Oct. 31, 1944. W. WEIMAR 2,361,726

MULTISTAGE COMPRESSOR

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Fig. 1.

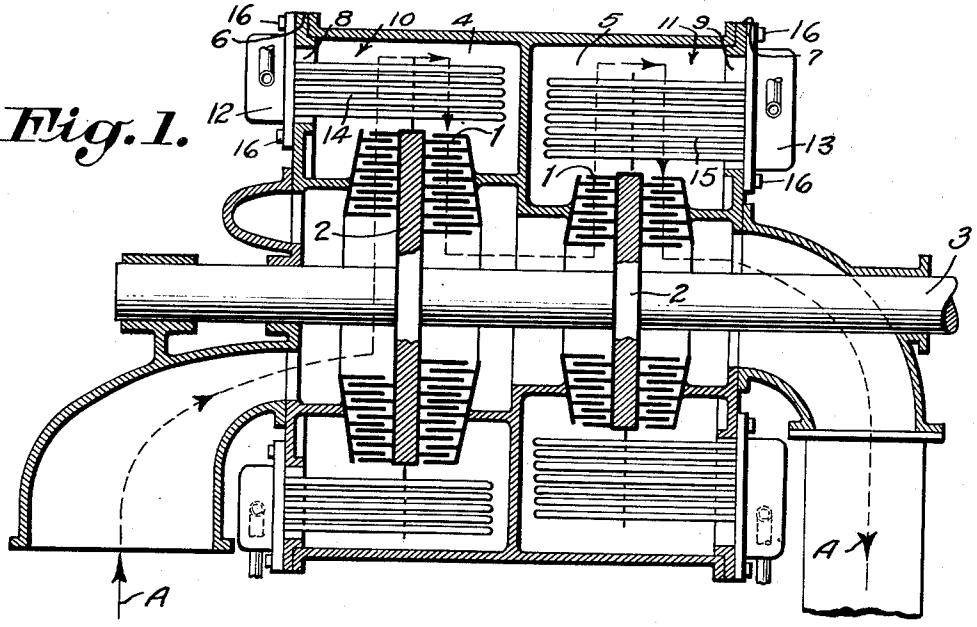
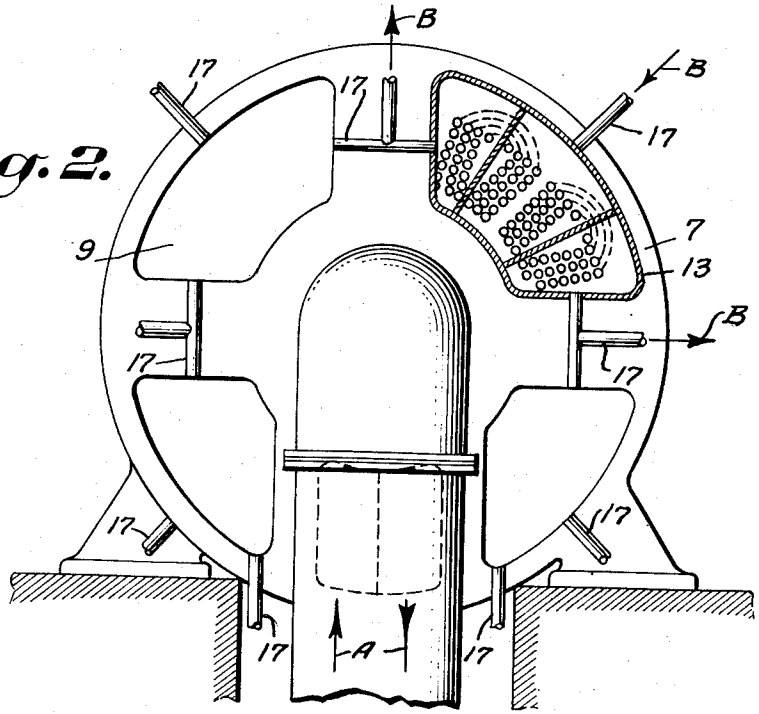


Fig. 2.



Inventor
Wilhelm Weimar.
By Albert Lonsdale
Attorney.

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MULTISTAGE COMPRESSOR

Wilhelm Weimar, Berlin-Siemensstadt, Germany; vested in the Alien Property Custodian

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4 Claims. (Cl. 230—209)

This invention relates to a turbine-like multi-stage compressor with radial admission of the working fluid, provided with intermediate cooling.

The work of compression in a compressor is, as is well known, the smaller, the more the curve of compression approaches the isothermal curve. The coincidence of the compression curve with the isothermal curve is the more difficult to bring about, the greater the number of stages of the compressor, which is particularly the case in turbine-like compressors with radial admission of the working fluid. Here the number of stages is so great and the dimensions of the blade are so small that the intermediate cooling cannot be practically carried out when employing hollow blades or similar means. There is no other remedy than to provide an intermediate cooling, for instance, between two stages. The object of the invention is therefore to suitably arrange the cooler within the compressor, particularly within a turbine-like multi-stage compressor with radial admission of the working medium and whose blades are subdivided into a plurality of rows of blades which are traversed one after the other by the working fluid. In this case the cooler or coolers of substantially the circular type are arranged in the by-pass space provided between two blade rings.

In the accompanying drawing is shown an embodiment of the invention in diagrammatic form, in which

Fig. 1 shows a longitudinal view and Fig. 2 a lateral view, partly in section.

In this turbine-like compressor with radial admission of the working fluid, the blading is subdivided into a plurality of blade groups 1, arranged on the shaft 3 at both sides of the discs 2 and traversed one after the other by the air to be compressed in the direction as indicated by the arrows A. Between these two rows of blades is provided an intermediate cooling, i. e., the intermediate coolers are arranged in the by-pass spaces 4 and 5 between two rows of blades. The great advantage of such an arrangement lies in the fact that the compressed air on its way from one group of blades to the other may flow directly through the cooler without encountering appreciable resistances. A reversal of the compressed air is necessary between two groups of blades so that as the only additional loss there results in the cooler itself the loss due to the resistance to flow. However, the loss may be reduced to a minimum by suitably dimensioning the blades and by a suitable choice of the velocity of flow.

Since in the case of coolers certain damages and pollutions must always be reckoned with, it is preferable to subdivide the cooler into a plurality of individual segments which may be arranged in the parallel or in series and which may be separately removed without great difficulties in order to clean and to replace the same. The by-pass spaces 4 and 5 have end walls 6 and 7 having apertures 8 and 9 respectively. The fluid coolers 10 and 11, in the spaces 4 and 5 respectively, comprise heads 12 and 13 and series of tubes 14 and 15 to serve as heat exchange elements. The coolers 10 and 11 are insertable through the apertures 8 and 9 and the heads 12 and 13 are attached to walls 6 and 7 by bolts 16. The cooling water circulates through the coolers 10 and 11 by pipes 17, as indicated by the arrows B. It will be noted (Fig. 1) that the cooler 11 disposed in space 5, the secondary stage chamber, is provided with a larger number of tubes 15, thus having a greater capacity than the cooler 10 disposed in the space 4, the primary stage chamber.

What is claimed is:

1. In a turbo-compressor wherein the working fluid flows generally outwardly to a peripheral chamber, and then flows generally radially inwardly therefrom, said chamber having an end wall with an aperture therein, a fluid cooler comprising a head which constitutes the means of attachment of said cooler to the rim of said aperture, and heat exchange elements attached to said head to form a unit, and insertable axially through said aperture so as to be entirely contained within said chamber.

2. In a turbo-compressor wherein the working fluid flows generally outwardly to a peripheral chamber, and then flows generally radially inwardly therefrom, a circular end wall for said chamber provided with a plurality of segmental apertures, and a plurality of fluid coolers insertable axially of the compressor through said apertures, respectively, so as to be entirely contained within said chambers, each cooler comprising a head constituting the means of attachment of the cooler to the rim of the aperture, and heat exchange elements attached to the head to form a unit.

3. In a multi-stage turbo-compressor wherein, in each stage, the working fluid flows generally outwardly to a peripheral chamber and then flows generally radially inwardly therefrom, there being a separate chamber for each stage,

an end wall for each chamber, having an aperture therein, and a plurality of fluid coolers insertable axially of the compressor through said apertures, respectively, so as to be entirely contained within said chambers, each cooler comprising a head constituting the means of attachment of the cooler to the rim of the aperture, and heat exchange elements attached to the head to form a unit.

4. In a turbo-compressor having primary and secondary stages, wherein in each stage the working fluid flows generally outwardly to a peripheral chamber and then flows generally radially inwardly therefrom, there being a separate chamber for each stage, an end wall for each chamber, having an aperture therein, and a pair of fluid coolers insertable axially of the compressor through said apertures, respectively, so as to be entirely contained within said chambers, each cooler comprising a head constituting the means of attachment of the cooler to the rim of the aperture, and heat exchange elements attached to the head to form a unit, the elements of the unit in the second stage chamber having a capacity greater than the elements of the unit in the primary stage chamber.

WILHELM WEIMAR.