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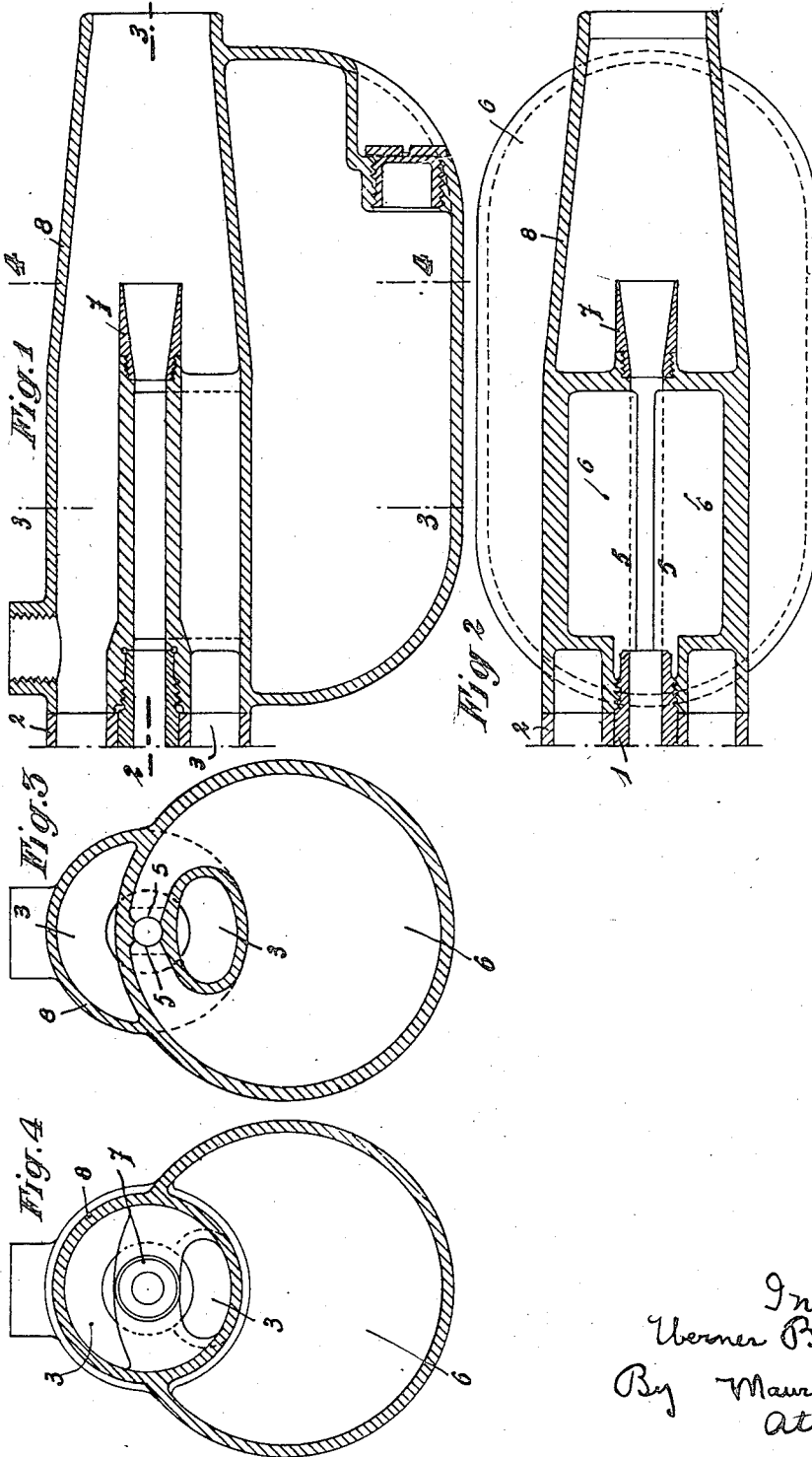
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2,042,449

QUICK FIRING ARM

Filed Jan. 28, 1933

2 Sheets-Sheet 1



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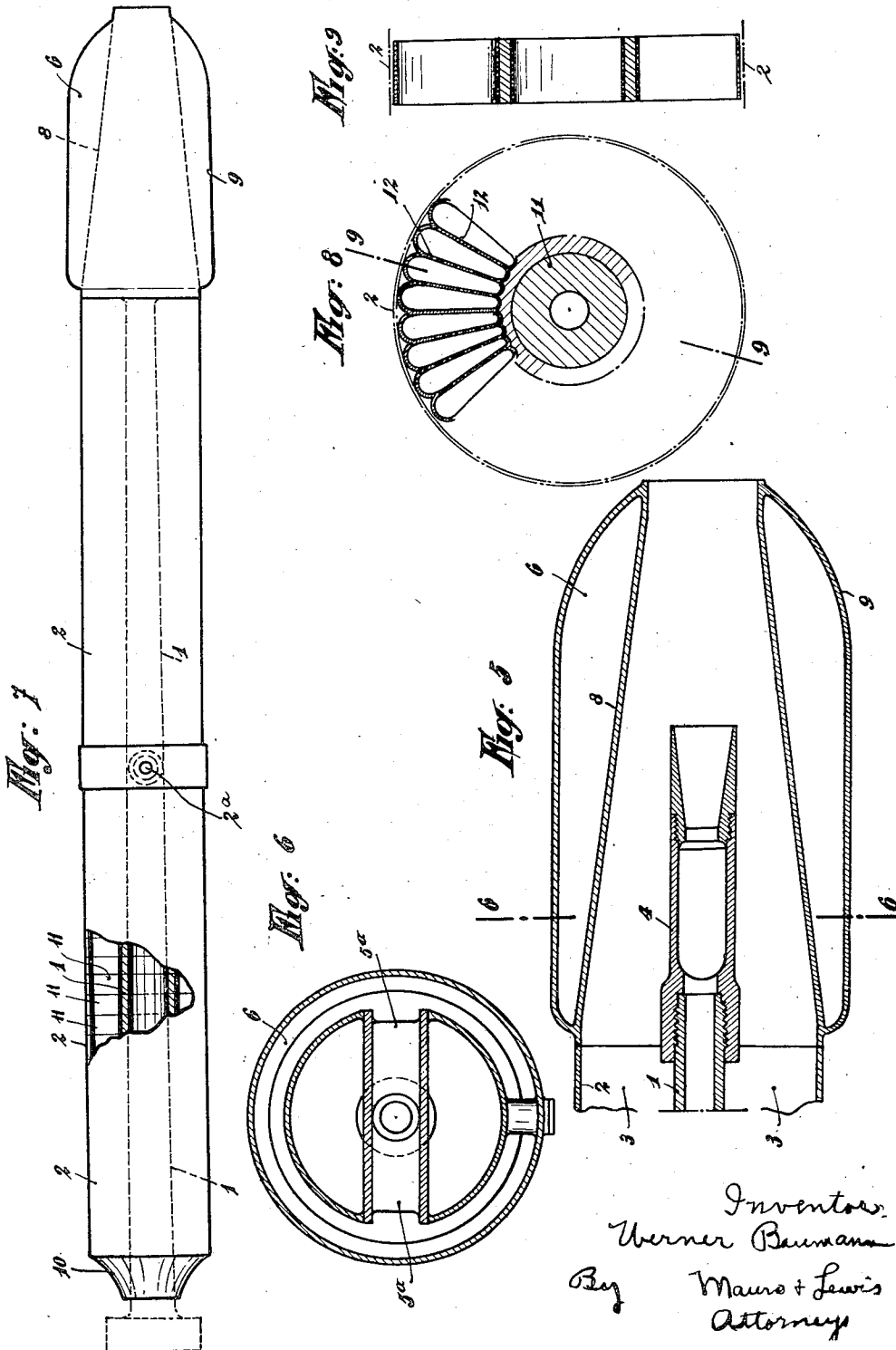
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UNITED STATES PATENT OFFICE

2,042,449

QUICK FIRING ARM

Werner Baumann, Paris, France

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9 Claims. (Cl. 89—14)

The present invention concerns a cooling arrangement for quick-firing arms (machine-guns, rifles, guns, etc.).

Up to the present time, the barrels of quick-firing arms (machine-guns) were water-cooled, or said barrels were made interchangeable, or again said barrels were made very thick and they were provided with cooling fins. All these systems have very serious drawbacks. In the first place, water is not always available, and in this case, a normally water-cooled arm is very quickly out of action. The use of interchangeable barrels limits too much the number of shots that may be discharged without interruption. Finally, the use of very thick barrels, even when they are provided with cooling fins, does not afford a sufficient cooling effect.

The object of my invention is to provide a cooling device for quick-firing arms that is free from all these drawbacks.

To this effect, I make use of atmospheric air as a cooling agent.

The essential feature of my invention is that I make use of the wasted energy of the discharge, which is about one third of the total energy produced, for circulating the cooling atmospheric air through a system of fins in intimate contact with the barrel or integral therewith. According to my invention, it is possible to recover a part of said energy and to utilize it owing to the arrangement, at the end of the barrel of the arm, of a chamber which causes the gases to expand a first time, and of an ejector-nozzle of a known type, which produces a second expansion of said gases and further determines the suction necessary for circulating the cooling air about the barrel.

If the gases were allowed to escape directly the suction that would be produced by the ejector would be extremely strong, but it would last for only one hundredth of one second, approximately. Its previous expansion into an intermediate chamber reduces the intensity of the suction action but causes it to last for about from one and a half to two tenths of one second for small arms and more for guns. Due to the quick firing of the arm there is thus produced a continuous and intensive flow of air along the cooling surfaces in contact with the barrel of the arm.

The advantages of such a device will be readily understood. First of all, as atmospheric air is always available, there is no risk whatever of the arm becoming disabled through loss of cooling fluid. Furthermore, as the temperature of atmospheric air is relatively constant, the tempera-

ture of the barrel takes a value that will never be exceeded, even in the case of a prolonged fire, which is particularly advantageous for practical purposes. Besides, it will be noted that it is possible to determine said maximum temperature by suitably choosing the material of which the cooling device is made and the dimensions of the parts. Finally the two expansions to which the escaping gases are subjected and their mixing with atmospheric air in the nozzle reduce considerably the noise produced by the firing of the arm and the flames that escape therefrom.

Preferred embodiments of my invention will be hereinafter described, with reference to the accompanying drawings, which are given merely by way of example, and in which:

Fig. 1 is a partial longitudinal sectional view of an embodiment of the cooling device according to my invention, said device being fitted to the end of the barrel of a quick-firing arm;

Figs. 2, 3, 4 are sectional views on the lines 2—2, 3—3, 4—4 respectively of Fig. 1;

Fig. 5 is a longitudinal sectional view of another embodiment of my invention;

Fig. 6 is a sectional view on the line 6—6 of Fig. 5;

Fig. 7 is an elevational view of an arm provided with the cooling device according to my invention, a part of the outer casing being cut away;

Fig. 8 is a detail front view; and

Fig. 9 is a sectional view on the line 9—9 of Fig. 8.

The barrel 1 of the arm is surrounded with a sleeve 2 which forms, along and around the barrel, an annular space 3 in which a stream of cooling air is caused to flow, under the effect of the suction created by the exhaust gases through means that will be hereinafter described. At the end of the barrel there is screwed a tubular body 4 the inner diameter of which is sufficiently large for allowing the projectile to pass freely and which communicates through two lateral ports 5, 5, with a closed chamber 6 of relatively large volume. Tubular body 4 is provided at its end with a divergent nozzle 7 which forms, with a convergent nozzle 8 provided at the end of sleeve 2, a kind of ejector. The exhaust gases penetrate through ports 5, 5 into chamber 6 where they expand, while remaining at a pressure higher than atmospheric pressure. It follows that their flow through divergent nozzle 7 is slower than their flow through the mouth of the barrel 1 and therefore lasts for a longer time. In the course of said flow, the gases undergo a second expansion,

which is utilized for drawing air from the atmosphere through sleeve 2, owing to the ejector-like structure formed by nozzles 7 and 8, thus circulating through sleeve 2 a stream of air which 5 cools the barrel. In arms that fire very quickly, for instance in machine-guns, revolver-guns, etc., it is possible, with my device, to obtain a nearly continuous stream of cooling air.

It should be well understood that the embodiment of my invention that has just been described 10 has been given merely by way of example and could be modified without departing from the principle of my invention. For instance, in the embodiment of Figs. 5 and 6, the intermediate expansion chamber 6 consists of an annular space 15 limited by convergent nozzle 8 disposed at the end of sleeve 2 and by an outer casing 9. With this arrangement, the whole of the apparatus forms a body of revolution about the axis of the barrel. Chamber 6 communicates with tubular body 4 20 screwed at the end of the barrel through two conduits 5a, which open on either side of body 4.

Fig. 7 shows an arm provided with the apparatus of Figs. 5 and 6. It will be seen from that 25 Figure 7 that sleeve 2 extends along the whole length of the barrel of the arm and that it is provided, on the side of the breech of the latter, with openings 10 for the inflow of air. At 2a, said sleeve is provided with a tube for the outlet 30 of a certain portion of the gases, for instance for the automatic working of the arm.

In order to improve the cooling of the barrel I have found it advantageous to provide annular space 3 with longitudinal partitions which 35 consist of metallic fins in contact with the barrel or integral therewith. This arrangement can be obtained by slipping over the barrel a plurality of annular members 11 of the type shown in Figs. 8 and 9, said members being provided with fins 40 12, which are placed in line with one another when said annular members are added.

While I have described, in this specification, what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto 45 as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of my invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. A cooling device for quick firing arms which comprises in combination, a sleeve surrounding said arm open at one end to the atmosphere, a 55 cylindrical body adapted to be fixed to the end of said arm, a chamber connected with the inside of said cylindrical body along an intermediate portion thereof but without direct communication with said sleeve, a nozzle fixed to the end of said sleeve and opening into the atmosphere, and a 60 nozzle fixed to the outer end of said cylindrical body and opening substantially coaxially into said first mentioned nozzle, whereby the exhaust gases escaping through the second mentioned nozzle cause a stream of cooling air to flow through said sleeve. 65

2. A cooling device for quick firing arms having at least one barrel, which comprises in combination, a sleeve surrounding said barrel open to 70 the atmosphere at one end, a cylindrical body adapted to be fixed to the end of said barrel, and provided with at least one longitudinal port, a chamber rigidly fixed to said body and connected with said ports, a convergent nozzle fixed to the 75 other end of said sleeve and opening into the

atmosphere, and a divergent nozzle fixed to the outer end of said cylindrical body and opening substantially coaxially into the first mentioned nozzle, whereby the exhaust gases escaping through the second mentioned nozzle cause a 5 stream of cooling air to flow through said sleeve.

3. A cooling device for quick firing arms having at least one barrel, which comprises in combination, a sleeve surrounding said barrel open to the atmosphere at one end, a convergent nozzle 10 fixed to said sleeve at the other end thereof, a cylindrical body fixed in said sleeve adapted to be screwed at the end of said barrel, and provided with at least one longitudinal port, a chamber fixed to the under part of said sleeve and 15 connected with said ports, and a divergent body fixed to the outer end of said cylindrical body and opening substantially coaxially into the first mentioned nozzle, whereby the exhaust gases escaping through the second mentioned nozzle cause a 20 stream of cooling air to flow through said sleeve.

4. A cooling device for quick firing arms having at least one barrel, which comprises in combination, a sleeve surrounding said barrel open to the atmosphere at one end, a convergent nozzle 25 fixed to said sleeve at the other end thereof, a cylindrical body coaxially fixed in said sleeve adapted to be screwed to the end of said barrel and provided with at least one longitudinal port, a chamber coaxially surrounding said sleeve and 30 connected with said port, and a divergent nozzle fixed to the outer end of said cylindrical body and opening substantially coaxially into the first mentioned nozzle, whereby the exhaust gases escaping through the second mentioned nozzle cause a 35 stream of cooling air to flow through said sleeve.

5. A device for cooling the barrel of a quick firing arm, which comprises in combination, a chamber communicating with the inside of said barrel for allowing the powder gases to expand 40 into said chamber down to a pressure higher than atmospheric pressure, discharge means between said chamber and the atmosphere, including a passage of restricted section of flow, for keeping the pressure in said chamber above 45 atmospheric pressure for a predetermined time after the passage of a projectile through said barrel, and air conveying means opening directly at both ends into the atmosphere and distinct from said chamber and said discharge 50 means for leading air along said barrel from the rear part thereof to a point close to said discharge means, whereby the jet of outflowing gases issuing through said discharge means induces a stream of cooling air through said air 55 conveying means.

6. A device for cooling the barrel of a quick firing arm, which comprises in combination, a chamber communicating with the inside of said barrel for allowing the powder gases to expand 60 into said chamber down to a pressure higher than the atmospheric pressure, discharge means between said chamber and the atmosphere, including a passage of a section of flow approximating the section of flow through said barrel, 65 for keeping the pressure in said chamber above atmospheric pressure for a predetermined time after the passage of a projectile through said barrel, and air conveying means opening directly at both ends into the atmosphere and distinct from said chamber and said discharge 70 means for leading air along said barrel from the rear part thereof to the end thereof, the outlet end of said air conveying means coaxially surrounding said discharge means, whereby the jet 75

of outflowing gases issuing through said discharge means induces a stream of cooling air to flow through said air conveying means.

5 7. A device for cooling the barrel of a quick firing arm, which comprises in combination, a chamber communicating with the inside of said barrel for allowing the powder gases to expand into said chamber down to a pressure higher than atmospheric pressure, a nozzle connecting
10 said chamber to the atmosphere, and the minimum section of which approximates the section of flow through said barrel, a sleeve surrounding said barrel and open at the rear to the atmosphere, and a nozzle connecting the front end
15 of said sleeve to the atmosphere coaxially surrounding said first mentioned nozzle, said sleeve and said second mentioned nozzle being distinct from, and unconnected with, said chamber, whereby the jet of outflowing gases issuing
20 through said first mentioned nozzle induces a stream of cooling air to flow through said sleeve and said second mentioned nozzle.

8. A device for cooling the barrel of a quick firing arm, which comprises in combination, a
25 chamber communicating with the inside of said barrel for allowing the powder gases to expand into said chamber down to a pressure higher than atmospheric pressure, a divergent nozzle

connecting said chamber to the atmosphere, a sleeve surrounding said barrel and open at the rear to the atmosphere, and a convergent nozzle connecting the front end of said sleeve to the atmosphere coaxially surrounding said first
5 mentioned nozzle, said sleeve and said convergent nozzle being distinct from, and unconnected with, said chamber, whereby the jet of outflowing gases issuing through said first mentioned nozzle induces a stream of cooling air to
10 flow through said sleeve and said second mentioned nozzle.

9. A device for cooling the barrel of a quick firing arm, which comprises in combination, a sleeve surrounding said barrel and open at the
15 rear end to the atmosphere, a chamber communicating with the inside of said barrel at a small distance from the end thereof but without direct communication with said sleeve, a nozzle at the front end of said sleeve opening into the
20 atmosphere, and a nozzle connected with the end of said barrel and opening coaxially into said first mentioned nozzle close to the open end thereof, whereby the jet of outflowing gases issuing through said second mentioned nozzle in-
25 duces a stream of cooling air to flow through said sleeve and said first mentioned nozzle.

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