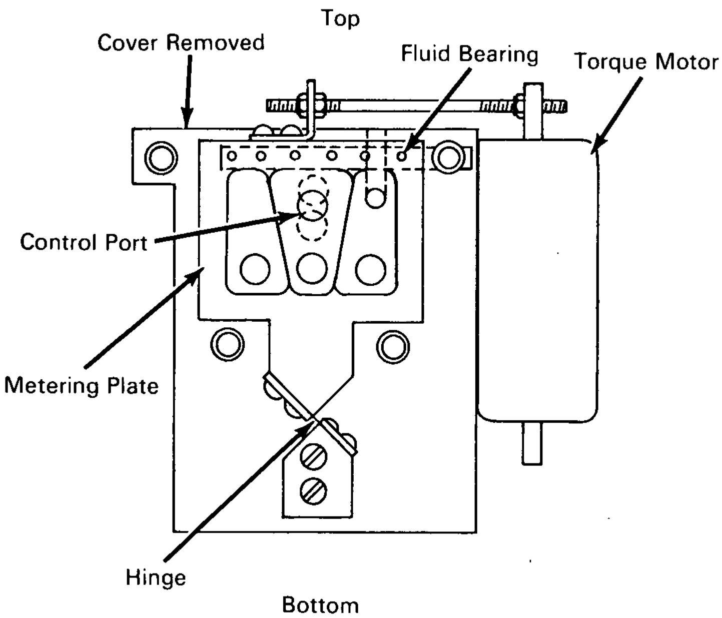
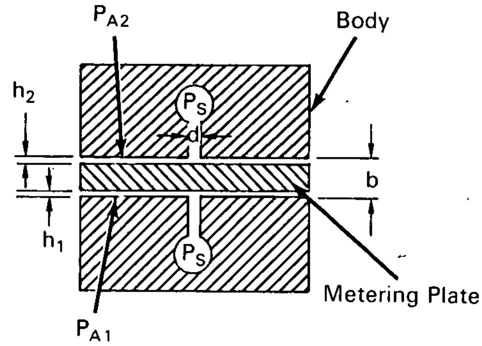
NASA TECH BRIEF

Low Friction Servo Valve





A valve has been developed using air bearings which provide frictionless operation. The servo valve is of the flat plate type with rectangular meter openings. Fluid bearings support the metering plate. The overlap is adjustable by means of a variable hinge block support. In conventional valves, this can only be done in the original fabrication of the valve.

The valve shown at the left above is a three-way plate valve positioned by an electrical torque motor. This valve consists of a metering means positioned by the torque motor to control the flow of fluid between the supply port and control port or between the control port and exhaust port. This is done by varying the area of the opening created between the metering plate and body. The area of the opening is proportional to the electrical torque motor current. Although the valve shown uses a torque motor for positioning the metering means, the servo valve is not restricted to this type of actuator.

The metering plate is supported between the body and the cover by a hinge at one end and by the fluid bearings at the other. The action of the fluid bearings is to keep the plate centered between the two halves of the body and to resist any external force which would tend to cause the plate to rub against the body causing friction in the valve action. Operation of the fluid bearings is illustrated at the right above. This is a simplified sketch showing a metering plate supported between two halves of the body. The distance, b, is fixed by spacers (not shown). For clarity, only one fluid bearing on each side of the plate is shown. In an actual application, several would be used

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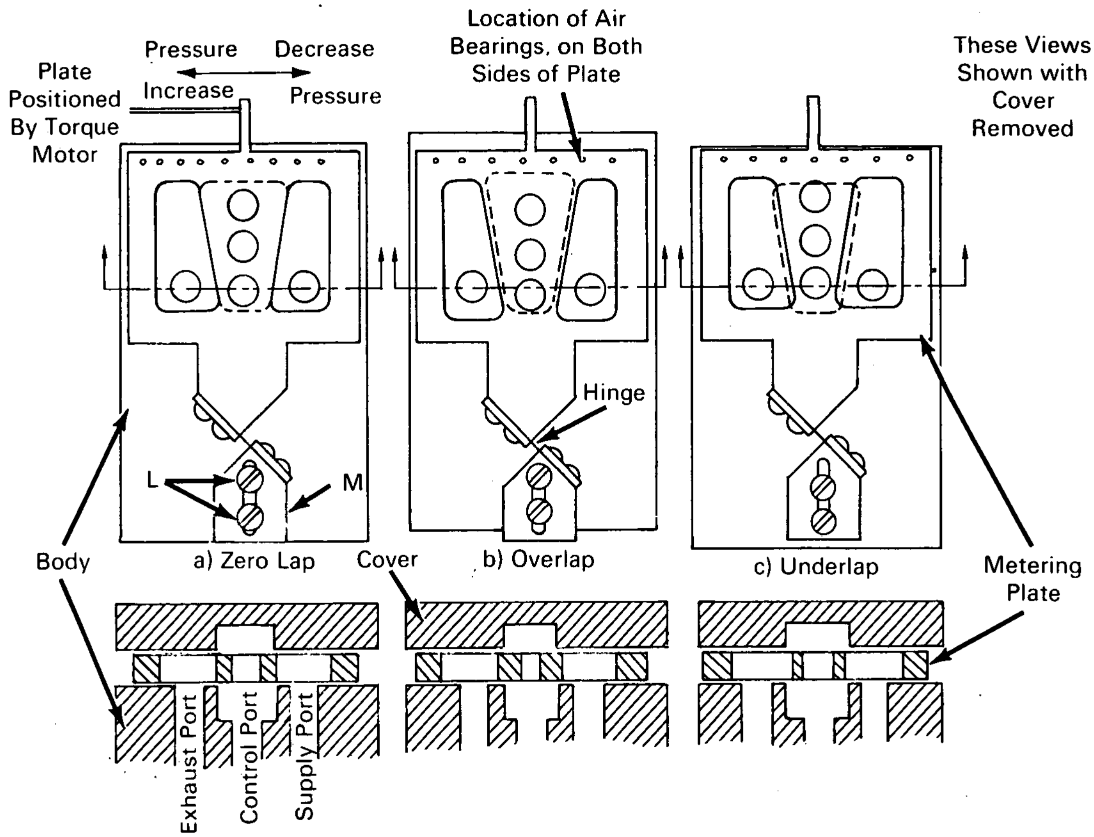

on each side of the plate. The fluid is supplied to the bearings at a constant pressure, P_s. Two restrictions are created, a fixed resistance at the drilled hole d, and a distributed resistance from the drilled hole out to the edge of the plate. The distributed resistance decreases as the clearance, h, increases. This causes a decrease in the average pressure, P_a. If a force is applied upward to the plate, the clearance, h_2, will decrease, causing the average pressure, P_{a2}, to increase. Also, the clearance, h_1, will increase causing the average pressure, P_{a1}, to decrease. The result is a net pressure differential across the plate in a direction opposing the applied force.

The other unique feature of the servo valve is the adjustment for changing the overlap of the valve. The operation of this feature is shown in the above figure. By loosening the two screws, L, which hold the hinge support block, M, to the body; the support block may be moved up or down. Because of the angle of the metering edges, the overlap will decrease when the block is moved up and increase when the block is moved down. Figure c shows the block moved to the extreme upward position resulting in an underlapped condition.

Notes:

1. The servovalve can be used in closed loop pressure control systems that require large instantaneous flow rates at low pressures. It has been used with a supply pressure up to 30 psig.
2. No additional documentation is available for this innovation.
3. Technical questions concerning this innovation may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B68-10440

Patent status:

No patent action contemplated by NASA.

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