March 26, 1946. W. RICART 2,397,434

CRANKCASE AND CYLINDER COOLING

Filed Nov. 15, 1943

Fig. 1.

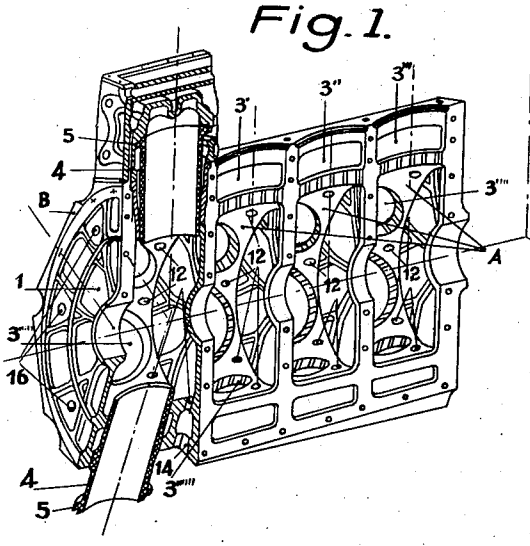


Fig. 2.

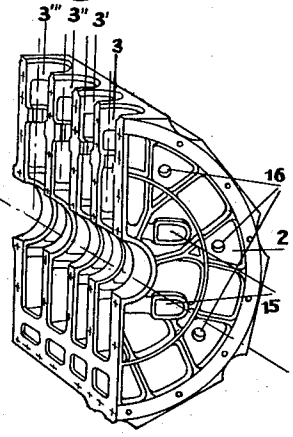


Fig. 3.

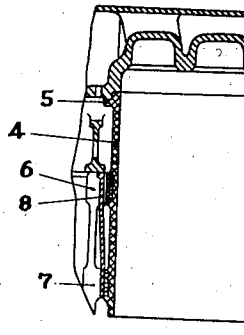
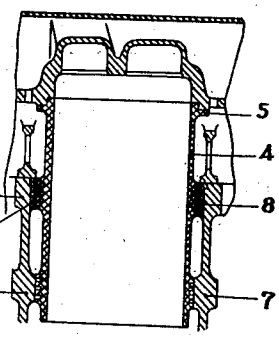


Fig. 4.



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CRANKCASE AND CYLINDER COOLING

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In Spain October 17, 1942

4 Claims. (Cl. 123—173)

This invention relates to a crank case for internal combustion motors, having various series of cylinders arranged radially.

The crank case mentioned is applied specially but not exclusively, to internal combustion motors destined for the driving of aerial vehicles and must fulfill a great number of conditions and especially must be able to transmit the weight of the motor and the torsional strain exercised on the whole, absorb the strain of inertia, etc. Consequently the said crank case must present sufficient rigidity to resist the strains to which it is subject, and at the same time must offer a certain facility in construction and mounting.

The art of construction of crank cases for internal combustion motors with two, three or four rows of cylinders, is already sufficiently known and does not offer any special difficulties. However, the crank cases known up to now for motors with various rows of cylinders and specially for motors with an odd number of rows of cylinders, form two parts not symmetrical and offer characteristics of resistance, rigidity and manufacture somewhat unfavourable, that might be due precisely to this lack of symmetry.

The crank case object of this invention, completely avoids the troubles mentioned above and presents, at the same time, advantages unknown up to now.

The crank case object of this invention, is constituted essentially, by two parts practically symmetrical, including in the case that they have to be applied to an odd number of rows or series of cylinders. The system of assembling may be the most convenient and also the refrigeration system may be chosen so that it corresponds in the best possible manner to the working conditions of the motor, (air cooling, water cooling, etc.)

When dealing with an even number of rows of cylinders the plane of separation will pass through the longitudinal axis of the crank case and between two opposing pairs of rows of cylinders, whilst when the number of rows of cylinders is uneven, the said plane of division will pass through the longitudinal axis, for one side, between two rows of cylinders and on the opposite side necessarily, through the middle plane or central plane of a row of cylinders. Even in this case there can be used any suitable system of refrigeration.

In the attached drawing there is shown, as an example, one of the forms of preferred construction of this invention.

Figures 1 and 2 show the two halves of a crank case in accordance with this invention, destined for an internal combustion motor with seven rows of cylinders.

Figure 3 is a section of a cylinder according to the same section plane of the crank case.

Figure 4 is a section of a cylinder according to a plane that passes through the longitudinal axis of the crank case and through the longitudinal axis of the cylinder itself.

Figures 1 and 2 show the two halves 1 and 2 of the crank case, in which there are to be found the openings 3, 3', 3'', 3''', 3'''', etc., in which are inserted the respective jackets 4, 4', etc., of the cylinders. On the said jackets and by any suitable system, for example by means of screws or bolts, there are fixed the cylinder heads which rest on the flanges or rims 5 of each jacket.

Every one of the openings 3, 3', etc., arranged in the crank case to serve as receptacles for the jackets 4, 4', etc., of the cylinders, has the ring shaped projections 6 and 7 respectively in the upper part and in the lower part (Figures 3 and 4) that allow of the perfect centering of such jackets 4, 4', etc., whilst the water chamber is found distributed uniformly around the jacket, as the ring shaped centering projection 6, has slots 8 parallel to the axis of the cylinder that allow of the passage of the water, making possible its access to the lower part of the jacket until reaching the lower projection 7 that makes a tight joint with the jacket itself. This joint may be made more perfect by means of an appropriate packing. In order that the construction may be easier, the top ring shaped projection 6 may have a diameter of considerable opening, so that between the jacket and the said projection there is sufficient play to place a ring provided with perforations parallel to their axis that shall allow of the passage of the refrigeration liquid towards the lower part of the jacket.

The two halves of the crank case are joined by means of bolts for which the respective perforations have been made.

When dealing with a motor with an odd number of rows of cylinders, one of the said rows will be found naturally, in the plane of the section of the crank case as has been stated and consequently in order to obtain a water tight joint between the said two halves of the crank case there is arranged, in accordance with this invention, a member 9 of an approximately cylindrical shape (Figure 3). The said member 9 is joined by a top flange 10 with a projection 11, whilst on its side surfaces, that is the surfaces parallel to the longitudinal axis of the crank case, this closing is obtained in the usual manner already known,

the same as in all the remaining rows of cylinders.

The joint or closing of the member 9 against the lower centering projection 7 is obtained by means of convenient packing, for example, of rubber or similar material.

As can be seen in the attached drawing and especially in Fig. 1, the crank case object of this invention has two surrounding walls, the internal one formed by the rigid parts A and the external B. The internal wall has the perforations or orifices 12 whilst the outer wall has escape apertures, such as 14. In the front wall of one of the halves of the crank case and in the cross reinforcing walls and parallel to such frontal wall, excluding however the back frontal wall, there have been arranged the openings 15. The object of this arrangement is as follows.

The arrangement of the two surrounding walls and of the reinforcing transversal walls, gives to the crank case a notable moment of inertia, both as regards flexion as well as twist, increasing its rigidity and resistance to the forces to which it is submitted.

It is also known, that the movement of the masses comprised in the interior of the crank case, produces, especially at high turning velocities, a pressure in the air, gas and oil that are found in the interior of the said crank case, pressure that acts upon the internal wall A. The lesser value of these pressures is found naturally, close to the longitudinal axis, whilst its maximum value is found in the internal surface of the internal covering A where the maximum effect of centrifugation is produced.

It is known also, that accumulating in the crank case a certain quantity of circulating oil, this latter may penetrate in the cylinders and, in this case, produce disturbances in the combustion. In order to avoid this trouble, there are arranged in the crank case apertures 14 for the exit of the oil, which returns then to the general circulation.

When dealing with motors of high velocity, there is produced another phenomenon of considerable importance; as has been stated, the circular movement of the masses held in the crank case, produces a circular movement of the gas, air and oil that are found in the interior of the same; the oil beaten continually by the set of connecting rods, by the counterweights, etc., is finally pulverised and mixes intimately with the gas above mentioned. Because of its circular movement communicated by the parts mentioned and consequently owing to the centrifugal force, this mixture adheres to the internal walls of the inner surrounding wall of the crank case, without the oil being able to separate itself from the gas and escape through the walls to the proper discharge apertures, to return subsequently to be put again into circulation, and owing to the amount of oil accumulated and in consequence of the internal pressure produced and by centrifugal force, there is facilitated the penetration of the oil into the cylinders with all the undesired consequences derived from this, such as increase in the consumption of lubricant, dirtying the sparking plugs etc.

These troubles are completely eliminated in the crank case constructed according to this invention.

The internal surrounding wall A has the discharge orifices 12 for the exit of the oil, which forced by the internal pressure as has been stated, penetrates into the space between the internal and the external cover which is subdivided, by the rows of cylinders and the reinforcements, into various longitudinal chambers, parallel to the longitudinal axis of the crank case. These orifices 12 are in such a number and of such dimensions that there is ensured the perfect discharge of the oil and of the gas from the interior of the crank case to the space between both surrounding walls, in which the oil pulverised and intimately mixed with gas and air, easily separates and then passing through the discharge apertures 14 returns to circulation. This separation is greatly helped by the low pressure, by ventilation and by the quietness of the ambient in which it takes place. Actually, in the outer surrounding wall and in its top part there are additional escape apertures (not shown) whilst in the end walls and corresponding with the spaces included between such surrounding walls there are arranged apertures 16 through which come out the air and the gas that had penetrated in these spaces together with the oil, to return again to the interior through the apertures 15 arranged in proximity of the longitudinal axis and this precisely as a consequence of the lesser pressure that is produced owing to the centrifugal force. In this way there is assured a ventilation and a relative cooling of the masses that are in movement.

It is understood that this invention may be put in practice with modifications of the embodiment above described and that the different parts may present modified forms of arrangements, without departing from the scope of the invention.

I claim:

1. Crank case for internal combustion engines with a plurality of series or rows of cylinders, particularly for cooled aviation engines, comprising two dismountably connected substantially identical parts, each comprising an internal surrounding wall and an external surrounding wall spaced therefrom, said external wall being provided with apertures for lodging the jackets of the cylinders and the internal wall having orifices for discharging oil and gas from the crank case interior to the space between said internal wall and said external wall, reinforcing partitions arranged in said space and subdividing the same into a plurality of separate chambers extending parallel to the longitudinal axis of the crank case, the said crank case being provided with front and rear walls and with spaced cross reinforcing walls extending across the crank case interior and adapted to sustain the supporting bearings of the crank shaft, said external surrounding wall being further provided with apertures for the discharge and escape of oil, and said front and cross reinforcing walls being provided with ventilation apertures in such manner as to result in a circulation due to the action of centrifugal forces, and an inlet for oil into the crank case interior.

2. Crank case for internal combustion engines with a plurality of series or rows of cylinders, particularly for cooled aviation engines, comprising two dismountably connected substantially identical parts, each comprising an internal surrounding wall and an external surrounding wall spaced therefrom said external wall being provided with apertures for lodging the jackets of the cylinders, upper and lower ring shaped projections arranged in said apertures, each upper projection being provided with slots for the passage of cooling means toward the lower part of the cylinder jacket.

3. Crank case for internal combustion engines with a plurality of series or rows of cylinders, particularly for cooled aviation engines, comprising two dismountably connected substantially identical parts, each comprising an internal surrounding wall and an external surrounding wall spaced therefrom, said external wall being provided with apertures for lodging the jackets of the cylinders, an upper and a lower ring shaped projection in each aperture, said upper projection having a greater diameter than its associated cylinder jacket, and a ring inserted between said projection and said jacket and provided with orifices for the passage of cooling medium therethrough.

4. Crank case for internal combustion engines with a plurality of series or rows of cylinders, particularly for cooled aviation engines, comprising two dismountably connected substantially identical parts, each comprising an internal surrounding wall and an external surrounding wall spaced therefrom, said external wall being provided with apertures for lodging the jackets of the cylinders, upper and lower ring shaped projections arranged in said apertures, each upper projection being provided with slots for the passage of cooling means toward the lower part of the cylinder jacket, and a flanged substantially cylindrical sealing member extending around said cylinder jacket, said cylindrical member being sealed at each end thereof.

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