C. B. KIRKHAM.

PUMP.

APPLICATION FILED SEPT. 5, 1918.

1,386,787.

Patented Aug. 9, 1921.

2 SHEETS—SHEET 1.

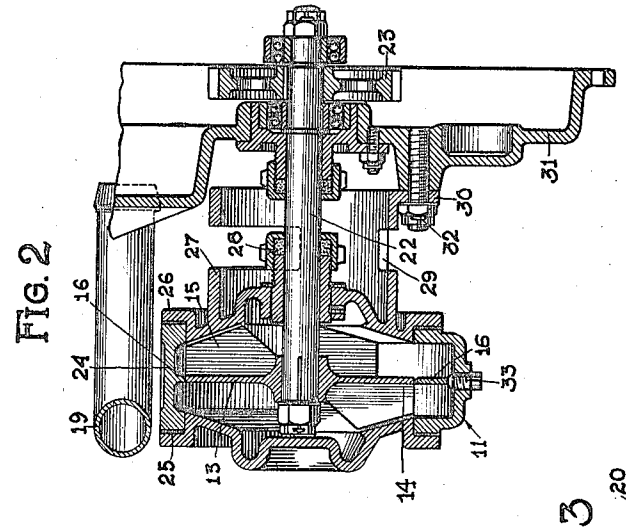


FIG. 2

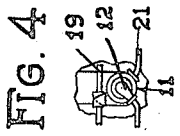


FIG. 4

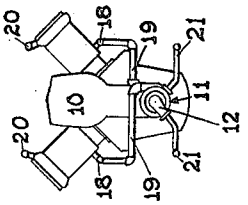


FIG. 3

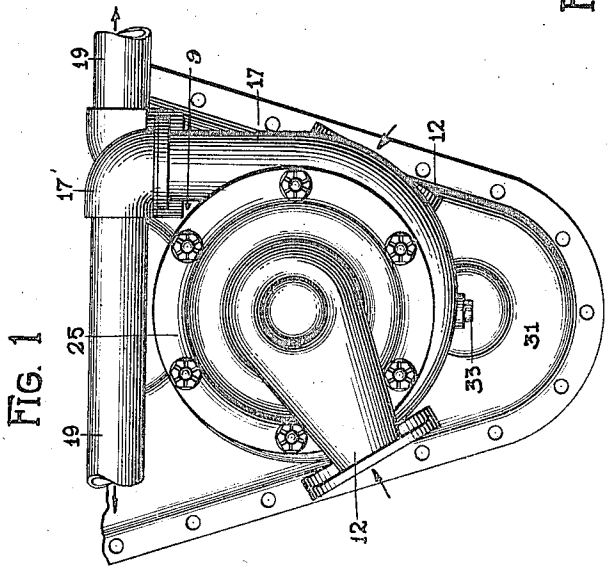


FIG. 1

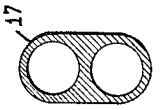


FIG. 9

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2 SHEETS—SHEET 2.

FIG. 5

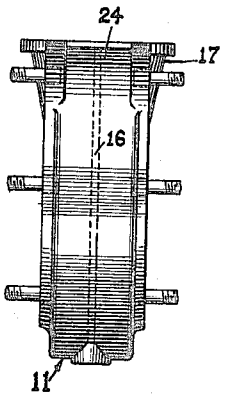


FIG. 6

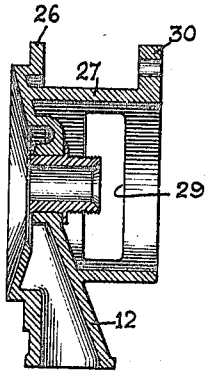


FIG. 7

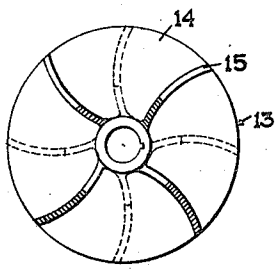
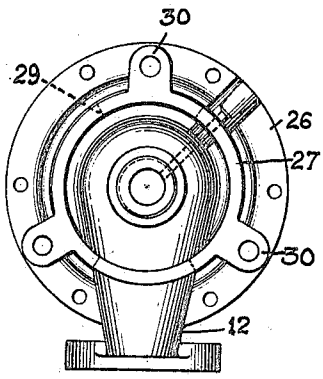


FIG. 8



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UNITED STATES PATENT OFFICE.

CHARLES B. KIRKHAM, OF NASSAU BOULEVARD, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CURTISS AEROPLANE AND MOTOR CORPORATION, A CORPORATION OF NEW YORK.

PUMP.

1,386,787. Specification of Letters Patent. Patented Aug. 9, 1921.

Original application filed September 27, 1916, Serial No. 122,439. Divided and this application filed September 5, 1918. Serial No. 252,716.

To all whom it may concern:

Be it known that I, CHARLES B. KIRKHAM, a citizen of the United States, residing at Nassau Boulevard, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

This application is a division of my application filed Sept. 27, 1916, Serial #122,439, motor cooling system, which in turn is a division of my application, Serial #51480, filed Sept. 28, 1915.

This invention relates to internal combustion engines and has reference more particularly to an improved cooling system designed for use in connection with V-type motors as constructed for high speed service in conjunction with aircraft. Motors of this type must have an ample water circulation to prevent the overheating of the engine cylinders.

Previous cooling systems, in so far as I am aware, operate to force the water or other cooling agent through a single main conduit. From this conduit, branch conduits lead to each cylinder bank and ultimately to each cylinder. The cooling agent travels in but a single main circulatory path. Such an arrangement not only results in retardation of the flow but necessitates the employment of a comparatively powerful pump because of the accumulated skin friction between the cooling agent and the circuit conduits. Moreover, should the flow of the cooling agent be interrupted or retarded at any point, the system in its entirety is immediately impaired. Absolutely no provision is made for an uninterrupted flow of the cooling agent through one bank of cylinders should the flow in the other bank of cylinders cease.

From the foregoing brief summary, it is apparent that each cylinder bank requires an individual service, *i. e.*,—a cooling system dependent upon a pump of duplex characteristics which permits individual service of the cylinder banks without duplication of service pipe, pump elements or similar circuit parts and at the same time permits uninterrupted circulation of water through one bank of cylinders even should the water circulating through the other bank of cylinders be interrupted or stopped.

More specifically, it is proposed by the present invention to provide a pump, the main operating element of which is in the nature of a double impeller so arranged with respect to the pump casing or housing as to independently circulate the cooling agent (in the present instance) via two circulatory paths.

Another and important object of this invention is to so construct and assemble the various pump elements as to provide for a reverse operation of the pump, should the motor be reversed, by simply reversing or re-arranging certain of the various pump elements or parts.

In describing my invention in detail, reference will be had to the accompanying drawings wherein like characters of reference designate like or corresponding parts throughout the several views, and in which:

Figure 1 is a face view of my improved duplex pump illustrating the preferred arrangement of the leads respectively thereto and therefrom;

Fig. 2 is a longitudinal sectional view of the pump and its directly associated driving means;

Fig. 3 is in the nature of a diagrammatic view illustrating the arrangement of the independent circulatory paths of my improved cooling system as arranged upon a multi-cylinder V-type motor;

Fig. 4 is a diagrammatic view similar to Fig. 3 illustrating the arrangement of pump parts reversed;

Fig. 5 is a detail and elevation of the pump casing;

Fig. 6 is a detail sectional view of the inside pump cover plate and its associated integrally formed support;

Fig. 7 is an elevation of the impeller;

Fig. 8 is an inside face view of the cover plate casting illustrated in Fig. 5, and

Fig. 9 is a section on the line 9—9, Fig. 1.

The V-type motor herein diagrammatically illustrated may be generally described as including an upper crank case section and a lower crank case section, cylinders angularly disposed in banks at each side of the longitudinal axis of the crank case, a crank shaft, a cam shaft, and pistons which are adapted to operate in the respective cylinders in quite the usual manner. Appropriate inlet and exhaust valve operating mechanism may be also included with the elements above noted as essential to the proper operation of the motor. So much of the motor as I have thus generally described may be designated in its entirety by the numeral 10.

The foregoing details or characteristics may be readily changed in any particular manner not conflicting with the application of this invention thereto since it is the purpose of the invention to adapt an explosion engine having these general characteristics to the high speed demands of aeronautical work by providing an adequate water cooling system. This system generally contemplates the individual service of the opposed cylinder banks and secures such service from a single pump duplex in form.

The pump casing 11 is of the general shape best illustrated in Fig. 2, including a hollow body and a pair of inlet tubes 12 communicating therewith. Within the pump body is rotatably mounted an impeller 13 comprising a disk 14 having its lateral faces formed with curved radially staggered vanes 15. The body of the pump is of a construction affording a pair of pump chambers adapted to be partially separated by an interiorly located annular flange 16 and to be completely separated by the impeller disk 14, the disk acting in conjunction with the flange to prevent communication between the chambers even during rotation of the impeller. With each of these chambers there connects one of the inlets 12 as well as outlets 17. The outlets extend laterally part way around the pump casing to a point on a line tangentially thereto or as illustrated to advantage in Fig. 1. A two-way or double elbow 17′ is located at the adjacent outlet terminals to engage with the opposed or oppositely extending feed-conduits later to be described.

Each of the cylinders of the engine is provided with a water jacket which is spaced from its cylinder in any desirable manner, completely inclosing the explosion chamber thereof. The lowest point in each water jacket is connected directly to a manifold 18 serving the bank to which the cylinder belongs, such manifold connecting, obviously, to one of the pump outlets 17. Oppositely extending conduits 19 afford the connecting means. From the highest point of each jacket, and diametrically opposite, a branch pipe leads, the pipes collectively serving to return the cooling agent, via the manifold 20, the radiator (not shown) and a return conduit 21, to the pump casing where it is again and continuously circulated in the paths thus defined.

The impeller 13 is keyed upon a shaft 22 and adapted to be actuated through the medium of a gear 23 mounted on this shaft to intermesh with a crank shaft gear (undisclosed) which is the lowermost element of a train of gears located at the forward or front end of the motor. While this drive arrangement is probably the most compact that could be constructed for the manifold requirements, it will be apparent that any desirable drive means for the pump can be used.

More specifically, the pump casing 11 may be described as comprising a body member 24 and cover plates 25 and 26, the plates engaging with the body member 24 after the manner illustrated in Fig. 2. The inside cover plate 26 has an integrally cast shell 27 formed thereon. The shell or support, as it may be more properly termed, is of a size and shape in cross section to completely embrace the pump shaft 22 and a packing gland 28 mounted adjacent the outer end of the said shaft at a point where the shaft penetrates the inner pump casing cover plate 26. In fact, the shell or support 27 is cut away as indicated at 29 that access may be gained to the packing gland 28 when required.

Ears 30, preferably three in number, are formed upon the support 27 to engage with the end crank case cover of the motor, designated 31. Bolts 32 are utilized to penetrate the ears 30 and the crank case cover 31 to afford a positive fastening means for the support and the pump casing carried thereby. This construction will eliminate the use of unnecessarily long bolts and yet provide for proper spacing of the pump away from the crank case cover. It is essential that the pump be thus spaced in order that the inlet 12 located at the inner side of the pump may extend therefrom after the fashion disclosed. Bearings of an appropriate design engage with the shaft 22.

By reference to the diagrammatic view Fig. 4, it will be noted that the conduit 19 and the double-elbow 17′ have been reversed. This reversible feature is, I believe, essentially novel. Without the introduction of a single new element and by simply re-arranging certain of the component pump parts the operation of the pump may be quickly and completely reversed. In obtaining a reverse operation of the pump it is but necessary to remove and replace the cover plate 25, remove, reverse and replace the conduits 19 and the elbow 17′ and remove, reverse and replace the pump body 24 and the im-

peller 13. This re-arrangement of parts, (assuming, of course, that the motor has been reversed) will, without alteration, completely and effectually reverse the operation of the pump. It is to secure this essential feature that the front cover 25 and the body 24 are made separate. Were the motor reversed and the pump parts unchanged as regards arrangement, the cooling agent, while active in so far as circulation is concerned, would circulate in a direction exactly opposite to that required. The parts enumerated only need be reversed.

In practice, the cooling agent is indrawn at opposite sides of the impeller disk into the pump casing and expelled therefrom by the action of the impeller. From the pump casing, the cooling agent travels in a circulatory path through the conduits 19, the manifolds 18, the cylinder water jackets, the manifolds 20, the radiator and the conduits 21 in the order named, the conduits 21 returning the cooling agent again to the pump casing for continued circulation after the manner disclosed. By dividing the pump casing interiorly, two independent yet correlated circuits are in evidence. The circuits in a sense act conjointly by reason of the utilization of but a single pump structure yet actually operate independently in that the cooling agent circulated for cooling each bank of cylinders travels in a distinct and non-communicating path. As suggested, should the water flow of one circuit be interrupted, or checked, the water flow in the other circuit will be in nowise affected. Even should the impeller at one side of the disk 14 be impaired, the circulation occasioned by continued rotation of the remaining active portion of the propeller would continue.

The advantages of a cooling system such as that described are believed to be evident from the fact that each cylinder bank is given a better service and a more direct service, while at the same time the number of pumps is not increased owing to the fact that the pump casing is provided with a similar pair each of inlets and outlets which respectively communicate with the opposed chambers, the inlets centrally of the pump casing and at opposite sides thereof and the outlets laterally of the pump casing and in a sense circumferentially or tangentially thereof. The location of the outlets with respect to the pump casing is such as to enable the pump to centrifugally expel the water via the conduits 19. To drain the pump casing a single plug 33 is provided, the plug engaging at the lower end of the pump casing with the flange 16, the said flange affording an abutment whereby adjustment of the plug is limited. By removing the plug both sections or chambers of the pump casing may be effectually drained.

Although I have described more or less precise forms and details of structure, I do not intend to be understood as limiting myself thereto as I contemplate changes in form, the proportion of parts and the substitution of equivalents as circumstances may suggest or render expedient and without departing from the spirit of the invention as claimed.

What is claimed is:

1. A duplex pump including a body, a central inwardly extending flange partially separating the body into chambers, an impeller rotatably alined with the flange to complete separation of said chambers, vanes carried by said impeller to project into each chamber, and an inlet and a circuit outlet separably communicating with each of said chambers.

2. A duplex pump including a body, a central annular inwardly extending flange partially separating the body into opposed chambers, opposed pump casing sections affording with said body a housing, an impeller rotatably alined with the flange to complete separation of said chambers interiorly of said housing, vanes carried by said impeller to project laterally into each chamber, and an inlet and a circuit outlet separably communicating with each of said chambers.

3. In a duplex pump, the combination of a body, an impeller constituting with associated means a partition for separating said body into two chambers, vanes carried by said impeller to project into each chamber, an inlet and an outlet separately communicating with each of said chambers, and a drain plug located intermediate the chambers for removal in draining the chambers as a unit.

4. A pump including a sectional pump casing having one of its sections fixed and the other reversible with respect to the casing support, and circulation induction means reversible within said casing to act conjointly with said reversible casing section in obtaining a complete reversal of the pump without altering the structure of or reversing the position of other and different parts of the pump.

5. A pump comprising a pump shaft and impeller reversibly mounted on said shaft, said impeller comprising a central partition disk and impeller blades carried by said disk, a casing for said impeller, said casing having a central casing section enveloping said impeller and said central casing section having outlets communicating respectively with the pump chambers and being reversibly mounted in its supports for adaptation to the reversible impeller for the purpose set forth.

6. A duplex pump including a sectional pump casing having one of its sections fixed

and the other reversible with respect to the casing support, and circulation induction means of a construction such that the casing is divided into separate chambers, the induction means being reversible within said casing to act conjointly with said reversible casing in obtaining a complete reversal of the pump without altering the structure of or reversing the position of other and different parts of the pump.

In testimony whereof I hereunto affix my signature.

CHARLES B. KIRKHAM.