Aug. 16, 1938. S. H. MacGREGOR 2,126,792

COOLING APPARATUS

Filed March 2, 1938

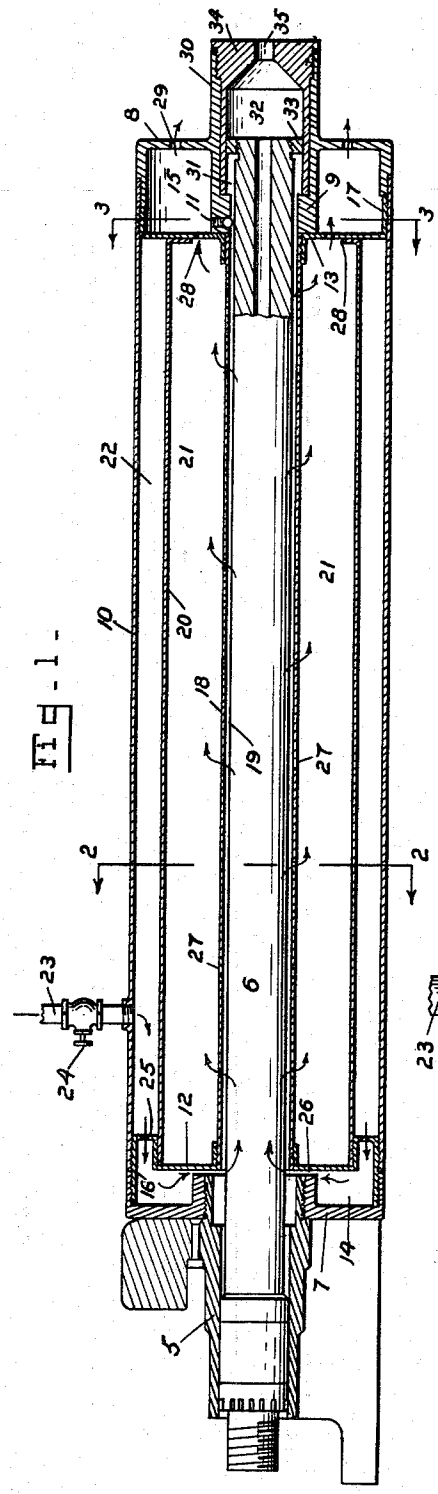


Fig. 1.

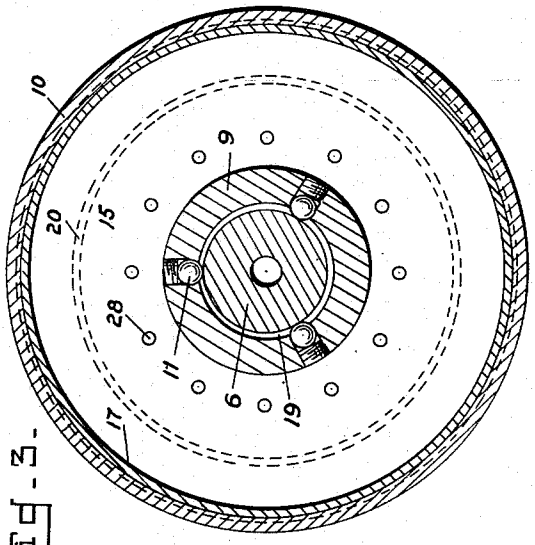


Fig. 3.

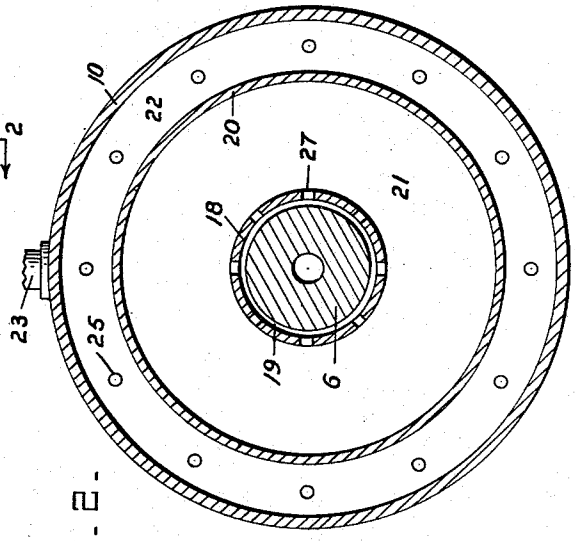


Fig. 2.

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COOLING APPARATUS

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Application March 2, 1938, Serial No. 193,535
3 Claims. (Cl. 89—14)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to a cooling apparatus.

The general purpose of the invention is to provide an apparatus in which cooling is accomplished by expansion of a compressed gas. More particularly the invention resides in an arrangement of cylinders disposed concentrically about a member to be cooled and providing firstly for expansion of the gas in an outer chamber, secondly for heating and recompression of the gas in an inner chamber where the gas is in contact with the member to be cooled, and thirdly for expansion of the gas into an intermediate chamber.

A further object of the invention is to provide a specific arrangement for a gun barrel in which the cooling influence is extended to the ends of the barrel.

To these and other ends, the invention consists in the construction, arrangement and combination of elements described hereinafter and pointed out in the claims forming a part of this specification.

A preferred embodiment of the invention illustrated in connection with a gun barrel, is shown in the accompanying drawing, in which,

Fig. 1 is a longitudinal sectional view of the improved cooling apparatus applied to a gun barrel.

Figs. 2 and 3 are sectional views on the corresponding lines of Fig. 1.

Referring to the drawing by characters of reference there is shown a support 5 which is a part of the receiver of a machine gun of the Browning type and which slidably mounts the rear end of a gun barrel 6. The support 5 carries a jacket comprising a rear end plate 7 threaded on the support 5, a front end plate 8 having a bearing 9 for receiving the muzzle end of the barrel, and an outer cylinder 10 associated with the front and rear plates. The bearing 9 preferably carries anti-friction contact elements, specifically balls 11, for engaging the gun barrel in rear of its muzzle.

Within the jacket and associated therewith are a rear header plate 12 and a front header plate 13 spaced respectively from the rear end plate 7 and front end plate 8 and establishing a rear chamber 14 and a front chamber 15. For convenience in assembling the rear header plate 12 has a flange 16 threaded to both the rear end plate 7 and the cylinder 10 while the front header plate 13 has a flange 17 threaded to the cylinder 10. The header plates carries a pair of concentric cylinders, the inner cylinder 18 being spaced from the gun barrel to provide an annular chamber 19 and the intermediate cylinder 20 being preferably disposed closer to the outer cylinder 10 and cooperating with the inner and outer cylinders to respectively provide an annular inner expansion chamber 21 and an annular outer expansion chamber 22.

A supply line 23 including a cut-off valve 24 is provided for admitting a gas, such as carbon dioxide, into the outer expansion chamber 22. Ports 25 in the rear header plate 12 enable the gas to flow into the rear chamber 14 which has communication with the chamber 19 by means of a restricted passage 26 which is conveniently provided by spacing the header plate from the front face of the support 5. The inner cylinder 18 is formed with small ports 27 leading into the expansion chamber 21. The front header plate which abuts or is secured to the bearing 9 is provided with ports 28 for conducting gas from the expansion chamber into the front chamber 15; and the front end plate has vents 29.

A tubular extension 30 is formed on the front end plate in prolongation of the bearing 9 and cooperates therewith in establishing an expansion chamber 31 for the gases of the propellent charge which issue from the muzzle of the barrel. This chamber contains a liner 32 within which a ring 33 on the muzzle of the gun barrel is slidably received. When the gun barrel is in its normal in battery position its front end is approximately in line with the front end plate 8.

A plug 34 on the outer end of the liner and provided with a bullet opening 35 serves to baffle a portion of the escaping gases of discharge and to build up pressure in the expansion chamber 31 which acts on the front face of the barrel and on the ring 33, and supplements the force of recoil in moving the barrel rearwardly and insuring proper functioning of the various parts of the machine gun.

When the gun is being fired the barrel rapidly attains a temperature which is greater than desired and which interferes with successful operation. In order to cool the barrel, gas under pressure is admitted into the outer expansion chamber 22 where it expands and thus has its temperature lowered. The gas passes through the ports 25 into the rear chamber 14 and then through the restricted passage 26 to the annular chamber 19 and into contact with the hot gun barrel. While in the chamber 19 the temperature of the gas is

raised and its pressure consequently increased. As the gas expands it passes through the small ports 27 into the cylinder 18 and enters the chamber 21 where its expansion results in a reduction of temperature. The gas in flowing towards the ports 28 to be relieved through the vents 29 tends to cool the inner cylinder 18 and the intermediate cylinder 20 and the gas contained in the chambers 19, 21, 22. The gas in the front chamber 15 extends its cooling influence to the bearing 9, to the muzzle of the barrel and to the liner 32 of the expansion chamber 31. A portion of the gas flows past the balls 11 and directly contacts the muzzle of the barrel.

I claim:

1. In a gun, a support, a barrel mounted in the support and projecting therefrom, a cooling apparatus for the barrel including an outer cylinder having a rear end plate mounted on the support and a front end plate with a bearing for receiving the muzzle of the barrel, rear and front header plates within the outer cylinder and spaced from the rear and front end plates to establish a rear and a front chamber, an inner cylinder fixed to the header plates and spaced from the barrel to establish an annular chamber in communication with the rear chamber, an intermediate cylinder fixed to the header plates between the inner and outer cylinders and establishing therewith an inner and an outer expansion chamber, ports in the rear header plates to establish communication between the outer expansion chamber and the rear chamber, ports in the inner cylinder, ports in the front header plate to establish communication between the inner expansion chamber and the front chamber, means for venting the front chamber to atmosphere, and means for admitting a compressed gas to the outer expansion chamber.

2. In a cooling apparatus, a member to be cooled, an outer cylinder having rear and front end plates receiving the member to be cooled, rear and front header plates within the outer cylinder and spaced from the rear and front end plates to establish a rear and a front chamber, an inner cylinder fixed to the header plates and spaced from the member to be cooled to establish an annular chamber, an intermediate cylinder fixed to the header plates between the inner and outer cylinders and establishing therewith an inner and an outer expansion chamber, ports in the rear header plate to establish communication between the outer expansion chamber and the rear chamber, ports in the inner cylinder, ports in the front header plate to establish communication between the inner expansion chamber and the front chamber, means for venting the front chamber to atmosphere, and means for admitting a compressed gas to the outer expansion chamber.

3. In a cooling apparatus, a member to be cooled, a jacket surrounding the member to be cooled and including an inner cylinder spaced from the member to be cooled, an outer cylinder and an intermediate cylinder cooperating with the inner and outer cylinders to establish respectively an inner and an outer expansion chamber, means for admitting a compressed gas to the outer expansion chamber, means for conducting gas from the outer expansion chamber to the space between the inner cylinder and the member to be cooled, means for conducting gas from said space to the inner expansion chamber, and means for venting the inner expansion chamber.

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