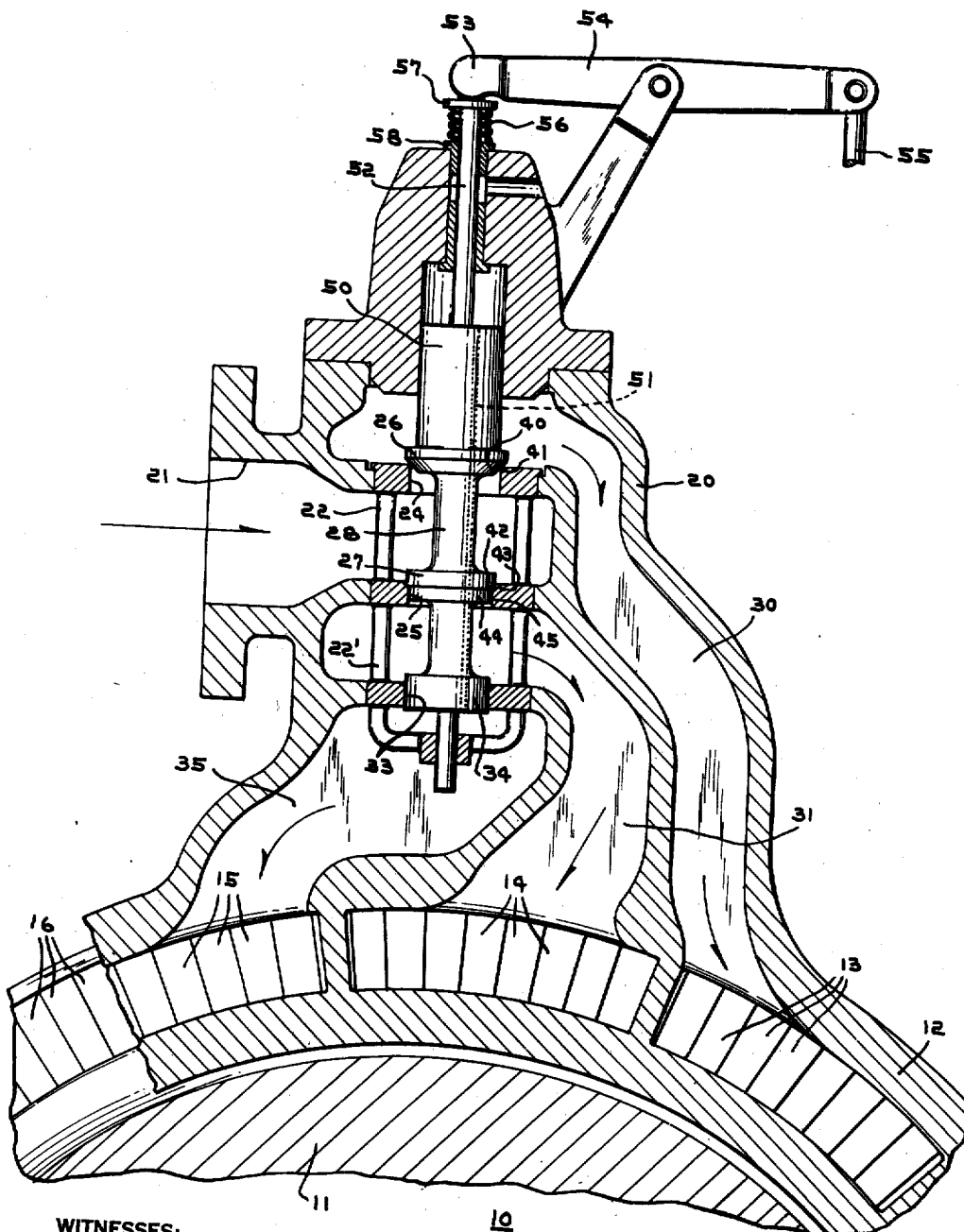


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FLOW CONTROL APPARATUS
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WITNESSES:

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FLOW CONTROL APPARATUS

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3 Claims. (Cl. 277-12)

This invention relates to valves, more particularly to an arrangement of valves for elastic-fluid-utilizing devices, for example, steam or gas turbines, compressors, etc., and has for an object to provide improved apparatus of this character.

Economical partial load operation is desirable for turbines as they frequently operate at loads other than full load, which is usually the most efficient point. Economical partial load can be obtained by reducing throttling losses. Throttling losses at partial load are greatest on turbines provided with only one steam admission valve. A single steam admission valve controls the output of the turbine by reducing or throttling the steam pressure to the nozzle. Reduced steam pressure on the nozzle reduces the steam flow and consequently the horsepower output. Conversely, an increase in output is obtained with the wider opening of the steam admission valve. Reduction of throttling losses is usually accomplished by dividing the first stage nozzle into several groups. The steam flow to each group is controlled by one or more steam admission valves. Variation in the turbine output is obtained by opening or closing the steam admission valves, thus varying the number of nozzle groups in service. To secure the greatest reduction in throttling losses, the steam admission valves should be automatically positioned so as to allow the proper amount of steam to flow to carry the load. This will be accomplished by opening or closing the steam admission valves in sequence. For example, assume that the turbine is provided with three steam admission valves which supply steam to three separate nozzle groups. At the lightest loads, only the first steam admission valve will be open or partially open and will be supplying steam to the first nozzle group. As the load on the turbine increases, the governor will automatically open the first steam admission valve until it is wide open, at which time the throttling losses are at a minimum. Further increase in load will cause the governor to automatically partially open the second steam admission valve an amount dependent upon the load. However, the first steam admission valve will remain fully open with minimum throttling of the steam flow through it. Further increases in load would cause the second valve to open wide, at which point minimum throttling is obtained before the third valve opens. With the use of automatic multi-valves it is seen that the throttling occurs only on the valve which is partially open.

With decreasing loads the steam admission

valves should be closed in sequence so as to again limit the throttling to only the valve that is partially open.

Thus, it is well known in steam turbine practice to provide valve structure wherein a plurality of valves are open and closed successively to obtain better partial load efficiency than could be had with a single valve, but such valve structures have left much to be desired in the way of balance, sealing when closed, manufacturing costs, etc.

Therefore, another object of the invention is to provide a novel valve structure and arrangement incorporating and providing the above mentioned desirable features.

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:

The single figure is a transverse sectional view showing a valve arrangement in accordance with the invention.

Referring now to the drawing more in detail, there is shown, at 10, a turbine comprising a rotor 11 and a casing 12 therefor, the latter having groups of nozzles 13, 14 and 15 for admitting suitable elastic fluid, such as steam, to the blading 16 of the rotor 11.

Steam is admitted to the valve casing 20 through an inlet passage 21, in which is mounted a valve cage 22 having opposed outlet ports 24 and 25, cooperating with valve members 26 and 27, respectively, formed integral with or rigidly mounted upon a valve stem 28.

Passage 30 serves to conduct steam from the outlet port 24 to the first nozzle group 13 and a similar passage 31 conducts steam from the port 25 to the second nozzle group 14.

The valve cage 22 is formed with an extension 22' including a third outlet port 33, with which cooperates a valve member 34, also formed integral with, or rigidly mounted upon, the valve stem 28. Steam passing through this port 33 is conducted to the third group of nozzles 15 by the passage 35.

The first valve member 26 is provided with a conical surface 40, cooperating with a sharp corner 41, formed on the valve cage 22 at the outlet port 24, with the result that when the valve is in closed position a relatively tight seal is obtained at this point. Similarly, the second valve member 27 is provided with a sharp corner 42 cooperating with the conical seat 43 on the port-forming portion 25 of the valve cage 22, whereby tight

sealing is obtained at this point also, when the valve is in closing position. It will be noted that the second valve member 27 also includes a cylindrical piston portion 44 cooperating with the cylindrical bore portion 48 of the outlet port 25, thereby providing for delayed opening of the second valve 27.

The cylindrical piston valve portion 34 cooperating with the third outlet port 33 in the cage extension 22' is of such length that opening of this port is delayed beyond the opening of the first and second valve members. Thus, it will be apparent that upon movement of the valve member 26 will immediately open, permitting flow of steam through the passage 30 to the first nozzle group 13. Continued movement of the valve stem in opening direction will result in successive opening of the second valve member 27 and the third valve member 34 for flow of steam through passages 31 and 35, respectively, to the second and third nozzle groups 14 and 15, respectively.

It will be noted that only the first and second valve members 26 and 27 are provided with the mating conical surfaces and sharp corners providing tight seals, inasmuch as only these two valves are subject to the high pressures present in the inlet passage 21. The third valve member 34 is subject only to the lower pressure existing below the second valve member 27 when the latter is open.

The valve stem 28 is provided with an enlarged balancing piston 50 above the first valve member 26 to balance the forces exerted against the under surface of the lowest or third valve member 34. To provide equalized pressures against these two piston surfaces, there is formed a pressure balance passage 51, extending from end to end of the valve member.

The valve member is operated in the usual manner, it having an extension or rod 52 projecting upwardly beyond the casing 20 and received between the ears 53 of the bifurcated lever 54, the latter being operated, through linkage 55, by suitable governor mechanism (not shown). A compression spring 56, confined between shoulder 57 formed integral with, or secured rigidly to, the valve rod 52 and the upper end of the bushing 58, serves to urge the valve rod upwardly for valve

opening when such movement is permitted by the corresponding movement of the bifurcated end of the lever 54. Downward movement of the bifurcated end forces the valve rod downwardly to effect valve closing.

While, for the sake of simplicity and clearness, the invention has been illustrated as involving only three valve members and passages, it will be obvious that additional valve members and passages could be provided without departing from the spirit of the present invention.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various 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. Valve mechanism comprising a valve housing having an inlet passage including first and second outlets; means providing a first discharge passage from said first outlet; means providing a second discharge passage from the second outlet, said second discharge passage having a branch outlet; means providing a third discharge passage from said branch outlet; and a unitary valve structure movable between first and second limits for simultaneously controlling flow through said outlets, said valve structure comprising a stem and first, second and third valve members carried thereby and so spaced therealong that at one limit of movement of the stem they close the first, second and branch outlets, respectively, and when moved from said one limit to the other limit they successively open the three outlets.

2. Structure as specified in claim 1, wherein the first valve member is of the poppet type and the second valve member is a combination of poppet type and cylinder type, whereby the outlets from the inlet passage may be sealed bottle-tight.

3. Structure as specified in claim 1, wherein the first valve member is of the poppet type, the third valve member is of the cylinder type and the second valve member is a combination of poppet and cylinder types.

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