

June 28, 1960

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2,942,845

NOZZLES FOR AIR OR OTHER GAS DRIVEN TURBINES

Filed Jan. 6, 1958

2 Sheets-Sheet 1

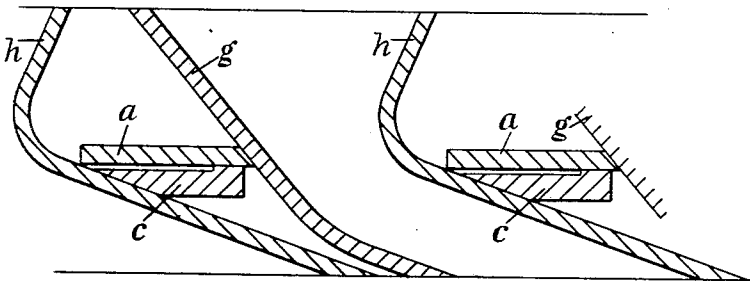


Fig. 1

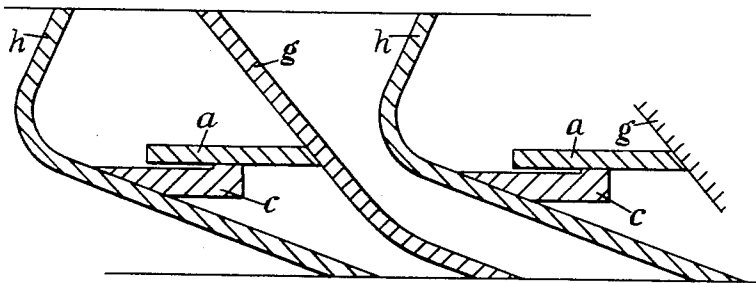


Fig. 2

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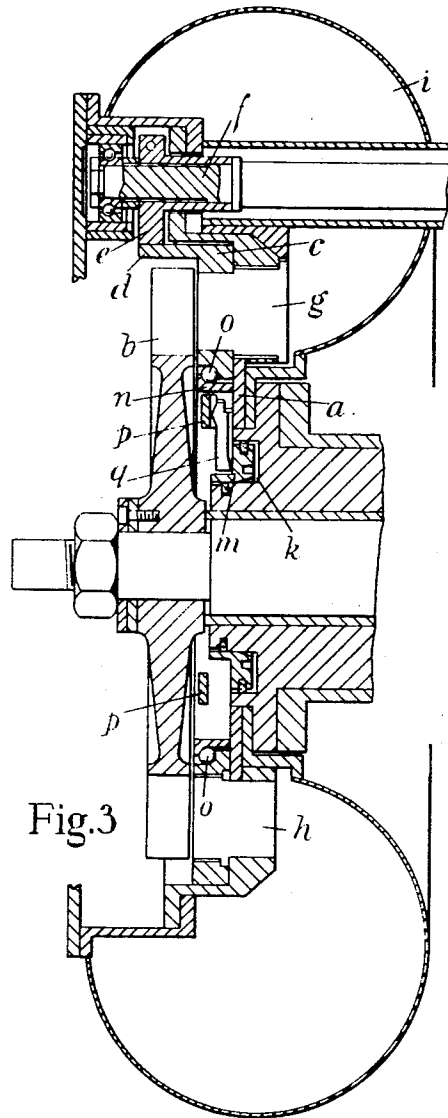


Fig.3

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NOZZLES FOR AIR OR OTHER GAS DRIVEN TURBINES

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2 Claims. (Cl. 253—78)

This invention relates to turbines of the axial-flow type for which the motive fluid is compressed air or other gas.

The object of the invention is to provide such a turbine with a motive-fluid system of nozzles in a form which enables the cross sectional area of the nozzles to be varied in a convenient manner, whilst at the same time maintaining high efficiency of flow.

A turbine in accordance with the invention comprises in combination a rotor, a plurality of nozzles each provided with a pair of opposite side walls shaped to direct motive fluid to the rotor, a pair of annular plates capable of relative angular adjustment, and each provided with a plurality of equi-spaced quadrilateral apertures corresponding in number to the nozzles, means supporting the plates in interfacial contact with each other at one side of the rotor, a series of members forming respectively one of the side walls of each of the nozzles, and secured respectively to one edge of each of the apertures in one of the plates, and a second series of members forming respectively the other side walls of the nozzles, and secured respectively to the opposite edges of the apertures in the other plate, so that relative angular adjustment of the plates serves to vary the cross sections of the nozzles.

The invention also comprises a turbine as specified in the preceding paragraph having combined therewith means for maintaining close interfacial contact of the plates in opposition to the pressure of the motive fluid acting on the movable plate.

In the accompanying drawings:

Figures 1 and 2 are diagrammatic views respectively illustrating two operative positions of a nozzle construction forming an essential feature of the invention. Figure 3 is a sectional side elevation of a turbine embodying the invention.

In the example illustrated by the drawings there is provided a flat annular plate *a* of any convenient radial width adapted to be secured within the turbine housing at one side of the rotor *b*, and in contact with the side of this ring adjacent to the rotor is mounted an angularly movable annular plate *c*, the latter being provided with a laterally extending lug *d* which is engaged by an arm *e* formed on or secured to a spindle *f* and is arranged to engage at its free end with the said lug for imparting angular movement to the plate *c*.

In each plate is formed a plurality of equispaced quadrilateral apertures, and on one edge of each aperture in the fixed plate *a* is secured a nozzle part *g* which extends across both sides of the plate and through the corresponding aperture of the movable plate. Likewise

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there is secured to the opposite edge of each of the apertures in the movable plate *c* a complementary nozzle part *h* which extends from both sides of the movable plate and through the adjacent aperture of the fixed plate.

As shown in Figures 1 and 2, the two parts *g*, *h* of each nozzle form the side walls of the nozzle and are shaped to any appropriate curved configuration for directing the motive fluid efficiently from a supply chamber *i* to the rotor blading. Variation of the cross-sectional area of the nozzles is effected by angular movement of the movable plate relatively to the fixed plate. Figure 1 shows the nozzle parts in the positions providing the maximum area of the throat between the parts *g*, *h*. Figure 2 shows the said parts in the positions providing a smaller area at the throat.

To prevent movement of the movable plate *c* away from the fixed plate *a* by pressure of the motive fluid, there is provided in the central portion of the fixed plate a shallow annular cylinder *k* to which the motive fluid can gain access from the supply chamber *i* through suitably arranged passages, and in this cylinder is contained an annular piston *m*. Also at the side of the movable plate adjacent to the rotor is mounted a ring *n* between which and the movable plate is contained an annular arrangement of thrust balls *o*. Further, there is provided adjacent to the ring *n* a fixed annular abutment *p* which supports an assembly of radially mounted levers *q* all of which at one end act on the ring and which at their other ends are in contact with the piston, the arrangement being such that the fluid pressure acting on the piston serves to hold the movable plate in its proper position.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. An air or other gas driven turbine of the axial-flow type, comprising in combination a rotor, a plurality of nozzles each provided with a pair of opposite side walls shaped to direct motive fluid to the rotor, a pair of annular plates capable of relative angular adjustment, and each provided with a plurality of equi-spaced quadrilateral apertures corresponding in number to the nozzles, means supporting the plates in interfacial contact with each other at one side of the rotor, a series of members forming respectively one of the side walls of each of the nozzles, and secured respectively to one edge of each of the apertures in one of the plates, and a second series of members forming respectively the other side walls of the nozzles, and secured respectively to the opposite edges of the apertures in the other plate, so that relative angular adjustment of the plates serves to vary the cross sections of the nozzle.

2. An air or other gas driven turbine according to claim 1, in which one of the annular plates is fixed and the other angularly movable, and in which means are provided for maintaining close interfacial contact between the plates, the said means including an operation connection between said plates arranged to exert lateral pressure on the movable plate in the direction for pressing it against the fixed plate.

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