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INTERNAL COMBUSTION ENGINE

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FIG. 1

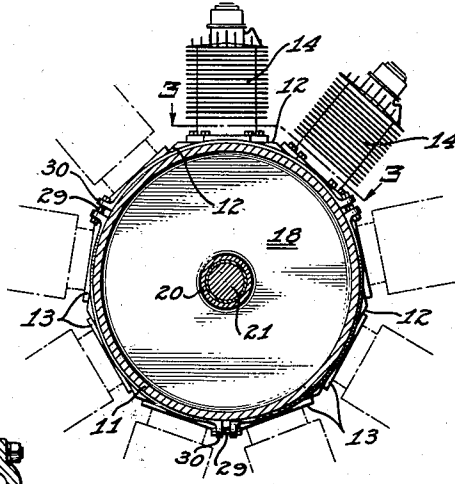
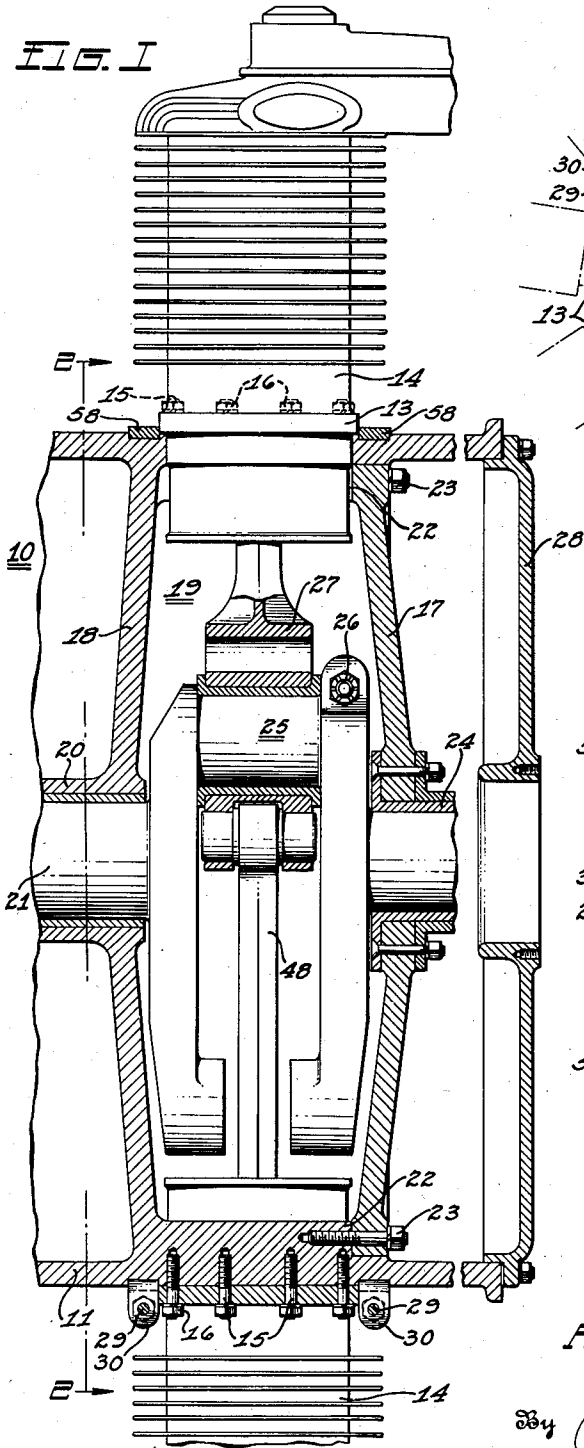


FIG. 2

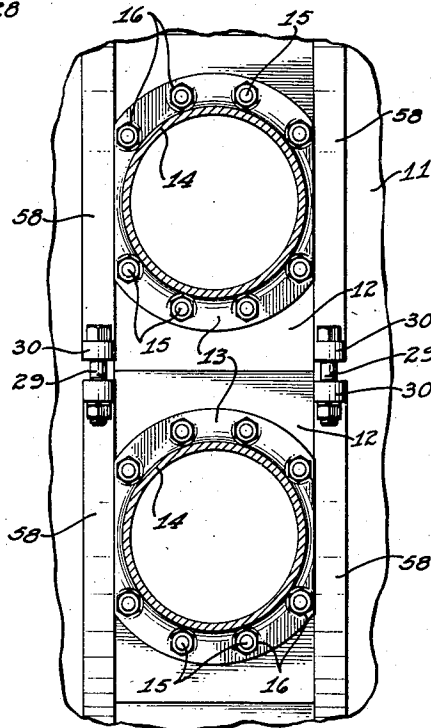


FIG. 3

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INTERNAL COMBUSTION ENGINE

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2 Claims. (Cl. 121—194)

This invention relates to internal combustion engines and more particularly to engine crank case construction.

For many uses, it is becoming more and more essential that engines must be light, and in this connection crank case construction is one of the chief considerations. The choice of materials has been one of the main factors in determining engine weight and the use of duralumin and aluminum has done considerable toward reducing engine weight.

When the cylinders are bolted to the crank case, the wall thickness must be sufficient to adequately withstand the explosive pressures at the points of cylinder attachment, and such wall thickness, even with the materials above mentioned, result in undesirable weight in many instances and particularly when the engine is of a high pressure type, such as Diesel engines.

An object of the invention is to provide a crank case structure for radial engines which is light in weight and at the same time rugged.

Another object of the invention is to provide a crank case structure for radial engines in which the interior walls carrying the crank shaft can be formed of relatively thin material through being placed in compression which cannot be overcome by forces developed during explosions which tend to move portions of the walls in opposite directions.

Other objects of the invention will appear from the following description taken in connection with the accompanying drawing forming a part of the specification, in which:

Fig. 1 illustrates a radial Diesel engine having the crank case structure in section.

Fig. 2 is an end view of the same taken on line 2—2 of Fig. 1.

Fig. 3 is another sectional view of a fragment of the engine taken on line 3—3 of Fig. 2.

Referring now to the drawing by the characters of reference, 10 indicates generally a barrel type of crank case having the main portion thereof formed preferably as a casting or forging and of material such as aluminum or duralumin. The outer wall 11 of the crank case is substantially circular in form except for flat faces 12 upon which flanges 13 on the cylinders 14 seat. In order to secure the cylinders to the crank case, studs 15 are secured in the flat faces of the wall 11 and project through openings in the flanges 13 and nuts 16 are screwed upon the studs to clamp the cylinder flanges tightly against the flat faces of the crank case.

A pair of reinforcing walls 17 and 18 are pro-

vided within the crank case and extend transversely of the interior thereof forming the chamber 19 into which the cylinders extend. The wall 18 is preferably formed integrally with the peripheral wall 11, and extending therefrom is a bearing portion 20 in which one end of the crankshaft 21 is supported. The wall 17 is detachably secured by bolts 23 to interior crank case bosses 22, and this detachable reinforcing wall carries a bearing 24 which also supports the crankshaft.

The crankshaft is preferably formed in two parts, one section being detachably secured upon the crank pin 25 by a clamp means 26. Encircling the crank pin is a master rod hub 27 to which connecting rods 48 are pivotally secured in a manner conventional with radial type engines. End wall 28 is detachably secured to the open rear end of the crank case, and between the walls 17 and 28 is a compartment for housing valve actuating mechanism (not shown).

In order that the crank case walls 17 and 18 can be formed relatively thin, so that engine weight is thereby considerably reduced, I provide tension means associated with the crank case for placing them in high compression. Such tension means consists of a plurality of band segments or sections 58 which are connected together at their adjacent ends by tension means 29. As shown, the band segments are provided with upturned ends 30 through which the tension means, in the form of a bolt and nut, is associated and the adjacent ends of band sections are spaced so that they can be contracted or expanded around the crank case by adjustment of the nuts on the bolts. The crank case is preferably formed with two grooves extending therearound and in parallel relation in which the band means are seated. It is preferable that the band means be associated on opposite sides of the cylinders and in alignment with the walls 17 and 18 so that the crank case compressing means is closely adjacent the cylinder flanges. It will be noted that the band means sections are located directly and entirely in engagement with the crank case and that the cylinders can be attached to or removed from the crank case while the band means are secured around the crank case.

The band segments are connected to form two crank case encircling hoops which are in tension greater than that to which the crank case is subjected through any explosion force in the cylinders through the attaching means. It is also worthy of consideration in this connection to note that a casting is much stronger when placed in compression and subjected to tensile

stresses than it is without compression, and with the band means encircling and engaging the crank case in tension as above set forth, there will be less tensile stress in the walls 17 and 18 resulting from explosion in the cylinders even though the cylinders are secured directly to the crank case by bolts or studs than if the bands were not used.

The band means herein described being directly in engagement with the crank case will distribute stresses around the crank case and thus relieve the same of severe localized stresses which ordinarily result from a bolted connection of this character, and therefore the thickness of the walls 17 and 18 can be materially reduced relative to that required in a crank case which is not under compression and in which only bolt means are utilized to fasten the cylinders.

Assuming that there is an explosion occurring in the top cylinder, as viewed in Figs. 1 and 2, the forces act against the cylinder tending to move it upwardly and they act against the piston tending to move it downwardly. As the cylinder is attached to the crank case, the upward forces are transmitted to the portions of the walls 17 and 18 adjacent the cylinder. As the piston is connected to the crank shaft which is mounted in bearings in the walls 17 and 18, the downward forces are transmitted from the piston to the portions of the walls below the bearings. Thus there are two sets of forces acting in opposite directions on the walls 17 and 18 during explosion periods, such forces tending to move portions of each wall in opposite directions. One method of providing sufficient strength in the walls to withstand these oppositely acting forces is to make them thick but this method introduces weight which is undesirable where lightness is a factor such as it is in aeroplane engines. By the employment of the tension band means, as herein described, the walls 17 and 18 are compressed to an extent such that the oppositely acting forces cannot introduce stresses and thus relatively thin walls can be employed. The combined weight of the thin walls 17 and 18 and the compression band means has been found to be less than that of walls of the thickness required when no compression band means is employed.

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is therefore to be limited only as indicated by the scope of the appended claims.

What I claim is:

1. In an internal combustion engine of the radial type, the combination with a crank case having a peripheral wall and relatively thin transverse walls, a plurality of cylinders mounted on the peripheral wall of the crank case and disposed in a single circumferential row thereon closely adjacent to and intermediate said transverse walls, said transverse walls being spaced to an extent sufficient to accommodate the working parts of one circumferential row only of cylinders, the spacing between the transverse walls being not substantially greater than the diameter of the cylinders, separate means associated with each cylinder for securing the same to the peripheral wall of the crank case for removal therefrom independently of the other cylinders, and a pair of tension devices independent of said securing means and surrounding the peripheral wall of the crank case on either side of and adjacent the row of cylinders and substantially in line with the said transverse walls, said tension devices being under an initial tension sufficient to compress said transverse walls to such an extent that stresses transmitted to the latter by explosions in the cylinders may be adequately resisted.

2. In an internal combustion engine of the radial type, the combination with a crank case of barrel form having a peripheral wall and relatively thin transverse walls, a crankshaft having bearings in said walls, a plurality of cylinders mounted on the peripheral wall of the crank case and disposed in a single circumferential row thereon closely adjacent to and intermediate said transverse walls, said transverse walls being spaced to an extent sufficient to accommodate the working parts of one circumferential row only of cylinders, the spacing between the transverse walls being not substantially greater than the diameter of the cylinders, means securing each cylinder to the peripheral wall of the crank case for independent removal therefrom, a pair of tension devices independent of said securing means and surrounding and directly engaging the peripheral wall of the crank case on either side of and adjacent the row of cylinders and substantially in line with the said transverse walls, said tension devices being under an initial tension sufficient to compress said transverse walls to such an extent that stresses transmitted to the latter by explosions in the cylinders may be adequately resisted, means for preventing displacement of said devices axially of the crank case, pistons in the cylinders, and connecting rods between the pistons and crankshaft.

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