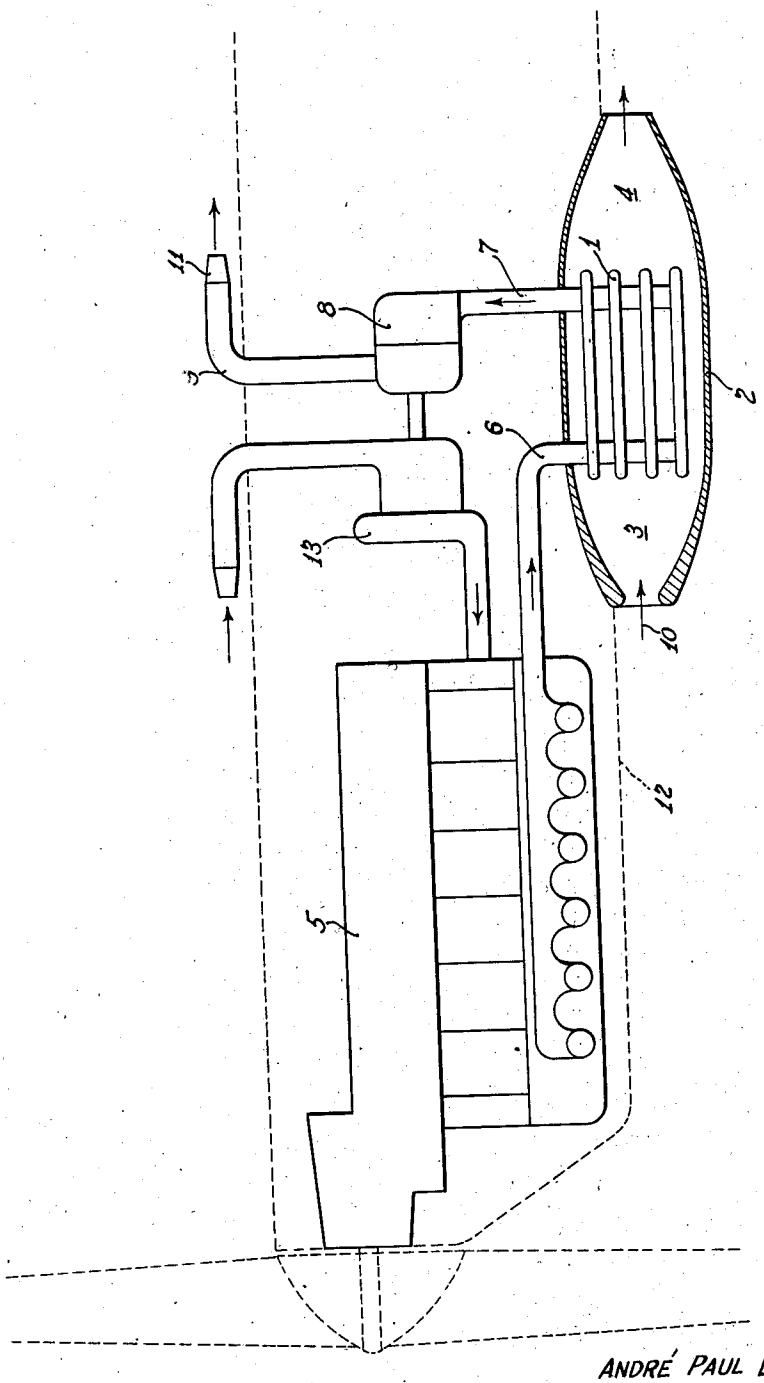
July 3, 1945. A. P. E. PLANIOL 2,379,541

FEED OF EXHAUST GASES TO TURBO SUPERCHARGERS

Filed Oct. 9, 1941



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Patented July 3, 1945

2,379,541

UNITED STATES PATENT OFFICE

2,379,541

FEED OF EXHAUST GASES TO TURBOSUPERCHARGERS

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Application October 9, 1941, Serial No. 414,328
In France February 10, 1941

2 Claims. (Cl. 60—6)

The use of the exhaust gases of airplane engines to operate turbines ordinarily causes difficulties of a thermal nature due to the excessive temperature of these gases which produces a premature destruction of pipes, collectors and rotating vanes of the turbo-machines.

This invention is characterized primarily by the provision of a heat exchanger comprising a plurality of tubes which is placed in a divergent, convergent enclosure traversed by a stream of air. The heat exchanger unlike those heretofore in use, is not arranged to lower the temperature of the cooling water to the engine but operates to lower the temperature of the exhaust gases from the engine which pass through the tubes of the heat exchanger before entering the turbine. The invention includes also the production of a supplementary propelling effect for the airplane.

In other words, according to the invention there is interposed between the exhaust collector of the engine and the inlet of the turbine one or several cooling equipments for the exhaust gases which are placed in such a way that the heat yielded by the exhaust gases to the ambient air is used to aid in propulsion of the airplane.

By lowering the temperature of the exhaust gases the energy of the exhaust gases available for actuating the turbine is necessarily reduced but this loss of energy is not wasted because of the useful propelling effect obtained from the use of the heat exchanger as hereinafter described. This heat exchanger constitutes a thermal machine of reaction of a known type where heat originates in the exhaust gases traveling from the engine to the turbine. The thermal machine of reaction receives at one end the air coming from the atmosphere compressed by the relative speed of the plane. Thereafter this air is heated by contact with the tubes of the exchanger which are in contact on their outer surfaces with the air and on their inner surfaces with the exhaust gases of high temperature. The thus heated air is directed to the rear and allowed to expand, thus increasing its speed and aiding in the propulsion of the plane.

The accompanying drawing illustrates one embodiment of the invention.

In accordance with the invention a heat exchanger 1 is positioned within an open ended enclosure 2 having a forward chamber 3 shaped like a divergent nozzle and a rear chamber 4 shaped like a convergent nozzle. The cooler 1 receives the exhaust gases from the engine 5 through pipe 6 and delivers the same through a system of pipes 7 to the exhaust turbine 8. From the exhaust turbine the gases pass to the atmosphere through a tube 9. As the airplane is flying from right to left of the drawing, air enters chamber 3 in the direction of the arrow 10 and passes about the tubes of the radiator 1 to cool the exhaust gases before admission to the turbine and in turn to be heated by contact with the walls of the tubes. As the heat exchanger 1 is preferably so positioned as to occasion but slight loss in pressure of the air in passing from chamber 3 to chamber 4, the increase in air temperature will result in expansion of the air in the chamber 4 and this work of expansion will be transferred nearly entirely into kinetic energy. The final temperature being higher than the initial temperature, the exit speed will be superior to the entrance speed of the air, the ratio $V/\sqrt{T}$ being constant when there is no loss of energy (V denoting speed and T the absolute temperature of the air). The excess of the kinetic energy between the outlet and the inlet provides the motive power developed by the system. It is quite obvious that the enclosure 2 may be positioned either outside of the body of the plane so as to receive the atmospheric air, or it may be placed at another part of the plane as, for example, in the wings or fuselage or adjacent the engines; the most advantageous position for the enclosure being determined according to the particular conditions to be fulfilled. In the particular embodiment of the invention illustrated in the drawing, the enclosure 2 is positioned below the fuselage 12.

It may occur at times that when the turbine is used only to drive the compressor 13 supercharging the aircraft engine, if the turbo-machine has a sufficiently high output, and if also the turbine can resist sufficiently high temperature, that the energy of the gases rendered available by the expansion to atmospheric pressure exceeds what is necessary to operate the turbine. In this case it would be advantageous, rather than to reduce the pressure of the exhaust gases in the heat exchanger 1 by more than is needed for the correct functioning of the machine, to provide the exhaust pipes of the turbine with a nozzle 11 directed to the rear and thus communicate a high speed to the gases passing from the turbine; the resulting kinetic energy creates a motive impulsion and the expansion of the exhaust gases is thus achieved in two separate steps, first in the turbine and second in the reaction nozzle 11. The propelling efficiency of this nozzle is of course greater the greater the speed of the airplane.

The following is claimed:

1. The combination in an airplane having an engine and an exhaust turbine operated by the exhaust gases thereof, of a heat exchanger inserted between the engine and the turbine for passage of the exhaust gases therethrough, and an open ended divergent-convergent enclosure containing said exchanger and positioned for passage of air therethrough in the direction of flight of the plane, said exchanger being so positioned within said enclosure as to occasion but slight loss in pressure of the air in passing from the divergent to the convergent portion of the enclosure, whereby the exhaust gases are cooled prior to introduction into the turbine and the air stream is heated by the gases and the increased kinetic energy of the air stream gives a propulsion effect to the plane.

2. The combination according to claim 1 including a rearwardly directed convergent nozzle for delivery of the exhaust gases from the turbine to the atmosphere.

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