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H. F. HAWTHORNE
MULTI-CHARGE CARTRIDGE FOR MULTI-BARREL
AUTOMATIC GUNS
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3,437,039

Fig. 1

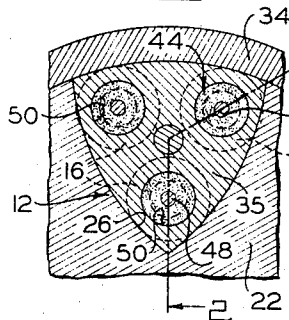


Fig. 2

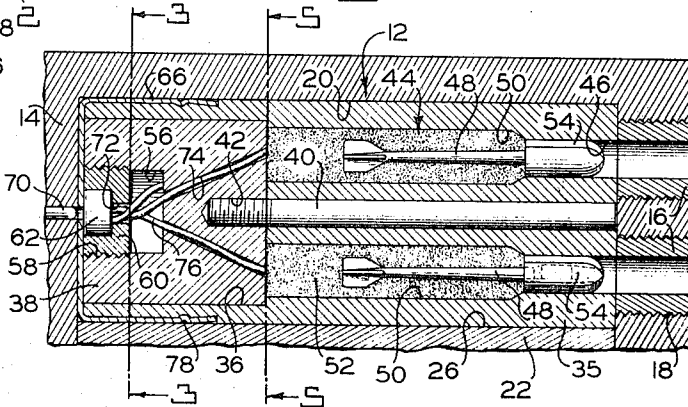


Fig. 3

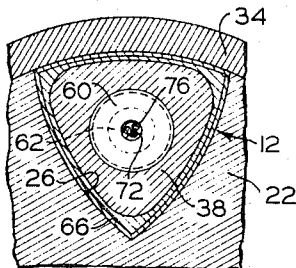


Fig. 4

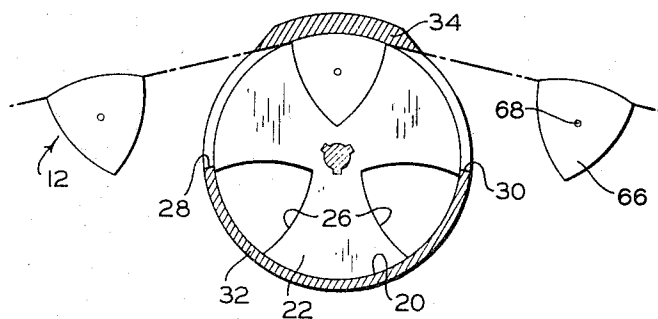


Fig. 5

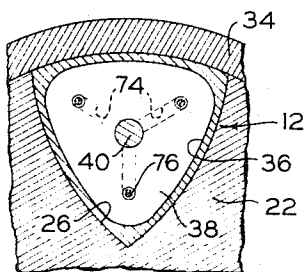
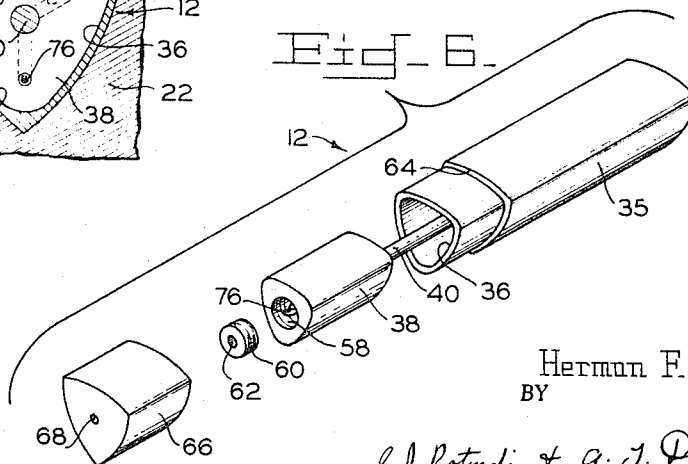


Fig. 6



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MULTICHARGE CARTRIDGE FOR MULTI-BARREL AUTOMATIC GUNS

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8 Claims

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to ammunition for automatic guns and is more particularly directed to cartridges having multiple projectiles adapted to be fired through an equivalent number of barrels.

In view of the growing complexity of modern warfare, it is essential that the firepower and accuracy of current military weapons be substantially improved in order to increase hit and kill probability. One means of effecting a desirable increase in firepower is shown in U.S. Patent No. 2,865,126 to David Dardick wherein a rotary drum is formed with a plurality of radially opening firing chambers which permit each cartridge to be rotated into firing position and to be ejected after firing without the necessity of any longitudinal movement during the entire cycle of operation. It is readily apparent that the reduced feeding travel of the cartridges provides a corresponding decrease in the time interval between successive firing cycles of the gun and, consequently, increases the quantity of projectiles which can be fired at a given target area in a given interval of time.

However, it has been found that despite the considerable increase in firepower obtained with the aforesaid open-chamber type of gun, the anticipated increase in hit probability did not materialize. Analysis of the problem indicated that the accuracy of fire was adversely affected by the inability of the operator to hold the gun on the target during continuous fire. This conclusion was confirmed by previous probability studies which clearly demonstrated that relatively short controlled bursts of fire provide substantially greater incapacitation of an enemy force than an equivalent quantity of ammunition delivered at the target area in continuous fire. Nevertheless, subsequent test firing of an open chamber gun in intermittent short bursts still did not provide the anticipated increase in hit probability and it was theorized that this was due to the recoil forces transmitted to the operator of the gun upon the firing of each round. Accordingly, it was suggested that these successive recoil forces could be limited to a single impact on the operator for each burst fired by providing the cartridge with a plurality of projectiles adapted to be simultaneously fired through an equivalent number of barrels or, alternately, an equivalent number of bores in a single barrel.

While multi-projectile cartridges of this type should increase the accuracy of fire since all the projectiles will emerge from the barrel prior to the impact of the recoil forces on the operator, it was found that hit probability did not improve to the extent anticipated. In fact, in some tests the accuracy of fire did not even reach the level obtainable with single projectile cartridges. It is believed that these disappointing results were primarily due to the turbulence created by the substantially simultaneous exit of all the projectiles from the muzzles of the multiple barrels. The extensive and rapid expansion of the discharge gases upon emergence from the barrel bore creates transverse pressures which cause the adjacent projectiles to deviate from the aimed trajectories thereof, especially those projectiles which are stabilized

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in flight by means of a plurality of rearwardly located fins. Accordingly, it is an object of this invention to provide an improved cartridge from which a plurality of projectiles can be fired within a single cycle of gun operation.

It is a further object of the present invention to provide a cartridge of the aforesaid type wherein the release of each projectile is successively delayed in a predetermined manner to stagger the emergence thereof from the barrel of the gun.

Another object of the present invention is to provide a cartridge having a plurality of projectiles adapted to successively leave the muzzle end of the barrel at predetermined intervals of time such that the total elapsed time for the exit of all the projectiles will still be less than the time required for the recoil forces produced by the firing to be transmitted to the operator of the gun.

It is a specific object of this invention to provide a cartridge of noncircular contour containing separate ignition means for the propellant charges associated with each of a plurality of spin or fin-stabilized projectiles.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a fragmentary transverse section through the breech end of an automatic gun showing the cartridge of the present invention in firing position;

FIG. 2 is a longitudinal section taken along line 2—2 in FIG. 1 to show the internal details of a fully assembled cartridge;

FIG. 3 is a cross-sectional view taken along line 3—3 in FIG. 2;

FIG. 4 is a schematic representation of the cartridges being fed through the gun in belted form;

FIG. 5 is a cross-sectional view taken along line 5—5 in FIG. 2 to show the exit arrangement of the passages for the primer cords; and

FIG. 6 is an exploded perspective view of the complete cartridge.

As best illustrated in FIGS. 2 and 4, the present invention consists of a cartridge 12 intended for use in an automatic gun having a cylindrical receiver 14 in which a plurality of barrels 16 are fixedly secured as by threads 18. Although barrels 16 are here illustrated as three separate units, it should be understood that cartridges 12 are equally operable in a gun having a single barrel in which a plurality of longitudinal bores are equidistantly spaced about the central axis thereof. Moreover, while optimum results can be achieved in guns with three barrels 16, the cartridge structure is not necessarily limited thereto but can be readily designed for guns with a greater or lesser number of barrels.

Rearwardly of barrels 16, receiver 14 is provided with a suitable breech opening 20 which is filled by a cylindrical drum 22 rotatably mounted on a splined pin 24. A plurality of radially disposed cartridge receiving cavities 26 are equidistantly spaced about the central axis of drum 22 and extend longitudinally therethrough for successive coaxial alignment with barrels 16 during rotation of drum 22. The interior of each cavity 26 is equilaterally formed with convexly shaped walls of the same arcuate contour as the exterior periphery of cartridges 12. In addition, each cavity 26 is so oriented that one side thereof coincides with the exterior periphery of drum 22 and, consequently, opens outwardly thereof.

Receiver 14 is provided with a transverse entrance 28 for the passage of flexibly belted cartridges 12 and an opposed exit 30 through which the fired cases are ejected. The locations of entrance 28 and exit 30 in receiver 14 result in a substantially semicircular bottom closure 32

and an overhead bridge 34 of greater peripheral extent than the open sides of cavities 26. As drum 22 is rotated during gun operation to index the vertical axis of each cavity 26 into alignment with the midpoint of bridge 34, as illustrated in FIG. 4, the resulting closure of such cavity forms a firing chamber for the discharge of a cartridge 12 therein. In order to withstand the gas pressure generated upon the firing of cartridges 12, the wall thickness of bridge 34 is substantially increased in comparison with the remainder of receiver 14.

Cartridge 12 includes a body 35 formed with an equilateral exterior periphery of sufficient length and configuration to fit closely but removably within cavities 26 in drum 22. Body 35 may be fabricated from brass of the type normally employed in the manufacture of cartridge cases or may be formed from such light but relatively strong materials as aluminum or a thermosetting plastic. The rear end of body 35 is hollowed out, as indicated at 36, to the same equilateral configuration as the exterior periphery thereof to seat a correspondingly formed primer holder 38. In order to maintain the desired light weight of cartridge 12, primer holder 38 is preferably fabricated of a relatively strong aluminum alloy. Forwardly of the hollow rear end 36 therein, cartridge body 35 is longitudinally drilled along the central axis thereof to receive a rod 40 which may be secured in place by a press fit or any other suitable retaining device. The rear end of rod 40 is threaded to engage in a mating hole 42 centrally formed into the front face of primer holder 38.

A plurality of counterbored launching chambers 44 are radially spaced about the interior of cartridge body 35 at equal distances from the central axis thereof and in respective coaxial alignment with barrels 16. The forward and smaller diameter portion 46 of each launching chamber 44 serves to seat the projectile 48 to be discharged while the rear and larger diameter portion 50 contains the propellant charge 52 for effecting the discharge. Chambers 44 are equally adapted for the discharge of spin or fin-stabilized projectiles. In the event the latter type of projectile is employed, the sabot 54 therefore is contained within forward portion 46 of chamber 44 with the projectile 48 in the preferred form of a flechette or needle-like arrow projecting rearwardly therefrom into the larger diameter portion 50 as best illustrated in FIG. 2.

The rear end of primer holder 38 contains a forwardly extending central recess 56 in which substantially the rearward half thereof is suitably threaded, as indicated at 58, to secure a retainer 60 for a conventional primer cup 62. The rear end of cartridge 12 is slightly reduced in wall thickness, as best shown at 64 in FIG. 6, to receive a correspondingly shaped cover 66 which holds the various parts in place and is provided with an axial hole 68 therethrough for passage of a conventional percussion type of firing pin 70. Communication between primer cup 62 and the propellant charge 52 in each chamber 44 is provided by an axial hole 72 in primer cup retainer 60 and a plurality of angular passages 74 in primer holder 38. Each passage 74 originates at a different location in the forward wall of recess 56 and extends completely through holder 38 to terminate in alignment with the center of the propellant charge portion 50 of launching chamber 44. Passages 74 serve to seat primer cords 76 which extend from the interior of primer cup 62 into actual contact with propellant charge 52.

In order to achieve a predetermined delay in the successive ignition of propellant charges 52, the composition of each primer cord 76 is varied to provide a slower or faster transmittal of the spark originally produced by the impact of firing pin 70 against the rear end of primer cup 62. The required variations in the burning times of primer cords 76 can be readily accomplished through proper selection of the composition thereof. Similar delays in firing may also be achieved by varying the actual lengths of each primer cord 76 without changing the extent of contact with propellant charge 52. As best

shown in FIG. 2, the space between the forward end of primer cup retainer 60 and the forward wall of recess 56 may be utilized to store the additional length of primer cords 76. Still another procedure for accomplishing a predetermined delay in the time interval between successive projectile discharges is the provision of a corresponding change in the diameter or thickness of primer cords 76. However, this type of primer cord construction is not as desirable as the two previously mentioned procedures in view of the complications introduced into the assembly thereof by the necessity for matching the diameter of each primer cord 76 with the correspondingly sized angular passage 74 through primer holder 38.

In the assembly of cartridges 12, the projectile 48 is first placed in the smaller diameter portion 46 of chamber 44 and then the required propellant charge 52 is poured into the larger diameter portion 50 thereof. Primer cords 76 are next inserted into angular passages 74 in primer holder 38 and the rear ends thereof are gathered together and pushed through the axial hole 72 in primer retainer 60 which is then threaded into recess 56 in primer holder 38. Primer cords 76 are thereafter adjusted to lie flush with the front end of primer holder 38 and primer cup 62 is inserted into retainer 60. After rod 40 is threaded into hole 42 in primer holder 38, the latter can be inserted into cartridge body 35 by pushing rod 40 into the axially drilled hole therein. Then cover 66 is placed over the rear end of cartridge body 35 and crimped in place, as best shown at 78 in FIG. 2, to hold the entire unit together.

Assembled cartridges 12 may be joined in belted form by any flexible type of interconnection and will be automatically fed into the gun by the rotation of drum 22 in response to the discharge of each cartridge 12 in the firing position thereof. As drum 22 is rotated, the leading unfired cartridge is drawn through entrance 28 in receiver 14 into the interior of the open cartridge receiving cavity 26. In view of the corresponding arcuate contour of cartridge 12 and cavity 26, the continued rotation of drum 22 cams cartridge 12 into full seating engagement therein by the time such cartridge is indexed into the firing position best shown in FIG. 4. In this position, the interior of cartridge cavity 26 and the underside of bridge 34 combines to provide a firing chamber capable of withstanding the pressures generated by the firing of cartridge 12. In the event excessive pressures are anticipated, the corners formed by the junctions of the equilateral sides may be strengthened by adding suitable reinforcing strips of metal or plastic along the entire length of the cartridge. Such reinforcement will preclude the rupture of cartridge body 35 or extrusion of the material thereof into the breaks or gaps which may exist at the areas in which the outer corners of cavity 26 contact the underside of bridge 34.

As primer cup 62 is ignited by the impact of firing pin 70, the resulting spark is simultaneously transferred to each of the trio of primer cords 76 which begin to burn at a rate dependent upon such factors as the composition and the total length thereof. As a result, the flame or flash produced by the burning of the primer cords 76 reaches one of chambers 44 to discharge the projectile 48 contained therein. Due to the variations in composition and length which were deliberately introduced into primer cords 76, the discharge of the second and third projectiles will be delayed by finite intervals measurable in milliseconds. During the firing of each projectile 48, deformation of the remaining unfired propellant charges 52 will be satisfactorily minimized by the strengthening effect of rod 40 in the center of cartridge body 35.

Thus, projectiles 48 will merge from the muzzle ends of barrels 16 in staggered sequence but still within an interval of time appreciably shorter than that required to transmit the resulting recoil forces to the operator of the gun. It is, therefore, apparent that the recoil produced by the discharge of all three projectiles 48 will be no

greater than that normally encountered in the firing of a single projectile from a cartridge of equivalent size. Consequently, each of the three projectiles 48 will follow the same aimed trajectory established upon firing of the cartridge thereby effecting considerable improvement in hit probability over the same amount of projectiles fired at a rate low enough to transmit successive recoil shocks to the operator of the gun.

Furthermore, since each projectile 48 leaves the gun in a staggered manner, the powder gases which normally accompany each projectile during passage through the barrel are completely dissipated prior to the emergence of the next projectile. This arrangement will, therefore, completely eliminate the disturbing influence heretofore introduced in the flight path of those projectiles which are simultaneously discharged from a single cartridge.

I claim:

1. A cartridge for an open chamber gun comprising a body of generally equilateral triangular configuration, a plurality of projectiles and associated propellant charges radially spaced about the longitudinal axis of said body, a percussion type primer disposed in the rear end of said body and spaced rearwardly from said propellant charges therein, and a plurality of primer cords each extending from the interior of said primer into contact with one of said propellant charges, said primer cords each having a different predetermined burning time designed to discharge said projectiles at successive intervals.

2. The combination defined in claim 1 wherein the composition of each of said primer cords varies in a manner designed to provide predetermined burning times of different duration.

3. The combination defined in claim 1 wherein said primer cords are each of different predetermined length.

4. In a triangular shaped cartridge for an open chamber gun, a body having a plurality of radially disposed firing chambers equidistantly spaced from each other and from the longitudinal axis of said body, each of said chambers containing a propellant charge and a projectile seated forwardly thereof, a removable primer holder disposed in said body rearwardly of said firing chambers and in abutment therewith, a percussion type primer seated in the rear of said primer holder and spaced from said firing chambers, and a plurality of primer cords each extending from the interior of said primer through said holder and into corresponding contact with one of said propellant charges, each of said primer cords being of a different predetermined length designed to provide a specific burning time for initiating said propellant charges in successively spaced intervals.

5. The combination defined in claim 4 wherein said firing chambers are longitudinally counterbored in said body, and said projectiles comprise fin-stabilized relatively long needles carried by a sabot at the forward end thereof.

6. A cartridge for an open chamber gun comprising a body of generally equilateral triangular configuration, a trio of longitudinal firing chambers radially spaced at equal distances about the central longitudinal axis of said body, each of said chambers being located in adjacent relation to one of the vertices in said body, said chambers being of counterbored configuration with the smaller

diameter portion at the forward end and the larger diameter portion at the rear end thereof, a fin-stabilized projectile seated in the smaller diameter portion of said firing chamber and a propellant charge contained in the larger diameter portion, a removable primer holder having means for fixedly retaining a percussion type primer therein, a cover fixedly secured to the rear end of said body for maintaining said primer holder in place, and a trio of primer cords each extending from the interior of said primer through said primer holder and into positive contact with one of said propellant charges in said firing chambers, each of said primer cords being of a different predetermined length designed to provide a specific burning time for initiating said propellant charges in successively spaced intervals.

7. A cartridge for an open chamber gun comprising a body of generally equilateral triangular configuration, a trio of longitudinal firing chambers radially spaced about the central axis of said body in radial alignment with the vertices thereof, a fin-stabilized projectile and a rearwardly adjacent propellant charge seated in each of said firing chambers, a primer holder having a cylindrical opening in the rear end thereof and a trio of angularly disposed passages extending forwardly therethrough from said cylindrical opening, a percussion primer removably mounted in said cylindrical opening in spaced relation to the forward end wall thereof, said cartridge body having a hollow portion in the rear end thereof for seating said primer holder therein with each of said primer passages in corresponding communication with one of said firing chambers, a cover secured to the rear end of said cartridge body to retain said primer holder therein, and a primer cord extending from the interior of said primer through each of said angular passages into contact with said propellant charges in said firing chambers, each of said primer cords varying in composition to provide a predetermined burning time for firing said projectiles in successively spaced intervals with sufficient rapidity to complete the exit thereof from the gun prior to the transmission of the resulting recoil forces to the operator thereof.

8. The combination defined in claim 7 wherein said cartridge body is provided with an axial hole centrally therethrough between said firing chambers, and said primer holder is provided with a forwardly projecting rod insertable in said axial hole to strengthen the interior of said cartridge body against deformation during the firing of said propellant charges.

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