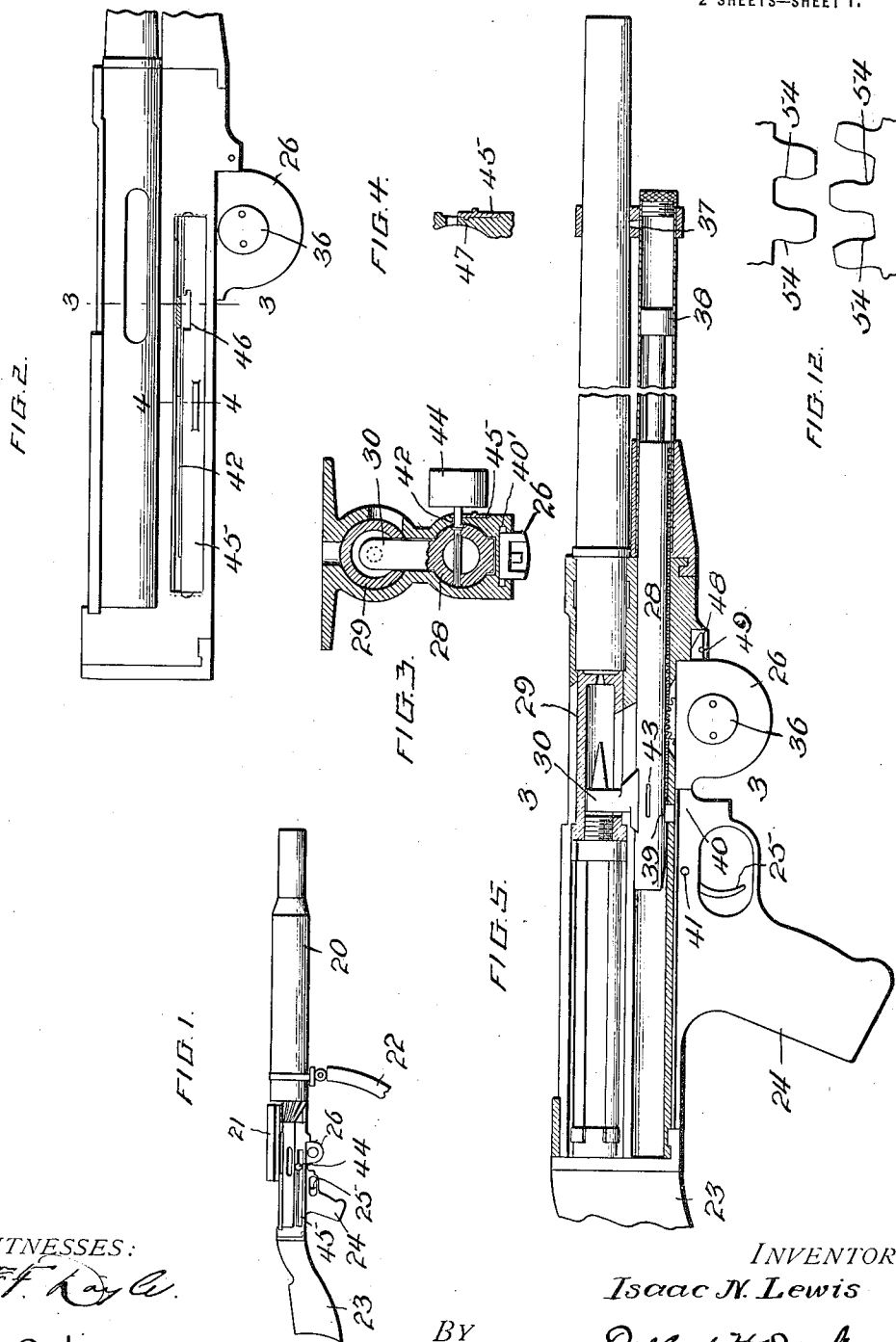


1,142,896.

I. N. LEWIS.
AUTOMATIC FIREARM.
APPLICATION FILED APR. 16, 1912.

Patented June 15, 1915.
2 SHEETS—SHEET 1.



WITNESSES:
W. F. Ray
D. P. Winston

BY

INVENTOR
Isaac N. Lewis
Delbert H. Decker

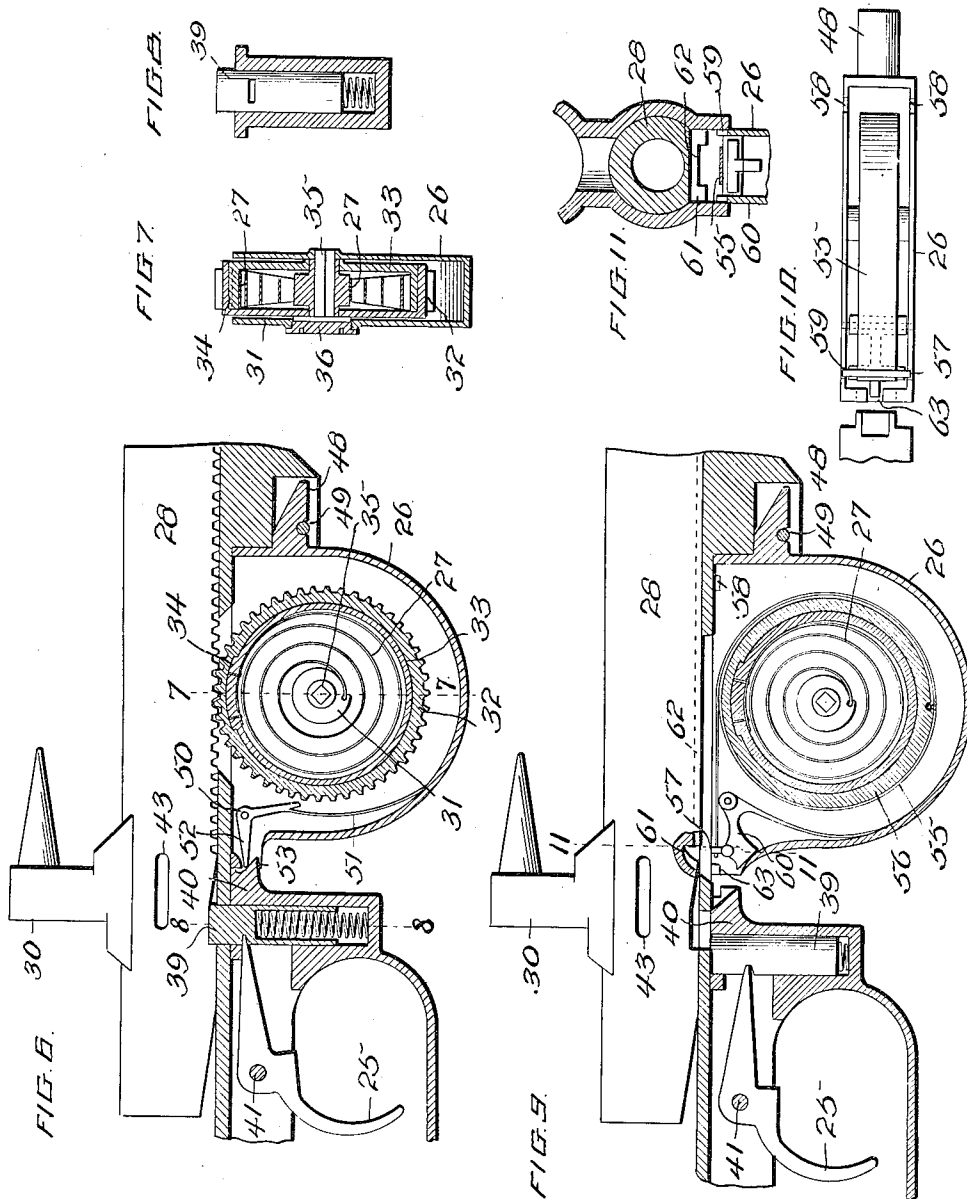
Attorney

1,142,896.

I. N. LEWIS.
AUTOMATIC FIREARM.
APPLICATION FILED APR. 16, 1912.

Patented June 15, 1915.

2 SHEETS—SHEET 2.



WITNESSES:

W. H. Rayle

D. P. Winston.

BY

INVENTOR

Isaac N. Lewis

Delbert H. Decker

Attorney

UNITED STATES PATENT OFFICE.

ISAAC N. LEWIS, OF NEW YORK, N. Y., ASSIGNOR TO THE AUTOMATIC ARMS COMPANY, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

AUTOMATIC FIREARM.

1,142,896.

Specification of Letters Patent.

Patented June 15, 1915.

Application filed April 16, 1912. Serial No. 691,135.

To all whom it may concern:

Be it known that I, ISAAC N. LEWIS, a citizen of the United States, and resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Firearms, of which the following is a specification.

This invention relates to firearms and particularly to automatic, gas-operated firearms wherein gases of one discharge store power in a spring for driving the feeding and firing mechanism in the succeeding discharge.

The chief object of the present invention is to provide a structure wherein said spring may be located outside the heated zone, that is to say, beyond the reach of heat injurious thereto.

Other features of the invention will appear in the following description.

The invention therefore consists in the structure of parts and in their coöperation and combination substantially as herein-after set forth and claimed.

In the drawings which form a part of this specification, Figure 1 represents, in side elevation, a gun in which the features of this invention are embodied; Fig. 2 is an enlarged elevation of a portion of the gun; Fig. 3 is a transverse section on the line 3—3 Fig. 2; Fig. 4 is a fragmentary transverse section in the plane indicated by the line 4—4 Fig. 2; Fig. 5 is a longitudinal, axial, vertical section through the receiver and gas cylinder; Fig. 6 is a vertical, longitudinal section, full size, through the spring drum and casing and a portion of the slide, sear and trigger; Fig. 7 is a transverse, vertical section on line 7—7 Fig. 6; Fig. 8 is a transverse section on line 8—8 Fig. 6; Fig. 9 is a sectional view, similar to that in Fig. 6, showing a modification in the connection between the spring and the piston rod; Fig. 10 is a plan of the spring casing and a portion of the slide carrying the grip; Fig. 11 is a transverse section on the line 11—11 Fig. 9; and Fig. 12 is an illustration of the form of gear teeth found necessary for the perfect operation of the mechanism illustrated in Fig. 5.

The gun shown in the drawings is an air-cooled gun and is provided with rotary magazine cartridge feed and is intended to be supported upon a tripod when in use.

The present invention, however, is in no sense limited to association with these specific features. It is intended for use in any gun wherein a portion of the gases of discharge is diverted and used for effecting automatic firing.

In Fig. 1 the gun barrel and gas cylinder are within the cooling jacket 20. The rotary cartridge magazine is represented at 21, the upper end of the tripod support at 22, the stock at 23, the pistol grip at 24, and the trigger at 25. In the sectional view of Fig. 5 and in the details of the other figures the special features of the invention appear.

In gas-operated guns heretofore designed the mainspring—the spring in which one discharge stores power for the next—has usually been located in the gas cylinder around the rod of the gas-driven piston. As such gas cylinder parallels the gun barrel for the greater portion of the length of the barrel the spring is directly in the heated zone and quickly deteriorates from the effect of the heat. The present invention replaces that sort of spring by a small convolute spring located to the rear of the gun barrel entirely out of the heated zone. The casing 26 contains the spring in question. The spring itself is seen at 27 in Figs. 6, 7 and 9. It is preferably so formed as to give practically a constant pull throughout each action thereof. This is best accomplished by gradually reducing its cross-sectional area toward the smallest convolution, as indicated in Fig. 7, preferably by gradually narrowing the spring while maintaining the same thickness.

Fig. 5 illustrates the way in which the spring has been applied in actual use. The casing 26 containing it is removably attached to the lower side of the receiver, to which also the grip 24 is removably attached. Within the receiver, as usual, are the piston rod 28 and the breech bolt 29 located in their respective cylinders, the breech bolt being reciprocated, locked and unlocked automatically by the firing-pin post 30, carried by the piston rod and projecting into the interior of the breech bolt, as well understood in this art.

By reference to Figs. 6 and 7, it will be seen that the spring 27 has its inner end attached to a hub 31 on the ends of which the spring drum is journaled. This drum con-

sists of the gear section 32 comprising an outer cup into which the cup 33 is slipped laterally before the drum is inserted in its casing 26. The inner cup is held against rotation in the outer cup by the radial projection 34 which fits a corresponding recess in the outer cup. The outer end of the spring is preferably riveted to this thickened portion of said inner cup. After the drum is inserted in the casing the squared pin 35 is inserted through one side of the casing and a cap 36 screwed into the opening against the head of the pin, the other end of the pin being inserted in a squared opening in the opposite side of the casing. By rotating the drum in one direction, the spring will be wound upon the hub, then by releasing the drum it will be rotated in the opposite direction by the spring. Therefore by applying the force of a portion of the gases of explosion to the rotation of the drum for winding up the spring, the spring in unwinding may be made to drive the feeding and firing mechanism of the gun. This has been accomplished in the present instance by forming a rack on the piston rod to mesh with the teeth formed on the geared section 32 of the spring drum as seen in Fig. 5. As heretofore in this class of guns, the gases of discharge entering the gas cylinder through the port 37 act upon the piston 38 to drive it and the piston rod 28 rearwardly thereby winding up the spring which on unwinding furnishes alone the full power for operating the firing mechanism; driving the piston forward to effect the advance of the breech bolt, the insertion of a cartridge, the locking of the breech bolt and the firing of the cartridge, in the manner usual in the automatic firing of guns of this class. If the piston rod is to be halted before firing, the sear 39 is released by the trigger and enters its notch in the piston rod as seen in Fig. 6. The sear may then be withdrawn by the trigger whereupon the spring will complete its work. After the first round, the gun will continue to fire automatically so long as the trigger is pressed. The first charge is fed in by hand manipulation of the piston rod as is usual in this class of guns. The means for operating the piston rod by hand will be explained farther on.

This invention provides for the employment of the simplest sort of trigger and sear mechanism. They are mounted in the slide 40 to which the grip 24 is attached. This slide is fitted to a longitudinal guideway formed in the underside of the receiver. This guideway is seen in cross-section at 40' in Fig. 3. The sear 39 is a cupped cylinder spring-seated in a socket in said slide 40, as seen in Fig. 6. In the side of the sear is a notch and into this projects the end of the bell-crank trigger 25 which is located in a recess in slide 40 and pivoted on pin 41.

Through the side of the receiver is formed a slot 42 and in the piston rod is formed a shorter slot 43. In the slot 43 there is inserted a knob 44, Fig. 3. By this knob the piston may be manually operated, the shank of the knob traversing the slot 42. This knob is preferably readily removable from the piston rod. For this reason its shank is split and the end of each fork is exteriorly ribbed to spring into a recess at its respective side of the slot 43 on the farther side of the piston rod. There are similar ribs also formed on the shank near the knob and these lie in recesses in the piston rod at either side of the slot 43. They also slide behind the edges of slot 42 which is narrower throughout the greater portion of its length than at the rear end where the shank of the knob is to be passed through for insertion in the piston rod.

To close the slot 42 a cover 45 is provided whose ends slide in ways formed in the wall of the receiver just below the ends of said slot 42. This cover 45 is slid up over the slot when the gun is not in use, to keep out dirt. It also serves as a safety check, since it is when the gun is cocked that the cover is used. It is therefore notched at 46 to span the shank of the knob 44. Should the trigger be accidentally pressed when the cover is over the slot, the cover will prevent the advance of the firing pin. The notch 46 is also preferably undercut at its forward end so that should such accidental pressure of the trigger occur the shank of the knob will enter said undercut, thereby preventing the withdrawal of said cover until the piston rod has been drawn back to cocked position. To hold the cover in withdrawn position or in place over the slot, a short rib 47 is formed on the back thereof (Fig. 4) to rest in a depression in the side of the receiver or over the lower edge of slot 42 respectively.

As above outlined, the slide 40 is removable by sliding it longitudinally rearward, the trigger being pressed and the stock having been removed from the receiver. The removal of the slide releases the spring casing which is pivoted by lug 48 upon a pin 49 traversing a recess in the underside of the receiver. The lug 48 is rounded on its upper surface enough to permit the gear casing to swing down till the teeth on the spring drum are disengaged from the rack on the piston rod. As the spring 27 should have a little initial tension, means are provided for preventing its running down when the casing is so swung down or removed altogether as it may be by pushing out pin 49. A detent 50 is provided in the casing 26 for engaging the gear teeth on the drum. This is preferably a spring detent, the integral plate spring 51 serving to hold the toe in mesh with the teeth. Since this detent must be held out of engagement with the teeth when the gear is

in operative position it is provided with a heel 52 with which the locking projection 53 on slide 40 may engage when all parts are assembled. As projection 53 is inserted in the recess of the spring casing under the heel 52, the toe is withdrawn from the drum gear. The gear of the drum is however then in mesh with the rack on the piston rod which in turn is held in place by the sear 39.

With the spring drum and casing constructed as described, it is an easy matter, should a spring break, to insert a new one. With the new spring inserted and the casing in hand, the initial tension is readily given to the spring by rolling the drum with the thumbs, the detent 50 holding the tension so given until the casing is in place on the receiver as above described.

The adoption of rack and pinion gearing for the joint operation of the spring and the piston rod necessitated the development of a special form of gear teeth. Such teeth are illustrated in Fig. 12. In the attempt to use the ordinary involute teeth the upward thrust on the piston rod, due to the line of pressure incident to such teeth, created so much friction as to render the mechanism inoperative. The involute teeth were therefore cut on the inner half of the engaging face (as at 54) in epicycloidal form, the other three-fourths of each tooth remaining of involute form. Therefore the engaging or driving faces of the teeth of the rack and pinion are half involute and half epicycloidal. It will be seen that in the action of rack and pinion in the present instance, the rack is the driving element in one direction while the pinion is the driving element in the other direction. With the teeth cut as above described the line of pressure upon the rack has been reduced from an angle of 14° , that of involute gearing, practically to zero or to parallelism with the direction of reciprocation of the rack.

The rack and pinion connection between the spring drum and the piston rod, constructed as above described, works perfectly yet it is possible to connect these parts otherwise, therefore the features of this invention relating to the adoption of a convolute spring are not to be limited by the use therewith of rack and pinion gearing. Another form of connection between the convolute spring and the piston rod is illustrated in Figs. 9, 10 and 11. Therein the casing 26, the spring and the spring drum, with the exception of the teeth on its periphery, and the manner of mounting the drum in the casing are the same as already described. Instead of the gear teeth, a metal tape is used for connecting the spring drum to the piston rod. This tape 55 is connected at its inner end to the drum 56 and has a crosspiece 57 secured to its outer end. When the drum is inserted in the casing this cross-

piece rests in the notches 58. Before putting the casing in place on the receiver, the desired initial tension may be given to the spring by carrying the crosspiece 57 over into vertical notches 59 at the other end of the casing. Under the crosspiece when thus located is the end of a spring arm 60 which arm is pivoted in the casing similarly to the detent 50. When the casing has been put into place, the application of slide 40 will, by the action of its locking lug, thrust the arm 60 upward and press up the crosspiece 57 into a notch 61 in the underside of the piston rod. There the crosspiece stays and as the piston is driven backward the tape rotates the drum 56 and winds up the spring. As the spring unwinds the tape is wound up and the piston returned, performing the functions attending its return as already described. A groove as indicated at 62 may be formed in the underside of the piston rod for the tape 55. In removing the casing 26, the crosspiece 57 must first be pushed back into notches 59. After slide 40 has been removed, this may be done by reaching in through the aperture 63 in the end of the casing 26.

Many modifications in the general structure and in the details above described may be made within the spirit of this invention.

The invention claimed is:—

1. In a gas operated gun, the combination of the gun barrel, a cylinder paralleling it, a rotary reciprocating breech bolt, a gas-driven piston in said cylinder whose rod carries the firing pin the post of which operatively engages the breech bolt, and a single spring mounted at the rear of the gas cylinder and gun barrel and connected to the piston rod for driving the entire mechanism.

2. In a gas operated gun, the combination of a rotary reciprocating breech bolt, a gas-driven piston whose rod carries the firing pin the post of which operatively engages the breech bolt, and a convolute spring operatively connected to said piston for driving all said parts and located in a readily removable manner at the rear of the gun barrel for the purpose set forth.

3. In a gas-operated gun, the combination of a receiver and a gas-driven piston, a cylinder for said piston paralleling the gun barrel, a readily detachable convolute spring mounted on said receiver, an operating connection between the piston and spring whereby the spring may be put under tension, a casing located at the rear of said cylinder and barrel out of the zone of damaging heat and containing said spring and detachably connected to the receiver for ready removal, and feeding and firing mechanism driven by said spring.

4. In a gas-operated gun, the combination of the receiver and the gas-driven piston, a cylinder for said piston paralleling the gun barrel, a convolute spring detach-

ably connected to said piston, a casing containing said spring and detachably connected to the exterior of the receiver at the rear of said cylinder and barrel whereby the spring may be out of the zone of damaging heat and whereby a new spring may be readily substituted for a defective one, and firing mechanism driven by said spring.

5. In a gas-operated gun, the combination with the receiver and gas-operated piston, of a removable spring casing, a spring-containing drum within said casing for operating the firing mechanism, and an interengaging driving connection between said drum and piston said interengagement being automatically effected in the act of attaching the said casing to the receiver.

6. In a gas-operated gun, the combination with the receiver and gas-operated piston, of a removable spring casing adapted to be locked to said receiver, a spring-containing drum within said casing for operating the firing mechanism, a driving connection between said drum and piston, and automatically acting means for effecting said connection in the act of locking said casing upon said receiver.

7. In a gas-operated gun, the combination with the receiver, of a gas-driven piston the rod of which reciprocates in said receiver, firing mechanism driven by said rod, a convolute spring for driving said rod, a casing containing said spring and removably attached to the receiver, means for holding said spring under tension when said casing is removed, and a connection between said spring and the piston rod whereby the spring may be wound up by the rearward movement of the piston and in unwinding may operate the firing mechanism.

8. In a gas-operated gun, the combination of the receiver, the gas-operated piston, a convolute spring adapted to be connected to said piston for operating the firing mechanism, a casing for holding said spring removably attached to the receiver, a device holding the spring under tension when the casing is removed from the receiver, and a slide carrying the grip and trigger mechanism and provided with means for releasing said tension holding device when said slide is put in place on the receiver.

9. In a gas-operated gun, the combination with the gas-driven piston having a gear rack upon the piston rod, of a rotary spring drum, a pinion driven thereby and adapted to mesh with said rack whereby the piston may wind up the spring and the spring in unwinding may operate the firing mechanism, a removable casing in which said drum is mounted, and a detent for engagement with the pinion when the casing is removed.

10. In a gas-operated gun, the combina-

tion with the gas-driven piston having a gear rack upon the piston rod, of a rotary spring drum having a pinion thereon adapted to mesh with said rack, a removable casing in which said drum is mounted, a detent in said casing for engaging the teeth of the pinion, and means for automatically withdrawing said detent from said teeth in assembling the parts of the gun.

11. In a gas-operated gun, the combination with a gas-driven piston having a gear rack upon the piston rod, of a rotary spring drum having a pinion thereon adapted to mesh with said rack whereby the piston may wind up the spring and the spring in unwinding may operate the firing mechanism, the engaging faces of the gear teeth having their outer halves in involute form and their inner halves in epicycloidal form for the purpose specified.

12. The combination with the spring casing, of a squared pin located transversely in said casing, a hub traversed thereby, a spring drum mounted for rotation upon said hub and consisting of an inner cup inserted within an outer one and connected thereto, a spring connected to said hub and to said inner cup, and driving means provided on the periphery of said drum.

13. In a gas-operated gun, the combination with the gas-operated piston and spring for returning the piston, of the piston rod provided with a notch in its underside, a vertically reciprocating sear for engaging in said notch consisting of a cupped cylinder with a notch in its side, a spiral spring seated in the cupped cylinder, and a bell-crank trigger for depressing said sear by its toe engaging the notch in the side of said cylinder.

14. In a gas-operated gun, the combination with the gas-driven piston and spring for returning the piston, of the piston rod provided with a slot therethrough, and a knob adapted to be removably located in said slot for manual operation of the piston.

15. In a gas-operated gun, the combination with the gas-driven piston, of the receiver provided with a cylinder for the piston rod and with a slot extending longitudinally through a side wall of said cylinder, an operating knob attached to the piston rod and adapted to reciprocate in said slot, and a cover for said slot notched to embrace the shank of said knob.

Signed at New York city in the county of New York and State of New York this 9th day of April A. D. 1912.

ISAAC N. LEWIS.

Witnesses:

D. P. RUDD,
W. L. WISE.