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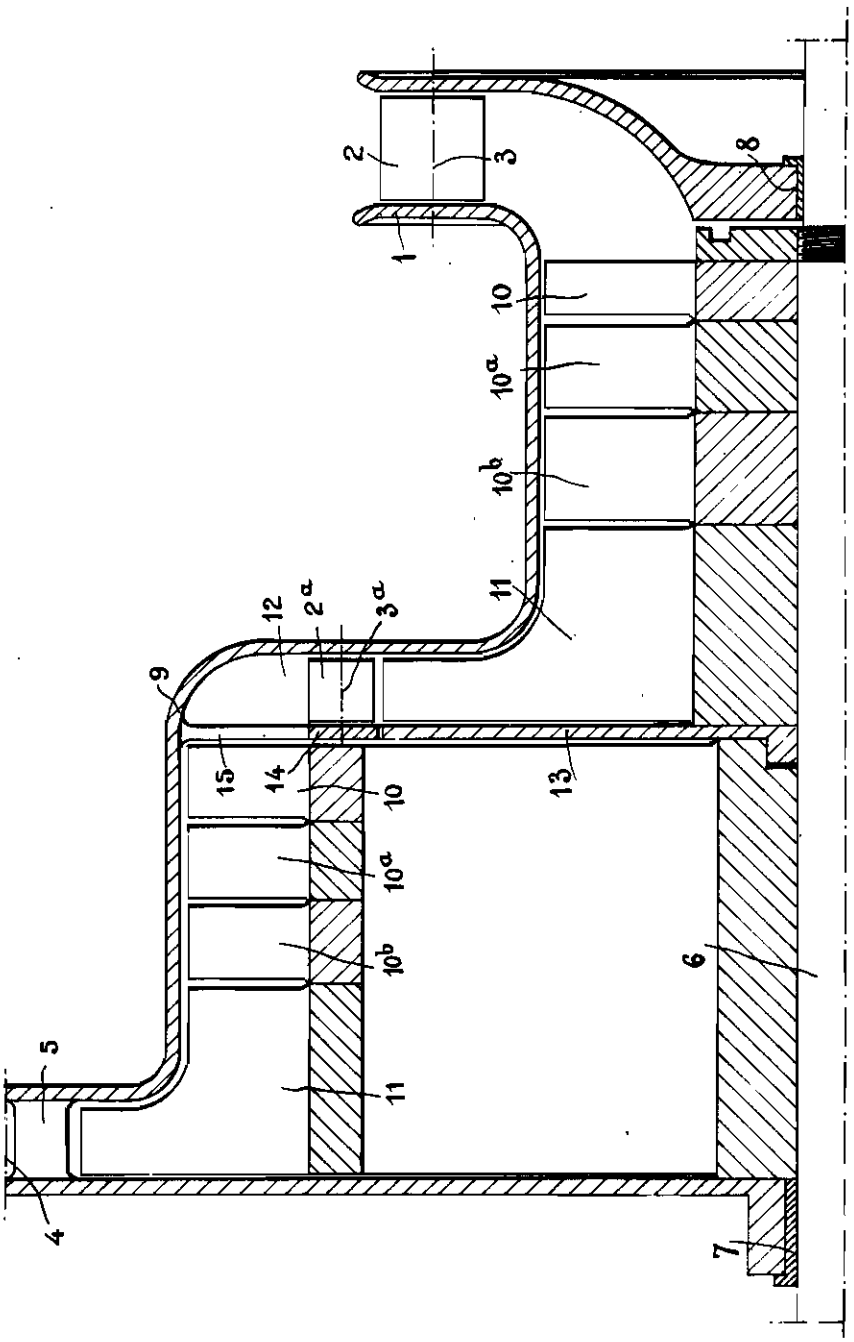

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MACHINES FOR DISPLACING AND COMPRESSING FLUIDS, SUCH AS TURBO-COMPRESSORS FOR FEEDING AIRCRAFT ENGINES

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Application filed March 8, 1941

The present invention concerns machines for displacing and compressing fluids, such as turbo-compressors for feeding aircraft engines.

For allowing a gain in weight to be obtained, said turbo-compressors are permanently coupled to a shaft of the engine, and the angular speed of their rotor is that of said shaft. On the ground, or at low altitude, the turbo-compressor does not produce any appreciable useful effect; it absorbs without benefit a part of the power of the engine.

If C_1 is the tangential component of the speed of the fluid at the inlet of the rotor,

C_2 the tangential component of the fluid at the outlet,

r the corresponding radius of C_1 at the inlet,

R the radius corresponding to C_2 at the outlet, the torque absorbed by the machine per unit of weight of the fluid is proportional to:

$$P=C_2R-C_1r$$

The value of P, and consequently, that of the power absorbed, can be theoretically lowered:

By giving to the term C_1r an absolute value as near as possible to that of C_2R.

But, C_1 cannot exceed an upper limit which is the speed of sound. For practical reasons, r cannot be as great as R.

By giving C_2 a value approximating C_1.

But this solution is inadmissible since C_2 which must subsequently be converted into pressure must be as high as possible.

In altitude, it is necessary to increase as much as possible the pressure generated by the machine and, consequently, the value P and, as the working speed of the engine, that is to say, the angular speed of the rotor of the turbine, as assumed, remains constant, in order to do so, a negative value is given to C_1r (C_1 being in this case limited below the speed of sound). The torque absorbed by the machine becomes proportional to:

$$C_2R+C_1r$$

The invention has for its object or industrial result, to reduce on the ground or at low altitude the difference:

$$C_2R-C_1r$$

and to increase, at high altitude, the sum:

$$C_2R+C_1r$$

For that purpose, the invention mainly consists in imparting to the fluid, at the outlet of the part of the rotor having purely a centrifugal action, a tangential component of variable value, negative or positive, which constitutes the tangential component of admission into a second machine, and so on.

This definition of the principle of the invention results in the fact that, if C_3 is the tangential speed of the radius r_3 at the inlet of the second machine, the two values:

$$P=C_2R-C_1r \text{ on the ground}$$

and

$$P_a=C_2R+C_1r, \text{ in altitude}$$

become respectively:

$$P_3=C_2R-C_1r-C_3r_3, \text{ on the ground}$$

and

$$Pa_3=C_2R\pm C_{1a}r+C_3r_3, \text{ in altitude}$$

With a structure of n machines arranged according to the invention, will be obtained:

$$P_n=C_2R-C_1r_1=C_3r_3 \text{ ---------- } -C_nr_n$$

$$Pa_n=C_2R\pm C_{1a}r+C_3r_3 \text{ ---------- } +C_nr_n$$

As regards the construction, the invention consists in associating the machines in such a manner that the inlet of one is connected to the outlet of the preceding one, doing away with the usual diffuser placed at each outlet and maintaining only the inlet guiding blades which impart to the fluid the required tangential component.

The single figure of the accompanying drawing illustrates, by way of example only, a form of construction of a turbo-compressor having two rotors, according to the invention. This figure is a somewhat diagrammatic axial half-section, of the machine.

The inlet of the machine is provided on the periphery of the ring 1 in which are arranged the blades 2 pivoted about spindles 3 so as to be set in such a manner that they impart to the fluid the required tangential component. The outlet is provided at 4, through the usual diffuser 5.

On the same driving shaft 6 mounted in the bearings 7 and 6 of the casing 9, are rigidly secured two rotors, each of which has the main arrangement of known machines and comprises, on the one hand, distinct sets of blades 10, 10_a, 10_b, the main function of which is to avoid separations noticed in the curved surfaces on the up side of turbo-compressors and, on the other hand, radial sets of blades 11 having purely a centrifugal action.

For obtaining a continuous path for the fluid with the minimum deviation, the outlet 12 of the first rotor is mingled with the inlet of the

second rotor, guiding blades 2*a* pivoted about spindles 3*a* allowing to impart to the fluid, when it enters the second rotor, the required tangential component, for the purpose described in the preamble to the present specification.

The machine illustrated comprises only two rotors, but it is obvious that it could be provided with a greater number.

The diagrammatic illustration contemplated comprises a disc 13 separating both rotors, rotating with the shaft 6, the spindles 3*a* of the guiding blades being supported, on the one hand, on the casing 9 and, on the other hand, by means of a ring 14 connected by narrow arms 15, suitably profiled, to the casing 9.

This arrangement is only given by way of indication and the disc 13 might be done away with, and the spindles 3*a* mounted in overhanging position on the casing 9.

The control of the orientation or setting of the blades 2*a* can be independent from or combined with that of the blades 2.

JOSEF SZYDLOWSKI.