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Perrine

[11] **3,783,739**

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[54] **GUN TOGGLE MECHANISM WITH BIASING MEANS POSITIONED IN PREDETERMINED AREA ON TOGGLE TO ABSORB SHELL EXPLOSIVE REACTIVE FORCES**

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[52] **U.S. Cl.** **89/189,** 89/199

[51] **Int. Cl.** **F41d 3/02**

[58] **Field of Search** 89/168, 175, 189, 89/199

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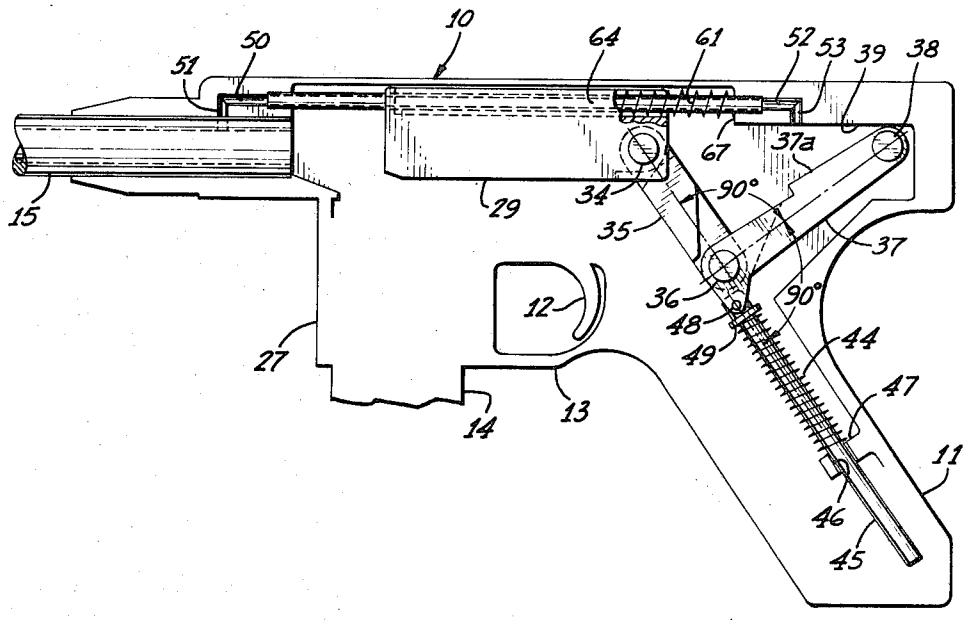
[57] **ABSTRACT**

A toggle action pistol in which a toggle is tripped to recede into its handle by the effects of gas pressure generated at the time of firing and employing a toggle biasing means in a given area on the toggle mechanism for absorbing shell explosive reactive forces.

12 Claims, 8 Drawing Figures



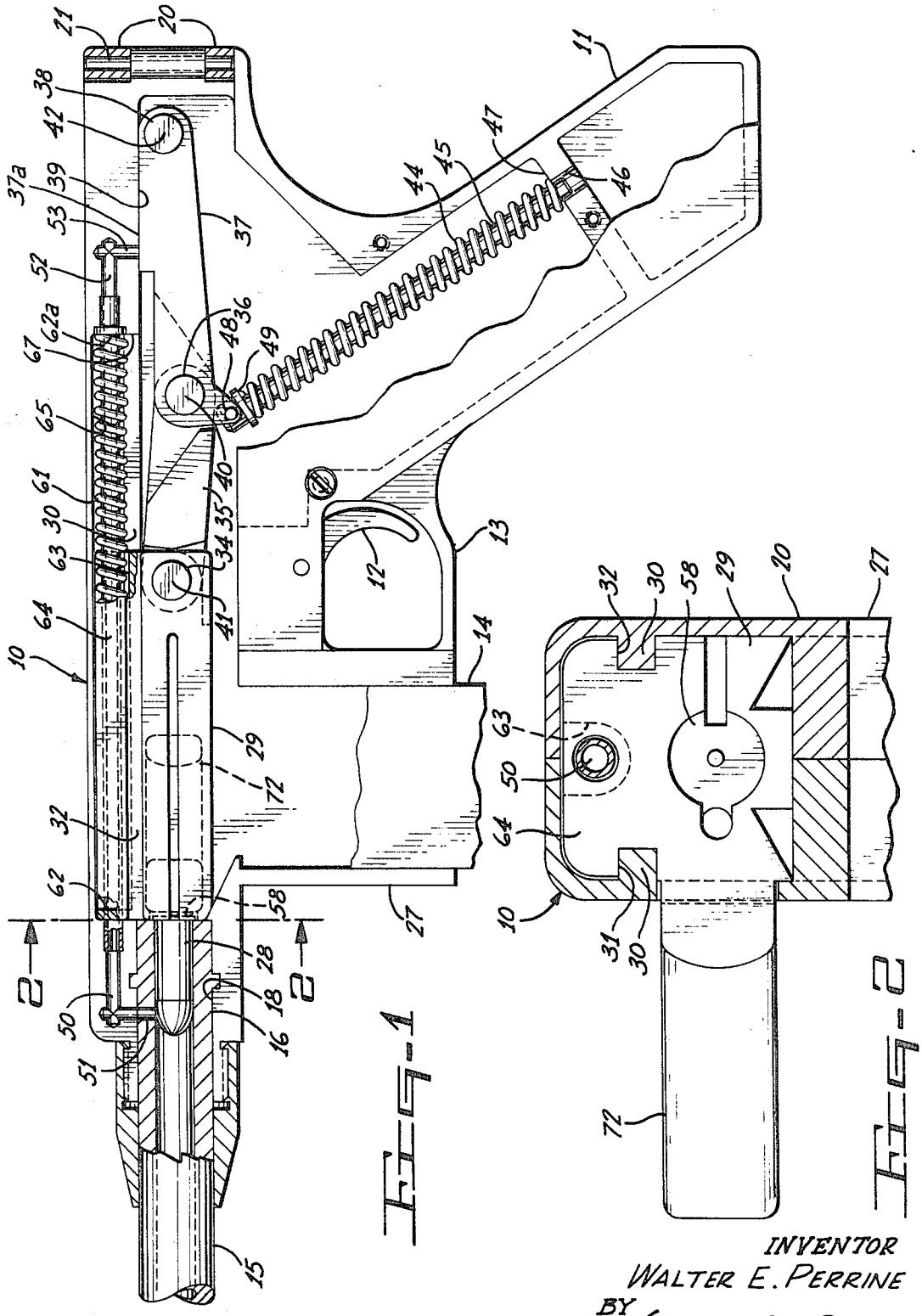


FIG-1

FIG-2

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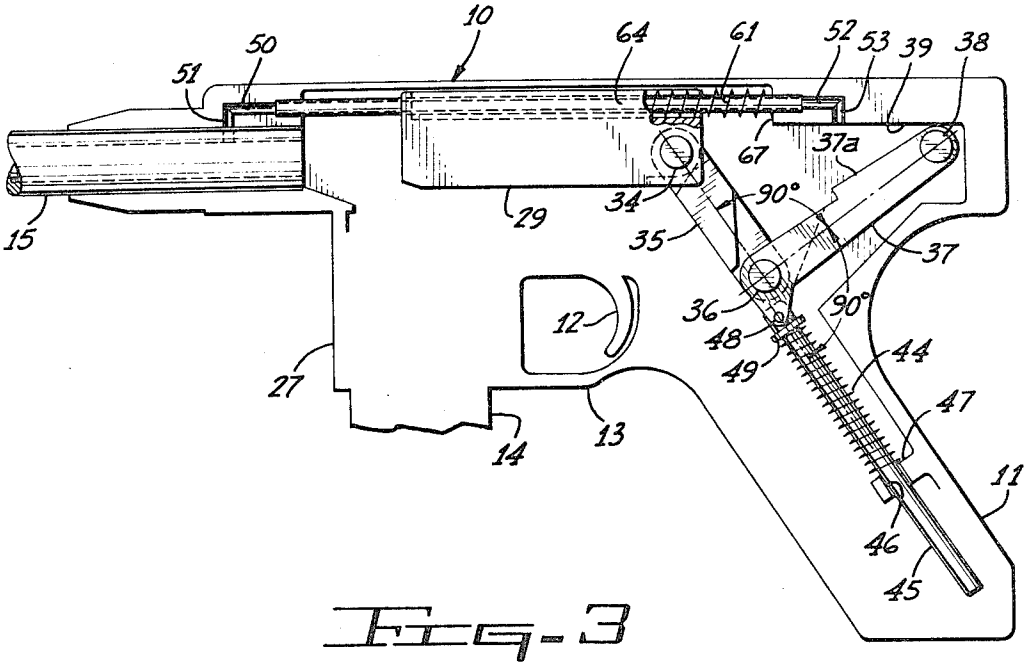

Fig-3

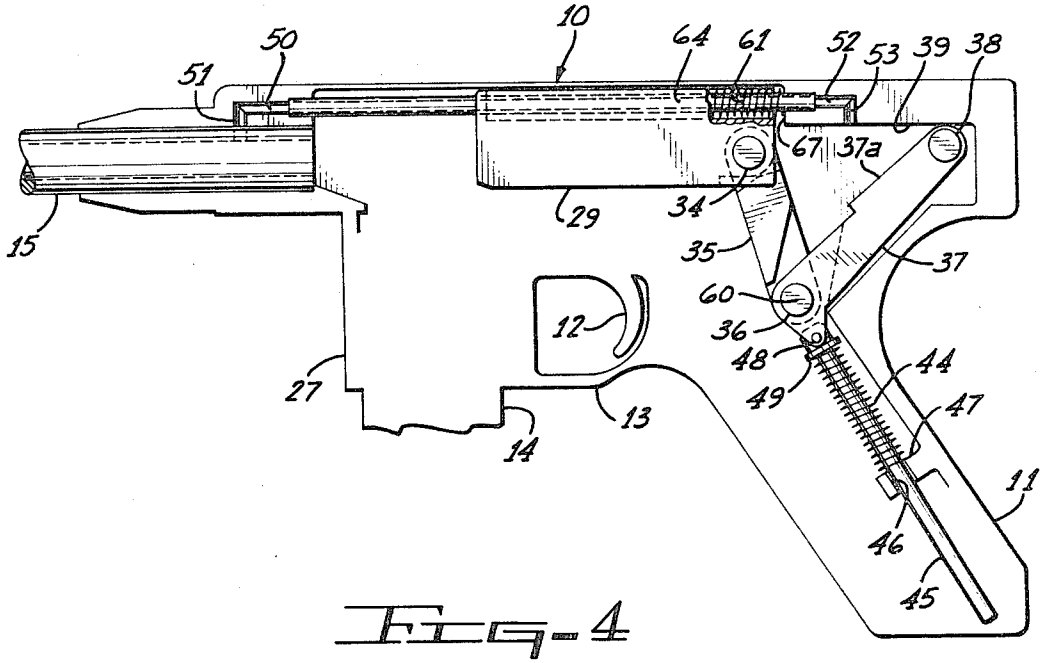

Fig-4

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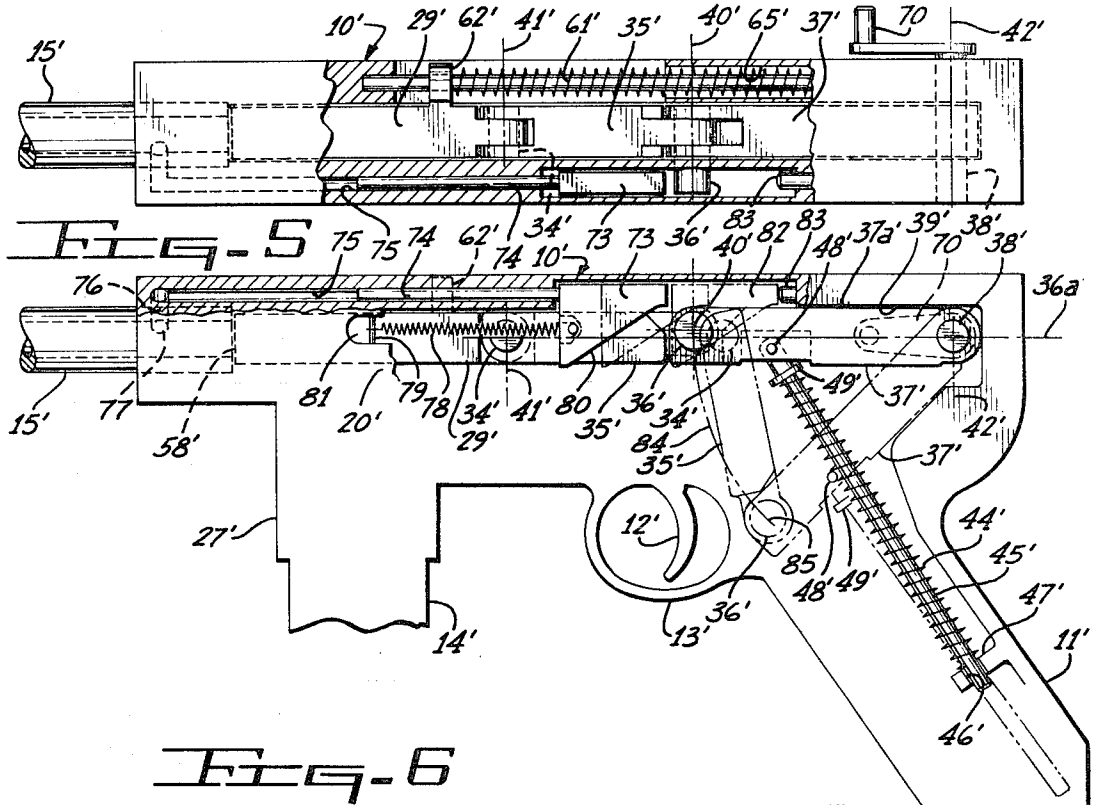

Fig-5

Fig-6

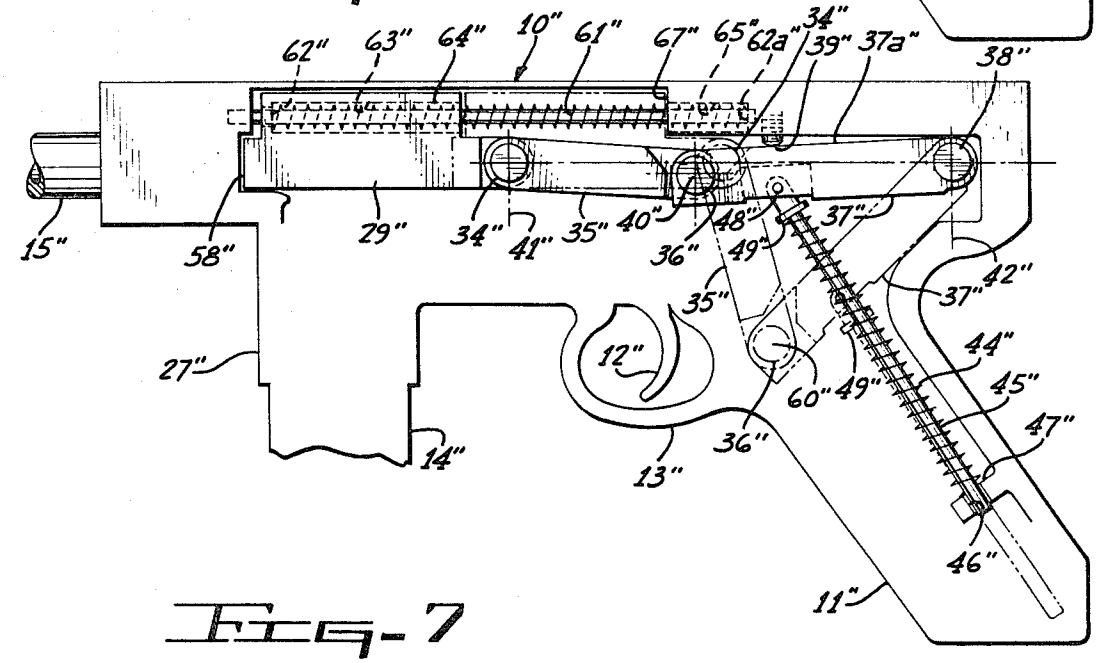

Fig-7

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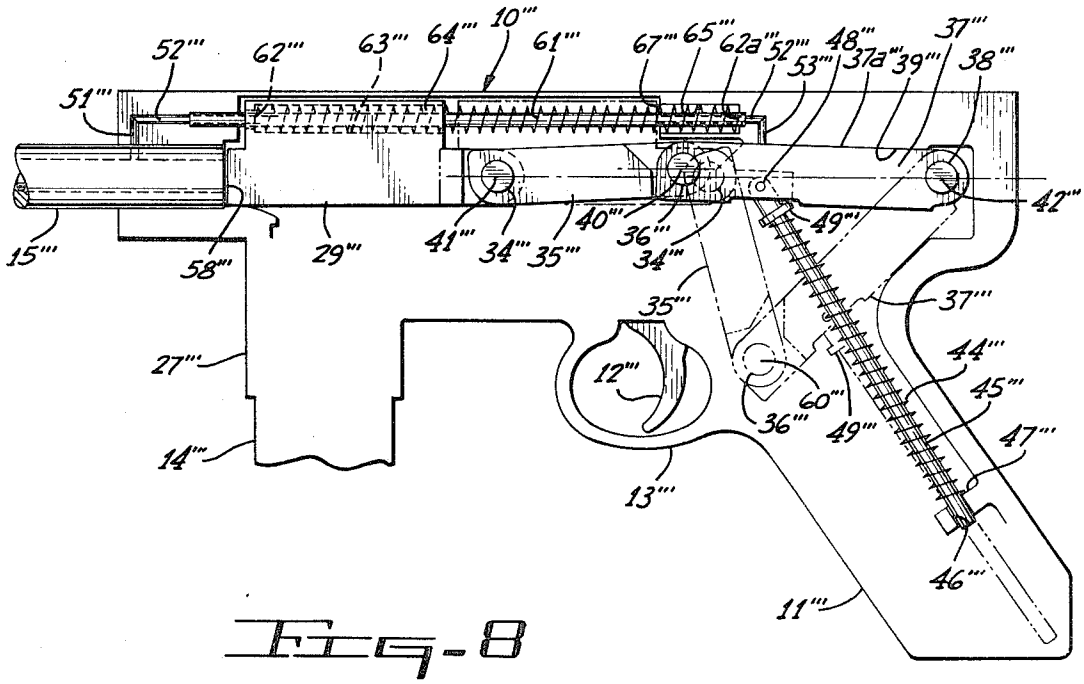

Fig-8

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GUN TOGGLE MECHANISM WITH BIASING MEANS POSITIONED IN PREDETERMINED AREA ON TOGGLE TO ABSORB SHELL EXPLOSIVE REACTIVE FORCES

BACKGROUND OF THE INVENTION

This invention pertains to toggle action weapons, and is particularly directed to means for causing a blow back toggle to recede into the handle of the pistol by gas pressure generated at the time of firing and employing a toggle biasing means in a given area on the toggle mechanism to absorb blow back forces.

FIELD OF THE INVENTION

This invention is particularly directed to toggle action weapons such as pistols wherein a bolt extending toggle is tripped from a locked position by gas pressure from the gun barrel when the gun is fired. The toggle is caused to recede into the handle of the pistol to offset the effects of firing recoil and is biased toward its locked position by a spring means bearing in a given area on the toggle.

DESCRIPTION OF THE PRIOR ART

Heretofore, the majority of all toggle actuated weapons of this class have been recoil operated, thus lending their complexity to a degree of inefficiency that was not acceptable to the public or to the military market. Further, all prior small and hand-held weapons, pistols, revolvers and submachine guns have been limited to the use of small, low energy pistol ammunition, and were limited as to size, weight, chamber pressure and velocity of the projectile.

Under-center and over-center toggles in toggle action weapons can be made to work efficiently and lock permanently when properly designed. These weapons, including pistols, can be designed to use high chamber pressure ammunition, i.e., heavy charged ammunition, and to use it effectively in short barreled guns if the toggles are biased properly in a given manner.

Heretofore it was thought necessary to use an over-center toggle if heavily charged ammunition was to be used efficiently. In fact, it has been found that heavily charged bullets can be used effectively in a short barreled gun having slightly under-center toggle locking mechanism because the toggle has a shorter distance to move before it collapses than does a similar over-center toggle action weapon, and accordingly its rate of repetetive operation or cycle of operation is of a shorter time than heretofore possible with the over-center toggle action weapons.

When comparing the under-center toggle action weapon to the known blow back and hesitation lock types of toggle action weapons the disclosed mechanism is a little slower than the blow back type of triggering toggle action weapon described in U. S. Pat. No. 3,630,119, entitled Gas Operated Toggle Aetion Weapon and the hesitation type weapon described in U. S. Pat. No. 3,709,091 entitled Adjustable Hesitation Blow Back Operated Gun Toggle Mechanism, both granted to Walter E. Perrine.

In accordance with the invention claimed herein, a new and improved toggle mechanism is disclosed which can be used effectively in any given mechanism to absorb the effects of the shell explosive forces, whether using an undercenter toggle, over-center toggle, or any variation thereof. The new and improved weapons employing such a toggle mechanism is disclosed which can be used effectively in any given mechanism to absorb the effects of the shell explosive forces, whether using an under-center toggle, over-center toggle, or any variation thereof. The new and improved weapons employing such a toggle mechanism utilize gun barrel pressure to drive the biased toggle from its locked position to its tripped position. At the time this happens the bullet has left the barrel of the gun and the residual pressure in the gun breaks or collapses the toggle and causes the toggle to move to its fully retracted position in the handle of the weapon. Recoil springs in the gun reacting on the toggle in a particular area or spot on the toggle arms return the toggle to a predetermined locked position.

SUMMARY OF THE INVENTION

In accordance with the invention claimed, an improved toggle action weapon is provided which is locked in a given position and triggered by gas pressure generated in its gun barrel.

It is, therefore, one object of this invention to provide an improved toggle action weapon, whether of the undercenter or over-center type, in which gas pressure generated in a gun barrel is needed to trip the toggle, causing it to recede to a retracted position in the handle of the weapon.

Another object of this invention is to provide an improved toggle action weapon biased to a given position by spring means engaging the toggle in a particular area on the toggle mechanism.

A further object of this invention is to provide a weapon with a toggle design such that it can utilize high chamber pressure ammunition.

A still further object of this invention is to provide a weapon having a collapsible toggle mechanism tripped by pressure generated in the gun barrel which controls the breech pressure at the time of opening so as to eliminate or greatly reduce residual pressure at the time the breech opens.

A still further object of this invention is to provide an adjustably positioned toggle mechanism for a weapon that employs a biasing means reacting against the toggle in a predetermined position so that it is dynamically balanced to accomplish a smooth, consistent, and continuous pressure throughout the movement of the bolt after tripping, in which the line of force from the moving parts is directed to the palm of the hand, thereby virtually eliminating all noticeable recoil.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a gas operated toggle action weapon incorporating the features of this invention;

FIG. 2 is a cross-sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a sectional view schematically showing the toggle of the gun shown in FIG. 1 in a toggle breaking position;

FIG. 4 is a sectional view similar to FIG. 3 of the weapon shown in FIG. 1 in toggle collapsed position;

FIG. 5 is a top view of a modification of the weapon shown in FIGS. 1–4 wherein a piston actuated toggle actuating wedge collapses the toggle as a result of the explosive forces of the shell;

FIG. 6 is a front view of the weapon shown in FIG. 5;

FIG. 7 is a further modification of the weapon shown in FIGS. 1–4 wherein an under-center hesitation locking mechanism is employed to control the bolt which mechanism is controlled by the explosive effects of the shells; and

FIG. 8 is a further modification of the weapon shown in FIGS. 1–4 employing an over-center toggle gas actuated mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1–4 illustrate an example of one embodiment of this invention similar to the gun illustrated in U.S. Pat. No. 3,630,119. More particularly FIGS. 1 and 2 illustrate a pistol having a frame **10**, handle **11**, trigger **12** with trigger guard **13**, and a bullet magazine **14**. A demountable adjustably positioned barrel **15** has a rear end diameter portion **16** which is received in the semi-circular bore **18** in the front end of frame **10**. An elongated clamp **20** is pivotally mounted on a suitable hinge screw **21** secured in the frame **10** so that the clamp **20** can swing outwardly. Reference is made to the U.S. Pat. No. 3,630,119 for more detail of this structure. The outer end of clamp **20** is provided with a mating semi-circular bore and groove to match bore **18** to grip the diameter portion **16** to secure the gun barrel **15** in firing position on frame **10**.

The bullet magazine **14** is demountably secured by the usual releasable latch in a guide sleeve **27** of frame **10** to feed the bullets **28** into insertion and firing position by the usual bolt **29**, which moves on the guide keys **30** in appropriate guide slots **31** and **32** in the frame **10** and clamp **20**. The rear end of the bolt **29** is pivotally connected by a pivot pin **34** carried in the front end of the front link **35**, the rear end of which is pivotally connected by a pivot pin **36** to the front end of the rear link **37**, in turn pivotally connected by a pivot pin **38** carried in the rear portion of the frame **10** to thus provide a toggle **35–37** for controlling the movement of the bolt **29**.

Normally, when the bullet **28** has been loaded in the barrel in firing position, the toggle **35–37** is aligned, as shown in full line in FIG. **1**, at which time the axis **40** of pin **36** is slightly below a line between the axes **41** and **42** of pins **34** and **38** so that the toggle **35–37** is in an under-center locked position as shown in full line in FIG. **1**. A compression spring **44** is carried on a push rod **45** slidingly supported in a clearance hole **46** in a baffle **47** in the handle **11** and pivotally connected by a pin **48** to the link **37**, the compression spring **44** operating between the baffle **47** and a flange **49** of the push rod **45** to normally yieldingly hold the toggle **35–37** against flat surface **39** in under-center locked firing position of the gun.

The toggle **35–37** is tripped from under-center locked position by gas pressure from the gun barrel when the gun is fired.

A gas tube **50** is provided which communicates between a port **51** in the gun barrel **15** and a chamber **52** arranged at the back or handle end of the weapon immediately above the under-center toggle **35–37**. Chamber **52** contains an opening or orifice **53** directly above the under-center toggle so that gas under pressure from the gun barrel can be communicated directly to the under-center toggle.

If desired, a pocket (not shown) may be formed in one of the links of the over-center toggle such as link **37** to form a means for holding or controlling the gas under pressure used to trip the toggle mechanism, although this pocket is not needed since gas under pressure in tube **50** will trip the under-center toggle without the pocket indentation.

As shown in the drawing, a compression spring **61** is arranged between a shoulder **62**, formed around a bore **63** defined in a protruding lug **64** of bolt **29** and a ridge **62*a*** formed in a bore **65** defined by frame **10** and clamp **20**. Lug **64** is shown as being integral with bolt **29**.

When bullet **28** is fired gas under pressure in barrel **15** is driven through port **51**, tube **50**, chamber **52** and its orifice **53** to link **37** of the over-center toggle tripping the toggle, causing it to start to retract to its position shown in the handle of the pistol in FIG. **3**.

At the time bullet **28** is fired and leaves the barrel **15** and is on its way to its target, residual pressure existing in a chamber **58** will drive bolt **29** backwards with sufficient force to complete the travel of the toggle mechanism **35–37** sufficient to move the center pin **36** and force it to complete its downward travel to its lowest point down inside the handle **11** of the gun against the bias of compression spring **44**, as shown in FIG. **4**.

The inertia of the bolt **29** continues rearwardly, compressing the recoil compression spring **61** until the end of the lug **64** engages a stop surface **67** of the frame **10**. The bolt **29** and toggle **35–37** are returned to their original positions by the stored-up energy in the two springs **44** and **61**. This completes the firing cycle and prepares the gun for the second firing, having picked up an additional bullet **28** from the clip magazine and placed it in the chamber when the bolt returned to its original position by well known conventional mechanism.

In order to trip the toggle **35–37** to load the first bullet into the gun, a manual lever **70**, as shown in FIGS. **5** and **6**, may be provided on the gun shown in FIG. **1** which, when rotated by the operator clockwise against the action of a spring, contacts the under-center toggle **35–37**, causing it to trip far enough to allow the operator to move the bolt **29** back sufficiently to allow a bullet **28** from the clip magazine **14** to enter the chamber of the gun for the first firing action. Upon collapse of the toggle, bolt **29** is moved rearwardly by the operator pulling on rod **72**, shown in FIG. **2**.

As shown in FIGS. **1–4**, the toggle **35–37**, when in the under-center locked position and in its collapsed position, causes very little lateral movement of push rod **45** so that most of the action of compressions spring **44** acts longitudinally of the length of push rod **45** to take substantially full advantage of its expansion and contraction forces for moving the toggle to its locked and unlocked positions. This type of action aids in absorbing the reaction forces or "kick" of the weapon upon explosion of the bullets used in the weapon.

FIG. **1** illustrated toggle **35–37** in its extended under-center locked position being forced there by compression springs **44** and **61**. Bolt **29** is then forced toward the barrel end of the gun.

When shell **28** explodes the initial reactive force or kick back is applied against the left end of bolt **29** and gas pressure is transmitted through port **51**, tube **50**,

chamber 52 to the top of toggle 35–37. This results in the collapse of the toggle to the position shown in FIG. 3. Spring 61 is compressed absorbing the initial kick back force in a direction longitudinally of bolt 29. The toggle now being tripped, link 37 of toggle 35–37 is moved to a position substantially at right angles to link 35 and push rod 45 as shown in FIG. 3, with link 35 and push rod 45 being substantially coaxially aligned. At this point in the recoil action, the result of the forces compressing springs 61 and 45 is directed substantially in a direction along the longitudinal axis of spring 44 and rod 45. Thus, at the moment of the greatest kick back force all of the pressure is directed along the longitudinal axis of spring 44.

Further compression of springs 61 and 44 results in the toggle 35–37 collapsing, causing link 37 to form an acute angle with link 35, as shown in FIG. 4. The complete collapse of the toggle occurs after the largest portion of the reactive forces has been absorbed by link 37 when at substantial right angles to link 35 and rod 45.

It should be noted that when spring 61 is most effective in its compression cycle it is substantially aligned with link 35 and when spring 44 is most effective in its compression cycle it is coaxially aligned with link 35 and link 37 is perpendicular to link 35. This arrangement greatly reduced the effect of kick back on the holder of the weapon.

In FIGS. 5 and 6 a weapon 10′ employing a piston actuated toggle collapsing wedge is shown and is disclosed in more detail in U. S. Pat. No. 3,630,119 referred to above, and is similar to weapon 10 shown in FIGS. 1–4. Like parts of a substantially similar configuration to weapon 10 are provided with the same reference characters as in FIGS. 5 and 6 but identified with a prime symbol.

Normally, when bullet 28 has been loaded in the barrel in firing position the toggle 35′–37′ is aligned as shown in full lines in FIG. 6, with the top surface 37*a*′ up against the locating abutment surface 39′ of the frame 10′ at which time the axis 40′ is slightly above a line 36*a*′ between the axes 41′ and 42′ of pins 34′ and 38′ so that the toggle 35′–37′ is in an over-center locked position as shown in full line in FIG. 6. Compression spring 44′ as in FIGS. 1–4 is carried on a push rod 45′ slidingly supported in a clearance hole 46′ in a baffle 47′ in the handle 11′ and pivotally connected by a pin 48′ to the link 37′, the compression spring 44′ operating between the baffle 47′ and a flange 49′ of the push rod 45′ to normally yieldingly hold the toggle 35′–37′ in over-center locked firing position of the gun.

The toggle 35′–37′ is tripped from over-center locked position by gas pressure from the gunbarrel when the gun is fired. One example of such mechanism may comprise an actuating cam 73 connected to a piston rod 74 slidably mounted in an elongated cylinder bore 75 formed in the clamp 20′, which bore 75 in turn is in communication through a port 76 in the clamp 20′ and an aligned port 77 in the gun barrel 15′. A tension spring 78 connected between an anchor pin 79 in the frame 10′ and the actuating cam 73 in retracted position as shown in full line in FIG. 6. When the cam 73 moves rearwardly from gas pressure from the gun barrel in cylinder bore 75, the sloping cam surface 80 engages the pin 36′ to push the pin downwardly below the line 36*a*′ to break dead center for the toggle 35′–37′.

At the time this happens, the bullet 28 has left the barrel 15′ and is on its way to its target. The force still remaining in the inertia of the piston rod 74 and the cam 73 plus the residual pressure still existing in the chamber 81 continues to drive the piston rod 74 and bolt 29′ with sufficient force to complete the travel of the piston rod, activating the cam to its rearmost travel position 82 against stop pin 83 sufficient to move the center pin 36′ and force it to complete its downward travel along the arcuate path 84 to its lowermost point 85 down inside the handle 11′ of the gun, compressing spring 44′.

The inertia of the bolt 29′ continues rearwardly, compressing the recoil compression spring 61′ acting between the bolt 29′ and the frame 10′ of the gun until the bolt engages the frame. At that time, spring 78 returns the piston rod 74 and cam 73 forwardly to retracted position shown in full line in FIG. 6. The bolt 29′ and toggle 35′–37′ are returned to their original positions by the stored-up energy in the two springs 44′ and 61′. This completes the firing cycle and prepares the gun for the second firing, having picked up an additional bullet 28 from the clip magazine and placed it in the chamber when the bolt returned to its original position by well known conventional mechanism.

FIG. 7 illustrates a hesitation blow back operated toggle mechanism for a weapon 10″ which is simi'ar to weapons 10 and 10′ shown in FIGS. 1–6 and wherein like parts of a substantially similar configuration are provided with the same reference characters identified with a double prime symbol. For a more detailed illustration and explanation of the weapon reference is made to U. S. Pat. No. 3,709,091.

As described in U. S. Pat. No. 3,709,091, the bullet magazine 14″ is demountably secured by the usual releasable latch in the guide sleeve 27″ of the frame 10″ to feed the bullets 28 into insertion and firing position by the usual bolt 29″ which moves on guide keys in appropriate guide slots in frame 10″. The rear end of bolt 29″ is pivotally connected by a pivot pin 34″ carried in the front end of the front link 35″, the rear end of which is pivotally connected by a pivot pin 36″ to the front end of the rear link 37″, in turn pivotally connected by a pivot pin 38″ carried in the rear portion of the frame 10″ to thus provide a toggle 35″–37″ for controlling the movement of the bolt 29″.

Normally, when the bullet 28 has been loaded in the barrel in firing position, the toggle 35″–37″ is aligned, as shown in full line in FIG. 7, with the top surface 37*a*″ up against an adjustable locating abutment means 39″ threadedly mounted in frame 10″, at which time the axis 40″ of pin 37″ is slightly below a line between the axes 41″ and 42″ of pins 34″ and 38″ so that the toggle 35″–37″ is in an under-center locked position as shown in full line in FIG. 7. A compression spring 44″ is carried on a push rod 45″ slidingly supported in a clearance hole 46″ in a baffle 47″ in the handle 11″ and pivotally connected by a pin 48″ to the link 37″, the compression spring 44″ operating between the baffle 47″ and a flange 49″ of the push rod 45″ to normally yieldingly hold the toggle 35″–37″ against adjustment means 39″ in under-center locked firing position of the gun.

The toggle 35″–37″ is tripped from under-center locked position by gas pressure from the gun barrel when the gun is fired.

In accordance with the invention claimed the adjustment locating means 39″ comprises an adjustment screw which makes it possible to hold the toggle

35''–37'' in one of a number of under-center toggle positions and to hold that position until gas pressure from the firing of the gun causes the toggle to recede into the handle.

As shown in the drawings a compression spring **61''** is arranged between a shoulder **62''**, formed around a bore **63''** defined in a protruding lug **64''** of bolt **29''** and a ridge **62a''** formed in a bore **65''** defined by frame **10''**. Lug **64''** is shown as being integral with bolt **29''**.

At the time bullet **28** is fired and leaves the barrel **15''** and is on its way to its target residual pressure existing in a chamber **58''** will drive bolt **29''** backward with sufficient force to complete the travel of the toggle mechanism **35''–37''** sufficiently to move the center pin **36''** and force it to complete its downward travel to its lowest point **60''** down inside the handle **11''** of the gun against the bias of compressing spring **44''**.

The inertia of the bolt **29''** continues rearwardly compressing the recoil compression spring **61''** until the end of the lug **64''** engages a stop surface **67''** of the frame **10''**. The bolt **29''** and toggle **35''–37''** are returned to their original positions by the stored-up energy in the two springs **44''** and **61''**. This completes the firing cycle and prepares the gun for the second firing, having picked up an additional bullet **28** from the clip magazine and placed it in the chamber when the bolt returned to its original position by well known conventional mechanism.

FIG. **8** illustrates an over-center toggle actuated weapon **10'''** wherein like parts of a substantially similar configuration with those shown in FIGS. **1–4** are provided with the same reference characters identified with a triple prime symbol. In this weapon the toggle **35'''-37'''** is actuated as in FIGS. **1–4** by gas under pressure from the exploding shell conducted through port **51'''**, gas tube **50'''**, chamber **52'''** and through orifice **53'''** to link **37'''** of the toggle mechanism in the same manner as in FIGS. **1–4.**

It should be noted that applicant has disclosed in FIGS. **1** through **8** a gas actuated toggle mechanism for weapons, some of which are locked in an over-center position and others in an under-center position.

In the over-center locked position as shown in FIG. **8,** the toggle mechanism is particularly suitable for rifles and high-powered bullets, 30 caliber machine guns and so forth, and also 3.08 automatic rifles. In the under-center toggle locked position of the weapons disclosed, the toggle mechanism may be more quickly collapsed than in the over-center locked position; therefore one advantage of the under-center locked type of weapon is that this type of toggle mechanism can be used effectively with weapons having shorter barrel lengths and still achieve the efficiency as with a long barrel and an over-center locked toggle mechanism. Where the over-center and under-center toggle mechanisms are embodied in pistol-type weapons, one creates a gun that is most effective when utilized in an under-center toggle mechanism, but more effectively locked when using an over-center toggle mechanism. The efficiency of operation increases when an under-center toggle action mechanism is used, since the gun may be more quickly actuated by tripping the toggle from that position than from an over-center position. Whether the toggle is in an under-center locked position or an over-center locked position, sufficient energy must be applied to it to trigger it to cause the mechanism to collapse and absorb the explosive forces of the shell during firing and the reloading cycle of the weapon.

Therefore, a need exists for both the under-center and over-center toggle mechanism called a hesitation lock, well known in the art.

When properly designed the under-center toggle mechanism operates as effectively and locks as permanently as an over-center toggle mechanism.

One important common characteristic about properly designed over-center, under-center and hesitation lock toggle mechanisms for weapon use and particularly those employed in pistol type guns, is the proper placing of the springs used to absorb the exploding shell recoil action of the weapon.

Heretofore, springs placed in the weapon to bias the toggle into its extended position had difficulty in placing the toggle and the bullet in the magazine in an identical position each time the weapon was fired. If a spring was positioned in the gun so as to be longitudinally arranged with the bolt of the weapon, the spring was then capable of driving the bullet forward into the chamber of the gun hard enough to seat it properly, but it was not in a favorable position for absorbing recoil of the weapon or to aid in positioning the toggle in its properly extended position each and every cycle of gun actuation. Thus, if only a single spring was used longitudinally of the toggle mechanism, the toggle, whether it was an under-center or over-center mechanism, usually sagged a bit, and if there was any friction in the operation of the moving parts, the sag prevented the bullet from being seated identically in the same position each time. Springs mounted to operate on the knee of the toggle arranged transversely to the longitudinal axis of the toggle failed also to seat the bullet each and every time and particularly were not in the most favorable position for absorbing recoil of the exploding shell.

Therefore, it is necessary to construct a toggle mechanism featuring springs that are dynamically balanced to operate in conjunction and combination with each other. The dynamic balance obtained by the use of a pair of springs properly positioned to absorb the recoil of the exploding shell as well as control the operation of the collapsing and extending of the toggle mechanism is an important feature of the new and improved weapons disclosed in this application. The pair of springs disclosed in each of the weapons shown in the figures of the drawing achieve a dynamic balance. The bottom spring **44** in each weapon illustrated pushes up against the toggle joint, premanently securing the bolt in identically the same position each and every firing cycle so that the bolt is always identically placed with the same identical pressure on it each time the weapons are discharged. This provides a consistency in the explosive and reactive reaction operation of the bolt in its forward and rearward movements each and every time it is actuated. As springs **44–44'''** are compressed during an explosive action of a shell, they recede into the handle of the weapon, becoming less and less effective, due to the angles and the change of angles of the toggle arms. Initially it absorbs a tremendous amount of recoil because of its position and later becomes almost totally ineffective when the toggle has reached a certain position. At this point, where the springs **44–44'''** become ineffective, the toggle still continues to go rearward and the top springs **61–61'''** compress and store up energy for the initial return of the bolt to the toggle extended position. In fact, springs **61–61'''** generally have more

force than is necessary to drive the cartridge carriage of the exploded shell out of the gun and to push forward a new shell into the chamber. When springs **61–61'''** become less effective after being extended in their effort to drive the bolt back to the toggle extended position, the lower springs **44–44'''** accelerate and add to the effort of the top spring sufficient energy to drive forward the bolt **29** and to lock it permanently in position through the proper positioning of the toggle arms of the toggle mechanism. This is accomplished identically the same each and every cycle of the firing of the weapon.

Heretofore, either one or two springs have been used to aid in positioning the toggle, but in each and every instance the springs were so designed that they did not exert this dynamic balance that applicant has achieved through his weapon design, and accordingly did not close the weapon in the same identical position each and every time.

Thus, in order to provide a toggle actuated mechanism which is of the ideal configuration for use in under-center, over-center or hesitation lock weapons, the toggle arms of the toggle linkage must be of specific lengths so that when the springs **44–44'''** and **61–61'''** act on them the proper collapsing effect occurs in such a manner as to totally absorb the recoil of the exploding shell. As shown in the Figures of the drawing, the toggle mechanism comprises two movable links **35** and **37**, **35'** and **37'**, **35''** and **37''**, and **35'''** and **37'''**, which are of given lengths so that when the toggle mechanisms have reached their midpoint in their collapsing action, the toggle arms **37, 37', 37''** and **37'''** are at substantial right angles to the other arm of each toggle mechanism, i.e. **35, 35', 35''** and **35'''** . At this instance it is also desirable that the springs **44–44'''** are positioned such that they are at right angles to the toggle arm **37, 37', 37''** and **37'''**.

In order to so design the toggle mechanisms shown in FIGS. **1–8** so that this collapsing feature exists in each of the guns shown, the longer linkage arm, i.e., **37, 37', 37''** and **37'''**, must be of sufficient length so that the bolt may move backward into the rear of the gun a distance equal to the feed ramp of the mechanism plus the length of the bullet plus sufficient distance to feed a new bullet into the chamber. In a given weapon, one linkage of the toggle mechanism is equal to a feed ramp (0.400 inches) plus the bullet (1.169 inches) and the distance necessary to feed a new bullet into the chamber (0.125 inches). The total linkage, then, is 1.694 inches. The second toggle arm of the linkage comprises a link which is the length of the linkage arm above defined times 0.707 inches. Thus, if a toggle mechanism is made of the above defined linkage lengths and so arranged in a toggle actuated weapon so that springs **44–44'''** are at substantial right angles to the toggle mechanisms when they have reached substantially midway in their collapsing operation, the toggles will be effective for absorbing substantially total recoil or kick back of the weapon, regardless of whether they are used in an over-center, under-center or hesitation lock mechanism. Additionally, in either of these gun weapon designs, springs **61–61'''** should be arranged such that they effectively operate on the bolt in a direction longitudinally to the longitudinal axis of the bolt travel.

Reference is made to FIG. **3** of the drawing wherein the toggle is shown in its mid position during a collapsing operation, showing arm **37** of the toggle linkage mechanism to be at substantial right angles to arm **35** of the mechanism, with spring **44** operating on the knee of the toggle in a direction substantially perpendicular to the longitudinal axis of link **37.** The disclosed mechanism results in the recoil force being directed into the palm of the hand of the holder of the weapon, which force is then absorbed by spring **44.** Part of the recoil force is absorbed by the top spring **61.**

Recoil is generated at the instant the bullet moves from its case through the barrel and out the gun. As bolts **29, 29', 29''** and **29'''** move backward in the weapon, springs **61, 61', 61''** and **61'''** absorb part of the force, the remainder of the force being directed into the handle of the weapon and absorbed by springs **44, 44', 44''** and **44'''**.

Heretofore in weapons of the type disclosed, the toggle mechanism acted as a locking device, and when collapsed the recoil had to be absorbed by the bolt as it struck an abutting surface at the rear of the weapon. The bolt would come to a dead stop at the rear of the weapon, thereby transmitting the recoil of the exploding shell to the holder of the weapon. In the FIGS. **1–8** the weapons shown absorb part of the recoil in the handle of the gun, and this is absorbed by springs **44, 44', 44''** and **44'''**. These springs are so situated that they work effectively during the recoil action by being compressed into the handle of the gun after the springs **61, 61', 61''** and **61'''** have provided their full shock absorbing action.

Although the toggles of the weapons shown in FIGS. **1–8** are triggered initially to collapse in different manners, as described, the force of the bolt moving back under the action of the exploding shell causes collapse of the toggle.

In any of these mechanisms, the toggle after it collapses transmits force to the holder of the weapon. In the weapons set forth in FIGS. **1–8,** this force is absorbed by a combination of the springs **44–44'''** and **61–61'''**, as heretofore described. The new and improved toggle actuated weapon disclosed employs a novel toggle mechanism of a certain geometrical configuration so biased by a combination of springs that substantially full recoil is absorbed by the weapon without distorting the gun causing a deflection of the weapon under the action of the explosive shell.

It should be noted that the toggle size can be identified by the characteristic of the gun. For example, it has been noted that if the length of the feed ramp of the gun is added to the length of the bullet plus a distance sufficient to feed a new bullet into the gun, this distance will result in the length of link **37** of the toggle. Link **35** will then be 0.707 times that distance.

Although but a few embodiments of the invention have been shown and claimed, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of invention or from the scope of the appended claims.

I claim:

1. A gas operated toggle action weapon comprising:

a frame,

a handle on the frame,

a barrel having a firing chamber,

a bolt movable in the frame axially to and from the firing chamber of the gun barrel,

a toggle interconnected between the bolt and the frame,

said toggle comprising a pair of pivotally connected links, the free end of one of said links being pivotally connected to said bolt and the free end of the other of said links being pivotally connected to said frame, said toggle being movable to a locked position when said bolt has been moved to said firing chamber,

a first compression means for controlling the movement of said toggle as it collapses by causing the intermediate pivot axis to swing downwardly away from said bolt, saod compression means comprising a push rod pivotally mounted on said toggle at a point between its ends and slidably mounted for movement transversely of said bolt, and a first spring means mounted on said push rod between a fixed flange in said handle and a fixed flange on said push rod for compression of said spring means during movement of said push rod upon collapsing of said toggle, said first spring means biasing said toggle to its locked position after a collapsing action of said toggle,

a second compression means mounted on said frame for controlling the movement of said toggle as it collapses, said second compression means comprising a second spring means mounted between said frame and said bolt for compression upon movement of said bolt during collapsing of said toggle, said second spring means biasing said bolt toward said firing chamber after a collapsing action of said toggle,

said second spring means extending longitudinally of said bolt and compressing immediately upon collapsing of said toggle to absorb a portion of the reactive force of an exploding shell in the weapon, said first spring means compressing to absorb another portion of said reactive force upon the further collapsing action of said toggle,

said links being of predetermined length so that they are perpendicular to each other, and said first spring means being longitudinally positioned with said one of said links when said toggle is partially collapsed to thereby distort said reactive force transversely to the longitudinal axis of said bolt.

2. The gas operated toggle action weapon set forth in claim **1** wherein said one of said links is 0.707 times the length of said other of said links.

3. The gas operated toggle action weapon set forth in claim **1** wherein said first spring means is substantially perpendicular with said other of said links when said links are perpendicular to each other, said links when perpendicular to each other causing said reactive forces to be distorted transversely to said bolt into the handle of said weapon.

4. A gas operated toggle action weapon set forth in claim **1** wherein the intermediate pivot axis of said toggle swings downwardly within the handle of the weapon.

5. A gas operated toggle action weapon set forth in claim **1** wherein a gas operated actuating device movable on the frame is arranged to actuate and release the toggle from its locked position by gas pressure developed in the barrel by firing of the weapon.

6. A gas operated toggle action weapon set forth in claim **1** wherein a gas operated mechanism for tripping the toggle from its locked position comprises a cylinder bore in the frame in communication with the gun barrel bore, a piston rod reciprocatable in the cylinder bore having cam means to engage an intermediate point of the toggle.

7. A gas operated toggle action weapon as set forth in claim **1** in further combination with conduit means interconnecting the interior of said hollow barrel with a zone immediately adjacent said toggle for transmitting gas under pressure in said barrel during firing to said zone for releasing said toggle from its locked position.

8. A toggle action gun as set forth in claim **1** wherein said push rod is pivotally mounted on said toggle and arranged to move substantially parallel with the longitudinal axis of the handle during movement of said toggle.

9. A toggle action weapon as set forth in claim **1** wherein said first and second compression spring means bias said toggle to an under-center locked position after a toggle collapsing operation slightly below a line between the pivotal connection of the toggle on the bolt and on the frame when said weapon is in operative position.

10. The toggle action weapon set forth in claim **1** wherein said first and second compression spring means bias said toggle to an over-center locked position after a toggle collapsing operation slightly above a line between the pivotal connection of the toggle on the bolt and on the frame when said weapon is in operative position.

11. The toggle action weapon set forth in claim **1** wherein said toggle is characterized by an under-center hesitation locked position slightly below a line between the outer pivot axes of the toggle on the bolt and on the frame when the weapon is in operative position.

12. The toggle action weapon set forth in claim **1** wherein said second spring means drives said bolt back to said firing chamber during a shell loading operation and said first spring means places said toggle in locked position.

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