March 13, 1956 M. J. CARRAU 2,737,941

MECHANICAL GUN

Filed Dec. 13, 1952

Fig. 1

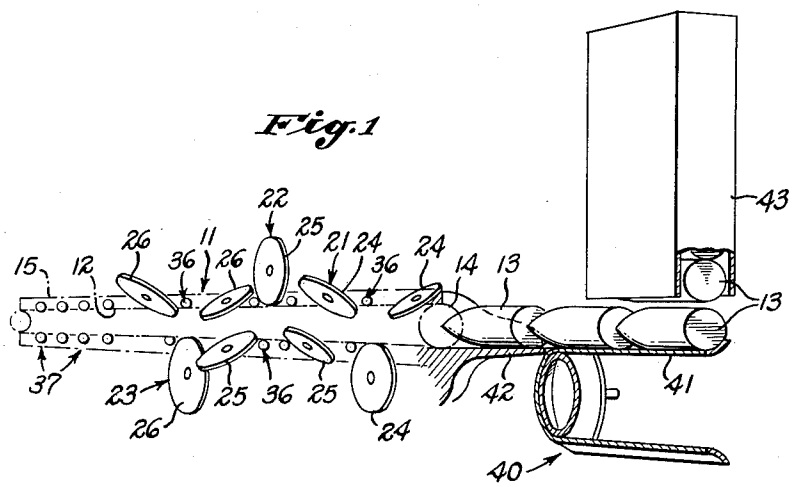


Fig. 2

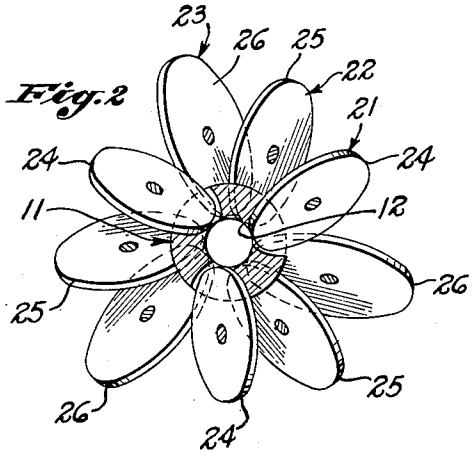


Fig. 3

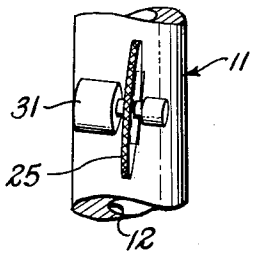
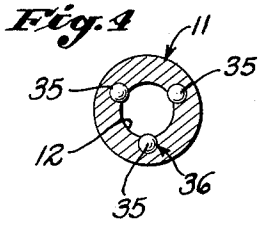


Fig. 4



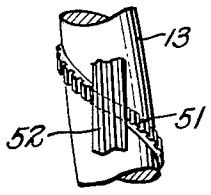


Fig. 5

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MECHANICAL GUN

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13 Claims. (Cl. 124—1)

The present invention relates to guns and, more particularly, to a gun which propels projectiles mechanically instead of explosively, a primary object of the invention being to provide such a gun which retains the accuracy of conventional guns utilizing explosive propulsion, together with other advantages of such conventional guns, but which eliminates many of the disadvantages thereof.

The present invention, by propelling projectiles mechanically, provides numerous advantages over conventional guns which utilize explosive charges for projectile propulsion. For example, the gun of the present invention produces no smoke or flash to reveal its position to enemy forces. Also, the gun of the present invention is quiet in operation to attain this same result. Another advantage of the present invention is that it is not subject to the overheating encountered with conventional guns using explosive charges so that it can be operated continuously for prolonged periods of time. Also, because of the absence of overheating, the useful life of the gun of the invention is materially increased over that of conventional guns, particularly since any moving parts can be lubricated effectively in view of the low operating temperatures involved. Furthermore, the gun of the present invention, by requiring projectiles only, avoids all the difficulties and expense attendant upon the manufacturing, shipping, supplying, storing and handling of conventional cartridges containing powder and projectiles. Furthermore, there is no limit to the amount of energy that can be imparted to a projectile with the gun of the present invention so that much greater fire power, i. e., much higher muzzle velocities, may be attained. The foregoing advantages of the present invention are merely representative of the many advantages attainable therewith and many other will occur to those skilled in the art.

Considering the present invention more particularly, an important object thereof is to provide a gun having a barrel means which includes a passage therethrough for a projectile, and to provide mechanical propelling means extending into the passage and engageable with a propectile therein for propelling the projectile along the passage and for simultaneously rotating it about the axis of the passage. Such simultaneous axial and rotational propulsion insures that the projectile will follow the desired trajectory accurately, which is an important feature of the invention not attainable with mechanical propulsion guns heretofore proposed.

Another object is to provide a projectile propelling means which includes a plurality of propelling wheels extending into the passage through the barrel means and engageable with a projectile in the passage so as to propel the projectile along the passage from the breech end of the gun toward the muzzle end thereof. An important object in this connection is to so orient the propelling wheels that they are rotatable in planes making acute angles with the axis of the passage, whereby a rotary component of motion is imparted to each projectile concurrently with the axial component of motion imparted thereto, thereby attaining the rotary or spinning motion hereinbefore discussed.

Another object is to provide a gun wherein the propelling wheels are arranged in groups of at least three wheels each to provide proper support for the projectile engaged thereby, the wheels of each group being uniformly spaced circumferentially.

Another object is to provide rotatable bearings carried by the barrel means and extending into the passage to provide additional support for a projectile passing through the passage and to minimize friction, such bearings also preferably being arranged in groups of at least three bearings each. The groups of bearings are also spaced apart along the axis of the passage, the bearings in each group being uniformly spaced circumferentially.

Another object of the invention is to provide the barrel means with a muzzle portion containing a plurality of such bearing groups, but no propelling wheel groups, whereby to insure that each projectile will be properly oriented on its desired trajectory as it passes through the muzzle portion of the gun.

Another object is to provide means for producing progressively increasing peripheral speeds for the propelling wheels of the groups in a direction from the breech end of the barrel means toward the muzzle end thereof so that each projectile is progressively accelerated as it encounters successive groups of propelling wheels.

Another object is to attain progressively increasing peripheral speeds by rotating the propelling wheels at progressively higher rotational speeds in a direction from the breech end of the gun toward the muzzle end thereof and/or by progressively increasing the diameters of the propelling wheels in a direction from the breech end of the gun toward the muzzle end thereof.

Another object is to provide the propelling wheels with roughened peripheries to produce maximum driving engagement between the propelling wheels and the projectiles, it being possible in some instances to coat the projectiles and/or the propelling wheel peripheries with an adhesive material for this purpose. In this connection, an object is to provide the peripheries of the propelling wheels with gear teeth adapted to mesh with complementary gear teeth on the projectiles, particularly for large projectiles.

The present invention may be utilized in conjunction with projectiles of varying sizes and types. For example, it may be utilized with projectiles ranging all the way from those conventionally used in small calibre weapons to those conventionally used in large artillery pieces. Also, the projectiles may be solid projectiles, or they may be shells containing explosive or other charges.

The foregoing objects, advantages and features of the present invention, together with various other objects, advantages and features thereof which will become apparent, may be attained with the exemplary embodiments of the invention illustrated in the accompanying drawing and described in detail hereinafter.

Referring to the drawings;

Fig. 1 is a diagrammatic perspective view of a gun which embodies the present invention;

Fig. 2 is a transverse sectional view looking toward the muzzle end of the gun and illustrating the propelling wheel arrangement;

Fig. 3 is a fragmentary elevational view illustrating the relationship between one of the propelling wheels and the axis of a longitudinal passage through a barrel means of the gun;

Fig. 4 is a transverse sectional view illustrating an arrangement of rotatable bearing members in the barrel means of the gun; and

Fig. 5 is a view somewhat similar to Fig. 3 but illustrat-

ing an alternative embodiment of the invention intended primarily for use with large projectiles.

Referring particularly to Fig. 1 of the drawing, the gun of the invention illustrated diagrammatically therein includes a barrel means **11** which may be of any suitable construction, the barrel means having a form similar to that of a conventional tubular gun barrel in the particular construction illustrated solely as a matter of convenience. The barrel means **11** provides a passage **12** which finds its counterpart in the bore of a conventional gun barrel and through which projectiles **13** are adapted to be propelled in sequence, the barrel means providing an open breech or breech portion **14** at one end of the passage **12** and a muzzle or muzzle portion **15** at the other end thereof.

The gun of the invention includes a propelling means for mechanically propelling successive projectiles **13** along the passage **12** from the breech end **14** thereof toward the muzzle end **15** thereof and for simultaneously mechanically rotating the projectiles about the axis of the pasage to give them the rotational components of motion necessary to attain accuracy. The propelling means includes a plurality of groups of propelling wheels which propel the projectiles axially of the passage **12** and rotate them about the axis of the passage at the same time in a manner to be described. For purposes of illustration, three such groups of propelling wheels have been shown in the drawing and are identified by the numerals **21**, **22** and **23**, respectively, these groups being spaced along the axis of the passage **12**. However, it will be understood that any desired number of groups of propelling wheels, similarly spaced along the axis of the passage **12**, may be employed. In the three groups **21**, **22** and **23** illustrated, the propelling wheels of the group **21** are identified by the numeral **24**, those of the group **22** are identified by the numeral **25**, and those of the group **23** are identified by the numeral **26**.

As shown in Figs. 1 and 2 of the drawing, each of the wheel groups **21**, **22** and **23** includes three wheels uniformly spaced circumferentially of the barrel means **11**. Although fewer than or more than three wheels may be used in each group, it is preferable to employ at least three wheels in each to provide adequate support for projectiles **13** passing therebetween in a manner to be described. Preferably, the wheels of each of the groups **21**, **22** and **23** are staggered circumferentially with respect to the wheels of adjacent groups, as best shown in Fig. 2 of the drawings.

The peripheries of the wheels **24**, **25** and **26** extend through the barrel means **11** radially and into the passage **12**, the wheels projecting into the passage **12** distances sufficient only to permit engagement of the peripheries of the wheels with projectiles **13** passing through the passage. In the particular construction illustrated, the wheels **24**, **25** and **26** are carried by shafts which may be mounted on any suitable frame or housing, not shown, surrounding the barrel means, the peripheries of the wheels projecting into the passage **12** through slots in the barrel means.

As will be apparent, as each projectile **13** enters the breech **14**, it is frictionally engaged by the peripheries of the wheels **24**, such engagement preferably taking place at at least three points which are uniformly spaced circumferentially so as to provide adequate support for the projectile. The wheels **24** of the first group accelerate each projectile **13** and propel it axially along the passage **12** to the wheels **25** of the second group **22**, which further accelerate the projectile and propel it to the wheels **26** of the third group **23**, the latter still further accelerating the projectile and delivering it to the muzzle portion **15**. In order to insure positive engagement between the wheel peripheries and the projectiles, the wheel peripheries are preferably knurled or otherwise roughened, as suggested in Fig. 3 of the drawing.

As will be apparent, in order to progressively accelerate each projectile **13** as it passes between the wheels of successive groups **21**, **22** and **23**, it is necessary that the peripheral speeds of the wheels **24**, **25** and **26** of the respective groups be progressively higher. This may be accomplished by driving the wheels of the successive groups **21**, **22** and **23** at the same rotational speeds if the wheels of successive groups are of progressively increasing diameters, as shown in Fig. 2. Alternatively, the wheels of successive groups **21**, **22** and **23** may be driven at progressively higher rotational speeds, in which case progressively increasing the wheel diameters is not necessary. As still another alternative, combinations of varying wheel diameters and varying rotational speeds may be utilized.

The wheels **24**, **25** and **26** may be driven in various ways and may be driven from a common prime mover, if desired. However, the driving wheels **24**, **25** and **26** may also be driven individually by individual electric motors, air motors, or the like, an individual drive motor **31** connected to one of the driving wheels **25** being illustrated in Fig. 3 of the drawing.

In order to impart a rotational component of motion to each projectile **13** as it is propelled through the passage **12** by the propelling wheels **24**, **25** and **26**, each of these wheels is so oriented that it rotates in a plane making an acute angle with the axis of the passage **12**, as best shown in Fig. 3 of the drawing. As will be apparent, such orientation of the driving wheels causes them to rotate the projectiles **13** about the axis of the passage **12**, as well as to propel them axially of the passage. Such rotation imparted to the projectiles **13** insures a more accurate trajectory in the same manner that the rotational component of motion produced by the rifling of conventional gun barrels increases accuracy. The angles of inclination of the planes of rotation of the propelling wheels **24**, **25** and **26** may be varied in accordance with the magnitude of the rotational component desired. As an example, an angle of 5½° would produce one revolution of each projectile **13** for each 10 inches of axial travel through the passage **12**, which is comparable to the rotation produced by the rifling in many conventional weapons.

In order to provide further support for the projectiles **13** as they are propelled through the passage **12** and in order to minimize friction, the passage **12** is, in effect, lined with rotatable bearing members, such as ball bearings **35**. Preferably, the ball bearings **35** are arranged in groups **36** of at least three spaced uniformly in a circumferential direction, as best shown in Fig. 4 of the drawing. In the event that the groups **21**, **22** and **23** of propelling wheels cannot be spaced sufficiently closely to provide proper support for the projectiles **13**, bearing groups **36** of the bearings **35** are interposed between the wheel groups, as indicated in Fig. 1. The muzzle portion **15** extends beyond the last wheel group **23** in the series an appreciable distance and includes a plurality of bearing groups **37** similar to the bearing groups **36** disposed between the wheel groups, the bearing groups **37** in the muzzle portion **15** being sufficiently closely spaced to provide adequate support for the projectiles **13** as they pass therethrough. Providing such a muzzle portion through which the projectiles coast after attaining the muzzle velocity imparted by the last wheel group **23** insures orientation of the projectiles along the desired trajectory in an accurate manner. which is an important feature.

Any suitable feeding means **40** for delivering the projectiles **13** to the breech **14** in sequence may be employed. The particular feeding means **40** shown includes a troughed conveyor **41** which is adapted to receive a plurality of the projectiles **13** arranged end to end and which slides the projectiles across a ramp **42** into the breech **14**, the latter preferably being sufficiently enlarged to compensate for minor misalignments of the projectiles. As each projectile is fed into the breech **14**

in this manner, it is engaged by the propelling wheels 24 of the first group 21, which accelerate it axially and circumferentially and deliver it to the propelling wheels 25 of the second group 22 in the manner hereinabove indicated. The projectiles are delivered to the conveyor 41 in sequence in any suitable manner, as from a chute or box 43, for example. In the event that the element 43 is a box, several such boxes, not shown, may be positioned above the conveyor 41 and automatic means, not shown, for discharging from successive boxes may be provided.

One feature of the present invention is that the projectiles, after being placed on the conveyor 41, move in a straight line all the way through the gun.

Considering the over-all operation of the invention, the projectiles 13 are delivered in a continuous stream to the breech 14 by the feeding means 40 and are accelerated to the desired axial and rotational velocities by the propelling wheel groups 21, 22 and 23, the projectiles thereafter traversing the aligning muzzle portion 15 before leaving the barrel means 11 so as to insure an accurate trajectory. The projectiles may be accelerated to any desired muzzle velocity by suitable selection of the power inputs to the wheel groups 21 to 23 and by suitable selection of the number of such wheel groups. If desired, muzzle velocities much higher than those practically attainable with explosive propulsion may readily be attained.

As hereinbefore pointed out, the gun of the present invention operates without flash or smoke and operates with a minimum of noise. Also, overheating is no problem so that the gun can be operated continuously and may be so operated over a much longer life span than can conventional explosive guns.

Referring to Fig. 5 of the drawing, in the case of large projectiles, I prefer to provide the projectiles with gear teeth 51 and to provide driving wheels with similar gear teeth 52 adapted to mesh with the gear teeth 51. With this construction, the projectiles are geared to the propelling wheels to attain maximum propulsive efficiency.

Although I have disclosed an exemplary embodiment of my invention herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined in the claims which follow.

I claim as my invention:

1. In a gun, the combination of: barrel means providing a passage therethrough for a projectile; and a plurality of propelling wheels positioned alongside said barrel means and extending into said passage and engageable with a projectile therein for propelling the projectile along said passage, the propelling wheels being rotatable in planes which make acute angles with the axis of said passage so that said propelling wheels simultaneously rotate the projectile about the axis of said passage as they propel it along said passage.

2. In a gun, the combination of: barrel means providing a passage therethrough for a projectile; and a plurality of propelling wheels positioned alongside said barrel means and extending into said passage and engageable with a projectile therein for propelling the projectile along said passage, the propelling wheels being rotatable in planes which make acute angles with the axis of said passage so that said propelling wheels simultaneously rotate the projectile about the axis of said passage as they propel it along said passage, said propelling wheels being arranged in groups of at least three wheels each and said groups being spaced apart along the axis of said passage.

3. A gun as defined in claim 1 including rotatable bearings carried by said barrel means and extending into said passage to support a projectile being propelled along said passage.

4. A gun as defined in claim 3 wherein said bearings are arranged in groups of at least three bearings each, said groups of bearings being spaced along the axis of said passage.

5. A gun as defined in claim 2 including rotatable bearings carried by said barrel means and extending into said passage to support a projectile being propelled along said passage.

6. A gun as defined in claim 5 wherein said bearings are arranged in groups of at least three bearings each, said groups of bearings being spaced along the axis of said passage.

7. A gun as defined in claim 2 wherein said propelling wheels are provided with roughened peripheries.

8. A gun as defined in claim 2 including feeding means for feeding successive projectiles into said passage.

9. A gun as defined in claim 8 wherein said feeding means includes means for feeding successive projectiles along a path which is an extension of said passage.

10. A gun as defined in claim 2 wherein said barrel means includes a breech portion at one end thereof and a muzzle portion at the other end thereof, said muzzle portion extending beyond said groups of propelling wheels and including a plurality of groups of at least three rotatable bearing members each carried by said muzzle portion of said barrel means and extending into said passage.

11. A gun as defined in claim 2 wherein said barrel means includes a breech portion at one end thereof and a muzzle portion at the other end thereof, said gun including means for progressively increasing the peripheral speeds of the propelling wheels of said groups in a direction from said breech portion toward said muzzle portion so as to progressively accelerate a projectile being propelled along said passage in said direction.

12. A gun as defined in claim 11 wherein the propelling wheels of said groups are of progressively increasing diameter in a direction from said breech portion toward said muzzle portion.

13. A gun as defined in claim 11 including means for rotating the propelling wheels of said groups at progressively increasing speeds in a direction from said breech portion toward said muzzle portion.

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