Oct. 20, 1970 C. BOULOGNE 3,535,540

HYDROELECTRIC BULB TYPE SET HAVING A HEAT EXPANSION COMPENSATOR FOR THE UPSTREAM SUPPORT

Filed Jan. 23, 1969

3 Sheets-Sheet 1

FIG. 1

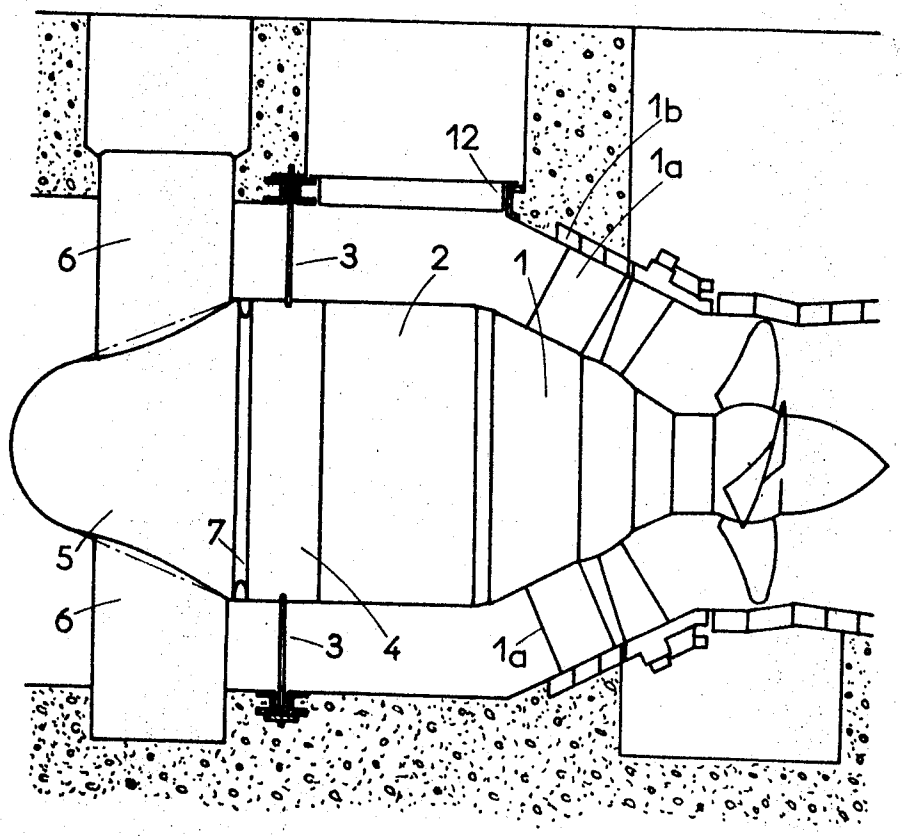

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FIG. 2

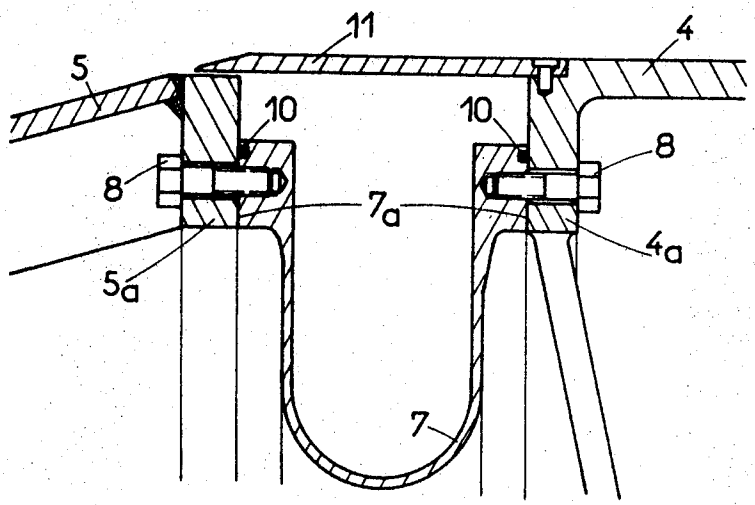

FIG. 3

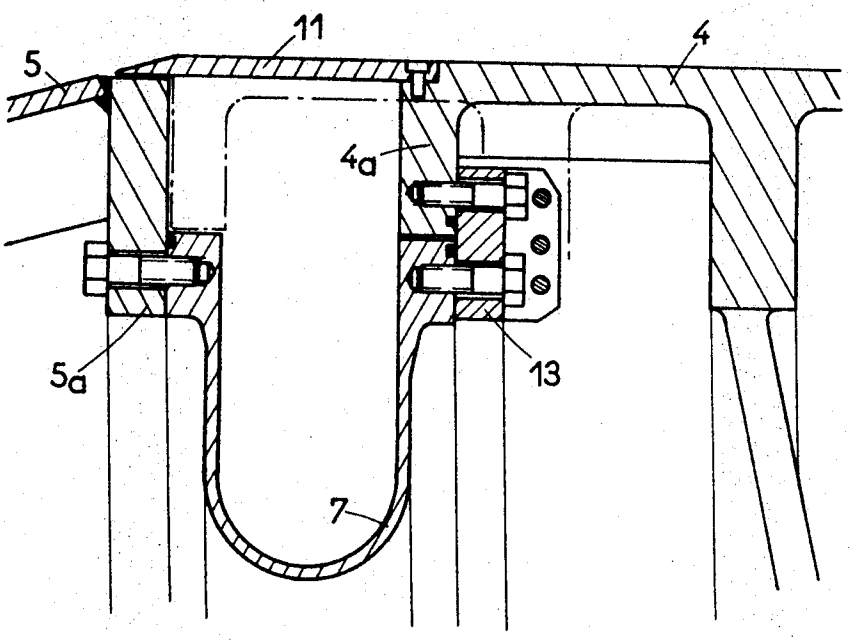

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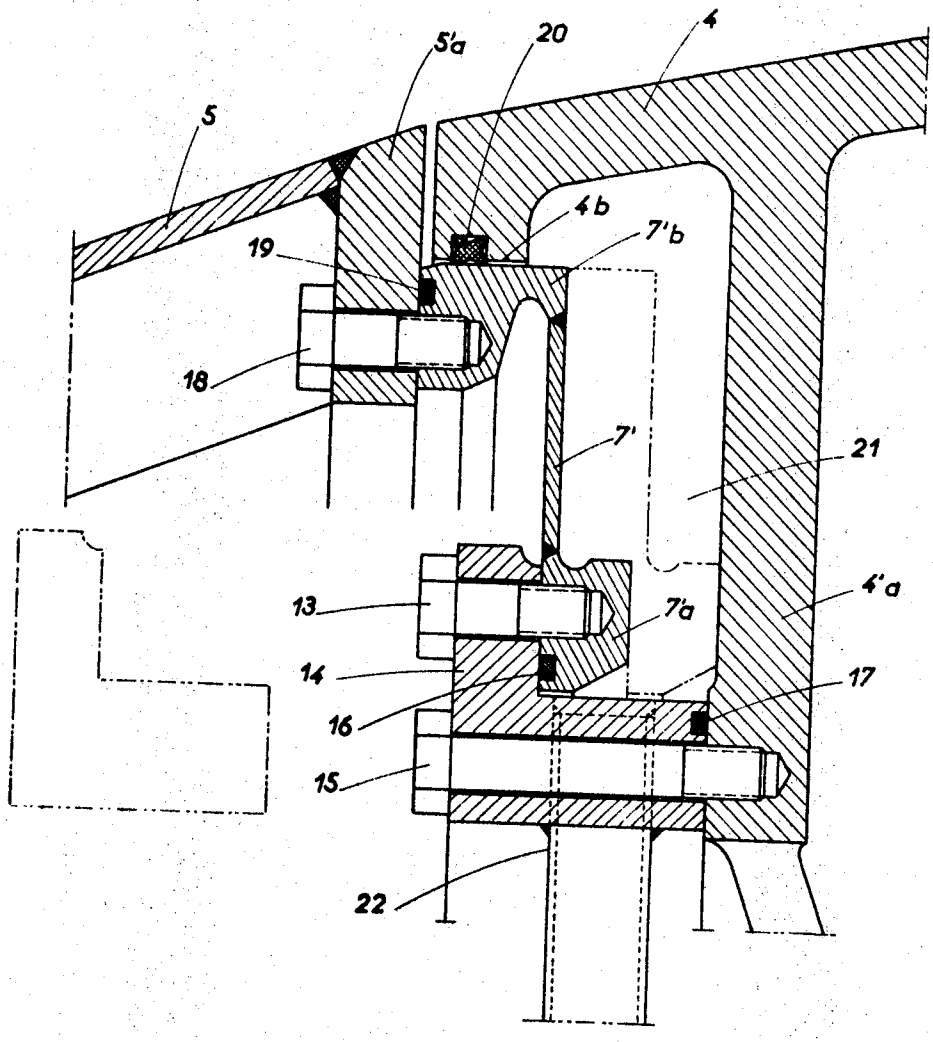
FIG: 4



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HYDROELECTRIC BULB TYPE SET HAVING A HEAT EXPANSION COMPENSATOR FOR THE UPSTREAM SUPPORT

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Int. Cl. H02k 7/18
U.S. Cl. 290—52 5 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to a heat-expansion compensator for the upstream support of bulb type hydroelectric sets. According to the invention, the hydroelectric set, which has a downstream support in the form of a front distributor, comprises an upstream support comprising: radial struts which bear the support spider of the upstream bearing of the set and which can absorb axial movements thereof by bending or oscillating; and at least two rigid arms which are anchored in the concrete of the pipeline and which bear the ogive of the set; and an expansion compensator in the form of an axially deformable hermetic equal ring connects the ogive to the upstream bearing support spider.

This invention relates to a hydroelectric bulb type set having a heat expansion compensator for the upstream support.

In sets of this kind the bulb part is usually borne by two supports disposed one downstream of and the other upstream of the alternator.

The downstream support usually takes the form of the combined blades and cross-members of the front distributor, such blades being secured to the concrete with the interposition of a sealing ring; in such cases the blades are required to withstand on their own (or possibly in combination with struts or other elements which bear some of the vertical loads rigidly while being ffexible axially) the axial hydraulic forces and the hydraulic and electrical torques of the set.

The upstream support usually takes the form either of a single horizontal or vertical arm or of two arms in a cross, which are rigidly sealed in the concrete to give a hermetic connection between the same and the arm or arms. These arms, although not essential for axial retention of the set, are usually designed so that access can be had through them to the set interior and demountable elements of the set, such as parts of the thrust bearing and the alternator busbars, can be passed through; the arms also act as a store for minor accessories and for the oil storage pans of the set. The arm dimensions are therefore such that the section modulus of the upstream support is of the same order of magnitude as for the downstream support, and so the two supports cannot be dissociated for calculations of axial load distribution, more particularly of forces arising from heat expansion of the alternator.

In the case of bulb sets having an alternator with a self-cooling carcass, heat stresses may rise to several times the hydraulic stressing and thus lead to overstressing in the welded or bolted support assemblies and to parts working loose in the concrete.

It is an object of this invention to enable the alternator carcass to be free to expand axially so that the two supports of the set do not experience expansion forces.

According to the invention, there is provided a hydroelectric bulb type set comprising a downstream support in the form of a front distributor, an upstream support comprising radical struts which bear the support spider of the upstream bearing of the set and which can absorb axial movements thereof by bending or oscillating, at least two rigid arms which are anchored in the concrete of the pipeline and which bear the ogive of the set, and an expansion compensator in the form of an axially deformable helmetic metal ring connecting the ogive to the upstream bearing support spider.

The invention will now be described in greater detail with reference to exemplary embodiments shown in the accompanying drawings, wherein:

FIG. 1 is a diagrammatic overall view of a bulb set having an expansion compensator;

FIG. 2 is a sectioned view to an enlarged scale showing assembly details of the expansion compensator;

FIG. 3 is a view similar to FIG. 1 showing an alternative form of heat compensator assembly; and

FIG. 4 shows the annular cross-section of the expansion compensator inserted between the ogive and the upstream bearing support spider.

FIG. 1 shows a bulb set having an alternator with a self-cooling carcass; the downstream support for the set comprises in known manner combined blades and cross-members **1***a* of a front distributor **1** rigidly anchored by way of its outer ring **1***b* in the concrete. The upstream end of the alternator carcass **2** is borne by struts **3** which form the upstream bearing for vertical loads. The struts **3**, which are disposed between a spider **4** bearing the upstream bearing and the concrete, are anchored therein and can be rocked by slight axial movements of the set.

Ogive **5** of the set is borne by a number of rigid arms **6** in the form of streamlined box members anchored hermetically in the concrete. The dimensions of the arms **6** are such as to give access to the set, to enable parts to be dismantled to be passed through and to receive the usual accessories. Disposed between ogive **5** and spider **4** is an annular expansion compensator **7** enabling the bulb to be moved axially as a result of heat expansion of the alternator carcass **2**.

As FIG. 2 shows, compensator **7** has a U-shaped cross-section having plane annular surfaces **7***a* bearing on a flange **5***a* rigidly secured to ogive **5** and on a flange **4***a* of spider **4**, securing being by screws or bolts **8** and sealing-tightness being ensured by gaskets **10**. Disposed around compensator **7** is a cover **11** which is secured to spider **4** and which provides continuous hydraulic streamlining and protects the compensator.

An alternative form of compensator **7** shown in FIG. 3 enables the alternator to be removed through an aperture **12** above the set (FIG. 1) in the top of the pipeline. The compensator **7** and spider flange **4***a* are assembled together with the interposition of a multi-element ring or crown **13**. When the same has been demounted, the spider **4** can be moved axially until flange **4***a* abuts ogive flange **5***a*, so that between alternator **2** and spider **4** a space is left which is equal to the length of the compensator and which enables the same to be released from its downstream support for removal through aperture **12**.

Referring to FIG. 4, the compensator comprises an axially flexible annular metal diaphragm **7'** welded at its central aperture to a ring **7'***a* and by its periphery to a ring **7'***b*. Ring **7'***a* is secured by screws **13** to a flange **14** securel by screws **15** to an annular partition **4'***a* of spider **4**, sealing-tightness being provided by gaskets **16**, **17**. Ring **7'***b* is secured by screws **18** to a flange **5'***a* of ogive **5** with the interposition of a gasket **19**. An axially deformable gasket **20** around the periphery of ring **7'***b* seals off a bore **4***b* in spider **4**.

The flexibility of diaphragm 7' helps to absorb the heat expansion likely in a bulb set having an alternator with a self-cooling carcass.

Possible leaks through gasket **20** are collected in an annular chamber **21** bounded by the compensator and by the spider **4** and are removed through a passage **22** which also serves to decompress chamber **21.**

The presence of the gasket **20** keeps the hydraulic pressure upstream of the set from acting on diaphragm **7'**; the passage **22,** by removing possible leaks and decompressing chamber **21,** precludes the build-up of any hydraulic or pneumatic pressure in the chamber **21.** Also, the state of gasket **20** can be checked at any time by inspecting the leaks removed through passage **22.** In the event of the diaphragm rupturing, the gasket **20** limits leakage flow.

Once the screws **13, 15, 18** have been removed, the compensator can be moved axially downstream, and the flange **14** can be moved axially upstream, into the positions shown in chain-dotted lines, for repairs to all the gaskets **16, 17, 19, 20,** without dismantling any other parts of the set.

The expansion compensator hereinbefore described can of course be modified in constructional and dismantling details without for that reason departing from the scope of the invention.

What is claimed is:

1. A hydroelectric bulb type set comprising a downstream front distributor, a support for said front distributor, an alternator carcass upstream of said front distributor, an alternator in said carcass, an upstream support for said carcass including radial struts, a support spider for said carcass supported by said struts, said strut absorbing axial movements of said carcass by bending or oscillating, an ogive upstream of said spider, at least two rigid arms anchored in the concrete of the pipeline supporting said ogive and an expansion compensator including an axially deformable hermetic metal ring connecting said ogive to said spider.

2. A hydroelectric set as set forth in claim **1,** said compensator including a U-section metal ring, two arms for said ring hermetically secured to two flanges, said flanges being rigidly secured one to said ogive and the other to said spider.

3. A hydroelectric set as set forth in claim **1,** said compensator being secured to said spider by a releasable ring demountable for axial movement of said spider and removal of the alternator.

4. A hydroelectric set as set forth in claim **1,** said compensator including an axially flexible annular metal diaphragm, an inner ring for said diaphragm hermetically secured to an annular partition of said spider and a peripheral ring for said diaphragm secured hermetically to a flange of said ogive, a gasket between the periphery of said compensator and a corresponding bore in said spider to seal said diaphragm from hydraulic pressure, an annular chamber bounded by said compensator and said spider and an orifice for said chamber, said chamber receiving any leakage past said gasket and decompressing said diaphragm.

5. A compensator as set forth in claim **4,** said inner ring of said diaphragm being secured to said annular partition of said spider by a releasable flange whereby said compensator can be moved downstream for access to said gaskets.

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U.S. Cl. X.R.

415—219; 290—1