April 30, 1957 M. C. MALONEY 2,790,453

ADJUSTING MECHANISM FOR VARYING THE OPENING OF VALVES

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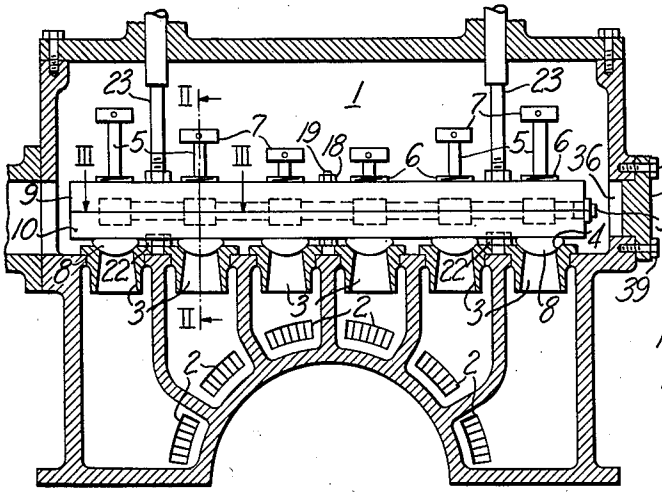


Fig. 1

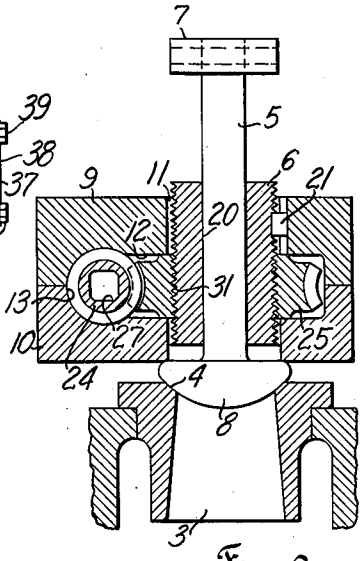


Fig. 2

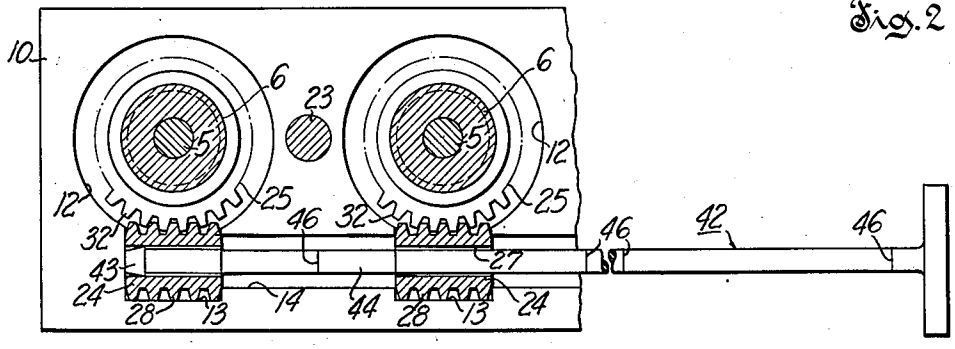


Fig. 3

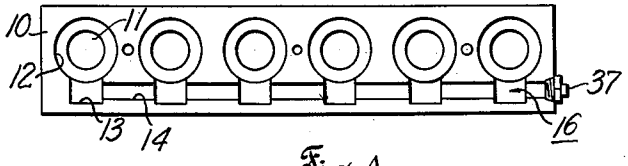


Fig. 4

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ADJUSTING MECHANISM FOR VARYING THE OPENING OF VALVES

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8 Claims. (Cl. 137—21)

This invention relates generally to a lost motion valve adjusting mechanism and more specifically to an adjusting mechanism in an elastic fluid turbine for varying the degree of opening of motive fluid inlet valves relative to one another.

In present day elastic fluid turbines, motive fluid, preferably steam, is supplied to a fluid confining chamber, sometimes called a steam chest, and the fluid conveyed therefrom through inlet valves to the fixed blading or nozzle segments of the turbine. In some types of turbines it is customary to use a steam chest or fluid confining housing in which a plurality of governor regulated inlet valves are connected by lost motion means to a lift bar so that raising or lowering the bar results in progressive opening or closing of the valves.

The governor regulated valves are usually of the disk or poppet type, and are actuated through a lift bar which is generally moved vertically by valve gear connected to the governor mechanism. Each valve includes a stem having a lost motion connection with the bar. The lost motion is effected by having a nut or lifting element threaded on the upper end of the valve stem in spaced relation to the bar and coacting therewith in response to movement of the bar. The nuts of the different valves are positioned at successively higher positions on the valve stems, so that as the lift bar is raised, the nuts successively engage with the lift bar, thereby providing successive opening of the valves upon upward movement of the lift bar. Upon downward movement of the lift bar, the valves are closed in the reverse order. The lift bar is raised or lowered by rods which are raised or lowered by any suitable governor controlled valve gear, as is well known in the art. The purpose of providing successive opening of the valves upon upward movement of the bar is to admit steam to separate nozzle segments or blading in a desired sequence.

When starting the turbine, only two valves are opened. As the load on the turbine increases, the other valves are successively opened by upward movement of the lift bar until steam is supplied to all of the nozzle segments or blading.

In such prior art constructions, in order to vary the amount of opening of each regulating valve for a selected position of the valve lift bar, it has been necessary to vary the amount of lost motion between the valves and the bar by adjusting the nuts on the valve stems so that the nuts are positioned a lesser or greater distance from the lift bar. As the lift bar is moved upward the valves are successively engaged sooner or later depending on the selected position of the nuts relative to the stems, thereby admitting more or less steam to the various nozzle segments or bladings. To make such an adjustment of the nuts, it has heretofore been necessary to dismantle both the valve gear and fluid chest. To eliminate this dismantling, which is time consuming and costly, applicant's invention provides means for rapidly adjusting the regulating valves through the side of the fluid chest without dismantling the valve gear or the fluid chest.

It is therefore an object of the present invention to provide an improved lost motion valve adjusting mechanism for varying the amount of lost motion therein.

Another object of the present invention is to provide in a bar lift valve mechanism for an elastic fluid turbine an improved means for more conveniently and more quickly adjusting governor regulated motive fluid inlet valves than has been heretofore known in the prior art.

Another object of the invention is to provide in a bar lift mechanism for an elastic fluid turbine an improved means for adjusting the governor regulated valves without dismantling the valve gear or the fluid chest.

Another object of the invention is to provide in a bar lift mechanism for an elastic fluid turbine an improved means for adjusting the amount of opening of the governor regulated valves for a selected position of the lift bar.

Other objects and advantages will appear from the following description of a valve adjusting mechanism illustrating an embodiment of the invention, reference being had to the accompanying drawing, in which:

Fig. 1 is a transverse view partly in section through a fluid chest and the nozzle segments of an elastic fluid turbine showing the inlet valves and valve adjusting mechanism embodying the invention;

Fig. 2 is a partial enlarged view in section taken along line II—II of Fig. 1;

Fig. 3 is a partial enlarged view in section taken along line III—III of Fig. 1 showing the means for adjusting individual valves;

Fig. 4 is a plan view of the bottom half only of the lift bar of Fig. 1 which houses portions of the valve adjusting assembly.

The invention is shown applied, in Fig. 1, to a bar lift valve mechanism movably mounted within a fluid confining chest or chamber 1 of an elastic fluid turbine. Motive fluid in the chest 1 is conveyed to the nozzle segments 2 and therethrough to blading of the turbine (not shown) by means of plurality of passages or inlet orifices 3. The flow of fluid through the inlet orifices 3 to the nozzle segments 2 is regulated by the bar lift valve mechanism. The bar lift mechanism comprises a movable horizontally disposed valve lift bar formed by bar halves 9, 10.

Mounted on the bar are a plurality of valves each having a valve stem 5 provided with a stop flange portion 7 on one end and a disk 8 on the other end. The disk 8 cooperates with a complementary valve seat 4 to open and close the inlet orifice 3. The bar lift mechanism further comprises lost motion means formed by the valve stems 5, stop flanges 7 of the valves, and threaded bushings 6. Mounted on the bar are lost motion adjusting means comprising a gear train cooperating with the bushings 6 of the lost motion means for varying the amount of lost motion between the bushings 6 and the stop flange portions 7 of the valves.

The valve lift bar may comprise substantially identical complementary upper and lower halves 9, 10 having a plurality of aligned longitudinally spaced circular openings 11 extending therethrough from top to bottom and transversely of the longitudinal axis of the bar. The aligned openings 11 in the upper and lower halves 9, 10 each have an annular recessed portion 12 which has a larger radial diameter than the opening 11, and extending to a depth of less than the depth of the halves 9, 10.

Between each annular recessed portion 12 and one vertically extending side of the bar half is an associated semicylindrical recess 13 which merges with the portion 12. The semicylindrical recesses 13 of each bar half are arranged in spaced relation to each other and extend parallel to the longitudinal axis of the bar. Disposed between the adjacent ends of the semicylindrical recesses

13 are semicylindrical grooves 14 of a lesser diameter than the semicylindrical recesses 13. The grooves 14 and semicylindrical recesses 13 together form a channel 16 which communicates with an opening in one end of each half 9, 10. The halves 9, 10 of the bar when assembled place the recesses in register to define a plurality of cavities or housings for the lost motion adjusting means and place the channels 16 in register to define a single passageway through the bar 9, 10 providing access to the hereafter described adjusting means. The halves 9, 10 may be fastened together by any suitable means such as a bolt 19 and nuts 18, and oppositely disposed nuts 22 on each of the lifting rods 23. The lifting rods are actuated by any suitable known governor controlled servomotor (not shown).

The lost motion means positioned within the aligned openings 11 in the upper and lower halves 9, 10 as hereinbefore explained each comprise the valve stem 5, the stop flange 7 of the valve and the threaded bushing 6. The bushing 6 has a smooth inner bore 20 therethrough to accommodate in sliding relation thereto the valve stem 5. The bushings 6 are keyed to the lift bar by means of keys 21 thereby preventing rotation of the bushings 6 relative to the bar, but providing for telescopic or vertical sliding movement of the bushings 6 relative to the bar.

The lost motion adjusting means positioned within the longitudinally spaced cavities each comprise a rotatable worm 24, and a worm wheel or nut 25. The worms 24 and worm wheels 25 may provide an adjustable positioning means for moving the bushings 6 relative to the bar. The worms 24 are horizontally disposed in the longitudinally spaced cylindrical cavities formed by the semicylindrical recesses 13 of the halves 9, 10 in register. The worms each have an opening therethrough in horizontal alignment with one another and with the passageway, and a helicoidal thread 28 on the outer periphery thereof. The worm nuts 25 are positioned in the cavities defined by the annular recesses 12 in the halves 9, 10 in register. Each worm nut 25 has an inner threaded bore 31 in threaded engagement with the complementary threaded bushing 6, and has outer gear teeth 32 in engagement with the helicoidal thread 28 of the worm 24.

An opening 36 is provided in the fluid chest 1 in communicative alignment with the passageway in the lift bar and the openings 27 in the worm gears 24. The passageway in the lift bar is provided with a stop plug 37 and the opening 36 in the fluid chest 1 is provided with a flange cover 38 attached to the fluid chest 1 by cap screws 39.

To adjust the amount of lost motion between each of the stop flange portions 7 and the corresponding bushing 6, the fluid turbine is shut down and the fluid shut off from the fluid chest 1. The lift bar is moved by the lift rods 23 into alignment with the opening 36 in the fluid chest 1. After the fluid chest 1 has cooled and the pressure therein has decreased to atmospheric, the flange cover 38 is detached from the fluid chest 1 by removing cap screws 39, and the stop plug 37 is unscrewed from the lift bar to uncover the passageway. A wrench 42 having a tip portion 43 complementary in shape to the opening 27 in the worm 24, and a shank portion 44 of reduced diameter, is inserted through the opening 36 in the fluid chest 1 and the passageway in the lift bar to engage the opening 27 in one of the worms 24. The distance the wrench 42 has to be inserted to engage the worm openings 27 may be controlled by convenient marks 46 properly located on the shank portion 44 of the wrench 42. Rotating the worm 24 causes the worm nut 25 to rotate, and since the worm nut 25 is in threaded engagement with the bushings 6, rotation of the worm nut 25 causes the bushing 6 to move telescopically relative to the bar and the associated valve stem 5. By rotating the worm 24 in the proper direction, the face end of the bushing 6 is moved closer to or further from

the stop flange 7 thereby varying the possible lost motion therebetween. Having positioned the bushings 6 to provide the desired lost motion between the stop flange 7 and complementary bushing 6, the wrench 42 is withdrawn, the stop plug 37 screwed in place, and the flange cover 38 is replaced. The fluid chest 1 and turbine are ready for the admittance of fluid.

It is not intended to limit the invention to the exact details of construction, combination, and/or operation herein set forth for purposes of illustration, as various modifications falling within the scope of the appended claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In a lost motion valve adjusting mechanism, a bar, a valve carried by said bar and movable in two directions relatively thereto, a valve seat for limiting movement of said valve in one of said directions, a bushing encircling said valve and movable in said directions relatively thereto, said bushing being mounted in said bar and movable in said directions relatively thereto, said bushing being movable with said bar relatively to said valve, said valve having a portion for engaging said bushing in abutting relation thereto, said portion of said valve, said bushing and said valve seat forming lost motion means connecting said valve to said bar, said portion of said valve engaging said bushing in response to movement of said bushing in the other of said two directions beyond a predetermined distance in response to the movement of said bar in said other of said two directions, and adjusting means operably connected with said bushing, said adjusting means being disposed in said bar for varying the position of said bushing relative to said bar thereby varying the amount of lost motion between said bushing and said portion of said valve.

2. In a lost motion valve adjusting mechanism, a bar, a plurality of valve units, each of said units compsising a valve movable in two directions, each said valve comprising a stem having a disk mounted on one end and a stop flange mounted on the other end, a valve seat for engaging said disk and limiting movement of said valve in one of said directions, a bushing encircling said stem and relatively movable along said stem in sliding engagement therewith, said bushing being mounted in said bar to be movable with said bar relatively to said stem, said bushing, said stop flange and said valve seat forming lost motion means connecting said valve with said bar, said flange engaging said bushing in abutting relation thereto in response to the movement of said bushing in the other of said two directions beyond a predetermined distance in response to the movement of said bar in said other of said two directions, an adjusting means operatively connected with said bushing, said adjusting means being disposed in said bar for varying the position of said bushing relative to said bar thereby varying the amount of lost motion between said bushing and said stop flange.

3. In a lost motion valve adjusting mechanism, a bar, a valve carried by said bar and movable in two directions relative thereto, a valve seat for limiting movement of said valve in one of said directions, a bushing encircling said valve and movable in said directions relatively thereto, said bushing being mounted in said bar and movable in said directions relative thereto, said bushing being movable with said bar relatively to said valve, said valve having a portion for engaging said bushing in abutting relation thereto, said portion of said valve, said bushing and said valve seat forming lost motion means connecting said valve to said bar, said portion of said valve engaging said bushing in response to the movement of said bushing in the other of said two directions beyond a predetermined distance in response to the movement of said bar in said other of said two directions, and means for adjusting said lost motion means, said adjusting means being disposed in said bar and comprising a worm and a worm nut enclosed and axially restrained in said bar, said worm drivingly engaging said worm nut and said

worm nut being in threaded engagement with said bushing for mounting said bushing in said bar in adjustable relation thereto, whereby said bushing may be telescopically moved relatively to said bar and said stem to vary the amount of lost motion between said bushing and said portion of said valve.

4. In a lost motion valve adjusting mechanism, a bar, a plurality of valve units, each of said units comprising a valve movable in two directions, each of said valves comprising a stem having a disk mounted on one end and a stop flange on the other end, a valve seat for engaging said disk and limiting the movement of said valve in one of said directions, a bushing encircling said stem and relatively movable along said stem in sliding engagement therewith, said bushing being mounted in said bar to be movable with said bar relatively to said stem, said bushing, said stop flange and said valve seat forming lost motion means connecting said valve with said bar, said flange engaging said bushing in abutting relation thereto in response to movement of said bushing in the other of said two directions beyond a predetermined distance in response to movement of said bar in said other of said two directions, and means for adjusting said lost motion means, said adjusting means being disposed in said bar and comprising a worm and a worm nut enclosed and axially restrained in said bar, said worm drivingly engaging said worm nut and said worm nut being in threaded engagement with said bushing for mounting said bushing in said bar in adjustable relation thereto, whereby said bushing may be telescopically moved relatively to said bar and said stem to vary the amount of lost motion between said bushing and said stop flange.

5. In a lost motion valve adjusting mechanism, a horizontal bar, a plurality of valve units, each of said units comprising a valve, said valve comprising a vertical stem having a disk mounted on one end and a stop flange mounted on the other end, a valve seat for engaging said disk and for limiting the movement of said valve in a downward direction, a bushing encircling said stem in axial sliding engagement therewith and mounted in said bar to be movable with said bar relatively to said stem, said bushing, said stop flange and said valve seat forming lost motion means connecting said valve with said bar, said flange engaging said bushing in abutting relation thereto in response to movement of said bushing upward beyond a predetermined distance in response to upward movement of said bar, and means for adjusting said lost motion means comprising a worm having a hub provided with a wrench engageable bore and a worm nut enclosed and axially restrained in said bar, said worm drivingly engaging said worm nut and said bushing being in threaded engagement with said worm nut for mounting said bushing in said bar in adjustable relation thereto; said bar having a longitudinally extending channel and said bores of said hubs of said worms being disposed in alignment with said channel whereby a wrench may be inserted through said channel selectively into said hub of each of said worms to selectively rotate said worm of one of said units, thereby telescopically moving said bushing relatively to said bar and said stem to vary the amount of lost motion between said bushing and said stop flange.

6. In an elastic fluid turbine, a fluid confining chamber having internal walls defining a plurality of passages for supplying motive fluid to said turbine; a movable bar positioned within said chamber; rod means passing through a wall portion of said chamber in sealing relation thereto for movably supporting said bar; a plurality of valve units; each of said units comprising a valve associated with one of said passages for opening and closing said one of said passages to control the flow of motive fluid to said turbine; said valve being carried by said bar and movable in two directions relatively thereto, a valve seat for limiting movement of said valve in one of said directions, a bushing encircling said valve and movable in

said two directions relatively thereto, said bushing being mounted in said bar and movable in said two directions relatively thereto, said bushing being movable with said bar relatively to said valve, said valve having a portion for engaging said bushing in abutting relation thereto, said portion of said valve, said bushing and said valve seat forming lost motion means connecting said valve to said bar, said portion of said valve engaging said bushing in response to movement of said bushing in the other of said two directions beyond a predetermined distance in response to the movement of said bar in said other of said two directions, and means for adjusting said lost motion means comprising a worm and a worm nut enclosed axially restrained in said bar, said worm drivingly engaging said worm nut and said worm nut being in threaded engagement with said bushing for mounting said bushing in said bar in adjustable relation thereto, said bushing being telescopically movable relatively to said bar and said valve for varying the amount of lost motion between said bushing and said portion of said valve.

7. In an elastic fluid turbine, a fluid confining chamber having internal walls defining a plurality of passages for supplying motive fluid to said turbine, one of said walls having an opening to atmosphere, a plate detachably mounted on said one of said walls for closing said opening, a movable bar positioned within said chamber; rod means passing through a wall portion of said chamber in sealing relation thereto for movably supporting said bar, a plurality of valve units; each of said units comprising a valve associated with one of said passages for opening and closing said one of said passages to control the flow of motive fluid to said turbine, said valve being carried by said bar and movable in two directions relatively thereto, a valve seat for limiting movement of said valve in one of said directions, a bushing encircling said valve and movable in said two directions relatively thereto, said bushing being mounted in said bar and movable in said two directions relatively to said bushing, said bushing being movable with said bar relatively to said valve, said valve having a portion for engaging said bushing in abutting relation thereto, said portion of said valve, said bushing and said valve seat forming lost motion means connecting said valve to said bar, said portion of said valve engaging said bushing in response to movement of said bushing in the other of said two directions beyond a predetermined distance in response to the movement of said bar in said other of said two directions, and means for adjusting said lost motion means comprising a worm having a hub provided with a wrench engageable bore and a worm nut enclosed and axially restrained in said bar, said worm drivingly engaging said worm nut and said worm nut being in threaded engagement with said bushing for mounting said bushing in said bar in adjustable relation thereto; said bar having a longitudinally extending channel and said bores of said hubs being disposed in alignment with said channel and said opening in said one of said walls whereby a wrench may be inserted through said opening and said channel selectively into said hub of each of said worms to selectively rotate said worm of one of said units, thereby telescopically moving said bushing relatively to said bar and said valve to vary the amount of lost motion between said bushing and said portion of said valve.

8. In an elastic fluid turbine, a fluid confining chamber having internal walls defining a plurality of passages for supplying motive fluid to said turbine; one of said walls having an opening to atmosphere, a plate detachably mounted on said one of said walls for closing said opening, a movable horizontal bar positioned within said chamber; rod means passing through a wall portion of said chamber in sealing relation thereto for supporting said bar and for vertically moving said bar; a plurality of valve units; each of said units comprising a valve associated with one of said passages for opening and closing

said one of said passages to control the flow of motive fluid to said turbine, said valve comprising a vertical stem having a disk mounted on one end and a stop flange mounted on the other end, said valve being carried by said bar and movable in two directions relatively thereto, a valve seat for limiting movement of said valve in one of said directions, a bushing encircling said stem and movable in said directions relative thereto, said bushing being mounted in said bar and movable with said bar relatively to said valve, said bushing, said stop flange and said valve seat forming lost motion means connecting said valve with said bar, said flange engaging said bushing in response to movement of said bushing in the other of said directions beyond a predetermined distance in response to movement of said bar in said other of said directions, and means for adjusting said lost motion means comprising a worm having a hub provided with a wrench engageable bore and a worm nut enclosed and axially restrained

in said bar, said worm drivingly engaging said worm nut and said bushing being in threaded engagement with said worm nut for mounting said bushing in said bar in adjustable relation thereto; said bar having a longitudinally extending channel and said bores of said hubs of said worms being disposed in alignment with said channel and said opening in said one of said walls whereby a wrench may be inserted through said opening and said channel selectively into said hub of each of said worms to selectively rotate said worm of one of said units, thereby telescopically moving said bushing relatively to said bar and said stem to vary the amount of lost motion between said bushing and said stop flange.

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