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Fig.1

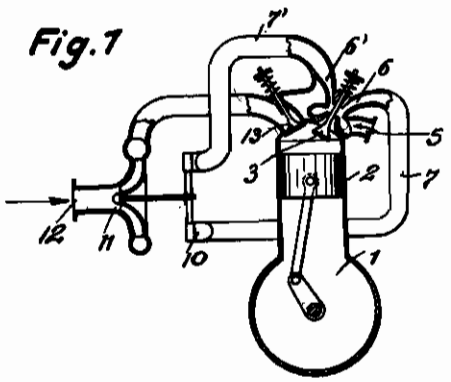
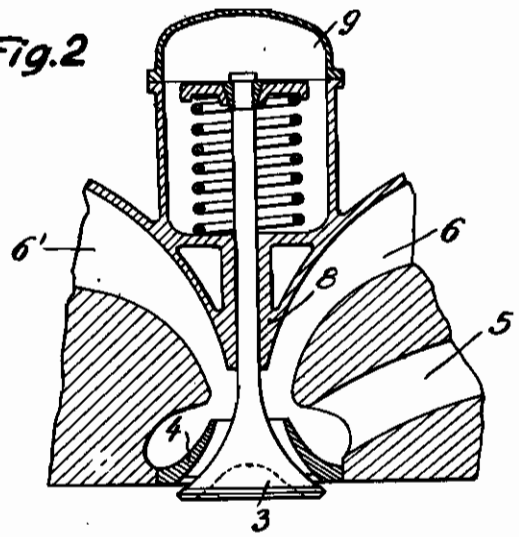


Fig.2



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ALIEN PROPERTY CUSTODIAN

INTERNAL COMBUSTION ENGINE

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The present invention relates to internal combustion engines and more particularly to a device for utilizing the energy of the exhaust gases from such engines.

It is well known that the power output of internal combustion engines can be increased when the energy in the exhaust gases is utilized for driving a supercharger to increase the charge to the engine or when, in the case of, for example, aircraft engines, the exhaust gases are allowed to escape in a direction opposite to that of the movement of the aircraft, so as to generate additional propulsion.

Hitherto the former measure has been used generally in the form in which the exhaust gases are compressed in front of the turbine and a fall in pressure to atmospheric pressure in the turbine utilized. This compression of the gases has, however, the drawbacks that the engine has to produce increased counter pressure during the exhaust stroke and that a greater amount of residual gases remains in the cylinder, so that both the charge and the output of the engine are reduced, and the temperature of the exhaust valve increased, leading possibly to its destruction through overheating. The result has been that the advantages of an exhaust gas turbine drive for the super charger as compared with a super charger mechanically driven by the engine are only slight, and it is not until high altitudes are reached that the superiority of the exhaust gas turbine driven super-charger becomes apparent. Moreover, in the case of aircraft it is desirable to increase the output of the engine when on the ground, in order to obtain rapid lift and climb. The increased output which this requires from the turbine driving the super-charger can, however, be obtained only by increased compression of the exhaust gases with its attendant drawbacks, which have led to a separate super charger driven by the engine being adopted for starting purposes.

In addition, the temperature of the exhaust gases from internal combustion engines is high and difficulties arise in the turbine drive, as the tensile strength of the rotating parts of the turbine decreases rapidly as the temperature rises. For this reason relatively slow running engines of great weight must be utilized. The fact that the manifold becomes red hot also tends to complicate construction and the exhaust valves are exposed to high temperatures which also influence their tensile strength and life.

Now, it has already been proposed to lower the exhaust temperature by mixing direct with the exhaust gases a portion of air conveyed by the supercharger by means of increased scavenging of the engine or by bye-passing the engine. However, some of the energy recovered from the exhaust gases is wasted owing to the necessity of increasing the output of the supercharger, the dimensions of which consequently also have to be increased.

On the other hand, when it is desired that the exhaust gases co-operate direct in generating propulsion, compression again becomes necessary and this involves the aforesaid drawbacks as regards greater counter pressure on the part of the engine during the exhaust stroke and more residual gases in the cylinder. In this method of utilizing the energy of the exhausting gases it is necessary to effect temperature reduction by admixing additional air in order to reduce the velocity of the exhaust flow by increasing the mass of the gas. High efficiency can be obtained only when the velocity of the exhaust gases is slightly greater than the speed of movement of the vehicle.

The object of the present invention is to provide a device for utilizing the energy of the exhaust gases of internal combustion engines by means of exhaust gas turbines or by means of recoil action, as a result of which air is added to the exhaust gases, the device being in the nature of a jet pump.

The aforesaid difficulties are completely eliminated by means of the new device. In principle it is no longer necessary to increase the size of the supercharger or to require from it a greater output. A separate supercharger driven by the engine for starting purposes is unnecessary.

According to the special constructional form of the present invention, the exhaust valve, the valve seat and the inner end of the exhaust manifold are designed in the manner of a jet pump, the valve and valve seat acting as enlarged nozzles which allow the gases to expand to below atmospheric pressure. This partial vacuum causes cooling air to be aspirated from the atmosphere, and the mixture of air and exhaust gases is then compressed to the initial pressure of the turbine or jet apparatus in a pipe line which acts as a diffuser. The admixed air increases the weight of the gas and lowers the temperature. In this manner the output of an exhaust turbine, where such is used, may be increased at moderate temperature, in order to increase the velocity and reduce the dead weight. This measure greatly benefits the engine, as the pressure behind the valve decreases to below ex-

ternal pressure and is equal to atmospheric pressure when the gas flow ceases, so that the residual burnt gases are thoroughly expelled from the combustion chamber and the counter pressure of the engine during the exhaust stroke reduced. The supercharging pressure may be increased for starting without unduly compressing the exhaust gases behind the valve, since the turbine has a high output when the pressure behind the valve is equal to the external pressure, inasmuch as the pressure at the end of the jet pump is higher than the pressure behind the valve. The valve and the valve seat are satisfactorily cooled by means of the incoming air, and this is of great advantage to the engine in many ways.

It is essential to the recovery of energy from the exhausting gases that the latter, which escape at a very high velocity, should not immediately be too suddenly deflected, as otherwise it will be impossible to obtain satisfactory working of the ejector constituted by the exhaust valve. For this reason care is taken to allow the exhaust gases to flow annularly through the ejector substantially in the direction of the valve stem after passing the valve.

In order to provide sufficient space for the control gear of the exhaust valve and to obtain efficient cooling of the valve guide it is preferable to divide the exhaust manifold into two or more pipes.

The invention is illustrated by way of example in the drawing in which,

Figure 1 illustrates diagrammatically a cross section through the cylinder of an internal combustion engine fitted with the device according to the invention, and

Figure 2 is a detail sectional view showing the construction and mounting of the valve.

The cylinder **2** of the internal combustion engine **1** expels the burnt gases during the exhaust stroke through the exhaust valve **3**. The exhaust valve **3** co-operates with the valve seat **4** and with said seat constitutes a jet nozzle through which cooling air is aspirated through the branch pipe **5**. The cooling air mixes with the exhaust gases and the mixture is compressed to the initial pressure of the turbine in the parts **6**, **6'** of the exhaust manifold which parts act as a diffuser. The exhaust manifold is divided into two pipes **7**, **7'**, communicating respectively with the parts **6**, **6'**, this construction providing a simple valve guide **8** and providing space for the disposition and mounting of the valve control gear. The exhaust gases are fed to the turbine **10**, and the latter drives the supercharger **11**, which conveys the fresh air aspirated through the branch pipe **12** to the inlet valve **13** and thus to the engine **1**.

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