May 31, 1932. R. W. A. BREWER 1,861,380

INTERNAL COMBUSTION ENGINE

Filed May 23, 1930

Fig. 1.

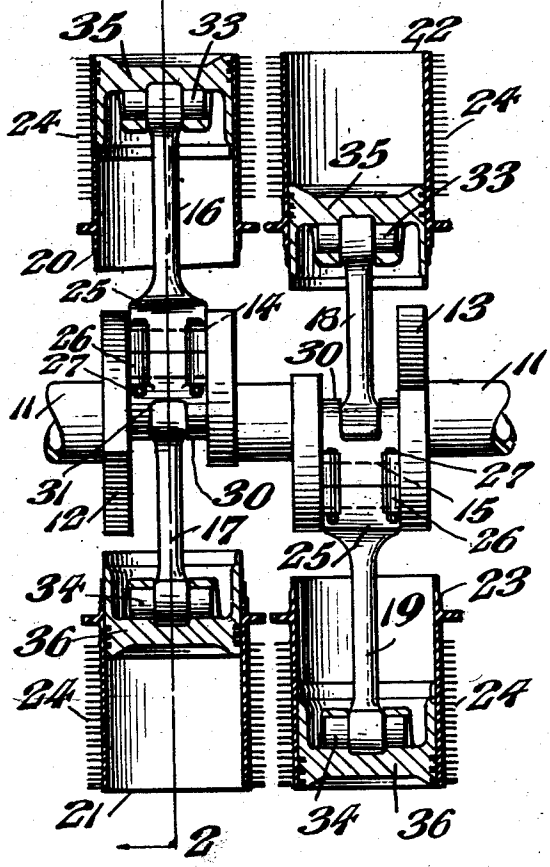
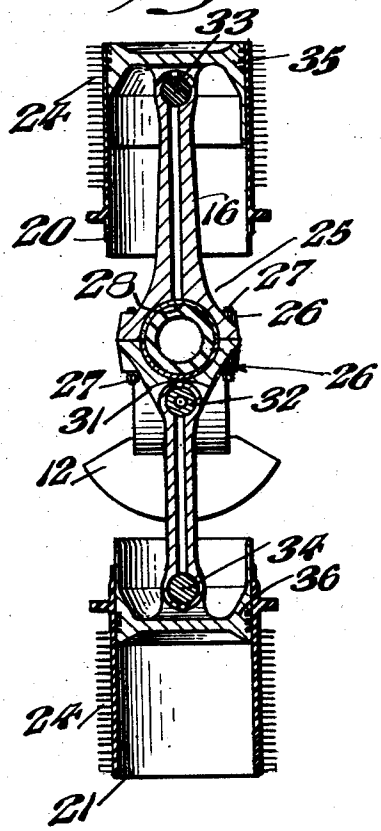



Fig. 2.




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Patented May 31, 1932 1,861,380

# UNITED STATES PATENT OFFICE

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## INTERNAL COMBUSTION ENGINE

Application filed May 23, 1930. Serial No. 454,947.

This invention, in general, relates to engines of the internal combustion or fluid type and more particularly to internal combustion reciprocating engines having opposed cylinders.

The principal object of the present invention is to provide an engine of the kind indicated of a design and construction particularly adapted to reduce vibration caused by rocking or mechanical couples which are inherent in the opposed cylinder type of engine, due both to inertia loading and fluid pressure.

A more specific object of the invention is to provide an improved construction and arrangement of the crank shaft, connecting rods and coacting parts associated directly therewith.

Another object of the present invention is to provide a reciprocating engine of the type indicated of a simplified, more efficient construction.

A further object is to provide an engine having an adequate bearing surface on the crank pin.

A still further object is to provide a reciprocating type of engine, a crank shaft and connecting-rod mechanism of a design and construction particularly adapted to achieve an engine in which the tendency to vibration is reduced to a minimum.

Other objects and advantages will appear hereinafter.

For the purpose of illustrating my invention I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of the instrumentalities as herein shown and described.

In the drawings:—

Figure 1 is a fragmentary, longitudinal sectional view, partly in elevation, of an internal combustion engine having opposed cylinders, in which the principles of my invention have been embodied; and

Figure 2 is a longitudinal sectional view taken on the line 2—2 of Figure 1.

In the drawings, wherein similar characters of reference indicate corresponding parts in the preferred form of the invention, 11 designates a hollow crank shaft having counterweights 12, 13 and crank bends or pins 14, 15. As best shown in Figure 2, the crank shaft 11 is operatively associated by the upper and lower connecting rods 16, 17, 18 and 19 respectively, with opposed cylinders 20, 21, 22 and 23, which latter are provided with radiating corrugations or fins 24. The connecting rod 16, which is rockingly connected to a piston 35 reciprocating in cylinder 20, is secured to or integrally formed with a bearing cap or head 25 which is fastened to a second similar bearing cap or head 26, by the bolt 27, a bushing 28 being confined between the two half bearing caps or heads 25, 26 for the reception of one of the crank pins or bends 14 of the crank shaft 11.

The second bearing cap or head 26 is formed with a clevis 30 which includes a cut out portion 31 adapted to rotatably receive a pin 32 revolvably secured in the clevis 30.

As an important feature of the present invention, it is to be observed that the connecting rods 16, 17, 18, and 19 as disposed about the crank pins or bends 14, 15, are so arranged that the loads are likewise disposed about the said crank pins 14 and 15 for a more equal distribution of the rubbing surface factors which are thereby reduced to a minimum. The present construction is preferable to the conventional arrangement wherein the connecting rods are grouped or positioned side by side, since with the same size crank pin twice the effective area is available. It is also to be noted that the design and construction illustrated herein lessens the manufacturing cost over the well known fork-rod type of construction, by reason of the greater simplicity of structure of my device, while the engagement of parts is more rigid in my device and in addition to this the load is disposed about the rubbing surface more evenly due to the absence of spring or re-

siliency which, as is well known, exists in conventional methods of connecting rod construction. The connecting rods 16 and 17 are mounted on piston pins 33, 34, which are secured in their respective pistons 35, 36 in cylinders 20, 21. As the parts in cylinders 22 and 23 are symmetrical and identical with those in cylinders 20, 21, it will be understood the functions are the same.

In carrying the present invention into practice, the crank turn or throw of the crank shaft 11 has been so disposed as to provide adjacent groups or pairs of throws which differ in phase by 180° while the mechanical or flexural couples inherent in each turn or group are balanced by the counterweights 12 and 13, one at each extremity or side of the group. The magnitude of the necessary balancing couple can be calculated quite approximately. It has generally been supposed that a crank shaft with four throws or turns of the conventional flat type is inherently in balance; but it can be demonstrated that the mechanical couples at the two ends of the shaft develop forces in opposition which give a considerable flexural couple at the middle of the crank shaft at that point or station known as the center bearing. By the present method of balancing couples, this flexural couple is eliminated, thereby not only reducing the load on the middle bearing but reducing the inherent tendency to vibration in any mechanical system of this type. This system, of course, may be employed with an indefinite number of pairs of cylinders, it being understood that for purposes of illustration simplicity of explanation, only two have been shown.

At the present time, in view of the present day tendency for high speed power plants, particularly in the field of self-propelled vehicles and high speed marine engines, efforts have been made to eliminate or at least to reduce substantially the tendency to vibration of the entire engine, and consequently of the associated mechanism when revolving at high speed. The employment of crank shafts which are provided with counterweights, together with multiple point suspensions or stations has undoubtedly lessened much of the vibration which hitherto proved rapidly self-destructive to high speed internal combustion engines, particularly those of the reciprocating type. Probably no problem at the present time plays so important a function in the long life, durability, and smoothness of an engine as the ever-present problem of vibration. It is therefore a particular and specific object of the present invention to provide a construction as described and illustrated for the express purpose indicated. It should be noted that in achieving the object of the present invention the crank shaft and connecting rod mechanism of the opposed cylinder type of engines has not been complicated by the addition of any structural details, but on the contrary has actually been simplified, with the result that a highly efficient type of engine in which vibration has been reduced to a minimum is now available, and with a substantial economy in cost both to manufacturer and consumer.

I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In an internal combustion engine, a group of pairs of alined cylinders, disposed about a crank shaft, crank pins on said shaft disposed at 180 degrees relatively to one another, pistons in said cylinders, connecting rods coacting with said pistons and said crank pins and comprising each a group of master rods and link rods disposed in opposite relation to each other in adjacent cylinders.

2. A mechanical movement for reducing secondary vibrations in a unit having pairs of opposed cylinders and pistons reciprocating therein and a shaft mounted between said opposed cylinders, comprising cranks disposed approximately 180° apart on said crank shaft, means connecting the pistons of one pair of opposed cylinders to its corresponding crank, and means having its parts in reverse relationship to the first mentioned means connecting the pistons of another pair of opposed cylinders to its corresponding crank.

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