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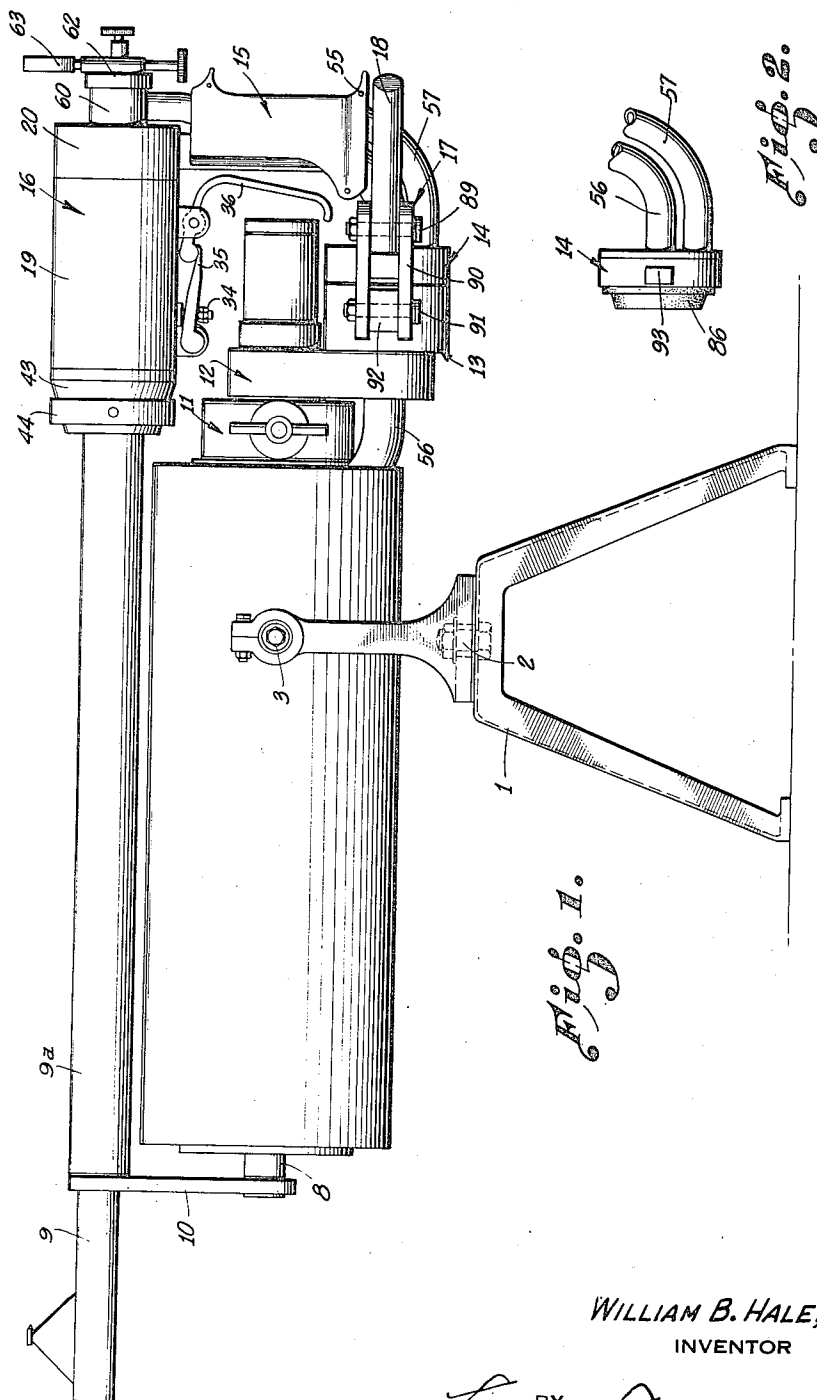
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2,357,951

PNEUMATIC GUN

Filed Aug. 19, 1941

5 Sheets-Sheet 1



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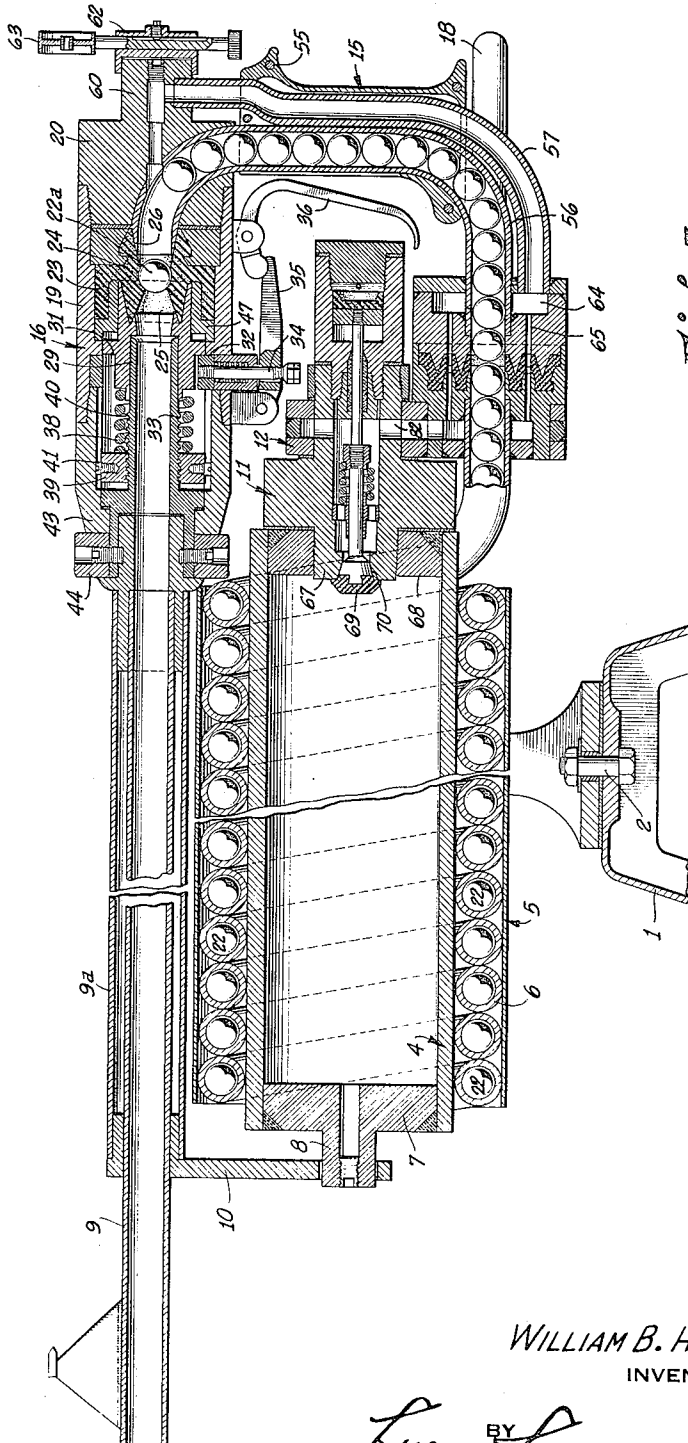
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PNEUMATIC GUN

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5 Sheets-Sheet 2



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PNEUMATIC GUN

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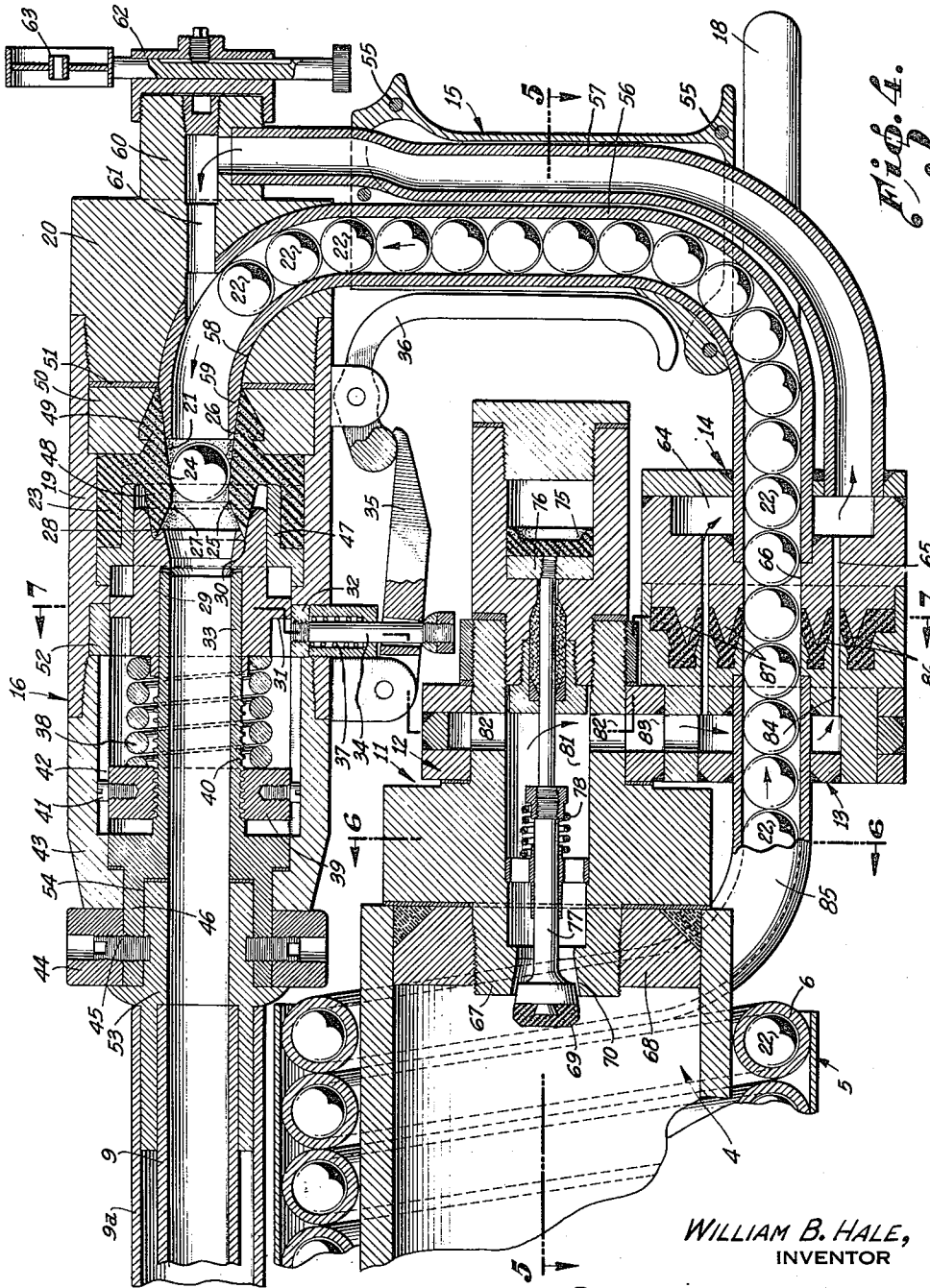


Fig. 4.

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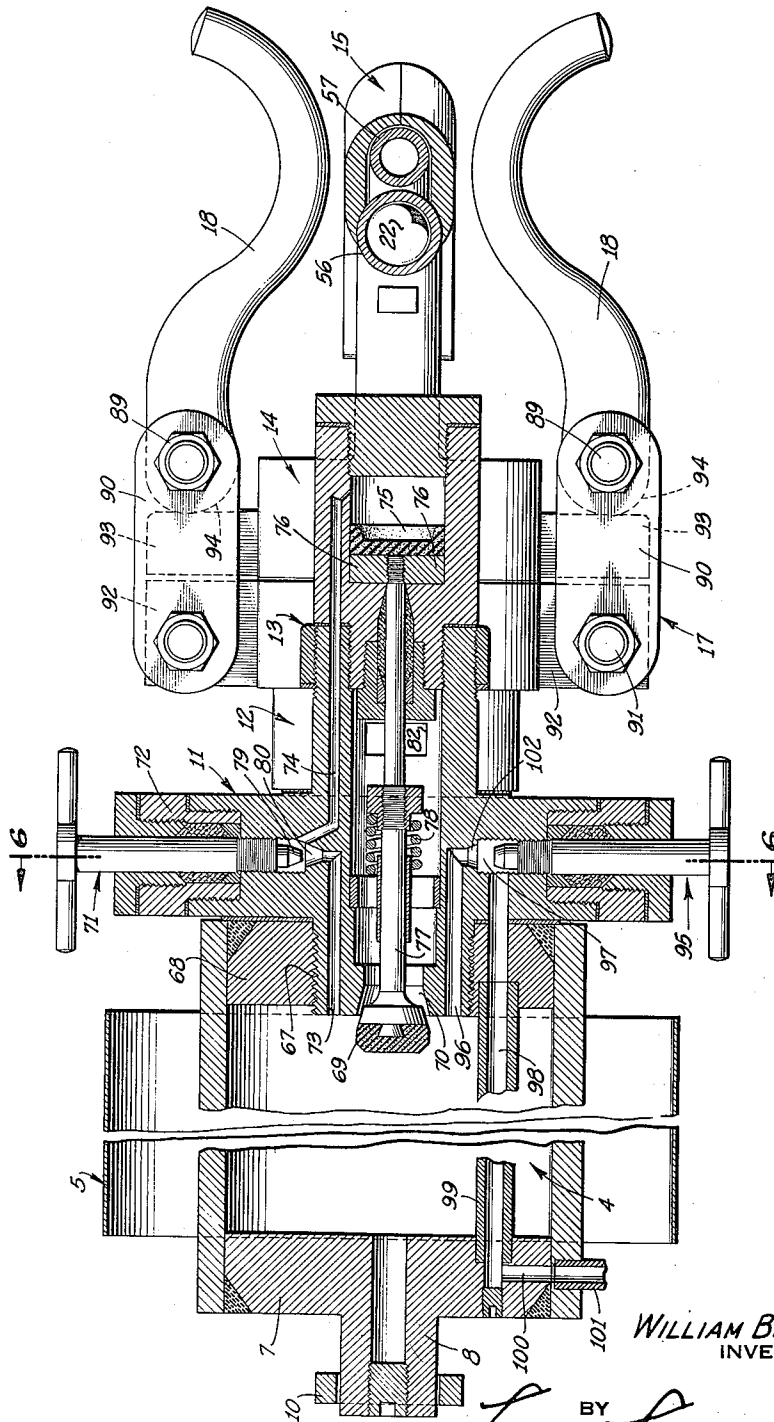


Fig. 5.

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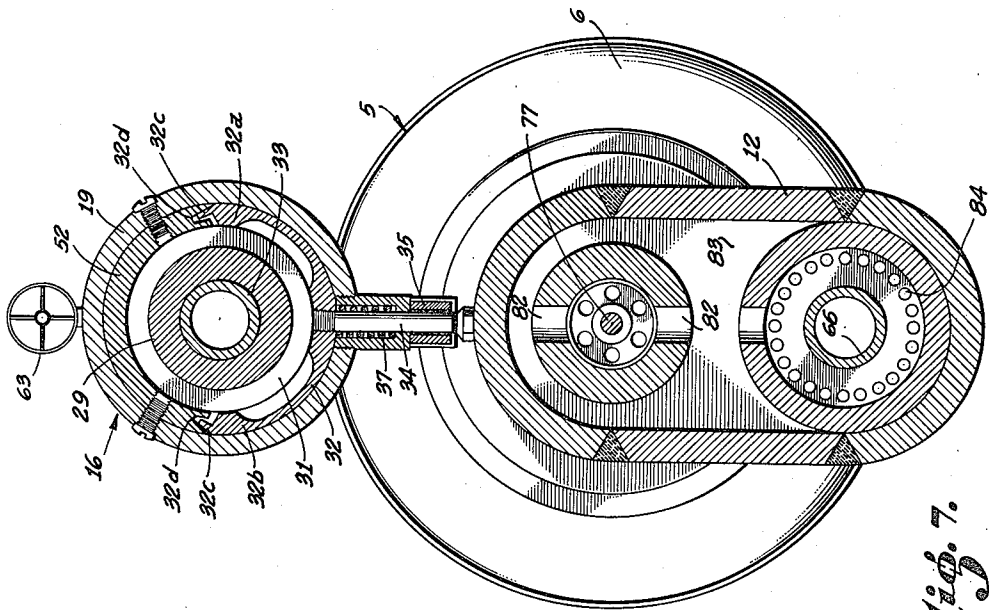
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2,357,951

PNEUMATIC GUN

Filed Aug. 19, 1941

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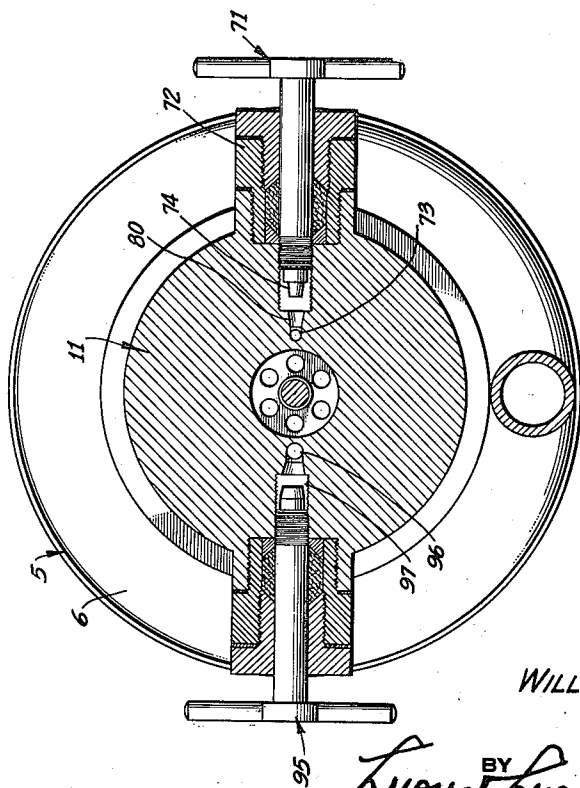


Fig. 6.

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UNITED STATES PATENT OFFICE

2,357,951

PNEUMATIC GUN

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Application August 19, 1941, Serial No. 407,427

18 Claims. (Cl. 124—11)

This invention relates to a fluid-operated or pneumatic gun, and the general object of the invention is to produce a gun of this type, which is so constructed as to enable it to fire projectiles at a relatively high rate per minute, and with a high muzzle velocity.

One of the objects of the invention is to produce a gun of this type that will be automatic in operation and capable of firing a continuous stream of projectiles as long as the control member or trigger of the gun is held in position for operating the gun.

A further object of the invention is to provide a construction which will enable a reservoir carrying compressed air or a source of compressed gas to be employed, associated with a magazine for carrying a considerable supply of projectiles; also to construct the reservoir and magazine for the projectiles in such a way that it can be handled as a unit, and readily connected up into operative connection with the gun.

A further object of the invention is to provide automatic means for effecting the feed of the projectiles into the air chamber of the gun, preparatory to propelling the same through the barrel.

In its preferred embodiment, the gun includes a breech from which a post projects downwardly to operate as a handle for moving the gun when aiming the same; and one of the objects of this invention is to provide a construction enabling this handle to be utilized as means for conducting the projectiles and, if desired, also conducting the compressed air to the breech of the gun.

In the preferred embodiment of the gun, the breech is provided with means for temporarily holding a projectile to be fired at the forward side of the air chamber from which the air stream operates to fire the projectile through the gun barrel; and one of the objects of this invention is to provide improved means for controlling the operation of this projectile detent so as to regulate the same, and so as to enable it to operate to fire projectiles in rapid succession. In this connection, one of the objects is to attain a mode of operation for the projectile detent, which will enable a continuous stream of the projectiles to be carried on the air stream passing through the barrel, in such a way as to enable a plurality of projectiles to pass through the barrel at the same time.

A further object of the invention is to provide means associated with the projectile detent for adjusting the same from the exterior of the gun.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient pneumatic gun.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Fig. 1 is a side elevation of the complete gun set up on its tripod.

Fig. 2 is a side elevation of a clamping head which is connected with the breech of the gun, and affords means for connecting up the unitary air reservoir and magazine. In this view the duct for the projectile and for the air are shown broken away.

Fig. 3 is a longitudinal vertical section broken away, passing through the gun barrel, the breech of the gun, and through the air reservoir and magazine for the projectiles. In this view the lower portion of the tripod supporting the gun, is broken away.

Fig. 4 is a view similar to Fig. 3, upon a larger scale but merely illustrating the breech of the gun with its connections to the inner end of the air reservoir and projectile magazine. This view shows the forward end of the magazine, air reservoir, and gun barrel broken away. It also illustrates the parts in firing position with the gun trigger depressed, and with valves open for continuously supplying compressed air to the gun from the reservoir.

Fig. 5 is a longitudinal horizontal section taken through the apparatus about on the line 5—5 of Fig. 4, and particularly illustrating the control valve for controlling the admission of the compressed air into the gun from the air reservoir, including the valve for admitting compressed air from the reservoir into the projectile magazine for advancing or assisting in advancing the projectiles to the gun breech from the magazine.

Fig. 6 is a vertical cross-section taken on the line 6—6 of Fig. 4, and 6—6 of Fig. 5, looking outwardly toward the muzzle of the gun.

Fig. 7 is a vertical section taken about on the line 7—7 of Fig. 4, and particularly illustrating a preferred embodiment of the means for controlling the action of the projectile detent that determines the release of the projectile into or through the barrel.

Referring to the parts of the apparatus, and

particularly to Fig. 1, the entire gun assembly is preferably mounted on a suitable frame or tripod 1 to swivel on a vertical axis at the bolt 2, and on horizontal pivots or trunnions 3 at each side. It should be understood, however, that the gun can be mounted in any desired manner.

Referring to Fig. 1 and Fig. 3, the equipment includes a reservoir 4 for the compressed air or other operating gas or fluid, which reservoir is preferably enveloped in a shell 5 that operates as protective housing for a projectile magazine. This magazine is preferably in the form of a coil, piece of tubing of slightly larger diameter than the projectiles. This reservoir has sufficient strength to withstand the high pressure of the air under which the gun operates. The outer end of the reservoir has a head 7, which may be provided with a coaxial extension 8 that supports the gun barrel 9 on an arm 10 having a hub on the gun barrel and extending down from the same. The inner end of the reservoir 4 is connected up to a valved head 11 carrying valves that will be described in detail later, which valves enable air and projectiles to be delivered from the reservoir and from the magazine through a casing 12 and a clamping head 13, to a clamping head 14, the latter of which is permanently connected with the gun proper and the former of which is carried with the compressed air and magazine unit.

In the operation of the gun, the air and projectiles pass through these clamping heads 13 and 14 and up through a post 15 at the rear of the gun breech 16, where the projectiles are brought into line with the gun barrel 9.

A quick detachable clamping connection 17 is provided for clamping the clamping heads 13 and 14 together, said connection including two levers 18 (see Fig. 5). The construction and operation of this clamping connection will be described more fully hereinafter.

The general construction of the gun breech and the parts immediately connected therewith, will now be described, reference being had particularly to Figs. 3 and 4.

The gun breech includes a body 19 back of which the breech block 20 is located, and within this breech block an air chamber 21 is formed, into which the projectiles 22 are delivered. In the normal position of the gun, when it is ready to be fired as shown in Fig. 3, the projectile indicated specifically by the reference numeral 22a, is held temporarily against being fired by means of an expandible projectile detent 23. This projectile detent is contractible from its expanded state and is normally held against expanding by means that is controlled at will to fire the gun. In other words, if the operating means or trigger of the gun is not operated, the projectile 22a will maintain itself on the air-tight seat 24 of the projectile detent.

While this projectile detent 23 may be of any desired construction, in the present instance it is in the form of a collar of yielding resilient material such as rubber or similar material, and it includes a center or nave 25 with a slightly conical opening 26 extending into it from the air chamber 21 with which the seat 24 is associated. The rear end of the opening 26 through the nave 25 and beyond the seat 24, is formed into an outwardly flaring delivery mouth 27, the well of which terminates in a tapered annular tip or edge 28. This edge 28 is engaged by means capable of pressing the rear end of the nave forwardly so as to control the resistance to passing of the

projectile 22a through the small end of the conical opening 26 into which the projectile passes. The means I prefer to employ for this purpose, consists of a sleeve 29, the rear end of which has an annular groove 30 to receive the tapering tip 28. Means controlled at will is provided for controlling the action of this sleeve 29. For this purpose, the sleeve 29 is provided with an outwardly projecting collar presenting an annular shoulder 31, and this shoulder, in the position of rest of the apparatus shown in Fig. 3, is located just forward of a movable stop in the form of a yoke 32. This yoke is shown in detail in Fig. 7. In Fig. 3 this yoke is shown in its restraining position in which its rear face projects across the shoulder 31 of the collar 29. In Fig. 4 the yoke is shown in a downwardly drawn position which removes it from the path of the shoulder 31, thereby permitting the sleeve 29 to move toward the left as viewed in Fig. 4, that is to say, toward the muzzle of the gun. This releases the constraint on the nave of the projectile detent 23 and permits it to expand sufficiently to let the projectile 22a pass through into the bore of a guide barrel 33 that is located just forward of the air chamber 21, and which is in perfect alignment with the gun barrel 9. This sleeve 29 slides on the rear end of the guide barrel 33. When the gun is fired, the yoke 32 is pulled down by a pin 34, the lower end of which is operated by a lever 35 operated by the trigger 36 of the gun which is pivoted just back of the lever. The coil spring 37 around the pin 34 exerts its force to push the yoke 32 back in front of the shoulder 31 when the sleeve 29 moves back to its normal position. This sleeve is returned to its normal position by the coil spring 38 mounted around the guide barrel 33. The forward end of the spring 38 thrusts against an adjustable nut 39 having a threaded opening through it, riding on a thread 40 formed on the exterior of the guide barrel 33. In order to keep the nut from rotating, its opposite sides are provided with set screws 41, the heads of which run in grooves 42 respectively, extending longitudinally in the bore of a cap 43 that forms the forward end of the breech 16 of the gun. In order to adjust the nut 39, of course the guide barrel 33 must be rotated on its axis, and in order to accomplish this, the forward end of the cap 43 is provided with a swivel ring 44 having radial set screws 45 that secure it to a forwardly extending sleeve 46 that is formed integrally with the forward end of the guide barrel 33.

The rear end of the sleeve 29 seats in a metal bushing 47 that carries the outer portion or body 48 of the projectile detent 23.

The rear end of the projectile detent 23 is formed with a conical tip 49 that is received in an undercut bore in a heavy breech plate 50 that backs up against a gasket 51 on the forward face of the breech block 20. This breech plate 50 is carried in a counterbore in the breech body 19.

In order to enable the stop 32 to engage the annular shoulder 31 of the sleeve 29 at more than one point, I may construct the yoke as illustrated in Fig. 7. In doing this, I form the yoke with two forks 32a and 32b, the ends of which are formed with inclined toes 32c that are received in inclined sockets 32d. These sockets 32d are formed in a bow 52 that is secured in the upper side of the breech body 19. When the firing pin 34 is returned by its spring 37, the inclined toes 32c will cause the upper ends

of the forks 32b and 32a to swing inwardly toward the axis of the barrel and engage the shoulder. Fig. 7 shows the stop 32 in its pulled-down position in which the sleeve 29 is released, thereby permitting the sleeve to be moved forwardly by the air pressure in the air chamber 21, exerting its force against the projectile 22a to expand its seat 24 and cause the projectile to pass through the detent.

The rear end of the barrel 9, is carried in a deep socket in a ring 53 that is received in a bore 54 formed in the forward end of the guide barrel 33, and this ring 53 has a bore of the same diameter as the bore of the gun barrel and the bore of the guide barrel 23.

The post 15 that projects down from the breech and which operates as a handle for aiming the gun, is preferably formed of two sections that are clamped together by horizontal bolts 55 which clamp the sections onto ducts 56 and 57 which come up from the clamping head 14, and the former of which carries the projectiles while the latter of which carries the compressed air. These ducts 56 and 57 are formed of tubing, and the duct 56 is carried up and received in a socket 58 in the breech block, and is formed with a conical tapered tip 59 that projects into the rear end of the conical bore or opening 26 of the projectile detent 23. The duct 57 is located toward the rear in the handle or post 15, and extends up into a reduced rear extension 60 formed at the rear end of the breech block 20, at which point it communicates with an air duct 61 which is substantially in axial alignment with the air chamber 21 and the projectile detent 23; and, of course, this means that it is also in line coaxially with the guide barrel 33. The rear end of the extension 60 is covered with a removable screw cap 62 which is provided with an adjustable sight 63.

The clamping head 14 is rigidly secured to the two ducts 56 and 57, and has an air chamber 64 supplied with air through a plurality of small air passages 65 that lead in through the clamping face of this clamping head. The projectile guide or duct 56 extends through this air chamber 64 and is rigidly secured in the body of this clamping head 14 and preferably in line with the projectile duct 66 that passes through this head.

The air reservoir and magazine unit will now be described more in detail, together with the valves for controlling the flow of air from the reservoir. Referring particularly to Fig. 5, the valved head 11 has a threaded nipple 67 that is screwed into the rear head 68 of the reservoir 4, and in this valved head I mount a pneumatically operated valve 69 that operates as a valve closure for an outlet port 70 from the interior of the reservoir. This valve 69 can be hand-operated if desired, but I prefer to operate it through the agency of a pilot valve 71 that is mounted in a stuffing-box 72 at one side of the valved head 11. When this pilot valve 71 is open, it admits air from the passage 73 that leads back through the nipple 67, thereby permitting the compressed air to flow back through a passage 74 to a pneumatic device in the form of a pneumatic cylinder 75 which operates a piston 76 which is attached to the stem 77 of the valve 69. The valve stem 77 is provided with a return spring 78 in the form of a coil. The pilot valve 71 preferably has a tapered tip 79 that closes upon a tapered or conical seat 80.

Referring now to Fig. 4, when the valve 69 is open, it permits air to flow in past it as indicated by the arrows in Fig. 4. This air flows into a valve chamber 81 and thence outwardly through ports 82 to an air chamber 83 formed in the casing 12, and thence into clamping head 13; and the rear wall of the clamping head 13 has a plurality of small passages 84 that register with the air passages 65 of the rear clamping head 14. In this way the compressed air is conducted back through the clamping heads to the air duct 57.

The rear end of the coil 6 that constitutes the projectile magazine, is formed with a neck 85 that passes in through the forward side of the clamping head 13 on the axis of this head. This head 13 is constructed somewhat like the clamping head 14, that is to say, the neck 85 passes through the air chamber 83 and is rigidly secured in the body of the head therebeyond, and in a position to align with the duct 66 so that this duct 66 can conduct the projectiles through the connected heads into the projectile duct 66.

The adjacent faces of the two clamping heads 13 and 14 are correlated to each other so that they will make an air-tight fit with the gasket 86 between the same. In the present instance the adjacent faces of these heads are formed with annular V-shaped ribs 87. These ribs are received in correspondingly formed sockets 88 in the gasket 86. This gasket is socketed into the rear face of the clamping head 13 and is preferably made of yielding material such as rubber, or similar material.

In order to enable the clamping heads 13 and 14 to be quickly clamped up to each other, I prefer to provide the disconnectible clamping connection 17 provided with the two clamping levers 18 already described. The pivot ends of these levers 18 are carried on bolts 89 between two links 90 located in pairs at each side. These links are attached on pivot bolts 91 to laterally projecting lugs 92 on the clamping head 13. These lugs 92 align with corresponding lugs 93 projecting out from the sides of the clamping head 14 (see Figs. 1 and 5). The heads of the levers 18 have cam faces 94, and in connecting up the heads the links 90 are swung around over the lugs 93, and the levers 18 are then swung inwardly so that their free ends lie near the post or handle grip 15 of the gun. When swung in this way the cam faces 94 draw the heads 13 and 14 tightly together so as to compress the gasket 86 between them.

The apparatus includes means for feeding the projectiles from the magazine through the clamped-up heads 13 and 14 into the duct 56 and up to a point near the air chamber 21. For this purpose I prefer to provide the valved head 11 with another valve 95 (see Fig. 5) which, in its open position shown in Fig. 5, will permit air to flow from the air reservoir 4 through an air passage 96 into a valve chamber 97 that communicates with a passage 98 in the inner head 68 of the reservoir; and this passage 98 communicates with a tube 99 that passes forward to the forward head 7, at which point it communicates with a radial passage 100, and this radial passage 100 communicates with the outer end 101 of the magazine coil which is anchored at this point in the side wall of the reservoir, as indicated in Fig. 5. The stem of the valve 95 is provided with a conical tip seating on a conical

seat 102. This arrangement enables the amount of air admitted to the reservoir to be nicely regulated so as to control its effect on the projectiles. In other words, by admitting compressed air at the forward end of the reservoir, this air flows through the magazine and causes the projectiles to pass rearwardly toward the gun breech.

The projectiles employed are preferably of round form so that they roll freely through the coil, and so that they are not impeded in any way in their progress by reason of the bends in the coil.

If desired, the gun barrel 9 or the guide barrel may be rifled to give the projectile a rotation on the longitudinal axis of the barrel. The barrel 9 of the gun is enclosed in a tubular housing or shell 9a.

In order to insure that the valve head 69 will be air-tight to retain a high pressure, its outside face is provided with a gasket head 69a of soft rubber or similar material. Under action of the pressure this head is "mushroomed" out so as to seal the crack of the valve. (See Fig. 3.)

When the main admission valve 69 is closed and in the position illustrated in Fig. 3, no air is admitted to the air chamber 21 for operating the gun. By opening the pilot valve 71 (see Fig. 5) air will be admitted through the ports 73 and 74 into the air cylinder 75, and this will move the piston 76 toward the left and open the valve 69 against its return spring 78. This will permit air to flow from the interior of the reservoir 4 through the air chamber 81, and thence through the ports 82 (see Fig. 4). This carries the air into the air chamber 83 at the back of the clamping head 13, and from this point the air passes forwardly through the ports 84 and 85 into the air chamber 64. From this point the air flows up through the air duct 57 and into the passage 61 directly back of the air chamber 21. If the trigger 36 of the gun is in the position in which it is shown in Fig. 3, the projectile 22a on the seat 24 of the projectile detent 23, will not be fired because the sleeve 29 in its extreme rear position will prevent the projectile detent from expanding. The spring 38, of course, assists in holding the sleeve 29 in this position, and counterbalances to a large extent the pressure of the annular shoulder 31 against the rear face of the stop yoke 32. When the trigger 36 is pulled, the lever 35 will become depressed and the yoke 32 will be pulled down by the firing pin 34 to the position in which it is illustrated in Fig. 4. This will release the sleeve 29 and this will permit the air pressure back of the projectile 22a to force the projectile past its seat 24 and through the opening in the projectile detent 23. The ball then passes through the tapered guide opening in the sleeve 29 and into the guide barrel 33, and thence into the barrel 9 of the gun. As soon as the air pressure back of the projectile 22a is released, the coil spring 38 will return the sleeve back to its extreme rear position, thereby compressing the nave 25 of the projectile detent constricting the opening through the same. In other words, this prepares the seat 24 to receive the next ball, when the sleeve 29 moves into its rear-most position. In this way the spring 37 of the firing pin will push the yoke 32 up to its holding position for the sleeve. In other words, it will move the yoke up in front of the shoulder 31. This is the operation in firing a single projectile, or one or two projectiles. However, the action

will terminate with a ball 22a resting on the seat 24 which, of course, operates as a valve to close off further flow of air from the air chamber 21 through the gun barrel. It will be noted that the upper end of the projectile duct 56 delivers the balls into the axial line of the air passage 61 in a forwardly inclined direction. This is desirable because it enables the air flowing through the passage 61 to exert an entraining action on the projectiles that are located near this point, tending to draw the same upwardly in succession into the air chamber 21. This entraining action on the balls is also enhanced by reason of the fact that the balls in the duct 56 are surrounded with air, which air is also subjected to an entraining action. This air in the duct 56, however, is a compressed air stream flowing with the projectiles from the magazine to the air chamber, and the amount of this projectile feeding air can be regulated if desired, by means of the valve 95.

If it is desired to fire the projectiles continuously from the gun to attain an action similar to that of a machine gun, the trigger 36 is maintained in its operating position, that is to say, pulled rearwardly into the position indicated in Fig. 4. If this is done, more or less of a reciprocating movement is developed by the action of the passing projectiles and the reaction of the spring 38. The projectiles will be driven through the barrel at high velocity, and at short distances from each other. In this way the projectiles ride with the stream of a high velocity of compressed air flowing through the barrel. The balls substantially fill the bore of the barrel so that there is substantially no leakage past the balls as they are driven through the barrel. If the gun is operated in a horizontal position, of course the balls tend to roll through the barrel freely, being impelled by the stream of air moving with the balls, and giving the balls their acceleration and high muzzle velocity. Of course, as the air expands when passing to the muzzle of the gun, a certain amount of heat is absorbed, which operates to keep the gun cooled. This feature compares very favorably with ordinary machine guns, the barrels of which tend to become quite hot from rapid firing. There is another advantage in the use of this gun, which contrasts it most favorably with a gun using an explosive charge. Where a gun uses an explosive charge, the gas from the explosion is quickly disseminated into the atmosphere at the muzzle, and there is no flow of gas other than that filling the barrel at the moment of the explosion; to give a follow-up propulsion to the projectile. In fact, shortly after the projectile leaves the muzzle of an ordinary gun, the atmosphere exerts a very marked retarding effect upon the butt end of the projectile, because it is not streamlined. With this pneumatic gun the effect at the discharge of the gun, if the trigger is maintained in operative position, is to project a stream of air at very high velocity to a considerable distance ahead of the gun. In this way a virtual lengthening of the gun barrel occurs operating to maintain the acceleration that has been given to the projectile, and at the same time, reducing the commencement of any resistance until the projectile has passed through the air for a considerable distance beyond the gun muzzle.

In operating the gun, of course, the projectile feed valve 95 can be cracked open as far as desired to give any speed or feed of the projectiles desired.

In designing the gun, the reservoir should carry sufficient air at sufficient pressure to insure that in ordinary use there will still be enough pressure in the air reservoir to fire effectively the last few projectiles carried by the gun. As soon as the projectiles are all used up, the exhausted reservoir and magazine unit will be unclamped at the clamping connection 17 and removed, and a new unit with a compressed air charge and full magazine of projectiles will be immediately substituted and clamped in position. This is accomplished by unclamping the clamp 17; pushing the magazine unit forward to get the clamping head 13 clear of the head 14. This forward movement is permitted by reason of clearance indicated in the drawings between the head 7 and the arm 10. After the unit is moved clear of the head 14, the rear end of the unit is swung laterally, and the neck 8 pulled out of its socket in the end of the arm 10.

Many other embodiments of the invention may be resorted to without departing from the spirit of the invention.

What I claim is:

1. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for the projectile upon which the air pressure holds the projectile before it passes into the barrel, means for normally holding the detent against expanding, and thereby preventing the projectile from passing, and means operatable at will to release the last-named means to permit the detent to expand and release the projectile.

2. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for holding back the projectile and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, means controlled at will for engaging the sleeve and operating when actuated to permit the sleeve to move and release the projectile.

3. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for the projectile capable of preventing passage of the projectile, and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, means controlled at will for engaging the sleeve and operating when actuated to permit the sleeve to move and release the projectile, and a spring for returning the sleeve to its normal position after the projectile has been released.

4. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for holding back the projectile and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, means controlled at will for engaging the sleeve and operating when actuated to permit the sleeve to move and release the projectile, a spring for returning

the sleeve to its normal position after the projectile has been released, and means capable of being operated from the exterior of the breech for adjusting the said spring.

5. In a pneumatic gun, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a projectile detent in the form of a collar with a contractible and expansible nave having an opening therethrough with a substantially air-tight seat for the projectile for holding back the projectile, and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel and mounted for movement along the axis of the barrel and capable in its normal, rear position, of holding the said nave contracted to hold back the projectile and preventing the same from expanding to release the projectile; and a movable stop associated with the sleeve for normally holding the same in its said rear position and operating when withdrawn to permit the projectile to pass through the sleeve into the barrel.

6. In a pneumatic gun, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a projectile detent in the form of a collar with a contractible and expansible nave having an opening therethrough with a substantially air-tight seat for the projectile for detaining the projectile, and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel and mounted for movement along the axis of the barrel and capable in its normal, rear position, of holding the said nave contracted and preventing the same from expanding to release the projectile; a movable stop associated with the sleeve for normally holding the same in its said rear position and operating when withdrawn to permit the projectile to pass through the sleeve into the barrel; and a coil spring located forward of the sleeve to return the same to its normal, rear position after the projectile has passed through the barrel.

7. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for the projectile for detaining the projectile, and upon which the air pressure holds the projectile before it passes into the barrel, means for normally holding the detent contracted and against expanding, means operatable at will to release the last-named means to permit the detent to expand and release the projectile, means for guiding the projectiles in succession into the air chamber, and means for admitting a compressed air current into the rear of the air chamber on a line substantially coaxial with the barrel.

8. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, a contractible and expansible projectile detent having a substantially air-tight seat for detaining the projectile and upon which the air pressure holds the projectile before it passes into the barrel, a projectile duct leading upwardly from below into the air chamber, and an admission duct for the compressed air back of the air chamber for admitting a current of compressed air into the air chamber substantially coaxially with the barrel.

9. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, said breech having an air chamber therein, a

compressed air reservoir located under the barrel, a magazine for the projectiles associated with the compressed air reservoir, a projectile duct leading from the magazine and passing upwardly into the air chamber from the rear, and having a forwardly disposed curved delivery end terminating with its axis substantially tangent to, and coinciding with, the axis of the barrel for delivering the projectiles in succession into the same by a movement along the axis of the barrel and toward the muzzle of the barrel, means for controlling the release of the projectiles into the barrel, said breech having a duct for admitting a current of compressed air into the rear of the air chamber and on a line substantially coaxial with the said barrel.

10. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, said breech having an air chamber therein, a compressed air reservoir located under the barrel, said reservoir being of substantially cylindrical form with its axis extending substantially parallel with the axis of the barrel, a magazine for the projectiles consisting of a coil of tubing encircling the reservoir, and a projectile duct leading from the delivery end of the magazine and passing upwardly into the air chamber having a curved forwardly disposed delivery end terminating with its axis substantially tangent to, and coinciding with, the axis of the barrel for delivering the projectiles in succession into the same by a movement along the axis of the barrel and toward the muzzle.

11. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, said breech having an air chamber therein, a compressed air reservoir located under the barrel, said reservoir being of substantially cylindrical form with its axis extending substantially parallel with the axis of the barrel, a magazine for the projectiles consisting of a coil of tubing encircling the reservoir, a projectile duct leading from the delivery end of the magazine and passing upwardly into the air chamber having a curved forwardly disposed delivery end terminating with its axis substantially tangent to, and coinciding with, the axis of the barrel for delivering the projectiles in succession into the same by a movement along the axis of the barrel and toward its muzzle, and means for admitting compressed air from the reservoir into the forward end of the magazine for assisting the forward feeding movement of the projectiles in the magazine.

12. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, said breech having an air chamber therein, a post extending down from the breech, a duct for projectiles in said post for delivering the projectiles into the air chamber, a compressed air duct also located in the said post, said breech having an air duct communicating with the air duct in the post, and extending forwardly into the air chamber on an axis substantially coinciding with the axis of the barrel; a clamping head carried by the lower end of said post, said clamping head having compressed air passages therein communicating with the said air duct of the post and having a duct therein for guiding the projectiles; and a compressed air reservoir with a projectile magazine associated therewith, and having a clamping head to clamp up against said first-named clamping head to enable compressed air from the reservoir to be delivered up through the air duct in the post, and to enable

the projectiles to pass through the clamped-up heads into the projectile duct in the post.

13. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, a compressed air reservoir mounted under the barrel, a magazine for projectiles associated with the reservoir, a valved head at the rear end of the reservoir, a post extending down from the breech, said post having an air duct and a projectile duct leading up through the same into the breech, means for effecting a connection from the magazine to the said magazine duct, including a valve in the valved head for enabling compressed air to be admitted from the reservoir into the magazine to assist the forward feeding movement of the projectiles; and means for effecting a connection from the interior of the reservoir to the air duct in the said post, including a valve in the valved head for controlling the flow of the air from the reservoir.

14. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, a post extending down from the breech, a duct in said post for delivering the projectiles into the breech, a clamping head carried by said post at a lower level than said breech, a magazine for the projectiles located forward of the post and having a clamping head to seat against the first-named clamping head, said clamping heads having communicating ducts therethrough for guiding the projectiles from the magazine into the post, and clamping means associated with said clamping heads at each side thereof, and including levers mounted to swing on a substantially horizontal axis and capable of assuming a locking position for the clamping heads with the clamping levers located adjacent to said post.

15. In a pneumatic gun, the combination of a breech, a barrel extending forwardly therefrom, a compressed air reservoir mounted under the barrel, a magazine for projectiles associated with the reservoir, a valved head at the rear end of the reservoir, a post extending down from the breech, said post having an air duct and a projectile duct leading up through the same into the breech, means for effecting a connection from the magazine with the said magazine duct, including a valve for admitting air from the magazine to the duct, with pneumatic means for operating the same; and a pilot valve for controlling the pneumatic means.

16. In a gun operated by compressed air, the combination of a breech having a compressed air chamber, a barrel in front of the air chamber, an expansible projectile detent having a substantially air-tight seat for the projectile for detaining the projectile, and upon which the air pressure holds the projectile before it passes into the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, means controlled at will for engaging the sleeve and operating when actuated to permit the sleeve to move and release the projectile, and a spring for returning the sleeve to its normal position after a projectile has been released and passed into the barrel and cooperating with the said means operatable at will, to discharge the projectiles in rapid succession as long as the said means operatable at will is held in its releasing position for the projectiles.

17. In a pneumatic gun, the combination of a breech having a compressed air chamber, a barrel forward of the air chamber, an expansible projectile detent having a substantially air-tight seat for the projectile for detaining the

projectile, and upon which the air pressure in the air chamber holds the projectile before it passes along the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, said sleeve having a shoulder thereon, a movable stop for engaging the shoulder of the sleeve to hold the same in its normal position; and a trigger operatable at will to withdraw the movable stop, thereby permitting the sleeve to move forward so as to release the projectile from the said detent.

18. In a pneumatic gun, the combination of a breech having a compressed air chamber, a barrel forward of the air chamber, an expansible projectile detent having a substantially air-tight seat for the projectile detaining the projectile,

5 and upon which the air pressure in the air chamber holds the projectile before it passes along the barrel, a sleeve coaxial with the barrel normally holding the detent against expanding, said sleeve having an annular shoulder thereon, a movable stop in the form of a yoke for engaging the shoulder of the sleeve to hold the same in its normal position; and a trigger with means operated thereby for moving the middle portion of the yoke inwardly toward the axis of the sleeve; and means cooperating with the forks of the yoke for moving the same inwardly when the yoke is actuated to engage the annular shoulder at other points adjacent the ends of the forks.

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