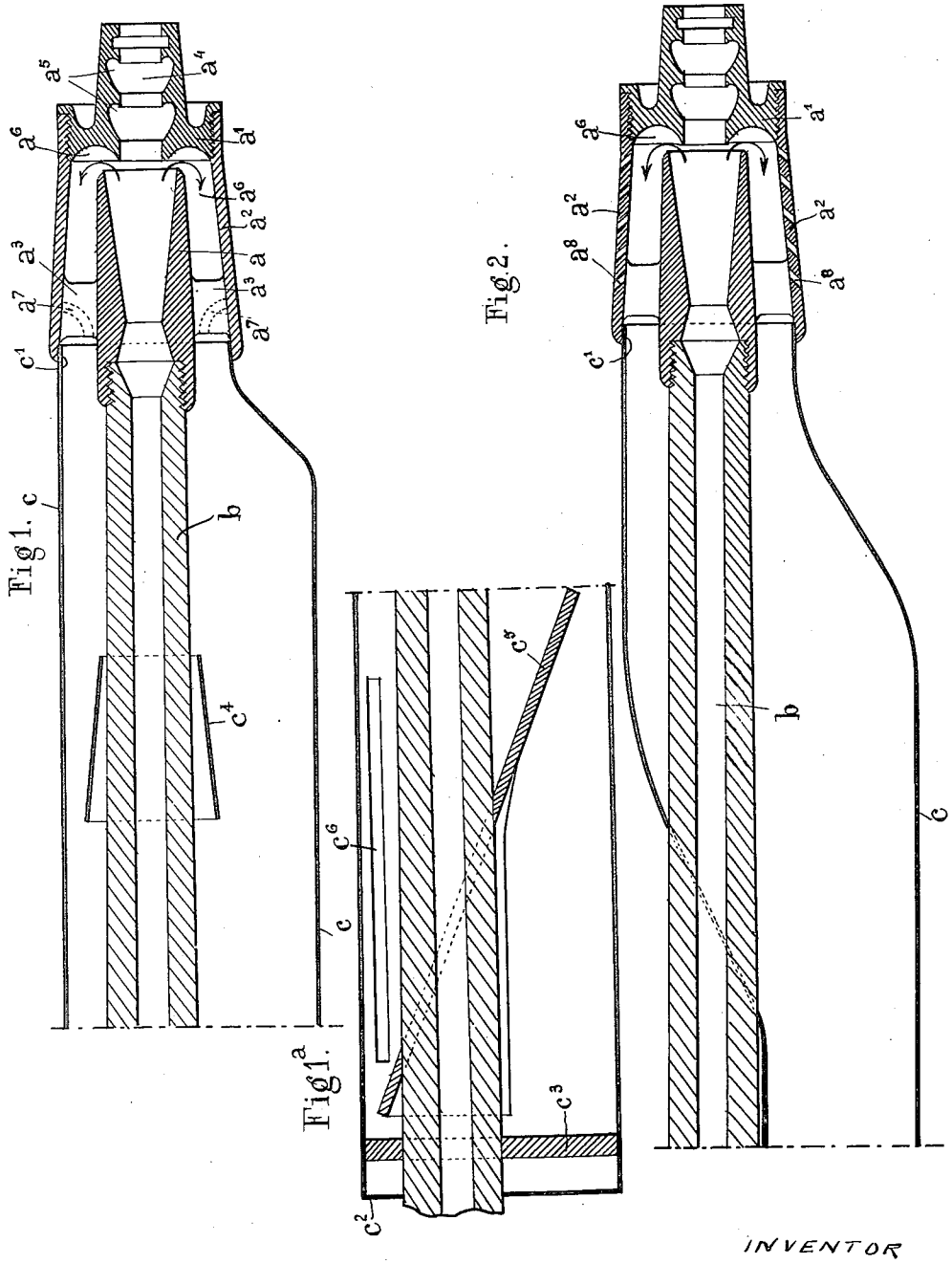
July 22, 1924. 1,502,558

N. J. A. GALLIOT

RECOIL ABSORBING MEANS FOR FIREARMS

Filed Nov. 1, 1921 2 Sheets-Sheet 1



INVENTOR

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BY Strauss and Strauss

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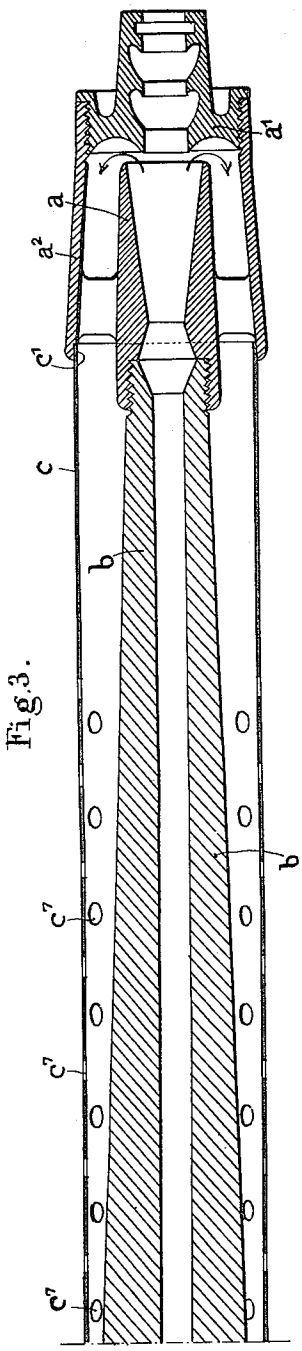

Fig.3.

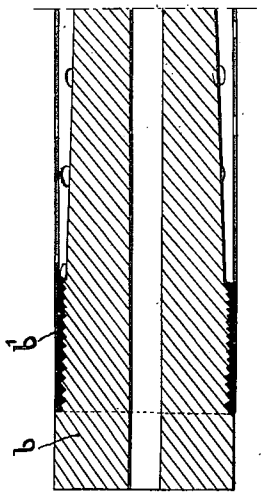

Fig.3a.

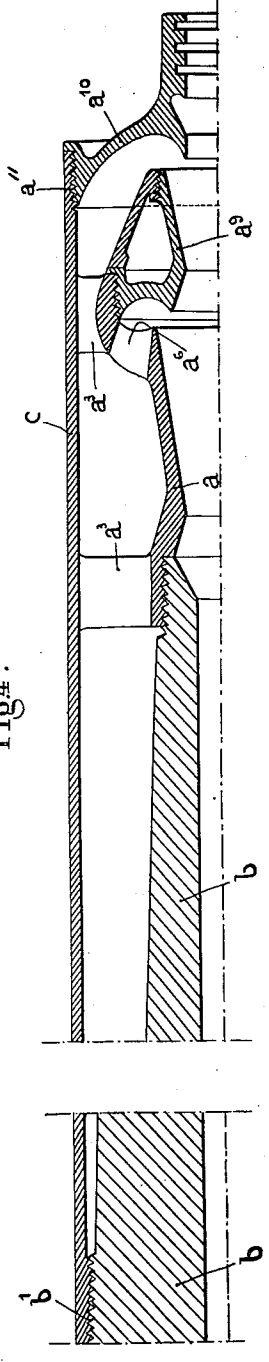

Fig.4.

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Patented July 22, 1924. 1,502,558

UNITED STATES PATENT OFFICE.

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RECOIL-ABSORBING MEANS FOR FIREARMS.

Application filed November 1, 1921. Serial No. 512,078.

To all whom it may concern:

Be it known that I, NORBERT JULES ANDRÉ GALLIOT, a citizen of the French Republic, and a resident of Vaucresson, Department of Seine-et-Oise, France, have invented new and useful Improvements in Recoil-Absorbing Means for Firearms, of which the following is a specification.

The present invention relates to improvements in a firearm provided with one or more recoil-absorbers of the type described in the United States Patent No. 1,333,402, dated March 9, 1920. Each of said recoil absorbers is mounted at the end of the barrel of the fire-arm, coaxially therewith, and rejects the gases of combustion in a backward direction. It comprises a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage, opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough.

The gases resulting from the combustion of the propellant, deflected by the recoil-absorber in a rearward direction, have retained a portion of their velocity, so that they constitute an inconvenience and even a danger for the personnel serving the fire-arm which is provided with the recoil absorber.

My present invention consists in the combination, in a fire-arm provided with one or more recoil-absorbers of the aforesaid type, of means placed behind said recoil absorber or absorbers for collecting substantially the whole of the gases escaping therefrom and for substantially completing the expansion of said gases, and of means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

There may also be provided means for silencing the expanded gases before their exit into the atmosphere.

More specifically, my invention consists in the combination in a fire-arm of a tube, forming a tubular collector and, if necessary, a silencer or expansion chamber, with one or more recoil-absorbers of the aforesaid type. This tube is connected directly to the discharge openings of the recoil-absorber or absorbers and is mounted either concentrically of the barrel or parallel to the latter, or at any suitable point and in any convenient direction, behind the muzzle of the weapon; this tube collects the whole, or at least the greater part, of the gases escaping from the recoil-absorber or absorbers after they have been utilized therein for breaking the recoil, and delivers them after as complete expansion as possible in a direction which is not dangerous for the personnel, thereby avoiding the injurious blast of gases upon the latter. When this tube is connected to an exhaust expansion chamber with or without a silencer device, it suppresses also the flash of the discharge and a great portion of the noise resulting from the direct escape of the gases to the free air.

It has already been proposed to utilize for the same purpose, a similar tube or sleeve in order to collect the back-blast from a recoil-reducing cap arranged at the front of the muzzle of the gun; but this recoil-reducing device consists of a single chamber or casing placed at the front of the gun. On the contrary, the recoil absorber according to the prior United States Patent No. 1,333,402 comprises a nozzle and a single reacter surface, of a shape affording a maximum transformation of the internal energy of the propellent gases into kinetic energy, and a maximum velocity and momentum of the gaseous streams at the moment of their exit from the recoil-absorber, without shocks or eddies.

This combination of the gas-collecting tube, forming a silencer or exhaust chamber, with the type of recoil-absorber according to the prior United States Patent No. 1,333,402, enables an extremely favorable result to be obtained.

Tests, made with a military rifle of the Springfield or United States Army type, provided with a device according to this invention, have shown not only a reduction of the recoil by 60 per cent, but also a reduction of the blast by 100 per cent, of the flash by 100 per cent, and of the travel of the report by 75 per cent.

The accompanying drawings represent

by way of example and in axial longitudinal section, different forms of construction of the invention.

Figs. 1 and 1^a are longitudinal sections through adjacent portions of the barrel of a fire-arm provided with my device;

Fig. 2 is a corresponding view of a modification;

Figs. 3 and 3^a are views similar to Figs. 1 and 1^a and show another modification; and

Fig. 4 is a longitudinal section through still another modification.

In said drawings Figs. 1 and 1^a represent the application of the present device to a military rifle. The recoil-absorber is of the type described and shown in the United States Patent No. 1,333,402, comprising a convergent-divergent nozzle a mounted immediately at the front end of the barrel b, and having an obturator a^1 affording the deflecting vanes, screwed upon an annular collecting tube a^2 secured to the nozzle a by suitably profiled arms a^3. Moreover, upon the axial passage a^4 into which the projectile enters at the centre of the vane-member a^1, there are formed in the known manner annular chambers a^5 having curved walls, this arrangement having been found effective for impeding the flow of the current of gas following the projectile, by the formation of eddying movements in this current of gas; the use of this last arrangement, not otherwise essential, has for object to ensure the rejection through the annular throat a^6 of the vane-member, that is to say in a backward direction, of the greatest possible proportion of the gases from the burnt charge, and to obstruct the flow of the very small portion which escapes through the central passage a^4 in the vane-member.

Upon the rear end of the recoil-absorber there is fitted at c^1 a metal tube c forming a silencer or expansion-chamber, arranged around the barrel b of the rifle and parallel to the latter; this tube collects the stream of gas which otherwise would tend to spread out into the atmosphere at the exit from the recoil-absorber, and conveys it in a cylindrical flow which is directed into the silencer or exhaust chamber c, like the exhaust gases of an explosion engine at leaving the manifold provided beyond the exhaust valves.

The tube c damps or muffles the gases rejected by the recoil-absorber, as a result of the expansion to which they are subjected in this tube. The latter surrounding the barrel b of the latter is closed at rear end as indicated at c^2 and is supported by the barrel by means of a distance piece c^3; this tube may contain baffles of any suitable shape, for instance a truncated conical baffle c^4 and the pallet-shaped baffle plate c^5, the latter directing the gases, which have expanded around the tube c, towards the exterior through one or more ports c^6. It is, however, to be noted, as regards the arrangement of the deflecting baffle c^5, in combination with the port c^6, that the reaction of the shock of the gases striking the pallet c^5, which deflects them upwards through the port c^6, tends to throw the weapon downwards; since the recoil tends on the contrary to raise the barrel, it results that the function of this baffle may thus be made useful in a favourable manner, at least for portable weapons.

In the arrangement illustrated, with the tube c surrounding the barrel b of the rifle, the silencer or expansion-chamber replaces the ordinary wooden stock of the gun, for a part or the whole of its length, without affecting either the balance of the weapon or its operation, or modifying materially its normal appearance.

This silencer or exhaust-chamber may be arranged so as not to be located for its whole length around the barrel b; such an arrangement is represented in the form of construction in Figure 2, which differs from the foregoing only by the fact that the tube c, connected to the recoil-absorber at c^1, is at first placed concentrically of the barrel b, then swept downwards and arranged below the barrel for the remainder of its length, parallel to the barrel or in any other manner. This arrangement allows improved cooling of the barrel of the rifle; but it may happen in certain cases that it is necessary to retain the exhaust chamber or tube c placed concentrically of the barrel b of the rifle, with risk of excessive heating of the latter; in such case, the escape of the gases of combustion from the recoil absorber into the tube c is made to serve to draw in a certain quantity of atmospheric air (by the draft of air produced by the escape of these gases) through one or more channels a^7, see Figure 1, formed in the thickness of the profiled arms a^3 of the recoil-absorber and communicating with the exterior.

Instead of delivering to the silencer the whole of the gases passing at a^6 from the guide-vanes of the recoil-absorbed, the duty of the silencer and therefore its size and weight may be reduced by allowing a portion of the gasses to escape into the atmosphere through ports formed in the tubular collector a^2 of the absorber; these ports, arranged either at right angles to the axis of the fire-arm or inclined in relation thereto, as shown at a^8 in Figure 2, are of comparatively small size so that the escape of the gases through these ports takes place without appreciable flash or report.

Figs. 3 and 3^a represent another form of construction, in which the tube c forming the silencer is arranged concentrically around the barrel b of the fire-arm; this

tube c is fitted at its front end at c^1 upon the recoil-absorber a, a^1 a^2, and at its rear end at b^1 upon the barrel; the tube c is pierced with a large number of small elliptical ports c^7 arranged in quincunx fashion, to allow the escape of the gases after their expansion in this tube, with a reduction of velocity and sound and without flash, in a direction where they cannot injure the personnel of the gun.

There may also be employed, as recoil-absorber, in combination with the silencer or projecting device above described a duplex-effect apparatus comprising two recoil-absorbers arranged in tandem. The tube c forming the silencer, and secured to the primary absorber by suitable profiled arms a^3, is screwed at its rear end at b^1 upon the barrel b of the gun; the vane-member a^{10} of the secondary absorber a^9 is screwed at a^{11} upon the front end of this tube, see Figure 4.

It will be understood that the forms of construction described above have been given given only by way of example and that there may be applied thereto a great number of modifications without departing from the principle of the invention, which consists in the fact of connecting directly to the recoil-absorber a tubular collector acting in the same way as the exhaust collectors of explosion engines, and having for object to trap the gases used by the recoil-absorber for the braking action and then rejected in a backward direction by the said recoil-absorber, instead of allowing these gases to expand immediately into the atmosphere in a stream with eddying or divergent currents, so as then either to be merely diverted in a direction non-injurious for the personnel, for example by introducing a bend in the collector, before being rejected to the atmosphere, or alternatively and preferably to be passed into a silencer device which may be formed by the collector itself or by an apparatus like the expansion-chambers employed upon automobiles. This silencer arranged behind the muzzle of the gun, expands the gases used by the recoil-absorber, and then rejects them almost without velocity and therefore without noise or flash and without any injurious effect upon those serving the gun.

What I claim is:

1. In a fire-arm, the combination of a barrel and of a recoil absorber mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage, opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with means arranged behind said recoil absorber for collecting substantially the whole of the gases escaping from said recoil absorber and being of sufficient size to permit substantially complete expansion of said gases, and means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

2. In a fire-arm, the combination of a barrel and of a recoil absorber, mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with a tube associated with said barrel and arranged behind said recoil absorber to collect substantially the whole of the gases escaping from said recoil absorber and being of sufficient size to permit substantially complete expansion of said gases, and means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

3. In a fire-arm, the combination of a barrel, and of a recoil absorber mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage, opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with a tube arranged concentrically of said barrel behind said recoil absorber to collect substantially the whole of the gases leaving said absorber and being of sufficient size to permit substantially complete expansion of said gases, and means for allowing said

gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

4. In a fire-arm, the combination of a barrel and of a recoil absorber mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with a tube arranged concentrically of said barrel behind said recoil absorber and supported on the one hand by said absorber and on the other hand by said barrel for collecting substantially the whole of the gases escaping from said absorber and being of sufficient size to permit substantially complete the expansion of said gases, and means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

5. In a fire-arm, the combination of a barrel and of a recoil absorber mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with a tubular collector placed behind said recoil absorber to collect substantially the whole of the gases escaping from said recoil absorber and being of sufficient size to permit substantially complete expansion of said gases, silencing means in said tubular collector, and means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

6. In a fire-arm, the combination of a barrel and of a recoil absorber mounted at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, said recoil absorber comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with a tubular collector placed behind said recoil absorber to collect substantially the whole of the gases escaping from said absorber and being of sufficient size to permit substantially complete expansion of said gases, openings in said tubular collector for allowing said gases after substantially complete expansion to escape into the atmosphere, and deflecting means within said tubular collector for diverting said expanded gases towards said openings.

7. In a fire-arm, the combination of a barrel and a plurality of recoil absorbers mounted one behind the other at the end of said barrel coaxially therewith and rejecting the gases of combustion in a backward direction, each of said recoil absorbers comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage, opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the escape of gases therethrough, together with means arranged behind said recoil absorbers for collecting substantially the whole of the gases escaping from said absorbers, and being of sufficient size to permit substantially complete expansion of said gases, and means for allowing said gases after substantially complete expansion to escape into the atmosphere, in a direction non-injurious to the personnel.

8. In a fire-arm, the combination of a barrel and a plurality of recoil absorbers arranged one behind the other at the end of said barrel coaxially therewith, and rejecting the gases of combustion in a backward direction, each of said recoil absorbers comprising a nozzle coaxial with the gun muzzle and arranged in extension thereof, said nozzle being of divergent shape toward its outer end to afford an expansion chamber, an end closure for the nozzle having a central opening for the passage of the projectile therethrough, and a single annular gas escape passage opening from the interior to the exterior of the nozzle, said passage being of increasing cross section toward its discharge end to accelerate the es-

cape of gases therethrough, together with a tubular collector placed behind said recoil absorbers to collect substantially the whole of the gases escaping from said recoil absorbers and being of sufficient size to permit substantially complete expansion of said gases, silencing means in said tubular collector, and means for allowing said gases after substantially complete expansion to escape into the atmosphere in a direction non-injurious to the personnel.

In testimony whereof I have signed my name to this specification.

NORBERT JULES ANDRÉ GALLIOT.

Witnesses:

F. ARMENGAUD AÎNÉ,

W. DEFERRIMONT.