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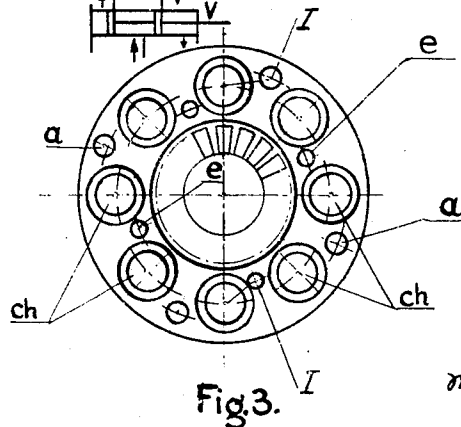
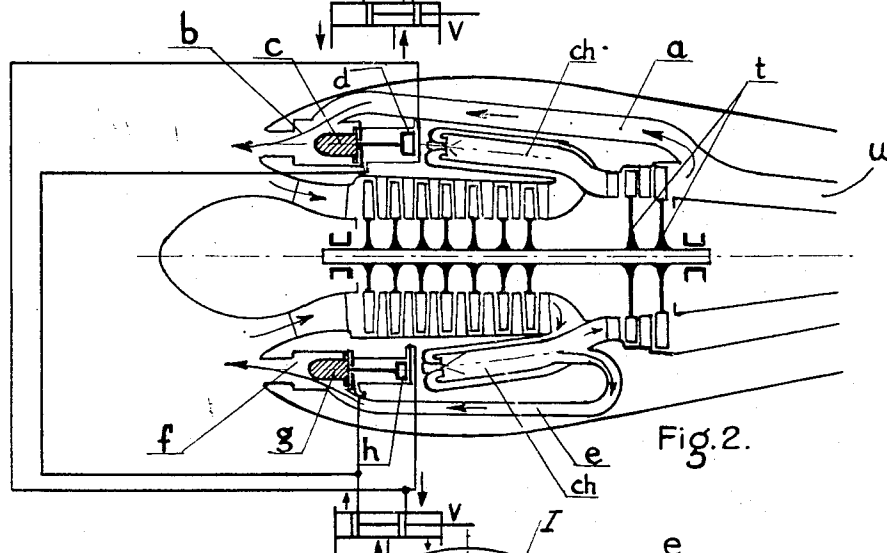
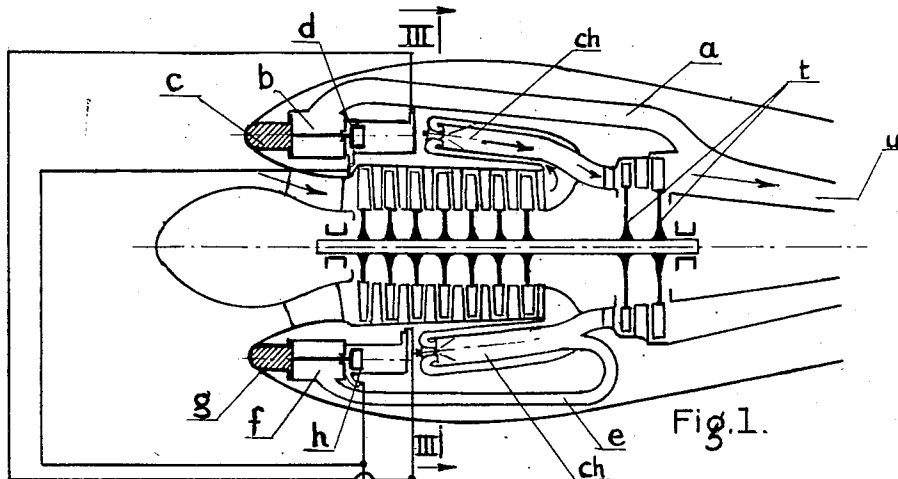
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2,647,367

MEANS FOR THE AERODYNAMIC BRAKING OF AIRCRAFT

Filed Feb. 10, 1948

2 Sheets-Sheet 1



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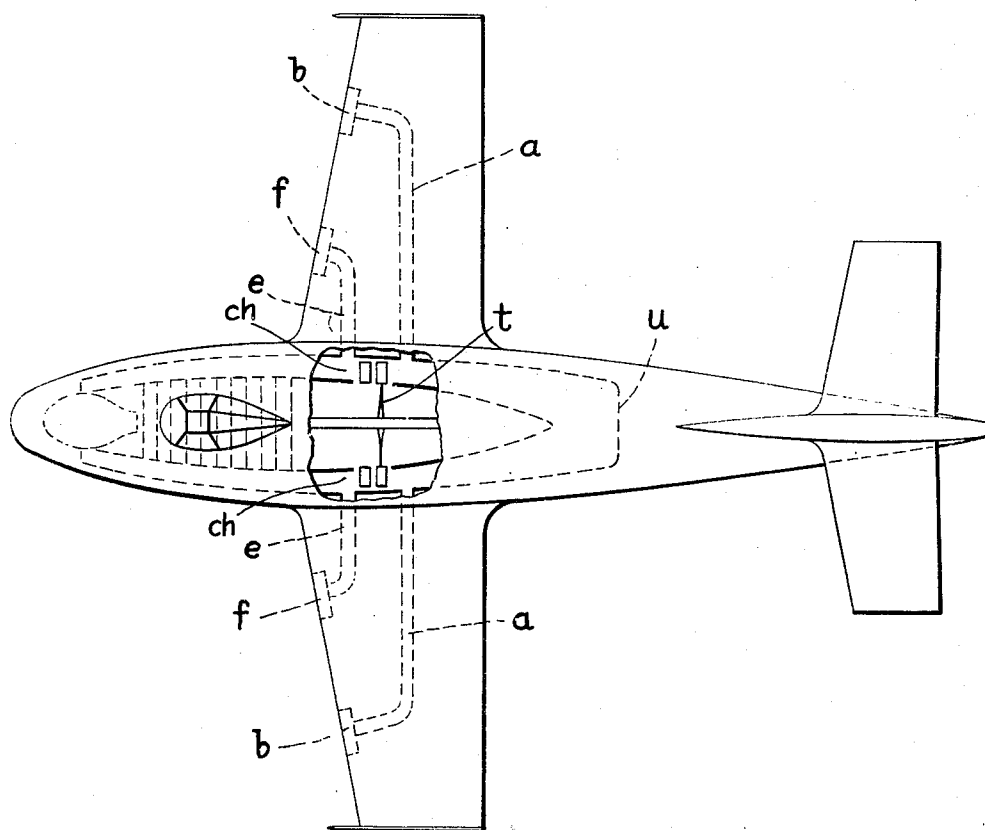
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MEANS FOR THE AERODYNAMIC BRAKING OF AIRCRAFT

Filed Feb. 10, 1948

2 Sheets-Sheet 2

Fig. 4.



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2,647,367

MEANS FOR THE AERODYNAMIC BRAKING
OF AIRCRAFT

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Application February 10, 1948, Serial No. 7,497
In France March 21, 1947

4 Claims. (Cl. 60—35.54)

1

It is known fact that reaction jet airplanes assume a considerable speed of progression when landing and that their stopping requires a substantial travel after they have come into contact with the ground. It is also necessary to be capable when landing to reduce and cancel the thrust due to reaction while retaining a possibility of immediate pick-up in the case of a failure in the landing.

It is already known to use to this purpose a deflection towards the front either of the exhaust gases or of the air before it passes through the combustion chamber so as to execute a braking reaction in a direction opposed to propelling reaction. These two methods show drawbacks as will appear hereinafter.

As concerns the deflection of air towards the front before it passes through the combustion chambers, such a method shows the drawback of modifying the operative opening of the compressor and of requiring a modification in the injection of fuel in order to avoid the rise in temperature resulting normally from the reduction of the air output. Moreover the reduction in the output through the turbine reduces the speed of the group and for any subsequent pick up, in the case of a failure in the landing for instance, it is necessary to begin by reaccelerating the machine, which may require a certain time. Lastly, the braking action is not very important by reason of the air expanded towards the front not being heated and of the drop in pressure accompanying the reduction in speed and the increase of the compressor opening.

The arrangement that uses a forward deflection of the jet of exhaust gases from the turbine does not show these drawbacks but it requires a special shape for the reaction jet nozzle that is comparatively intricate and difficult to control while furthermore leading during normal operation to a certain loss of energy.

The present invention relates to a method that does not show these drawbacks and that allows even for a comparatively important braking action the integral retaining of all the possibilities of pick up of the machine; in other words it does not modify or modifies only to a negligible extent the speed, the temperature and the amount of fuel injected. Furthermore, it requires no modification in the aerodynamic circuit during normal operation.

According to this method, there is ejected simultaneously towards the front, gas removed from the exhaust of the turbine and driving fluid removed prior to admission into said turbine.

2

The invention covers also an arrangement for executing said method and including the association of a by-pass for the exhaust gases of the turbine towards the front without any modification in the reaction jet nozzle serving for normal operation, with another by-pass returning towards the front the gases from the combustion chambers before their entrance into the turbine.

The following description with reference to accompanying drawings will allow understanding how the invention may be embodied.

In said drawings:

Fig. 1 is a diagrammatic axial cross-section, on line I—I of Figure 3, of an aircraft fuselage equipped with a reaction jet turbine including an embodiment of the invention shown in its inoperative position.

Fig. 2 shows the same fuselage with the arrangement according to the invention in its operative position.

Fig. 3 is a transverse cross-section through line III—III of Fig. 1.

Figure 4 shows diagrammatically a plan view of an aircraft provided with a braking device according to the invention.

The upper longitudinal half cross-section of Fig. 1 shows the deflection of the exhaust gases passing out of the turbine *t* before entering the propelling reaction jet nozzle *u*. This deflection is provided through the channel *a* leading to a chamber *b* located to the front of the fairing. Said chamber includes at least one exhaust port for the gases towards the front, which port is closed during normal operation of the aircraft by a valve *c*. This valve is actuated by means of a piston *d* with a pneumatic or hydraulic control or through any other device within the skill of the designer.

The lower longitudinal half cross-section of Fig. 1 shows the deflection towards the front of the driving fluid removed from the combustion chamber *ch* before or preferably after the combustion in order to increase the temperature of the gases and consequently the speed of braking. This deflection is performed through a channel *e* leading to a chamber *f* provided with at least one opening for the ejection of the gases towards the front, said port being closed during normal operation by means of a valve *g*. Said valve is rigid with a piston *h* that is also controlled as above through any suitable means such as a pneumatic or hydraulic system.

The simultaneous actions of both deflection by-passes, are adapted to one another in order to obtain with a constant injection of fuel a rotary

speed of the reaction jet turbine that is substantially unchanged as well as a temperature without any substantial variation at the admission into the turbine.

This is possible as may well be understood from the following disclosure. The increase (by opening of *c*) in the cross-sectional area of the output of the exhaust gases from the turbine reduces the exhaust counter pressure; this leads to an increase in the drop of thermic energy available in the turbine and if the output of motive gases simultaneously by-passed through valve *g* before entering the turbine is suitably reckoned, taking into account the reduction in pressure mentioned, there is no modification in the power delivered by said turbine and thereby in its rotary speed. It is just possible to find a certain increase in the opening of the compressor and thereby a certain reduction in pressure. The latter does not modify substantially the output of air which in the case of an injection of fuel that is unvarying corresponds as desired to the keeping of the temperature of the gases at a constant value.

When the braking is to be performed, the operator proceeds with the simultaneous control of the valves *c* and *g* opening the deflection by-passes towards the front, said control being obtained through a single operation in order to satisfy the conditions of stability as disclosed hereinabove. To this end the fluid acting on the pistons *d* and *h* may be controlled by a common hand-operated distributor *v*.

When the valves *c* and *g* are in their open position illustrated in Fig. 2, the currents of braking gases follow the circuit illustrated by the arrows.

The control of this action may be a gradual one so as to obtain for instance a zero thrust for full speed of the unit.

In order to make the engine pick up, the pilot has just to close the outputs for the braking gases. The result thereof is that automatically after a very short time that depends only on the inertia of the gas streams, a forward thrust is produced that is equal to maximum thrust.

In the embodiment shown in the drawing the braking jets are directed parallel to the common axis of the compressor and of the turbine, but they may be directed obliquely with respect to said axis.

For a greater clarity of the drawings, the outputs of gas towards the front are shown as lying to the front of the reaction jet turbine, which in the case of a single engine on the aircraft might inconvenience the pilot if the latter is seated behind these outputs or even further to the rear. As a matter of fact the outputs of braking gases are not necessarily bound to the propelling unit and may be located at any other part of the aircraft in particular in the wings; it is sufficient therefore to provide the necessary connecting pipes. Figure 4 shows an arrangement of this kind wherein several chambers *b* and *f* are disposed inside the wings of an aircraft at points regularly spaced along the leading edge of said wings. The chambers *b* and *f* are connected by respective pipes *a* and *e* to the exhaust side of the gas turbine *t* and to the exit of the combustion chambers. The chambers *b* and *f* open frontwardly on the leading edge and are provided with control valves similar to valves *c* and *g* described above. Such an arrangement shows the considerable advantage of allowing a setting of the braking effort that suits to the best

the stability of the aircraft, which is not the case in any prior arrangement.

In the embodiment shown in the drawing it is supposed that if there are several combustion chambers *ch* arranged for instance around the compressor, it is possible to distribute several chambers *b* and *f* fed respectively by pipes *a* and *e* in alternation along a circle coaxial with the axis of the compressor.

In order to allow a better understanding of Figs. 1 and 2, the deflecting channels have been illustrated as lying outside the space occupied by the combustion chambers, but as apparent from Fig. 3 that is a transverse cross-section of Fig. 1 through said combustion chambers, these pipes *a* and *e* may be housed without any difficulty between said chambers, said arrangement having the advantage of not increasing the bulk in diameter of the fairing of the reaction jet turbines.

Lastly, it will be noticed that the deflection of the gases leads only to the provision of supplementary pipes and consequently they do not require the arrangement in the normal path of the gases of any hindrance that might be a cause of a lowering in the efficiency or of a reduction in the thrust during normal operation.

Obviously, the forms of execution described have been given out by way of mere examples and they may be modified chiefly through the substitution of technical equivalents without widening thereby the scope of the invention.

What I claim is:

1. In an aircraft driven by a reaction jet turbine fed with hot gases by combustion chambers, braking means comprising a set of by-pass channels forming an annular arrangement coaxial with the combustion chambers, the alternate channels being connected respectively to the exhaust side of the turbine and to the exit of said combustion chambers, said channels being adapted to convey and discharge frontwardly a part of the hot gases from the combustion chambers and a part of the effluent from said turbine and opening each into the atmosphere at the front of the aircraft, and means for simultaneously controlling the outputs of all said by-pass channels into the atmosphere.

2. In an aircraft driven by a reaction jet turbine having a combustion chamber provided with means for burning fuel therein, a source of air under pressure connected to said chamber in order to supply it with combustion air so as to form hot gases, a gas turbine having its inlet connected to the exit of said combustion chamber so as to be fed with hot gases therefrom, and a jet forming nozzle rearwardly directed and connected to the exhaust side of said turbine, braking means comprising: at least one channel connected to the exhaust side of said turbine and frontwardly directed, said channel being adapted to by-pass and discharge frontwardly a part of the effluent from said turbine, at least another channel separate from the former connected to the exit of the combustion chamber and frontwardly directed, said second channel being adapted to by-pass and discharge frontwardly a part of the motive hot gases issuing from said combustion chamber, valve means on each of said channels, and control means for opening and closing simultaneously the valve means of said channels.

3. The combination of claim 2 wherein the respective channels are adapted to convey gas outputs which are proportioned to one another in

order to keep substantially constant the rotary speed of the turbine.

4. In an aircraft driven by a reaction jet turbine fed with hot gases from combustion means, the combination of a front exposed surface having a plurality of apertures therein directed forwardly and regularly spaced along said surface, a valve for controlling each aperture, pipe means for delivering gases from said combustion means to some of said apertures, other pipe means for delivering gases from the effluent of said turbine

5

10

to the other apertures and means for opening and closing the valves for all apertures simultaneously.

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References Cited in the file of this patent
UNITED STATES PATENTS

Number	Name	Date
2,280,835	Lysholm -----	Apr. 28, 1942
2,527,732	Imbert -----	Oct. 31, 1950