Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 1

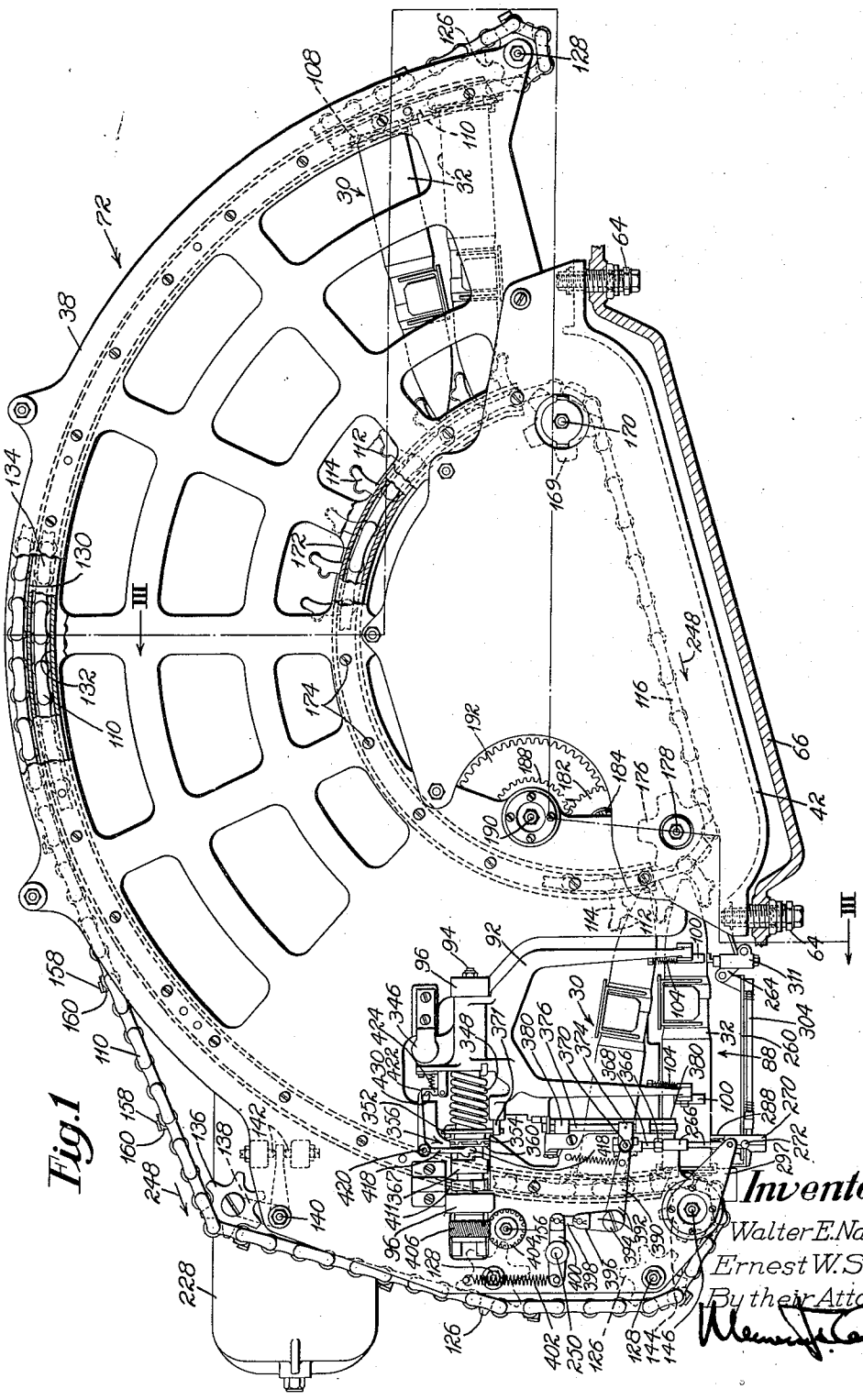


Fig. 1

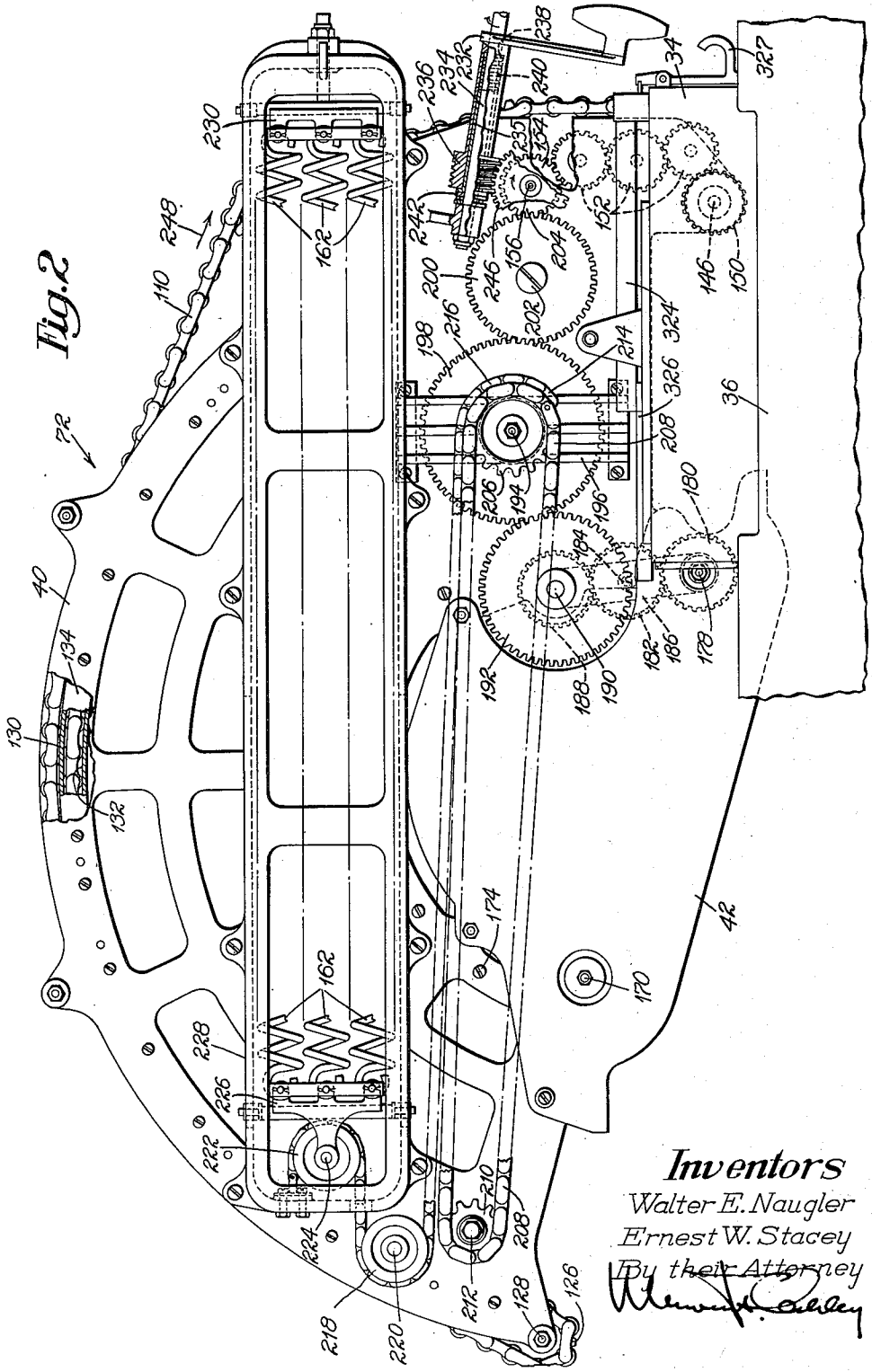
Inventors
Walter E. Naugler
Ernest W. Stacey
By their Attorney

Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 2

Fig. 2



Inventors

Walter E. Naugler

Ernest W. Stacey

By their Attorney

Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 3

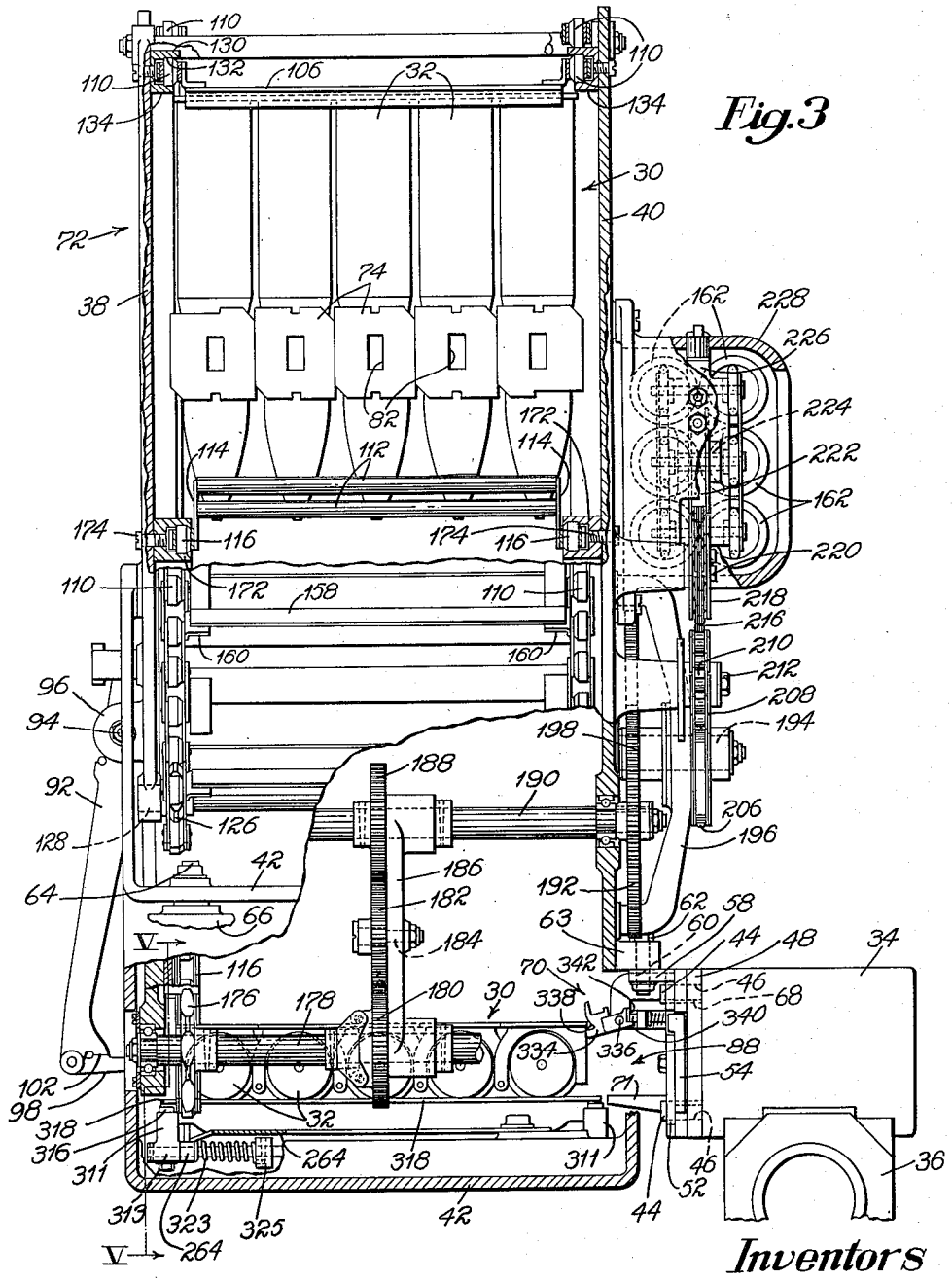


Fig. 3

Inventors

Walter E. Naugler

Ernest W. Stacey

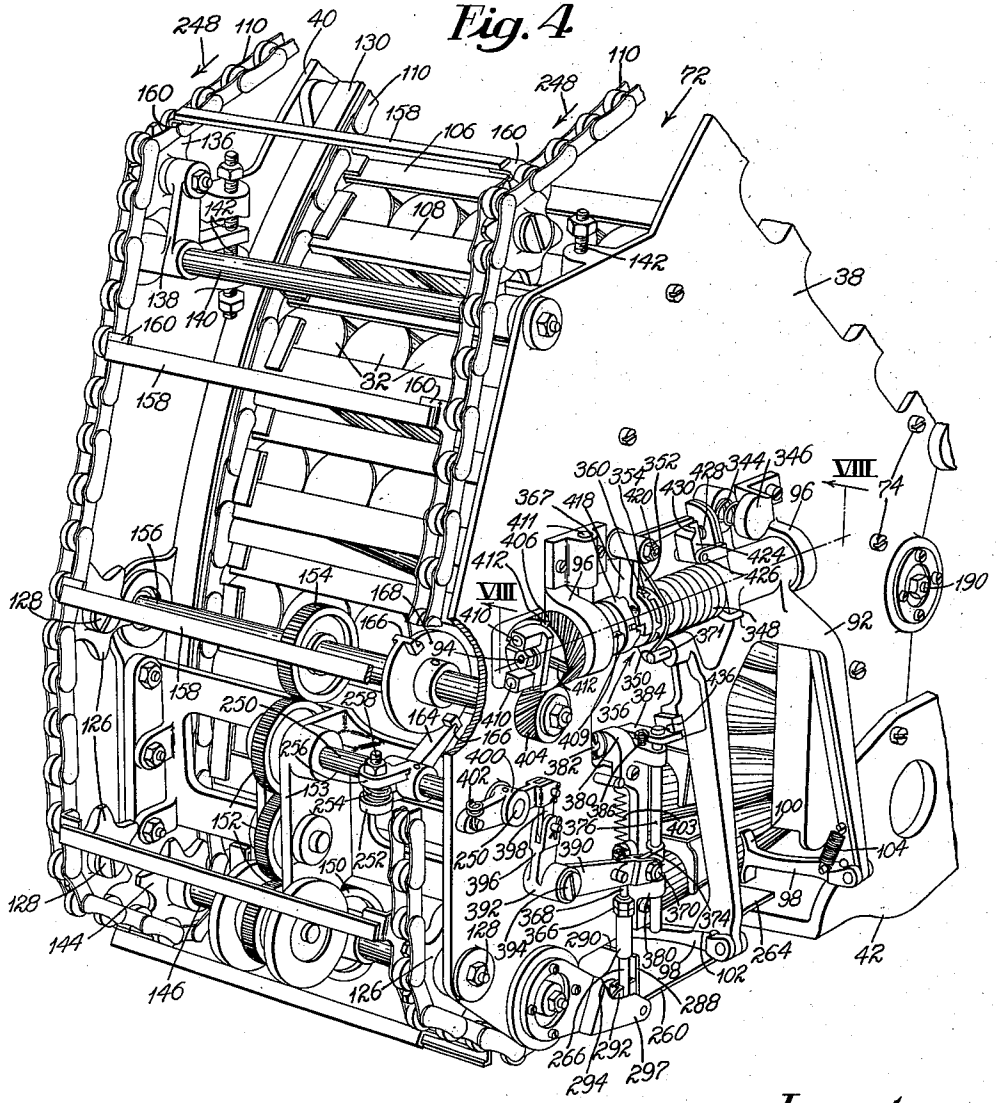
By their Attorney

Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 4

Fig. 4



Inventors

Walter E. Naugler

Ernest W. Stacey

By their Attorney

Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 5

Fig.5

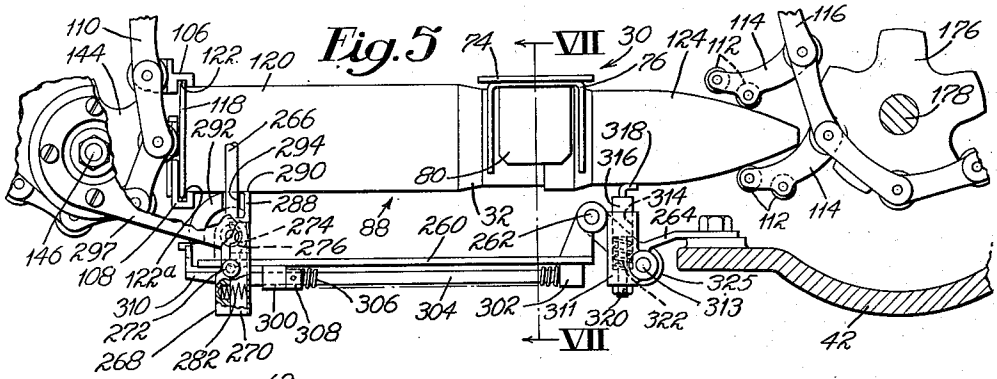


Fig.6

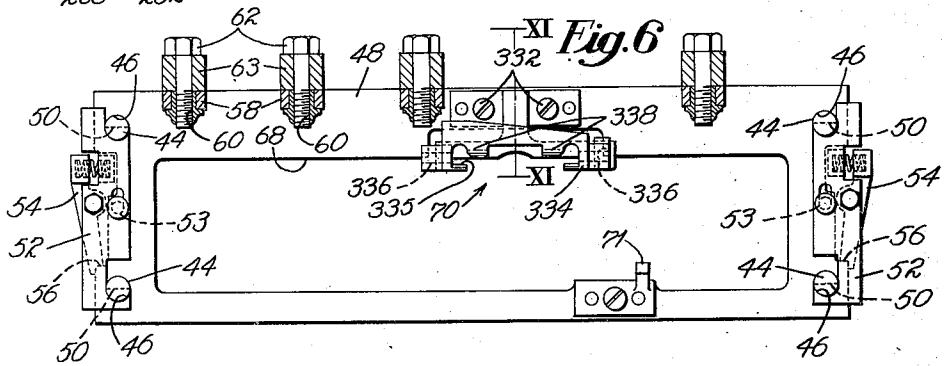


Fig.7

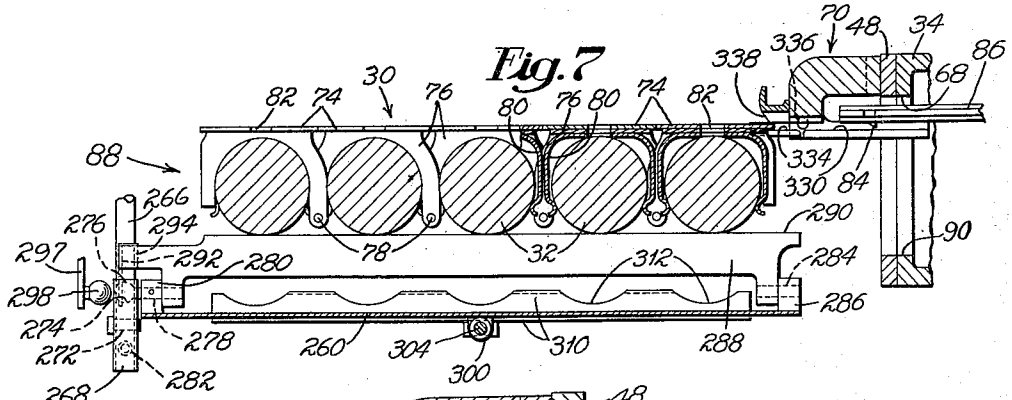
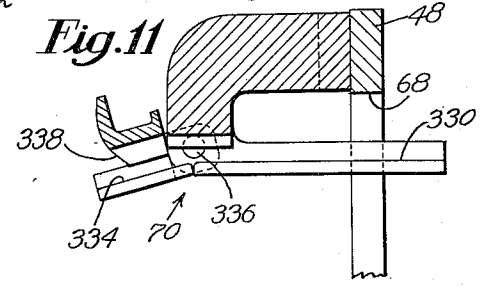


Fig.11



Inventors

Walter E. Naugler

Ernest W. Stacey

By their Attorney

Oct. 3, 1950 W. E. NAUGLER ET AL 2,524,132

AMMUNITION FEEDER

Filed Feb. 7, 1946 6 Sheets-Sheet 6

Fig. 8

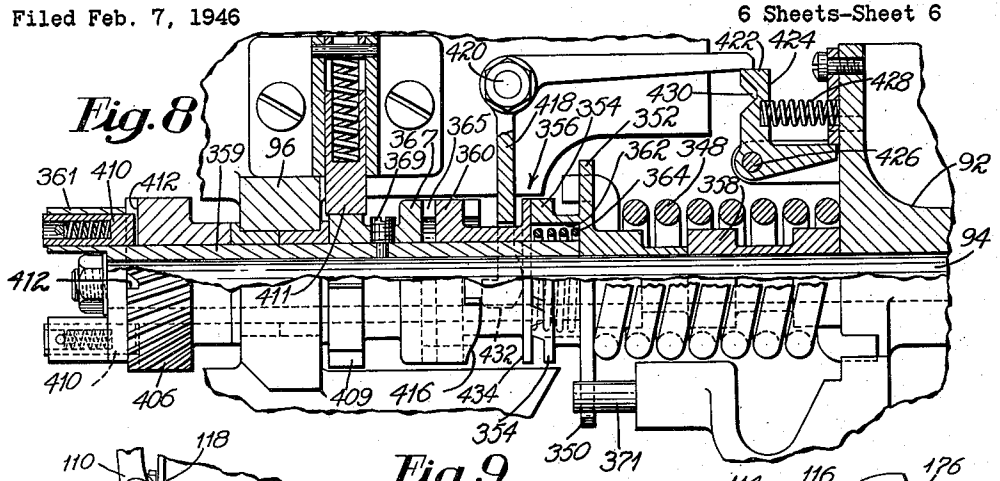


Fig. 9

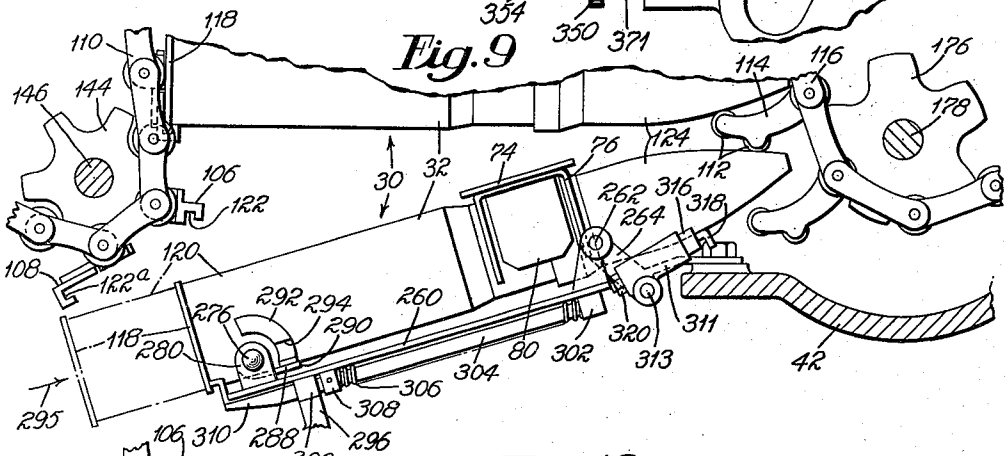
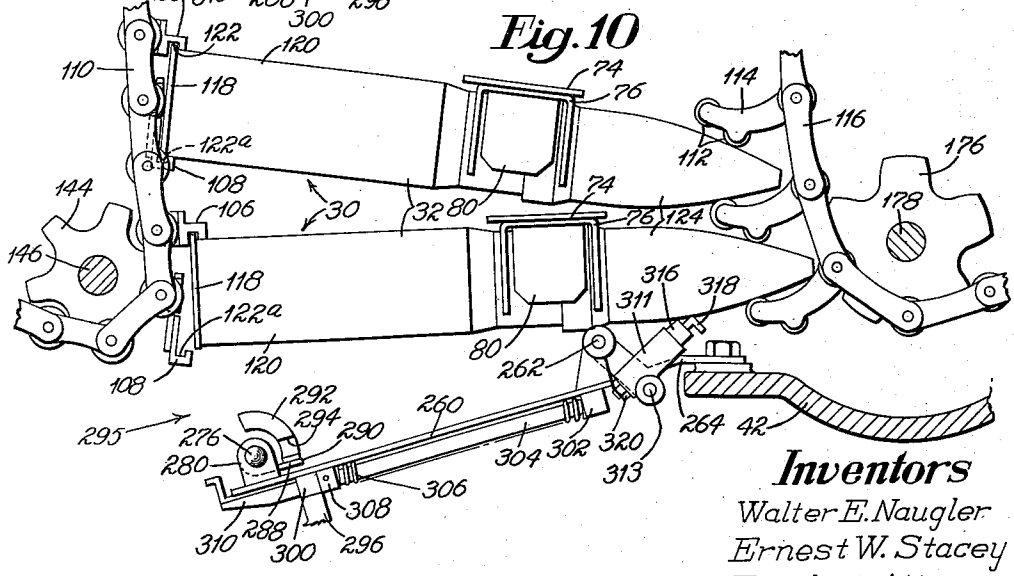


Fig. 10



Inventors

Walter E. Naugler

Ernest W. Stacey

By their Attorney

Patented Oct. 3, 1950 2,524,132

UNITED STATES PATENT OFFICE

2,524,132

AMMUNITION FEEDER

Walter E. Naugler and Ernest W. Stacey, Beverly, Mass., assignors to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application February 7, 1946, Serial No. 646,174

5 Claims. (Cl. 89—33)

1

This invention relates to ordnance and is illustrated as embodied in a feeder for automatically supplying clips of cartridges to a feed box of a 37 mm. gun.

In order to insure that a 37 mm. gun mounted in an airplane, for example, may be fired in short bursts at its maximum rate, it is highly desirable that an automatic ammunition feeder be provided. Such a feeder for use in an upper pressurized turret of an airplane is disclosed in United States Letters Patent No. 2,494,728, granted January 17, 1950 or an application filed in the names of Ernest W. Stacey and Frank W. Reinhold. Because of the limited space available and various other considerations it is often impracticable to use the same feeders in corresponding turrets of different airplanes or in different turrets of the same airplane.

It is an object of the present invention to provide an improved feeder for automatically supplying clips of cartridges to a 37 mm. gun mounted, for example, in a lower turret of an airplane. The illustrative feeder, in accordance with a feature of the present invention, comprises two pairs of endless chains which are operated in timed relation and oppositely arranged sections of which are movable in arcuate paths, channeled bars carried by one pair of said chains, said bars being constructed and arranged to engage opposite sides of the rims of cases of cartridges assembled in clips, rods carried by the other pair of chains, said rods being constructed and arranged to engage opposite sides of projectiles of cartridges assembled in said clips, spring-energized means for intermittently moving or indexing said pairs of chains in said arcuate paths to deliver the clips of cartridges successively to a transfer station arranged adjacent to a feed box of a gun, a driver, and means comprising a member responsive to movement of the clips of cartridges to the transfer station for causing said driver to force said clips of cartridges from said bars and rods into the feed box.

The driver comprises a lever which is mounted for pivotal movement and has pivotally connected to it arms constructed and arranged to engage said clip of cartridges at the transfer station, a relatively weak spring being provided for constantly urging the driver to a retracted position in which it is retained until released by a latch. When the driver has been released, a relatively powerful coil spring causes the driver to feed clips of cartridges at the transfer station into the feed box, means responsive to movement of the driver being provided for causing said spring to become, in effect, part of the driver

2

during retractive movement of the driver, and for causing the spring to be energized, after the driver has been retracted, to feed the next clip of cartridges into the feed box after the latch, which is responsive to movement of a clip of cartridges to the transfer station, has been released.

The illustrative feeder also comprises means for guiding the clips in which the cartridges are assembled, into the feed box, said means including a guide which is fixed to the feed box and is constructed and arranged to receive said clips, and a pivotally mounted ramp which is constructed and arranged to be deflected by the clips as they are moved toward the guide in order to facilitate moving said clips into the guide.

The illustrative feeder is also provided with mechanism for filling the magazine with clips of cartridges, said clips of cartridges being supplied manually to the transfer station, which at such time serves as a loading station. Mechanism is also provided for operating the pairs of chains and the ammunition supporting bars and rods carried thereby in reverse directions against the action of the above-mentioned spring-energized means to move the clips of cartridges presented to the feeder at the loading station, into stacked relation in the magazine. In order to assist in feeding the clips of cartridges to the channeled bars and rods carried by the pairs of chains, respectively, there is provided a movable member constructed and arranged to position the clips of cartridges and to facilitate presentation of said clips to the various clip supporting bars and rods of the chains properly indexed to receive said clips.

The various features of the invention will be understood and appreciated from the following detailed description read in connection with the accompanying drawings, in which

Figs. 1 and 2 are views showing the opposite sides, respectively, of the illustrative ammunition feeder, portions of which have been broken away;

Fig. 3 is a view on line III—III of Fig. 1;

Fig. 4 is a perspective view of the rear portion of the feeder;

Fig. 5 is a view on line V—V of Fig. 3;

Fig. 6 is a view showing in detail mechanism for positioning the feeder with relation to a feed box of a gun;

Fig. 7 is a view partly on line VII—VII of Fig. 5;

Fig. 8 is a view partly on line VIII—VIII of Fig. 4;

Figs. 9 and 10 are views on line V—V of Fig. 3, illustrating loading mechanism of the feeder dur-

ing two different stages of the filling of the magazine of the feeder with clips of cartridges: and

Fig. 11 is a section on line XI—XI of Fig. 6.

The illustrative feeder is described with reference to supplying clips 30 (Figs. 1, 3, 5, 7, 9 and 10) of cartridges 32 to a feed box 34 (Figs. 2, 3 and 7) of a 37 mm. gun 36 such as disclosed in United States Letters Patent No. 1,525,065, granted February 3, 1925, on an application filed in the name of John M. Browning, and comprises arcuate web side plates 38 (Figs. 1, 3 and 4), 40 (Figs. 2, 3 and 4) which are bolted to a base 42 and are joined together by tie-rods. The side plates 38, 40 and the base 42 together form a housing or magazine 72 in which the clips 30 of cartridges 32 are stacked in radial arrangement.

In order to position the ammunition feeder with relation to the feed box 34 of the gun 36, said box has extending from its left side, as viewed from the front of the gun, four studs 44 (Figs. 3 and 6) which fit in holes 46 (Fig. 6) respectively of a plate 48 (Figs. 3, 6, 7 and 11) and have notches 50 (Fig. 6) formed in them. The plate 48 is secured to the feed box 34 by a pair of clamps 52 (Figs. 3 and 6) which are supported for vertical sliding movement upon studs 53 secured to the plate and which engage the outside face of the plate and fit in the notches 50 of the studs 44, each of the clamps being held in its raised locking position by a spring-pressed lever 54 (Figs. 3 and 6) which engages a shoulder 56 (Fig. 6) of the plate and prevents the clamp from moving out of its locking position in the notches.

Formed integral with and extending laterally from the plate 48 are a pair of flanges 58 (Figs. 3 and 6) having bores 60 for receiving screws 62 (Fig. 3) extending through vertical bores in bosses 63 at the lower end of the side plate 40, said bosses resting upon the flanges and being properly positioned thereon by said screws. It will be understood that the above mechanism is merely for the purpose of locating the ammunition feeder with relation to the feed box 34, the base 42 of the machine, after being properly positioned, being supported in such position by a plurality of screws 64 (Figs. 1 and 3) mounted upon a bearing 66 to which the receiver of the gun 36 is secured. As will appear later, the plate 48 has formed in it an ammunition receiving opening 68 (Figs. 3, 6, 7 and 11) and has secured to it an ammunition guide 70 and a cartridge guide rail 71 (Figs. 3 and 6). The illustrative machine, if desirable, may be advantageously incorporated in a lower pressurized turret of an airplane.

The cartridge assembling clips, which are best shown in Fig. 7, comprise a plurality of flat plates 74 to which are secured yokes 76 (Figs. 5, 7, 9 and 10) hinged through pins 78 (Fig. 7) to the yokes of adjacent plates, the yokes having secured to them spring clasps 80 constructed and arranged to receive the cartridges and to retain them in assembled relation. Formed in each of the plates 74 and the yokes 76 is a hole 82 (Fig. 7) for receiving a pawl 84 of a slide 86 forming part of the feed mechanism of the gun. As will be hereinafter explained, clips 30 of cartridges 32 are fed successively to a transfer station 88 (Figs. 1, 3, 5 and 9) arranged adjacent to the cartridge receiving opening 68 of the plate 48, which opening is in alinement with a cartridge receiving opening 90 (Fig. 7) in the side of the feed box 34 of the gun 36, and are pushed into said feed box by a spring-energized yoke-shaped driver or lever 92 (Figs. 1, 3, 4 and 8) which is pivotally mounted upon a shaft 94 rotatably supported in bosses 96

of the side plate 38 of the housing 72, the lower ends of vertically arranged bifurcations of the driver 92 being pivotally connected to a pair of arms 98 (Figs. 3 and 4) having at their inner ends arcuate cartridge engaging portions 100 (Figs. 1 and 4). The arms 98 are constantly urged into contact with stop shoulders 102 of the driver 92 by springs 104 the opposite ends of which are attached to studs on said bifurcations and arms respectively.

Each clip of cartridges 32 is supported in the housing 72 by a pair of channeled bars 106, 108 (Figs. 4, 5, 9 and 10) which are secured to successive side links of outer endless chains 110, and a pair of rods 112 opposite ends of which are secured to lugs 114 forming parts of side links of pairs of endless chains 116. As best shown in Fig. 5, the cartridges 32 are supported by the bars 106, 108 and the rods 112 with lips 118 (Figs. 5, 9 and 10) of the cases 120 of the cartridges resting in opposed channels 122, 122a of the bars 106, 108, respectively, and the opposite sides of the projectiles 124 of the cartridges engaging the rods 112.

The outer endless chains 110 pass over idler sprockets 126 (Figs. 1 to 4) mounted upon stub shafts 128 supported by the side plates 38, 40 of the magazine or housing 72, override arcuate surface 130 of the side plates, and, on their inner stretch, move into U-shaped grooves 132 (Figs. 1, 2 and 3) formed in guides 134 secured by screws to the side plates. The endless chains 110 also pass over a pair of sprockets 136 (Figs. 1 to 4) which are rotatably mounted upon bell-crank levers 138 fulcrumed upon a tie-rod 140, the levers 138 being angularly adjustable on said rods to tension the endless chains by turning screws 142. In order to drive the outer chains 110 there is provided a pair of sprockets 144 (Figs. 1, 4, 5, 9 and 10) secured to the opposite ends of a drive shaft 146 (Figs. 1, 2 and 4) which is rotatably mounted in bearings of the side plates 38, 40 of the housing 72 and has secured to its central portion a gear 150 (Figs. 2 and 4) operatively connected through idler gears 152, rotatably mounted in a cross frame 153 (Fig. 4) secured to the side plates, with a gear 154 secured to a drive shaft 156 (Figs. 1, 2 and 4) rotatably mounted in bearings supported by said side plates.

In order that the oppositely arranged chains 110 shall be effectively tied together over a section where the bars 106, 108 have been discontinued, there are provided tie-bars 158 (Figs. 1, 3 and 4) which are secured to projecting flanges 160 of associated side links of the chains. As will be explained later, the inner and outer endless chains 110, 116 are energized by powerful springs 162 (Figs. 2 and 3) to enable said chains, when released by moving a pawl 164 (Fig. 4) from a shoulder 166 of a ratchet 168 secured to the shaft 156, to move sufficiently to move or index one of the clips 30 of cartridges 32 arranged in the magazine just above the transfer station 88 to said station after the previous clip of cartridges has been slid by the yoke-shaped driver 92 into the feed box 34 of the gun 36, the construction and arrangement being such that the ratchet 168 moves half a turn before being stopped by the pawl, as will be hereinafter explained.

The inner pair of chains 116, to which the rod carrying lugs 114 are secured, pass over idler pulleys 169 (Fig. 1) secured respectively to stub shafts 170 rotatably mounted in bearings supported by the side plates 38, 40 of the housing

72, along an arcuate guide 172 (Figs. 3 and 4) of U-shaped cross section secured by screws 174 to the plates, and over driving sprockets 176 (Figs. 1, 3, 5, 9 and 10) secured to opposite ends of a drive shaft 178 supported for rotation in bearings mounted in the side plates.

Secured to the drive shaft 178 is a gear 180 (Figs. 2 and 3) driving, through an idler gear 182 rotatably mounted upon a pivot pin 184 carried by a bearing frame 186, a gear 188 pinned to a shaft 190 (Figs. 1 to 4) rotatably mounted in bearings carried by the side plates 38, 40 of said housing 72. Secured to an end of the shaft 190 outside the side plate 40 is a gear 192. Fixed to a shaft 194 (Figs. 2 and 3) rotatably mounted in bearings of a strut 196 secured to the side plate 40 is a gear 198 which meshes with the gear 192 and is operatively connected, through an idler gear 200 (Fig. 2) rotatably mounted upon a pivot pin 202 supported by the side plate 40, with a gear 204 secured to the shaft 156. Also secured to the shaft 194 is a sprocket 206 (Figs. 2 and 3) upon which is mounted an endless chain 208 which also passes over a sprocket 210 rotatably mounted upon a pivot pin 212 secured to a boss of the side plate 40. Secured by couplings 214 (Fig. 2) to the endless chain 208 is a chain 216 which passes over an idler pulley 218 mounted upon a pivot pin 220 rotatably supported by said plate 40, and around a pulley 222 rotatably mounted upon a pivot pin 224 carried by a header 226, the end of the chain being secured to a spring housing 228 screwed to the side plate 40. Secured to the rear end of the housing 228 is a rear header 230 having attached to it the rear ends of the springs 162 the forward ends of which are attached to the header 226.

The drive shaft 156 may be rotated to fill the housing or magazine 72 with clips 30 of cartridges 32 by a crank 232 (Fig. 2) which has a worm 236 formed integral with it and which is rotatably supported upon a rod 234 and upon a sleeve 235 loosely mounted upon the rod which is fixed to a boss of the side plate 40. Enclosed in a bore 238 of the crank 232 and surrounding a portion of the rod 234 is a spring 240 the rear end of which engages the crank and the forward end of which engages the sleeve 235 which is continuously forced by said spring against a thrust bearing 242 mounted upon the rod. When the crank 232 is slid forward along the rod 234 and is rotated clockwise, as viewed from the rear, upon said rod 234 against the action of the spring 240, it meshes with a gear 246 fixed to the outer end of the drive shaft 156 and moves forward on the rod until the worm 236 engages the thrust bearing 242, further rotation of the crank in the same direction causing, through mechanism above described, rotation of the drive shaft 156 in the direction of the arrow (Fig. 2), thus effecting rotation of the inner and outer pairs of chains 110, 116 in directions indicated by arrows 248 (Figs. 1, 2 and 4) against the action of the spring-loaded chain 216. When, during the loading of the clips 30 of cartridges 32 into the housing or magazine 72, the crank 232 is released, the worm 236 serves as a lock for preventing rotation of the gear 246 in an opposite direction under the action of the spring-loaded chain 216.

It will be noted that the two shoulders 166 (Fig. 4) of the ratchet 168 are spaced 180° apart and that when the opposite bars 106, 108 and the rods 112, which together constitute a supporting unit or carrier for the clips 30 of cartridges 32, are in the transfer station 88, the pawl 164, which is rotatably mounted upon a shaft 250 (Figs. 1 and 4) serving as a fulcrum pin for one of the idler gears 152, is in engagement with the lower of the two shoulders 166, as shown in Fig. 4. The pawl has a rearward extension 252 (Fig. 4) which is constantly urged counterclockwise, as viewed in Fig. 4, by a spring 254 which fits in a socket of said extension and has its upper end fitting in a socket of an arm 256 secured to the shaft 250, a retaining screw 258 carried by the arm 256 serving to keep the spring in said sockets. As the crank 232 is rotated clockwise, as viewed from the rear, to rotate the ratchet 168 counterclockwise as viewed in Fig. 4, the pawl 164 will be depressed against the action of the spring 254 as the outer surface of the ratchet 168 slides along the pawl and, under the action of the spring 254, drops past one of the shoulders 166 of the pawl as the next supporting unit for receiving a clip 30 of cartridges 32 arrives at the transfer station 88. As will appear later, when the housing or magazine 72 is being filled, the arm 256 is held fixed. It will be noted that the transfer station 88 is also the place where the clips 30 of cartridges 32 are manually fed successively to the supporting units for the clips of cartridges, the loaded supporting units being swung bodily clockwise, as viewed in Figs. 1 and 4, into radially stacked relation until twenty clips of cartridges have been loaded into the magazine.

After disconnecting a carrier 260 (Figs. 1, 4, 5, 7, 9 and 10), which is pivoted on pins 262 forming part of a bracket 264 secured to the base 42, from a vertical rod 266 (Figs. 1, 4, 5 and 7) and swinging said carrier into a lowered position, shown in Fig. 10, the gunner presents the clips 30 of cartridges 32 manually to the machine through the use of mechanism which will now be described. As will be explained later, it is the purpose of means mounted upon and movable with the carrier 260 to depress the vertical rod 266 when a clip of cartridges arrives at the transfer station 88, thereby actuating, by mechanism hereinafter described, the yoke-shaped driver 92 to enable it to move the clips of cartridges at said station into the feed box 34 of the gun 36 and then to cause the pairs of spring-energized chains 110, 116, which together with the bars 106, 108 and the rods 112 form a conveyor for the clips of cartridges, to be operated to deliver the next successive clip of cartridges to said transfer station and to energize the driver for the next cartridge feeding operation.

The rod 266 has a lower end 268 (Fig. 5) which is straddled by a clasp 270 (Figs. 1 and 5) of U-shaped cross section, the clasp being pivoted upon a pin 272 carried by the lower end 268 of the rod. The clasp 270 has a recess which together with an opposing recess in the lower end 268 of the rod 266 forms a spherical recess 274 for receiving a ball 276 (Figs. 5, 7, 9 and 10) forming the outer end of a pin 278 (Fig. 7) secured in a bore of a boss 280 of the carrier 260. A spring 282 fitting in opposing recesses of the lower end 268 of the rod 266 and clasp 270 normally operatively connects the carrier 260 to the rod in order that downward swinging movement of said carrier by the action of the clips of cartridges delivered to the transfer station 88 will effect vertical movement of the rod 266, causing the driver 92 to operate and various other operations hereinafter described to take place.

Fulcrumed upon the pin 278 and upon a pin 284 (Fig. 7) secured to a boss 286 of the carrier

260 is a detecting plate or feeler 288 (Figs. 1, 3, 4, 5, 7, 9 and 10) having a straight upper edge 290 constructed and arranged to be engaged by cartridges in the clips moved from the magazine 72 to the transfer station 88. Upon being engaged by said clips of cartridges the detecting plate 288 is depressed slightly against the action of mechanism hereinafter described, causing the carrier 260 to pivot slightly counterclockwise, as viewed in Fig. 5, about the pins 262. When the machine or feeder is feeding clips of cartridges to the gun, the detecting plate 288 is held vertically positioned, as shown in Figs. 5 and 7, by an arcuate lug 292 which is secured to the plate and is provided with a recess 294 (Figs. 4, 5, 9 and 10) in which the rod normally registers to hold the plate in its operative position, shown in Figs. 5 and 7.

Clips of cartridges are supplied manually to the machine from beneath and to the rear of the transfer station 88 through an opening 295 (Figs. 9 and 10), the carrier 260 having been swung about the fulcrum pins 262 against a stop 296 forming part of the base 42. Before lowering the carrier 260, it is first necessary to disconnect the ball 276 from the rod 266 by swinging the clasp 272 clockwise, as viewed in Fig. 5, against the action of the spring 282 and shifting the rod laterally away from the ball 276. In order to preserve the timing between the various parts of the machine, as will appear later, it is desirable to retain the rod 266 stationary while the magazine 72 is being filled with clips of cartridges and accordingly there is secured to a lug 297 (Figs. 4, 5 and 7) screwed to the side plate 38, a ball 298 (Fig. 7) arranged in receptive adjacency to the spherical recess 274 so that the clasp 270 can clamp the rod to the ball 298 after said rod has been disconnected from the ball 276.

Slidingly mounted in alined bores of depending bosses 300 (Figs. 5, 7, 9 and 10), 302 of the carrier 260 is a rod 304 which is normally urged rearward, that is to the left as viewed in Fig. 10, by a spring 306 the front end of which engages the boss 302 and the rear end of which engages a collar 308 pinned to the rod. Secured to the rear end of the rod 304 is a platform 310 having a flat face engaging the underside of the carrier 260 and having an upstanding flange provided with recesses 312 (Fig. 7) having substantially the same curvature as the cases 120 of the cartridges 32. In order to fill the magazine 72 with clips of cartridges, the operator manually moves said clips successively forward and upward through the opening 295 (Figs. 9 and 10) to the position shown in Fig. 9, the projectiles 124 of the cartridges extending between the rods 112 of adjacent lugs 114 and the cartridge cases 120 lying in the recesses 312 and upon the then turned-down plate 288 with the rims 118 of said cases resting against the platform 310. At this time, one of the channeled bars 106 of the chain 110 is stopped in the position shown in Fig. 9, an associated channeled bar 108 being swung back out of alinement with the bar 106. The carrier 260 will then be manually swung clockwise as viewed in Fig. 9, together with the platform 310, until the rims 118 of the cartridge cases 120 engage the channel 122 of the bar 106. The platform 310 is then permitted to drop to its lowered position and the clip of cartridges is manually held elevated, the crank 232 thereafter being rotated clockwise, as viewed from the rear of the machine, to swing the following channeled bar 108 past the position shown in Fig. 10 so that its channel 122a engages the lips of the cartridge cases to support the cartridges, the clip of cartridges during this time being manually supported by and moved along with the chains. As the crank 232 is rotated as above described, the rods 112 will be raised into engagement with the projectiles of the cartridges of the clip and will cooperate with the bars 106, 108 in moving the clip of cartridges to the transfer position. The above procedure is repeated until the magazine 72 has been filled with clips of cartridges and there is one clip of cartridges at the transfer station 88.

Formed in bosses 311 (Figs. 3, 5, 9 and 10) secured to opposite ends of a rod 313 rotatably supported upon the bracket 264 are recesses 314 (Fig. 5) constructed and arranged to receive plungers 316 which, together with a header 318 secured thereto, form a buffer with which the projectiles of the cartridges engage as the cartridges are moved successively to the transfer station 88, each of the plungers being normally held in a raised position, in which a nut 320 secured to it is forced against the bottom of the bracket, by a spring 322. Each of the bosses 311 is normally held in its upright operative position, shown in Fig. 5, by a coil spring 323 (Fig. 3) the inner end of which is fixed to a collar 325 pinned to the rod 313 and the outer end of which is fixed to the bracket 264. It will be apparent that the bosses 311 together with the header 118 will readily yield to positions shown in Fig. 9 when the magazine 72 is being filled with clips of cartridges.

As the clips of cartridges from the housing 72 are moved to the transfer station 88 (Figs. 1, 3, 5 and 7), they depress the registering plate 288 and the buffer header 318 slightly, causing the rod 266 to release the yoke-shaped driver 92, which at that time is spring energized and cocked, to effect transfer of said clips of cartridges to the feed box 34 of the gun 36.

When the magazine or housing 72 has received twenty clips of cartridges, it is filled to capacity. In order to prepare the gun 36 for automatic fire and the feeder for automatic feed, it is necessary to place a clip of cartridges in the then empty transfer station 88 and to move said clip, through mechanism hereinafter described, into such a position that the hole 82 (Fig. 7) of the leading plate 74 is in registration with the pawl 84 of the feed slide 86 of the gun. A lock frame (not shown) of the gun is then moved back to its retracted position by actuating an operating lever (not shown) of the gun, after which an operating handle 324 (Fig. 2) is actuated to cause a slide 326, together with associated elements of the gun, to chamber the leading round of the clip in order that the gun may be fired when a trigger 327 is pulled. Thereafter, the rounds will be automatically fed into the gun, the clips of cartridges moving to the transfer station and being fed, through mechanism hereinafter described, into the feed box of the gun.

In order to guide clips of cartridges to suitable positions below the feed pawl 84, the guide 70 is provided with a guideway or ways 330 (Figs. 7 and 11) for receiving the plates 74 of said clips, said guide being secured by screws 332 (Fig. 6) to the plate 48. In order to insure that the clips in which the cartridges are assembled shall be effectively fed into the ways 330, the guide is provided with a ramp 334 (Figs. 3, 6, 7 and 11), which is pivoted upon a pair of trunnions 336 mounted upon the guide 70 and has the upper

end of its ways 335 (Figs. 7 and 11) in abutting relation with the ways 330 so that the plates 74 of the clip in which the cartridges are assembled can be effectively moved up the ways 335 of the ramp 334 and along the ways 330 of the guide. The common axis of the trunnions 336 extends transversely of the ways 330, 334 and lies in close proximity to the abutting ends of the ways. It has been found that there is sometimes a slight vertical vibration of the clips of cartridges as they are being transferred to the feed box 34 and accordingly it is desirable to provide the ramp 334 with a face 338 which is inclined to the ways 335 and is constructed and arranged to be engaged by the leading plate 74 of the clip to swing the ramp upwardly slightly so as substantially to aline the ways 335 of said ramp with the ways 330 of the guide 70. The ramp 334 is normally held in its downward tilted position, shown in Figs. 3 and 11, by a spring-pressed plunger 340 (Fig. 3) which engages a shoulder 342 of the ramp, downward movement of said ramp being limited by engagement of an extension of the ramp with the plunger. As the clips of cartridges are moved toward the feed box 34 of the gun 36, the leading plate 74 of each of the clips in which the cartridges are assembled engages the face 338 of the ramp 334, causing said ramp to swing clockwise, as viewed in Figs. 3, 7 and 11, the ways 335 of the ramp being moved into approximate alinement with the ways 330 of the guide 70, as shown in Fig. 7, so that the cartridges may be effectively moved into the feed box of the gun.

When the magazine or housing 72 is filled to capacity, the powerful springs 162 are almost fully extended, as shown in Fig. 2. The crank 232 (Fig. 2) is then rotated counterclockwise as viewed from the rear of the machine, enabling the spring 240 to move the worm 236 to an idle position away from the gear 246, engagement of the pawl 164 with one of the shoulders 166 of the ratchet 168 serving to prevent rotation of the pairs of inner and outer chains 110, 116 under the action of the springs 162.

The mechanism for automatically moving the clips 30 of cartridges 32 successively to the feed box 34 of the gun 36 will now be described. The yoke-shaped driver 92 is constantly urged to its retracted or starting position approximately as shown in Fig. 4 by a coil spring 344 (Fig. 4) one end of which fits in a recess of a lug 346 (Figs. 1 and 4) secured to the side plate 38 and the opposite end of which fits in a recess of the driver. The driver 92 is operated to slide the clips of cartridges mounted upon the bars 106, 108 and the rods 112 into the feed box 34 of the gun 36, by a powerful spring 348 (Figs. 1, 4 and 8) one end of which is attached to the driver and the other end of which passes through a hole in a plate 352. The plate 352 has a hooked portion 350 and forms part of a toothed driven member 354 of a clutch 356. Interposed between the driven member 354 of the clutch 356 and the driver 92 is a stepped sleeve 358 (Fig. 8) which is rotatably mounted upon the shaft 94 and, if desirable, may be formed integral with said driven member.

The clutch 356 also comprises a slidable toothed driving member 360 (Figs. 1, 4 and 8) which is movable longitudinally along a sleeve 359 (Fig. 8) of a coupling 361 into driving relation with the toothed driven member 354 of the clutch. Enclosed in a recess 362 of the driven member 354 of the clutch 356 is a spring 364 the left end of which engages the driving member 360 of the clutch. The spring, when permitted, moves said driving member 360 of the clutch 356 to the left, as viewed in Fig. 8, along guideways 365 of a cam 367, which is secured to the sleeve 359 and to the shaft 94 by a screw 369, to disengage the driving and driven members of the clutch. Initial loading of the spring 348 is maintained by attaching the forward end of the loaded spring to the driver 92, as above explained, and by causing the hooked portion 350 of the plate 352 to be forced against a stud 371 of the driver except during such time as the spring is further energized, as will appear later. It will thus be clear that when the driving member 360 of the clutch 356 is out of driving relation with the driven member 354 of the clutch, the spring 348 is in effect initially tensioned between different parts of the driver.

When the pawl 164 is moved out of engagement with the shoulder 166 of the ratchet 168, the inner and outer pairs of chains 110, 116, respectively, acted upon by the heavy coil springs 162, move the leading radially arranged clip of cartridges in the magazine 72 to the transfer station 88. As the clips of cartridges arrive at the transfer station, said cartridges, as above explained, depress the detecting plate 288 which is operatively connected to the rod 266, causing said rod to be moved downward.

Threaded into the upper end of the rod 266 and secured thereto by a lock nut 366 (Fig. 4) is a threaded rod 368 carrying a screw 370 which passes through an elongated recess of an arm 374 secured to a rod 376 vertically slidable in alined bores of bosses of a bracket 380 screwed to the side plate 38 of the machine. Fitting in a horizontal bore at the upper end of the bracket 380 is a pin 382 upon which is fulcrumed a latch or latch plate 384 through which passes the rod 376, a head of said rod overriding the upper surface of the plate. A spring 386 opposing ends of which are housed in alined recesses in the bracket 380 and the plate 384 constantly urges the plate, and accordingly the rod 376, upward.

The screw 370 also passes through elongated slots formed at the bifurcated end of a lower arm 390 (Figs. 1 and 4) of a bell-crank lever 392 which is fulcrumed upon a screw 394 threaded into a boss on the side plate 38 and has an upwardly extending arm 396 operatively connected through a pin-and-link connection 398 to a lever 400 which is pinned to the pawl carrying shaft 250. The lever 400 is constantly urged clockwise, as viewed in Figs. 1 and 4, by a relatively powerful spring 402 and the bell-crank lever 392 is constantly urged counterclockwise, as viewed in Figs. 1 and 4, by a relatively weak spring 403. Rotatably mounted upon and secured to the shaft 250 are the arm 252 and the rearward extension 256 of the pawl 164, respectively, through elongated openings of which passes the screw 258, said extension, as above explained, being operated by the arm through the spring 254.

Secured upon the drive shaft 156 (Figs. 1, 2 and 4) outside the side plate 38 is a helical gear 404 which meshes with a helical gear 406 mounted upon the shaft 94. Secured by the screw 369 (Fig. 8) to the shaft 94 is the coupling 361 which is formed integral with the sleeve 359 and in which are slidable spring-pressed plungers 410 (Figs. 4 and 8) constructed and arranged to engage channels 412 which are formed in the outer face of the helical gear 406 and are of V-shaped cross section. It will be noted that the opposite sides of the channels 412 are disposed at right

angles and inclined at low angles respectively to the rear face of the helical gear 406 and that the ends of the plungers 410 are of complemental shape, the construction and arrangement being such that clockwise rotation of the helical gear 406 upon clockwise movement of the helical gear 404, as viewed in Fig. 4, will cause a corresponding rotation of the shaft 94, but counterclockwise rotation of the helical gear 406 uopn counterclockwise movement of the helical gear 404 will cause the plungers 410 to ride out of the channels 412 with the result that the shaft remains stationary, for reasons which will hereinafter appear.

The cam 367 has formed on it four ratchet faces 409 (Fig. 4) spaced 90° apart which cooperate with a spring-pressed pawl 411 (Figs. 4 and 8) to prevent counterclockwise movement of the coupling 361 (Fig. 8) and the shaft 94, the arrangement being such that one of the ratchet faces is in engagement with the pawl as the clip of cartridges is being delivered to the transfer station 88.

As above explained, the driving member 360 of the clutch 356 is slidable lengthwise upon the sleeve 359 in the guideways 365 of the cam 367 which has a front operating face 416. The driving member 360 of the clutch 356 is constantly urged to the left (Fig. 8) to a non-driving position by the spring 364 but is moved at predetermined times into driving relation with the driven member 354 of the clutch by a bifurcated lever 418 (Figs. 1, 4 and 8) which is rotatably mounted upon a fulcrum pin 420 threaded into the side plate 38 and having an arm which normally engages a face 422 (Fig. 8) of a cam 424. The cam 424 is constantly urged to an operative position, shown in Figs. 1, 4 and 8, about a fulcrum pin 426 carried by the driver 92 by a spring 428 opposite ends of which fit in recesses of the cam and the driver, respectively. The rear face of the cam 424 is provided with a notch 430, counterclockwise movement of the cam as viewed in Figs. 1, 4 and 8, under the action of the spring 428 being limited by the engagement of the cam with a shoulder of the driver. When the clutch actuating lever 418 engages the upper surface 422 of the cam, bifurcations 432 (Fig. 8) of said lever engage a face 434 of the driving member 360 of the clutch 356 and accordingly force teeth of said driving member into driving engagement with teeth of the driven member of the clutch.

As above explained, the initially loaded spring 348 is energized as each clip of cartridges is moved from the loading station in the magazine 72 to the transfer station 88 by rotating the driven member 354 of the clutch 356 through mechanism above described, the driver 92 at such time being held by the latch plate 384 in its retracted position.

Assuming that a clip 30 of cartridges 32 has just moved to the transfer station 88, the detecting plate 288 will have been depressed by the cartridges, causing the latch plate 384 (Fig. 4), which heretofore has been in front of an abutment face 436 of the driver 92, to be lowered, with the result that the driver moves the clips in which the cartridges mounted upon the bars 106, 108 and upon the rods 112 are assembled into the ways 330 of the guide 70 secured to the feed box against the previous clip which has partially passed through the feed box of the gun but still has two cartridges left in it. At the start of the cartridge transferring movement of the driver the teeth of the driving and driven members 360, 354, respectively, of the clutch 356 are in meshing relation, the stud 371 of the driver 92 being spaced slightly from the hooked portion 350 of the plate 352 of the driven clutch member 354.

When the clip 30 of cartridges 32 being transferred to the feed box 34 of the gun 36 has moved away from the detecting plate 288, said plate will rise under the action of the spring 403. At approximately the same time the cam 424 on the driver 92 will move away from the clutch operating lever 418, thereby permitting said lever to swing clockwise, as viewed in Fig. 8, with the result that the clutch spring 364 causes the teeth of the slidable driving member 360 of the clutch 356 to move out of engagement with the teeth of the driven member 354 of the clutch. When this occurs, the hooked portion 350 of the plate 352 of the driven member 354 will be in approximate engagement with the stud 371 of the driver and after disengagement of the clutch will be forced by the spring against said hooked portion.

The driver 92, together with the driven member 354 of the clutch 356 and the spring 348, will then swing back as a unit to retracted position under the action of the spring 344. When the clip 30 of cartridges 32 is moved from the transfer station 88 into the feed box 34 of the gun 36, the detecting plate 288, as above stated, rises, causing upward movement of the rod 266 and accordingly permitting the latch plate 384 to be raised by the action of the spring 386 to a locking position behind the abutment face 436 of the driver 92 and breaking the toggle formed by the arm 396 and the pin-and-link connection 398, and thus, through mechanism previously described, moving the pawl 164 away from the ratchet shoulder 166 with which it engages. As soon as the pawl 164 has moved away from the shoulder 166, the pairs of chains 110, 116 begin to rotate under the action of the springs 162, causing an adjacent clip of cartridges in the magazine 72 to be delivered to the transfer station 88 and also causing the ratchet 168, which is geared for rotation in timed relation with the chains, to rotate clockwise, as viewed in Fig. 4. Rotation of the shaft 156 to which the ratchet 168 is secured causes the helical gear 406, and accordingly the shaft 94 together with the driving member 360 of the clutch 356, to move clockwise, as viewed in Fig. 4, the coupling 361 during such movement being in driving relation with the shaft 94.

As the driver 92 moves back to its retracted position in which the abutment face 436 of the driver is locked behind the latch plate 384, the clutch actuating lever 418 is arranged in the notch 430 of the cam 424. As the cam 367 rotates clockwise, as viewed in Fig. 4, its face 416 (Fig. 8) engages the bifurcated portion 432 of the actuating lever 418, causing said lever to swing counterclockwise, as viewed in Fig. 8, back to its position shown in Fig. 8, thus causing the teeth of the driving and driven members 360, 354 of the clutch 356 to be in meshing relation, after which the cam 367 continues to rotate about 20°, to energize the spring 348, and then comes to rest. During the energizing of the spring 348, the hooked portion 350 of the member 354 of the clutch 356 is moved away from the stud 371 on the driver 92.

The stopping of the movement of the chains 110, 116, and accordingly the clips of cartridges in the magazine 72 and at the transfer station 88, as well as movement of the driving and driven

members 360, 354 of the clutch 356, is effected when the following shoulder 166 of the ratchet 168 engages the pawl 164, said pawl always being swung into a position to be engaged by the succeeding shoulder by the straightening out of the toggle due to the depression of the rod 266 actuated by the downward movement of the detecting plate 268 under the weight of the clip of cartridges arriving at the transfer station 88.

By providing a yielding drive between the rearward extending portion 252 of the pawl 164 and the rearward extending arm 256 secured to the shaft 250, it will be apparent that the pawl will swing clockwise upon counterclockwise movement of the ratchet 168, during the filling of the magazine 72 with clips of cartridges, without moving the shaft 250 which at such time is held against any substantial movement by reason of the fact that the vertical rod 266 is secured to the ball 298 mounted on the lug 297. Moreover, during the filling of the housing 72 with clips of cartridges, it will be understood that counterclockwise rotation of the spiral gear 406, as viewed in Fig. 4, will not effect counterclockwise movement of the shaft 94 which is held against such movement by the pawl 411, the plungers 410 of the coupling 461 being constructed and arranged to ride out of the channels 412 in the rear face of the gear 406 during counterclockwise movement of said gear.

Having described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for feeding ammunition to automatic guns, clips in which cartridges are assembled, a driver for moving said clips of cartridges delivered to a transfer station into a feed box of a gun, a rotatable driven member of a clutch, a coil spring one end of which is attached to the driver and the other end of which is attached to said driven member of the clutch, means for locking the driver in a retracted position from which it moves to force said clip of cartridges arranged at the transfer station into said feed box, means for rotating the driven member of the clutch to energize said spring while the driver is held in its retracted position, means responsive to movement of the clips of cartridges to the transfer station for releasing said locking means to cause the driver to operate, means responsive to movement of the driver for causing the driven clutch member to be released from a driving clutch member when the driver has completed its driving movement, said driven clutch member when released being held by the driver against rotation under the action of the spring to insure that the spring retains a residual tension, means for moving the driver together with the driven clutch member and the spring as a unit back to retracted position, and means responsive to movement of the clips of cartridges to said transfer station for causing said driving clutch member to be thrown into driving relation with the driven clutch member thereby causing the driven clutch member to be rotated with relation to the driver additionally to energize the spring.

2. In a machine for feeding ammunition to automatic guns, clips in which cartridges are assembled, means for successively moving said clips of cartridges to a transfer station adjacent to a feed box of a gun, a movable detecting member constructed and arranged to be engaged by the clips of cartridges as they arrive at said transfer station, a spring-energized driver for successively feeding the clips of cartridges at the transfer station into said feed box, a latch for maintaining the driver in a cocked position, clip guiding means comprising a guide fixed to the feed box of the gun and constructed and arranged to receive clips in which the cartridges are assembled, and means responsive to movement of said detecting member for releasing the latch to cause the driver to move said clips in which the cartridges are assembled and which are then at said station into said guide, said clip guiding means comprising a pivotally mounted ramp which is constructed and arranged to be deflected by the clips in which the cartridges are assembled as they are moved toward said guide in order to facilitate moving said clips into said guide.

3. In a machine for feeding ammunition to automatic guns, clips in which cartridges are assembled, a driver comprising a lever which is mounted for pivotal movement and has pivotally connected to it arms provided with arcuate portions constructed and arranged successively to engage said clips of cartridges arranged at a transfer station positioned adjacent to a feed box of a gun, a relatively weak spring for constantly urging the driver to a retracted position from which it is moved to force the clips of cartridges at said station into the feed box, a latch for maintaining the driver in its retracted position, means for tripping the latch, a relatively powerful spring for causing the driver to feed the clips of cartridges into the feed box when the latch is tripped, and means responsive to movement of the driver for causing said powerful spring to be moved as a unit together with the driver during the retractive movement of the driver and for causing the powerful spring to be moved with relation to the driver after the driver has been retracted, thereby re-energizing said spring.

4. In a machine for feeding ammunition to automatic guns, clips in which cartridges are assembled, a spring, a driver which is actuated by said spring for moving said clips of cartridges at a transfer station into a feed box of a gun, means for successively moving clips of cartridges to said transfer station, a feeler for registering the arrival of said clips of cartridges at said station, a latch for holding the driver in a cocked position ready to move the clips of cartridges from said station into the feed box, power-operated means for re-energizing the spring after the driver has moved the clips of cartridges into the feed box and has moved to a retracted position, and means responsive to movement of and operative in timed relation with the feeler for releasing the latch and for effecting actuation of said power-operated means.

5. In a machine for feeding ammunition to automatic guns, clips in which cartridges are assembled, a driver for moving said clips of cartridges from a transfer station located adjacent to a feed box of a gun into said feed box, an initially loaded spring for operating said driver, a clutch comprising driving and driven members, said spring being operatively connected to the driver and to the driven member of the clutch, a feeler for detecting the arrival of the clips of cartridges at the transfer station and the departure of the clips of cartridges from said station, power-operated means operatively connected to the driving member of the clutch, means responsive to movement of the feeler for starting and stopping said power-operated means, and means operative in timed relation with said

power-operated means for causing the driving member of the clutch to be thrown in and out of driving relation with the driven member of the clutch.

WALTER E. NAUGLER.
ERNEST W. STACEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
924,732	Carey	June 15, 1909
1,343,444	Formby	June 15, 1920
2,364,510	Bertran et al.	Dec. 5, 1944
2,401,654	Molins et al.	June 4, 1946

FOREIGN PATENTS

Number	Country	Date
288,976	Germany	June 1, 1920