HORIZONTAL CENTRIFUGAL-WEIGHT GOVERNOR DIRECT ACTING

Description

This governor is of the horizontal weight, centrifugal type, in which the centrifugal force of the weights is opposed by the compression force of the governor spring or springs. This same principle has been used for many years but the detail construction of this governor differs materially from older types.

Referring to Fig. 1, the governor hub "4" is a tight fit on the rotor shaft and is further secured to the shaft by the overspeed trip weight retainer. This hub carries the weight fulcrum blocks "20" which support the governor weights "19". Each weight is made in a single piece and has machined on it the knife edge about which it pivots and works against the weight seat "7". The knife edge and seat are properly hardened to withstand the service to which they are subjected.

With the machine at rest, the governor weights are held in their inner position by the force exerted by the compression springs "12" and "13". These springs are secured to the shaft at the outer end and exert a force which is transmitted to the toe of each governor weight through the spring seat "10", the inner race of the ball bearing "8" and the weight seat "7".

Operation

As the speed of the turbine increases, the governor weights move outward due to the increased centrifugal force and, being fulcrumed on the blocks "20", this movement compresses the governor springs and moves the ball bearing "8" outward. As the speed decreases, the spring force moves the spring seat "10" and adjacent parts inward with the weights moving inward a corresponding amount. Therefore, the axial position of the ball bearing "8" varies with the speed. In order to transmit this governor movement to the governor valve, which controls the steam inlet, the sleeve "14" is threaded in the bearing housing "9" so as to clamp the ball bearing retainer "11". The outer end of the sleeve makes contact with the governor lever through the governor sleeve extension "16", thus completeing the linkage. The ball bearing carries any thrust which may be exerted by the steam valve and transmits the governor movement with a minimum of friction. The governor lever is fulcrumed so that outward movement of the governor weights closes the steam valves while inward movement of the weights opens them.

Lubrication

The governor ball bearing is lubricated by oil supplied through an opening in the bearing housing "9" by means of an oiling connection, shown in section A-A. For land applications a standard constant level oiler is used while for marine applications where rolling and pitching are encountered, a wick oiler is used.

To Dismantle Governor

1. Remove the governor lever "21" by removing the pin "22".
2. Remove the cover "5".
3. Loosen the set screw and unscrew the sleeve "14".
4. Mark the nut "15"and the shaft, and count the number of threads exposed so the nut can be tightened to the same point when reassembled.

5. Loosen the nut "15" until all compression of springs "12" and "13" is relieved. NOTE: In some cases the inner spring is omitted.

6. As the springs become loose, lift out the governor weights "19". The weights and the hub "4" should be marked so they can always be assembled in their original positions.

7. Take the nut "15" all the way off. Then the springs "12" and "13", spring seat "10" and the bearing parts can easily be taken off the end of the shaft.

To Assemble Governor

1. Assemble on the end of the shaft in the following order: the bearing housing "9", the bearing "8", and the spring seat "10".

2. Then assemble the springs "12" and 13".

3. Place the weights "19" in position and push inward on the spring to hold them.

   NOTE: To see if these parts operate properly, press inward on the governor spring and at the same time pull one weight outward. Release the weight suddenly, still maintaining pressure on the spring. If the weight snaps back freely, it is correct. If a rub occurs, it can be felt. Repeat this test for the other weight, and then for both weights.

4. Tighten the nut "15" the same amount as originally found.

5. Install the sleeve "14" and lock it with the set screw.

6. Replace the cover "5".

7. Install the governor lever "21".

Adjustment

Before making any change in the governor setting, be sure that the governor valve is set correctly according to instructions under "Governing Valve".

The normal speed maintained by the governor is determined by the compression of the springs "12" and "13" and can be adjusted by means of the nut "15".

To increase the speed, tighten the nut "15".

To decrease the speed, loosen the nut "15".

One complete turn of the nut "15" will change the speed approximately 70 rpm.

Governing Valve

The steam chest "36" which encloses the governing valve is located below and to one side of the governor, and is bolted and doweled to the casing base.

The governing valve "33" is of the double-seated, balanced, poppet type and operates within the cage "35". The valve is pinned to the stem "32" which is guided by the cage at the inner end, and by the bushing "31" at the outer end. The coupling "29" on the end of the inner stem is connected to the governor lever through the outer stem "26" and spring retainer

"25" so that the valve "33" opens and closes in response to movements of the governor. The spring "24" eliminates lost motion between the valve and lever by constantly exerting a force in one direction.

The bushing "31" serves to reduce to a minimum the leakage of steam along the stem. A leak-off connection is provided so that any steam which does leak past the inner portion can be led to a point where it will not be objectionable. No other form of stem packing is used and excessive leakage should be corrected by installing a new bushing. When installing this bushing, it should be pressed into the cover and reamed in place. The surface of the stem must be kept smooth and free of galled spots, paint, rust and dirt. Any binding or sticking of this stem will cause unstable governor action.

Valve Adjustment

The valve travel (or lift) is very important and is set accurately at the factory when the turbine is tested. Therefore, it is recommended that the travel (or lift) be checked on each new machine when first received, and this travel recorded in a permanent record. Then at any future time, the travel can be checked against the original setting.

In order to check the setting, proceed as follows:

1. With the turbine at rest, trip the overspeed trip mechanism by hand, which will cause the spring to close the governing valve "33".
2. Measure the distance between the cover "23" and the spring retainer "25".
3. Re-set the overspeed trip. This will open the governing valve wide.
4. Again measure the distance between the cover "23" and the retainer "25". The difference between the two measurements taken is the valve travel which should be recorded for future reference. It is advisable to go through the above checking process a second time to insure the correctness of the record.

It will be noted that the valve and seats form line contacts and not surface contacts. Therefore, this valve cannot be "ground-in" to stop leakage. A test to determine whether or not the valve is leaking too badly for use may be applied as follows:

1. Shut down the turbine by tripping the overspeed trip mechanism; then immediately reset the "Butterfly Valve Trip" only.
2. If the steam leakage through the steam chest valve is sufficient to keep the turbine rotating, it is evident that the valve is leaking too badly for practical use.

If it should be found necessary to re-seat the valve, re-machine the valve and cage as follows (refer to Fig. 2):

1. Chuck the valve cage in a lathe with a compound slide rest and center the cage so that its axis runs true.
2. Remove sufficient metal from the face "C" at an angle of 45° until a clean surface is obtained. Do not increase the bore "E" because any increase in this diameter will unbalance the valve.
3. Mount the valve in a lathe by the valve stem at one end and support and center the other end in a steady rest.

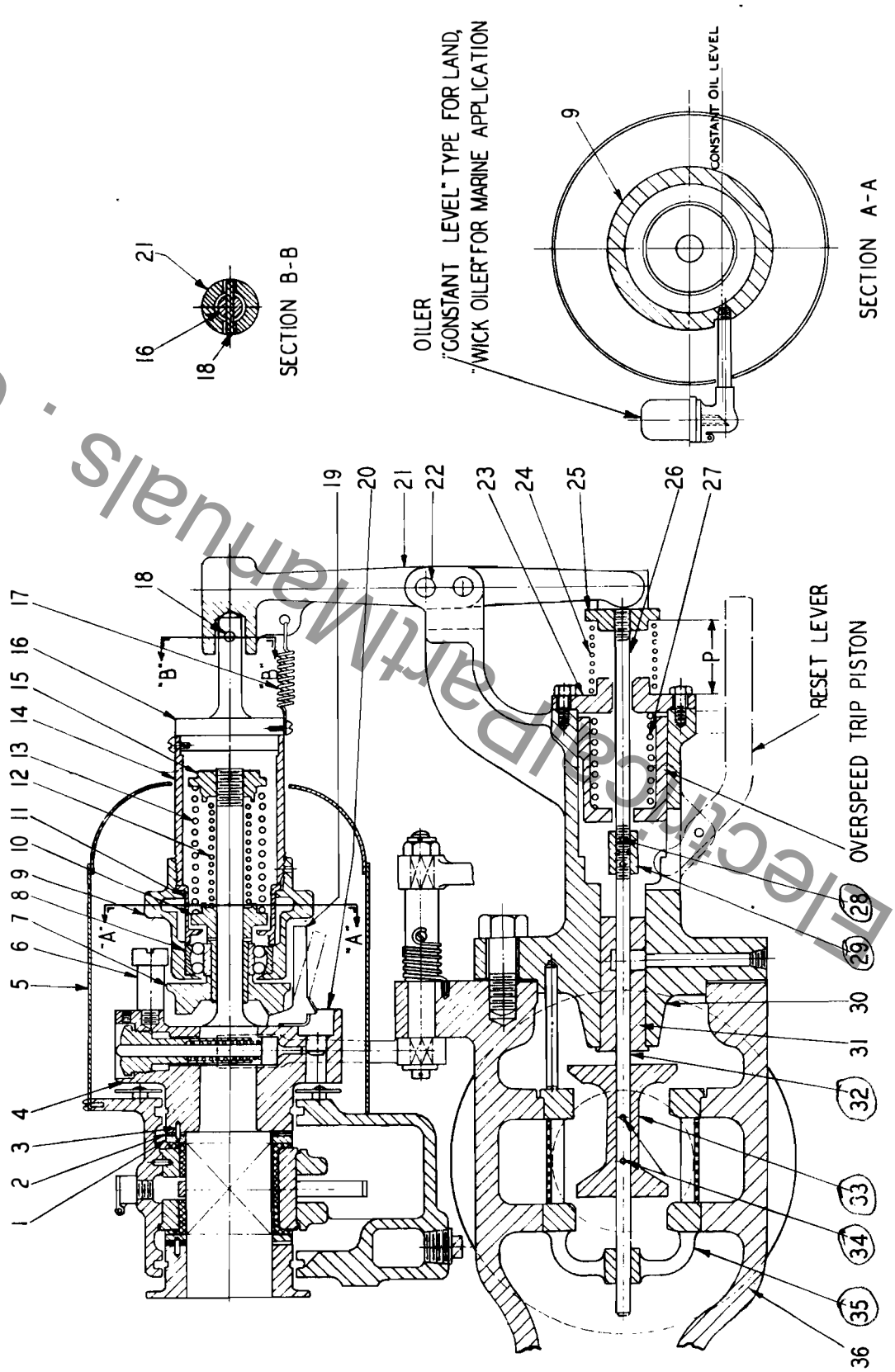

Figure 1

4. Remove sufficient metal from the face "J" to obtain a clean surface and then machine surface "A" at an angle of 45° until all markings are removed. Do not decrease the diameter "F" because any decrease in this diameter will unbalance the valve.

5. Insert the valve in the cage and determine whether "A" makes contact with "B" or "D" with "C". Machine sufficient metal off "A" if "A" and "B" are contacting, or off "J" if "C" and "D" are contacting until "A" and "B" are in contact at the same time that "C" and "D" are in contact.

6. A piece of thin paper placed between the valve and seats while the valve is turned a little, will help to determine where the metal is to be removed. If the above conditions are fulfilled, the valve will be balanced for pressure and give good service. Any "grinding-in", however little, will cause an unbalanced condition.

When removing the cage, the steam chest should be heated by turning steam into it, and the cage cooled by ice or wet rags (preferably ice). The cage can then be pulled out of the steam chest. Likewise, the steam chest should be heated when installing the cage in order to avoid galling the press fit.

Repair Parts

The accompanying Parts List has been compiled to facilitate ordering spare or renewal parts. When ordering parts, give the serial number of the turbine and the item number and name of each part desired.

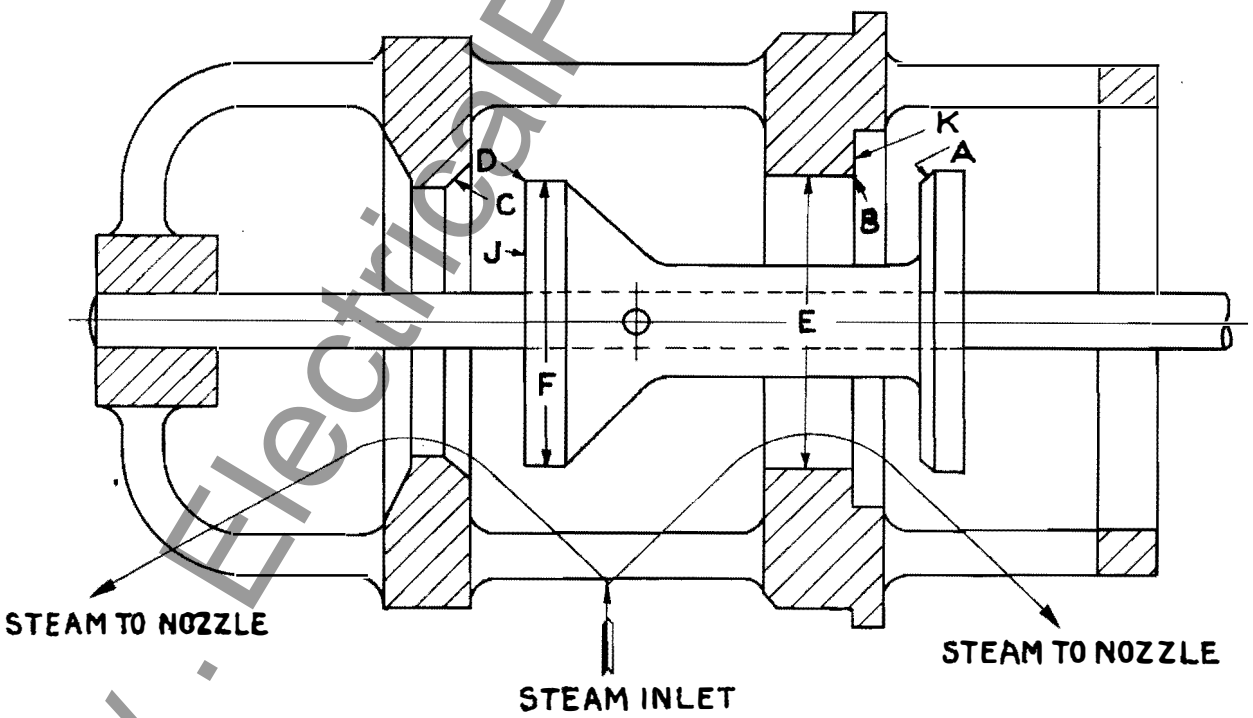

Figure 2

Figure 1

PARTS LIST FOR GOVERNOR AND STEAM CHEST

Item No.	Name of Part
1	Thrust Ring
2	Thrust Ring Liners
3	Thrust Ring Pin
4	Governor Hub
5	Governor Cover
6	Governor Stop Screw
7	Governor Weight Seat
8	Governor Thrust Bearing
9	Governor Thrust Bearing Housing
10	Governor Spring Seat
11	Governor Thrust Bearing Retainer
12	Governor Spring - Inner
13	Governor Spring - Outer
14	Governor Sleeve
15	Governor Spring Nut
16	Governor Sleeve Extension
17	Governor Sleeve Extension Stop Pin
18	Governor Lever Spring
19	Governor Weight
20	Governor Weight Fulcrum Block
21	Governor Lever
22	Governor Lever Fulcrum Pin
23	Steam Chest Cover Trip Cylinder Cover
24	Valve Stem Balance Spring
25	Valve Stem Balance Spring Retainer
26	Valve Stem - Outer
27	Overspeed Trip Piston Spring
28	Valve Stem Coupling Pin
29	Valve Stem Coupling
30	Steam Chest Cover
31	Steam Chest Cover Bushing
32	Valve Stem - Inner
33	Steam Chest Valve
34	Steam Chest Valve Pin
35	Steam Chest Valve Cage
36	Steam Chest Body

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