Dec. 25, 1962 H. W. WELSH 3,070,353

SHROUD ASSEMBLY

Filed Dec. 3, 1958 2 Sheets-Sheet 1

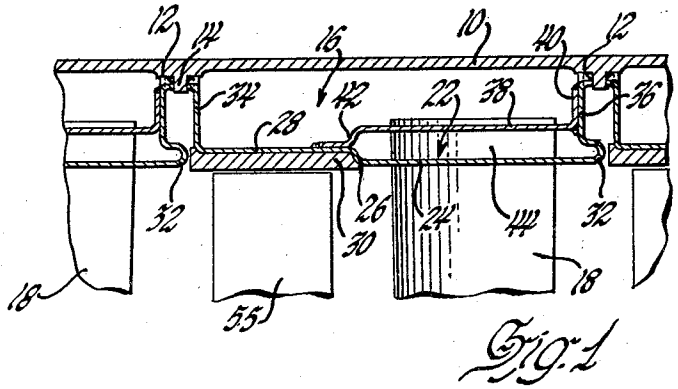


Fig. 1

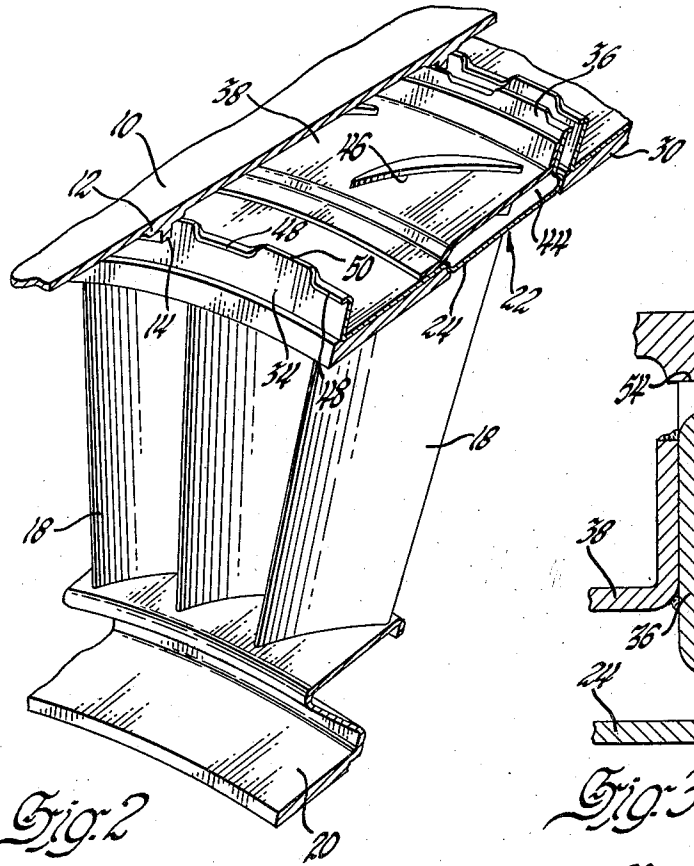


Fig. 2

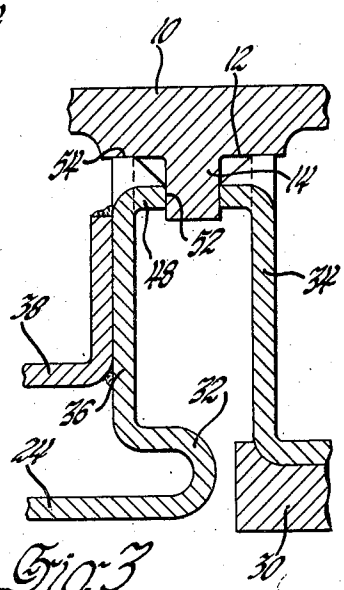


Fig. 3

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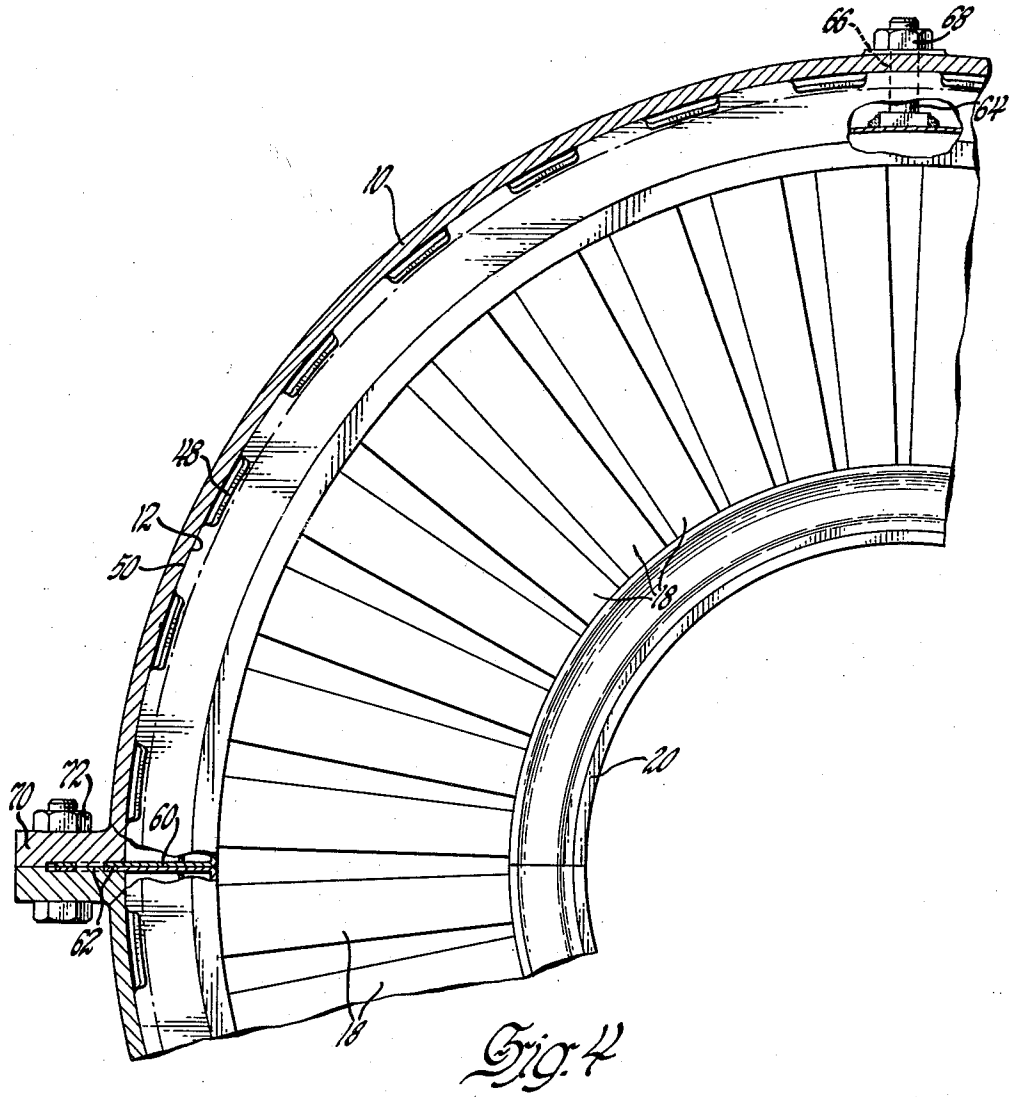


Fig. 4

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SHROUD ASSEMBLY

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This invention relates to compressor and turbine constructions.

More specifically, this invention relates to the construction of a stator vane assembly for either a turbine or compressor of a gas turbine engine with particular attention being directed to the shroud ring for supporting both the stator vanes and rotor blade abradable shroud rings.

This invention further relates to a shroud assembly constructed in a manner to be quickly and easily fitted within the compressor or turbine casing. This invention accomplishes this objective by providing a shroud ring with upstanding flanges having axial and radial crimped portions circumferentially alternated thereon abutting depending axially spaced annular ridges secured to the compressor or turbine casing, thus both axially and radially locating the shroud ring with respect to the casing.

Therefore, it is an object of this invention to provide a shroud ring of the type described with radial and axial crimped or crinkled portions cooperating with the turbomachine casing for axially and radially locating the shroud.

Other features, advantages and objects will become apparent by reference to the detailed description of the invention and to the drawings wherein there is shown the preferred embodiments of this invention.

In the drawings:

FIGURE 1 is a cross-sectional view of a portion of an engine casing together with the shroud rings embodying this invention,

FIGURE 2 is a perspective view of portions of two adjacent shroud rings,

FIGURE 3 is an enlarged view of a detail of FIGURE 1, and

FIGURE 4 is an enlarged cross-sectional view of a portion of the shroud ring assembly of FIGURE 2.

Referring now more particularly to the figures, there is shown therein a casing **10** of a gas turbine engine, which in this case may be either a compress or turbine casing enclosing the respective compressor or turbine. Formed as a part of the engine casing **10** are a number of axially spaced annular bosses or pads **12** having depending flanges or ridges **14** extending internally of the casing.

Secured to the engine casing between adjacent flanges or ridges **14** by means to be described is a combined stator vane and rotor blade shroud ring assembly **16** forming the subject of this invention.

Each assembly **16** comprises a plurality of circumferentially spaced stator vanes **18** secured by welding or other suitable means to an inner shroud ring **20** and an outer shroud ring **22**. The inner shroud ring **20** is formed as shown in an annular zigzag or labyrinth manner to provide for thermal expansion and sealing. The outer shroud **22** to which this invention is primarily directed includes an annular sheet metal plate **24** stepped or rolled at one portion **26** to provide a recess **28** for the insertion therein and securing thereto of an abradable ring **30** constituting the rotor blade shroud ring. The plate **24** is beaded at **32** for a purpose to be described and is bent at both edges to form radial outwardly extending flanges **34** and **36**.

Secured to both the flat portion and radial flange of plate **24** is a second annular sheet metal plate **38** flanged and rolled at **40** and **42**, respectively, and spot-welded to the plate **24** and flange **36** as shown to form a hollow box section **44** for supporting the stator vanes **18**. Suitable apertures **46** equally spaced circumferentially around each of the plates **24** and **38** are provided therein for the insertion therethrough and welding thereto of the stator vanes **18**, the apertures **46** in the two plates being radially aligned and equal in number. Thus the stator vanes are securely held against axial and radial movement with respect to the shroud, and are located with respect to the rotor blades.

The radial flanges **34** and **36** are each crimped or ruffled at their outermost radial portions or edges as shown more clearly in FIGS. 2 and 3 to provide an axial flange portion **48** alternating with a radial flange portion **50**, the two radial and axial portions being circumferentially alternated around the entire annulus. The axial and radial flanges **48** and **50** are thus adapted to abut the radial and axial surfaces **52** and **54** provided on the ridges **14** and pads **12**, respectively, formed on the casing **10**. Thus, an axial and radial locating surface is provided for axially and radially locating the stator vane and rotor blade shroud ring with respect to the rotor blades **55** and casing **10**. As shown, the alternate radially and axially crimped portions of each of the flanges **34** and **36** face outwardly, with the axial distance therebetween defining the axial width of the shroud section corresponding to the axial distance between the ridges **14**. As seen in FIGURE 3, the shroud plate **24**, as mentioned previously, is rolled at **32** so as to underlie the ridge **14** and extend to a point closely adjacent the abradable rotor blade shroud **30** therefore acting as a gas seal to restrict communication of the hot motive fluid to the engine case **10**. Thus, it will be seen that opposite edges of the shroud sections abut opposite face portions of the ridges **14**.

While the shroud rings have been referred to as annular, by referring to FIGURE 4, it will be seen that these shroud rings are composed of two 180° segments having radially outwardly directed flanges **60** formed at each end thereof for insertion into recesses **62** in the engine casing. Centrally of each shroud section, a threaded pin **64** is welded thereto to plate **38** between the blade members and extended through a suitable aperture **66** in the engine casing to be secured thereto by a nut **68**. The engine casing is also formed in two 180° segments with flanged portions **70** at their abutting edges joined together by nut and bolt means **72**, the nut and bolt means also securing the two flanged portions **60** of the shroud rings together.

To assemble the shroud ring of this invention, the annular sheet metal ring **24** is bent and rolled as shown to provide the two radial flanges **34** and **36**, the recess for the abradable rotor blade shroud and the axially extending portion **32**. The outer portions of the flanges **34** and **36** are then crimped as shown to provide circumferentially alternated axial and radial flanges **48** and **50**. The sheet metal plate **38** is then formed as shown and secured to the plate **24**. Slots are then cut in both the plates **24** and **38**, the abradable surface **30** is secured thereto, and the vanes **18** are inserted through the slots and secured to the plates. The shroud ring assembly now being complete, the radial and axial locating surfaces are then machined to fit the particular compressor case cooperating with the ridges **14** and pads **12**. The shroud ring assembly is then inserted in one half of the engine case with the flanges **48** and **50** abutting the radial and axial portions of ridges **14** and pads **12** thus radially and axially locating the shroud ring with respect to the casing and rotor blades **55**. The shroud ring is then secured to the engine casing by the nut **68** as seen in FIGURE 4. The other half of the engine case is assembled in the same manner, and the two segments are then positioned over the rotor of the turbine or compressor, whichever the case may be, and secured together by the nut and bolt means **72**.

While the shroud ring has been defined as extending axially to provide for a rotor blade shroud, it will be clear that this could be used just as a stator vane shroud without departing from the scope of the invention.

Thus, it will be seen that the crimped or deformed edges **48** and **50** provide a machining surface that can be machined accurately and easily to conform to the axial width between ridges **14** and the interior case diameter, therefore permitting easy and accurate assembly of the shroud ring to the casing. Thus, the shroud can be machined to fit a particular installation and accommodates for any case distortion during manufacture.

From the foregoing it will be seen that this invention provides an efficient and quick method of assembling a stator vane and rotor blade shroud ring to an engine casing with means for both radially and axially locating the shroud ring with respect to the rotor blades and also the engine case. While the invention has been illustrated by FIGURES 1–4 in its preferred form, it will be clear to those skilled in the art that many modifications can be made thereto without departing from the scope of the invention.

I claim:

1. A turbomachine shroud ring locating assembly comprising, in combination, an annular turbomachine case having internal mutually adjacent axially and radially facing locating surfaces, a relatively thin sheet metal shroud ring within said case having a locating surface contacting edge extending radially outwardly into contact with said case locating surfaces, the outer periphery of said contacting edge being annular and defined by circumferentially alternated radially and axially extending bent portons contacting respectively the radially and axially facing locating surfaces on said case to radially and axially locate said shroud ring with respect to said case.

2. A turbomachine shroud ring locating assembly comprising, in combination, an annular turbomachine case having axially spaced ridges depending internally from said case, said ridges having opposite axial sides each side having mutually adjacent axially and radially facing locating surfaces, a plurality of relatively thin sheet metal shroud rings within said case each having a locating surface contacting flange extending radially outwardly from opposite axial edges of said ring each into contact with a set of said case locating surfaces, the outer periphery of each of said contacting flanges being annular and defined by circumferentially alternated radially and axially extending bent portions contacting respectively the radially and axially facing locating surfaces on said case with which the portions are associated to radially and axially locate said shroud ring with respect to said case, the shroud rings being axially adjacent each other to provide spaced sets of mutually adjacent contacting flanges, the different flanges of each set of flanges being aligned with and contacting different sides of the same case ridge.

3. A turbomachine shroud ring locating assembly comprising, in combination, an annular turbomachine case

having axially spaced ridges depending internally from said case, said ridges having opposite axial sides each side having mutually adjacent axially and radially facing locating surfaces, a plurality of relatively thin sheet metal shroud rings within said case each having a locating surface contacting flange extending radially outwardly from opposite axial edges of said ring each into contact with a set of said case locating surfaces, the outer periphery of each of said contacting flanges being annular and defined by circumferentially alternated radially and axially extending bent portions contacting respectively the radially and axially facing locating surfaces on said case with which the portions are associated to radially and axially locate said shroud ring with respect to said case, the shroud rings being axially adjacent each other to provide spaced sets of mutually adjacent contacting flanges, and means formed on one of the flanges of one of said sets cooperating with the adjacent flange of the set to form a fluid seal therebetween to restrict communication of fluid radially outwardly from said rings to said case.

4. A turbomachine shroud ring locating assembly comprising, in combination, an annular turbomachine case having internal mutually adjacent axially and radially facing locating surfaces, a relatively thin sheet metal shroud ring within said case having a locating surface contacting edge extending radially outwardly into contact with said case locating surfaces, the outer periphery of said contacting edge being annular and defined by circumferentially alternated radially and axially extending bent portions contacting respectively the radially and axially facing locating surfaces on said case to radially and axially locate said shroud ring with respect to said case, a plurality of circumferentially spaced stator vanes secured to said shroud ring, said shroud ring including axially extending means secured thereto and having a portion spaced therefrom together with said ring forming a tubular stator vane supporting structure having radially inner and outer separated walls, said walls having apertures therein constituting guide means upon the insertion of said stator vanes therein and therethrough to axially locate said vanes with respect to said shroud ring.

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