

# PATENT SPECIFICATION



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## COMPLETE SPECIFICATION

### Improvements in or relating to Internal Combustion Engines of the Opposed Free Piston Type

We, SULZER FRÈRES SOCIÉTÉ ANONYME, a Company organised under the Laws of Switzerland, of Winterthur, Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention relates to an internal combustion engine of the type having opposed free pistons which are provided with coupling rods connected to oscillating bodies of which one actuates the members which control the operation of the engine.

According to this invention in an engine of this type there is provided a supplementary oscillating mass which may be a ratchet wheel and whose effect as a flywheel is approximately equal to that of the mechanism controlling the operation of the engine, this supplementary oscillating mass being attached to the oscillating body which does not actuate the control members in order to keep uniform the stresses on the rods which connect the pistons to both oscillating bodies.

The oscillating bodies may be rocking levers connected to the pistons by rods, but alternatively these bodies may be toothed wheels connected to the pistons by racks.

An example of a construction of engine in accordance with this invention is shown diagrammatically in the accompanying drawings, in which

Figure 1 is a side view of the improved engine partly in longitudinal sectional elevation and showing part of the mechanism for operating the controls.

Figure 2 is a cross-section through the middle of the engine as shown in Figure 1.

Figure 3 shows the engine as seen from the side opposite from that viewed in Figure 1 and is partly an elevation and partly a longitudinal section, the supplementary oscillating mass being shown together with the mechanism in engagement with it.

The pistons 1 and 2 acted on by the combustion gases are connected to the compressor pistons 3 and 4 and operate

in effect as free pistons in the cylinder 8. The compressor pistons 3 and 4 draw in air, for example from the atmosphere, through suction valves 5 and deliver the compressed air by way of the valves 6 to the cylinder 8.

The coupling rods 10 and 11 are attached by pins 7 and 9 to points approximately in the middle of the length of the pistons 1 and 2 and thus these rods couple the two pistons together through the oscillating member 12. This member 12 is connected to the coupling rods 10 and 11 by pins 30 and 31. The pistons always move oppositely and are accurately synchronised. The coupling rods 10 and 11 and the member 12 lie at one side of the middle or combustion cylinder 8 which is indicated in the drawing by dotted lines.

Connected to the oscillating member 12 which is mounted on a shaft 13 is a toothed wheel 14 which transmits motion through the toothed wheels 15 and 16 mounted on shafts 17 and 18 to the cams 20 (see Figure 2). On the other side of the cylinder 8 there is a similar arrangement of coupling rods namely the rods 22 and 23 (see Figure 3) which are connected by pins 24 and 25 to the oscillating member 26 mounted on a shaft 27. Connected to this member 26 is a wheel 28 which has ratchet teeth 33. The coupling rods on both sides of the cylinder 8 can be seen in the cross-section in Figure 2.

In addition to the cams 20 the other members which control the operation of the engine are housed in the casing 21 and also actuated through the toothed wheels 14, 15 and 16. During the working of the engine all these control-operating parts and the wheels 14, 15, 16 and cams 20 exert alternately accelerating and retarding forces which are transmitted by the oscillating member 12 and rods 10 and 11 to the pins 7 and 9 on the pistons.

In order that the forces expended on the pistons may be the same on all sides, that is to say in order that forces may be exerted not only on the pins 7 and 9 but also on the pins 34 and 35 lying opposite to them, a supplementary oscillating mass 28 is attached to the oscillating member 26 and the flywheel effect of this mass,

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that is to say its resistance to acceleration and retardation, is approximately equal to the resistance to acceleration and retardation of the operating gear 14, 15, 5 16 and 20 and the member 12.

It is desirable for the supplementary oscillating mass 28 to be provided with external teeth 33 adapted to engage a ratchet device consisting of a clutch lever 10 37 shown in Figure 3, a pawl 38 and the pin 36 attached to the framing. This device can be used for barring the pistons by hand.

Owing to the supplementary oscillating mass 28 the flywheel effect will be approximately equal to that of the mechanism which controls the engine and/or the parts operating that mechanism in order to keep approximately uni- 20 form the stresses on the coupling rods 10, 11, 22 and 23.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be 25 performed, we declare that what we claim is:

1. An internal combustion engine of the type indicated having a supplementary oscillating mass, which may be a ratchet wheel, and whose flywheel effect is approximately equal to that of the mechanism controlling the operation of the engine, this supplementary oscillating mass being attached to the oscillating body which does not actuate the control members for the purpose of keeping uniform the stresses on the rods which couple the pistons to both oscillating bodies. 30 35

2. An internal combustion engine as claimed in Claim 1 in which the oscillating bodies are rocking levers connected to the pistons by rods. 40

3. An internal combustion engine as claimed in Claim 1 in which the oscillating bodies are toothed wheels connected to the pistons by racks. 45

Dated this 6th day of October, 1943.

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Fig. 1.

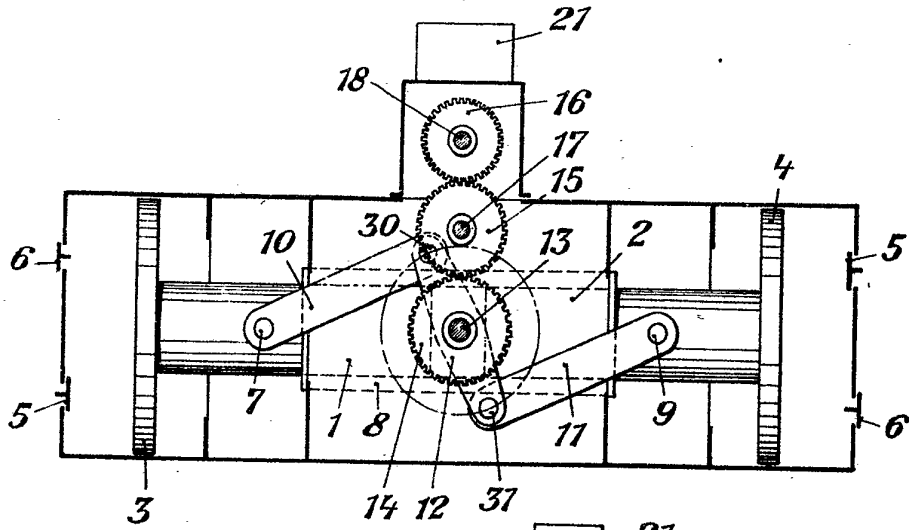


Fig. 2.

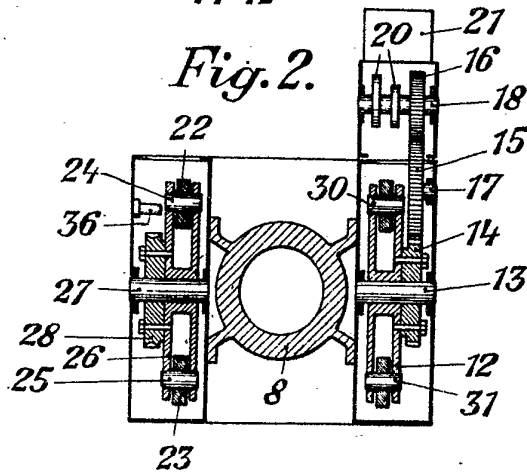
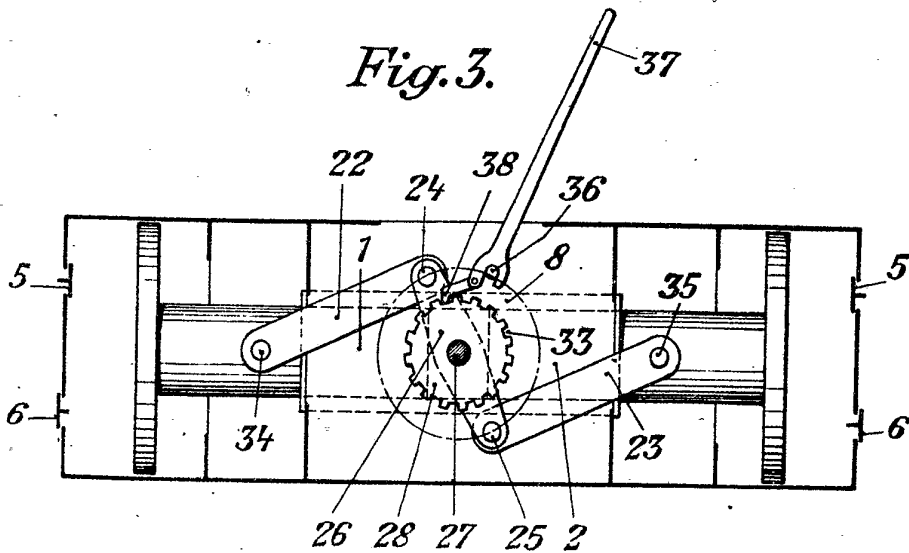


Fig. 3.



[This Drawing is a reproduction of the Original on a reduced scale.]