K. HAUSSNER.

RUNNING-OUT GUN.

APPLICATION FILED MAY 19, 1910.

997,912. Patented July 11, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

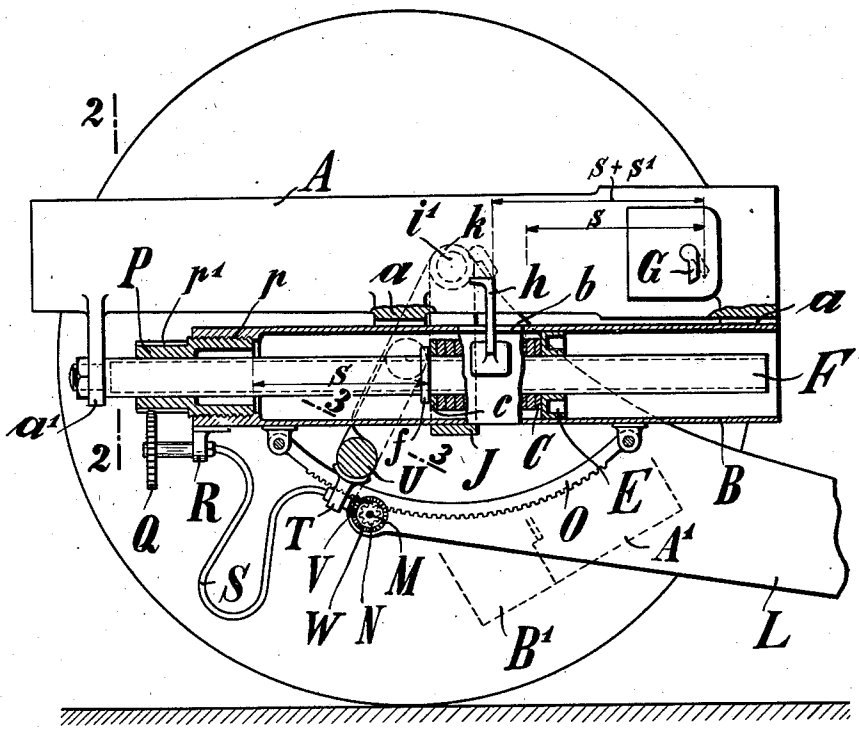


Fig. 3.

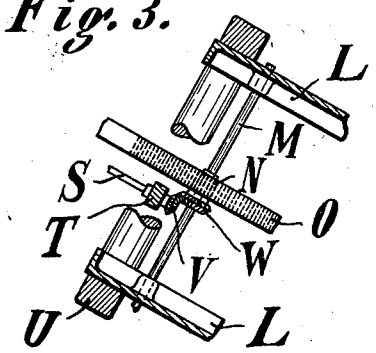
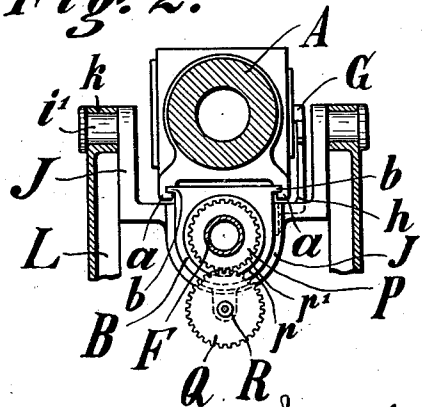


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 5.

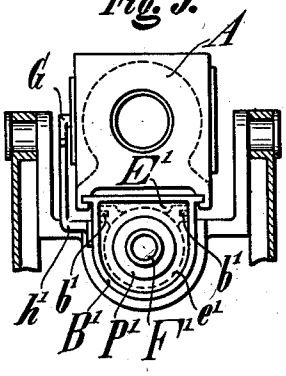


Fig. 4.

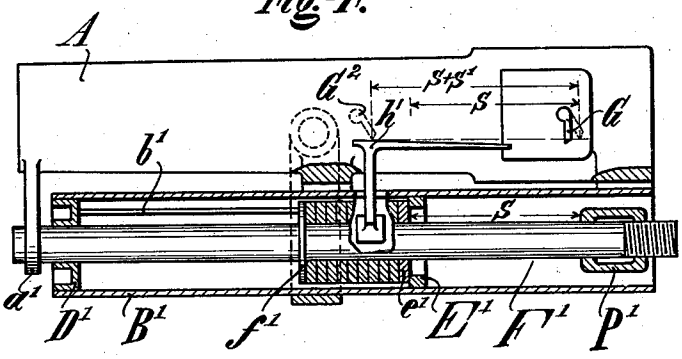


Fig. 7.

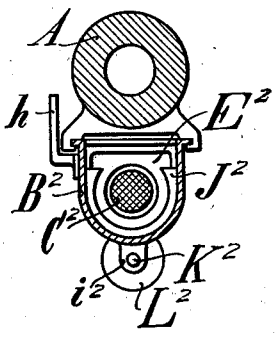


Fig. 6.

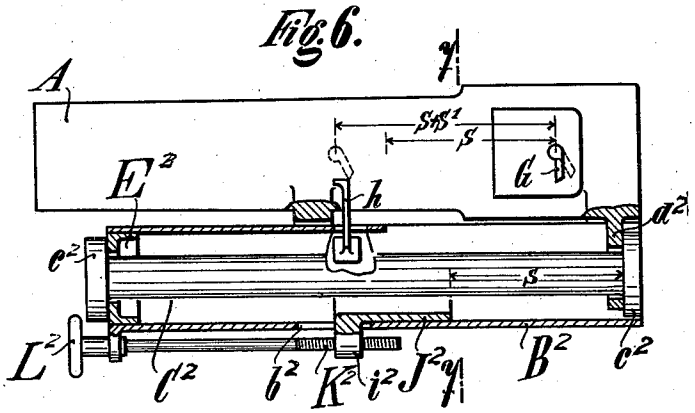


Fig. 9.

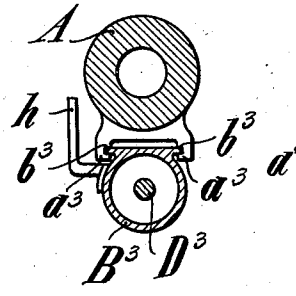
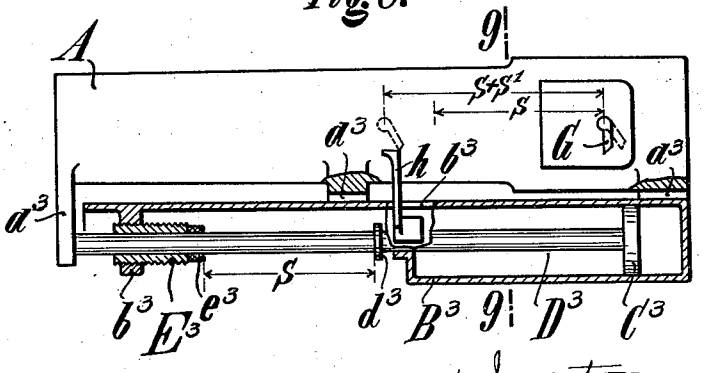


Fig. 8.



Witnesses
J. M. Huybekoop.
E. R. Heine.

Inventor,
Konrad Haussner,
By Knight Bros
his attorneys.

UNITED STATES PATENT OFFICE.

KONRAD HAUSSNER, OF EISENACH, GERMANY.

RUNNING-OUT GUN.

997,912. Specification of Letters Patent. Patented July 11, 1911.

Original application filed August 16, 1909, Serial No. 513,069. Divided and this application filed May 19, 1910. Serial No. 562,277.

To all whom it may concern:

Be it known that I, KONRAD HAUSSNER, a subject of the Emperor of Germany, residing at and whose post-office address is Eisenach, Germany, have invented certain new and useful Improvements in Running-Out Guns, of which the following is a specification.

In the firing of differential recoil guns, there results a variable distance of recoil, accordingly as the gun-barrel is elevated or depressed, due to the weight of the gun-barrel, which recoil is however, invariable for one and the same angle of elevation or depression.

It is therefore, the purpose of the present invention to devise an arrangement whereby to regulate or vary the extent of recoil of the gun barrel commensurate with the angle of firing.

This application forms a division of my co-pending case, bearing the Serial No. 513,069 and dated August 16, 1909, and for a further discussion of the principle involved herein, reference may be had to my said co-pending application.

Summarily stated, the arrangement herein set forth consists in providing a means for automatically or manually determining the running-out velocity of the accumulator as distinct from determining the period at which firing is effected, which latter condition is characteristic of the arrangement proposed in the before mentioned case.

The invention is shown in several embodiments in the accompanying drawings wherein;

Figure 1 is a side elevation of a gun with parts in section; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a section thereof on the line 3—3. Figs. 4 and 5 illustrate a modified embodiment of the invention, Fig. 4 being a side elevation of the gun barrel and the accumulator, the latter being shown in section, and Fig. 5 being a rear elevation of the same parts, with the trunnion bearings in section; Figs. 6 and 7 show by a side elevation partly in section and by a transverse section on the line 7—7 of Fig. 6 still another embodiment of the invention; and Figs. 8 and 9 show by side elevation partly in section and by vertical transverse section on the line 9—9, Fig. 8, another embodiment of the invention.

Referring in detail to the several figures and with like characters of reference indicating corresponding parts in the different views shown, the arrangement selected in Figs. 1 to 3 shows an embodiment of the invention in which the impact piece *h* against which the trigger G impinges, is rigidly connected with the over-carriage. The distance selected for the impact piece *h* from the trigger G is such that the accumulator is in a condition to produce the necessary running-out velocity at the moment of explosion, either by the greatest elevation and with different charges, or with the greatest charges. The length of travel during which the accumulator acts upon the barrel is determined by introducing the accumulator pressure upon the barrel at a sooner or later period. The barrel A is supported and slides with its claws *a*, *a* upon the guiding rails *b*, *b* of the over-carriage B. The accumulator consists of a spring C whose rear abutment is provided by the bearing E which is rigidly connected with the over-carriage and serves as guide for the hollow spring guide rod F. The forward abutment is provided by the disk *c* loosely mounted upon the spring guide rod, which disk rests against the shoulder *f* of the spring guide rod. The forward end of the spring guide rod F is connected with the barrel through the barrel extension a^1 and in this manner the forward pressure of the spring is brought to bear upon the barrel. The over-carriage swings through the medium of its trunnions i^1 i^1 journaled in the trunnion bearing *k*, *k* of the under-carriage, which trunnions are located upon the trunnion carrier J rigidly connected to the over-carriage B. The elevation or depression of the over-carriage B together with the barrel A results from the shaft M journaled in the under-carriage walls upon which is secured the gear wheel N that meshes with the toothed arc O secured to the over-carriage. The forward portion of the over-carriage is provided with internal threads in which is screwed a regulating piece P provided on its rear end with a correspondingly threaded part *p*. The rear part of the regulating

piece is further provided with a recess, the diameter of which is somewhat greater than that of the shoulder f on the spring rod. The forward outer end p^1 of the regulating piece is toothed throughout its length. In these teeth meshes the small gear wheel Q, whose shaft is guided in the bearing R on the over-carriage. Said shaft is connected with a flexible shaft S which in turn is coupled at its other end with a shaft member guided in bearing T secured in the carriage axis U. Said shaft member carries the cone wheel V which engages with the cone wheel W secured to the elevating shaft M. When the barrel is released in horizontal position, to deliver a shot, the accumulator C acts acceleratingly upon the barrel until the disk c reaches the rim of the rear portion p of the regulating piece P, during which the gun barrel has traveled the distance s. From thereon, the barrel continues its forward movement, without further influence of the accumulator, until the trigger G impinges the impact piece h and causes the explosion of the powder charge. If elevation is imparted to the barrel, the rotation of the elevating shaft N causes the regulating piece to be screwed farther forward. With the greatest elevation which is indicated in the drawing by the dotted position of the rear end of the barrel and of the over carriage A^1, B^1, the regulating piece finds itself farthest forward, so that after release of the barrel, the accumulator can act against it through the distance $s+s^1$. If depression is imparted to the barrel, the regulating piece moves rearward and in consequence the accumulator can act against the barrel through a distance which is smaller than s. Since the regulating piece determines a longer or shorter duration of action of the accumulator against the barrel as in the previously introduced constructions, (*in re* application Ser. No. 513,069) the effect is the same as in the arrangement therein described and therefore, need not be referred to with more particularity. The automatic adjustment of the regulating piece, instead of resulting from the elevating mechanism can follow from the movement of the sighting device. Also, instead of being adjusted automatically, it can be adjusted by hand. In order to compensate for different charges or different weights of shot, it is merely necessary to shift the regulating piece, correspondingly, by hand. In this case, however, it is necessary that such regulating pieces be made longer in their threaded and toothed portions.

The construction shown in Figs. 4 and 5 differs from those previously described in that the distance during which the accumulator acts against the barrel, is rendered variable by adjusting the regulating piece P^1 and thereby sooner or later, during the running-out of the barrel A, transferring the rearwardly acting spring pressure from the bearing secured to the over-carriage B^1 upon the regulating piece, and thereby transferring it through the spring guide rod F^1 to the entire moving mass of the barrel. In this manner the spring pressure acting from the spring guide shoulder f^1 forward upon the moving mass, will be neutralized. The striking piece h^1 is again rigidly connected with the over-carriage and so far removed from the trigger G, that this distance $s+s^1$ indicates the greatest travel, during which the accumulator must act against the barrel, in order to produce the necessary extent of running-out velocity in the barrel. Upon the impact piece h is provided an arm whose upper surface is extended in a bent direction so that the trigger lever G, on the running out of the gun barrel, is thrown, not suddenly but gradually into the firing position G^2, shown in dotted lines. In this manner, the shock imposed upon the trigger lever during the running out of the gun barrel is nullified. The forward abutment of the accumulator spring constitutes the shoulder f^1 of the spring guide rod. The spring guide rod F^1 itself is rigidly connected at its forward end with the barrel projection a^1, and through this arrangement transmits to the barrel mass the forwardly directed spring pressure. The rear abutment consists of a disk e^1 which transmits the rearwardly directed spring pressure to the bearing E^1, which is rigidly connected with the overcarriage. While the disk e^1 serves simultaneously as a rear guide for the spring guide rod, it finds its own support and guide upon the ribs b^1 b^1 arranged within the closed over-carriage. The forward closing piece D^1 of the over-carriage merely serves for preventing entrance of dust and other foreign substances. As will be seen from the drawing, the rear bearing E^1 has a recess, the diameter of which is somewhat larger than that of the regulating piece P^1. The latter is mounted through the medium of threads upon the spring guide rod F^1 and in the horizontal position of the barrel, is removed from the disk which serves as an abutment a distance corresponding to the travel s, during which the accumulator must act against the barrel in order to give the latter the required running out velocity. Thus when the barrel is released for delivery of the shot, the forwardly acting spring pressure takes the barrel forward with an accelerating movement, while the rear spring pressure acts against the over-carriage. But as soon as the regulating piece impinges against the disk e^1, the rear spring pressure will be transferred to the spring supporting rod instead of to the over-carriage, and likewise act, naturally, toward the rear. But in this manner, the spring effect against

the barrel will be relieved and the barrel will then move forward without further driving impulse, until it has covered the distance $s+s^1$ and explosion has taken place. If in imparting elevation, a greater running-out speed is necessary, the regulating piece is screwed farther outward, and with the greatest elevation it can be turned outward until its distance from the disk e^1 is equal to $s+s^1$, whereupon the maximum running out velocity will exist. If it is desired to fire with small charges, or even with practice cartridges, the regulating piece must be screwed farther inward, in order to further reduce the distance, during which the accumulator may act. In this case, the thread must reach farther forward. That automatic adjustment through means of the elevating mechanism, or sighting device, can here take place, requires no further setting forth.

Instead of employing the forward regulating piece P alone, according to Fig. 1, or the rear regulating piece P^1 alone, according to Fig. 4, both may be made to work alike and at the same time. The result of this would be that after traveling the distance s, not only would the action of the spring power against the barrel not be removed, but a counter-force would be secured, which would seek to delay the barrel until explosion took place.

In the constructions introduced by Figs. 6 and 7, the striking piece h is again secured immovably. But instead of a spring accumulator, a rubber column C^2 adjusted for tension is employed. The forward end c^2 of the distended rubber column lies against the abutment E^2 rigidly connected with the over-carriage B^2, while the rear end $c^{2\times}$ of the rubber column is supported against the barrel extension a^2. Within the over-carriage is located a regulating disk J^2 which is guided on the inner surface of the over-carriage. The projection i^2 of the disk which moves in a slot b^2 of the over-carriage contains an internal thread, in which the conducting spindle K^2 mounted on the over-carriage engages. By rotating hand wheel L^2 rigidly attached to the conducting spindle, the disk can be moved forward and backward. The inner surface of the disk is so recessed that the barrel projection a^2 can pass unhindered. If the gun barrel is released from the loading and aiming position, the barrel will be accelerated forward correspondingly to the force of tension of the rubber exerted against the barrel projection a^2, until the rear end of the rubber column C^2 impinges against the rear rim of the regulating disk J^2. The rearward rubber pressure will then be transmitted to the over-carriage and the barrel will move without the influence of the accumulator, a farther distance forward until the trigger G strikes against the impact piece h, thereby producing the explosion. With the indicated horizontal position of the barrel, the distance s is necessary, through which the moving mass must travel before the rear end $c^{2\times}$ of the rubber column lies against the rear rim of the regulating disk J^2. But if firing takes place at the greatest angle of elevation, the regulating disk will be moved so far forward that the distance for the action of the accumulator can be raised to $s+s^1$, that is to say, the distance of the trigger G from the striking piece h. Instead of having, as shown in the drawings, only a comparatively slight movement of the disk, the construction can also be made in such a manner that the different charges, and even practice charges can be compensated for. Instead of the adjustment of the disk by hand, it can be done automatically.

Figs. 8 and 9 show an arrangement of the invention which likewise employs an immovable striking piece h, which serves a differential recoil gun having an air accumulator. The air cylinder B^3 serves simultaneously as the over-carriage, and for this purpose is provided with ribs b^3 b^3, upon which the barrel A with its claws a a slides. Upon the air cylinder is secured the striking piece h, which serves in the known manner for the impact of the trigger in igniting the charge. Behind the air cylinder piston C^3 is located the compressed air. On the forward side of the piston C is located the piston rod D, which, in the position of the parts illustrated in the drawing, lies with its forward end against the iron a^1 of the gun barrel. The piston rod is further provided with a shoulder d^3, which together with the regulating stop E^3 defines the length of travel during which the accumulator acts against the barrel. This regulating stop is provided with external threads and screws into the internal threads of the projection b^3 of the over-carriage B^3, so as to move forward and backward. Behind the regulating stop E^3 is an elastic buffer e^3 for the purpose of lessening the shock of the piston rod and piston imposed upon the shoulder d^3. If the barrel is released in the indicated horizontal position, the barrel will be accelerated forward by the air pressure transmitted through the piston, for a length of time until the piston rod shoulder d^3 strikes against the buffer e^3 of the regulating stop E^3, so that the forwardly exerted air pressure is taken up by the over-carriage B^3. The distance of this travel is s. After traveling the farther distance s^1 without any effect of the accumulator, the trigger G strikes against the impact piece h and the explosion of the charge is produced. In firing with the greatest angles of elevation, the regulating stop is screwed outward and forward such a distance that the accumula-

tor can act through a distance of $s+s^1$, and thereby produce the maximum running out velocity. In firing with the barrel depressed, the regulating stop is correspondingly screwed backward.

I claim:—

1. In a differential recoil gun having a recuperating accumulator, a member automatically coöperating with said recuperating accumulator during the last part of the running out of the gun barrel to arrest the acceleration of the gun barrel, said member being adjustable to modify the time of travel during which the accumulator acts acceleratively against the gun barrel.

2. In a differential recoil gun having a recuperating accumulator, a member adjustably arranged upon a part of the gun not partaking in the running out movement of the gun barrel and adapted to be brought into contact with the end of the accumulator actuated during the running out, and to cooperate with the accumulator to prevent it from longer accelerating the gun barrel after said accumulator end has been arrested by said member.

3. In a differential recoil gun having a recuperating accumulator, an adjustable member adapted to coöperate with said accumulator during the running out of the gun barrel to prevent the accumulator from longer accelerating the gun barrel, an elevating mechanism for the gun barrel, and a connection between the elevating mechanism and said adjustable member, positively adjusting said member so that the length of travel, during which the gun barrel will be accelerated, is increased with increasing elevation of the gun barrel.

The foregoing specification signed at Erfurt, Germany, this 6th day of May, 1910.

KONRAD HAUSSNER.

In presence of—
CHAS. BORNGRAEBER,
BERTICE B. BUSSER.