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(54) **AIR GUN FIRING OPERATING SYSTEM**

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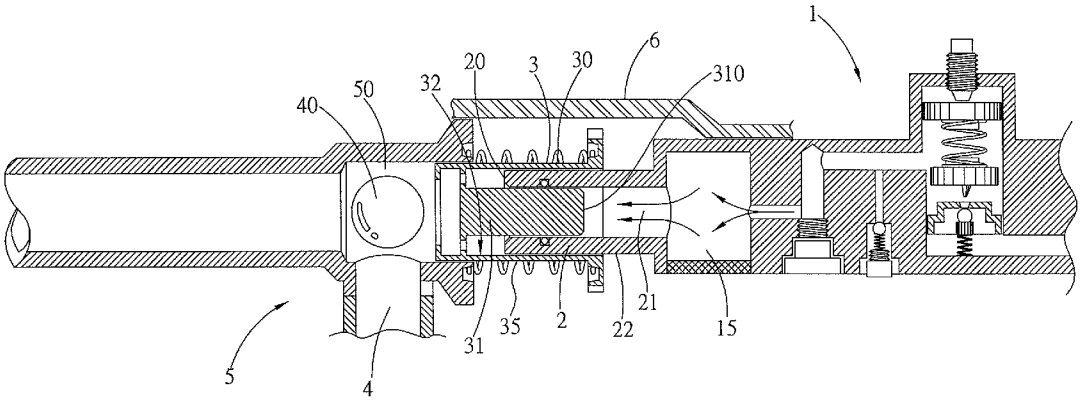
(57) **ABSTRACT**

The present invention provides an air gun firing operating system that uses compressed air to eject bullets by purely mechanical means, and enabling single firing or high-speed continuous firing. During the firing operation, the system uses a sliding shuttle tube that is able to slide back and forth in a linear line between a bullet chamber and a cylinder. The sliding shuttle tube is provided with a sliding column, and relative linear motion between the sliding column and the end opening of the cylinder determines critical opening and closing to obtain air pressure blasts, thereby achieving high-speed back and forth motion and continuous firing of bullets. The relevant driving position of a trigger device is provided with a sliding retainer, which is able to effect transient retaining of the sliding shuttle tube, thereby restricting the system for single firing, or opening the sliding retainer to enable a continuous firing operation.



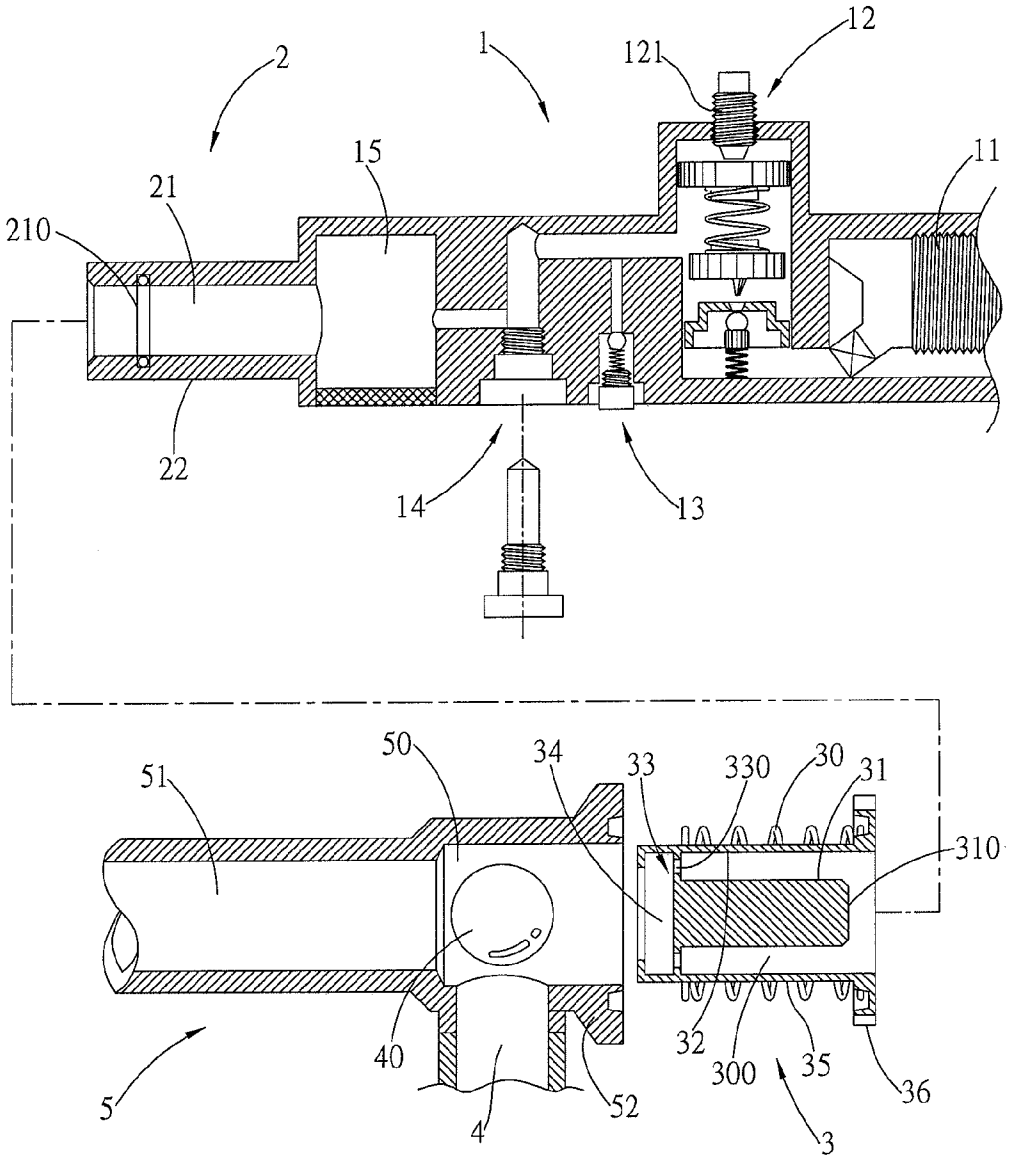

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FIG. 1

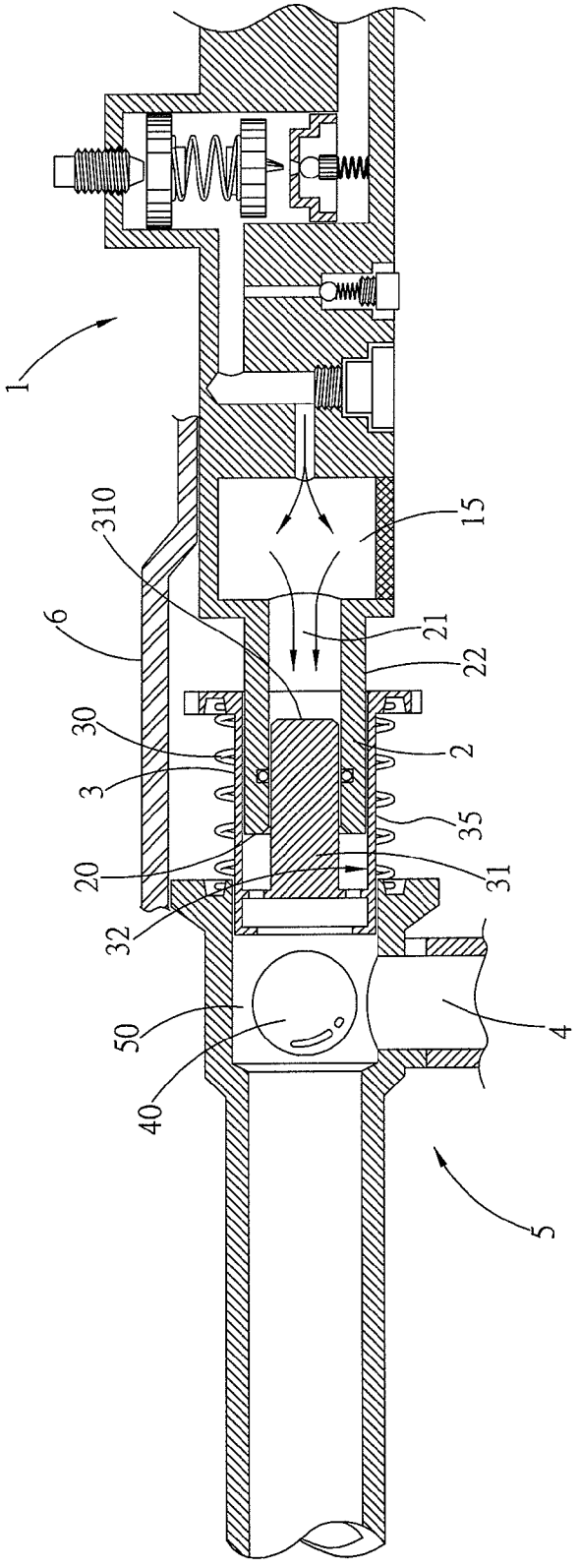

FIG. 2

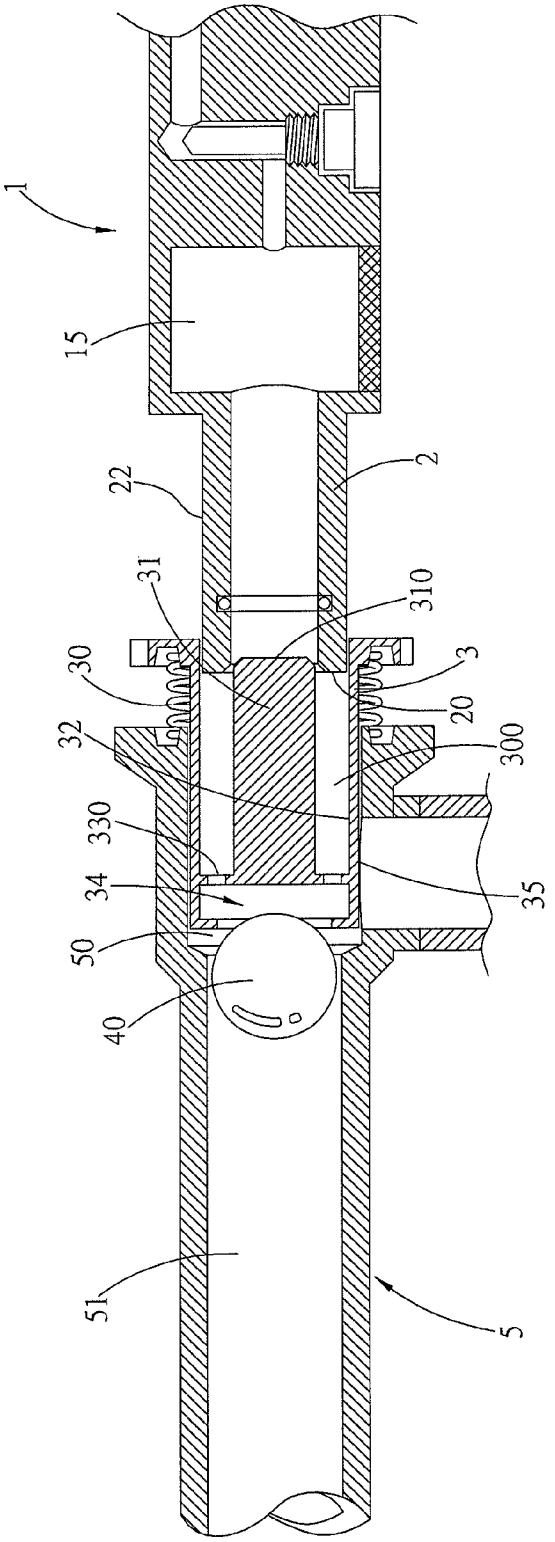

FIG. 3

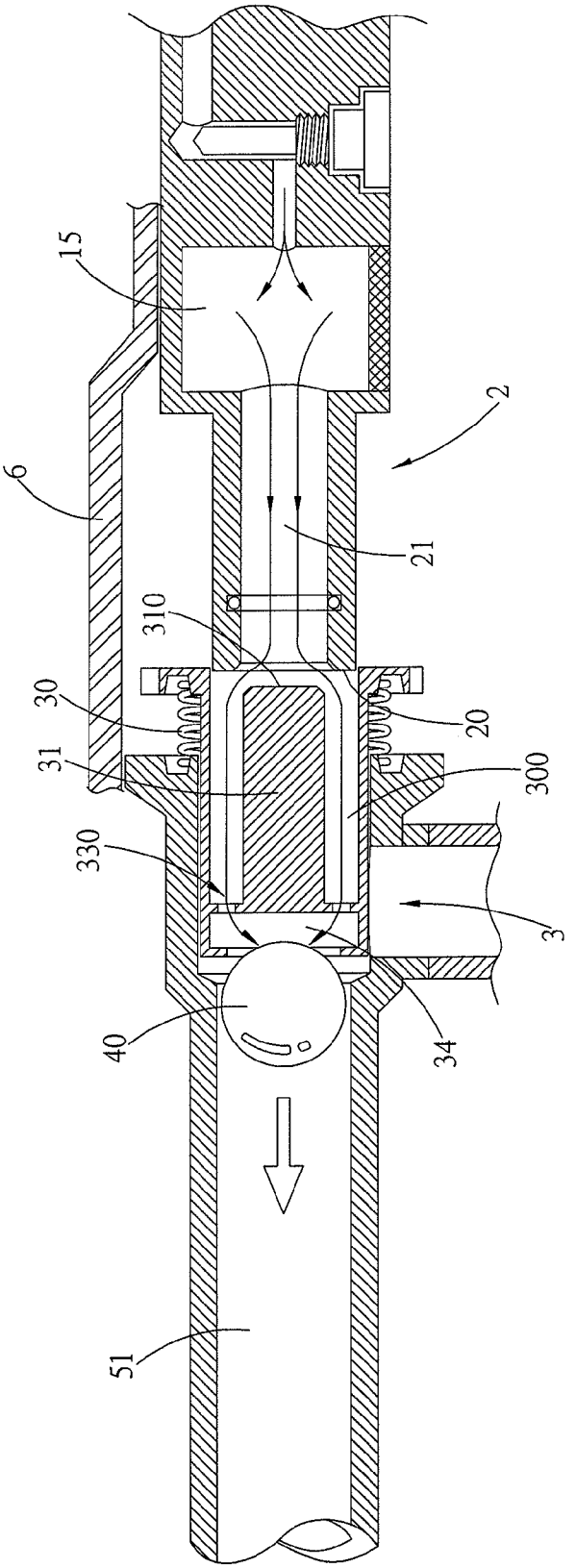

FIG. 4

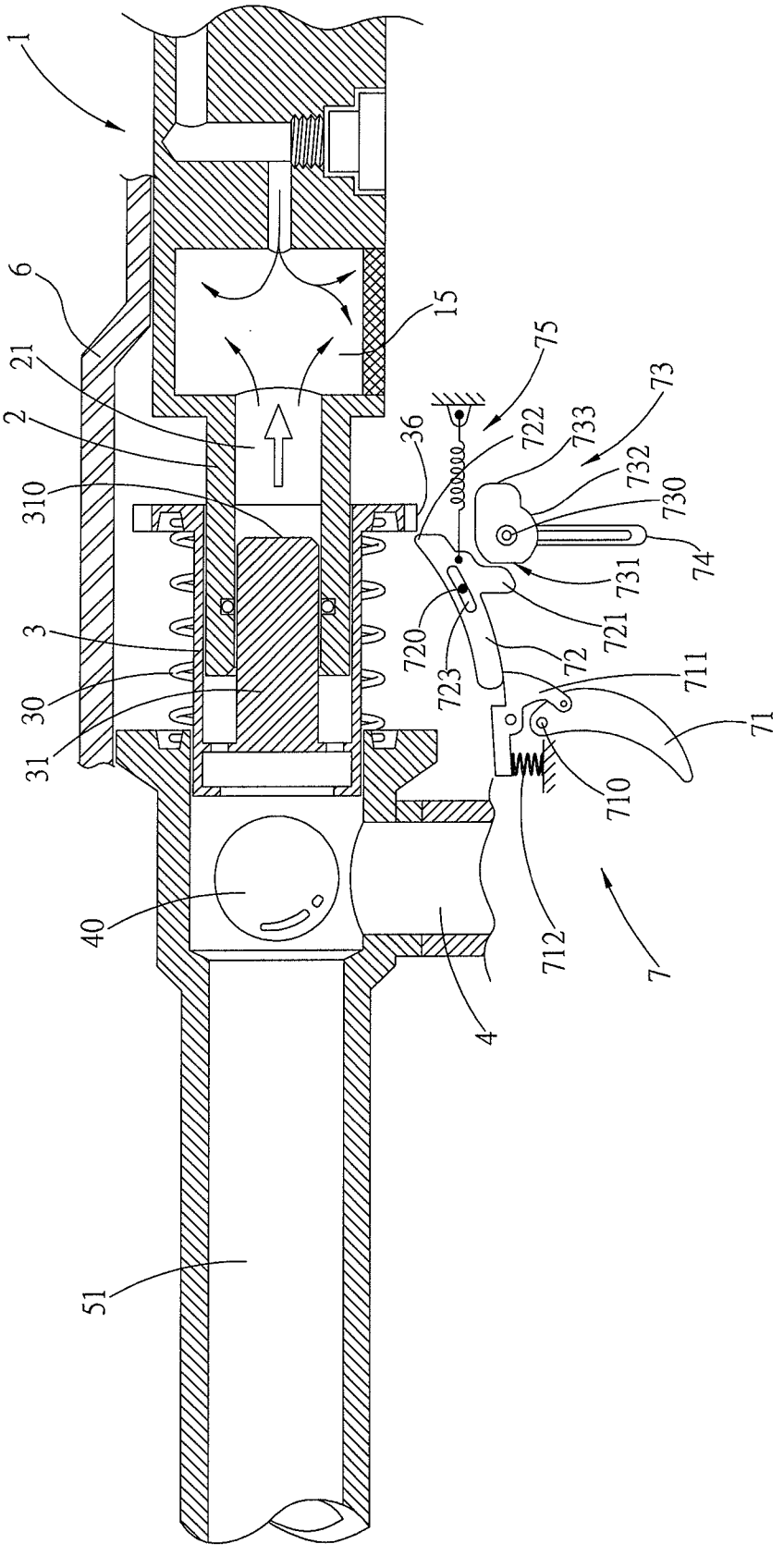
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FIG. 5

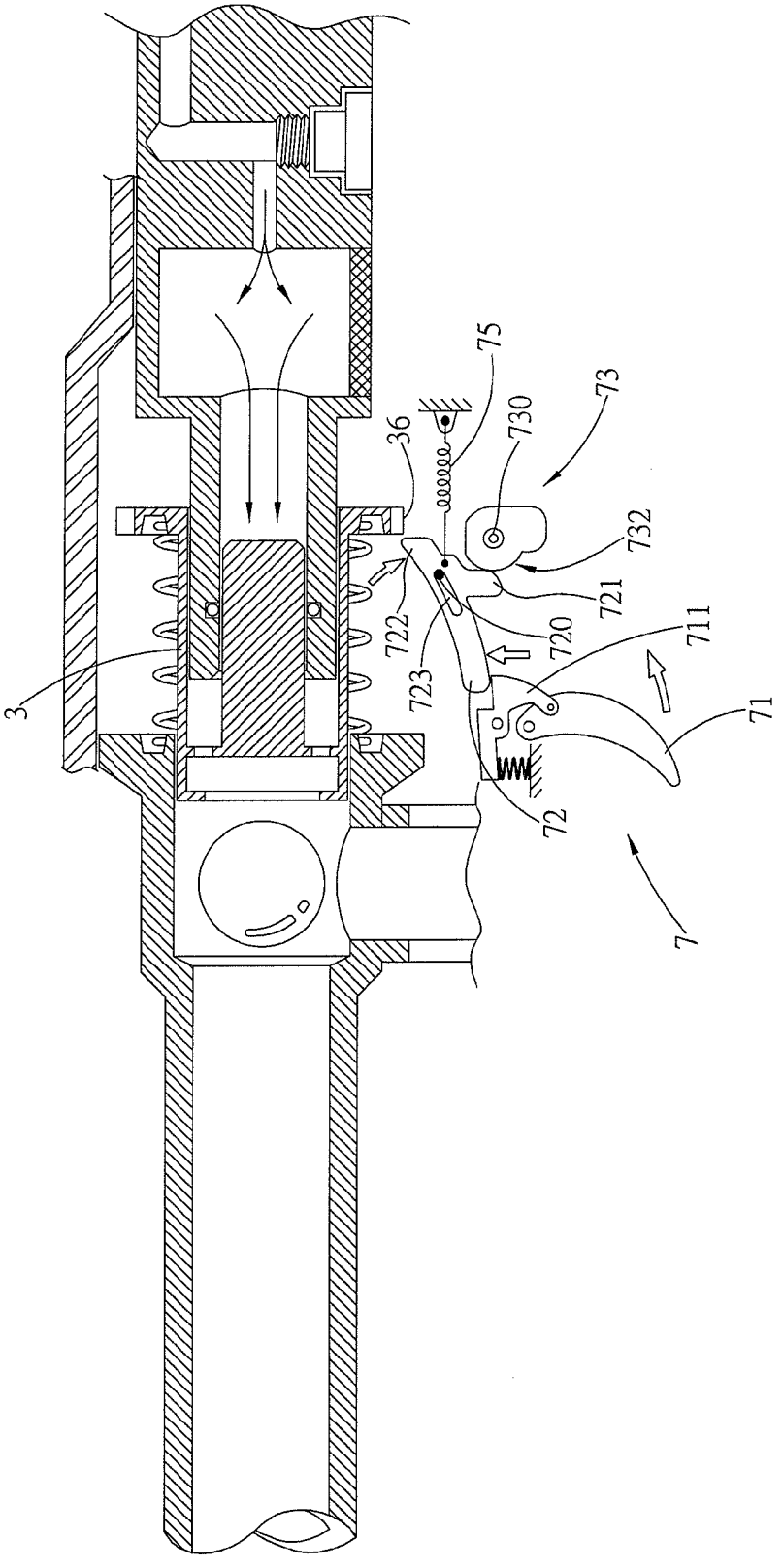

FIG.6

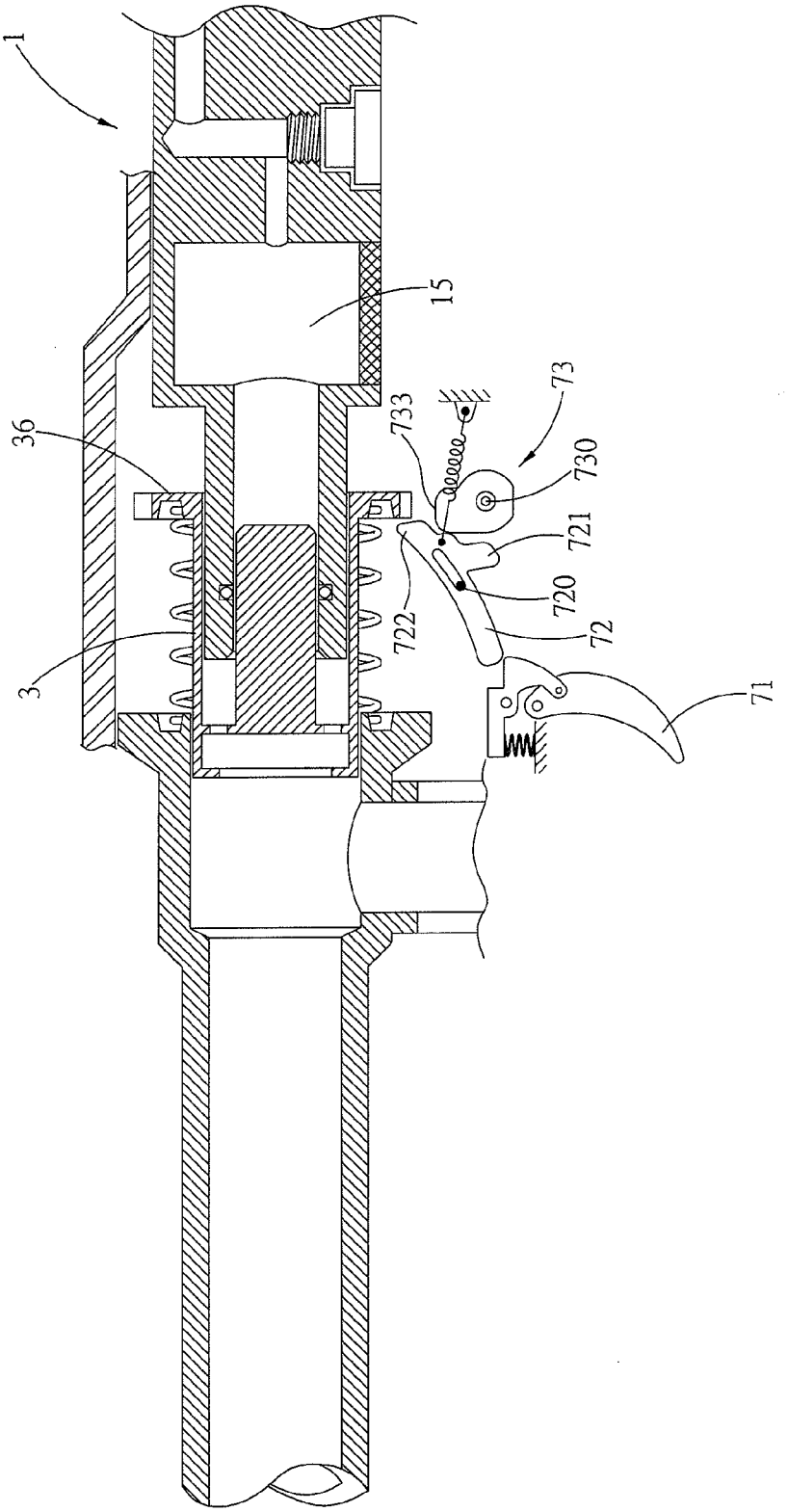

FIG. 7

AIR GUN FIRING OPERATING SYSTEM

BACKGROUND OF THE INVENTION

[0001] (a) Field of the Invention

[0002] The present invention provides an air gun firing system, which is able to employ a purely mechanical system to achieve a high speed continuous firing or single firing operation, and uses a sliding shuttle tube able to move frontward and rearward between a bullet chamber and a cylinder, thereby achieving a firing and bullet loading operation during the process of the back and forth motion. The back and forth motion of the sliding shuttle tube continues when not restricted by an external force, and intervention of a sliding retainer restricts the system to a single firing operation.

[0003] (b) Description of the Prior Art

[0004] Pressurized air guns fire paint balls or BB balls during use thereof, and the source of the air pressure is compressed air. After regulating the pressure of the firearm, an instantaneous high pressure enables firing of the bullet. There are two methods of firing, namely single firing and continuous firing. As for the continuous firing mode, this is commonly determined by electronic solenoid valve operation of an air blast. However, this solenoid valve is frequently subjected to change in pressure value of the pressure source, causing a change in the working condition and resulting in malfunction of the system.

SUMMARY OF THE INVENTION

[0005] A primary objective of the present invention is to provide an improved air gun that effects a stable firing operation for continuous firing, and adopts a purely mechanical working mode, which, under stable physical conditions, allows a uniform pulse type high-speed continuous blast of air pressure for firing of bullets. Moreover, the present invention uses the restrictive function of a trigger device to enable restraining the system to operate in a single firing mode or be used as a safety lock.

[0006] A second objective of the present invention lies in using a sliding shuttle tube to achieve the aforementioned objective, in which the interior of the sliding shuttle tube is coaxially fitted with a sliding column, the outer circumference of which is slidably disposed in a bullet chamber, and the internally fitted sliding column is slidably disposed in a cylinder body of a cylinder. Unidirectional return of the sliding shuttle tube is realized by means of an arch returning spring, and compressed air conveyed by the cylinder acts on the sliding column, thereby causing the sliding shuttle tube to move toward the bullet chamber. After the end surface of the sliding column separates from the cylinder body, then the cylinder body comprises a pressure buffer chamber containing the entire compressed gas, which propels a bullet by means of the sliding shuttle tube to achieve the firing objective. After the drop in pressure, the arch returning spring prepares to return the sliding shuttle tube, thereby achieving a continuous motion operation.

[0007] A third objective of the present invention lies in using a trigger device, which drives a sliding retainer by means of a cam. The sliding retainer subjects the sliding shuttle tube to a transient line of motion to achieve a single firing function or can be opened for continuous firing or for safety locking.

[0008] A fourth objective of the present invention lies in the cylinder connected to an air pressure regulating system, in which the air pressure regulating system is installed with a pressure regulating device and an overvoltage protection device and a flow control device, whereby regulation of the inflow of compressed air is carried out to stabilize pressure and protect against overpressure, thereby avoiding the danger of bullets traveling too fast during firing.

[0009] To enable a further understanding of said objectives and the technological methods of the invention herein, a brief description of the drawings is provided below followed by a detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a front and rear dispositional view of the system of the present invention.

[0011] FIG. **2** is a configurational view of the structural relationship before firing of the system of the present invention.

[0012] FIG. **3** is a configurational view of the structural relationship of critical points before firing of the system of the present invention.

[0013] FIG. **4** is a schematic view of the configuration of the relevant positions of the various critical components of the present invention.

[0014] FIG. **5** is a schematic view of the system configuration of the present invention after returning of moving components to original positions.

[0015] FIG. **6** is a schematic view depicting the configurational view of the structural relationship showing use of the single limit stop-retaining continuous firing of a trigger device of the present invention.

[0016] FIG. **7** is a schematic view depicting the configurational view of the structural relationship of a sage locking mechanism of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0017] Referring first to FIG. **1**, the present invention primarily comprises a sleeve-shaped sliding shuttle tube **3**, a sliding column **31** disposed within the sliding shuttle tube **3**, in which the sliding column **31** is disposed to slide in a cylinder body **21** installed center of a cylinder **2**, the outer circumference of the sliding shuttle tube **3** is slidably disposed in the inner circumference of a bullet chamber **50** of a gun barrel **5**, the inner circumferential surface **32** of the sliding shuttle tube **3** is further mounted to slide on the outer circumferential surface of the cylinder **2**, thereby causing cooperative movable airtight tolerance between the sliding column **31** and the cylinder body **21** and between the inner circumferential surface **32** and the outer circumferential surface **22**.

[0018] A bullet **40** is caused to enter the bullet chamber **50** through a bullet loading opening **4**, in which the bullet **40** enters so as to be aligned with the center position of a gun chamber **51**. The bullet chamber **50** is provided with a pressing ring **52** facing the expanded open side periphery of the cylinder **2**, and the pressing ring **52** is used to compress a corresponding end of an arch returning spring **30**.

[0019] One end of the sliding shuttle tube **3** mounted on the cylinder **2** is outwardly widened to form a ring-shaped retaining shoulder **36**, and one side of the retaining shoulder **36** corresponding to the pressing ring **52** similarly compresses an end opening of the arch returning spring **30**.

[0020] The base of the sliding column **31** of the sliding shuttle tube **3** connects to a radial connecting portion **33** to form a suspended rod form, and the connecting portion **33** is a pressure feed opening **34** directed toward the end opening of the firing direction. Passageways are realized between the pressure feed opening **34** and a trough **300** of the sliding shuttle tube **3** through air holes **330** defined in the connecting

portion **33**. The length of the sliding column **31** is shorter than the overall length of the sliding shuttle tube **3**, and an end surface **310** thereof is positioned within the space of the trough **300**.

[0021] The cylinder body **21** is fitted in the interior of the cylinder **2**, and the cylinder body **21** is radially fitted with a compression ring **210**. The elastic effect of the compression ring **210** is used to further improve the airtight effectiveness of the aforementioned sliding column **31**.

[0022] The cylinder body **21** of the cylinder **2** is linked in the direction of an air pressure regulating system **1**, and the cylinder body **21** first enables channeling to a pressure buffer chamber **15** of the air pressure regulating system **1**, the pressure buffer chamber **15** then enables channeling to a channeling portion **11** through the air flow path. In order for the channeling portion **11** to accept the intake of the compressed air source, after intake of the compressed air by the channeling portion **11**, the compressed air is first adjusted using a pressure adjusting device **12**, which is able to adjust the magnitude of the pressure value. Adjustment can be achieved by transferring pressure to the outside using an adjusting screw **121**, while an overpressure protection device **13** fitted in the path is able to automatically release excessive pressure. Moreover, a flow control device **14** can be fitted in the path for fast adjustment, whereby adjustment of the flow control device **14** enables changing the speed relationship, thereby forming a pressure effect in the interior of the pressure buffer chamber **15**.

[0023] Referring to FIG. **2**, the gun barrel **5** is coupled to the air pressure regulating system **1** by means of a barrel component **6**, the barrel component **6** being one part of the barrel, and the gun barrel **5** and the air pressure regulating system **1** form a coaxial linear relationship front-rear assembly. The sliding shuttle tube **3** is coaxially, disposed so as to slide on the cylinder **2**, and the cylinder **2** is joined to the air pressure regulating system **1** to connectively channel air pressure from the pressure buffer chamber **15**. The bullet chamber **50** of the gun barrel **5** enables the outer circumferential surface **35** of the sliding shuttle tube **3** to be slidably disposed thereon, and the side feeding bullet loading opening **4** enables loading into the sliding shuttle tube **3**. Joining of the barrel component **6** causes a coaxial linear assembly to form between the gun barrel **5** and the cylinder **2**, thereby enabling the sliding shuttle tube **3** to rely on the linear support of the bullet chamber **50** and the cylinder **2** to produce a back and forth motion, and the arched pressure of the arch returning spring **30** is used to push back and effect restoring of the sliding shuttle tube **3**. During the pushing back process, the end surface **310** of the sliding column **31** effects damping in the direction of the pressure buffer chamber **15**.

[0024] Before a firing operation, the compressed air of the pressure buffer chamber **15** acts on the end surface **310** of the sliding column **31**, and the sliding column **31** connectively drives the outer circumferential surface **35** by means of the inner circumferential surface **32**, whereupon, the bullet chamber **50** slides into the gun barrel **5**, and the arch returning spring **30** is simultaneously compressed. The compressed air of the pressure buffer chamber **15** successively acts on the sliding column **31** of the sliding shuttle tube **3**, thereby causing the entire sliding shuttle tube **3** to be displaced toward the bullet chamber **50**. At this time, the compressed air remaining in the cylinder body **21** of the cylinder **2** and the end surface **310** forms an internal space with the sliding column **31**, and the sliding shuttle tube **3** is squeezed to finally retain the bullet **40**.

[0025] FIG. **3** depicts the end surface **310** of the sliding column **31** receiving the pressurization of the pressure buffer chamber **15**, thereby connectively displacing the entire sliding shuttle tube **3**. The pressure feed opening **34** of the sliding shuttle tube **3** receives the bullet **40**, and causes the bullet **40** to be positioned in the outer external end of the gun barrel **5**. The arch returning spring **30** is subjected to extreme compression, and the end surface **310** almost separates from an end opening **20** of the cylinder **2**.

[0026] Referring to FIG. **4**, pressure from the pressure buffer chamber **15** continues to act on the sliding column **31** of the sliding shuttle tube **3**, and after the end surface **310** of the sliding column **31** is pressed to separate from the end opening **20** of the cylinder **2**, then compressed air of the pressure buffer chamber **15** is conveyed toward the trough **300** of the sliding shuttle tube **3** through the cylinder body **21** of the cylinder **2**, further passing through the air holes **330** of the trough **300** of the sliding shuttle tube **3** and being completely channeled into the pressure feed opening **34**, whereupon instantaneous collapse of the compressed air is realized, and the bullet **40** is ejected from the bore of the gun **51**, at which time instantaneous squeezing causes internal air pressure of the trough **300** of the sliding shuttle tube **3** and the cylinder body **21** of the cylinder **2** to be instantaneously released.

[0027] Referring to FIG. **5**, because of the pressure drop after the aforementioned release of the internal air pressure, thus, arch pressure of the arch returning spring **30** is used to push back the sliding shuttle tube **3** toward the cylinder **2**. During the process of pushing back, the end surface **310** of the sliding column **31** forms an additional pressure by means of the limit relationship of the cylinder body **21** during the process of backing up, and restores it back in the pressure buffer chamber **15** ready for firing again.

[0028] Under unrestricted movement of the sliding shuttle tube **3**, the aforementioned firing process enables back and forth continuous running of the sliding shuttle tube **3** to allow the bullets **40** to be continuously ejected, in which the successive bullets **40** are continuously loaded into the bullet loading opening **4**. As long as the bullet loading opening **4** is filled with a quantity of the bullets **40**, and the sliding shuttle tube **3** is able to continuously move back and forth, then a continuous firing operation is achieved. The aforementioned operations are all mechanical movements, and as long as these movements are not subjected to external force causing interference therewith, then a continuous firing operation is achieved.

[0029] The present invention is purely a mechanical firing operation, and also uses mechanical restrictions to allow the system to provide a choice between being used for single firing or continuous firing. One side of the travel line of the sliding shuttle tube **3** of the present invention is fitted with a trigger device **7** able to cause interference, and functions to restrict the sliding shuttle tube **3**, enabling selection of continuous firing to allow continuous movement of the sliding shuttle tube **3** and thereby achieve continuous firing of bullets, or for single firing use by operating a trigger **71** using a transient state restriction.

[0030] The trigger device **7** basically comprises the trigger **71**, and a triggering operation of the trigger **71** drives a sliding retainer **72**. A retainer tip **722** of the sliding retainer **72** enables retaining the corresponding end of the retaining shoulder **36** of the sliding shuttle tube **3**, and the cylinder **2** is used to hold up or open the retaining shoulder **36**, thereby achieving selection for continuous firing or single firing operation. In which the trigger **71** is fastened to a fixed position of the gun body by means of a pin **710**, and is able to elastically restore its position. When the trigger **71** is pulled, a tripping arm **711** indirectly squeezes the corresponding end

of the sliding retainer **72** causing it to turn upward one time around the pin **710** as an axis center point, after which the tripping arm **711** is subjected to the position returning elasticity of the spring **712** and repositioned, while simultaneously connectively moving the trigger **71** to return to its original position.

[0031] The sliding retainer **72** is used as a working pivot by means of the pin **720**, moreover, the sliding retainer **72** is subjected to the action of a pulling spring **75** to pull it toward the right side and hold the position thereat, and displacement is only produced when subjected to operation of the trigger **71**. The sliding retainer **72** is tripped every time the trigger **71** is pulled and produces a horizontal displacement each time, thereby allowing the retainer tip **722** to cause single downward drawing back of the restriction of the retaining shoulder **36** by means of the axis center support function of the pin **720**. Accordingly, the retaining shoulder **36** is released to achieve a firing operation, and the retaining shoulder **36** is subjected to the arching action of the arch returning spring **30**, producing a cutting pressure on the upper surface of the retainer tip **722** and causing recoiling thereof, after which the retainer tip **722** is restrained through restriction thereof, forming a transient stoppage, and thereby achieving a single firing function.

[0032] The sliding retainer **72** is provided with a kidney shaped hole **723**, and the kidney shaped hole **723** enables slidably disposing therein of the pin **720** joined to the gun body, while the linear length of the kidney shaped hole **723** allows two angular rotational movements of the sliding retainer **72**, such as left and right or up and down.

[0033] Regarding application of continuous firing of the present invention, the lower suspended position of the sliding retainer **72** is fitted with a shearing arm **721**, and turning of a cam **73** enables restraining the shearing arm **721** to an angular position, thereby determining whether or not the height position of the retainer tip **722** impinges on the retaining shoulder **36**. Disposition of the cam **73** involves using a pin **730** to movably fix the cam **73** to the gun body, and a switch stop **74** enables moving angular position thereof. The periphery of the cam **73** is provided with a single firing give way notch **731**, and after the shearing arm **721** is pulled by the pulling force of the pulling spring **75**, then the single firing give way notch **731** enables maximum position limitation by the shearing arm **721**. After changing angular position, the cam **73** is further provided with a continuous firing restraining surface **732**, and after changing angular position again, the cam **73** is further provided with a safety locking butt retaining convex protrusion **733**. The continuous firing restraining surface **732** provides a restraining function to enable continuous firing, and the butt retaining convex protrusion **733** serves to function as a safety lock.

[0034] Regarding implementation of the single retaining continuous firing operation, please refer to FIG. **6**, in which after the angular position of the cam **73** has been changed, the continuous firing restraining surface **732** thereof tangentially compresses one side of the shearing arm **721** to produce a cam-like pushing effect, thereby shear compressing the corresponding side of the shearing arm **721**. The retaining shoulder **36** is originally restrained by the retainer tip **722** to maintain a blocking effect and disable the sliding shuttle tube **3** from moving, and when angular position of the cam **73** is adjusted to allow the continuous firing restraining surface **732** to act on the shearing arm **721**, then the sliding retainer **72** is restricted to the shifted down angular position, and the trigger device **7** triggers the corresponding end of the sliding retainer **72** to hold the selection. The pivot function of the pin **720** enables the sliding retainer **72** to cause the retainer tip **722** to maintain a dropped give way state, at which time, the sliding shuttle tube **3** disengages interference with the system, and a continuous back and forth motion is formed, thereby achieving a continuous firing operation. Releasing the trigger **71** causes the retainer tip **722** to again rise and impinge on the retaining shoulder **36**, thereby stopping movement of the sliding shuttle tube **3**.

[0035] The standard principle of the aforementioned continuous firing operation comprises the sliding retainer **72** being displaced by pulling on the trigger **71**, whereby after the trigger **71** is released by the finger, then the retainer tip **722** of the sliding retainer **72** is able to upwardly reposition through use of the pulling force of the pulling spring **75** and the support of the pin **720**, thereby impinging again on the retaining shoulder **36** of the sliding shuttle tube **3**. Moreover, the trigger **71** enables the sliding retainer **72** to maintain a restraining relational position, that is, the shearing arm **721** of the sliding retainer **72** is impinged on by the protrusion of the continuous firing restraining surface **732** and pushed toward the left, at which time, the pin **720** is at the right side of the kidney shaped hole **723** of the sliding retainer **72**, and, correspondingly, the remote end of the sliding retainer **72** extends into the upper surface of the tripping arm **711** to be subject to pulling and displacement of the trigger **71**, after which the sliding retainer **72** continues to be prompted upward, and through the support of the pin **720**, the respective retainer tip **722** is forced to drop to a height that separates it from the interfering with the sliding shuttle tube **3**, thereby obtaining the continuous firing operation.

[0036] Referring to FIG. **7**, which shows disposition of the butt retaining convex protrusion **733** of the present invention, in which, changing the angular position of the cam **73** enables the cam **73** to press and secure the retainer tip **722** of the sliding retainer **72** to maintain an upper position, and further restrains the retaining shoulder **36** of the sliding shuttle tube **3**. Moreover, the end of the sliding retainer **72** corresponding to the trigger **71** is further able to relationally compress the trigger **71**, thereby restricting the trigger **71**. Such a locking state functions as a safety switch as used in general firearms.

[0037] The present invention basically provides a purely mechanical system enabling a continuous firing operation, and uses the inside and outside of the sliding shuttle tube **3** to form an axial sliding relationship between the front and rear of bullet chamber **50** and the cylinder **2** and the cylinder body **21** of the cylinder **2**, whereby, during the process of the sliding shuttle tube **3** mounted and sliding on the cylinder **2**, before firing, a critical opening is achieved between the end surface **310** of the sliding column **31** of the sliding shuttle tube **3** and the end opening **20** of the sliding shuttle tube **3**, thus allowing compressed air from the cylinder body **21** of the cylinder **2** to pass through the air holes **330** provided in the trough **300** of the sliding shuttle tube **3** and fill the pressure feed opening **34** to fire the bullet **40**. After firing, because of the instantaneous drop in pressure, the arched resistivity of the arch returning spring **30** forces back the sliding shuttle tube **3** toward the cylinder **2**. Accordingly, repeating the aforementioned pressure operated firing enables achieving a continuous operating mechanism. As soon as the trigger device **7** is pulled and intervenes, then a single limit stop-retaining single firing mode or single limit stop-retaining continuous firing mode is obtained, as well as providing a safety lock for the firing system of firearms.

[0038] The present invention is based on a purely mechanical mechanism system to achieve stable operation, and will not malfunction because of changes in pressure difference. Moreover, operation by specific mechanical alteration is further achieved, and in use provides higher reliability and a stable configuration. Furthermore, the pressure adjustment

device **12** fitted in the air pressure regulating system **1** portion is used to stabilize the pressure, and under circumstances whereby there is excessive pressure, then release of pressure by the overpressure protection device **13** enables achieving safe control of the amount of firing force. In addition, use of the flow control device **14** enables changing the amount of flow to regulate the air pressure relationship.

[0039] The present invention uses a completely mechanical system to achieve continuous firing or single firing or single limit stop-retaining continuous firing or complete safe locking of the system, and is clearly an innovation design in the field of air gun design. Accordingly, a new patent application is proposed herein.

[0040] It is of course to be understood that the embodiments described herein are merely illustrative of the principles of the invention and that a wide variety of modifications thereto may be effected by persons skilled in the art without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. An air gun firing operating system, providing an air gun using compressed air to eject a bullet, thereby achieving a firing operating system able to effect single firing or high-speed continuous firing by purely mechanical working means, comprising:

a cylinder, an air pressure regulating system provides an air pressure source for the cylinder, a cylinder body is axially disposed in the cylinder, the exterior body has a tubular circumferential surface, with an end opening facing the firing end;

a sleeve shaped sliding shuttle tube, the inner circumferential surface of the sliding shuttle tube is axially, slidably disposed on the outer circumferential surface of the cylinder, and is radially provided with a connecting portion facing the firing end; the sliding shuttle tube separates out a trough and a pressure feed opening, and air holes provide passageways to the trough and the pressure feed opening; a sliding column is suspended in the center of the sliding shuttle tube in the trough direction, and the sliding column is coaxially pin mounted on the cylinder body of the cylinder; the end surface of the sliding column is positioned within the space of the trough, an outward expansion of the opening of the trough is provided with a ring retaining shoulder;

a gun barrel, is provided with a bullet chamber, and the bullet chamber is coaxially connected to the bore of the gun; the inner circumferential surface of the bullet chamber enables the outer circumferential surface of the sliding shuttle tube to be coaxially, slidably disposed thereon;

a barrel component, is rigidly connected to the cylinder and the bullet chamber assuming a coaxial alignment relationship;

an arch returning spring, is arched between the sliding shuttle tube and the gun barrel, thereby providing the force to return the sliding shuttle tube to its original position.

2. The air gun firing operating system according to claim **1**, wherein the bullet loading opening is provided in the side passageway of the bullet chamber.

3. The air gun firing operating system according to claim **1**, wherein the pressure input end of the cylinder is connected to allow passage to a pressure buffer chamber of an air pressure regulating system.

4. The air gun firing operating system according to claim **3**, wherein the pressure buffer chamber is externally assembled to the air pressure source through a channeling portion, and a pressure regulating device is installed between the pressure buffer chamber and the channeling portion.

5. The air gun firing operating system according to claim **3**, wherein the pressure buffer chamber is externally assembled to the air pressure source through a channeling portion, and an overvoltage protection device is installed between the pressure buffer chamber and the channeling portion.

6. The air gun firing operating system according to claim **3**, wherein the pressure buffer chamber is externally assembled to the air pressure source through a channeling portion, and a flow control device is installed between the pressure buffer chamber and the channeling portion.

7. The air gun firing operating system according to claim **1**, wherein a trigger device able to interfere with movement of the sliding shuttle tube is installed in the motion path of the sliding shuttle tube.

8. The air gun firing operating system according to claim **7**, wherein the trigger device comprises:

a trigger, an upper end of the trigger is fastened to the gun body by means of a pin;

a sliding retainer, the body of the sliding retainer is fastened to the gun body by means of a pin, one end of the sliding retainer is repelled by the trigger repulsion, and the other end is able to clamp a retaining shoulder of the sliding shuttle tube;

a pulling spring, one end pulls the sliding retainer toward the rear, and one end is fixed to the gun body.

9. The air gun firing operating system according to claim **8**, wherein a shearing arm laterally extends from the sliding retainer, the shearing arm is positioned at one side of the pulling spring and is restrained by limit stops of a cam, thereby restricting angular displacement, the cam is provided with a switch stop.

10. The air gun firing operating system according to claim **9**, wherein the cam is pivotal disposed on the gun body by means of a pin, the radial surface is provided with a single firing give way notch, and after changing angular position, the cam is provided with a butt retaining convex protrusion.

11. The air gun firing operating system according to claim **9**, wherein the cam is pivotal disposed on the gun body by means of a pin, the radial surface is provided with a single firing give way notch, and after changing angular position, the cam is provided with a continuous firing retaining surface.

* * * * *