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 "19", relay bellows "23", bellows spring "26" and operating piston "10".

High pressure oil, delivered by the main oil pump, is admitted to the relay as shown in Section "A-A", for operating the piston. 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 "15" is connected to the steam valve so that upward movement of the piston opens the valve, and downward movement of the piston closes it.

The illustration shows the piston rod arranged for connection to the steam valve linkage at the top. On some units this connection is made at the lower end of the stem. The operation of the mechanism is the same in either case.

Movements of the relay are controlled by the differential pressure acting on the bellows "23". An orifice in a high pressure oil supply line 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 leaflet). 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 "19" 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 "16" 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 directly 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.

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 "30" 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.

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 "7" 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 of Part
1	Gasket
2	Piston Rod Crosshead
3	Drip Pan
4	Piston Rod Stop
5	Piston Rod Oil Seal Retainer
6	Piston Rod Oil Seal Ring
7	Piston Rod Oil Seal
8	Piston Rod Bushing
9	Cylinder
10	Piston
11	Piston Ring
12	Gasket
13	Cylinder Cover
14	Piston Rod Bushing
15	Piston Rod
16	Relay Spring
17	Relay Spring Seat (Upper)
18	Relay Bushing
19	Relay
20	Relay End Plug
21	Gasket
22	Bellows Housing
23	Bellows Complete
24	Bellows Rod
25	Relay Bellows Spring Nut (Upper)
26	Relay Bellows Spring
27	Bellows Spring Bolt (Lower)
28	Bellows Spring Nut (Lower)
29	Follow-Up Lever Spacer Bolt
30	Follow-Up Lever (In Pairs)
31	Follow-Up Lever Crosshead
32	Follow-Up Lever Crosshead Ball Bearing
33	Follow-Up Lever Fulcrum Pin
34	Follow-Up Lever Spacer
35	Follow-Up Lever Link
36	Round Head Shoulder Pin

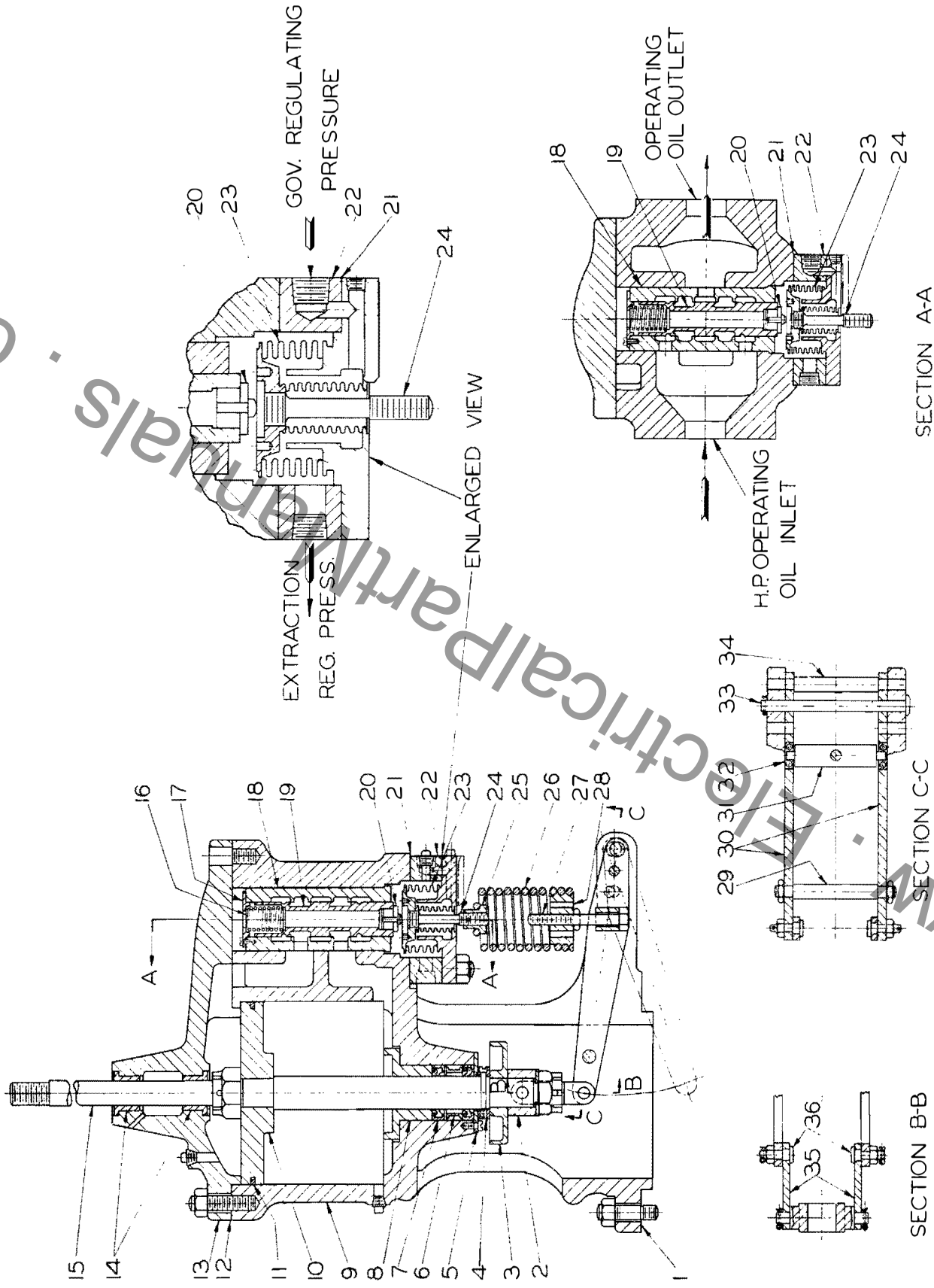

Figure 1