

Should the 'Diesel' Really Be Called an 'Akroyd'?

Most people think that the internal combustion engine was invented in the late 1800s, but the principle of internal combustion was demonstrated by Dutch scientist Christian Huygens way back in 1673. In the Huygens engine a piston was blown upwards in a cylinder by a gunpowder explosion.



When the resulting hot gases in the cylinder cooled atmospheric pressure forced the piston down again, completing its 'working' stroke.

Other experimenters followed in Huygens' footsteps, using flammable gases to drive pistons. These early internal combustion (IC) engines had little practical value, but proved the IC principle that is still employed in today's modern engines.

The first successful IC engine was patented by French engineer J J E Lenoir, in 1860. In this engine design the piston, for the first half of its stroke, drew in a mixture of air and flammable gas that was then ignited by a spark. The resulting expanding hot gases pushed the piston through the second half of its stroke, before escaping to the atmosphere. The flywheel maintained the piston's momentum as it returned, drawing from the other end of the cylinder an air/gas mixture that was ignited by a spark.

The next major design improvement was initiated by Dr N A Otto, in 1876. The Otto engine compressed the air/gas mixture before ignition, greatly improving thermal efficiency and fuel economy. This design was the first 'four stroke' engine.

In Otto's engine the first stroke of the piston served to suck in an air/gas mixture; the second stroke compressed the mixture; the third stroke was a power stroke, following ignition; and the fourth stroke pushed the burnt gases out of the cylinder. Ignition was accomplished by exposing the air/gas charge to a flame, a heated tube or by using an electrical spark.

At this stage of IC engine development the principal fuel used was coal gas; it being readily available as a light and heat source for industry and homes, and all early IC engines were stationary ones.

The need for a portable fuel led to the development of petroleum spirit, but the high cost and highly dangerous nature of petrol sent inventors looking for engine designs that would operate on a cheaper, safer liquid fuel, such as paraffin.

The first successful oil-fired engine was built in the UK by Priestman Bros in 1885. In this engine oil was sprayed into a manifold vaporiser, heated by exhaust gases, where it mixed with air, before being drawn into the cylinder. An external lamp was used for starting the engine.

Compressing an inflammable air/gas mixture made the early IC engine developers only too familiar with the phenomenon of pre-ignition, when the mixture exploded before the ignition was triggered, causing severe engine damage.

A solution to the pre-ignition problem was sought by a British inventor, Herbert Akroyd Stuart, who patented his compression-ignition engine in 1890.

In this engine only air was drawn into the cylinder on the induction stroke, eliminating the risk of pre-ignition. The oil fuel was sprayed into a bulb-shaped extension of the cylinder, where it was ignited by the heat of the compressed air inside the cylinder. The bulb was heated by a blow-lamp for starting.

The Akroyd Stuart engine used a mechanical pump to spray fuel into the engine and this 'solid injection' system employed the principle used in subsequent automotive compression ignition injection systems.

Richard Hornsby and Sons Ltd produced several Akroyd Stuart engines in 1892-93, one of which was still operating in a Bletchley timber yard in the late 1920s.

Over in Germany in 1892 the man whose name would be forever associated with the compression ignition engine, Dr Rudolph Diesel, had worked out mathematically that a compression ignition engine had thermodynamic advantages over a spark-ignition one.

In his design there was no need for an external heat source, for starting.

Because pulverised coal was Rudolph Diesel's first choice his early engine designs used air-blast injection, but the coal-fuelled engine proved cranky and one exploded, killing a laboratory assistant. Development of Diesel's engines by MAN and Krupp saw oil fuel injection largely adopted.

Herbert Akroyd Stuart died in 1937, having seen developments of his and Dr Rudolph Diesel's engine designs power the modern world. Diesel wasn't so fortunate, being lost at sea in 1913.