July 11, 1967 R. C. KVAVLE ETAL 3,330,108

EXPLOSIVELY ACTUATED TOOL

Filed Aug. 16, 1965

4 Sheets-Sheet 1

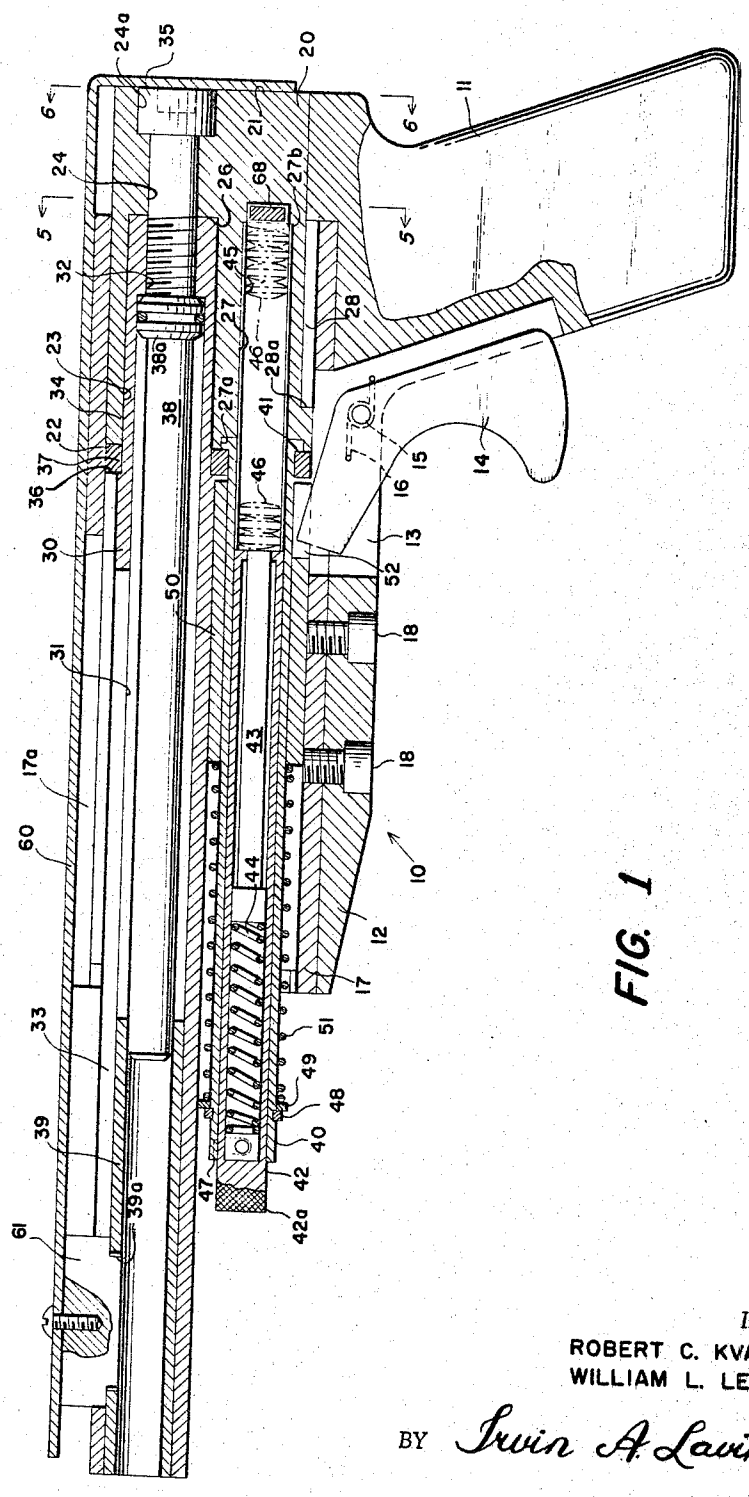


FIG. 1

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4 Sheets-Sheet 2

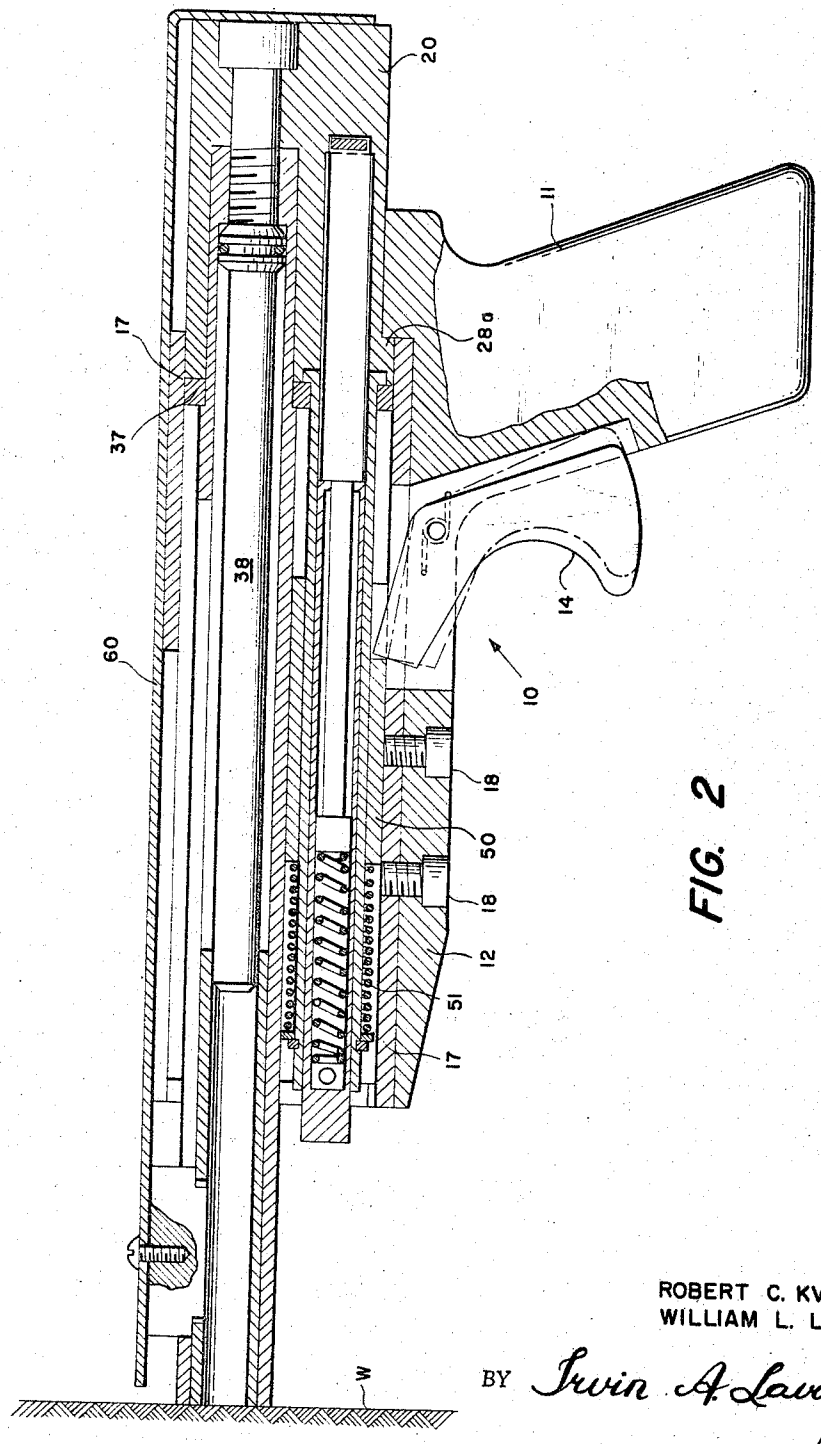


FIG. 2

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Filed Aug. 16, 1965 4 Sheets-Sheet 3

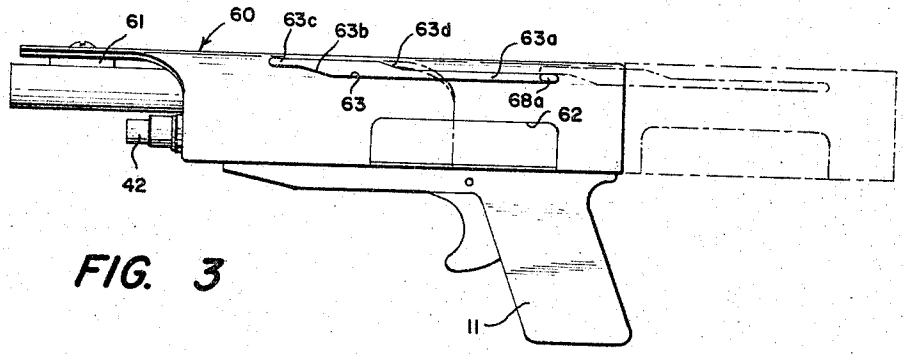


FIG. 3

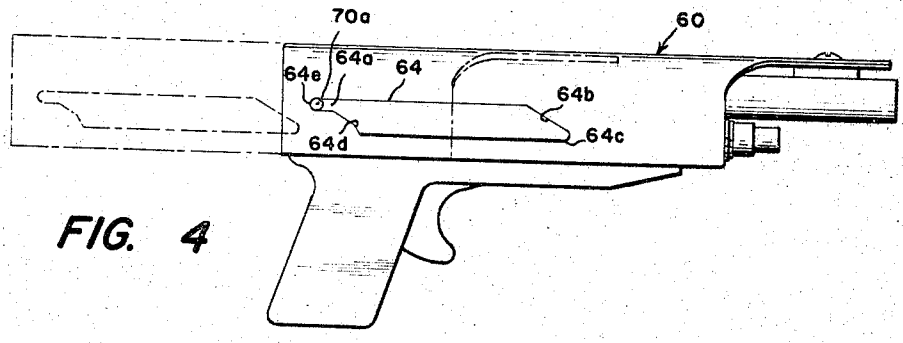


FIG. 4

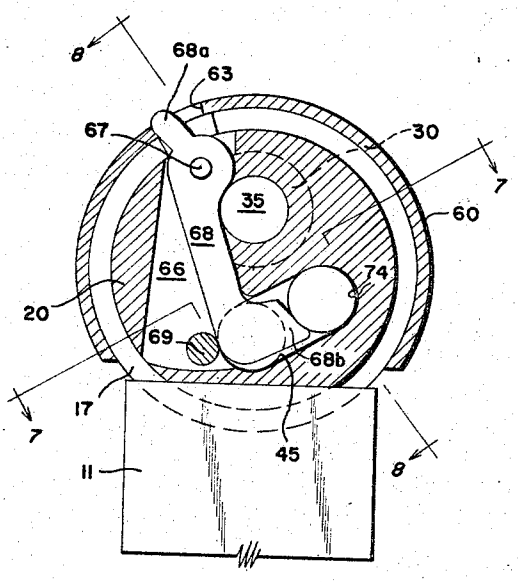


FIG. 5

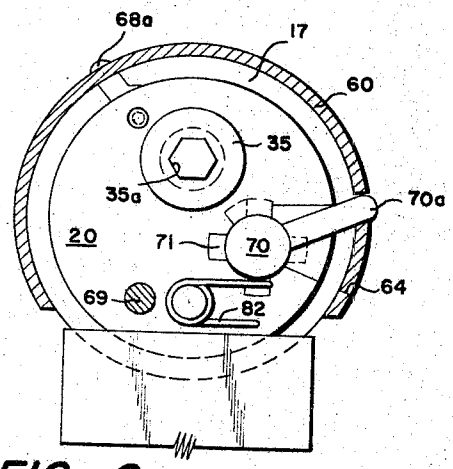


FIG. 6

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Filed Aug. 16, 1965 4 Sheets-Sheet 4

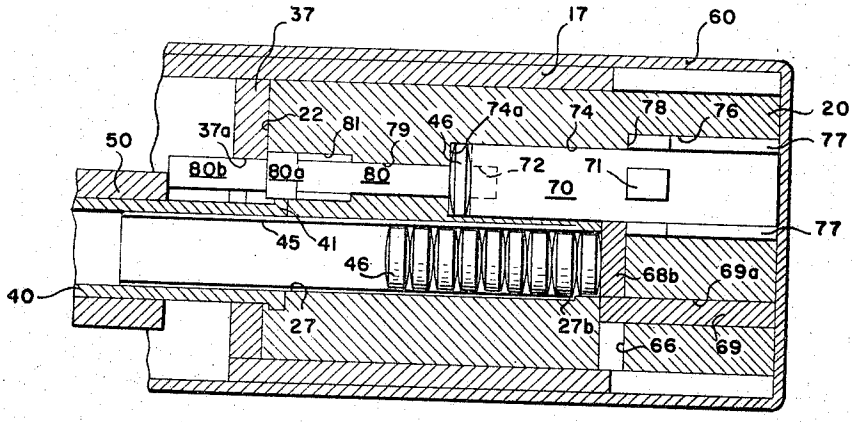


FIG. 7

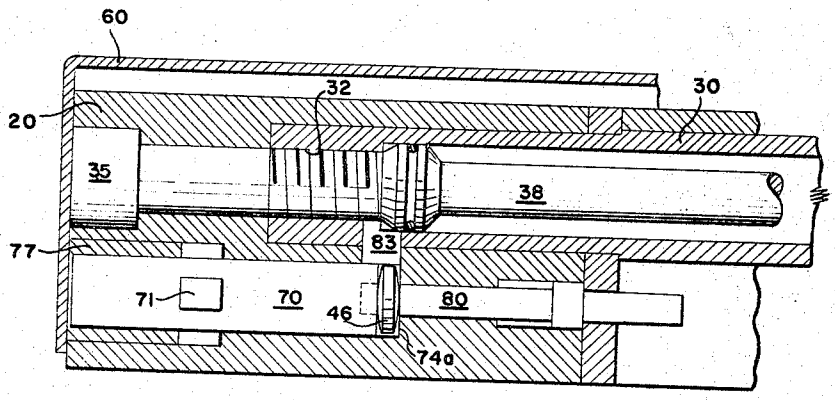


FIG. 8

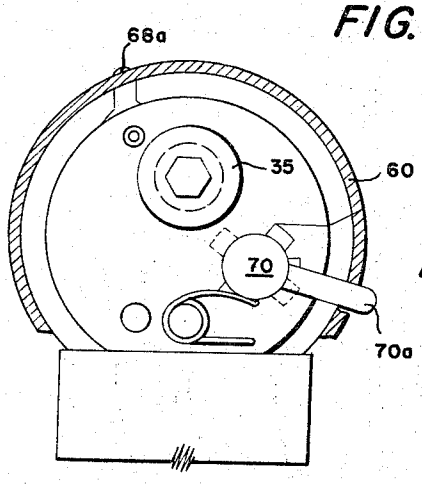


FIG. 9

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United States Patent Office 3,330,108 Patented July 11, 1967

3,330,108

EXPLOSIVELY ACTUATED TOOL

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Filed Aug. 16, 1965, Ser. No. 479,779
12 Claims. (Cl. 60—26.1)

ABSTRACT OF THE DISCLOSURE

A reliable, multi-shot explosively operated device which is compact and preferably uses primerless charges. A single control slide is reciprocable to (1) reposition a driving ram, (2) actuate mechanism for positioning successive charges to be ignited, (3) control movement of a bolt against which the fed charge is to be ignited, and (4) to cock the tool preparatory to such ignition.

The present invention relates to a powder actuated tool, and more particularly to a tool primarily intended for inserting fastening elements driven by the deflagration of a low explosive cartridge.

Powder actuated tools have in recent years gained wide acceptance for performing a variety of tasks. One of the most widely known uses of powder actuated tools has been for the insertion of fastening elements into relatively hard material, such as concrete and steel. These tools have utilized cartridges comprising a casing, a high explosive primer, and a low explosive charge. There has recently been developed a method and apparatus by which the cartridge need not include a metal or the like casing, and does not include a high explosive primer, but is composed of a low explosive material which is substantially if not entirely consumable in the deflagration. Such a method and apparatus is disclosed in copending patent application of Robert C. Kvavle entitled "Method for Direct Percussive Ignition of Stable Explosives and Apparatus Therefor," filed May 29, 1964, Ser. No. 371,242, now matured into Patent 3,283,657.

Some main objects of the present invention are to provide a tool for practicing the method described in the mentioned patent, which tool is safe to use, has a cartridge supply magazine, is relatively short, is easily operated after each shot in order to reload the tool automatically and to reposition a ram incorporated in the tool, and can be readily manufactured of available materials. While these are the primary objects of the present invention, other objects exist and will be understood, together with the objects specifically noted and various novel features and details in construction, from a consideration of the following specification and drawings relating to an illustrative embodiment, wherein:

FIG. 1 is a cross-sectional view of a tool in accordance with the present invention.

FIG. 2 is a cross-sectional view of the tool of FIG. 1 in position for firing.

FIG. 3 is an elevational view of the left side of the tool.

FIG. 4 is an elevational view of the right side of the tool.

FIG. 5 is a cross-sectional view taken on the line 5—5 of FIG. 1.

FIG. 6 is a cross-sectional view taken on the line 6—6 of FIG. 1.

FIG. 7 is a cross-sectional view taken on the line 7—7 of FIG. 5, and looking in the direction of the arrows.

FIG. 8 is a cross-sectional view taken on the line 8—8 of FIG. 5, and looking in the direction of the arrows.

FIG. 9 is a view similar to FIG. 6, but showing parts in alternate positions.

Referring now to the drawings, wherein like or corresponding reference numerals are used for like or corresponding parts throughout the several views, there is shown in FIG. 1 a power actuated tool 10 comprising a downwardly and rearwardly extending handle 11. Handle 11 has a forwardly extending portion 12 and a trigger recess 13 housing a trigger 14. Trigger 14 is rotatably mounted on a pin 15 and is spring urged in a clockwise direction as shown in FIG. 1 by the spring 16. A tubular frame 17 is secured by bolts 18 which extend through the portion 12 and into the tubular frame 17.

A breech block 20 is of generally cylindrical configuration, fitting in substantial engagement with the tubular frame 17, as is shown in FIG. 5. Breech block 20 has a rear face 21 and a forward face 22; a first bore 23 extends inwardly into breech block 20 from face 22 and a second bore 24 extends inwardly into breech block 20 from face 21, the bores 23 and 24 being in axial alignment, with bore 24 being smaller than bore 23. There is thereby provided a shoulder 26 between said bores; a barrel 30 extends into the first bore, engaging the shoulder 26.

Barrel 30 has a first relatively large internal diameter 31, and at its rear portion a smaller, threaded bore 32. To hold the barrel 30 in assembled relation in the breech block 20, a bolt 35 extends through the bore 24 in breech block 20 and is in threaded engagement with the threaded bore 32 of barrel 30. The bore 24 in breech block 20 is preferably enlarged at 24*a* in order to accommodate the head of bolt 35. The head of bolt 35 may be provided with a recessed socket 35*a*, as shown in FIG. 6, to enable it to be secured in position.

The barrel 30 has an axially extending slot 33 at the upper portion thereof which extends from slightly rearwardly of the muzzle end of barrel 30 to a point slightly forward of the breech block 20. The barrel 30 has a reduced diameter 34 at its rear portion, to thereby provide a shoulder 36 which abuts against a retainer plate 37; further, it houses a ram 38 having an enlarged rear portion 38*a*, an end of ram 38 being received in a tube 39 which is slidable in the barrel 30.

A bore 27 having a forward enlarged portion 27*a* extends into the breech block 20 from the face 22, the enlarged portion 27*a* receiving the flange 41 of a magazine tube 40. Through this construction, the bolt 35 serves, by means of the retainer plate 37, to retain the magazine tube 40 in assembled relationship with the breech block 20.

Tubular magazine 40 has therein a follower tube 42 with a knurled forward end 42*a*, follower tube 42 being hollow and having a follower 43 therein which is urged rearwardly (to the right) by the spring 44. Partially within magazine 40 and partially within the bore 27 of the breech block 20 is a cartridge container 45 having a plurality of low explosive cartridges 46 therein. At its rear, the bore 27 has a shoulder 27*b*, against which the rear end of the disposable container 45 lodges. The follower tube 42 is retained in the magazine tube 40 by means of a bayonet-slot connection, generally indicated at 47. It will thereby be seen that the spring 44 will cause the follower 43 to urge the cartridges 46 rearwardly, until the last of the cartridges has been used, after which the follower tube 42 may be partially removed from the magazine 40 by rotating the tube 42 to unlock the bayonet-slot arrangement 47, after which it may be slid forwardly.

Breech block 20 is provided with a sector-shaped cutout portion 28 extending along the bottom thereof from a shoulder 28*a*, the cutout portion 28 permitting the breech

block 20 to slide axially relative to the handle 11 and tubular frame 17, as will be set forth hereinbelow.

The magazine 40 includes a retainer ring 48 in a groove adjacent the front end thereof, retainer ring 48 preferably being a split ring of resilient material. Retainer ring 48 serves to hold an annular plate 49 on the magazine 40, and a relatively strong spring 51 encircles the magazine 40, extending between the plate 49 and an annular striker 50. Striker 50 has a slot 52 in the bottom rear portion thereof, for cooperation with the trigger 14.

Tubular frame 17 is provided at the upper portion thereof with a slot 17*a* which extends axially rearwardly from the front to a point which lies generally above the trigger 14.

The tool 10, as may be seen from FIGS. 3 and 4, is provided with an operating cover generally designated 60, which may be translated axially between the full and dotted line positions shown. Cover 60 has a generally cylindrical shape, as may be seen from FIGS. 5, 6 and 9, and is in engagement with and guided by the exterior surface of tubular housing 17; it is provided with a key 61 adjacent its front end, which extends inwardly through the slot 33 in barrel 30 and enters into a slot 39*a* in the tube 39. When the cover 60 is moved rearwardly, it carries with it the tube 39, to thereby effect a repositioning of the ram 38 into the position shown in FIG. 1, after which the cover 60 is returned to its original position. The cover 60 includes an opening 62 on the left side thereof, as shown in FIG. 3. Opening 62 is a loading opening, by which the container 45 of explosive cartridges 46 may be loaded into the tool upon partial withdrawal of the follower 42 in the manner described above. Also on its left side, cover 60 is provided with a slot 63 which serves to cam a follower, for purposes to be hereinbelow described. The slot 63 has a first elongate portion 63*a*, a camming surface 63*b* and a second shorter portion 63*c*. There is also provided a second camming portion 63*d* in axially spaced relation with camming portion 63*b*. It will be understood that these camming portions 63*b* and 63*d* serve to change the position of the follower between the positions determined by the portions 63*a* and 63*c*.

Referring now to FIG. 4, there is shown the right side of the tool 10, there being shown therein a cam slot 64 in the cover 60 for causing both rotational and translational movement of a follower engaged therewith. Cam slot 64, which operates a bolt, has a first position 64*a*, a camming surface 64*b*, a withdrawal notch 64*c*, a camming surface 64*d* and a return notch 64*e*.

Referring now to FIG. 5, there is shown a cross-sectional view of the tool 10 wherein there may be seen the breech block 20, the tubular frame 17, and the cover 60 with slot 63. The breech block 20 is provided with a generally L-shaped recess 66 in which is a feed lever 68 (FIGS. 1, 5) pivotally mounted in the block 20 for movement about an axis parallel to the barrel by the pin 67, and having a feeding finger 68*b* at the lower end thereof and an actuating arm 68*a* which extends through the camming slot 63 in cover 60. Immediately to the left of the feeding finger 68*b* of feed lever 68 is a slidable locking pin 69, the function of which will be set forth below. The purpose of feed lever 68 is to feed cartridges 46 singly from the magazine 45 to a combustion and ignition chamber, and the lever 68 is oscillated by movement of cover 60.

Referring now to FIG. 7, there may be seen the breech block 20, container 45 in the bore 27, tubular housing 17 and cover 60. There may also be seen the recess 66, feed finger 68*b* of feed lever 68 and locking pin 69, it being evident that locking pin 69 in integral with or attached to cover 60, and is slidable in a bore 69*a* in breech block 20.

A bolt 70 having ears 71 extending substantially radially therefrom at a mid-portion thereof is provided at its forward end with an ignition cavity 72. Bolt 70 is rotatably

and slidably mounted in a bore 74 in breech block 20, the forward portion 74*a* of bore 74 forming a combustion chamber. Rearwardly of bore 74, and in alignment therewith, is a splined bore 76 which includes splines 77 extending from the rear of breech block 20; the forward ends of splines 77 are spaced from a shoulder 78 defining the boundary between the bores 74 and 76. As is apparent, the ears 71 of bolt 70 are dimensioned to be positioned between the forward ends of the splines 76 and the shoulder 78. In FIG. 6, there may be seen the bolt 70, the ears 71 and an actuating arm 70*a*. Referring again to FIG. 7, there may be seen forwardly of the bore 74 a relatively small bore 79 and a larger bore 81, which latter extends inwardly from the face 22 of breech block 20. A firing pin 80 is slidably mounted in the bore 79, and has an enlarged head 80*a* in the bore 81. Firing pin 80 has an extension 80*b* which extends through an aperture 37*a* in plate 37. This extension 80*b* is in position to be struck by the rear face of the striker 50. The plate 37 serves to provide a stop for the enlarged head 80*a* of the firing pin 80.

In FIG. 6, there may be seen the breech block 20, securing bolt 35, combustion chamber bolt 70 and the cover 60. The actuating arm 70*a* of the bolt 70 is shown extending through the cam slot 64 in cover 60 and as will be apparent rotational movement of the bolt 70 will cause the ears 71 to assume positions between the splines so that withdrawal of the bolt 70 may occur. A spring 82 extends across the opening between two splines, to limit the movement rearwardly of the bolt 70 by engaging one of the ears 71. In FIG. 9, the parts are shown in the positions they will assume when the cover 60 has been withdrawn, as indicated by the dotted lines in FIGS. 3 and 4. The actuating arm 70*a* of bolt 70 will be seen to be rotated, and while not apparent from FIG. 9, the bolt 70 will have been withdrawn by movement of the cover, as permitted by the entry of the ears 71 between the splines 77. Further, the actuating arm 68*a* of the feed lever 68 is shown rotated from the position shown in FIGS. 5 and 6, and as will be understood the feed lever 68 will have been rotated in a clockwise manner, this being permitted by the withdrawal of feed lever locking pin 69 with cover 60.

Referring now to FIG. 8, the combustion chamber 74*a* may be seen with bolt 70 and firing pin 80 adjacent to it. There may also be seen the securing bolt 35 through breech block 20 engaging the threaded bore 32 of barrel 30. The ram 38 is shown positioned at the rear end of barrel 30, and an extension of combustion chamber 74*a* is shown at 83 extending from combustion chamber 74*a* through breech block 20 and barrel 30 to the rear of ram 38. As will be understood, the extension 83 permits the rapidly expanding gases from the deflagration of an explosive cartridge 46 to drive the ram 38 forward.

In operation, the tool is loaded by rotating and withdrawing follower tube 42 from magazine 40 to the extent that follower 43 extends no further to the rear than the position shown in FIG. 1. It will be appreciated that the spring 44 will have urged follower 43 to the right, so that follower 43 extends to the right beyond the end of follower tube 42. A disposable container 45 of low explosive cartridges 46 is then inserted through the slot 62 in cover 60 and through corresponding slots in tubular frame 17, breech block 20, magazine 40 and striker 50. The follower 42 is then responsive in magazine 40, with engagement of the bayonet-slot construction 47, so that the parts occupy the position shown in FIG. 1. The cover 60 is then moved rearwardly, as indicated by the dotted line showings in FIGS. 3 and 4, and is thereafter returned forward to the full line position. This movement of the cover 60 accomplishes four functions.

First, the tube 39 is moved rearwardly in barrel 30 by the key 61 on cover 60, thereby carrying with it and repositioning the ram 38 into the position shown in FIG. 1, it being understood that after the prior shot the ram 38 is forwardly of the position shown in FIG. 1.

Second, the rearward movement of cover **60** will cause withdrawal of the feed lever locking pin **69** and, subsequently, the clockwise rotation of feed lever **68** from the position shown in FIG. 5 to a position in which the end of feed finger **68***b* is to the left of the container **45**. The spring **44** will then cause the follower **43** to urge the entire series of explosive cartridges **46** to the rear, so that the rearmost cartridge **46** lies in the plane of feed lever **68**. It will be appreciated that due to the construction of cam slot **63** as shown in FIG. 3, the feed lever locking pin **69** will be withdrawn while the feed lever actuating arm **68***a* is riding in the portion **63***a* of slot **63**. At the rearmost position of cover **60**, the actuating arm **68***a* will lie in the portion **63***c* of cam slot **63**. Upon forward movement of cover **60**, the feed lever **68** will be rotated counter-clockwise as viewed in FIG. 5 to thereby feed a cartridge **46** into the bore **74**. After return of feed lever **68** to the position shown in FIG. 5, the feed lever locking pin **69**, carried by cover **60**, will enter behind it in order to prevent rotation of it.

The third function accomplished by movement of cover **60** is the manipulation of bolt **70**; the initial movement of cover **60** results in a dwell action, until the cam surface **64***b* engages the actuating arm **70***a*, at which time it causes rotational movement of arm **70***a* and bolt **70** to thereby align the ears **71** with the spaces between the splines **77**. Thereafter, the actuating arm **70***a* will engage in the notch **64***c*, and continued movement of cover **60** to the rear will result in withdrawing bolt **70** to the rear so that, referring to FIG. 7, the front portion of the bolt **70** is rearwardly of the recess **66** in which feed lever **68** moves. Upon forward movement of cover **60**, and following feeding movement of feed lever **68** due to engagement of arm **68***a* with cam surface **63***d*, bolt actuating arm **70***a* will be engaged by the lower portion of cam surface **64***d*. This will cause the bolt **70** to move forward, carrying with it the explosive cartridge **46** which has been fed into the bore **74**. Due to the shape of cam surface **64***d*, there will be a force tending to rotate actuating arm **70***a* in an upward or counter-clockwise manner, and after the ears **71** have passed the ends of splines **77**, in rotation of bolt **70** will occur so that actuating arm **70***a* then occupies the return notch **64***e*, as shown in FIG. 4. In this position, the feed lever locking pin **69** will be in the position shown in FIG. 7, and the explosive cartridge **46** will be in position in combustion chamber **74***a*.

The fourth function of cover **60** is to insure that the assembly including breech block **20**, barrel **30** and striker **50** is in the position shown in FIG. 1, relative to the handle **11**, and in particular to insure that the striker **50** is in such position that the upper portion of trigger **14** enters in the slot **52** of striker **50**.

A fastener element, such as a pin, bolt, etc., is then inserted into the tube **39**, lying ahead of the front of ram **38**. A pull on trigger **14** at this point will have absolutely no effect, so that the tool is safe against accidental firing. To fire the tool **10**, referring now to FIG. 2, the muzzle end of barrel **30** is placed against a wall W and the handle **11** is pushed towards the wall W while the trigger **14** remains in the full line position. This will slide barrel **30**, breech block **20**, cover **60** and associated parts relative to handle **11** and tubular frame **17** until the shoulder **28***a* engages a forwardly facing shoulder on the handle **11**. Striker **50** will not be permitted to move relative to handle **11**, however, because of engagement with it by the upper portion of trigger **14**. Therefore, the spring **51** will be compressed, and the rear end of striker **50** will be substantially removed from the forward end of firing pin **80**, specifically extension **80***b* thereof. The trigger **14** is now pulled in the usual manner, and thereby releases striker **50** so that it may be driven rearwardly by spring **51** into engagement with extension **80***b* of firing pin **80**. This causes the firing pin **80** to drive a portion of cartridge **46** into ignition chamber or cavity **72**, causing deflagration of that portion of cartridge **46**, as explained in the above referenced application. Hot gases evolving from that deflagration will drive the firing pin **80** forward, its movement being arrested by plate **37**; also, energy is absorbed during the course of its movement by striker **50**, which has a relatively large mass. The hot gases of the initial deflagration will then cause the deflagration of the remaining portion of the cartridge **46**, and the hot expanding gases thereform will pass through the passage **83** and so enter behind the ram **38** and drive it rapidly forward, to thereby drive a fastening element into the wall W. Thereafter, it is only necessary to slide cover **60** rearwardly and then forwardly, and insert another fastening element to again prepare the tool **10** for its next shot, preparatory to placing the muzzle end of barrel **30** against a wall. Such rapid utilization of the tool **10** may continue until all of the cartridges **46** have been expended.

While many important features and constructions are included in the tool **10**, a few exemplary ones will be pointed out specifically. The bolt **70**, due to its substantial extent in and its close engagement with bore **74**, provides an effective seal for the gases evolved from the deflagration of the explosive cartridge. Also, the feed lever locking pin **69** insures against any possibility that the feed lever will be moved on its pivot by gases from the deflagration, which action would permit the combustion gases to find their way to the container **45** and so cause deflgration of the explosive cartridges **46** therein; also, such movement might cause a jam by the feeding of a second cartridge. The tool **10** is unusually short, due to the fact that the firing mechanism is not axially rearwardly of the barrel, but is parallel and below it. Mounting of the tubular striker **50** on the magazine tube contributes to the safety and short construction. A large portion of the explosive forces acting on the firing pin are absorbed by the striker **50**, which has a large mass, so as to avoid heavy stresses on the striker spring **51**. The assembly including the bolt **35** for holding the barrel to the breech block, and through it the plate **37**, contributes to a sturdy and economical construction; the plate **37** has the functions of being a stop for the firing pin **80** and being a holding element for magazine tube **40**. Further, the provision of cover **60** for causing cartridge feeding, bolt manipulation and ram repositioning serves to make the tool simple in operation. It is also to be noted that the tube **39** has the function of serving as a support and guide for the front end of the ram **38**, a repositioner and stop for the ram, as well as being a receiver for the fastener element which is to be inserted.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In an explosively actuated tool, a member having a first elongate bore, bolt means of substantially the same cross-sectional size and shape as said bore slidably extending therein, means for locking said bolt means in said bore with the inner end of the bolt means spaced from the inner end of said bore to thereby define a combustion chamber, manually operable feed means for introducing an explosive charge in predetermined uniform position in said chamber, a second bore in said member and extending from said combustion chamber, and a firing pin slidable in said second bore for acting on the charge in cooperation with the inner end of the bolt means when locked, said bolt means having substantially surface engagement with said first bore axially therealong to thereby seal said bore against the escape of combustion gases.

2. An explosively actuated tool comprising a barrel, a combustion chamber communicating with the rear portion of said barrel, a movable firing pin having one end

in juxtaposition with said combustion chamber, said firing pin extending forwardly of said combustion chamber from said end of the pin, a magazine for explosive cartridges, means for feeding cartridges singly from said magazine to a predetermined position in said combustion chamber, striker means slidable on said magazine, spring means for urging said striker means toward the forward end of said firing pin, and means for controlling said striking means.

3. In an explosively actuated tool, a barrel, a combustion chamber communicating with the rear portion of said barrel, a firing pin and a magazine tube both parallel to and at least partially coextensive with said barrel, means for feeding explosive cartridges from said magazine tube to said combustion chamber, said firing pin being in juxtaposition with said combustion chamber for striking a cartridge in said combustion chamber, a striker for said firing pin slidable on said magazine tube, and means for urging said striker into engagement with said firing pin.

4. In an explosively actuated tool, a breech block, a barrel secured in said breech block, a combustion chamber in said breech block, means communicating said combustion chamber with the rear portion of said barrel, magazine means for holding a supply of explosive cartridges and including spring means for urging cartridges toward an outlet of said magazine means, feed lever means adjacent said magazine means outlet and pivotally mounted to said breech block about an axis parallel to said barrel, said feed lever means including an actuating arm, cover means axially slidable on said breech block and including cam slot means receiving said actuating arm for causing said feed lever means to oscillate upon reciprocation of said cover means, a bore in said breech block parallel to said barrel and extending from adjacent said feed lever means in a selected position thereof, and locking pin means carried by said cover means and slidable in said bore for locking said feed lever means when said cover is in a forward position.

5. In an explosively actuated tool, a barrel, a combustion chamber communicating with the rear portion of said barrel, magazine means for holding a supply of explosive cartridges and including spring means for urging cartridges toward an outlet of said magazine means, feed lever means adjacent said magazine means outlet and pivotally mounted about an axis parallel to said barrel, said feed lever means including an actuating arm, axially slidable cover means including cam slot means receiving said actuating arm for causing said feed lever means to oscillate upon reciprocation of said cover means, and means carried by said cover means for locking said feed lever means after the feeding of a cartridge from said magazine means to said combustion chamber.

6. In an explosively actuated tool, a barrel, a combustion chamber communicating with the rear portion of said barrel, magazine means for holding a stacked supply of explosive cartridges, feed means for transferring cartridges successively from said magazine means to a position of predetermined orientation within said combustion chamber, and means operable by said feed means for locking said feed means after the transferring of each cartridge to said combustion chamber.

7. In an explosively actuated tool, a barrel, a combustion chamber communicating with the rear portion of said barrel, magazine means for holding in stacked, side by side arrangement a supply of explosive cartridges, feed lever means for successively transferring cartridge without change in orientation from said magazine means to said combustion chamber, and slidable pin means for automatically locking said feed means after the transferring of each cartridge to said combustion chamber.

8. In an explosively actuated tool, a barrel, a combustion chamber communicating with the rear portion of said barrel, magazine means for holding an axially stacked supply of explosive cartridges, feed lever means for transferring successive endmost cartridges laterally in their respective general plane from said magazine means to said combustion chamber, means for locking said feed lever means after the transferring of a cartridge to said combustion chamber, and means for simultaneously actuating said feed lever means and said locking means.

9. In an explosively actuated tool, a barrel, a cylindrical bore parallel to and communicating with the rear portion of said barrel, a bolt slidable and rotatable in said bore, an actuating arm on said bolt extending outwardly beyond said barrel, magazine means for holding a supply of explosive cartridges, pivoted lever means for feeding cartridges from said magazine means to said bore including an arm extending outwardly beyond said barrel, axially movable slide means on said barrel including first cam slot means engaging said bolt actuating arm for rotating and sliding said bolt and second cam slot means engaging said lever arm for feeding cartridges to said bore.

10. The tool of claim 9, characterized by the provision of a ram in said barrel, and means responsive to movement of said slide means for moving said ram rearwardly.

11. In an explosively actuated tool, a handle, a movable assembly including a breech block and a barrel, means mounting said assembly on said handle for sliding movement relative thereto, said tool including a combustion chamber, magazine means at least partly within the breech block for receiving a disposable container of cartridges, means including a pivotal lever cooperative with the container for introducing explosive cartridges successively in the same orientation to said combustion chamber, a firing pin in juxtaposition with said combustion chamber for striking an explosive cartridge fed therein by said lever, striker means, means mounting said striker means for movement within said handle and relative to said firing pin, spring means for urging said striker means toward said firing pin, and trigger means on said handle for releasably engaging said striker means upon predetermined movement of said assembly, whereby upon moving said trigger means said striker means is released to permit said spring means to impel it into engagement with said firing pin.

12. In an explosively actuated tool, a breech block, an elongate bore in said breech block having an inner end, bolt means slidable in said bore, a transverse recess in said breech block extending to said bore, said recess being spaced from the inner end of said bore and communicating therewith, means in said recess for feeding successive cartridges into said bore, means for sliding said bolt means in said bore from a locked position in which the inner end of said bolt means serves as a fixed anvil for a fed cartridge and is slightly spaced from the inner end of said bore to retracted position in which the inner end of said bolt means is on the opposite side of said recess from said bore inner end, and reciprocable control means for sequentially moving said bolts means, after explosion of the fed cartridge, from said first mentioned position to said retracted second mentioned position, then actuating said feed means, and then returning said bolt means to said first mentioned position.

References Cited

UNITED STATES PATENTS

413,079	10/1889	Koka	42—16.1
931,983	8/1909	Ashton	42—16.1
1,685,148	9/1928	Conant	42—16.1
3,283,657	11/1966	Kvavle	89—1

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