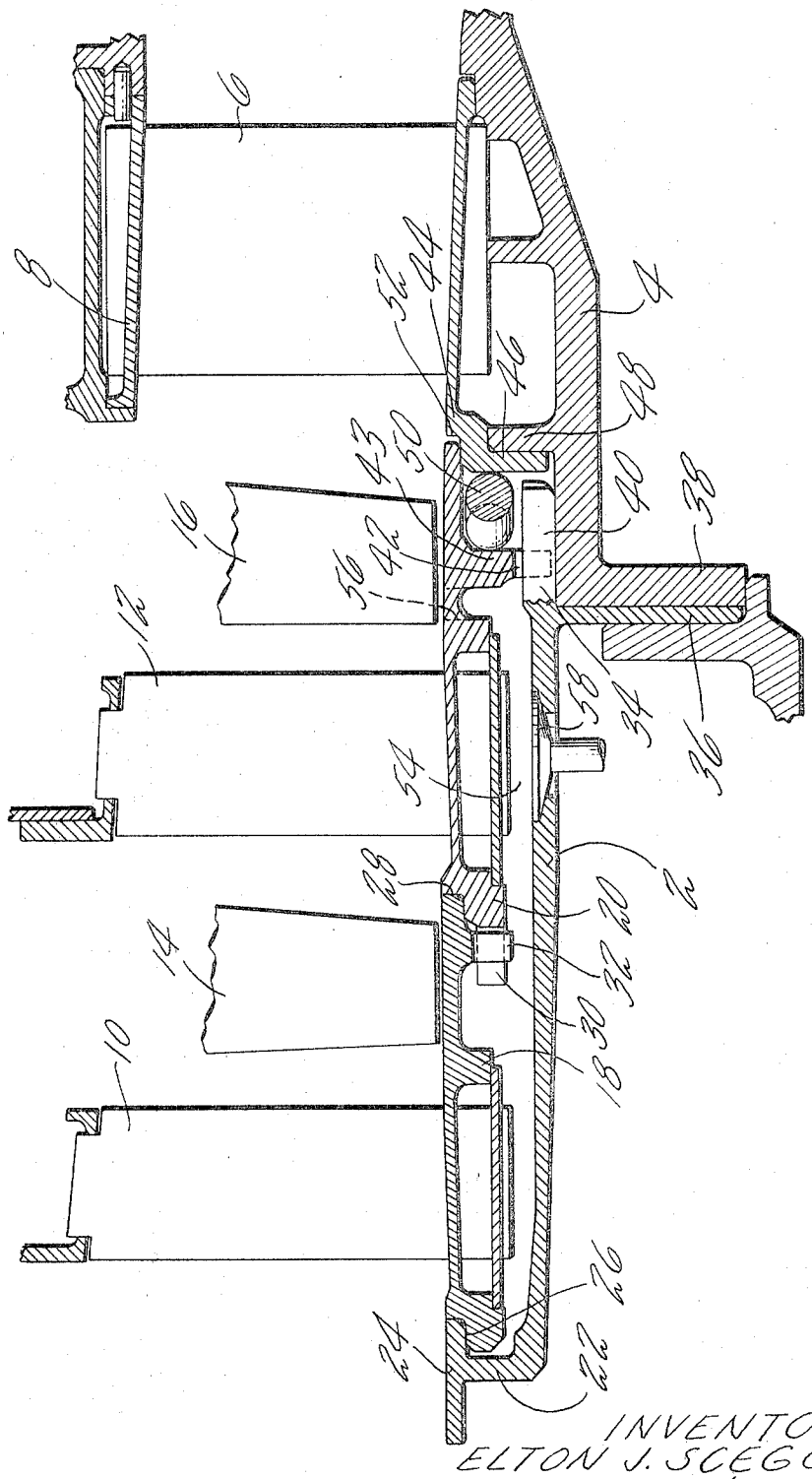
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COMPRESSOR STATOR SHROUD ARRANGEMENT

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COMPRESSOR STATOR SHROUD ARRANGEMENT

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This invention relates to a stator construction for use in axial flow compressors.

One feature of this invention is to eliminate or minimize the leakage between compressor stages. Another feature is the arrangement for axially loading the several individual vane supporting rings of the compressor stator so as to prevent leakage past these stator rings.

One well-known type of high performance axial flow compressor has each individual row of stator vanes supported by a surrounding stator ring and the several stator rings are positioned in end-to-end relation within a compressor casing as shown, for example, in the Hasbrouck et al. Patent No. 2,749,026. Pressure loadings and thermal growth of these rings may cause separation between the rings and thereby cause leakage particularly from a higher pressure stage to a lower pressure stage with a resulting loss of performance. One particular feature is the resilient loading of these rings in an axial direction within the casing so that any leakage spaces will all be located where it can be controlled, as, for example, at the high pressure end of the assemblage since if there is no leakage at a lower pressure location there can be no recirculation of leakage air. Another feature is the location of the leakage at a point where bleeding of the compressor during starting is provided and the spaces provided by the spring loading of the rings will supply a path for bleed air from the compressor to the bleed control valves.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawing which illustrates an embodiment of the invention.

The single figure is a longitudinal sectional view through a portion of a compressor casing embodying the invention.

The invention is shown in use in conjunction with the last two stages of a multistage axial flow compressor. As shown, the compressor casing 2 is bolted to the upstream end 4 of the diffuser casing, the latter supporting a row of vanes 6 located downstream of the last compressor stage. The inner ends of the vanes are interconnected by a shroud ring 8.

Two stages of the compressor are shown including rows of stator vanes 10 and 12 alternating with rows of blades 14 and 16 on the rotor of the compessor. The vanes 10 are supported by a shroud ring 18 at their outer end and this shroud ring is of sufficient length axially of the compressor to extend over the tips of the blades 14. The row of vanes 12 is supported by an outer shroud ring 20 which also is of sufficient length axially to overlie the tips of the row of blades 16. The casing 2 has an inturned flange 22 at its downstream end and this flange in turn carries a sleeve-like flange 24, the latter engaging in a notch 26 in the shroud ring 18 serving to pilot the ring 18 within and in spaced relation to the casing 2. The downstream end of the shroud 18 engages in a notch 28 in the shroud ring 20 serving to pilot these rings, one with respect to the other. Relative turning movement between shroud rings 18 and 20 is prevented by axially extending lugs 30 on the shroud ring 20 in locking relation with radially extending lugs 32 on the ring 18.

The compressor case 2 has an axially projecting flange 34 to receive and pilot the end of the case 4 and cooperating bolting flanges 36 and 38 on the compressor case and the case 4, respectively, provide for attachment of the two cases together as by bolts 39. The flange 34 is notched as at 40 to receive projecting lugs 42 on an outwardly projecting flange 43 on the ring 20 thereby to prevent turning movement of the shroud ring 20 within the compressor case.

The row of vanes 6 are supported within the case 4 by an outer shroud ring 44 which has an outwardly projecting flange 46 in a position to engage with a cooperating inwardly extending flange 48 on the case 4. The flange 43 on the shroud ring 20 is axially spaced from the flange 48 on the casing 4 and a wave spring 50 is positioned between these two flanges. This wave spring is constructed to assert an axial force when it is compressed and when the cases 2 and 4 are bolted together the flange 48 acts on the spring 50, the flange 46 being, in effect, a washer therebetween urging the spring to the left and thereby urging the shrouds 20 and 18 both to the left. In effect, this prevents any leakage around the shoulder 26 and also any leakage around the shoulder 28 so that all of the leakage that occurs will of necessity take place between the downstream end of the shroud ring 20 and the end of the shroud ring 44 for the vanes 6. It will be noted that at this point the shroud ring 44 has a notch 52 to receive and pilot the end of the shroud ring 20. Since this is the point of highest pressure existing between the flange 24 and the vanes 6, it will be apparent that no leakage can occur other than sufficiently to raise the pressure inside of the casing 2 to a pressure substantially to that existing within the flow path at the shoulder 52. Since the spring 50 keeps the shroud assembly tight at the shoulders 26 and 28, it is obvious that no leakage into the gas path of the compressor can occur at these points. Accordingly, the effect of the spring is to prevent any recirculation of compressed fluid from a high pressure point in the gas path to a lower pressure location. This is particularly essential in high performance compressors where the temperature changes existing as a result of the increase in the temperature of the gas during compression causes axial expansion of the shroud rings at a greater rate than the expansion of the surrounding casing 2. It will be apparent that the chamber 54 between the casing 2 and the shroud rings 18 and 20 effectively reduces the rate at which the casing ring 2 is heated during operation of the compressor.

In certain instances it may be desirable to provide for bleeding the compressor as, for example, through ports 56 in the shroud ring 20 and a bleed valve 58 of well-known construction is provided in the casing 2. The spring 50 by effective sealing against leakage past the ends of the respective shroud rings assures that all of the bleeding takes place at the bleed ports 56.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

I claim:

1. A stator construction for a multistage axial flow compressor including a plurality of rows of stator vanes, a plurality of shroud rings at the outer ends of the vanes, one for each row of vanes and in which the vanes are positioned to define stator ring assemblies, for supporting the rows of vanes in spaced axial relation, said rings being arranged in end-to-end relation and in engagement one with another, and a two-part casing surrounding the rings, one part being substantially cylindrical with an end shoulder at one end for engagement with the outer end of one end ring, and the other casing part having a flange adjacent to the outer end of the other end shroud ring, said other end shroud ring having a cooperating radial

surface adjacent to and in axial alignment with said flange, an axially-acting spring between said flange and said radial surface to urge said rings into endwise contact and means for holding said casing parts together axially, said spring being located substantially in axial alignment with the shroud rings.

2. A stator construction for a multistage axial flow compressor having a casing including two annular aligned parts, a plurality of rows of stator vanes within one of said parts, a plurality of axially aligned shroud rings at the outer ends of said rows of vanes, one ring for each row of vanes and in which the vanes are positioned for supporting the rows of vanes in spaced axial relation to one another, said rings being in end-to-end engagement, cooperating means between the rings to prevent relative turning and cooperating means between one of the rings and the casing to prevent turning of the rings within the casing, said one of said casing parts having a shoulder therein engaging axially with the outer end of one end shroud ring, said shoulder also piloting the shroud ring within the casing part, the other casing part having a flange adjacent to the outer end of the other end shroud ring, said other end shroud ring having a cooperating radial surface adjacent to and in axial alignment with said flange, an axially-acting spring between said flange and said radial surface to urge said rings into endwise contact and means for holding said casing parts together axially, said spring being located substantially in axial alignment with the shroud rings.

3. A stator construction for a multi-stage axial flow compressor having a casing including two annular aligned parts, a plurality of rows of stator vanes within one of said parts, a plurality of axially aligned shroud rings at the outer ends of said rows of vanes, one ring for each row of vanes and in which the vanes are positioned for supporting the rows of vanes in spaced axial relation to one another, said rings being in end-to-end engagement, cooperating means between the rings to prevent relative turning and cooperating means between one of the rings and the casing to prevent turning of the rings within the casing, said one of said casing parts having a shoulder therein engaging axially with the outer end of one end shroud ring, said shoulder also piloting the shroud ring within the casing part, an additional row of vanes downstream of said plurality of rows of vanes, an outer shroud for said additional row of vanes, said outer shroud being piloted within the other casing part, the latter having an annular flange therein, said outer shroud ring having a cooperating flange engaging axially with said annular flange, an axially acting spring engaging with said cooperating flange to hold it axially against the annular flange, the other end of the spring acting axially against the end ring of the axially aligned shroud ring remote from said shoulder on the casing part thereby to hold said aligned shroud rings in axial contact and against said shoulder, and means for holding said casing parts in axially assembled relation thereby to apply an axial load on the spring.

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