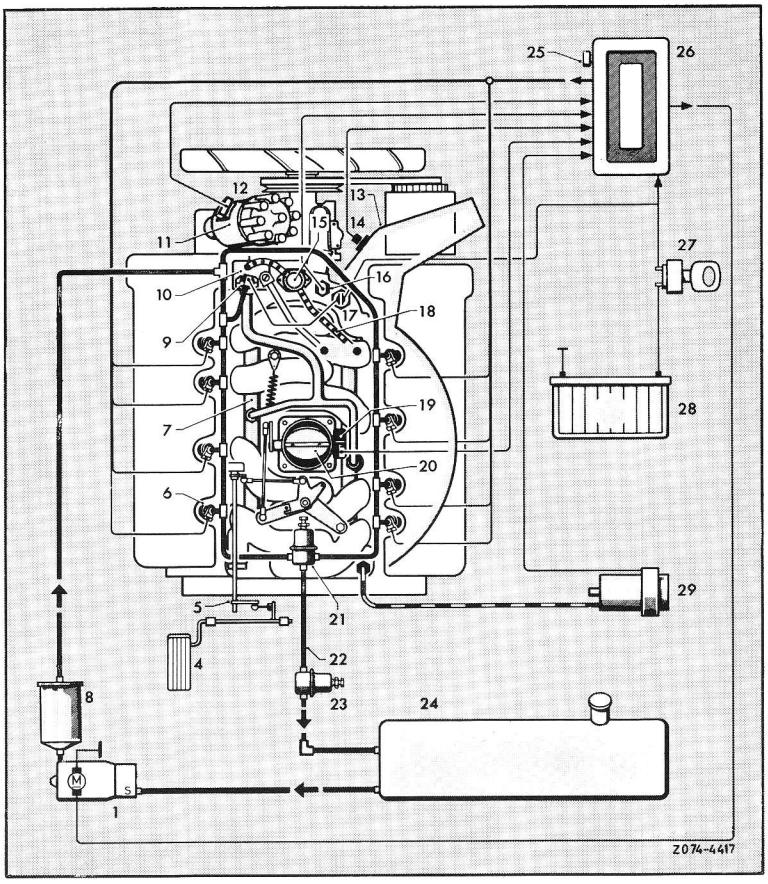

Fig. 1

Electronically controlled fuel injection system and pressure control

1 Fuel pump
3 Fuel pressure line
4 Accelerator pedal
5 Regulating linkage
6 Injection valves
7 Idling speed air duct
8 Fuel filter
9 Starting valve
10 Idling air distributor
11 Impulse trigger
12 Ignition distributor
13 Air cleaner
14 Air temperature sensor
15 Supplemetary air valve
16 Cooling water temperature sensor
17 Thermal time switch in cooling water circuit
18 Supplementary air line
19 Throttle valve switch
20 Throttle valve
21 Fuel pressure regulator
22 Fuel return line
23 Diaphragm damper
24 Fuel tank
25 Idling speed control, adjusting screw
26 Electronic control unit
27 Ignition starter switch
28 Battery
29 Pressure sensor

The electronically controlled and electromagnetically actuated injection valves (6) are metering the pertinent fuel quantity for each operating condition of the engine. Each cylinder is provided with an injection valve in the suction duct of the cylinder head directly in front of the inlet valve. Injection is intermittent and once per power stroke. The opening period of the valve is determined by the quantity of fuel injected. An electrically driven fuel pump (1) delivers the fuel to the injection valves and to a starting valve (9) on the intake pipe.

In contrast to the former type of injection systems, the fuel pump is also simultaneously generating the injection pressure, which has been set to 2 atü.

The fuel delivery line is provided with a fuel filter (8). An overflow pressure regulator (21) with return flow to the fuel tank keeps the pressure constant.

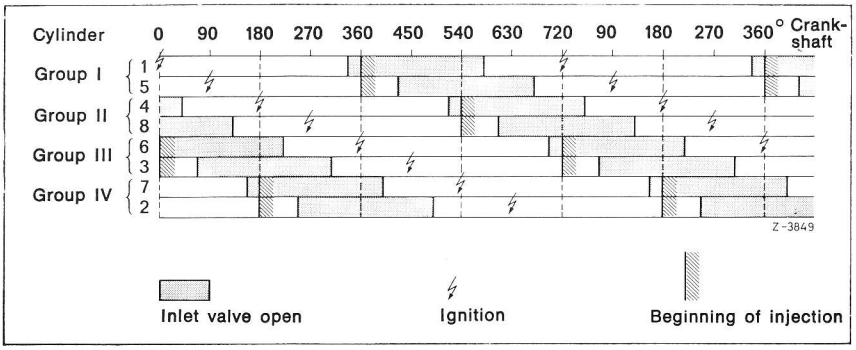

Fig. 2

Injection pattern for 8-cylinder engine

Noises in the fuel return line (22) are eliminated by a diaphragm damper (23). The delivery capacity of the fuel pump is essentially above the max. required fuel quantity and guarantees excellent flushing of delivery lines (pressure lines) to prevent vapor lock (Fig. 1).

The injection valves are combined in groups. The valves included in a group belong to cylinders which are firing one after the other (Fig. 2).

The opening of the valve groups is controlled by an impulse trigger installed in ignition distributor with one contact each per group.

The opening period is determined by an electronic control unit (6) which operates in dependence of the engine operating condition. The control unit receives the required information from a number of sensors attached in engine compartment (Fig. 3). For electronically controlled injection the operating condition of the engine is characterized by the two characteristics speed and intake pipe (intake manifold) pressure. The frequency of the trigger impulses entering the control unit serves to determine the engine speed. A pressure sensor (29) connected to the intake pipe measures the intake pipe pressure and transmits that pressure to the control unit.

In addition to these two main characteristics, several correcting factors are fed to the control unit which guarantee perfect engine function at all operating conditions. A temperature sensor (16) located in the cooling water circuit serves to enrich the mixture while the engine is running warm. Another temperature sensor (14) in the air cleaner controls the composition of the mixture in dependence of the air temperature. The transition stage when the throttle valve is open is improved by an increase of the regular fuel quantity injected and by additional injection pulses. The required electric signals are transmitted to the control unit via a switch (19) actuated by the throttle valve shaft. The same switch operated by the throttle valve shaft prevents the generation of injection signals when the throttle valve is closed. Under thrust conditions (driving downhill etc.) the fuel feed will then be completely shutoff to lower fuel consumption and to prevent undesired exhaust gas emissions. To keep the engine from stopping, the fuel shutoff is cancelled shortly before the engine attains idling speed.

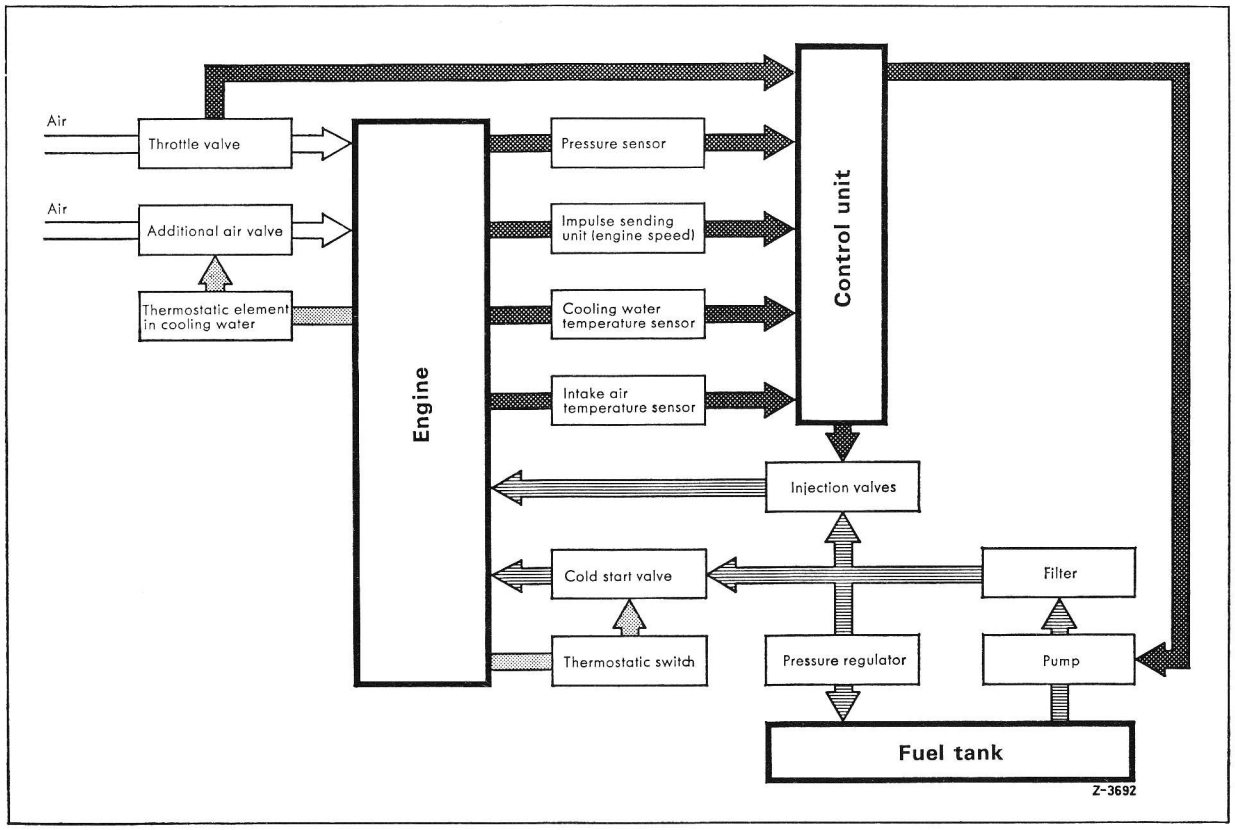

Fig. 3 Diagram of electronically controlled gasoline injection system

When the cold engine is started, a starting valve (9) injects additional fuel into intake pipe.

The valve is controlled by means of the ignition starting switch in combination with a thermal time switch (17) located in cooling water circuit.

During a cold start and as long as the engine has not attained its operating temperature, additional air will be required at idling speed to obtain a perfectly smooth-running engine. This air is sucked in via the air cleaner and fed to the intake pipe via a supplementary air valve (15).

The supplementary air valve is controlled mechanically by means of a paraffin-filled expanding element around which the cooling water circulates.

The electronically controlled gasoline injection system is accurately tuned to the engine. Any attempts to change the control unit or other components are therefore senseless and not permitted.