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F. EGERSDÖRFER
INTERNAL COMBUSTION ENGINES
Filed Aug. 30, 1938

Serial No.
227,468
3 Sheets-Sheet 1

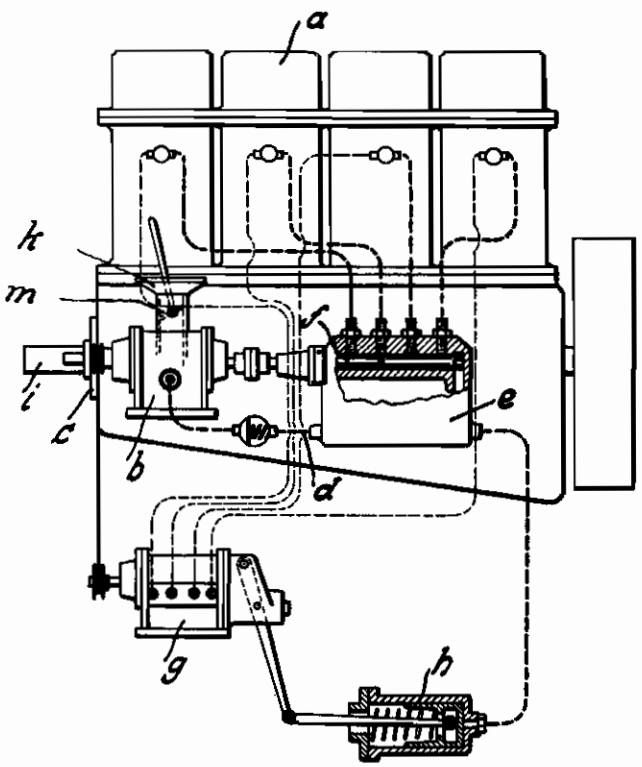

Fig. 1

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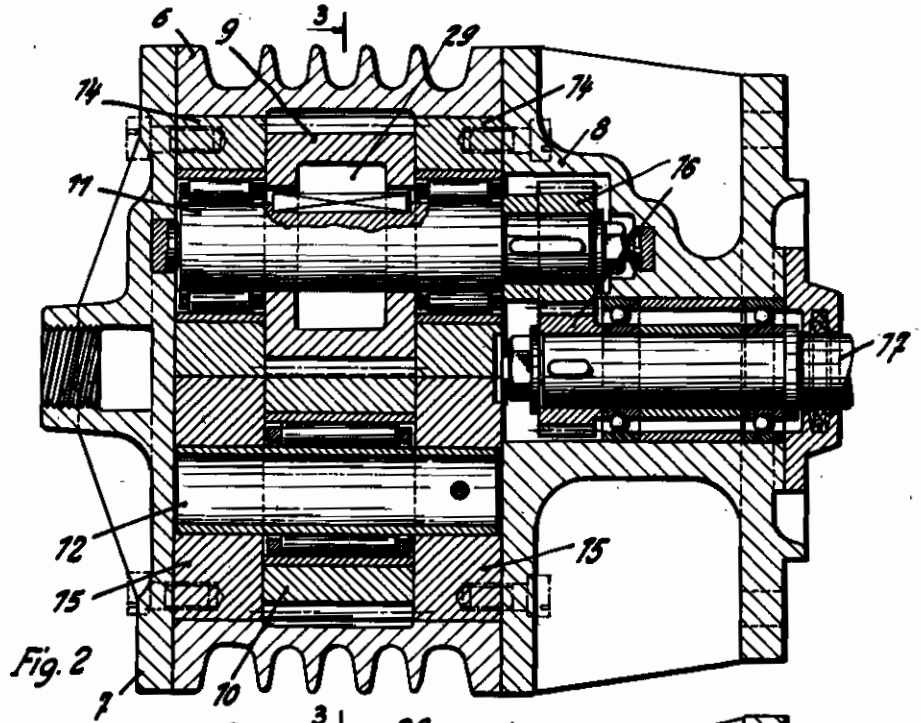

Fig. 2

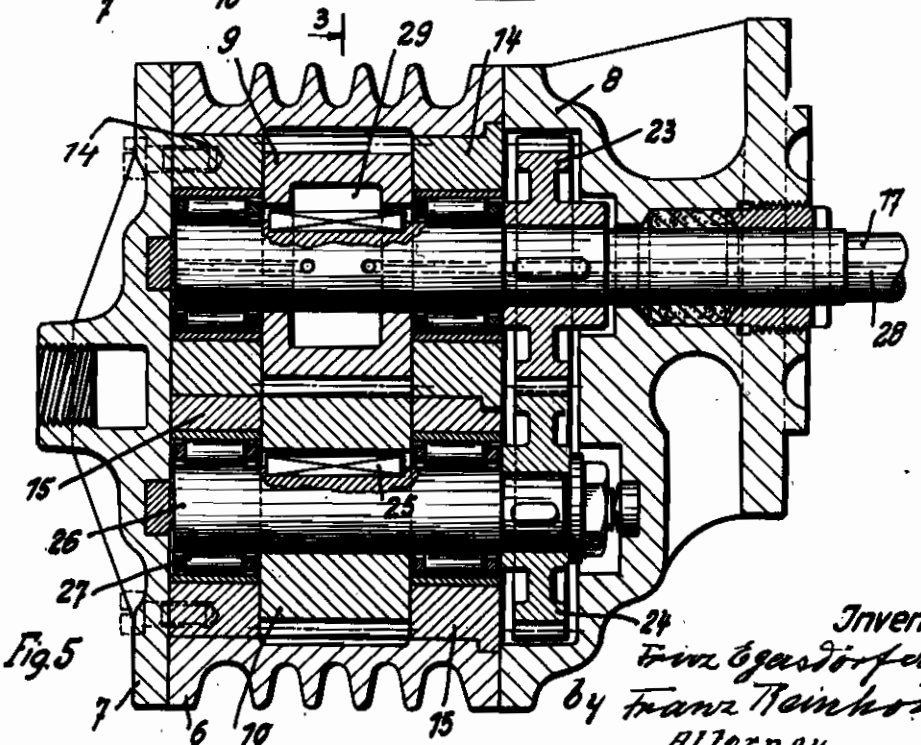

Fig. 5

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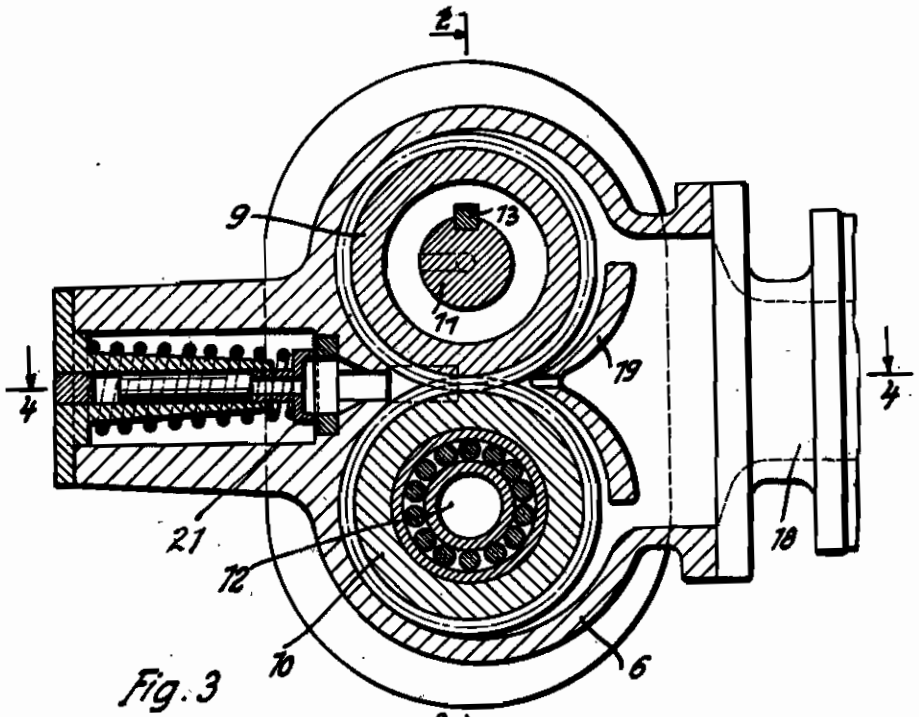

Fig. 3

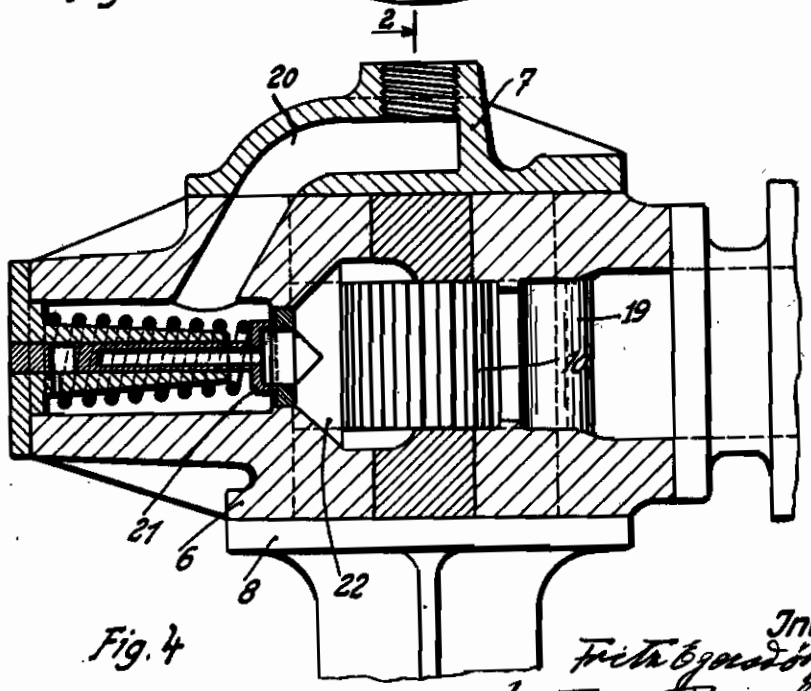

Fig. 4

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ALIEN PROPERTY CUSTODIAN

INTERNAL COMBUSTION ENGINES

Fritz Egersdörfer, Berlin, Germany; vested in the Alien Property Custodian

Application filed August 30, 1938

My invention relates to improvements in internal combustion engines, and more particularly in the means for supplying pre-compressed air for supporting combustion and scavenging. One of the objects of the improvements is to provide an engine of this type in which air for producing the combustible mixture and for scavenging may be supplied at high pressure say of four atmospheres and more, by means of a small pump which is driven from a rotary part of the engine, and which requires little space, so that it may be readily associated with the engine. Another object of the improvements is to provide an engine in which the pump for supplying the air may be driven at very high speed such as 24,000 per minute, and in which notwithstanding this high velocity the pump has a high volumetric efficiency, and in which loss of air from the pump is avoided.

Another object of the improvements is to provide an engine which may be readily controlled by varying the amount of air supplied by the pump.

Further an object of the improvements is to provide an engine in which the means for supplying the said air under pressure are simple in construction and consist of a comparatively small number of elements which require little attention by the engineer.

With these and other objects in view my invention consists in combining the engine with a gear pump for supplying the said air under pressure which pump comprises interengaging gear wheels compressing the air and supplying the same to the cylinder or cylinders of the engine, the said pump being connected with a suitable rotary part such as the crank shaft of the engine through a transmission gearing having a high gear ratio of say 1 to 6, so that the number of revolutions of the pump is a multiple of that of the driving element. For regulating the volume of air supplied by the pump a valve or gate is provided in the suction pipe of the said pump.

The air pump is preferably associated with a fuel pump which is controlled in dependence of the pressure of the air delivered from the pump.

My improved system may be used in connection with two-stroke and four-stroke cycle internal combustion engines.

For the purpose of explaining the invention two examples embodying the same have been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings

Fig. 1 is a diagrammatic elevation partly in section showing a four-cylinder internal combustion engine having the air supplying pump and other parts associated therewith,

Fig. 2 is a sectional elevation showing the pump,

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 2,

Fig. 4 is a sectional plan view taken on the line 4—4 of Fig. 3, and

Fig. 5 is a sectional elevation similar to the one illustrated in Fig. 2 and showing a modification.

Referring at first to the diagrammatical elevation shown in Fig. 1, a four-cylinder internal combustion engine *a* is associated with a gear pump *b* for supplying air under high pressure of say four atmospheres or more for producing the combustible mixture and for scavenging, the said gear pump being connected with the crank shaft *i* of the engine by a transmission gearing *c* transmitting power at the gear ratio of 1 to 6, so that the number of revolutions of the pump is six times that of the said crank shaft. The said gear pump delivers air under pressure through a pipe *d* and a wind chest *e* into the manifold of the internal combustion engine. The suction conduit *k* of the pump is provided with a throttle valve *m* for regulating the volume of air delivered by the pump.

As is shown in Figs. 2 to 4 the gear pump consists of a cylinder 6 formed with cooling ribs and closed at its ends by heads 7 and 8. Within the cylinder there are two gear wheels 9 and 10 which are mounted on shafts 11 and 12. The gear wheel 9 is fixed to the shaft 11 by means of a feather 13 permitting axial displacement of the gear wheel on the shaft. The shaft 11 is mounted in bushings 14 the diameter of which is equal to the outer diameter of the gear wheel, and the said bushings are likewise loosely mounted within the cylinder 6. Thus the bushings set themselves with their outer end faces flush with the end faces of the cylinder 6, and their inner end faces are in loose engagement with the end faces of the gear wheel 9. The gear wheel 10 is rotatable on the shaft 12, and the said shaft is fixed in bushings 15 the outer diameter of which is equal to that of the gear wheel 10, and the said bushings are formed with segmental recesses accommodating the adjacent portions of the bushings 14. Also the gear wheel 10 and the bushings 15 are floating within the pump casing. Thus the gear wheels are free to set themselves within the casing so that there is no wedging

of the parts though the bearings of the shafts have close fit within the casing.

The driving shaft 11 is driven through a toothed gearing 16 from a driving shaft 17 which is connected by means of the transmission gearing *c* with the crank shaft of the engine.

In the suction passage 10 of the pump there are guide plates 19 by means of which the air has a gradual and smooth flow to the gear wheels. When such guide members were not provided the air would intermittently flow to the spaces between the teeth of the gear wheels 9 and 10, which would cause a strong noise. Within the pressure chamber 20 there is a spring pressed valve 21 which prevents the air delivered from the spaces between the teeth of the gear wheel from returning from the pressure conduit to the pressure chamber 22.

The modification shown in Fig. 5 is similar in construction to the gear pump shown in Figs. 2 to 4, and the same reference characters have been used to indicate corresponding parts. As distinguished from Figs. 2 to 4, the gear wheels 9 and 10 are connected with gear wheels 23 and 24, the gear wheel 10 is connected with its shaft 26 by a feather 25, and the said shaft is rotatably mounted in antifriction bearings 27 fitted in the bushings 15. The gear wheels 23 and 24 are set so that they are able to take up the moment transmitted from the driving shaft 17 to the shaft 26, so that the pressure of the teeth of the gear wheels 9 and 10 is not higher than is needed for tight engagement of the teeth. Thus the friction between the gear wheels 9 and 10 is reduced substantially to zero so that the gear wheels do not run hot. The teeth of the gear wheels 23 and 24 are preferably disposed angularly of each other.

In the operation of the internal combustion engine the air is supplied by the gear pump *b* and, if desired, through a distributor or controlling device *f*. The intake valves of the internal combustion engine may be automatically controlled by means of the compressed air through the intermediary of the distributor. When the load of the engine is increased the throttle valve *m* provided in the suction pipe of the pump is opened for supplying a larger amount of air to the working cylinders. If it is desired for example to increase the velocity of the engine provided for example on an air craft, the throttle valve *m* is further opened, so that the amount of air and fuel supplied to the engine and thereby the velocity of the engine are increased. Preferably the gear wheels are provided with cooling chambers 29 to which cooling air may be supplied from without for example through bores 20 made in the shaft 17.

The fuel injection pump *g* is controlled by means of a spring pressed plunger *h* in accordance with the air pressure within the chest *e*, so that the volume of fuel corresponds to the volume of air supplied to the engine particularly in case of operation of the engine with precompressed air.

FRITZ EGERSDÖRFER.