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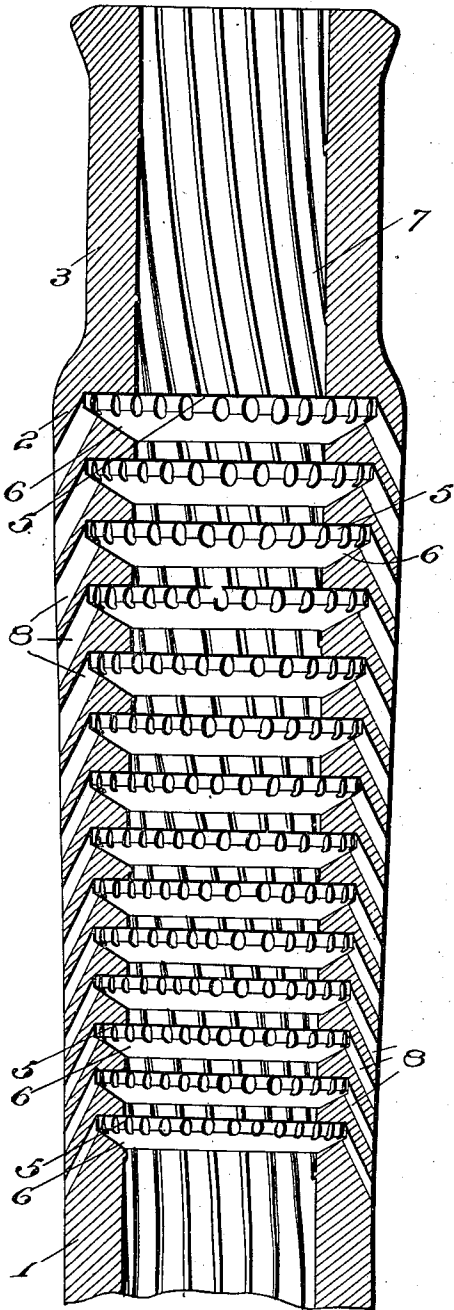
PATENTED MAR. 28, 1905.

S. N. McCLEAN.

DEVICE FOR COUNTERACTING RECOIL IN GUNS.

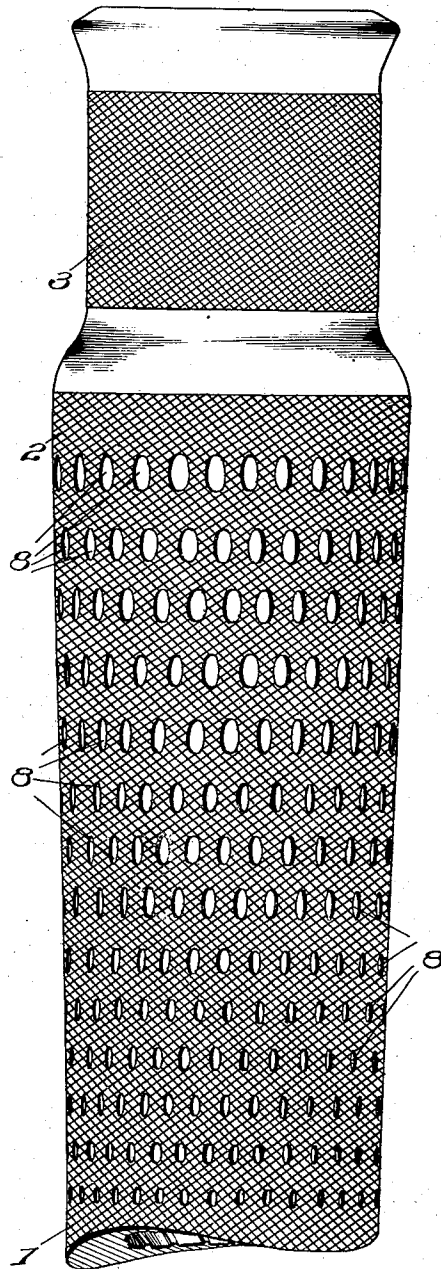
APPLICATION FILED JAN. 26, 1904.

2 SHEETS—SHEET 1.



Witnesses

Wm. H. H. H. H.
Wm. H. H. H. H.



Inventor

Fig. 2.

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by
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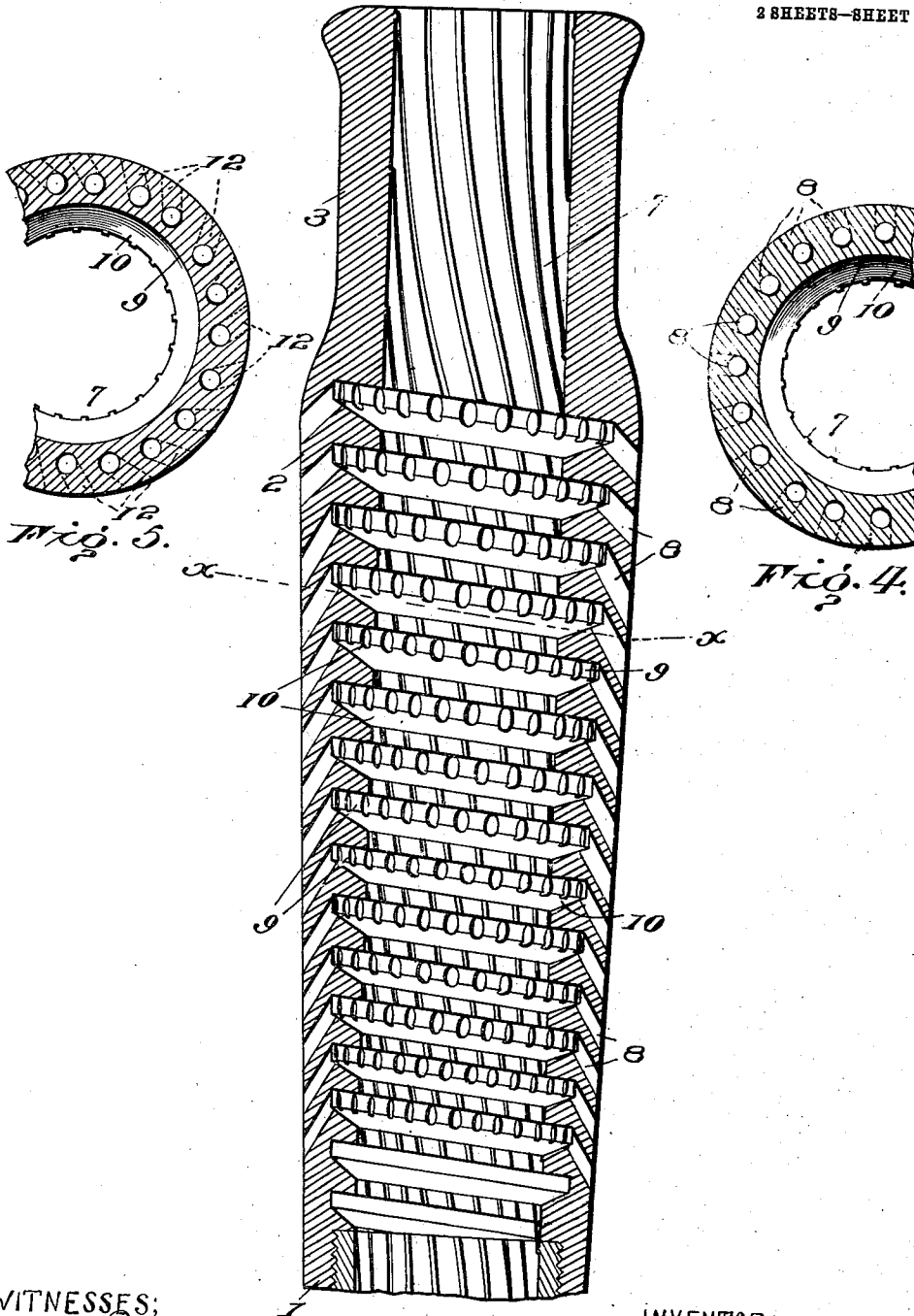
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2 SHEETS—SHEET 2.



WITNESSES;

Wm. H. Miller
Wm. H. Miller

Fig. 3.

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UNITED STATES PATENT OFFICE.

SAMUEL N. McCLEAN, OF CLEVELAND, OHIO.

DEVICE FOR COUNTERACTING RECOIL IN GUNS.

SPECIFICATION forming part of Letters Patent No. 785,973, dated March 28, 1905.

Application filed January 26, 1904. Serial No. 190,741.

To all whom it may concern:

Be it known that I, SAMUEL N. McCLEAN, of Cleveland, Ohio, have invented a new and useful Device for Counteracting Recoil, &c., in Guns, which invention is fully set forth in the following specification.

My invention relates to firearms, and more particularly to a construction of gun-barrel for utilizing the energy of the powder-gases to drive the projectile, oppose the recoil, and to control the powder energies for various other purposes in and about the gun.

The invention is applicable to all kinds of firearms, including hand and shoulder firearms, machine-guns, and ordnance.

In the common gun the powder-gases push the projectile through the barrel and escape at the muzzle, performing the sole function of driving the projectile, and the powder energies are dissipated in such manner as to produce a series of correlated and coacting strains which are injurious to the gun and its mount, with the associated structure, and involves complex and costly construction of great weight and difficult operation, with great danger of breakage and other injurious effects. The recoil of the gun is due in part to the reaction of the powder-gases between the gun and projectile and in part to the reaction of the powder blast between the gun and the air in front of the gun after the projectile leaves the gun.

For the purpose of overcoming the recoil in guns it has heretofore been proposed to attach a cap, nozzle, or other structure in front of the muzzle of the barrel, which structures are provided with openings for the passage of the projectile and a surface or surfaces against which the gases impinge after they escape from the muzzle of the barrel, said gases ultimately escaping in a forward or both forward and lateral direction. Such structures are open to several objections. Unless they are made so heavy as to be cumbersome they are liable to be blown off by the powder blast issuing from the muzzle of the barrel. Moreover, they perform their function after the projectile has left the muzzle of the barrel, and hence after the control of the projectile by the barrel itself has ceased, and as the

greatest violence of the recoil occurs at the instant when the projectile leaves the muzzle of the barrel it follows that these devices only serve to oppose rather than to prevent or reduce the amount of the recoil.

It is one object of the present invention to utilize the energy of the gases in opposition to the recoil and to also lessen the energy of recoil by diminishing that part of the recoil due to the reaction of the gases between the gun and the air in front of the muzzle.

With these objects in view the invention consists in the provision of means whereby the gases of discharge before they issue from the gun's muzzle may exert a portion of their energy in opposition to the recoil and at the same time have their tension, direction of movement, and velocity and quantity so controlled that the recoil due to the reaction of the gas which issues from the muzzle of the gun shall be minimized and the injurious blast of discharge eliminated.

More specifically stated, the invention consists in a gun-barrel formed to present on the interior walls of the barrel itself and to the rear of its muzzle a series of consecutively-arranged areas of resistance to the forward flow of the powder-gases, in association with a system of vents, also formed in the walls of the gun-barrel proper, for controlling both the striking energy and direction of movement of the powder-gases. The areas of resistance to the flow of the gases, as well as the vents associated therewith, are formed in the muzzle portion of the gun-barrel itself, (as contradistinguished from a structure carried in front of the barrel's muzzle; but said muzzle portion of the barrel may be either integrally formed with or detachably secured to the rest of the gun-barrel.

In the form of the invention chosen for illustration the gun-barrel is formed with a series of circumferential grooves or a gradually-deepening spiral groove on its interior, associated with a series of lateral rearwardly-inclined vents so constructed and proportioned that the gases shall impinge upon the surfaces of the grooves, and thus exert a pull in opposition to the recoil, and after impinging upon said surfaces the gases will escape

in a rearward direction through the vents, the resulting reaction of the vented gases upon the air offering a further opposition to the recoil. Moreover, this venting of the gases through the rearwardly-inclined lateral vents not only offers opposition to the recoil in the manner described, but also greatly decreases their quantity, tension, and velocity of movement, and hence the energy of the gases which issue from the gun's muzzle, and thereby greatly diminishes that portion of the recoil of the gun due to the reaction of the gases between the gun and the air in front of the gun. The grooves are preferably formed with their forward walls in planes substantially at right angles to the bore of the gun and their rear walls in planes oblique to the gun-bore and slanting forward and outward from the gun-bore toward the outer edge of the forward walls of the grooves. This enables the powder-gas to impinge upon the forward walls of the grooves with its maximum pulling power.

To secure the best results, the area of the vents associated with each groove or surface of resistance should bear such a relation to the area of resistance as to secure the desired striking energy of the powder-gases on the resistance-surfaces and the desired reaction of the gases escaping from the rearwardly-inclined vents, and at the same time obtain the requisite reduction in the quantity, velocity, and tension of the gases issuing from the muzzle to minimize the part of the recoil due to this cause.

Preferably the area of resistance is arranged so as to gradually increase from the rear toward the muzzle, the area of the vents associated with the resistance surface or surfaces increasing in the same way. Thus when the area of resistance takes the form of interior circumferential grooves the smallest or shallowest groove is the one farthest removed from the muzzle, and the grooves gradually increase in depth as the muzzle is approached. Also when the area of resistance is in the form of a continuous spiral circumferential groove its shallowest end is the one farthest from the muzzle, and it gradually increases in depth as it approaches the muzzle. In either of the forms of groove mentioned the deeper the groove the larger will be the combined area of the vents associated therewith. This results not only in the required reaction of the gases escaping from the vents to resist the recoil, but also in the reduction of the striking energy of the gases which eventually issue from the muzzle, so that the recoil due to this latter cause is largely eliminated, or if not eliminated is reduced to a point where it is easily controlled.

Referring to the accompanying drawings, which are intended merely to illustrate certain forms which the invention may assume, and not as defining its scope, Figure 1 is a cen-

tral vertical longitudinal section of the muzzle end of a gun-barrel with my invention applied thereto. Fig. 2 is a side elevation of Fig. 1, and Fig. 3 is a central longitudinal section of a modified form of the invention, while Figs. 4 and 5 are cross-sectional details.

Referring to Figs. 1 and 2, reference-numeral 1 indicates the muzzle end of the gun-barrel, which is preferably provided with walls gradually increasing in thickness from the rear part forward until it acquires its greatest thickness at 2, from which point the walls may, if desired, be made lighter, as shown at 3. A series of interior circumferential grooves 4 is formed in the walls of the muzzle portion of the barrel. The front faces 5 of each groove afford an area of resistance to the forward flow of the gas-current, and such faces 5 are preferably in planes substantially at right angles to the gun's bore, while the rear faces 6 are inclined forward and outward from the bore. It will be observed that the grooves 4 gradually increase in depth from the rear forward, whereby each groove offers a greater area of resistance to the flow of the gas-current than is offered by the groove immediately preceding it. Moreover, it will be noted that the gradual increase in the thickness of the walls of the gun guards against any undue weakening of the walls of the barrel by this increase in the depth of the grooves. Preferably the grooves do not extend to the extreme muzzle of the barrel, a portion 7 being left entirely free from grooves. Vents 8 are provided in the walls of the barrel and are symmetrically arranged in association with some or all of the grooves or areas of resistance and are inclined outward and rearward. As here shown, there are a number of these rearwardly-inclined vents symmetrically arranged in relation to each area of resistance 5; but manifestly some of these areas of resistance might be formed without the vents, if desired. Since the area of the vents associated with any given area of resistance should be proportioned thereto, it will be noted that the vents 8 gradually increase in size from the rearmost series forward. Moreover, for the purpose of distributing the gases escaping from all the vents over as wide a zone as possible the angle of inclination of the vents gradually increases from the rear forward, as is clearly shown in Fig. 1. The outward inclination of all the vents, however, is such as to leave a clear zone to the rear around the breech of the gun that will be free from the effects of the gases escaping through the vents. This effectually guards against any injury to the gunner from this source. Preferably the vents associated with one area of resistance are in staggered relation with the vents associated with the next area of resistance, so as to avoid weakening the walls of the gun-barrel to too great an extent along any given longitudinal line.

In Fig. 3 is shown a modification wherein the area of resistance to the forwardly-moving gas-current is secured by forming a circumferential spiral groove 9 of slight pitch on the interior of the bore of the gun. Preferably this groove is of gradually-increasing depth from its rearmost end forward, and the vents 8 associated therewith gradually increase in diameter from the rear of the groove forward. The front face 10 of the groove is formed to afford an effective area of resistance to the advancing gas-current, and the vents are to the rear of but in close proximity to this face and preferably are located along the groove of the rifling between the lands thereof, so that the action of the lands of the rifling upon the projectile shall not be interfered with. In Fig. 3 there is also shown a screw-thread 11, formed in a counter-bore at the rear of the area of resistance, whereby the muzzle portion 1 of the barrel may be detached from the main portion of the barrel for cleaning, inspection, &c., though this is not essential, as the muzzle portion 1 of the barrel may be separably connected to or integrally formed with the rest of the barrel, as desired.

As shown in Fig. 4, the inclined vents 8 are shown inclined outward from the gun's axis, but in a longitudinal radial plane passing through the walls of the gun-barrel, and when thus formed the reaction of the gases issuing from the vents will tend only to move the gun forward; but in Fig. 5 the vents 12 are not only inclined outward from the gun's axis, but are also oblique to a longitudinal radial plane passing through the walls of the gun, and in this case the reaction of the gases issuing from the vents 12 is not only in opposition to the recoil, but is also in opposition to the tendency of the gun-barrel to twist or turn under the influence of the rifling.

While the drawings herein show the vents as always associated with areas of resistance, it will be understood that this is not absolutely essential, as a part of the benefits of the invention would be obtained by the employment of areas of resistance disassociated from the vents, as well as the employment of vents which are not in immediate relation with the areas of resistance.

Preferably when vents are formed without the grooves constituting areas of resistance they are located to the rear of that part having grooves formed therein, thereby serving to utilize the energy of the gases before they reach that part of the barrel where the resistance areas of the grooves are utilized. Moreover, these vents thus formed to the rear of the grooves will also offer some resistance areas to the forward flow of the gases, as well as securing the advantages arising from the deflection, reversing, and reduction of the gas-current. It will also be understood that the portion 7, which is forward of the areas of resistance and vents, may be made longer or

shorter, as may be required, and that the length of said portion will determine the duration of time within which the gases shall act on the areas of resistance and the vents. In the arrangements of the vents of either character the interior ends of the vents preferably follow the rifle-grooves, as shown in Fig. 1, and when the areas of resistance are in the form of a continuous circumferential groove, as shown in Fig. 3, the vents are preferably arranged so as not only to follow the groove constituting the area of resistance, but the rifle-grooves as well, as will clearly appear from an inspection of Fig. 3.

While the vents as herein shown are arranged in series extending entirely around the barrel, it will be understood that the invention is not limited to this specific construction, as the vents may be and in some cases are arranged on the right and left hand sides of the barrel. In fact, the vents may be arranged in a variety of ways without departing from the fundamental principles of the invention.

While I have herein shown and described one form of the invention wherein the resistance areas are in the form of a spiral groove within the barrel, with vents associated therewith and leading through the walls of the barrel, the same is not specifically claimed herein, as such specific construction forms the subject-matter of a divisional application filed February 18, 1904.

What is claimed is—

1. A gun-barrel having interior circumferential areas of resistance to the flow of the gases of discharge and rearwardly-inclined lateral vents extending through the walls of the barrel from points adjacent to, but to the rear of said areas of resistance.

2. A gun-barrel having interior circumferential grooves and rearwardly-inclined lateral vents extending through the walls of the barrel from said grooves.

3. A gun-barrel formed with areas of resistance to the forward flow of the gases of discharge on its interior surface near, but to the rear of the muzzle, and rearwardly-inclined lateral vents extending through the barrel in proximity to said areas of resistance.

4. A gun-barrel formed with a plurality of grooves on its interior surface near, but to the rear of the muzzle, and rearwardly-inclined lateral vents extending through the barrel in proximity to said grooves.

5. A gun-barrel provided with a plurality of resistance-surfaces for the powder-gases, associated with a series of rearwardly-inclined lateral vents in proximity to said resistance-surfaces, the aggregate area of the several series of vents decreasing from the muzzle rearward.

6. A gun-barrel provided with a plurality of rearwardly-facing surfaces on its interior, and a plurality of rearwardly-inclined vents in proximity to said surfaces.

7. A gun-barrel having a plurality of rearwardly-facing surfaces disposed on its interior in planes substantially normal to the axis of the barrel, and a plurality of rearwardly-inclined vents in proximity to said surfaces.
8. A gun-barrel provided with a plurality of rearwardly-facing surfaces on its interior, and a plurality of rearwardly-inclined symmetrically-arranged vents in proximity to said surfaces.
9. A gun-barrel having a plurality of rearwardly-facing resistance-surfaces on its interior, the areas of the several surfaces decreasing from the muzzle rearward, and rearwardly-inclined vents in proximity to said surfaces.
10. A gun-barrel having a plurality of rearwardly-facing resistance-surfaces on its interior, the areas of the several surfaces decreasing from the muzzle rearward, and a plurality of rearwardly-inclined vents in proximity to said resistance-surfaces, the aggregate area of the vents associated with the respective surfaces decreasing from the muzzle rearward.
11. A gun-barrel having a plurality of annular rearwardly-facing surfaces on its interior, the area of each surface being less than that of the one in front of it, and a series of rearwardly-inclined vents located to the rear of each surface.
12. A gun-barrel having a plurality of annular rearwardly-facing surfaces on its interior, the area of each surface being less than that of the one in front of it, and a series of rearwardly-inclined vents located to the rear of each surface, the aggregate area of each series of vents being less than that of the series next in front of it.
13. A gun-barrel having a plurality of annular grooves formed on its interior near the muzzle, each of said grooves being of less depth than the one immediately in front of it, and the forward surface of the grooves being normal to the axis of the gun, while the rear surface is inclined at an angle thereto, and rearwardly-inclined vents in proximity to said surfaces.
14. A gun-barrel having a series of spirally-arranged rearwardly-inclined vents in the walls thereof.
15. A gun-barrel having a plurality of resistance-surfaces formed on its interior, and a spirally-arranged series of rearwardly-inclined vents each of which is in proximity to one of said resistance-surfaces.
16. A rifled gun-barrel having a plurality of resistance-surfaces formed on its interior, and a plurality of rearwardly-inclined vents in the walls of the gun opposite the grooves of the rifling.
17. A gun-barrel having several series of rearwardly-inclined vents formed in its walls, the vents of each series being symmetrically arranged in a plane at right angles to the bore of the gun.
18. A gun-barrel having several series of rearwardly-inclined vents formed in its walls, the angle of inclination of the vents of one series differing from the angle of inclination of the vents of another series.
19. A gun-barrel having a plurality of series of rearwardly-inclined vents formed in its walls, the angle of inclination of the vents of any series being less than the corresponding angle of the series of vents adjacent thereto on its muzzle side.
20. A gun-barrel having a series of rearwardly-inclined vents in the walls thereof, and a second series of rearwardly-inclined vents between the muzzle and the first-named series, the angle of inclination of the vents of the first series being less than that of the second.
21. A gun-barrel having its walls thickened near its muzzle portion and an interior circumferential groove formed in said thickened portion with lateral vents leading through said portion.
22. A gun-barrel having its walls thickened near its muzzle portion and an interior circumferential groove formed in said thickened portion with lateral rearwardly-inclined vents leading through said portion.
23. A gun-barrel having its walls gradually thickened near the muzzle and a series of interior circumferential grooves the grooves of the series gradually increasing in depth with the increase in the thickness of the walls, and lateral vents associated with said grooves, the cross-sectional areas of said vents gradually increasing as the thickness of the walls and the depth of the grooves increase.
24. A gun-barrel having a groove on its interior and a series of obliquely-inclined vents leading through the walls of the gun from said groove.
25. A gun-barrel having a groove on its interior and a series of rearwardly-inclined vents leading through the walls of the gun from said groove.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

SAMUEL N. McCLEAN.

Witnesses:

REEVE LEWIS,

GUSTAVE R. THOMPSON.