

ATTORNEYS

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GAS ACTUATED GUNS

2,881,752

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2 Sheets-Sheet 2

FIG. 4.

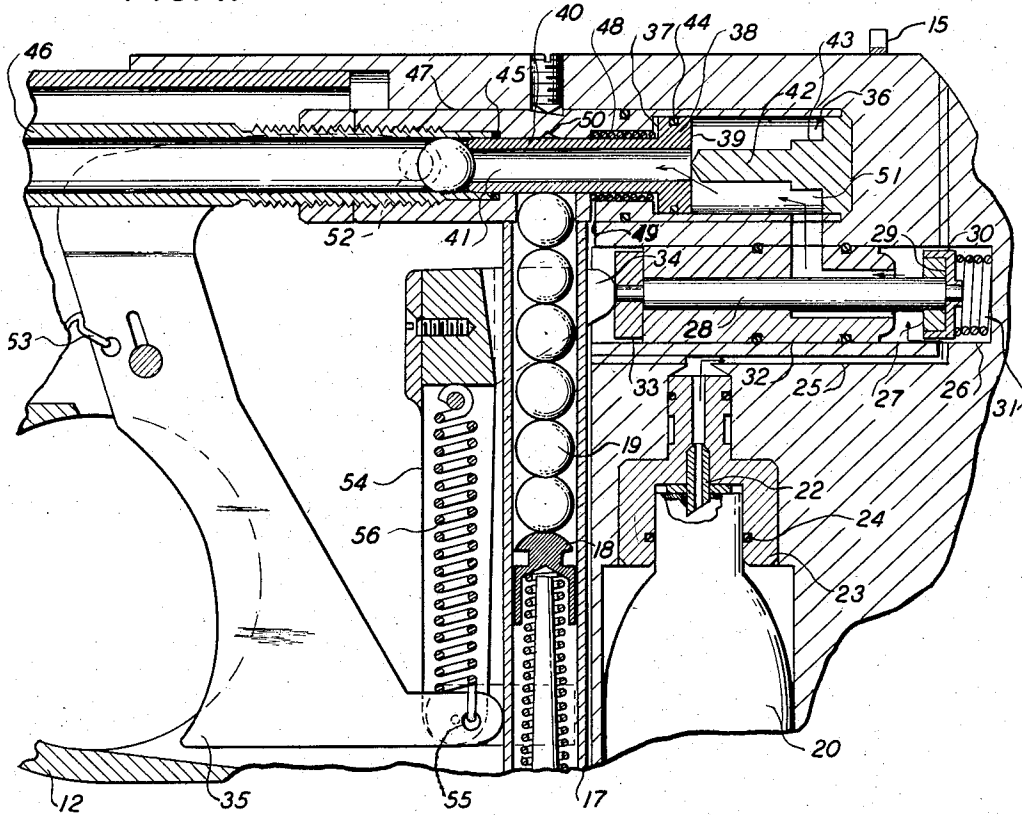
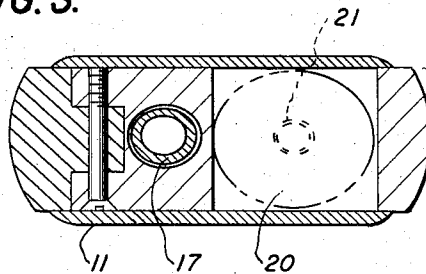


FIG. 3.



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2,881,752

GAS ACTUATED GUNS

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11 Claims. (Cl. 124—11)

This invention is concerned with gas actuated guns, i.e. those in which compressed gas rather than an explosive charge is used as a propellant. The invention provides improvements in guns of this type which are frequently called "air guns," and in its preferred form provides a semi-automatic gun in which loading is accomplished automatically immediately after each shot.

An early type of gas-actuated gun employed compressed air, which was actually compressed in the gun by a built-in pumping mechanism. The accuracy of such guns is impaired by variations in air pressure between shots. More recent gas-actuated guns employ a removable reservoir of compressed gas, the most popular being a small commercially available bottle or cylinder of carbon dioxide. The bottles contain a small amount of non-gaseous carbon dioxide and over a substantial portion of the useful life of the bottle the pressure exerted from shot to shot is substantially constant. Accordingly, the accuracy of successive shots may be equal to that of a conventional "22" cartridge employing a solid explosive.

My invention is applicable to gas-actuated guns of either of the foregoing types, but it finds its major application in the latter type in which a removable cylinder or bottle of compressed gas is used.

The mechanism of my invention is simple, rugged and reliable. It permits the manufacture at a reasonable cost of a semi-automatic gas-actuated gun—something that has not been available heretofore.

The gun of my invention employs a barrel with a magazine opening into the side of its bore adjacent the breech. The magazine is adapted to contain a series of projectiles, say "BB" or "22" caliber pellets. The magazine may feed into the barrel by gravity, but I prefer to force the projectiles into the barrel one by one by means of a spring loaded ram.

In all forms of the device of my invention a cylinder is disposed adjacent the breech with its axis parallel to that of the bore. Preferably the cylinder is round in internal cross section, but it may be of any shape so long as the cross section is substantially uniform throughout its effective length.

The gun of my invention is provided with a piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston being long enough to cover the opening from the magazine to the bore when the piston is in a forward position. Means are provided for limiting the forward motion of the piston so that during firing the opening will be covered until the projectile being fired leaves the muzzle of the barrel. A pin is disposed in the cylinder parallel to its axis and there is a passageway through the piston from the cylinder to the bore with the pin fitting and slidable in the rear of the passageway, i.e. the portion remote from the breech of the barrel. Conveniently this pin is fastened to the rear wall of the cylinder. The length of the pin is such that the passageway is substantially unobstructed by the pin

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when the piston is in its forward position covering the opening to the magazine. In other words, the piston suddenly slides off the end of the pin as it attains this forward position.

5 The gun is provided with a pressure chamber for the gas propellant employed. A conduit connects this chamber with the cylinder at a point behind the piston when it is in its rearmost position, and a valve, which may be actuated by a trigger mechanism, is disposed in this conduit.

10 Preferably the gun of my invention is provided with means such as a compression spring which forces the piston back so that its forward end is to the rear of the opening into the bore from the magazine except when the gun is actuated. This permits successive projectiles to enter the barrel between shots.

15 The gun is actuated by opening the valve. The compressed gas is thus admitted to the cylinder at the rear of the piston and the piston is forced forward carrying with it the projectile in the bore. When the piston has moved forward sufficiently far to cover the opening from the magazine the pin comes out of the passageway in the piston and permits gas in the cylinder to escape through the passageway behind the projectile. The gas pressure then forces the projectile out of the barrel.

20 As soon as the valve is closed, in the preferred form of my invention, the spring loaded piston returns to its original position with its front end to the rear of the opening into the bore from the magazine. Then another projectile is free to enter the barrel.

25 I prefer to employ a spring loaded valve which is ordinarily kept closed by the spring, but which opens momentarily to permit a burst of gas to enter the cylinder when the valve is opened, as by being struck by the hammer of a trigger mechanism. Immediately afterward the spring closes the valve. By adjusting the strength of the spring the size of the burst can be regulated to the optimum required for a particular projectile size and barrel length.

30 The valve preferably is operated by a trigger provided with a toggle mechanism which snaps a hammer against the valve. Thus my invention contemplates the combination in a gun having a frame which comprises a trigger pivoted on the frame, a hammer pivoted on the frame at a point remote from that at which the trigger is pivoted, but with the two pivots substantially parallel to each other; a tension spring is fastened at one end to the hammer remote from its pivot and by its other end to the trigger remote from its pivot. Preferably the trigger is spring-loaded by another spring attached between it and the frame and tending to hold it in a forward position. The action of the apparatus just described is that of a toggle and as the trigger is pulled it passes to and through a dead center position with respect to the hammer. While the trigger is passing to the dead center position the spring which connects it to the hammer is tensed. As the dead center position is passed the spring causes the hammer to snap suddenly.

35 These and other aspects of my invention will be understood more thoroughly in the light of the following description of a presently preferred example. This description is illustrated by the accompanying drawings, in which:

40 Fig. 1 is a side view of a pistol employing a CO₂ cylinder as a source of gas;

45 Fig. 2 is a sectional side elevation of the gun of Fig. 1, the parts being shown at rest during a non-firing interval;

50 Fig. 3 is a section through the butt of the gun of Fig. 1 taken along the line 3—3; and

55 Fig. 4 is an enlarged fragmentary sectional side eleva-

tion of the gun of Fig. 1 illustrating the mechanism in greater detail, the parts being shown in the position they assume at a moment when a projectile is being fired.

The pistol illustrated has a conventional frame 10 provided with a butt or handle 11, a trigger guard 12 and a false barrel 13 carrying a front sight 14, the rear sight 15 being disposed on the frame proper. The actual barrel 16 of the gun is a tube extending through the false barrel into the frame. A tubular magazine 17 is connected to the side of the barrel near its breech and extends down into the butt of the gun perpendicular to the axis of the bore. It is provided with a spring-loaded ram 18 at its lower end which pushes a series of projectiles 19, say "22" pellets, upwardly so that they enter the breech of the barrel one by one as the mechanism is actuated. The gun is loaded by screwing out the base of the ram and inserting the projectiles.

A conventional CO₂ cylinder or bottle 20 is disposed in a recess in the butt of the gun with its neck up. It is forced upward by a screw 21 threaded through the bottom of the butt so that its neck is forced against a conventional puncture tube mechanism 22. At the same time the neck of the bottle is forced into an adapter 23 having an O-ring 24 around it which seals the side of the bottle neck and permits carbon dioxide gas to flow from the bottle through a passageway 25 into a valve chamber 26. A plunger type valve 27 is disposed in the chamber with the axis of its plunger 28 parallel to the axis of the barrel. The valve is provided with a seat 29 toward its rear end against which a cap 30 is held by a compression spring 31 disposed in the valve chamber between the cap and the rear end of the chamber. The valve plunger is fitted and slides in a guide member 32, the forward end of the plunger terminating in a striker plate 33. When the striker plate is forced to the rear by the action of a hammer 34 actuated by a trigger 35 the valve is opened, admitting the propellant gas into a cylinder 36 disposed behind the barrel and coaxial with it. This cylinder is of larger diameter than the bore of the barrel, but opens into it at its forward end, there being an annular step 37 at the point where the cylinder communicates with the barrel. A piston 38 is slidable in the barrel. Its rear portion 39 is of the same diameter as the cylinder and its front portion 40 is slidably fitted in the barrel proper. The front and rear portions of this piston are formed integrally with each other. When the piston is in its forward position it extends as shown in Fig. 4, beyond the opening from the magazine into the barrel. The step 37 acts as a stop and prevents the piston from going beyond the forward position illustrated in Fig. 4.

A coaxial passageway or bore 41 extends through the piston. This bore is of such size as to slidably fit the front portion of a pin 42 which is fixed coaxially at the rear of the cylinder and points forward. This pin is fastened to the rear of the cylinder and is provided with an enlarged step portion 43 which acts as a stop against the motion of the piston to the rear, so that there will always be a space at the rear of the cylinder into which gas can be admitted by the action of the valve.

The rear portion of the piston is provided with an O-ring seal 44 to prevent gas leakage from the cylinder and a second O-ring 45 is employed as a seal around the front portion of the piston ahead of the opening from the magazine. The O-ring is squeezed when the forward portion 46 of the barrel is forced against the O-ring seat by screwing it into the rear portion 47 of the barrel, which is formed integrally with the cylinder.

At the breech of the barrel there is a recess in which an annular compression spring 48 is disposed around the piston. When the valve is closed so that the pressure in the cylinder is low, this spring forces the piston back against the stop 43 so that the pin enters the rear portion of the bore or passageway 41 in the piston and closes it.

The front portion of the cylinder is vented through a

small conduit 49 which extends downward to atmosphere through the wall of the barrel from the annular recess in which the spring is held. This prevents air from being compressed in the front portion of the cylinder and cushioning the forward movement of the piston at the time of firing.

Fig. 2 shows the condition of the pistol between shots. The ram in the magazine has forced one of the projectiles into the breech of the gun where it is held by a detent or dimple 50 in the side of the bore. The spring 48 holds the piston back against the stop 43. When the valve is open, the gas enters the space 51 (see Fig. 2) at the rear of the cylinder and forces the piston forward against the force of its spring. The front of the piston pushes the projectile forward in the barrel and at the same time prevents the escape of gas through the magazine and prevents the next projectile from entering the barrel. When the piston has travelled forward to the position shown in Fig. 4, its rear has travelled beyond the front end of the pin, thus opening the bore or passageway through the piston and permitting the full force of the gas charge to act on the projectile, shooting it out of the barrel. When the valve is closed, the spring will return the piston to its rearward position, sealing the cylinder and at the same time permitting another projectile to enter the bore from the magazine.

The essential mechanism of the apparatus of Figs. 1 to 4 has now been described. However, the invention contemplates several additional features which are highly desirable. Not the least of these is the triggering mechanism. The trigger 35 is pivoted on a pin 52 (see Fig. 2) and is ordinarily held in a forward position by a tension trigger spring 53. The hammer 34 is a U-shaped piece with its base fastened to a lever 54 of a toggle mechanism pivoted on the lower pin 55. The two legs of the U are spaced so that when the lever is pushed backward they pass on each side of the magazine tube and hit the striker plate 33. The lever of the toggle mechanism is normally held in a forward position by a tension toggle spring 56, one end of which is fastened to the toggle lever adjacent the hammer with the other or lower end fastened to the lower portion of the trigger of the gun. When the trigger is in its forward position, the toggle lever is held forward against the trigger by the toggle spring. When the trigger is pulled the lower end of the toggle spring swings to the rear past the dead center position or the pivot point 55 when the action of the toggle spring pulls the lever back carrying the hammer sharply against the striker plate. This forces the valve plunger 28 to the rear and opens the valve momentarily, the duration of the valve opening period being controlled by the mass of the hammer and the strength of the spring in the valve. As soon as the hammer has struck the striker plate the action of the toggle spring brings it back to its original position as soon as pressure on the trigger is released and the trigger is pulled back to its forward position by the trigger spring 53, as shown in Fig. 2.

Fig. 4 shows the hammer at the time that it has driven the striker plate back, opening the valve and causing the piston to move forward in the barrel of the gun carrying the projectile forward in the barrel and opening the passageway through the piston so that the charge of gas from the cylinder is free to expel the projectile. The direction of gas flow from the CO₂ cylinder to the projectile is shown by arrows in Fig. 4.

I claim:

1. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the

opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, and a valve in the conduit.

2. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder of larger cross section than the bore disposed adjacent and to the rear of the breech parallel to the bore, a piston having a rear portion fitted to and slidable in the cylinder and a second front portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, and a valve in the conduit.

3. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, a valve in the conduit, and spring means holding the piston to the rear so that it does not cover the opening from the magazine to the bore when the valve is closed.

4. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a stop in the cylinder limiting the rearward travel of the piston to a point ahead of the rear of the cylinder, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to

the cylinder behind the piston in its most rearward position, and a valve in the conduit.

5. Apparatus according to claim 4 in which the stop is on the pin.

6. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having one portion fitted to and slidable in the cylinder, and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, a valve in the conduit, and a spring mechanically linked to the valve and tending to keep it closed.

7. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder of larger cross section than the bore disposed adjacent and behind the breech coaxial to the bore a, piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, a spring mechanically linked to the piston and tending to hold it to the rear so that the opening from the magazine is uncovered, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a vent to atmosphere connected to the forward portion of the cylinder, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, and a valve in the conduit.

8. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a spring-loaded ram disposed in the magazine, a cylinder disposed adjacent the breech parallel to the bore, a piston having one portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, a valve in the conduit, and spring means linked to the piston and tending to hold it back so that the opening from the magazine is uncovered.

9. In a gas-actuated gun having a barrel with a bore extending through it to its breech, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the

breech parallel to the bore, a piston having a first portion fitted to and slidable in the cylinder and a second portion fitted to and slidable in the bore adjacent the breech, the second portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, the barrel being made in two parts with the breech part formed integrally with the cylinder and the forward part threaded into the breech part adjacent the second portion of the piston, a gasket disposed coaxial with the bore between the two parts of the barrel, means limiting the forward travel of the piston beyond said position, a fixed pin disposed in the cylinder parallel thereto, there being a passageway through the piston from the cylinder to the bore, with the pin fitting and slidable in the end of the passageway remote from the bore, the length of the pin being such that the passageway is unobstructed by the pin when the piston is in its forward position, a pressure chamber for the gas employed to actuate the gun, a conduit connecting the chamber to the cylinder behind the piston, and a valve in the conduit.

10. In a gas-actuated gun having a barrel with a bore extending through it to its breech, said barrel being mounted on a frame, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having a front portion fitted to and slidable in the cylinder and a rear portion fitted to and slidable in the bore adjacent the breech, the front portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, the piston having a straight longitudinal passageway extending entirely through it from the cylinder to the bore, a pressure chamber carried by the frame for the gas employed to actuate the gun, a conduit connecting the pressure chamber to the cylinder rearwardly of the piston, a valve in the conduit, said valve being operable to charge the cylinder with gas from the pressure chamber when the piston is in a rearward position, and means disposed within the cylinder to prevent the flow of gas

through the passageway from the cylinder to the bore until the opening from the magazine to the bore is covered by the front portion of the piston.

11. In a gas-actuated gun having a barrel with a bore extending through it to its breech, said barrel being mounted on a frame, the combination which comprises a magazine opening into the side of the bore adjacent the breech, a cylinder disposed adjacent the breech parallel to the bore, a piston having a front portion fitted to and slidable in the cylinder and a rear portion fitted to and slidable in the bore adjacent the breech, the front portion of the piston covering the opening from the magazine to the bore when the piston is in a forward position, means limiting the forward travel of the piston beyond said position, the piston having a straight longitudinal passageway extending entirely through it from the cylinder to the bore, a pressure chamber carried by the frame for the gas employed to actuate the gun, a conduit connecting the pressure chamber to the cylinder rearwardly of the piston, a valve in the conduit, means independent of the piston and responsive to the trigger to open and close said valve to charge the cylinder with gas from the pressure chamber when the piston is in a rearward position, and means disposed within the cylinder to prevent the flow of gas through the passageway from the cylinder to the bore until the opening from the magazine to the bore is covered by the front portion of the piston.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,881,752

Carl E. Blahnik

April 14, 1959

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 61 and line 62, for "pistol" read ~~--- piston ---~~; column 6, lines 53 and 54, for "paralleling" read ~~--- parallel ---~~.

Signed and sealed this 11th day of August 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents