United States Patent

Ashley et al.

[15] **3,706,259**

[45] **Dec. 19, 1972**

[54] **MULTIBARREL AUTOMATIC WEAPON**

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[73] Assignee: **General Electric Company**

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[21] Appl. No.: **18,099**

[52] **U.S. Cl.**.....**89/12**, 89/33 MC

[51] **Int. Cl.**.....**F41d 7/02**

[58] **Field of Search**.....89/12, 13, 126, 155, 33; 42/39.5

[56] **References Cited**

UNITED STATES PATENTS

3,041,939	7/1962	Dardick	89/155
1,424,751	8/1922	Bangerter	89/155 X
2,959,106	11/1960	O'Brien	89/33 MC
2,856,819	10/1958	Meyers et al.	89/33 MC

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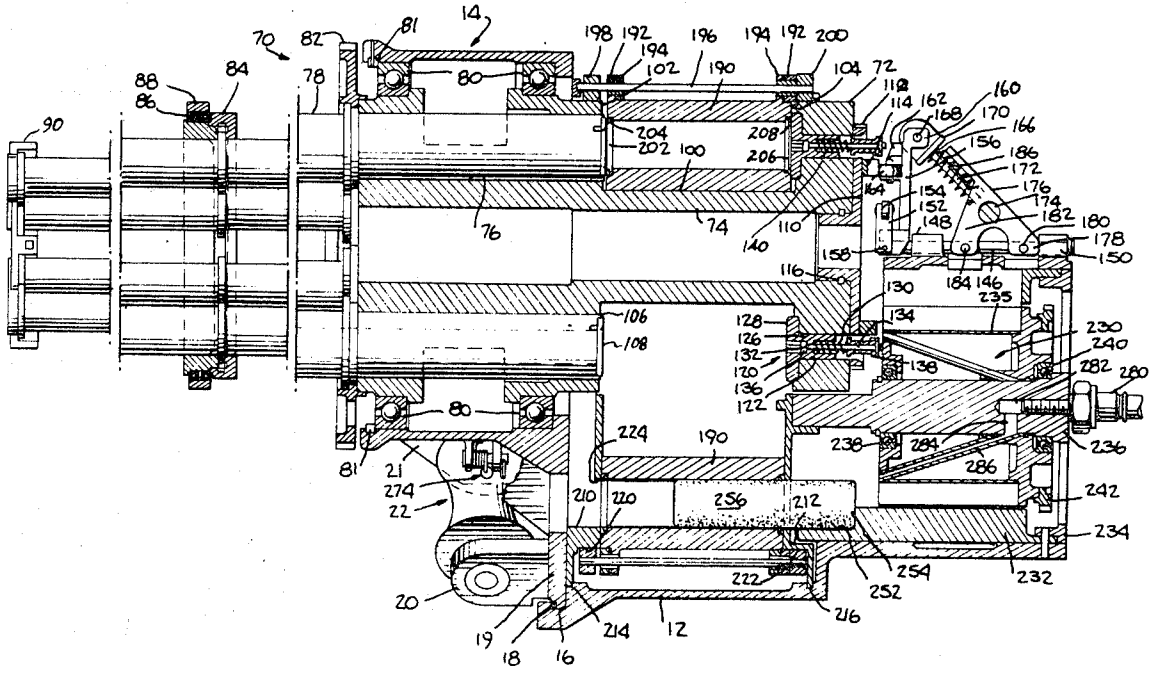
[57] **ABSTRACT**

A Gatling type gun having a plurality of barrels fixed in a rotor, and an endless chain of separable chambers passing along a path around said rotor into and out of alignment with said barrels, and means for rigidly controlling the movement of said chambers along said path.

9 Claims, 12 Drawing Figures



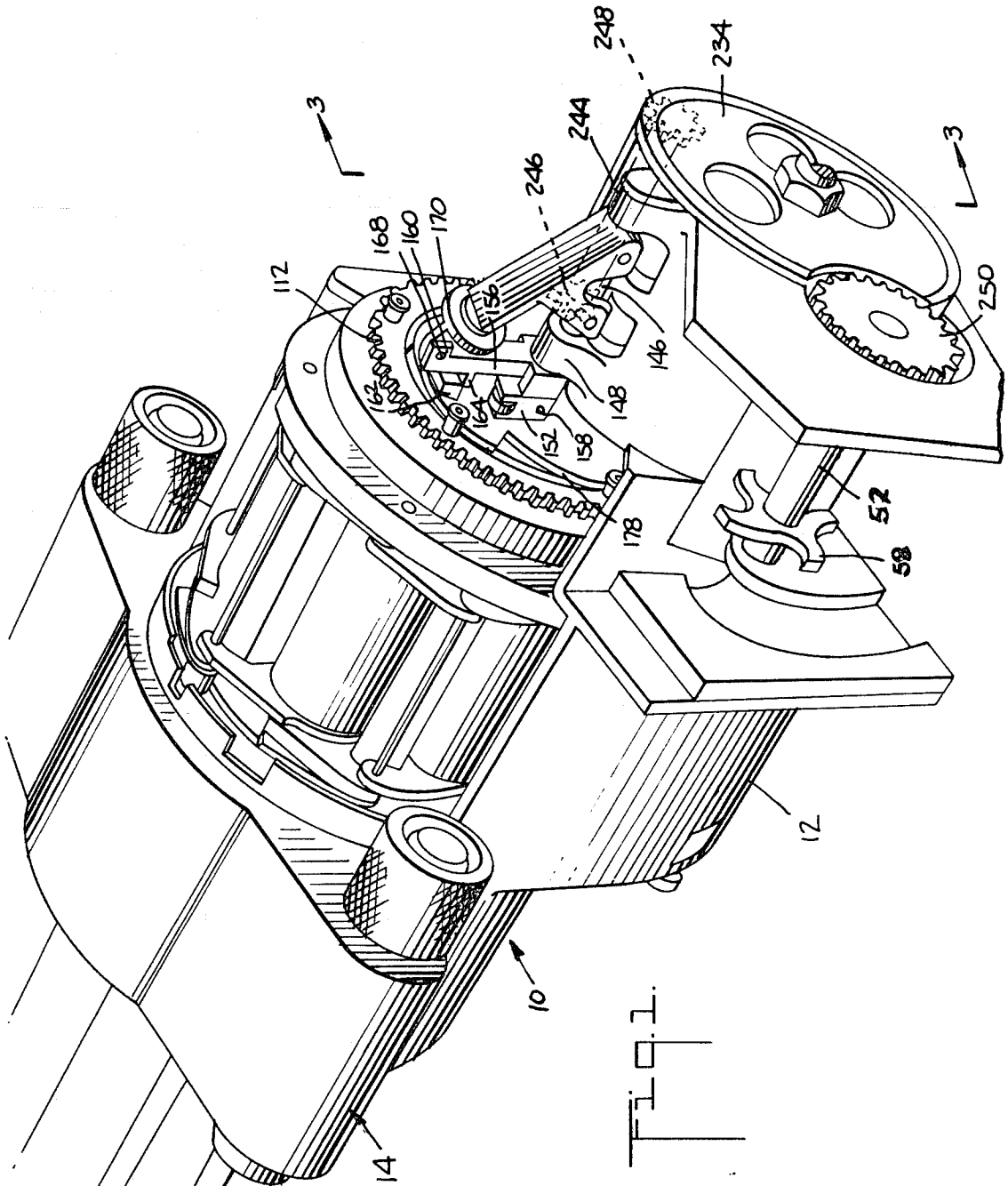


FIG. 1.

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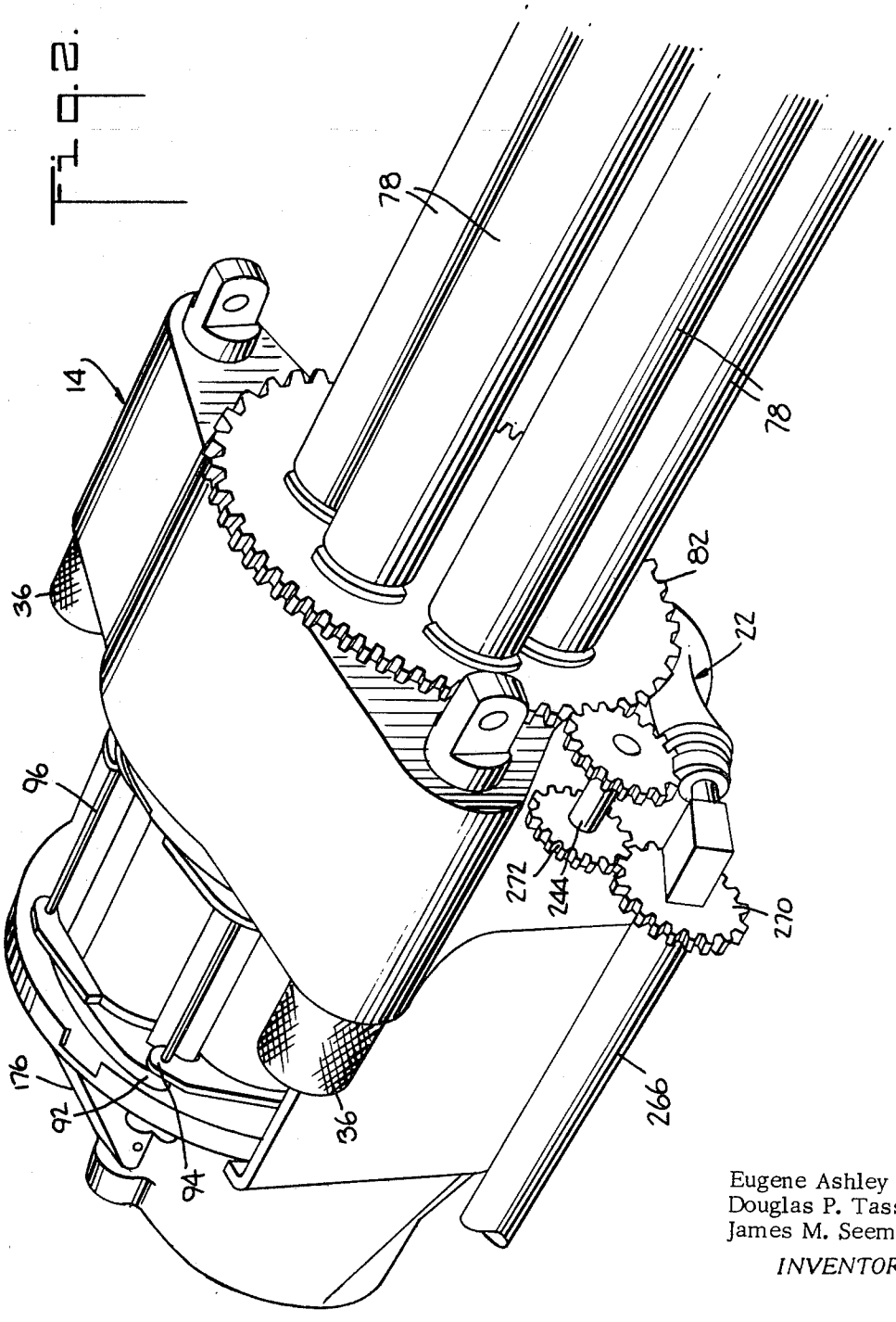
Fig. 2.



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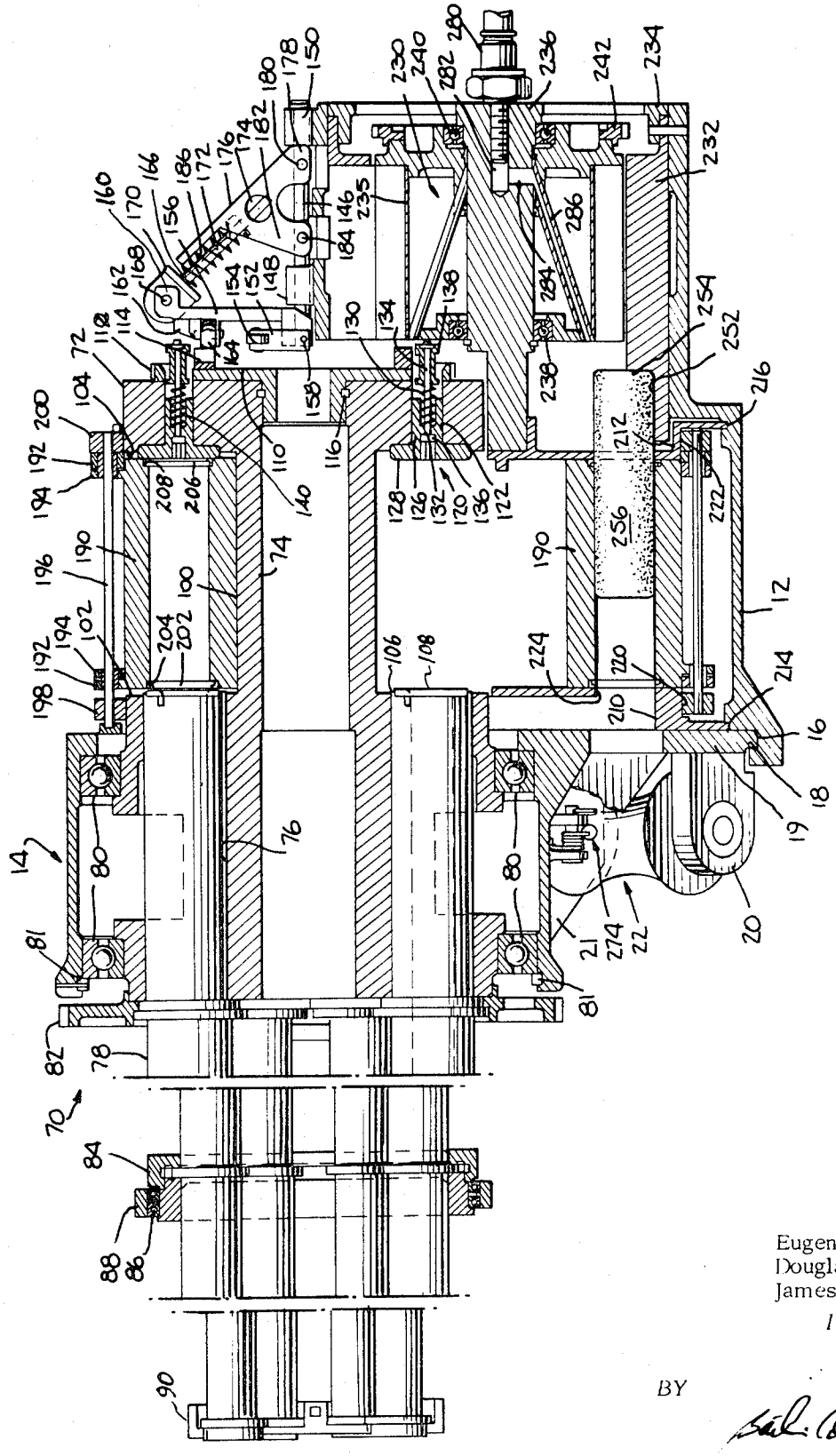

FIG. 3

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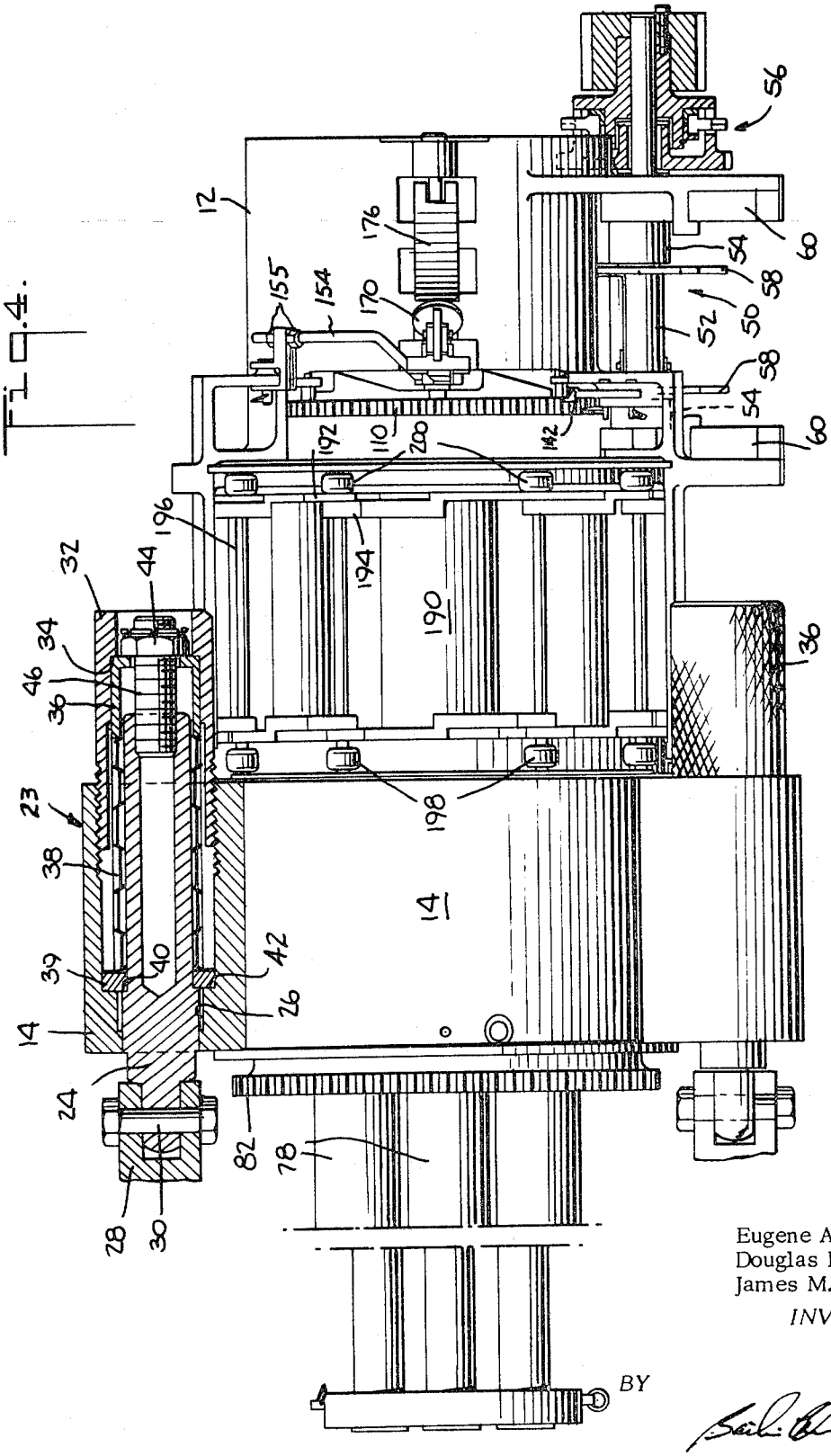
FIG. 4.



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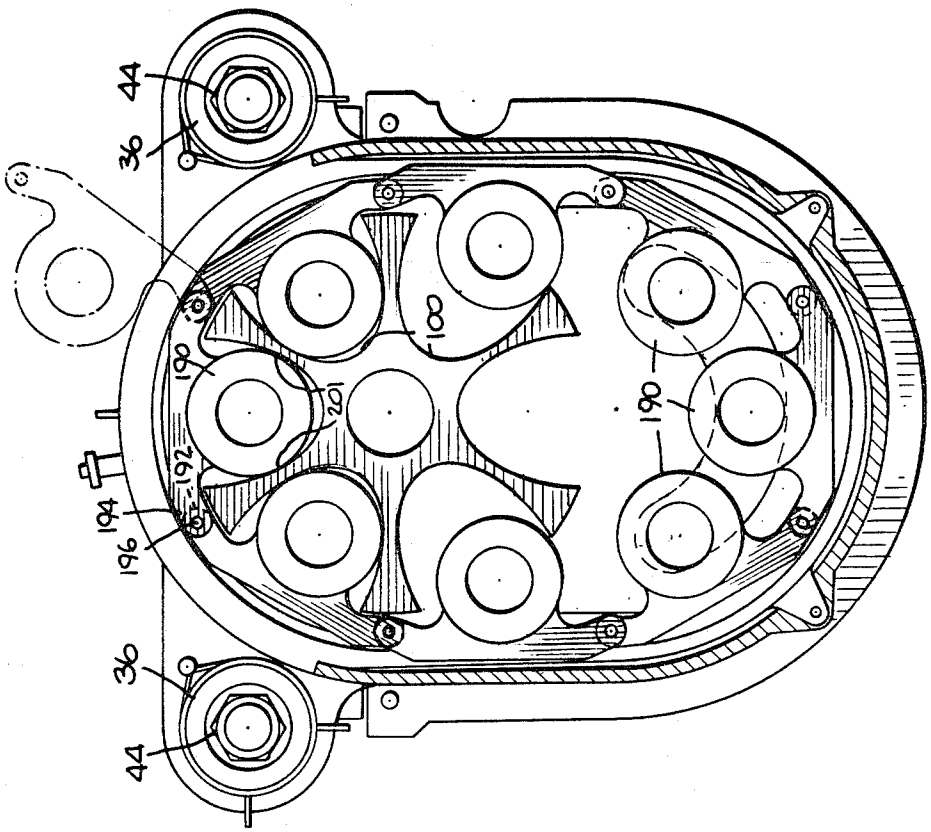

Fig. 6.

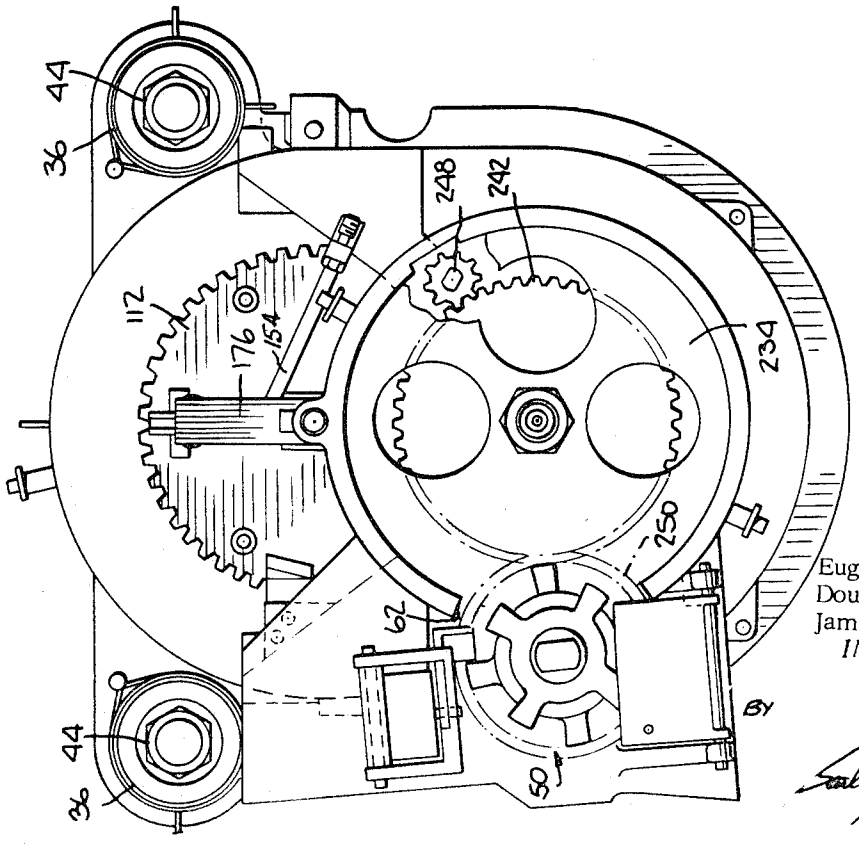

Fig. 5.

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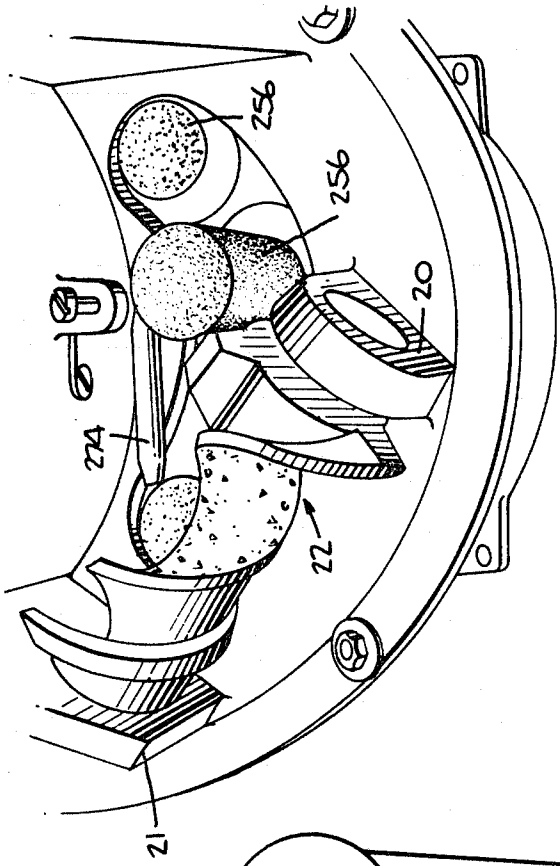

Fig. 8.

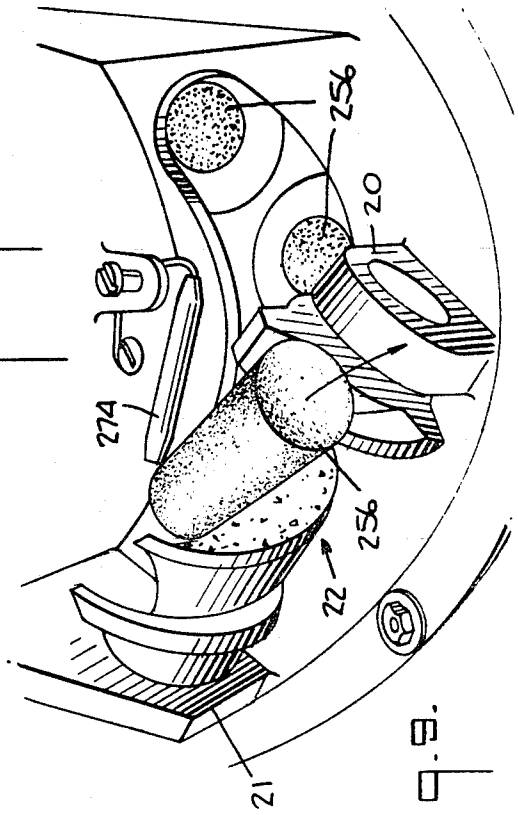

Fig. 9.

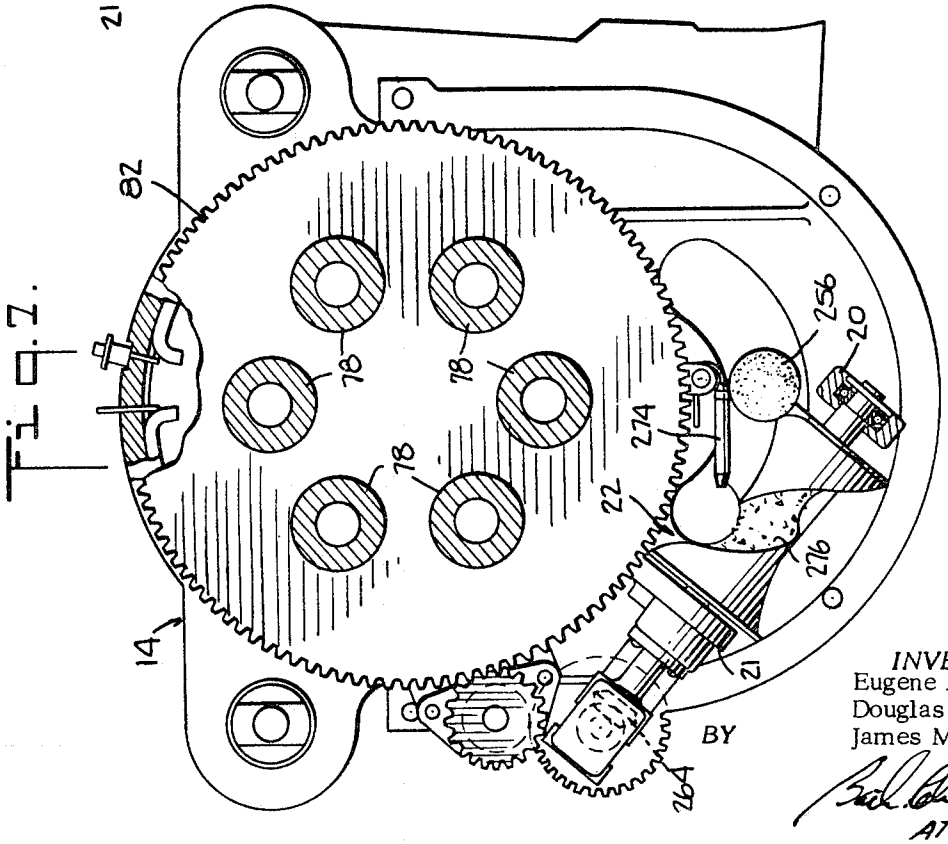

Fig. 7.

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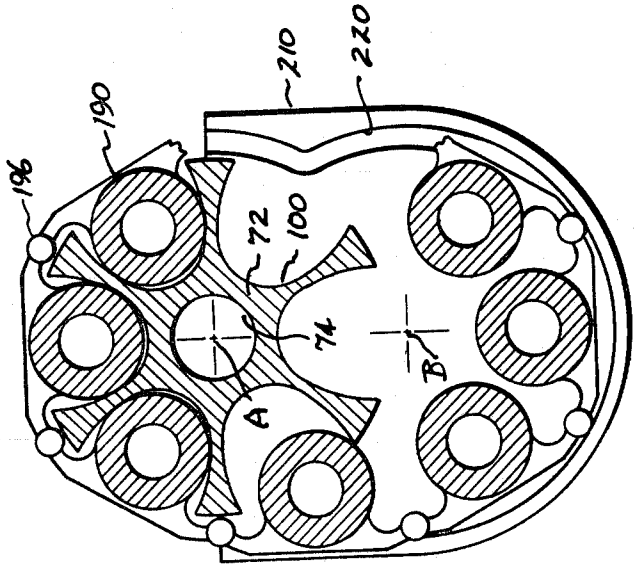

Fig 10

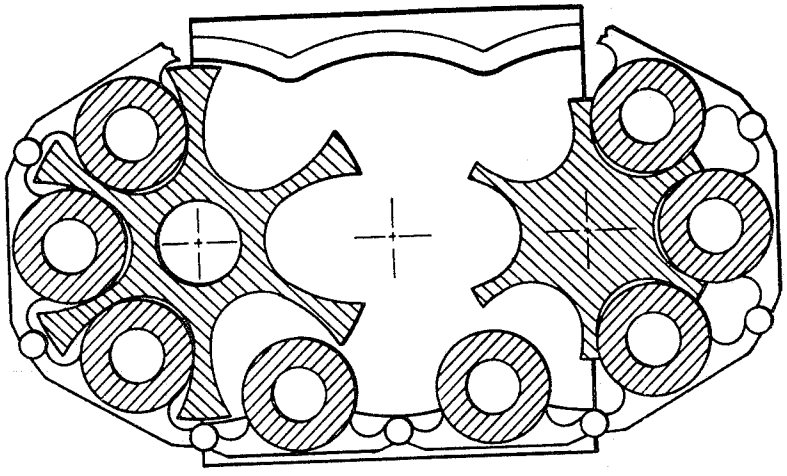

Fig 11

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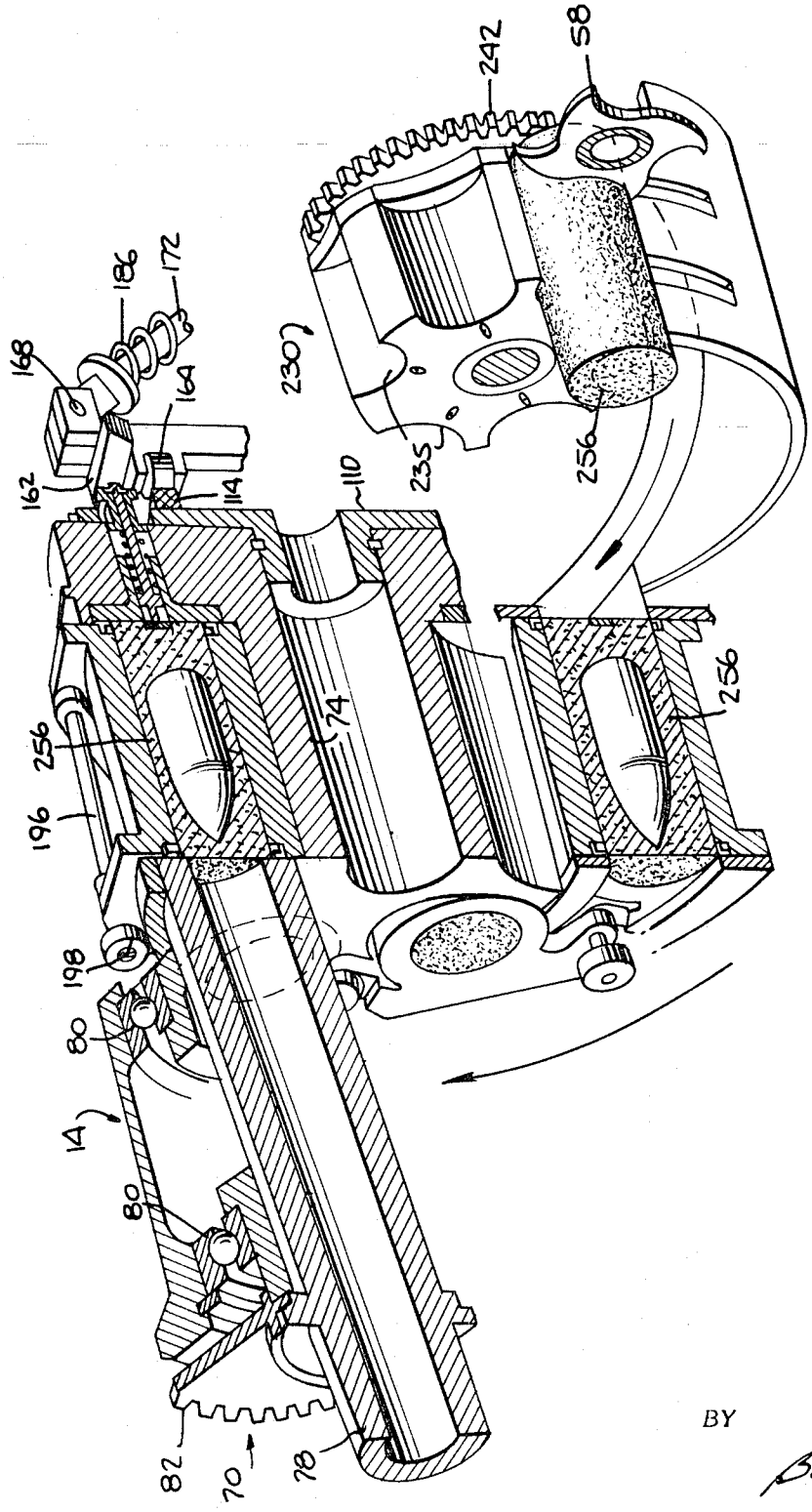

Fig. 12.

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MULTIBARREL AUTOMATIC WEAPON

BACKGROUND OF THE INVENTION

The invention herein described was made in the course of or under a contract or subcontract thereunder with the Department of Defense.

1. Field of the Invention

This invention relates to automatic weapons having a plurality of barrels mounted for rotation about a common axis and adapted to shoot caseless ammunition.

2. Prior Art

The classic revolving battery gun is shown in U.S. Pat. No. 125,563 issued to Richard J. Gatling on Apr. 9, 1872. This gun had a stationary housing; and a rotor assembly, journaled within the housing, having 10 barrels and 10 reciprocating bolts. The bolts were cammed by the housing and their function was responsive to the angular rotation of the rotor assembly. The gun fired cased ammunition, which was chambered, fired, and ejected by the bolt assembly. The first modern version of the Gatling gun is shown in U.S. Pat. No. 2,849,921 issued to Harold McC. Otto on Sept. 2, 1958, and a more recent version is shown in U.S. Pat. No. 3,380,343 issued to Robert E. Chiabrandy et al. on Apr. 30, 1968. Each of these modern guns is similar to the classic gun in having pluralities of barrels, chambers and bolts to shoot cased ammunition.

In cased ammunition the case serves, inter alia, two functions, viz: it provides a seal at the aft end of the chamber; and it provides a handle on the round of ammunition for ejection in the event of a misfire. However, the case amounts to some 40 percent of the weight of the round, which if saved, would provide a responsive decrease in system weight, or would provide that much more ammunition storage capacity.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide an automatic gun having a high rate of fire of caseless ammunition.

A particular object of this invention is to provide a Gatling type gun with chambers which are loaded and cleared remotely from the rotor assembly, and are fully controlled at all times.

A feature of this invention is the provision of a Gatling type gun having a plurality of barrels fixed in a rotor, and an endless chain of separable chambers passing along a path around said rotor into and out of alignment with said barrels, and means for rigidly controlling the movement of said chambers along said path.

BRIEF DESCRIPTION OF THE DRAWING

These and other objects, features and advantages will be apparent from the following specification thereof taken in conjunction with the accompanying drawing in which:

FIG. 1 is a perspective view from an aft viewpoint of a weapon embodying this invention;

FIG. 2 is a perspective view from a forward viewpoint of the weapon of FIG. 1;

FIG. 3 is a side elevated view, in cross-section, of the weapon of FIG. 1;

FIG. 4 is a top plan view of the weapon of FIG. 1;

FIG. 5 is an aft end view of the weapon of FIG. 1;

FIG. 6 is an aft end view in cross-section taken along the plane VI—VI of FIG. 3, particularly illustrating the chain of chambers;

FIG. 7 is a forward end view in cross-section taken along the plane VII—VII of FIG. 3, particularly illustrating the misfire conveyor; and

FIGS. 8 and 9 are detail perspective views of the misfire conveyor,

FIG. 10 is a diagram of FIG. 6 for an eight chamber gun,

FIG. 11 is a diagram of a second embodiment, similar to FIG. 6, for a 10 chamber gun, and

FIG. 12 is a broken view of the weapon of FIG. 1.

THE PREFERRED EMBODIMENT

The weapon shown in FIG. 1 is a variant of the classic Gatling principle, and uses a rotating cluster of barrels which is secured in a rotor assembly and is driven by an external power source. Conventional, reciprocating bolts are not employed. Instead, a series of linked tubular firing chambers transport the cartridges into the rotor. In the firing position each chamber rests in a respective deep recess in the rotor and is longitudinally secured or locked between the barrel breech face and a surface of the rotor recess. The chambers are swung out of the rotor recess for loading fresh cartridges, and for ejecting such misfires as occur. This is accomplished by using more chambers than barrels, e.g., a loop of eight or more chambers for a cluster of six barrels. Since the length of the loop is thus longer than the circumference of the pitch circle of the barrel cluster, the loop extends free of the rotor for a portion of its travel and is open for loading and chambering by a stationary cam. The chamber then moves laterally into lock position and firing can thereupon take place. There is no need for a structural locking operation. The fore and aft components of the firing pressure pulse are reacted directly into the rotor structure, and the lateral components are contained by hoop tension in the wall of the chamber.

The housing assembly **10** includes an aft housing **12** and a forward housing **14**. The aft housing has a rabbet **16** which receives a lip **18** on the transverse wall **19** of the forward housing for longitudinal alignment. Radial alignment and clamping are provided by a plurality of mating bolt holes and bolts, not shown. A bearing block **20** extends forwardly from the wall **19**, and together with a rib **21**, supports the misfire ejection assembly **22**. A pair of recoil attenuator assemblies **23** are also housed in the forward housing **14**. Each recoil attenuator assembly, as best seen in FIG. **4**, includes a spindle **24** disposed in a bore **26** through an enlargement in the housing. The forward end of the spindle extends into a clevis **28** of the gun mount and is retained by a pivot bolt **30**. An aft external bushing **32** is adjustably threaded into the bore **26**, and has a shoulder **34** to retain the aft end of an aft internal bushing **36**. A multi-element, friction damped spring **38** is captured between the bushing **36** and a forward washer **39** which bears against a shoulder **40** on the spindle, and a shoulder **42** in the housing bore. Compression of the spring is adjusted by a nut **44** bearing against the bushing **36** and threaded on a stud **46** which is threaded into the aft end of the spindle **24**.

The feeder assembly 50 is also housed in the aft housing 12. The feeder assembly includes a drive shaft 52 which is journaled through bearing blocks 54 and coupled to a knife blade clutch assembly 56. A pair of four toothed sprockets 58 are fixed to the shaft to positively advance rounds, coming down along and between a pair of guides 60, through an opening 62 in the housing. The clutch assembly 56 may be of the type shown in U.S. patent application Ser. No. 386,656 filed Oct. 1, 1969 by L. K. Wetzel and assigned to a common assignee.

A rotor assembly 70 is journaled for rotation in the housing. The rotor assembly includes a main rotor 72 which has a central, longitudinal bore 74 and six longitudinal bores 76 in an annular row. Six gun barrels 78 are respectively mounted in the bores 76 and secured to the rotor by suitable means, not shown, such as interrupted threads. The rotor is journaled to the forward housing by a pair of annular ball bearing assemblies 80 which is secured by a retaining ring 81. A forward ring gear 82 is captured onto and between the gun barrels and the rotor. A mediate clamp 84 clamps the barrels together and is journaled by a ring bearing 86 to a forward gun mount ring 88. A forward clamp 90 clamps the forward ends of the gun barrels.

The aft portion of the rotor 72 has six recesses 100, each coaxial with a respective gun barrel and having a forward transverse face 102 and an aft transverse face 104. The aft ends 106 of the barrels have respective inserts 108 fixed thereto which project slightly aft of the face 102. A ring gear 110 is fixed to and is coaxial with the aft end of the rotor. The gear has a peripheral annulus of centrifugally directed teeth 112, and an aft, longitudinally extending annulus of six cam ramp surfaces 114.

A retaining fastener 116 which is used to longitudinally secure the gear to the rotor comprises a formed rectangular wire ring. The ring takes a G shape with the distal ends of both legs turning centrifugally from the circumference. The ring has a diametral clearance fit around a circumferential groove in the hub of the gear. The legs of the ring protrude through a slot in the hub so that they can be reached through the center hole of the gear. The outside diameter of the ring, when the ring is unconstrained, is slightly larger than the outside diameter of the hub. When the legs of the ring are squeezed together, accessible through the center hole, the ring contracts to an outside diameter equal to or less than the diameter of the hub. The hub can then be inserted into the rotor bore 74 which contains a groove to accommodate the ring when it is unconstrained. When the hub is assembled and the legs are released, the ring is disposed in part in each groove, locking the hub longitudinally.

Six firing pin assemblies 120 are mounted in the aft end of the rotor 72. Each assembly is disposed in a respective bore 120 which is coaxial with a respective gun barrel, and includes a body 124 having a stem portion 126 press fitted into the bore and a head portion 128. The body has a central bore 130 with an internal neck 132. A spindle 134 rides in the bore 130 and has a forward flange 136 and an aft spool 138. A compression spring 140 is disposed on the spindle between the bore neck 132 and the spindle spool 138 to bias the spindle aft, that is, to retract the firing pin. A fixed retraction blade 142 is fixed to the aft housing to ensure the retraction of the spool 138, by camming rearwardly any unretracted spool.

Each of the six firing pins is struck in sequence by a single, spring loaded hammer assembly 144. The assembly includes a rod 146 mounted through and between two bearing blocks 148 and 150 which extend outwardly from the aft housing. A support block 152 is fixed at its lower end to the forward end of the rod 146 and at its upper end to one end of a lateral rod 154 whose other end is adjustably fixed to the housing, by two nuts 155, whereby to preclude rotation of the rod 146. A hammer arm 156 pivotally mounted at its lower end to a clevis on the block 152 by a pin 158. The upper end of the arm is formed as a clevis 160, and below the clevis has an integral, forward facing hammer block 162, and therebelow, a forward facing cam follower 164. A plunger 166 has a forward end pivotally mounted to the clevis 160 by a pin 168, an intermediate collar 170, and an aft spindle 172. The aft end of the spindle rides in a diametral bore through a dowel 174 which is mounted in a lateral bore through a toggle bracket 176. The bracket has an aft clevis 178 pivotally mounted to the rod 146 by a pin 180, and a forward clevis 182 mounted to the rod 146 by a pin 184. A compression spring 186 is mounted on the spindle 172 between the collar 170 and the bracket 176. The cam follower 164 rides on each of the cam ramps 114 to compress the spring 186 which is preloaded. The hammer assembly may be safed by extracting the pin 184 and swinging the toggle bracket 176 aft about the pin 180, to preclude any effective compression of the spring 174. The hammer assembly may be armed and the spring 174 preloaded by swinging the toggle bracket 176 forward and inserting the pin 184.

Each of the eight chambers 190 is formed as a tube having a pair of longitudinally distal lugs 192 at one end and a pair of longitudinally set back lugs 194 at the other end. The tubes are alternated end for end so that a lug 192 can overlap the next adjacent lug 194. Each lug has a longitudinal bore therethrough which receives a respective bushing, and adjacent lugs are linked by respective rods 196 each having a forward roller 198 and an aft roller 200. A forward ring seal 202 is disposed in a recess 204 in the forward end of the chamber and an aft ring seal 206 is disposed in a recess 208 in the aft end of the chamber.

A forward cam plate 210 and an aft cam plate 212 are respectively disposed in a forward channel 214 and an aft channel 216 in the rear housing, and are pinned in place. When the rotor is in place, the plates must be unpinned from the rear housing before the housing can be removed. The rear cam plate may be removed once the rear housing has been detached. The front cam plate can be removed after the chambers 190 have been removed. Two holes 218 in the upper portion of the rear cam plate can be utilized for longitudinal withdrawal of any two adjacent rods 196 to permit the removal of the contained chamber, as for inspection of the chamber seals. The cam plates 210, 212 have respective cam tracks 220, 222 for respectively supporting the rollers 198, 200 for guiding the chambers 190 through the transition between the upper and lower portion of the loop, and around the lower portion. In the upper portion of the loop each chamber is

disposed in and carried by a respective recess **100** in the rotor. Each chamber has two lines of contact **201** with the recess wall profile. This assists in the accurate alignment of the chamber and the respective barrel bore, and provides a clearance space at the bottom of the recess for the accumulation of foreign matter which might otherwise disturb the chamber position.

As shown in FIGS. **6** and **10**, the barrels and the rotor **72** revolve about a longitudinal axis A. The chain of chambers **190** is carried around by the rotor **72** serving as a six tooth sprocket, and is guided around a virtual six tooth sprocket having a longitudinal axis B. The transverse distance between the axes A and B is equal to the transverse distance between the axes of adjacent shafts **196**, i.e., the link length. The transverse distance between the axes A and B is also equal to the transverse distance between the axis A and the axis of the shaft **196** of any chamber engaged with the rotor **72**, and is also equal to the transverse distance between the axis B and axis of the shaft **196** of any chamber effectively carried around the virtual sprocket. The virtual sprocket, as shown, can not be realized since it would then overlap in volume the real sprocket **72**. However, the effect of the sprocket is provided by the cam tracks **220**, **222** which guide the rollers on the shafts, and, thereby, the chambers through the cusp transitions between the sprockets and around the virtual sprocket. No cam tracks are provided around the upper semicircle **72** as the rollers **198**, **200** ride on the sprocket. It may be noted that by locating the axes of the shafts **196** external to the rotor, relatively deep recesses **100**, with relatively thick distal rib sections therebetween, can be provided. Should it be desired to realize the virtual sprocket and/or to increase the number of chambers in the chain, as shown in FIG. **11**, it is merely necessary to make the transverse distance between the axes of the rotors a multiple of the link length, and to add one additional cam track cusp for each additional link length. For example, ten chambers can be accomodated around and between two rotors whose rotors axes are spaced apart by two link lengths, and provided with cam tracks having two cusps per side. The use of the cusps is necessary to maintain the rotor inter axis spacing constant during movement of the chain of chambers around the rotors.

The forward and aft cam plates also serve to retain the chamber seals in the respective chambers during the feed cycle when these chambers are in the lower portion of the loop. The forward cam plate also serves as a fixed stop and has an elastomeric shock absorbing surface adjacent the end of an ejection slot **224** in the lower portion of this plate to halt newly chambered rounds flush with the forward end of the respective chamber.

Rounds handed into the gun by the feeder assembly **50** are chambered by a rotary feed tray **230** and a stationary ram cam **232**. A back plate **234** is fixed to the aft end of the aft housing. A longitudinal support rod **236** is fixed to the back plate. The rotary feed tray **230** has six longitudinal recesses **235**, each for receiving a cartridge, and is journaled on the rod **136** by a forward bearing **238** and an aft bearing **240**. An annular spur gear **242** is coaxial with and fixed to the aft end of the tray **230**. A shaft **244** is journaled to the aft housing, has a forward spur gear **246** fixed thereto and meshed with and driven by the rotor spur gear **112**, and has an aft spur gear **248** fixed thereto and meshed with and driving the tray gear **242** through an aperture in the housing. A spur gear **250** of the feeder assembly clutch **50** is also meshed with and is driven by the tray gear **242**. The stationary ram cam **232** is a lateral section of a type and has a cycloidal cam slot **252** having a forwardly sloping shoulder **254** which extends around the complete ram arc at the bottom of the housing and slopes forward one full round length.

Gun action may be considered to start with a cartridge in the feeder sprocket **58**. The feed tray **230** rotates in synchronization with the loop of chambers **190** and the rotor **72**. Depending upon the type of feed system used, the cartridge will have been picked up by the sprocket from a conveyor, or handed in directly from the exit unit of a storage drum. As the feeder sprocket rotates, the cartridge is cammed centrifugally by the side guides until its pitch velocity matches that of the rotary feed tray. Hand off into a recess of the rotary feed tray is thus accomplished without any abrupt change in velocity. After hand off, the cartridge is controlled by the feed tray. Lateral movement of the cartridge is precluded by the contour of the respective recess and the adjacent interior wall of the stationary ram cam **252**. The cartridge is carried in coaxial alignment with an empty chamber and is free to move forward longitudinally. Forward ramming begins after the cartridge has been fully captured in the rotary feed tray. As the cartridge is carried around by the rotary feed tray it is also slid along in the stationary ram cam slot **252**, whose shoulder **254** abuts the aft end of the cartridge and cams the cartridge longitudinally forward into the chamber. In FIG. **3**, cartridge **256** is shown partially chambered. Once chambered, the cartridge remains chambered as the respective chamber moves into its respective rotor recess **100** and is sealed between its respective barrel **78** and firing pin head portion **128**. The cycloidal shape of the ram cam accelerates the cartridge uniformly, and allows it to decelerate as much as possible under the effect of friction before striking the stop. As the chamber passes the firing position the cam follower **164** rides off a respective cam ramp surface **114** and the released compression spring **186** drives the hammer arm **156** forward to impact the firing pin spindle **134** to fire the cartridge. Since the cartridge is caseless and consumable, the chamber is empty after firing and is ready to receive a fresh cartridge. To clear the gun at the end of a burst, the clutch **56** is disengaged to halt the feeder assembly drive shaft while the rotor assembly continues to rotate and fire all chambered cartridges. The gun comes to a full stop with all of its chambers empty.

The gun is designed to utilize a telescoped cartridge having a cylindrical shape without any step or taper. Thus a fresh cartridge incoming aft will displace a misfired cartridge presently in a chamber and force it out forward. No provision need be made for separable extraction of misfired cartridges, and this combining of the feeding and extracting processes greatly simplifies the gun. Room is left ahead of the loading area for a misfired cartridge to clear the housing. As a misfire begins to be ejected from its chamber, it is captured and controlled by a gear driven ejector assembly forward of the chamber, as shown in FIGS. **3**, **7**, **8**, and **9**.

The misfire ejector assembly comprises a worm **260** fixed on a shaft **262** which is journaled to and between the bearing block **26** and the rib **21**, and has a mitre gear **264** fixed thereto. A power shaft **266** is journaled to the housing and at its aft end is coupled to a power source, not shown, such as a hydraulic motor. A mitre gear **268** is fixed to the forward end of the shaft and meshed with the worm mitre gear **264**. A spur gear **270** is also fixed to the shaft **266** and is meshed with a spur gear **272** fixed on the shaft **244**. A pressure roller **274** is mounted to the housing by a spring **276** at an angle to the worm. The worm is provided with a friction surface composed of wire studs embedded in the worm surface and fixed with epoxy.

As the eight chambers rotate around the lower portion of the loop on a six chamber circle past the ejection slot **224** they maintain a spacing of 60° between adjacent chambers. The worm lead is also 60° of profile rotation for one revolution of the worm. Thus the concavity **276** in the worm provides a shape which laterally mates with the cylindrical shape of the cartridge, so that the cartridge remains longitudinally aligned with the bore of the chamber as the chamber progresses along the ejection slot. For each revolution of the rotor the worm is geared to rotate six times, allowing the concavity shape to follow all six chambers.

As a chamber containing a misfired cartridge progresses along the ejection slot, the fresh cartridge then being chambered by the ram cam pushes the misfired cartridge longitudinally forward, from the chamber bore, through the ejection slot, as shown in FIG. **8**, into the concavity **276** of the worm, under the spring loaded roller **274**. The worm acts as an endless conveyor which supports, cradles and longitudinally stabilizes the cartridge as it is ejected. In addition, the relatively high peripheral speed of the worm accelerates the cartridge out of the chamber and creates a gap between the aft end of the misfired cartridge and the fresh cartridge being chambered. The ejection slot terminates, and the wall of the forward cam plate **210** is accomodated in this gap. The aft surface of the forward cam plate serves to stop the fresh cartridge when it is fully chambered. The spring loaded roller ensures engagement between the misfired cartridge and the worm during gun low speed or hand cycling. Centrifugal force serves this function at relatively higher gun speeds.

To insure clearing of all chambers at the end of a burst of firing, after the declutching operation has occurred,an air blast is provided. If a misfire should occur in the last eight rounds chambered prior to declutching, the air blast must serve in lieu of an incoming round to displace the misfire. An air fitting **280** is fitted into a longitudinal blind bore **282** in the support rod **236** which communicates with a radial bore **284** directed downwardly. Six air tubes **286** are disposed in the feed tray **230**, each respectively aligned with a recess **235**. The air tube for the lowermost recess, which is the chamber-eject position, is in communication with the bore **282**. When the burst of firing is to be ended, the supply of cartridges to the feeder assembly **50** is discontinued and a supply of air is delivered to the fitting **280**. As the feed tray rotates, a blast of air is delivered successively through each air tube to the respective chambers to blast out any misfired cartridge contained therein.

In a revolving battery gun it is desirable that the ammunition propellant ignite at the twelve o'clock position to preclude or at least minimize, lateral torque on the gun mounts. In ammunition having a stab primer there is a significant delay between the time of firing pin impact and propellant ignition. Thus it is necessary to finely adjust the searing of the hammer to preceed the chamber arriving at the 12 o'clock position by the delay interval. This adjustment is accomplished by adjusting the effective length of the rod **154**, by means of the two nuts **155**, to swing the hammer assembly on its pivot rod **146**.

While there has been shown and described a preferred embodiment of this invention, it will be appreciated that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What is claimed is:

1. A machine gun comprising:

a housing;

a first rotor journaled for rotation in said housing about a first axis;

a first plurality of barrels fixed in said first rotor in an annular row;

a first plurality of individual, spaced apart recesses, equal in number to said first plurality of barrels and formed in the periphery of said first rotor in an annular row, each recess longitudinally aligned with a respective barrel and having longitudinally spaced apart forward and aft ends, said forward end opening on said respective barrel and said aft end closed by an aft portion of said rotor;

second rotor equivalent means having a second axis spaced from and parallel to said first axis; and

a second plurality of chambers, greater in number than said first plurality of barrels, linked together in an endless chain, guided for movement around said first rotor with each said chamber periodically occupying and longitudinally fore and aft and centripetally supported by a respective recess, and guided for movement around said second rotor equivalent means;

each of said chambers being linked to and between its next adjacent chambers by a pivotal connection having a cam follower,

the transverse distance between the axes of immediately adjacent pivotal connections defining the link length of said chain;

the transverse distance between said first and second axes being equal to a multiple of said link length; and

the transverse distance between said first axis and each of the respective adjacent pivotal connection axes, and between said second axis and each of the respective adjacent pivotal connection axes being equal to said link length.

2. A machine gun according to claim **1** further including:

cam track means for receiving said cam followers and guiding said respective chambers between said first rotor and said second rotor equivalent means;

said cam track means including:

a first portion for guiding said links between said first rotor and said second rotor equivalent means,

a second portion for guiding said links between said second rotor equivalent means and said first rotor, and

each of said portions includes at least

one cusp and an additional cusp for each multiple over the first of said link length distance between said first and second axes.

3. A machine gun according to claim 2 wherein:

said transverse distance between said first and second axes is equal to one multiple of said link length;

said firs rotor is real;

said second rotor equivalent means is a continuation of said cam track means between and including said first and second portions of said cam track means for guiding said cam followers and said respective chambers along a path identical to that which would be provided by a real rotor; and

each said portion of said cam track means has one cusp respectively.

4. A machine gun according to claim 2 wherein:

said transverse distance between said first and second axes is equal to two multiples of said link length;

said first rotor is real;

said second rotor equivalent means is a real rotor journaled in said housing for rotation about said second axis and has a second plurality of recesses, equal in number to said first plurality of recesses, formed in the periphery thereof, and

each said portions of said cam track means has two cusps respectively.

5. A gun according to claim 1 wherein:

as each chamber enters a respective recess in said first rotor it pivots relative to said recess about its leading pivotal connection, the cam follower of said leading pivotal connection being disposed external to the peripheral surface of said first rotor.

6. A machine gun comprising:

a housing;

a first rotor journaled for rotation in said housing about a first axis;

a first plurality of barrels fixed in said first rotor in an annular row;

a first plurality of individual, spaced apart recesses, equal in number to said first plurality of barrels and formed in the periphery of said first rotor in an annular row, each recess longitudinally aligned with a respective barrel and having longitudinally spaced apart forward and aft ends; said forward end opening on said respective barrel and said aft end closed by an aft portion of said rotor;

second rotor equivalent means having a second axis spaced from and parallel to said first axis;

a second plurality of chambers, each for repeatedly receiving rounds of ammunition, greater in number than said first plurality of barrels, linked together in an endless chain, guided for movement around said first rotor with each said chamber periodically occupying and longitudinally fore and aft and centripetally supported by a respective recess, and guided for movement around said second rotor equivalent means; and

feeder means for sequentially inserting a round of ammunition in each of said chambers in said chain as it passes around said second rotor equivalent means.

7. A gun according to claim 6 wherein:

the longitudinal axis of each of said recesses in said first rotor is spaced from and parallel to the longitudinal axis of each of said chambers when disposed therein, whereby the longitudinal outer wall surface of said chamber abuts the longitudinal inner wall surface of the respective recess along two lines of contact, with a gap between the bottom of said recess surface and the adjacent chamber surface.

8. A gun according to claim 6 wherein:

said first rotor has a like first plurality of firing pin assemblies, equal in number to said first plurality of barrels, said firing pin assemblies being disposed in a transverse annular row through the aft end of said rotor, each pin assembly being coaxial with a respective barrel:

each pin having a plunger extending aft of said rotor and having an enlargement thereon; and

a cam fixed on said housing and adapted to engage each plunger enlargement in sequence, after a respective chamber has left the respective recess, to positively reset the respective plunger aft.

9. A gun according to claim 6 further including:

a like first plurality of firing pin assemblies, equal in number to said first plurality of barrels, said firing pin assemblies being disposed in a transverse annular row through the aft end of said rotor, each pin assembly being coaxial with a respective barrel, and each pin having a plunger extending aft of said rotor;

an ignition station defined as a point along the path of travel of said chambers while recessed in said first rotor and aligned with a respective barrel;

means for actuating each plunger in sequence as it approaches the ignition station;

means for supporting said actuating means and for adjusting its spacing from said ignition station.

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