spring against a stop 123 on the bracket 80. Thus the lever 78 is normally kept in a position (i. e. the position shown in Figure 6) to be engaged by the roller 81 as the depressor arm descends. The movement may be followed from Figure 5 where the roller 81 is shown in full lines and also in another position in chain lines where it has just engaged the lever 82 and slightly displaced the double-armed lever 78 on its pivot. The tailpiece is guided during these movements in a slot 83 in the bracket 80 and the motion takes place against the influence of an adjustable compression spring 84 which surrounds the stud 46 previously mentioned. An abutment 85 on the tailpiece presses on a collar 86, see Figure 2.

It should be understood that during the operation of a gun of fairly large calibre fitted with this hopper, that substantial shocks are sustained and various devices for ensuring the correct functioning of the parts under such conditions are provided. Further it is necessary that the mechanism shall be capable of being manually operated or manipulated during loading. The various parts for these requirements will now be described mainly with reference to Figures 4, 5 and 6. For instance there is a tendency for the depressor lever to swing upwards under shock and this is prevented by a ratchet catch device, spring mounted as described below, and comprising an arcuate lever 87 provided with downwardly-directed ratchet teeth 88. A square pin 89 having its free end of triangular section is fixed on the depressor arm and during normal operation, that is when the lever is moving down stage by stage to feed rounds, the pin trips over the teeth (two at a time) and is prevented from rebound by engagement of the pin with the ratchet teeth. The idle tooth of the two which the pin trips over is to prevent rebound of the lever at the half-way stage. Below the lowest tooth the arcuate lever has a nose or abutment 90. The lever is pivoted on a stud 91 fixed to the bracket 32 previously described. A strong torsion spring 92, Figure 1, tends to turn the arcuate lever clockwise as viewed in Figure 4. Thus the arcuate lever turns anti-clockwise on its pivot to a slight extent against the influence of the torsion spring each time the depressor arm moves down two teeth. A small lever 93 is formed on the arcuate lever and can at times engage the tailpiece 76 and depress it. The arcuate lever is controlled during part of a cycle of operations as to the position it takes up under the influence of the torsion spring by a cam follower 94 which engages the exterior of a cam 95 rotatable with the camshaft 31. The cam follower is attached to an extension 96 of the arcuate lever and there is also fixed at the point of the attachment of the cam follower a pawl-shaped abutment 97 which also controls the position of the arcuate lever at times. This pawl is adapted to engage at times with a stop piece 110 fixed on a member generally indicated by the reference 98, comprising an arcuate hook 99, which is pivoted at 103 to one arm 104, of a double-armed lever pivoted at 105 to the bracket 32. The member 98 further comprises a bent lever 106. The longer arm 107 of the double-armed lever is provided at its free end with a spring stud 108 mounted in a hand knob 109 fixed on the end of the lever. The spring stud can be manually engaged with either of two holes, one marked A (automatic) being coaxial with the stud in the position shown in Figure 4 and the other bearing the reference H (hand). The spring stud is shown engaged in the hole H in Figure 6. The holes are made in the bracket 80 previously referred to. The cam 95 above referred to has a further function which is to engage the extremity of the arcuate hook 99 at times, as will be seen later.

The arcuate lever 87 is also provided with a thumb piece 111 by which it may be manually operated when desired and a notched plate 112 (both these parts being omitted from Figure 1) in which the triangular pin 89 may rest if it is desired to raise and hold the depressor-arm in the top position when loading the hopper or otherwise manipulating the mechanism.

The chargers are provided with top members to prevent rounds from being dislodged by accident when the hopper is subjected to shock or violent movements of any kind.

In the case of the nose guides the top members consist of stays 113 which bridge the top opening of the guides. The base-guides may have spring plates 114 or spring plungers 115 or some of each as shown in Figures 1 and 3. When spring plates are used, the nose of a round is placed in a nose guide and the base of the round pressed down on the spring plate of the base-guide which gives and permits the round to pass into the guide. The spring plungers require to be manually withdrawn to let a round pass into the base guide.

Power is supplied to the motor from a contact socket 116 (Fig. 1) from which leads pass to the motor, one being connected through the switch in the box 53. A handle 117 is provided by means of which the hopper may be worked manually when required, chiefly when winding the chargers back into the hopper as explained later. The handle is loosely mounted on the cross-shaft 27 and may be brought into operation by pressing the knob towards the hopper. This causes a dog

clutch 118 to engage, the movement being against a flat spring 119 which disengages the dogs when the pressure is released, thus declutching the handle.

A gun for which this ammunition hopper is suitable is fully shown and described in the co-pending U. S. application Serial No. 488,454, and in order to render clear the manner of fitting the hopper to such a gun, a few parts of the latter are indicated in Figure 3.

The reference B. R., Figure 3, indicates the top of the breech ring while the references C. M. are the channel members on which the automatic feeding devices of the gun in question are carried and correspond to the parts 7 and 8 in said application Serial No. 488,454. The hopper is supported as shown in Figures 1 and 3 by brackets 120 and 121 which are fixed to these channel members.

From Figures 2 or 3 it will be seen that the chargers are of different heights and have different capacities. The reason for the difference in height is that the hopper shown is designed for use in an aeroplane and the outline of the hopper as viewed in Figure 3 conforms more or less to the cross-section of the fuselage at the position occupied by the hopper.

The operation of the apparatus is as follows. The hopper is arranged as shown in Figure 1 with all the chargers within the hopper so that the leading charger is at the discharging position and the charger whose base-guide and nose-guide are connected to the driving worms is at the other end of the hopper. The chargers are filled with rounds. The depressor-arm 35 is in its raised position and the roller 37 attached to its free end rests on the uppermost round in the leading charger. At this stage the cam 33 is stationary as in the position shown in Figure 4 so that the depressor-arm is not supported by the cam and therefore tends to press the rounds downwardly in the charger by reason of the pressure of the spring-barrel 41 which urges the depressor-arm downwardly. The rounds are supported in the leading full charger at the discharging position by any suitable means disposed beneath the charger until it is desired to feed a round to the gun. These means may be the same as described in U. S. application Serial No. 488,454 and form no part of the present invention. The rounds in the remaining chargers are supported by the plates 48 and 60 which form parts of the framework of the hopper.

Assuming that the gun is on the ground or in some vehicle where there is sufficient room to permit access to the gun and hopper by the gun crew and it is desired to fire the gun, the lowermost round is allowed, by suitable manipulation of the automatic feeding-devices of the gun itself, to fall from the leading charger and is then fed to the gun. The remaining rounds in the charger are moved downwardly by the depressor-arm and are supported in the charger until the next round is to be fed to the gun.

If, however, the gun is mounted in an aircraft where there is not normally room for a gunner to operate the gun, the procedure is somewhat different. In this case a round is put into the gun breech and the hopper is filled. When occasion arises the gun is fired by a fire-control device operated by the pilot and then the automatic feeding devices of the gun function and the first round from the hopper is fed to the gun.

In either case, the first operation of all should be to cock the lever 75 by pulling it upwards

and in the case of an airborne gun this is imperative as it is done before the machine leaves the ground. The function of the cocking lever will be explained later.

The downward pressure exerted by the depressor-arm ensures that the rounds move downwardly in the charger although the hopper is tilted, as shown in Figure 3 or even more, or tilted lengthwise as may sometimes be the case when the apparatus is employed in an aircraft, or on an anti-aircraft gun. As successive rounds are discharged, the depressor-arm moves further and further downwardly, until the last round has left the charger. At any stage of the downward movement, any tendency the arm may have to swing upwards due to shock such as the motion of an aircraft, is checked by the triangular pin 89 engaging the arcuate rack 87. The depressor-arm finally moves down to its fullest extent and the triangular pin moves on to the nose 90 of the arcuate rack.

Cocking of the lever 75 causes the bar 62 to move to the right, Figure 2, against the tension of the spring 68. This enables the catch 61 on the bar 62 to snap up on the leading corner of the slide member 15 of the first charger. As will appear later the upper surface of the catch 61 would, prior to cocking, be in engagement with the undersurface of said slide member. Cocking also causes the brake to be put on but this is of no importance at this stage.

As the depressor arm moves towards the bottom of the first charger as above recited, the roller 81 engages the curved part of the lever arm 82 when the roller 81 reaches the chain line position in Figure 5, and afterwards moves down the right hand side thereof to the position shown in Figure 4. This causes the double-armed lever 78 to move anti-clockwise on its pivot 79 and the end of the lever arm 77 contacts with the tailpiece 76 and depresses it against the influence of the spring 84. When the depressor arm is at the bottom of its stroke (the position shown in Figure 4) the tailpiece is fully depressed and the catch 61 is disengaged from the slide member 15 of the leading charger. The bar 62 is then pulled to the left, Figure 2, by the spring 68 which is powerful enough to overcome the friction on the bar due to the grip of the arm 77 and the spring-urged collar 86 and the brake is released. The movement also causes the pin 70 to move the switch-operating member to the left, Figure 2, and switch on current to the motor. The motor starts and the worms 19, 20 feed the first charger out of the hopper, i. e. out of alignment with the roller 37 of the depressor arm. Rotation of the worm 19 also rotates the cam 33, in the direction of the arrow Figure 4, through the gear wheels 29, 30 and the depressor arm is raised up to its initial position against the tension of the spring barrel 41. During this upward movement of the depressor arm the rack 88 is kept out of the way of the pin 89 as explained later. The second charger is brought forward to the discharging position and the slide member 15 of the nose-guide thereof will engage the catch 61 as the latter will move up to the engaging position as the tailpiece 76 rises when the pressure due to the depressor arm is released on the rise of the latter. When finally the second charger occupies the place occupied in the drawings by the first charger, the bar 62 will have been pulled by the second charger to switch off the motor and apply the brake. This sequence

of operations will automatically repeat as long as firing continues until the hopper is empty.

It will be seen from the foregoing description that when the last nose guide (i. e. the one on which the nut 21 is fixed) is in the discharging position and the depressor arm has emptied it that the motor would be started again by movement of the bar 62 to the left, Figure 2, if this movement were not prevented. The hook 124 is provided to meet this contingency and by engagement with the nut 21 it holds the bar 62 to the right, that is with the motor switched off and the brake on.

When this last charger has been emptied, a main switch (not shown) controlling the motor circuit is switched off, this operation being part of the gun drill when this invention is being used.

When the hopper is to be refilled it is first necessary to lift the arm 35 by hand to clear the roller 34 out of the way of the cam 33 and reverse the drive to the chargers. The arm may be held in this up position by latching the square pin 89 in the notched plate 112, the arcuate lever 87 being manipulated by the thumb-piece 111 for this purpose, see Figure 6. The driving of the worms in the reverse direction is done manually. The handle 117 is manipulated to engage the driving dogs 118, and then turned in the required direction whereupon all the guides comprising the chargers are moved back into the hopper. During this movement the cam follower 94 runs on the inside of the cam 95. The hook 99 is moved out of the path of the cam 95 for this reverse movement by shifting the spring stud 108 from A to H, as will be explained in greater detail below. As the catch 61 is released during the operation of moving all the guides back into the hopper, it will be held to the left, Figure 2, by the spring 68 and will eventually lie beneath the slide member 15 of the first charger and thus will require cocking when the hopper has been refilled and the gun is to be fired again. After cocking, the main control switch referred to above is switched on and everything is ready for operating the gun once more.

The purpose of the arcuate hook 99, the stop piece 110 and the associated parts, is to effect close control over the disposition of the tail piece 76 at different times during the manipulation and operation of the whole mechanism as will now be explained.

It has previously been stated that the torsion spring 92 tends to turn the rack clockwise on its pivot and when the mechanism is operating automatically the triangular pin 89 on the lever 35 clicks over two teeth of the rack 88, for each feeding movement. The rack lever 87 twists anticlockwise on its pivot each time and back again under the influence of the spring 92, the degree of movement being controlled or restricted by the inter-engagement of the pin 89 and the rack. During this feeding movement the hook 99 is in the position shown in Figure 5 because when the hopper is working automatically the spring stud 108 is in the hole A.

It will be seen from Figure 5 of the drawings that the operative face of 110 is an arc concentric with the centre of the pivot 91 and it thus permits free oscillatory movement of the pawl 97 about said centre as the ratchet operates although, as will appear later, the pawl-shaped abutment 97 remains in engagement with the stop 110 all the time the pin 89 on the depressor arm 35 is moving downwards over the rack teeth under the force of the spring barrel 41.

The stop piece 110 remains in engagement with the abutment 97 whilst the arm 106 is in engagement with the tailpiece 76. Thus the arm 106 supports the tail piece 76 and prevents premature displacement downwards due to vibration or shock, the spring 84 not being enough for this purpose. During the whole of the downward movement of the pin 89 over the rack the stop 110 is therefore maintained substantially in the position shown in Figure 5 by said engagement between the tailpiece 76 and the bent lever 106. When the lever 35 is near the end of its downward movement the pin 89 leaves the rack 88 and presses against the nose 90 and moves the arcuate lever 87 anti-clockwise a greater amount than usual, that is to the position substantially as shown in Figure 4.

This moves the free end of the abutment 97 so far down that it is below the level of the stop 110.

As the cam 95 is in the position shown in Figure 4 and out of the way of the extremity of the hook 99 during all the downward feeding movement of the lever 35, the extremity of the hook is free to move inwards as soon as the stop 110 is clear of (i. e. above) the abutment 97. So the lever 98 turns clockwise on its pivot 103 by gravity and also under the pressure of the tailpiece 76 which is caused to press on the free end of the leevr 106, as the tailpiece is itself being pressed down by the end of the lever 77 which as aforesaid is moved anticlockwise on its pivot 79 under the action of the roller 81 on the lever 82. Thus the lever 106 falls rapidly away out of engagement with the tailpiece 76.

As the motor is restarted by the endwise movement of the bar 62 when the catch 61 is tripped, the cam 33 lifts the depressor arm again and during this movement, which takes place in about the first 155° of the revolution, the rack is held out of the way of the triangular pin 89, as will now be explained. At first the pin 89 engages with the nose 90 and holds the rack back and thereafter the cam follower 94 is engaged by the exterior of the cam 95. Shortly after the upward movement of the depressor arm is completed, the cam 95 engages the extremity of the hook 99 and restores it to a position which is substantially that shown in Figure 5. This movement causes the lever 106 to strike the tailpiece 76 smartly and assist its rapid upward movement and also enables the abutment 97 to rise under the action of the torsion spring 92 into contact with the stop 110 and the parts thereupon assume a position which is substantially that of Figure 5 so that the arcuate lever 87 is once more in position to control the arm 35 as previously explained. As the cam 95 leaves the follower 94 the depressor arm is held in the up-position by the roller 34 resting on the maximum radius of the cam 33. The cam 33 eventually stops in the position shown in Figure 5 and the roller 34 drops slightly so that the roller 37 of the depressor arm engages the top round in the charger now in the discharging position and the pin 89 engages the upper part of the rack 87.

When, for the purpose of winding back the chargers, the depressor arm is to be manually raised and thereafter held up by the notched plate 112 as shown in Figure 6, the spring stud 108 is first moved to hole H whereupon the lever 98 swings on its pivot 103 under gravity to the position shown. The cams 33 and 95 may then be rotated in the reverse direction by suitably turning the handle as the hook 99 is clear of the

path of the cam 95. Also while the depressor arm is held by the notched plate 112 the part 93 presses on the tailpiece 76 and holds it down so as to keep the catch 61 out of the way of the slide members on the chargers, irrespective of the direction of movement.

The modified base guide shown in Figure 7 is bent or curved to accommodate the bases of the rounds when the taper of these is sufficient to cause them to lie more or less fanwise when superimposed. The base guide is also provided with an intermediate lip 130 to permit rounds to be inserted without the necessity of passing them down the whole length of the guide.

What we claim as our invention and desire to secure by Letters Patent is:

1. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted side by side for feeding movement toward a round-discharging station, means for moving said sets in succession to said station and for removing said sets in succession from said station after their rows of rounds have been discharged, and means operable on said base-end and nose-end guide-members after removal from said discharging station for moving them transversely of the direction of feeding movement.

2. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted side by side for feeding movement toward a round-discharging station, means for moving said sets in succession to said station and for removing said sets in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said discharging station so constructed and arranged as to direct the movement of said base-end and nose-end guide-members in directions transverse to the direction of feeding movement for collocation of said guide-members alongside the hopper.

3. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted side by side for feeding movement toward a round-discharging station, means for moving said sets in succession to said station and for removing said sets in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said discharging station so constructed and arranged as to direct the movement of said base-end and nose-end guide-members in directions transverse to the direction of feeding movement for collocation of said guide-members alongside the hopper, one of said guide tracks being reversely curved outwardly of and substantially parallel to the side of the hopper.

4. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted side by side for feeding movement toward a round-discharging station, means for moving said sets in succession to said station and for removing said sets in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said discharging station so constructed and arranged as to direct the movement of said base-end and nose-end guide-members in directions transverse to the direction of feeding movement for collocation of said guide-members alongside the hopper, one of said guide tracks being located across the end of the hopper beyond said discharging station.

5. An ammunition hopper as claimed in claim 2, wherein at least some of said guide-members are flexible to accommodate changes in their direction of movement along their guide track.

6. An ammunition hopper as claimed in claim 2, wherein at least some of said guide-members are formed of a plurality of parts hinged together whereby they are capable of flexing to accommodate changes in their direction of movement along their guide track.

7. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, the guide-members of adjacent sets being flexibly interconnected to provide a flexible row of base-end guide-members and a flexible row of nose-end guide-members, supporting means on which said rows of guide-members are mounted for feeding movement toward a round-discharging station, means for moving said rows of guide-members along said supporting means to feed said sets in succession to said station and to remove them in succession from said station after their rows of rounds have been discharged, and means operable on said rows of guide-members at points beyond said station for moving them transversely of the direction of feeding movement.

8. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, the guide-members of adjacent sets being flexibly interconnected to provide a flexible row of base-end guide-members and a flexible row of nose-end of guide-members, supporting means on which said rows of guide-members are mounted for feeding movement toward a round-discharging station, means for moving said rows of guide-members along said supporting means to feed said sets in succession to said station and to remove them in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said station so constructed and arranged as to direct the movement of said rows of guide-members in directions transverse to the direction of feeding movement.

9. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, the guide-members of adjacent sets being flexibly interconnected to provide a flexible row of base-end guide-members and a flexible row of nose-end guide-

members, supporting means on which said rows of guide-members are mounted for feeding movement toward a round-discharging station, means for moving said rows of guide-members along said supporting means to feed said sets in succession to said station and to remove them in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said station so constructed and arranged as to direct the movement of said rows of guide-members in directions transverse to the direction of feeding movement, one of said guide tracks being reversely curved outwardly of and substantially parallel to the path of feeding movement of said guide-members.

10. An ammunition hopper for use on an automatic gun having a round-discharging station adjacent one end of the hopper and comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, the guide-members of adjacent sets being flexibly interconnected to provide a flexible row of base-end guide-members and a flexible row of nose-end guide-members, supporting means on which said rows of guide-members are mounted for feeding movement toward a round-discharging station, means for moving said rows of guide-members along said supporting means to feed said sets in succession to said station and to remove them in succession from said station after their rows of rounds have been discharged, and guide tracks located beyond said station so constructed and arranged as to direct the movement of said rows of guide-members in directions transverse to the direction of feeding movement, one of said guide tracks being located across the end of the hopper beyond said station.

11. An ammunition hopper as claimed in claim 8 wherein at least some of said guide-members are formed of a plurality of parts flexibly connected together.

12. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted for feeding movement toward a round-discharging station, means for moving said sets to feed them in succession to said station and for removing them in succession from said station after their rows of rounds have been discharged, a round-discharging element adapted to be resiliently urged into engagement with the last round of a row of rounds at said station, means actuated by movement of said element when said last round is discharged for initiating operation of said feeding means to move the next succeeding set and its row of rounds into said station, means driven by said feeding means to restore said element to a position to engage the last round of said next succeeding row, and means operating on said base-end and nose-end guide-members after removal from said station for moving them transversely of the direction of feeding movement.

13. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members, each set comprising a guide-member adapted to accommodate the base-ends and a guide-member adapted to accommodate the nose-ends of a row of rounds, supporting means on which said sets are mounted for feeding movement toward a round-discharging station, means for moving said sets to feed them in succession to said station and for removing them in succession from said station after their rows of rounds have been discharged, a round-discharging element adapted to be resiliently urged into engagement with the last round of a row of rounds at said station and to follow the movement of said last round as the preceding rounds of its row are discharged, a ratchet and pawl device operated by said element for preventing its movement in the reverse direction, means actuated by movement of said element when said last round is discharged for initiating operation of said feeding means to move the next succeeding set and its row of rounds into said station, means driven by said feeding means for separating said ratchet and pawl and restoring said element to a position to engage the last round of said next succeeding row, and means operating on said base-end and nose-end guide-members after removal from said station for moving them transversely of the direction of feeding movement.

14. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members each comprising a guide-member for the base-ends and a guide-member for the nose-ends of a row of rounds, supporting means on which said sets are movably mounted, an electric motor and feeding means driven thereby for moving said sets along said supporting means and in succession to a round-discharging station, a switch controlling the operation of said motor and an operating member therefor resiliently urged toward switch-closing position, said operating member being so constructed and arranged as to be engaged and moved to switch-opening position by said sets as they move into round-discharging position at said station, a round-discharging element adapted to be resiliently urged into engagement with the last round of the row of rounds at said station, means actuated by movement of said element when said last round is discharged for releasing said operating member from engagement with the set of guide-members at said station, thereby permitting said operating member to be resiliently urged into switch-closing position, and means driven by said motor for restoring said element to a position to engage the last round of the row of rounds in the next succeeding set and for resetting said operating member to a position to be engaged by said next succeeding set as it moves into said station to open said switch.

15. An ammunition hopper for use on an automatic gun comprising a plurality of sets of guide-members each comprising a guide-member for the base-ends and a guide-member for the nose-ends of a row of rounds, supporting means on which said sets are movably mounted, an electric motor and feeding means driven thereby for moving said sets along said supporting means and in succession to a round-discharging station, a switch controlling the operation of said motor and an operating member therefor resiliently urged toward switch-closing position, said operating member being so constructed and arranged as to be engaged and moved to switch-opening position by said sets as they move into round-discharging position at said station, a round-discharging element adapted to be resiliently urged into engagement with the last round of the row of rounds at said station, a ratchet and pawl device operated by said element and preventing movement

thereof in a direction opposite to that of said last round, means actuated by movement of said element when said last round is discharged for releasing said operating member from engagement with the set of guide members at said station, thereby permitting said operating member to be resiliently urged into switch-closing position and means driven by said motor for separating said ratchet and pawl, for restoring said element to a position to engage the last round of the row of rounds in the next succeeding set and for resetting said operating member to a position to be engaged by said next succeeding set as it moves into said station to open said switch.

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