No. 864,534. PATENTED AUG. 27, 1907.

N. E. HARRIS.

AIR COOLED ENGINE.

APPLICATION FILED DEC. 2, 1904.

Fig. 1.

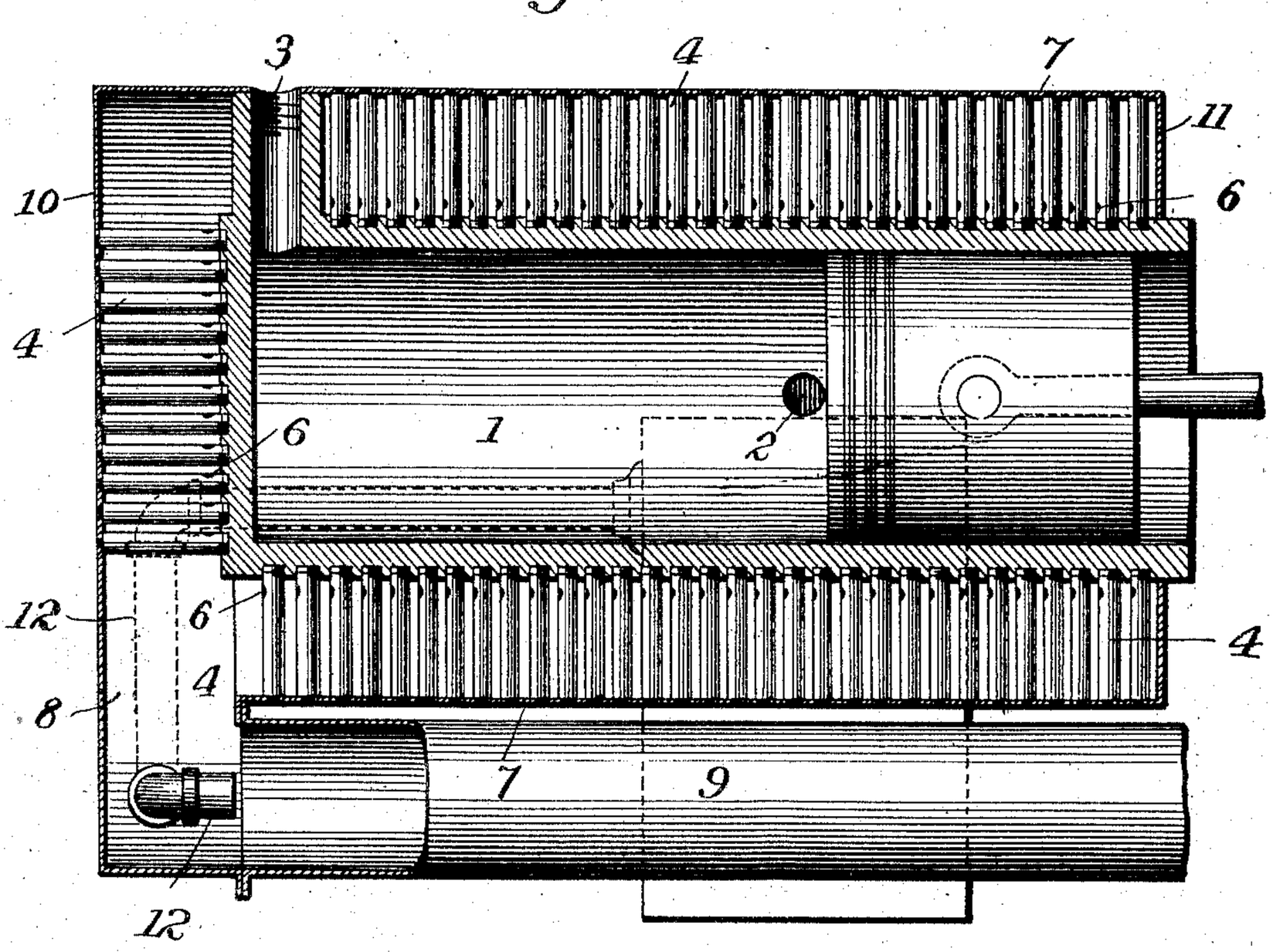


Fig. 2.

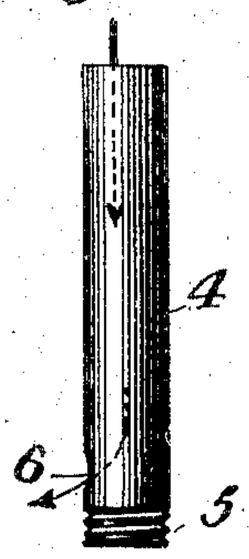
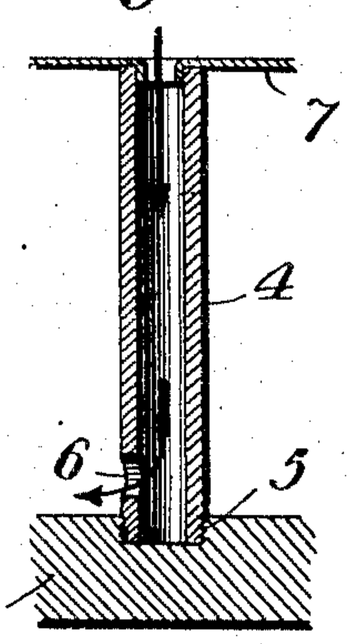


Fig. 3.



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UNITED STATES PATENT OFFICE.

NEVILLE E. HARRIS, OF PORT HURON, MICHIGAN.

AIR-COOLED ENGINE.

No. 864,534. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed December 2, 1904. Serial No. 235,186.

To all whom it may concern:

Be it known that I, NEVILLE E. HARRIS, a citizen of the United States, residing at Port Huron, county of St. Clair, State of Michigan, have invented certain new and useful Improvements in Air-Cooled Engines, of which the following is a specification.

The present invention relates to improvements in means for cooling the cylinders of explosive engines, and has for its object, first, to provide a greatly increased radiating surface for the cylinder; and, secondly, to provide means by which the exhaust from the cylinder of an explosive engine will be caused to maintain about the cylinder during the operation of the engine a constant cooling air current as distinguished from an intermittent current operating only at or immediately following each action of the exhaust.

In the accompanying drawing,—Figure 1 is a sectional view through the cylinder of an explosive engine constructed in accordance with the present invention; Fig. 2 is a detail elevation, on an enlarged scale, of one of the radial ducts or tubes through which the air current passes; Fig. 3 is a sectional view of one of said tubes.

Referring to the drawings, 1 designates the cylinder of an explosive engine which may be of any type or style. As the present invention is applicable to any form of explosive engine, it has not been thought necessary to illustrate in complete detail the means for supplying the explosive charges to the cylinder or exhausting therefrom the gases resulting from an explosion, but merely to show, conventionally, an exhaust port 2 and inlet 3.

Secured to and projecting radially from the side walls and head of the cylinder 1 are a series of tubes 4. These tubes may be of any suitable diameter and length. Preferably, in order to obtain a maximum radiation with economy of space, they are provided with a bore or passage about three-sixteenths of an inch in diameter, the outside diameter of the tubes being about three eighths of an inch and their length not exceeding two inches. Said tubes are arranged relatively close together, every four occupying about one square inch of surface on the cylinder wall. Said tubes are firmly connected at their inner ends with the wall or head of the cylinder, preferably by having a threaded section 5 screwed into suitable sockets formed in the cylinder and in each tube, near the inner end thereof is formed a lateral aperture or perforation 6.

The cylinder provided, as above described, with the radially projecting, laterally apertured, tubes is inclosed within a suitable casing or jacket 7 provided with suitable openings with which the outer ends of the radial tubes 4 communicate. Said casing is of greater length than the engine cylinder and projects beyond the head thereof to form a chamber 8, through, or across which the tubes 4 secured to the cylinder head extend and with which chamber communicates the draft duct or pipe 9 through which the exhaust is finally discharged. The ends of said casing or jacket 7 are closed by walls 10, 11. The draft- or exhaust-discharge, pipe 9 is arranged in the most convenient location for the type of the engine with which it is employed and the exhaust from the cylinder 1 is conveyed to said draft pipe through a pipe 12 leading from the port 2, or srom a muffler connected with said port, to the chamber 8 and having its discharge end near the inner end of and in line with said draft pipe.

When the engine is running the escape of the exhaust from the cylinder 1, through the draft pipe 9 acts to draw a current of air through each of the tubes 4 from the outer end thereof and through the casing or jacket 7 and chamber 8. The radially projecting tubes are so arranged that the openings 6 near the inner ends thereof, face the closed end or head of the cylinder 1, and the current of air created as aforesaid thus passes over the inner and outer surfaces of each tube 4 as well as over the inner surface of the casing 7 and the wall and head of the engine cylinder. The course of the air through each of the tubes 4 is indicated by the arrow in Fig. 2. In thus passing longitudinally of the casing 7 and throughout the length of each of said tubes the air takes up the heat radiated from the cylinder 1 and communicated to said tubes and effectually prevents over-heating of the cylinder.

In order that the circulation of air through the casing 7 and about the engine cylinder may be continuous while the engine is operating, the draft pipe is, in the embodiment of the invention shown in Fig. 1, of such length that, with the engine running at a slow speed, the length of time required for an exhaust impulse to traverse said tube will be greater than that elapsing between discharges through the port 2. Therefore a constant suction, or partial vacuum, is maintained in the draft pipe 9 when the engine is working. The cross sectional area of the draft pipe should not be less than one fourth the cross sectional area of all of the radiating tubes in order to obtain the best results.

It will be seen that fresh air, or air from the outside of the casing or jacket 7, is supplied directly to every point at which heat is radiated from the cylinder and as such circulation is continuous and rapid and covers every portion of heat radiating surface, there being from twelve to eighteen square inches of such radiating surface for every square inch of cylinder surface, the cylinder is kept cool at all times. The circulation of air through the tubes near and on the cylinder head is necessarily stronger than at the other end so that the cooling effect is greatest adjacent the hottest parts of the cylinder.

Referring to Fig. 1 it will be seen that the free end of the exhaust pipe 12 does not extend into the draft

pipe 9 but terminates some distance beyond the end thereof. This arrangement as it provides no obstruction whatever within the draft pipe or at the mouth thereof permits the passage of a maximum quantity of air through said pipe and, as before pointed out, the current introduced through the tubes 4 is strongest in or through those tubes connected with the cylinder head, or the hottest part of the cylinder, and the current passing through the other tubes is of gradually less intensity as the distance of the tube from the cylinder head is increased.

As is well known, the cooling effected by the passage of a current of air over a heated surface depends directly upon the amount of fresh air which is employed. In order to obtain the best results a continuous and definite current of fresh air must reach all parts of the radiating surface; and this is accomplished by the relative arrangement of the several tubes, the exhaust nozzle and the draft pipe.

The advantages of the invention will be readily understood. It provides for effectually cooling the cylinder of an explosive engine, without the necessity of employing any pump, fan, or other means requiring special power to actuate them. It is equally applicable to engines of any type and the cooling effect is controlled and regulated by the amount of work which the engine is accomplishing at any particular time. That is, the strength of the cooling air current depends only on the strength of the exhaust, and therefore as the exhaust increases in strength, the strength of the cooling air current is proportionately and correspondingly increased. This feature renders the invention particularly applicable for use with explosive engines for automobiles, as the strength of the cooling air current does not depend upon the speed with which the vehicle moves, but is controlled, as above pointed out, directly by the speed at which the engine is running. Therefore in climbing hills, for instance, where the vehicle is moving relatively slow, although the engine is possibly operating at its maximum speed, there is no danger of the cylinder becoming overheated,

Another great advantage of the invention is the fact that it does not undesirably increase the size of the engine cylinder to which it is applied. By this invention also the radiating coils, pipes, pumps, etc., required in water cooled engines are dispensed with and there are no moving parts to get out of order and require repair.

It will be understood that the accompanying illustration is more or less conventional and only intended to represent such an embodiment of the invention as will disclose the operation thereof; and that said invention may be applied to any style or construction of explosive engine.

What I claim is:—

1. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding the cylinder and inclosing the head thereof, a plurality of tubes extending from the sides and head of the cylinder to said casing and communicating with apertures in the casing, each of said tubes having a lateral opening therein, and means for causing the exhaust from the cylinder to create a current of air through said casing and tubes.

2. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding the cylinder and extending beyond the head thereof, a plurality of tubes having their inner ends connected with the head and sides of the cylinder and extending therefrom to said casing said tubes communicating with apertures in the casing or jacket, a discharge pipe communicating with the chamber formed between the casing and the cylinder head, and an exhaust pipe opening into said discharge pipe.

3. The combination with a cylinder of an explosive engine of a casing or jacket surrounding the cylinder and extending beyond the head thereof, a plurality of tubes extending from the sides of the cylinder, and transversely to the axis thereof, to the sides of the jacket and communicating with openings therein, a second group of tubes extending from the face of the cylinder head to the end of the jacket covering such head, and communicating with openings therein, each tube having a lateral opening adjacent the cylinder wall, and means for maintaining a constant current of air through said tubes.

4. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding said cylinder, a plurality of tubes having their inner ends secured to the cylinder and their outer ends communicating with openings in said casing, each of said tubes having a lateral aperture therein between the cylinder and casing, and means for causing a current of air to pass through each of said tubes and the casing.

5. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding said cylinder and extending longitudinally beyond the head or closed end thereof, the ends of said casing or jacket being closed, a plurality of tubes having their inner ends secure to the side walls and head of the cylinder and their outer ends communicating with openings in said casing, each of said tubes having an aperture in the wall between the cylinder and casing, a draft pipe communicating at one end with the section of said casing that projects beyond the head of the cylinder, and a duct connected with the exhaust port of the cylinder and adapted to discharge the exhaust products into the draft pipe, said draft pipe being of such length that the time required for an exhaust impulse to traverse it is greater than that elapsing between the discharges from the exhaust port of the cylinder, whereby continuous and definitely directed currents of fresh air are maintained over all the radiating surfaces.

6. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding said cylinder and inclosing the head thereof, a plurality of tubes having their inner ends secured to the side walls of the cylinder and the head thereof and their outer ends communicating with openings in said casing, each of said tubes having an aperture in its wall between the cylinder and casing, a draft pipe communicating at one end with the section of the casing that projects beyond the head of the cylinder, and a duct connected with the exhaust port of the cylinder and adapted to discharge the exhaust products into said draft pipe, the communication of the draft pipe with the projecting end of the casing being such that the currents induced through the tubes are strongest in those tubes connected with the cylinder head.

7. The combination with a cylinder of an explosive engine, of a casing or jacket surrounding said cylinder, a plurality of tubes having their inner ends in contact with the cylinder and their outer ends communicating with openings in said casing, each of said tubes having a lateral aperture therein between the cylinder and casing, and means for causing a current of air to pass through each of said tubes and the casing.

8. The combination with a cylinder of an explosive engine, of a plurality of tubes projecting from and having their inner ends connected with the head and sides of the cylinder, and means for maintaining a constant circulation of air through all of said tubes while the engine is running, the air current passing through each tube being independent of that acting on any of the other tubes.

9. In an internal combustion engine; the combination with a cylinder and cooling jacket therefor, of a plurality of tubular radiator members extending across the jacket transversely to the cylinder axis and engaging the cylinder walls at their inner ends, the outer ends of said radiator members being left open.

10. The combination with a cylinder of an explosive engine, of a jacket surrounding said cylinder and extending longitudinally beyond the head or closed end thereof, the ends of said casing or jacket being closed, a plurality of tubes connected with the side walls and head of the cylinder and communicating with openings in said casing, each of said tubes having an aperture in its wall between the cylinder and casing, a draft pipe communicating at one end with the section of said casing that projects beyond the head of the cylinder, and a duct connected with an exhaust port of the cylinder and extending into said section of the casing beyond the cylinder head, the free end of said duct terminating in alinement with but outside of said draft pipe, substantially as and for the purpose described.

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

NEVILLE E. HARRIS.

Witnesses:
FRANK R. WATSON,
ANNA MOORE.