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FORWARD AND REVERSE TURBINE OPERATED BY COMBUSTION PRODUCTS AND AIR

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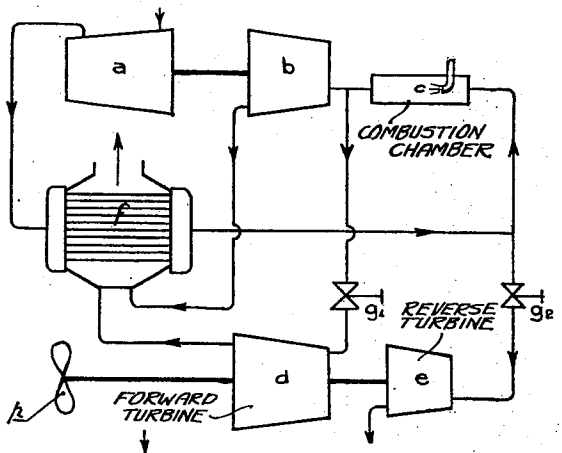


Fig. 1

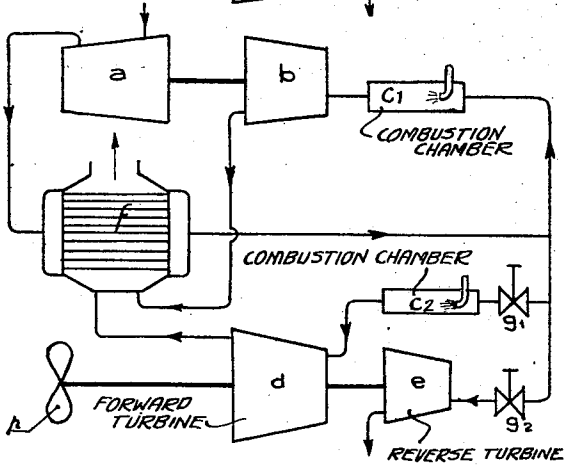


Fig. 2

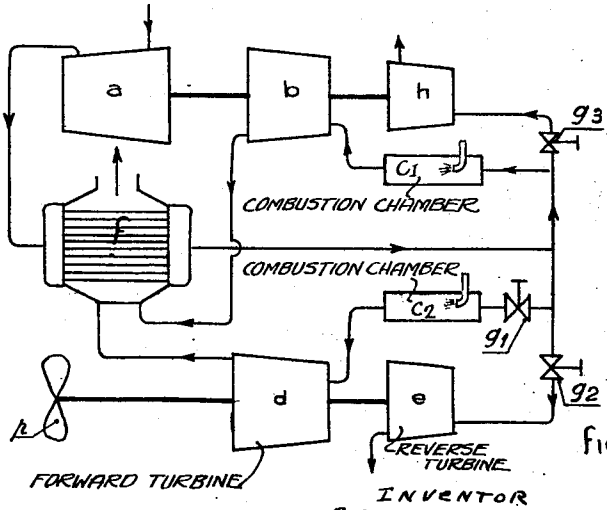


Fig. 3

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FORWARD AND REVERSE TURBINE OPERATED BY COMBUSTION PRODUCTS AND AIR

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1 Claim. (Cl. 60—49)

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In power machines comprising gas turbines, the high temperature of the gases and the considerable inertia of the moving masses make it difficult to execute reversals in speed, either from forward to backward movement or reversely, unless mechanical reversing means are resorted to.

The present invention relates to the case where the power required for rearward operation is much less important than that required for normal forward operation, as may be the case with ships for instance.

According to the invention, the rearward motion is obtained by means of a gas turbine fed with the gases removed at the outlet of a recuperator without said gases being submitted to a complementary heating in a combustion chamber.

The following description to be read in association with accompanying drawing, of a form of execution given by way of example and by no means in a limitative manner, will allow the execution of the invention to be well understood; the features appearing either in the drawing or in the specification form of course part of said invention.

Figs. 1, 2 and 3 show diagrammatically three different forms of execution of the invention.

There is shown diagrammatically in Fig. 1 a thermic engine with gas turbines adapted to drive a ship's propeller and including an auxiliary turbine for driving the air compressor. In said figure, *a* designates the air compressor, *b* the auxiliary gas turbine driving same, *c* the combustion chamber cooperating with the auxiliary turbine and with the principal driving turbine *d*. The latter drives the propeller *p* for forward motion; *e* designates the driving turbine for rearward motion and *f* the heat exchanger or recuperator heating the air under pressure provided by the compressor *a* by means of the heat contained in the exhaust gases of the auxiliary turbine *b* and of the principal driving turbine *d* for forward operation. The invention consists in making use of the moderate amount of power required for the rear operation turbine *e* for feeding the latter with compressed air which has already passed through the heat exchanger *f* without any complementary heating due to a combustion of fuel inside said air. In order to ensure under such conditions the feeding, as desired, of either driving turbine, the turbine *d* for forward motion on one hand and the turbine *e* for rearward motion on the other hand may be selectively isolated through actuation of the valves g_1, g_2.

This arrangement shows however the drawback

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consisting in that the valve g_1 or the like isolating part for the forward operation turbine is submitted to the very high temperature of the combustion gases passing out of the burners in the combustion chamber *c*.

In order to remove this drawback, it is possible to provide in conformity with Fig. 2 a similar arrangement in which two combustion chambers are used of which one, c_1 feeds the auxiliary turbine *b* with hot compressed gases while the other, c_2, feeds the principal driving turbine *d* for forward motion with hot compressed gases.

This latter arrangement shows the double advantage—

1. Of allowing the driving turbine *d* to be fed at the maximum temperature allowed by reason of the possible flow of the metal without any other consideration as to the balance of power between the power of the auxiliary turbine and that absorbed by the air compressor.

2. Of inserting no isolating valve or the like part in the path of the hot gases at the outlet of the combustion chambers, the isolating parts being arranged in the path of the gases passing at a lower temperature out of the recuperator. Thus Fig. 2 shows the valve g_1 inserted upstream with reference to the combustion chamber c_2.

At the outlet of the driving turbine for forward motion, the exhaust gases may or may not pass through the heat recuperator *f*; the case is the same for the exhaust gases passing out of the driving turbine for rearward motion.

The invention covers also the recuperation of the hot gases which have passed through the recuperator and which it is necessary to remove when they are available when the turbines for forward or rearward motion operate at zero power or have stopped. In conformity with the diagram of Fig. 3, a small elementary gas turbine *h* similar to the rear motion turbine and fed solely by means of the gases which have passed through the recuperator is coupled with the system comprising the auxiliary turbine *b* and the compressor *a*. A valve g_3 allows inserting said turbine in the circuit for operation in order to provide for the working of the motor, when idling, with a lesser expenditure of fuel, the flow of fuel inside the chamber c_1 being then reduced.

In all cases (Figs. 2 and 3), the burner in the combustion chamber of the driving turbine for forward motion may, during idling operation, be held operating at a very low rate with the minimum corresponding flow of air. This arrangement allows therefore a very speedy passage from

forward operation to rear operation and reversely, which furthers thus the ease of manoeuvring which is highly to be appreciated in particular on board warships.

The essential condition to be observed in all cases is the obtention of the highest temperature possible in all the turbines and at all rates of running.

Obviously, the forms of execution described have been given solely by way of example and by no means in a restrictive sense and they may be modified for instance by replacing a given part by an equivalent device without widening thereby the scope of the invention, as defined by accompanying claim.

What we claim is:

In a gas turbine plant for driving ship propellers, having a gas turbine for forward motion of the driven apparatus, another gas turbine for rearward motion and a common source of air under pressure comprising an air compressor and an auxiliary gas turbine for driving the same, the combination which comprises a heat exchanger for receiving, in heat exchange relation, the whole of the exhaust gases of both the first named gas turbine and the auxiliary gas turbine and also the air under pressure delivered by said

compressor, piping means connecting the outlet of said heat exchanger to said forward motion gas turbine and to said auxiliary gas turbine, for conducting the heated air to said turbines respectively, said piping means comprising a combustion chamber and valve means ahead of said forward motion gas turbine, other piping means connecting directly the air outlet of said heat exchanger to said rearward motion gas turbine, and valve means mounted in said last named piping means ahead of said rearward motion gas turbine.

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MARCEL HENRI LOUIS SÉDILLE.

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