

July 21, 1964

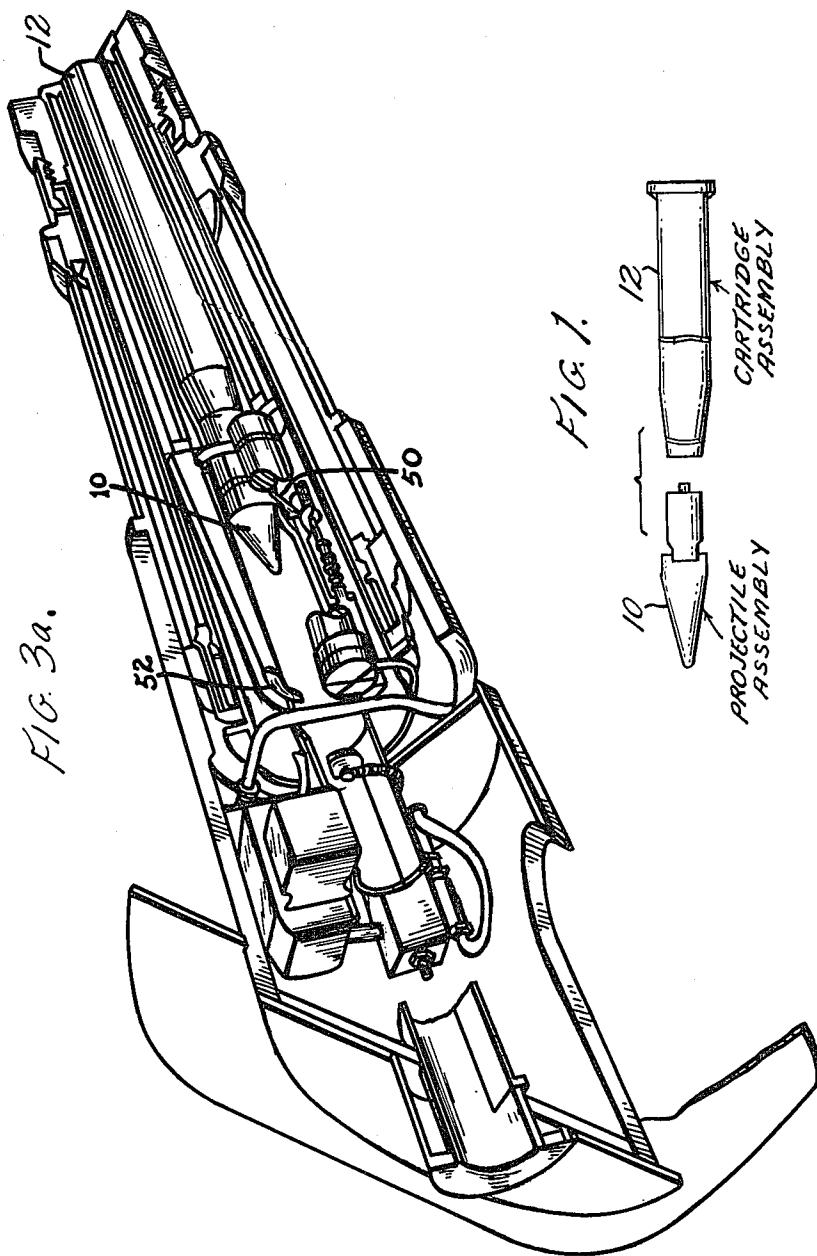
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3,141,246

SEPARABLE SIMULATED ROUND OF AMMUNITION

Filed Oct. 26, 1962

7 Sheets-Sheet 1



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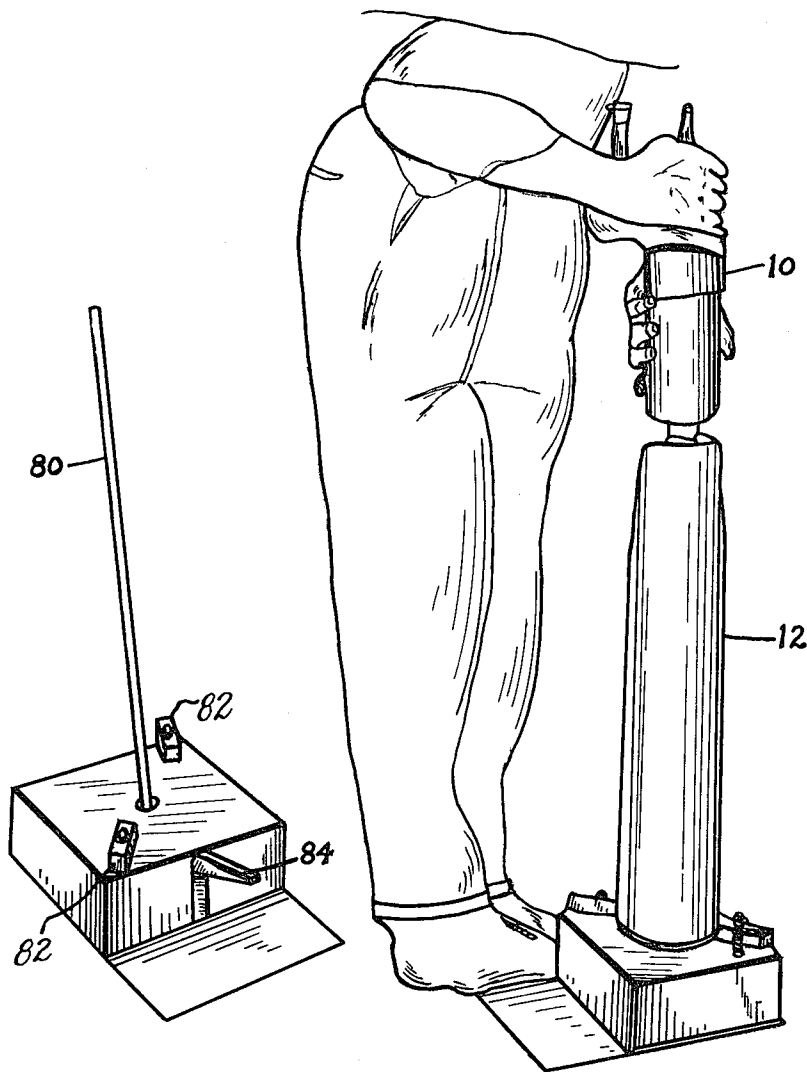


Fig. 2

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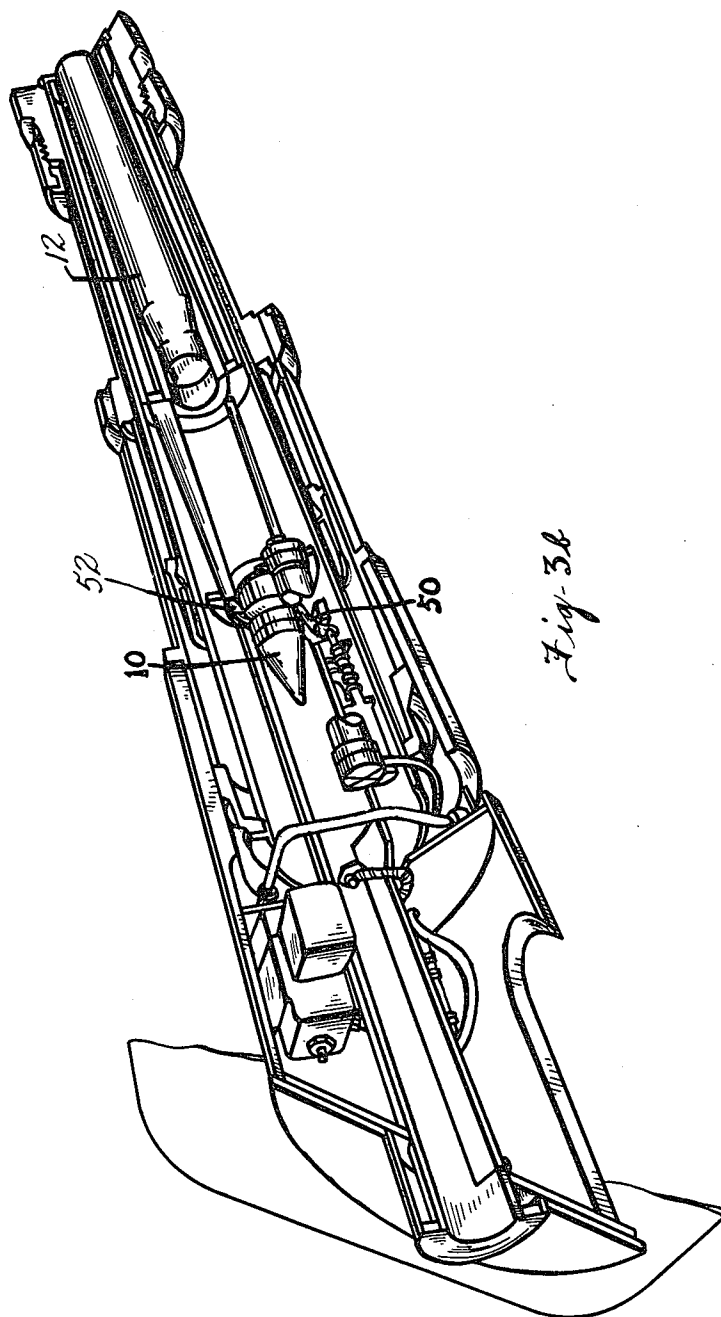


Fig. 3b

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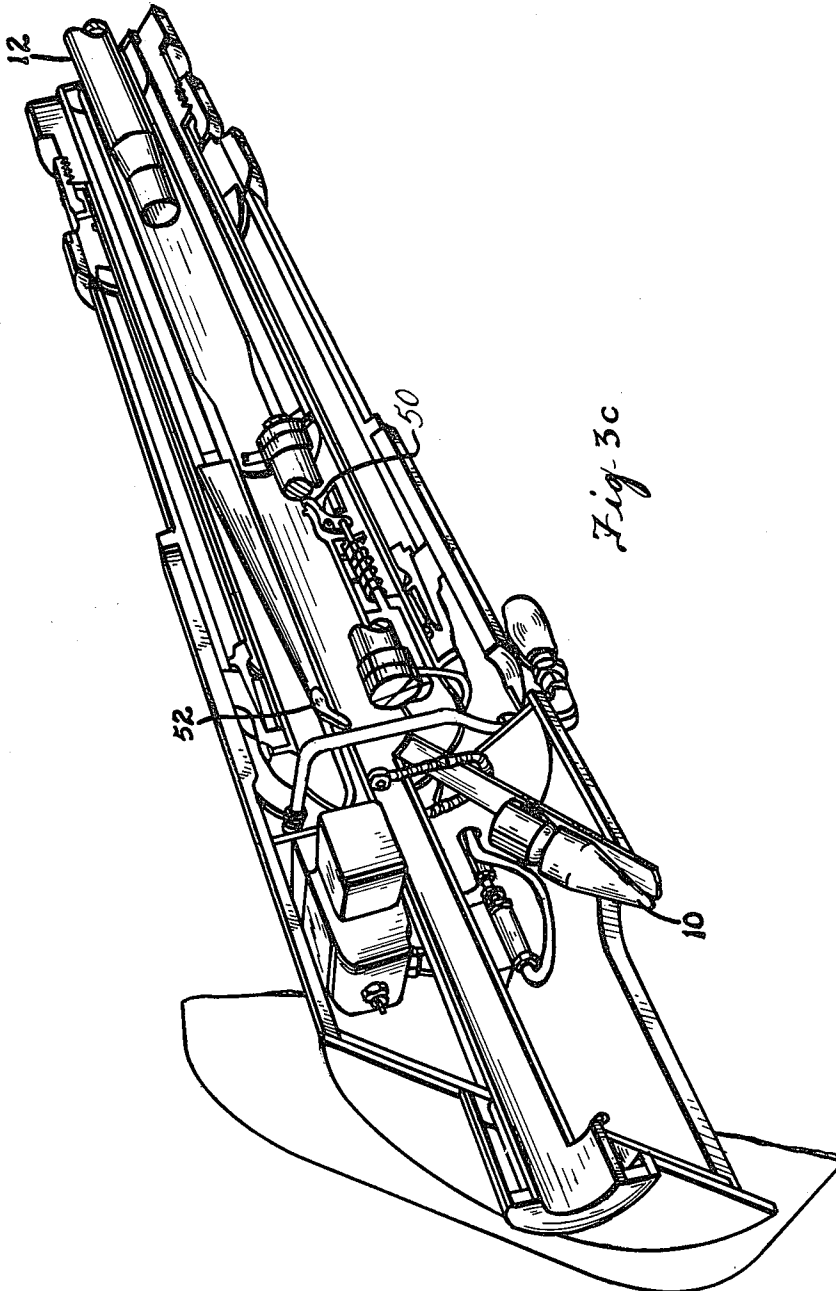


Fig. 3c

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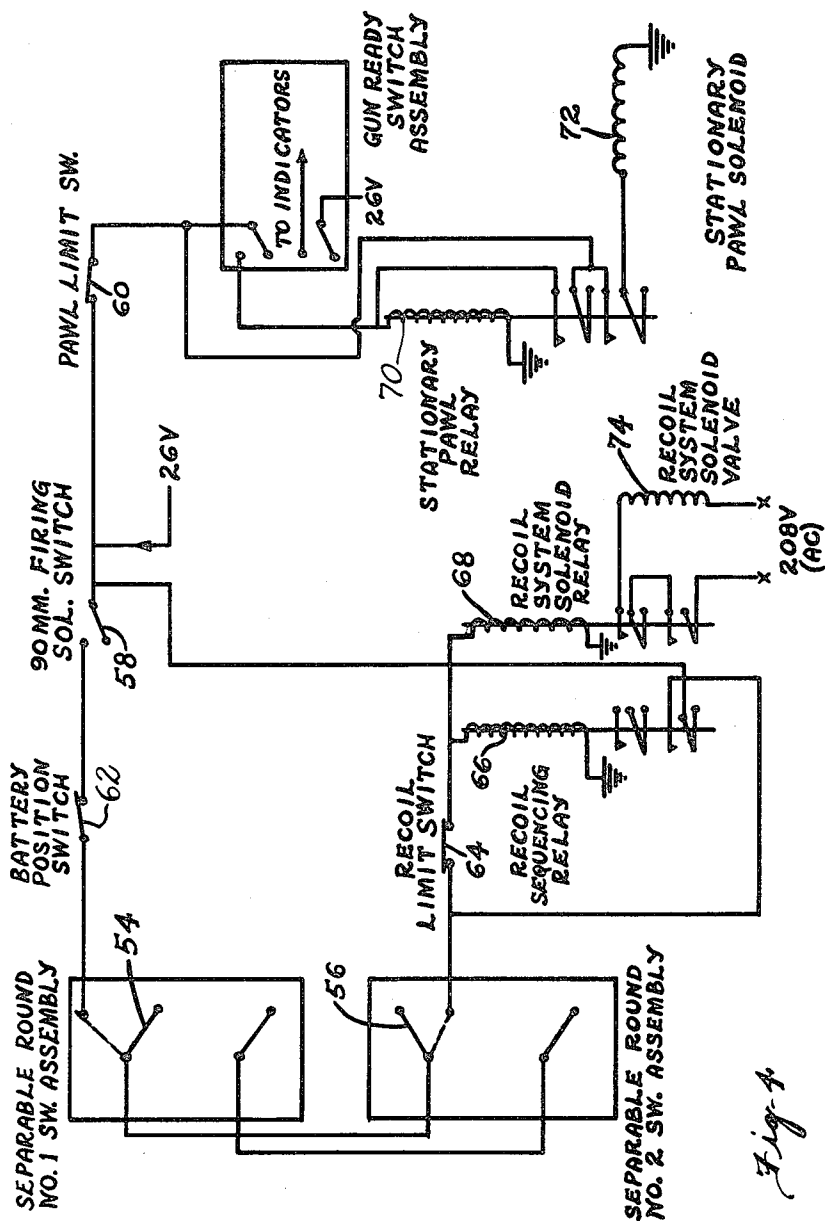
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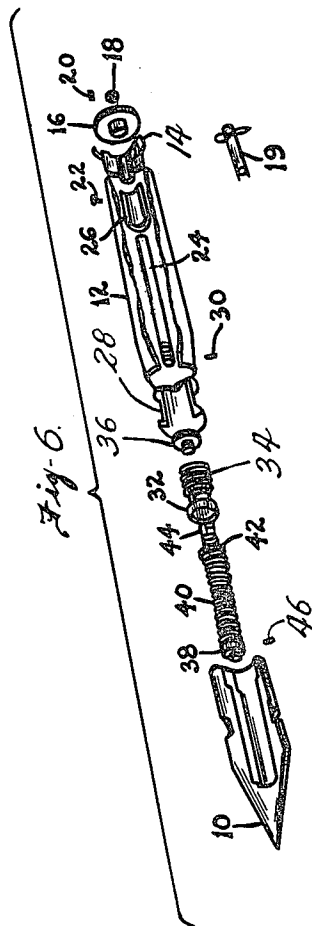
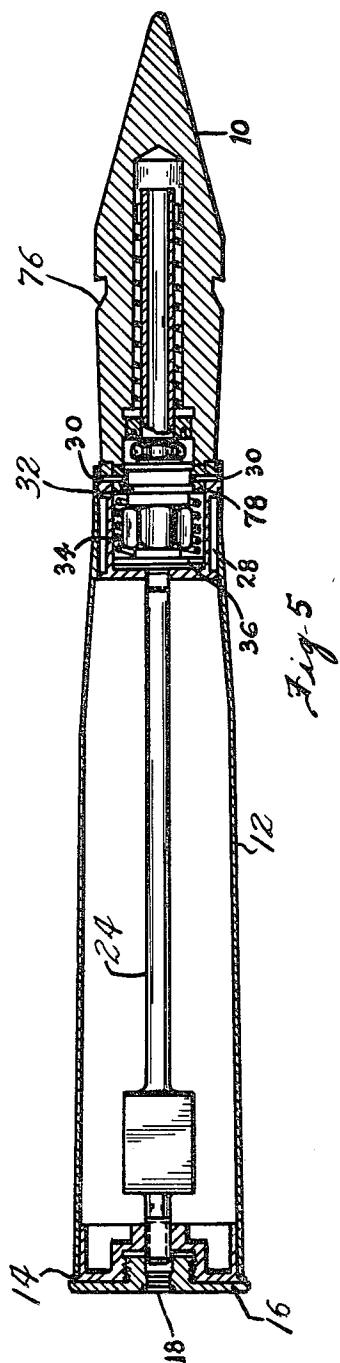
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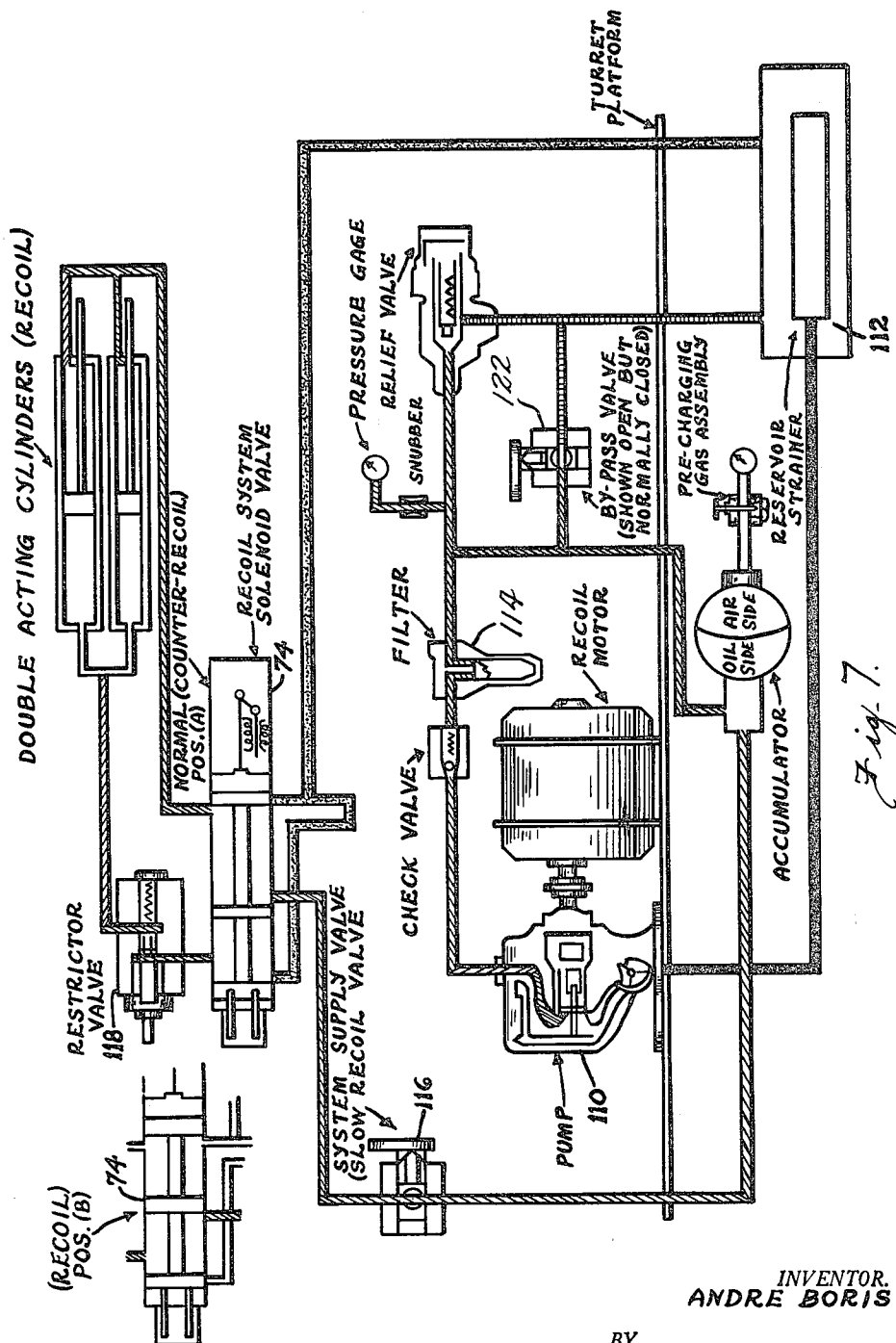


Fig. 7.

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SEPARABLE SIMULATED ROUND OF
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5 Claims. (Cl. 35—25)

This invention relates to training devices in general and in particular to a separable round which simulates the appearance and weight of a 90 mm. round. It is desirable to use the instant device instead of actual operable rounds because there is a safety factor involved and there is a savings in money and time.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 shows the major assemblies of the separable round;

FIG. 2 is a pictorial view showing the assembly of the separable round;

FIGS. 3a, 3b and 3c are cutaway detailed views showing the operation of the separable round within the gun chamber;

FIG. 4 is a schematic diagram of the electrical circuitry for the separable round;

FIG. 5 shows a cross section of the separable round;

FIG. 6 is an isometric exploded view of the separable round; and

FIG. 7 shows the recoil system hydraulic circuitry.

Referring to FIGS. 1, 5 and 7, the separable round consists of two major assemblies, the projectile assembly and the cartridge assembly. Each assembly consisting of other sub-assemblies. Removing the two set screws 20 permits the rear strike plate 16 to be unscrewed from the end block 14. The primer plug 18 can be unscrewed from the rear striker plate 16 with a special spanner wrench 19. The end block 14 can then be unscrewed from the tie rod 24 and removed from the cartridge case 12 at the same time the coupling housing 28 and tie rod 24 can be removed from the cartridge case 12. The tie rod 24 can then be removed from the coupling housing 28 by unscrewing it. When set screws 30 which retain the female coupling assembly in the coupling housing 28 are removed, the assembled coupling retainer 78, coupling female end 32, the spring 34 and spring retainer 36 can now be removed from the coupling housing 28. The coupling female 32 can be unscrewed from the spring retainer 36. At this point the spring is removed also. The coupling retainer 78 and female coupling then are separated.

The projectile assembly comprising the projectile 10, the spring retainer 38, spring 40, positioning nut 42 and male coupling 44 are contained in one removable assembly. This is the separable projectile which mates with the female coupling 32. That is, the male coupling 44 is inserted into the female coupling 32 when pressure on female coupling 32 is released so that the male coupling 44 may be inserted. When the round is fired this projectile assembly is separated from the cartridge assembly. To remove the internal assembly in the projectile the positioning nut 42 is unscrewed from the interior of the projectile 10. The assembly then comprises the spring retainer 38, the buffer spring 40, the positioning nut 42 and the male socket in the coupling 44 and retainer set screws 46. Removal of the set screws 46 from the retainer 38 permits the retainer to be unscrewed from the coupling 44 thereby permitting removal of the spring 40 and the positioning nut 42. The projectile 10 is separated from

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the cartridge assembly by pulling the couplings 44 and 32 apart. This is accomplished by a mechanical system consisting of a stationary pawl 50, a movable pawl 52 located within the gun tube and a breech mechanism, FIGS. 3a, 3b and 3c. The electrical circuit, FIG. 4, has sets of interlocking switches 54, 56, 58, 60, 62 and 64 and relays 66, 68, 70, and solenoids 72 and 74. Whenever the separable round is located in the gun chamber, the breech closed and the gun made ready to fire; the stationary pawl solenoid 72 is energized. The pawl 50 moves and engages the detent 76. When recoil takes place this pawl 50 holds the projectile in place as the cartridge assembly is pulled back by the breech. This separates the coupling. At full recoil the movable pawl 52 engages the detent 76 and pushes the projectile forward in the tube to bring counter recoil. At this point the cartridge is ejected rearward into the turret by operation of the breech and extractors. In the meantime, the solenoid 72 of the stationary pawl 50 is de-energized and the pawl drops down out of the tube. As the gun returns to battery, the movable pawl 52 pushes the projectile through the tube until it reaches the chute where it drops into the projectile receiver tray. The sequence of operation is shown in FIGS. 3a, 3b and 3c.

The operation of the electrical circuitry is as follows. When the gun is in battery and the breech is open the pawl limit switch 60, the battery position switch 62 and the recoil limit switches 64 are closed. When the recoil circuit is energized, 26 volts is made available to the projectile separation circuits. When a round is loaded and the breech is closed a switch is closed to apply 26 volts to the stationary pawl circuit. Closing the gun ready light switch completes the circuit to the stationary pawl relay 70 to energize it. A normally open contact on this relay energizes the stationary pawl solenoid 72 and a second normally opened contact on the same relay locks it in. The energized solenoid pushes the pawl up through a slot in the gun tube to engage the detent 76 in the projectile. At full recoil the recoil limit switch 60 is opened, breaking the circuit to relay 70. This deenergizes the pawl solenoid and causes the pawl to disengage the projectile and drop back down again at the same time that the movable pawl 52 is engaging the projectile to push it forward. Two separable round switches 54 and 56 are located beneath the stationary pawl arm so as to be mechanically operated by movement of the pawl. Separable round switch No. 1, 54 and No. 2, 56 are normally open. These are closed when the pawl moves up and engages the projectile. This completes the circuit between the 90 mm. solenoid firing switch 58 and the recoil system solenoid relay 68 and the recoil sequencing relay 66. Momentary closing of the firing switch 58 energizes the coil of relay 66 and relay 68 to apply 208 volts to the recoil system solenoid valve 74. When the gun reaches full recoil the recoil limit switch 64 is mechanically opened to break the circuit between the 90 mm. firing switch 58, relay 66 and relay 68. Relay 66 and relay 68 are thus de-energized which in turn de-energizes the recoil system solenoid valve 74 and the gun is returned to battery by the action of the firing valve admitting fluid to the rear of the hydraulic cylinders.

The operation of the recoil system hydraulic circuitry which is shown on FIG. 8 is as follows. The pump 110 draws fluid from the reservoir 112 and furnishes approximately 1,250 p.s.i. pressure at a rate of 6.9 gallons per minute. A ten micron filter 114 in the pressure side of the pump absorbs impurities that might block valves and piping. The system supply valve 116 permits adjustment of the rate of recoil and is normally operated full open. The spring loaded solenoid firing valve normally is in position A74. With the valve in this condition pressure is applied to the back side of recoil pistons to hold the gun in battery. The valve and gun remain in this posi-

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tion until the solenoid is energized. The solenoid is energized when the firing button is pressed. This moves the solenoid valve spool to position B74. The flow of pressure on the pistons is reversed and they are forced back to recoil the gun. During this stage fluid in the back side of the recoil cylinders is returned to the reservoir through one side of the firing solenoid valve. A microswitch opens the electrical circuit between the firing button and the solenoid when the gun reaches its full recoil limit, de-energizing the solenoid. The valve spring automatically returns the valve spool to position A to reverse the pressure flow and to start counter recoil movement. During counter recoil fluid in front of the recoil pistons is forced back through the restrictive valve bypass 118 through the solenoid valve and returns to the reservoir.

The separable round can be utilized again and again by merely reassembling it. The reassembly is accomplished with a special jig-type fixture. The projectile assembly and cartridge assembly are held together by a two piece clutch-type coupling 44 and 32. The male end of the coupling 44 is in the base of the projectile and engages the female end 32 in the upper part of the cartridge. This coupling is sturdy enough to withstand normal handling during drill operations and flexible enough to permit smooth, quick operation of the two parts when the gun is fired. The assembly of the separable round is accomplished in the following manner. Firstly, the primer plug 18 is removed from the striker plate 16 with the spanner wrench 19. The cartridge assembly is then placed on the assembling jig with the rod 80 inserted into the base. The cartridge assembly is secured to the jig with the clamps 82. Pressing the foot lever moves the rod 80 up against the spring retainer 36 and compresses the spring 34 thereby spreading the clutch of the female coupling 32 permitting the male end 44 to be easily inserted. Placing the projectile assembly on the cartridge case assembly, releasing foot lever 84, and releasing the securing clamps 82 makes the separable round ready for reuse. Thus, it is seen that the invention pertains to a separable round which is simple, novel, reusable and easy to manufacture.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A simulated round comprising a projectile and a

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cartridge, said projectile being separably connected to said cartridge and means for removing and reconnecting said projectile with said cartridge whereby an actual operable round of ammunition is simulated and the projectile is capable of being reused, said projectile containing a detent in its outer surface for insertion of a pawl within a gun simulator for removal of said projectile from said cartridge, wherein said projectile comprises a case, a tube assembly removably mounted within said case, said tube assembly comprising a spring retainer tube and the male member of a clutch coupling, said tube being fixedly attached to said male member of said coupling, a spring retainer attached to one end of said tube, said spring retainer comprising a spring and a positioning nut.

2. The combination of claim 1 wherein said cartridge comprises a coupling housing mounted at the upper surface of said cartridge, said coupling housing containing a retainer having the female part of said clutch coupling, a spring for providing pressure on said female coupling for opening and closing it, and retainer means for retaining said female coupling and spring within said coupling housing.

3. The combination of claim 2 wherein said cartridge contains tube means for insertion of a rod for compression of said female coupling spring means to open and close said female coupling for reception of a male coupling of said projectile.

4. The combination of claim 3 and primer plug means secured to the rear end of said projectile for insertion of rod means to open and close said female coupling means.

5. The combination of claim 4 and electrical switch means and relay means said electrical switch and relay means being operatively connected to said means for removing and reconnecting said projectile to said cartridge for operation thereof, whereby said simulated round is separated in simulation of the operation of an actual projectile when said control means and sequence means operate said switch and said relay electrical means.

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