Extraction Valve Servo-Motor

The extraction steam valve servo-motor (or operating mechanism) is shown in Figure 1. It consists essentially of a relay controlled, oil operated piston. The principal parts are:- the relay "18", relay bellows "23", bellows spring "26" and operating piston "9".

High pressure oil, delivered by the main oil pump, is admitted to the relay, as shown, for operating the piston "9". Upward movement of the relay uncovers ports connecting the operating oil inlet to the space above the piston and connecting the space below to the outlet, thus moving the piston downward. Downward movement of the relay uncovers ports connecting the operating oil inlet to the space below the piston and connecting the space above to the outlet, thus moving the piston upward. The piston rod "2" is connected to the steam valve so that upward movement of the piston opens the valve and downward movement of the piston closes it.

Movements of the relay are controlled by the differential pressure acting on the bellows "23". As shown in the illustration, a small hole from the H.P. oil inlet chamber allows a small quantity of oil to flow to the space above the bellows thus building up a pressure on top of it. From this chamber above the bellows, the oil is led to the reservoir through the relief valve of the "Extraction Pressure Regulator" (which is described in a separate supplement). Consequently the oil pressure maintained above the bellows is controlled by the "Pressure Regulator". In addition, the main governor regulating pressure is connected to the chamber below the bellows.

From the above it will be seen that the position of the relay "18" is determined by four forces:-

1. The extraction regulating pressure above the bellows "23", acting downward, which is varied by the "Pressure Regulator".

2. The governor regulating pressure below the bellows, acting upward, which varies directly as the square of the turbine speed.

3. The tension of the spring "26" acting downward.

4. The force of the compression spring "15" which causes the relay to follow all movements of the bellows.

In normal operation, the principal actuating force is the extraction regulating pressure above the bellows which is controlled by the "Pressure Regulator". If the regulator moves to increase this oil pressure, the relay moves downward, thus admitting oil below the operating piston and opening the steam valve. If the regulator moves to decrease this oil pressure, the relay moves upward, admitting oil above the piston and closing the steam valve.

Due to the fact that the governor regulating pressure below the bellows varies as the square of the turbine speed, if other conditions remained constant, this mechanism would respond to changes in speed in the same manner as a standard governor. However, the spring "26" is adjusted so that the controlling force resulting from changes in speed (that is, the governor regulating pressure below the bellows) is not effective until the speed increases or decreases a comparatively large amount. Therefore, the actual close speed regulation of the unit is maintained by the main governor.

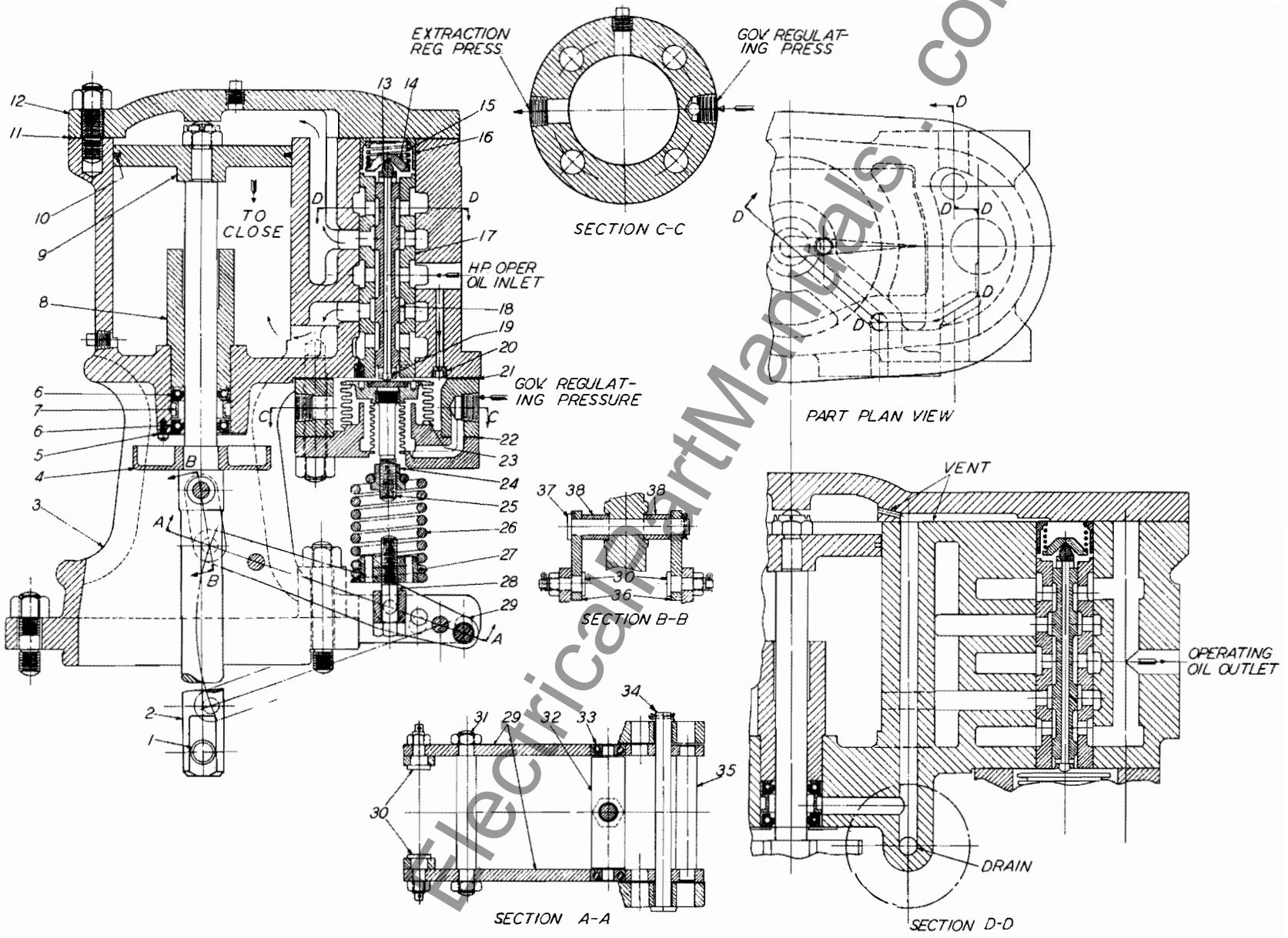

Fig. 1 - Assembly

From the above description, it will be noted that following any movement of the relay, the operating piston moves in the opposite direction. The follow-up lever, item "29", which connects the operating piston rod and the bellows spring, is fulcrumed so that, following any relay movement, the resulting piston movement changes the tension in spring "26" so as to return the relay to its neutral position until another change in regulating pressure occurs.

As shown in "Section D-D" of the illustration, the chambers above the operating piston and above the relay are vented into a vertical drain passage in order to eliminate any accumulation of air. This same drain passage connects to the space between the oil seal rings "6" and carries away any oil leakage past the upper seal.

The following list has been compiled to facilitate ordering spare or renewal parts by item number and name together with the serial number of the turbine:

Item No.	Name
1	Operating Piston Rod Pin Bushing
2	Operating Piston Rod
3	Operating Cylinder
4	Drip Pan
5	Operating Piston Rod Oil Seal Retainer
6	Operating Piston Rod Oil Seal
7	Operating Piston Rod Oil Seal Ring
8	Operating Piston Rod Bushing
9	Operating Piston
10	Operating Piston Ring
11	Gasket
12	Operating Cylinder Cover
13	Relay End Plug (Upper)
14	Relay Spring Seat (Lower)
15	Relay Spring
16	Relay Spring Seat (Upper)
17	Relay Bushing
18	Relay
19	Relay End Plug (Lower)
20	Orifice Plug
21	Gasket
22	Gasket
23	Relay Bellows (Complete)
24	Relay Bellows Spring Nut (Upper)
25	Relay Bellows Spring Bolt
26	Relay Bellows Spring
27	Relay Bellows Spring Nut (Lower)
28	Relay Bellows Spring Bolt (Lower)
29	Follow-Up Lever (In Pairs)
30	Follow-Up Lever Shoulder Pin
31	Follow-Up Lever Spacer Bolt
32	Follow-Up Lever Crosshead
33	Follow-Up Lever Crosshead Ball Bearing
34	Follow-Up Lever Fulcrum Pin
35	Follow-Up Lever Spacer
36	Follow-Up Lever Link (In Pairs)
37	Follow-Up Lever Link Pin
38	Follow-Up Lever Link Spacer

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