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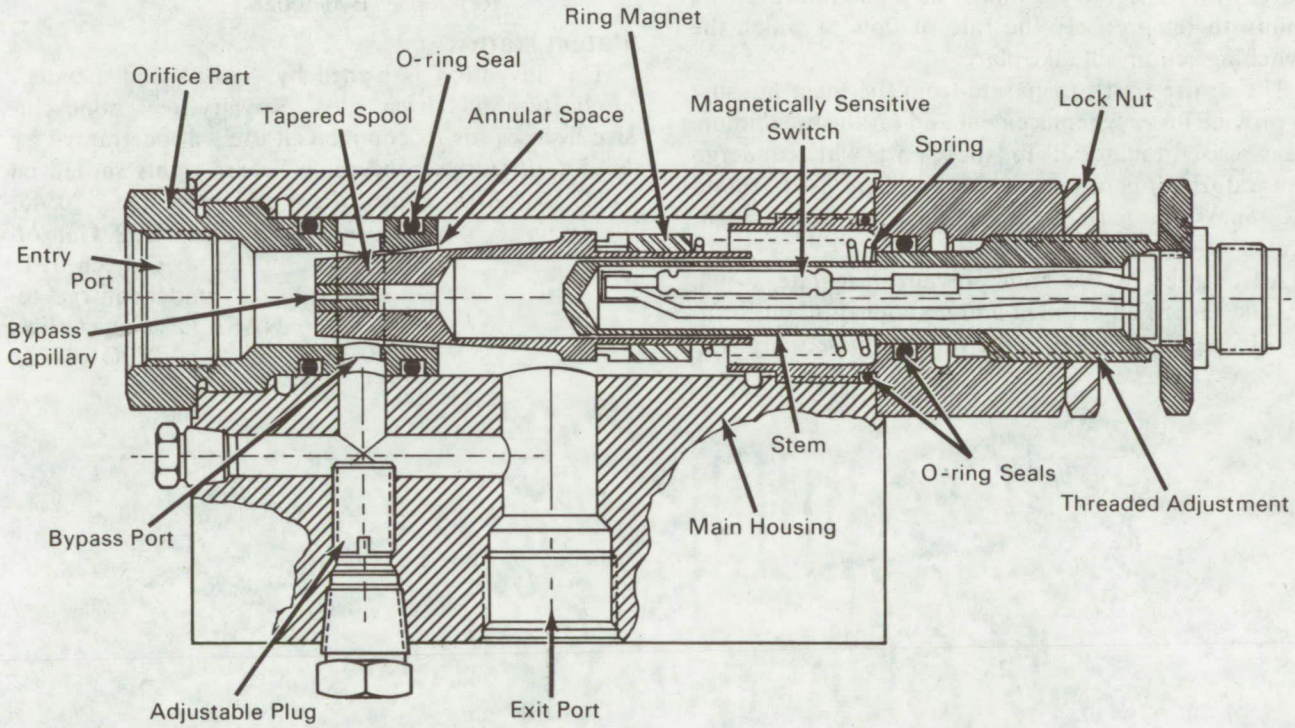
NASA TECH BRIEF

High Pressure Flow-Rate Switch



A reliable high pressure flow-rate switch of a new design adjusts easily over a wide switching range and operates uniformly over many cycles. It should find ready acceptance in commercial hydraulic applications.

The diagram helps to explain the action of the switch. Oil enters the switch housing through an entry port. A portion of the oil flows through the bypass ports and directly to the exit port. An adjustable plug limits or controls the amount of oil which can escape by this bypass route and, therefore, becomes a coarse range adjustment. A small amount of oil flows through the bypass capillary located in the center of the end of the tapered spool, and then around the stem which acts both as the guide for the spool and as a housing for the magnetic switch. This small flow of oil lubricates the guide for the spool and thereby facilitates repeated operation of the switch. The bypass capillary creates a restricted passage to damp out any surges in oil flow rate which could cause erratic switching actions.

The rest of the oil flows through the annular space between the tapered spool and the orifice. The bypass ports through the orifice part are arranged symmetrically around the spool, so that the oil flow in the

(continued overleaf)

annular space is symmetric with respect to the spool. This design eliminates side forces which might cause the spool to bind. Increasing the rate of flow forces the spool out of the orifice; the distance the spool moves is porportional to the rate of flow. A spring resists the motion of the spool and returns it to position as the flow rate decreases. A ring magnet pressed onto the spool actuates a magnetic switch when the spool is forced a preset distance out of the orifice. A threaded adjustment and a locknut on the housing allow for positioning the magnetic switch closer to or farther from the magnet on the spool. This position determines the flow-rate which will actuate the switch. Locating several magnetic switches in the housing can meet any requirement for multi-point flow-rate switching. Tapering the spool increases the distance it will travel with respect to the rate of flow and improves the ability to set precisely the rate of flow at which the switching action will take place.

The orifice part is separate from the main housing to provide for easy replacement and for the use of more wear-resistant materials for those parts which undergo abuse during operation. O-ring seals are used around the removable parts at all points where leaks might occur.

Advantages of the high pressure flow-rate switch include ease of adjustment and maintenance, uniformity of operation, wide range of control settings, and ease of adaptation to the control of various fluids, as well as the possibility of introducing multi-point switching. These advantages result from the combination of various novel design features such as: the tapered spool, balanced porting, capillary-bypass lubrication, and capillary-restriction damping.

Notes:

1. This high pressure flow-rate switch was developed to replace flow switches currently used on a 210 ft advanced antenna system hydrostatic bearing.
2. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B70-10028

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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