

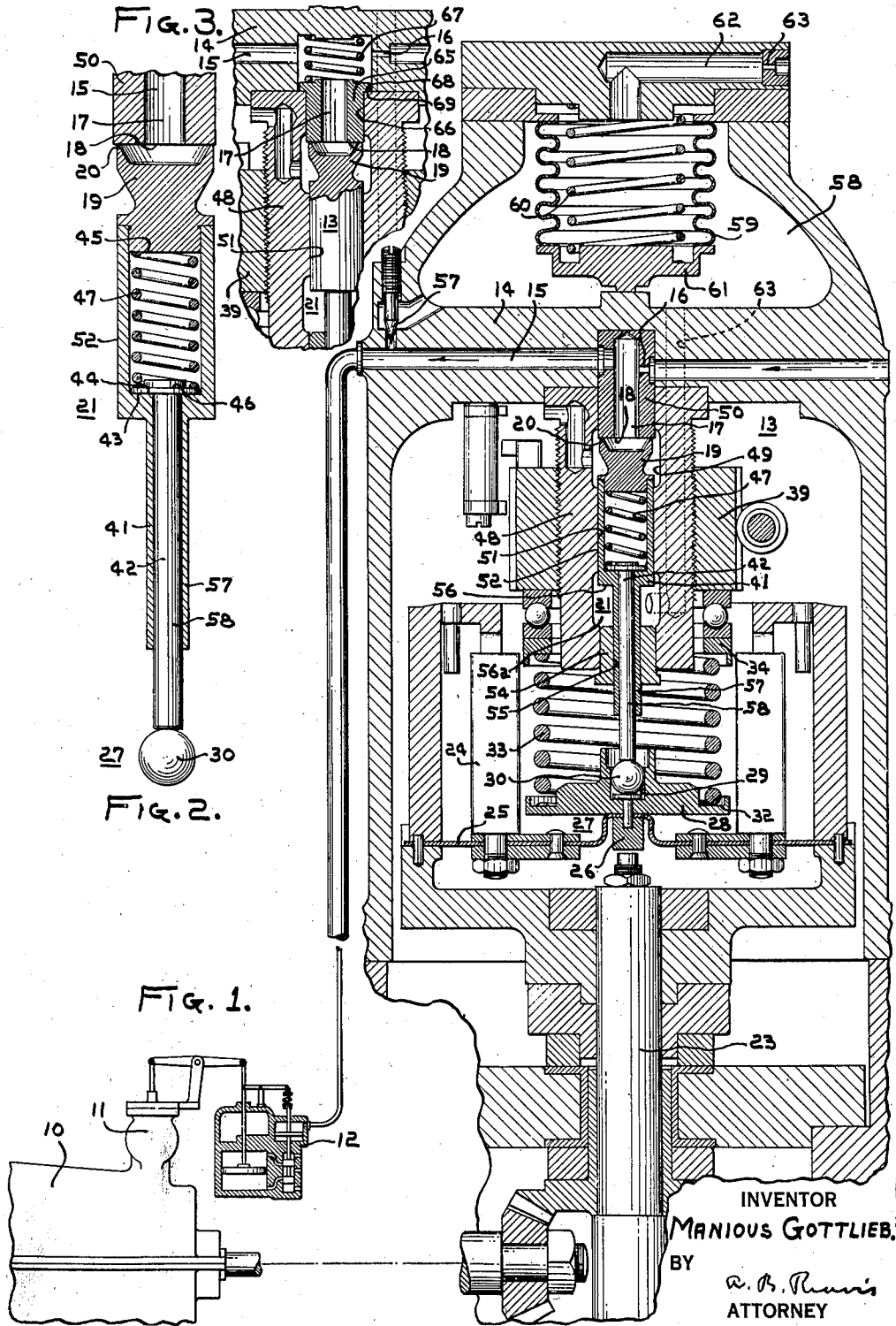
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TURBINE GOVERNING APPARATUS

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TURBINE GOVERNING APPARATUS

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The invention relates to governing apparatus such as disclosed in the prior Patents No. 2,237,780, April 8, 1941, and No. 2,239,602, April 22, 1941, and it has for an object to provide yieldable means to avoid the possibility of injury to the valve or its seat or to the thrust-transmitting connection between the stem and the means for applying force thereto.

In governors such as disclosed in the afore-said patents, particularly Patent No. 2,239,602, injury to the thrust-transmitting connection has been occasionally experienced. Probably, this was due to the attainment of tripping speed while the speed changer was in the low speed position. In accordance with the present invention, injury to the apparatus in the respects indicated for any reason is preferably avoided by having the stem comprised by first and second parts with a spring disposed between the parts, the first part carrying and guiding the valve and the second part being operated upon by the speed-responsive means. A further object of the invention is to provide apparatus having these improved features.

A further object of the invention is to provide apparatus of the character described having improved means for effecting speed compensation.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a sectional view of the improved governor shown diagrammatically in relation to a prime mover;

Fig. 2 is a detail sectional view showing the valve and the improved stem construction; and

Fig. 3 is a fragmentary sectional view of a modified form.

In the drawing, there is shown a turbine or prime mover 10 having an admission valve 11 controlled by pressure-responsive means 12. Fluid under pressure for the pressure-responsive means is provided by the transformer, at 13, controlled by suitable means acting in response to speed of the prime mover.

The transformer apparatus, at 13, embodies structure 14 defining a chamber or enclosed space 15 in communication with the pressure-responsive means 12. An orifice 16 supplies fluid to the chamber or space from a suitable pressure source. The structure has an escape port 17 for the chamber or space and a seat 18 disposed about the port.

A cup valve 19, in covering relation with respect to the discharge end of the port 17, has a thin

edge or rim 20 cooperating with the seat 18 to define an escape orifice bounding a valve pressure area subject to pressure in the enclosed space 15. The valve 19 is connected to one end of the stem construction, at 21, and the other end of the latter cooperates with any suitable means for applying force thereto dependent upon turbine or prime mover speed and in opposed relation to the force of chamber pressure applied to the cup valve pressure area.

As shown, the means providing a force dependent upon speed comprises a rotary member or shaft 23 driven by the prime mover, fly weights 24, a leaf spring 25 carrying the fly weights and having its ends disposed outwardly of the latter attached to the rotary member or structure 23. The leaf spring extends diametrically or transversely with respect to the axis of rotation of the structure 23 and it has a central thrust-transmitting portion 26 from which force is transmitted through the thrust-transmitting means, at 27, to the lower end of the stem construction, at 21.

The thrust-transmitting means, preferably, includes a seat member 28 having a cavity 29 for a ball 30 engaging the bottom of the cavity and the lower end of the stem construction. The seat member 28 has an annular seat 32 for the lower end of the load spring 33 whose upper end is engaged by a follower 34 capable of adjustment upwardly and downwardly by means of the nut 39 of the speed changer apparatus.

The stem construction, at 21, comprises outer and inner members 41 and 42. The valve 19 is attached to the upper end of the outer member 41 so as to constitute, in effect, a part thereof and the lower end of the inner member 42 is engaged by the thrust-transmitting means, at 27. A first pair of opposed abutments 43 and 44 are carried, respectively, by the outer and inner members, and the outer and inner members have second pair of opposed abutments 45 and 46 located between the first pair of abutments and the cup valve and between which is disposed the yieldable means or spring 47. Normally, the force of the spring 47 is effective to maintain the abutments 43 and 44 in contact so that thrust transmitted to the lower end of the stem construction is effective to act on the cup valve to modify the fluid pressure in the space or chamber 15 in accordance with the force; however, should, for any reason, an excessive force be applied to the structure including the thrust-transmitting means, at 27, the stem construction, at 21, the valve 19, and the seat of the latter, injury to any or all of these features

of construction will be avoided due to the yieldable means or spring 47, the latter operating, under such circumstances, to permit relative movement of the inner member 42 with respect to the outer member 41.

The structure 14 has a depending tubular or barrel element 48 having a bore 49 within the upper end of which is disposed a structure 50 having the escape port 17. The bore also has a portion 51 providing a guide for the cylindrical shell 52 forming a part of the outer element 41 of the stem construction and enclosing the yieldable means or spring 47. As the valve 19 is aligned with the shell 52 and attached to the upper end of the latter and as the guide 50 is arranged at right angles to the plane of the seat 18, it will be apparent that the cylindrical shell 52 confines the valve 19 to movement in a direction normal to the seat. In addition to the guide 51 provided by the bore, a plug 54 inserted in the lower end of the bore provides a guide 55 for the sleeve portion 57 of the stem element 41, the sleeve portion 57 having telescopic relation with respect to the stem or rod portion 58 of the inner stem element 42. Thus, it will be seen that the outer stem element 41 is effectively guided by the guides 51 and 55 cooperating with the portions 52 and 57 of the outer stem element 41; and, as the stem 58 of the inner stem element 42 has telescopic relation with respect to the tubular portion 57 of the outer element, the inner element will be effectively guided by the outer element. Thus, there is provided a structure which affords the required flexibility to protect it against excessive applied forces and which at the same time assures of absence of any play which would impair the accuracy of the governor.

As shown, speed compensation for load change is provided by the delayed application of changes in pressure in the space 15 to the chamber 56a to which is exposed the piston or pressure area 56 provided by the upper portion of the stem structure, at 21, and arranged in opposed relation to the area of the cup valve 19 exposed to pressure of the space 15.

The pressure space 15 is connected by an orifice 57 to the chamber 58 rendered expansible by means of the bellows 59, the interior spring 60, and the spring abutment 61 constituting a closure for the lower end of the bellows. A passage 62, preferably including an orifice 63, provides for communication of the interior of the bellows with the atmosphere. The expansible chamber 58 is connected by a passage 63 with the chamber 56a for the pressure area 56.

Operation of the compensating apparatus is as follows: Assuming a change in load, the speed changes temporarily due to load change and then the compensator comes into play to compensate the change in speed for the change in load. A change in load and accompanying change in speed results in change in force applied to the lower end of the stem construction, at 21, and this brings about, due to the cup valve 19 and its seat 18, a change in pressure in the space 15 to operate the pressure-responsive means 12 to change the admission of motive fluid to the prime mover 10 to suit the change in load. The last-mentioned step would be the final one for conventional or uncompensated governor operation wherein a change in speed from no load to full load is inherent. With the compensator, pressure change in the space 15 is followed by delayed change in pressure in the chamber 58 occurring on account of the orifice 57 and the

bellows 59, and the delayed change bringing about further adjustment so as to reduce the speed change due to load change. With the pressure area 56 equal to the cup valve area, following a change in load, the parts would come to an equilibrium position with the fluid pressure forces acting on the stem construction in equilibrium and with the force of the flyweights balancing the force due to the load spring, that is, the governor would operate isochronously, motive fluid being admitted to the turbine so as to operate the latter at the same speed from no load to full load.

In Fig. 3, instead of the spring being incorporated in the valve stem structure to limit contact pressure of the valve 19 with the seat 18, the same result is achieved by providing an element 65 having the port 17 and the seat 18. The element has a sliding fit with respect to an opening 66 formed in the structure 48, and it is biased toward the cup valve portion 19 of the valve element by means of the spring 67, movement due to force of the spring being limited by the shoulder 68 cooperating with the seat 69.

Whenever the contact pressure of the valve element with the element 65 tends to exceed a value determined by the spring 67, the latter yields and permits movement of the element 65, with the result that, as hereinbefore pointed out, various parts of the construction are protected against injury.

While the invention has been shown in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. In a prime mover having an admission valve controlled by pressure-responsive means, means providing an enclosed space for supplying fluid under pressure to the pressure-responsive means; an orifice for supplying fluid from a suitable pressure source to the space; said means having an escape port for the space and providing a seat encompassing the port; a valve in covering relation with respect to the port and cooperating with the seat; means including a stem structure having its upper end connected to the valve; a force-transmitting element engaging the lower end of the stem structure; means responsive to speed of the prime mover for applying force to said element; said stem structure including inner and outer elements and the outer element comprising an upper portion of larger diameter and a lower portion of smaller diameter joined so that the upper portion defines a pressure area about the lower portion and in opposed relation to the area of the cup valve exposed to space pressure; said upper portion having upper and lower abutments; means connected to the upper end of the inner element and providing upper and lower abutments arranged between the first abutments; a spring between the upper abutments and normally serving to maintain the lower abutments engaged; guide means for the stem structure and providing a chamber to which said piston area is exposed; means defining an expansible chamber including a bellows element closed at its inner end and having its interior open to the atmosphere; a spring acting on the bellows element in such a direction as to tend to diminish the volume of the expansible chamber;

means including an orifice for connecting said space to the expansible chamber; and a passage for connecting the expansible chamber to the chamber for said pressure area.

2. In a prime mover having an admission valve controlled by pressure-responsive means, means providing an enclosed space for supplying fluid under pressure to the pressure-responsive means; an orifice for supplying fluid from a suitable pressure source to the space; said means having an escape port for the space and providing a seat encompassing the port; a valve in covering relation with respect to the port and cooperating with the seat; means including a stem structure having its upper end connected to the valve; a force-transmitting element engaging the lower end of the stem structure; means responsive to speed of the prime mover for applying force to

5 said element; said stem structure including an upper portion of larger diameter and a lower portion of smaller diameter formed so that the upper portion defines a pressure area about the lower portion and in opposed relation to the area of the cup valve exposed to space pressure; guide means for the stem structure and providing a chamber to which said pressure area is exposed; means defining an expansible chamber and including a bellows closed at its inner end and having its interior open to the atmosphere; a spring acting on the bellows in such a direction as to tend to diminish the volume of the expansible chamber; means including an orifice for connecting said space to the expansible chamber; and a passage for connecting the expansible chamber to the chamber for said pressure area.

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