N° 1003 A.D. 1911

(*Under International Convention.*)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in Italy), 14th Jan., 1910

Date of Application (in the United Kingdom), 13th Jan., 1911

At the expiration of twelve months from the date of the first Foreign Application, the provision of Section 91 (3) (a) of the Patents and Designs Act, 1907, as to inspection of Specification, became operative

Accepted, 7th Sept., 1911

COMPLETE SPECIFICATION.

An Improved Two Stroke Cycle, Internal Combustion Engine.

I, ARNOLD ZOLLER, of 79 *via* Assietta, Turin, Italy, Engineer, 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 two stroke double acting internal combustion engines.

It has been proposed in such engines in order to combine lightness and simplicity, to arrange three pistons in tandem in one open ended cylindrical chamber. The two outer pistons are tied together by external yokes operating on two outer cranks, whilst the centre double acting piston which controls a series of circumferential ports drives the centre crank by a rod passing through one of the outer pistons.

It has also been proposed in a two stroke double acting internal combustion engine to compress the scavenging air and fuel by means of blowers, the compressed gases entering and leaving the cylinders through series of circumferential ports. A turbine blower has also been used in connection with two stroke cycle internal combustion engines having cylinders arranged in tandem and provided with ports controlled by the pistons.

The present invention consists in a two stroke cycle double acting internal combustion engine in which the air or explosive mixture used for scavenging is compressed by a turbo-compressor and is admitted to the cylinder through two series of circumferential ports controlled by the double acting piston which is attached to two connecting rods arranged symmetrically outside the cylinder and at either side thereof, and connected to two side cranks on the crank shaft.

With a turbo-compressor directly driven from the engine the final pressure of the scavenging air increases in proportion to the number of revolutions of the engine; consequently, owing to the greater pressure of the air, the scavenging is more rapidly effected.

When the turbo-compressor is used in connection with an engine on a vehicle, the air pressure caused by the motion of the vehicle can be directly utilised as the initial pressure whereby an increased final pressure of the scavenging air is obviously attained.

[*Price* 8*d.*]

Moreover a greater pressure of the air, whether obtained by increasing the compression of the air itself or from increased velocity of the vehicle on which the engine is mounted, causes an increased compression in the said engine, and is also of great advantage to the scavenging.

A constructional form of the improved engine is given by way of example in the accompanying drawings in which:—

Figure 1 represents the engine in vertical section through one of its three radially disposed cylinders, through the turbo-compressor, and the carburetter.

Figure 2 is a vertical section through the same cylinder, the plane of section being at right angles to that of Figure 1, and showing the connection by means of lateral side rods of the pistons II and III of the engine.

Figure 3 is a horizontal section through the cylinder at the height of the lower exhaust ports; and

Figure 4 a similar section at the height of the upper exhaust ports;

Figure 5 is a horizontal section of the cylinder at the height of the ports for the admission of the scavenging air;

Figure 6 is a front elevation of the engine with three radially arranged cylinders,

Figure 7 is a crank diagram, and

Figure 8 a transverse section of the crank.

In the present invention and referring to Figs. 1 and 2 the engine piston I is connected by means of the two symmetric lateral connecting rods 1 to the lateral cranks 2 of the engine crankshaft 3, and thus directly transmits the axial forces so that owing to the relief thus given to the walls of the engine cylinder 4, a large number of ports may be made all round the cylinder, and the holding down bolts of the cylinder and of the crank case, the bearings 6 and the crankshaft 3 be made very light. Finally this construction, in which the engine piston I is connected to the crankshaft 3 by lateral connecting rods 1, enables this piston to be used as a double acting piston, thus providing a double acting engine without piston rods, stuffing boxes, cross heads or guides, and consequently without any means for cooling and lubricating such members. In addition to its extreme simplicity this arrangement has the further advantage that owing to the piston rods being eliminated, the back and front effective surfaces of the piston are equal which assists the smoothness of the running of the engine.

Owing to the piston II, arranged in the upper explosion chamber, being connected to the lower piston III by means of lateral coupling rods 7, the axial forces acting on the upper piston are transmitted to the lower piston, which has the function of a cross head and is connected through a connecting rod 8 to the central crank 9 of the crankshaft 3. The central crank 9 therefore, by means of the two outer pistons governs alternately the lower and upper exhaust ports 10 and 11 respectively. The side cranks 2 on the other hand, through the side connecting rods 1 and the double acting piston I, govern the ports 12, 13, for the admission of the scavenging mixture.

In order to lower the pressure in the cylinder to the value necessary for effecting an economical scavenging, the exhaust ports 10, 11 are opened in advance relatively to the admission ports 12, 13. That is to say the crank 9 connected to the pistons governing the exhaust ports 10, 11, is advanced by an angle δ relatively to the side cranks 2, governing the ports 12, 13 (see Figs. 7, 8). This arrangement has the slight drawback of causing different dead points, but may be compensated by a retardation of ignition or of the fuel injection.

A two stroke cycle double acting engine, with valveless distribution, as above described, without piston rods or stuffing boxes and provided with a turbo-compressor for the compression of the scavenging mixture has therefore considerable advantages over known engines. In the first instance advantages from the standpoint of economic efficiency owing to the turbo-compressor producing a very considerable useful effect and ensuring perfect scavenging, secondly advantages as regards mechanical efficiency owing to the elimination of all

valves, springs, cams, shaft and gear wheels corresponding thereto, and lastly the advantages resulting from great durability and smooth, silent running.

It is easy to understand the working of the engine from the foregoing. The air passing through the funnel 14 mixes in the tube 15 with the benzene issuing from the spraying tube 16. This mixture is drawn in by the rotors or moving wheels 17, 18 of the turbo-compressor (Fig. 1), compressed, and driven through the compression pipes 19 into the radially disposed cylinders 4^{I}, 4, 4^{II}, (see Figs. 1 & 6). The mixture coming from the pipes 19 passes through the ports 12, 13, governed by the piston I connected to the cranks 2, to the lower and upper ends of the cylinders alternately. The mixture, after undergoing compression, ignition and expansion, issues from the cylinders alternately through the exhaust ports 10, 11, governed by the pistons II, III through the agency of the crank 9.

The radial arrangement of the cylinders (Fig. 6), in which the centre lines of two successive cylinders form an angle of 60°, enables six working phases to be obtained during one revolution of the crankshaft. Such an arrangement corresponds therefore to a four stroke cycle engine with twelve cylinders. It is obvious that this engine may equally well be rotary; in this case the cylinders are arranged radially and symmetrically about the axis of rotation.

The engine hereinbefore described is chiefly remarkable for the absence of distribution valves, its reliable, smooth and silent running, its durability, its light weight for any given power, and is especially applicable to aviation, dirigibles, motor cars and boats. With a few small alterations to make it suitable for consuming mineral oils, this engine may be applied to any industrial purpose.

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

1. A two stroke cycle double acting internal combustion engine in which the air or explosive mixture used for scavenging is compressed by a turbo-compressor and is admitted to the cylinder through two series of circumferential ports controlled by the double acting piston which is attached to two connecting rods arranged symmetrically outside the cylinder and at either side thereof, and connected to two side cranks on the crank shaft.

2. An engine as claimed in Claim 1, in which each cylinder has its two outer pistons interconnected by means of side coupling rods external to the cylinder, these pistons being connected to a single connecting rod and central crank, and controlling upper and lower sets of exhaust ports.

3. The improved two stroke cycle double acting internal combustion engine, substantially as hereinbefore described and illustrated in the accompanying drawings.

Dated this 13th day of January, 1911.

MARKS & CLERK,
57 & 58, Lincoln's Inn Fields, London, W.C.,
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25, Market Street, Manchester,
Agents.

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ZOLLER'S COMPLETE SPECIFICATION.

Fig. 1

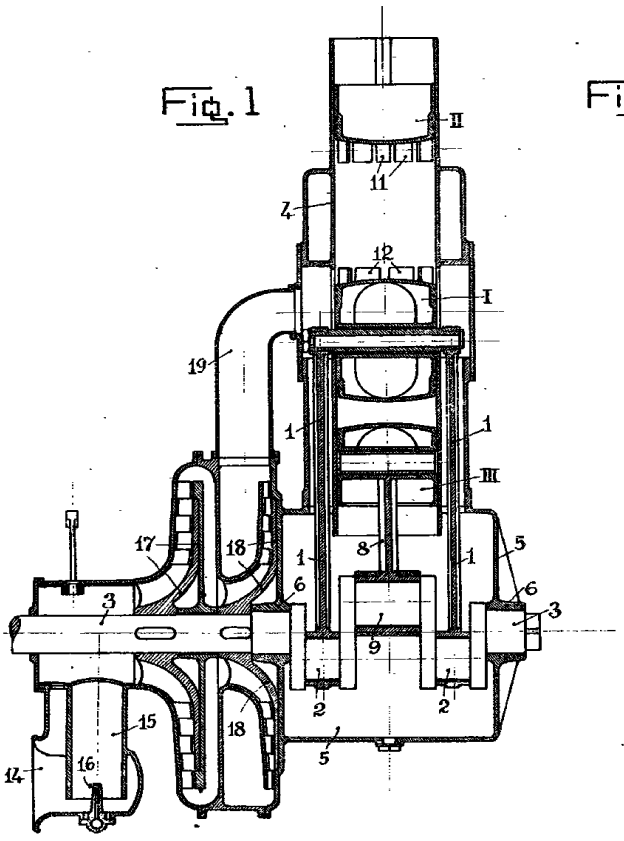


Fig. 2

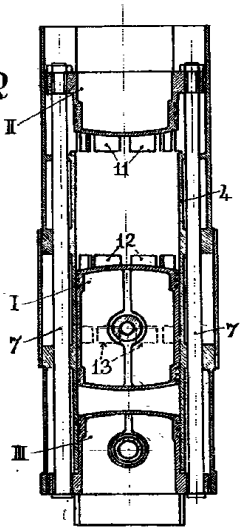
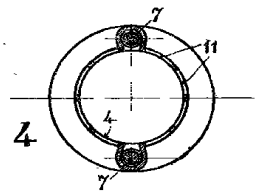


Fig. 4



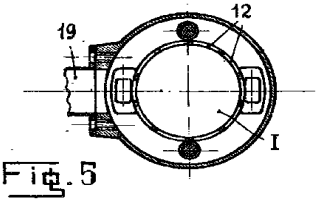


Fig. 5

Fig. 3

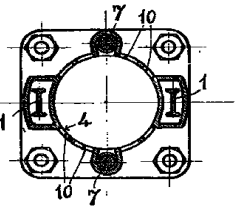


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Fig. 1

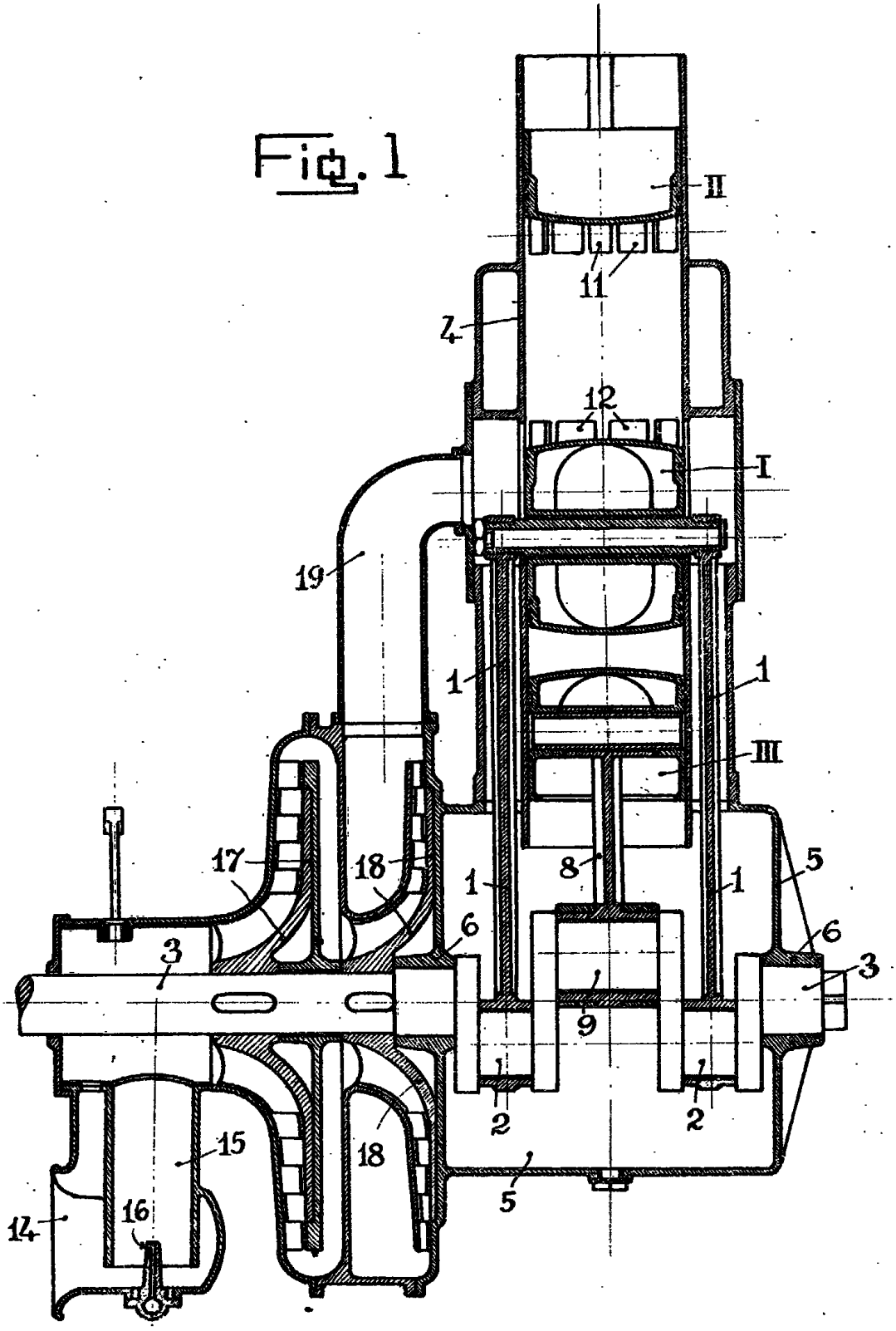


Fig. 2

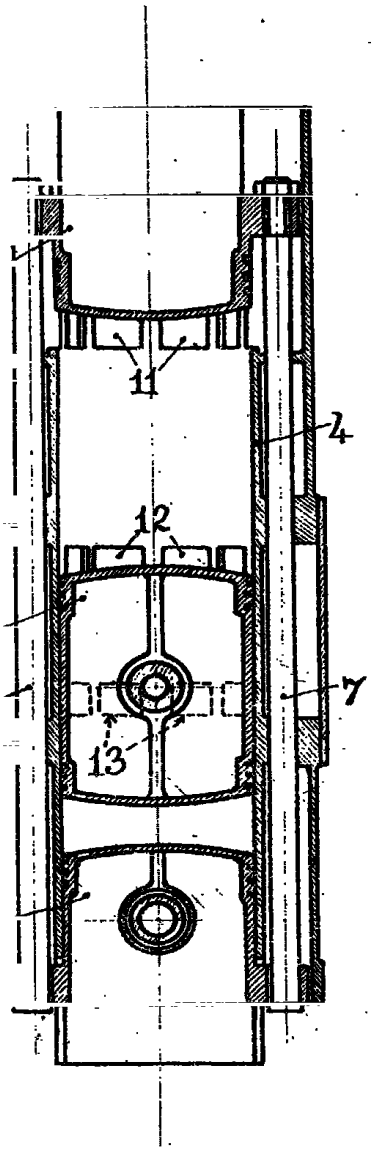
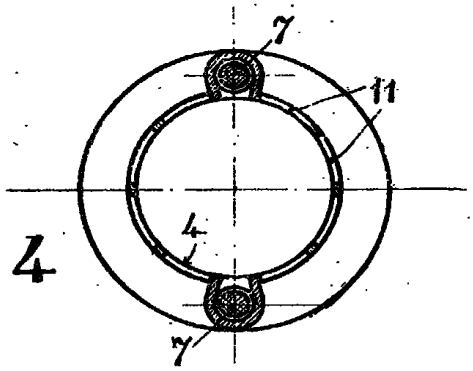


Fig. 4



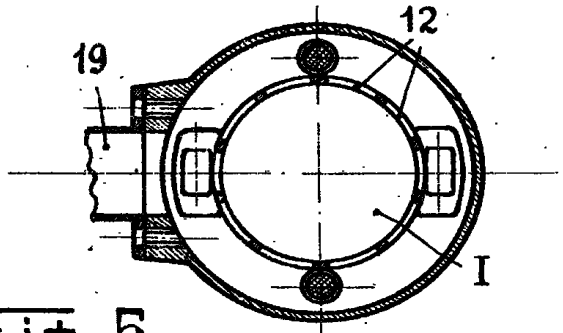


Fig. 5

Fig. 3

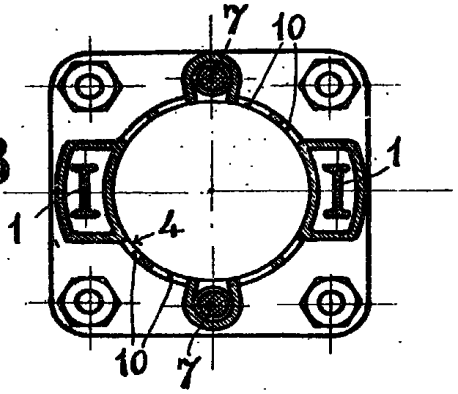


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FIG. 7

FIG. 6

FIG. 8

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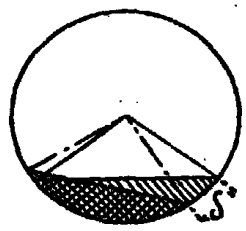


Fig. 7

Fig. 6

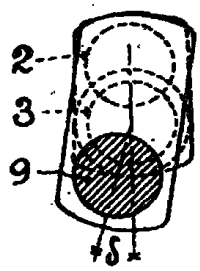
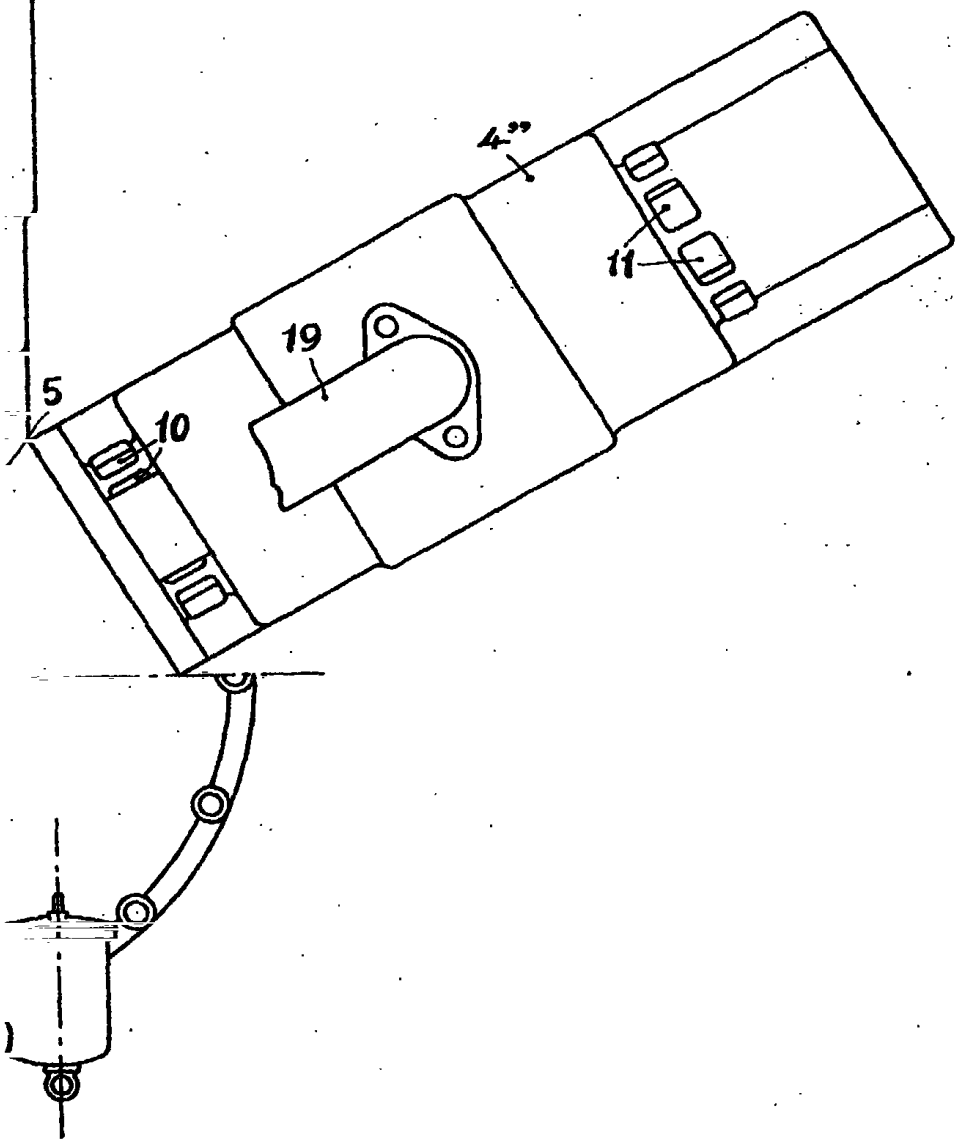


Fig. 8



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