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Hancox

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[54] **FIREARMS FOR USE IN THE HUMANE SLAUGHTERING OF ANIMALS**

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[51] **Int. Cl.²** **A22B** 3/02

[58] **Field of Search** ..... 42/1 M, 10, 15, 39.5; 17/1 B; 227/9, 10

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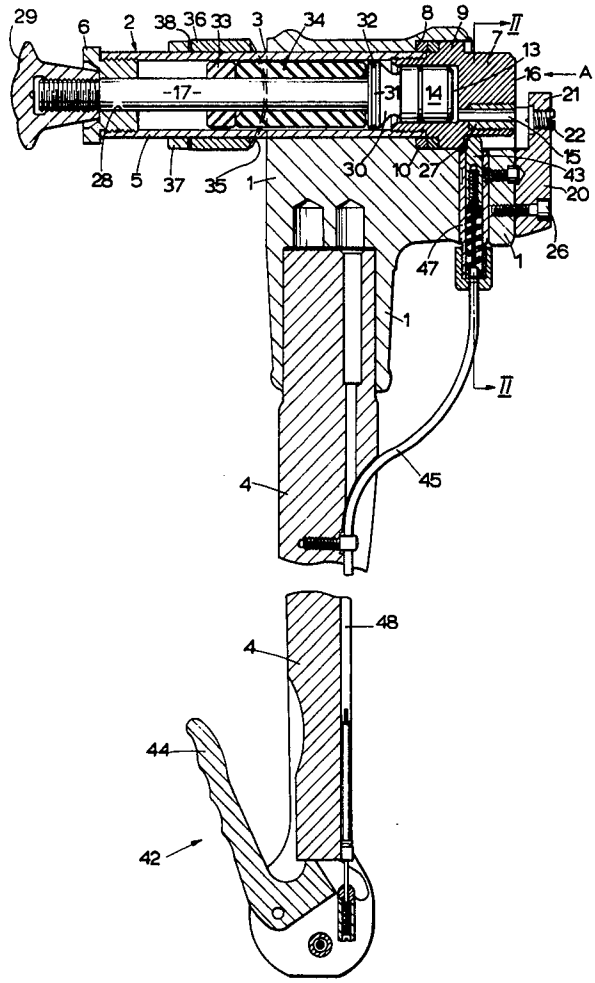
[57] **ABSTRACT**

A device for use in the humane slaughter of animals comprising a body having a stock and mounting a barrel and breech block. The barrel slidably locates a captive bolt a headed end of which protrudes from the muzzle of the barrel. The breech block is axially movable relative to the body and the bolt is axially movable relative to the breech block. The breech block is provided with a cartridge chamber for a blank cartridge and which communicates with the rear face of the block and the rear end of the barrel behind the bolt. The body supports a fixed firing pin positioned opposite to and axially spaced from the rear face of the block. In operation of the device the cartridge chamber is aligned with the pin and the block is forced rapidly rearwardly by striking the headed end of the bolt against an animals head whereupon the cartridge strikes the pin and the bolt is shot.

17 Claims, 6 Drawing Figures



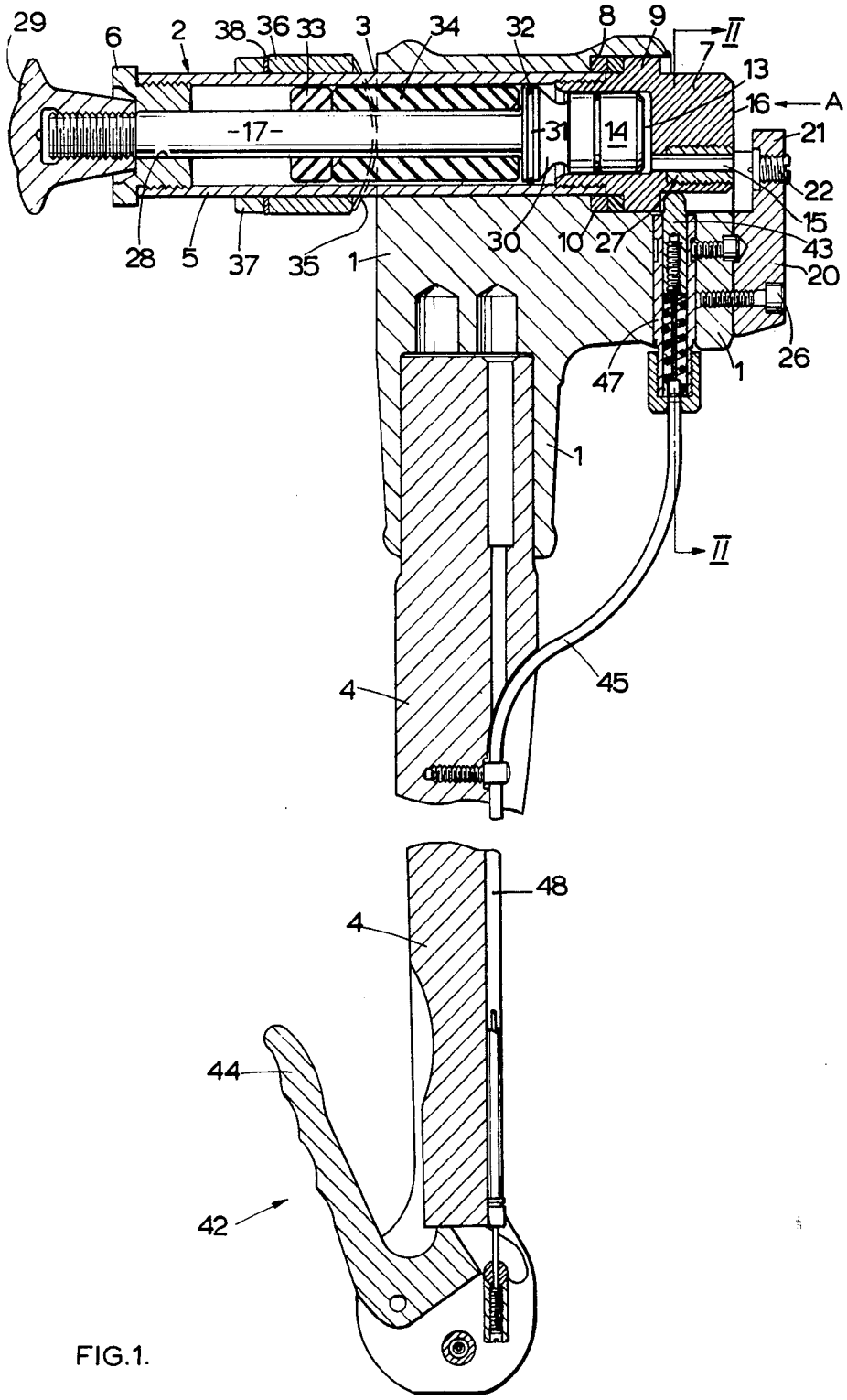

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FIG.1.

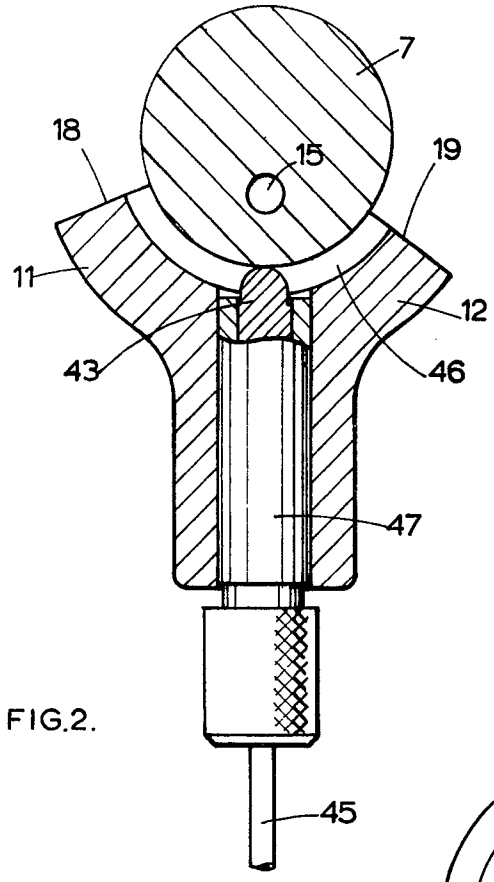

FIG.2.

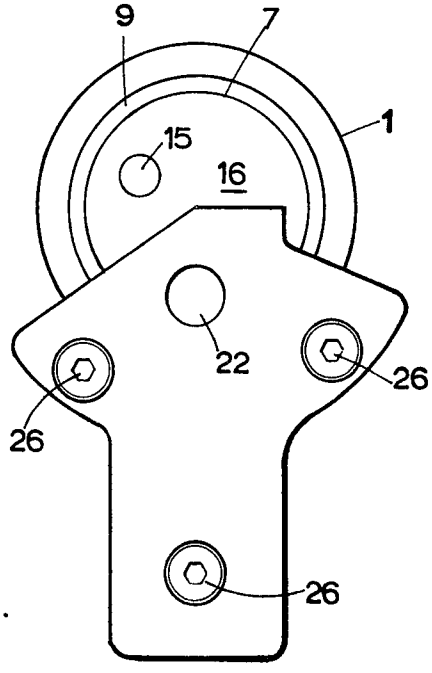

FIG.3.

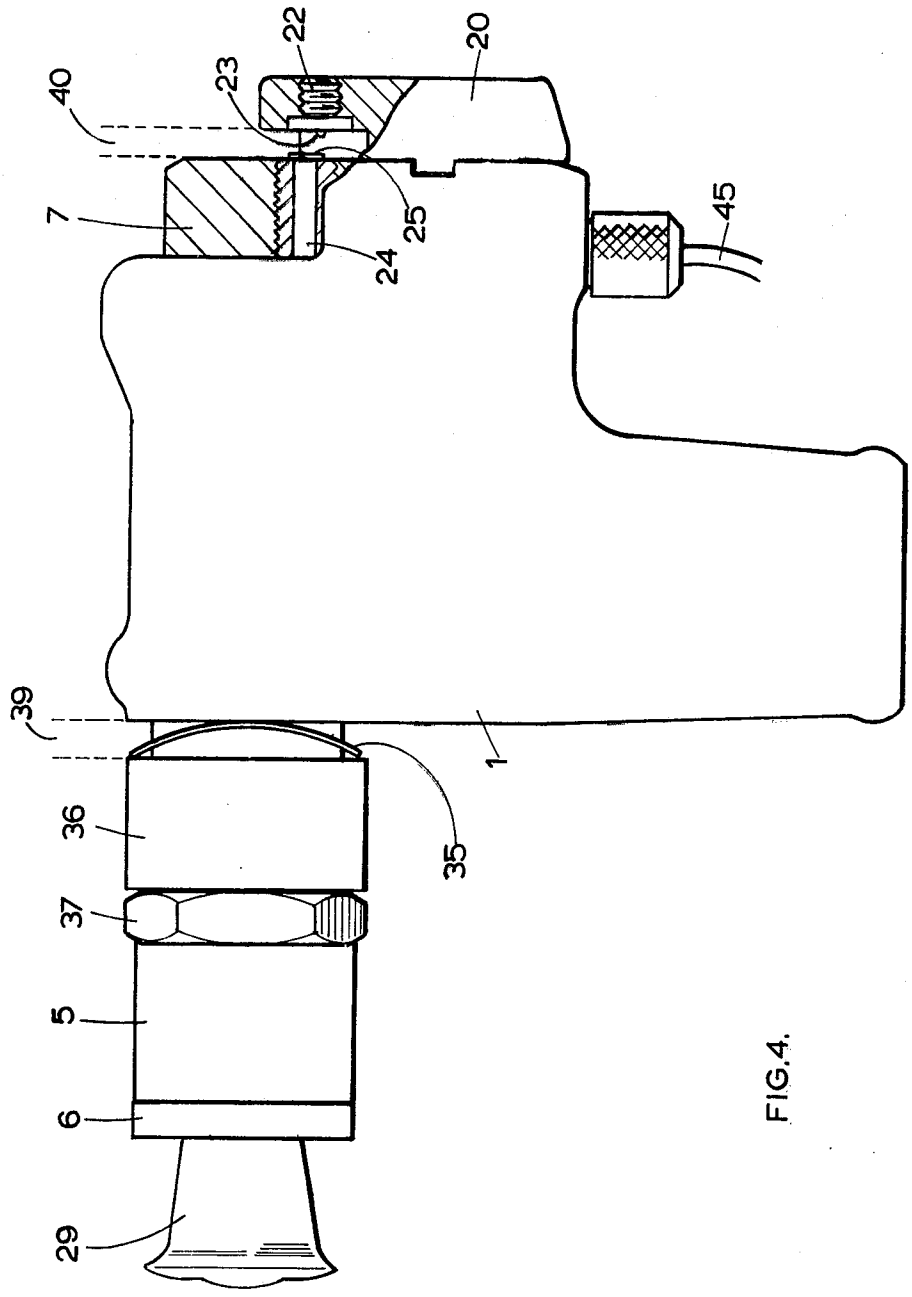

FIG.4.

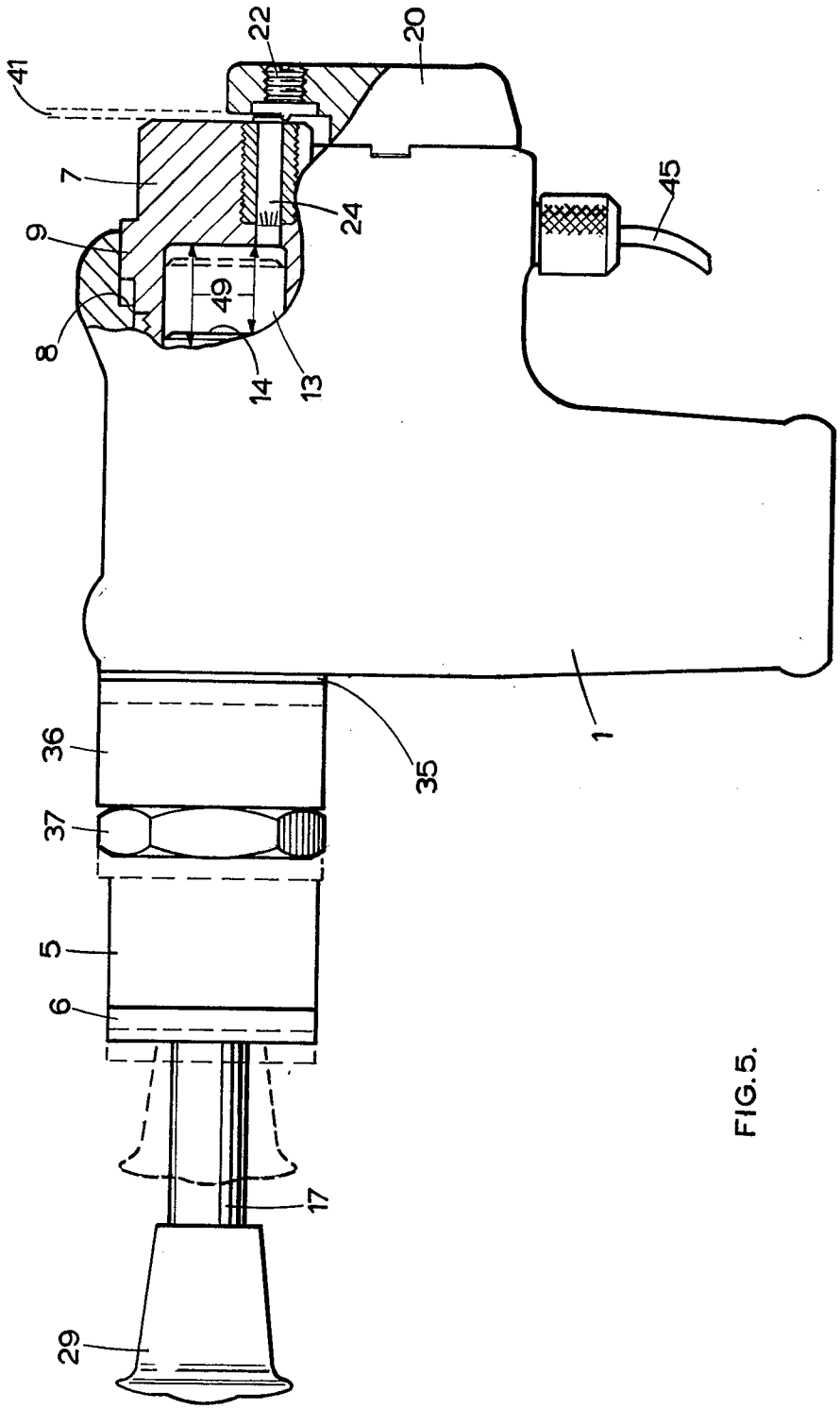

FIG.5.

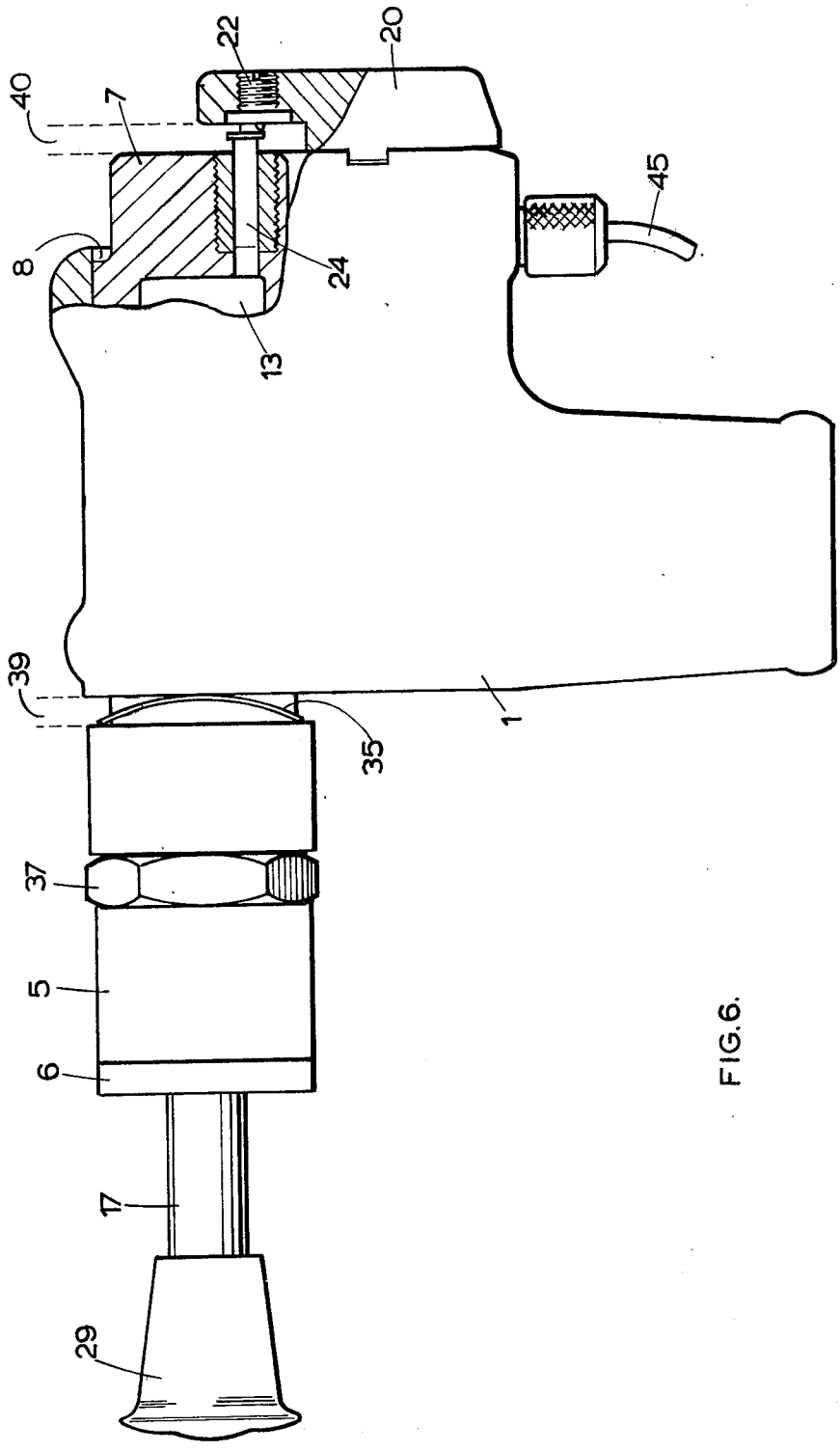

FIG.6.

FIREARMS FOR USE IN THE HUMANE SLAUGHTERING OF ANIMALS

This invention relates to devices, such as pistols of the captive bolt type for use in the humane slaughtering of animals. In devices of this type the bolt is accommodated within and co-axially of the barrel of the device and is adapted to be driven lengthwise of the barrel by an explosive force applied thereto when a blank cartridge is fired in a breech block of the device.

Known devices of this type employing movable firing pins, are often of complicated construction, and are consequently expensive to produce.

It is an object of this invention to provide a device of the type set forth herein which is of simplified construction and which could consequently be cheaper to manufacture and less prone to defects.

According to this invention from its broadest aspect we provide a device for use in the humane slaughter of animals comprising a body mounting a barrel and a stock, said barrel slidably locating a captive bolt, a breech block slidably mounted within said body rearwardly of said barrel for axial movement relative to said body, a cartridge chamber for blank cartridges in said breech block extending between a forward and a rearward face of said breech block and communicating with said barrel rearwardly of said bolt, a firing pin fixed rigidly to said body opposite the rearward end of said cartridge chamber and in a first spaced relationship to said rearward face defining the non-operative position of the device, said breech block being movable rearwardly into a second spaced relationship to said rearward face in which said firing pin is closely adjacent to said rearward face defining an operative position of the device.

Preferably, the barrel and breech block are combined as a unit which is reciprocable relative to the body.

An important new principal is embodied in this invention by which most of the impact load of the unit at the end of its rearward movement is taken on the body and not on the firing pin, or a part carrying the firing pin. Additionally, when the bolt is shot most of the recoil force is absorbed by the mass of the body and not by an appendage thereto such as the firing pin mounting.

As it is essential that the breech block is moved rearwardly to fire the cartridge there must be a gap between the breech block in its extreme forward or non operative position and the firing pin and, in order to prevent the cartridge being moved rearwardly out of the cartridge chamber and explosive gases escaping therefrom, the breech block is maintained in its rearmost or operative position during the period of the explosion. The inertia of the bolt is such that during the period of the explosion, the breech block is held in the rearmost or operative position by the explosive gases acting in a rearward direction which also act simultaneously in the opposite direction to drive the bolt forwardly.

According to the present invention from another aspect I provide a device for use in the humane slaughtering of animals comprising a body having a stock, said body mounting a barrel housing a captive bolt, wherein that end of the barrel remote from the muzzle connects with a breech block and forms a composite unit which is axially slidable within said body between a non-

operative and an operative position of the device and rotatable between a loading and a firing position, said breech block being provided with a cartridge chamber for a blank cartridge, the longitudinal axis of said chamber being substantially parallel with the longitudinal axis of said barrel, one end of said chamber opening at a rear face of said breech block and the other communicating with said barrel behind said bolt, said body supporting a fixed firing pin located opposite to and normally spaced from said rear face and positioned on a projected locus of rotation of said chamber, said bolt being axially movable within said barrel relative to said unit, first resilient means being provided for controlling axial movement of said unit whereby said unit is urged away from said firing pin into said non operative position and second resilient means for controlling axial movement of said bolt.

Preferably, the firing pin is mounted in a member which is detachably connected to the body. The firing pin may also be detachably located in the member.

The first resilient means for controlling the axial movement of the unit preferably comprises a spring which urges the unit away from the firing pin, the spring being of such thickness that in operation of the firearm when the spring is fully compressed by rearward movement of the unit there is a gap between the rear face of the breech block and the front face of the member which is substantially the same as the thickness of the spring. Preferably the firing pin is of such length that it indents the cartridge without the breech block striking the front face of the member. It is also preferable that configuration of the cartridge chamber is such that the rim of the cartridge protrudes from the end of the chamber and the said gap is approximately equal to the width of the rim of the cartridge. Conveniently, the spring may be mounted on the barrel between an abutment face formed on the body and a collar which is slidably located on the barrel. The spacing between the body and the collar is preferably adjustable. Means such as a spacing washer trapped between the collar and a threaded nut may be provided for this purpose.

In a preferred arrangement the barrel is cylindrical and the second resilient means comprises one or more cylindrical resilient buffers having a diametrical dimension slightly less than the bore of the barrel and slidably mounted on the bolt, the length of the buffer being less than the distance between an abutment provided on the rear end of the bolt and an abutment provided on the muzzle end of the barrel. Thus in use when the bolt is shot the surplus energy is absorbed by the buffer and the bolt remains protruding from the barrel.

The second resilient means may further comprise an expandible ring located on a peripheral part of the bolt in such manner that it is forced into contact with the wall of the barrel and provides sufficient friction therebetween to prevent free sliding movement of the bolt.

A spent cartridge may be extracted with the fingers once the breech has been rotated to the loading position, but may also be extracted by compressing the air within the barrel which forces the cartridge out of the breech block. This is achieved by the operator as the bolt is returned manually to its retracted position within the barrel.

Preferably, safety means are provided to lock the barrel and breech unit against inadvertent rotation and rearward movement. Such means may comprise a

spring biased plunger engageable with an abutment on, or a recess in, the breech block and actuated by means of a trigger on the grip or stock. Alternatively, the safety means may comprise a combination of two separate means, one to prevent rearward movement of the breech unit, such as the aforementioned plunger and one to prevent rotation of the unit, such as a spring biased detent.

Rotation of the breech block is preferably restricted to an arc of movement between the loading and firing positions. Conveniently, a stop is provided on the breech block which contacts abutments on the body of the device at the loading and firing positions.

A preferred embodiment of the invention will now be described by way of example only with reference to the accompanying drawings wherein:

FIG. 1 is a vertical cross sectional view of a device according to this invention taken on the centre line thereof,

FIG. 2 is a vertical cross section taken on the line II—II of FIG. 1,

FIG. 3 is a view in the direction of the arrow A on FIG. 1 showing the breech block turned to the cartridge "extraction" position,

FIG. 4 is a diagrammatical representation of the device shown in FIG. 1 illustrating a first stage in the working cycle thereof,

FIG. 5 is a similar representation to that of FIG. 4 illustrating a second stage of the working cycle, and

FIG. 6 is a similar representation to that of FIGS. 4 and 5 illustrating a third stage of the working cycle.

In this embodiment a device of the pistol type has an L-shaped body **1**, one arm of which is bored to receive a barrel and breech block unit **2** which is slidable and rotatable within the bore **3** and the other arm of which connects with an elongate grip or stock **4**. The barrel **5** comprises a cylindrical tube the front end of which is provided with a fixed muzzle member **6** screwed into the bore of the barrel and the rear end of which connects with a generally cylindrical breech block **7** which is likewise screwed into the bore of the barrel **5**. The bore **3** within which the unit is slidable is counterbored from the rear face of the body **1** to provide an annular abutment **8** which is complementary in configuration to an annular flange **9** of square section provided on the breech block. A pair of square section buffer rings **10** are inserted between the abutment **8** and flange **9** to prevent damage to the flange in use. The abutment **8** and the flange **9** limit the forward movement of the unit **2**. An exposed cylindrical end part of the breech block **7** extends from the annular flange **9** rearwardly between arcuately shaped shoulders **11** and **12** formed on the body **1** and which partially surround said end part. The cylindrical end part is of lesser diameter than the flange **9**. Thus the rear end of the unit **2** is guided within the counterbore only by the peripheral face of the flange **9** and the peripheral face of the cylindrical end part is spaced from the inside faces of the shoulders **11** and **12**.

That part of the breech block **7** which is within the body **1** is provided with a cylindrical expansion chamber **13** which is engaged by a piston **14** formed on the rear end of a captive bolt **17** when the latter is in its retracted position. The breech block **7** has a throughbore **15** communicating between the expansion chamber **13** and its rear outer face **16** to provide a cartridge chamber and gas passage which extends longitudinally of the block **7** parallel with the longitudinal axis of the barrel **5** and the bolt **17**. The cartridge chamber **15** is offset from the longitudinal axis of the block **7** and opens into the expansion chamber **13** adjacent to the side wall thereof. The end of the cartridge chamber **15** is provided with a stainless steel bush **27** to prevent wear and corrosion.

The respective upper face **18** and **19** of the arcuate shoulders **11** and **12** are inclined at an angle to each other and provide abutment faces for a projection (not shown) extending radially from the breech block which serves to limit the rotation of the unit **2** between a loading and cartridge extraction position, shown in FIG. **3** and a firing position shown in FIGS. **1** and **2**.

A stepped back plate **20** is detachably mounted by means of three socketed screws **26** on the rear face of the body **1**, the stepped portion **21** facing inwardly and extending parallel with the rear face **16** of the block **7** but spaced therefrom. A plug **22** carrying a fixed firing pin **23** is housed within a bore in the stepped part of the back plate. The firing pin **23** is so positioned that when the breech unit **2** is rotated to the said firing position the pin **23** is aligned with the longitudinal axis of the cartridge chamber **15** but outwardly offset from the mouth thereof. The mouth of the cartridge chamber defines a plain bore so that when a cartridge **24** is inserted into the chamber **15** the rim **25** thereof stands proud from the end of the chamber. The firing pin **23** protrudes from the face of the stepped part **21** of the back plate **20** be approximately the same dimension as the thickness of the rim **25** of the cartridge. The top part of the back plate **20** has angled faces of similar configuration to the arcuate shoulders **18** and **19** and thus covers a sector of the breech block **7**.

The bolt **17** together with its piston **14** is of greater length than the barrel **5** and when retracted the piston **14** is slidably supported within the breech block **7** by the bore of the expansion chamber **13** and the opposite end is supported by a bore **28** in the muzzle **6**. A bell shaped head **29** is secured to a part of the bolt protruding from the muzzle **6**. Adjacent to and forwardly of the piston **14** the bolt **17** is formed with a waisted portion **30** which flares outwardly from the end of the piston to a generally cylindrical portion around the periphery of which there is an annular groove **31**. The groove **31** locates an expansible spring ring **32** which contacts the barrel wall and supports the piston end of the bolt **17** when it moves out of the expansion chamber **13**. The ring **32** also provides sufficient frictional contact with the barrel to prevent free sliding of the bolt **17**. The spring ring **32** comprises the second resilient means hereinbefore referred to. Mounted on the narrower shank portion of the bolt which extends between the generally cylindrical portion and the muzzle **6** there are two freely slidable resilient sleeves **33** and **34** which act as surplus energy absorbers. The combined length of the two sleeves **33, 34** is approximately two thirds the distance between the rear face of the muzzle **6** and the front face of the generally cylindrical portion which form flat annular abutment faces for the sleeves. Thus, when the bolt **17** is fully extended it protrudes from the muzzle **6** by about one third of the above-mentioned distance. The sleeves **33** and **34** further comprise the second resilient means for controlling bolt movement.

Referring now to the previously mentioned first resilient means for controlling the movement of the barrel and breech block unit, this means is provided in this

embodiment by a spring washer **35** which is mounted on the outside of the barrel **5** between the flat front face of the body **1** and the rear face of a slidable collar **36.** The collar **36** can move rearwardly against the force of the spring washer **35** but is restrained from forward movement by a threaded nut **37.** A spacing washer **38** is provided on the barrel **5** trapped between the nut **37** and the collar **36.** Thus it will be understood that the spring washer **35** urges the barrel and breech block unit **2** forwardly at all times. When in its extreme forward position the annular flange **9** on the breech block **7** abuts the buffer rings **10** which in turn abut the complementary annular flange **8** in the body bore **3** and there is a gap **39** (FIGS. **4** and **6**) between the front face of the body **1** at the point where the barrel **5** extends therefrom and the rear face of the collar **36.** This gap is adjustable by means of the nut **37** and spacing washer **38** and is adjusted to be greater than the gap **40** (FIGS. **4** and **6**) between the rear face of the breech block **7** and the front face of the back plate **20** by the thickness of the spring washer **35** when the latter is fully compressed. Hence when the unit **2** is pushed back to its rearmost position and the spring washer **35** is fully compressed there remains a gap **41** (FIG. **5**) between the rear face of the breech block **7** and the back plate **20** which is equal to the thickness of the spring washer **35.** This gap **41** is also approximately equal to the amount of protrusion of the firing pin **23** from the front face of the back plate **20** and to the rim **25** of the cartridge **24** from the cartridge chamber. The size of the gaps **39, 40,** and **41** is important for reasons which will be explained hereinafter when the operation of the device is described.

The said other arm of the L-shaped body **1** extends at right angles to that arm in which the barrel and breech unit **2** is located and is approximately equal in length to said one arm. An elongate shaft comprising the grip or stock **4** which is normally held with both hands is connected to this arm and forms a co-axial extension thereof. A lever mechanism **42** for operating a safety device is mounted on the end of the stock **4.** This lever mechanism operates a spring loaded plunger **43,** which can be engaged with the rear face of the annular flange **9** formed on the breech block **7** and acts as a safety device. The plunger **43** is slidable in a bush **47** housed in a bore extending through the body **1** normally to the breech block **7.** This bore opens into the counterbored portion of the body **1** at a point intermediate the annular abutment **8** and the back plate **20** and the arrangement is such that the plunger **43** can only be engaged with the rear face of the flange **9** when the unit **2** is in the forward position. The plunger **43** is connected to a spring biased pivoted lever **44** positioned at the free end of the stock **4** by means of a Bourden cable **45** which extends between the lever **44** and the plunger **43** and actuates the plunger **43** in known manner. Conveniently, the outer extent of the cable **45** is accommodated within a recess **48** in the stock **4.** When the unit **2** is in the forward position and the lever **44** is released the plunger **43** is urged into the arcuate space **46** (FIG. **2**) between the shoulders **11** and **12** and the cylindrical end part of the breech block **7.** Thus in this position of the plunger the breech unit cannot be moved rearwardly to contact the firing pin **23.** Pressure on the lever **44** withdraws the plunger **43.**

In order to prevent inadvertent rotation of the barrel and breech unit **2** the periphery of the annular flange **9** is formed with two grooves (not shown) extending parallel to the axis of the block and circumferentially spaced apart. These grooves can be contacted by a spring loaded detent (not shown) which slidably locates the block **7** in either the "firing position.", as shown in FIGS. **1** and **2** or the "cartridge extraction position" as shown in FIG. **3.** The detent comprises a spring loaded steel ball which is housed in a radial bore extending through the body **1** forwardly of the bore housing the bush **47.** The detent can be over-ridden by the operator when desired.

In operation of the device, the bolt **17** is first pushed inwardly to a position where the head **29** abuts the muzzle **6** and there is a relatively small space between the rear face of the piston **14** and the rear wall of the expansion chamber **13.** Thus most of the air or residual gas is displaced and expelled from the expansion chamber **13** through the cartridge chamber **15.** The barrel and breech block unit **2** is then rotated manually to the "load" position in which the end of the cartridge chamber **15** is exposed and the operator is able to insert a cartridge, the rim of which stands proud of the end of the breech block. The load and "extraction" positions are one and the same. The unit **2** is then rotated in the reverse direction into the "firing" position (FIGS. **1** and **2**) in which the end of the cartridge chamber **15** is aligned with the firing pin **23.** As will be understood from the earlier detailed description, in this position there is a gap **40** between the firing pin **23** and the end of the cartridge **24** which is slightly les than the width of the afore-mentioned spring washer **35** when uncompressed. The safety device **43** is automatically applied all the time the lever **44** is released.

When the plunger **43** of the safety device is disengaged by actuating the lever **44** and the head **29** of the bolt **17** is tapped against the animals head from a distance of about 6 inches the unit **2** moves rearwardly and the rim of the cartridge **24** is forced against the fixed firing pin **23** and explodes. The shock of this rearward movement is taken on the front face of the body **1** as the spring washer **35** is compressed against it by the barrel collar **36.** The unit **2** moves rearwardly just sufficiently for the firing pin to indent the cartridge but does not strike the backplate **20.**

As the cartridge **24** explodes and the gases therefrom expand within the expansion chamber **13,** the gas pressure acts in both rearward and forward directions simultaneously, as indicated by the arrows **49** in FIG. **5,** with equal force. The unit **2** cannot move any further rearwardly because it is prevented from doing so by the compressed spring washer **35.** Consequently, the bolt **17** is forced rapidly forwards and there is an equal and opposite reaction force or recoil which is again taken on the front face of the body **1** and not the back plate **20.** The inertia of the bolt **17** is such that the unit **2** is held in a "breech closed" or rearmost position during the period of the explosion which is only a fraction of a second. Thus as the gap **41** between the end face of the breech block **7** and the front face of the back plate **20** at this time is equal to the rim thickness of the cartridge **24** the gases cannot force the cartridge **24** rearwardly out of the cartridge chamber **15** with the possibility of a flashback and malfunctioning of the firearm. After firing and the return of the unit **2** to its forward or non-operative position (FIG. **6**) under the force of the spring washer **35** residual gas pressure will partially extract the empty cartridge case from the cartridge

chamber **15**. After the operator has rotated the unit to the load position he may extract the case **24** with his fingers. Alternatively, he may extract the case by pushing the bolt **17** to its rearmost position thus compressing the air within the barrel **5** which completely extract the case from the chamber **15**.

It will be appreciated that several modifications are possible and within the scope of the invention. For example, the breech block may include more than one cartridge chamber radially equi-distant from the axis of the breech block, and further grooves could then be provided in the flange **9** on the breech for locating the unit **2** in the required number of positions. Similarly, other types of safety device may be utilized.

Although the embodiment described relates to a captive bolt device in which a headed bolt protrudes from the end of the barrel and is fired by tapping the bolt against the animals head, this is not an essential feature. The bolt may be shorter than the barrel and in such modified form the device is fired by striking the end of the barrel, or a sleeve attached thereto and protruding beyond the end of the bolt, against the animals head. In such modified form the bolt may be returned manually or by a spring.

The invention also lends itself to poleaxe type devices provided with a penetrating bolt.

I claim:

1. A device for use in the humane slaughter of animals comprising a body mounting a barrel and a stock, said barrel slidably locating a captive bolt, a breech block slidably mounted within said body rearwardly of said barrel for axial movement relative to said body, a cartridge chamber for blank cartridges in said breech block extending between a forward and a rearward face of said breech block and communicating with said barrel rearwardly of said bolt, a firing pin fixed rigidly to said body opposite the rearward end of said cartridge chamber and in a first spaced relationship to said rearward face defining the non-operative position of the device, said breech block being movable rearwardly into a second spaced relationship to said rearward face in which said firing pin is closely adjacent to said rearward face defining an operative position of the device.

2. A device as claimed in claim **1** wherein said barrel and said breech block are substantially cylindrical in configuration and are joned co-axially as a composite unit reciprocable and rotatable within said body, said unit being rotatable between a loading position in which said cartridge chamber is exposed for inserting a cartridge and a firing position in which said cartridge chamber is aligned with said firing pin.

3. A device as claimed in claim **2** including stop means for arresting rearward movement of said unit in said operative position, said stop means comprising cooperating abutments on said unit and said body remote from said firing pin.

4. A device as claimed in claim **3** further including mounting means detachably mounting said firing pin to said body, said mounting means having a front face directly opposite said rearward face, said firing pin protruding from said front face and being positioned on a projected locus of rotation of said cartridge chamber, said abutments being so positioned that in said operative position there is a gap between said front face and said rearward face.

5. A device as claimed in claim **4** wherein said cooperating abutments comprise an annular face formed on said barrel and a substantially flat part of said body adjacent to said annular face, first resilient means being disposed between said abutments urging said unit towards said non-operative position.

6. A device as claimed in claim **5** wherein said annular face comprises a collar adjustably mounted on said barrel and said first resilient means comprises a spring washer, the axial dimension of said washer in the unstressed state being substantially equal to said first spacing and in the fully stressed state substantially equal to said gap and to the extent of protrusion of said firing pin from said front face.

7. A device as claimed in claim **6** wherein at least the rearward end of said cartridge chamber is defined by a plain bore which opens to said rearward face normally, and the internal configuration of said bore is such that it slidably receives the body of a cartridge but prevents the rim thereof from entering said bore.

8. A device as claimed in claim **7** wherein the inertia of said bolt is such that in use said unit is held in said operative position during the period of the explosion by means of gas pressure acting rearwardly on said unit.

9. A device for use in the humane slaughtering of animals comprising a body having a stock, said body mounting a barrel housing a captive bolt, wherein that end of the barrel remote from the muzzle connects with a breech block and forms a composite unit which is axially slidable within said body between a non-operative and an operative position of the device and rotatable between a loading and a firing position, said breech block being provided with a cartridge chamber for a blank cartridge, the longitudinal axis of said chamber being substantially parallel with the longitudinal axis of said barel, one end of said chamber opening at a rear face of said breech block and the other communicating with said barrel behind said bolt, said body supporting a fixed firing pin located opposite to and normally spaced from said rear face and positioned on a projected locus of rotation of said chamber, said bolt being axially movable within said barrel relative to said unit, first resilient means being provided for controlling axial movement of said unit whereby said unit is urged away from said firing pin into said non-operative position and, second resilient means for controlling axial movement of said bolt.

10. A device as claimed in claim **9** wherein said firing pin is secured in a mounting detachably connected to said body and extends towards said rear face from a front face of said mounting, said unit being manually movable between said non-operatiive position and said operative position in which said rear face is closely adjacent to said front face, abutment means being provided on said unit and said body for preventing contact between said front face and said rear face.

11. A device as claimed in claim **10** wherein said abutment means comprise an annular face on said barrel and a flat part of said body opposite and adjacent to said annular face and said first resilient means comprise a spring washer disposed between said annular face and said flat part.

12. A device as claimed in claim **11** wherein said abutment means comprise a collar slidably mounted on said barrel.

13. A device as claimed in claim **12** wherein said collar is adjustably located on said barrel.

14. A device as claimed in claim **11** wherein the thickness dimension of said washer when fully com-

pressed between said annular face and said flat part in said operative position of the device is such that there is a gap between said rear face and said front face which is substantially equal to the thickness of said washer and the extent of protrusion of said firing pin from said front face.

15. A device as claimed in claim **9** wherein said second resilient means comprise an expandible ring located on a peripheral part of said bolt within the barrel, said ring being in contact with the wall of said barrel and providing sufficient friction therebetween to prevent free sliding of said bolt.

16. A device as claimed in claim **9** further including stop means for preventing inadvertent rearward movement of said unit.

17. A firearm as claimed in claim **16** wherein said stop means comprises a spring biased plunger engageable with an abutment formed on said breech block, said plunger being operably connected to a lever mounted on said stock whereby manual pressure on said lever frees said unit for rearward movement.

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