

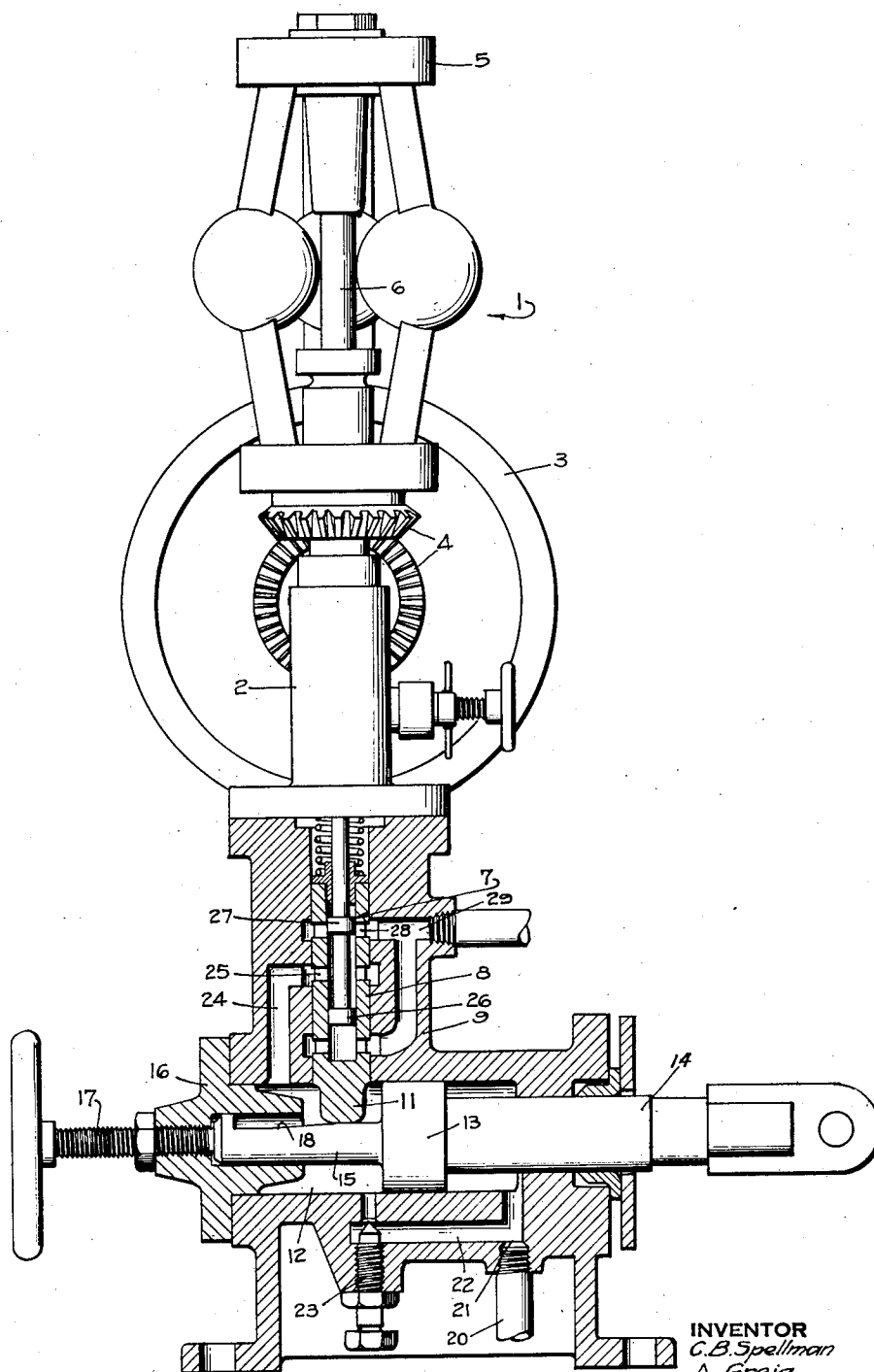
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GOVERNOR

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GOVERNOR

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2 Claims. (Cl. 121—42)

This invention relates generally to speed governing mechanism for prime movers and more particularly to an improved self-contained governor and servo-motor unit arranged to provide a relatively simple fluid pressure control of the servo-motor by a governor-actuated pilot valve.

A great many speed governor controls have heretofore been proposed, but they are relatively expensive especially when applied to hydraulic impulse wheels of small capacity as then the cost of the governor constitutes a very large proportion of the total cost.

It is one object of our invention to provide an improved combination in a governing unit having a differential servo-motor piston continuously supplied with fluid pressure to its opposite sides and governor actuated valve means for controlling the discharge of said pressure from only one side of said piston.

A further object is to provide improved and simplified means for effecting a restoring action on the valve mechanism automatically in accordance with movement of the servo-motor piston, this restoring action being effected more specifically by the provision of an extension element projecting rearwardly from the differential servo-motor piston and having a cam surface directly engaging and moving a portion of the valve mechanism.

A still further object is to provide an improved valve arrangement in combination with the restoring mechanism whereby the valve in its constant speed position permits a continuous restricted discharge of actuating fluid from that end of the servo-motor cylinder containing the larger differential piston area thereby to balance the total pressure force acting on the smaller piston area on the opposite side.

As a result of the foregoing and other objects, we are able to provide an extremely simple and economical unit that is thoroughly reliable in operation and is particularly adapted to control any usual or well-known form of jet deflector for hydraulic impulse wheels to control the speed thereof, although it will be apparent from the disclosure herein that the invention is applicable to other types of turbine or prime mover control valves.

The figure disclosed in the drawing is a vertical sectional view of our improved governing unit with parts broken away to show details of construction.

In the particular embodiment of the invention which is disclosed herein merely for the purpose of illustrating one specific form among pos-

sible others that the invention might take, we have shown a conventional type of centrifugal governor head generally indicated at 1 mounted on a standard 2 for rotation by a turbine (not shown) through any suitable driving means from the turbine shaft. One such driving means may include a belt-driven pulley 3 actuating a pair of bevel gears 4. As the speed of the turbine or other prime mover varies, an upper head 5 moves either up or down to similarly actuate a shaft 6 which extends downwardly through standard 2 and is connected to a reciprocable pilot valve generally indicated at 7. This pilot valve is reciprocable within what might be termed a restoring sleeve 8 forming in effect a part of the valve mechanism for controlling the servo-motor. This sleeve is disposed in a suitable bore formed axially of a casting or valve housing 9 in which the various fluid control passages are disposed. This housing is preferably, but not necessarily, formed integral with the servo-motor cylinder so as to be supported thereby at substantially right angles thereto. The sleeve 8 is normally biased downwardly by a spring interposed between the upper end of the sleeve and the bottom of standard 2, this standard being bolted to the top of valve housing member 9. The lower end 11 of restoring valve sleeve 8 projects inwardly of a servo-motor cylinder 12.

The servo-motor includes a differential piston 13 having a relatively large piston rod 14 extending through one end of the cylinder for connection to usual jet deflecting linkage mechanisms. Projecting rearwardly from the other side of piston 13 is an extension element 15 of any suitable cross-sectional shape but preferably cylindrical so as to be slidably supported in a bore of a head 16. A threaded adjustable shaft 17 is adapted to engage the end of extension member 15 to limit the outward movement of piston 13. The extension 15 is provided with a restoring cam surface 18 engaged by the end 11 of valve sleeve 8. The slope or curvature of surface 18 is determined by the necessary restoring characteristics of the governor or prime mover to be controlled.

Operation.—Assuming the prime mover to be operating at a desired constant speed, then pilot valve 7 and restoring sleeve 8 are in the positions shown in the drawing. Fluid pressure, preferably water supplied from the turbine penstock, is supplied by pipe 20 through an unrestricted inlet 21 leading to the right end of cylinder 12 while a passage 22 controlled by an adjustable needle valve 23 allows restricted flow of fluid to the left end of cylinder 12. This communica-

tion with opposite ends of the cylinder is continuous at all times. A passage 24 communicates through ports 25 with an annular space between two spools 26 and 27 of pilot valve 7, fluid therein
 5 discharging through a port 28 in the valve sleeve 8 and draining through passage 29. The port 28 is slightly opened for a constant speed position, this port opening being of just sufficient extent to reduce the pressure in the left end of cylinder
 10 12 so that the total pressure force acting on the left side of differential piston 13 will just balance the total pressure force acting on the right side of said piston, thereby maintaining the same in a fixed position. If the prime mover speed varies so as to change the speed of the centrifugal head and thus raise pilot valve 7, then fluid can discharge through passage 29 from the left end of cylinder 12 at a greater rate than it flows into the same through restricted passage 22. Hence
 20 the constantly supplied fluid pressure to the right end of cylinder 12 will cause movement of piston 13 in a left direction. As the piston thus moves, the restoring cam 18 will raise restoring sleeve 8 and thus gradually tend to restrict fluid discharge through port 28 until the inflow of fluid through restricted passage 22 is sufficient to build up pressure in the left end of cylinder 12 and thus stop movement of piston 13. In the event that the prime mover speed varies so that pilot valve 7
 30 moves downwardly, then the restricted discharge through port 28 would be further restricted or prevented, thereby allowing fluid pressure to build up within the left end of cylinder 12 and due to the differential piston cause movement
 35 thereof toward the right. As the piston moves to the right, the restoring surface 18 would lower the restoring sleeve 8 and thus gradually open port 28 to allow restricted discharge of fluid from the left end of cylinder 12 and accordingly equalize the pressure forces on opposite sides of piston 13 to stop movement thereof. Pilot valve 7 is maintained in an axially balanced condition due to the lower end thereof being in constant communication with drain passage 29.
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 45 From the foregoing disclosure it is seen that we have provided an extremely simple and economical arrangement whereby supply of fluid pressure in constant communication with a differential piston may be adequately controlled
 50 merely by varying the discharge of fluid from one

side of the piston. As a result of this improved arrangement a relatively simple passage and valve arrangement is permitted, and at the same time a very effective arrangement of the restoring mechanism is obtained without undue complications in the structure or mode of operation.

It will of course be understood by those skilled in the art that various changes may be made in the details of construction and arrangement of parts without departing from the spirit of the invention as set forth in the appended claims.

We claim:

1. A self-contained speed governing unit comprising, in combination, a servo-motor having an operating piston and cylinder, means for supplying fluid pressure to at least one end of said cylinder, a speed responsive element, a valve mechanism actuated by said element to control fluid pressure for said cylinder, a restoring mechanism for said valve mechanism including a rod having a cam surface disposed within said cylinder so as to be exposed to the operating fluid pressure therein, and means interposed between said cam surface and said valve mechanism so as to effect a restoring action thereon upon movement of said piston.

2. A self-contained speed governing and servo-motor unit comprising, in combination, a servo-motor cylinder, a differential piston therein having a piston rod projecting through one end of said cylinder, a restoring cam extension disposed within said cylinder so as to be exposed to liquid therein and projecting from said piston oppositely to said rod, means for continuously supplying unrestricted pressure fluid to the end of said cylinder containing the smaller piston area, means for continuously supplying restricted pressure fluid to the opposite end of said cylinder, a valve housing supported by said cylinder at said restricted end and at substantially right angles thereto, a reciprocable valve mechanism disposed in said housing axially thereof for controlling discharge of fluid from said restricted end, said valve projecting into said cylinder for engagement with said restoring cam extension, and a centrifugal speed responsive head supported on said housing to control said valve mechanism.

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