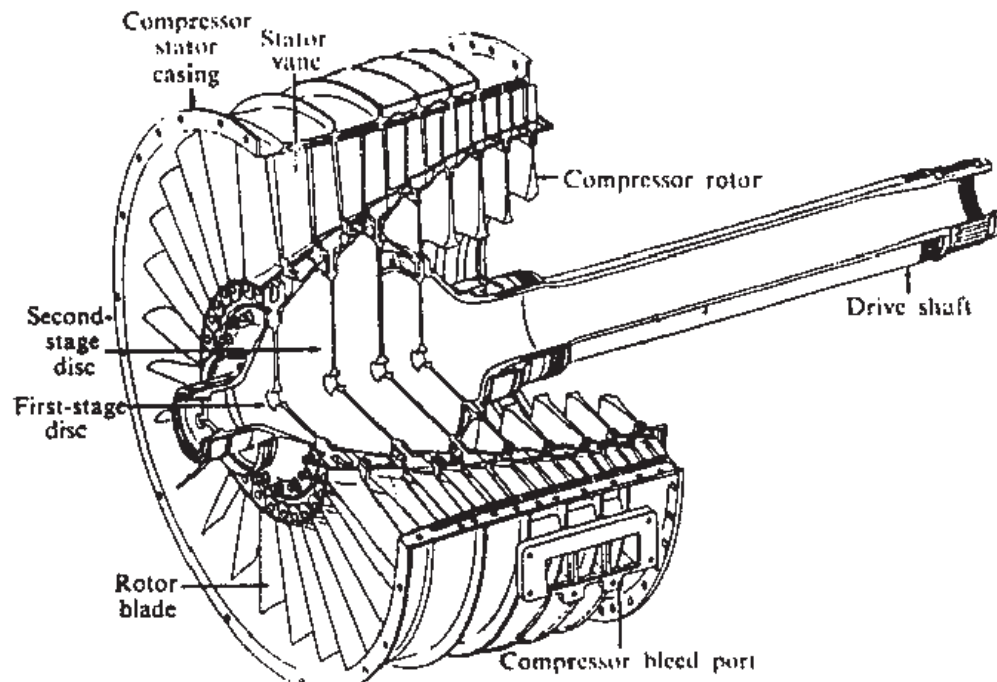


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## **AXIAL COMPRESSOR:**

### **INTRODUCTION**

The maximum pressure ratio achieved in centrifugal compressors is about 4:1 for simple machines (unless multi-staging is used) at an efficiency of about 70–80%. The axial flow compressor, however, can achieve higher pressures at a higher level of efficiency. There are two important characteristics of the axial flow compressor—high-pressure ratios at good efficiency and thrust per unit frontal area. Although in overall appearance, axial turbines are very similar, examination of the blade cross-section will indicate a big difference. In the turbine, inlet passage area is greater than the outlet. The opposite occurs in the compressor, as shown in Fig.(1). Thus the process in turbine blades can be described as an accelerating flow, the increase in velocity being achieved by the nozzle. However, in the axial flow compressor, the flow is decelerating or diffusing and the pressure rise occurs when the fluid passes through the blades., it is much more difficult to carry out efficient diffusion due to the breakaway of air molecules from the walls of the diverging passage. The air molecules that break away tend to reverse direction and flow back in the direction of the pressure gradient. If the divergence is too rapid, this may result in the formation of eddies and reduction in useful pressure rise. During acceleration in a nozzle, there is a natural tendency for the air to fill the passage walls closely (only the normal friction loss will be considered in this case). Typical blade sections are shown in Fig. (2). Modern axial flow compressors may give efficiencies of 86–90%—compressor design technology is a well-developed field. Axial flow compressors consist of a number of stages, each stage being formed by a stationary row and a rotating row of blades.



**Figure (1) Cutaway sketch of a typical axial compressor assembly: the General Electric J85 compressor. (Courtesy of General Electric Co.)**

Figure (3) shows how a few compressor stages are built into the axial compressor. The rotating blades impart kinetic energy to the air while increasing air pressure and the stationary row of blades redirect the air in the proper direction and convert a part of the kinetic energy into pressure. The flow of air through the compressor is in the direction of the axis of the compressor and, therefore, it is called an axial flow compressor. The height of the blades is seen to decrease as the fluid moves through the compressor. As the pressure increases in the direction of flow, the volume of air decreases. To keep the air velocity the same for each stage, the blade height is decreased along the axis of the compressor. An extra row of fixed blades, called the inlet guide vanes, is fitted to the compressor inlet. These are provided to guide the air at the correct angle onto the first row of moving blades. In the analysis of the highly efficient axial flow compressor, the 2-D flow through the stage is very important due to cylindrical symmetry.