Jan. 5, 1926. 1,568,209

G. B. COLLIER

WRIST PIN FOR RECIPROCATING ENGINES

Filed Jan. 2, 1924

Fig. 1

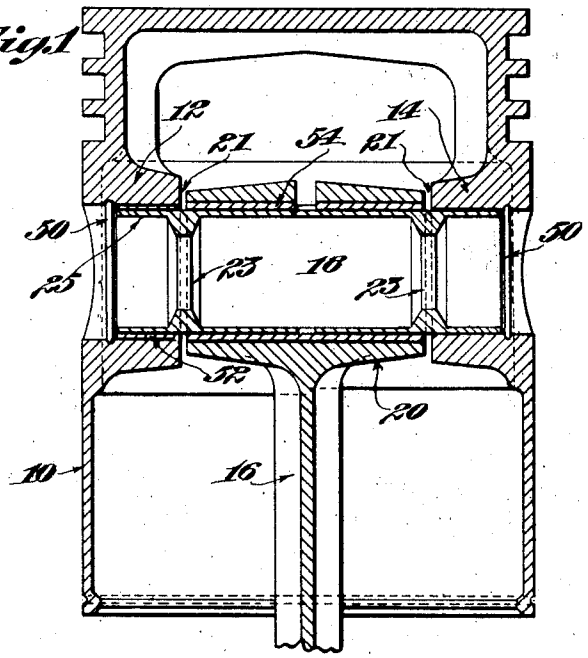


Fig. 4

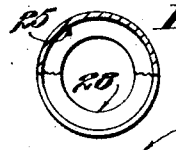


Fig. 3

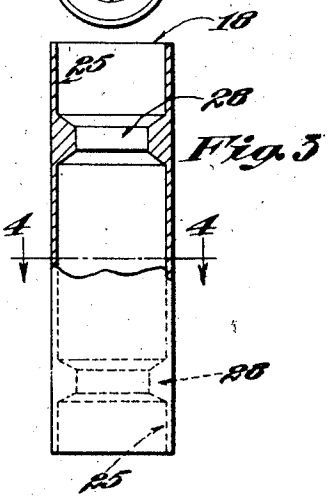


Fig. 5

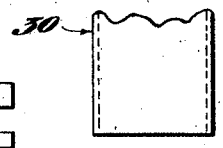


Fig. 7

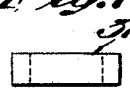


Fig. 2

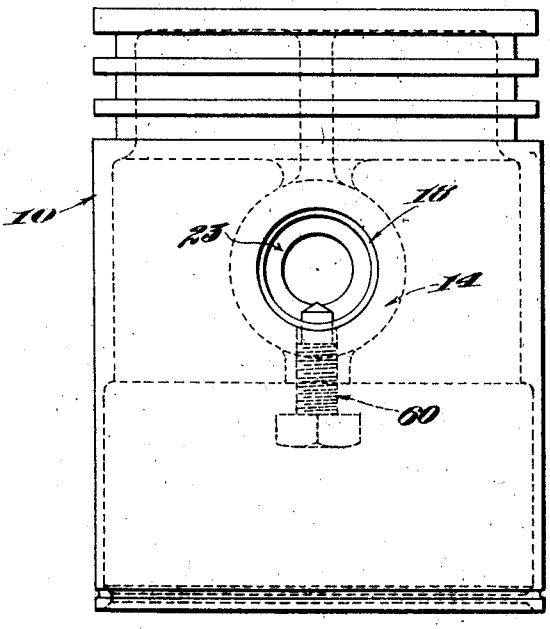


Fig. 6



Fig. 8



Fig. 9



Fig. 11

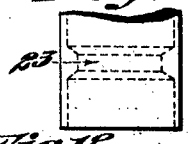


Fig. 10



Fig. 12



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UNITED STATES PATENT OFFICE.

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WRIST PIN FOR RECIPROCATING ENGINES.

Application filed January 2, 1924. Serial No. 683,877.

To all whom it may concern:

Be it known that I, GUY B. COLLIER, a citizen of the United States, residing at Kinderhook, in the county of Columbia and State of New York, have invented certain new and useful Improvements in Wrist Pins for Reciprocating Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to wrist pins for reciprocating engines and more particularly to wrist pins employed in connection with internal combustion motors.

It is well recognized that vibration in an internal combustion motor may be materially reduced through reduction in weight of the reciprocating parts and with this end in view pistons and connecting rods of light weight metals and alloys have been constructed. No substantial reduction in the weight of the wrist pin has been made, however, as these pins are made of steel alloy in the form of a thick walled tube averaging one inch in diameter and approximating in length the diameter of the piston. It will be evident that the weight of the wrist pin is a considerable factor in determining the total weight of the piston unit, especially when the piston is made of a light weight metal alloy.

The object of the present invention is to redesign and improve wrist pins with a view to substantially reducing the weight.

With this object in view, the several features of the invention consist in certain novel features of construction, combinations and arrangements of parts hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

In the accompanying drawings illustrating the preferred form of the invention, Fig. 1 represents a section in elevation of a piston with the improved wrist pin embodied therein; Fig. 2 is an elevation of the piston showing an elevation of the wrist pin; Fig. 3 is a sectional elevation of the wrist pin removed from the piston; Fig. 4 is an end view partly in section of the pin shown in Fig. 3; Figs. 5 and 6 represent a partial elevation and end view, respectively, of a metallic tube employed for the production of the wrist pin; Figs. 7 and 8 represent an elevation and plan of an annulus adapted to be inserted within the tube; Figs. 9 and 10 represent a partial elevation and plan view of a modified form of wrist pin embodying certain principles of the invention; and Figs. 11 and 12 represent a partial elevation and end view of a still further modification of the invention.

The illustrated embodiment of the invention shows a piston 10 of conventional form having oppositely disposed bosses 12 and 14 projecting inwardly for the support of the wrist pin. A conecting rod indicated at 16 is operatively connected with the piston through a wrist pin indicated generally at 18. The hub portion 20 of the connecting rod is received between the opposite faces of the bosses 12 and 14, leaving comparatively narrow intervening regions 21. According to the present invention, the regions 21, forming the gap between the hub 20 of the connecting rod and the piston bosses, are bridged in each case by an annulus 23 extending across the region 21 and for a substantial distance at either side. Each annulus is formed as an integral part of a relatively thin walled tube 25 extending throughout the diameter of the piston and serving as the means for spacing and locating each annulus with respect to the region separating the connecting rod from the piston. This construction provides in effect a tubular wrist pin having relatively thin walls throughout its length except at two regions intermediate the ends and corresponding to the regions separating the connecting rod from the bosses of the piston, at which regions the walls of the wrist pin are substantially thickened to provide walls having a thickness at these regions which may average two and one-half to four times the thickness of the walls throughout the remainder of the shell. It has been found as the result of extended research and mathematical calculation that the total stresses exerted upon the wrist pin at the regions 21 far exceed the stresses at other points throughout the length of the pin and that if the wrist pin has the requisite strength in cross section at these regions it may be made with relatively thin walls throughout the remaining portion of its length.

The annulus or thickened portion of the wrist pin may be varied, as indicated in Figs. 1 and 3, the annulus 23 shown in Fig. 1 being adapted for service relatively lighter

than the annulus indicated at 28 in Fig. 3.

The wrist pin indicated generally in Figs. 1 and 3 may be formed by removing a portion of the material from a relatively thick walled tube, leaving the thickened portions projecting into the interior intermediate the ends, or the pin may preferably be formed as indicated in Figs. 5 to 8 inclusive. In this construction, a thin walled tubing of uniform internal and external diameter as indicated generally at 20 is adapted to have a ring or annulus 32 received therein. After being located in the proper position with respect to the tube, the annulus is welded thereto to form an integral part of the tube and the whole may then be finished in any suitable manner to provide the wrist pin approximately as shown in Figs. 1 and 3.

The wrist pin is the equivalent of a beam fixed at opposite ends and having a load applied uniformly over its central region, that is the region embraced by the hub of the connecting rod. This load varies, however, throughout the circumference of the pin and is at its maximum at the top and bottom of the pin, these regions of maximum stress being indicated in Fig. 10 at 41 and 42 and in Fig. 12 at 43 and 44. In order to provide the requisite strength throughout these regions and avoid the use of unnecessary material throughout the remainder of the tube, the latter may be constructed as indicated in Figs. 9 to 12 inclusive. As shown in Figs. 9 and 10, a tube is provided having an elliptical internal bore providing a wall which is thickest at the top and bottom portions of the tube, gradually decreasing until it reaches a minimum at the side portions of the tube, as indicated at 45 in both full and dot and dash lines. In the form of tube shown in Figs. 11 and 12, the reinforcing annuli or rings are made with an elliptical internal diameter and a circular outer diameter to provide a reinforcement varying in thickness throughout the circumference, these reinforcements as shown having the greatest thickness at the top and bottom regions and the least thickness at the side regions.

The improved form of wrist pin may conveniently be retained in assembled relation within the piston as indicated in Fig. 1, through the employment of locking rings 50 which are received in grooves formed within the bosses 12 and 14 and engage with opposite ends of the wrist pin to hold the latter in place. In the event that this type of construction is employed, it is desirable to insert a bushing 52 between the wrist pin and the piston boss in addition to the usual bushing 54 inserted within the hub 20 of the connecting rod. In place of the construction shown in Fig. 1, the wrist pin may be retained in place by a locking pin 60, which is threaded in the boss of the piston and extends at its free end through the wrist pin to lock the latter against rotative as well as longitudinal movement. This type of locking construction must necessarily be used in the event that the general form of wrist pin shown in Figs. 9 to 12 is used, as this type of pin must be permanently held in position with the regions 41 and 42 positioned respectively at the top and bottom of the pin.

It will be evident to those skilled in the art that the form of wrist pin described in the foregoing specification provides the requisite strength throughout the regions where such strength is necessary but is relieved of all surplus material throughout the remaining portions of the pin. The wrist pin in effect consists of two rings of sufficient width to extend throughout the regions of greatest stress with intervening relatively thin webs or walls, which serve the purpose of holding the rings in the desired operative relation and of withstanding the relatively small stresses which occur in the length of the wrist pin outside the regions of greatest stress.

While it is preferred to employ the specific construction and arrangement of parts shown and described, it will be understood that this construction and arrangement is not essential except so far as specified in the claims and may be changed or modified without departing from the broader features of the invention.

The invention having been described, what is claimed is:

1. A piston assembly for a reciprocating engine comprising a hollow piston having internal bosses adapted to receive a wrist pin, a connecting rod positioned between the bosses and havng relatively small regions of clearance upon opposite sides, a wrist pin extending through the connecting rod and received at opposite ends within the piston bosses, and a reinforcing rib or annulus formed integral with the wrist pin and bridging each region of clearance between the connecting rod and the piston boss.

2. A piston assembly for a reciprocating engine comprising a hollow piston, internal bosses formed upon the piston, a connecting rod supported between the bosses, an annulus connecting each side of the rod with the piston boss and bridging the space therebetween, and a relatively thin cylindrical wall having the same outer diameter as that of the annuli, connecting the two annuli and serving to retain the annuli in proper relation and withstand minor stresses.

3. A wrist pin comprising a tubular shell having a uniform external diameter and having annular reinforcing ribs extending inwardly therefrom intermediate the ends

and adapted to bridge the regions of clearance between the connecting rod and the piston when the pin is assembled with the piston and connecting rod.

4. A piston assembly for reciprocating engines comprising a hollow piston, a connecting rod, a wrist pin passing through the connecting rod and received at opposite ends in the piston, an annular reinforcement formed upon the interior of the wrist pin adjacent the regions of clearance between the connecting rod and the piston, and means for retaining the wrist pin in assembled relation within the piston.

GUY B. COLLIER.