

[54] **CASELESS AMMUNITION AND GUN THEREFOR**

[75] Inventor: **John Gonsalves Rocha**, Westfield, Mass.

[73] Assignee: **Maremont Corporation**, Chicago, Ill.

[22] Filed: **Sept. 29, 1971**

[21] Appl. No.: **184,856**

Related U.S. Application Data

[62] Division of Ser. No. 791,308, Jan. 15, 1969, Pat. No. 3,626,620.

[52] U.S. Cl. **102/38, 89/35 R, 102/DIG. 1**

[51] Int. Cl. **F42b 5/18**

[58] Field of Search 102/38, 39.93, 40, 102/DIG. 1, 100, 101; 89/35 R; 42/39.5

[56] **References Cited**

UNITED STATES PATENTS

3,429,220	2/1969	Goode.....	89/35 R
3,078,765	2/1963	Falcone et al.	89/35 R
2,996,988	8/1961	Kunz.....	89/35 R
3,046,842	7/1962	Sergay	42/39.5 X
3,336,871	8/1967	Quinlan	102/38

Primary Examiner—Robert F. Stahl

Attorney—Martin Kirkpatrick

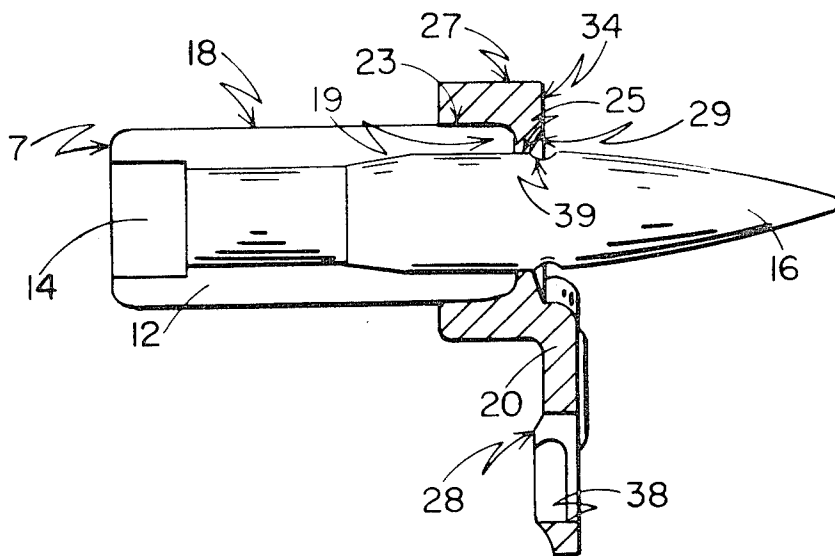
[57] **ABSTRACT**

A caseless small arms cartridge including a generally

cylindrical solid propellant body having a bullet projecting from the front end thereof with an organic plastic seal ring and link element mounted on the bullet with the bullet projecting forwardly therebeyond. The seal ring has an outer surface of a diameter greater than that of the solid propellant body for providing a seal with a surrounding firing chamber and has an arm portion extending radially outward beyond the ring with a bore for receiving either the bullet of a second like cartridge for assembling a plurality of cartridges to provide a belt thereof or for engaging the loading plunger of the gun breech.

The gun for firing such caseless cartridges comprises a receiver element, a barrel mounted therein, a novel floating firing chamber element mounted in the receiver element for limited movement between a loading position away from and a firing position toward the barrel, and firing means for moving the floating firing chamber element to its firing position. The novel floating firing chamber has an enclosed bottom with abutment means thereon for contacting the primer of the cartridge and an open forward end adjacent the barrel for receiving the cartridge body within the chamber with the bullet within the barrel when the floating firing chamber is in its loaded position. The firing means moves the firing chamber to its firing position to drive the abutment means into contact with the primer to fire the cartridge.

5 Claims, 7 Drawing Figures



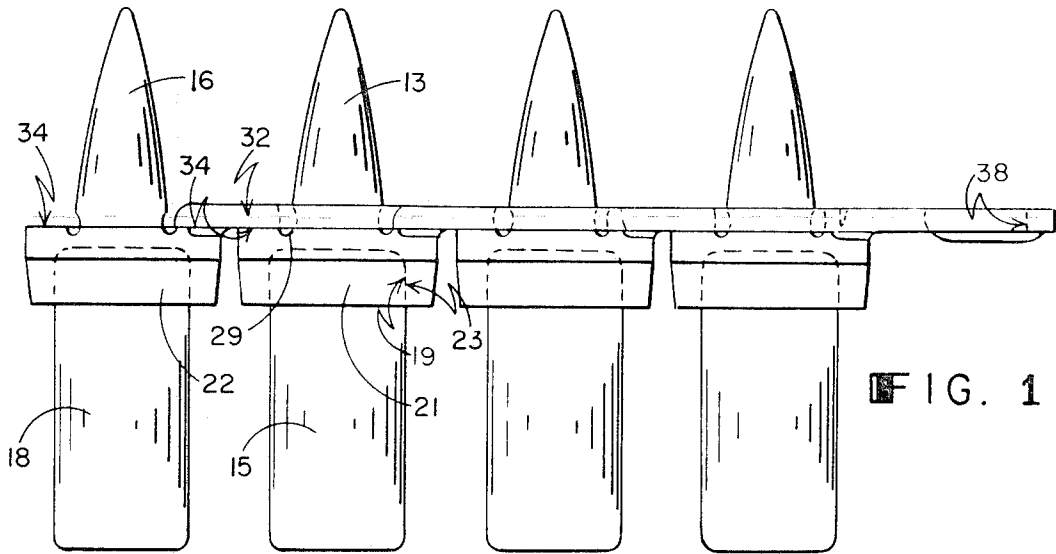


FIG. 1

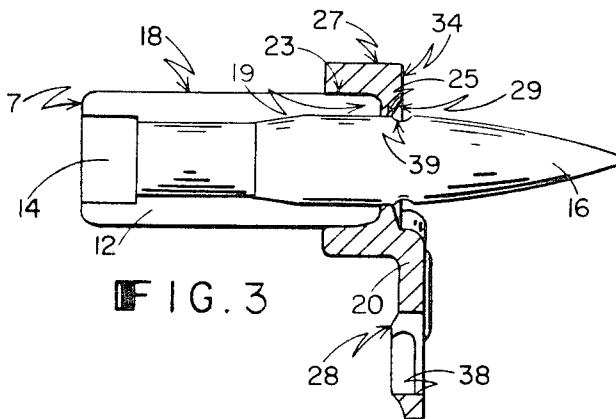


FIG. 3

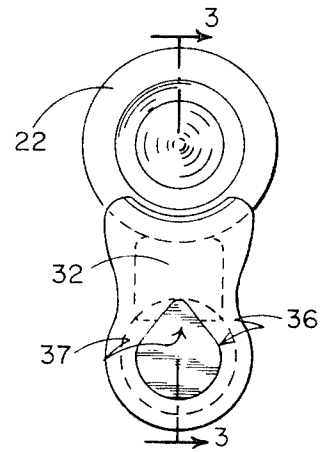


FIG. 2

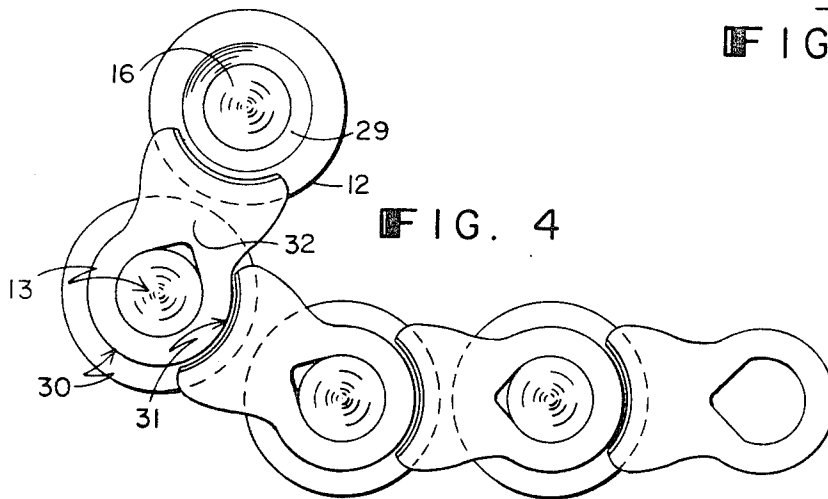


FIG. 4

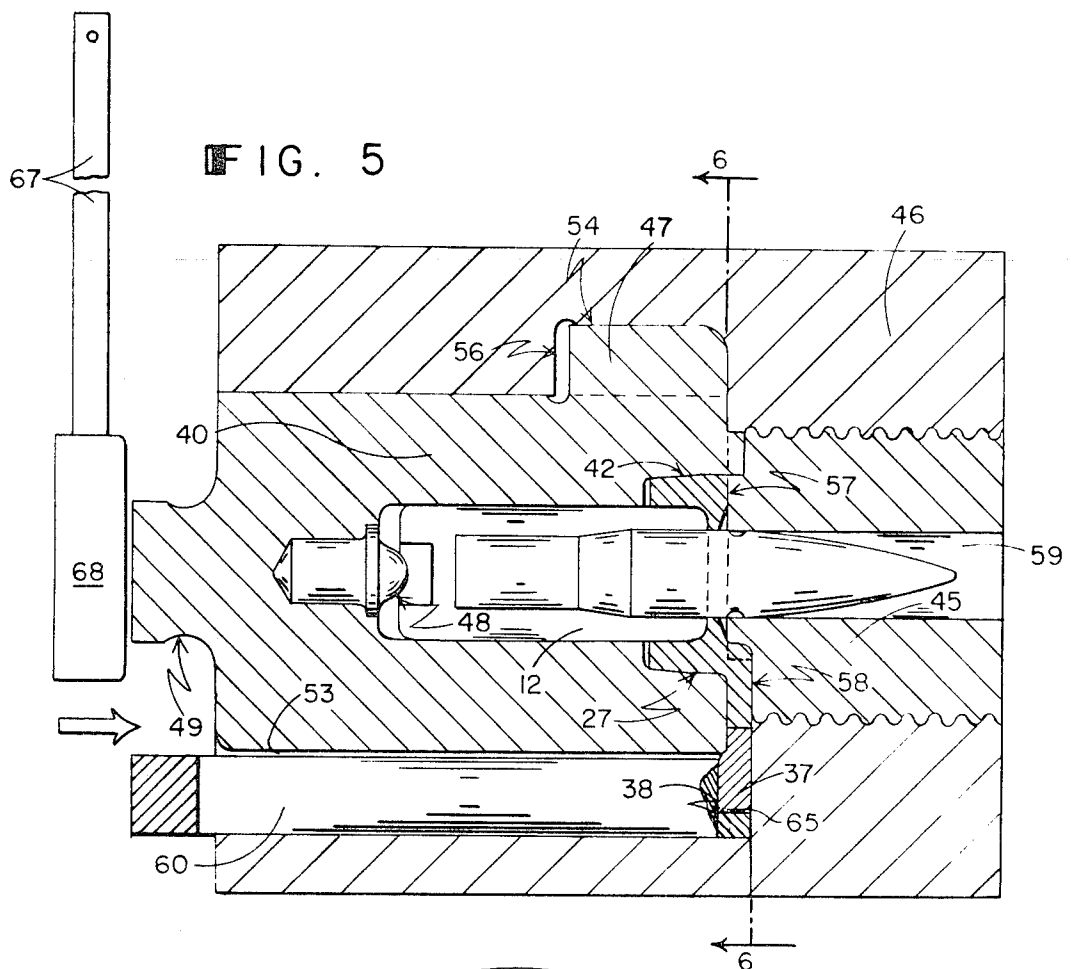
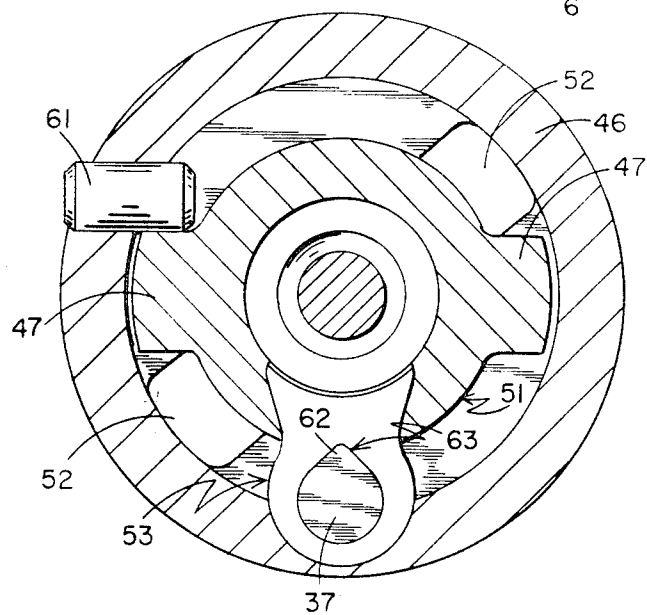
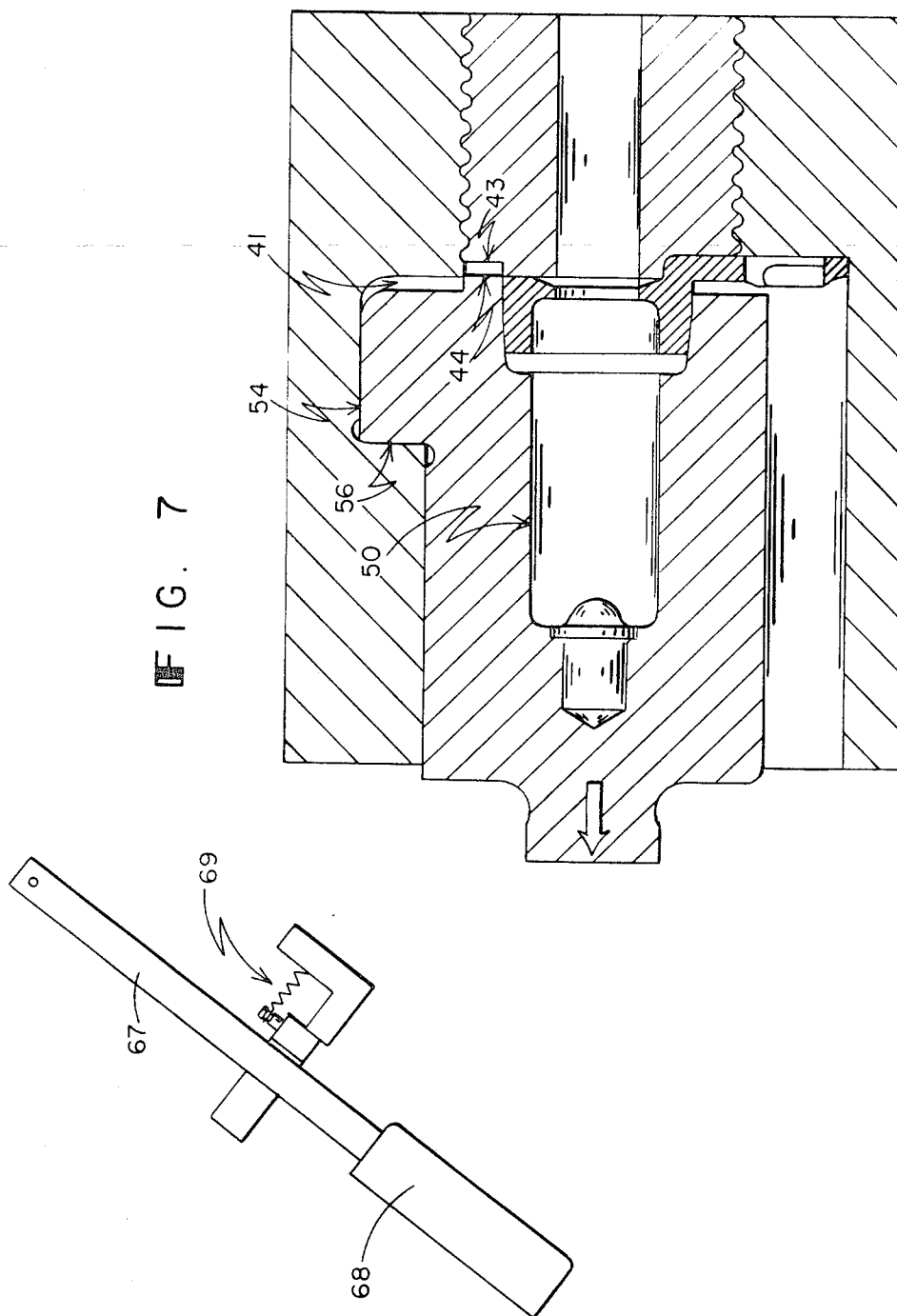


FIG. 7



CASELESS AMMUNITION AND GUN THEREFOR

This is a division of application Ser. No. 791,308, filed Jan. 15, 1969, now U.S. Pat. No. 3,626,620.

This invention relates to novel caseless ammunition and guns for use therewith.

In recent years, there have been developed rounds of so-called "caseless" small arms ammunition, wherein a solid propellant body has molded therein a bullet at one end and a primer at the other to provide a unitary cartridge without the usual metallic case. Although such ammunition provides important weight, size and cost savings, it has proved to be difficult to design small arms, especially of the automatic and semi-automatic type, suitable for its use. This was because, with metallic cased cartridges, the metallic case served the vital functions of providing (1) an obturation seal for preventing propellant gases from escaping directly from the firing chamber, (2) a structurally strong container of the propellant which could withstand the stresses and impacts during the feeding cycle, and (3) a structural element which could be assembled into feeding belts and which could be removed from the gun in case of misfire. On the other hand, caseless ammunition, being relatively fragile, and self-consumable except for the bullet, served none of these functions.

Accordingly, it is a major object of the present invention to provide novel caseless ammunition and gun construction therefor which solves all of the above mentioned problems and, for the first time, makes practicable the use of such cartridges in automatic small arms weapons.

This object of the invention is accomplished, in general, by providing a novel cartridge having an integral seal, an integral link for either attaching it to another like cartridge if desired or alternatively attaching it to a breech loading mechanism, and by providing a novel gun construction for such cartridges.

More specifically, the integral seal aspect of the invention is accomplished by providing, in a caseless cartridge including a generally cylindrical solid propellant body having a bullet projecting from the front end thereof, an organic plastic ring seal element having an inner surface of a diameter closely surrounding the bullet with the bullet projecting forwardly therebeyond and having an outer surface of a diameter greater than that of the solid propellant body for providing a seal with a surrounding firing chamber. The link aspect of the invention includes a link element mounted on the bullet with the bullet projecting forwardly thereof with an arm portion extending outwardly from the bullet. The arm portion has a bore for receiving the bullet of a second like cartridge, preferably for rotation therein, for assembling a plurality of cartridges to provide a linked belt thereof. The link element is preferably of organic plastic material molded integrally with the seal ring element.

The gun according to the invention for firing such caseless cartridges, comprises a receiver element, a barrel mounted therein, a novel floating firing chamber element mounted in the receiver element for limited movement between a loaded position away from and a firing position toward the barrel, and firing means for moving the floating firing chamber element to its firing position. The novel floating firing chamber has an enclosed bottom with abutment means thereon for contacting the primer of the cartridge and an open forward

end adjacent to the barrel for receiving the cartridge body within the chamber with the bullet within the barrel when the floating firing chamber is in its loaded position. The firing means moves the firing chamber to its firing position to drive the abutment means into contact with the primer to fire the cartridge. Preferably, the gun of the invention is provided with removable cartridges sealing means which may be in the form of an organic plastic ring carried by the cartridge as above described and with cartridge control means engaging the cartridge link both for feeding the cartridge and extracting a misfire.

For the purpose of more fully explaining further objects and features of the inventions, reference is now made to the following detailed description of preferred embodiments thereof, taken together with the accompanying drawing, wherein:

FIG. 1 is a side view of four caseless cartridges which are linked together with four link-seal elements according to the present invention to form a continuous belt;

FIG. 2 is the front elevation of a cartridge with the link-seal element of FIG. 1;

FIG. 3 is a longitudinal section of a cartridge with the link-seal element of FIG. 1 taken along line 3—3 of FIG. 2;

FIG. 4 is a front elevation of a linked belt of ammunition showing the degree that the cartridges and link seal assemblies of the invention are free to rotate about their respective link arm bore axes;

FIG. 5 is a longitudinal section of a breech fixture, which simulates a machine gun breech, showing a cartridge and link seal in the firing position;

FIG. 6 is an axial section taken along line 6—6 of FIG. 5;

FIG. 7 is a view of the breech shown in FIG. 6 in the setback position which occurs after the cartridge is fired.

Referring to FIGS. 1 through 4, the so-called "caseless" ammunition shown therein is generally well known to the art as comprising a generally cylindrical molded body 12 of solid propellant incorporating at its rear end a primer 14 and at its forward end a metallic bullet 16 of smaller diameter projecting forwardly therefrom, such elements together providing a single ammunition cartridge 18. Upon firing, the metallic bullet is propelled from the gun, while primer 14 and propellant body 12, being entirely of combustible material, are entirely consumed, thus leaving no residual cartridge case or other material to be ejected from the firing chamber.

Nevertheless, while such a cartridge is known to be useful, its relatively fragile construction, due to the relatively weak plastic molded material of the solid propellant body 12, has limited its usefulness, not only because of its inability to provide a firing chamber seal, but also, especially in automatic weapons, both as to major difficulties in carrying out the usual feeding of the cartridge into the breech and its extraction in the event of a misfire.

According to the present invention, these problems are solved in a unique manner, preferably simultaneously, by providing a novel link-seal element, generally designated 20, which is preferably molded of organic plastic material, such as nylon or other suitable plastic. More specifically, link seal element 20 includes a seal ring portion 22 mounted on bullet 16 and a link arm 32 extending radially outwardly therefrom. Seal

ring portion 22 has a central bore with its inner surface at its rear end portion 23 closely surrounding solid propellant body 12 and at its forward end portion 25 of reduced diameter closely surrounding the rear end of bullet 16. Such seal element 20 is held on bullet 16 and propellant body 12 by a gas-tight interference fit, so that the relatively fragile body is not only protected, but may be handled thereby. The outer surface 27 of seal ring portion 22 being of greater diameter than the body 12, acts as a sealing collar when enclosed by the forward recess 42 of floating firing chamber 40 when the breech is closed in the firing position (FIG. 5). Said outer surface 27 has a slight rearward taper, and by extending for a substantial axial distance, provides a breech seal for the interface between the rear barrel face 43 and forward chamber face 44 throughout the distance of chamber float; from the firing position FIG. 5 to the recoil position FIG. 7. When seated in the chamber forward recess 42, the seal ring 22 effectively seals the only obturation path from the breech, because the rear or bottom of the ignition chamber is completely closed, there being no firing pin aperture.

The link arm portion 32 of the link seal is adaptable for use either as a means of linking two cartridges together to form an ammunition belt, or alternatively as a cartridge control tab. Such arm element 32 is integrally fastened to the forward seal ring face 34 and extends radially outward to provide a bore 36 which is adapted to receive either the loading plunger flanged tip 37, FIG. 5, or alternatively a bullet of a second like round of ammunition, FIG. 1.

When the arm 32 is used as a belt link shown in FIG. 1, bore 36 closely surrounds the forward projecting bullet 13 of a like adjacent cartridge 15 with inner annular surface 38 locking in bullet groove 39 thereby preventing axial movement of the cartridge 15. In this link position link arm 32 overlays the forward face 34 of seal ring 21 with lip 28 being received by the conical recess 29 of seal ring 21 of cartridge 15 and the outer circumferential tip 30 of arm 32 being slidably received by arcuate recess 31. The forward portion of cartridge 15 is supported by the inner seal ring bore 23 which is formed to receive the curved cartridge shoulder 19. With link arm 32 thus interlocked with seal ring 21 and bullet 13, longitudinal displacement of cartridge 15 relative to cartridge 18 is prevented, and both cartridges are maintained in the same plane. A plurality of cartridges may be successively linked together in this manner to form an ammunition belt of indeterminate length. The linked belt does permit axial rotation of cartridge 18 about the axis of link arm bore 36, as bullet groove 39 is rotatably held by the inner annular surface 38, of said bore. FIG. 4 shows a front elevation of a plurality of rounds linked together, and it further shows that the respective link seals, are free to rotate about the axes of their respective link arm bores 36, coaxially received by the bullets of adjacent like rounds of ammunition, thereby providing a means for rotating the round held by the respective seal ring relative to the round held by the link arm.

Further and important features of the invention are embodied in the breech assembly of the novel gun construction shown in FIGS. 5 through 7 which is adapted to fire caseless ammunition and which solves in a unique manner the problems of sealing the ignition chamber and of handling the relatively fragile caseless cartridge 18.

According to the present invention, such gun comprises a barrel 45 threaded into a receiver element 46 which accommodates a floating firing chamber 40. Said floating firing chamber 40 is a rotatable piston provided with two locking lugs 47, a firing abutment 48, an anvil 49 and an inner cylindrical cavity 50. Said inner cylindrical cavity 50 is uniquely adapted to slidably enclose a cartridge 18 with link seal 20 attached, when in the firing position, FIG. 5, and to provide a closed ignition chamber to the rear of said barrel 45. Said closed ignition chamber contains a fixed firing abutment 48 in lieu of the commonly used movable firing pin, thereby eliminating all gas leakage paths at the base of the inner cylindrical cavity 50, and achieving a more reliable firing means which can better resist the high pressures and temperatures encountered during ignition.

The novel location of the ignition chamber within said floating chamber is useful because it permits a concentration of all obturation at a single juncture, the interface between the barrel and floating firing chamber, which is readily sealed. The barrel floating chamber interface is sealed by ring seal 20 which is mounted in the forward recess 42 of floating firing chamber 40 with seal ring face 34 abutting rear barrel extension 57 and link arm 32 extending downward through a recess 58 provided in the barrel and receiver. With the floating chamber in the firing position (FIG. 5) bullet 16 extends into the barrel bore 59 and seats in the lands (not shown) of said bore thus sealing the forward opening of the ignition chamber.

The axial section of the receiver 46, FIG. 6, taken along line 6—6 in FIG. 5 shows the inner cylindrical bore 51 which supports the floating firing chamber 40. Two channels 52 are cut in the receiver body 46 to accommodate locking lugs 47 and permit the floating firing chamber 40 to be removed from the receiver when the locking lugs 47 are aligned with the channels. These channels extend longitudinally from the rear of receiver 46 to a counter bore 54 (FIG. 7). The locking lugs are rotatable from alignment with the channels 52 within counter bore 54 to abut the receiver abutment 56 and pin 61 to axially lock the floating chamber in the closed position, FIG. 7. The counter bore 54 is axially longer than the locking lugs thus providing a space 41 in which the floating firing chamber is free to slide through a limited distance from the closed position, FIG. 7, away from the barrel 45, wherein locking lugs 47 abut receiver abutment 56 to the firing position FIG. 5 toward said barrel wherein the forward chamber face 44 abuts the rear barrel face 43. Upon being urged forward, the floating chamber brings firing abutment 48 in contact with primer 14, FIG. 5, and upon being urged rearward the floating chamber comes in contact with primary mass 68.

Another novel aspect of the present invention resides in the method of loading cartridges into the open breech by ramming the cartridge by the bullet 16 rather than at the cartridge base 17. More specifically, the loading means consists of a loading plunger 60, fitted with a flanged tip 37 formed to be received by link arm bore 36 having the same cross-section as said bore 36. A longitudinal cylindrical channel 53 is cut in the bottom of the receiver 46 to accommodate the link arm 32 and plunger 60. As shown in FIG. 6, plunger tip 37 contains a rounded projection 62, which is received by the enlargement 63 of bore 36, thereby preventing rotation of said bore 36 relative to tip 61, resulting in positive

rotational control of cartridge 18. Loading forces applied to the plunger 60 are transmitted via the link seal 20 to the structurally strong bullet 16, leaving the moulded body 12 and primer 14 free of impact stresses thus minimizing the hazards of accidentally detonating the primer prematurely or causing deformation of the cartridge. In case of misfire the defective cartridge may be readily withdrawn from the opened breech by means of the plunger 60 as tip 61 is provided with a groove 65 which mates snugly with the link arm annular surface 38 to provide positive longitudinal round control.

In operation, a cartridge 18 with link seal 20 attached is removed from the linked belt by urging (by manual or mechanical means) the rear face of seal ring of said cartridge 18 forward, thereby detaching the link arm bore 36 from bullet groove 39 and permitting said bore 36 to be advanced forward over bullet 13 until said cartridge 18 and link seal 20 assembly are clear of the belt. The link seal 20 is then secured to the loading plunger 60 by inserting the flanged tip 37 into link arm bore 36, the plunger being used to carry the round with link seal attached into the open breech during the loading cycle.

Prior to loading, the floating firing chamber 40 is removed from the receiver 46 to provide an open breech. The cartridge 18 with link seal 20 is loaded through the rear of the open breech, and is advanced within the breech by means of plunger 60, link arm 32 being aligned with receiver channel 53, until bullet 16 protrudes into bore 59 with seal ring 22 abutting the rear barrel extension 57 and link arm 32 seating in recess 58 provided in the barrel and receiver. During loading, all forces used to propel the round forward into the firing position are applied to link arm 32 by plunger 60 as it slides forward through channel 53. The round is securely held in the firing position by bore 59 and link arm 32 supported in recess 58.

The breech is closed by inserting floating firing chamber 40 in the rear of the receiver cylindrical bore 51 with locking lugs 47 in alignment with channels 52 and manually advancing it to slidably enclose cartridge 18 and link seal 20. During advancement, locking lugs 47 slide through channels 52 into counter bore 54, permitting the floating firing chamber to be rotated to axially lock the locking lugs against pin 61. In the closed breech position, the locking lugs 47 rest against receiver abutment 56 with a space 41 existing between the forward face of the floating firing chamber 44 and the rear barrel face 43, and firing pin 48 immediately adjacent to primer 14.

Firing is accomplished by releasing the pendulum latch 69 permitting the pendulum actuated mass 68 to strike anvil 49 driving floating firing chamber 40 forward to firmly seat against the seal ring 22 and rear barrel face 43, causing firing abutment 48 to detonate primer 14, which in turn ignites moulded body 12 propelling bullet 16 through bore 59. The explosive force retracts the floating firing chamber 40 rearwardly through space 41, with anvil 49 striking mass 68 with sufficient force to return pendulum 67 to the cocked position where it is caught and held by the spring loaded latch 69. Rearward displacement of floating chamber ceases when locking lugs come in contact with receiver abutment 56.

During ignition the propellant gas pressure acts to hold the link seal face 34 forward firmly against the rear barrel extension 57 as the floating chamber 40 re-

tracts in set back, and to keep the outer cylindrical surface 27 of seal ring 22 in sliding contact with forward recess 42, thereby sealing the only obturation path from the ignition chamber.

The caseless cartridge 12 and primer 14 are consumed upon ignition, leaving only the link seal to be manually rearwardly ejected by the loading plunger 60 after the floating chamber 40 has been manually rotatably unlocked, and retracted to open the breech.

Various modifications of the invention, within the scope of the invention and the appended claims, will be apparent to those skilled in the art.

What is claimed is:

1. In a caseless cartridge including a generally cylindrical solid propellant body having a bullet projecting from the front end thereof,

that improvement which consists of:

an organic plastic seal ring and link element mounted on said bullet by an interference fit with said bullet projecting forwardly and said solid propellant body rearwardly therebeyond and having an outer surface of a diameter greater than that of said solid propellant body for providing a seal with a surrounding firing chamber, said element having an arm portion extending outwardly from said bullet, said arm portion having a bore for receiving the bullet of a second like cartridge for assembling a plurality of said cartridges to provide a linked belt thereof,

said bullet of said second like cartridge being loosely mounted in said bore for rotation therein relatively to said element and

said element further including means for rotating said element relatively to said second like cartridge.

2. In a caseless cartridge as claimed in claim 1, wherein

said bullets have a reduced diameter recess forward of said element mounted on said bullet for receiving said bore.

3. In a caseless cartridge as claimed in claim 1, wherein

said means for rotating said element includes an enlarged portion in said bore.

4. In a caseless cartridge as claimed in claim 1, wherein

said arm portion extends forwardly to a position on said bullet of said second like cartridge overlying the seal and element of said second like cartridge to maintain said cartridges in a plane.

5. In a caseless cartridge including a generally cylindrical solid propellant body having a bullet projecting from the front end thereof,

an organic plastic ring seal element mounted on said bullet by an interference fit with said bullet projecting forwardly and said solid propellant body rearwardly therebeyond, said element having an outer surface of a diameter greater than that of said solid propellant body for providing a seal with a surrounding firing chamber and having arm portion means extending radially outwardly beyond said outer surface for engagement with a loading plunger of a gun breech for controlling said cartridge during loading of said bullet into said firing chamber and removal of a misfire therefrom.

* * * * *