June 27, 1967 C. O. BRODERS ET AL 3,327,552

TEMPERATURE COMPENSATED LINKAGE

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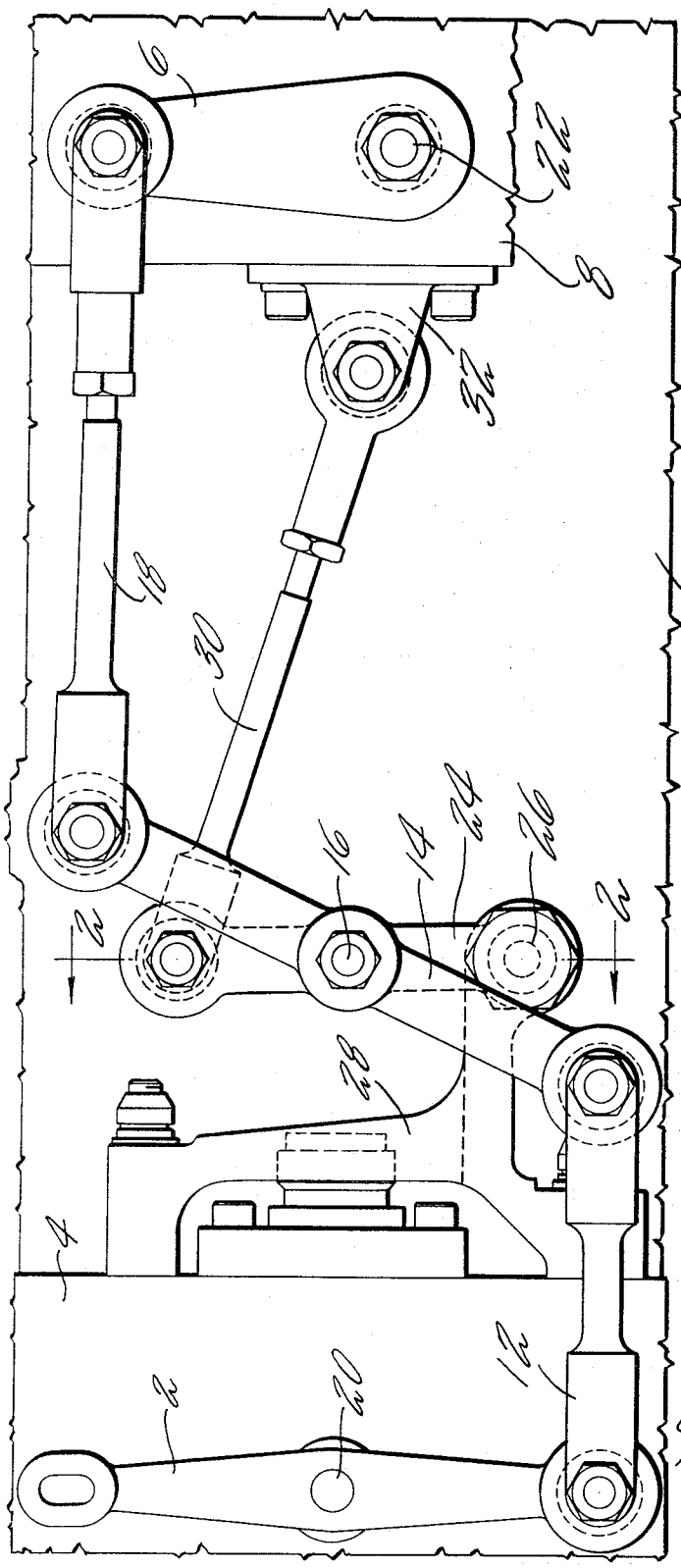


FIG. 1

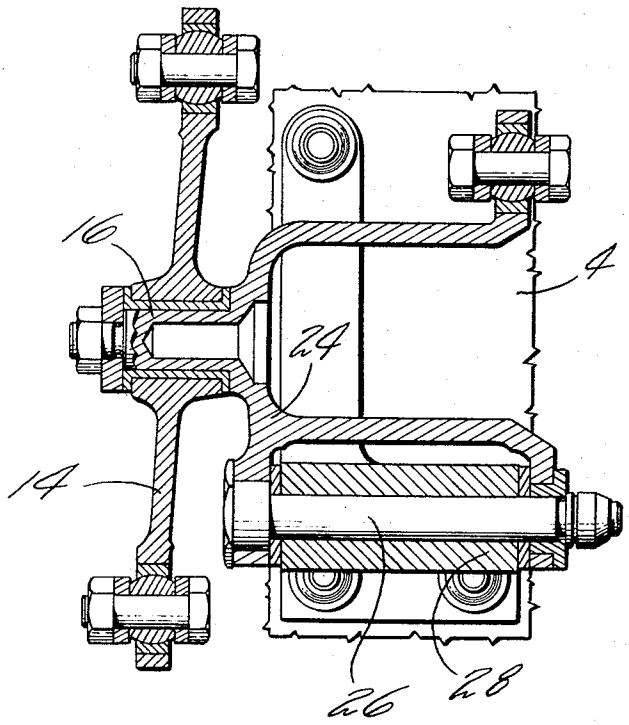
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FIG. 2



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United States Patent Office 3,327,552 Patented June 27, 1967

3,327,552

TEMPERATURE COMPENSATED LINKAGE

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Filed Apr. 22, 1965, Ser. No. 450,143
3 Claims. (Cl. 74—469)

This invention relates to a compensating linkage and particularly to a linkage to compensate for thermal changes occurring in the linkage support structure.

A feature of the invention is an arrangement by which to compensate for thermal expansion between two interconnected support structures where, by a change in their relative position as, for example, as a result of thermal expansion, the effective positions of the linkage will be changed.

A particular feature of the invention is to provide within the actuating linkage for a compensation for thermal expansion between the turbine engine parts that support the linkage. It has been found that, at different flight conditions, the existing temperatures within the engine or afterburner cause a substantial expansion to take place axially between the support structures for the linkage. A prime feature of the present invention is to compensate for this expansion so that the control linkage will still provide the appropriate control even though the support structures have moved substantially with respect to each other.

Other features and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

FIG. 1 is a side view of a linkage embodying the invention.

FIG. 2 is a sectional view substantially along the line 2—2 of FIG. 1 but with both levers positioned in the plane of the section.

Referring first to FIG. 1, the mechanism as shown includes an actuating lever 2 mounted on a base 4 which may represent in the particular embodiment the casing of a jet engine. The actuating lever 2 operates through linkage, to be described in detail, to move an actuated lever or arm 6 mounted on a support structure 8. The support structure 8 may be, under certain circumstances, the afterburner structure of a jet engine.

The structures 4 and 8 are interconnected by a connecting wall 10 and it is the expansion of this wall as a result of temperature changes that causes the supporting structures 4 and 8 to move with respect to one another thereby affecting the actuating linkage. It will be understood that as the wall 10 expands the structures 4 and 8 will move apart from one another.

The actuating linkage shown includes the actuating lever 2, a connecting link 12 connected to a pivoted lever 14, the latter being mounted to turn on a stub shaft 16, better shown in FIG. 2. The end of the lever 14 remote from its connection to the link 12 is connected by another link 18 to the actuated arm 6. So long as no relative movement takes place between the supporting structures 4 and 8 the stub shaft 16 is effectively fixed and pivotal movement of the lever 2 about its support pin 20 on the structure 4 will cause a corresponding movement of the actuated arm 6 about its pivotal support 22 on the supporting structure 8.

The structure by which to accommodate for relative movement between the parts 4 and 8 includes a lever 24 which carries the stub shaft 16 between its ends and is pivoted at one end on a pin 26 mounted in a bracket 28 attached to the supporting structure 4. The end of the

lever 24 opposite to the pin 26 is connected by a lever 30 to a bracket 32 mounted on the supporting structure 8. Thus, as above stated, so long as the supporting structures 4 and 8 remain fixed with respect to each other the lever 24 does not move and therefore the stub shaft 16 remains fixed with respect to both supporting structures 4 and 8. However, if the supporting structure 8 is moved by thermal expansion or otherwise with respect to the supporting structure 4, the bracket 32 moves with the structure 8 carrying with it the link 30 and thereby swivelling the lever 24 about the pin 26 and also moving the shaft 16 a distance which is proportional to the movement of the supporting structure 8. By properly selecting the lengths of the arms of the lever 24 from the stub shaft 16 to the opposite pivots for this lever, it will be possible to proportion the movement of the stub shaft 16 so that it may be exactly one-half of the relative movement of the supporting structure 8 with respect to the support 4. Obviously other proportions may be selected depending upon the extent of the correction desired.

If no movement of the actuating lever 2 takes place and the supporting structure 8 moves to the right with respect to the supporting structure 4, the pivotal movement of the lever 24 resulting from this relative movement will move the pivotal support 16 to such an extent that no oscillating movement of the arm 6 will take place. This arrangement has been found to be particularly useful in the arrangement of control connections extending from the main control of a gas turbine powerplant mounted on the engine casing to the afterburner fuel control mounted downstream of the main control on the fan duct. In this arrangement, if there is no relative movement between the supports for the main control and the afterburner fuel control, no error is introduced in the control moved by the actuated am 6. However, when relative movement occurs between the supports, as at different flight conditions or at different operating conditions in the engine, a serious error would be introduced into the linkage without the compensating structure shown.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departure from its spirit as defined by the following claims.

We claim:

1. A linkage to compensate for thermal expansion including two interconnected supports, which are subject to movement relative to each other by temperature changes, an actuating lever on one support, an actuated lever on the other support, an interconnecting linkage between said levers for moving the actuated lever in response to movement of the actuating lever, said linkage including a connecting lever having a pivot, an arm pivotally mounted on said one support and carrying said pivot, and a link from said arm to said other support for moving the arm as the supports move relative to one another in response to relative thermal movement therebetween.

2. A linkage as in claim 1 in which said arm is a compensating lever pivoted to the same support as the actuating lever, said compensating lever carrying said pivot at a point spaced from the pivotal axis of said compensating lever, a connection from said compensating lever to said other support on which the actuated lever is mounted, and the arms of said compensating lever between said pivot and the remote connections of said compensating lever are of proportional length to the arms of said connecting lever thereby causing proportional movement of said pivot as said supports move relative to one another.

3. A linkage including two interconnected supports subject to relative movement therebetween, an actuating lever on one support, an actuated arm on the other support,

an interconnecting linkage between said lever and arm for moving the arm in predetermined relation to the actuating lever, having a pivot and connections from said connecting lever to said actuating lever and actuating arm, a compensating lever pivotally mounted on one of said supports and supporting said pivot at a point spaced from its pivotal mounting, a connection from said compensating lever to the other of said supports, and the arms of said compensating lever between said pivot and the remote connections of said compensating lever being of proportional length to the arms of said connecting lever for causing proportional movement of said pivot as said supports move relative to one another.

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