Bleeder or Inlet Pressure Regulator Type BD-1-C

This mechanism automatically controls the bleeder valve operating mechanism so as to maintain the desired pressure at the bleeder (or L.P. inlet) zone, within reasonably close limits. It accomplishes this purpose by controlling the oil pressure above the oil operated relay of the bleeder valve operating mechanism.

Referring to Figure 1, the principal parts are: the diaphragm "40", the counter-balance weights "6", "7", and "8", and the frictionless relief valve "34". The chamber below the relief valve is connected to the chamber above the relay of the bleeder valve operating mechanism; and the pressure maintained by this relief valve determines the differential pressure acting on the relay which controls the opening of the bleeder valve.

The bleeder or inlet line is connected to the lower side of the diaphragm "40" and the pressure, which is to be controlled, acts upward on this diaphragm. The upward force against the diaphragm is counterbalanced by the weights "6", "7" and "8". Therefore, the bleeder pressure maintained is determined by the number of weights used. The lever "17" which connects the diaphragm and weights is supported on knife edges so as to be practically frictionless. The weights act on the lever through the spring "10" and their movement is dampened by the dashpot piston "3". With this arrangement there is no movement of the weights unless there is a definite change in bleeder pressure. However, with a definite change, the weights and dashpot piston will follow up to restore the same tension in the spring "10".

When the bleeder line pressure becomes greater than that for which the regulator is set, the diaphragm "40" moves upward and in turn raises the diaphragm rod "42". This causes the lever "17" to move about the knife edge "20" as a fulcrum and increase the compression of the spring "29" on the relief valve "34" which is connected to the bleeder valve operating mechanism relay. Therefore, the oil pressure above the relay of the bleeder valve operating mechanism is increased, thus opening the bleeder valve, to maintain the correct bleeder pressure.

When the bleeder line pressure becomes lower than that for which the regulator is set, the opposite movements occur. This causes the bleeder valve to respond in the same manner as described above, but in the opposite direction, thus closing the bleeder valve to maintain the correct bleeder pressure.

OPERATION

When starting the turbine it is recommended that the regulator be cut out of operation until the turbine is on the line. Likewise, when shutting down, the regulator should be cut out of operation before the unit is taken off the line. In order to cut the regulator out of service:-

1 - Remove the weights "7" and "8", one at a time until the lever "17" rises to its upper limit of travel. The bleeder valve will then be wide open.
2 - As the weights are removed, adjust the speed changer to maintain the electrical load constant.
3 - Close the valve in the oil line between the relief valve and the bleeder valve operating mechanism relay, thus definitely holding the bleeder valve in its full open position.
4 - Screw the knurled lock nut "15" up against the lever "17" to hold it in its upper position.

In order to cut the regulator into service:-

1 - Gradually open the valve in the oil line between the relief valve and the bleeder valve operating mechanism relay. The bleeder valve should still remain open.
2 - Add weights "7" and "8" to give the approximate bleeder pressure desired (as determined by previous experience).
3 - Slowly screw down the knurled nut "15" thus allowing the lever "17" to drop gradually.
4 - At the same time, adjust the speed changer to maintain the electrical load constant.
5 - Change the weights "8" if necessary to maintain the desired bleeder pressure.
6 - Screw the knurled nut "15" down against the nuts "14" so that it cannot become loose and interfere with the operation of the regulator.

A loop is provided in the steam line leading to the diaphragm "40" to serve as a condenser so that the diaphragm will be subjected to water instead of steam. This is necessary to protect the diaphragm, and it is important to fill the section of pipe adjacent to the diaphragm with water before starting up, following a shut-down during which this pipe may have been removed and the trapped water lost.

The drain line between the relief valve "34" and the reservoir must be kept free of obstruction at all times in order to avoid any pressure being imposed on the relief valve diaphragm "31".

Erratic operation of the regulator may be caused by small particles of dirt lodged under the relief valve "34", thus preventing proper seating of this valve. Such trouble frequently can be cleared by raising the spring "29" free of the valve, thus allowing the oil to flow freely through the valve and wash away the dirt.

The design of any pressure regulator is based on the fundamental governing principle that there must be a slight change in the pressure controlled in order to actuate the regulator. Therefore, in order to obtain stable operation, the pressure held when bleeding the maximum amount of steam (with the bleeder valve closed) must be somewhat lower than when bleeding smaller quantities of steam. Generally, the pressure when bleeding maximum steam should be 1 to 2 lb/in^2 lower than when bleeding no steam, although a greater difference may be permissible on many installations.

In order to keep this pressure variation within the narrow limits desired, the compensating bellows "44" is used below the lever "17". The chamber below the bellows is connected to the chamber below the relief valve "34".

As described above, an increase in bleeder pressure below the diaphragm "40" moves the lever "17" upward which results in an increased pressure in the chamber below the relief valve "34" to move the bleeder valve in the proper direction. This increased pressure in the chamber acts also below the bellow "44" and thus exerts an additional upward force on the lever "17" ao as to compensate, at least in part, for the inherent pressure variation required to actuate the regulator.

If the pressure maintained when bleeding maximum steam is higher than when bleeding no steam, the regulator is said to have a "negative pressure characteristic" or is over-compensated. Such a condition may cause the pressure regulator and bleeder valve operating mechanism to "hunt" or it may cause the bleeder valve to close suddenly and thus exhaust steam through the bleeder steam line relief valve.

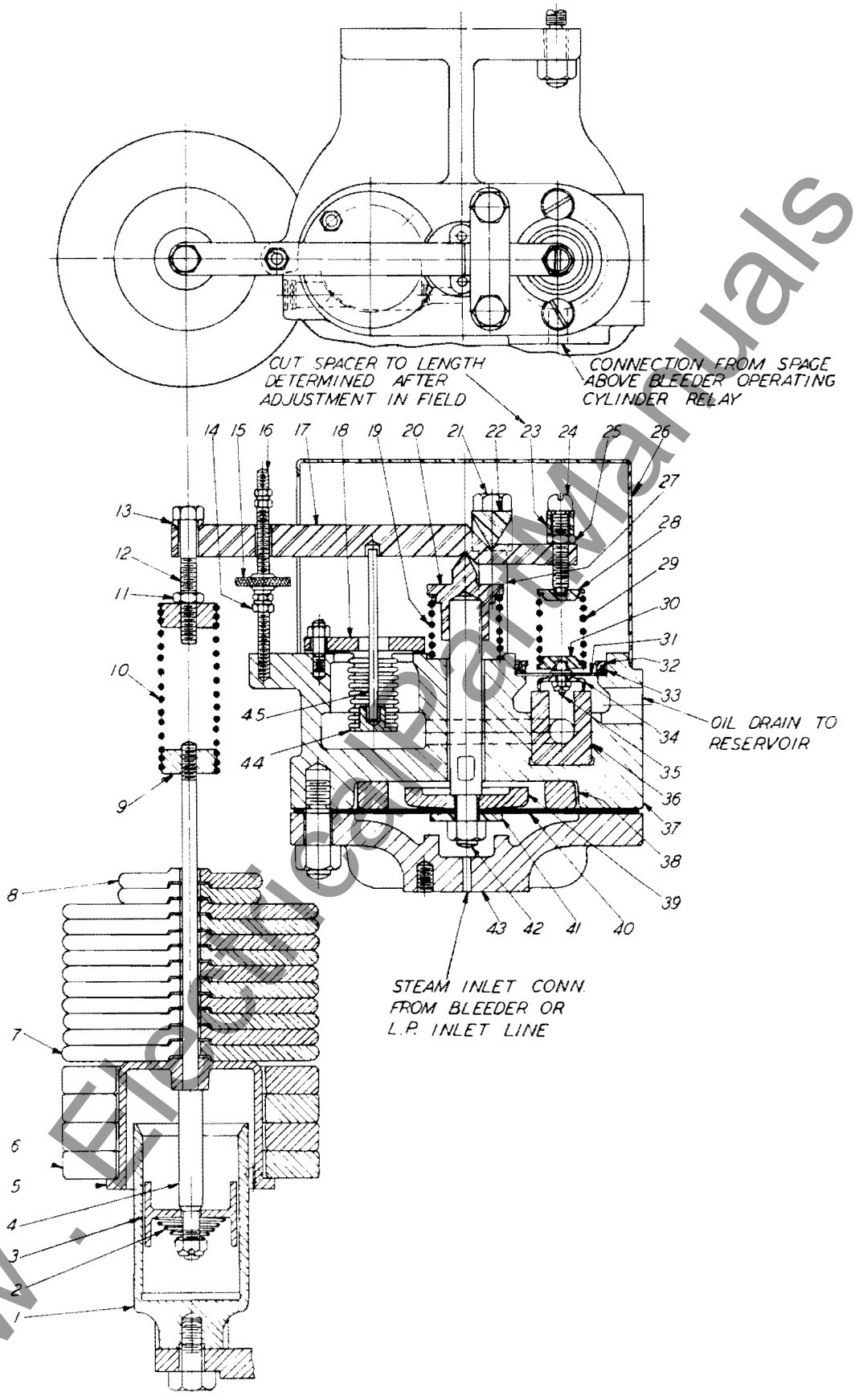
In order to check this pressure variation, proceed as follows:

1 - The regulator should first be adjusted for pressure with the bellows rod "45" removed.
2 - The steam pipe leading from the diaphragm is made up with a union and a gauge connection adjacent to the diaphragm. Disconnect this union and connect an air (or steam) pressure supply, with a leak-off branch and the necessary valves so that the pressure below the regulator diaphragm can be varied as desired. Also install a gauge to indicate the pressure below the diaphragm. The oil should be removed from the dashpot while making this test. It is generally advisable to connect the bled steam line to atmosphere to avoid building up steam pressure at the turbine bleeder zone when making the test.
3 - With the machine operating at no load and normal operating speed, admit pressure below the diaphragm "40" and note the pressure required to hold the lever "17" at its upper limit of travel.
4 - Note the pressure required to hold the lever just clear of its lower stop.
5 - The difference between these two readings is the pressure variation between bleeding no steam and bleeding maximum steam. It should be from 2 to 4 lb/in^2 gauge with the bellows rod removed. A variation greater than 4 lbs. indicates other regulator trouble such as: misalignment and binding of the levers, chipped knife edges, etc.
6 - Insert the bellows rod "45".
7 - With the machine operating as before (no load and normal operating speed) take another set of readings to determine the pressure required below the diaphragm to hold the lever at its upper and lower limits of travel.
8 - The pressure required with the lever at the bottom should be between 1 and 2 lb/in^2 gauge less than with the lever at the top.

This test should be repeated several times in order to insure accurate results. The diameter of the bellows determines the amount of compensation. A smaller diameter bellows will increase the pressure variation. A larger diameter bellows will decrease the variation, and if too large will cause over-compensation (or a "negative pressure characteristic".)

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	Regulator Dashpot
2	Regulator Dashpot Spring
3	Regulator Dashpot Piston
4	Regulator Weight Rod
5	Regulator Dashpot Cover
6	Regulator Weight
7	Regulator Weight
8	Regulator Weight
9	Regulator Weight Spring Nut
10	Regulator Weight Spring
11	Regulator Weight Spring Adjusting Screw Lock Nut
12	Regulator Weight Spring Adjusting Screw
13	Regulator Weight Spring Adjusting Screw Washer
14	Regulator Lever Stop Stud Nut
15	Regulator Lever Lock Nut
16	Regulator Lever Stop Stud
17	Regulator Lever
18	Regulator Bellows Flange
19	Regulator Diaphragm Spring
20	Regulator Lever Knife Edge (Lower)
21	Regulator Lever Knife Edge Tap Bolt
22	Regulator Lever Knife Edge (Upper)
23	Regulator Relief Valve Adjusting Screw Spacer
24	Regulator Relief Valve Adjusting Screw
25	Regulator Relief Valve Adjusting Screw Lock Nut
26	Regulator Lagging
27	Regulator Lever Knife Edge Spacer
28	Regulator Relief Valve Spring Seat (Upper)
29	Regulator Relief Valve Spring
30	Regulator Relief Valve Spring Seat (Lower)
31	Regulator Relief Valve Diaphragm
32	Regulator Relief Valve Diaphragm Ring (Inner)
33	Regulator Relief Valve Diaphragm Ring (Outer)
34	Regulator Relief Valve
35	Regulator Relief Valve Bolt
36	Regulator Relief Valve Seat
37	Regulator Body
38	Regulator Diaphragm Ring
39	Regulator Diaphragm Support
40	Regulator Diaphragm
41	Regulator Diaphragm Washer
42	Regulator Diaphragm Rod
43	Regulator Diaphragm Cover
44	Regulator Bellows
45	Regulator Bellows Rod



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