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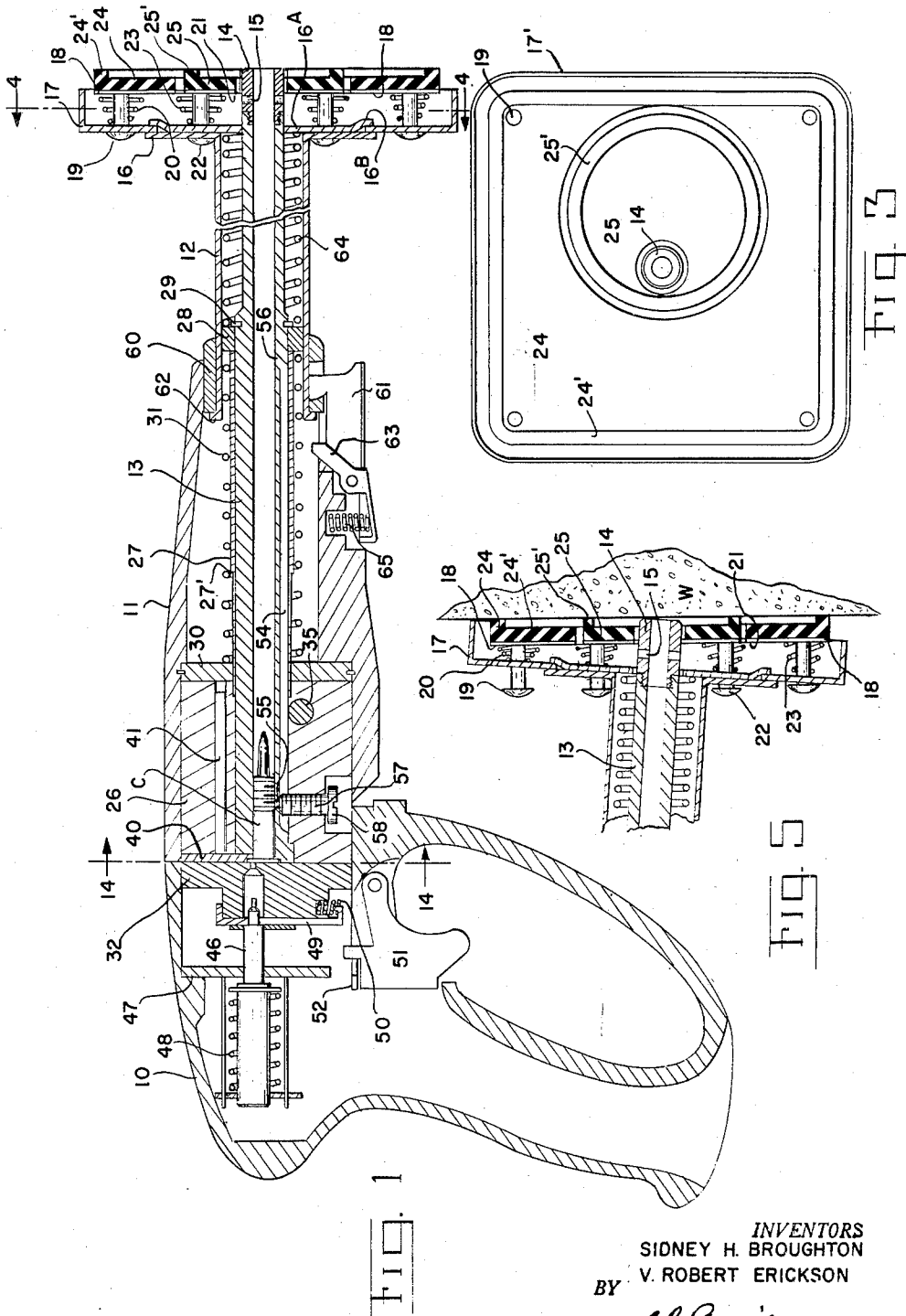
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SAFETY SHIELD FOR EXPLOSIVELY DRIVEN TOOLS

Filed May 17, 1954

4 Sheets-Sheet 1



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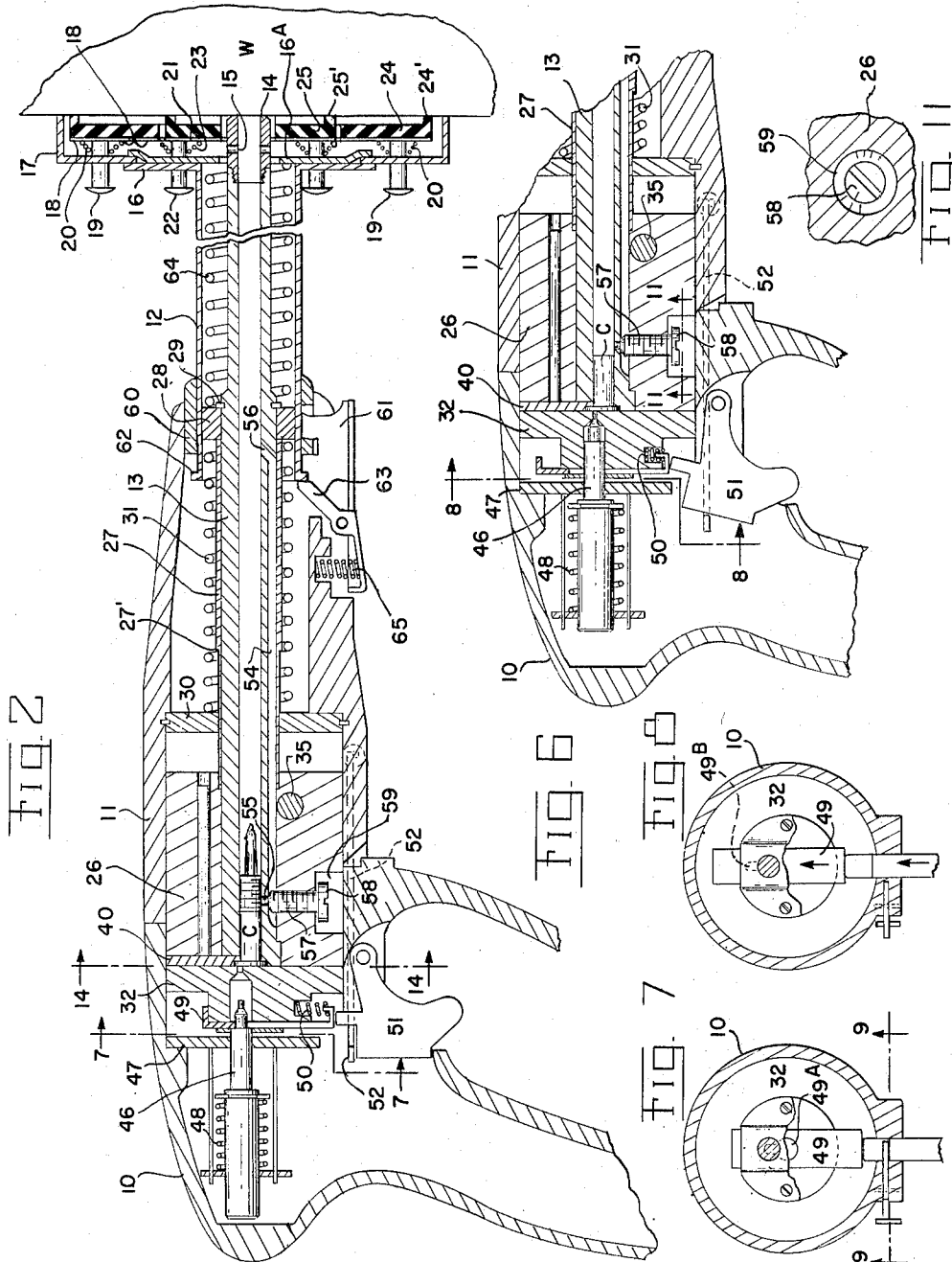
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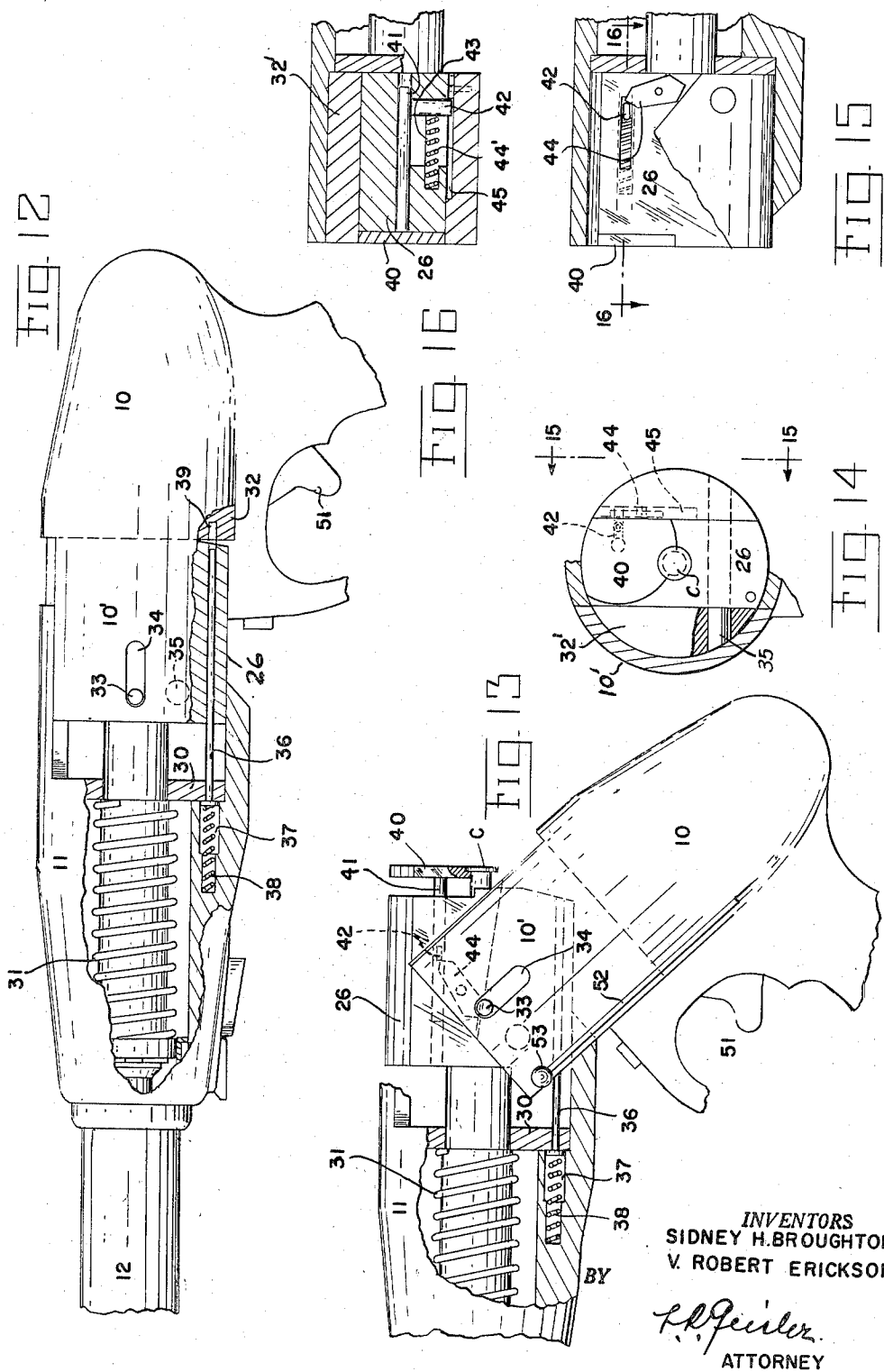
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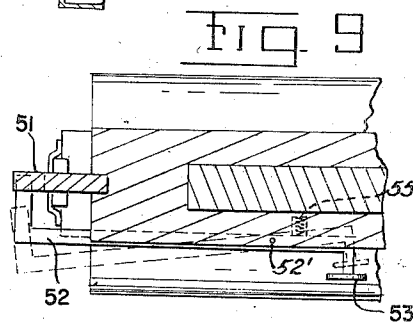
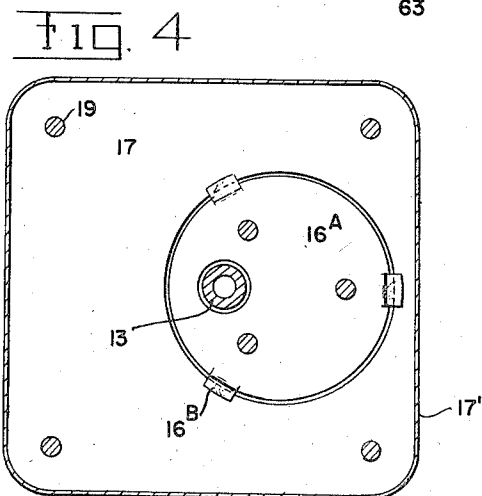
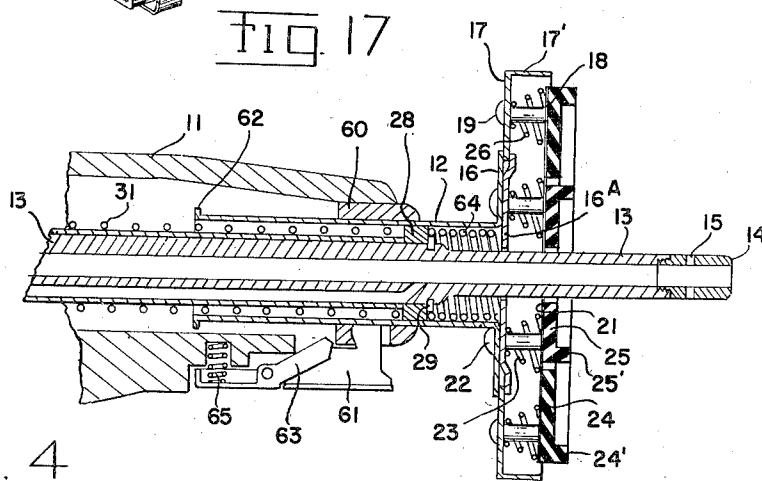
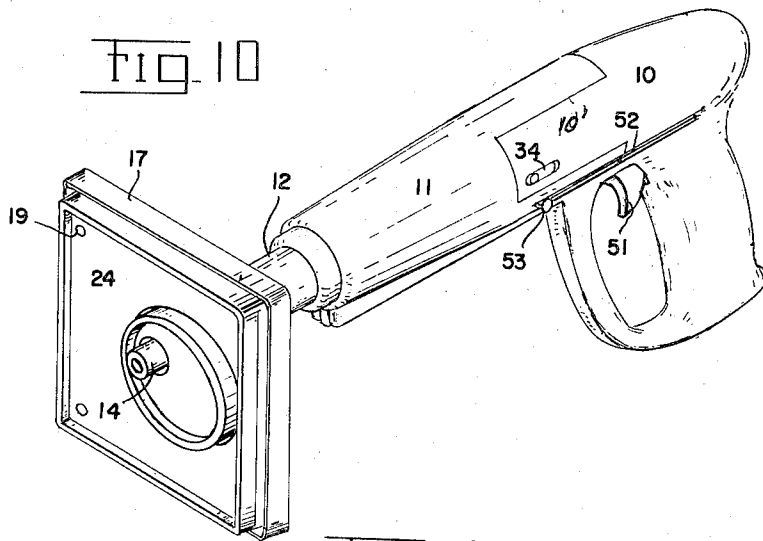
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SAFETY SHIELD FOR EXPLOSIVELY DRIVEN TOOLS

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Application May 17, 1954, Serial No. 430,288

11 Claims. (Cl. 1—44.5)

This invention relates to devices or tools which employ an explosive charge for forcibly imbedding fastening elements, such as bolts, studs and the like, in masonry or in other hard or semi-hard surfaces and substances.

The use of explosively driven projectiles in the form of bolts and studs for the purpose of providing anchoring or fastening elements on such structures as concrete walls, for example, is well known, and various devices or tools have been developed for this purpose. Such tools employ explosively driven projectiles and are provided with firing mechanism generally of more or less familiar type.

One of the problems presented in the use of such explosively actuated tools is the possible danger to bystanders as well as to the operator from small chips or bits of masonry which are likely to be dislodged from the immediate area adjacent the muzzle end of the gun barrel of the tool by the high velocity discharge gases.

An important object of the present invention is to provide suitable and practical protective means on an explosively actuated tool of this nature which will restrain any such dislodged particles and prevent them from flying off from the work and thus prevent any possible injury to the operator or to bystanders from such particles.

A related specific object of the invention is to provide such a protective means which will afford the desired and necessary protection, even though the gun barrel of the tool may inadvertently be tipped somewhat from the proper position of perpendicularity with respect to the surface of the work.

An explosively actuated tool of the general type with which this invention is concerned may be used for imbedding elements into walls or other bodies of different density. If, for example, the density of the work surface is considerably less than that of ordinary concrete, the use of the same explosively driven projectiles suitable for ordinary concrete would be likely to result in the projectile being driven too far into the work and thus being driven in so far that it would be of no use as a fastening element.

Accordingly, another object of the invention is to provide an explosively actuated tool in which the force with which a given explosively driven projectile is driven into the work can be adjusted and modified to some extent in a simple and practical manner whenever this is necessary.

While generally the work in which the projectile or fastening element is required to be imbedded has a continuous flat surface and the muzzle end of the gun barrel of the tool is held against such surface and approximately perpendicular thereto, it is sometimes necessary for a fastening element to be secured in a recessed portion of a surface. A further object of the present invention is to provide an improved explosively actuated tool in which the gun barrel muzzle can be held in a recess while the protective means, previously mentioned, at the same time can be held against the outer face of the work around the recess in order to afford the desired protection against any particles which may be dislodged in the recess in the

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operation of the tool and which particles otherwise might be forcibly ejected from the recess and thus constitute a dangerous hazard to the operator or to any other persons standing nearby.

5 An additional object of the invention is to provide an improved explosively actuated tool having a gun barrel and associated suitable firing mechanism so arranged that the tool cannot be fired unless the barrel is pressed against the portion of the work in which the projectile is to be imbedded; and further with the firing mechanism so controlled that it cannot then be fired by the operator unless the operator releases a safety control with one hand while he actuates the trigger with the other hand, thus making impossible any inadvertent firing or discharging of the tool.

10 A still further object of the invention is to provide an explosively actuated tool which will accomplish the previously indicated objects, and which must be opened each time for loading, the opening requiring special manipulation on the part of the operator, and from which a previously fired cartridge will be automatically ejected upon the opening of the tool.

The construction and manner of operation of our improved explosively actuated tool and the means by which these mentioned objects and other advantages are achieved will be briefly described and explained with reference to the accompanying drawings.

In the drawings:

Figure 1 is a sectional elevation taken longitudinally along the approximate center line of the device showing the device loaded with a projectile to be explosively driven, but with the device shown prior to being set for firing;

Figure 2 is a similar sectional elevation showing the device set for firing;

Figure 3 is an end elevation taken from the right of Figure 1 showing the front face of the safety pad attachment, which safety pad is placed against the work in the ordinary use of the device;

Figure 4 is a sectional elevation taken on line 4—4 of Figure 1;

Figure 5 is a fragmentary sectional elevation taken along the longitudinal section of the muzzle end of the gun barrel of the device and through the safety pad, and illustrates the manner in which the safety pad will accommodate a slight tilting of the barrel with respect to the work surface during the firing of the device;

Figure 6 is a fragmentary sectional elevation corresponding in part to the left hand portion of Figure 2, but showing the position of the trigger and related members of the firing mechanism when the device is being fired;

Figure 7 is a fragmentary section taken on line 7—7 of Figure 2;

Figure 8 is a corresponding fragmentary section taken on line 8—8 of Figure 6;

Figure 9 is a fragmentary sectional plan taken on line 9—9 of Figure 7 and looking upwardly as indicated by the arrows;

Figure 10 is a perspective view of the entire device viewed from the opposite side;

Figure 11 is a fragmentary sectional plan taken on line 11—11 of Figure 6;

Figure 12 is a fragmentary elevation of the rear or handle end of the device with a portion broken away and showing the breech end of the gun barrel, and also illustrating the device as partly opened preparatory to the ejecting of the empty cartridge and the reloading of the device;

Figure 13 is a similar fragmentary elevation corresponding to Figure 12, with a portion similarly broken away and shown in section, but showing the device fully

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opened and the empty fired cartridge in the process of being ejected;

Figure 14 is a fragmentary sectional elevation taken on line 14—14 of Figures 1 and 2;

Figure 15 is a fragmentary elevation, with portion broken away, taken from the left of Figure 14;

Figure 16 is a fragmentary plan section taken on line 16—16 of Figure 15; and

Figure 17 is a sectional elevation corresponding in part to Figures 1 and 2, but showing the muzzle portion of the gun barrel pressed into extended position beyond the safety pad for special use in discharging a projectile into a recess in the work.

Referring first to Figures 1, 2 and 10, the housing for the device is made up of three separate portions, namely, the handle portion 10, the intermediate portion 11, and a front end sleeve portion 12. The gun barrel 13 of the device extends through housing portions 11 and 12 and the housing is longitudinally slidable to a limited extent relative to the gun barrel. The muzzle end of the gun barrel preferably has a removable tip 14, which tip has a bore coinciding with the gun barrel bore and which tip also has two or more radially extending exhaust gas ports 15 located at the approximate relative distance from the end of the tip 14 shown in Figures 1 and 2. Although the tip 14 could constitute an integral part of the muzzle end of the gun barrel we prefer to have the tip removable so that it can be easily replaced in the event of damage or excessive wear in the course of the use of the device.

The outer end of the sleeve portion 12 of the housing has an integral eccentric circular flange 16. A square shaped housing or shield 17, having an off-center circular opening of slightly less diameter than that of the flange 16, is rotatably mounted on the circular flange 16 by means of a circular disc 16A, attached to the flange 16 by suitable rivets and having lugs 16B (Figure 4) which engage the underside of the housing 17 around the circular opening in the housing. The housing 17 is formed with a wall 17' extending around all four sides. Due to the fact that the circular flange 16, on which the housing 17 is mounted, is eccentric with respect to the gun barrel 13 and also due to the fact that the housing 17 is eccentric with respect to the circular flange 16, the housing 17 can be rotated with respect to the gun barrel muzzle so as to bring the gun barrel muzzle either close to an edge of the housing 17 or at the center of the housing 17. Figures 3 and 4 show the gun barrel muzzle at the center of the housing 17. The reason for having the housing 17 movable and adjustable with respect to the gun barrel channel will be explained later.

A square plate 18 (Figures 1, 2 and 5), slightly smaller than the housing 17, is mounted in the housing 17 by means of four mounting pins 19, located at the four corners of the plate 18, which pins extend freely through slightly larger apertures in the top of the housing 17. These pins terminate in enlarged heads in order to prevent the plate 18 from dropping away from the housing 17. A coil spring 20 is carried on each pin 19 and held under slight compression between the plate 18 and the housing 17. The plate 18 has an off-center circular opening corresponding to and in registration with the off-center circular opening in the housing 17.

A second plate 21, which is circular and the diameter of which is less than the diameter of the circular opening in the plate 18, is located in the opening, and this second plate is similarly mounted in the housing 17 by similar pins 22 which extend through the flange 16. Coil springs 23 are similarly mounted on the pins 22.

A pad 24, preferably of resilient material such as rubber, covers the outer face of the plate 18 and is secured to the surface of the plate. A similar pad 25 covers the second plate 21 and is secured to the second pad. The plate 24 is preferably formed with a rim shoulder 24' at its periphery and the pad 25 is similarly formed preferably with a rim shoulder 25' at its periphery.

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The breech end of the gun barrel 13 is secured to a barrel block 26 on which the housing portion 11 of the device is slidable to a limited extent. A sleeve 27, firmly mounted on the central portion of the gun barrel, has one end held in a recess in the barrel block 26 and the opposite end held in engagement with a ring 28, the ring 28 in turn being held in place on the gun barrel by a locking ring 29. The sleeve 27 extends through a wall partition 30 which is secured within the housing portion 11, and the wall 30 slides on the sleeve 27 when the housing portion 11 is moved with respect to the gun barrel. Similarly, the front housing sleeve portion 12 of the device is slidable on the ring 28. A coil spring 31, held under compression between the wall 30 and the ring 28, normally holds the housing portion 11 in the position shown in Figure 1, with reference to the gun barrel, but permits the housing portion 11 to be moved forwardly with respect to the gun barrel against the force of spring 31 (thus towards the right as viewed in Figure 1), to the position illustrated in Figure 2. A shoulder 27' on the sleeve 27 limits the forward movement of the housing assembly with respect to the gun barrel by engaging the wall 30.

The front end sleeve portion 12 of the housing and the ring band 60 are relatively slidable with respect to each other. The ring band is firmly held in the end of the housing portion 11 by a latch member 61, which, in turn, engages a locking notch in the ring 60. The inner end of the sleeve portion 12 has a rim flange 62 which engages the ring 60 when the sleeve portion 12 is in the normal position shown in Figure 1. A spring 64, extending around the muzzle portion of the gun barrel, is held under compression between the ring 28 on the gun barrel and the disc 16A which is secured to the flange 16 of the sleeve portion 12. A spring-controlled lever lock 63 ordinarily limits the extent to which the housing portion 11 can be moved forwardly with respect to sleeve portion 12.

As will be later explained, before the device can be fired the housing assembly must be thrust forwardly against the force of springs 31 and 64 from the position of Figure 1 to the position of Figure 2. This is done by placing the muzzle end of the gun barrel (or the end of the tip 14 when the gun barrel is equipped with the removable tip) against the work W (Figure 2), and pressing the device against the work sufficiently to cause the housing portion 11, and with it the handle portion 10, to be pushed forwardly the necessary distance for bringing the device into position for firing. While this is done the pads 24 and 25 on the spring-mounted plates 18 and 21 will be held pressed against the work as illustrated in Figure 2. In such position the pads 24 and 25 with their surrounding housing 17 will act as a protection to the operator and to any bystanders against any fragments or particles which may be dislodged from the work around the gun barrel muzzle as a result of the firing of the device, for any such dislodged fragments will strike against the pads 24 and 25 and be restrained by the pads. The rim shoulders 24' and 25' on the forward face of the pads furthermore will prevent any possibility of such fragments being discharged laterally between the pads and the work surface. The pads 24 and 25 with their rim shoulders, are held against the surface of the work not only by their springs 20 and 23 but, during the firing of the device, some of the high velocity air and gases will pass through the ports 15 at the muzzle end of the gun barrel and will momentarily cause pressure to be exerted on the rear face of the plates 18 and 21 within the housing 17 and thus exert additional force to keep the pads 24 and 25 firmly pressed against the work as the projectile is driven into the work.

Even though the device is held by the operator at the time of the firing of the same, in such way that the gun barrel is inadvertently tilted slightly out of the desired position of perpendicularity with respect to the work

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surface, and thus if the gun barrel should be held in the manner illustrated in Figure 5, the plates 18 and 21 and their pads 24 and 25, due to the fact that the pins 19 and 22 are loosely mounted in the housing 17 and flange 16 respectively, will nevertheless accommodate themselves to any such slight inclination of the gun barrel with respect to the work surface and thus continue to perform their function of preventing any fragments from flying away from the work surface.

Ordinarily the housing or shield 17 and the protecting pad 24 are arranged as shown in Figures 3 and 4, thus with the gun barrel centrally located with respect to the pad and its surrounding housing. However, there may be occasions when the projectile is required to be driven into the work adjacent a wall extending at right angles to the work. In such case, the housing 17, and with it the plate 18 and pad 24, upon being rotated 180° with respect to the gun barrel and the flange 16, will cause one outside edge of the pad 24 and housing to be brought close to the gun barrel, thus enabling the gun barrel to be positioned in close proximity to the intersection of such wall with the work surface.

A breech block 32 (Figures 1, 2, 6, 7, 8, 14 and 16) is positioned in the handle portion 10 of the housing assembly, and the handle portion is slidable to a limited extent on the breech block 32. This breech block is U-shaped in horizontal cross section, having two separated extending portions 32', shaped in the form of cylindrical segments, which are positioned within extended side portions 10' (Figures 13 and 16) of the housing portion 10. A lug 33 (Figures 12 and 13) extends outwardly from one of these portions 32' of the breech block and extends through a slot 34 in the corresponding housing extension 10'. The engagement of the lug 33 with the ends of the slot 34 limits the travel of the handle portion 10 with respect to the breech block 32. The two extending portions 32' of the breech block 32 are positioned respectively adjacent the flat sides of the barrel block 26 at the breech end of the gun barrel (Figures 13 and 16), and these portions 32', and with them the breech block 32 and handle 10, are pivotally mounted on the barrel block 26 by means of the pivot pin 35 (Figures 1, 2, 6 and 12) by which the portions 32' are connected to the block 26.

A rod 36 (Figures 12 and 13) extends longitudinally through the barrel block 26 and is slidable therein and is also slidably mounted in the housing wall 30. This rod 36 has an enlarged head which is located within a recessed chamber 37 in the housing portion 11 and engages a coil spring 38. The opposite end of this rod 36 is arranged for engagement with a recess 39 (Figure 12) in the middle body portion of the breech block 32. The arrangement is such that the rod 39 prevents any pivoting of the breech block 32 and handle portion 10 with respect to the barrel block 26 and housing portion 11 until the handle portion 10 of the housing assembly and the portion 11 are first pulled a maximum distance apart from each other, which results in thrusting the housing portion 11 forwardly with respect to the gun barrel and pulling the handle portion 10, and with it the barrel block 26 and gun barrel as far as possible in the opposite direction, as illustrated in Figure 12. When this is done the handle portion of the device can then be pivoted with respect to the rest of the device and thereby bring the device into the opened position illustrated in Figure 13.

A cartridge ejector plate 40 (Figures 1, 13, 14, 15 and 16), normally seated in a corresponding recess in the rear face of the barrel block 26, is mounted on a rod 41 which is slidable in a channel in the barrel block 26. A pin 42, secured to the rod 41 and extending at right angles from the rod 41, slides in a slot 43 in the barrel block 26 and extends a slight distance beyond the side face of the barrel block 26 as shown in Figure 16. A coil spring 44 engages the pin 42 and normally holds the pin

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42 and rod 41 and ejector plate 40 in the position illustrated in Figures 15 and 16.

An arm 44 (Figures 13, 15 and 16), located in a recess 45 on the face of the portion 32' of the breech block 32 and opposite the slot 43, which arm 44 is pivotally supported in the recess 45 for limited movement, is so shaped and arranged (as shown best in Figures 13 and 15) that, when the device is opened and the handle portion is swung down (in counter-clockwise direction, as viewed in Figure 15, and in clockwise direction, as viewed in Figure 13), the arm 44 will normally engage the pin 42, pushing the pin 42, and with it the rod 41 and ejector plate 40 against the force of spring 44' and thrusting the plate 40 into the ejecting position shown in Figure 13. However, as the handle portion is rotated downwardly still further, the arm 44 then slips out of engagement with the pin 42 and the plate 40 will be returned to its normal position by the force of the spring 44'. The ejector plate 40 is formed with a curved shoulder along its bottom edge which is concentric with the gun barrel channel and which is adapted for engagement with the rim of the head of the cartridge C as shown in Figures 1 and 13.

The breech block 32 (Figures 1, 2 and 6) has a channel to accommodate the firing pin 46 so as to enable the firing pin to strike the cap on the head of the cartridge C when the firing pin is released. The firing pin 46 is slidably mounted in a stationary wall 47 and is moved by the force of a compression spring 48. A sear plate 49 is slidable up and down to a limited extent on the breech block 32.

The firing pin 46 has a reduced diameter portion at its forward end forming a shoulder on the firing pin. The sear plate 49 (see also Figures 7 and 8) has an aperture 49a, the diameter of which corresponds to the firing pin diameter behind the shoulder, and this sear plate also has a slot 49b extending above the aperture 49a the width of which slot corresponds to the smaller firing pin diameter ahead of the shoulder. When the sear plate is in the normal low position of Figures 1 and 7 it holds the firing pin back from engagement with the cartridge, but when raised to the firing position of Figures 6 and 8, the sear plate releases the firing pin. A spring 50 holds the sear plate normally in the low, firing-pin-engaging position. A trigger 51 (Figures 1, 2 and 6) is so positioned as to enable the sear plate 49 to be raised when the breech block 32 is moved to the rear position of Figures 2 and 6.

In order to prevent any inadvertent actuation of the trigger 51, even when the members of the device are in firing position, a trigger safety locking lever 52 is provided (Figures 2, 6, 9, 10 and 13) which is pivotally mounted in an outside recess in the housing part 10' and which has an outwardly extending finger push knob 53 (Figures 9 and 13) at its forward end. The opposite or rear end of the lever 52 extends inwardly into the device sufficiently to rest on the top of the trigger, as shown in Figures 1 and 2, and prevents actuation of the trigger when in such position. The lever 52 is pivotally mounted on the pin 52' (Figure 9) and a spring, indicated at 53', holds the lever 52 in its normal position (shown in full lines in Figure 9), in engagement with the trigger but permits the lever to be moved out of trigger-engaging position by finger pressure on the knob 53. Thus, in order to fire the device not only must the muzzle of the gun barrel be pressed against the work and the device held thrust against the work, but the knob 53 must also be pressed inwardly before the trigger can be pulled. Due to the location of the knob 53, both hands of the operator are required to be used in order to fire the device. Consequently any inadvertent firing of the device is quite impossible.

The inner portion of the gun barrel 13 is formed with a longitudinally-extending groove 54 (Figures 1 and 2) on its outside wall. Ports 55 and 56 at the ends of this groove respectively connect with the gun barrel channel. The groove 54 is formed into a separate channel by the

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encompassing walls of the sleeve 27 and barred block 26. Thus the resulting channel groove 54, due to its connection at each end with the main gun barrel channel, constitutes an auxiliary bore or gas escape passage. An adjustable screw 57, controlling passage through the port 55, is capable of allowing some of the discharge gas from the discharge cartridge C to pass through this auxiliary bore, and consequently the adjusting of this screw 57 regulates the amount of discharge gas which will pass through the auxiliary bore. The screw 57 can, of course, close off the auxiliary bore entirely.

The head 58 of this adjustment screw 57 (Figures 1, 2 and 6) is located in a recess 59 in the bottom of the barrel block 26 (see also Figure 11) and is accessible for adjustment when the device is in fully opened position. Preferably the head 58 of the adjusting screw and the cavity wall are provided with some indicia markings so that the screw 57 can be set for a predetermined accurate adjustment and in this way provide for accurate control of the passage of gas through the port 55 and thus through the auxiliary bore.

As will be evident from Figures 1 and 2, the purpose of this auxiliary bore or gas escape passage 54 is to enable a portion of the explosive gases, discharged upon the firing of the cartridge C, to pass through the auxiliary bore, when desired, in order to reduce the amount of driving force exerted upon the projectile by the discharged gases released from the fired cartridge. By bleeding off some of the discharged gases behind the fired projectile and delivering them subsequently back into the main bore of the gun barrel (which gases will be delivered back into the gun barrel bore due to the inertia in the projectile, when first acted upon by the explosive gases) the force with which the projectile is driven into the work can be modified. This is an important feature since it enables identical explosively driven projectiles to be used on different densities of material without having the projectile driven too far into the work surface if the density of the work happens to be less than that for which such explosively driven projectile was originally intended.

Preparatory to operating the device the handle portion 10 and the portion 11 of the housing are pulled a maximum distance apart into the relative position shown in Figure 12. The handle portion 10 is then swung downwardly to the position illustrated in Figure 13, causing any previously fired cartridge to be ejected, and, as the handle portion 10 swings down slightly further, the ejector plate 40 returns to normal position, enabling a cartridge and projectile to be placed in the breech end of the gun barrel. The handle portion 10 is then moved back into normal position and the handle portion 10 and portion 11 of the housing are allowed to come together. The device will now be in the normal position illustrated in Figures 1 and 10 and loaded for firing.

In the firing operation the muzzle end of the gun barrel is placed against the surface into which the projectile is to be discharged and the handle portion 10, and with it the housing portion 11, are thrust forwardly on the gun barrel against the force of the springs 64 and 31, and also against the force of the springs 20 and 23 which bear against the plates 18 and 21 respectively. This brings the device into the position illustrated in Figure 2. While the device is held thrust in this position the operator presses the knob 53 (Figure 10) inwardly to release the trigger locking lever 52, and then presses the trigger 51. The pressing of the freed trigger raises the sear plate 49 (Figure 2) and releases the firing pin 46, causing the firing pin, under the impetus provided by the spring 48, to strike the head of the cartridge and cause the explosively-driven projectile to be discharged.

Occasionally it may be desired to drive the projectile or fastening element into the work at some point which is recessed from the remaining work surface. If the muzzle end of the gun barrel were held spaced from the bottom of each recess it would then be spaced from

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the actual surface to be pierced by the projectile. This would prevent the firing of our improved device, but even if firing were possible with the gun muzzle end spaced from the surface to be pierced the results would not be satisfactory. Therefore, we have made provision so that the gun barrel muzzle in such case may extend for considerable distance beyond the protective pads 24 and 25 and the housing 17.

The inner end of the housing portion or sleeve 12 has a rim flange 62 which is normally engaged by the spring-controlled locking lever 63 when the device is set for firing. However, release of the locking lever 63, which is done by pressing the opposite end of the lever against the force of spring 65, enables the rest of the housing assembly, together with the gun barrel, to be thrust forwardly against the force of spring 64 to some such position as illustrated in Figure 17. In this position this muzzle end of the gun barrel will extend considerable distance beyond the protective pads 24 and 25.

Thus, by releasing the locking lever 63, the muzzle tip of the gun barrel can be caused to engage the inner wall of a recess in the work while at the same time the protection pads 24 and 25 are held by spring force against the main surface of the work around such recess and will continue to perform that function of protecting the operator and bystanders against any fragments which may be dislodged by the impact of the projectile or discharged gases.

Several minor modifications would be possible in our improved device without departing from the principle and scope of our invention. The device in the form as described and illustrated has been found to be very satisfactory in practice and we regard this as the preferred construction, but it is not our intention to limit our invention otherwise than as set forth in the claims.

We claim:

1. In a device of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted for limited slidable movement with respect to said gun barrel, spring means holding said housing assembly in normal extended position with respect to said gun barrel but permitting said housing assembly to be moved with respect to said gun barrel against the force of said spring means, a protecting pad on the forward end of said housing for engagement with said work surface, said pad extending about said gun barrel and normally positioned in a plane substantially perpendicular to the bore axis of said gun barrel, a flange on said housing end, a pad-carrying shield mounted on said flange, and resilient means supporting said pad in said shield, whereby said protecting pad will be held over the portion of said work surface surrounding said muzzle when said muzzle tip engages the work and said device is fired.

2. In a device of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted for limited slidable movement with respect to said gun barrel, spring means holding said housing assembly in normal extended position with respect to said gun barrel but permitting said housing assembly to be moved with respect to said gun barrel against the force of said spring means, a protecting pad on the forward end of said housing for engagement with said work surface, said pad extending about said gun barrel and normally positioned in a plane substantially perpendicular to the bore axis of said gun barrel, an eccentric circular flange on said forward end of said housing, a pad-carrying housing eccentrically and rotatably mounted on said flange, and resilient means supporting said pad in said latter mentioned housing, whereby said protecting pad will be held over the portion of said work surface surrounding said muzzle when said muzzle tip engages the work and said device is fired.

3. In a device of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted for limited slidable movement with respect to said gun barrel, spring means holding said housing assembly in normal extended position with respect to said gun barrel but permitting said housing assembly to be moved with respect to said gun barrel against the force of said spring means, a protecting pad on the forward end of said housing assembly for engagement with said work surface, said pad extending about said gun barrel and normally positioned in a plane substantially perpendicular to the bore axis of said gun barrel, a flange on said forward end of said housing, a pad-carrying shield mounted on said flange, resilient means supporting said pad in said shield, and a radially-extending exhaust port in the muzzle tip of said gun barrel so positioned that exhaust gases from said port will enter in between said pad and said shield when said device is fired, and thereby aid in holding said pad firmly against said work surface when said device is fired.

4. In a device of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted for limited slidable movement with respect to said gun barrel, spring means holding said housing assembly in normal extended position with respect to said gun barrel but permitting said housing assembly to be moved with respect to said gun barrel against the force of said spring means, a protecting pad on the forward end of said housing assembly for engagement with said work surface, said pad extending about said gun barrel and normally positioned in a plane substantially perpendicular to the bore axis of said gun barrel, an eccentric circular flange on said forward end of said housing, a pad-carrying housing eccentrically and rotatably mounted on said flange, resilient means supporting said pad in said latter mentioned housing, and a radially-extending exhaust port in the muzzle tip so positioned that exhaust gases from said port will enter in between said pad and said latter mentioned housing when said device is fired, and thereby aid in holding said protecting pad against the work surface when said device is fired.

5. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, and spring mounting means for said pad in said latter mentioned housing normally maintaining said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged.

6. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said

latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, and spring mounting means for said plate normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged.

7. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, a rim shoulder on the forward, work-surface-engaging face of said pad, and spring mounting means for said plate in said latter mentioned housing normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self-adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged.

8. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, a radially-extending exhaust port in the muzzle tip of said gun barrel so positioned that exhaust gases from said port will enter in between said plate and said rear wall of said latter mentioned housing when said muzzle tip and said pad are positioned against said work surface and said tool is discharged and thereby aid in holding said pad firmly against said surface as the projectile enters the surface, and spring mounting means for said plate normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged.

9. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in

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said housing assembly surrounding the muzzle portion of said gun barrel, said sleeve portion telescopically mounted in said housing assembly, a coil spring urging said sleeve portion to extended position with respect to said housing assembly, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, spring mounting means for said plate normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, and locking means normally limiting the telescoping of said sleeve portion with respect to said first mentioned housing assembly but enabling a greater amount of said sleeve portion to be received into telescoped position when said locking means is unlocked, whereby to enable the muzzle end of said gun to extend beyond said pad and into a recess in said work surface.

10. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, spring mounting means for said plate normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged, a radially-extending exhaust port in the muzzle tip of said gun barrel so positioned that exhaust gases from said port will enter in between said plate and said rear wall of said latter mentioned housing when said muzzle tip and said pad are positioned against said work surface and

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said tool is discharged and thereby aid in holding said pad firmly against said surface as the projectile enters the surface, a gas escape passageway extending along said gun barrel adjacent the bore of said gun barrel, an inlet port leading from the gun barrel bore into said passageway, and an outlet port at the end of said passageway leading back into said gun barrel bore ahead of said exhaust port for said pad plate.

11. In an explosively actuated tool of the character described for driving projectile fastening elements into a solid work surface, a gun barrel, a housing assembly mounted on said gun barrel, a forward sleeve portion in said housing assembly surrounding the muzzle portion of said gun barrel, a protecting pad positioned around the muzzle tip of said gun barrel for engagement with said work surface, a housing for said pad mounted on the outer forward end of said sleeve portion, said pad normally extending forwardly a short distance beyond said latter mentioned housing, the rear wall of said latter mentioned housing being perpendicular to the common axis of said gun barrel and of said sleeve portion, a supporting plate in said latter mentioned housing for said pad, a radially-extending exhaust port in the muzzle tip of said gun barrel so positioned that exhaust gases from said port will enter in between said plate and said rear wall of said latter mentioned housing when said muzzle tip and said pad are positioned against said work surface and said tool is discharged and thereby aid in holding said pad firmly against said surface as the projectile enters the surface, a gas escape passageway extending along said gun barrel adjacent the bore of said gun barrel, an inlet port leading from the gun barrel bore into said passageway, adjustable means in said inlet port controlling the escape of gas into said passageway from said gun barrel bore, an outlet port at the end of said passageway leading back into said gun barrel bore ahead of said exhaust port for said pad plate, and spring mounting means for said plate normally maintaining said plate and therewith said pad substantially parallel to and spaced slightly from said rear wall in said latter mentioned housing but enabling some self adjustment of said plate and therewith of said pad to take place when said pad is brought into engagement with said work surface, whereby said pad will be capable of proper engagement with said surface even if said gun barrel is held slightly out of perpendicularity with respect to said surface when said tool is discharged.

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