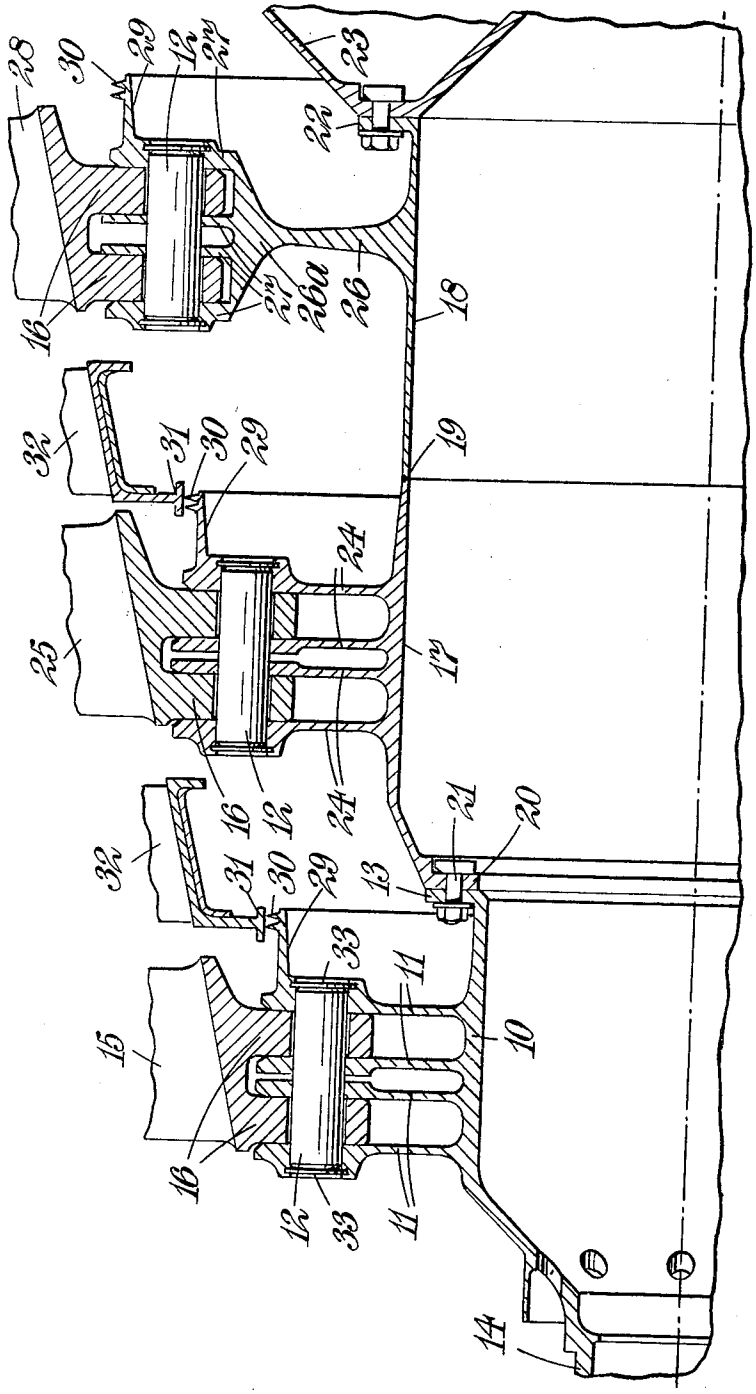
Aug. 28, 1962 N. H. KENT ETAL 3,051,436

ROTOR FOR AXIAL-FLOW FLUID MACHINE

Filed Feb. 10, 1960



United States Patent Office 3,051,436 Patented Aug. 28, 1962

3,051,436

ROTOR FOR AXIAL-FLOW FLUID MACHINE

Nelson Hector Kent and Thomas Steel, Derby, England, assignors to Rolls-Royce Limited, Derby, England, a company of Great Britain

Filed Feb. 10, 1960, Ser. No. 7,869
Claims priority, application Great Britain Feb. 5, 1960
3 Claims. (Cl. 253—39)

This invention comprises improvements in or relating to rotors for axial-flow fluid machines. One example of such a machine is a multi-stage axial-flow compressor as is employed in gas-turbine engines.

A rotor of an axial-flow fluid machine usually comprises a central shaft and a separate structure mounted on the shaft for carrying blades of the rotor.

According to the present invention, a rotor for an axial-flow fluid machine comprises a hollow central torque-carrying member having formed in one piece with it outwardly-extending flange means to which the blades of the rotor are directly attached.

According to a feature of this invention, the rotor may comprise a plurality of such hollow torque-carrying members arranged end to end in axial alignment. The members may be butt-welded together or may be provided with abutting bolting flanges. Preferably each such member has in one piece with it flange means for a single stage of rotor blading.

The arrangement of the invention has advantages in manufacture and assembly.

One construction of rotor embodying the above and other features of invention is illustrated in the accompanying drawing.

The drawing shows the inlet end of a rotor for a multi-stage axial-flow compressor suitable for a gas turbine engine.

The rotor comprises a first hollow torque-carrying member **10** having formed in one piece with it a series of four axially-spaced radial flanges **11**, a bolting flange **13**, and a stub shaft extension **14** for engaging a front bearing. The flanges **11** have aligned bores in them to receive pivot pins **12** which pivotally attach first stage rotor blades **15** to the member **10**, the pins **12** passing through lugs **16** on the root ends of the blades **15**.

The rotor also comprises second and third hollow torque-carrying members **17**, **18** respectively which are of the same general diameter and are secured together in axial alignment over a butt-welded joint **19**. The member **17** has a bolting flange **20** at its upstream end to abut flange **13** and to receive a ring of bolts **21** holding the member **10** in axial alignment with the members **17**, **18**. The member **18** has a bolting flange **22** at its downstream end to receive bolts **23** for attaching the members **10**, **17**, **18** to a further part **23** of the rotor. The part **23** may be constructed for blade-carrying in accordance with the invention or may be of any other convenient or conventional construction.

The member **17** has in one piece with it between its ends a series of axially-spaced radially-extending annular flanges **24** to which the second stage rotor blades **25** are attached in the same manner as described for blades **15**.

The member **18** has in one piece with it between its ends a radially-extending annular flange **26** which has an

axially-thickened portion **26***a* at its periphery and a series of axially-spaced radially-extending annular flanges **27** are provided externally of the thickened portion **26***a*. Third stage rotor blades **28** are pivotally attached to the flanges **27** in the same way as described for the blades **15**, **25**.

The end flanges of the groups of flanges **11**, **24**, **27** may be provided with axial extensions for co-operating with stationary structure of the compressor to provide labyrinth type seals. For instance in the illustrated construction the downstream flange of each group has an axially-projecting annular extension **29** formed with annular ribs **30** co-operating with stationary parts **31** carried at the inner ends of stator blades **32** of the compressor.

The pivot pins **12** are retained in position by circular spring rings **33** snapped into grooves in the end flanges of each group.

It will be seen that each of the hollow torque-carrying members **10**, **17**, **18** is of tubular form and has a relatively thin wall thickness and further, that the internal diameter of each is large compared with the wall thickness. It will also be seen that the blade-carrying flanges **11**, **24** and **26** have a radial extent which is small compared with the internal diameter of the respective torque-carrying member **10**, **17**, **18**. As a result the compressor rotor has a very much lighter weight than known constructions of compressor rotor in which each ring of blades is carried by a separate radially extensive disc. The members **10**, **17** and **18** are also relatively simple and cheap to manufacture as compared with known arrangements as just described.

We claim:

1. A bladed rotor according to claim 3, having some at least of the tubular members butt-welded together.

2. A bladed rotor according to claim 1, having some at least of the members provided with abutting bolting flanges, there being bolts extending through the flanges to secure the members in axial alignment.

3. A rotor for an axial-flow fluid machine comprising a plurality of tubular members secured together end to end to provide a hollow torque-carrying structure of the rotor, the tubular members having a radial wall thickness which is small and an internal diameter which is large compared with the wall thickness, and each tubular member having in one piece with it and extending radially outwards from it between its ends radial external flange means the radial extent of which is substantially smaller than the internal diameter of the tubular member, each said tubular member having a smooth internal bore extending axially from one end thereof to beyond said external flange means, and a series of rings of blades, each ring of blades being mounted on a corresponding one of the tubular members, each blade in a ring having a root portion directly attached to the radial flange means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,200,287	Lysholm	May 14, 1940
2,317,092	Allen	Apr. 20, 1943
2,440,933	Cunningham	May 4, 1948
2,711,631	Willgoos	June 28, 1955
2,747,367	Savin	May 29, 1956
2,751,189	Ledwith	June 19, 1956
2,918,252	Haworth	Dec. 22, 1959
2,922,620	Shapiro	Jan. 26, 1960