The valve shown in Figure 1 is of the double plug type consisting of two valves, one within the other, and an internal pilot valve. It is operated by the hydraulic operating mechanism shown in Figure 2.

STEAM VALVE

The valve is composed of two single seated unbalanced valves (5) and (18) placed concentrically on the valve stem (27). When the valves (5) and (18) are in the closed position, as shown in the illustration, the steam pressure combines with the operating mechanism spring load to hold each valve tightly on its seat. A pilot valve (18) is secured to the valve stem (27) and is retained by the valve stem guide (7). Upward movement of the valve stem (27) equalizes the steam pressure on both sides of the valve (18). Further movement of the valve stem (27) causes a flange machined on it to engage the nut (32) thus lifting the valve (18) to allow passage of steam. When the valve (18) is fully open, sufficient steam enters the turbine to bring the unit up to full speed with no load.

The valve stem packing consists of closely fitted bushings with suitable leak-off openings. On valves built for pressure up to and including 400 lb. one leak-off is used and should be led to a point at atmospheric pressure where a small amount of escaping steam is not objectionable. On valves built for pressures above 400 lbs. two leak-off openings are provided. The upper one should be connected to a point of lower pressure, determined by the operating steam conditions, while the lower one should be connected to a point at atmospheric pressure.

The steam strainer (8) is cylindrical in shape and is placed around the outer steam valve. This strainer can be removed for cleaning after removing the valve body cover (16).

The following points should be noted in connection with reseating these valves. The seating surfaces of the outer valve (5) and the seat (19) are machined and then lapped a very small amount which gives a narrow, continuous surface of contact. If the valve and seat are in good condition but leaking slightly, they can be made tight by additional lapping provided the width of the contacting surfaces does not exceed 1/16 inch. If the width exceeds 1/16 inch, both the valve and seat must be re-machined, using the same radii as on the original pieces. When machining the seat (19), after finding the correct radius, the center should be moved downward (as viewed in the illustration) in a line parallel with the axis of the seat so as to take the cut off the top and not increase the diameter of the opening through the seat. After this machining, the parts should be lapped just enough to make them tight. It should also be noted that there is no gasket between the seat (19) and the valve body. The seating surfaces of the inner valve can be ground to a tight seat in the usual manner.

OPERATING MECHANISM

The principal parts of the operating mechanism Figure 2 are: The operating piston (14) which is attached to the piston rod (18), the closing spring (13), the oil by-pass valve (20), the handwheel (37) and the bevel gears (11 and 53). The operating piston rod is connected to the steam valve stem by the coupling consisting of items (1), (4) and (5). Consequently, the operating piston and steam valve moves as a single piece. The handwheel (37) is connected to the operating nut (26) by the rod (31) and bevel gear (53) so that rotation of the handwheel gives a position rotation of the operating nut just as if the handwheel were connected to it directly. The oil by-pass valve (shown enlarged at view "M" on the illustration) consists of the oil by-pass valve sleeve (25), the spring loaded by-pass valve (20) and the valve seat which is integral with the operating piston (14). Movement of the handwheel controls the pressure acting below the operating piston (14). It will be noted that the ported sleeve (25) and the by-pass valve (20) control the flow of oil from the chamber below the operating piston to the chamber above (which is connected to drain) at "X" and "Y" respectively. High pressure oil is supplied to the chamber beneath the operating piston by the auxiliary or main oil pump through an orifice which restricts the flow to the proper amount.

With the operating mechanism in its closed position, as shown in the enlarged view, the oil by-pass valve (20) is held on its seat at "Y" by the compression spring (21). The by-pass valve sleeve (25) is forced downward against the operating piston (14) opening the ports "X" allowing the high pressure oil to flow from beneath the piston through the machined ports in the sleeve (25) to drain.

As the handwheel is turned counter-clockwise the sleeve (25) moves upward while valve (20) stands still thus closing the ports "X" in the sleeve (25). The high pressure oil acting in the chamber below the operating piston then raises the operating piston, compressing the closing spring (13).

During normal opening movement, the seat "Y" remains closed. If the oil pressure should tend to raise the operating piston more rapidly than the oil by-pass valve sleeve, the ports "X" will open allowing the high pressure oil to flow to the space above the piston, and thence to the drain. Therefore, the piston can rise only as fast as the by-pass valve sleeve (25) is being raised. If the oil by-pass valve should be raised at a rate of speed so great that the high pressure oil supplied through the orifice is unable to raise the operating piston at the same rate, the seat "Y" will open, which will allow the high pressure oil below the piston to flow to drain. The valve will, therefore, drop to its closed position. If such a case is experienced, the handwheel should be turned to its closed position and the valve opened again more slowly. In case it cannot be turned open at the rate of one turn per second without dropping shut it shows that the supply of oil has been reduced or that some foreign matter is preventing proper seating of the valve (20), or that the overspeed trip valve is not seated properly. The filter or strainer in the oil supply line to the throttle valve should be checked to see that it has not become fouled, or that the orifice has not become plugged.

In the fully opened position the by-pass valve sleeve (25) stops against the bushing (10) and the by-pass valve (20) rests against the nut (23). This means that with the operating mechanism in its fully open position the ports "X" will be closed and higher oil pressure will build up in the chamber beneath the operating piston. In this position the oil by-pass valve acts as a relief valve to limit the pressure beneath the operating piston by lifting and discharging at "Y".

To close the valve by hand, the handwheel is turned in a clockwise direction causing the oil by-pass valve sleeve (25) to move downward. The downward movement of the sleeve opens the ports "X". This allows the high pressure oil to flow to the top and thence to the drain thus reducing the pressure below piston (14).

With the reduced pressure below the piston, the closing spring (13) lowers the operating piston and steam valve. It will be noted that this feature serves also as an automatic stop in case of loss of oil pressure. If for any reason, the oil pressure should drop below that necessary to balance the downward forces caused by the spring load and steam pressure, the spring (13) will automatically close the valve, shutting down the turbine. Also, it is impossible to open the valve until oil pressure is established, thus insuring proper lubrication of all bearings.

The closing spring is sufficiently strong to overcome any friction which may be experienced and exerts a closing force on the operating piston at all times. However, in case of necessity the valve can be closed manually without the help of the closing spring. The application of force at the rim of the handwheel results in the development of a greatly increased positive downward force in the valve operating mechanism.

The indicator (2) clamped between the coupling nuts (1) and (5) shows the position of the throttle valve at all times.

It should be noted that it is not practical to take the load off the unit by closing the throttle valve. As the valve approaches its seat the unbalanced steam force across the valve increases and at some point becomes so great that the valve will drop to its seat suddenly, thus dropping the remainder of the load. Due to this same design characteristic, this valve may drop shut if it has not been fully opened before putting a heavy load on the turbine. If the throttle trips, it is advisable to open it wide before applying more than approximately 10% load.

The automatic closing is accomplished by releasing the oil pressure below the operating piston (14). As stated before, the high pressure oil supply to the piston is regulated by an orifice. Thus high pressure is established but actual flow is restricted. The space below the operating piston is connected to our standard overspeed trip valve, which, under normal operating conditions remains closed and maintains the high pressure oil below the piston. However, if the overspeed trip functions, the valve is opened, releasing the pressure under the operating piston. The line connecting the high pressure oil chamber to the drain through the overspeed trip valve is of considerably greater capacity than the high pressure inlet orifice which insures a drop of pressure below the operating piston. The closing spring (13) then closes the valve in the same manner as described above. After the first downward movement of the piston, the ports "X" close and seat "Y" opens, which provides another outlet for the high pressure oil so that the piston moves much more rapidly in the closing direction.

Contraction of the throttle valve stem (27) Figure 1 as the throttle valve cools after closing, acts as an additional valve closing force and may cause the operating mechanism to be hard to open. To eliminate this possibility, the overspeed trip should be tripped and the handwheel (37) rotated three turns in the opening direction after the throttle valve has been closed. With the overspeed trip mechanism tripped it will be impossible for the throttle valve to open and pass steam through the turbine while it is shut down. The steam unbalance acting downward on the throttle valve and the operating piston spring (13) will hold the throttle valve on the seat with ample force.

Immediately before starting the turbine after a shutdown, the throttle valve handwheel should be turned to the closed position and the overspeed trip reset.

LIST OF PARTS

The following list has been compiled to facilitate ordering Spare or Renewal Parts. In ordering parts, it is of utmost importance to give the Turbine Serial Number, Instruction Leaflet 1250-3163, Item Number and Name of Part.

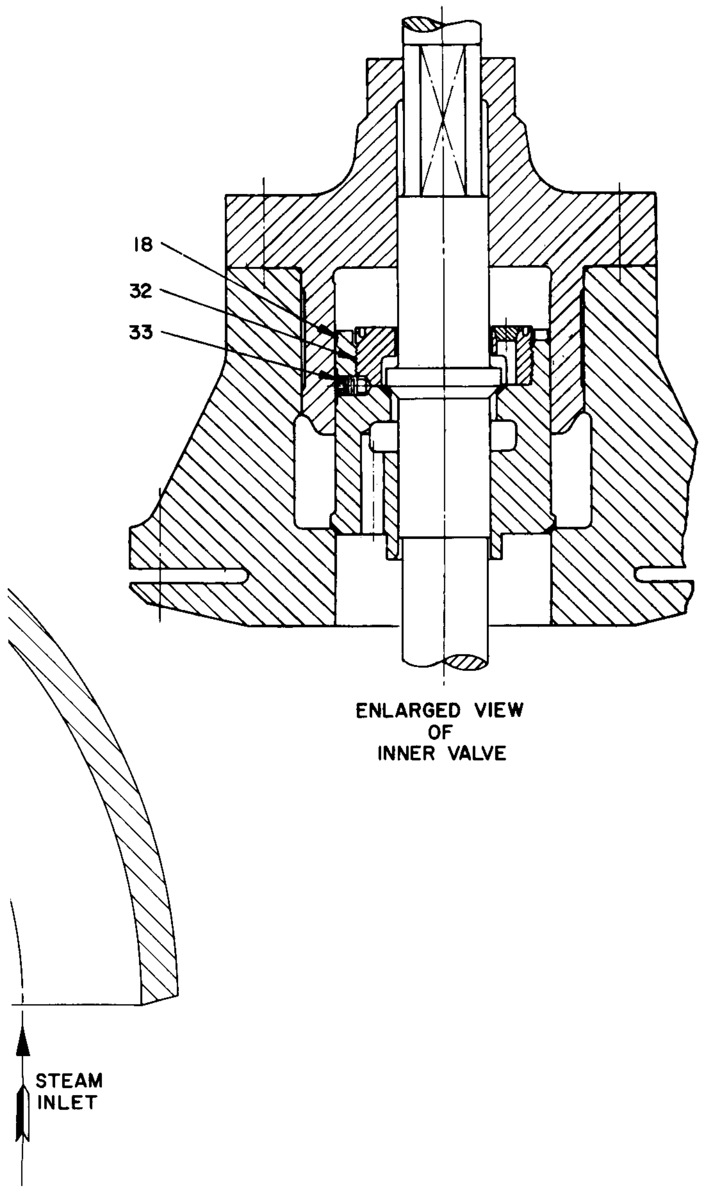
FIGURE 1

Item	Name
1	Valve Body
2	Strainer Position Retaining Pin
3	Valve Ring
4	Ring Retaining Screw
5	Main Throttle Valve

Item	Name
6	Valve Guide Retaining Screws
7	Valve Guide
8	Steam Strainer
9	Screw
10	Gasket
11	Washer (Female)
12	Washer (Male)
13	Cover Retaining Stud
14	Screw
15	Extension Nut
16	Valve Body Cover
17	Valve Stem Bushing (In Cover)
18	Inner Valve
19	Throttle Valve Seat
20	Stem Bushing Sleeve (Upper)
21	Stem Bushing (Upper)
22	Stem Bushing (Middle)
23	Stem Bushing (Lower)
24	Bushing Retainer
25	Valve Stem Nut
26	Nut Retaining Pin
27	Throttle Valve Stem
28	Retaining Stud
29	Nut
30	Lagging Plate
31	Plate Retaining Screw
32	Inner Valve Retaining Nut
33	Locking Screw

FIGURE 2

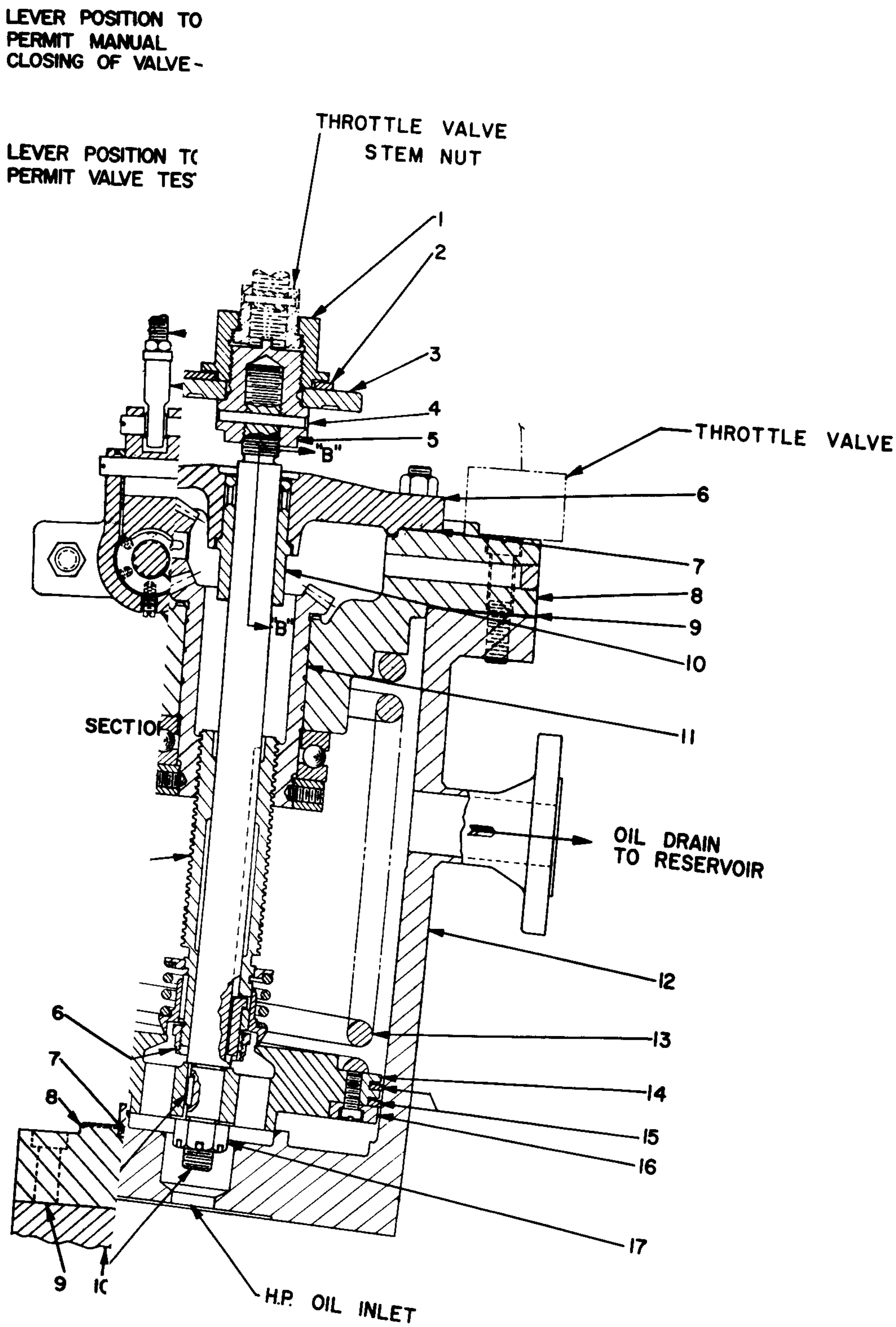
Item	Name
1	Coupling Nut
2	Valve Position Indicator
3	Steam Deflector
4	Coupling Locking Pin
5	Coupling Half (Male)
6	Cylinder Cover
7	Gasket
8	Gear Support
9	Gasket
10	Piston Rod Bushing
11	Bevel Gear (Driven)
12	Operating Cylinder
13	Operating Piston Spring
14	Operating Piston
15	Piston Rings
16	Piston Ring Retaining Ring
17	Piston Retaining Nut
18	Piston Rod
19	Piston Rod Key
20	Oil By-pass Valve
21	By-pass Valve Spring
22	By-pass Valve Spring Seat
23	Valve Nut
24	Stem Key
25	By-pass Valve Sleeve
26	Operating Nut
27	Nut Locking Screw
28	Thrust Bearing
29	Hand Wheel Stem Bushing
30	Hand Wheel Support
31	Hand Wheel Shaft
32	Stop Nut
33	Test Stop Plunger
34	Test Stop Plunger Bushing
35	Hand Wheel Shaft Sleeve
36	Hand Wheel Shaft Bushing
37	Hand Wheel
38	Hand Wheel Direction Plate
39	Hand Wheel Cap Nut
40	Rod End (LH)
41	Rod
42	Test Lever Position Plate
43	Test Handle Knob
44	Test Lever Arm
45	Weight Retaining Screw
46	Weight
47	Rod End (RH)
48	Linkage Pin
49	Bushing
50	Cap Linkage Pin
51	Lever Support Cap
52	Thrust Washer
53	Bevel Gear



THROTTLE VALVE
13-A-2753

REF. DWG.
1-E-4497

Figure 1



LEVER POSITION TO
PERMIT MANUAL
CLOSING OF VALVE-
LEVER POSITION TC
PERMIT VALVE TES
THROTTLE VALVE
STEM NUT
1
2
3
4
5
"B"
THROTTLE VALVE
6
7
8
9
10
"B"
11
SECTIO
OIL DRAIN
TO RESERVOIR
12
13
6
7
8
14
15
16
17
9
1C
H.P. OIL INLET

Figure 2