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Longley et al.

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[54] **BLADE ASSEMBLY FOR A FLUID FLOW MACHINE**

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[30] **Foreign Application Priority Data**

June 26, 1973 United Kingdom.............. 30252/73

[52] **U.S. Cl.**.................................. **416/219;** 416/193
[51] **Int. Cl.**[2] **F01D 5/18;** F01D 5/24
[58] **Field of Search** 416/191, 193, 219, 221

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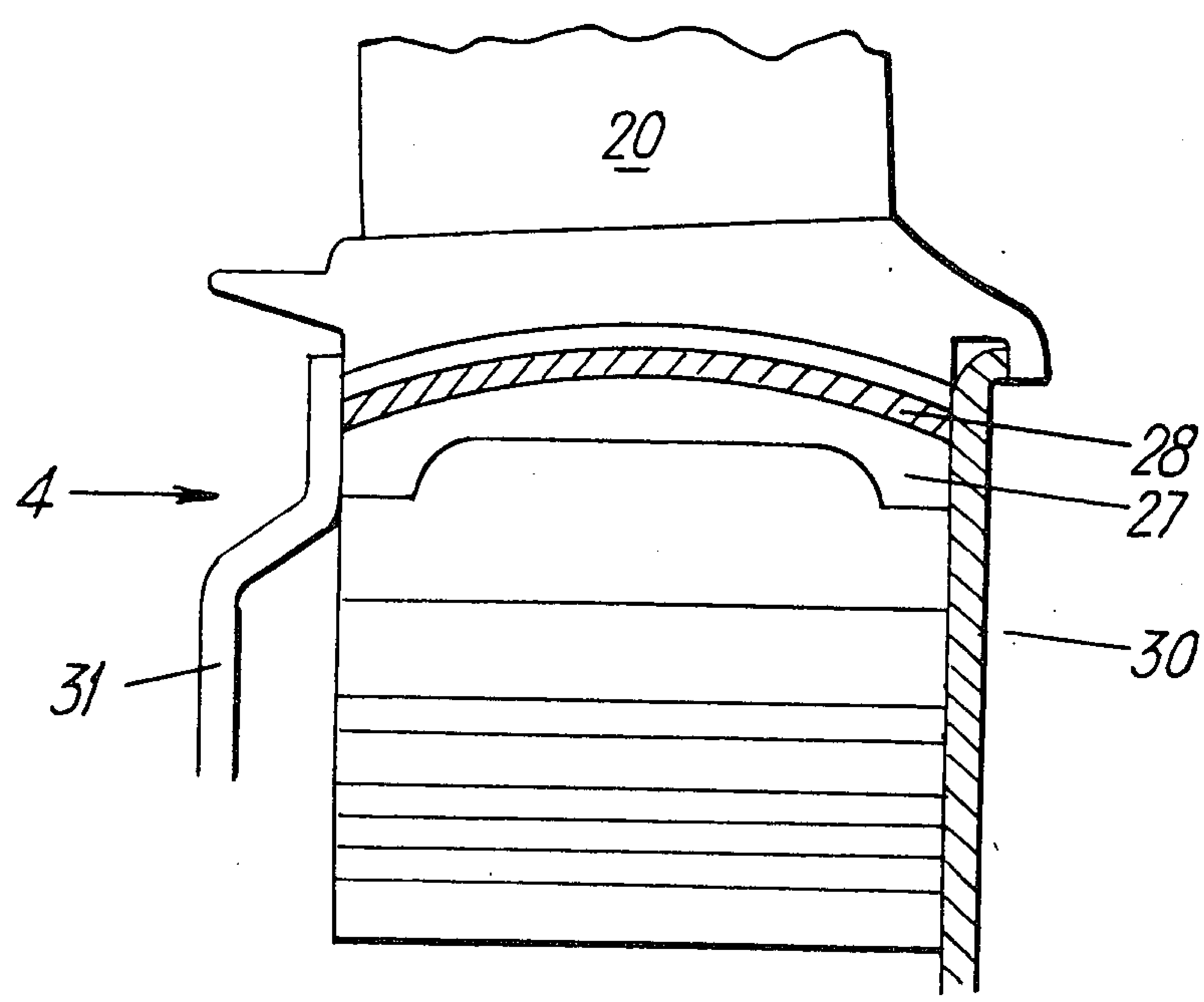
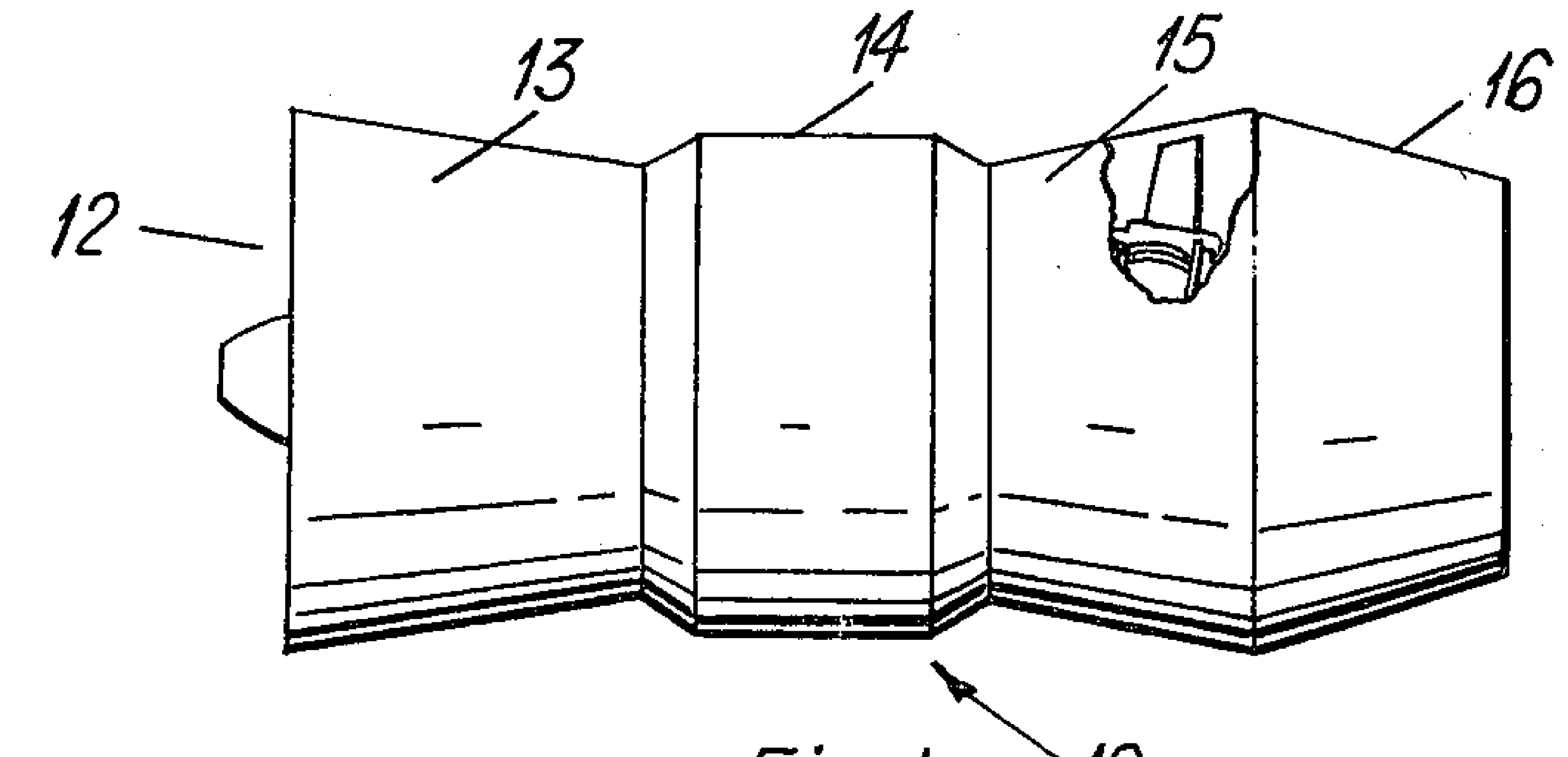
[57] **ABSTRACT**

In a bladed rotor for a gas turbine engine the shrouds or platforms of the blades each have a face which co-operates with a corresponding face on the next adjacent blade to form a radially tapering groove whose width decreases as the radial distance from the rotor axis increases, and a sealing member such as a wire is mounted in the groove to seal between the adjacent platforms or shrouds.

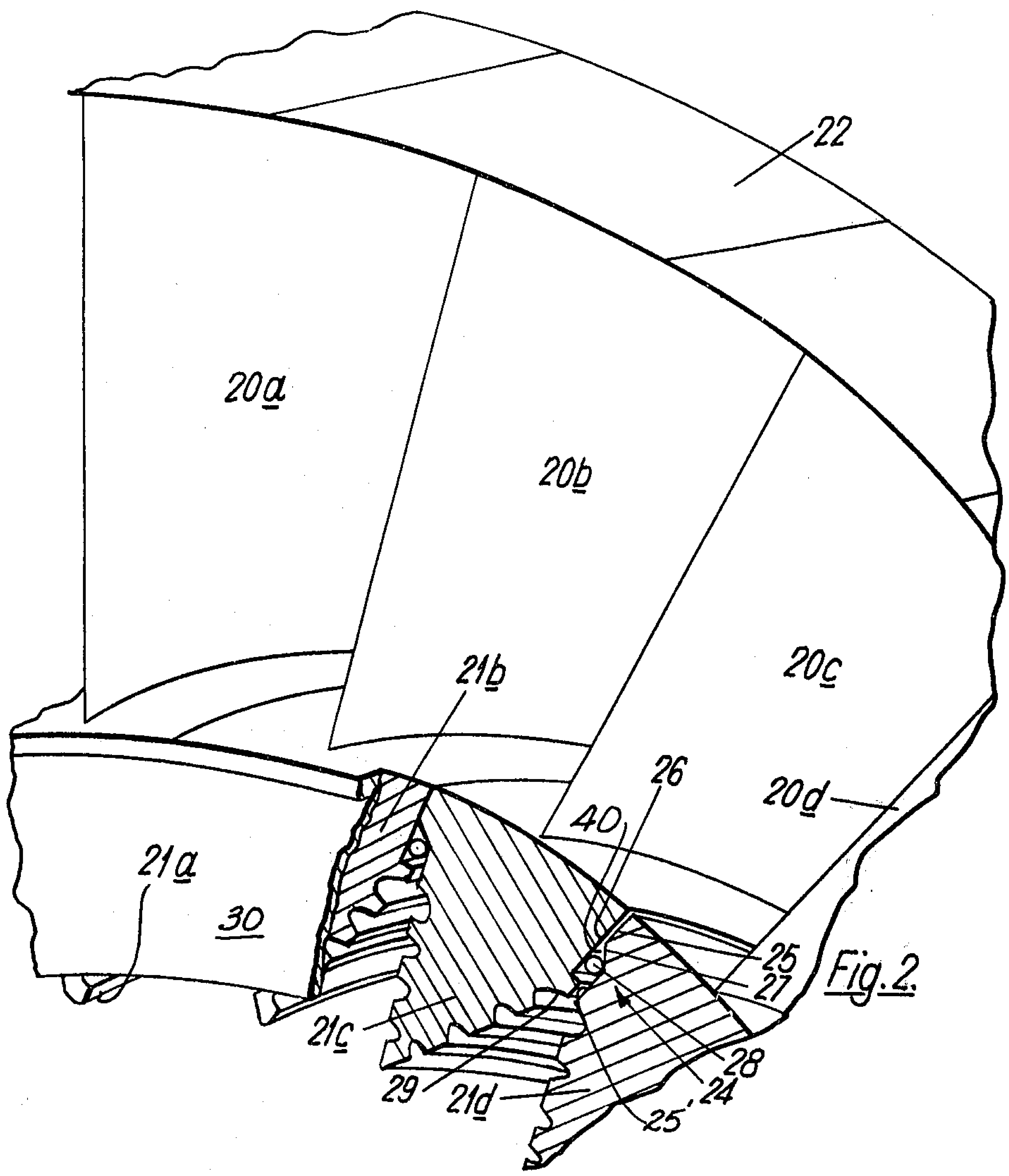
7 Claims, 6 Drawing Figures





13
14
15
16
12
10

Fig. 1.



22
20a
20b
20c
20d
21b
21a
30
26
40
25
27
28
24
25'
21c
29
21d

Fig. 2.

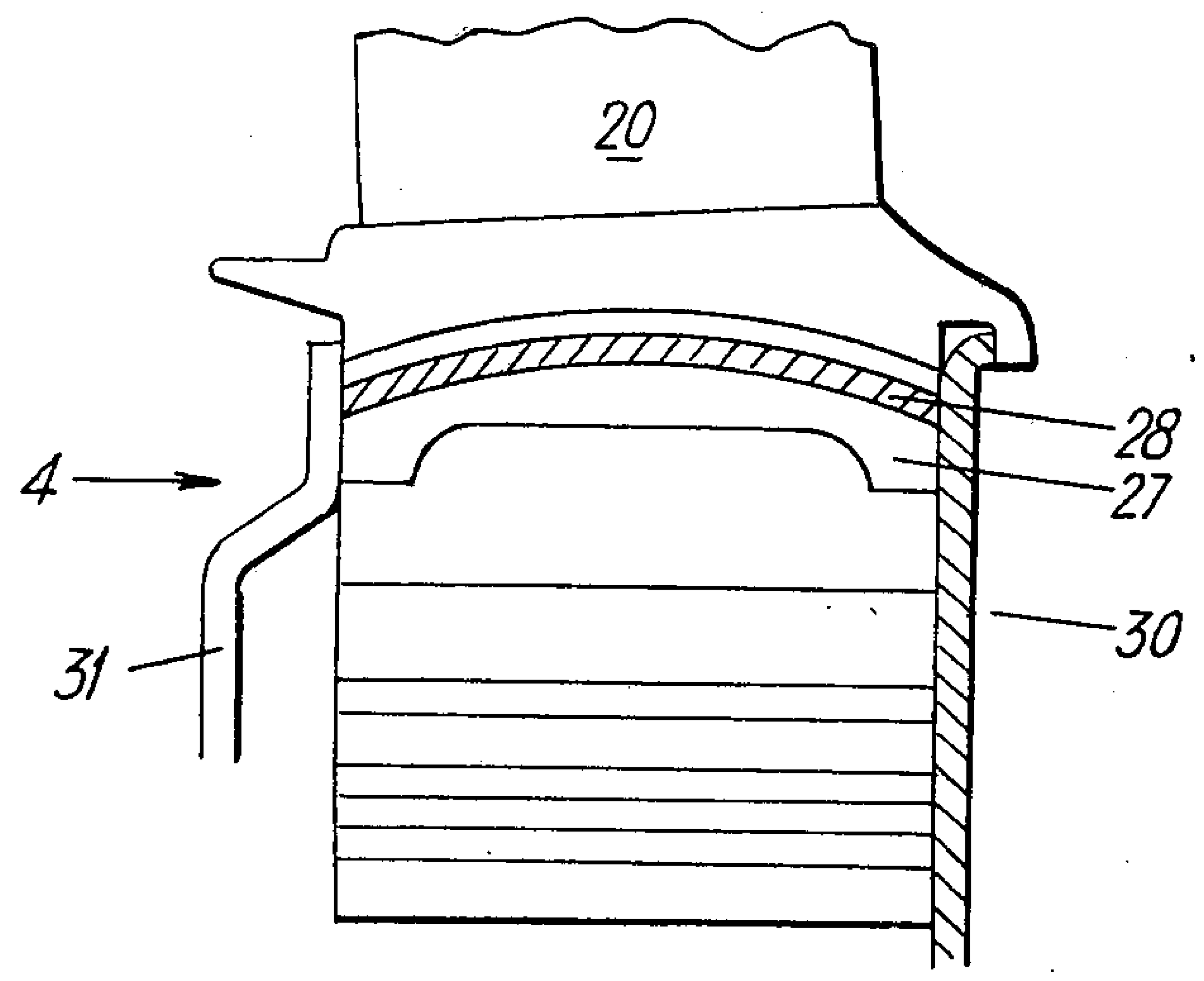


Fig.3.

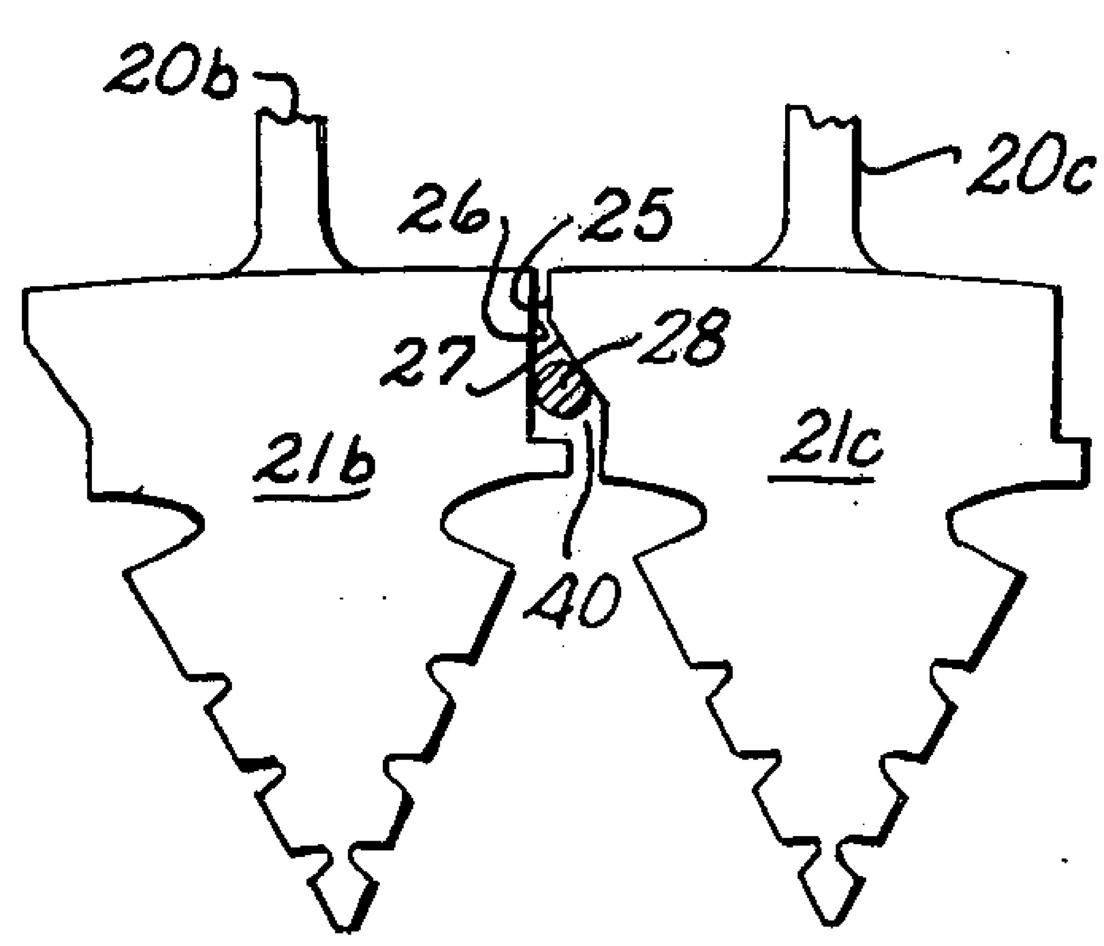


Fig.4.

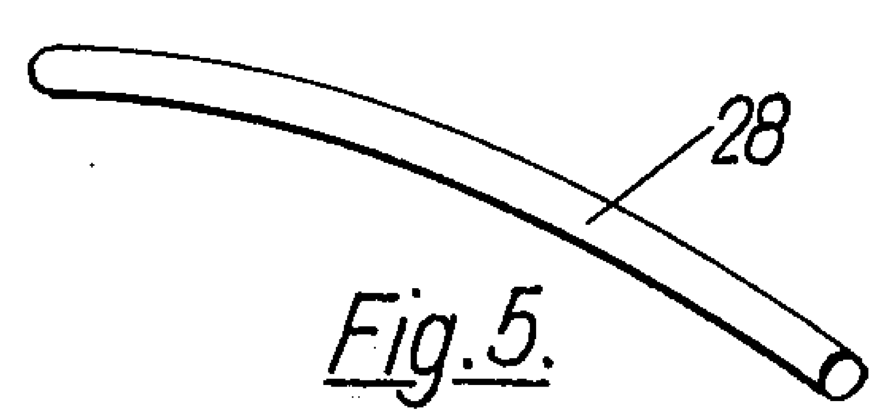


Fig.5.

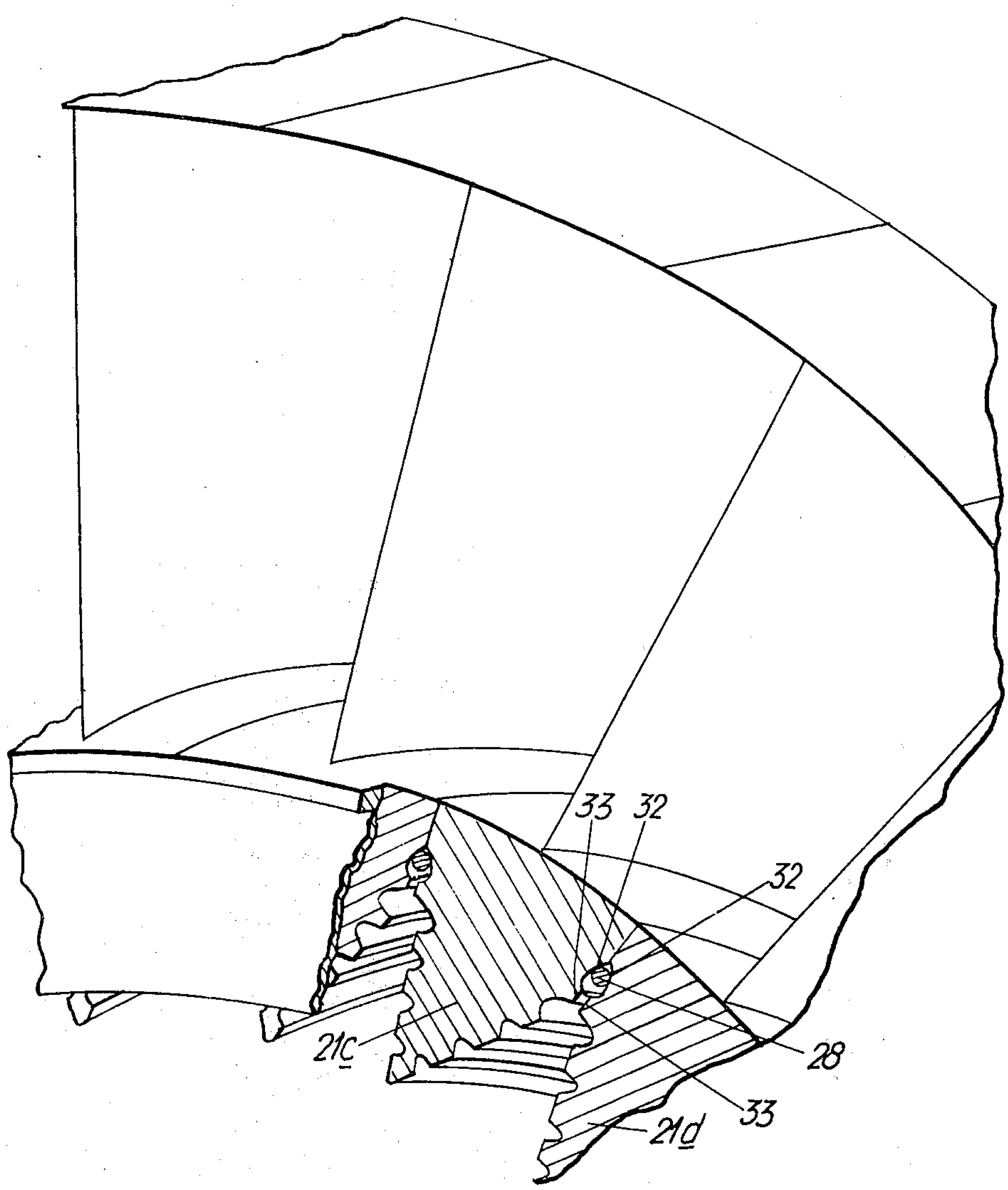


Fig. 6.

BLADE ASSEMBLY FOR A FLUID FLOW MACHINE

This invention concerns a bladed rotor for a gas turbine engine.

In the bladed rotors of gas turbine engines, it is normally necessary to provide sealing means between the parts of adjacent blades which form part of the flow annulus, i.e., between the root platforms and/or between the shrouds.

In the past there have been many systems available for providing these seals, however, most of them have suffered from a similar defect in that whilst the seals may be extremely efficient while the rotor is stationary, when the rotor is running at a comparatively high rotational speed the centrifugal force acting upon it tends to make it expand and therefore make the seals less effective. Other difficulties are encountered with the sealing of a turbine rotor due to expansion of the turbine components caused by large change in temperature at which the turbine operates.

It has been found that by use of an embodiment of the present invention the above mentioned disadvantages may be substantially overcome.

According to the present invention there is provided a bladed rotor for a gas turbine engine comprising a plurality of angularly spaced apart aerofoil blades each having a platform or shroud having a face which cooperates with a corresponding face on the next adjacent blade to form a radially tapering groove whose width decreases as the distance from the rotor axis increases in which a sealing member is mounted so as to seal between the adjacent platforms or shrouds.

Preferably there is at least one projection from said face or faces adapted to prevent said sealing member falling radially inward to disengage from the groove.

The groove may be formed between a radial surface on one face and an inclined surface on the corresponding face, or between an inclined surface on one face and an oppositely inclined surface on the corresponding face.

In a preferred embodiment the sealing member comprises a wire which is curved longitudinally to match the curve of said tapered groove.

The invention will now be particularly described merely by way of example with reference to the accompanying drawings in which:

FIG. **1** shows a diagrammatic view of a gas turbine engine showing an embodiment of the present invention,

FIG. **2** shows an enlarged pictorial view of the embodiment shown at FIG. **1**,

FIG. **3** shows a section taken between two respective blades shown at FIG. **2**,

FIG. **4** shows an end elevation of two adjacent blade roots taken in direction of arrow **4** at FIG. **3**,

FIG. **5** shows an enlarged pictorial view of the sealing member, and

FIG. **6** is a view similar to FIG. **2** but of a second embodiment of the invention.

Referring to FIG. **1** a gas turbine engine shown generally at **10** comprises an intake **12**, compressor section **13**, combustion section **14** and turbine section **15** terminating in exhaust nozzle **16**. A brokenaway portion of the casing round the turbine section **15** shows diagrammatically the turbine rotor in accordance with the invention.

FIG. **2** is an enlarged pictorial view of the broken away section shown at FIG. **1** and shows individual aerofoil shaped turbine blade members **20***a*, 20*b*, 20*c* and **20***d* terminating in blade root portions **21***a*, 21*b*, 21*c* and **21***d* only three of which are wholly or partially exposed in the drawings, the blade roots in turn are secured in the rotor disc (not shown) by means of fir tree root members. The outer tips of the blades **20***a*, *b*, *c*, *d*, etc. are in turn bounded by a shroud portion **22** which it will be appreciated may also be provided with a similar sealing system as that shown at the blade roots.

Referring to the sealing arrangement shown generally at **24** it will be appreciated that a slight clearance must be allowed at the abutting surfaces **25** and **26** provided on the blade root portions for manufacturing tolerance, and it is therefore necessary to provide a seal to prevent any through flow of air or gas through this gap.

It will be seen that the surface **25** is provided with a recessed portion **25′**, the recess terminating in an inclined arcuate surface **27** against which the arcuate wire sealing member **28** rests. The inclined surface **27** and flat surface **26** together form a tapered groove **40** whose width decreases as the radial distance from the rotor axis increases, and the wire **28** is of the same length as the root portion of the blade. This construction can also be seen at FIG. **4**. The sealing members **28** are prevented from moving radially inwardly by means of a projecting portion **29** being provided upon the substantially flat surface **26**, the projection **29** being spaced radially inward of that part of the flat surface **26** which corresponds with the inclined surface **27**.

The sealing members and blades are prevented from moving axially from the disc by means of lock plates **30** and **31** shown in more detail at FIG. **3**.

FIG. **6** shows a further embodiment of the invention, in this case the sealing member **28** is arranged to nestle in the tapered arcuate groove formed between two inclined arcuate step portions **32** provided upon the radially outermost surfaces of two recessed portions one of which is provided on each side of the blade root portion; again cooperating projections **33** radially inward of the surfaces **32** prevent the member **28** falling radially inwardly.

It will be readily understood that during operation of the turbine the centrifugal load imposed upon the sealing members **28** tend to force them radially outwards such that they are forced into the tapered section **27** of the recessed portion **25′** (shown at FIG. **2**) or between the two tapered portions **32** (shown at FIG. **6**) thus providing an efficient sealing arrangement. The material of the wire will be chosen to have sufficient malleability to enable it to bed into the tapered groove. It will also be understood that the arcuate sealing members **28** also help damp out vibration occurring the blades, and by choosing seals of a particular size and weight, desired damping characteristics could be obtained.

Since the sealing members **28** are interposed between the platforms, they prevent these platforms fretting against one another, and their position at the inner end of the aerofoil enables them to provide damping of this area; clearly the faster the rotor rotates, the more centrifugal load acts on the sealing members and the greater will be the damping. It will also be understood that expansion or contraction occurring in the turbine may be accommodated by the above mentioned sealing arrangements.

It will also be appreciated that by producing seal members **28** in arcuate form the curved shape gives angular location to enable the ends of the seal member to be shaped by machining to conform with the surface of the blade front and rear faces **21***a* and **21***b* etc. The arcuate shape also prevents twisting of the seal member **28** and ensures friction damping.

It will be appreciated that whilst an embodiment of this invention has been described in connection with a turbine sealing device the invention is in no way restricted to such a device and could equally well be used for the sealing of a compressor rotor or similar device.

We claim:

1. A bladed rotor assembly for a gas turbine engine comprising a rotor and a plurality of angularly spaced apart aerofoil blades supported from the rotor, each blade having a platform member, said platform member having a face which cooperates with a corresponding face on the next adjacent blade to form a radially tapering groove whose width decreases as its distance from the rotor axis increases, said radially tapering groove being curved longitudinally relative said rotor assembly, and a sealing member mounted in the tapered and longitudinally curved groove so as to seal between the adjacent platforms, said sealing member comprising a wire curved longitudinally relative said rotor assembly and being substantially complementary to the longitudinal curve of said groove.

2. A bladed rotor assembly as claimed in claim **1** and in which there is at least one projection from one said face adapted to prevent said sealing member falling radially inward to disengage from said groove.

3. A bladed rotor assembly as claimed in claim **1** and in which there is a radially extending surface on one said face and an inclined surface on the cooperating face between which surfaces is formed said groove.

4. A bladed rotor assembly as claimed in claim **1** and in which there is an inclined surface on one said face and an oppositely inclined surface on the cooperating face between which surfaces is formed said groove.

5. A bladed rotor assembly as claimed in claim **1** and comprising lock plates which engage between said rotor and said blades to limit axial movement of the blades and sealing members with respect to the rotor.

6. A bladed rotor assembly as claimed in claim **1** and in which said platforms comprise the root platforms of the blades.

7. A bladed rotor assembly as claimed in claim **1** and in which said platforms comprise the shroud platforms of the blades.

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