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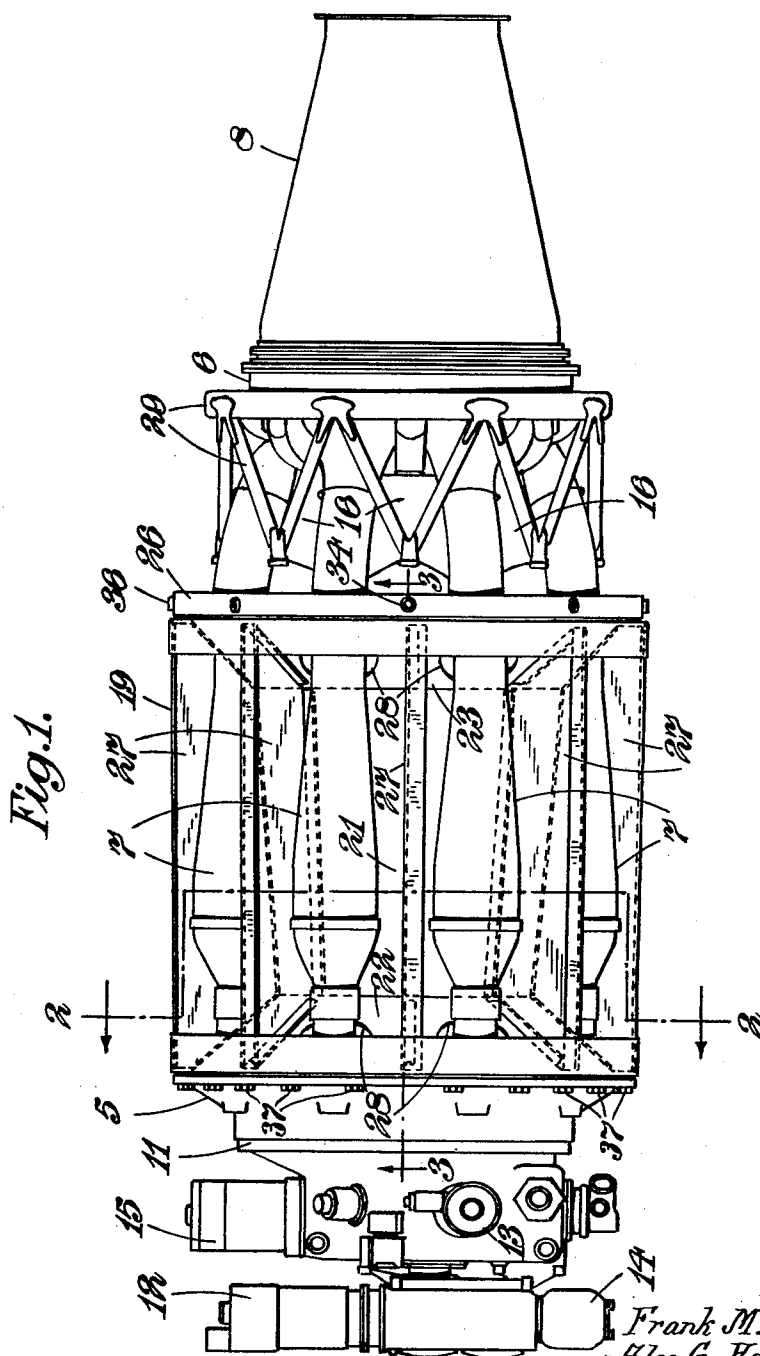
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MEANS FOR SUPPORTING GAS-TURBINE POWER PLANTS

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3 Sheets-Sheet 1



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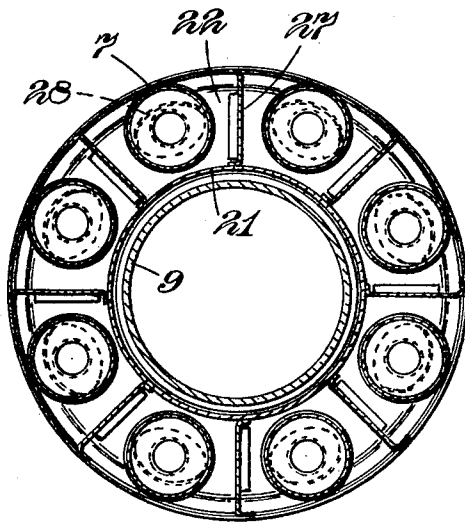
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Fig. 2.



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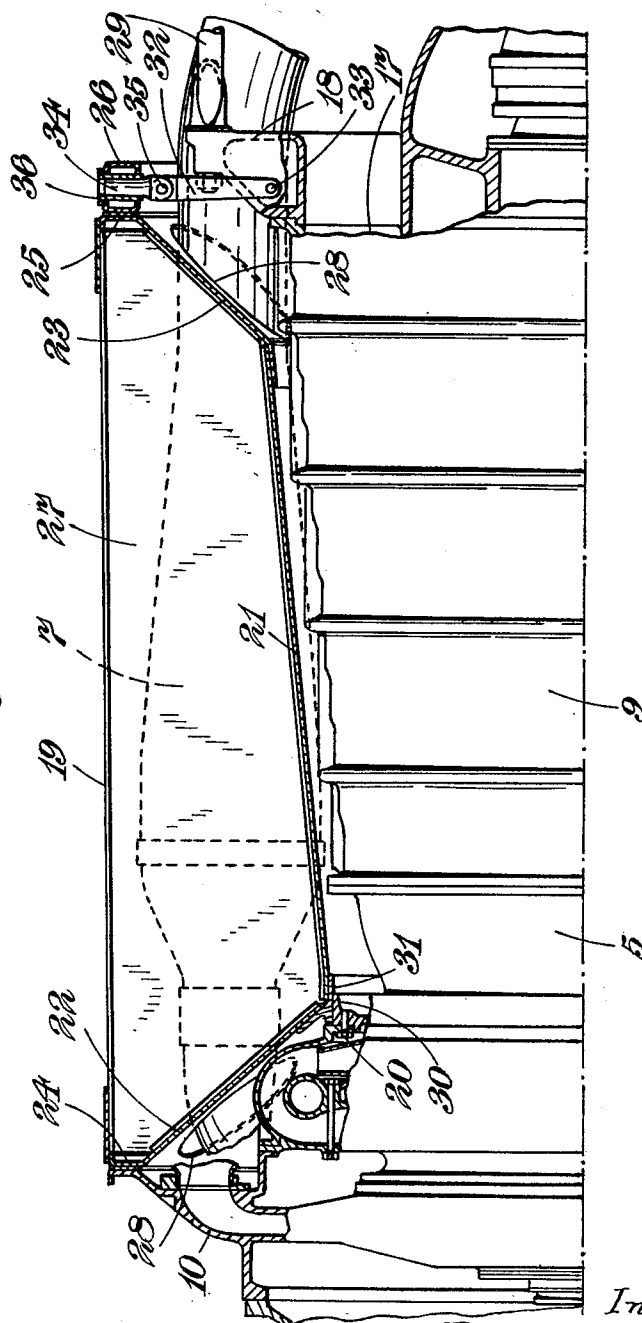
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Fig. 3.



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MEANS FOR SUPPORTING GAS-TURBINE
POWER PLANTS

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3 Claims. (Cl. 60—41)

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This invention concerns means for supporting a gas-turbine power-plant. The object of this invention is to provide a support which enables the external loads of one or more members of the power-plant to be borne solely by said member or members. The external loads (that is, those due to weight and inertia forces) are therefore not transmitted from other members of the power-plant to said member and vice versa.

According to the present invention means for supporting a gas-turbine power-plant is attached to the power-plant at positions spaced along the length thereof, part of the plant being supported cantileverwise of said means and part between said attachments.

The present invention finds particular application to gas-turbine power plants having an axial-flow compressor and, according to another feature of the present invention, such a power-plant is supported as described with said compressor disposed between said attachments. As a consequence the compressor is relieved of the external loads due to the other parts of the power-plant. The stator casing may be designed, therefore, to carry the loads due to the operation of the compressor and only the external loads of the compressor.

According to another feature of the present invention, that part of the power-plant which is disposed between the attachments is capable of a limited movement relatively to the supporting structure in an axial and/or radial direction of the power-plant.

In order that the present invention may be understood a practical application will now be described by way of example with reference to the accompanying drawings whereof

Figure 1 is a side elevation of a gas-turbine power-plant having support means in accordance with the invention.

Figure 2 is a section on the line 2—2 of Figure 1 and

Figure 3 is a section on the line 3—3 of Figure 1 but to an enlarged scale.

The gas-turbine power-plant which is about to be described is adapted for the propulsion of an aeroplane and comprises a compressor unit generally indicated by the reference numeral 5, a turbine 6 for driving the compressor unit, a plurality of combustion chambers 7 and a tail pipe 8. The turbine 6 is disposed adjacent the tail pipe 8 (being at the rear end of the power-plant) and is connected with an axial and centrifugal compressor 9 and 10 respectively. The axial and centrifugal compressors together constitute the com-

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pressor unit 5. The compressors are disposed in line with the turbine 6 and between the latter and a housing 11. The latter carries a group of power plant ancillaries such as at 12, 13, 14 and 15. It is clear from Figure 1 that these are disposed at the opposite end of the power-plant to the turbine 6, that is, at the front end of the power-plant.

The working fluid is admitted to the axial compressor between the latter and the turbine 6 as at 16 and thereafter the working fluid passes in succession through the axial compressor 9 and the centrifugal compressor 10, which is of the two-stage type. The working fluid (during compression) therefore travels from the rear end of the power-plant to the front end where it is discharged into the combustion chambers 7. The latter are spaced around the compressor 9 and convey the working fluid rearwardly from the centrifugal compressor 10 to the turbine 6.

The output shaft of the turbine 6 passes through the turbine casing and is suitably connected with a shaft (not shown) which supports the rotor and impellers of the compressor unit which extends into the housing 11. In this way drive is transmitted from the turbine to the compressor unit and also to the ancillaries.

The various members of the power-plant are subjected to loads due to their operation and also to external loads due to the weight of the power-plant and as a result of the aeroplane being manoeuvred. It is desirable that the stator casing of compressor 9 be relieved of these external loads, the casing being required to carry only those loads due to the operation of the compressor and the external loads to which this stator casing alone is subjected.

That end of the stator casing which in part defines the mouth 17 of the compressor 9 is attached to an annular member 18 which is itself supported from a structure 19. The delivery end of the stator casing is secured to the casing of the centrifugal compressor 10 as at 20. The casing of the centrifugal compressor 10 is also supported from the structure 19. The manner of supporting the stator casing and the casing of the centrifugal compressor from the structure 19 will be described hereinafter.

The structure 19 comprises a truncated conical member 21 which surrounds the stator casing of compressor 9 and a pair of end pieces 22 and 23. The latter are secured to the central member 21, as by welding, and are themselves of truncated conical form. Each end piece 22, 23 slopes upwardly from the central member 21 to

a circumferential flange 24, 25 respectively. The flange 24 is secured, as by bolts 37, to the casing of the centrifugal compressor 10 and the flange 25 is welded to a mounting ring 26. The mounting ring (as is clear from Figure 1) encircles the power-plant and is attached to the aeroplane by means of a rigid tubular structure (not shown).

The depth from the attachment flanges 24, 25 to the central member 21 is considerable in order that the structure 19 may possess the required rigidity. This rigidity is further increased by having a plurality of beam members 27 which extend lengthwise of the support structure 19 and generally radially thereof. The members 27 are secured to the central member 21 and the end pieces 22 and 23 of the support structure.

With a view to reducing the overall diameter of the power-plant each combustion chamber 7 lies within the structure 19 and between a pair of adjacent beams 27. The end pieces 22 and 23 are formed with a plurality of holes 28 through which the ducts leading to and from the combustion chambers pass.

The support structure described has a high resistance to bending since the radial depth thereof is considerable. That portion of the power-plant lying ahead of a plane containing the flange 24 and behind a plane containing the flange 25 will be carried cantileverwise from the structure 19 and the external loads to which these parts of the power-plant are subjected will not be transmitted to the stator case of the compressor 9, they will be transmitted directly to the support structure and thence to the aeroplane. The stator casing may therefore be designed solely to carry the loads due to the operation of the axial compressor and due to the external loads to which the stator casing alone is subjected.

The portion of the power-plant lying ahead of the plane passing through the flange 24 comprises the housing 11 and the ancillaries 12 to 15. That portion of the power-plant lying behind the flange 25 comprises the turbine 6, the tail pipe 8 and the discharge ends of the combustion chambers. The turbine 6 is supported from the annular member 18 by a structure indicated by the reference numeral 29.

The various members of the power-plant are subjected to temperatures which vary widely. Accordingly it is considered necessary that provision be made for relative expansions between certain members of the power-plant. For instance whilst the temperature of the working fluid entering the compressor 9 may be low (being atmospheric) the temperature in the combustion chambers 7 and in the turbine 6 is relatively very high.

Each end of the stator casing of compressor 9 is supported from the structure 19 so as to enable such expansions to take place. The casing of the axial compressor 9 adjacent its point of attachment 20 to the centrifugal compressor 10 is formed with a circular flange 30. Secured to the central member 21 and the end piece 22 at the junction thereof is an annular strip 31 the inner face of which engages with the flange 30. The strip 31 and flange 30 permit relative movements between the casing of compressor 9 and the structure 19 in the axial direction of the power plant, radial movements, however, not being permitted.

The annular member 18 to which the casing of the compressor 9 is secured is supported from the mounting ring 26 so as to enjoy freedom of movement relatively thereto in the axial and radial directions. The support for the member 18 com-

prises a plurality of links 32 which are disposed generally radially of the power-plant the inner end of each link being pivotally secured, as at 33, to the annular member 18. The outer end of each link is pivotally secured, at 35, to a stud 34 which passes through a radial collar 36 carried by the mounting ring 26.

With such an arrangement the annular member 18 (and hence the stator casing attached thereto) is capable of axial movements relatively to the support structure 19 since with such movements the links 32 pivot about the point of attachment 35. The relative movements between the support structure 19 and the stator casing in a radial direction are permitted by the studs 34 and their associated collars 36.

Considerable freedom is allowed in the design of the stator casing for the compressor 9 when a gas-turbine power-plant as described is supported in accordance with the present invention. Accordingly this casing may be formed in two or more segmental sections which are bolted together to form a joint which extends lengthwise of the power-plant. Alternatively the stator casing may, if desired, be formed in two or more sections which are joined together by one or more peripheral joints extending around the casing.

We claim:

1. The combination with a gas-turbine engine comprising a compressor assembly, an axial-flow compressor constituting part of said assembly, combustion equipment to receive air from the compressor assembly and in which fuel is burnt and a turbine to drive the compressor assembly; said turbine, which is driven by the hot gases from the combustion equipment being supported from one end of the compressor assembly with the combustion equipment supported therebetween, of a compressor structure surrounding the axial-flow compressor, means fixing one end of the compressor structure to the compressor assembly, a connection between the other end of the compressor structure and the compressor assembly said connection allowing of relative radial and axial movements between the assembly and said structure and a cantilever structure secured to said compressor structure to support the gas turbine engine as a unit.

2. The combination with a gas-turbine engine comprising a compressor assembly, an axial-flow compressor constituting part of said assembly, combustion equipment to receive air from the compressor assembly and in which fuel is burnt and a turbine to drive the compressor assembly; said turbine which is driven by the hot gases from the combustion equipment, being supported from one end of the compressor assembly with the combustion equipment supported therebetween, of a frusto-conical member having outwardly-flared end pieces of frusto-conical form, a mounting ring secured to one end piece, means fixing one end piece to the compressor assembly, a connection between the mounting ring and the compressor assembly said connection allowing of relative radial and axial movements between the assembly and the frusto-conical member and a cantilever structure secured to said mounting ring to support the gas turbine engine as a unit.

3. The combination with a gas-turbine engine comprising a compressor assembly, an axial-flow compressor constituting part of said assembly, combustion equipment to receive air from the compressor assembly and in which fuel is burnt and a turbine to drive the compressor assembly,

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said turbine which is driven by the hot gases from the combustion equipment being supported from one end of the compressor assembly with the combustion equipment supported therebetween, of a frusto-conical member having outwardly-flared end pieces of frusto-conical form, a plurality of beams extending from one end piece to the other and radially disposed of the frusto-conical member, a mounting ring secured to one end piece, means fixing one end piece to the compressor assembly, a connection between the mounting ring and the compressor assembly said connection allowing of relative radial and axial movements between the assembly and the

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frusto-conical member, and a cantilever structure secured to the mounting ring to support the gas-turbine engine as a unit.

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ALEC GEORGE HENSTRIDGE.

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