No. 835,277. PATENTED NOV. 6, 1906.

L. A. FRAYER & W. J. MILLER.

AIR COOLING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED JAN. 11, 1905.

2 SHEETS—SHEET 1.

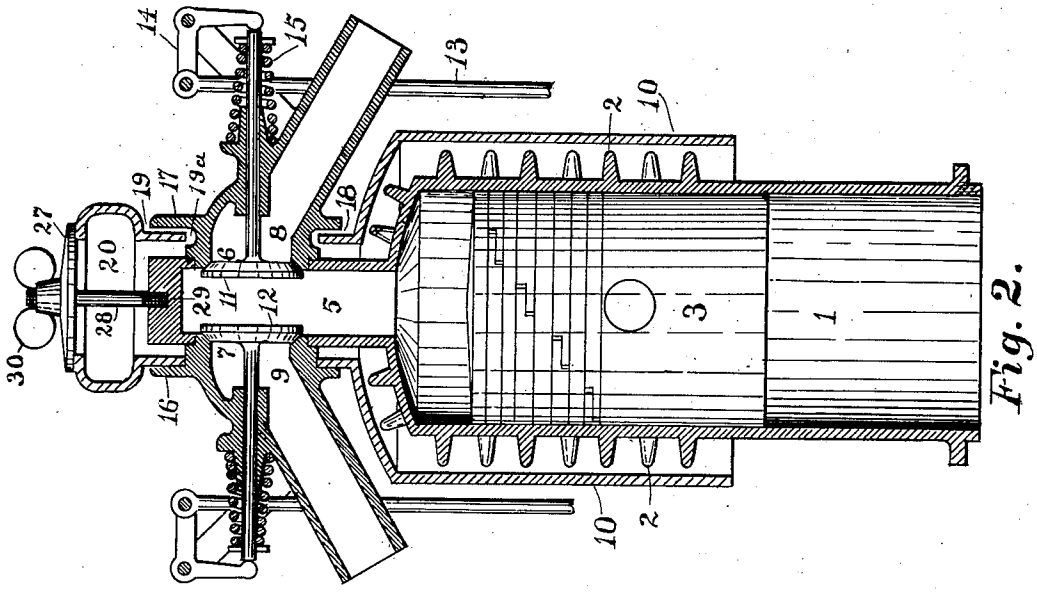

Fig. 2.

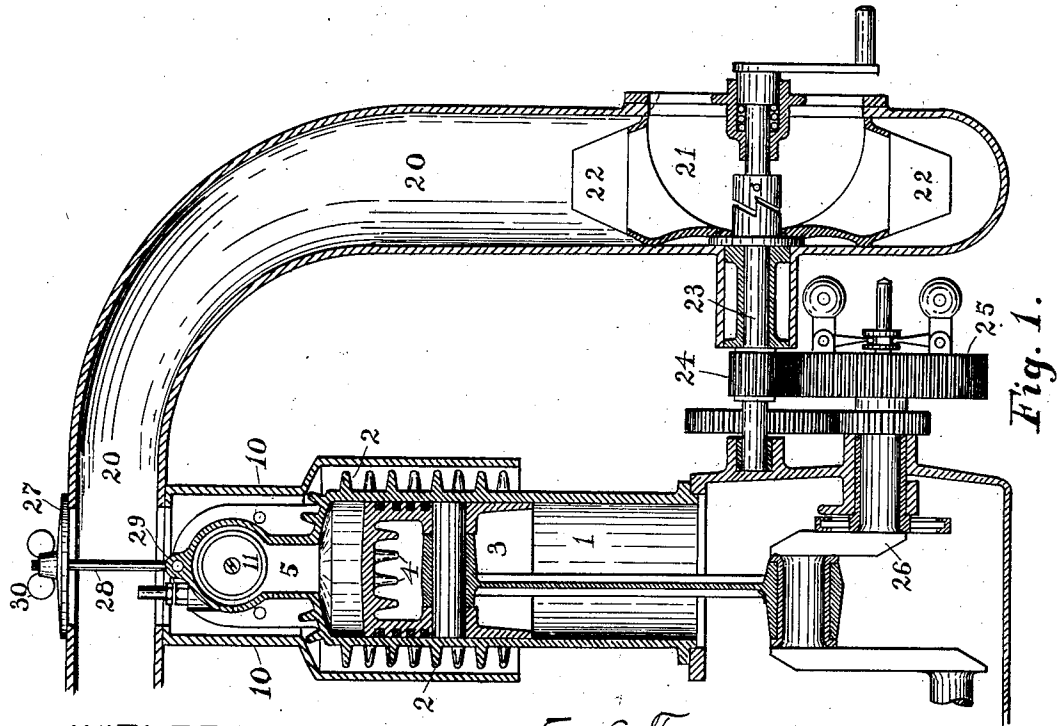

Fig. 1.

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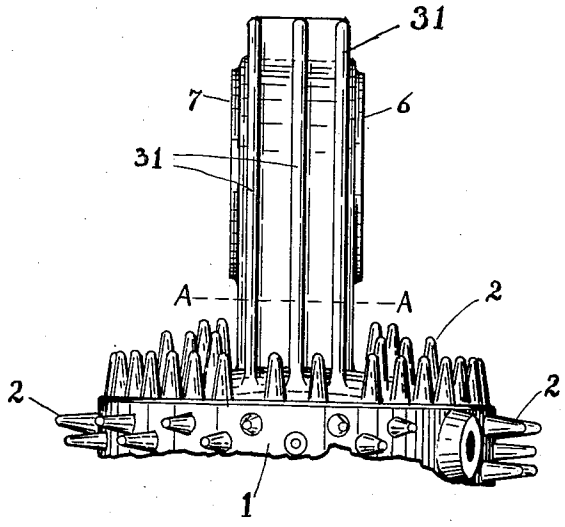

Fig. 3.

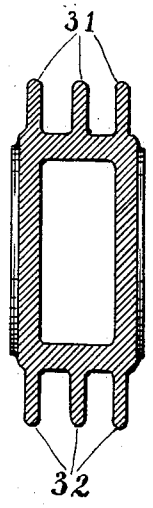

Fig. 4.

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UNITED STATES PATENT OFFICE.

LEE A. FRAYER AND WILLIAM J. MILLER, OF COLUMBUS, OHIO, ASSIGNORS TO THE OSCAR LEAR AUTOMOBILE COMPANY, OF COLUMBUS, OHIO, A CORPORATION OF OHIO.

AIR-COOLING DEVICE FOR EXPLOSIVE-ENGINES.

No. 835,277. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed January 11, 1905. Serial No. 240,569.

To all whom it may concern:

Be it known that we, LEE A. FRAYER and WILLIAM J. MILLER, citizens of the United States, residing at Columbus, in the county of Franklin, in the State of Ohio, have invented certain new and useful Improvements in Air-Cooling Devices for Explosion-Engines, of which the following is a specification.

Our invention relates to air-cooling devices for explosion-engines, especially those used in the operation of automobiles; and it consists in the various devices and arrangement of parts hereinafter set forth.

We provide a narrow vertical chamber in the head of the cylinder, in the walls of which, directly opposite each other, we place inlet and exhaust valves, so that the cooling charge drawn in by the downward stroke of the piston may pass directly against and around the exhaust-valve and valve-chamber which, it is well understood, are the parts most intensely heated in the operation of an explosion-engine. Extra precaution must be taken not only to direct all the cooling forces possible thereon, but also to provide that as little as possible of the air which has served to cool the exhaust-valve chamber may be drawn down over the cylinder-head. This renders it advisable, therefore, to provide means for communicating with the surrounding atmosphere without first passing over the head of the cylinder. We provide upon the exterior of the above-mentioned narrow chamber corrugations extending vertically along the front and back thereof. Difficulty is also experienced in the heating of the piston-head, the center of which is subjected to excessive heat. Various devices have been suggested for removing this difficulty; but we prefer to remedy it by placing on the under side of the piston-head spines cast thereon, which greatly increase the radiating surface and in practice are found to produce the desired effect.

Our improved device will now be described, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional side view. Fig. 2 is a sectional front view. Fig. 3 is a front view of the combustion-chamber, showing the corrugations, and Fig. 4 is a section along the line A A of Fig. 3.

Like numerals of reference designate similar parts throughout.

In the accompanying drawings, 1 is a cylinder provided upon the circumference and upper part with spines 2.

3 is the piston, carrying upon the inside of the head spines 4. The object of the latter is to produce a greater cooling-surface. Opening into the head of the cylinder is a combustion-chamber 5, in the opposite walls of which are openings 6 and 7, communicating with the exhaust-valve chamber and intake-valve chamber, respectively. A casing 10 is adapted to be slipped down over the combustion-chamber and cylinder-head and contains openings 8 and 9, which are brought into register with the openings in the combustion-chamber. The intake and exhaust valve chambers are then inserted through these openings and secured in place to communicate with the cylinder through the combustion-chamber.

The chamber 5 is narrow, as stated, and when the exhaust-valve 11 and the inlet-valve 12 are seated the distance between them is very slight, being just great enough to permit them to perform their function. The charge drawn in through the intake-valve by the descent of the piston is a cool mixture, and owing to the proximity of the exhaust-valve it will travel against and be drawn around the same, thereby producing a desirable cooling effect upon the exhaust-valve.

The valve 11 is operated by means of a cam-actuated push-rod 13, the bell-crank lever 14, and the spring 15 in a manner readily understood. Valve 12 is operated in a similar manner.

It will be observed that the metal casing fits close against the shoulder 16 of the intake-valve chamber, whereas the shoulder 17 of the exhaust-valve chamber is positioned at a short interval from the casing, as appears at 18 and 19. At 19^a is shown an annular channel on the circumference of the exhaust-valve chamber, which permits air forced down through the inside of the casing to travel over and around said valve-chamber and out through the wall of the casing. The speed at which the air travels causes it to seek an exit at all points of this annular channel, and it therefore passes into the

surrounding atmosphere in all directions between the casing and the shoulder on the exhaust-valve chamber. The air driven down from above, as hereinafter shown, passes down over the exhaust-valve chamber and the narrow vertical chamber, a portion passing downward over the cylinder proper, the remainder passing out through the annular channel 19[a] and the space indicated at 18 and 19 between the casing and the shoulder into the general body of the surrounding atmosphere. This provision for the escape of the heated air on all sides of the exhaust-valve chamber is of the greatest importance, and when utilized in connection with the provision for cooling the exhaust-valve by the downward current of the driven air and the incoming charge of the explosive mixture, as shown above, the difficulty hitherto experienced in cooling explosion-engines by air is obviated. Therefore practice shows that an engine constructed and arranged as ours is can be operated continuously and successfully, so far, at least, as any difficulty due to the excessive heating of the parts is concerned.

The casing 10 is fitted over the upper part of the cylinder, so as to leave a larger open area for the passage of air on the side of the chamber 5 to which the exhaust-valve chamber is attached, and in consequence of this arrangement a larger volume of air is brought into contact with the parts subjected to the greatest heat.

The casing 10 at its lower extremity communicates with the outer atmosphere and at the top with the air-pipe 20. Located in an enlarged portion 21 of the air-pipe 20 is a blower 22, driven at a high rate of speed through gearing operated from the prime moving shaft, as shown at 23, 24, 25, and 26.

A detachable plate 27 in the upper side of the pipe 20 is held in place by the rod 28 engaging the combustion-chamber at 29 and carrying a wing-nut 30 at its outer end. When the plate 27 is removed, ready access to the combustion-chamber and the sparking device is provided. 31 and 32 indicate the corrugations on the front and rear of the combustion-chamber, whereby a greater surface is exposed to the cooling effect of the air-current.

The drawings show only one cylinder by way of illustration; but it will be understood that our improved devices for cooling are adapted to be used on any number of cylinders that may be employed in the operation of the car.

Suppose that the engine is started. The blower actuated through the gearing connection will be driven at a high rate of speed, and a current of air will be forced inward through the pipe 20. It will travel along until it reaches the casing 10, opening into the pipe 20. Here a portion of the current of air will be forced downward over the narrow chamber 5, and a part thereof will sweep through corrugations thereon, down among the spines on the cylinder, and out at the bottom of the casing. A portion passes down and around the exhaust-valve chamber and down over the cylinder. Another portion passes over and around the exhaust-valve chamber and out through the annular channel into the surrounding atmosphere in all directions. It is seen that the annular channel 19[a], being let into the circumference of the exhaust-valve chamber, does not only permit the air to escape therethrough, but also affords a greater surface for the contact of the air with this highly-heated portion. The current of air driven by the blower is moving at a very high speed and sweeps over the heated parts at so great a rate that the resulting cooling effect is produced in part by convection. Meanwhile within the cylinder the incoming charges of the explosive mixture have exercised a cooling effect on the exhaust-valve and valve-seat, and in the piston-head the downwardly-projecting spines have operated to produce a cooling effect also.

It will be noted that the shoulder 17 on the exhaust-valve chamber is circumferential and outside the casing and located at a slight distance therefrom. It forms a continuation of the outer wall of the annular channel, and air rushing into the channel seeking an escape from the casing will strike the shoulder and tend to be deflected, thereby tending to produce cross-currents and retaining the air slightly longer in contact with the annular channel, and thereby permitting it to exercise a greater cooling effect.

It will be noted, further, that the annular channel is substantially in the plane of the opening through the casing admitting the exhaust-valve chamber, and the inner wall of the casing therefore directs the current of air down against the inner wall of the annular channel, thereby causing deflection of the stream of air, which also aids in prolonging the cooling effect.

It is seen from the foregoing description that our improved air-cooling device provides for the creation of a swiftly-moving current of air which is directed through a casing against the most highly heated parts, that provision is made for the egress of air through the side of the casing circumferentially of the exhaust-valve chamber and also at the bottom of the casing circumferentially of the cylinder, and that a shoulder arranged on the exhaust-valve chamber circumferentially thereof outside of the casing deflects the discharging air inwardly and upwardly and tends to increase its cooling effect by momentarily causing it to "play" between the shoulder and the chamber. This combination of the side opening in the casing, the shoulder, the opening at the bottom of the casing, the cor-

rugations and spines, and the means for directing air into and through the casing produces an air-cooling device which successfully overcomes the difficulties hitherto experienced.

Our arrangement of parts furnishes a highly-efficient operating mechanism, occupies a minimum amount of space, and serves greatly to decrease the weight, all of which are considerations of the greatest moment in automobile construction.

What we claim as new, and desire to secure by Letters Patent, is—

1. In an explosive-engine, a cylinder, an exhaust-valve chamber connecting therewith, a casing over said cylinder, means for creating a current of air, means for directing the same into said casing upon said exhaust-valve chamber, and means adapted to permit the escape of air from the casing circumferentially of said exhaust-valve chamber whereby air heated by said exhaust-valve chamber is driven from the casing without passing over the cylinder.

2. In an explosive-engine, a cylinder, an exhaust-valve chamber connecting therewith, a casing over said cylinder containing an opening for the reception of said exhaust-valve chamber, means for creating a current of air, and means for directing the same into said casing upon said exhaust-valve chamber, said opening being adapted to facilitate the discharge of air from the casing circumferentially of said exhaust-valve chamber, whereby air heated by said exhaust-valve chamber is driven from the casing without passing over the cylinder.

3. In an explosive-engine, a cylinder, an exhaust-valve chamber connecting therewith, a casing over said cylinder containing an opening for the reception of said exhaust-valve chamber, an annular channel on said exhaust-valve chamber substantially in the plane of said opening, means for creating a current of air, means for directing the same into said casing upon said chamber, into said channel and out through said opening circumferentially of said chamber, whereby air heated by said chamber is driven from the casing without passing over said cylinder.

4. In an explosive-engine, a cylinder, a casing thereon having an opening therein, an exhaust-valve chamber introduced into the casing through said opening and connecting with said cylinder, means for creating a current of air and means for directing the same into said casing upon said chamber, an annular channel on said exhaust-valve chamber substantially in the plane of said opening, a circumferential shoulder upon said chamber outside of said casing adapted to coöperate with said channel and casing to compel the discharge of air from the casing radially outward from said exhaust-valve chamber, whereby said air is continued longer in contact with said chamber and the cooling effect is increased.

5. In an explosive-engine, a cylinder provided with a vertical combustion-chamber in the head thereof, a casing for said combustion-chamber and cylinder, an intake and an exhaust valve chamber opening from opposite sides into said combustion-chamber, corrugations upon the exterior of said combustion-chamber and spines upon the exterior and upper part of said cylinder, means for creating a current of air, means for directing the same into said casing over said cylinder and said exhaust-valve chamber and combustion-chamber, said casing being constructed to permit the air to circulate freely upon all sides of said combustion-chamber and cylinder and exhaust-valve chamber, and to escape from said casing at one side thereof circumferentially of said exhaust-valve chamber, and at the lower end thereof circumferentially of said cylinder.

6. In an explosive-engine, an air-pipe, a blower therein actuated through the prime moving shaft, a casing communicating with said air-pipe, a cylinder inclosed on its upper end within said casing, an exhaust-valve chamber passing through said casing and connecting with said cylinder, means permitting the escape of air out through said casing on all sides of said exhaust-valve chamber, and means permitting the escape of air at the lower end of said casing on all sides of said cylinder, whereby air heated by the exhaust-valve chamber is not circulated over the cylinder, and air heated by the cylinder is not circulated over the exhaust-valve chamber.

7. In an explosive-engine, a cylinder, a narrow combustion-chamber in the head thereof, an intake and an exhaust valve chamber opening into said combustion-chamber opposite each other, an intake-valve, an exhaust-valve contiguous thereto, a casing on said cylinder and combustion-chamber having an opening for the reception of the exhaust-valve chamber, an annular channel on said exhaust-valve chamber substantially in the plane of said opening, means for creating a current of air, means for directing the same into said casing over the exhaust-valve chamber and a portion thereof down over said cylinder and out at the lower end of said casing, whereby air cooling the exhaust-valve chamber is ejected from the casing without passing over the cylinder-head, and air cooling the cylinder-head is ejected without passing over the exhaust-valve chamber.

In testimony whereof we affix our signatures in presence of two witnesses.

LEE A. FRAYER.
WM. J. MILLER.

Witnesses:
B. BLUCK,
C. M. ROGERS.