

Aug. 6, 1963

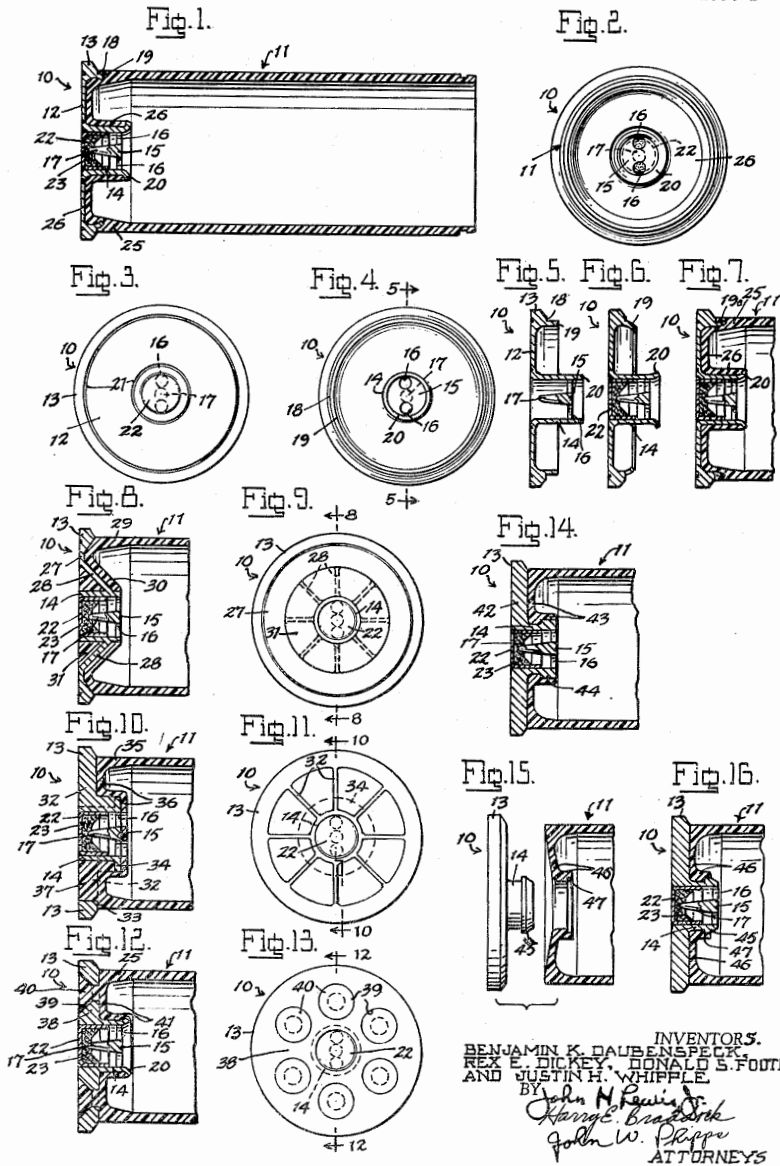
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3,099,958

FIREARM CARTRIDGES

Filed Jan. 12, 1960

5 Sheets-Sheet 1



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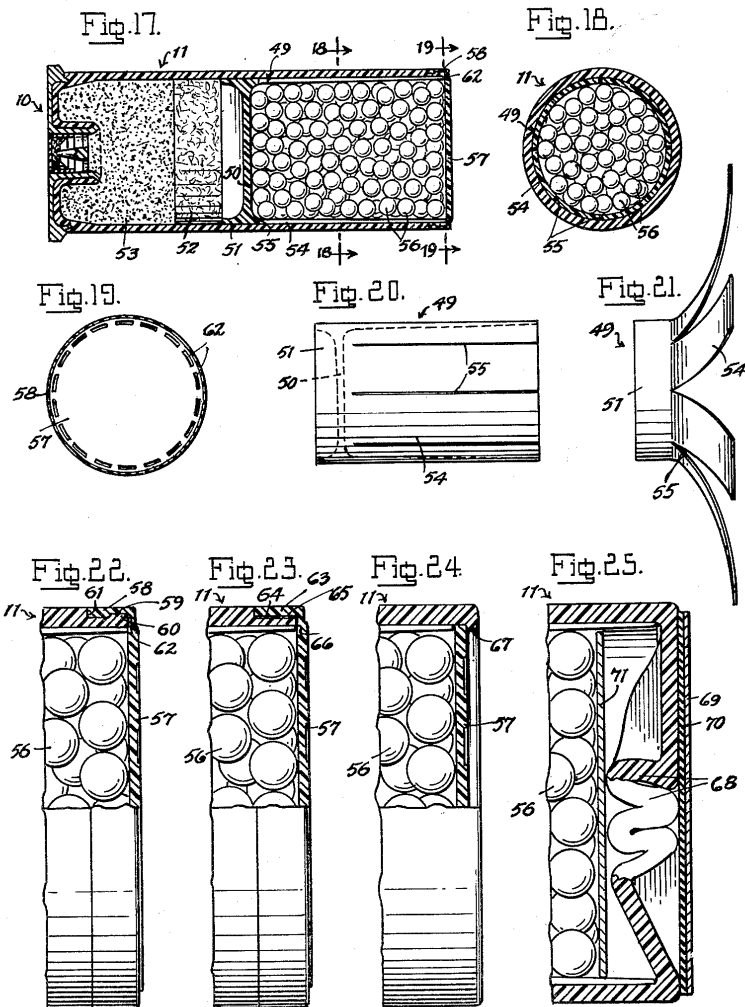
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FIREARM CARTRIDGES

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5 Sheets-Sheet 2



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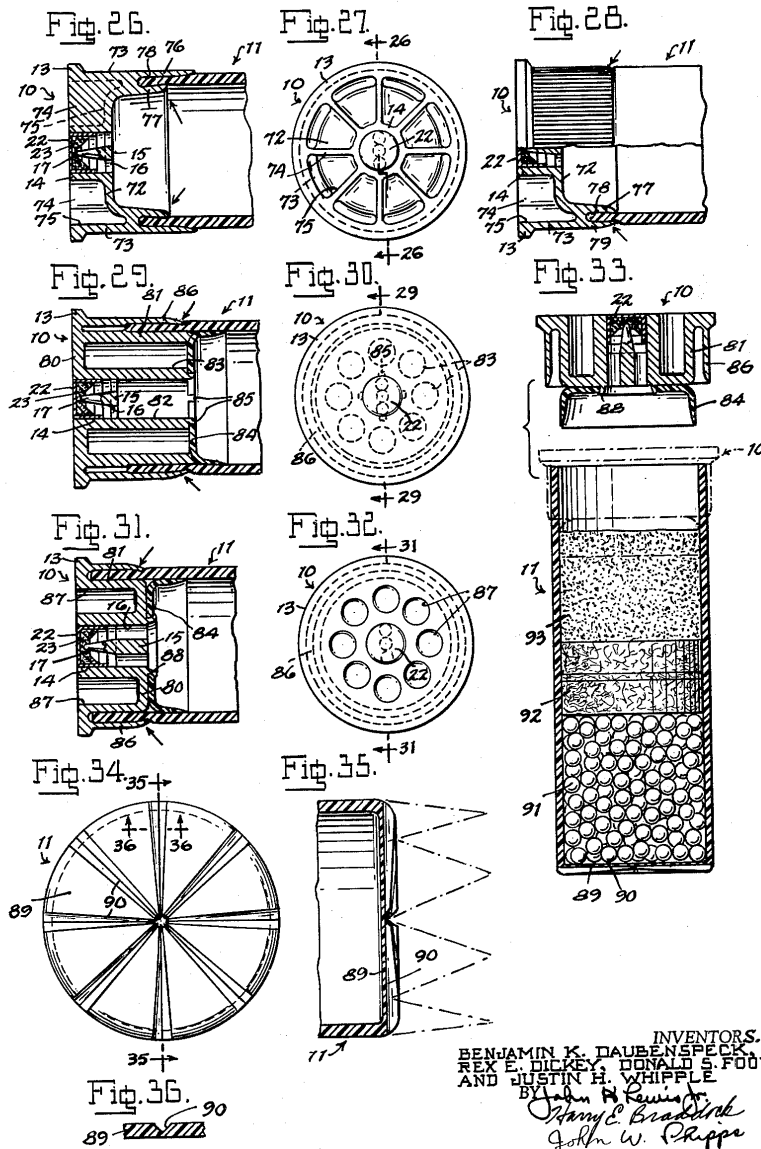
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FIREARM CARTRIDGES

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5 Sheets-Sheet 3



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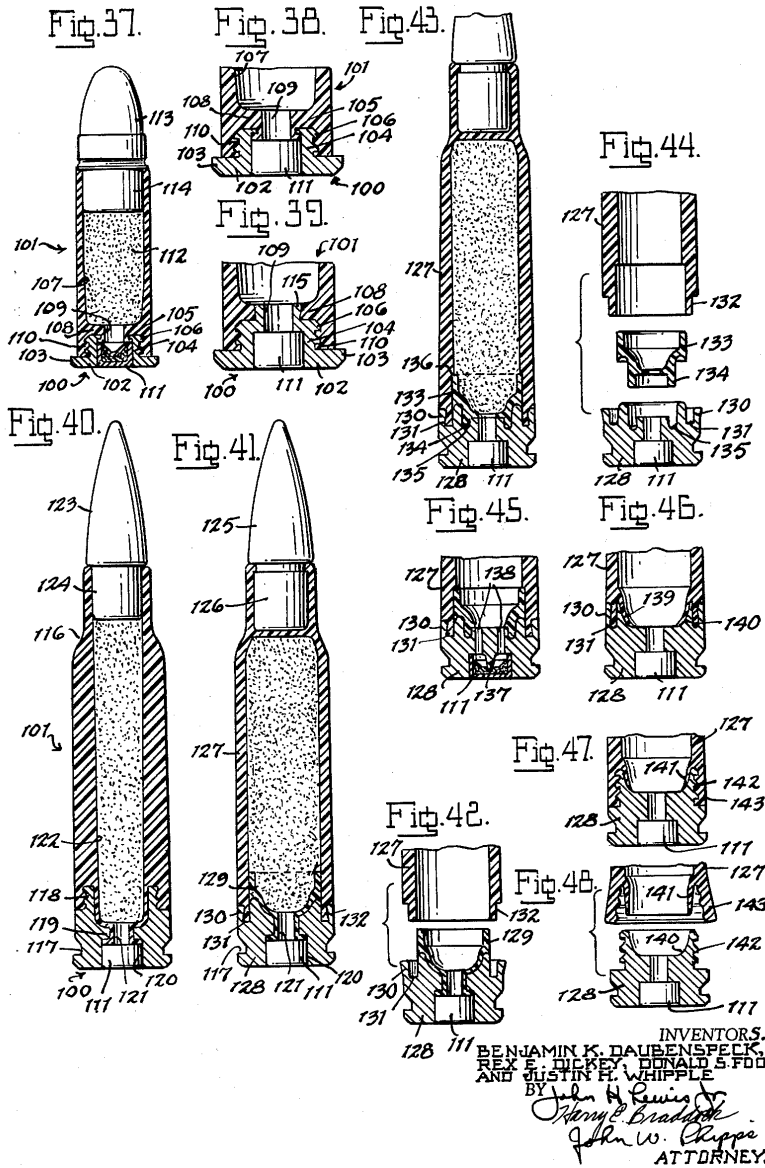
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FIREARM CARTRIDGES

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Fig. 49.

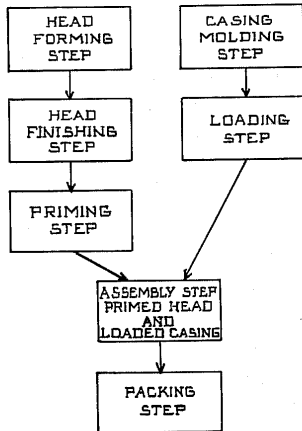


Fig. 50.

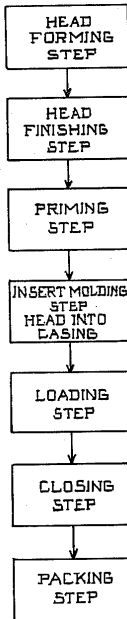


Fig. 51.

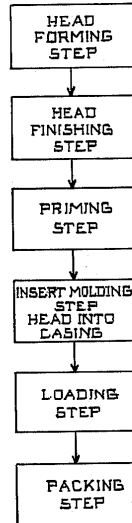
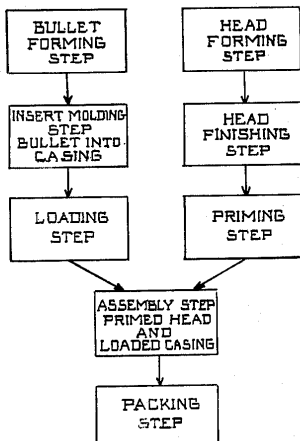


Fig. 52.



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3,099,958

FIREARM CARTRIDGES

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17 Claims. (Cl. 102—42)

The present invention relates to firearm cartridges and method of manufacture and assembly thereof, and is concerned with both shotshell and centerfire types. A primary object of the invention is to combine materials of different properties in a way that utilizes the favorable properties of each to its fullest advantage. It is proposed to provide a cartridge structure comprising a primer carrying head of rigid material of high compressive strength, which may be precision formed, as for instance by die casting, and a plastic body or casing of plastic material having high tensile strength and controlled flexibility under expansive pressure. Linear polyethylene and copolymers of ethylene and other alpha olefins have been found to be highly satisfactory in performance. Other suitable plastic materials which have given satisfactory results are ethyl cellulose, cellulose acetate, styrene butadiene, and styrene butadiene acrylonitrile terpolymer. Such materials are capable of formation into desired cross-sectional shapes by economical molding procedures, for example, injection molding for independent formation of the casing, as well as insert injection molding for the simultaneous molding of the casing and the attachment thereto of associated metallic parts of the cartridge.

Other objects and advantages will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a satisfactory embodiment of the invention is shown. However, it will be understood that the invention is not limited to the details disclosed but includes all such variations and modifications as fall within the spirit of the invention and the scope of the appended claims.

In the drawings:

FIG. 1 is a longitudinal sectional view of a cartridge casing and head, according to the invention, wherein the head is secured by insert injection molding to the casing;

FIG. 2 is an end elevation as seen from the right in FIG. 1;

FIG. 3 is an end elevation as seen from the left in FIG. 1;

FIG. 4 is an end elevation showing the forward side of the head in its form as die cast;

FIG. 5 is a sectional view of the head taken along the line 5—5 of FIG. 4;

FIG. 6 is a sectional view showing the die cast head shaped by swaging prior to assembly by insert injection molding to the casing;

FIG. 7 is a sectional view similar to FIG. 1 showing a modified interlocking rim formation provided upon the head;

FIG. 8 is a sectional view taken along the line 8—8 of FIG. 9, showing a modified form of head secured by insert injection molding to the casing;

FIG. 9 is an end elevation as seen from the left in FIG. 8;

FIG. 10 is a sectional view taken along the line 10—10 of FIG. 11 showing another modified head formation secured by insert injection molding to the casing;

FIG. 11 is an end elevation as seen from the left in FIG. 10;

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FIG. 12 is a sectional view taken along the line 12—12 of FIG. 13, showing still another modified head formation secured by insert injection molding to the casing;

FIG. 13 is an end elevation as seen from the left in FIG. 12;

FIG. 14 is a sectional view showing another modified head formation secured by insert injection molding to the casing;

FIG. 15 is a view partially in side elevation and partially in section showing still another modified head and casing formation wherein the casing is secured to the head by snap engagement therewith, the parts being shown in separated relation;

FIG. 16 is a sectional view showing the head and casing as illustrated in FIG. 15 in their assembled relation;

FIG. 17 is a longitudinal sectional view of a complete loaded cartridge, including a shot container capsule according to the invention, the illustrated head and casing being similar to the modification shown in FIG. 1;

FIG. 18 is a transverse sectional view taken along the line 18—18 of FIG. 17;

FIG. 19 is a transverse sectional view taken along the line 19—19 of FIG. 17;

FIG. 20 is a side elevation of the shot container capsule, as employed in the cartridge illustrated in FIG. 17, the same being shown in its normal position for fitting within the casing;

FIG. 21 is a side elevation showing the manner in which the shot container capsule illustrated in FIG. 20 is flared or distorted as it is discharged from the firearm barrel following firing from the cartridge;

FIG. 22 is an enlarged fragmentary view partially in side elevation and partially in longitudinal section of the closure end of the cartridge illustrated in FIG. 17;

FIGS. 23, 24 and 25 are views similar to FIG. 22 showing modified forms of closure ends;

FIG. 26 is a fragmentary sectional view taken along the line 26—26 of FIG. 27 of another modification in which a die cast head is secured to the casing by swaging;

FIG. 27 is an end elevation as seen from the left in FIG. 26;

FIG. 28 is a view partially in side elevation and partially in longitudinal section showing a modified form of head secured to the casing by swaging;

FIG. 29 is a fragmentary longitudinal sectional view taken along the line 29—29 of FIG. 30 of another modified head formation secured by swaging to the casing and provided with a plastic overlay;

FIG. 30 is an end elevation showing the inner end of the head as illustrated in FIG. 29;

FIG. 31 is a fragmentary longitudinal sectional view taken along the line 31—31 of FIG. 32 of another modified head formation secured by swaging to the casing and having a plastic overlay;

FIG. 32 is an end elevation as seen from the left in FIG. 31;

FIG. 33 is a longitudinal sectional view of the head and overlay as illustrated in FIGS. 31 and 32 shown in separated relation to the loaded casing, the dot-and-dash lines showing the assembled relation of the head and overlay with the casing;

FIG. 34 is an end elevation on an enlarged scale of the closure end of the casing shown in FIG. 33;

FIG. 35 is a sectional view taken along the line 35—35 of FIG. 34, and showing in dot-and-dash lines the open position of the closure end of the casing following firing;

FIG. 36 is a sectional view taken along the line 36—36 of FIG. 34;

FIG. 37 is a view partially in side elevation and partially in longitudinal section of a further modified form of the

invention wherein the cartridge is of bullet type for use in a rifle barrel having a straight bore;

FIG. 38 is a fragmentary sectional view on an enlarged scale showing the head end of the cartridge illustrated in FIG. 37, secured by insert injection molding to the casing;

FIG. 39 is a sectional view similar to FIG. 38 showing a modified form of head;

FIG. 40 is a view partially in side elevation and partially in longitudinal section showing another modified form of cartridge, according to the invention, for use in a rifle barrel having a shoulder bore and wherein an integral overlay is provided in relation to the head;

FIG. 41 is a view similar to FIG. 40 showing a modification in which the bullet projectile is secured by insert injection molding to the casing, and wherein the head having an overlay secured thereby by insert injection molding is assembled with the casing end secured by swaging following loading of the casing from the head end thereof;

FIG. 42 is a fragmentary sectional view showing the head and overlay in separated relation with respect to the casing;

FIG. 43 is a view similar to FIG. 41 of a modified form of cartridge in which the overlay is separately formed from the head and is retained in engagement therewith by an interlocking formation on the casing;

FIG. 44 is a fragmentary sectional view showing the head overlay and casing of FIG. 43 in separated relation;

FIG. 45 is a fragmentary sectional view showing a modification of the cartridge as illustrated in FIG. 43 wherein the primer anvil is integrally formed with the head;

FIG. 46 is a sectional view similar to FIG. 45 showing another modification, wherein the overlay is integral with the casing;

FIG. 47 is a fragmentary sectional view of a modification of the form of the invention shown in FIG. 46, wherein the head is secured to the casing by heat and pressure molding of the casing in relation to an interlocking formation on the head;

FIG. 48 is a fragmentary sectional view showing the head and casing of FIG. 47 in separate relation prior to assembly;

FIG. 49 is a diagram showing the steps of the method of manufacturing and assembling cartridges according to the invention;

FIG. 50 is a diagram of a modification of the method;

FIG. 51 is a diagram of another modification of the method;

FIG. 52 is a diagram of still another modification of the method.

In FIGS. 1-36 of the drawings the invention is illustrated as embodied in shotshell type cartridges, and in FIGS. 37-48 the invention is illustrated as embodied in center fire type cartridges. The improved methods of manufacture and assembly according to the invention are illustrated diagrammatically in FIGS. 49-52. Both the shotshell and center fire type cartridges of the invention come under two categories: (1) wherein the primed head is assembled with the plastic body, loading of the cartridge taking place after assembly, and (2) wherein the primed head is mechanically assembled with the pre-formed plastic body. In the second category the body may be loaded prior to assembly through the open head end thereof, the forward end being provided with a load retaining closure prior to loading.

Referring to FIGS. 1-7 of the drawings, the shotshell cartridge which is shown in its unloaded condition, comprises a rigid head 10 of high compressive strength material, preferably produced by die casting, and a molded plastic body 11 which is injection molded and simultaneously assembled with the head as an insert in the molding die, the primer cup being assembled with the

head prior to the insert molding operation, as will presently more fully appear. The material of the head is preferably zinc die casting alloy, although the invention is not limited to this material. The head 10 comprises an annular base wall 12 provided at its outer periphery with a beveled extractor rim 13 and at its inner periphery with cylindrical wall constituting a battery cup 14 having an integral transverse web 15 inwardly spaced from its forward end and provided with vent holes 16-16 and an integral centrally disposed tapered anvil 17 projecting rearwardly therefrom.

The extractor rim 13 is provided inwardly of its annular beveled surface with a forwardly facing flat annular ledge 18, and with an annular lip 19 which curves inwardly with respect to the inner wall of the rim for interlocking cooperation with the plastic body, as will presently more fully appear. The forward end of the cylindrical wall of the battery cup 14 is provided with an outwardly curved annular flange 20, also for interlocking cooperation with the plastic body. In die casting the head, identifying legends, trademarks, or the like may be cast in its outer surface in the form of indentations, a pair of concentric circular indentations 21 being illustrated by way of example.

The primer cup 22 contains a priming composition 23 and is assembled within the battery cup 14 prior to assembly of the head with the body. As illustrated in FIGS. 4 and 5 the rim 19 and the forward flange 20 of the battery cup 14 are die cast in straight relation in accordance with economical die casting methods, and are thereupon formed into their curved shapes as shown in FIG. 6 by suitable dies. This operation may be performed in the same machine which assembles the primer cup with the head.

The plastic body 11 is of generally cylindrical tubular form and is interlocked with the head 10 by insert injection molding, the head being inserted in the injection molding die in such relation to the core of the die that the plastic material is molded into conforming interlocking relation with the forward surfaces of the head, the internal surfaces of the plastic body being so shaped that the core of the die may be removed by a straight draw movement of the core. At the head end the body is thickened as at 25 to encompass the inwardly curved lip 19 with its outer cylindrical surface carried to the inner edge of the annular beveled surface of the annular rim 13, so that outwardly of the lip 19 the rearward edge of the body engages the annular ledge 18. From the thickened portion 25 encompassing the lip 19 the plastic material of the body extends as an overlay 26 over the forward surface of the wall 12 of the head and in surrounding relation to the annular wall of the battery cup 14, the outwardly curved forward end portion 20 of the wall being in interlocking abutting relation to the forward edge of the overlay. Thus the inner surface of the head is provided with a plastic overlay, the body is firmly interlocked with the head, and the substantial surface engagement of the overlay with the head between the forward edge of the battery cup 14 and the extractor rim 13 establishes an effective gas seal.

In FIG. 7 there is shown a modification in which the interlocking lip 19a is curved outwardly. The structure of this modification can be formed conveniently by a die casting apparatus utilizing a lateral slide mechanism to form the undercut portions.

In the modification illustrated in FIGS. 8 and 9, the head 10 comprises an annular ring-like base wall 27 integral with the beveled rim 13 and connected to the battery cup 14 in outwardly spaced concentric relation thereto by a plurality of radial spoke portions 28 inclined outwardly and rearwardly, preferably at an angle of approximately 45°, from a point rearwardly spaced a slight distance from the forward end of the battery cup to the base wall 27. The plastic body of casing 11 is thickened as at 29 adjacent the head, and is carried inwardly over the forward sides of spoke portions 28 to the forward end of the battery cup

in the form of a circumferentially continuous overlay 30 and is carried between the spokes into flush relation with the rearward surface of the base wall 27 to form an exposed ring 31 of plastic material disposed between the base wall and the battery cup. The arrangement provides an effective interlocking relation between the head and the casing and an effective gas seal. The reinforcing mass of plastic interengaged with the spoked head enables a substantial reduction of the metal employed in the head.

In FIGS. 10 and 11 there is illustrated a modification of the spoked head arrangement illustrated in FIGS. 8 and 9, wherein a plurality of radial spoke portions 32 extend between the battery cup 14 and the beveled extractor rim 13 with their rearward surfaces flush with the rearward surfaces of the battery cup and rim. Their forward surfaces are substantially L-shape in cross section and extend inwardly from a flat annular ledge surface 33 of the extractor rim and forwardly along the cylindrical wall of the battery cup 14 to an outwardly extending flange 34 provided at the forward end of the battery cup. The plastic body is provided with a thickened portion 35 adjacent to the head which abuts the ledge 33 and is carried as a circumferentially continuous overlay 36 over the inner surfaces of the spokes and forwardly over the flange 34, being carried between the spokes, as at 37, into flush relation with the rearward surfaces of the extractor rim 13 and the battery cup 14.

In the modification illustrated in FIGS. 12 and 13 the head 10 comprises a base wall 38 substantially thicker than the base wall of the embodiment shown in FIGS. 1-6, its forward surface being flush with the inner edge of the beveled surface of the extractor rim 13. A plurality of equally spaced rearwardly divergent rivet holes 39 is provided in the base wall 38 between the battery cup 14 and the extractor rim 13 into which are molded interlocking rivet portions 40 of the plastic body, these rivet portions extending into the holes 39 from an overlay portion 41 into flush relation with the rearward surface of the base wall 38.

In FIG. 14 there is illustrated a modification in which the base wall 42 of the head 10 is somewhat similar in its thickness dimension to the base wall 38 of the embodiment shown in FIGS. 12 and 13, but it is not provided with rivet holes for interlocking the casing. The plastic body 11 is provided with an overlay portion 43 which extends over the forward surface of the wall 42 and forwardly in surrounding relation to the battery cup 14, the latter being provided exteriorly with a shoulder 44 in relation to which the overlay is interlockingly molded.

The modification illustrated in FIGS. 15 and 16 is substantially similar in structure to that illustrated in FIG. 14, but in this case the battery cup 14 is provided with a beveled shoulder 45, and the plastic body 11 is provided with an overlay portion 46 having an annular recess 47 for interlocking engagement by the beveled flange 45. Unlike the modifications illustrated in FIGS. 1-14 where the head constitutes an insert during the injection molding of the body, the body in the modification of FIGS. 15 and 16 is separately molded with the overlay portion 46 inclined slightly forwardly from the outer surface of the body. The plastic material has sufficient resilience or elasticity so that the plastic body may be snapped into interlocking relation with the head, the overlay portion 46 thereupon assuming a flat position in snug engagement with the forward surface of the head as shown in FIG. 16.

In FIGS. 17-22 the shotshell cartridge is shown provided with a plastic shot container or capsule 49 which is adapted to be fired from the cartridge with the shot for the purpose of better controlling the shot pattern, minimizing shot distortion, and preventing leading of the firearm barrel. While the shot capsule may be incorporated in the various modified forms of the shotshell it is illustrated by way of example as being embodied in the modi-

fication illustrated in FIGS. 1-6. The capsule comprises a transverse wall 50 provided with a rearwardly extending skirt 51 against which the wad 52 engages, the powder charge 53 being disposed rearwardly of the wad. A relatively thin cylindrical wall 54 extends forwardly from the transverse wall 50 and is preferably slightly tapered in thickness toward its forward end. A plurality of longitudinal circumferentially spaced slits 55 are provided in the wall 54 extending from its forward end to a point contiguous to the transverse wall 50. These slits provide a series of leaf-like portions which upon forward propulsion from the firearm barrel spread into an open position substantially as shown in FIG. 21. The skirt 51 functions as a gas-sealing wad.

The capsule 49 is filled with shot 56 and these are retained in the cartridge by a closure cap 57. The closure cap as illustrated in detail in FIG. 22 is adapted to be snapped into engagement with the body, and for this purpose is provided with a flange rim 58 having an internal recess 59 which is adapted to snap into engagement with the shoulder projection 60 of the annular recess 61 in the end of the body. A series of grooves 62 at the inner side of the cap adjacent the rim 59 provide a circumferential weakened line which under the force of the explosion of the cartridge permits the closure cap to break away from the rim 58.

In FIG. 23 the closure cap 57 is provided with a rim flange 63 having sliding engagement with an annular recess 64 in the end of the body, and which is secured by cementing the contacting surfaces of the rim and recess as at 65. An annular groove 66 in the inner side of the closure cap adjacent the rim provides a weakened line for separation of the closure cap from its rim.

In FIG. 24 the closure cap 57 is snapped into place behind an inwardly projecting bead 67 at the forward end of the body.

In FIG. 25 the body is provided with a folded-in closure end 68 of the type as disclosed in the patent to Finlay et al., No. 2,242,907, dated May 20, 1941. A disk 69 is secured to the forward side of the folded-in closure by adhesive 70, and a separation disk 71 is preferably provided between the shot 56 and the folded-in closure.

In the modification illustrated in FIGS. 26 and 27 a transverse base wall 72 extends outwardly from the forward end of the battery cup 14 to an outer cylindrical wall 73 extending forwardly from the extractor rim 13, a plurality of radially extending ribs or spokes 74 being provided between the battery cup and inner side of the wall 73 to provide a reinforced rigid light weight head structure in which the cut out pockets 75 between the ribs 74 minimize metal usage. An annular skirt portion 76 extends forwardly from the outer wall 73 and an annular skirt portion 77 extends forwardly from the base wall 72 and define between them an annular recess 78 in which the end of the cylindrical plastic body 11 is engaged and clamped by expanding the inner swirl portion 77 outwardly, as indicated by the arrows. This operation is preferably performed by means of a suitable punch, preferably shaped with a 45° entrance angle, the outer annular skirt portion 76 being at the same time supported in a suitable die.

The arrangement provides an effectual obturating gas seal. Also, the integral battery cup and anvil which are adapted to have the primer cup assembled with the head prior to assembly of the body therewith eliminates the conventional base wad, anvil, battery cup and associated assembly operations for these components.

In FIG. 28 the head 10 is substantially similar to that shown in FIGS. 26 and 27, but in this case the outer skirt 79 is shortened so that its forward end does not project beyond the forward end of the inner annular skirt 77. The end of the cylindrical plastic body 11 is engaged in the annular recess 78 and clamped by swaging the outer annular skirt 79 inwardly, as indicated by the arrows.

In the modification illustrated in FIGS. 29 and 30 the

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head 10 is provided with a base wall 80 flush with the extractor rim 13 and having a forwardly extending annular wall portion 81 provided with a central cylindrical passage 82 which forms a forward continuation of the battery cup 14. An annular series of cylindrical pockets 83 in the wall portion 81 extend from its forward surface to the base wall 80 and serve to reduce weight and minimize metal usage. A plastic cup shaped overlay 84 is secured upon the forward end of the head preferably by insert injection molding, the overlay being interlocked with the head by means of a plurality of lugs 85 provided about the forward end of the passage 82. An outer annular skirt 86 extends forwardly from the extractor rim 13 in concentric spaced relation to the wall portion 81 and provides an annular recess in which the end of the plastic body 11 is engaged and clamped by swaging the forward end portion of the skirt 86 inwardly, as indicated by the arrows.

The modification illustrated in FIGS. 31 and 32 is substantially similar to that illustrated in FIGS. 29 and 30, but in this case the head 10 is provided with a series of pockets 87 in reverse arrangement to the pockets 83, being extended forwardly from the rear face of the head. Instead of the lugs 85 an outwardly curved flange 88 is provided for interlocking connection of the plastic overlay 84.

The modifications as illustrated in FIGS. 28-32 are adapted for the assembly of the primed head following the loading of the body 11. In carrying out this operation the forward end of the body can be provided with a closure which may be similar to those illustrated in FIGS. 22-25, or it may be provided with an integral frangible closure as illustrated in FIGS. 33-36. This closure consists of an integral end wall 89 provided with radial grooves 90 extending from its center to its outer edge to form a series of weakened lines, which, upon firing of the cartridge, break and allow the sections of the closure to be forced forwardly as indicated by the dot-and-dash lines in FIG. 35.

The manner of assembly of the head with the loaded body is illustrated in FIG. 33, the head being shown by way of example as the modification illustrated in FIGS. 31 and 32. The body is provided with shot 91, wads 92 and a powder charge 93. With the body in vertical position with its closure end downwardly, the head 10 provided with the plastic overlay 84 is assembled with the upwardly disposed open end of the body, as indicated by the dot-and-dash lines, and is thereupon secured by swaging in the outer skirt portion 86 in the manner indicated by the arrows in FIG. 31.

In FIGS. 37-48 there are illustrated modifications of the invention of the center fire type and which embody features common to the foregoing shotshell type embodiments.

The embodiment illustrated in FIGS. 37 and 38 comprises a rigid head 100 of high compressive strength material, for instance, zinc alloy, preferably produced by die casting, and a molded plastic body 101 which is injection molded and simultaneously assembled with the head as an insert in the molding die. The head comprises a base 102 having a laterally projecting extractor rim 103, and provided at its forward side with a battery cup portion 104 having an inwardly extending annular lip 105 at its forward end. A plurality of annular teeth or ribs 106 are provided upon the outer surface of the battery cup portion for interlocking engagement with the plastic body or casing 101, as will presently more fully appear.

The plastic casing 101 is substantially cylindrical and is provided with a powder containing chamber 107, the base of which is in the form of an integral overlay portion 108 molded over the inner end of the battery cup and extended inwardly about the lip 105 to the interior of the primer pocket, a central vent or flash hole 109 being provided in the overlay portion. Additionally the body is molded into interlocking relation with the ribbed outer side of the battery cup as at 110. A conventional primer

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cup 111 is inserted in the primer pocket and preferably this operation is carried out prior to the insert injection molding of the body to the head. A powder charge 112 is placed in the chamber 107 and a bullet or projectile 113 having a reduced heel 114 is engaged with a friction fit into the forward open end of the body.

In the modification illustrated in FIG. 39 the battery cup portion 104 is provided with an annular flange projection 115, undercut at its outer side for interlocking engagement therewith of the overlay portion 108 of the body through insert injection molding.

The modification illustrated in FIG. 40 is somewhat similar to that illustrated in FIGS. 37 and 38, the plastic body or casing 101, however, being of the necked-down type provided with a shoulder 116, and the head 100 being provided with an annular extraction groove 117. The body is insert injection molded about an externally ribbed flange 118 upon the forward end of the head, and is carried as an integral overlay over the inner surface of the flange 118 and about an annular rib 119 provided at the forward end of the primer pocket 120 to the interior of the pocket, a central vent or flash hole 121 being provided for communication between the primer pocket and the powder containing chamber 122 of the casing. A conventional primer cup 111 is engaged in the pocket 120, and a bullet or projectile 123 having a reduced diameter heel portion 124 is engaged with a friction fit in the forward end of the body.

In the modification illustrated in FIGS. 41 and 42, the bullet or projectile 125 provided with a reduced diameter heel portion 126 is assembled through insert injection molding with the plastic body or casing 127, and after loading with powder the body is mechanically joined to the head 128, the latter being substantially similar to the head 110 of the embodiment shown in FIG. 40. Instead of an integral overlay, however, a separate plastic overlay 129 is provided, and this is preferably joined to the head by insert injection molding. An annular flange 130 surrounding an annular recess 131 is provided upon the head and in the pre-assembled relation this flange projects outwardly and the recess 131 is straight walled, as shown in FIG. 42. In assembling the head and casing the recessed end 132 of the body is engaged in the recess 131 of the head, and thereupon the flange 130 is swaged inwardly by a suitable ring die into interlocking relation with the casing as shown in FIG. 41. The construction of FIG. 41 can be obtained by separate fabrication of the casing and bullet which can be later assembled by a "snap" fit.

In the modification shown in FIGS. 43 and 44, the plastic overlay 133 is engaged with a friction fit in the head, the overlay being provided for this purpose with an annular tongue portion 134 for engagement with an annular groove 135 in the head. In the assembled relation of the casing and head, as seen in FIG. 43, an internal shoulder 136 of the casing abuts the forward end of the overlay to thus retain the overlay in assembled relation. The partition behind the bullet illustrated in FIGS. 41 and 43 may be omitted, if desired.

The modification illustrated in FIG. 45 is substantially similar to that shown in FIGS. 43 and 44, except that the head is provided with an integral anvil 137 for cooperation with the primer 111 and a pair of vent or flash holes 138-139 are provided instead of the single flash hole shown in FIGS. 43 and 44.

The modification illustrated in FIG. 46 is substantially similar to the modifications of FIGS. 43 and 44 and FIG. 45, but in this case an integral overlay 139 is provided which engages in conforming relation with the cupped surface 140 of the head as the plastic casing is assembled with the head.

In the modification shown in FIGS. 47 and 48, the plastic casing is provided with an integral overlay portion 141 substantially like that shown in FIG. 46, but, instead of connecting the body by a swaged-in flange, the head is provided with annular teeth or ribs 142 with which a

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flange portions 143 of the body is interlockingly engaged through the application of heat and pressure to mold said flange portion into interlocking relation with the head. The body is preferably molded with the flange 143 flared outwardly as shown in FIG. 48 to facilitate its engagement with the head, and in the assembled relation shown in FIG. 47 the flange is molded into conforming relation with the peripheral surface of the head.

In FIGS. 49-52 the improved methods of manufacture and assembly according to the invention are illustrated diagrammatically. The method as illustrated in FIG. 49 comprises a first sequential arrangement, consisting of a head forming machine, for instance a die casting machine, and a head priming machine, a second sequential arrangement in theoretically parallel or collateral relation to the first sequential arrangement, consisting of a casing molding machine and a casing loading machine, and a third sequential arrangement, consisting of an assembly machine and a packing machine, wherein the primed heads and loaded casings are assembled and the completed cartridge packed. The product of this method is exemplified by the cartridge modifications of the invention illustrated in FIGS. 28-33 and FIGS. 41-48.

The method illustrated in FIG. 50 comprises the sequential arrangement of a head forming machine, a priming machine, a casing molding machine wherein the head is attached to the casing by insert molding, a casing closing machine, and a packing machine for receiving the completed cartridge. The product of this method is exemplified by the cartridge modifications illustrated in FIGS. 1-25.

The method illustrated in FIG. 51 is similar to that illustrated in FIG. 50, except for the omission of the closing machine, and is particularly concerned with production of centerfire cartridges which do not involve a casing closing operation. The product of the method illustrated in FIG. 51 is exemplified by the cartridge modifications illustrated in FIGS. 47-49. In the methods of FIGS. 50 and 51, the step of priming and insert molding the head into the casing may be interchanged, if desired.

The method illustrated in FIG. 52 is also particularly concerned with the production of center fire cartridges, and comprises a first sequential arrangement, consisting of a bullet forming machine, a casing molding machine where the bullet is connected to the casing by insert injection molding, and a casing loading machine, a second sequential arrangement in theoretically parallel or collateral relation to the first sequential arrangement, consisting of a head forming machine and a priming machine, and a third sequential arrangement, consisting of an assembling machine and a packing machine, wherein the primed head and the loaded casing are assembled and the completed cartridge packed. The product of the method illustrated in FIG. 52 is exemplified by the cartridge modifications illustrated in FIGS. 41-48.

What is claimed is:

1. In a firearm cartridge, a plastic casing including an annular wall, a rigid head including an extractor rim and a primer positioning battery cup, means fastening said head to said casing, a plastic slot container within said casing, said shot container comprising a transverse base wall, an annular wall integral with said base wall including a circumferentially continuous gas sealing skirt portion extending rearwardly from said transverse wall and an expandible portion extending forwardly therefrom and having a plurality of circumferentially spaced longitudinal slits extending from its forward end into contiguous relation to said transverse wall, shot within said shot container and entirely separated from said annular wall by said container, and releasable closure means normally retaining said shot and said shot container in said casing.

2. In a firearm cartridge, a casing of plastic material having high tensile strength and controlled flexibility under expansive pressure, said casing including an annular wall, a thin rigid head for said cartridge of zinc die

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casting alloy, said head including a body having an extractor rim projecting laterally therefrom and a primer positioning battery cup projecting forwardly from said body to a position within said plastic casing, a short circumferentially continuous lip extending forwardly from near the peripheral portion of said body in the direction of the wall of said plastic casing for a distance not substantially more than the maximum thickness of said plastic casing and curved over to define a reentrant flanged surface facing said body, an integral part of said plastic casing completely encasing said lip and engaging the forward face of said body in engagement with the periphery of said battery cup thereby to interlock said head and said casing, a primer in said battery cup, projectile means, and means securing said projectile means in said casing.

3. The invention as described in claim 2, wherein said battery cup is provided with a circumferentially continuous flange curved outwardly with respect to the longitudinal axis of the cartridge and in engagement with that portion of the plastic casing in engagement with the periphery of said battery cup.

4. The invention as described in claim 3, wherein said battery cup is provided with an integral anvil for cooperation with the primer.

5. The invention as defined in claim 2, wherein said lip is curved inwardly with respect to the longitudinal axis of the cartridge.

6. The invention as described in claim 5, wherein said battery cup is provided with a circumferentially continuous flange curved outwardly with respect to the longitudinal axis of the cartridge and in engagement with that portion of the plastic casing in engagement with the periphery of said battery cup.

7. The invention as described in claim 2, wherein said casing is interlocked with head by injection molding said casing with said head supported as an insert in the molding die.

8. The invention as described in claim 1, said rigid head including a thin metallic body having an extractor rim projecting laterally therefrom and a primer positioning battery cup projecting forwardly from said body to a position within said plastic casing, a short circumferentially continuous lip extending forwardly from near the peripheral portion of said body in the direction of the wall of said plastic casing for a distance not substantially more than the maximum thickness of the plastic casing and curved outwardly to define a reentrant flanged surface facing said body, an integral part of said plastic casing completely encasing said lip and engaging the forward face of said body in engagement with the periphery of said battery cup thereby to interlock said head and said casing.

9. The invention as described in claim 8, wherein said battery cup is provided with a circumferentially continuous flange curved outwardly with respect to the longitudinal axis of the cartridge and in engagement with that portion of the plastic casing in engagement with the periphery of said battery cup.

10. The invention as described in claim 9, wherein said casing is interlocked with said head by injection molding said casing with said head supported as an insert in the molding die.

11. The invention as described in claim 1, said rigid head including a thin rigid metallic body including an extractor rim and a primer positioning battery cup, said means fastening said head to said casing including connecting means defining circumferentially spaced openings in said metallic body into which integral parts of said casing are interlockingly molded.

12. The invention as described in claim 11, wherein overlay means integrally molded with said casing extend from the annular wall of said casing over the forward side of said connecting means into engagement with said battery cup.

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13. The invention as described in claim 12, said circumferentially spaced openings being defined by a plurality of evenly spaced radially extending spokelike members interconnecting said extractor rim and said battery cup, the interlockingly molded portion of said casing extending through said openings into a common plane with the face of said body remote from that portion of the casing defining the annular wall.

14. The invention as described in claim 13, said spokelike members being inclined outwardly and rearwardly from the portion of said battery cup within said plastic casing to said extractor rim to provide an annular space in surrounding relation to the rearward end of the battery cup, there being a plastic ring integral with the remainder of said interlockingly molded plastic casing within said annular space.

15. The invention as described in claim 12, wherein said circumferentially spaced openings in said metallic body are in the form of rearwardly divergent rivet holes passing through said metallic body and filled with integral portions of said casing.

16. The invention as described in claim 1, said rigid head including a disklike metallic body having an extractor rim and a primer positioning battery cup projecting forwardly from said head and a diametrically enlarged formation on and integral with the exterior of said battery cup, said means for fastening said head to said casing including an integral part of said casing overlaying and in engagement with the forwardly facing surface of said body and having an opening interlockingly engaged with the periphery of said battery cup and with said diametrically enlarged formation thereon.

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17. The invention as described in claim 16, said diametrically enlarged formation on the battery cup being formed to define a forwardly and inwardly tapered surface having at its forward end a diameter less than that of said opening in said casing and at its rearward end a diameter greater than that of said opening, whereby said battery cup with the enlarged formation thereon may be inserted into said opening and forced therethrough to have a resilient snaplike engagement with said casing, the rearward end edge of said diametrically enlarged portion being so disposed forwardly of said disklike body as to overlay and engage a portion of the inner surface of the integral part of said casing engaging said body.

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