COMPRESSOR GROUP WITH INTERCOOLER

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1 Claim. (Cl. 230—209)

The invention relates to a compressor group, in particular of a gas turbine plant comprising two intercoupled axial-flow compressors traversed by the flow medium in series in the same direction and a cooler interposed in the flow path between the two compressors.

In a known compressor group of this type, an annular cooler is arranged coaxially with the machine axis, an annular diffuser at the outlet of the first compressor conveying the flow medium leaving the first compressor to the cooler inlet and the flow medium leaving the cooler arriving in an annular inlet chamber of the second compressor. In this known construction, the annular cooler encircles the outlet chamber of the first compressor as well as the inlet chamber of the second compressor. This does not only require a relatively large diameter for the annular cooler with a correspondingly large requirement in space, but, further, the flow medium leaving the first compressor must, before being introduced to the cooler, be returned through about 180° in a direction opposite to the direction of flow in the compressors, and therefore, still before reaching the cooler, the flow direction must be changed again. The same applies to the flow medium leaving the cooler before entering the following compressor.

A flow reversal of 180° has proved disadvantageous in a diffuser with respect to its efficiency. Thus, large flow losses occur in the annular diffuser following the first compressor of the arrangement described above.

In a compressor group of the type hereinbefore specified, having an annular intercooler coaxial with the machine axis, an annular diffuser at the outlet of the first compressor supplies the flow medium leaving the first compressor to the inlet of the cooler, the working medium leaving the cooler reaching an annular inlet chamber of the second compressor, the disadvantage referred to is avoided by the invention in that the annular diffuser is formed as an annular chamber diverging regularly with respect to the compressor axis, at least part of the annular inlet chamber of the second compressor being encircled by said annular diffuser, and in that the inlet end of the cooler when viewed from the first compressor is situated beyond the inlet of the second compressor.

The drawing illustrates by way of example an embodiment of the invention. The compressor group of a gas turbine plant comprises two intercoupled axial flow compressors having bladed rotors 1 and 2 traversed in series by the working medium, and an annular cooler 3 which is coaxial with the machine axis. The inlet of the second compressor is situated axially adjacent the outlet of the first compressor. The two compressors are driven by a turbine having a bladed rotor 4. The cooler 3 is arranged in the flow path between the outlet of the first compressor and the inlet of the second compressor. It is located in a common housing 6 with the rotors of the compressors and the turbine, the housing being split at 5. The compressor 2 is disposed between the first compressor and the turbine. The compressors and the turbine are all traversed by the working medium axially in the same direction, namely in the direction from the first compressor toward the turbine. The rotor 2 of the second compressor is encircled by a stationary blade carrying shell 21. The annular intercooler 3 encircles the shell 21 and the rotor 2.

At the outlet end of the first compressor there is provided an annular diffuser 7 in the form of an annular chamber diverging regularly with respect to the compressor axis and mainly bounded from outside by a conical part of the housing 6 and from inside by a conical annular partition wall 61. The annular diffuser conveys the working medium leaving the first compressor to the inlet end of the cooler 3. The latter is traversed by the working medium in a direction axially opposite to the direction of flow in the compressors 1 and 2. The connection between the outlet end of the annular diffuser 7 and the inlet end of the cooler 3 is formed by an annular channel 8 encircling the cooler 3, and an inlet chamber 81, both bounded from outside by a part of the housing 6. The inlet end of the cooler 3, as viewed from the first compressor, is situated beyond the inlet of the second compressor. At the outlet end of the cooler 3 there is located an annular chamber 9 encircled by the diffuser 7 and serving as an inlet chamber for the compressor 2. This inlet chamber is defined partly by the partition wall 61 and by a further partition wall 62 situated within the housing 6.

In the embodiment as illustrated, the rotors 4 and 2 for the turbine and the second compressor are made in one piece. The rotor 1 for the first compressor is flange coupled to a terminal shaft portion of this one piece. All three rotors are supported at a total of only three points, in bearings 10, 11, 12—at the two outer ends and between the two compressors.

The turbine rotor 4 is enclosed by an inner housing 41 which also defines an inlet chamber 43 for the working medium flowing to the turbine. The housing 6 encircles the annular inlet chamber 81 for the working medium flowing to the cooler 3 and also encloses the inner turbine housing, whereby a discharge space 91 for the working medium leaving the second compressor is left between the two, and a discharge chamber 41 for the working medium leaving the turbine. An interior partition wall 62 separates the discharge space 91 from the annular chamber 81.

In the construction described, the flow medium is only generally deflected in the annular diffuser 7 after leaving the impellers of the first compressor. The diffuser has a relatively long path in which the direction of the flow medium is hardly changed at all. Thus the amount of recovered kinetic energy from the flow medium leaving the first compressor, the outlet end of the cooler 3, the latter can have a smaller diameter. This also results in space saving and a saving in constructional expenses. The housing 6 has a comparatively small outer diameter which enhances the strength. The construction described is therefore a suitable set of machines for gas turbine plants having a pressurized working medium circuit.

What is claimed is:

A compressor group comprising two coaxial and intercoupled rotary axial-flow compressors traversed sequentially in the same axial direction by a gaseous flow medium, the first of said compressors having an inlet at one end and an annular outlet at the other end, and the second of said compressors having an annular inlet
adjacent to but distinct from the outlet of the first compressor, said second compressor having also an outlet at the end remote from its inlet; an intercooler generally cylindrical in external contour, mounted coaxially with said compressors and encircling the second thereof, said intercooler having an annular inlet communicating directly with the annular outlet of the first compressor, and an outlet chamber communicating with the annular inlet of the second compressor, said intercooler including a double-walled enclosing envelope serving as a diffuser and comprising two conical walls between which the annular outlet of the first compressor discharges compressed medium, said two walls flaring at different respective angles from the compressor axis so as to be in converging relation with each other in the direction of medium flow between them, said conical walls extending to and merging with spaced coaxial cylindrical walls which are portions of said envelope, the spacing of the cylindrical envelope walls approximating the closest approach of the conical walls toward each other.

References Cited in the file of this patent

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