Oct. 30, 1928. 1,689,671

A. JUDE

TURBO AIR OR GAS COMPRESSOR

Filed April 9, 1927

Fig. 2.

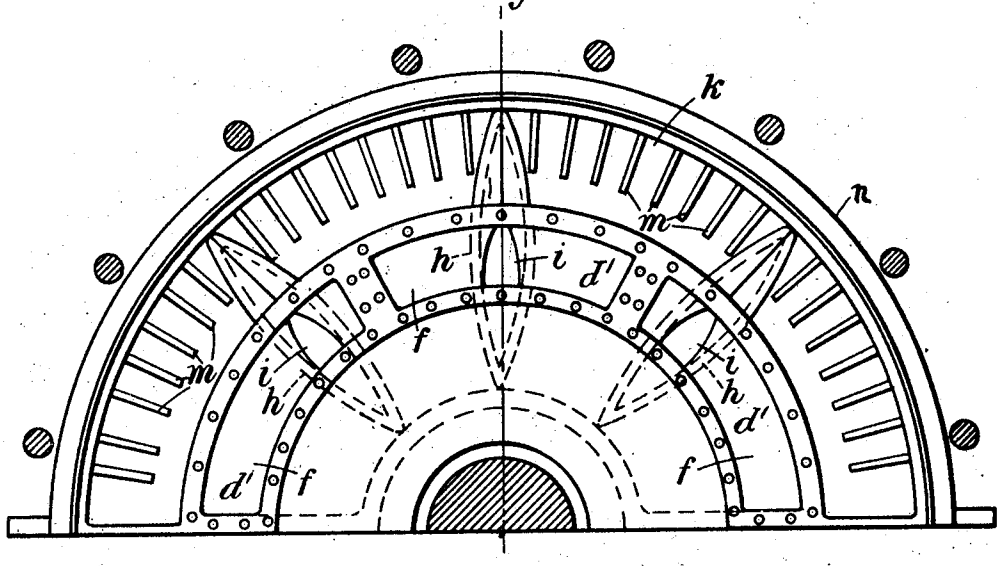
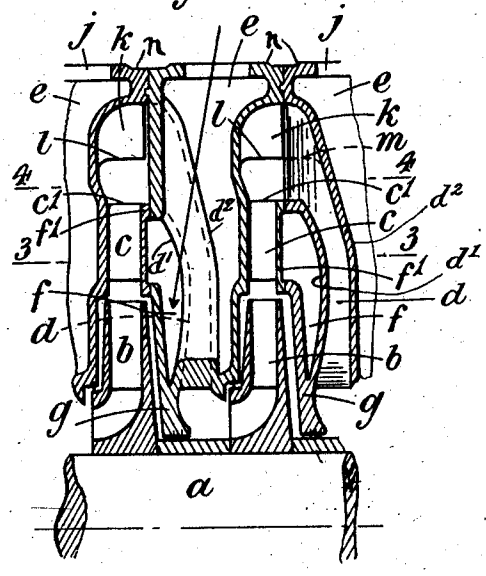


Fig. 1.



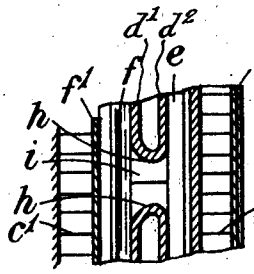


Fig. 3.

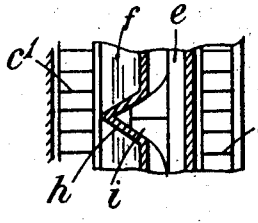


Fig. 4.

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UNITED STATES PATENT OFFICE.

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TURBO AIR OR GAS COMPRESSOR.

Application filed April 9, 1927, Serial No. 182,263, and in Great Britain May 31, 1926.

This invention relates to the provision of water cooling chambers and passages in the stators of turbo air or gas compressors.

Whilst the most efficient situation for cooling the gaseous fluid undergoing compression in a turbo compressor is at the several diffusers, constructional difficulties arise in the provision of inner water chambers within the partition walls between the diffusers and the return channels leading therefrom back to the rotor wheel. Such water chambers have, by involved casting and plugging and patching methods, been provided in the partition walls, together with water passages leading thereto from outer water chambers through the flying webs which support such partitions. The inaccessibility of the so-provided inner water chambers and passages, however, practically precludes their being cleaned should they, as readily occurs with dirty cooling water, become clogged with deposited impurities.

To avoid these difficulties, sometimes either one, sometimes both, it is common to abandon all provision for cellular cooling and to provide intercoolers external to the turbo compressor casing through which the gaseous fluid in course of compression is led between certain stages of compression. It has also been proposed to provide intercoolers within the turbo compressor casing in the return channels leading from the diffusers back to the impellers constituting the rotor wheel.

As above stated, the most efficient situation for cooling is at the diffusers, and the object of the present invention is to provide a construction of stator casing for a turbo compressor wherein readily castable and accessible water cooling chambers are present in the partition walls of the diffusers, without at the same time introducing obstructions to the flow of air.

With these objects in view, according to the invention, the water cooling chambers within the partition walls between the diffusers and return channels leading to the impellers in a turbo air or gas compressor are arranged to have radial-cum-axial communications from the outer to the inner water cooling chambers of the casings through correspondingly directed webs. Thus, instead of the water chambers in the diffuser partition walls of a turbo compressor being connected to the external water space of the casing by passages in the connecting webs extending in the axial direction of the machine, or in a radial direction by means of inserted small bore tubes which is another well known manner, the connection to such partition chambers is effected by radial-cum-longitudinally extending passages through correspondingly directed webs. Moreover the longitudinal cross section of these passages is divergent, thus not only do they permit radial access by a rake, scraping tool or the like to the chamber in the partition but they permit oblique manipulation of the tool around the portions of the chamber between the passages.

An example of a construction of a portion of a turbo compressor on the above described lines is illustrated on the accompanying drawing, in which:—

Fig. 1 is a longitudinal section of a portion of a turbo compressor embodying the present invention.

Fig. 2 is an end elevation of an upper semi-annular segment of the stator casing, with the covers of the inner water chambers removed and the impellers omitted, the rotor shaft being shown in transverse section.

Figs. 3 and 4 are sections respectively on the line 3—3 and the line 4—4 of Fig. 1.

The casing of the turbo compressor is built up of a plurality of longitudinally abutting upper and lower semi-annular hollow segments n. One of these segments n is shown in Fig. 2 and a longitudinal section through one complete segment and portions of two segments abutting against same is shown in Fig. 1.

a is the rotor shaft and b two consecutive impellers or rotor wheels thereon. c, c are two consecutive diffusers to which air is delivered by the impellers b. d is the return channel leading from a diffuser c back to the next impeller b.

Each segment n of the casing is formed on one face with a segmental annular recess to serve as a diffuser c, and internally with a segmental annular chamber constituting a return channel d leading from the diffuser c of the preceding segment.

The walls d^1, d^2 of the return channel d divide the space within the hollow casing segment n into two cooling water chambers, an outer chamber e and an inner chamber f.

g is a substantially radial partition wall which at its radially inner end separates the diffuser c of the segment n in front from the return channel d formed behind the wall g.

The segmental annular return channel d is interrupted at angularly separated intervals by radial-cum-axial webs h, Fig. 2, 3 and 4, which interconnect the two walls d^1, d^2 between which the return channel d is formed.

The outer water chamber e is connected to the inner water chamber f by substantially radially-cum-axially extending passages i extending through the similarly located webs h provided at the angularly separated intervals. The longitudinal cross section of the radial-cum-axial passages i diverges rearwardly (see Fig. 4) i. e. in the direction towards the delivery end of the machine, and consequently in the direction towards the interconnected outer water chamber e. The radial situation of the passages i readily permits the insertion of a scraper tool into the inner water chamber f and the rearwardly V section of the passages i permits the lateral manipulation of such tool into and around the portions of the inner water chamber located between the inner ends of the passages i, moreover, the full V section prevailing across the entrance to the return channel d, the flow of air into that channel is not obstructed. At the inner water chamber the V shape is largely lost (see Fig. 3).

The bottom half of the compressor (all such compressors being jointed on the horizontal centre line) is thus readily cleaned and the dirt will drop out of the inner chambers f after scraping, into the outer chambers e, and thus can be removed through the door-closed cleaning apertures j. The top half of the compressor can thus, as usual, be disconnected and turned upside down, when the dirt can be dealt with as in the bottom half.

Cooling of the air in the diffusers c by the water in the inner chambers f is facilitated by making each inner chamber cover f^1 of brass or other metal more heat-conductive than cast iron. Such covers f^1 may be made much thinner than when of cast iron, the diffuser blades c^1 (Figs. 3 and 4) being cast with the covers f^1 and acting as strengthening ribs.

It is the common practice in compressor design to provide a guide passage leading from the exit of the diffuser proper, having a smooth sweep around as shown, the purpose being to conserve the residual velocity of air from each diffuser c and pass it along to the next impeller b. Instead of this, however, a large cavity k (Fig. 1) is provided for the portion which may be termed the ultra-diffuser in which are cast a large number of fins l, m so that the heat created by the normal inefficiency of the compressor (as distinguished from the heat of adiabatic compression, most of which is intended to be extracted in the diffusers c, although of course the two heats are mostly produced together), can be more readily extracted without unduly increasing the wall surfaces at the expense of longitudinal crushing strength. At the same time, the fins serving as ribs increase the normal crushing strength.

I claim:

1. In a turbo gas compressor, a casing formed with an outer water cooling chamber, a plurality of impellers in said casing, said casing being formed with a diffuser and a return channel leading from one said impeller to the next impeller, walls of said return channel separating said outer water chamber from an inner water cooling chamber between said diffuser and said return channel, and approximately radial webs formed with approximately radial passages communicating with said outer and inner water chambers interconnecting said walls.

2. In a turbo gas compressor, a casing formed with an outer water cooling chamber, a plurality of impellers in said casing, said casing being formed with a diffuser and a return channel leading from one said impeller to the next impeller, walls of said return channel separating said outer water chamber from an inner water cooling chamber between said diffuser and said return channel, and approximately radial webs formed with approximately radial passages of outwardly divergent section communicating with said outer and inner water chambers interconnecting said walls.

3. In a turbo gas compressor, a casing formed with an outer water cooling chamber, a plurality of impellers in said casing, said casing being formed with a diffuser and a return channel leading from one said impeller to the next impeller, walls of said return channel separating said outer water chamber from an inner water cooling chamber between said diffuser and said return channel, and approximately radial webs formed with approximately radial passages of outwardly and rearwardly divergent section communicating with said outer and inner water chambers interconnecting said walls.

4. In a turbo gas compressor, a casing formed with an outer water cooling chamber, a plurality of impellers in said casing, said casing being formed with a diffuser and a return channel leading from one said impeller to the next impeller, walls of said return channel separating said outer water chamber from an inner water cooling chamber between said diffuser and said return channel, and approximately radial webs formed with approximately radial passages of outwardly and rearwardly divergent rear-

wardly V-section communicating with said outer and inner water chambers interconnecting said walls.

5. In a turbo gas compressor, a casing formed with an outer water cooling chamber, a plurality of impellers in said casing, said casing being formed with a diffuser and a return channel leading from one said impeller to the next impeller said return channel providing a large cavity at the exit from said diffuser, fins in said cavity, walls of said return channel separating said outer water chamber from an inner water cooling chamber between said diffuser and said return channel, and approximately radial webs formed with approximately radial passages communicating with said outer and inner water chambers interconnecting said walls.

In testimony whereof I have signed my name to this specification.

ALEXANDER JUDE.