E. B. CUSHMAN.

RADIATOR.

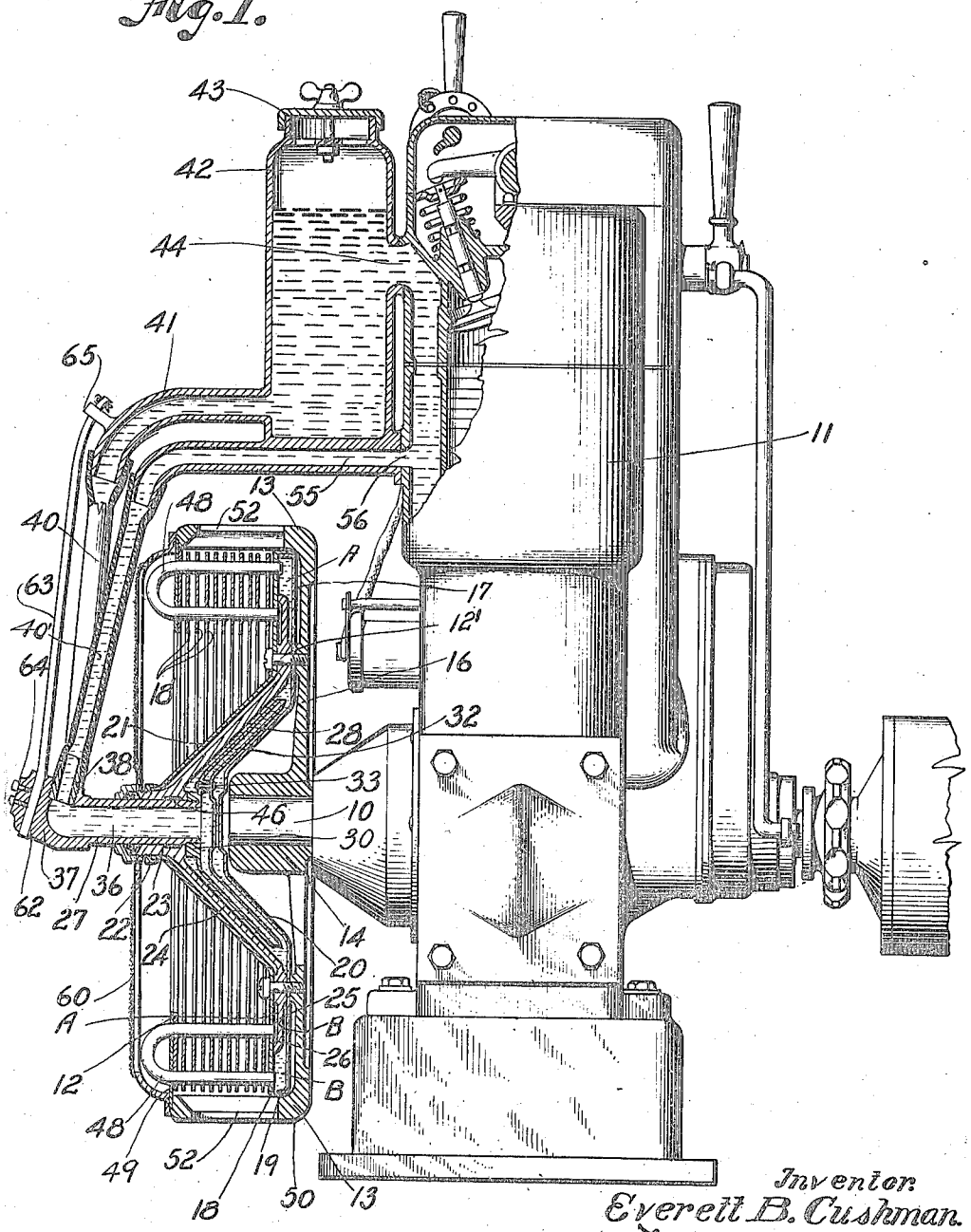
APPLICATION FILED MAR. 15, 1920.

1,417,037.

Patented May 23, 1922.

4 SHEETS—SHEET 1.

Fig. I.



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4 SHEETS—SHEET 2.

Fig. II.

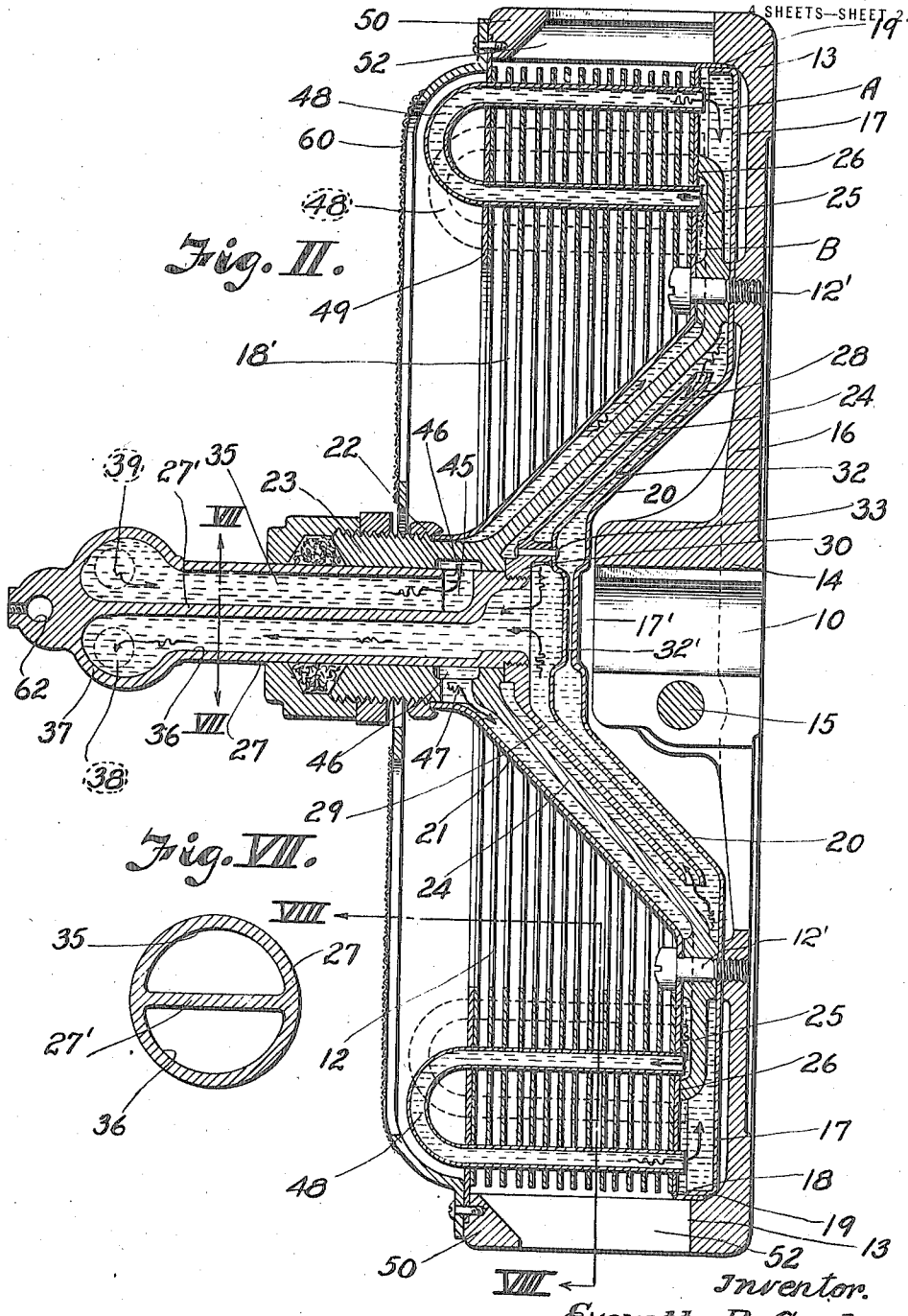


Fig. VII.

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4 SHEETS—SHEET 3.

Fig. IV.

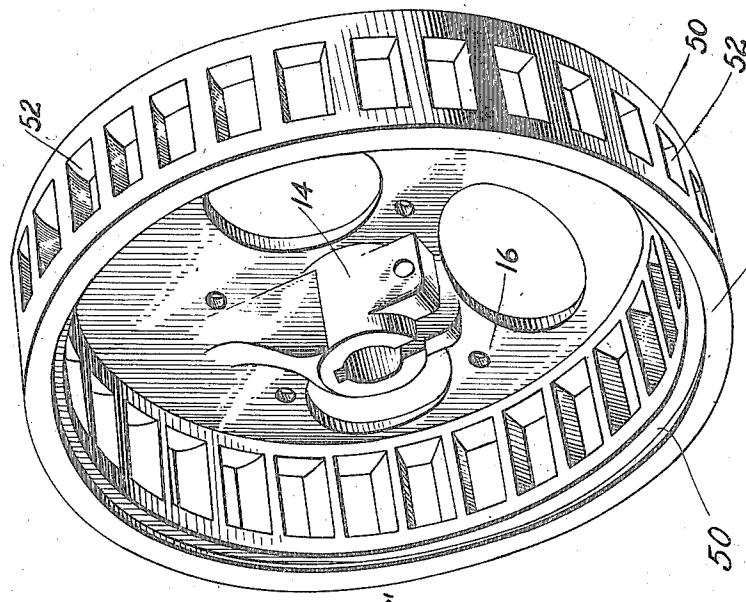
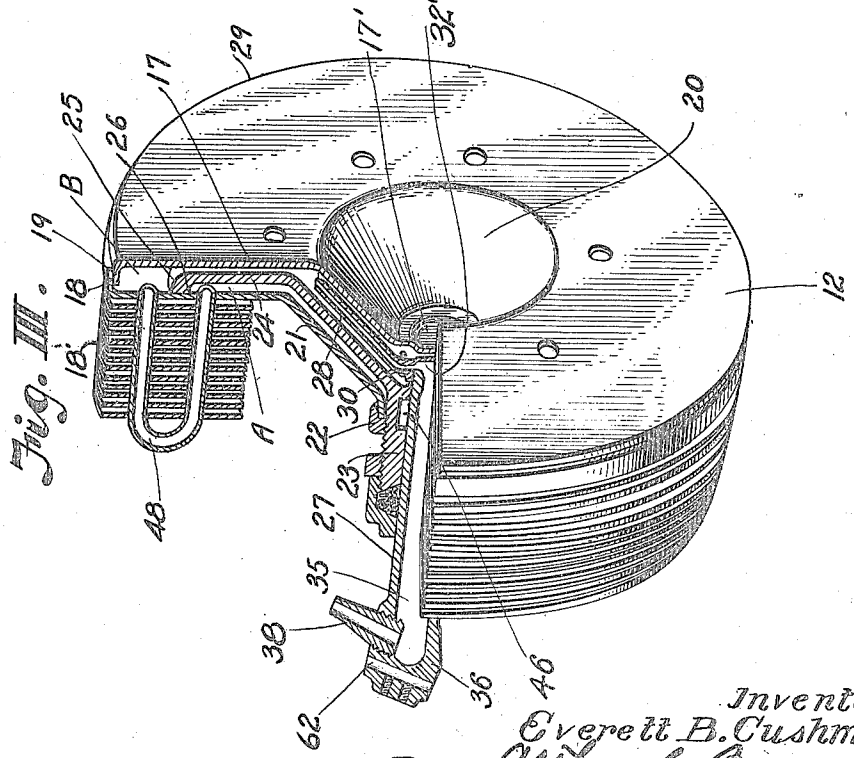


Fig. III.



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4 SHEETS—SHEET 4.

Fig. V.

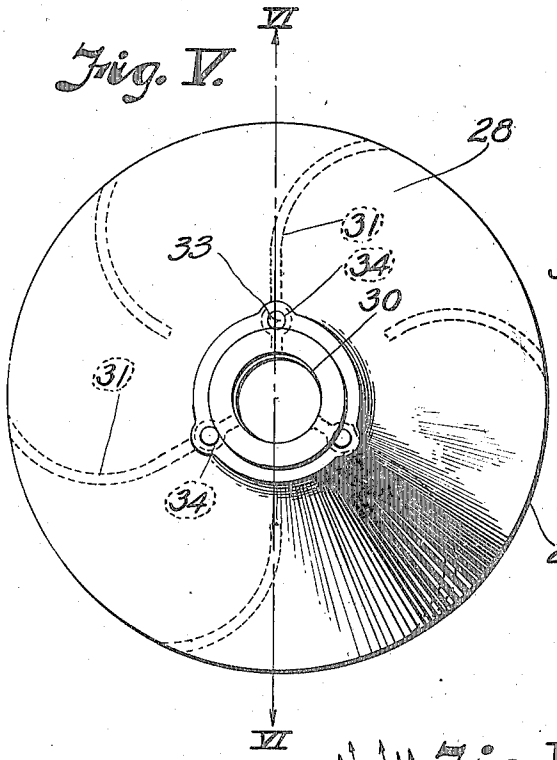


Fig. VI.

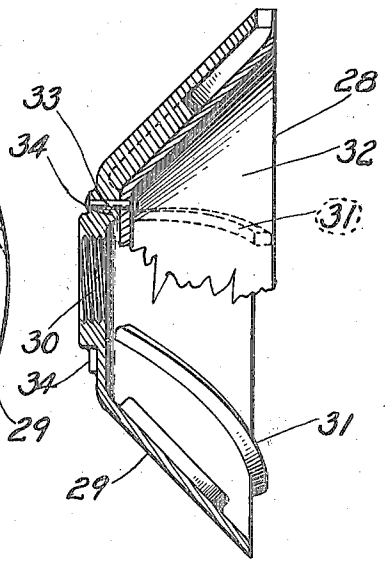
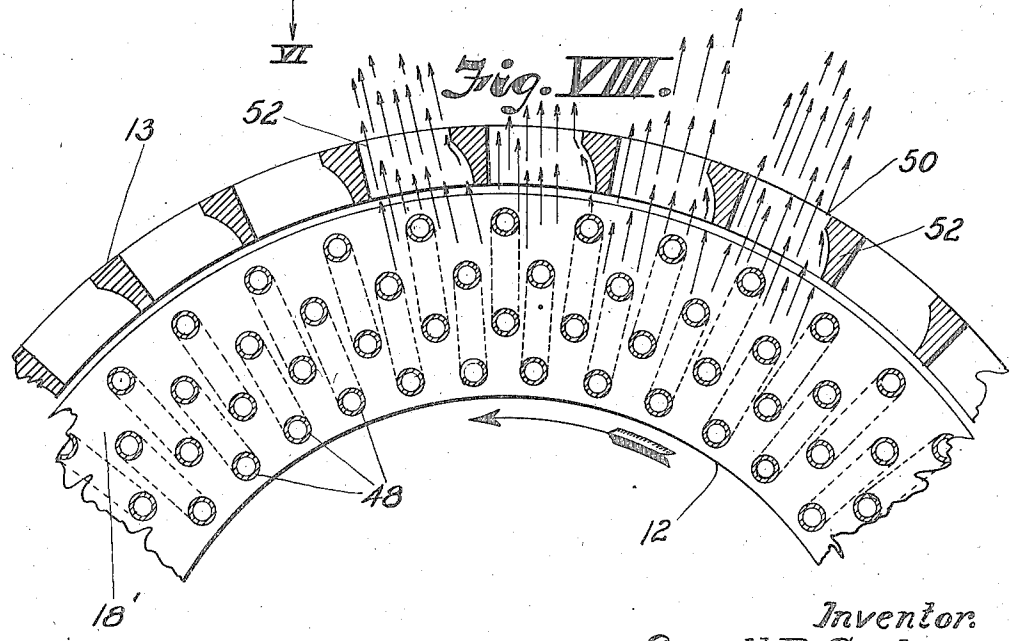


Fig. VIII.



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UNITED STATES PATENT OFFICE.

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RADIATOR.

1,417,037. Specification of Letters Patent. Patented May 23, 1922.

Application filed March 15, 1920. Serial No. 365,737.

To all whom it may concern:

Be it known that I, EVERETT B. CUSHMAN, a citizen of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Radiators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to a radiator for disposing of the objectionable heat generated at some point in a mechanical construction, the primary object being to induce an efficient circulation of the fluid about the element to be cooled in such manner that heat generated in the mechanical construction may be absorbed by the fluid and then dissipated by air currents, so that the temperature of the fluid may be maintained within practical limits for the purpose intended.

The particular embodiment of my invention herein illustrated comprises a rotary radiator having ported communication with the cooling jacket of a hydrocarbon engine, and driving connection with the engine shaft, means being provided for inducing circulation of water through the radiator and through the water jacket of the engine, and the construction of the radiator and its supporting element being such that air will be forced about water passages in the radiator to carry off heat from the water as the water circulates in the system.

More particularly does the invention contemplate such combination of the radiator with the engine fly wheel that the fly wheel serves as a casing or carrying body for the radiator, so that the radiator is rotated during the mechanical cycles of the engine, to provide a rate of flow of the water proportionate to the speed of the engine, with a corresponding induction of cooling air through the radiator and about the water passages therein, as in my co-pending application Serial No. 364,043.

Since the fly wheel is adjacent to the cylinder of the engine, the fly wheel is heated from the cylinder, and I therefore provide, in the present invention, for taking air from the face of the fly wheel remote from the cylinder, so that air enters the radiator at a temperature appreciably below that which is available between the fly wheel and the cylinder, and a more efficient cooling of the water is effected than if the air were taken from between the radiator and cylinder.

In the specific embodiment of the invention, I prefer to conduct the water transversely through the spaced rings or luminæ of the radiator in U-shaped tubes so that air currents will be directed over and about the tubes to carry off heat from the circulating water, means being provided at the perimeter of the fly wheel for accelerating the velocity of the air currents to avoid liability of the cooling air becoming trapped or retarded in the radiator.

In the drawings, wherein the preferred form of the invention is illustrated:

Fig. I is a side elevation of an internal combustion engine equipped with my improved radiator, illustrating in section the parts of the engine structure which co-act with the radiator.

Fig. II is a diametrical section through the radiator, taken at right angles to the section illustrated in Fig. I.

Fig. III is a perspective view, partly in section, of the radiator unit, separate from the fly wheel.

Fig. IV is a perspective view of the fly wheel unit.

Fig. V is a side elevation of the impeller for effecting circulation of water through the radiator.

Fig. VI is a section on the line VI—VI of Fig. V.

Fig. VII is a section on the line VII—VII of Fig. II, and

Fig. VIII is a fragmentary section taken on the line VIII—VIII of Fig. II.

Referring more in detail to the drawings; 10 designates the crank shaft of a stationary, internal combustion engine 11, the particular construction of which is immaterial to the present invention.

Mounted on the crank shaft 10 is a radiator comprising a laminated unit 12 removably mounted in a fly wheel unit 13. The fly wheel unit 13 is provided with a split hub 14 which is secured to the shaft 10, by clamping screws or bolts 15, for rotation

therewith, and the radiator unit 12 is attached to the web portion 16 of the fly wheel unit, preferably by screws 12′, to permit the radiator unit to be disconnected from the fly wheel unit when desired. The web of the fly wheel unit is substantially closed to shut off air from the side adjacent the engine and insure intake of cooler air from the outer side of the wheel.

The radiator unit 12 comprises disks 17—18 and a plurality of spaced rings 18′, the disks 17—18 being spaced to form the water chamber hereinafter described and their free edges being bent, lapped and soldered, welded or connected in any manner suitable to form a water-tight joint. The disk 17 is provided with an out-struck central, conical portion 20 which accommodates the split hub 14 of the fly wheel unit 13 and the disk 18 is provided with a companion out-struck, substantially conical portion 21, the apex of which is apertured and clamped, by a suitable collar 22, upon the periphery of a coupling sleeve 23, formed at the apex of the conical portion 24 of the casting 25, which divides the space between the disks 17 and 18 into separate water chambers A and B, and which has an outturned peripheral flange 26 engaging the plate 18 to seal the chambers between the ends of the tubes, as hereinbefore described. A hollow shaft 27 extends through the sleeve 23 and opens at its inner end into the chamber A, and threaded onto the inner end of the shaft is one member of a substantially conical impeller 28 which serves to force circulation of the cooling water through the radiator.

The impeller 28 comprises an outer, substantially conical shell 29 having the threaded hub 30 which receives the threaded inner end of the shaft 27. The shell 29 has a plurality of vanes or directional blades 31 (Figs. V and VI) therein, curving tangentially from the periphery of the shell towards the axis thereof to direct the cooling fluid inwardly towards the shaft 27, and spacing the inner shell 32 which is attached to the outer shell 29 by rivets 33, certain of the directional vanes 31 being provided with perforated bosses 34 to receive the rivets 33.

The shaft 27 comprises a diaphragm 27′, dividing its interior into parallel, longitudinally extending passageways 35 and 36 which open into a head 37 formed upon the outer end of the shaft and provided with nipples 38 and 39. Flexible conduits 40 and 40′ are connected to the nipples 38 and 39, respectively. The conduit 40 has communication with the passageway 35 through the nipple 39 and is connected to a nipple 41 formed upon a receptacle 42, for containing a supply of cooling water. The container 42 may be attached in any suitable manner to the engine structure 11 and has a removable cap 43 to permit filling. The outlet port 44 of the water jacket of the engine 11 opens into the container 42 so that water from the jacket of the engine 11 may pass into the container and gravitate therefrom through the nipple 41, conduit 40 and nipple 39 into the passageway 35 in the shaft 27. The passageway 35 opens out through one side of the shaft 27, as shown at 45 (Fig. II), into an annular passageway 46, formed in the sleeve 23. Water entering this annular passageway 46 passes therefrom through an opening 47 into the chamber B through which it is forced, by the combined thermosiphon action of the rotating radiator and the impeller 28, towards the perimeter of the radiator and into and through U-shaped tubes 48, as clearly shown in Fig. II of the drawings. One end of each of the tubes 48 communicates with the chamber B while the opposite end communicates with the chamber A and consequently the fluid passing through the tubes passes from the chamber B into the chamber A, where it is attracted or drawn inwardly by the action of the impeller 28.

The U-shaped tubes are braced adjacent their bight portions by a disk 49 which is attached to the annular flange 50 of the fly wheel 13 in any suitable manner, the parallel legs of the tubes extending through suitable openings in the spaced rings 18′, which constitute heat dissipating laminæ, effect diffusion of the heat from the cooling fluid as it passes through the tubes.

The circulation of air through the radiator is induced by the particular construction of the walls of the openings 52, which are formed in circumferentially spaced relation in the flange 50 of the fly wheel 13 and serve as air impellers or vanes as more fully described in my companion application.

The radiator unit has its side outward from the fly wheel 13, and consequently the side which is remote from the engine 11, open while its inner side is closed by the plate 17, as clearly shown in Fig. III of the drawings. This causes the air that is circulated through the radiator to be taken from the side of the radiator remote from the engine, resulting in greater cooling efficiency of the air owing to the fact that the air taken into the radiator is not heated by travel in close proximity to the engine, but first contacting with the conical plate 21 cools the water in the chamber B and, passing out between the laminæ or rings 18′, cools the water in tubes 48 by carrying off heat that has been inducted to the plate and rings from the circulating water.

The water which is collected or impelled inwardly by action of the impeller 28 is forced outwardly through the apex of the impeller into the passageway 36, passing through the conduit 40′ into the passageway

55, which is in communication with the inlet 56 of the water jacket of the engine 11, thereby maintaining a complete circuit or system of circulation of the water through the water jacket, container and radiator.

The U-tubes 48 are arranged in staggered relation about the radiator, as clearly shown in Fig. VIII, permitting the inclusion of a maximum number of tubes in a minimum space.

I may place a guard 60 over the bight portions of the tubes 48 as shown in Figs. I and II of the drawings, to protect these portions of the tubes from injury during rotation of the fly wheel, and different working conditions may require or dictate the use of various forms of protector and it is, therefore, to be understood that any form of protector may be utilized or the protector may be eliminated without departing from the spirit of this invention.

The head 37, on shaft 27, is provided with an opening 62 which receives therein the lower end of an anchor rod 63, for holding the shaft 27 and the impeller 28 against rotation while permitting the fly wheel 13 and radiator unit 12 to rotate about the shaft 27 during the operation of the engine. Suitable fastening means, such as set screws 64, may be provided for preventing disconnection of the rod 63 from the head 37, the upper end of the rod being connected to an ear 65 on the nipple 41.

The disk 17 and the impeller shell 32 are provided with facing, struck-up axial portions 17′ and 32′, respectively, which act as a thrust bearing upon inward movement of the shaft 27 and impeller member 29 to prevent wear upon the disk 17 by the adjacent portions of the impeller which would be brought into frictional engagement upon inward movement of the shaft were these bosses not provided.

It is to be understood that packing boxes, glands, etc., are to be employed and are to be sufficiently tight to prevent leakage of water in the radiator and that the U-tubes 28 may be brazed, soldered or otherwise secured as the best practice may dictate and that obvious changes in the minor details of construction may be resorted to without in any way affecting the scope of the invention.

What I claim and desire to secure by Letters-Patent is:

1. In combination with a mechanical structure comprising passages for the circulation of a fluid, a rotatable radiator having passages corresponding to those in said structure and connected therewith, and means for directing air from the side of the radiator remote from the structure in cooling relation to said passages in the radiator, the side of the radiator adjacent the structure being closed.

2. In combination with a mechanical structure comprising passages for the circulation of a fluid, a rotatable radiator having passages corresponding to those in said structure and connected therewith, means for directing air from the side of the radiator remote from the structure in cooling relation to said passages in the radiator, and means for inducing circulation of fluid through said passages, the side of the radiator adjacent the structure being closed.

3. In combination with a mechanical structure comprising passages for the circulation of a fluid, a rotatable radiator having passages corresponding to those in said structure and connected therewith, means for directing air from the side of the radiator remote from the structure in cooling relation to said passages in the radiator, and a stationary impeller in one of said passages.

4. In combination with a mechanical structure comprising passages for the circulation of a fluid, a rotatable radiator assembled with the structure and comprising a chamber housing closing the side of the radiator adjacent the structure and shaped to deflect air radially from the side of the radiator remote from the structure, means dividing the interior of said housing into separate chambers, means connecting said chambers and extending into the path of deflected air to permit flow of fluid from one chamber to the other and dissipation of heat from the flowing fluid, means in the path of deflected air connecting said chambers, and means connecting said chambers with corresponding passages in the mechanical structure.

5. In combination with a mechanical structure comprising passages for the circulation of a fluid, a rotatable radiator assembled with the structure and comprising a chamber housing closing the side of the radiator adjacent the structure and shaped to deflect air radially from the side of the radiator remote from the structure, means dividing the interior of said housing into separate chambers, means in the path of deflected air connecting said chambers, means connecting said chambers with corresponding passages in the mechanical structure, and means in one of said chambers for impelling the fluid.

6. In combination with a mechanical structure comprising passages for the circulation of a fluid, a fly wheel unit having a substantially closed side adjacent the structure and an outwardly directed apertured, rim flange, an annular, laminated body carried by the wheel within the rim flange, a housing rotatable with the wheel, means separating the interior of the housing into separate chambers, means, extending through the laminated body and connecting said chambers, means connecting said chambers with corresponding passages in the mechanical structure, and an impeller for maintain-

ing circulation through the passages and chambers.

7. In a radiator, a pair of spaced disks having their edges connected in a fluid-tight joint, and comprising registering, substantially conical central portions, a casting between the disks dividing the space therebetween into a receiving and a discharging chamber, external means establishing communication between said chambers, means for inducing a flow of air across said means of communication, a shaft, and a sleeve formed upon the apex of the casting and rotatable about said shaft, said shaft being provided with passageways to guide the incoming and outgoing fluid to and from said chambers.

8. In a radiator, a pair of spaced disks having their edges connected to form a fluid-tight enclosure, a partition dividing the space between the disks into receiving and discharging chambers, external means establishing communication between said chambers, a shaft, a sleeve formed upon said partition and rotatable about said shaft, means for inducing a flow of air across said means of communication and means carried by said shaft, within one of said chambers, to induce circulation of fluid through the chambers and said external means.

9. In a radiator, a pair of spaced disks having their edges connected to form a fluid-tight enclosure, a partition between the disks dividing the space therebetween into receiving and discharging chambers, external means establishing communication between said chambers, means for inducing a flow of air across said means of communication, a shaft, a sleeve formed upon said partition and rotable about said shaft, and means carried by said shaft within one of said chambers to induce circulation of fluid through the chambers, said shaft being provided with passageways to guide the incoming and outgoing fluid to and from the chambers.

10. In a radiator, a pair of parallel, spaced disks having their edges connected to form a fluid-tight enclosure, a partition between the disks dividing the enclosure into receiving and discharging chambers, a plurality of substantially U-shaped tubes having their ends opening one into the receiving chamber and the other into the discharging chamber to establish communication between said chambers, and laminæ in cooling relation with said tubes.

11. In a radiator, a pair of parallel, spaced disks having their edges connected to form a fluid-tight enclosure, a partition between the disks dividing the enclosure into receiving and discharging chambers, a plurality of substantially U-shaped tubes having their ends opening one into the receiving chamber and the other into the discharging chamber to establish communication between said chambers, said tubes projecting outwardly from the disks, laminæ mounted on said disks in cooling relation with said tubes, and a protecting guard extending over the outer portions of said tubes.

12. A radiator comprising a carrying body and means for attaching the body to a driving element, a removable radiator unit on the carrying body, open at the side opposite the body, a pair of parallel disks in said radiator unit, having their edges connected to form a fluid-tight enclosure, a partition between the disks dividing the enclosure into receiving and discharging chambers, laminæ on said carrying body, and a plurality of U-tubes establishing communication between said chambers and extending through said laminæ.

13. A radiator comprising a carrying body and means for attaching the body to a driving element, a removable radiator unit on the carrying body, open at the side opposite the body, a pair of parallel disks in said radiator unit having their edges connected to form a fluid-tight enclosure, a partition between the disks dividing the enclosure into receiving and discharging chambers, a plurality of U-tubes establishing communication between said chambers, heat dissipating laminæ through which said tubes extend, and a protecting guard on said carrying body, enclosing the bight portions of said U-tubes.

14. A radiator comprising a carrying body and means for attaching the body to a driving element, a removable radiator unit on the carrying body having an inlet opening at its side remote from the body, a stationary, axial shaft extending into said radiator unit and provided with passageways to guide incoming and outgoing fluid to and from the radiator unit, means for dissipating heat from fluid flowing in the radiator and a substantially conical impeller on the end of said shaft within the radiator unit to induce circulation of fluid therethrough.

15. In a radiator, a pair of parallel disks having their edges connected in a fluid-tight joint, registering, substantially conical portions on the centers of said disks, a casting between the disks and dividing the space therebetween into receiving and discharging chambers, external means establishing communication between said chambers, means for dissipating heat from fluid flowing in the radiator.

16. In a radiator, a fly wheel unit comprising a substantially closed web, an outwardly directed hub and an apertured rim member, a shaft containing separate, longitudinal passages, a bearing on said shaft, having a conical extension connected with the fly wheel unit, spaced plates connected with the bearing and fly wheel respectively, and enclosing the bearing extension in spaced rela-

tion thereto whereby the space between the plates is divided into separate chambers, having communication respectively with corresponding passages in said shaft, annular, spaced rings adjacent said rim members, means extending through the rings and connecting said chambers, means for directing a flow of air between said rings and an impeller in one of said chambers, one wall of the impeller and an adjacent enclosing plate having facing projections for the purpose set forth.

In testimony whereof I affix my signature.

EVERETT B. CUSHMAN.