

Oct. 16, 1956

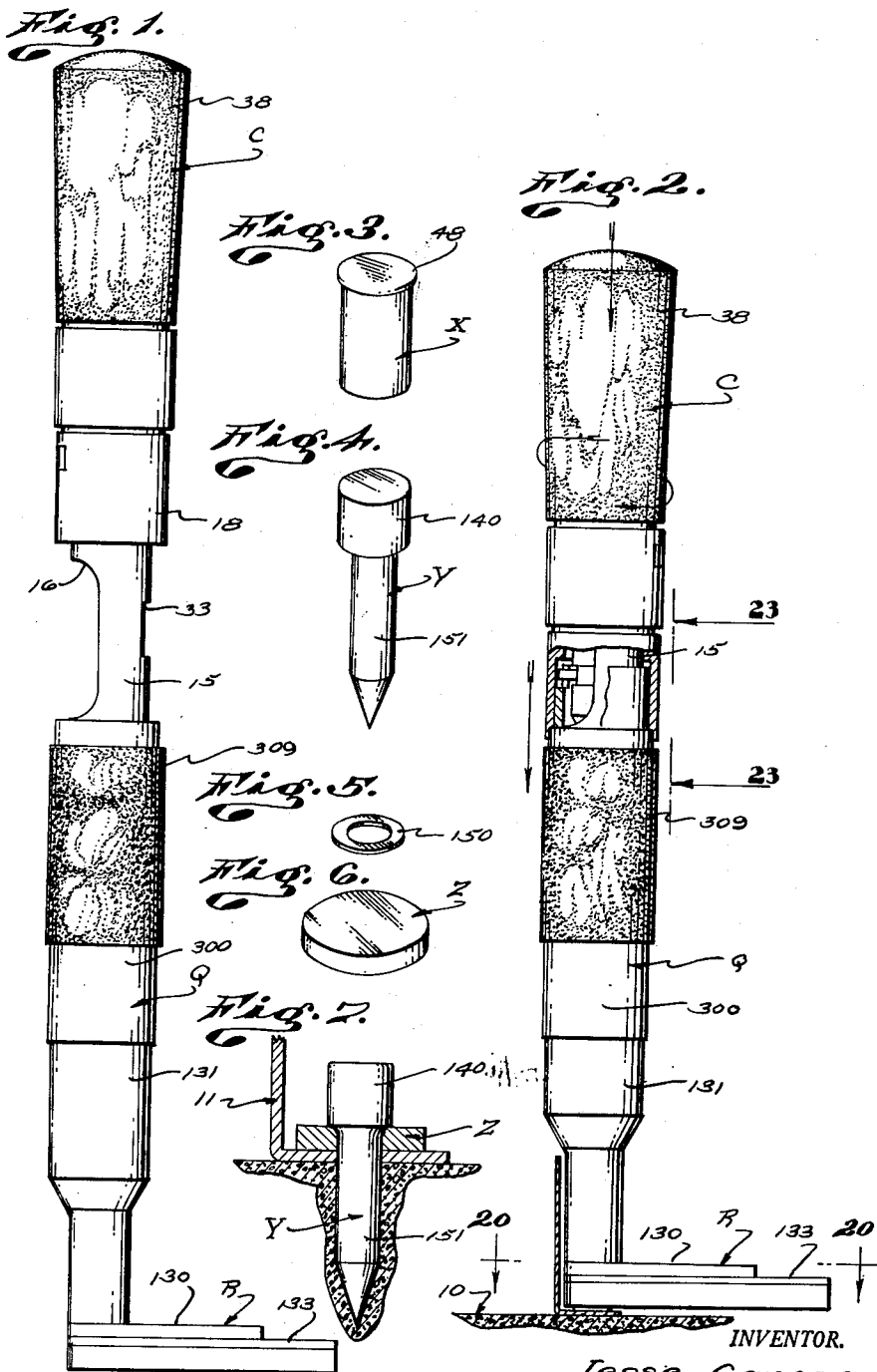
J. GANNON

2,766,451

EXPLOSIVE ACTUATED FASTENER APPLICATOR

Filed Aug. 3, 1953

6 Sheets-Sheet 1



INVENTOR.
Jesse Gannon
BY *R. H. H. H.*
Attorney

Oct. 16, 1956

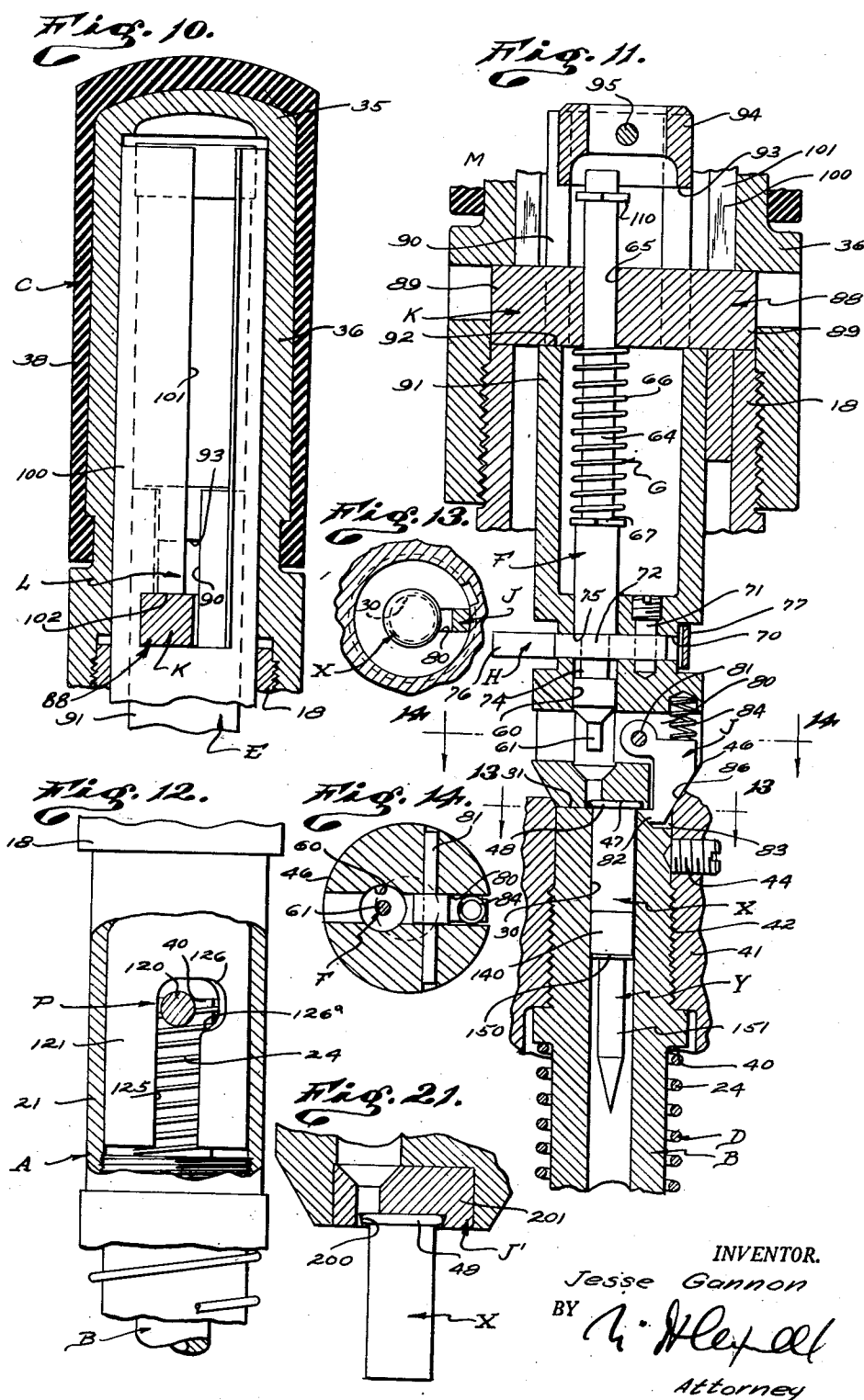
J. GANNON

2,766,451

EXPLOSIVE ACTUATED FASTENER APPLICATOR

Filed Aug. 3, 1953

6 Sheets-Sheet 3



INVENTOR.
Jesse Gannon
BY *H. H. H. H.*
Attorney

Oct. 16, 1956

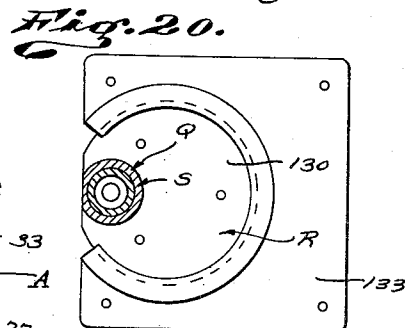
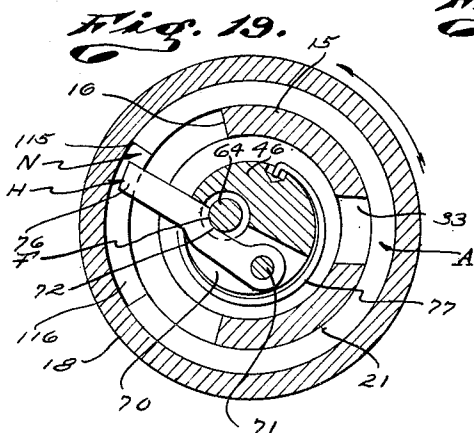
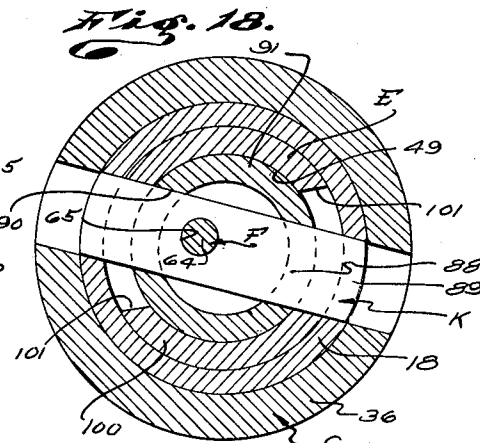
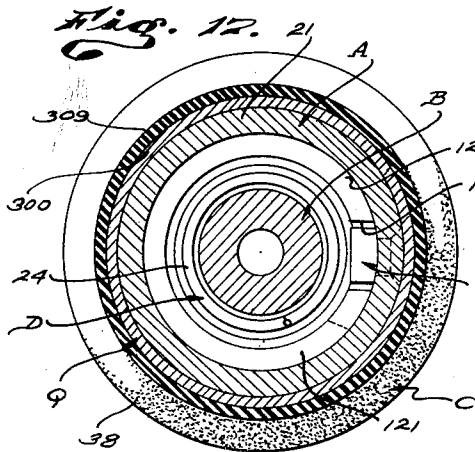
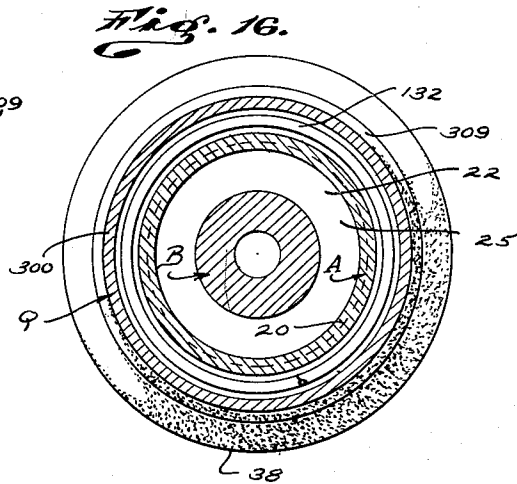
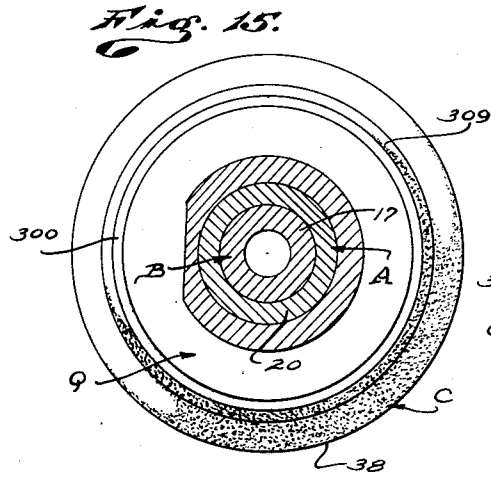
J. GANNON

2,766,451

EXPLOSIVE ACTUATED FASTENER APPLICATOR

Filed Aug. 3, 1953

6 Sheets-Sheet 4



INVENTOR.

Jesse Gannon

BY

W. H. Hall

Attorney

Oct. 16, 1956

J. GANNON

2,766,451

EXPLOSIVE ACTUATED FASTENER APPLICATOR

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Fig. 22.

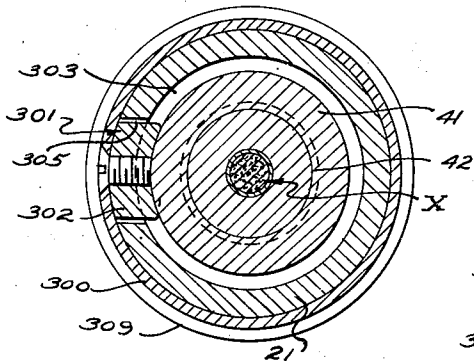


Fig. 23.

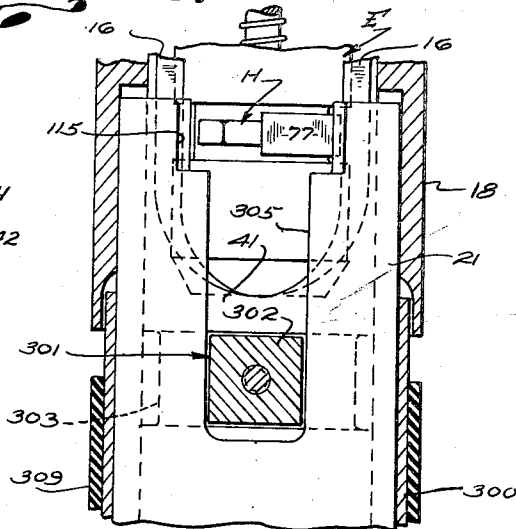


Fig. 24.

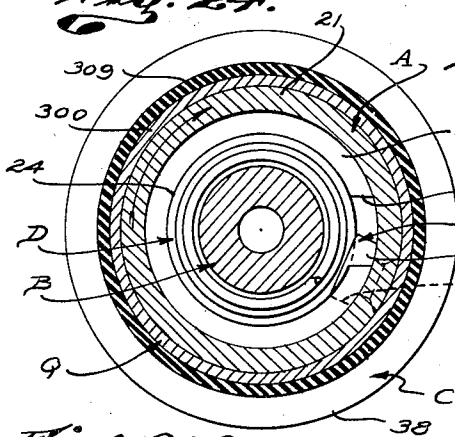


Fig. 25.

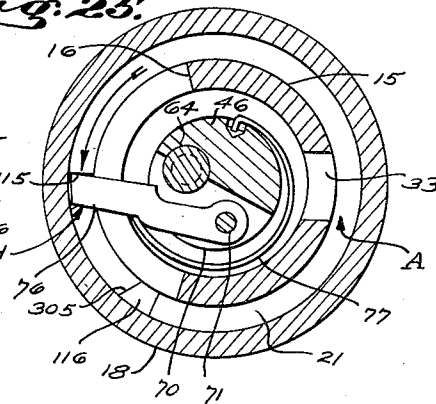
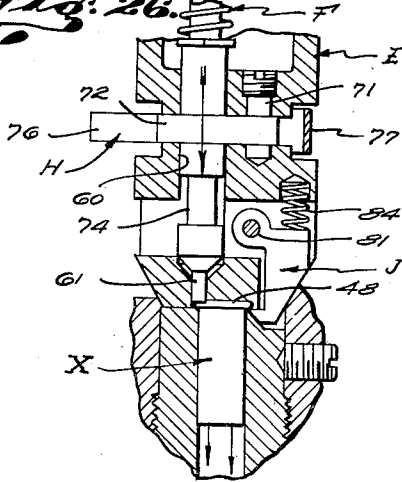


Fig. 26.



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J. GANNON

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EXPLOSIVE ACTUATED FASTENER APPLICATOR

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Fig. 27.

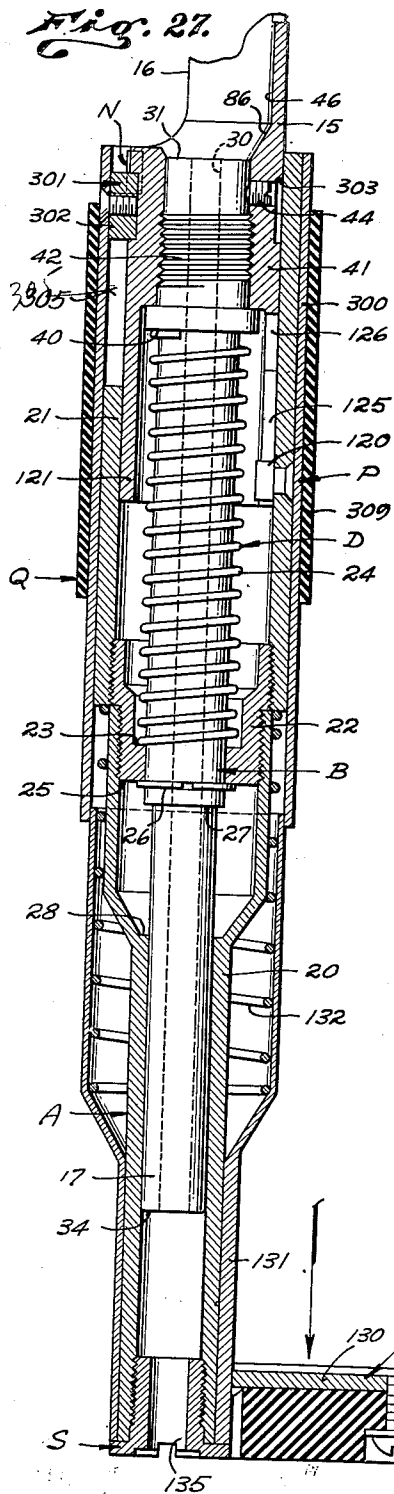
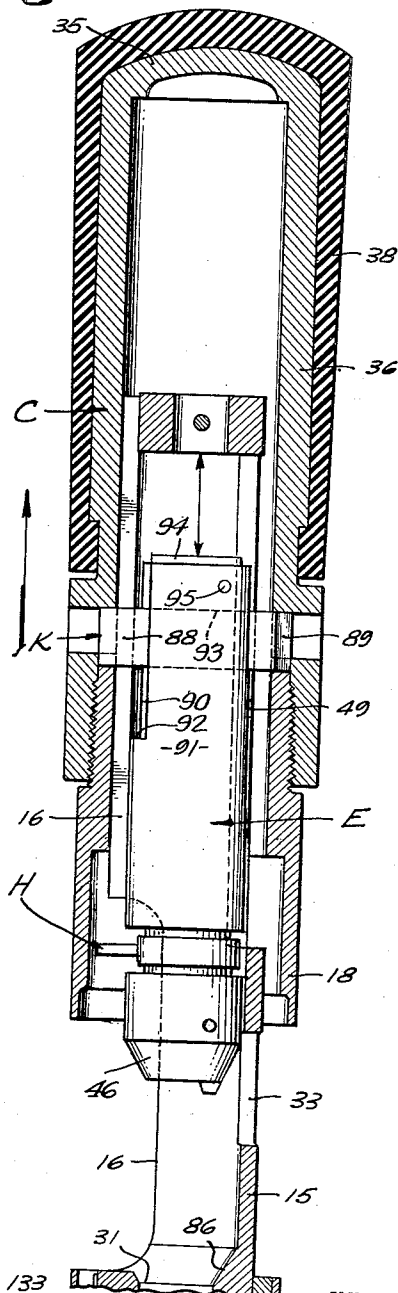


Fig. 28.



INVENTOR.
Jesse Gannon

BY *W. H. Maxwell Jr.*
Agent.

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2,766,451

EXPLOSIVE ACTUATED FASTENER APPLICATOR

Jesse Gannon, Culver City, Calif., assignor to
Ben Weingart, Los Angeles, Calif.

Application August 3, 1953, Serial No. 372,096

18 Claims. (Cl. 1—44.5)

This invention has to do with an explosive actuated fastener applicator, and it is a general object of the invention to provide a simple practical improved mechanism of this general character.

There are many situations that require that fasteners, or like devices, be applied to bodies or objects that resist proper application by ordinary means or by means of ordinary equipment. It has been found that in many situations as, for instance, where fasteners, or the like, are to be applied to metal bodies or plates or to cement or concrete, explosive charges can be employed for the generation of power for the desired applications, and applicators have been developed for use in such situations. The present invention is concerned with such an applicator, and it is a general object of the invention to provide a mechanism of this character which is of simple practical improved construction.

Another object of this invention is to provide an applicator of the general character referred to which is such that fasteners, or the like, and explosive charges or cartridges can be easily and quickly applied thereto, to the end that the applicator can be operated rapidly.

It is another object of this invention to provide an applicator of the general character referred to which is simple to operate and which is at the same time safe or, in effect, foolproof, so that it is not dangerous to the user or to persons that might occasionally handle it. The structure of the invention is free of separable parts subject to causing accidental igniting of the propelling charge.

It is a further object of this invention to provide a device of the general character referred to which involves few and simple dependable parts that are simple and inexpensive of manufacture and convenient to handle and operate.

The applicator provided by this invention can be used to advantage to handle a fastener, or the like, in the form of a spike or nail having an elongate shank with a head thereon, and it may also handle a washer which is adapted to be pierced by the fasteners and which is finally lodged beneath the head of the fastener in a manner common to devices of this general character.

The device embodying the present invention is characterized by three telescopically-related elements, one a barrel-supporting sleeve assembly having a work-engaging portion at its lower end, another a barrel assembly within said barrel-supporting sleeve assembly, and another a handle positioned at the upper ends of said assemblies. The barrel-supporting sleeve assembly has a work-engaging portion at its lower end adapted to be applied to the work into which the fastener is to be secured, and such work-engaging portion is maintained in engagement with the work while the fastener is being applied. The barrel assembly includes a breech portion near the upper end thereof with a side opening for the insertion into and removal therefrom of a fastener and an explosive cartridge, and also includes a barrel portion having a lower end portion slidable relative to the lower portion of the barrel-supporting sleeve assembly, the barrel serving to de-

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liver the fastener through the work engaging portion of said barrel-supporting sleeve assembly and into the work. The handle is the uppermost element of the device and has a skirt portion depending from its lower portion and adapted to extend over the combined upper end portions of the barrel supporting sleeve assembly and the barrel assembly, said skirt, when said handle is in its lowermost position with respect to said assemblies, serving to cover or close the side opening in the breech portion of the barrel assembly. A means, preferably a spring, yieldingly holds the barrel in an up position relative to the barrel-supporting sleeve assembly, and a breechblock operates vertically in the breech portion of the barrel assembly, and, when in its lowermost position with respect to the upper end of the barrel of said barrel assembly, immediately overlies the cartridge inserted into the open, upper end of said barrel. A firing pin is carried by the breechblock and operates to strike and ignite the cartridge mounted in the open, upper end of said barrel. A spring means is provided to operate the firing pin to firing position, and a control trigger is carried by the breechblock and serves to releasably hold the firing pin in its uppermost position against the action of the spring means, the trigger being pivotably mounted on the breechblock to swing laterally with respect to the axis of the device and being yieldingly held in engagement with the firing pin. A preferred ejecting means for the empty cartridge shell includes a cavity in the lower end of the breechblock into which cavity the bead of the cartridge head is seated when the breechblock occupies a position immediately above and closing the breech opening in the upper end of the barrel of the barrel assembly. If desired, a pivoted ejector may be carried by the breechblock adjacent the lower end thereof and serves to remove the discharged cartridge from the breech opening of the barrel following firing of the cartridge and upward movement of the breechblock with respect to the breech opening of the barrel. A means, preferably a crossbar, couples the handle and breechblock, and a lock means is provided for locking the breechblock in its operative position immediately overlying the cartridge in the breech opening of the barrel. The lock means preferably includes a tubular sleeve which is a part of the barrel assembly and which sleeve surrounds the breechblock and is located within, and surrounded by, the handle, this sleeve having J-slots therein in which the crossbar operates. A cocking means is provided for retracting the firing pin against the action of its spring, and in one case includes a tubular extension of the breechblock having slots therein, the walls defining said slots slidably engaging the crossbar. Further, a stop on the firing pin is engaged by the crossbar so that the firing pin is lifted when the crossbar is moved up to a position where the trigger moves into set position with respect to the firing pin. An actuating means for release of the trigger is provided and is operated by relative rotation between the main elements of the device in a manner to be hereinafter described. The handle is rotated to turn the breechblock relative to the barrel-supporting sleeve assembly while the said handle is in its lowermost or fully depressed position, such rotation causing the trigger to engage with, and to be tripped by, a trip shoulder on the barrel-supporting sleeve assembly. A safety means is provided for locking the barrel assembly and the barrel-supporting sleeve assembly against relative rotation to prevent movement of the trigger relative to the barrel-supporting sleeve assembly sufficient to trip the trigger until a spring means positioned between the barrel assembly and the barrel-supporting sleeve assembly is compressed and the barrel of the barrel assembly is depressed a predetermined amount relative to the barrel-supporting sleeve assembly. A shield is provided at the lower end

portion of the barrel-supporting sleeve assembly, and the work-engaging portion at the lower end of the barrel-supporting sleeve assembly preferably includes a magnetic shoe adapted to hold a part, such as a washer or the like, in the path of the fastener to be projected from the lowermost end of the barrel when the cartridge at the upper end of the barrel is discharged, the work engaging member at the lower end of said barrel-supporting sleeve assembly being engaged with, and pressed tightly against, an object, such as a body of cement or the like, to bear thereon at or around the point where the fastener is to be applied.

The various objects and features of my invention will be fully understood from the following detailed description of typical forms and applications of the invention, throughout which description reference is made to the accompanying drawings in which:

Fig. 1 is a side elevation of an applicator provided by the present invention, showing the various parts in their extended or unactuated positions;

Fig. 2 is a view similar to Fig. 1, but showing the parts in their compressed or actuated positions with the work-engaging member at the lowermost end of the barrel-supporting sleeve assembly engaged with a bracket to be secured to an object by means of a fastener to be applied by the applicator of the present invention, certain parts being shown in section in this figure;

Figs. 3 to 6, inclusive, illustrate elements adapted to be handled by the applicator, Fig. 3 being a perspective view of a cartridge to be employed as a means for delivering a propelling force to a fastener, Fig. 4 being a perspective view of a simple, typical fastener to be handled by the applicator, Fig. 5 being a perspective view of a retaining collar applicable to the fastener and serving to hold it temporarily in the upper portion of the bore of the barrel of the barrel assembly preliminary to operation of the applicator, and Fig. 6 being a perspective view of a washer adapted to be combined with a fastener and showing said washer prior to its being pierced by the fastener;

Fig. 7 is an enlarged, detailed sectional view showing the bracket and object illustrated in Fig. 2 coupled by a fastener and washer applied as by the applicator of the present invention;

Fig. 8 is an enlarged, vertical sectional view of a portion of the device illustrating the mechanism of the present invention with the parts compressed and positioned as shown in Fig. 2 and ready to be fired to drive a fastener. The broken lines in Fig. 8 indicate the uppermost position to which the work engaging shield can be shifted;

Fig. 9 is a vertical sectional view similar to Fig. 8 and illustrating the upper portion of the device or the balance of the device shown in Fig. 8, and showing the handle compressed and ready to be rotated in order to release the trigger;

Fig. 10 is a view similar to a portion of Fig. 9, being a view taken as indicated by line 10—10 on Fig. 9, with internal portions of the device shown in elevation to illustrate details of construction and showing the manner in which the trigger is engaged by the handle;

Fig. 11 is a fragmentary, enlarged, vertical sectional view showing the mechanism illustrated in the preceding figures to illustrate the details of construction;

Fig. 12 is an enlarged, detailed view taken substantially as indicated by line 12—12 on Fig. 8, with certain parts thereof being broken away to show in section in order to illustrate the safety element which involves a projection that operates in a J-slot;

Fig. 13 is a detailed, transverse sectional view taken as indicated by line 13—13 on Fig. 11 and illustrates a portion of the cartridge extractor;

Fig. 14 is a transverse sectional view taken as indicated by line 14—14 on Fig. 11 and illustrates the relationship between the firing pin and the cartridge extractor;

Fig. 15 is an enlarged, transverse sectional view taken

as indicated by line 15—15 on Fig. 8 and shows the barrel and bore element of the structure;

Fig. 16 is an enlarged, detailed, transverse sectional view taken as indicated by line 16—16 on Fig. 8 and shows the shielding means that surrounds the barrel and the bore element;

Fig. 17 is an enlarged, detailed, transverse sectional view taken as indicated by line 17—17 on Fig. 8 and shows the projection of the safety means that I have provided as it operates in the J-slot;

Fig. 18 is an enlarged, detailed transverse sectional view taken as indicated by line 18—18 on Fig. 9 and illustrates the crossbar that I provide in the upper end of the structure;

Fig. 19 is an enlarged, detailed, transverse sectional view taken as indicated by line 19—19 on Fig. 9 and showing the trigger in locked position with respect to the firing pin;

Fig. 20 is a plan sectional view taken as indicated by line 20—20 on Fig. 2 and shows the shape of the shield at the lower end of the structure;

Fig. 21 is an enlarged, detailed, fragmentary sectional view showing a modified construction that may be used to effect extraction of a cartridge from the breech opening at the upper end of the barrel of the barrel assembly;

Fig. 22 is an enlarged, detailed, transverse sectional view taken as indicated by line 22—22 on Fig. 8 and shows the coupling means that I have provided for connecting the guard sleeve and breechblock;

Fig. 23 is an enlarged, fragmentary sectional view taken as indicated by line 23—23 on Fig. 2 with certain parts shown in sections and shows the said coupling means (Fig. 11) and further illustrates the trigger;

Fig. 24 is a view similar to Fig. 17 showing the handle element rotated in a manner to fire the cartridge;

Fig. 25 is a view similar to Fig. 19 but showing the trigger in unlocked position with respect to the firing pin;

Fig. 26 is an enlarged, detailed, fragmentary sectional view showing portions of the mechanism illustrated in Fig. 11 after the trigger has released the firing pin and such pin has been spring projected to fire the cartridge positioned within the breech opening of the barrel of the barrel assembly.

Figs. 27 and 28 are similar to Figs. 8 and 9, respectively, showing the various parts of the structure in the extended or unactuated position as they are positioned on the structure, as shown in Fig. 1 of the drawings.

The applicator provided by the present invention can be used to advantage in many situations, and it can be used to handle various charges, fasteners, and like accessories. It is to be understood that when I use the term "fastener" I mean to include not only devices or mechanisms that are strictly fastening devices but I refer to any and all devices or mechanisms or combinations thereof that may be employed in the applicator that I have provided. In the case illustrated, the structure is specifically provided to handle typical, simple or conventional equipment. However, it is to be understood that it can be readily modified, if desired, to accommodate special or different equipment or accessories. The particular applicator shown in the accompanying drawings can be used to advantage to handle an explosive charge carried within a cartridge X, as shown in Fig. 3 of the accompanying drawings, and the cartridge can be employed to drive or operate a fastener Y as shown in said drawings. Further, if desired, the applicator can handle a washer Z initially in the form of an imperforate disc held by the holder S at the lowermost end of the barrel-supporting sleeve assembly so that said washer is pierced by the fastener Y in the course of application thereof to the work. In the particular case illustrated, the applicator is shown as used for applying the fastener Y to a body 10 of cement or concrete, and is further shown as applying a bracket 11 to the concrete or cement by means of the fastener Y. It is to be understood that such de-

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tails are no part of the present invention and that they may be varied widely as various operating conditions are encountered.

The applicator embodying the present invention involves, generally, three telescopically-related main elements, one a barrel-supporting sleeve assembly A including a lower portion carrying a work holder portion S at its lower end, a barrel assembly B including a barrel 17 mounted within, and axially slidable with respect to, the lower portion of said barrel-supporting sleeve assembly A, and a handle C positioned at the upper ends of said barrel-supporting sleeve assembly A and said barrel assembly B. The barrel-supporting sleeve assembly A involves, generally, three tubular elements, one a lower portion 20 that guides the barrel 17, one an upper tubular sleeve 21 that surrounds the breech portion of the assembly B, and the third a coupling member 22 that connects the elements 20 and 21. The barrel assembly B involves, generally, three elements, one the barrel 17, one a breechblock guide bushing 15, and the third a breechblock E that is shiftably carried in the guide bushing 15. The barrel assembly also has incorporated in it, various other features of construction as will be hereinafter described. The handle C, which is the outermost of the three main elements, has a lower skirt portion 18, depending over the combined upper portions of the barrel-supporting sleeve assembly, and an upper shield 36 that houses the upper end of the barrel assembly B and the barrel assembly.

The structure further includes spring means D which yieldingly holds the barrel assembly B in its uppermost position relative to the barrel-supporting sleeve assembly A. A breechblock E operates vertically in the breech block bushing 15 of the barrel assembly and immediately overlies and closes the breech opening 30 at the upper end of barrel 17 when said breechblock is down or engaged with the upper end thereof. A firing pin F is mounted for reciprocation within the breechblock E and extends through a bore in said breechblock in a direction parallel to the axis of said breechblock, said firing pin being operative, in a manner to be hereinafter described, into engagement with a cartridge X placed in the breech opening 30 at the upper end of the barrel 17, to fire said cartridge. A spring means G is provided for actuating the firing pin F into firing contact with cartridge X, the said firing pin being controlled by a trigger H carried by the breechblock E and adapted to releasably hold the firing pin E in a retracted position against the action of spring means G, as best shown in Fig. 11. An ejector J is carried by the breechblock E and serves to dislodge the cartridge following discharge thereof as said breechblock E is moved away from the upper end of the barrel 17 subsequent to firing of cartridge X. A means K, preferably in the form of a crossbar, couples the handle C and breechblock E so that said breechblock can be moved into and out of engagement with the upper end of the barrel 17 by lowering and raising said handle with respect to said upper end of said barrel. A lock means L (see Fig. 10) is provided for locking the breechblock E in its down or engaged position with the gun barrel assembly B, and a cocking means (see Fig. 11) is provided for positioning the firing pin F with the spring means G compressed and the trigger H engaged with said firing pin (see Figs. 11 and 19). An actuating means N (see Fig. 19) is provided and is operated by rotation of handle C relative to the barrel-supporting sleeve assembly A when the handle C is fully depressed, so that the trigger H is engaged and is tripped to release the firing pin F (see Figs. 19 and 25). A safety means P (see Fig. 12) is provided to lock the barrel assembly B and the barrel-supporting sleeve assembly A against relative rotation until such time as the component parts of the device are in their proper positions for safe and efficient deliberate operation of the device. A shield R (see Figs. 1, 2, and 8) is preferably provided at the lower end of the barrel-supporting

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sleeve assembly, and a work holder S (see Fig. 8) is preferably provided at the lowermost end of the barrel 17 when the device is being employed in a manner herein set forth.

The lowermost portion of the barrel-supporting sleeve assembly A (see Fig. 8) is an elongate tubular unit that surrounds and slidably engages the barrel 17 of the barrel assembly B, and, in the case illustrated, it is characterized by an elongate tubular lower end portion 20 that slidably supports and guides the lower portion of the barrel 17, and by an upper portion of a diameter somewhat greater than that of lower portion thereof. In the particular case illustrated, the upper end portion of portion of the sleeve assembly A is threadedly connected to a coupling member 22 which is also threadedly connected to a tubular sleeve 21 which extends upwardly from said coupling member, the internal configuration of said coupling member being such as to provide a shoulder 23 which constitutes an abutment for the lower end of the coiled compression spring 24 of spring means D, all as clearly shown in Fig. 8 of the accompanying drawings. Furthermore, the lower end 25 of coupling member 22 serves as a stop or abutment which is engaged by a fixed stop or abutment 26 on the barrel of the barrel assembly B to limit upward movement of said barrel relative to the barrel-supporting sleeve assembly A, while a downwardly-facing shoulder 27 on the barrel 17 engages a fixed, upwardly-facing shoulder 28 on portion 20 of the barrel-supporting sleeve assembly A to limit downward movement of the barrel 17 relative to the barrel-supporting sleeve assembly. The upper end of coiled compression spring 24 engages beneath a downwardly-facing shoulder 40 on the barrel 17, and, hence, this spring serves to yieldingly hold the barrel 17 in its up or elevated position with reference to portion A of the barrel-supporting sleeve assembly.

The barrel 17 of the barrel assembly B has a cartridge-receiving breech opening 30 (see Figs. 8 and 11) that opens upwardly at a shoulder 31 constituted by the upper end of said barrel 17 while the breechblock bushing 15 is threadedly connected to and continues upwardly from the upper portion of the barrel where it is provided with a side opening 16 (see Fig. 1), which breechblock bushing 15 is tubular and is of increased diameter to accommodate therein the breechblock E with sufficient clearance to permit said breechblock to reciprocate freely within such bushing 15. The breechblock bushing 15 projects upwardly a substantial distance above the shoulder 31, and the side or lateral opening 16 provided therein is of substantial length so that it will freely pass the parts required for insertion into the breech opening 30 at the upper end of the barrel 17, for example, the fastener Y and cartridge X. In practice, it is desirable to provide the breechblock bushing 15 of the barrel 17 with a second opening 33 (see Fig. 1) diametrically opposite opening 16 to facilitate lateral displacement of a discharged cartridge that has been elevated to a position opposite the side or lateral opening 16 through the action of the extractor or ejector J.

The apertured breechblock bushing 15 is preferably formed separate from the main portion of said barrel and said portion preferably has a lower collar portion 41 (see Figs. 8, 9, 11 and 27) that surrounds the upper end of the barrel 17 and is joined thereto by a threaded connection indicated by reference number 42. The collar 41 can be maintained in position with respect to barrel 17 by means of a set screw 44.

The lower end portion of the barrel 17 of the barrel assembly B is a straight tubular part of substantial length (see Fig. 8), and in the case illustrated, its lower or discharge end 34 occurs somewhat above the lowermost end of the applicator when the cartridge X is fired, so that the workholder S which is threadedly connected within the lower end of said lower end portion, is accommodated between the lower end of the barrel 17 and the

work, as clearly shown in Fig. 8 of the drawing. The work holder S is preferably provided with a plurality of vent openings 34a for ready escape of the gases developed within the bore of the barrel 17 by the explosion of the cartridge X.

The handle C includes a tubular member or shell 36 closed at its upper end by a wall or top 35, the shell 36 being of substantial length to surround and enclose certain elements of the mechanism, and to carry the crossbar 88 of coupling means K (see Figs. 9, 10, and 11). The skirt 18 of handle C is joined to the shell 36 and depends therefrom to surround and slidably pass over the upper end portions of the barrel-supporting sleeve assembly A and the barrel assembly B and to constitute an external closure or cover for the side or lateral opening 16 in the breechblock bushing 15 when the handle C is in its lowermost position and the component parts of the applicator are in position for firing of the cartridge X (see Figs. 2 and 9). When the handle C is in its uppermost position, the skirt 18 exposes or uncovers the side or lateral opening 16 of breechblock bushing 15 as clearly shown in Figs. 1 and 28 of the accompanying drawings. In practice, it is desirable to provide the exterior surfaces of shell portion 36 and of top 35 of the handle C with a cushioning jacket or cover 38 of suitable material such as rubber or the like.

The spring means D, as best seen in Figs. 8 and 27, comprises a simple helical compression spring 24 surrounding an intermediate portion of the barrel of the barrel assembly B and acting under compression between coupling 22 and a downwardly facing shoulder 40 on the barrel 17. In the preferred form of the present invention, the shoulder 40 is formed by the underside of a circular flange on the barrel 17 positioned immediately beneath an internal shoulder at the bottom of the thick, intermediate portion of collar portion 41. With the spring 24 surrounding the intermediate portion of the barrel 17 and under compression between shoulders 23 and 40, said spring serves to yieldingly hold the barrel 17 in its uppermost or elevated position with respect to the barrel-supporting sleeve assembly A, as shown in Fig. 27.

The breechblock E (see Figs. 9 and 11) is located immediately above the upper end of the barrel 17 and operates with the breechblock bushing 15 of the barrel assembly B. The breechblock E includes an elongate, vertically-disposed member having an end portion 46 co-operating with the upper end of the barrel 17 to close or cover the barrel opening 30 and thus confine a cartridge X therein as clearly illustrated in the accompanying drawings. When the breechblock E is in its lowermost or engaged position as clearly illustrated in Figs. 8 and 11, its end portion 46 rests on the shoulder 31 constituted by the upper end of the barrel 17. In the case illustrated, the end portion 46 is recessed at 47 to accommodate the head or cap portion 48 of cartridge X, the rim of which cartridge rests on the shoulder 31. The breechblock E is preferably round in cross sectional configuration and is slidably carried within, and is free to reciprocate within, the vertical opening or bore 49 of breech portion 15, so that it may be readily shifted or reciprocated between its lowermost position shown in Figs. 8 and 9 and an elevated position where it ceases to obstruct the openings 16 and 33 in the breechblock bushing 15 as shown in Figs. 27 and 28.

The firing pin F (see Figs. 11 and 26) is slidably carried in a vertically-extending bore or guideway 60 provided in, and extending axially of, the breechblock E, this bore or guideway being eccentrically located with respect to this axis of the breechblock so that the tip or pin portion 61 of firing pin F engages the rim portion of cap 48 of the cartridge X in a manner to effectively fire or explode said cartridge. The firing pin F is provided with a vertical extension or stem 64 the upper portion of

which stem slidably engages a guide opening 65 provided in the crossbar 88 of the coupling means K.

The means G, best shown in Fig. 11, for actuating the firing pin F is preferably a helical compression spring 66 carried on the stem 64 between an upwardly facing shoulder 67 on the firing pin F and the underside of crossbar 88 of coupling means K. The parts are arranged and proportioned so that the spring 66 serves to operate the firing pin F to a down position when said pin is released by action of the trigger H, in which released position the pin 61 engages the cap 48 of the cartridge X to fire or explode said cartridge.

The trigger H, as best shown in Figs. 9, 11, 19, 25, and 26, is provided to control the downward movement of firing pin F, and is carried in a slot 70 (see Fig. 19) provided in the breechblock E where said trigger is pivotally mounted on a vertically-disposed pivot pin 71. The trigger H extends laterally of the breechblock E and has a portion 72 (see Fig. 19) adapted to enter a circumferential recess 74 in firing pin F so that said trigger portion 72 engages beneath a downwardly-faced shoulder 75 (see Fig. 11) on said firing pin which shoulder is established by the recess 74. An extended portion 76 of the trigger H projects laterally from breechblock E, and a spring 77 carried by said breechblock serves to urge said trigger toward and into its locked position with respect to said firing pin (see Fig. 19).

The extractor or ejector J, as best seen in Figs. 11, 14, and 26, is preferably provided for the purpose of displacing or removing the spent or discharged cartridge X from the breech opening 30 of the barrel assembly when the breechblock E is elevated by handle C following firing of the cartridge. In the case illustrated, the ejector J (Figs. 11 and 26) is located in a recess 80 provided in the breechblock E where it is pivotally mounted on a horizontally-disposed pivot pin 81, and said ejector has a catch head 82 that depends into a recess 83 provided in the upper end of the barrel of assembly B. A spring 84 yieldingly holds the ejector J in position where the catch head 82 thereof will engage beneath the radially-projecting rim of cartridge cap 48. When the breechblock E is in its lowermost or operative position, the catch head 82 of the ejector J is confined and supported by an inclined shoulder 86 on the member 41 of the barrel assembly as clearly shown in Fig. 11.

The modified form of cartridge extractor J¹ shown in Fig. 21 involves a socket or cavity 200 in the lowermost face of the breechblock that engages shoulder 31 when said breechblock is in its down or operative position. The head or cap portion 48 of cartridge X is engaged within the socket 200 when said breechblock is in said down or operative position. When cartridge X is fired, the pressure developed within the bore of the barrel B forces the cartridge X upwardly and thus seats the head 48 of said cartridge tightly in socket 200 so that the shell of the discharged or fired cartridge is lifted as the breechblock is lifted or retracted with respect to shoulder 31 constituted by the upper end of the barrel 17 of assembly B. In practice, the socket 200 may be slightly undercut, and said socket may be formed in a hardened insert 201 provided in, and as a part of, the lowermost face of the breechblock.

The coupling means K, as best shown in Figs. 9, 10, 11, 18 and 28 is provided between the handle C and the breechblock E and preferably includes a crossbar 88 carried by the handle C and engaged with said breechblock. The crossbar 88 is shown diametrically disposed within the handle C with its end portions 89 held between shell 36 of said handle (see Figs. 9, 11, and 28). The crossbar 88 extends through diametrically opposite, axially extending slots 90 provided in a vertical tubular extension 91 constituting the upper end of the breechblock E. When handle C is depressed, the crossbar 88 engages the walls 92 defining the lower ends of slots 90 and thus forces the breechblock E down into engagement with the

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shoulder 31 formed by the upper end of the barrel 17 of assembly B, whereas, when the handle C is lifted or elevated, said crossbar engages the walls 93 defining the upper ends of the slots 90 and thus lifts the breechblock E upwardly to raise the lowermost end of said breechblock away from the shoulder 31 formed by the upper end of the barrel 17. The upper ends of slots 90 are closed by a block 94 secured at the uppermost end of the tubular extension 91 of breechblock E by means of a transversely extending pin 95 (see Fig. 11). The slack or relative movement provided between the handle C and breechblock E through the mechanism just described, provides for the resetting of the firing pin F in a manner to be hereinafter more fully described.

The lock means L, as best shown in Figs. 10 and 18, is provided for locking the breechblock E in its down or operative position where it closes the upper end of the barrel 17 of assembly B, and, in the case illustrated, it includes a vertical tubular extension 100 of breechblock bushing 15 of the barrel assembly B of the device, which extension constitutes a part or element of said barrel assembly and is disposed concentrically between tubular extension 91 of the breechblock E and skirt 18 of handle C as best shown in Fig. 18, and which extension 100 has diametrically opposite J-slots in which the crossbar 88 of coupling means K operates. Each of said J-slots (see Fig. 10) has an elongated or vertical section 101 of a width slightly exceeding the width of crossbar 88, from the lower end of which vertical section 101 a lateral section 102 extends. The elongated or vertical sections 101 of the J-slots, best shown in Fig. 10, accommodates the end portions 89 of crossbar 88, the construction being such that the handle C can move vertically relative to the breechblock E and the barrel assembly B. However, when the handle C is fully depressed, i. e. when said handle is in its lowermost position, which causes the lowermost end of breechblock E to engage the shoulder 31 formed by the upper end of the barrel 17 of assembly B, the ends 89 of crossbar 88 are disposed in alignment with the lateral sections 102 at the bottom of sections 101 of said slots and, hence, the handle can be rotated relative to breechblock E to move the crossbar 88 into said lateral section 102 of the J-slots, as shown in Fig. 10.

The resetting or cocking means M, as best shown in Fig. 11, utilizes the vertical slack or relative vertical movement permitted to occur between the handle C and breechblock E, and in the form of the invention shown in the accompanying drawings, said cocking means includes a stop or abutment 110 on stem 64 of firing pin F, which stop is located above the crossbar 88 and is so located and spaced that as the crossbar 88 is moved upwardly by manipulation of handle C toward the walls 93 defining the upper ends of slots 90, and before the said crossbar 88 reaches the walls 93, said crossbar engages the stop 110 to lift or elevate stem 64 and its associated firing pin F relative to the breechblock E as said crossbar 88 moves toward engagement with the walls defining the upper ends of slots 90. This elevating of the stem 64 and its associated firing pin F, is sufficient to move the notched or recessed portion 74 of said stem upwardly so that the shoulder 75 on the stem 64 is positioned at a point where trigger H can engage beneath said shoulder 75 under the action of spring 77. As will be obvious, the trigger H remains in this position and holds the firing pin F in its uppermost or cocked position. The firing pin F is not put under the pressure of spring 66 until such time as the crossbar 88 is moved downwardly by manipulation of handle C whereupon the breechblock E is locked in the firing position. The trigger may then be released from engagement beneath shoulder 75 to fire the cartridge.

The trigger actuating means N, best shown in Figs. 9 and 19 of the accompanying drawings, includes a shoulder 115 on the upper sleeve portion 21 of the barrel-supporting sleeve assembly A, which shoulder is estab-

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lished by providing an arcuate recess 116 in the tubular sleeve 21 of the barrel-supporting sleeve assembly, which recess extends downwardly from the upper, open end of said tubular sleeve 21. The arcuate recess 116 (Fig. 19) provided in portion 21 to establish the shoulder 115, receives the extended portion 76 of trigger H, and the shoulder 115 is so located that relative rotation between the handle C and the barrel-supporting sleeve assembly including portion 21 results in engagement between the said extended portion 76 of the trigger H and the shoulder 115 and movement of said trigger H about its pivot pin 71, so that the trigger H is released from engagement with the firing pin F thus freeing it for operation by its cooperating propelling spring 66 to fire the cartridge X.

The safety means P, as best shown in Figs. 8, 12, 17 and 24, locks the tubular sleeve 21 of the barrel-supporting sleeve assembly A against relative rotation with respect to the barrel assembly B and thus prevents release of the trigger H in the manner above described until the spring 24 which yieldingly holds the barrel assembly B in the uppermost position with respect to the barrel-supporting sleeve assembly A, is compressed and until the barrel assembly is depressed relative to said barrel-supporting sleeve assembly a predetermined amount, following which, the safety means P allows for, or provides for the relative rotation necessary to trip the trigger H. The parts are arranged and proportioned so that when the shoulder 27 (see Fig. 8) on the barrel of assembly B engages shoulder 28 on the lower portion of portion A of the barrel-supporting sleeve assembly A, the safety means P allows for relative rotation between the parts sufficient to effect tripping or release of the trigger H.

The safety means P in the form illustrated herein, (see Figs. 8, 12, 17 and 27), includes a projection 120 extending inwardly from tubular sleeve 21 of the barrel-supporting sleeve assembly A to operate in a J-slot 125 provided in the wall of a cylindrical skirt 121 that depends from the collar 41 of the breechblock bushing 15 of the barrel assembly B and which is positioned within the tubular sleeve 21 of the barrel-supporting sleeve assembly A, it being noted that skirt 121 is positioned centrally within and immediately adjacent the inner surface of the tubular sleeve 21. The J-slot provided in skirt 121 includes an axially-extending portion 125 (see Fig. 12) that allows for free axial movement between the barrel-supporting sleeve assembly A and barrel assembly B, and also includes a laterally-extending portion 126 located at the upper end of portion 125 of said J-slot. It will be obvious that portion 125 of said J-slot permits relative axial movement between the barrel assembly B and barrel-supporting sleeve assembly A but prevents relative rotary movement between the said assemblies, and that when projection 120 on the tubular extension 21 is opposite the laterally-extending portion 126 of said slot, the said assemblies may partake of relative rotary movement, the length of portion 126 being such as to permit sufficient relative rotary movement between the assemblies to effect tripping of the trigger H in the manner, and by the means, hereinabove described. The projection 120 operates in the portion 126 of the J-slot with some clearance, and the lower wall which defines portion 126 of said slot has a cam section at 126a which deflects the skirt 121 so that it turns back to occupy a position wherein the projection 120 is positioned within portion 125 of said slot as the applicator operates under influence of an explosive charge strong enough to cause such operation of the parts. If a relatively light charge is used to propel or project the fastener Y, the projection 120 will remain in the lateral portion 126 of the J-slot.

In the preferred form of the invention (see Figs. 8, 9, 16, 17, and 24), I provide shielding means Q for rendering the barrel-supporting sleeve assembly A inaccessible so that said assembly cannot be gripped by an op-

erator of the applicator in a manner that might result in an untimely, improper, and unsafe firing of the cartridge X. The means Q further provides a convenient grip portion that aids or assists in the handling of the applicator. The means Q, in the form shown, includes a cylindrical guard sleeve 300 that surrounds the portion or section 21 of the barrel-supporting sleeve assembly A, which portion or section would be otherwise exposed, the guard sleeve 300 being slidable on said portion or section 21 and depending below said portion or section as can be seen by comparing Figs. 27 and 8 of the drawings.

Coupling means 301 (see Figs. 8, 22, 23 and 27) connects the guard sleeve 300 to the collar 41 of the barrel assembly B so that said guard sleeve is free to rotate relative to said barrel assembly but cannot move longitudinally thereof. Said coupling means 301 is shown as including a lug 302 projecting inwardly from the guard sleeve 300 and entering an annular channel 303 formed in the exterior of the collar 41. In passing from the guard sleeve 300 to the annular channel 303 in collar 41, the lug 302 passes through an elongate guide slot 305 in the tubular sleeve 21 of the barrel-supporting sleeve assembly A. This construction provides for free relative longitudinal movement between the guide sleeve 300 and the barrel-supporting sleeve assembly A and, at the same time, the guard sleeve 300 is coupled to the collar 41 of the barrel assembly B so that these parts move as a unit lengthwise of the structure. It follows that to shift the breechblock E and the parts moving longitudinally therewith relative to the barrel 17 of assembly B from the position shown in Figs. 27 and 28 to the position shown in Figs. 8 and 9, so that rotation of handle C and all parts rotatable therewith causes firing of the cartridge X and projection of the fastener, it is merely necessary to apply the lowermost end of the applicator into contact with, or against, an abutment such as the work 10 and manually depress the handle C. It is preferred to provide a suitable grip 309 of rubber or the like on the exterior of the guard sleeve 300.

In the form of the invention illustrated, a shield R (see Figs. 1, 2, 8 and 20) is provided at the lower end of the barrel-supporting sleeve assembly A, i. e. at the lower portion of said assembly, and includes a shoe shown as made up of a horizontally disposed, circular plate 130 carried on, and extending outwardly from, a sleeve 131 surrounding the lower end portion of the barrel-supporting sleeve assembly A and normally yieldingly urged downwardly along said lower end portion by a spring 132. An extension 133 is provided on plate 130, which extension is rotatably mounted on said plate in the manner clearly disclosed in Fig. 20 of the accompanying drawings.

In the particular case illustrated, where a washer Z (see Figs. 6, 7, and 8), or other element, is to be combined with, and pierced by, the fastener Y, it is preferable to provide a suitable holder S (see Fig. 8) at or beyond the lower end of the barrel-supporting sleeve assembly A. In the case illustrated, the holder S comprises a suitable tubular fitting threadedly connected to the lower end of said assembly A, and, in practice, the holder S may be a permanently magnetized element that will temporarily maintain the part Z in place as the device is positioned with respect to the work preparatory to firing of the cartridge X. The particular holder S illustrated in the accompanying drawings has a central, vertical bore or opening 135 which registers with the lowermost end of the barrel B and is of a sufficient internal diameter to permit passage therethrough of the head 140 of the fastener Y. It is important to observe that the part S which I have termed a holder is, in effect, a pressure plate carried by, or forming a part of, the lower end of the barrel-supporting sleeve assembly A. This holder S remains in pressure engagement with the work 10 when

or as the fastener Y is driven into said work. Hence, holder S acts as a guard and also as a part preventing or minimizing shattering of the work 10 in the area of said work surrounding the opening made by the fastener Y as said fastener pierces said work. As the holder S is rigidly attached to the lowermost end of the barrel-supporting sleeve assembly A, said holder can remain stationary on the work as the barrel assembly B works away from the work or backs away therefrom due to the recoil occasioned by the firing of the cartridge X, or for other reasons.

In the particular case illustrated, the retainer 150, shown in Fig. 6, may be employed in connection with the fastener Y and is placed on the shank 151 of said fastener to occupy a position beneath the head 140 of said fastener, the said retainer 150 having an external diameter slightly greater than that of the bore or barrel B and of the head 140 of the fastener Y, whereby said retainer 150 will frictionally engage the wall defining the bore of the barrel, to thus resist free passage of the said fastener through said bore, and tends to hold the fastener Y in the desired position beneath the cartridge X prior to actual firing of said cartridge.

To operate the applicator hereinabove described, the elements are extended or elevated to the relative positions shown in Figs. 1, 27, and 28 to permit insertion of the fastener Y and cartridge X into the breech opening 30 at the upper end of barrel B. If a washer Z is to be employed, such washer may be placed on the lower end of holder S to underlie said holder. If desired, the applicator may be loaded and the breechblock locked in position as above described, before the lowermost end of the applicator is placed into contact with the work 10. The applicator is then placed against the work to which the fastener is to be applied, whereupon the handle C is moved downwardly causing the breechblock E to be moved into operating position (see Figs. 2, 8, 9, 11 and 21) where it effectively retains and engages the cartridge X. With the breechblock E in position, the lock means 40 L is engaged by initially rotating the handle C, following which, further downward pressure is applied to the handle C until shoulders 27 and 28 (see Fig. 8) engage, whereupon, further turning movement between the barrel-supporting sleeve assembly A and handle C causes shoulder 115 on the upper portion of tubular sleeve 21 of the barrel-supporting sleeve assembly A to move trigger H in a counter-clockwise direction as viewed in Fig. 19, which movement of trigger H releases said trigger from engagement with the firing pin F, which firing pin, under the action of spring 66, effects firing of the cartridge X. The firing of the cartridge X drives the fastener Y downwardly through the barrel and through the washer Z, if such washer has been employed, and into the work 10 to finally attain a position such as that shown in Fig. 7 of the accompanying drawings. As this operation occurs, the holder S at the lowermost end of the barrel-supporting sleeve assembly A, being movable relative to the barrel 17 of the barrel assembly B, remains stationary on, and in pressure contact with, the work 10, due to the pressure exerted on the applicator by the operator thereof.

Following the operation just described, the various elements or parts of the device are again returned to their extended or elevated positions or relationships (see Fig. 1), in the course of which the ejector J lifts the expended cartridge X from the breech opening 30 of the barrel 17 thus positioning it for discharge through the opening 16. The applicator is then ready for reloading preparatory to a subsequent fastener applying operation.

Having thus described only typical forms and applications of my present invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and which fall within the scope of the following claims.

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Having thus described my invention, I claim:

1. An explosive actuated fastener applicator including three relatively-movable main elements, one a barrel-supporting sleeve assembly having a lower work-engaging portion; one a barrel assembly mounted in and axially slidable within said barrel-supporting sleeve assembly and including a barrel having an upper end portion adapted to receive a fastener and an explosive cartridge with the cartridge overlying said fastener, the lower end of said barrel terminating adjacent the lower work-engaging portion of said barrel-supporting sleeve assembly, and the other a manually engageable handle mounted for rotation and axial shifting movement on the upper end of the handle supporting sleeve assembly; said barrel assembly including a breechblock above said upper end portion of said barrel mounted for shifting movement into and out of position where it confines the fastener and explosive cartridge in said upper end portion, a trigger-restrained spring-projected firing pin mounted in said breechblock for exploding said cartridge upon release of said trigger, and lock means for securing the breechblock in said confining position, said handle being operatively connected to said breechblock to move the same axially into and out of said confining position, said handle being operatively associated with said lock means and said trigger and being rotatable with respect to said assemblies to an initial position to actuate said lock means to retain said breechblock in said confining position and to a final position to release said trigger to permit spring actuation of said firing pin to explode said cartridge.
2. An explosive actuated fastener applicator as defined in claim 1, wherein the spring for projecting said firing pin upon release of said pin by actuation of said trigger is energized by axial shifting of said handle as said handle moves said breechblock into said confining position.
3. An explosive actuated fastener applicator as defined in claim 1, wherein said handle is coupled to said breechblock and to the firing pin therein so that axial shifting of said handle to move said breechblock into said confining position simultaneously energizes the spring projecting means of said firing pin.
4. An explosive actuated fastener applicator as defined in claim 1, wherein the barrel-supporting sleeve assembly has a charging opening therein adjacent the upper end portion of said barrel permitting the passing of the fastener and cartridge into said upper end portion.
5. An explosive actuated fastener applicator as defined in claim 1, wherein the barrel-supporting sleeve assembly has a charging opening therein adjacent the upper end portion of said barrel permitting the passing of the fastener and cartridge into said upper end portion, said opening being uncovered when said handle has moved said breechblock out of said confining position and being covered by said handle when said breechblock is in said confining position.
6. An explosive actuated fastener applicator as defined in claim 1, wherein a compression spring is positioned between said barrel-supporting sleeve assembly and said barrel assembly and is effective to yieldingly maintain said barrel assembly in an upwardly extended position relative to said barrel-supporting sleeve assembly.
7. An explosive actuated fastener applicator as defined in claim 1, wherein a laterally-extending shoe is slidably mounted on the barrel-supporting sleeve assembly adjacent the lower work-engaging portion thereof and is engageable with the work to which the fastener applicator is applied.
8. An explosive actuated fastener applicator as defined in claim 1, wherein a laterally-extending shoe is slidably mounted on the barrel-supporting sleeve assembly adjacent the work-engaging portion thereof and is engageable with the work to which the fastener applicator is applied, and wherein a compression spring is positioned between the barrel-supporting sleeve assembly and said shoe for

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normally yieldingly urging said shoe downwardly with respect to said barrel supporting sleeve assembly.

9. An explosive actuated fastener applicator as defined between said barrel-supporting sleeve assembly and said barrel assembly and is effective to yieldingly maintain said barrel assembly in an upwardly extended position relative to said barrel-supporting sleeve assembly, wherein a laterally-extending shoe is slidably mounted on the barrel-supporting sleeve assembly adjacent the lower work-engaging portion thereof and is engageable with the work to which the fastener applicator is applied, and wherein a compression spring is positioned between the barrel-supporting sleeve assembly and said shoe for normally yieldingly urging said shoe downwardly with respect to said barrel-supporting sleeve assembly.
10. An explosive actuated fastener applicator as defined in claim 1, wherein means are provided for coupling said handle to said breechblock for limited relative movement of said handle and breechblock with respect to said barrel assembly.
11. An explosive actuated fastener applicator as defined in claim 1, wherein said breechblock is slidably mounted in said barrel assembly and is coupled to said handle and operated axially thereby into and out of said confining position.
12. An explosive actuated fastener applicator as defined in claim 1, wherein said firing pin has a shoulder thereon engageable by the trigger when said firing pin is maintained under compression by its associated spring, and wherein a shoulder on said barrel-supporting sleeve assembly is movable upon rotation of said handle to its final position to engage said shoulder on said barrel-supporting sleeve assembly with said trigger to release said trigger from the shoulder on said firing pin freeing said firing pin for operation by its associated spring.
13. An explosive actuated fastener applicator as defined in claim 1, wherein the trigger is pivotably mounted on said breechblock and the free end of said trigger is engageable by a shoulder moved into engagement with said free end of said trigger upon rotation of said handle to its final position thus freeing said firing pin for operation by its associated spring.
14. An explosive actuated fastener applicator as defined in claim 1, wherein the handle is operatively connected to said breechblock by a crossbar passing transversely through said breechblock and having its ends mounted in said handle whereby movements of said handle effect corresponding movements of said breechblock.
15. An explosive actuated fastener applicator as defined in claim 1, wherein the handle is operatively connected to said breechblock by a crossbar passing transversely through axially elongated passages in said breechblock and having its ends mounted in said handle, and wherein a stationary tubular extension at the upper end of the barrel assembly and within the handle is provided with diametrically opposite J-slots in which the crossbar operates, each J-slot including an axially-extending portion and a communicating laterally-extending portion, whereby said handle and crossbar may move axially relative to said breechblock when said crossbar operates within said axially-extending portions but are locked against axial movement relative to said breechblock when said crossbar is positioned within said laterally-extending portions.
16. An explosive actuated fastener applicator as defined in claim 1, wherein the handle is operatively connected to said breechblock by a crossbar passing transversely through axially elongated slots in said breechblock and having its ends mounted in said handle whereby axial movements of said handle effect corresponding axial movements of said breechblock when said crossbar engages the walls defining opposite ends of said slots, said axially-elongated slots permitting limited axial movement

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of said crossbar and handle without effecting corresponding axial movements of said breechblock; and wherein the firing pin includes a stem having a first abutment thereon above the upper surface of said crossbar, a second abutment thereon below the lower surface of said crossbar, and a coiled compression spring surrounding said stem and extending between said second abutment and the lower surface of said crossbar, said first mentioned abutment being engaged by said crossbar when said crossbar is moving upwardly in said axially-elongated slots to move said stem upwardly to trigger-restraining position and to compress said spring between said second abutment and the lower surface of said crossbar.

17. An explosive actuated fastener applicator as defined in claim 1, wherein safety means are provided for holding said handle against rotation to its final position to release said trigger to permit said firing pin to explode said cartridge until said handle has been moved to its initial position to actuate said lock means to retain said breechblock in said confining position.

18. In an explosive actuated fastener applicator of the character described, a barrel assembly including a barrel having an upper end portion and a breechblock mounted to axially shift relative to said upper end portion into and out of position closing said portion, said breechblock

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having a trigger-restrained spring projected firing pin mounted therein; means for lifting and resetting the firing pin and for closing said breechblock and compressing the spring to bias the firing pin; a barrel-supporting sleeve assembly surrounding said barrel assembly, the lower end of said barrel-supporting sleeve assembly being adapted for positioning on the surface of the work to which the fastener is to be applied, said barrel-supporting sleeve assembly being mounted to rotate relative to said breechblock and having a recess with a part of the trigger entered therein and a shoulder to operate the trigger and effect release of the firing pin; and a guard sleeve surrounding said barrel-supporting sleeve assembly and operatively keyed thereto against relative rotation and having a lower portion mounted to shift lengthwise of the barrel and to rotate freely relative thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

20	2,395,354	Temple	Feb. 19, 1946
	2,645,772	Walker	July 21, 1953
	2,669,716	Catlin	Feb. 23, 1954
	2,679,645	Walker	June 1, 1954

FOREIGN PATENTS

25	1,058,870	French	Nov. 10, 1953
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