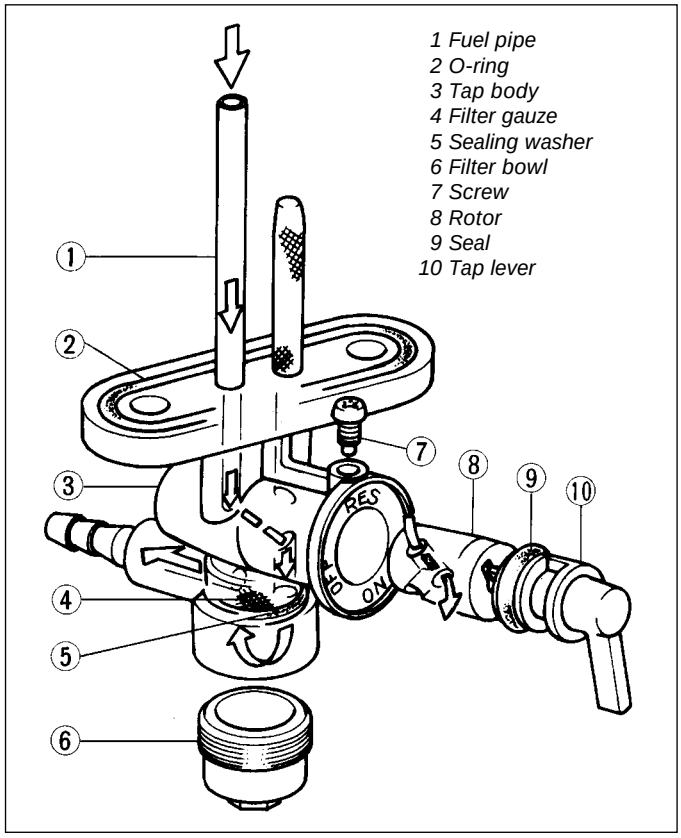
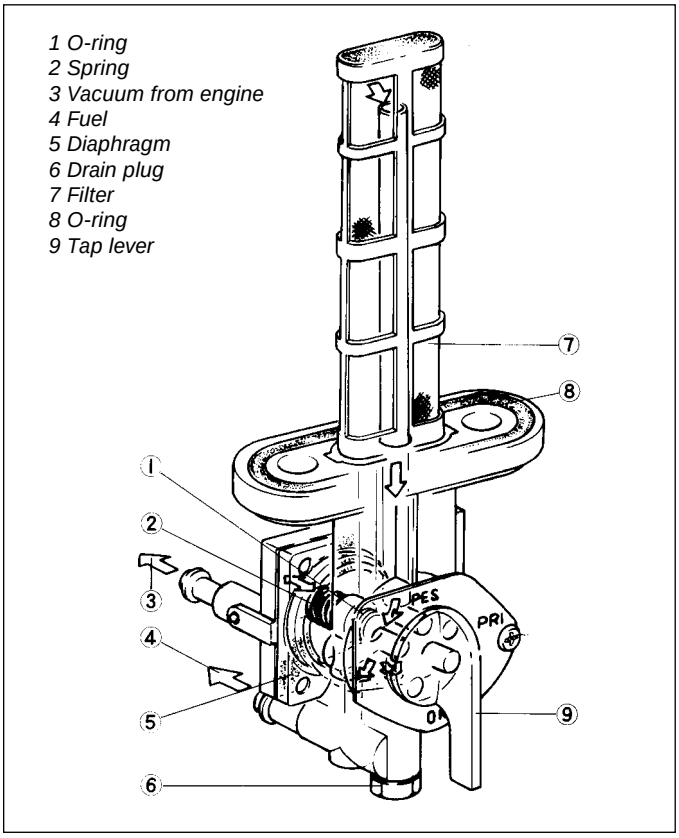


2.9a Manual fuel tap operation



2.9b Automatic fuel tap operation

example. It is situated at the lowest point on the fuel tank and linked by flexible hoses to the fuel system.

On many machines the tap is manually operated, having a small lever on the side of the tap to select the OFF, ON or RES (reserve) positions as required **(see illustration 2.9a)**. An internal rotor allows fuel to flow through the selected port to the fuel pipe. The RES setting switches to a second feed pipe that is set lower in the tank than the main one, gives access to the fuel in the bottom of the tank, and serves as a reminder that you are low on fuel. The transition from main to reserve must be made manually by turning the lever on the tap. Many motorcycles now incorporate a fuel gauge and/or low fuel warning light, which often means there is no reserve facility fitted in the tap.

An automatic vacuum-operated fuel tap is a common alternative to the manual type **(see illustration 2.9b)**. The tap is operated by a flexible diaphragm inside the main body. This is connected by a synthetic rubber hose to the inlet port of the engine. The depression which exists in the inlet port when the engine is running opens the fuel tap, supplying fuel to the carburettor. As soon as the engine stops and the inlet port returns to atmospheric pressure, the tap closes.

On most vacuum-operated taps there is an additional manual reserve setting, and also a priming position, denoted by PRI. The latter allows the carburettor float bowls to be filled after they have run dry or have been drained; without this facility it would be necessary to crank the engine for a long time until sufficient fuel had flowed through to allow it to start.

There have been examples of electrical switching for fuel taps. Yamaha's FZR1000 was fitted with an auxiliary control set in the fairing cockpit panels to ease the task of switching over to reserve.

Fuel pump

In many cases the fuel flow from the tank to the carburettors is by gravity alone and a pump is not needed. However, with the use of straighter and almost vertical intake ducts the carburettors and air box sit much higher in the frame, and often occupy the space that would have previously been occupied by the fuel tank. The tank therefore has to fit around the airbox, and to maintain capacity much of the fuel is now stored in the rear of the tank, quite low down. This, coupled with the high position of the carburettors, means that a pump is required to feed the fuel from the tank to the carburettors.

Motorcycles with fuel injection require a pump to achieve the high fuel pressure required for the system. Typically a fuel pump used in an injection system would supply fuel at around 30 to 50 psi, compared to the pump pressure of 1.5 to 3 psi used for a carburettor system. Refer to Section 7 for more details.

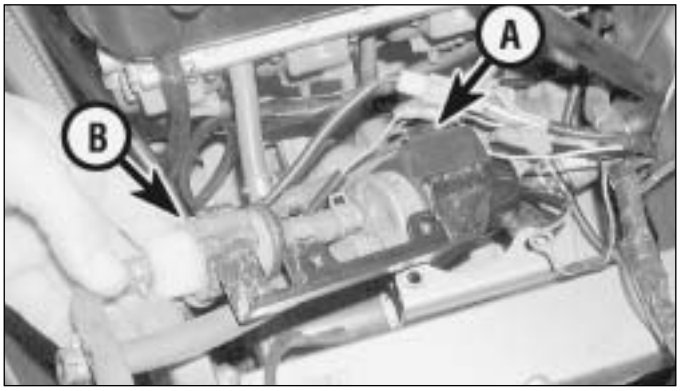
The fuel pump is usually electrically operated and is controlled by the ECU or engine management unit via a relay. Mechanical and vacuum-operated fuel pump designs have been used in the past, but have given way to more reliable and compact electrically powered pumps.

There are several types of fuel pump, the low pressure reciprocating plunger type and the high pressure roller cell, internal gear, peripheral channel and side channel types. The pump is either located in the fuel line from the tank, usually with a filter unit between them, or inside the fuel tank **(see illustrations 2.9c and d)**. High pressure pumps are often immersed in fuel or have fuel running through them to cool the pump.

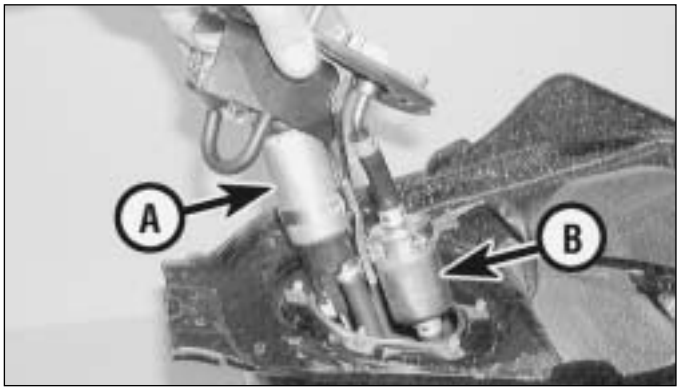
10 The air filter, airbox and air intake systems

Air filter

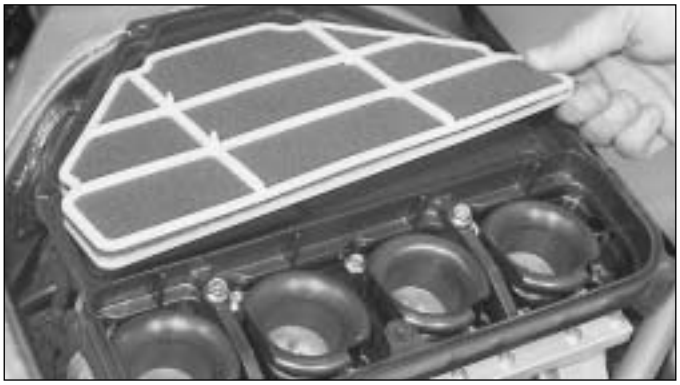
The reasons for fitting an air filter to an engine need little explanation, but it is worth considering the ways in which a supply of clean air can be achieved. Like most other components on motorcycles, the air filter has become increasingly sophisticated over the years; the early wire mesh arrangements having been replaced by the far more effective oil-impregnated foam or pleated paper filters used today **(see illustrations 2.10a and b)**.



2.9c Fuel pump (A) and filter (B) are mounted in the fuel line from the tank to carburettors



2.9d Fuel pump (A) and filter (B) mounted inside the tank

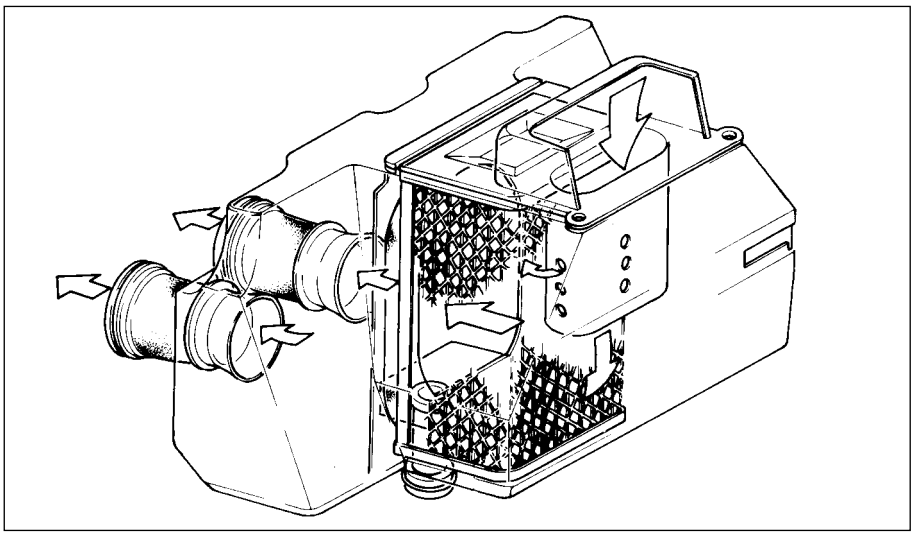


2.10a An impregnated foam type filter as used on Kawasaki's ZX6-R

2.10b A pleated paper type filter as used on Yamaha's R1

Both types are effective methods of trapping the airborne dust which would otherwise enter the engine to wear away the various moving parts, and it follows running the engine with the filter missing or damaged will effectively shorten the engine's life. Also because a filter's flow rate is designed in conjunction with the fuel system so that the correct fuel/air mixture is achieved, to run a bike with a dirty or missing air filter will upset the carburation of the machine.

Most four-strokes and many two-strokes use a filter element of pleated resin-impregnated paper. The resin impregnation prevents the paper from becoming saturated by moisture and thus disintegrating. The pleated arrangement presents the maximum filter area within the limits imposed by the filter housing. This allows the pores in the paper to be kept as fine as possible to trap almost all of the incoming dust, and at the same time avoids restricting the airflow to the engine. The oil-impregnated foam elements found on many smaller two-strokes are rather coarser in texture, and at first sight might seem less effective as filters. In practice, the oily surface presented to the incoming air catches a good deal of the dust.



2.10c Section view of typical air filter housing

All types of filter element require regular cleaning or renewal. The performance of the filter falls off gradually until it begins to affect the mixture strength or to allow dust to pass through it. In the case of the paper elements, the pores in the paper will become more and more clogged, air will pass through it less freely and the mixture will become excessively rich. With foam types, once the oily coating is covered by dust particles it will be unable to trap further dust until the filter element has been cleaned and re-oiled.

The airbox

The airbox used to be nothing more than a housing for the air filter, and on many smaller commuter motorcycles that it still mainly what it does.

In recent years it has developed into an integral part of the overall fuel system on sports and performance machines, working in conjunction with air intake systems (see below) **(see illustration 2.10c)**. It is designed