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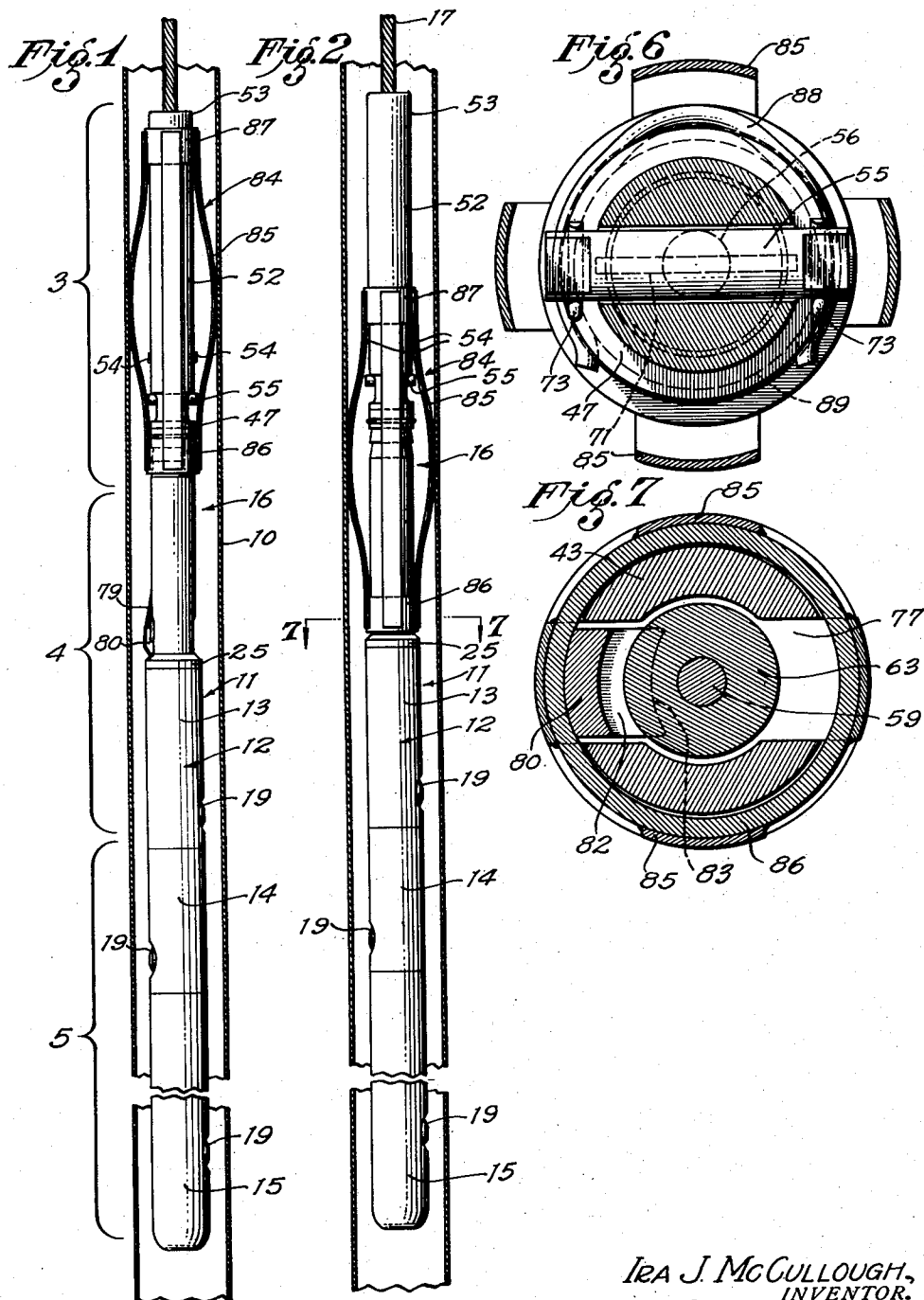
I. J. McCULLOUGH

2,218,802

GUN PERFORATOR

Filed Feb. 27, 1939

3 Sheets-Sheet 1



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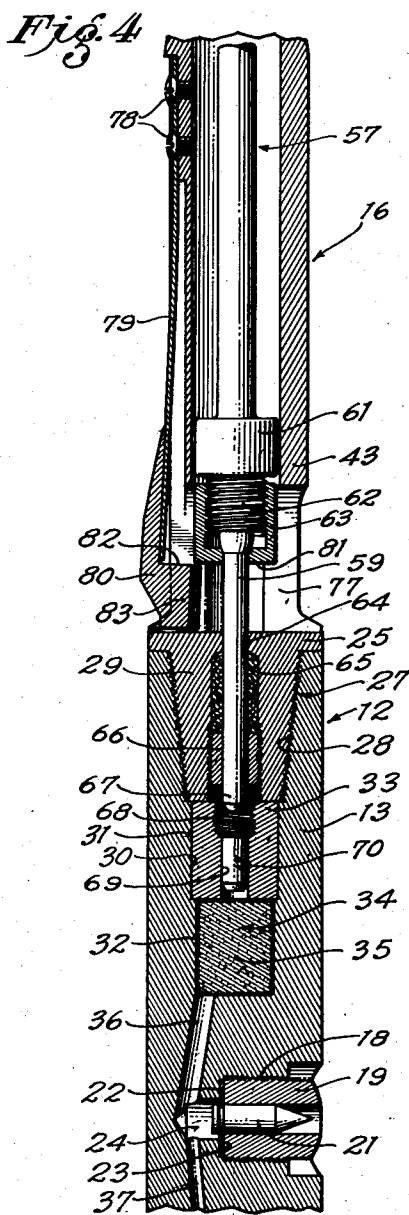
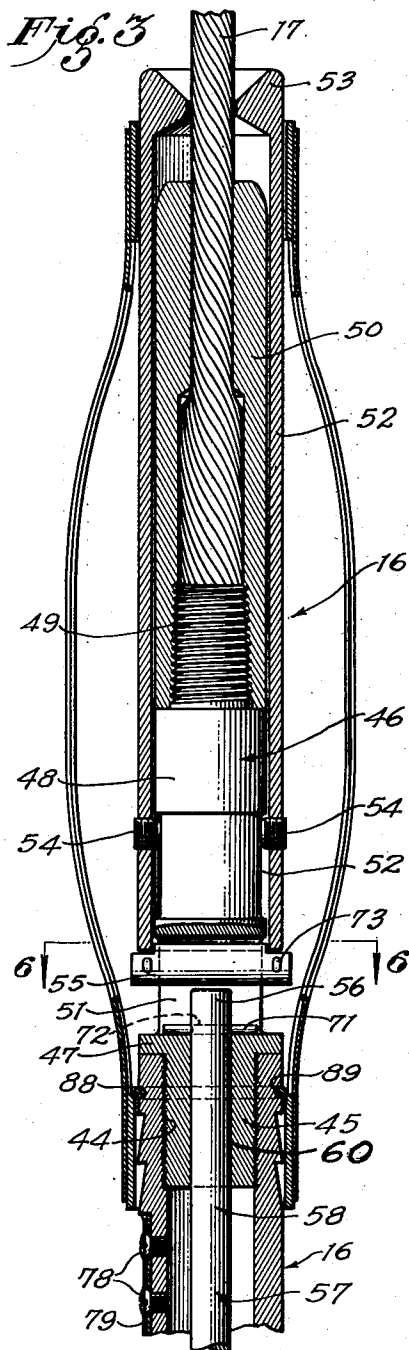
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GUN PERFORATOR

Filed Feb. 27, 1939

3 Sheets-Sheet 2



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Oct. 22, 1940.

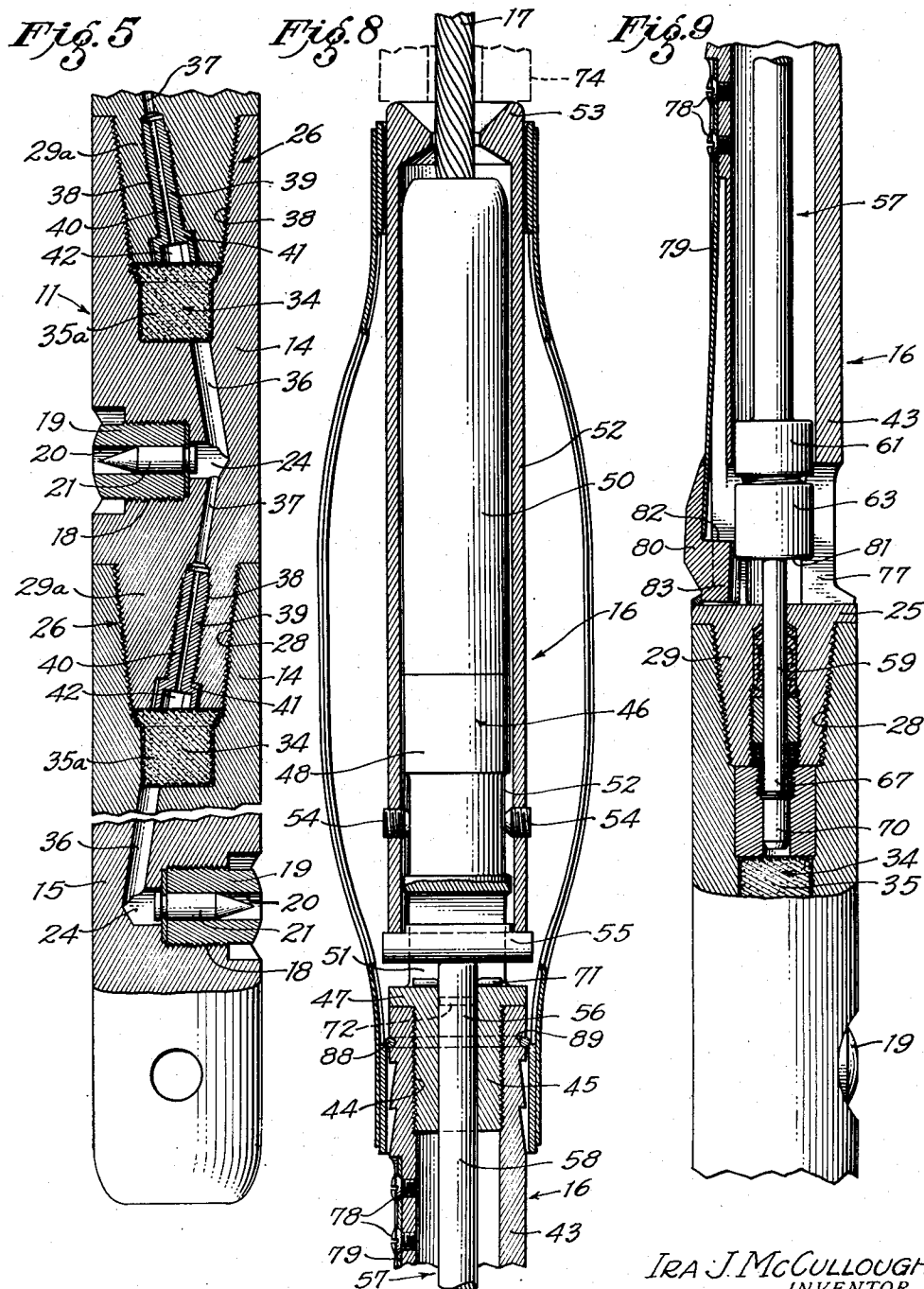
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GUN PERFORATOR

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3 Sheets--Sheet 3



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2,218,802

GUN PERFORATOR

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Application February 27, 1939, Serial No. 258,606

22 Claims. (Cl. 164—0.5)

My invention relates to guns of the type adapted to be lowered into a well casing wherein the firing of the gun will drive projectiles out through the wall of the casing to perforate the same, and for the same general purpose and use as the inventions of my copending applications entitled Method and apparatus for perforating well casing, Serial No. 80,548, filed May 19, 1936, and Gun perforator, Serial No. 129,624, filed March 8, 1937. It relates in particular to improvements in perforating guns of this general character to enable the making of a gun of such small diameter that it may be employed in small diameter casing.

It is an object of the invention to provide a perforating gun having a gun body of small diameter, yet with gun bores of such lengths that sufficient projectile velocity will be attained to readily accomplish penetration of the casing wall.

It is also an object of the invention to provide a perforating gun wherein the firing powder chamber for the explosive is placed to one side of the gun bore, or, in other words, is offset from the gun bore in the direction of the axis of the gun body so that a maximum portion of the diameter of the gun body may be utilized for the gun bore which receives the projectile. By this expedient the gun bore is given sufficient length to assure ample muzzle velocity for the projectile so that it will readily penetrate the wall of the casing.

It is a further object of the invention to provide a perforating gun having a body so formed that the explosive charges and the projectiles may be readily placed and replaced to charge and recharge the gun.

It is a further object of the invention to provide a perforating gun wherein the gun body is formed by a plurality of body sections secured together in end to end relation, with the powder chambers so placed as to be exposed for charging when the gun body sections are disconnected, and which powder chambers are closed when the sections are secured together in end to end relation.

It is a further object to provide a perforating gun having simple and effective means whereby an ignition flame may be carried from one powder chamber to another without material loss of explosive force or pressure resulting from the firing of explosive charges in the powder chambers.

It is a further object of the invention to provide a perforating gun of the general character hereinbefore described wherein the explosive

charges in the powder chambers are fired by flames which pass through ignition passages and wherein such passages are provided with restraining means to minimize the loss of explosive force or pressure through the ignition passages.

It is a further object of the invention to provide a perforating gun having a simple form of firing means which is positive in its operation and which is so formed that the parts which are deteriorated in the operation of the gun may be readily replaced.

A further object of the invention is to provide an improved lock for the firing means automatically operative to prevent inadvertent or accidental operation of the firing device during the time the gun is being manipulated in the well.

A further object of the invention is to provide a gun body having a suspension means extended upwardly therefrom, this extension having a firing pin in the lower part thereof and an anvil supported on the upper portion thereof in position to be struck by a hammer which descends from the top of the well along the cable by which the perforating gun is suspended, locking means for the firing device disposed in the lower portion of the extension, and an actuating means for the locking means which is slidable on the upper and lower portions of the extension and is positioned so as to surround and protect exposed parts of the firing device.

Further objects and advantages of the invention will be brought out in the following part of the specification.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a partly sectioned fragmentary view showing a preferred form of my perforating gun being lowered into a casing.

Fig. 2 is a view similar to Fig. 1 showing the gun being raised in the casing.

Fig. 3 is an enlarged fragmentary section of the portion of the device indicated at 3 in Fig. 1.

Fig. 4 is an enlarged fragmentary section of the succeeding portion of the device indicated at 4 in Fig. 1.

Fig. 5 is an enlarged fragmentary section of the portion of the device indicated at 5 in Fig. 1.

Fig. 6 is an enlarged cross-section taken substantially on the plane indicated by the line 6—6 of Fig. 3.

Fig. 7 is an enlarged fragmentary section on the plane indicated by the line 7—7 of Fig. 2.

Fig. 8 is a sectional view similar to Fig. 3, but showing the positions of the parts after actuation of the firing device of the perforator gun.

Fig. 9 is a fragmentary section similar to Fig. 4 showing the position of the firing pin after actuation of the firing device.

In Fig. 1 I show the well casing 10 with a perforating gun 11 therein. This gun 11 is described as having a gun body 12 comprised of an upper gun body section 13, a plurality of intermediate gun body sections 14, and a lower gun body section 15. The upper part of the gun 11 is referred to as a suspension means 16 for the gun body 12, this suspension means 16 projecting upward from the body 12 and having a cable 17 secured thereto, by which the perforating gun 11 may be moved in the casing 10 to a desired position for firing.

As best shown in Fig. 4, the upper body section 13 comprises a bar of durable metal, such as alloy steel, having a threaded opening 18 leading in from a side thereof to receive a threaded gun barrel 19 having a gun bore 20 in which a bullet or projectile 21 is placed, this projectile 21 carrying near its rear or inner end a metal collar 22 which serves as a shearable or separable flange for the projectile. At the bottom of the threaded opening there is a radial shoulder 23, and communicating with the inner end of the opening 18 there is a recess 24 in centralized relation to the inner end of the bullet 21.

The upper end of the body section 13 is connected to the lower portion 25 of the suspension means 16 by means of a pin and box joint 27, the upper end of the section 13 having a threaded box 28 which receives a threaded pin 29 formed on the lower end of the portion 25. Extending downward from the box 28 there is an opening 30 having an upper section 31 and a lower section 32, the upper section 31 being of larger diameter than the lower section 32 and receiving a body or plug 33 which essentially closes the lower section 32 to form a powder chamber 34 in which a charge of explosive 35 is placed. A passage 36 connects the powder chamber 34 with the recess 24 to transmit to the rear end of the bullet 21 the explosive force or pressure resulting from the firing of the charge 35 in the chamber 34.

As shown in Fig. 5, the gun body sections 14 and 15 are joined in consecutive order to the upper section 13 by means of pin and box joints 26, the sections 13 and 14 each having a threaded pin 29a projecting down from the lower ends thereof, and the sections 14 and 15 having a threaded box 28 at the upper end thereof to receive the pin of the upper adjacent section. Like the upper section 13, the sections 14 and 15 each have a laterally extended gun bore 20 preferably formed by a barrel 19 which is threaded into an opening 18. At the inner end of each gun bore 20 there is a recess 24 connected by a passage 36 with a powder chamber 34 formed at the inner end of a threaded box 28.

Means are provided whereby heat and pressure resulting from the firing of a charge in one of the chambers 34 will result in the firing of these charges in the remaining chambers. For example, the firing of the explosive charge 35 in the upper chamber 34, Fig. 4, will result in the firing of the charges in the remaining chambers 34, Fig. 5. To accomplish this purpose I provide ignition passages which serially connect the consecutive powder chambers 34. As shown in Figs. 4 and 5 such ignition passages include the passages 36 and passages 37 which extend downward

from the recesses 24 of the sections 13 and 14 through the threaded pins 29a of such sections. Each passage 37 has an enlarged threaded section 38 to receive a restraining means 39 comprising a threaded member having an orifice 40 of small diameter and considerable length through which the heat and pressure, or ignition flame, from the firing of a charge in one chamber 34 is transmitted to the charge in the next lower chamber 34. The restraining means 39 is replaceable 10 and for this purpose has a head 41 suitably prepared, as with a socket 42, to receive a wrench. Replaceability of the restraining means 39 is important in the practice of the invention, for the following reason. The passage 40 must be only 15 of such diameter that it will permit flame and pressure to pass therethrough to ignite the associated succeeding firing powder charge in a chamber 34, and it must be of such limited diameter that there will be only a relatively small escape of pressure therethrough when the firing powder charge is ignited. After a period of use this passage 40 burns out to larger diameter so that its effectiveness as a restraining means is reduced, and so that the operation of the gun will 25 be maintained at high efficiency the restraining means 39 are replaced whenever the openings 40 therethrough have become enlarged to a predetermined maximum value.

When the charge 35 in the upper powder chamber 34 is ignited, by means which will be hereinafter described in detail, the combustion products therefrom pass down through the passage 36, Fig. 4, to the recess 24 to discharge the bullet 21, and some of these superheated combustion products 35 pass down through the passage 37 to the charge 35a, such ignition gases or flame being under restraint of the orifice 40 of the restraining member 39 which is disposed between the charges 35 and 35a. The passage of the ignition flame, or pressure, or both to the charge 35a results in the ignition thereof, and the products of combustion resulting from this ignition pass principally downward through the associated passage 36. A small proportion of the combustion products will pass upward from the charge 35a through the orifice 40 of the restraining means 39 placed directly thereabove, but the restraining effect of the orifice 40 is such that the loss of combustion products therethrough is kept relatively small 50 and accordingly does not materially affect the discharge of the bullet 21 from the gun bore 20 which is directly associated with the charge of explosive 35a. In accordance with the foregoing explanation, the ignition effect is carried downward from one powder chamber to the next, with the result that all of the bullets 21 are discharged from the gun. Each restraining means 39 serves in dual capacity. For example, when the charge 35 shown in Fig. 9 is fired, the restraining means 60 39 positioned therebelow protects the succeeding charge 35a, Fig. 5, from the full force of the explosion of the charge 35. The passage 40 of such restraining means merely permits an ignition flame and pressure to pass to the charge 35a to 65 ignite the same. When this charge 35a is thus ignited the restraining means 39 thereabove serves to prevent undue loss of explosive pressure in upward direction. Accordingly, the restraining means 39 acts to restrain a firing charge against 70 its back pressure and against the explosive force of another firing charge.

The lower portion 25 of the suspension means 16 has a tubular portion 43 projecting upward therefrom, with internal threads 44, Fig. 3, at 75

the upper end thereof to receive a threaded projection 45 on the lower end of the upper section 46 of the suspension means 16. The upper section 46 includes a flange 47 which rests against the upper end of the tubular wall 43 and an essentially cylindrical body 48 above the flange 47, this body 48 having a threaded pin 49 projecting therefrom to receive a cable socket 50 by which the cable 17 is secured to the suspension means.

Directly above the flange 47, the body 48 has a diametral, vertically elongated opening 51, and above the opening 51 there is a shallow depression or channel 52' of annular form in the body 48. Slidable on the upper portion of the body 48 and the cable socket 50, I provide a tubular member 52 which is referred to as the anvil for the reason that it is adapted to be struck, by a tubular weight which is dropped down the cable 17 so as to strike the upper end 53 of the member 52 and to be thereby driven forcibly downward to accomplish the result of actuating the firing means of the perforating gun. The anvil 52 may be considered as forming a part of the structure of the suspension means 16, although it has limited movement relative to the remaining parts. To limit the upward movement of the member 52, it is provided with screws 54, threaded through the lower portion thereof into engagement with the bottom wall of the annular channel 52'. It is preferable to set these screws 54 tightly against the bottom wall of the channel 52' so that the pressural engagement thereof with the body 48 will hold the member 52 in raised position during the lowering of the perforating gun into the well.

When the anvil 52 is driven downward, the movement thereof is transmitted through a removable crossbar 55 to the upper end 56 of a firing pin 57, which extends through the lower section 25 of the suspension means 16 and through the threaded pin 29 thereof. The firing pin 57 comprises an upper part 58, which is a permanent part of the perforator gun, and a lower replaceable part 59 of smaller diameter. The permanent part 58 of the firing pin 57 extends through an opening 60 in the threaded projection 45 and on its lower end has a guide head 61 which is slidable in the lower part of the tubular portion 43. This head 61 has a threaded portion 62 to receive a threaded inverted cup 63 by which the replaceable pin part 59 is connected to the permanent firing pin part 58.

The threaded pin 29 of the joint 27, Fig. 4, has an opening 64 through which the firing pin part 59 passes, this opening 64 being provided with packing means 65 compressed by a gland 66 which threads into the lower part of the pin 29. The lower end 67 of the member 59 is sharpened, and is positioned so as to project into a threaded counterbore 68 formed in the removable block 33, to hold in the opening 69 of this block 33 an igniting device 70 which may consist of a powder-charged cartridge positioned so that the discharge therefrom will be directed downward against the charge 35 placed in the upper firing powder chamber 34. The firing pin 57 is normally held in raised position, as shown in Figs. 3 and 4, by means of a shear pin 71 which is passed through an opening 72 near the upper extremity of the firing pin part 58 and in a position to rest against the upper face of the flange 47. During transportation and handling of the perforator gun, the crossbar 55 is removed from the position in which it is shown in Fig. 3 so that at this time there will be no connection between

the lower end of the anvil 52 and the upper end 56 of the firing pin 57. When the perforator gun is in position to be lowered into the well casing, the crossbar 55 is placed in operative position, and the cotter pins 73, Figs. 3 and 6, may be placed in the ends thereof adjacent the ends of the lateral opening 51, to secure the crossbar 55 against removal.

When it is desired to fire the gun, a tubular weight or hammer is placed on the upper portion of the cable 17, and is released so that it will drop along the cable 17 and strike against the upper end 53 of the anvil 52, as indicated by dotted line 74 in Fig. 8, the impact of this hammer against the anvil 52 driving the same downward to a position such as shown in Fig. 8, forcing the crossbar 55 downward and transmitting movement to the firing pin 57, to shear the pin 71, and drive the lower sharpened end 67 of the firing pin part 59 down against the cartridge 70, as shown in Fig. 9. The flash of the cartridge 70 will ignite the upper charge 34 and each consecutive charge will be ignited through the ignition passages which serially connect the powder chambers of the device. After removal of the gun from the well, the pin and box joints 27 and 26 may be broken, exposing the powder chambers so that they may be recharged. The gun barrels 19 may be unscrewed from the threaded opening 18 so as to be recharged with projectiles 21. After a number of operations of the device it will be found necessary to replace the restraining members 39 because of the burning out which produces an enlarging of the orifices 40 thereof.

As clearly shown in Figs. 4 and 7, the lower portion 25 of the suspension means 16 has a lateral opening 77 positioned above and close to the threaded pin 29. This opening 77 provides access to the cup 63 which may be regarded as a removable portion of the head 61 for raising the same and for inserting a new shear pin 71. Screws 78, near the upper end of the tubular wall 43, secure the upper end of a leaf spring 79 which extends downward along the tubular wall 43 and has a dog 80 secured thereto in a position to project into the lower part of the opening 77. When the firing pin 57 is supported in raised position by the shear pin 71, the lower face 81 of the cup 63 will be in a plane above the upper face 82 of the dog 80 so that inward pressure against the dog 80 will move the same into a position, such as shown in Fig. 7, wherein the inner portion 83 of the dog 80 will lie under the cup 63 so as to prevent downward movement of the firing pin 57. The lock thus provided, is automatically operated when the gun is moved upward in the well as the result of the relative movement of a resilient engager or drag 84 which, as shown in Figs. 1 and 2, has bow springs 85 which resiliently engage and drag along the wall of the casing 10. The lower ends of the bow springs 85 are connected to a sleeve 86 which is slidable on the lower portion of the suspension means 16, and the upper ends of the bow springs 85 are connected to a sleeve 87 which surrounds the upper portion of the suspension means 16, such sleeve 87 being freely slidable on the anvil 52. After the engager 84 is placed on the gun, so that the lower sleeve 86 thereof surrounds the tubular portion 43, an upper stop is placed at the upper end of the tubular portion 43 to limit the upward movement of the engager 84. Such stop may consist, as shown in Figs. 3 and 6, of a U-shaped spring clip 88 which is snapped into a cir-

cumferential groove 89 formed in the tubular wall near the upper end thereof.

When the perforating gun 11 is being lowered in the casing 10, as shown in Fig. 1, the engager 84 will be in raised position with the lower sleeve 86 in engagement with the stop 88 and also in a position above the upper end of the spring 79, as shown in Fig. 3. Should it become necessary to raise the gun 10 without having first fired the same, upward movement of the gun 11 resulting from a pull on the cable 17 will move the suspension means 16 upward through the engager 84 so as to cause the engager 84 to assume the position thereof shown in Fig. 2. The sleeve 86, in moving relatively downward into the position in which it is shown in Fig. 2, will force the spring 79 inward and will ride into a position surrounding the dog 80 so as to force this dog 80 inward to a position such as shown in Fig. 7, wherein it will be positioned to lock the firing pin 57 against downward movement. When the firing device is thus locked, there will be no danger of inadvertent discharge of the gun as it is lifted from the well.

I claim as my invention:

1. In a well perforating gun of the character described, the combination of: a body having a plurality of gun bores with projectiles therein, firing charge chambers communicating with the ends of said gun bores, and passages serially connecting said firing charge chambers, there being restraining means in said passages between said firing charge chambers; firing charges in said firing charge chambers; and means to effect a firing of a firing charge in at least one of said firing charge chambers, said restraining means each being so formed and placed as to serve to conduct products of explosion from the firing of a charge in one of said chambers to ignite the firing charge in the next succeeding firing charge chamber, and to restrain loss of explosion products from the associated firing charge which has been fired.

2. In a well perforating gun of the character described, the combination of: a gun body having a plurality of gun bores with projectiles therein, firing charge chambers connected to the inner ends of said gun bores, a separate firing charge isolated in each of said firing charge chambers, means for effecting a firing of at least one of said firing charges, and means serially connecting said firing charge chambers, said last named means each comprising a passage through which the products resulting from the firing of a firing charge on one side thereof will pass to the firing charge on the opposite side thereof to effect a firing of the same, and each of said last named means restraining the reverse flow of explosion products from a firing charge chamber associated therewith.

3. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a body comprising a plurality of sections having means for connecting them in end to end relation, each of said sections having means forming a gun bore to receive a projectile, a powder chamber connected to the inner portion of said gun bore, and firing duct means for exploding a charge in said powder chamber, said firing duct means being operatively connected when said sections are connected in end to end relation.

4. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body comprising a plurality of sections with associated means for connecting them in end

to end relation; each of said sections having a means forming a gun bore to receive a projectile, a powder chamber axially offset from said gun bore, and a passage connecting said powder chamber with the inner end of said gun bore; and means operative to fire the charges in said powder chambers.

5. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a body of relatively small diameter having means to form therein a gun bore the outer end of which communicates with the side wall of said body, a powder chamber spaced axially from said gun bore, and a passage connecting said powder chamber and the inner end of said gun bore; and means to explode a charge in said powder chamber.

6. In a perforating gun of the character described, the combination of: a plurality of body sections connected in end to end relation, certain of said body sections which are connected in consecutive order having a lateral gun bore to receive a projectile, a firing charge chamber having communication with the inner end of said gun bore and firing means for firing a charge in said firing charge chamber, said firing means being disconnected when said body sections are disconnected and being connected for operation when said body sections are connected; and a plurality of projectiles, one each of which is disposed in one of said gun bores.

7. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a plurality of gun body sections with means for securing said sections in end to end relation; certain of said sections each having means forming a gun bore extending out through a side wall thereof and a powder chamber formed in an end thereof and communicating with the inner portion of said gun bore, there being wall means positioned to close the outer end of said chamber when said sections are connected in end to end relation; and means for firing charges in said powder chambers.

8. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a plurality of gun body sections with means for securing said sections in end to end relation, certain of said sections each having means forming a gun bore extending out through a side wall thereof and a powder chamber formed in an end thereof and communicating with the inner portion of said gun bore, there being wall means positioned to close the outer end of said chamber when said sections are connected in end to end relation; means for firing a charge in a selected one of said powder chambers; and means connecting said selected chamber to other of said chambers to explode charges therein.

9. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a plurality of gun body sections with means for securing said sections in end to end relation, certain of said sections each having means forming a gun bore extending out through a side wall thereof and a powder chamber formed in an end thereof and communicating with the inner portion of said gun bore, there being wall means positioned to close the outer end of said chamber when said sections are connected in end to end relation; means for firing a charge in a selected one of said powder chambers; and means extending lengthwise of the assembly of connected body sections operating to fire charges in the remain-

ing sections in consequence of the firing of the charge in said selected chamber.

10. For use in a perforating gun of the character described: a gun body section having connecting means at the ends thereof, means forming a gun bore extending out through a side thereof, a powder chamber between said bore and one end of said body, said powder chamber communicating with the inner portion of said bore and also being in communication with said end of said body to enable a charge to be placed therein, and a passage extending to the other end of said body, said passage communicating with said powder chamber

11. For use in a perforating gun of the character described: a gun body section having connecting means at the ends thereof, means forming a gun bore extending out through a side thereof, a powder chamber communicating with the inner end of said gun bore and also having communication with one of said ends of said body, and a passage extending to the other end of said body, said passage communicating with said powder chamber.

12. For use in a perforating gun of the character described: a gun body section having connecting means at the ends thereof, means forming a gun bore extending out through a side thereof, a powder chamber communicating with the inner end of said gun bore and also having communication with one of said ends of said body, and a passage extending to the other end of said body, said passage communicating with said powder chamber, and a restraining member replaceably secured in said passage.

13. For use in a perforating gun of the character described: a gun body having a plurality of spaced gun bores extending out through the side wall thereof, a powder chamber communicating with the inner end of each of said gun bores, there being passage means serially connecting said powder chambers; means for firing the charge in one of said powder chambers; and restraining means in said passage means between said powder chambers.

14. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body comprising a plurality of sections connected in end to end relation, said sections each having a gun bore, a powder chamber to receive a firing charge communicating with said gun bore, there being passage means in the several sections to serially connect said powder chambers when said sections are connected together; a restraining member in each of said passage means insertable in operative position through the ends of said sections when said sections are disconnected; and means for igniting a charge in at least one of said powder chambers.

15. In a perforating gun of the character described, the combination of: a body having serially arranged gun bores and cooperating chambers connected individually to said gun bores to receive propellant powder charges; means to ignite a powder charge in at least one of said chambers; and serial firing means connecting said chambers, each of said firing means receiving at least a portion of the blast resulting from the burning of a powder charge in one of the chambers to which it is connected and in consequence thereof causing ignition of the powder charge in the other of the chambers to which it is connected.

16. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body comprising a plurality of sections

secured by box and pin joints, each of said sections having a gun bore leading out through a side thereof, a powder chamber formed at the bottom of the box thereof to receive a firing charge, a passage connecting said powder chamber with said gun bore, and an ignition passage extending through the pin thereof to connect said powder chamber to the powder chamber of an adjacent section; and means for firing a charge in at least one of said powder chambers.

17. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body comprising a plurality of sections secured by box and pin joints, each of said sections having a gun bore leading out through a side thereof, a powder chamber formed at the bottom of the box thereof, a passage connecting said powder chamber with said gun bore, an ignition passage extending through the pin thereof to connect said powder chamber to the powder chamber of an adjacent section, and a removable restraining member in said passage exposed at the end of said pin for removal when said pin is unscrewed from its cooperating box.

18. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: suspension means having a threaded pin projecting downward therefrom; an upper gun body section having a threaded box screwed on to said pin, an opening leading downward from said box to form a powder chamber, a gun bore below said powder chamber and having its inner end connected to said powder chamber, a threaded pin projecting downward from said section, and an ignition passage leading upward from the lower face of said last named pin, said passage communicating with said powder chamber; a plurality of succeeding gun body sections connected in consecutive order to said upper body section, each of said succeeding sections being substantially counterparts of said upper section; and means for firing a charge in said powder chamber of said upper gun body section, said firing means including a firing pin extending through said threaded pin of said suspension means and means carried by said suspension means for actuating said firing pin.

19. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body having a laterally directed gun bore for a projectile and means for holding a firing charge in operative position relative to said projectile; suspension means for said gun body extending upward therefrom, said suspension means comprising a lower portion and an upper portion; and firing means for said charge comprising a firing pin extending longitudinally in said lower portion of said suspension means, an anvil movably supported on the upper portion of said suspension means so as to be driven down by a suitable hammer against said firing pin; lock means for said firing pin mounted on said lower portion of said suspension means so as to be engaged with said firing pin, said lock means comprising a resiliently supported dog arranged to be moved into engagement with said firing pin; and actuating means for said lock means comprising a sleeve slidable on said lower portion of said suspension means for moving said dog into engagement with said firing pin when said sleeve is lowered on said lower portion of said suspension means, a sleeve slidably disposed around the upper portion of said suspension means; and resilient pipe engaging means connecting said sleeves.

20. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body having a laterally directed gun bore for a projectile and means for holding a firing charge in operative position relative to said projectile; suspension means for said gun body extending upward therefrom; firing means for said charge comprising a firing pin having an engageable portion; lock means for said firing pin having an engager normally supported out of engagement with said engageable portion of said firing pin; actuating means for said lock means comprising a member slidable on said gun body for relative movement between raised and lowered position, said actuating means effectuating movement of said engager into position for engagement with said engageable portion of said pin when said actuating means is in said lowered position; and means operative to move said actuating means into said lowered position.

21. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body having a laterally directed gun bore for a projectile and means for holding a firing charge in operative position relative to said projectile; suspension means for said gun body extending upward therefrom; firing means

for said charge comprising a firing pin having an engageable portion; lock means for said firing pin having an engager normally supported out of engagement with said engageable portion of said firing pin; and actuating means operating in consequence of upward movement of said gun body in a pipe in said well to effectuate engagement of said engager with said engageable portion of said pin.

22. In a perforating gun of the type adapted to be lowered into a well casing, the combination of: a gun body having a laterally directed gun bore for a projectile and means for holding a firing charge in operative position relative to said projectile; suspension means for said gun body extending upward therefrom; firing means for said charge whereby the same may be fired when the gun is in the well, said firing means comprising a member which moves between raised and lowered position and has a downwardly faced shoulder; a blocking element supported on said gun body for movement into a position under said shoulder whereby to prevent downward movement of said member; and actuating means operative to move said blocking element into said position under said shoulder.

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