

April 9, 1946.

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2,397,944

BELT LOADER

Filed Aug. 4, 1942

5 Sheets-Sheet 1

FIG. 1.

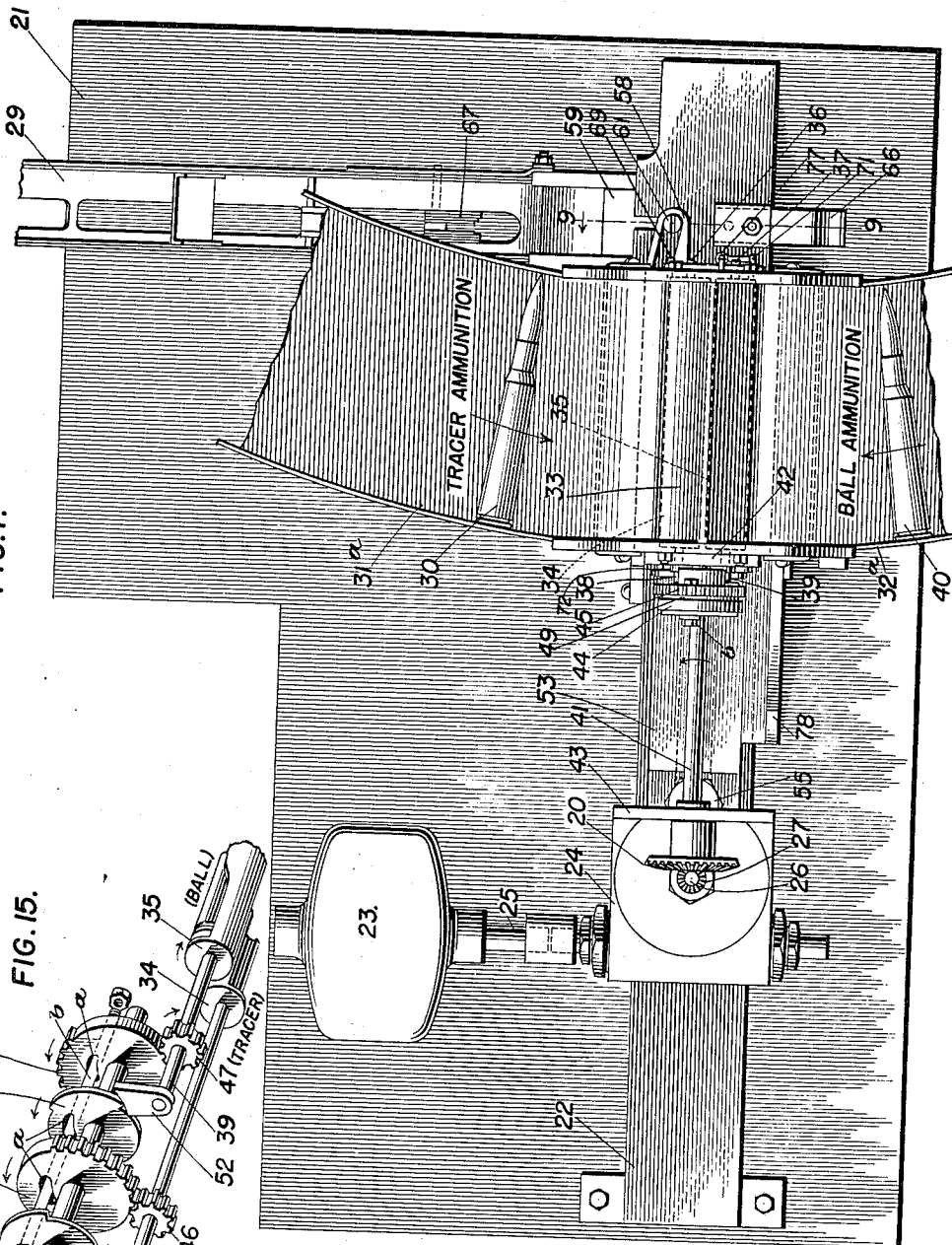
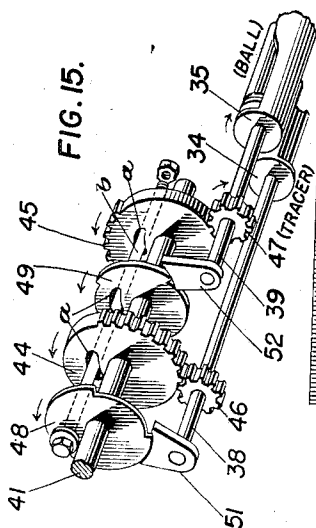


FIG. 15.



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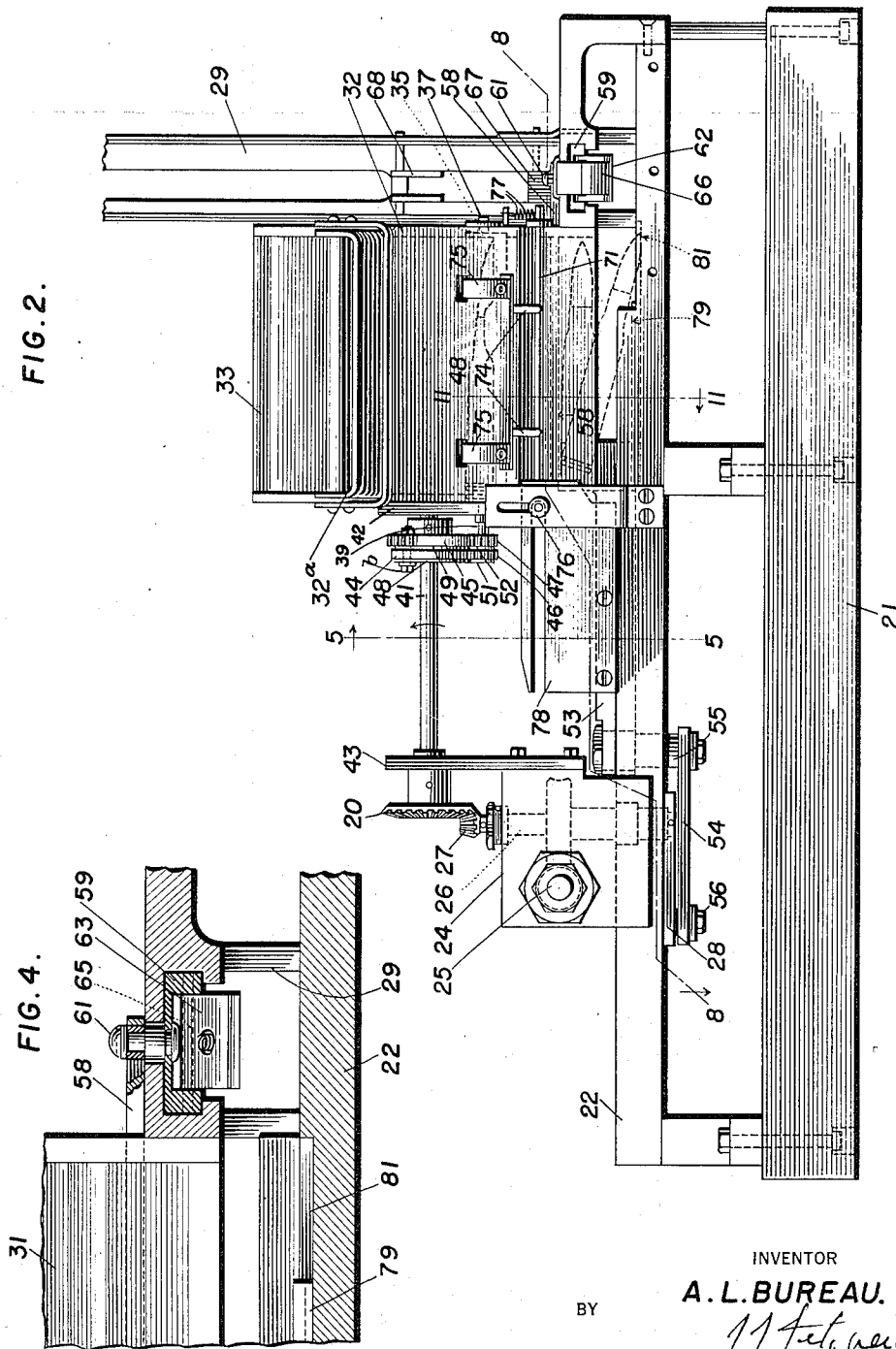
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5 Sheets-Sheet 2

FIG. 2.



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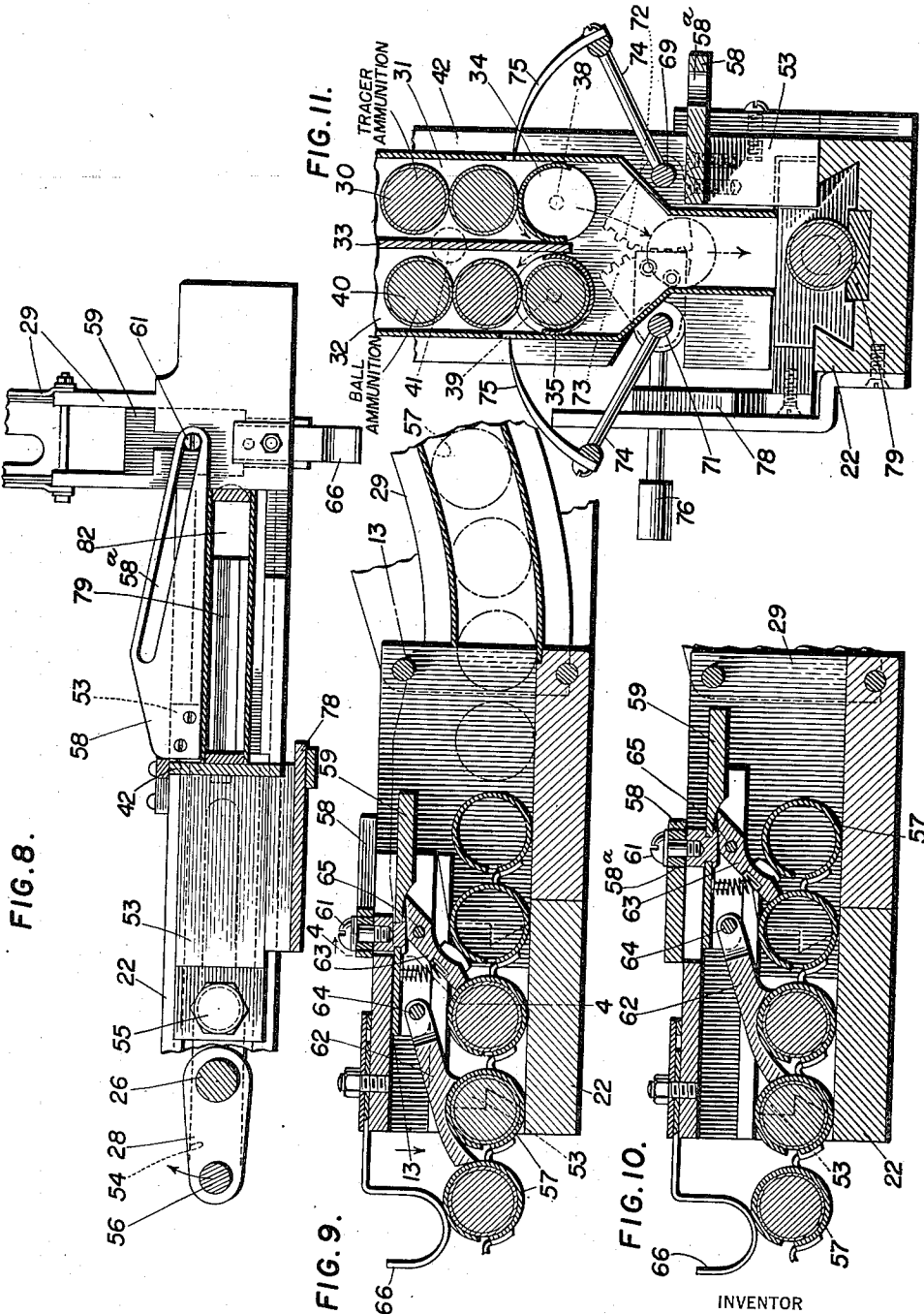
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5 Sheets-Sheet 4



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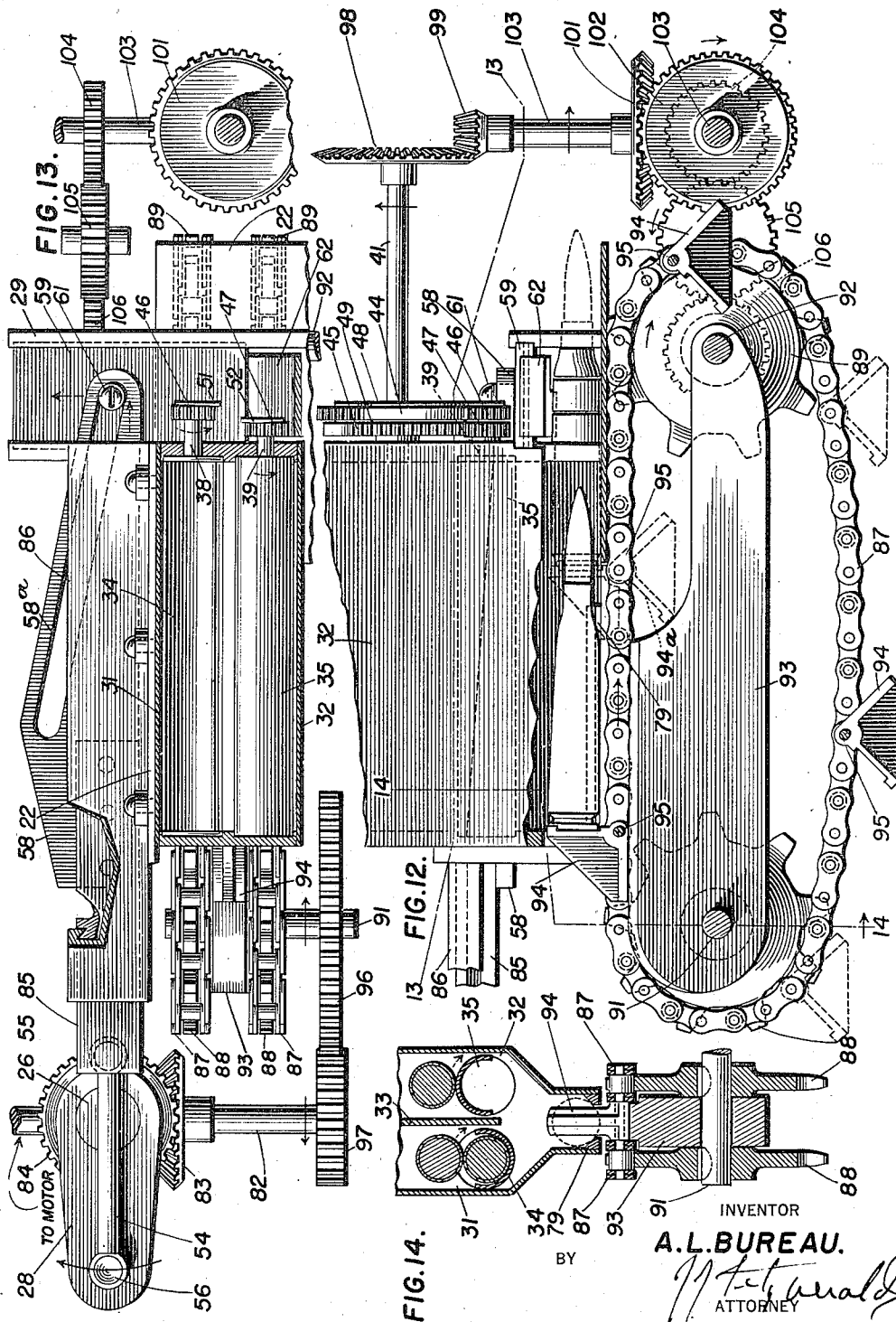
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BELT LOADER

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UNITED STATES PATENT OFFICE

2,397,944

BELT LOADER

Arthur L. Bureau, United States Navy

Application August 4, 1942, Serial No. 453,545

10 Claims. (Cl. 86—48)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to a machine for loading and forming ammunition belts, and in particular to the disintegrating type of belt in which the individual rounds of ammunition serve to connect adjacent interfitting links of the belt.

It is an object of this invention to provide a machine which will automatically load a cartridge belt with a plurality of types of ammunition in any desired ratio.

Another object of this invention is to provide an ammunition belting machine which will be capable of semi-automatically making "breaks" in the ammunition belt which is to be formed.

A still further object of the invention is to provide an ammunition belting and loading machine for all types of ammunition, which will be more convenient and efficient in operation.

Still further objects, advantages, and improvements will be apparent from the following description of the invention taken in connection with the accompanying drawings, of which:

Fig. 1 is a plan view of a preferred embodiment of the belt loading machine.

Fig. 2 is a side elevation of the machine.

Fig. 3 is an end elevation of the machine, partly in section, as seen from the right in Fig. 2.

Fig. 4 is a detailed cross-sectional view of the link advancing mechanism with cartridges and links removed, taken along the line 4—4 of Fig. 9.

Fig. 5 is a cross section taken on the line 5—5 of Fig. 2, particularly illustrating the timing gear and "feed-stop" mechanism.

Fig. 6 is a perspective view of the construction of the disintegrating type of ammunition belt, showing the cartridges in position, and one cartridge partly inserted in the belt.

Fig. 7 is a perspective detailed view of an individual link which forms the cartridge belt.

Fig. 8 is a detailed plan view, partly in section, of the ramming slide and link advancing mechanism, taken along the line 8—8 of Fig. 2.

Fig. 9 is a detailed cross-sectional view of the link advancing mechanism at the point where it is about to begin its stroke, taken on the line 9—9 of Fig. 1.

Fig. 10 is similar to Fig. 9 except that the link advancing slide has ended its stroke, having advanced the links one position.

Fig. 11 is a detailed cross-section of the feed magazine and gates, taken on line 11—11 of Fig. 2.

Fig. 12 is an elevational view, partly in section, of a modified form of ramming mechanism.

Fig. 13 is a horizontal section taken on line 13—13 of Fig. 12.

Fig. 14 is a detailed cross-section of the modified form of ramming mechanism, taken on the line 14—14 of Fig. 12.

Fig. 15 is an exploded perspective view of the timing gear mechanism which is used to provide intermittent feed for the gates.

Referring now to the drawings, on which like numerals of reference are employed to designate like parts throughout the several views, and more particularly to Figures 1, 2, and 3 thereof, it will be seen that the belt loading apparatus may conveniently be assembled on a base plate 21 upon which is mounted a principal supporting member 22 and a source of power 23 which is preferably an electric motor connected to a suitable source of electricity. A gear box 24 is mounted on supporting member 22 and operated from the motor 23 by means of the shaft 25. This shaft drives shaft 26 through a suitable gear inside the gear box. A pinion gear 27 is fixed to one end of shaft 26, while the other end of the shaft is provided with a crank arm 28.

Also mounted on supporting member 22 is the link chute 29 and the feed magazine for ammunition. This feed magazine comprises a hopper 31 and a hopper 32, separated by a partition 33. In the form of mechanism as shown the tracer ammunition 30 is contained in the hopper 31 while the ball or service ammunition 40 is contained in the hopper 32. Longitudinally disposed within the hoppers at their lower ends are placed rotary gates 34 and 35. The gate 34 (see Figs. 1, 3, and 11) is supported in hopper 31 on a spindle 36 at one end and at the other end on a short shaft 38 which extends through an opening provided in the hopper. Gate 35 is likewise supported by spindle 37 and a short shaft 39.

A timing shaft 41 (see particularly Figs. 1 and 2) is supported at one end by bearing 42, which is attached to the feed magazine, and at the other end by a bearing mounted in the bracket 43, the bracket in turn being attached to the gear box 24. A beveled gear 20 is fixed to the timing shaft at its free end beyond the bracket and meshes with the pinion 27, thus transmitting rotary movement from the shaft 26 to shaft 41. Two timing gears 44 and 45 are fixed to shaft 41 adjacent the magazine end thereof so as to rotate with said shaft. The timing gear 44 (see Figs. 2 and 15) engages a spur gear 46 which is fixed to the end of the short shaft 38 by means of which arrangement the rotary movement of shaft 41 is transmitted to the gate 34. In a similar manner, the timing gear 45 engages the spur gear 47, attached to the short shaft 39, and thus the rotary movement of shaft 41 is transmitted to gate 35. It will be noted that in order to secure proper functioning of the apparatus, shaft 38 is longer than shaft 39.

Referring now particularly to Figure 15 it will be seen that the teeth of the timing gears extend over only a portion of their circumferences, the teeth of one timing gear being arranged in relation to the teeth of the other timing gear so that there will not be simultaneous operation of the gates. As an example of one embodiment, spur gears 46 and 47 each have 9 teeth, while timing gear 44 is provided with 9 teeth placed over only

one-fourth of its total circumference and the timing gear 45 is provided with 27 teeth which extend over three-fourths of its total circumference. As a result of this arrangement, it will be seen that, while the shaft 41 is making one revolution, the toothed segment of gear 44 will drive gate 34 through spur gear 46 one complete revolution and timing gear 45 will drive gate 35 through spur gear 47, three complete revolutions. Moreover, the gear teeth on gear 44 are placed so that they will engage the spur gear 46 only when the teeth of the gear 45 are not engaging the teeth of spur gear 47. The result is an alternate intermittent uni-directional operation of the gates. In order to insure a positive stop for the gates when they are not being rotated, disc-shaped cams 48 and 49 coordinated with the operation of timing gears 44 and 45, respectively, are fixed to shaft 41 for cooperation with locking plates 51 and 52 which are secured to shafts 38 and 39 on which are mounted the spur gears 46 and 47, respectively. The extending portions of the locking plates are formed in the shapes of concave arcs whose radii of curvature are the same as those of the outer surfaces of cams 48 and 49, with which they cooperate. Each of the cams 48 and 49 has a cut-out portion along the portion of its circumference adjacent the gear teeth of its corresponding timing gear. This permits rotation of the locking plates when the spur gears are in mesh with the toothed portions of the timing gears, but such rotation is prevented when the gears are not meshed. Arcuate openings or slots *a* are provided in timing gears 44 and 45, and in cams 48 and 49. A bolt *b* extends through these openings to lock the cams and timing gears together so that when the relative positions of each element are properly adjusted on shaft 41, they will be retained in such position. The openings are made arcuate so that slight adjustments may be made both in relation of the cams and timing gears to each other, and the cams and timing gears relative to the spur gears 46 and 47.

A ramming slide 53 (see Figs. 2, 5, and 8) operates in a slideway cut in the supporting member 22. The forward face is counterbored so as to avoid contacting the primers in the cartridges. This slideway, and the slide, may be dovetailed as shown in the preferred embodiment so as to retain the ramming slide in position, but the sides of the slide or the ways may be cut in any fashion that will retain the slide in the ways, such as with arcuate faces. A connecting rod 54 is attached at one of its ends to the ramming slide 53 by a bearing 55 which is formed on the end of a projection extending through a slot cut in the support 22, and at the other end to the crank arm 28, by means of the bearing 56. Rotation of the shaft 23 thus results in reciprocation of the ramming slide 53 as well as operation of the gates 34 and 35.

The mechanism for advancing the links 57 is shown in detail in Figures 8, 9, and 10. A plate 58, having a slot 58*a* therein is attached to and moves with the ramming slide 53. A link advancing slide 59 moves in the link chute 29. A stud 61, on top of the slide 59, projects through a slot cut in the top of the link chute and engages slot 58*a* in the plate 58. The slot 58*a* in the plate 58 is placed at an angle to the direction of movement of the plate and ramming slide so that the reciprocating movement of the ramming slide 53 will produce corresponding reciprocatory movements of the link advancing slide 59. Pawls 62 and 63, pivoted to slide 59 at 64 and 65 respectively, engage the links 57 and urge them towards the dis-

charge end of the chute. Therefore, upon each forward movement of the ramming slide 53, which rams a cartridge into a link of the link belt, the belt is advanced one link so that the belt will be positioned to receive the next cartridge. A flat U-shaped spring 66, attached at the outlet of the link chute 29, presses against the links as they pass out of the machine so as to prevent the weight of the links in the other part of the chute from prematurely forcing the links past the ramming mechanism. The pivoted fingers 67 and 68 (see Fig. 3) are also provided in the link chute so as to prevent the links from "backing up" when the link advancing slide 59 pulls the pawls 62 and 63 back over the links on its return stroke.

A "stop feed" mechanism is also provided which is shown in detail in Figs. 3, 5, and 11. This mechanism comprises two horizontally disposed rods 69 and 71, which are supported at their ends so as to be free to rotate, one on each side of the feed mechanism. The meshing gear segments 72 and 73 are fixed to the ends of these rods so as to provide coactive rotation of the rods. The arms 74 are attached to the rods 69 and 71 and project upwardly outside of the feed mechanism. These arms are provided at their upper ends with arcuate fingers 75, which project inwardly towards the feed mechanism and can be inserted through appropriate openings into the hoppers 31 and 32 in the path of the dropping cartridges when the rods 69 and 71 are rotated. An operating handle 76 is attached to the rod 71, and movement of this handle will rotate rod 71 and also rod 69 through the coacting gear segments 72 and 73. The fingers 75 are held in the inoperative position outside of the feed magazine, by the spring 77. A vertically extending plate 78, attached to one side of the ramming slide 53, is provided with a horizontal slot so as to clear the operating handle 76 when it is in the lower, or inoperative position. The top of the plate 78 is at a height sufficient to maintain the operating handle 76 in an operative position during the course of one stroke of the ramming slide.

In operating the belt loader, the ammunition is first put in the hoppers and the link chute is filled with links. During operation, this chute should be kept as nearly full of links as possible while the rounds of ammunition should be kept supplied to the hoppers and to the hopper trays 31*a* and 32*a*. When current is supplied to the motor 23, the rotation of shaft 25 will impart rotation to the shaft 26 through the appropriate gearing in box 24. The shaft 26 will then impart a reciprocating motion to the ramming slide 53 through the crank arm 28 and connecting rod 54, while at the same time the timing shaft 41 will be rotated through the bevel gears 27 and 20. Rotation of the timing shaft will cause one of the gates 34 or 35 to be rotated, depending upon which of the timing gears 44 or 45 is in mesh with the spur gear 46 or 47. As soon as one of the gates has been rotated so that its open side is facing downwardly, as exemplified by the gate 34 in Fig. 11, the round will drop from the gate and down on top of the ramming slide, as shown in the dotted lines in Fig. 2. As the ramming slide 53 is drawn backwardly, the round will drop down, nose first, into the V-shaped trough 79. A slight depression 81, in the forward end of this trough, is provided for the nose of the bullet to rest against as shown also in the dotted lines in Fig. 2. This depression prevents the round from moving forward until it has dropped completely into the trough 79, which occurs when the ramming

slide has been moved back to the limit of its stroke. While the ramming slide 53 is moving back, the cam 58 (see Fig. 8) will also be moved back and at the same time will advance the link advancing slide 59, which in turn, through the pawls 62 and 63 (Fig. 10) will advance the links 57 one space so that an empty link will at this point be located just in front of the nose of the bullet which is lying in the trough 79. Further operation of the mechanism will result in the ramming slide 53 being moved forward thus pushing the round directly into the empty link in front of it. On the forward movement of the ramming slide, the movement of the cam plate 58 will return the link advancing slide 59 to the position shown in Fig. 10. On this stroke, the slide 59 exerts no influence on the links 57 because the pawls 62 and 63 simply slide over the tops of the links. Assuming that gate 34 is intended to make only one revolution to every three of the gate 35, it will be apparent that when the round which dropped from the gate 34 has been rammed into position the next round will be dropped out of the gate 35 and out of the top of the ramming slide in the same fashion as that which was previously dropped from gate 34. The next succeeding three cartridges following that which dropped from gate 34 will drop from gate 35 and be rammed into the links 57 in the same fashion as already described. As a result, when the belt is completed, no matter what its length may be, every fourth cartridge will be a tracer and all the others will be ball or service ammunition. It will be understood that by substituting gear segments provided with other ratios of gear teeth, other proportions of feed between the tracer and service ammunition may be obtained.

When it is desired to "break" the belt, this can be accomplished by the feed stop mechanism which prevents the feeding of one round of ammunition to the ramming slide so that when the belt comes out of the machine there will be no cartridge to join together the two adjacent links at this point and the belt will separate. The feed stop mechanism is operated by lifting the handle 76 (Figs. 3 and 11) for space of time just long enough to withhold one round from the ramming mechanism. Examining Figure 11, it will be seen that an upward movement of the handle 76 will place the fingers 75 in the path of the cartridges in both hoppers 31 and 32. Thus, no matter whether gate 34 or 35 is in position to receive a cartridge, and only one of them will be, it will be prevented from receiving it as long as the fingers 75 prevent their progress. The purpose of the plate 78 is to prevent operation of the feed stop mechanism for longer than is necessary to withhold one round from the belt. It will be seen from Fig. 2 that the horizontal slot in the plate 78 will prevent lifting the handle until the ramming slide is in its forward position. If the handle is then lifted, the plate 78, which moves with the ramming slide 53, will almost immediately return and pass under the handle 76 and thus hold it in position during one entire cycle of operation of the ramming slide, after which the handle is returned to its usual position by the spring 77. While the cartridge which was dropped on top of the ramming slide during the previous stroke will be rammed into position, nevertheless, one of the gates, depending upon which was in position to receive a cartridge, will now be empty and when it next comes time for that one to drop a cartridge upon the ramming slide there will be

none to fall and consequently at that point no cartridge will be rammed into the links 57.

A modification of the subject invention is shown in Figs. 12, 13, and 14. The principal difference in this form is in the provision of a continuous belt ramming mechanism. In this modified form of the invention, shaft 82 is rotated by a suitable source of power, such as an electric motor (not shown). This rotational movement is transferred to shaft 26 by means of the bevel gears 83 and 84. The crank 28 is attached to this shaft 26 above the gears and operates the slide 85 through the connecting link 54. The slide 85 reciprocates in a slideway 86 which is attached to one side of the supporting member 22. The cam plate 58 is attached to the slide 85, and operates the link advancing slide 59 to feed the links 57, in the same manner as shown in the embodiment of Figs. 1 through 11.

The ramming mechanism comprises the endless chains 87 carried by the two sets of double sprockets 88 and 89 which rotate with the shafts 91 and 92. These shafts are supported on bearings in the bed-plate 93 which is attached to the supporting member 22. A plurality of ramming fingers 94 are pivotally attached between the chains 87 on suitable pins 95 which extend from one chain to the other. Movement of the chains is effected by the gear 96, attached to shaft 91, which gear meshes with gear 97 fixed to the power shaft 82.

The timing mechanism is the same as that used in the principal form of the invention but may be mounted at the other end of the feed magazine as shown in Figs. 12 and 13, so as to provide for convenient disposition of the working parts. The timing shaft 41 is rotated through suitable bevel gears 98, 99, 101 and 102, countershaft 103, and idler gears 104 and 105, (the latter meshing with the gear 106 attached to shaft 92). Shaft 92 is turned by the sprockets 89, engaging the chains 87, operated as described above. Any other suitable means could be used to transmit motion to the timing shaft, providing that such means is suitably geared to the other operating mechanism. In the operation of this modification of the invention, the gates 34 and 35 are operated by the timing mechanism, and the links 57 are advanced in the link chute 29, in the same manner as in the preferred embodiment. But instead of being rammed into the links by a reciprocating ramming slide, the rounds of ammunition are pushed forward by the ramming fingers 94.

Referring to Fig. 12, it will be seen that a cartridge has just fallen on to the trough 79 and is just being engaged by the finger 94 as shown in the full-line portion of the drawings. As a chain 87 moves forward the finger 94 moves forward through a slot provided in the bottom of the trough 79, while the tail of the finger is supported by the bed-plate 93. When the ramming finger reaches the point at which the bed-plate is cut away, the cartridge will be fully rammed into position and the finger will fall away as shown by 94a in the dotted-line portion of the drawings. Further movement of the chain 87 will be necessary before the next ramming finger will come into position to begin the next operation. During this interval the cam plate 58 will be moved forward so as to advance another link into position in the link chute, while one or the other of the gates 34 or 35 will deposit another cartridge on the trough 79, after which the cycle of operations will be repeated.

While the invention has been described with

reference to certain preferred examples thereof which give satisfactory results, it will be understood by those skilled in the art to which the invention pertains, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is my intention, therefore, to cover in the appended claims all such changes and modifications.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A machine for automatically forming a continuous disintegrating type cartridge belt comprising cyclically operating ramming mechanism for ramming into adjacent interfitting links cartridges advancing along a prescribed path, and means normally displaced from the path of the cartridges but optionally movable thereinto for withholding cartridges from said ramming mechanism during at least a single cycle of its operation for breaking the belt.

2. A machine for automatically forming a continuous disintegrating type cartridge belt by ramming cartridges into adjacent interfitting links, comprising a ramming mechanism, a cartridge hopper in communication with the ramming mechanism for feeding cartridges to the ramming mechanism, means normally retracted from the hopper but movable thereinto for detaining cartridges in said hopper, means on said ramming mechanism for retaining said detaining means in detaining position during a cycle of operation of the ramming mechanism and then enabling retraction to normal position.

3. A belt loading device comprising a cartridge magazine, a ramming mechanism including a reciprocating ramming slide making successive ramming and retrograde strokes with respect to the magazine, means for feeding a cartridge from said magazine to said mechanism on each retrograde stroke of the slide, a link chute, means actuated by said ramming mechanism for advancing a link from said chute on each retrograde stroke of the slide into position to be loaded with a cartridge by the ramming mechanism on the ramming stroke of the slide thereby to complete a cycle of operation, and means for retaining a cartridge from the ramming mechanism during a cycle of operation for breaking the cartridge belt.

4. A belt loading machine comprising a plurality of cartridge hoppers, a ramming mechanism including a reciprocating ramming slide making successive ramming and retrograde strokes with respect to the hoppers, means for feeding a cartridge from said hoppers in a selected order to said mechanism on each retrograde stroke of the slide, a link chute, means actuated by said ramming mechanism for advancing a link from said chute on each retrograde stroke of the slide into position to be loaded with a cartridge by the ramming mechanism on the ramming stroke of the slide thereby to complete a cycle of operation, and means for retaining cartridges in all hoppers from the ramming mechanism during a cycle of operation of the machine for breaking the cartridge belt.

5. In a feeding mechanism, a plurality of hoppers, each for containing articles of different types, a rotatable gate for each hopper, means

operable with a constant rotary motion, permuted drive means between the operable means and each of the gates, for imparting a diversity of numbers of rotations to said gates in a prearranged order of selection, and means for preventing rotation of the gates during interim periods of non-rotation.

6. In a feeding mechanism, a plurality of hoppers, each for containing articles of different types, a rotatable gate for each hopper, means operable with a constant rotary motion, permuted drive means between the operable means and each of the gates for imparting single full rotations to one of the gates and succeeding plural rotations to another gate, and means for preventing rotation of the gates during interim periods of non-rotation.

7. In an article feeding mechanism, a hopper for containing the article supply, a revoluble gate for the hopper, a spur gear connected with the gate, a constantly rotatable mutilated timing gear, the tooth course of which is periodically engageable with the spur gear to impart a full revolution to the gate, and locking means connected with the timing gear and gate, mutually engaging to hold the gate stationary in the interim between tooth course and spur gear engagements.

8. In a mechanism for feeding articles of at least two kinds, hoppers for containing the articles of the several kinds, a revoluble gate for each hopper, a spur gear connected to each of the gates, driving means operable with a constant rotary motion, mutilated timing gears connected to the driving means, said gears having tooth courses consisting of predetermined multiples of the spur gear tooth courses, there being one timing gear for each of the gates, the tooth courses of the timing gears being angularly separated with respect to each other to space their engagements with the spur gears and thus vary the sequence of full revolution of each gate, and locking means connected with the driving means and gates, becoming operative in the interim between timing gear and spur gear engagements to hold the respective gate stationary.

9. In an article feeding mechanism, a revoluble gate for passing articles in succession, a spur gear connected to the gate, driving means operable with a constant rotary motion, a mutilated timing gear connected to the driving means having a tooth course at least as long as the tooth-circumference of the gear thereby to cause a full revolution of the gate upon engagement of the teeth, and locking means independent of the gears, having components respectively connected to the driving means and gate, said components mutually engaging in the interim between tooth engagements to hold the gate stationary.

10. In a machine for forming a cartridge belt by ramming cartridges into adjacent interfitting links, said machine comprising a ramming mechanism, a cartridge hopper for feeding cartridges to the ramming mechanism, movable means assuming a displaced position with respect to the hopper but being movable with respect to the hopper to intercept the cartridges, and a plate carried by the ramming mechanism onto which a portion of the movable means is superimposed to support said means in the intercepting position during a cycle of operation of the ramming mechanism.

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