June 26, 1962 N. MOSS ETAL 3,040,761

REED-TYPE GOVERNORS

Filed Feb. 13, 1961

Fig. 1.

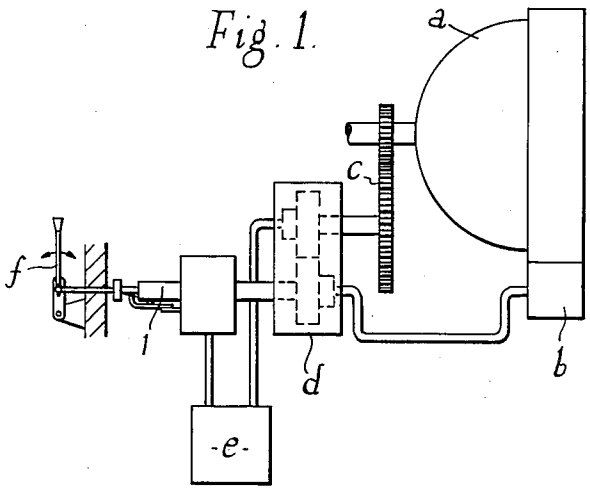
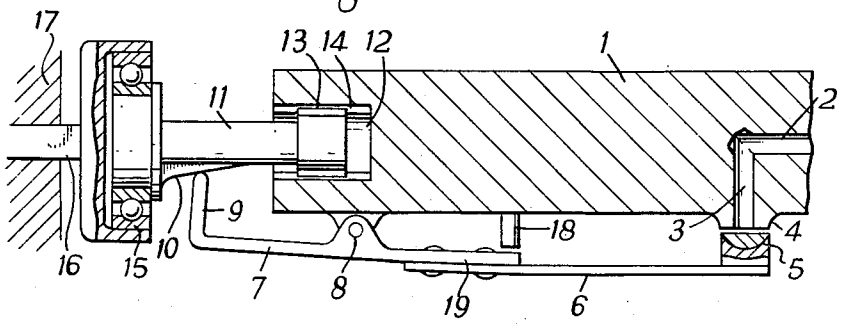


Fig. 2.



United States Patent Office 3,040,761
Patented June 26, 1962

3,040,761

REED-TYPE GOVERNORS

Norman Moss, London, and Michael John Broad, Enfield, England, assignors to The Plessey Company Limited, London, England, a British company

Filed Feb. 13, 1961, Ser. No. 89,068
Claims priority, application Great Britain Feb. 18, 1960
3 Claims. (Cl. 137—56)

This invention relates to governors in which a valve element is carried at or near one end of a leaf spring by which it is held on to a seat at the end of a radial passage in a rotating shaft so that centrifugal force tends to lift the valve off its seat. Governors of the kind specified will hereinafter be called reed-type governors. They can be used for engine-fuel control, for example by causing the valve element to control a spill passage which permits part of the fuel delivered by a fixed-displacement fuel pump to return to the pump inlet without reaching the engine burner or burners, and it is an object of the present invention to provide an improved read-type governor, the setting of which can be varied while the engine is running.

It has previously been proposed to combine a reed-type governor with an adjustable biasing device which supplements the force of the resilient reed by a force which acts resiliently upon the valve element and which is adjustable so as to permit the speed at which the valve will open, to be set to correspond to a desired operating speed of the governor, above the speed determined by the loading of the reed. With this known construction the biasing device was so constructed as to permit the bias to be varied while the governor is rotating, but since jamming of the biasing device might prevent the opening of the valve, it has been the practice, even if the setting means for the valve were so constructed as to normally limit the supplementary force to a value enabling the valve to open at a maximum permissible speed, to use the adjustable reed governor of the said known construction together with a second non-adjustable reed governor set for the maximum permissible speed of the engine in order to prevent reliably such maximum speed from being exceeded.

The present invention has for an object to provide an improved construction of adjustable reed-type governor which can be so designed as to ensure opening at a predetermined maximum speed irrespective of any jamming in the adjusting means.

According to one aspect of the present invention a reed-type governor is equipped with adjustment means which act upon the reed at a point spaced from the valve axis preferably in the direction in which the attachment point of the reed is located so that the whole of the pre-loading force is applied to the valve by means of a resilient length of reed. From another aspect the invention consists in a reed-type governor comprising a rotatable shaft having a passage extending longitudinally of the shaft for part of the length of the shaft and a radial passage communicating with said longitudinal passage and terminating in a valve seat at the circumference of the shaft, a valve element for co-operation with said valve seat, a blade spring element supported on said shaft at one point of its length and carrying said valve element at another point of its length in co-operative relation with said valve seat for movement towards and away from said seat when the blade is longitudinally flexed, and means for adjustably pre-loading said blade spring to apply to said valve an adjustable bias force towards its seat, said pre-loading means including a setting member relative to which the shaft is rotatable about its axis. Stop means are preferably provided for so limiting the pre-loading of the reed that the resilient force of the said length of reed is overcome by the centrifugal action of the valve element at the permissible maximum speed.

Preferably, but not necessarily, the reed is pivotally attached to the shaft about an axis extending transversely to the longitudinal direction of the reed and to the direction of opening movement of the valve, and adjustable setting means operable during the rotation of the shaft are provided for varying, according to the desired governor speed, the angle at which this pivotal attachment is set.

Yet another aspect of the invention consists in a fuel system for an internal-combustion engine or turbine including a volumetric fuel pump and a reed type governor according to the invention connected to the fuel delivery side of said pump. Other objects and features may be ascertained from the following description of an embodiment with reference to the drawing.

One embodiment of the invention is illustrated in the drawing accompanying the specification. FIGURE 1 is a somewhat diagrammatic elevation of a complete fuel system including a governor according to the invention, and FIGURE 2 is an elevation, partly in axial section, of part of a governor shaft, which may be integral with the shaft, or one of the shafts of a fuel pump, together with one form of adjustable governor according to the present invention.

Referring now first to FIGURE 2, a gear-pump shaft **1** has an axial bore **2** which communicates with pump delivery, and from which a branch passage **3** extends radially of the shaft to a valve seat **4**, which is formed at the periphery of the shaft. A half-ball valve element **5** co-operating with the seat **4** is carried and resiliently urged on to the seat by a blade spring **6** also referred to as reed. The blade spring is fixed to a lever **7**, which is pivoted to the shaft **1** by means of a fulcrum pin **8** which extends at right angles to the length of the reed **6** and to the plane which contains the axes of the shaft **1** and of the valve seat **4**. That end of the lever **7** which projects away from the half-ball valve **5**, is formed with a nose **9** which projects towards the axis of the shaft **1**, and which co-operates with a cam surface **10** provided on a setting element **11**. The element **11** is longitudinally guided in an axial bore **12** of the shaft **1** and is formed with keys **13** which engage grooves **14** of the bore **12**, thus forcing the element **11** to participate in the rotation of the shaft. The outer end of setting element **11** co-operates by a ball-type combined thrust and radial bearing **15** with a speed-setting member **16** which is non-rotatably guided in the stationary frame **17** of the governor. By axially moving the member **16**, the cam surface **10** may be caused to tilt the lever **7**, which, as a result, will alter the pre-stress of reed **6** and thereby the speed at which the centrifugal force of the half-ball valve element **5** is sufficient to raise the half-ball valve element **5** from its seat. The possibility of prestressing of the reed **6** can by suitably dimensioning the depth of the bore **12** in relation to the length of the element **11**, and/or by providing a suitably dimensioned stop member **18** on the shaft **1** for co-operation with the end **19** of the lever **7** (or conversely on the arm **19** of lever **7** for co-operation with the shaft **1**), be so limited as to ensure that valve **5** will open when the shaft **1** rotates at the maximum permissible speed. This speed-limiting operation of the valve **5** cannot be prevented by any blocking or other failure in the speed-setting mechanism, so that the need for providing a second overspeed-protection governor is avoided.

Details of the illustrated and described embodiment may be varied within the scope of the invention. Thus a toggle link pivoted to the centre of the bearing **15** and to the nose **9** of lever **7** may be provided instead of the setting element **11** and its cam surface **10**.

In FIGURE 1, which illustrates the complete fuel system, a gas turbine *a*, having a combustion chamber *b* into which fuel is to be injected, drives through a reducing gear drive *c* a gear-type fuel pump *d* which draws fuel

from a fuel tank *e* via the inlet chamber of the pump and delivers fuel from the delivery chamber of the pump to inject it into the combustion chamber *b*. The gear pump has, in a conventional manner, a driver gear, which is driven by the turbine via the gear drive *c*, and a driven gear of which the shaft **1** is constructed as a governor in the manner illustrated more in detail in FIGURE 2, the axial movement of the external control member **16** (FIG. 2) being arranged for actuation by a hand control lever *f*.

What we claim is:

1. A reed-type governor comprising a rotatable shaft having a passage extending longitudinally of the shaft for part of the length of the shaft and a radial passage communicating with said longitudinal passage and terminating in a valve seat at the circumference of the shaft, a valve element for co-operation with said valve seat, a blade spring element supported on said shaft at one point of its length and carrying said valve element at another point of its length in co-operative relation with said valve seat for movement towards and away from said seat when the blade is longitudinally flexed, and means for adjustably pre-loading said blade spring to apply to said valve an adjustable bias force towards its seat, said pre-loading means including a setting member relative to which the shaft is rotatable about its axis.

2. A governor as claimed in claim 1, wherein stop means are provided for so limiting the pre-loading of the blade spring that the resilient force of the said length of the blade spring is overcome by the centrifugal action of the valve element at the permissible maximum speed.

3. A governor as claimed in claim 1, including a rocker member pivoted to the rotatable shaft for movement about a pivot axis at right angles to the longitudinal direction of the shaft, said rocker carrying the blade spring element at one side of the pivot axis and having an abutment at the other side of the pivot axis, a wedge member mounted on the shaft for rotation therewith in contact with said abutment and for movement longitudinally of the shaft for moving the rocker about its pivot and thereby varying the preloading of the blade spring, and thrust bearing means interposed between the setting member and said wedge member.

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