

PORSCHE

911T

CONTINUOUS INJECTION SYSTEM



MODEL 73

PORSCHE + AUDI

A DIVISION OF VOLKSWAGEN OF AMERICA INC.

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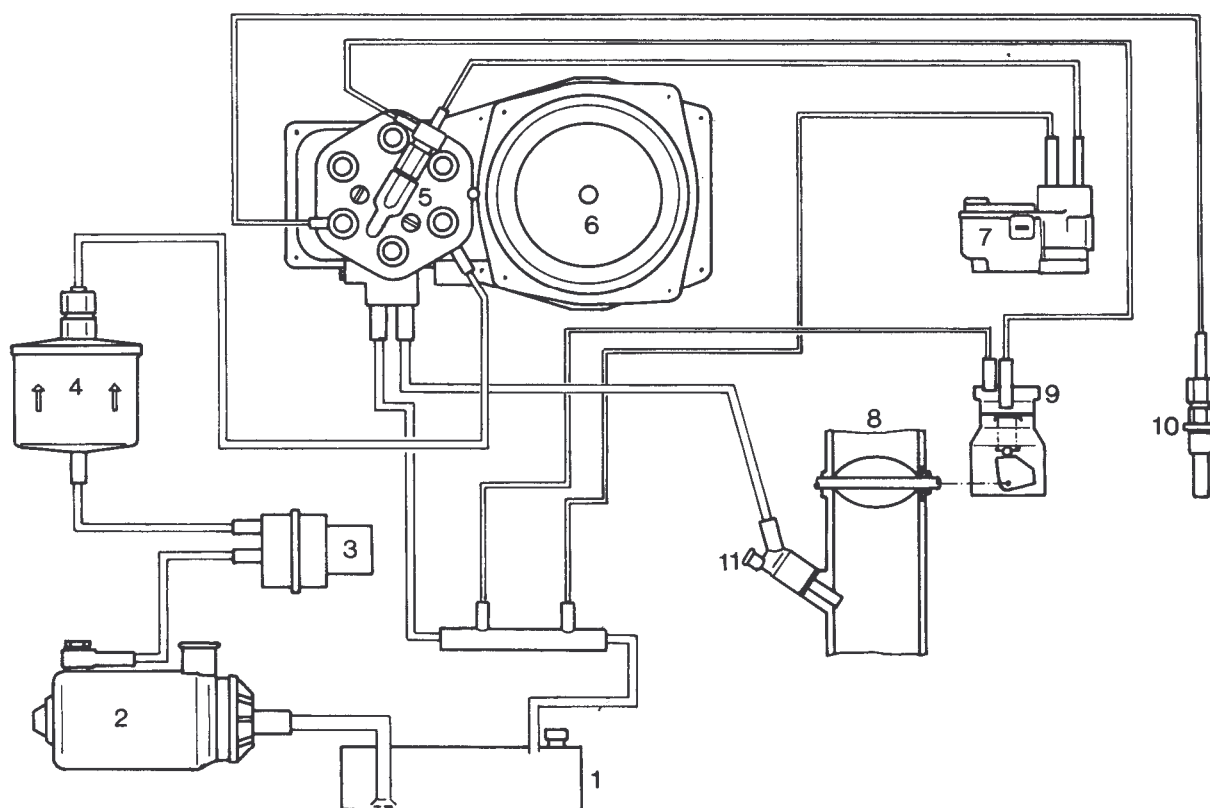
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The Bosch Continuous Injection System (CIS)

Porsche 911 T

Contrary to conventional fuel injection systems, the Porsche 911 T now features a Continuous Injection System (CIS). This system is not actuated mechanically or electronically. Its working principle depends on measuring the intake air flow rate to determine the amount of fuel to be injected.

The main components of the Continuous Injection System are shown in the following illustration.

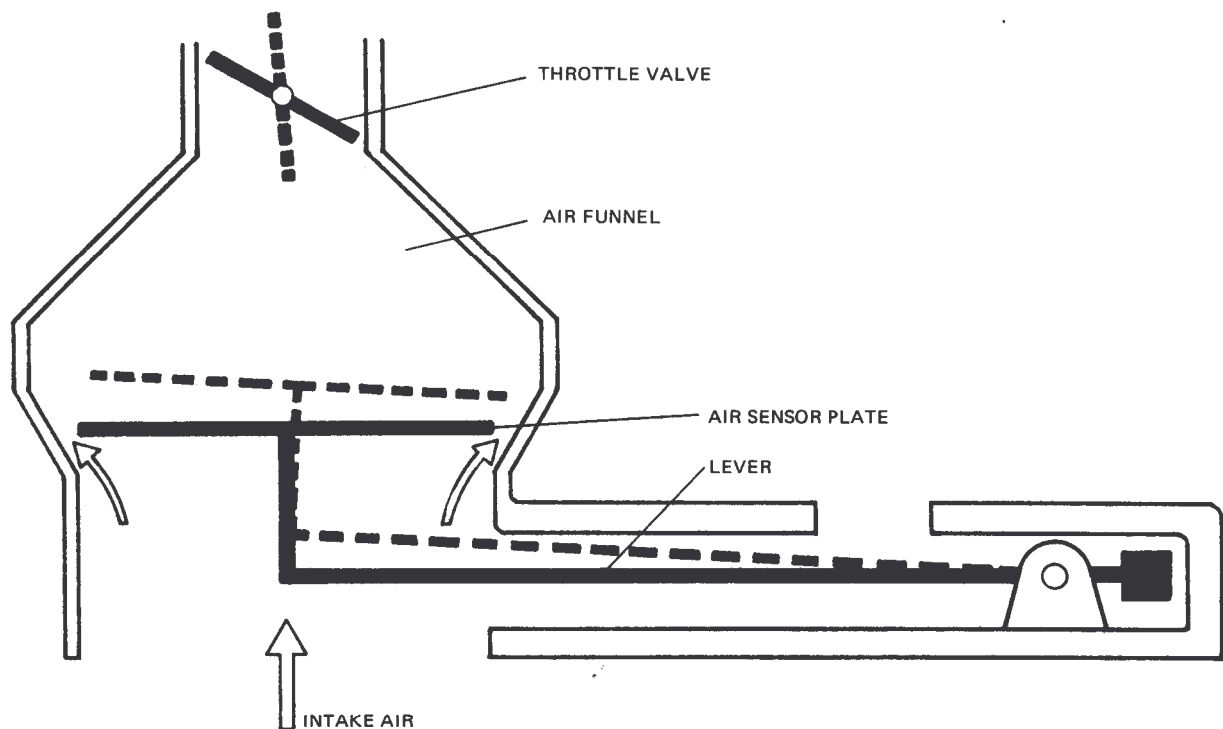


SYSTEM COMPONENTS

- | | |
|---|--|
| 1. Fuel tank | 8. Throttle valve |
| 2. Fuel delivery pump | 9. Control pressure regulator w/throttle position compensation |
| 3. Accumulator | 10. Injection valve |
| 4. Filter | 11. Start valve |
| 5. Fuel distributor | |
| 6. Air sensor | |
| 7. Control pressure regulator w/warm running compensation | |

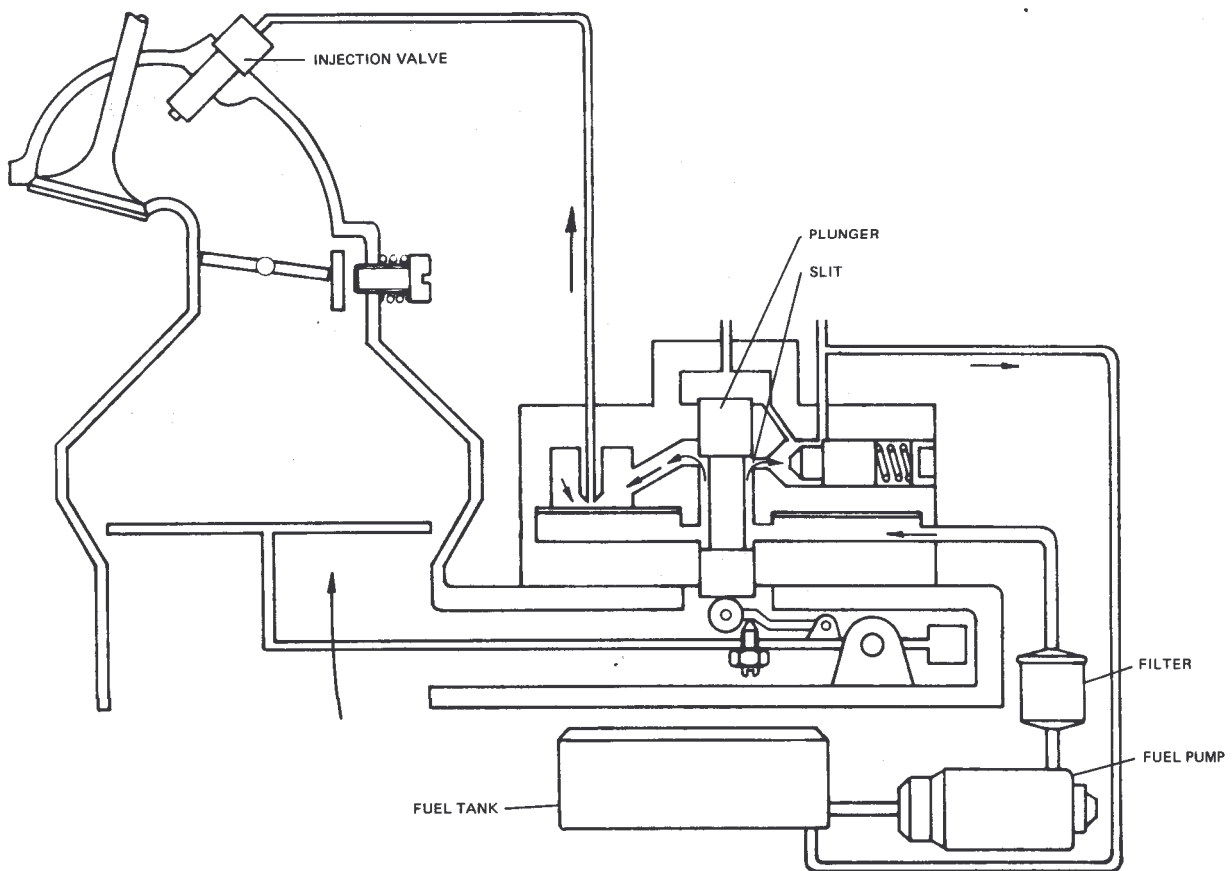
The main function of any carburetor or fuel injection system is to mix air and fuel for most efficient combustion. The theoretical ratio is 14 parts of air to one part of fuel. In the Continuous Injection System, the air requirement of the engine is measured first and later the necessary fuel is added.

Depending on the position of the throttle valve, the engine draws in more or less air. Ahead of the throttle valve in an air funnel is an air flow sensor plate connected to a lever. The sensor plate rises in the air funnel to permit air to pass through. The position of the sensor plate in the air funnel determines the quantity of fuel required.

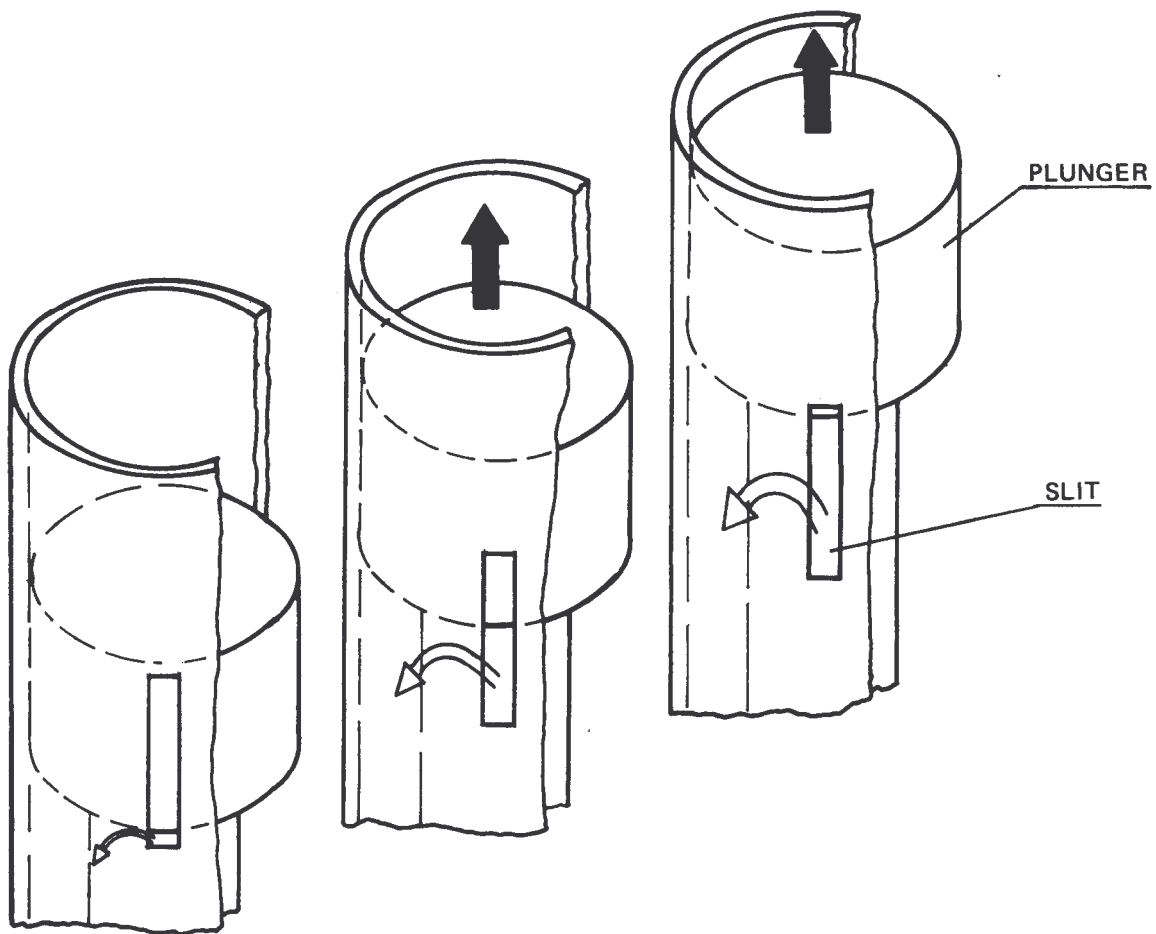


The air sensor plate is mounted on a lever. A balance weight is attached to the short end of the lever. In the air funnel the quantity of intake air lifts the air sensor plate until an equilibrium is reached between the air flow and the hydraulic counter pressure which acts on the lever through a plunger.

In this balanced position, the plunger maintains a certain position in the fuel distributor thus opening small metering slits, one for each engine cylinder. The fuel under a controlled pressure from the fuel pump passes through the slit opening to the injection valves. The slit openings determine the correct amount of the fuel rather than the injection valves as in electronic fuel injection systems.

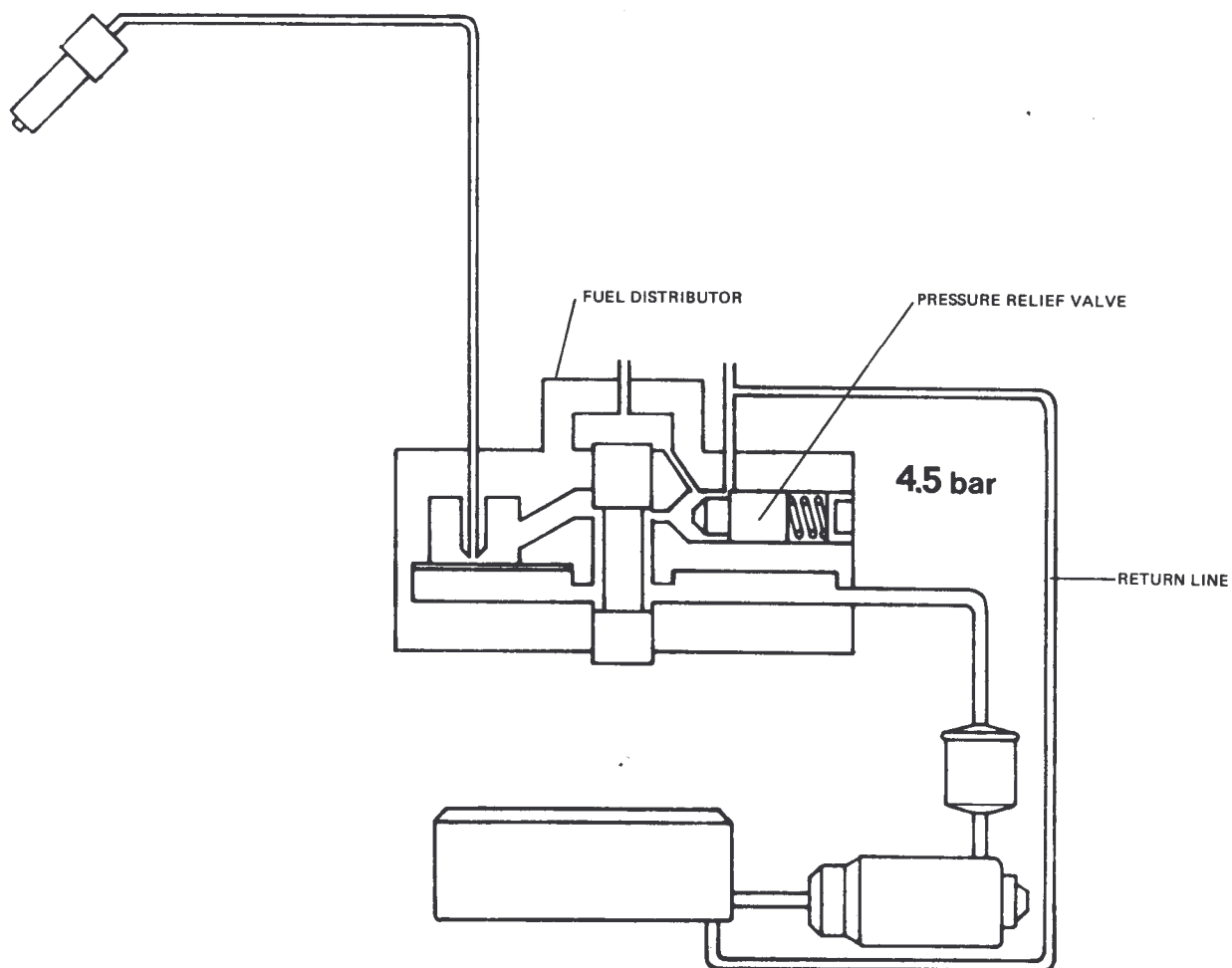


In a cutaway view of the plunger and its cylinder, the metering slits are visible. The plunger opens or closes the slits depending on its position.



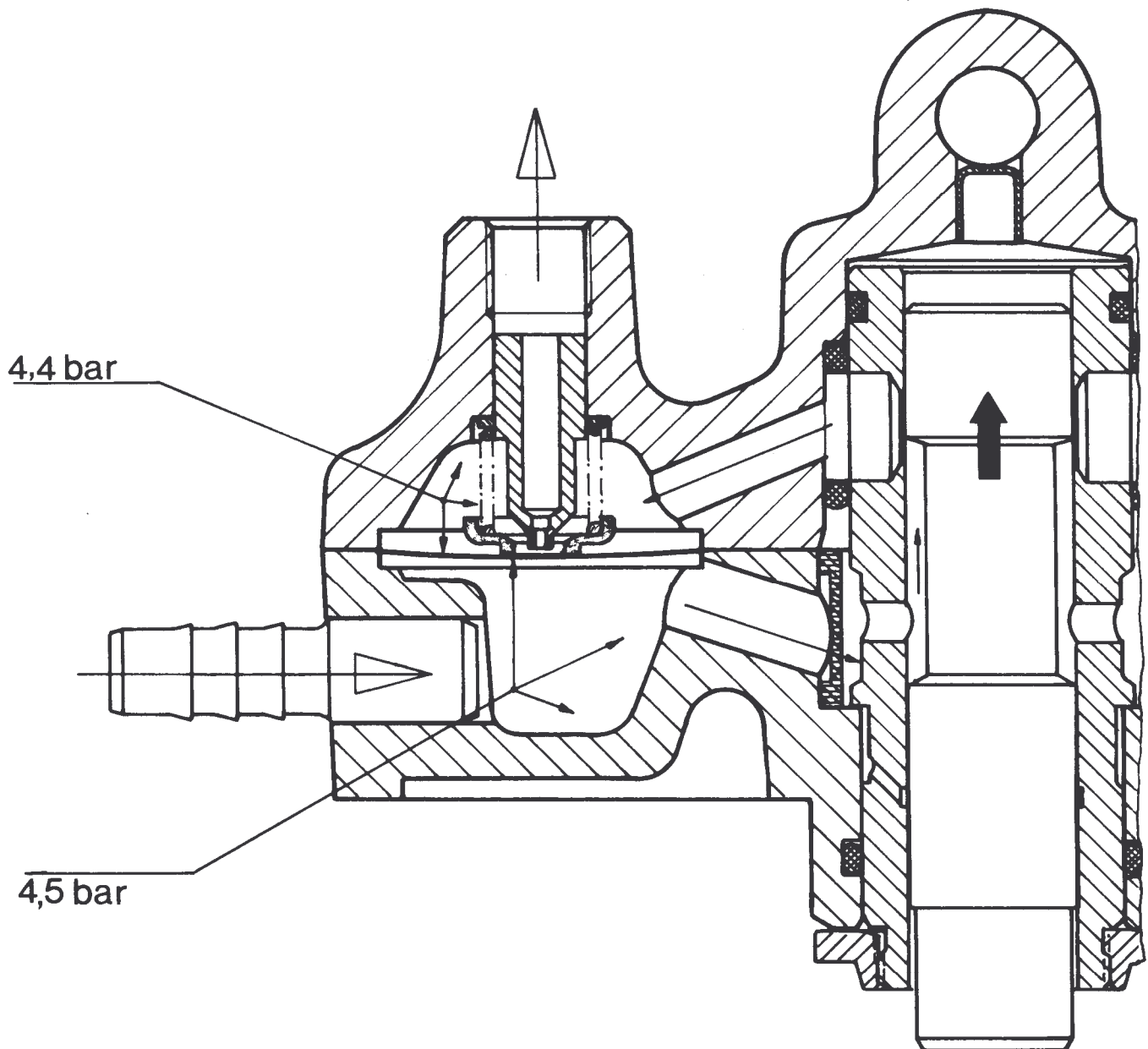
In order to maintain a fuel pressure of precisely 4.5 bar *, a pressure relief valve is located in the primary fuel circuit of the fuel distributor. Excess fuel is diverted back via a return line to the fuel tank.

*) 1 bar equals approximately 1 kp/cm² (14.5 psi)



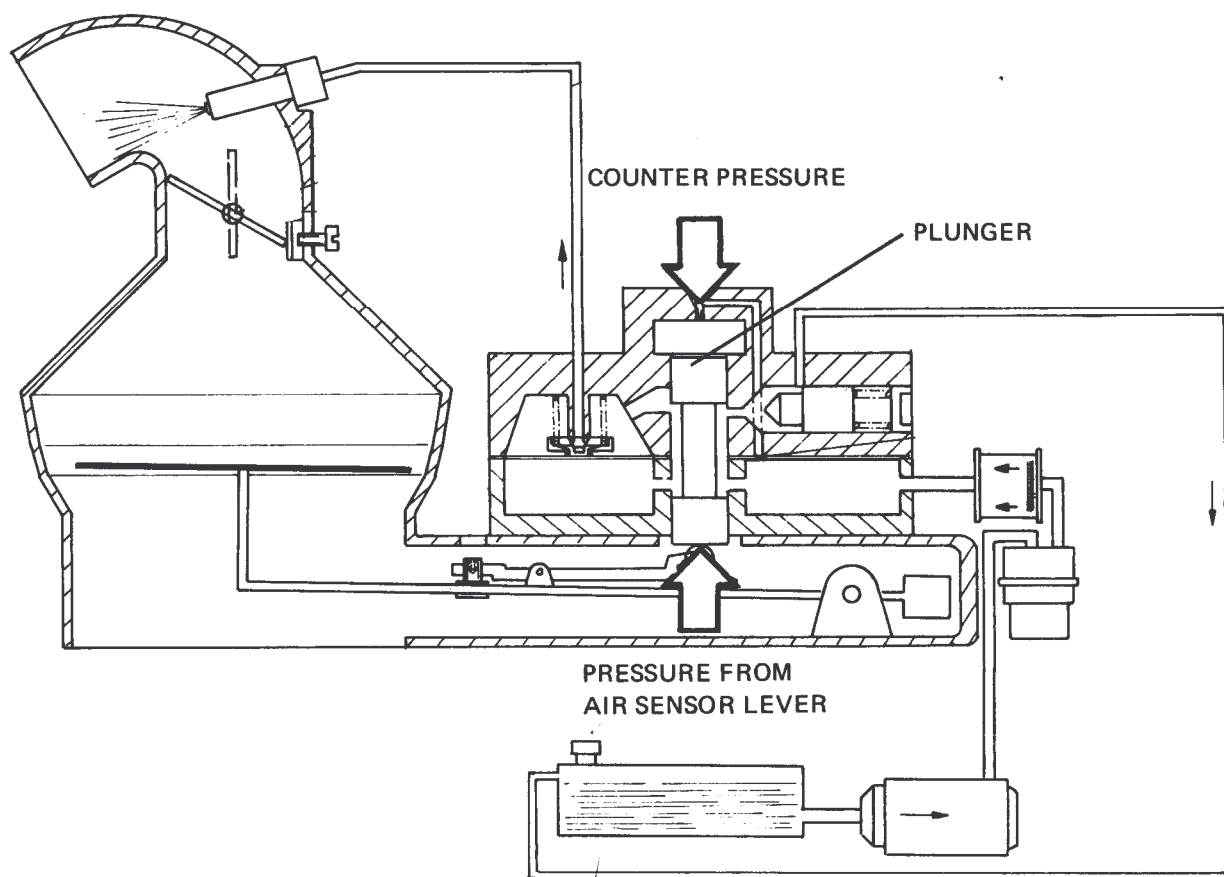
To assure that the quantity of fuel flowing through the slit openings depends only on the open area of the slit, an exact pressure differential must exist at all times at the inlet opening. The pressure is controlled by a pressure regulating valve (one valve for each cylinder) consisting of a spring loaded steel diaphragm and an outlet to the injection valves. Looking at the illustration you can see that the diaphragm separates the upper from the lower chamber.

The pressure regulating valve maintains an exact pressure differential of 0.1 bar between the pressure in the upper chamber (4.4 bar) and the pressure in the lower chamber (4.5 bar). Both pressures act on the spring loaded steel diaphragm which opens the outlet leading to the injection valves. The amount of opening at the outlet is always just sufficient to maintain the pressure differential of 0.1 bar at the metering slit. If a larger amount of fuel flows, the diaphragm opens further to allow more fuel to flow, thus maintaining a pressure of 4.4 bar in the upper chamber. If a smaller amount of fuel enters the upper chamber, the diaphragm opens less, permitting less fuel to flow to the injection valves. In both cases the pressure differential between upper and lower chamber is always constant at 0.1 bar. In practice, the diaphragm moves only a few hundredths of a millimeter.

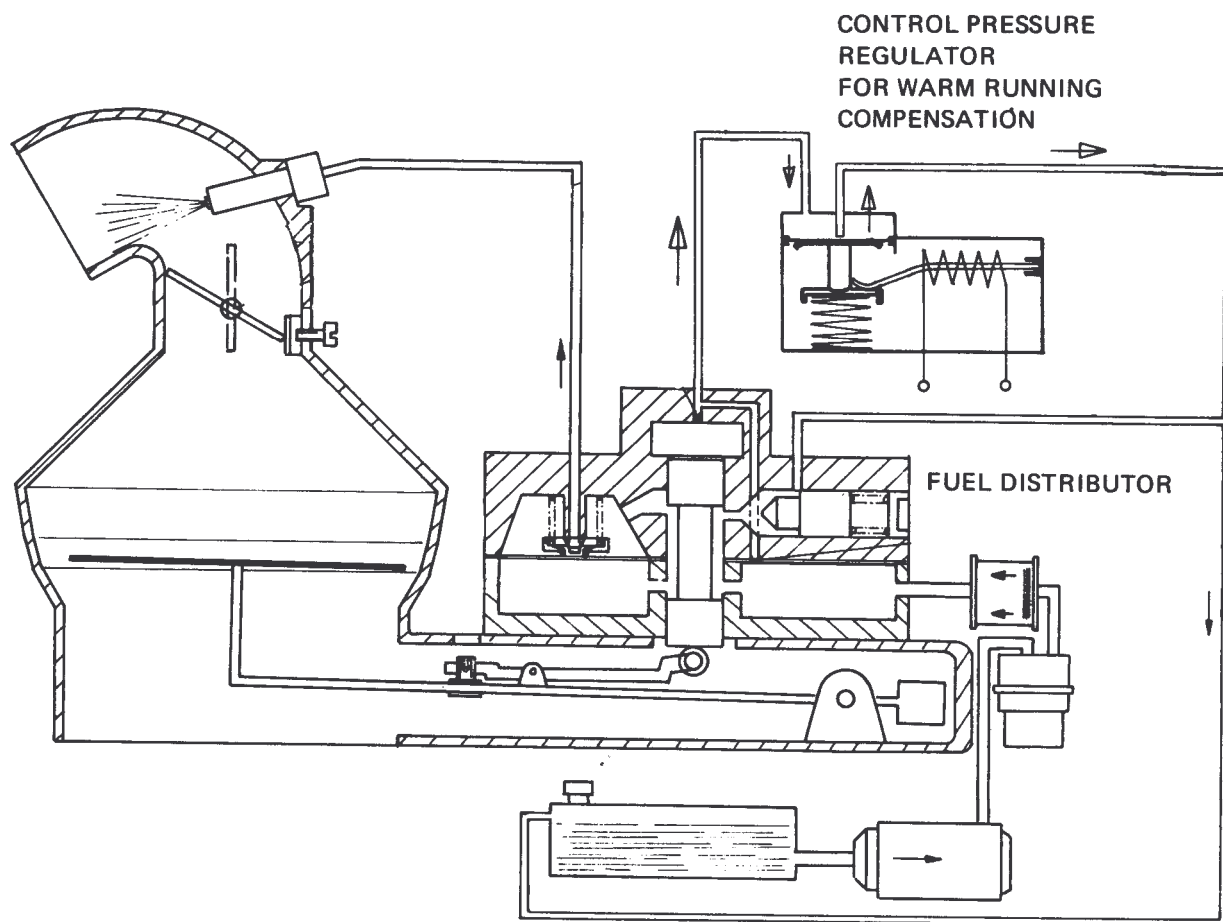


We talked earlier about the counter pressure on the plunger which keeps the lever in balance. This counter pressure acting on the top of the plunger is used to influence the fuel quantity needed depending on the various operating conditions of the engine. Limiting the travel of the plunger by exerting more force on the top, the slits open less, thereby permitting less fuel to the injection valves. In turn decreasing the pressure or force on the plunger permits the plunger to open the slits further, thus increasing quantity of fuel to the injection valves. The hydraulic pressure on top of the plunger is obtained from the primary fuel circuit.

The pressure can be varied by two control pressure regulators, one regulating according to engine and outside temperatures, the other according to accelerator pedal movement.



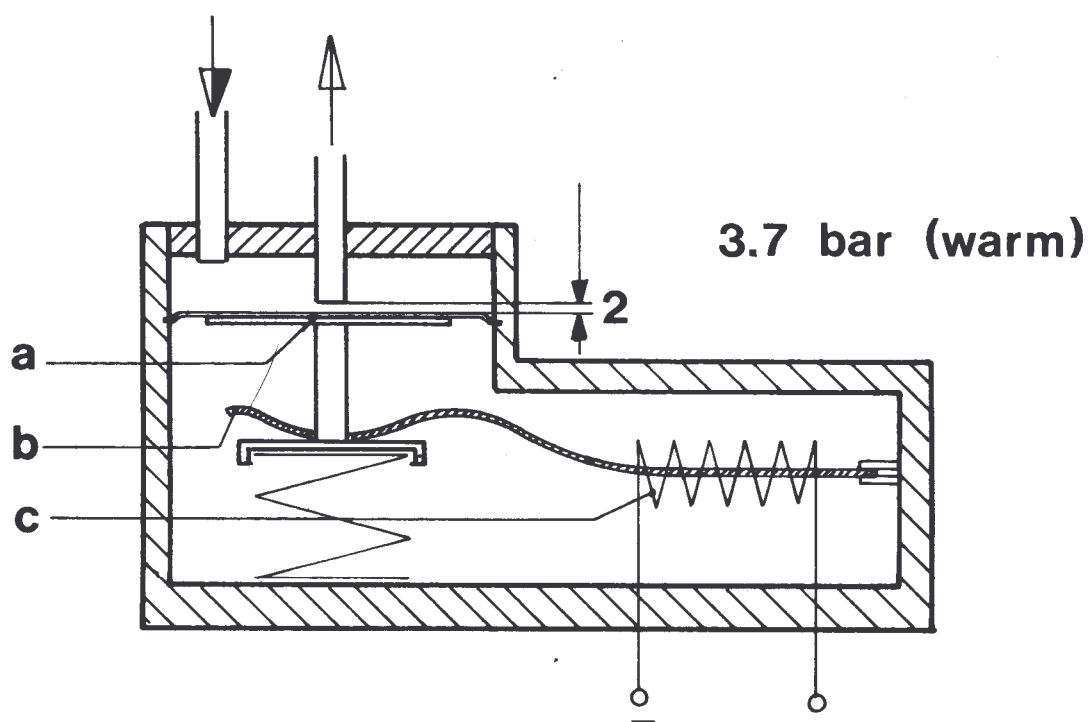
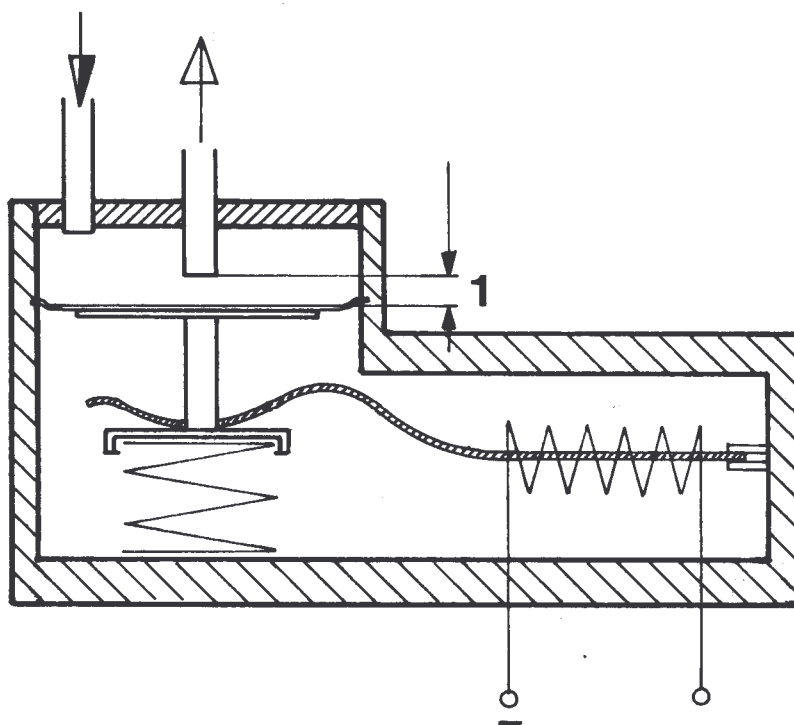
The Control Pressure Regulator for Warm Running Compensation is mounted on the engine crankcase. During engine warm-up it maintains the correct air/fuel ratio by enriching the mixture. As the engine reaches its normal running temperature, it leans out the mixture as necessary.



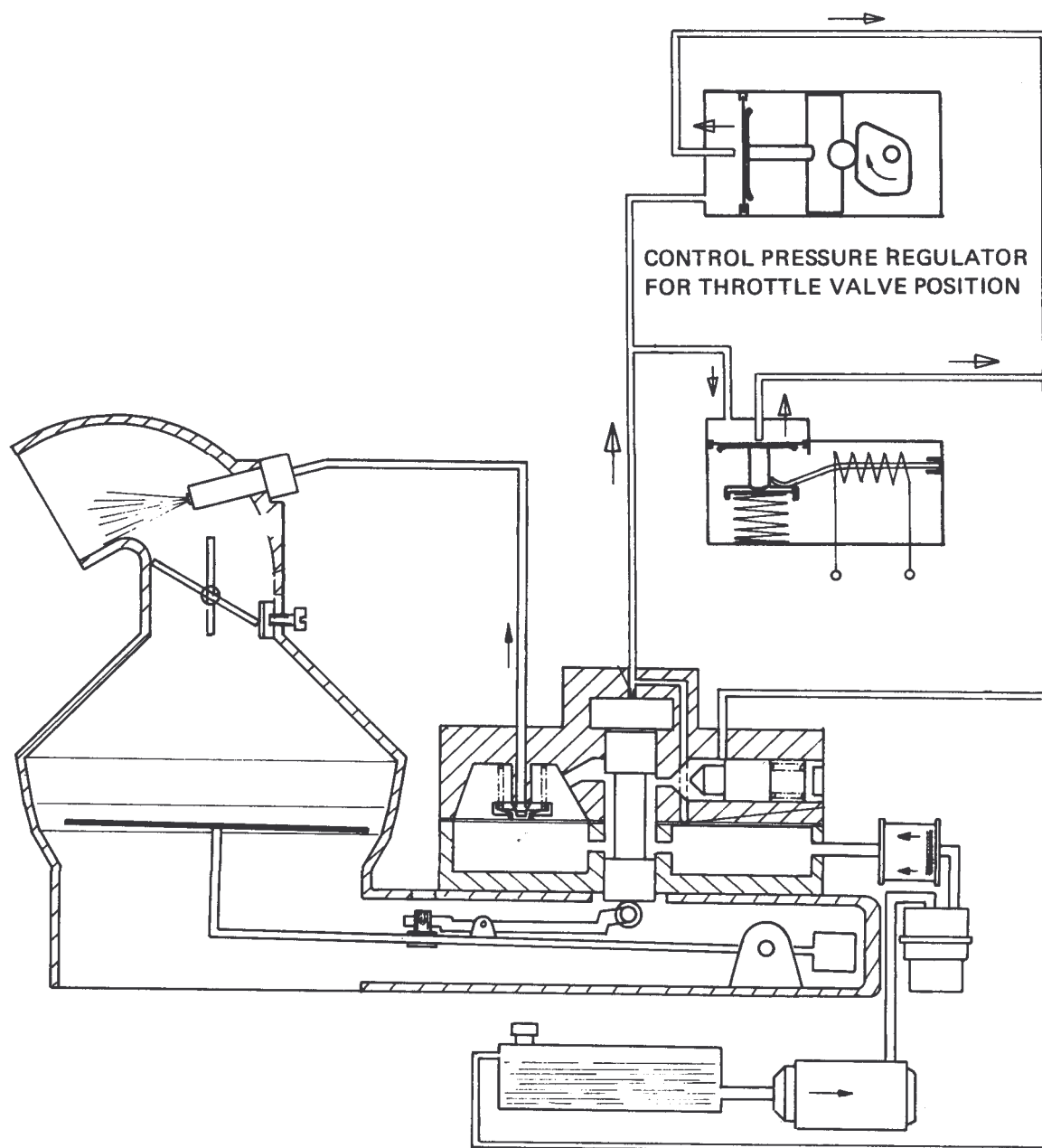
The control pressure regulator for warm running compensation contains a bymetallic spring acting on a spring loaded diaphragm.

When the engine is cold, the diaphragm (see illustration) keeps both inlet and outlet sufficiently open to maintain a minimum pressure on the plunger. As the heating coil of the bymetallic spring activated through the ignition system heats up, it permits the diaphragm to close off the outlet opening, thus increasing the control pressure on the top of the plunger to a maximum of 3.7 ± 0.2 bar.

CONTROL PRESSURE REGULATOR FOR WARM RUNNING COMPENSATION



The Control Pressure Regulator for Throttle Valve Position (accelerator pedal) is mounted on the throttle valve shaft. According to accelerator movement, the control pressure on top of the plunger is changed to provide the correct fuel/air ratio.



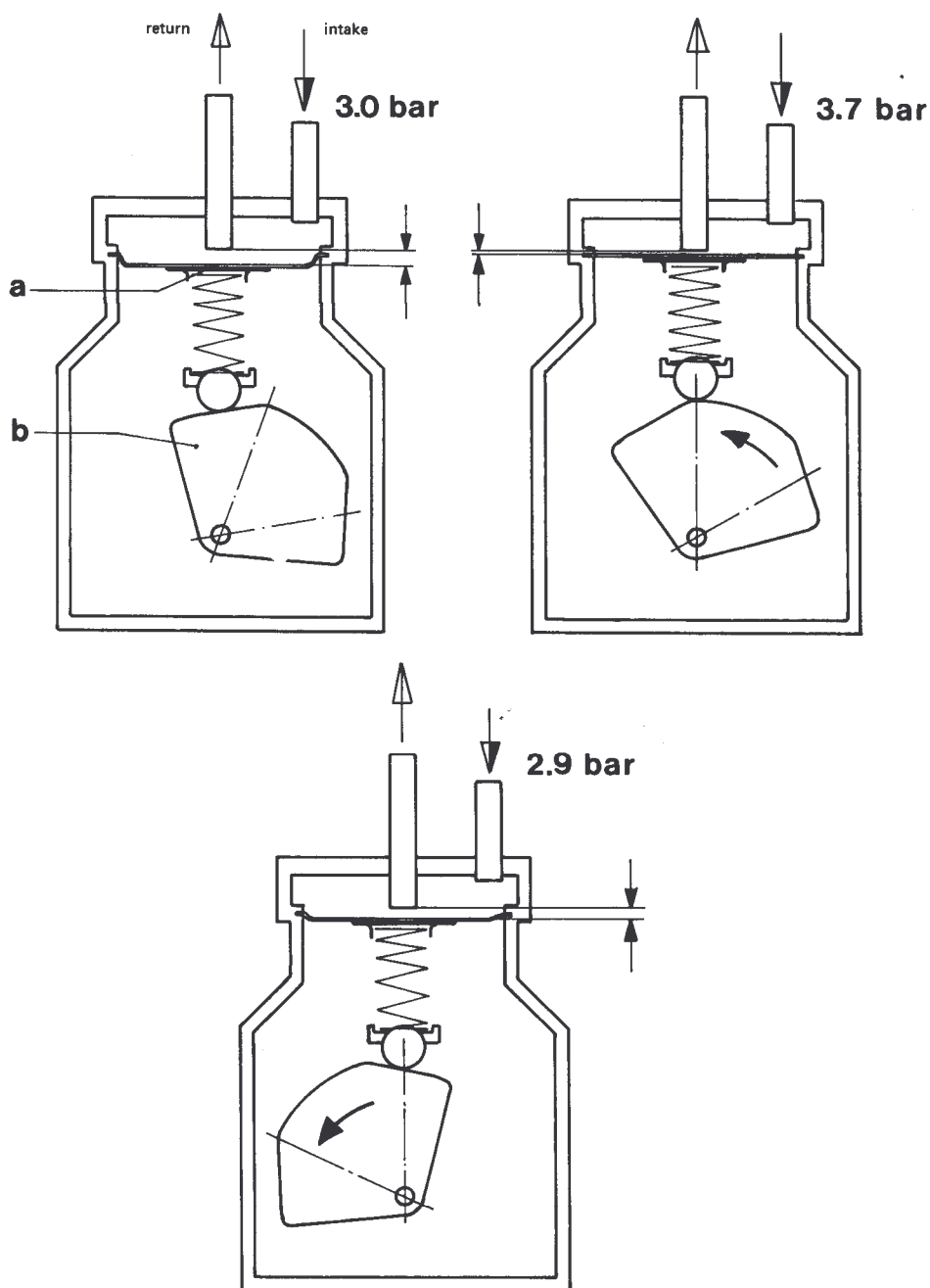
The Control Pressure Regulator for Throttle Valve Compensation consists of a cam mounted on the throttle shaft acting on a spring loaded diaphragm.

When the throttle is in the idle position, the diaphragm keeps both the inlet and the outlet sufficiently open to maintain a minimum pressure on the plunger of $3.0 \pm 0,05$ bar.

At mid-range throttle opening, the control pressure is increased to 3.7 ± 0.2 bar to lean out the mixture as necessary.

As the throttle is fully opened, the pressure is again decreased to approximately 2.9 ± 0.2 bar thus slightly enriching the mixture.

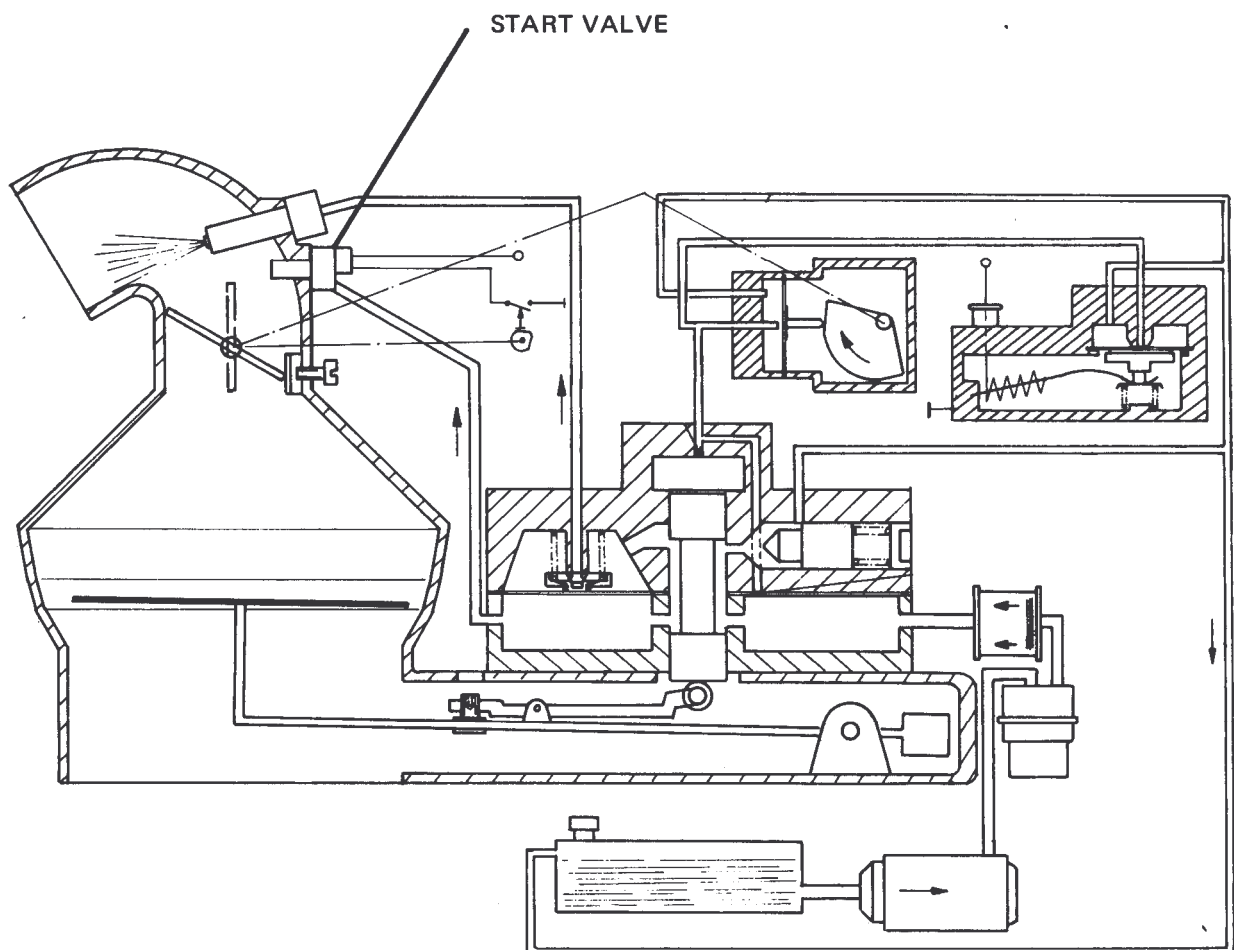
CONTROL PRESSURE REGULATOR FOR THROTTLE VALVE COMPENSATION



In addition to the two control pressure regulating valves, an additional injection valve (start valve) is provided in the air distributor. The purpose of the start valve is to provide sufficient fuel during the starting cycle since the air flow created by the engine pistons is not sufficient to actuate the plunger of the fuel distributor. The start valve receives its fuel under pressure from the primary circuit of the fuel distributor.

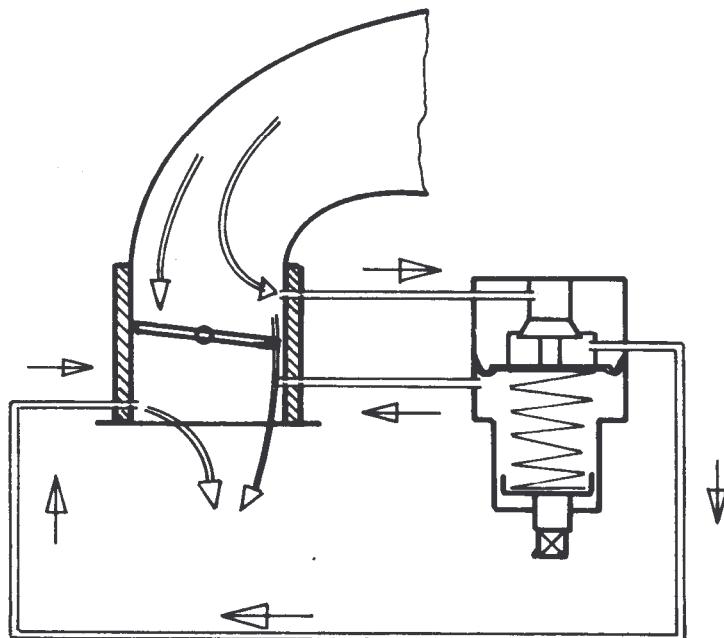
The start valve is activated during the starting cycle, that is, whenever the engine is cranked by the starter motor with the hand throttle fully open.

The solenoid of the starter valve receives its current from the starter circuit via a switch on the hand throttle. To activate the switch on the hand throttle, it has to be pulled out all the way.



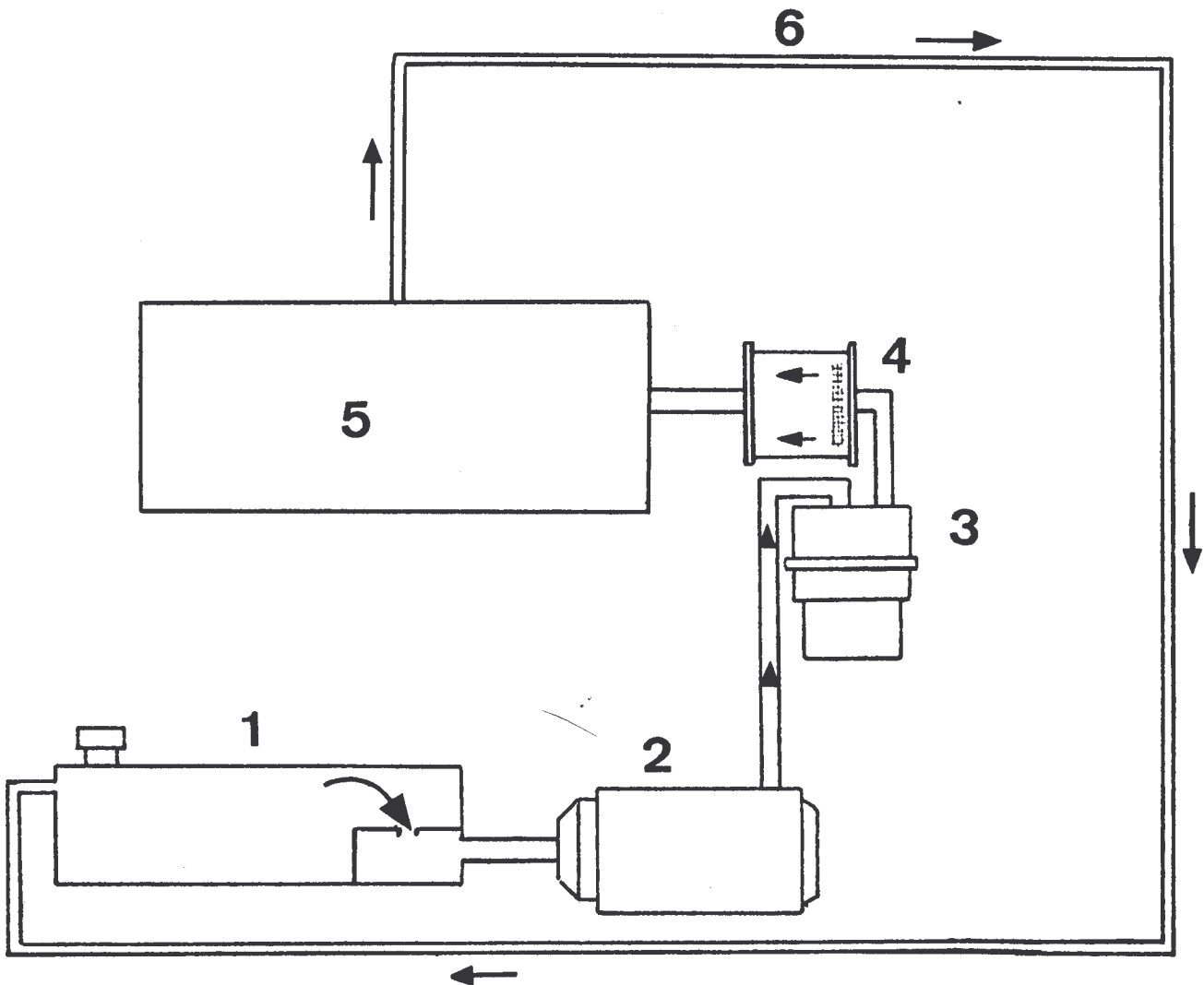
To assure a good fuel/air ratio under deceleration, that is, high engine rpm and closed throttle valve, an auxiliary air device is used. The high negative pressure below the throttle valve is used to open a valve in the auxiliary air device. This allows fresh air to bypass the closed throttle valve, thus leaning out the mixture as necessary.

AUXILIARY AIR BYPASS FOR OVERRUN



To prevent vapor locking of the system, a Fuel Accumulator is provided as a fuel reservoir to release sufficient fuel under pressure to the system when the engine is switched off for a short period of time. The Fuel Accumulator also acts as a pressure damper to absorb the initial pressure surge at the moment the ignition is turned on. This dampening action is needed to prevent the plunger from being forced up before sufficient control pressure has been allowed to build up.

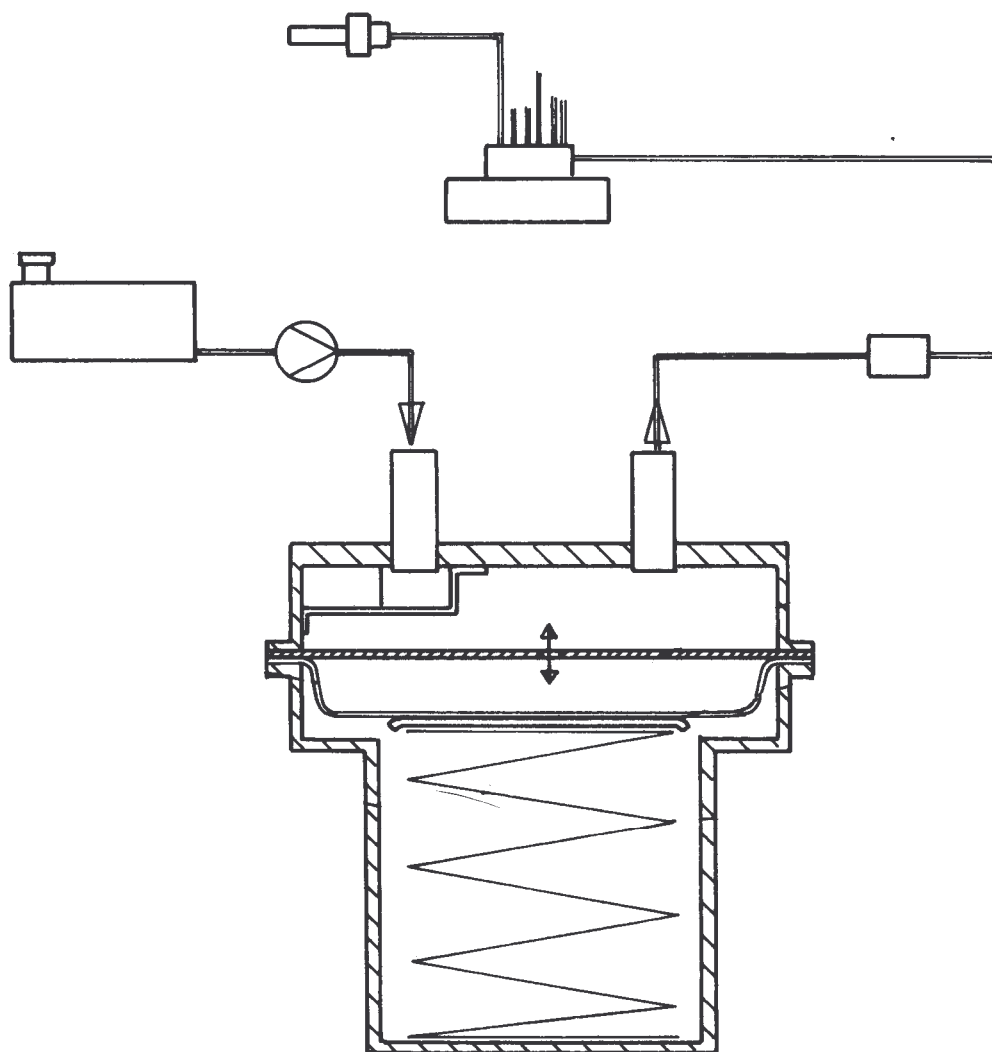
PRIMARY FUEL CIRCUIT



1. Fuel tank
2. Fuel pump
3. Accumulator
4. Fuel filter
5. Mixture control unit
6. Return line

The Fuel Accumulator consists of a container in the fuel delivery line. A spring loaded diaphragm provides the damping action. The expanded chamber serves as the reservoir to keep the system under sufficient pressure when the engine is stopped for short periods.

FUEL ACCUMULATOR



To make basic adjustments possible, an air bypass screw for idle speed adjustment is provided. To obtain the basic CO setting at idle, an adjustment screw is provided on the air sensor lever. These are the only adjusting provisions. The adjustment procedures are described in the following maintenance instructions.

