Aug. 21, 1934. J. S. KEAN 1,970,565

SURFACE RADIATOR

Filed June 2, 1932 5 Sheets-Sheet 1

Fig. 1.

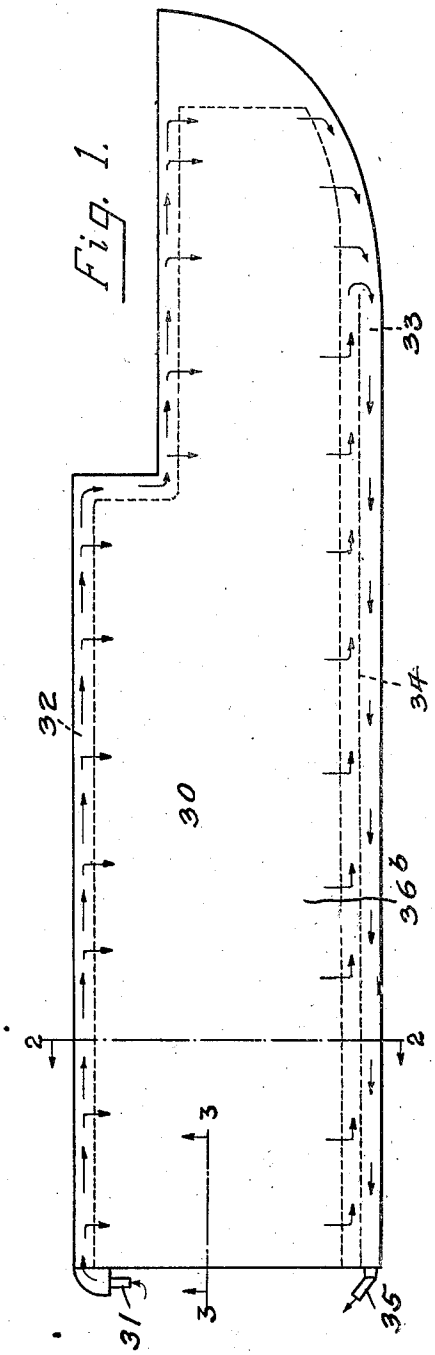


Fig. 2.

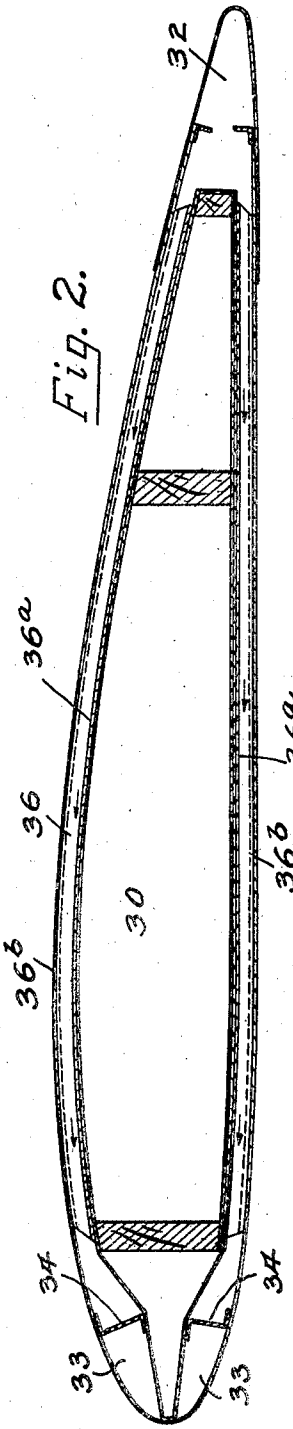
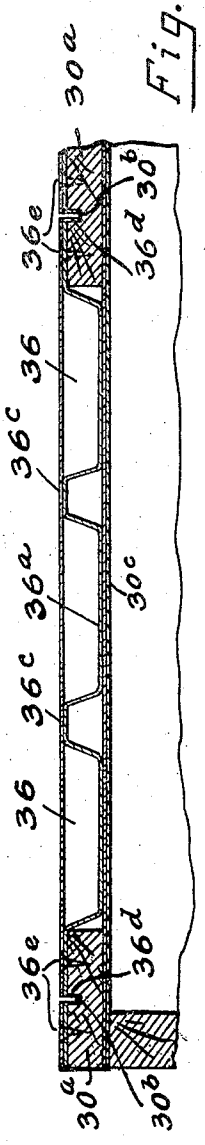


Fig. 3.



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SURFACE RADIATOR

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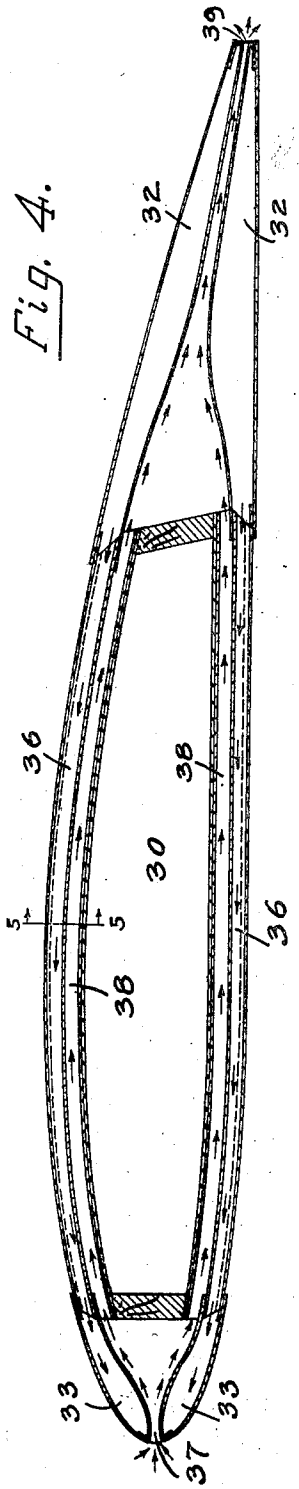


Fig. 4.

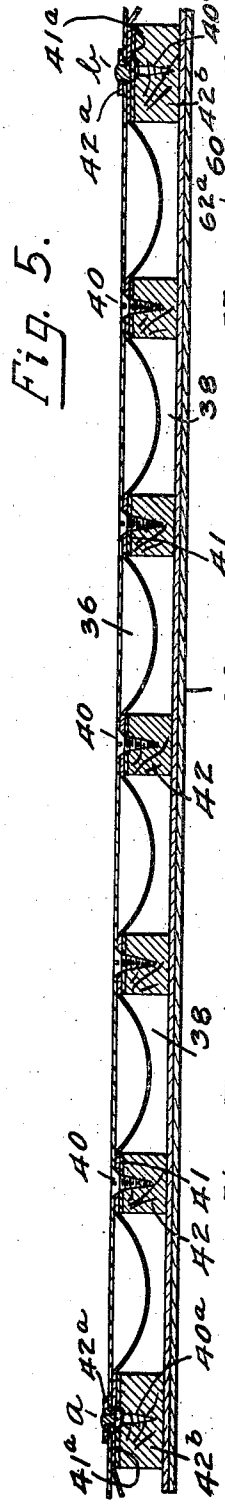


Fig. 5.

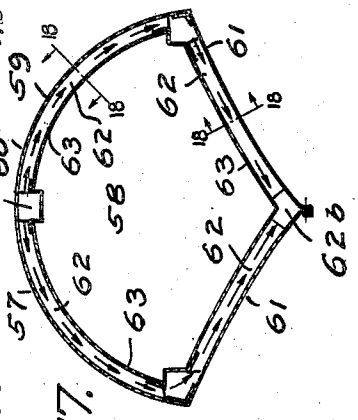


Fig. 17.

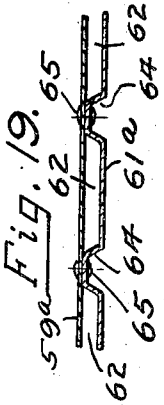


Fig. 19.

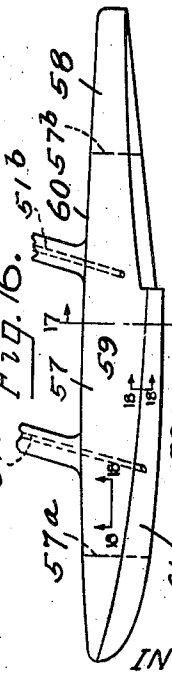


Fig. 16.

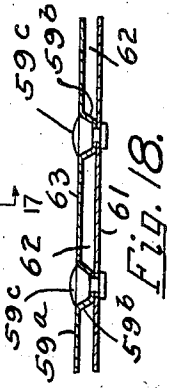


Fig. 18.

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SURFACE RADIATOR

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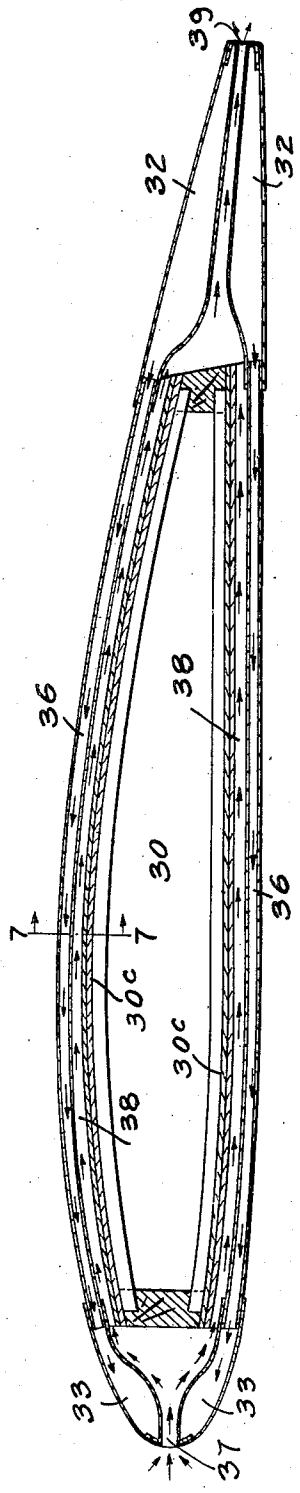


Fig. 6.

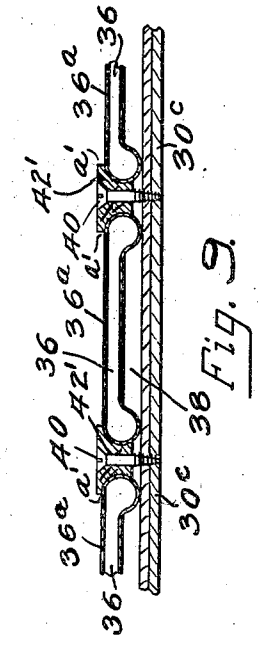


Fig. 9.

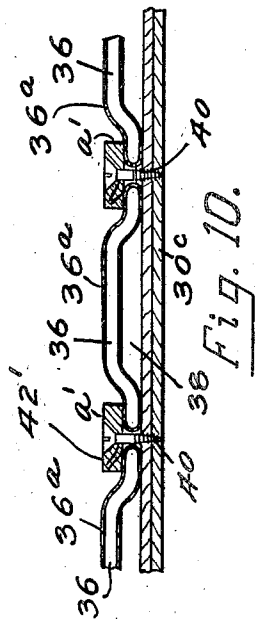


Fig. 10.

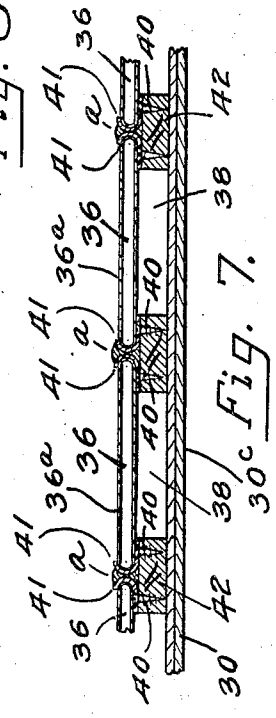


Fig. 7.

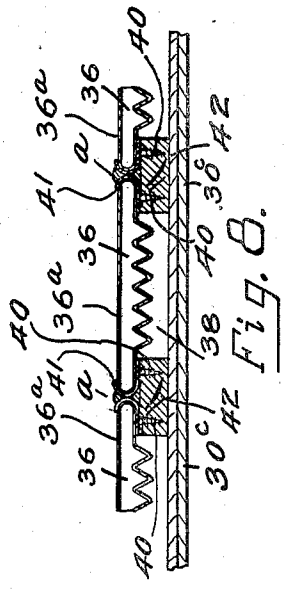


Fig. 8.

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SURFACE RADIATOR

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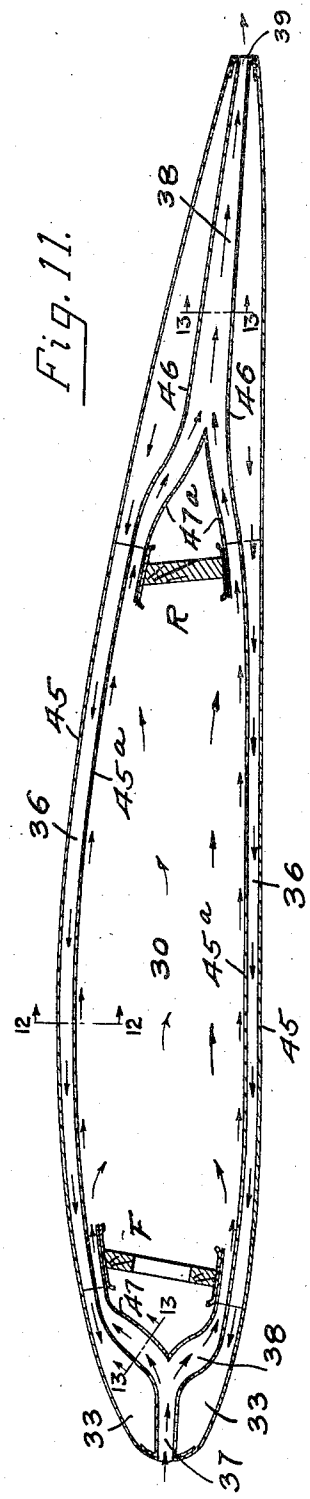


Fig. 11.

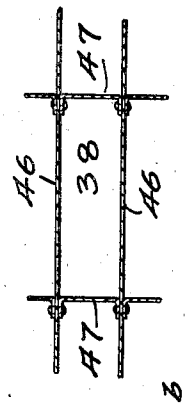


Fig. 13.

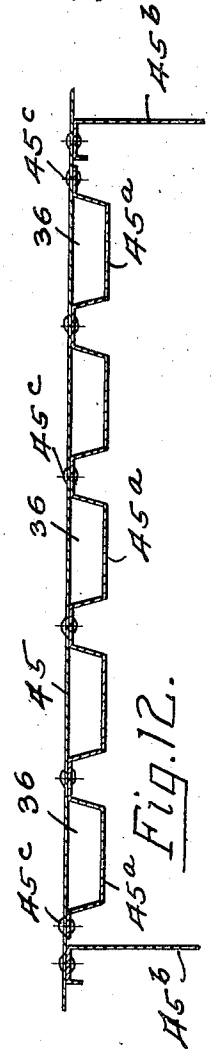


Fig. 12.

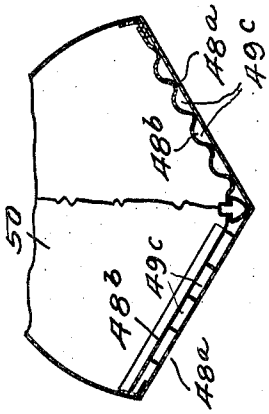


Fig. 15.

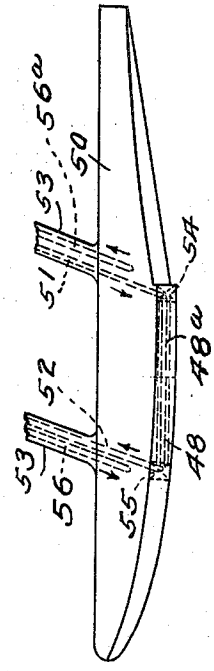


Fig. 14.

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SURFACE RADIATOR

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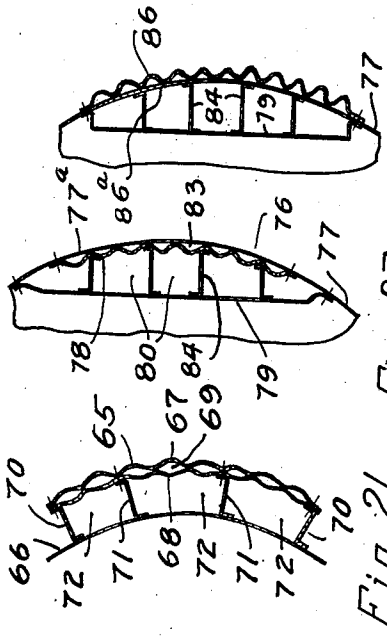


Fig. 24.

Fig. 23.

Fig. 21.

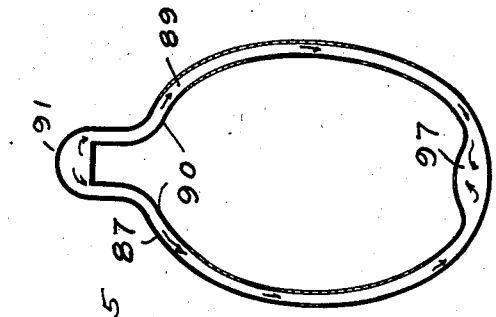


Fig. 26.

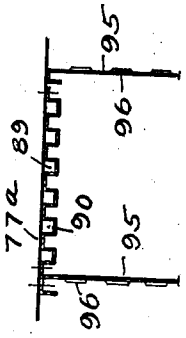


Fig. 27.

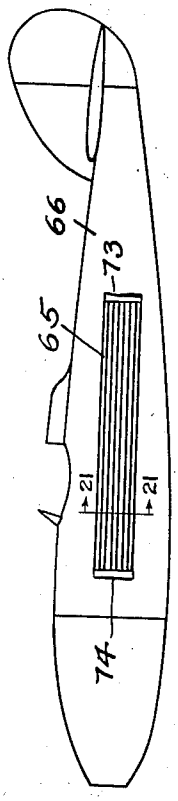


Fig. 20.

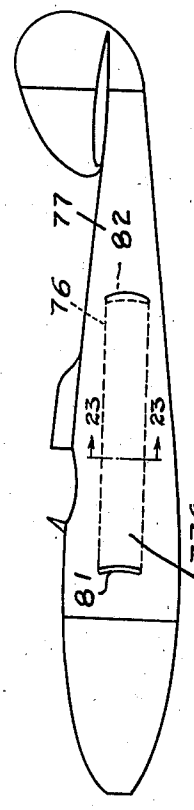


Fig. 22.

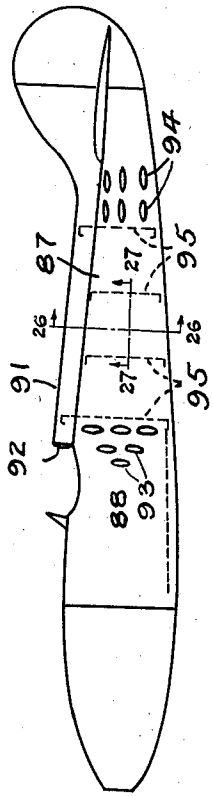


Fig. 25.

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UNITED STATES PATENT OFFICE

1,970,565

SURFACE RADIATOR

John S. Kean, Philadelphia, Pa.

Application June 2, 1932, Serial No. 614,948

13 Claims. (Cl. 244—31)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention relates broadly to heat dissipating devices for reducing the temperature of the coolant element of internal combustion engines, and particularly to the cooling of or the radiation of heat from oils or the coolant by the provision of especially constructed radiators, condensers or headers of very light and novel construction for the lowering of the running temperatures of aircraft engines.

An object of my invention is to provide heat radiators, condensers or the like having smooth outer surfaces, most desirable where a most efficient stream-line is essential such as when used in aircraft.

A further object of my invention is to provide for the uniform circulation of coolant element by directing the flow of the same through the radiators, condensers, headers or the like, for example, when constructed as a wing radiator, so as to permit the passage of the coolant from the engine to a header located at the trailing edge of the wing, then through the various coolant spaces to a header at the leading edge in a direction opposite to the air-stream.

Another object of my invention is to so construct cooling devices on the exterior of the wings or fuselage of an airplane as not to present any appreciable resistance in the air-stream and without sacrificing any space within the interior of the airplane.

A further object is to provide that the path of coolant be such that use is made of the more favorable heat dissipation characteristics of the entering edge of an air foil or other member.

Another object is to provide for the utilization of interior surfaces forming the radiator as heat radiating members.

A further object is the provision of means for admitting and distributing air to the interior surfaces of a radiator for the purpose of dissipating heat from such surfaces.

Another object is the reduction of aerodynamic drag of a body whether or not it is provided with a surface radiator by providing for the flow of air through openings in the forward portion of the wing and exhausting this air from the after portion of the wing.

A further object is the provision of means for ready installation or replacement, when damaged, of elements forming the radiators.

Another object is the provision of means for installation of members without the extensive use of heat such as is involved in welding, brazing or soldering.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts as will be described more fully hereinafter.

Reference is to be had to the accompanying drawings forming a part of the specification, in which like reference characters indicate corresponding parts throughout the several views, and in which:

Fig. 1 is a diagrammatic plan view of a typical airplane wing showing the direction of flow by arrows of my coolant means;

Fig. 2 is a vertical sectional view on line 2—2 of Fig. 1, showing a more detailed representation of one form of my invention;

Fig. 3 is an enlarged detail vertical transverse view taken on line 3—3 of Fig. 1, showing the detailed construction of a form of coolant space or flow ducts;

Fig. 4 is a slightly modified form of construction wherein provision is made for admitting an air flow to both sides of the coolant flow ducts;

Fig. 5 is an enlarged detail view on line 5—5 of Fig. 4, showing the detail construction of the coolant ducts and air ducts;

Fig. 6 is a section through an airplane wing showing a further slightly modified form of construction for admitting air flow to both sides of the coolant ducts;

Fig. 7 is an enlarged detail taken on line 7—7 of Fig. 6, showing one method of forming the ducts and air flow spaces;

Figs. 8, 9 and 10 show further modifications of detail constructions similar to those set forth in Fig. 7;

Fig. 11 is a sectional view through an airplane wing showing a further modification in the construction of the ventilated coolant duct;

Fig. 12 is an enlarged detail view on line 12—12 of Fig. 11;

Fig. 13 is a detail view on lines 13—13 of Fig. 11, showing the construction in a transverse direction;

Fig. 14 is a view in side elevation of an airplane float incorporating one form of my invention into the bottom thereof;

Fig. 15 is a transverse view of the construction shown in Fig. 14, but showing a broken line indicating the construction at two points along the fore-and-aft line of the float;

Fig. 16 is a view in side elevation of an airplane float showing a modified construction of my invention extending entirely around the same;

Fig. 17 is a view on line 17—17 of Fig. 16 showing by arrows the direction of flow through my coolant ducts;

Figs. 18 and 19 show slightly modified detail construction for providing the coolant ducts;

Fig. 20 is a side elevation of an airplane fuselage showing the application of my coolant members located in the sides thereof;

Fig. 21 is a detail section in line 21—21 of Fig. 20, showing a form of my radiator applied to the outside of the airplane;

Fig. 22 is a view similar to Fig. 20, showing a radiator construction applied to the inside of the airplane;

Fig. 23 is a view on line 23—23 of Fig. 22, showing the form of construction built inside of the contour of the fuselage;

Fig. 24 is a further slight modification of the construction as shown in Fig. 23;

Fig. 25 is a similar view to Fig. 20, showing air inlet and outlet openings in the side of a fuselage;

Fig. 26 is a detail enlarged section on line 26—26 of Fig. 25 showing the coolant duct surrounding the rear portion of the fuselage;

Fig. 27 is a detail view taken on line 27—27 of Fig. 25 showing the method of reinforcement and formation of the coolant ducts.

Referring more particularly to Figs. 1, 2 and 3 of the drawings, 30 indicates an airplane wing of a conventional type, in this case of wooden basic construction with a wooden inner structural member or skin 30*c*, having a smooth surface radiator construction covering the entire wing area. Inlet pipe 31 communicates with the intake manifold or header compartment 32 located along the trailing edge. 33 designates the manifolds or header compartments located at both upper and lower surfaces along the leading edge of the wing which are connected to the return pipe 35. Pipes 31 and 35 are connected through proper tubing or hose connections to the water jacket of the internal combustion engine.

Communication for flow of the cooling agent between the compartments 32 and 33 is accomplished through the passages 36 formed by the corrugations of the inner sheet 36*a*, which is secured to the outer smooth exterior surfaces 36*b* by solder, as at 36*c*. The ribs 30*a* attached by any usual manner to member 30*c*, are provided with grooves 30*b* for receiving the flanges 36*d* to insure a smooth and rigid exterior surface. Baffle plates 34 are located along the span of the wing to lengthen the return path of the coolant, particularly in the forward portion of the surface where cooling is most efficient, to the pipe 35. Individual sections of the radiator surfaces, by being formed in sections as shown in Fig. 3, may be readily replaced in case of local damage.

With reference to Figs. 4 and 5 of the drawings, it will be noted that I have shown a slight modification by providing a wing structure having a smooth outer surface construction covering the entire wing area, and in addition provide for an air flow to pass between the coolant ducts and the wing structure. An opening 37 in the leading edge of the wing 30, or in such other location in the forward portion of the surface as may be desirable by reason of existing pressure conditions, permits air to circulate around the inner wall of the front header 33, through passages 38 and around rear headers 32 and thence through opening 39 in the wing 30 to the atmosphere. This air flow is accomplished by reason of the difference in air pressure existing at or near the leading edge as at 37 and at or near the trailing edge as at 39 when the plane is in motion.

The construction of the radiator in separate sections is shown in Fig. 5. In this form I secure the sections at "*a*" and "*b*" by bending back the metal cleats 42*a* and soldering the same as indicated, to strip 41*a*, which in turn is attached to strip 42*b* by screws 40*a* or the like. Between these points "*a*" and "b" I secure the portions by screws or the like 40, and by soldering the sheets forming the inner surface of the ducts 36 to the metal strips 41 placed on the fore-and-aft wooden spacers 42.

Referring to the modifications shown in Figs. 6, 7, 8, 9 and 10, it will be noted that the operation is practically the same as that shown in Fig. 4, except for minor details of construction. The opening 37 in the leading edge permits air to circulate on the inner side of the front header 33, through passages 38 and around rear headers 32, and finally to pass out through the opening 39 in the trailing edge.

Figs. 7, 8, 9 and 10 show various details of the coolant ducts. It will be noted that each duct 36 is formed by a separate fluid-tight tube 36*a* of unusual section, individually attached by soldering or the equivalent, making a fluid-tight joint to the headers 33 and 32, thus forming a fluid passage between the headers. Referring to Figs. 7 and 8, the individual tubes 36*a* are attached to the wing skin by bending strip 41 around the edge of the tube and soldering as at "*a*". Strips 41 are attached to strips 42 by wood screws 40 or the like. It will be apparent that any individual tube 36*a* can be removed and replaced without disturbing any other tube in the radiator.

In the case of Fig. 8, the inner surface of tube 36*a* is corrugated in order to increase the area of the radiating surface and hence the amount of heat radiated.

Figs. 9 and 10 indicate modifications in the shape of tube 36*a* intended to permit installation of these parts without soldering or fastening by the like methods, except at the fluid-tight joints to the headers. In Fig. 9 spacer 42, of any desired material, is provided with a lip as at "*a*'" by which tubes 36*a* are clamped to wing skin 30*c* when screws 40 are drawn up. In Fig. 10 tubes 36*a* are so formed that spacer 42 is set into a recess formed by the adjacent tubes in order that a smooth outer contour may be provided.

The construction outlined in Figs. 9 and 10 provides a ready means for removing tubes since in order to remove a damaged tube, it is necessary only to remove the adjacent strips 42' and to break the soldered joint joining the tube to headers 32 and 33. Replacement would involve resoldering a new tube to headers 32 and 33 and replacing strips 42'. A further purpose of the non-rigid construction noted in Figs. 9 and 10 is the elimination of the adverse effects of distortion from heat generated by soldering or by the introduction of hot coolant into the ducts.

Referring to Figs. 11, 12 and 13, a further modification of a smooth surface wing radiator construction is shown in which the radiator and the coolant ducts 36 form a portion of the wing. Additional circulation is provided by permitting the air-stream entering the opening 37 at the leading edge of the wing to be deflected by the baffle plates 47 around the forward spar F and enter the interior of the wing 30, around the baffle plates 47*a* behind the rear spar R and through space 38 to the opening 39 at the trailing edge of the wing.

The wing 30 as shown in Fig. 12 is of all metal construction. The smooth outer surface 45 supports the corrugated or channel sections of the inner surface 45*a* forming coolant ducts 36. Each

coolant section of my radiator construction is built in between bays formed by the ribs 45*b* and is secured by rivets or the like 45*c*, and/or by soldering to outer surface 45.

Fig. 13 shows a cellular super structure construction of the leading edge and the trailing edge in which the partitions 46 forming the coolant ducts 36 are reinforced by secondary partitions 47, attached by soldering or the like. The air passage is represented at 38. The arrows indicate the direction of flow of the coolant and also the direction of air flow within the wing. The secondary partitions 47 serve also as supplementary heat dissipating surfaces.

Figs. 14 and 15 disclose a form of my radiator 48 installed in the bottom 49 of a float 50, and is intended to take advantage of the heat absorption properties of the water in which the radiator is submerged or in contact while the plane is at rest or running on the water, and also to dissipate heat to the air while the plane is in flight. The smooth outer surface 48*a* represents the bottom of the float, and 48*b* represents the inner corrugated surface forming the coolant ducts 49*c*. Cooling agents are circulated from the engine to the radiator, and return by tubing 51 and 52 respectively housed within the struts 53. The direction of flow of the coolant is indicated by arrows. Header manifolds 54 and 55 are connected at each end of the radiator sections 48 and to the tubings 51 and 52. The cooling air enters the float 50 through the tubing 56 and exhausts through 56*a*; circulation is produced in any well known manner. The construction of the radiator shown in the right half of Fig. 15 represents a cross-section intermediate of frames, while the left half of the figure discloses the construction at the frames or bulkheads.

Referring to Figs. 16 to 19 inclusive, I have shown a further modification of a radiator 57 incorporated into the structure of a float 58 in which the smooth outer surface 59 surrounds the entire float between certain limits designated as 57*a* and 57*b*, thus utilizing both the deck 60 and the bottom 61 of the float, and dissipating heat not only to the water in which the plane is supported but also to the spray which may come in contact with the deck and also to dissipate heat to the air while the plane is in flight. The coolant duct 62 having its inner surface 63 constructed either as shown in Fig. 18 in which the outer surface 59*a* is pressed in as at 59*b* to receive the rivets 59*c* and is sealed by soldering if necessary for fluid tightness, or, as shown in detail in Fig. 19, the outer surface 59*a* may remain smooth and the inner surface 61*a* may be indented as at 64 and be secured by rivets 65, and/or by soldering or by other means used alone or in combination.

In the construction shown in Fig. 16, the air flow is forced through the tubing 51*a* into the interior of the float 58 where it comes in contact with the inner surface 63, and is then drawn out through the tubing 51*b* by any suitable means such as a suction fan, air driven or power driven, as preferred.

The coolant enters between the outer surfaces 60 and 61 and the inner surface 63, through a manifold 62*a* located at the top of the float, and is returned through the return header 62*b* at the keel. The arrows indicate the direction of coolant flow.

Referring to Figs. 20 and 21, it will be noted that I incorporate my surface type radiator construction 65 on the sides of the fuselage 66 of an airplane. In this form I provide the coolant ducts 69 by using a corrugated outer sheet 67 and inner corrugated sheet 68. The sheets forming the coolant ducts 69 are spaced away from the fuselage by longitudinal members 70 and 71. The members 70 are preferably solid, in order to restrain and direct the air flow, while the members 71 may contain a series of lightening holes. Air is permitted to flow through the spaces 72 thus formed, to cool the inner surface 68 of the radiator 65, while the outer surface 67 is cooled by the normal air stream. Headers 73 and 74 are connected to the ducts 69 and to the engine by tubing, not shown.

Referring to Figs. 22, 23 and 24, I have shown a further modification of my radiator 76 applied to the sides of a fuselage 77 so that the same is constructed into the contour of the fuselage to form a smooth outer surface wall 77*a*, and a corrugated inner surface 78, a partition 79 being built on the inside of the fuselage to provide space 80 for the air flow to reach the inner surface 78. Air flow will enter a port 81 and pass out through the port 82 in the sides of the fuselage. The coolant ducts 83 formed by the parts 77*a* and 78 are reinforced by the longitudinal stiffening members 84, and the air flow passes through the passages 80.

Fig. 24 shows a slight modification of the construction of the coolant ducts in which the outer surface 86 is corrugated and the inner surface 86*a* conforms to the contour of the fuselage.

Referring to Figs. 25, 26 and 27, I have shown a form of my radiator construction 87 applied to an extensive area of the skin of fuselage 88 as, for example, that portion between the pilot's cockpit and the tail surfaces, the coolant space 89 being located between the smooth outer surface 87 and a corrugated or fluted inner wall 90. This construction permits the radiator being integrally built in to form the stress members of the fuselage. The streamlined portion 91 back of the head-rest 92 is utilized for the intake header for the cooling agent which is permitted to flow down between the surfaces 87 and 90 to the collector manifold 97 located along the bottom, the direction of flow of the coolant being indicated by arrows in Fig. 26. Louvers 93 and 94 are located in the sides of the fuselage so as to permit circulation of air into the interior of the fuselage against the inner wall 90. Fuselage bulkheads 95 in the area covered by the radiators are provided with openings 96 to permit the air flow to pass out through the louvers 94.

It will be understood that the above description and accompanying drawings comprehend only the general and preferred embodiments of my invention, and that various changes in the materials, construction, proportion and arrangement of parts may be made within the scope of the appended claims without sacrificing any of the advantages of my invention.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon.

What I claim is:

1. In an aircraft, heat dissipating devices for aircraft engines, in combination, a series of coolant ducts spaced apart and arranged in parallel relation with respect to each adjacent duct and in conformity to the streamline exterior of the aircraft, said ducts forming sections of the outer skin of the aircraft, headers connected to each

end of said ducts and in communication with the jackets of the engine, a coolant agent adapted to circulate through said ducts in opposite direction to the forward travel of the aircraft, baffle plates arranged parallel to the fore and aft line of travel for forming air passages within the streamline contour of the aircraft to cool the walls of said ducts, intake openings in communication with the air passages formed by said baffle plates and located in a region of increased air pressure, and escape openings also in communication with the air passages formed by said baffle plates located in a region of reduced air pressure.

2. In heat dissipating devices for aircraft engines integrally connected into a fusiform structure of an aircraft, in combination, a smooth outer skin constituting the primary outer surface of and conforming to the contour of the structure, an inner skin constituting a secondary structural element and means shaped to form a series of coolant ducts arranged in parallel relation with respect to each other between said inner skin and primary surface, headers connected to each end of said ducts and in communication with the jackets of the engines, a coolant agent adapted to circulate through said ducts in an opposite direction to the forward motion of the aircraft, air intake ports located in the outer skin of the aircraft and in a region of increased air pressure for forcing air under pressure between the ducts and the inner skin, and air outlet ports located in the outer skin at a region of reduced air pressure for expelling the air from the interior of said fusiform structure.

3. In heat dissipating devices for aircraft engines, integrally constructed into an aircraft, in combination, a fusiform member, a smooth outer metallic sheet constituting the outer skin and conforming to the contour of said fusiform member, a corrugated inner member forming a series of coolant ducts and reinforcing said outer metallic sheet, headers connected to each end of the ducts formed by said inner member, said headers connected with the engine, a coolant agent adapted to circulate through the ducts and said headers in opposite direction to the slipstream generated by forward motion of the aircraft, intake ports located in said outer sheet in a region of increased pressure for forcing air under pressure to the interior of said fusiform body and around the ducts formed by the corrugated member, and outlet ports located in said outer sheet in a region of reduced pressure for expelling air from the interior of said fusiform body.

4. In heat dissipating devices for aircraft engines integrally constructed into an aircraft member, in combination, a float having a smooth outer skin for its planing surface, a corrugated inner member reinforcing said outer skin and forming a series of coolant ducts, headers connected to each end of the ducts formed by said inner member, a coolant agent adapted to circulate through the ducts and said headers in opposed direction to the forward motion of the aircraft, intake and outlet pipes connected to the said headers for circulating said coolant agent to the engine, and air intake attached to said float for directing a flow of air under pressure to the interior of said float for cooling the ducts within the float, and in a pipe for exhausting the air from the interior of the float.

5. In heat dissipating devices for aircraft engines integrally constructed into an aircraft, in combination, a fusiform member, a smooth outer metallic sheet constituting the outer skin and conforming to the contour of said fusiform member, a corrugated inner member reinforcing said outer sheet and forming a series of cooling ducts, an outlet header integrally formed by protruding said outer sheet on top of said fusiform body, an inlet header integrally formed between said outer sheet and inner member in the bottom of said fusiform body, said inlet and outlet headers connected with the ducts formed by said inner sheet and also with the aircraft engine, a coolant agent adapted to precipitate through the ducts and said headers in a direction from said inlet header to said outlet header, intake ports in said outer sheet in a region of increased pressure for forcing air under pressure to the interior of said fusiform body and against the ducts formed by the corrugated member, and escape ports in said outer sheet located in a region of reduced pressure for expelling air from the interior of said fusiform body.

6. In heat dissipating devices for aircraft engines, integrally constructed into an aircraft member, in combination, a float having a smooth outer skin forming a curved deck and a planing bottom, a corrugated inner member reinforcing said outer skin and forming a series of coolant ducts, headers connected to each end of the ducts formed by said inner member, a coolant agent adapted to circulate through the ducts and said headers in opposed direction to the forward motion of the aircraft, and air intake attached to said float for directing a flow of air under pressure to the interior of said float for cooling said ducts and an outlet member for exhausting the air from within the float.

7. In heat dissipating devices for cooling an aircraft engine, in combination, a series of coolant ducts spaced apart and arranged in parallel relation to each other, headers connected to each end of said ducts, a coolant agent adapted to circulate through said ducts and headers in a direction opposite to the forward travel of the engine, and spacing members located between each of the ducts having securing means for attaching said ducts.

8. In heat dissipating devices for aircraft engines, in combination, an aerofoil section having a plurality of spars, an inner sheet for enclosing the space between the spars, an outer metallic sheet enclosing the entire aerofoil and conforming to the contour of the aerofoil section, an inlet header along the trailing edge of said aerofoil section, a corrugated sheet secured between said metallic sheet and said inner sheet, fluid ducts formed by alternate corrugations of said corrugated inner sheet, said fluid ducts communicating with said inlet header, a plurality of outlet headers located along the entire leading edge of said aerofoil section and in communication with said fluid ducts and baffle plates within said outlet headers and extending to a return opening toward the tip of said aerofoil section whereby a coolant agent circulates from the inlet header forwardly through said fluid ducts located along the upper and lower surfaces to said outlet headers and then is deflected outwardly by contact with said baffles and caused to flow toward the tip of said aerofoil where the flow is direct around the baffles to the leading edge of the aerofoil.

9. In a heat dissipating device for aircraft engines, in combination, an aerofoil section, a series of coolant ducts arranged in parallel relation with respect to each other and in a fore-and-aft position with respect to said aerofoil section, headers

connected at their ends to said ducts, a coolant agent adapted to circulate through said ducts in an opposite direction to the forward travel of said aerofoil, spacer ribs separating said ducts one from the other, said spacer ribs forming air passages between said aerofoil section and said ducts, means for directing air from a pressure area of the wing to said air passages and means for discharging the air from the wing and means for securing said spacer ribs and said ducts to said aerofoil section.

10. In a heat dissipating device for aircraft engines, in combination, an aerofoil section having an area between its spars enclosed by an upper and lower surface, a series of coolant ducts arranged parallel to each other and away from the surfaces of said aerofoil section, headers located along both leading and trailing edges of said aerofoil section connecting said ducts, a coolant agent adapted to circulate through said headers and flow through said ducts in a direction opposite to the forward travel of said aerofoil, spacer ribs separating said ducts, said spacer ribs forming passages between the surfaces of said aerofoil section and said ducts for permitting air flow to increase the range of radiation by contact with the inner exterior surfaces of said ducts, an air intake at a pressure area of the wing to said air flow passages and an exhaust port from said passages for discharging the air from the wing and means for the removal and attachment of each individual duct.

11. In a heat dissipating device for aircraft engines, in combination, an aerofoil section having an area between its spars enclosed by an upper and lower surface, a series of coolant ducts arranged parallel to each other and spaced away from the surfaces of said aerofoil section, headers located fore-and-aft of the spars of said aerofoil, said headers connected to communicate with said ducts, a coolant agent within said headers adapted to flow forward through said ducts, spacer ribs separating said ducts, said spacer ribs forming passages between the surfaces of said aerofoil and said ducts for permitting air flow to increase the range of radiation produced by said coolant by contact with the inner exterior surfaces of said ducts, air intake passages bounded by said forward headers and in communication with the passages formed by said spacer ribs, air outlet ducts bounded by said aft headers for exhausting air flow after passing said ducts and securing means for the removal and replacement of the respective ducts.

12. The combination of an aerofoil, comprising a built-in heat dissipating device for cooling an aircraft engine, an area bounded by the spars of said aerofoil having an upper and lower skin surface, a series of coolant ducts having a smooth outer exterior conforming to the contour of said aerofoil and arranged parallel with respect to each other and spaced away from the skin surfaces of said aerofoil, a plurality of forwardly located headers spaced apart and conforming to the contour of the leading portion of said aerofoil and connected to communicate with said ducts, a plurality of rearwardly located headers spaced apart and conforming to the contour of the trailing portion of said aerofoil and connected to communicate with said ducts, a coolant agent within said headers adapted to flow in a forward direction through said ducts, spacer ribs separating said ducts, passages formed by said spacer ribs for admitting air to flow to increase the range of radiation of said coolant by contact with the inner exterior surfaces of said ducts, air intake passages bounded by said forwardly located headers and in communication with said air passages, air outlet passages bounded by said rearwardly located headers and in communication with said air passages formed between said ribs, and securing means whereby said ducts may be removed individually from the exterior of said aerofoil.

13. In a heat dissipating device for aircraft engines, in combination, an aerofoil having upper and lower surfaces extending between the spars thereof, a series of coolant ducts forming a smooth outer exterior surface conforming to the contour of said aerofoil and arranged parallel with respect to each other and away from the upper and lower surfaces, respectively, of said aerofoil; headers located fore-and-aft of the spars of said aerofoil in communication with said ducts above the upper surface of said aerofoil, headers arranged fore-and aft of the spars of said aerofoil in communication with said ducts below the lower surfaces of said aerofoil, said forward headers and aft headers being divided to provide an air passage in communication with the spaces formed along the outer interior faces of said ducts, an air inlet passage at the leading portion of the aerofoil to the forward air passage and an air outlet from the aft air passage at the trailing edge of the aerofoil, spacer ribs separating said ducts and holding the same away from the surfaces of said aerofoil, and securing means whereby said ducts may be removed individually from the exterior of said aerofoil.

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