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TOOTHED ROTOR MECHANISMS FOR AUTOMATIC GUNS FED FROM TWO CARTRIDGE BELTS

Filed June 26, 1967 4 Sheets-Sheet 1

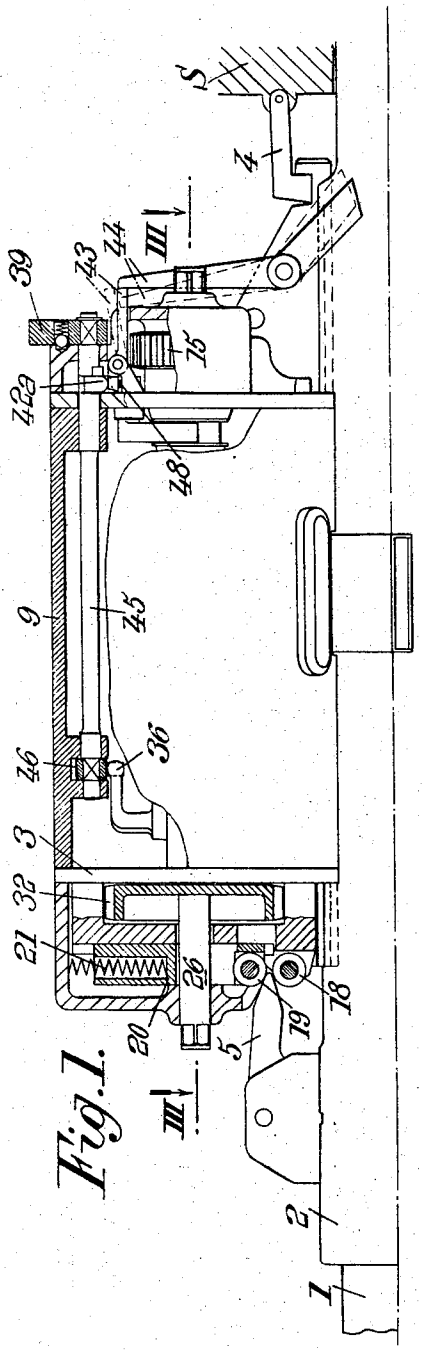

Fig. 1.

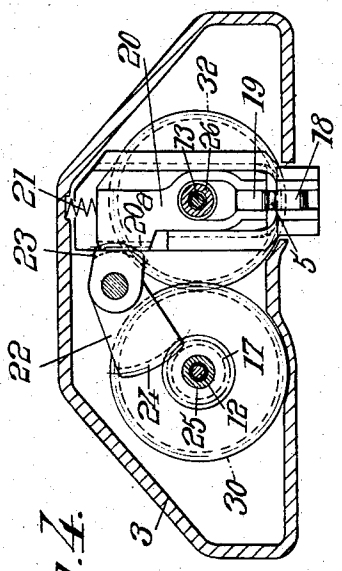

Fig. 4.

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Fig. 2.

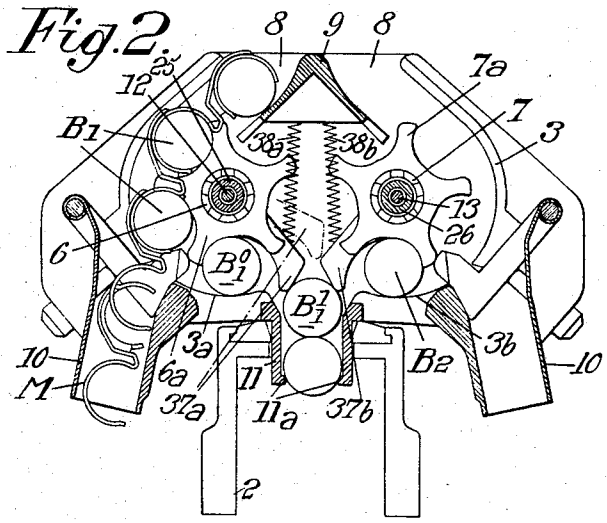

Fig. 3.

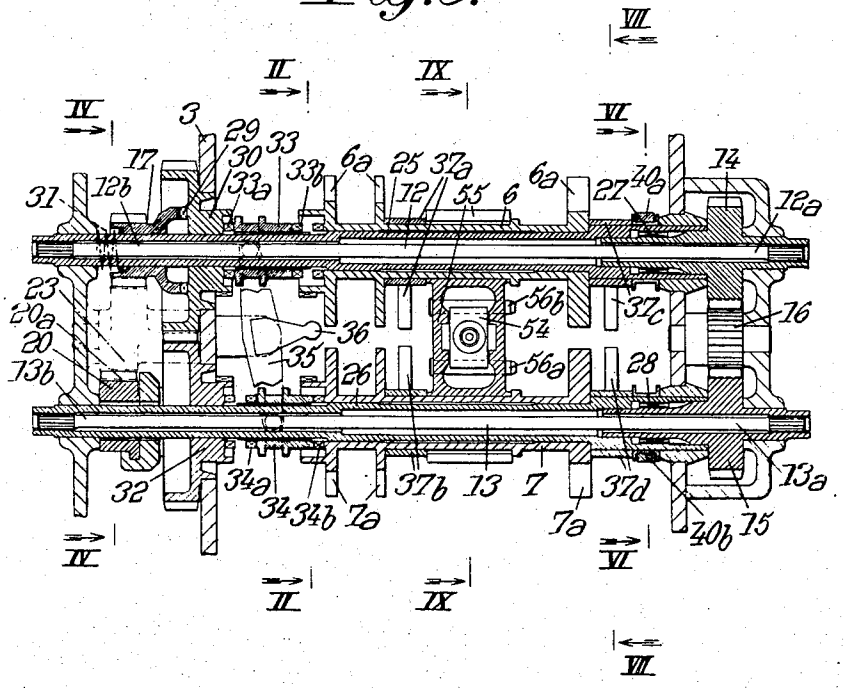

Fig. 5.

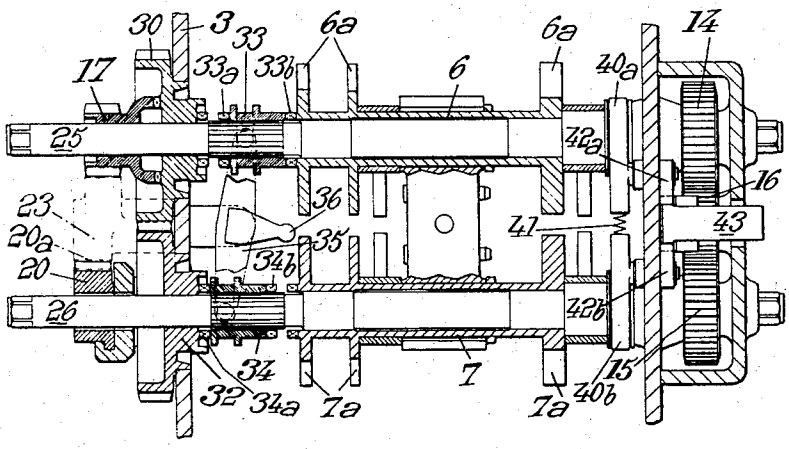
30
3
33
6a
6a
14
17
33a
33b
6
40a
25
42a
16
23
36
41
43
20a
35
34b
20
26
42b
34
7
15
32
34a
7a
7a
40b

Fig. 6.

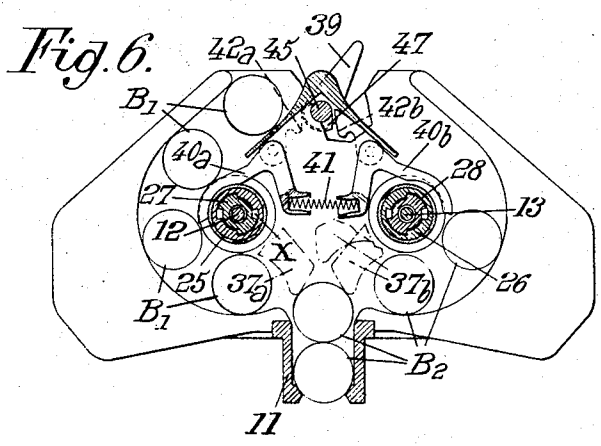
39
42a
45
47
B1
42b
40b
40a
41
28
27
13
12
X
25
37a
37b
26
B1
B2
11

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Fig.7.

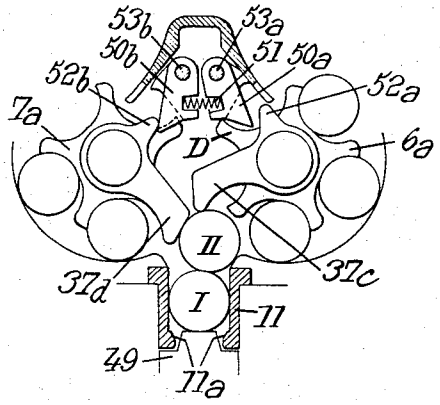


Fig.8.

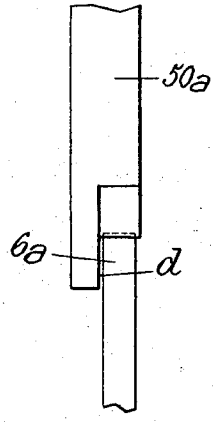
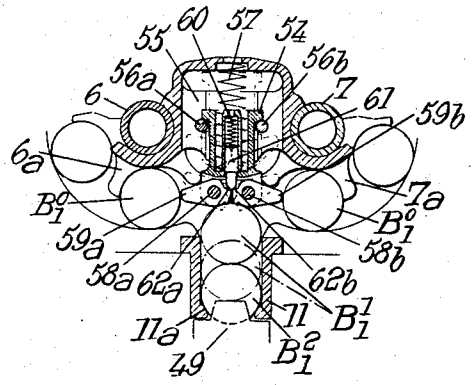


Fig.9.



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3,417,657

TOOTHED ROTOR MECHANISMS FOR AUTOMATIC GUNS FED FROM TWO CARTRIDGE BELTS

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Claims priority, application Luxembourg, July 1, 1966, 51,456/66; Feb. 23, 1967, 53,051/67
16 Claims. (Cl. 89—33)

ABSTRACT OF THE DISCLOSURE

A feed mechanism including two tubular toothed rotors is actuated, from an oscillating pinion operated by the recoil of the gun, through two torsion rods housed in said rotors and coupled together in series.

The present invention relates to feed mechanisms for automatic guns including two toothed rotors adapted to cooperate respectively with two cartridge belts, means being provided for coupling one or the other of these rotors with a common driving mechanism, advantageously operated by the recoil movements of a movable portion of the gun, whereby said gun can be fed from one or the other of said belts, which belts may be fitted with ammunitions of different kinds, for instance explosive shells for one of the belts and armor piercing projectiles for the other belt.

The chief object of our invention is to provide a feed mechanism which is better adapted to meet the requirements of practice than those existing at the present time, especially from the point of view of simplicity and safety of operation.

Such a feed mechanism includes two tubular toothed rotors for conveying corresponding cartridge belts respectively toward two pulling systems from either of which the extracted cartridges are moved into a common feed passage leading to the gun, one or the other of said rotors being rotated from a common driving device actuated, on the firing of every cartridge, by the recoil movement of a heavy part of the gun, and possibly of the whole of said gun, with respect to a stationary cradle.

The chief feature of our invention consists in making use, for rotating one or the other of the rotors from the common driving device, of two torsion rods housed respectively in said two rotors and coupled together in positive and permanent fashion at their ends located on one side of the device so as to form a transmission having a capacity of torsion greater than that of each torsion rod, coupling means being provided for, on the one, hand, angularly coupling with said common driving device either of the free ends of said transmission and, on the other hand, angularly coupling the other free end of said transmission with the rotor in which is housed the torsion rod to which belongs said last mentioned free end of the transmission, abutment means being advantageously provided for limiting the angular displacement of each rotor to a given pitch for every shot that is fired.

Another feature of our invention consists in arranging the feed mechanism of the type in question in such manner that both of the cartridge belts enter the feed mechanism at the upper part thereof, that the elimination of the empty links takes place laterally on either side of the feed mechanism and preferably in the downward direction, and that the cartridges torn away from their links are pushed toward a middle delivery passage located at the lower part of the feed mechanism.

A third feature of our invention, for use in a feed mechanism including two distinct systems each for detaching

the cartridges from the corresponding cartridge belt and feeding them through a respective guideway to a common outlet passage through which they are led to the gun, consists in providing each of these guideways with at least one movable lever adapted to shift, against the action of resilient return means and under the thrust of a cartridge running through the guideway supposed to be in operation from a guideway closing position to a guideway clearing position, the movable lever located in the other guideway (not in operation) then remaining in its closing position where it compels the cartridges coming from the guideway in operation to penetrate into the delivery passage common to both of the guideways.

A preferred embodiment of the present invention will be hereinafter described with reference to the appended drawings given merely by way of example and in which,

FIG. 1 is a side view, with portions in vertical section of a feed mechanism made according to the present invention;

FIG. 2 is a cross-sectional view on the line II—II of FIG. 3;

FIG. 3 is a horizontal section on the line III—III of FIG. 1 in the position for which the gun is fed with cartridges from one of the cartridge belts;

FIG. 4 is a cross-sectional view on the line IV—IV of FIG. 3;

FIG. 5 is a view similar to FIG. 3, but more diagrammatic, and in the position for which the gun is fed with cartridges from the other cartridge belt;

FIG. 6 is a cross-section on the line VI—VI of FIG. 3;

FIG. 7 is a cross-section on the line VII—VII of FIG. 3;

FIG. 8 shows an enlargement of a detail of FIG. 7; and

FIG. 9 is a cross-section on the line IX—IX of FIG. 3.

In the embodiment of our invention illustrated by the drawings, the feed mechanism includes two toothed rotors for feeding cartridges supplied by means of two cartridge belts B_1 and B_2, the cartridges of each belt being connected together through links M. It will be supposed that the cartridges of belt B_1 are explosive shell cartridges and that the cartridges of belt B_2 are fitted with armor piercing projectiles. The automatic gun comprises a relatively heavy portion recoiling, upon every shot, against the action of resilient return means. The gun proper may for instance constitute this recoiling portion moving with respect to a stationary support or cradle S, with the interposition of a resilient element (not shown by the drawings) which absorbs the recoil of the gun and ensures its return into shooting position.

The cartridge feed mechanism is operated, every time a cartridge is shot, by the recoil of the gun, including the barrel **1** and the breechcase **2** fixed thereto. The casing **3** of the feed mechanism is slidable on the top of breechcase **2**, said casing being connected to support S by a holding member **4**, whereby the whole of the feed mechanism remains stationary during firing. The relative movement of the gun with respect to the feed mechanism is used, during the recoil strokes of said gun, to actuate the feed mechanism through a cam **5** carried by casing **2** and acting upon a driving device belonging to the feed mechanism and which will be hereinafter fully described.

As shown by FIGS. 1 to 6, the feed mechanism includes two tubular toothed rotors **6** and **7** having their axes parallel to the longitudinal plane of symmetry of the gun and disposed symmetrically to each other with respect to said longitudinal plane. Said rotors **6** and **7** comprises, respectively, three toothed reels **6***a* (for rotor **6**) and **7***a* (for rotor **7**).

The feed mechanism is arranged, as shown by FIG. 2, so that the two cartridge belts B_1 and B_2 enter it at the upper part thereof through two inlet passages **8** separated

from each other by a deflector **9** and that the empty links escape laterlly and downwardly on either side of the feed mechanism, through evacuation passage **10**. Furthermore the cartridges torn away from their links are pushed toward a delivery passage **11** located in the middle bottom portion of the mechanism and the sidewalls of which project into breechcase **2** so as to guide the cartridges detached from their links into an introduction position where they lie upon the introduction edges **11***a* of passage **11**.

With a feed mechanism of this type it is advantageous to provide a resilient transmission between the mechanism driving device and rotors **6** and **7**. Such a resilient transmission permits of storing up the energy collected from the recoil of the gun during its short recoil stroke and of transmitting this energy to rotors **6** and **7** during a longer time interval.

For this purpose, according to this invention, the resilient transmission includes two torsion rods **12** and **13** (FIG. 3) housed respectively in rotors **6** and **7** and extending substantially over the whole length of the feed mechanism.

These two torsion rods **12** and **13** are coupled together in a positive and permanent fashion through their respective ends **12***a* and **13***a* located at the rear of the mechanism, so as to constitute a resilient transmission having a total torsion capacity equal to twice that of each of the torsion rods **12** and **13**; for instance on the ends **12***a* and **13***a* of torsion rods **12** and **13** we fix two identical pinions **14** and **15** connected together by an intermediate pinion **16**.

We provide means capable, on the one hand, of angularly coupling with the device from which the feed mechanism is driven either of the three ends **12***b* and **13***b* of torsion rods **12** and **13** and, on the other hand, of angularly coupling the other free end (**13***b* or **12***b*) of said torsion rods with the rotor (**7** or **6**) in which is housed the torsion rod (**13** or **12**) to which belongs said other free end (**13***b* or **12***b*).

The device for driving the feed mechanism is to be operated by cam **5** during the recoil movement of the gun.

This driving device actuates a rotary member **17** (FIGS. 3 and 4) rotated, every time a shot is fired, through an angle equal to, or just a little greater than one pitch, that is to say $2\pi/n$ (n being the number of teeth of each of the wheels of rotors **6** and **7**). For this purpose, as shown by FIGS. 1 and 4, this driving device essentially comprises the following elements:

A roller **18** carried by the casing of the feed mechanism and located across the recoil trajectory of cam **5** and a roller **19** located opposite roller **18** and carried by a push-piece **20** slidable in said casing against the action of a return spring **21**, the rearward movement of cam **5** between said rollers **18** and **19** imparting an upward displacement to push-piece **20** whereas the return of said cam toward the front permits a return downward movement of said push-piece **20** under the action of spring **21**, and

An area **22** carrying two toothed sectors **23** and **24** one of which, **23**, is in mesh with a rack **20***a* carried by push-piece **20** whereas the other one, **24**, imparts a reciprocating movement to rotary member **17**, consisting of a pinion in mesh with said toothed sector **24**.

Between oscillating pinion **17** and toothed rotors **6** and **7**, we provide a transmission such that there is left, between central pinion **17** and each of the toothed rotors **6** and **7**, an angular play X corresponding to a portion of a complete pitch of either of said rotors, torsion rods **12** and **13** tending to maintain this play. Thus, if during a motive impulsion imparted by pinion **17**, the toothed rotor that is active does not rotate sufficiently under the action of torsion rods **12** and **13**, said pinion **17** absorbs this play X so as finally to ensure a positive drive of said toothed sector.

In order to contstitute the transmission means which permit of coupling at will oscillating control pinion **17** with one or the other of toothed sectors **6** and **7**, use is made of the arrangement illustrated by the drawings and in particular by FIG. 3.

There is provided, between each rotor **6** or **7** and the corresponding torsion rod **12** or **13**, an intermediate tubular piece (**25** for rotor **6** and **26** for rotor **7**) on which the corresponding rotor is freely rotatable.

The end **12***b* of torsion rod **12** is angularly coupled by means of splines with the corresponding end of intermediate piece **25** and the end **13***b* of torsion rod **13** is similarly coupled by means of splines with the corresponding end of intermediate piece **26**. The other ends of said intermediate pieces **25** and **26** are respectively coupled with the hubs of the coupling pinions **14** and **15** of the torsion rods through the intermediate of abutment means **27** and **28**, having with respect to the corresponding intermediate pieces **25** and **26**, the above mentioned angular play X intended to permit the desired operation for torsion rods **12** and **13** (play X visible in FIG. 6).

Oscillating control pinion **17** is freely rotatable and slidable with respect to intermediate piece **25** and it is provided, on its side, with teeth **29** adapted to cooperate in a non reversible manner with corresponding teeth provided on the side of a toothed wheel **30** freely rotatable with respect to said intermediate piece **25**. The whole of pinion **17** and teeth **29** is urged axially toward toothed wheel **30** by spring **31**. Thus, as long as pinion **17** is rotating in one direction, its teeth **29** cooperate with the teeth carried by toothed wheel **30** on the left hand side thereof so as to cause rotation of said wheel **30**. But when pinion **17** rotates in the opposed direction, its teeth **29** slide on the side teeth of wheel **30** and do not drive said wheel.

Toothed wheel **30** is constantly in mesh with a similar toothed wheel **32** freely rotatable in the intermediate tubular piece **26** corresponding to toothed rotor **7**.

This transmission system further comprises reversing coupling means as above mentioned, which must permit of driving through pinion **17** either rotor **6** or rotor **7**.

Said coupling means are shown by FIG. 3.

On intermediate tubular piece **25** there is provided a sliding sleeve **33** adapted to rotate together with said intermediate piece by means of a sliding key. Said sleeve **33** carries at its ends two dog clutch sets of teeth **33***a* and **33***b*. Teeth **33***a* are adapted to cooperate with corresponding teeth provided on toothed wheel **30** and teeth **33***b* are adapted to cooperate with corresponding teeth provided on the corresponding edge of rotor **6**.

On intermediate tubular piece **26**, there is provided a sliding sleeve **34** adapted to rotate together with said intermediate piece by means of a sliding key. Said sleeve **34** carries, at the ends thereof, dog clutch sets of teeth **34***a* and **34***b*. Teeth **34***a* are adapted to cooperate with corresponding teeth carried by toothed wheel **32** and teeth **34***b* are adapted to cooperate with corresponding teeth provided for this purpose on the corresponding edge of rotor **7**.

A rocking bar **35** operable by a lever **36** is provided for imparting sliding displacements in opposed directions respectively to sleeves **33** and **34**. This permits of bringing into operation simultaneously, either the teeth **33***a* of sleeve **33** cooperating with toothed wheel **30** and the teeth **34***b* of sleeve **34** cooperating with rotor **7** (case of FIG. 3) or the teeth **33***b* of sleeve **33** cooperating with rotor **6** and the teeth **34***a* of sleeve **34** cooperating with toothed wheel **32** (case of FIG. 5).

In the first case (FIG. 3), the transmission system drives toothed rotor **7** due to the fact that the rotation of pinion **17** is transmitted through toothed wheel **30**, sleeve **33**, intermediate tubular piece **25**, torsion rod **12**, pinions **14**, **15** and **16**, torsion rod **13**, tubular piece **26** and sliding sleeve **34**. Toothed rotor **7** is thus resiliently driven through both of the torsion rods **12** and **13** in torsional prestressed state, the drive becoming imperative

in case of the angular play X being absorbed, as above stated.

In the second case (FIG. 5), the transmission system drives toothed rotor **6** due to the fact that the rotation of pinion **17** is transmitted through toother wheel **30**, toothed wheel **32**, sleeve **34**, intermediate piece **26**, torsion rod **13**, pinions **16**, **15** and **14**, torsion rod **12**, intermediate piece **25** and sliding sleeve **33**. Toothed rotor **6** is thus driven, either resiliently or, on the contrary, imperatively if play X is absorbed.

Thus, in both cases, torsion rods **12** and **13** introduce the sum of their respective torsions in the drive of the toothed rotor which is to be operated.

Advantageously, as shown by FIGS. 2 and 6, the feed mechanism comprises, in each of the guideways connecting the points where the carriages are torn away from belts B_1 and B_2 to the common delivery passage **11**, at least one movable lever **37***a* or **37***b* adapted to shift, against the action of a return spring **38***a* or **38***b* working in compression and under the thrust of a cartridge travelling through the guideway supposed to be in operation, from a guideway closing position to a guideway clearing position, the movable lever **37***b* or **37***a* located in the other guideway (not in operation) then remaining in its closing position, in which it compels the cartridges coming from the guideway in operation to penetrate into delivery passage **11**.

In FIG. 2 we have shown levers **37***a* and **37***b* in their guideway closing position, the feed of cartridges taking place from the left hand cartridge belt B_1 to which corresponds the glideway provided with lever **37***a*. Cartridge B_1^0, which has just been extracted from its link, rests upon a fixed guide **3***a* rigid with the casing and when said cartridge is urged toward evacuation passage **11** by rotor **6** it compels lever **37***a* to lift against the action of spring **38***a* (position shown in dot-and-dash lines in FIG. 2) and thus displacement of said cartridge B_{10} which comes into position B_1^1, above evacuation passage **11**. For this position, cartridge B_1^1 is, on the one hand, pushed toward said evacuation passage **11** by lever **37***a* returned into its guideway closing (lower) position by spring **38***a* and, on the other hand, compelled to penetrate into said evacuation passage **11** by lever **37***b* kept in guideway closing (lower) position by spring **38***b*.

Of course, when the gun is fed from the right hand cartridge belt B_2, it is lever **37***a* that remains in guideway closing (lower) position, leved **37***b* reciprocating between its lower and its upper positions (FIG. 6).

On the other hand, it is of interest to provide a feed mechanism as above described with automatic stopping means which stop firing when one of the bolts B_1 or B_2, is exhausted and preferably in this case the operation of a single control member **39** (FIGS. 1 and 6) simultaneously permits of operating sliding sleeves **33** and **34** and of resetting said automatic means.

In the embodiment described, said automatic stopping means include, as shown by FIG. 6, two feeler members **40***b* subjected to the action of a spring **41** urging them to pivot upwardly, said feeler members being prevented from pivoting by the presence of the cartridges travelling toward the corresponding extraction position (case of the feeler lever **40***a* on the left hand side of FIG. 6). Each feeler lever is adapted, when it pivots upwardly (case of feeler lever **40***b* in FIG. 6) to cause, through a rocker arm (**42***a* or **42***b*) turning together with the corresponding feeler lever, the pivoting of a last shot stopping lever **43** which then permits the lever **44** of the trigger system (FIG. 1) to escape, thus making the trigger system inoperative. The operator then ceases to act upon said trigger system and lever **44** returns to its normal position, as shown in solid lines in FIG. 1.

In these conditions, the single control member **39** consists of a handle actuating,

On the one hand, through a spindle **45** and a fork **46**, the lever **36** for controlling sliding sleeves **33** and **34**, and,

On the other hand, a cam **47** capable of pushing back the rocker arm **42***a* or **42***b* precedingly driven by the rotation of the feeler lever **40***a* or **40***b* corresponding to the exhausted cartridge belt, this movement of rocker arm **42***a* or **42***b* permitting the return of the last shot stopping lever **43** to its initial position under the action of a return spring **48**.

Thus, control member **39** permits of both controlling sliding sleeves **33** and **34** and resetting the automatic stopping means.

Advantageously, a feed mechanism as above described further includes means for limiting, on every shot that is fired, the rotation of the operating rotor to one pitch (that is to say to an angle equal to $2\pi/n$; n being the number of teeth of the wheels of the toothed rotor). This in order to ensure that, after every shot that is fired, the cooperating teeth of the two dog clutch mechanisms are in a position permitting their cooperation. In other words, the means in question are intended to guarantee the possibility, under all circumstances, of good operation of the coupling means which are to permit of bringing into action the rotor that was precedingly inoperative.

By way of example it will be supposed that the feed mechanism is to be used with an open breech automatic gun of the type in which, when the breech is closed, the first cartridge to be introduced rests upon the upper edge of the breechblock **49** of the gun (case of FIG. 7), whereas, when the breech is open, that is to say in the rear position, where it is held by the sear when the gunner has stopped firing, the first cartridge to be inserted rests upon the edges **11***a* of evacuation passage **11**, breechblock **49** being then located at the rear of said evacuation passage and being ready, on its return stroke toward the front, to catch said first cartridge to introduce it into the cartridge chamber of the gun (case of FIG. 9).

For a gun of this type it will be of interest to make the means for limiting the rotation of the rotors to one pitch for every shot such that said means are operative both when breechblock **49** is in closing and when it is in opening position.

For this purpose it seems simpler to divide said means into two groups of elementary means the first of which operates when breechblock **49** is in closing position (case of FIG. 7) whereas the second one works when said breechblock is in opening position (case of FIG. 9).

The first group of elementary means may be made as illustrated by FIGS. 7 and 8.

One of the wheels **6***a*, **7***a* of each rotor is associated with a retractable abutment **50***a*, **50***b* capable of shifting from an active position (wherein it forms an abutment for a tooth of said rotor toothed wheel which has just completed an angular movement of one pitch) to a neutral position (for which it permits movement of said tooth, that is to say a new angular displacement of the rotor).

Retractable abutments **50***a* and **50***b* are subjected to the action of return means, for instance a common spring **51**, constantly urging said retractable abutments toward their active positions.

Retractable abutments **50***a* and **50***b*, respectively, are controlled by two levers **37***c* and **37***d* analogous to the above mentioned levers **37***a* and **37***b* and carrying each a control cam (**52***a* for lever **37***c* and **52***b* for lever **37***d*) adapted to cooperate with the corresponding retractable abutment **50***a* or **50***b* to shift it from its active position to its neutral position against the action of a return spring **51** when the lever **37***c* or **37***d* that is considered shifts from the position for which it permits the passage of the cartridges through the corresponding guideway (position of lever **37***c* in FIG. 7) to the position for which it closes said guideway (position of lever **37***d* in FIG. 7).

Each retractable abutment **50***a*, **50***b* consists of a pawl pivoting about a spindle **53***a*, **53***b*, respectively, and pro-

vided, near its end, with a lateral recess *d* permitting the passage of the teeth of toothed wheel **6***a* or **7***a*, which teeth then come into contact with the base of this lateral recess when the pawl is in active position (as clearly visible for pawl **50***a* in FIG. 7 and on an enlarged scale in FIG. 8) whereas the teeth in question can move on in rotation when the pawl is in neutral position (case of the pawl **50***b* in FIG. 7).

The operation of such means is then as follows, breechblock **49** being in the closing position.

When lever **37***c* has been turned upwardly by the passage of a cartridge II, bearing upon the next cartridge I resting upon the upper edge of breechblock **49**, the control cam **52***a* of this lever **37***c* releases the corresponding pawl **50***a* which, under the action of spring **51**, comes into its active position for which it is located across the path of travel of a tooth D of toothed wheel **6***a*, thus temporarily preventing further rotation of said toothed wheel, the forward displacement of which is thus limited to one pitch. As soon as said cartridge II has moved forward (due to the resetting of breechblock **49** and to the downward movement of the first cartridge to be shot onto the edges **11***a* of passage **11**) lever **37***c* rotates downwardly and its control cam **52** compels pawl **50***a* to come, against the action of return spring **51**, into its neutral position for which it permits a further rotation of toothed wheel **6***a*. This further rotation is also limited to one pitch due to the upward movement of lever **37***c* produced by the passage of the cartridge moved forward by this further angular rotation, said cartridge being, at the end of the pitch, temporarily blocked by breechblock **49** in closing position.

As for the second group of elementary means for limiting to one pitch the rotation of the toothed rotors, said means being intended to operate when shooting has been stopped with breechblock **49** in opening position, it may be made as illustrated in FIGS. 3 and 9.

The upper portion of the feed mechanism casing **3** carries, above evacuation passage **11** a push-piece **54** slidable vertically in a guide frame **55** between an upper position and a lower position determined, respectively, by two lateral abutments **56***a*, **56***b* disposed at the same level and with which cooperate either of two external shoulders located respectively at the ends of said push-piece **54**. The latter is subjected to the action of a return spring **57** urging it toward its lower position, shown in solid lines in FIG. 9.

To the lower end of push-piece **54** are pivoted, respectively about axes **58***a* and **58***b*, two abutments **59***a* and **59***b* the free ends of which are located respectively opposite the outlets of the two guideways leading to the common evacuation passage **11**.

Pivoting abutments **59***a* and **59***b* are subjected to the action of return means urging them from an active position (illustrated in solid lines in FIG. 9) for which said abutments stop, through their free ends, the outlets of the corresponding cartridge guideways, to a neutral position (illustrated in dot-and-dash lines in FIG. 9) for which said abutments are partly retracted upwardly, thus forming marginal cams in the outlets of the two cartridge guideways. Said return means advantageously consist of a spring **60** (weaker than spring **57**) housed in the central portion of push-piece **54** and bearing upon a push rod **61** adapted to cooperate with heels **62***a* and **62***b* carried by pivoting abutments **59***a* and **59***b*, respectively.

The operation is as follows, the gun breechblock **49** being supposed to be in the opening position as illustrated by FIG. 9.

Cartridge B_1^2 which rests upon the edges **11***a* of delivery passage **11** is ready to be introduced into the gun on the next frontward stroke of breechblock **49**. Push-piece **54** is close to its lowermost position for which it would bear upon side abutments **56***a* and **56***b* and the pivoting abutments **59***a* and **59***b* are applied through their heels against cartridge B_1^1 which is located before cartridge B_1^2 in delivery passage **11** by spring **57** acting, through axes **58***a* and **58***b*, in opposition to return spring **60**. Said pivoting abutments **59***a*, **59***b* are therefore compelled to remain temporarily in their active positions where they close the outlets of the two guideways leading to delivery passage **11**. As soon as cartridge B_1^2 has been caught by breech-block **49**, cartridge B_1^1, under the action of spring **60**, moves into delivery passage **11** toward the position shown in dot-and-dash lines in FIG. 9, where it rests upon the upper face of breechblock **49**. Simultaneously with this displacement of cartridge B_1^1, heels **62***a* and **62***b* are released from pivoting abutments **59***a* and **59***b* which, under the action of return spring **60**, come into their retracted positions (shown in dot-and-dash lines in FIG. 9) where they clear the outlets of the two guideways, while forming side cams on the upper edges of these outlets. The first cartridge B_1^0, fed by the rotor that is in operation, bears against the oblique plane formed by the corresponding pivoting abutment **59***a* or **59***b* in retracted position and, through a cam effect, said cartridge B_1^0 compels push-piece **54** to move upwardly against the thrust of its return spring **57** until cartridge B_1^1 (which rested upon the top face of breechblock **49**) moves down into introduction position where it bears upon the edges **11***a* of delivery passage **11**. This downward movement of cartridge B_1^1 permits a corresponding and simultaneous downward movement of cartridge B_1^0 which thus releases the corresponding pivoting abutment **59***a* or **59***b* and permits push-piece **54** to come back into its lowermost position under the action of its return spring **57**. The whole is again in its initial position illustrated in solid lines in FIG. 9, pivoting abutments **59***a* and **59***b* closing the outlets of the two guideways and thus temporarily stopping the two rotors through the cartridges present in said guideways. Thus the angular stroke of the rotors is limited to one pitch for every shot that is fired.

It will be noted that these devices for limiting the rotation strokes will play their part not only during firing but also when the cartridge belts are being engaged, which requires imparting rotation of the rotors, for instance by acting upon flat faces provided on the hubs of pinions **14** and **15** or acting upon intermediate tubular pieces **25** and **26**.

Furthermore said limiting devices eliminate any risk of engagement of the delivery passage **11**.

In a general manner while we have, in the above description, disclosed what we deem to be practical and efficient embodiments of our invention, it should be well understood that we do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of our invention as comprehended within the scope of the appended claims.

What we claim is:

1. For use with an automatic gun including a fixed portion and a movable portion having a reciprocating recoil and frontward movement with respect to said fixed portion, a feed mechanism which comprises, in combination,

a fixed frame carried by said gun fixed portion,

two toothed rotors, a first one and a second one journalled in said frame about respective axes parallel to the gun axis, and located on opposite sides, respectively, of said gun axis, said rotors including each at least two toothed wheels for engaging cartridges belonging to two cartridge belts, respectively,

a common feed passage carried by said frame between said two rotors for receiving cartridges from either of them and guiding said cartridges toward said gun,

a driving part movable step by step with a given pitch in said frame in response to said gun movable portion recoil displacements,

first transmission means for rotating said first rotor in response to every pitch of said driving part,

second transmission means for rotating said second rotor in response to every pitch of said driving part,

both of said transmission means including in common two torsion rods, a first one and a second one, respectively journalled in said rotors coaxially therewith and having corresponding respective first ends angularly coupled together,

said first transmission means being adapted angularly to couple the second end of said first torsion rod with said driving part and the second end of said second torsion rod with said second rotor,

said second transmission means being adapted angularly to couple the second end of said second torsion rod with said driving part and the second end of said first torsion rod with said first rotor,

clutch means for alternately making one of said transmission means operative and the other one inoperative, and

means for operating said clutch means.

2. A feed mechanism according to claim **1** wherein both of said torsion rods are of the same length.

3. A feed mechanism according to claim **1** including two pinions secured to the respective first ends of said torsion rods and a pinion journalled in said frame interconnecting said two pinions together.

4. A feed mechanism according to claim **3** wherein said driving part is a pinion journalled in said frame, further including means operative by the reciprocating movement of said gun movable portion for imparting a rotation of one pitch to said pinion in response to every reciprocation of said gun movable portion with respect to said gun fixed portion.

5. A feed mechanism according to claim **4** wherein said transmission means are adapted to provide, between said driving part and said rotors, an angular play corresponding to a portion only of said pitch, this play tending to be maintained by said torsion rods.

6. A feed mechanism according to claim **5** wherein

said first transmission means comprise, coaxially interposed between said first rotor and the corresponding torsion rod, a first tubular piece on which the corresponding rotor is freely rotatable, and

said second transmission means comprise, coaxially interposed between said second rotor and the corresponding torsion rod, a second tubular piece on which the corresponding rotor is freely rotatable,

said driving part being a pinion coaxial with said first tubular piece and freely rotatable and longitudinally slidable thereon, said pinion being provided, on one side thereof, with a set of non-reversible teeth,

the feed mechanism comprising

a first toothed wheel freely rotatable on said first tubular piece, provided on its side with a set of non-reversible teeth adapted to cooperate with the above mentioned set of non-reversible teeth,

resilient means for urging said pinion toward said first toothed wheel to tend to engage said two sets of non-reversible teeth with each other,

a second toothed wheel in mesh with said first toothed wheel and freely rotatable on said second tubular piece,

a first dog clutch sleeve slidable longitudinally on said first tubular piece but angularly fixed with respect thereto, said dog clutch sleeve being provided at its respective ends with two sets of teeth, a first one adapted to cooperate with a corresponding set of teeth provided on the opposite side of said first toothed wheel and a second one adapted to cooperate with a corresponding set of teeth provided on the opposite edge of the corresponding toothed rotor,

a second dog clutch sleeve slidable on said second tubular piece, this last mentioned sleeve being slidable longitudinally on said second tubular piece but angularly fixed with respect thereto, said second dog clutch sleeve being provided at its respective ends with two sets of teeth, a first one adapted to cooperate with a corresponding set of teeth provided on the opposite side of said second toothed wheel and a second one adapted to cooperate with a corresponding set of teeth provided on the opposite edge of the corresponding toothed rotor, and

control means of a reversing type for imparting sliding displacements in opposite directions to said dog clutch sleeves, said control means being arranged in such manner as to make it possible simultaneously to engage either the first set of teeth of said first sleeve with said first toothed wheel and the second set of teeth of said second sleeve with the corresponding rotor, or the second set of teeth of said first sleeve with the corresponding rotor and the first set of teeth of said second sleeve with said second toothed wheel.

7. A feed mechanism according to claim **1** comprising a common delivery passage, two guideways extending between the points where the cartridges are detached from the respective cartridge belts and said common delivery passage, a movable lever in each of said guideways, resilient return means working in compression, adapted to act on said levers respectively, each of said levers being adapted to shift, under the effect of the thrust exerted thereon by the next cartridge travelling through the guideway in operation, from a lowermost position, in which it closes said guideway to an uppermost position in which it permits passage of said cartridge, the movable lever present in the other guideway then remaining in its lowermost position where it compels by abutment the cartridges travelling through the guideway in operation to penetrate into the common delivery passage.

8. A feed mechanism according to claim **1** including an automatic stopping system to interrupt firing when one of the cartridge belts is exhausted, which further comprises a single control member for simultaneously operating said clutch means and rearming said automatic stopping system.

9. A feed mechanism according to claim **6** including an automatic stopping system to interrupt firing when one of the cartridge belts is exhausted, which further comprises a single control member for simultaneously operating said dog clutch sleeves and rearming said automatic stopping system, wherein the automatic stopping system comprises two feeler levers and a spring tending to pivot upwardly, said feeler levers prevented from pivoting by the presence of the cartridges arriving at the place where they are detached from the cartridge belt, a rocker arm fixed on the axis of the corresponding feeler lever, respectively, to cause, through the corresponding rocker arm, pivoting of a least shot stopping lever which then permits the escape of the lever of the trigger system, thus neutralizing it, said single control member being adapted to operate

on the one hand, the dog clutch sleeves control means, and

on the other hand, a cam capable of pushing back the rocker arm precedingly driven by the swinging movement of the feeler lever corresponding to the exhausted cartridge belt, this pushing back of said rocker arm having for its effect to permit the return of the last shot stopping lever into its initial position.

10. A feed mechanism according to claim **1** wherein the two cartridge belts enter said feed mechanism at the top through two inlet passages, discharge of the empty links taking place laterally on either side of said feed mechanism, the common feed passage to which are fed the cartridges released from their links being located at the lower part of the mechanism.

11. A feed mechanism according to claim **1** which further comprises means for limiting, on every shot that is fired, the rotation of the rotor in operation to one pitch, that is to say to an angle equal to $2\pi/n$, n being the number of teeth of each of the wheels of said rotor.

12. A feed device according to claim **11** intended for use on an open breech automatic gun of the kind of those

where, when the breech is closed, the first cartridge to be introduced rests upon the upper face of the gun breechblock, whereas when the breech is opened, the first cartridge to be introduced rests upon edges provided at the end of the delivery passage, the breechblock being then at the rear of said delivery passage and ready, during its frontward return stroke, to catch said first cartridge to be introduced to engage it into the cartridge chamber of the gun, wherein, the means for limiting the rotation of the rotors to one pitch for every shot that is fired are arranged to be operative both when the breechblock is closed and when it is open.

13. A feed mechanism according to claim **12** wherein last mentioned means form two groups, the first one acting when the breechblock is in closed position and the second one acting when said breechblock is in open position.

14. A feed mechanism according to claim **13** comprising, to constitute said first group,

to act on one of the wheels of each rotor, a retractable abutment adapted to shift from an active position where it forms an abutment for one tooth of this rotor toothed wheel, at the end of an angular stroke of one pitch to a neutral position where it permits rotation of said tooth,

to act on the retractable abutments corresponding to the two toothed rotors, resilient return means constantly urging said retractable abutments toward their active position, and

to control said retractable abutments, two levers each bearing a control cam adapted to cooperate with the corresponding retractable abutment to shift said abutment from its active position to its neutral position, against the action of resilient return means, when the lever that is considered shifts from the position where it permitted the passage of the cartridges through the corresponding guideway to the position where it closes said guideway.

15. A feed mechanism according to claim **14** wherein each retractable abutment consists of a pivoting pawl provided near its end with a lateral recess permitting the passage of the teeth of the corresponding rotor toothed wheel, said teeth then coming into contact with the base of this lateral recess when the pawl is in active position, whereas said teeth can move forward in rotation when the pawl is in neutral position.

16. A feed mechanism according to claim **13** which comprises, to constitute said second group of means for limiting the rotation of the rotor to one pitch for every shot that is fired,

carried by the upper portion of the frame of the mechanism, on the vertical of said common feed passage, a push-piece slidable in said frame between an uppermost position and a lowermost position,

a return spring for urging said push-piece towards its lowermost position,

carried by the lower end of said push-piece, two axes on which are pivoted respectively two abutments the free ends of which are located respectively opposite the outlets of the two guideways leading to said common feed passage, and

acting on said pivoting abutments, return means urging them from an active position, where said abutments close by their free ends the outlets of the corresponding guideways, to a neutral position where said abutments are partly retracted upwardly, thus forming side cams in the outlets of the two guideways.

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