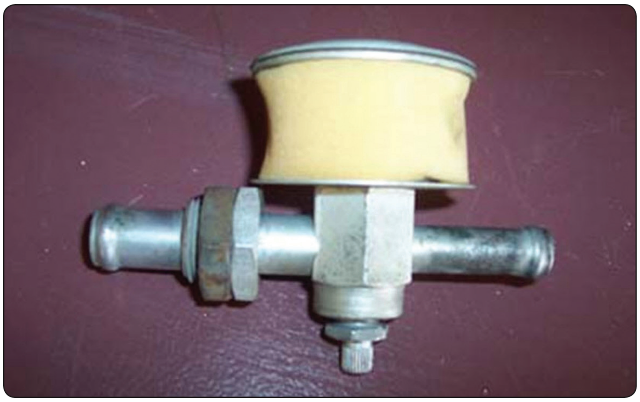

Figure 10-89. *A vacuum regulator, also known as a suction relief valve, includes a foam filter. To relieve vacuum, outside air of a higher pressure must be drawn into the system. This air must be clean to prevent damage to the pump.*

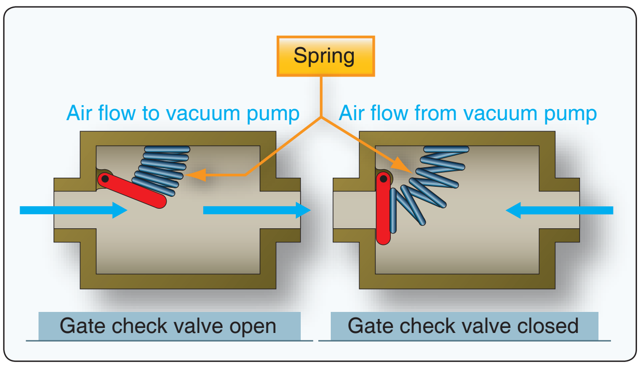

Figure 10-90. *Gate check valve used to prevent vacuum system damage from engine backfire.*

Selector valve—In twin-engine aircraft having vacuum pumps driven by both engines, the alternate pump can be selected to provide vacuum in the event of either engine or pump failure, with a check valve incorporated to seal off the failed pump.

Restrictor valve—Since the turn needle of the turn and bank indicator operates on less vacuum than that required by the other instruments, the vacuum in the main line must be reduced for use by this instrument. An in-line restrictor valve performs this function. This valve is either a needle valve or a spring-loaded regulating valve that maintains a constant, reduced vacuum for the turn-and-bank indicator.

Air filter—A master air filter screens foreign matter from the air flowing through all the gyro instruments. It is an extremely import filter requiring regular maintenance. Clogging of the master filter reduces airflow and causes a lower reading on the suction gauge. Each instrument is also provided with individual filters. In systems with no master filter that rely only upon individual filters, clogging of a filter does not necessarily show on the suction gauge.

Suction gauge—a pressure gauge which indicates the difference between the pressure inside the system and atmospheric or cockpit pressure. It is usually calibrated in inches of mercury. The desired vacuum and the minimum and maximum limits vary with gyro system design. If the desired vacuum for the attitude and heading indicators is 5 inches and the minimum is 4.6 inches, a reading below the latter value indicates that the airflow is not spinning the gyros fast enough for reliable operation. In many aircraft, the system provides a suction gauge selector valve permitting the pilot to check the vacuum at several points in the system.

Suction/vacuum pressures discussed in conjunction with the operation of vacuum systems are actually negative pressures, indicated as inches of mercury below that of atmospheric pressure. The minus sign is usually not presented, as the importance is placed on the magnitude of the vacuum developed. In relation to an absolute vacuum (0 psi or 0 "Hg), instrument vacuum systems have positive pressure.

Figure 10-91 shows a typical engine-driven pump vacuum system containing the above components. A pump capacity of approximately 10"Hg at engine speeds above 1,000 rpm is normal. Pump capacity and pump size vary in different aircraft, depending on the number of gyros to be operated.

Twin-Engine Aircraft Vacuum System Operation

Twin-engine aircraft vacuum systems are more complicated. They contain an engine-driven vacuum pump on each engine. The associated lines and components for each pump are isolated from each other and act as two independent vacuum systems. The vacuum lines are routed from each vacuum pump through a vacuum relief valve and through a check valve to the vacuum four-way selector valve. The four-way valve permits either pump to supply a vacuum manifold. From the manifold, flexible hoses connect the vacuum-operated instruments into the system. To reduce the vacuum for the turn and bank indicators, needle valves are included in both lines to these units. Lines to the artificial horizons and the directional gyro receive full vacuum. From the instruments, lines are routed to the vacuum gauge through a turn and bank selector valve. This valve has three positions: main, left turn and bank (T&B), and right T&B. In the main position, the vacuum gauge indicates the vacuum in the lines of the artificial horizons and directional gyro. In the other positions, the lower value of vacuum for the turn and bank indicators can be read.