THESIS

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by

Redacted for Privacy

Approved: Redacted for Privacy

Department of Mechanical Engineering

Redacted for Privacy

In the construction of a rifle for sporting or target work there are several conditions to be met. In the first place the rifle must be made to balance easily at all times, whether the magazine is full of loaded cartridges or is empty. In all cases the barrel of the rifle must be bored with accuracy and rifled so as to give the proper amount of twist to the bullet as compared with its mass and velocity. But this can be found only by a long series of experiments at a great cost of time; therefore no attempt is made along that line in this work. The strength and simplicity of the parts are also of some consideration. This special advantage is claimed be the model. Only three simple parts are there to the loading mechanism. Among the other advantages are the number of shots at the marksman's disposal, about three or four times that of a common repeater—and the ability to operate the magazine with either long or short cartridges, or alternating long and short. This is an advantage which is not claimed at present by any manufacturer or inventor of small rifles.

The primary problem in the design of a repeating gun is to contract a mechanism that will carry the cartridge, as it is presented at the mouth of the magazine, to the chamber of the barrel, ready to be fired. In a repeater, and especially in a self-loading gun, it is essential that this action shall cock the gun so that the single operation of pulling the trigger fires the gun and
and reloads it.

In this model the backward force of the explosion ejects the empty shell and preforms the first function of reloading the gun, by driving the bolt back; and in so doing cocks the hammer and revolves the carrier into position with a loaded cartridge at the same time closing the magazine. This action also compresses the spring around the magazine, which, as soon as the work of the shell is done, takes up the second part of the action, drawing the bolt back toward the chamber, engaging the loaded shell, forcing it into the chamber, and closing the bolt over it, ready for the another shot.

In order that the loading mechanism may be more easily understood, it is designed first by a plane link motion (Fig. 1). The sliding link A moves backward and forward along the line MN. The connecting link B fastened to A and D to revolve about C as a centre. The travel of A is limited to the diameter of a circle whose radius is equal to the length of the part $\overline{cd}$-bd of the revolving link D. Here A represents the bolt and D the carrier of the gun. The problem now is to transfer a shell from the position as shown to a position with the axis of the shell parallel to MN. It will be seen then that D must be revolved through an angle of 90°, then taking the limiting positions of D, the limiting positions of A may be determined by taking bd as a centre, and with a radius equal to B, finding the intercepting points on MN. It is, however, necessary that A move slightly ahead of B and D. This end can be reached by making a slot in A at ab. This causes A to have a great-
er travel along MN, the original length plus the length of the slot at ab. When the axis of the cartridge is parallel to the line MN, the cartridge is engaged by A, the bolt, on its return and forced into the chamber.

The hammer and trigger must also be designed according to the travel of the bolt; since the firing pin is located in the bolt and the cocking is done by the backward movement of the bolt (Fig.2). The trigger is held against the hammer by the upward force of the spring A. The backward movement of the bolt revolves the hammer about C through the angle \( \angle MON \) and compresses the spiral spring B. At the same time, the trigger catches in the notch at C and holds the hammer in its new position until released by a force or moment which overcomes the pressure, P, exerted by A on the trigger. By pulling the trigger this force may be overcome.

For economy of space the magazine is placed along and under the barrel of the rifle. The cartridges are thrust into the magazine in an upright position, with their axes perpendicular to the axis of the rifle barrel. The long spring in the magazine is compressed as the cartridges are thrust into the magazine, and the work of the spring in overcoming this strain forces a cartridge into the receiver each time the bolt is closed ready for the discharge (Fig.3). The magazine may be filled by opening the gate, Cr, and thrusting in the cartridges, as shown in the diagram. To prevent the magazine spring from coming too far back, it is arranged to lock itself automatically at L, L.

The long spring around the magazine is designed primarily to
return the bolt to its original closed position, after its has been forced back by the explosion. This is effected by overcoming the strain produced in the spring when it is compressed in length from N to M. The spring must not only be strong enough to overcome the friction in the working parts in returning the bolt but must also be made by experiment strong enough to act as a cushion or resistance to the backward force of the explosion and can be so made that the force of the explosion will be almost entirely overcome when the work of forcing the bolt back and cocking the gun is completed.

The ejection of the empty shell completes the cycle. When the cartridge is thrust into the chamber by the return of the bolt, the ejector closes over the rim of the cartridge. When the bolt is drawn backward again the shell is withdrawn from the chamber and carried back until the rim opposite the ejector (Fig. 4) strikes at A. This gives the shell a rotary motion causing it to be thrown out.

In order to compress the reloading spring the three-sided rod connected to the bolt and passing inside of the spring to its termination in the head H is used. This rod has a cross sectional area at its weakest point of .1 and therefore a tensile strength of 65000 X .1 or 6500 pounds when constructed of mild steel. At its connection with the bolt it is subjected to a shearing force, and in order that it may be able to withstand a shearing force equal to its tensile strength it must have a cross sectional area of 6500.

or.13sq. in., or .36inches squared.

The safety (Fig.5) is a simple device operated by moving the slide D and so causing the piece F to revolve about O and through the angle A. When D is up the hammer is free to move and the reading below the slide is "Unsafe", when D is down the piece F takes its corresponding position safely locking the hammer by revolving into the slot at the top of the hammer.

The magazine will hold about forty cartridges per foot of clear magazine, thus placing forty shots at the disposal of the operator, by the simple act of drawing the bolt and loading the first time.

The diagrams are made to show the different positions of the parts when the gun is opened and closed.
DIAGRAM OF PARTS. BOLT CLOSED.

CROSS-SECTIONS PASSED THROUGH

THE AXIS OF THE CHAMBER

OF A CARTRIDGE IN

THE CARRIER.
BOLT OPEN.