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HEAT EXCHANGE APPARATUS
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Fig. 1

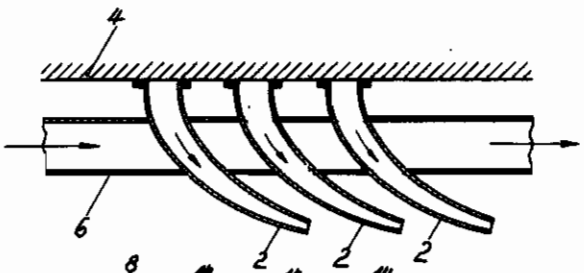


Fig. 2

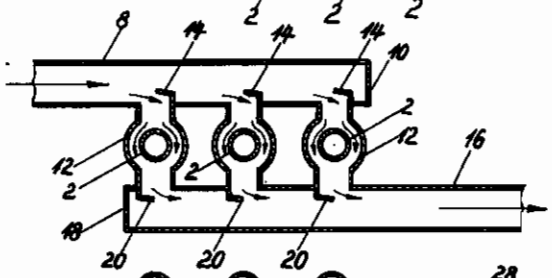


Fig. 3

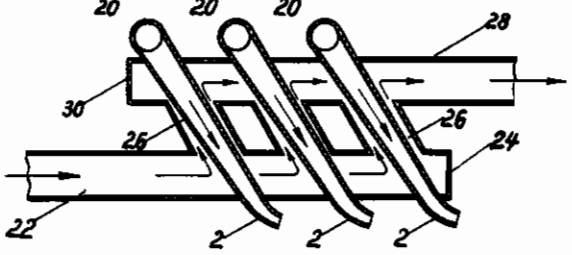


Fig. 4

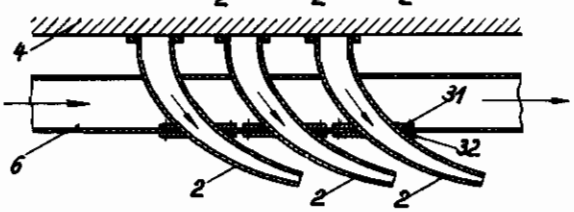


Fig. 5

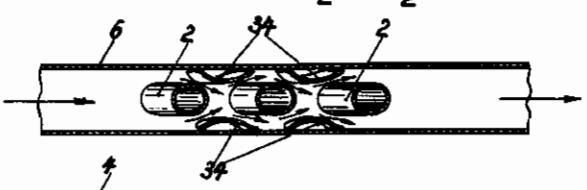
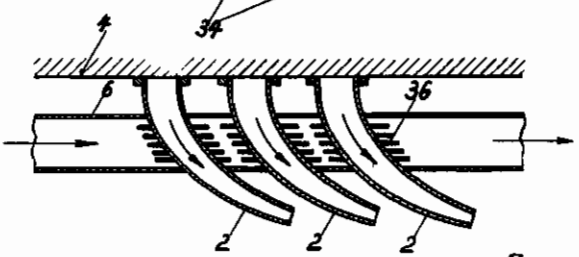


Fig. 6



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ALIEN PROPERTY CUSTODIAN

HEAT EXCHANGE APPARATUS

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Application filed July 6, 1939

This invention is directed to apparatus for absorbing heat from specially shaped exhaust conduits so that the heat can be used in other parts of an air craft, for example, in heating the cabin of the aircraft or for heating the de-icing devices.

In aircraft engines having exhaust conduits designed as nozzles for the purpose of obtaining a recoil action from the gases emitted from the nozzles for the purpose of aiding in the forward propulsion of the aircraft, considerable importance is placed upon the cooling of the conduits. Because of their relatively short length, and because of the gas pressures and high temperatures developed in them, by reason of their nozzle shape, great care must be taken in the cooling to prevent deformation and destruction of the nozzles with a consequent loss in the efficiency of recoil. Prior structures merely exposed the nozzles to a cooling medium such as the air stream passing the aircraft, whereas it is an object of this invention to construct an apparatus for the more effective application of a cooling medium to the highly heated nozzles, so that better cooling of the nozzles is obtained while at the same time sufficient heat is absorbed by the cooling medium to render the now heated medium useful for other purposes, such as for heating the aircraft cabin, or de-icing apparatus.

It is an object of the invention to construct a novel and simple apparatus for applying a cooling medium to recoil exhaust conduits for the absorption of heat therefrom.

A further object of the invention is to construct a heat exchange system including the exhaust conduits of an aircraft engine in which leakage of the exhaust from the conduits is prevented.

Another object of the invention is to cool the exhaust conduits which extend from individual cylinders of an engine by passing the cooling medium transversely of the direction taken by the gases in the exhaust conduits, one cooling system being common to all of the individual exhaust conduits.

Another object of the invention is to provide special fin constructions in order to obtain a more efficient heat exchaneg action between the conduits and the cooling medium.

The objects of the instant invention are obtained by forming the heat exchange conduits as tubes directing the flow of the cooling medium, such as air, against confined areas of the recoil exhaust nozzles, with the advantage that sufficient heat is absorbed so that the cooling medium can be used for other purposes, such as the heating of the cabin of an aircraft, or the heating of de-icing apparatus.

The means by which the objects of the invention may be obtained are more fully described in the following specification taken in connection with the accompanying drawings, in which:

Fig. 1 is a sectional view showing the use of one conduit for cooling successively a plurality of exhaust conduits.

Figs. 2 and 3 are similar views showing modified forms of conduits for cooling the recoil exhaust nozzles with separate streams of air.

Fig. 4 is a view similar to Fig. 1 showing means for obtaining a tight joint between cooling conduits and the individual exhaust conduits.

Fig. 5 is a similar view showing the use of special baffles between the exhaust conduits for effecting a more efficient cooling thereof; and

Fig. 6 is a similar view showing the use of fins to effect a more efficient cooling of the exhaust conduits.

In Fig. 1, individual exhaust conduits 2 are shown extending from the wall 4 of a motor; conduits 2 of course being connected to the exhaust ports of the various combustion chambers of the motor. Conduits 2 are of special construction and are curved rearwardly to form at their ends nozzles which produce a recoil effect to aid in the forward propulsion of the aircraft.

An air duct 6 successively traverses each of the conduits 2. This duct 6 is open at its forward end for the entrance of air which passes by each individual conduit 2, and is discharged from the rear end of the conduit, as indicated by the arrows. It is noted that the passage of the cooling air is substantially as right angles to the direction of the passage of the gases through the individual exhaust conduits. This provides a very efficient means of cooling these relatively short conduits 2 as air forced through duct 6 impinges with increased pressure upon conduit 2. Air having been heated through the absorption of heat from walls of the conduits, can be conducted to the interior of the cabin of the aircraft for the purpose of heating the same, or can be used for heating de-icing apparatus.

In Fig. 2, a second form of conduit is shown in which air is admitted into the duct 8 which is closed at one end 10. The individual exhaust conduits 2 are connected to duct 8 by individual manifolds 12, the air entering duct 8 being aided in its passage through manifolds 12 by baffles 14. The air leaves manifolds 14, and passes into duct 18 from which it is conducted to any point of use.

Duct 16 is closed at one end 18, and the movement of the air entering the conduit 16 is facilitated by baffles 20. In this construction as in Fig. 1, the gases are passing at right angles to the direction of flow of the cooling air.

An arrangement somewhat similar to that shown in Fig. 2 is illustrated in Fig. 3. Therein, duct 22 is common to all the exhaust conduits 2; duct 22 being closed at one end 24. Air not only passes transversely of the direction of flow of gas in the conduits 2, but further travels in a direction opposite the direction of flow of the gases in exhaust conduits 2 by being passed through manifolds 26, each of which encloses a portion of the length of an exhaust conduit 2. Manifolds 28 empty into duct 26 closed at one end 30 from which heated air is conducted to a point of use. In this arrangement substantially the entire length of the short exhaust conduits 2 is enclosed by the ducts 22 and 26, and connecting manifolds 26. Consequently substantially the entire length of each exhaust conduit 2 is subjected to the cooling air.

In Fig. 4 a joint structure between the duct 6 and the individual exhaust conduits 2 is shown. Spaced annular flanges 31 and 32 surround each exhaust conduit 2, and a wall of duct 6 is clamped between these flanges. This construction enables the use of conduits 2 which need not be of seamless tube construction, inasmuch as the surrounding joint employed prevents the entrance of gas which may leak from a welded tube forming a nozzle extending through the duct 6.

In Fig. 5 the duct 6 is again shown extending transversely of the individual exhaust conduits 2. In between adjacent exhaust conduits 2 are placed arcuately shaped baffles 34 which are convex toward the interior of duct 6 and constrict the passageway of duct 6 between adjacent individual exhaust conduits, and accordingly produce an increase of pressure against the walls of the exhaust conduits, which in turn creates a better cooling action, or a more efficient heat exchange between the walls of the exhaust conduits and the cooling air.

In Fig. 6 the exhaust conduits 2 are again traversed by duct 6. In order to facilitate the heat exchange between the walls of exhaust conduits 2 and the cooling medium, a plurality of annular fins 36 are secured to each exhaust conduit 2 within duct 6, and in the path of the cooling air.

By the above constructions the short exhaust conduits which are constructed as recoil nozzles, are kept from overheating so that the material forming the nozzle shaped conduits does not distort, and by such distortion cause a loss of efficiency in the recoil action. By the use of the air conduits shown, the heat contained in the exhaust conduits can be transferred to a cooling medium, and used for other purposes, as for the heating of an engine or the prevention of the icing of the wings. By using the construction of Fig. 4, it is not necessary to use seamless tubing for the construction of the exhaust conduits as the connecting flanges form an efficient sealing construction to prevent leakage of gases from the exhaust conduit into the cooling medium.

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