No. 660,073. Patented Oct. 16, 1900.

W. F. DAVIS.

MEANS FOR COOLING EXPLOSIVE ENGINES.

(Application filed Jan. 2, 1900.)

(No Model.) 3 Sheets—Sheet 1.

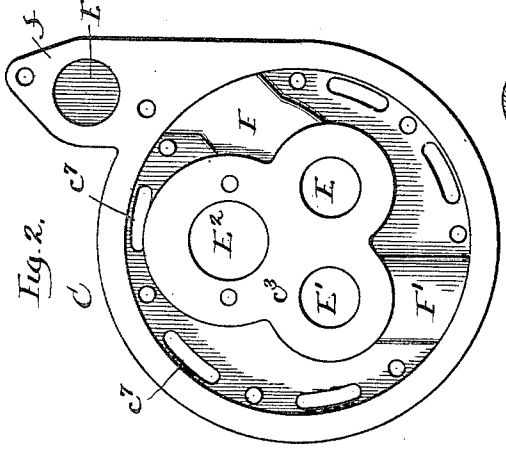

Fig. 2.

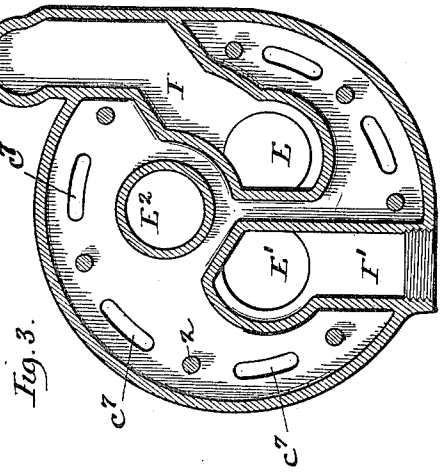

Fig. 3.

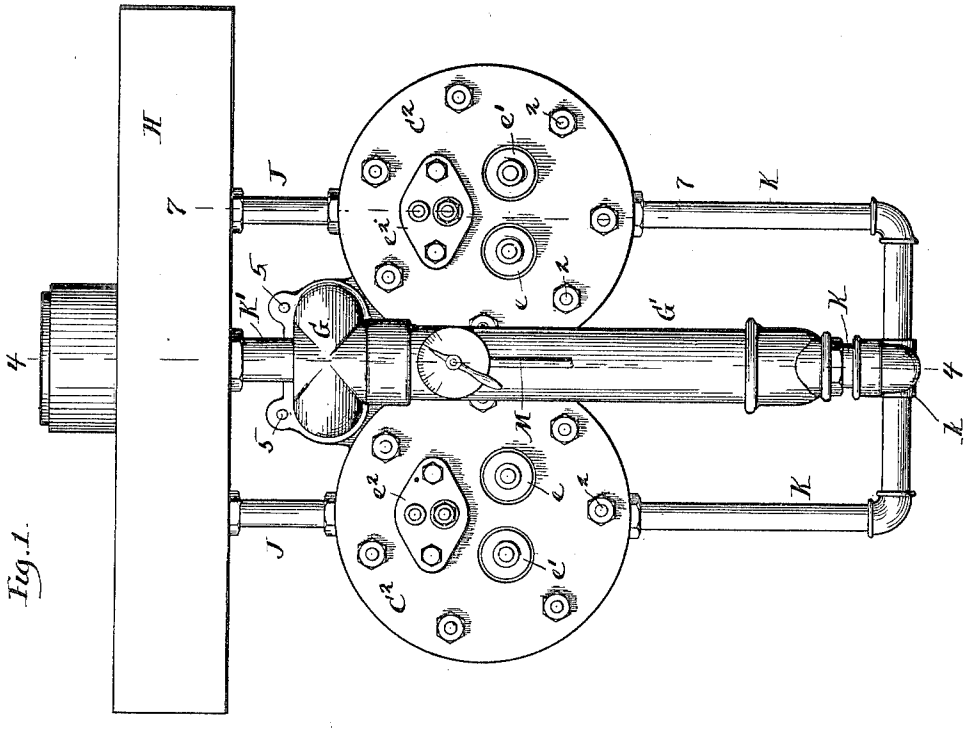

Fig. 1.

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Fig. 5

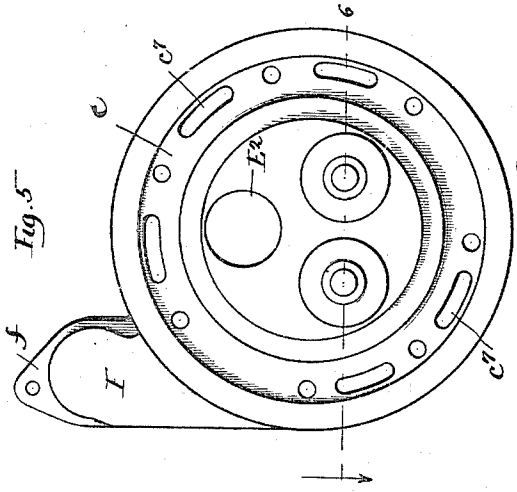


Fig. 6

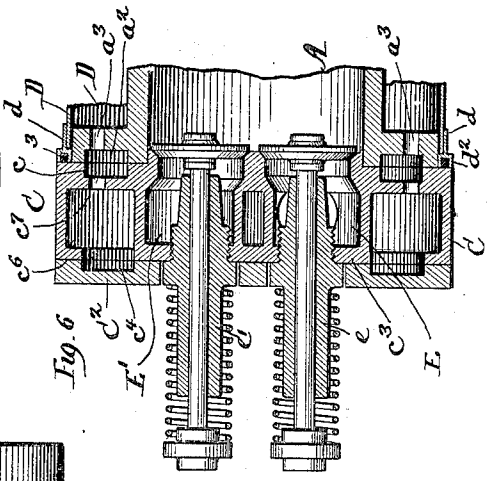
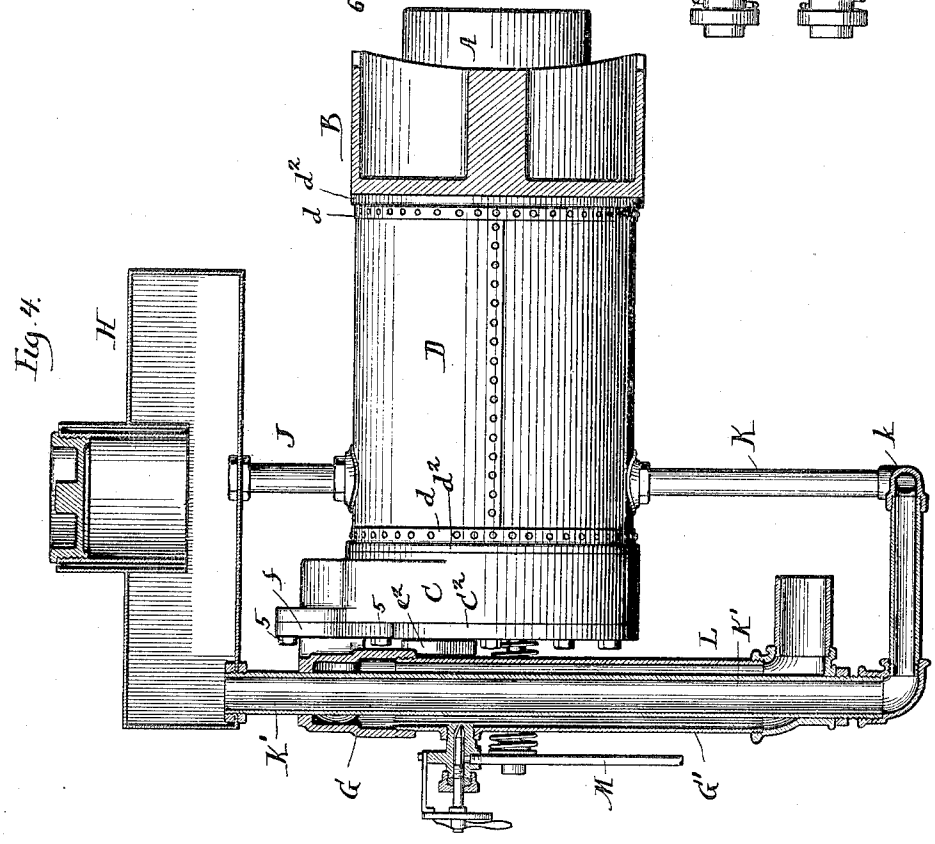


Fig. 4.



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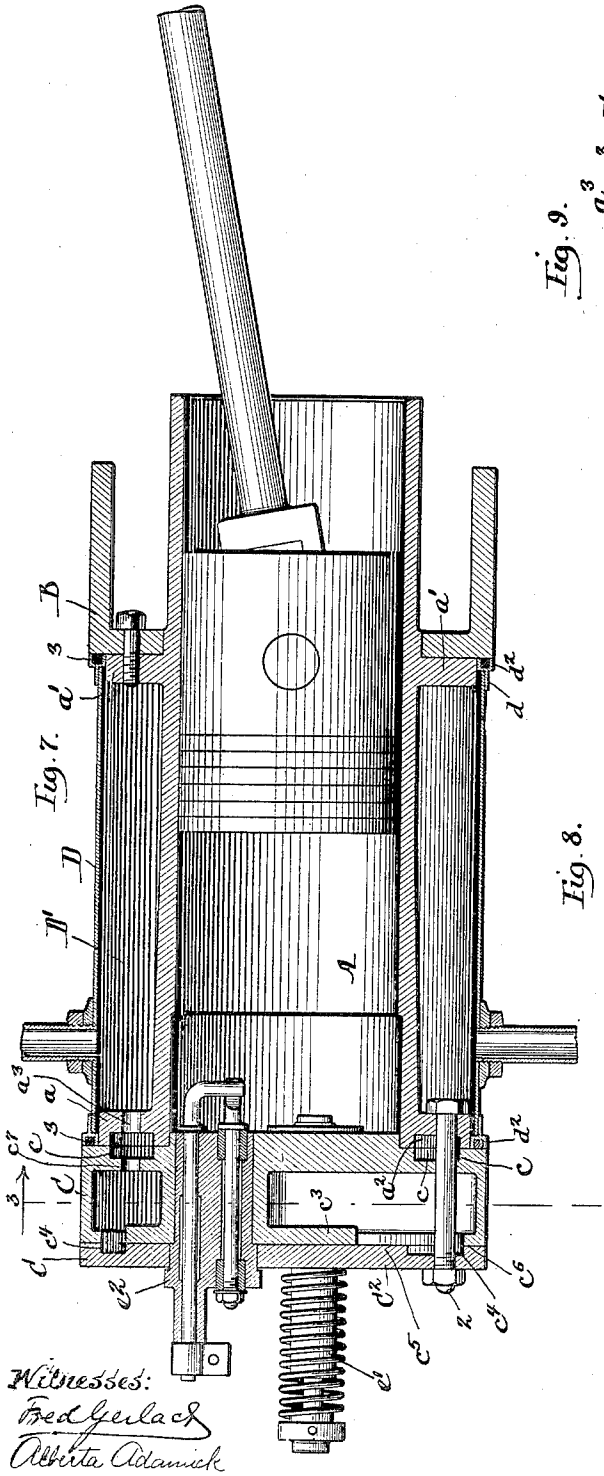

Fig. 7.

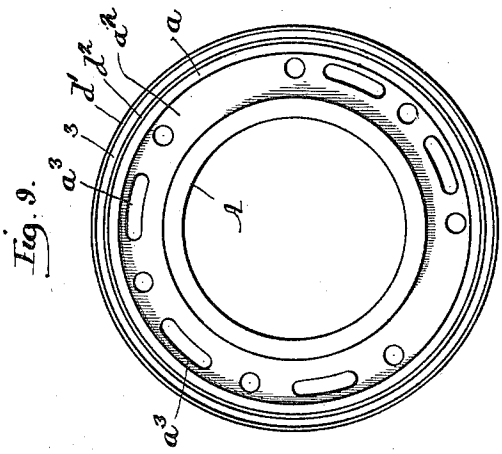

Fig. 9.

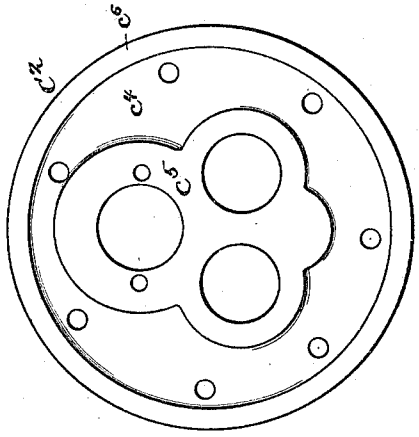

Fig. 8.

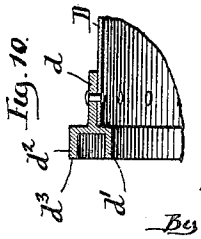

Fig. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM F. DAVIS, OF MILWAUKEE, WISCONSIN.

MEANS FOR COOLING EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 660,073, dated October 16, 1900.

Application filed January 2, 1900. Serial No. 100. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. DAVIS, a resident of Milwaukee, in the county of Milwaukee, State of Wisconsin, have invented certain new and useful Improvements in Means for Cooling Explosive-Engines, of which the following is a full, clear, and exact description.

This invention has for its object to provide an improved means for cooling the cylinders of explosive-engines and other adjacent parts that are exposed to high temperature.

The invention consists in the features of improvement hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a front view of a twin-cylinder engine having my invention applied thereto. Fig. 2 is a view of the cylinder-head with the outer plate removed. Fig. 3 is a view in vertical cross-section on line 3 3 of Fig. 7, the valve mechanism being omitted. Fig. 4 is a view in central vertical longitudinal section on line 4 4 of Fig. 1. Fig. 5 is an inner face view of the cylinder-head removed. Fig. 6 is a view in horizontal cross-section through the cylinder-head, the section showing the admission and discharge valves in position. Fig. 7 is a view in central vertical longitudinal section through one of the cylinders shown in Fig. 1. Fig. 8 is an inner face view of the cylinder-head cap-plate. Fig. 9 is a front end view of one of the cylinders with the cylinder-head removed. Fig. 10 is an enlarged view in cross-section of a detail of the water-jacket.

In the accompanying drawings my invention is shown as applied to a twin-cylinder engine, but manifestly the invention is applicable as well to an engine in which a single cylinder is employed. Each of the cylinders A is of like construction and is supported in any convenient manner by a suitable frame or bed, a portion only of the frame B being shown in the drawings. Each of the cylinders A is provided at its outer end with a peripheral flange a and adjacent its inner end with a similar flange a', these flanges extending around the cylinder. To the flange a is connected, as by bolts 2, the cylinder-head C, that extends radially or laterally slightly beyond a periphery of the flange a. The flange a' of the inner end of the cylinder A is conveniently bolted to the frame B, (see Fig. 7,) this frame extending radially or laterally somewhat beyond the periphery of the flange a'. Upon the peripheries of the flanges a and a' rest the ends of the water-jacket D, the preferred construction of which is illustrated more particularly in Figs. 7 and 10 of the drawings. As shown, this jacket consists of a sheet-metal cylinder, the lapping edges of which are joined, preferably, by rivets and solder, and to the ends of this cylinder are connected rings adapted to receive the packing 3, whereby a tight joint for the ends of the water-jacket is secured. As shown, each of the rings comprises an annular web d, that is connected to the adjacent end of the jacket D, preferably by rivets and solder, and comprises also the inner and outer flanges d' and d^2, that form the annular chamber wherein the packing 3 will be received. Preferably the rings at the ends of the jacket D will be of cast metal. By reference more particularly to Fig. 7 of the drawings it will be seen that when the water-jacket D is in place upon the cylinder the packing 3 is held within the annular grooves or ends of the jacket, and the packing at the outer end of the jacket bears against the inner face of the cylinder-head, while the packing at the inner end of the jacket bears against the face of the projecting portion of the frame B. By forming the water-jacket of a sheet-metal cylinder I am enabled to produce a light jacket, while by forming annular chambers or grooves at the end of the jacket the packing is securely retained against danger of being forced out and can be readily removed and replaced with the cylinder. It will be observed by reference to Figs. 7 and 10 that each of the rings at the ends of the jacket D presents a square bearing-face d^3—that is to say, a bearing-face that extends approximately at right angles to the axis of the cylinder A. Consequently when the water-jacket D has been placed over the cylinder A and the cylinder-head is drawn to its position by its retaining-bolts 2 the packing 3 at the ends of the water-jacket will be brought into firm bearing against the inner face of the cylinder-head at one end and against the projecting face of the cylinder B at the opposite

end, and this pressure will not tend to spread the ends of the cylinder, the pressure being in the line with the water-jacket. Manifestly this feature might be embodied in other forms of water-jackets than that shown, and I do not wish the invention to be understood as limited to the specific construction of water-jacket except as such construction is specifically defined in the claims at the end of the specification and relating thereto. When the water-jacket D is formed with its end portions integral with its body, the inner flanges d' will be omitted. Jacket D will then rest directly upon the annular flanges of the engine-cylinder, and the shoulder-flange d^2, together with such flanges and the projecting parts B and cylinder-head C, will form recesses for the packing material.

In the outer face of the flange a of the cylinder A is formed an annular groove or channel a^2, and in the flange a are formed ports a^3, by which water will pass from the chamber D', that surrounds the cylinder A, to and from the channel a^2. The cylinder-head C is formed of cast metal, and upon the inner face is a groove or channel c, that coincides with the groove a^2 at the end of the cylinder and forms with the groove or channel a^2 a space for passage of water. By reference more particularly to Figs. 2, 3, 5, and 6 of the drawings it will be seen that the head C of each cylinder is chambered for the passage of water therethrough and is provided with ports E and E', that serve to receive, respectively, the admission and exhaust valve casings e and e' and with the port E^2 adapted to receive the body of the block or plug e^2, that carries the poles of the igniter mechanism. With the admission-port E connects a channel F, that extends laterally through the periphery of the cylinder-head and is connected, preferably by a cap or plate G, with the air-delivery pipe G', and from the exhaust-port E' a channel F' leads laterally through the periphery of the cylinder-head and has connected to its outer end a suitable exhaust pipe or conduit (not shown) for carrying away the products of combustion.

So far as I am aware the present invention presents the first instance of a chambered cylinder-head having the admission and exhaust conduits (one or both) leading laterally through the periphery or side of the cylinder-head. This feature is of advantage, because it effects a greater exposure of water to the incoming explosive vapor and to the outgoing products of combustion. The incoming explosive vapor tends to reduce the temperature of the water within the cylinder-head, and this in turn tends to reduce the temperature of the cylinder-head, thereby cooling the valve-casings, their stems, and bushings. The provision of the water-channel formed by the grooves a^2 and c (one or both) also aids in effecting a larger surface exposure to the water, thus aiding materially and preventing the cracking of the cylinder-head and of the flange about the outer end of the cylinder. By reference to Figs. 2, 6, and 7 of the drawings it will be seen that around the casings e, e', and e^2 extends a bearing-surface c^3, of metal, formed integral with the cylinder-head and with the walls of the channels F and F' and with the wall of the port E^2, and upon this flattened surface, and as well also upon the outer edge of the cylinder-head, rests the cap-plate C^2, this cap-plate being held in place by the bolts 2, that pass through it. Preferably this cap-plate C^2 has its inner face formed with a recess c^4, the raised central portion c^5 of the cap-plate bearing against the flattened portion c^3 of the cylinder-head, while the outer flange c^6 of the cap-plate (see Figs. 7 and 8) bears against the outer face of the cylinder-head. The inner wall of the cylinder-head C (see Fig. 5) is formed with a series of ports c^7, that communicate with the annular channel c to permit the circulation of water from the chamber D' around the cylinder into and through the cylinder-head.

Water is supplied to the chamber D' around the cylinder preferably from an overhead tank H, that is connected with the water-jacket D by the pipes J and K. When two cylinders are employed, the pipes K will be united by a coupling k to a single pipe K', that connects with the overhead tank H. The pipe K' extends upward through the air-pipe G', by which air is delivered to the cylinders, and into this air-pipe G' leads the oil-delivery pipe M, by which the liquid fuel is delivered to the cylinder from a suitable source of supply. The water-pipe K' extends upward through the cap G, and the branches of this cap are bolted, as at 5, to the projecting portions f of the admission-channels F. Hence it will be seen that as air is admitted at the lower end of the air-pipe G' it will pass around the water-pipe K', thereby tending to cool the water within this pipe, and the vaporized oil or like fuel admitted by the pipe M will further tend to cool the water within the pipe. Not only is this construction advantageous in that it tends to reduce the temperature of the water, but it possesses the further advantage of raising the temperature of the explosive vapor admitted to the cylinder, and thus securing its more effective action.

So far as I am aware I believe my invention presents the first instance in which a water-pipe that connects with the cylinder-jacket has been exposed to the air or vapor supply to the engine, and therefore I do not wish the invention to be understood as restricted to the specific features of construction hereinbefore described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An explosive-engine, the cylinder of which is provided with a water-jacket forming a water-space around the cylinder, in combination with the cylinder-head chambered to form a water-space and an annular chan-

nel intermediate the water-spaces of said cylinder and said head, and connected by ports with each of said spaces.

2. An explosive-engine, the cylinder of which is provided with a water-jacket forming an annular space around the cylinder and which is provided also at its front end with an annular flange having an annular groove in its outer face, in combination with a cylinder-head having an annular groove in its inner face coincident with the annular groove in the outer face of the flange at the end of the cylinder, said flange being formed with suitable ports for the passage of water from the water-space to the annular grooves in the cylinder-head and flange.

3. An explosive-engine, the cylinder of which is provided with a water-jacket forming a water-space around the cylinder, in combination with the cylinder-head having inner and outer walls with a water-circulating space between them, and having partitions between said walls forming lateral admission and exhaust channels extending through the periphery of the cylinder-head, the inner wall of said channels having ports opening into said cylinder and provided with puppet-valves, openings in the outer wall opposite said ports for supporting the bushings of said valves, and openings connecting the water-space of said head with the water-jacket of the cylinder.

4. An explosive-engine, the cylinder of which is provided with a water-jacket forming a water-space around the cylinder, in combination with the cylinder-head having inner and outer walls with a water-circulating space between them, and having partitions between said walls forming lateral admission and exhaust channels extending through the periphery of the cylinder-head, the inner wall of said channels having ports opening into said cylinder and provided with puppet-valves, openings in the outer wall opposite said ports for supporting the bushings of said valves, openings in the inner wall of said head connecting the water-space therein with the water-jacket of the cylinder, and an opening in the outer wall of said cylinder-head for exposing said water-space, and a removable cap-plate for closing the opening.

5. The combination with an engine-cylinder having raised annular flanges at its inner and outer ends and having at its inner end a raised part extending laterally beyond the adjacent annular flange, and having at its outer end a cylinder-head extending laterally beyond the adjacent annular flange, of a water-jacket having its ends extending outside and around said annular flanges of the cylinder and provided with annular shouldered flanges, the outer faces of which flanges extend at substantially right angles to the axis of the cylinder, and abut against said raised part and the ends of the said cylinder-head to form recesses for the packing material.

6. The combination with an engine-cylinder having raised annular flanges at its inner and outer ends and having at its inner end a raised part extending laterally beyond the adjacent end of the flange, and having at its outer end a cylinder-head extending laterally beyond the adjacent annular flange, of a removable water-jacket surrounding said cylinder and resting on the annular flanges thereof, said jacket being provided at each end with an annular flange, each flange having a bearing-surface to engage packing material placed between said flange and said raised part, and between said flange and said cylinder-head, said bearing-surface extending substantially at right angles to the length of the jacket.

7. The combination with the cylinder of an explosive-engine, of a separable jacketing-cylinder, the ends whereof are provided with outwardly-facing grooves adapted to receive packing material, and bearing-surfaces for the ends of said jacketing-cylinder secured to but extending laterally beyond the ends of said engine-cylinder.

8. A water-jacket for an explosive-engine comprising a cylindrical body D of sheet metal provided at its ends with rings formed separate therefrom and connected thereto, said rings having outwardly-facing grooves to receive packing.

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