May 23, 1961 A. SCHEITERLEIN 2,985,156

ENGINE WITH RECIPROCATING PISTONS

Filed July 28, 1959 3 Sheets-Sheet 1

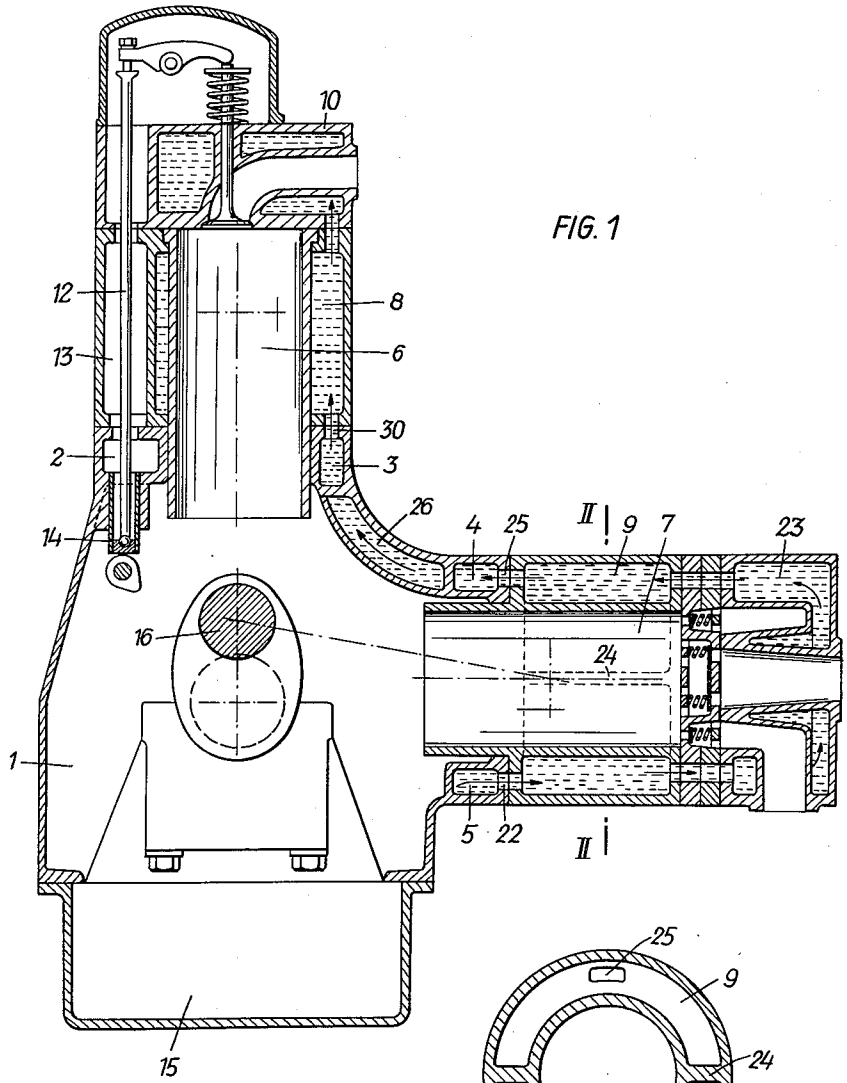


FIG. 1

FIG. 2

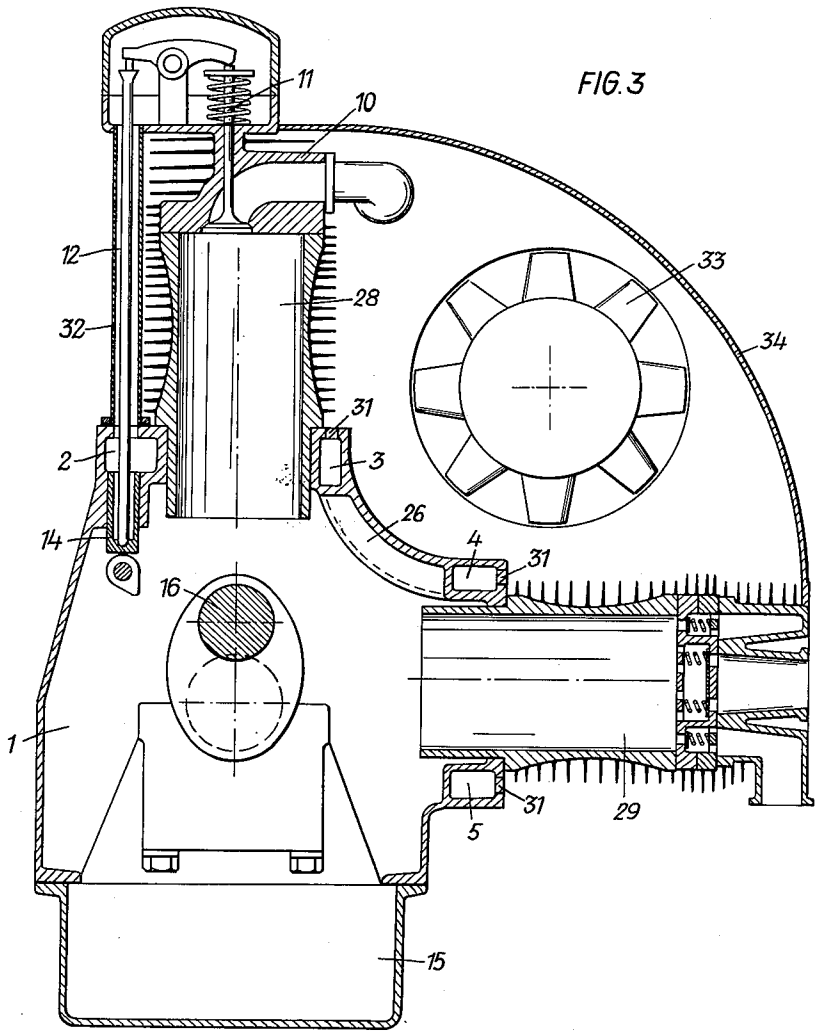
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FIG. 3



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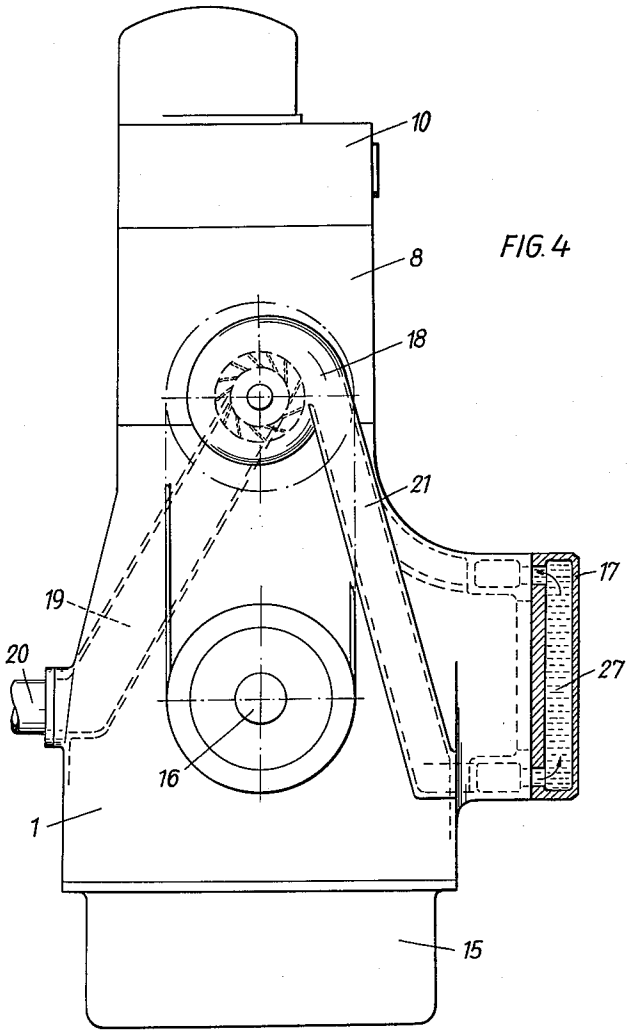


FIG. 4

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2,985,156

Patented May 23, 1961

2,985,156

ENGINE WITH RECIPROCATING PISTONS

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Filed July 28, 1959, Ser. No. 830,079

Claims priority, application Austria Aug. 30, 1958

5 Claims. (Cl. 123—41.74)

The invention relates to the design of the crankcase housing of piston engine assemblies for the purpose of using the same housing for different applications of the engine and for essentially different operating conditions. The advantages of such a housing reside in the possibility of low-cost serial production of voluminous and complicated castings which is in this instance extended to such machines, so far precluded from the benefit of these advantages, as have to be produced in comparatively small numbers in view of alterations in design which are necessary to suit a variety of different operating conditions and applications. Formerly, this involved the necessity of producing three or four different types of housings whereas a single type of housing will be sufficient if the features according to the invention are applied. The consequent rise in manufacturing numbers for a housing designed according to the invention to three or four times the production number of each of the conventional types of housings renders serial production with its inherent advantages possible. In addition, the application of the features of the invention will produce certain advantages related to the resistance of the crankcase housing to various stresses.

The scope of the suggestions according to the invention comprises the sector of internal combustion engines with cylinders arranged in V-configuration or in a single row and simultaneously combined machine-and-drive assemblies such as in particular, engine-and-compressor assemblies with engine and compressor cylinders arranged in V-configuration, the design of the engine permitting in every case indiscriminately either two or four-stroke operation of the engine unit. In addition, the housing according to the invention allows in every possible application the use of air or liquids for the cooling of the engine unit or of the whole assembly, thus providing for adaptation to various operating conditions within wide limits.

The crankcase of the engine according to the invention designed to receive two rows of cylinders arranged in V-configuration presents ports on both sides as already envisaged for a crankcase of a two-stroke internal combustion engine with cylinders in V-configuration with uniflow scavenging, the extremities of the cylinders protruding into the crankcase through said ports, reinforcing elements of a closed, preferably rectangular cross-section extending alongside the surface of attachment between the cylinders and the crankcase housing and over the entire length of the housing. According to the invention, these reinforcing elements are formed with internal components and with ducts for the collection and delivery of working materials for the operation of the piston engine. Depending on the conditions in which the crankcase is utilised, these ducts communicate through appropriate ports in the reinforcing ribs with the intakes and outlets for the working materials used as well as with the manifolds for these materials in such sections of the piston engine as are, in individual cases, attached to the crankcase. These ports are an essential

prerequisite to the versatility of the crankcase according to the invention. By closing selected ducts, the reinforcing elements can be simply adapted to perform various distributing, collecting or discharging operations as may be necessary for the different working materials such as lubricating oil, cooling-water etc.

For the purpose of taking full advantage of the reinforcing effect due to the particular cross-section, the longer sides of the cross-section of the reinforcing elements are preferably arranged parallel to the axes of the adjacent row of cylinders as has already been suggested for a conventional type of crankcase, providing, however, for internal ribs extending parallel to the housing wall in the area between the cylinders.

It has been known to provide continuous reinforcing cavities extending along crankcases either in the sidewalls of the crankcase or outwardly on said walls and constituted by laterally spreading skirtings. The arrangement of the reinforcing elements alongside the surfaces of attachment of the rows of cylinders which represent the basic feature of the invention is superior to the conventional design insofar as the sidewalls and the cylinder-supporting closing plates of the crankcase benefit simultaneously from the reinforcing action. This results in lesser wall thicknesses particularly as compared with the conventional crankcase housings for air-cooled internal combustion engines of identical design. The formerly necessary reinforcing ribs and flanges may be dispensed with.

The compartments extending internally in relation to the rows of cylinders are interconnected by means of transverse ducts.

In the case of valve-controlled engines or of a valve-controlled engine unit of an assembly, another feature of the invention provides for the arrangement of the valve tappets on the outer side of the row of engine cylinders, said tappets traversing the reinforcing element located at this point and designed to receive and discharge the lubricating oil flowing out of the valve gears.

In this capacity the reinforcing element traversed by the tappets differs considerably from the previous suggestion to provide cavities in the crankcase for the supply of lubricating oil to auxiliary machines attached to the sides of the crankcase, said cavities extending longitudinally over the entire length of the engine, wherein balancing shafts extend through the crankshaft housing. These cavities are arranged inside the crankshaft housing approximately at mid-height and are contrary to the design of the housing according to the invention, at a considerable distance from the surface of attachment for the engine cylinders. As a result, the reinforcing action of these cavities is lost to the said surface of attachment on the one hand, and the resistance to bending of the housing is, on the other hand, not increased to the extent attainable with the design of these housings according to the invention.

Finally, if the engine is water-cooled, the reinforcing elements are used for the distribution of the coolant to the cooling jackets of the row of cylinders attached to the crankcase, unless they serve for the collection and return of the lubricant.

Further details of the invention will appear from the following description of several embodiments of the invention with reference to the accompanying drawings in which

Figure 1 shows a cross-section through a water-cooled engine-and-compressor assembly,

Figure 2 a section on line II—II of Figure 1,

Figure 3 the utilization of the crankcase housing already illustrated in Figure 1 in connection with an air-cooled engine-and-compressor assembly,

Figure 4 illustrates the way in which the coolant is

delivered and directed to the rows of cylinders. At the same time, Figure 4 shows the use of a housing according to the invention in conjunction with a single-row engine.

In every instance, reference number 1 designates the crankcase housing, the reinforcing elements 2 to 5 of which extend on both sides of the two rows of cylinders. The cylinder liner 6 of the engine unit and 7 of the compressor unit of the illustrated assembly protrude with their inner extremities into the crankcase, being in the case of a liquid-cooled unit (Figures 1 and 2) surrounded by the cooling jackets 8 and 9 respectively, designed as a separate attachment of the housing 1. The cylinder head 10 of the engine unit operating in a four-stroke cycle in the design shown in Figure 1 comprises valves 11 actuated by tappets 12 located at the side of the cooling jacket of the engine cylinders. The tappet guide 14 is arranged below the stiffening or reinforcing element 2 so that if the engine unit of the assembly is to operate in a two-stroke cycle, the parts located outside the housing only will have to be exchanged and the reinforcing element 2 situated on the side of the valve tappets can be used for the collection and delivery of the lubricant flowing away from the valve gear through the tappet chamber 13. The discharged lubricant passes—preferably through the ducts of reinforcing element 2—into the oil well 15 at the bottom of the housing containing the crankshaft 16.

In water-cooled units the reinforcing elements 3 to 5 serve not only to reinforce the housing 1 but also to direct and distribute the cooling-water. In the example illustrated in Figure 4, the cooling-water is sucked in by the cooling-water pump 18 through the duct 19 and through the connection piece 20 of the water reservoir or cooler (not shown) and delivered to the compartments of the reinforcing elements of the crankcase housing through the duct 21. It preferably reaches the lowermost element 5 before reaching the other reinforcing elements. As appears from Figure 1, the water distributed by the reinforcing element 5 over all of the compressor cylinders flows through connecting ducts 22 into the cooling jackets 9 around the compressor cylinders from where it passes through cooling-water ducts 23 into the compartment of the element 4 situated at a higher level. As appears from Figure 2, partitions 24 force the cooling-water through the ducts 23. The water enters the element 4 through the upper connecting ducts 25, from where it passes through transverse ducts 26 into the compartment of the element 3 for the engine cylinders, distributing it also over the entire length of the housing to the various cylinders of the engine unit. After passing the cooling jacket 8 and the ducts in the cylinder heads of the engine unit, the cooling-water is again returned to the reservoir or cooler.

If the housing is used for a single-row internal combustion engine, its adaptation for that purpose requires only the additional elements shown in Figure 4. In that case, the ports of the horizontal housing attachment which otherwise serve to receive the cylinders, are closed by covers 17 the cavity 27 of which provides a connection between the superimposed elements 4 and 5. The resulting resistance to the flow of the coolant is solely dependent upon the design of the closing members, but can in any case be held to a negligible minimum as there are no restrictions affecting their design.

In accordance with the basic idea of the invention the housing can also be used for air-cooled units as shown in Figure 3. In this illustration, identical parts are designated by the corresponding reference numbers of the other figures, thus explaining also the function of this embodiment of the invention.

The engine cylinder 28 and the compressor cylinder 29 are now provided with cooling ribs. In this case, the overflow ducts 22, 25, 30 of the reinforcing elements 3—5 are closed by plugs 31. The lubricant emerging

from the valve gear is returned through sheathings 32 of the valve tappets 12. In accordance with an approved design, the cooling-air blower 34 is located in the housing between the rows of cylinders serving for the distribution of the cooling air.

If the housing is used with a single row of cylinders, that is, with a single-row engine, closing plates are substituted for the compressor cylinders since as different from the elements to be provided for water-cooling systems under identical conditions, no cavities are required for the connection between the overflow ducts 22 and 25. In this case, the cooling-air blower 34 in Figure 3 is replaced by a sheathing through which the entire air delivered by the blower is directed to the engine cylinders.

The above-mentioned structural means refer to certain embodiments of the invention without restricting its scope in any sense whatsoever. Obviously, the application of measures according to the invention in the design of the crankcase of engines with cylinders in V-configuration with no working cylinders attached to the housing offers the same advantages as are recognizable in the examples of an engine-and-compressor assembly and of a single-row engine as hereabove described. Besides, the application of the invention is not restricted to engine-and-compressor assemblies, but is advantageous for all units where the same housing is alternatively used in connection with air or water-cooling systems, since in these cases the reinforcement of the housing results in a substantial improvement of the engine crankcase in view of the introduction into the crankcase of the forces transmitted by the cylinder bolts.

I claim:

1. A crankcase for use in internal combustion engines comprising a housing formed with two exposed mutually inclined faces each parallel with the axis of the housing, two pairs of elongated hollow stiffening elements each forming part of said housing and each parallel with said axis, the stiffening elements of one of said pairs located adjacent to the lateral edges of one of said faces and the stiffening elements of the other of said pairs located adjacent to the lateral edges of the other face, each stiffening element defining therewithin an elongated compartment and each formed with duct means constituting communicating passages between its compartment and the adjacent face, each pair of said stiffening elements comprising a first and a second stiffening element respectively nearer to and more distant from the stiffening elements of the other pair, said housing formed with transverse channel means for connecting the compartments of said first stiffening elements.

2. A crankcase for use in internal combustion engines comprising a housing formed with two exposed mutually inclined faces each parallel with the axis of the housing, two pairs of elongated hollow stiffening elements each forming part of said housing and each parallel with said axis, the stiffening elements of one of said pairs located adjacent to the lateral edges of one of said faces and the stiffening elements of the other of said pairs located adjacent to the lateral edges of the other face, each stiffening element defining therewithin an elongated compartment of substantially rectangular cross-sectional contour and each stiffening element formed with duct means constituting communicating passages between its compartment and the adjacent face, each pair of said stiffening elements comprising a first and a second stiffening element respectively nearer to and more distant from the stiffening elements of the other pair, said housing formed with transverse channel means for connecting the compartments of said first stiffening elements.

3. A crankcase for use in internal combustion engines comprising a housing formed with two exposed mutually inclined faces each parallel with the axis of the housing, two pairs of elongated hollow stiffening elements each forming part of said housing and each parallel with said axis, the stiffening elements of one of said pairs located

adjacent to the lateral edges of one of said faces and the stiffening elements of the other of said pairs located adjacent to the lateral edges of the other face, each stiffening element defining therewithin an elongated compartment and each formed with duct means constituting communicating passages between its compartment and the adjacent face, each pair of said stiffening elements comprising a first and a second stiffening element respectively nearer to and more distant from the stiffening elements of the other pair, said housing formed with transverse channel means for connecting the compartments of said first stiffening elements, and means for releasably sealing selected duct means of said stiffening elements.

4. A crankcase for use in internal combustion engines comprising a housing formed with two exposed mutually inclined faces each parallel with the axis of the housing, two pairs of elongated hollow stiffening elements each forming part of said housing and each parallel with said axis, the stiffening elements of one of said pairs located adjacent to the lateral edges of one of said faces and the stiffening elements of the other of said pairs located adjacent to the lateral edges of the other face, each stiffening element defining therewithin an elongated compartment and each formed with duct means constiuting communicating passages between its compartment and the adjacent face, said housing formed with transverse channel means for connecting the compartment of a stiffening element of said one pair with the compartment of a stiffening element of said other pair, and cover means connected to one of said faces, said cover means formed with connecting channel means communicating with the duct means of stiffening elements adjacent to said last mentioned face whereby the compartments of said last mentioned stiffening elements communicate with each other.

5. A crankcase usable for V-type internal combustion engines comprising a crankcase housing formed with two cylinder supporting first wall portions and internal reinforcing second wall portions arranged in two pairs with each pair adjacent to one of said first wall portions, said first and second wall portions forming internal compartments extending along said first wall portions and said first wall portions formed with duct means communicating with the respective compartments, the compartments formed by one of said first wall portions and the respective second wall portions including a first and a second compartment respectively nearer to and more distant from the other first wall portion, said housing formed with channel means for connecting said first compartments with each other.

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