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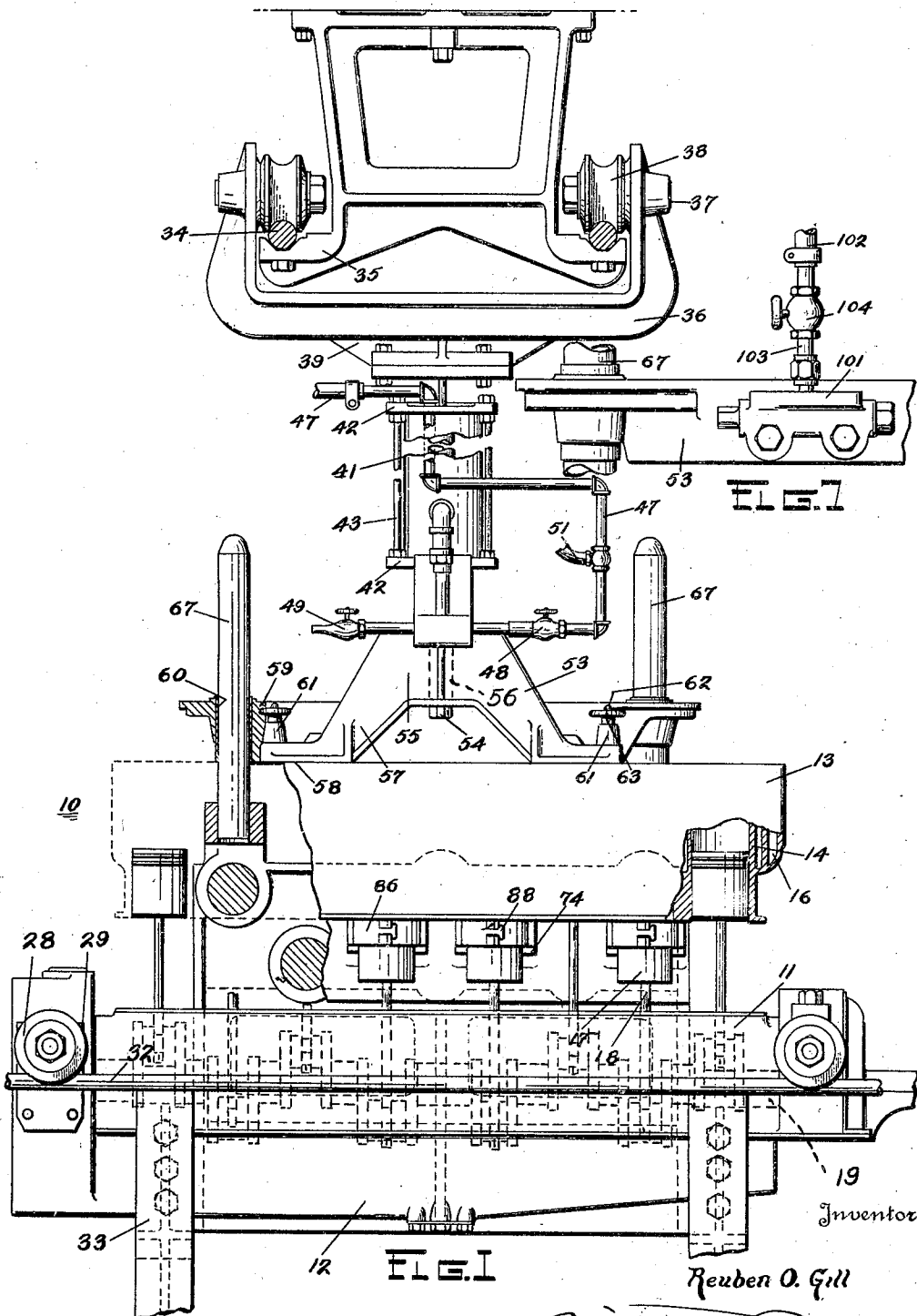
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MEANS FOR ASSEMBLING INTERNAL COMBUSTION ENGINES

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2 Sheets-Sheet 1



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UNITED STATES PATENT OFFICE

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MEANS FOR ASSEMBLING INTERNAL-COMBUSTION ENGINES

Original application filed February 13, 1924, Serial No. 692,506. Divided and this application filed January 19, 1925. Serial No. 3,330.

This invention relates to internal combustion engines, particularly to the assembly during manufacture of such engines, being a division of application Serial No. 692,506, filed February 13, 1924. It has for an object to provide means by which the process of the said application may be practiced to assemble certain major units of such engines more quickly and easily than heretofore, and without danger or strain to any of the parts thereof.

Other objects of the invention will appear from the following description taken in connection with the drawings, which form a part of this specification, and in which:

Fig. 1 is an assembly view, partially in side elevation, partially in section, and partially broken away, of apparatus constructed in accordance with this invention;

Fig. 2 is a view, partially in end elevation and partially in section, of a portion of the apparatus illustrated in Fig. 1;

Fig. 3 is a perspective view of one of the piston clamps;

Fig. 4 is a view, partially in section and partially in longitudinal elevation, through the clamp actuating slide;

Fig. 5 is an end elevation of part of an internal combustion engine showing the method of securing the crank shaft thereof against rotation during assembly;

Fig. 6 is a perspective view of a guiding and clamping bracket for the cylinder block preferred for use in connection with this invention, and

Fig. 7 is a view in front elevation of a portion of the bracket illustrated in Fig. 6, showing the vibrating means.

It is customary in the manufacture of internal combustion engines to assemble various units of such engines at separate points, subsequently bringing the units to a final assembly. For example, in the usual type of engine having a crank case, a cylinder block, a detachable oil pan on the crank case and a detachable head block on the cylinder block, it has been customary to place the engine crank shaft in the bearings in the crank case, and to assemble the pistons and connecting rods on the crank pins of the crank shaft. At a fur-

ther stage in the process the cylinder block is placed over the pistons onto the crank case and is secured thereto, and the cylinder head is afterwards secured to the cylinder block. The oil pan may be attached at any convenient stage of the process of assembly.

In most modern internal combustion engines, especially of the automotive type, the cylinder block consists of a casting which constitutes a considerable percentage of the total weight of the engine. In the assembly of these engines as heretofore practiced, it has been customary to lower such cylinder blocks over the pistons toward the crank case either by hand, or by the use of an ordinary chain block. As the heavy casting was lowered, the pistons, secured to their respective connecting rods on the engine crank shaft, were individually started into their proper cylinders in the cylinder block, the rings on each of the pistons being compressed in turn, as necessary. In this process of handling the work, there is no adequate control over motions of the cylinder block, especially lateral motions thereof. As a result, pistons have frequently stuck in their cylinders, because of difficulty in adequately compressing the rings in their grooves and for other reasons, and it has not been uncommon practice to pull and shake the cylinder block, and even to rap it with a hammer, in an endeavor to free a stuck piston. Such practices result in more or less lateral motion of the block with respect to the crank case, and as will be readily understood, such lateral motion puts a tremendous strain upon the rods and bearings of those pistons that are already engaged in their cylinders, and rods were frequently sprung and bent, and bearings distorted and cracked for this reason.

The present invention contemplates the provision of means to effect the assembly of such units as the crank case with its crank shaft, connecting rods and pistons, and the cylinder blocks, in a manner so guided and controlled as to obviate the imposition of any unusual or dangerous strain on any of the parts.

Referring to the drawing, at 10 is shown a portion of an internal combustion engine in

the process of assembly, said engine having a crank case 11, to which is secured an oil pan 12, and a cylinder block 13. The block 13 is a casting of the usual type, providing cylinders 14 surrounded by appropriate cooling jackets 16 of ordinary construction. The cylinders 14 are adapted for the reception of pistons 17, pivotally secured in the usual manner to connecting rods 18, which are journaled in any well known way to a crank shaft 19 mounted in the crank case 11.

The crank case 11 is provided with laterally disposed arms 21, by means of which the completed engine is supported, and with a flange 22 forming a portion of a fly wheel housing which is adapted to be secured by peripherally arranged bolts 23. The rear end of the crank shaft 19 is provided with a flange 24, located within the housing and provided with suitable bolts 26 for attachment to the engine fly wheel (not shown).

During assembly, the crank case 11 is supported from the arms 21 by means of grooved wheels 28, journaled in blocks 29 which are secured, as by bolts 31, to said arms 21. The grooved wheels 28 are adapted to cooperate with rails 32, suitably supported on standards 33 of any well known form and constituting an assembly track. The crank case 11 of the engine traverses the entire length of this assembly track receiving various additions from time to time until a complete engine is assembled.

Mounted above the main assembly track 32 and arranged substantially at right angles thereto, is a traversing track consisting of rails 34 supported on suitable hanger members 35 which are suspended in any appropriate way from the roof of the building or any other convenient point.

Mounted on the rails 34 is a traversing trolley comprising a frame 36 suspended in any convenient manner from the shafts 37 of grooved wheels 38, which cooperate with the rails 34. Suspended from the frame 36, as by means of a bracket 39 is a hoisting mechanism of any suitable type. As shown, this mechanism is of the well known pneumatic type having an air cylinder 41 clamped between end plates 42 by means of rods 43, which are connected to and supported from the bracket 39. The cylinder 41 contains the usual piston or plunger (not shown) which is connected to a rod 45 projecting through a packing gland 46 in the lower plate 42. The space within the cylinder 41 below the plunger is adapted to be supplied with compressed air by means of a pipe 47, communicating with any suitable source thereof. This pipe 47 is provided with a cock 48 for controlling the admission of compressed air to the cylinder 41, and the cylinder is also provided with the usual escape cock 49 by means of which air is allowed to escape from the interior of the cylinder 41 in the well known

manner. The operation of the pneumatic hoist above described is so well known that further description is deemed unnecessary. The pipe 47 may also have a connection 51 from which a supply of compressed air for other purposes may be taken to any convenient point, if desired.

The lower end of the rod 45 is provided with a suitable fixture or bracket 53, secured thereto in any convenient way as by the bolt 54, and which is adapted for cooperation with the cylinder block casting 13. This bracket 53 is formed with a central or bridge portion 55 having a hole 56 for passage of the bolt 54, and with end portions 57 each symmetrically arranged thereon. Each of these end portions 57 has a downwardly disposed face 58 adapted to contact with the top of the cylinder block casting 13, and a wing portion 59 in which is provided an accurately formed guide hole 60. The guide holes 60 are formed with parallel axes which are normal to the face 58 of the downwardly disposed portions and which are parallel to each other. The portions 58 are also provided with lugs 61 spaced and drilled to cooperate with two or more of the cylinder stud bolts 62, and are provided with suitable wing nuts 63 by means of which the bracket 53 is rigidly secured to the cylinder head casting 13.

Mounted alongside the assembly track is a fixture 65, which may be rigidly secured to the supports 33 of the track by means of bolts, as clearly shown in Fig. 2. The fixture 65 has a horizontally disposed portion 66 adapted to overhang the track. At the outer end of the portion 66 are arranged a pair of vertically disposed guide posts 67, which are adapted for cooperation with the guide holes 60 formed in the bracket 53. The upper end of the posts 67 may be slightly tapered or rounded to facilitate the entrance of the posts into the holes 60. They are accurately formed, and rigidly secured in a vertical position, and are adapted to closely fit the holes 60 to insure rectilinear travel of the bracket 53 and the attached block 13 during the operation of lowering the block casting 13. The guide holes 60 have a sufficient bearing surface on the posts 67 to prevent chattering and twisting of the bracket 53 thereon.

The horizontal portion 66 of the fixture 65 is also adapted to support a pair of horizontal slides 69, arranged one above the other and mounted in suitable guides 71 formed within the portion 66 of the fixture. Each of the slides 69 is formed at its forward end with a transverse beam member 72, arranged parallel to the track 32 and adapted for horizontal movement toward and from the pistons 17. The outer ends of the beam members 72 are provided with vertically disposed pins 73, adapted to support suitable spaced piston clamps 74. Each of the piston clamps 74 has a housing member 76 adapted to slide verti-

cally on the associated pin 73 and having a guiding surface 77 adapted for cooperation with the beam member 72. A compression spring 78 is preferably placed between a suitable shoulder 79 on the pin 73 and an internal shoulder 81 on the member 76, and acts to urge the housing 76 and clamp 74 toward the upper end of the pin.

The outer end of each of the piston clamps 74 is formed with a semi-cylindrical notch 82 of a diameter corresponding to that of the piston 17 with which it is adapted to cooperate. At the ends of the notch 82, the clamp 74 is formed with lugs 83 to which are hinged, as by means of the pins 84, a pair of cooperating clamp bands 86, which define with the notch 82 a circular clamp, adapted to embrace the piston 17 and compress the rings thereof in their grooves. The clamp bands 86 are urged into their clamping position by any appropriate means, such as the leaf springs 87, and are preferably provided at their meeting ends with a suitable latch 88, adapted to retain them in closed position.

Each of the slides 69 is adapted for actuation in a forward direction by a piston 92, connected to the slide by a piston rod 91, and mounted in the usual manner in a cylinder 93. This cylinder 93 may be formed in the horizontal fixture portion 66 as by casting, or it may be separately formed and secured in place in any desired way. The front head 94 of the cylinder is preferably formed as a two part ring, seated against a shoulder 95 in the cylinder wall. The ring may be secured in position against the shoulder 95 by means of a set screw 96, or in any other convenient way. The piston rod 91 passes through an opening in the center of the head 94 and may be engaged by suitable packing 97. The rear end of the cylinder 93 is closed by the usual head. The admission of air under pressure to the cylinder 93, to actuate the piston 92, is under the control of suitable valves 98, provided with handles 99. It will be understood that each of the slides 69 is provided with a pneumatic actuating mechanism such as that described, which is of a well known type requiring no further description. When, upon appropriate movement of the handle 99, the control valve 98 is open to exhaust the cylinder 93, each of the slides is returned to its inner position by means of tension springs 100, as clearly shown in Fig. 2.

Suitably mounted upon the bracket 53 is a vibrating mechanism 101. This mechanism may be of any suitable form but it is preferably of the pneumatic type and consists of a miniature air hammer adapted to deliver light blows in rapid succession to an anvil block located within its casing (not shown). As vibratory mechanism of this kind is well known, a detailed description thereof is not considered necessary. The vibrator 101 may

be supplied with compressed air through any suitable connection, such as the hose 102, and this hose may be conveniently connected to the hose 51 in the air pipe 47. The hose 102 is connected to a suitable inlet nipple 103 through a stop cock 104, by means of which the admission of air to the vibrator 101, and consequently the operation of this vibrator, is controlled.

The operation of this device will be readily understood. The crank case 11 of the engine, together with the crank shaft, and the piston and piston rods thereof, is rolled on the assembly track into position before the fixture 65, where it is suitably clamped in any convenient way. The engine crank shaft 19 is then rotated into a position such that the engine pistons 17 occupy a common vertical plane and are arranged in a pair of horizontal planes, one above the other; some of the pistons being in one of the horizontal planes and the others in the other horizontal plane, depending on the design of the crank shaft 19. This crank shaft 19 may be secured in the position stated in any suitable manner, but it is preferably secured by means of a link 106 which connects one of the bolts 26 in the crank shaft flange 24 to one of the bolts 23 on the housing flange 22. In this position of the crank shaft the handles 99 are manipulated to open their respective valves 98 and admit air under pressure behind the pistons 92 in the cylinders 93. The pistons 92 are thus forced forward in their respective cylinders, carrying the slides 69 with them, through the rods 91 against the tension of the springs 100. The forward motion of the slides 69 advances the cross bars 72, and with them the piston clamps 74, into piston engaging position. One of the engine pistons 17 is now disposed in each of the semi-circular notches 82, and the clamp bands 86 are closed about the piston and secured by means of the latch 88, thus compressing the piston rings in their respective grooves in a manner well understood in the art to which this invention relates. It will thus be seen that the pistons are rigidly alined in a vertical plane and are supported in position to receive the cylinder block 13.

The cylinder block 13 is brought from any convenient point to a position beneath the traversing track, where it is attached by means of the stud bolts 62 and nuts 63 to the lugs 61 on the bracket 53. The faces 58 of the bracket are thus rigidly clamped against the upper face of the cylinder block 13. Air is now admitted by means of the valve 48 into the cylinder 41 beneath the plunger therein and the cylinder block 13 is thus hoisted in the well known manner. It is then brought by means of the traversing trolley to a point directly over the crank case 11, at which point the trolley frame 36 is secured in any convenient manner (not shown).

The escape cock 49 is then opened slowly and air allowed to escape from the cylinder 41, thus permitting the block 13 to slowly descend by gravity toward the crank case 11.

At the proper point in its travel the guide pins 67 are started in the guide holes 60. Thereafter the travel of the cylinder block is a strictly rectilinear descent in exact alignment with the crank case 11, each of the cylinders 14 being alined with its cooperating piston 17.

Just before the lower face of the cylinder block reaches the upper row of clamped pistons, air is admitted by means of the cock 104 to the vibrator 101 which thus imparts to the bracket 53, and consequently to the whole cylinder block 13 a rapid vibration of small amplitude. In this manner the tendency of any of the pistons 17 to stick in their cooperating cylinders 14 is readily overcome without the imposition of any strain on the parts. As the lower edge of each of the cylinders 14 passes over its corresponding piston 17, it strikes against the upper face of the clamp 74, pushing the latter downward against the tension of the spring 78. In this manner the piston embracing clamp notch 82 and its cooperating bands 86 are pushed axially from the piston 17, thus successively releasing the piston rings. Such release is not effected, however, until after each ring has started within the piston 14.

When the cylinder block 13 has been lowered to a point where the pistons supported by the upper slide have been entered in their respective cylinders 14, the downward travel of the cylinder block 13 is arrested by closing the escape cock 49, and the upper slide 69 is retracted by releasing the air in the corresponding cylinder 93 and permitting the spring 100 to act. After retraction of the upper slide 69, the escape cock 49 is again opened and the lowering of the cylinder block 13 is continued over the pistons clamped at the lower level. After the remainder of the pistons 17 are started in their respective cylinders 14 the lower slide 69 is retracted in a manner similar to that of the upper slide, and the cylinder block 13 is allowed to descend into contact with the crank case 11.

It will be evident that this invention provides a means of assembling internal combustion engines by which the principal units of the structure may be quickly and easily erected, and in which all danger of sticking and ensuing strain on the connecting rods, pistons and bearings is obviated.

It will be understood that various forms of the invention other than those described above may be used without departing from the spirit or scope of the invention.

What is claimed is:

1. In a device for assembling an internal combustion engine having a crank case, a

cylinder block, a crank shaft mounted in the crank case, and pistons secured to the crank shaft, the combination of a fixture having upwardly disposed guide members, means adapted to secure the crank case in fixed relation to the fixture, a bracket adapted to slide upon the guide members, and means for securing the cylinder block to the bracket.

2. In a device for assembling parts of an internal combustion engine having a cylinder block, a crank case, a crank shaft therein, and pistons connected to the crank shaft, the combination of a fixture, vertically disposed guide members on the fixture, a slide mounted on the fixture at right angles to said guide members, clamping means on the slide adapted to maintain the pistons in a vertical plane, a bracket having portions adapted to cooperate with the guide members, and means for securing the cylinder block to the bracket.

3. In a device for assembling internal combustion engines having a crank case, piston and connecting rod assemblies mounted therein and a cylinder block adapted for mounting on said crank case to cooperate with said pistons, the combination of guide members vertically disposed in fixed relation to the crank case, a bracket adapted to be rigidly secured to the cylinder block having portions adapted for cooperation with the guide member, and means for lowering the block into position on the crank case under the control of said guide members.

4. In a device for assembling internal combustion engines having a crank case, piston and connecting rod assemblies mounted therein and a cylinder block adapted for mounting on said crank case to cooperate with the pistons, the combination of a guide member, a bracket secured to the cylinder block and engaging the guide member and means cooperating with the bracket for lowering the block into position on the crank case under the control of said guide members.

5. In a device for assembling internal combustion engines having a crank case, piston and connecting rod assemblies mounted therein and a cylinder block adapted for mounting on said crank case to cooperate with said pistons, the combination of vertically disposed parallel guiding pins mounted in fixed relation to the crank case, a bracket having guide surfaces adapted to cooperate with said pins and removably secured to the cylinder block, means to support the pistons in a common vertical plane, and means for lowering the block over the pistons into position on the crank case under the control of said guide members.

6. The combination in a device for assembling internal combustion engines having a crank case with a piston and connecting rod assembly therein, and a cylinder block adapted for mounting on said crank case, of means for securing the pistons in a common vertical

plane above the crank case, and means for guiding the cylinder block over the pistons into position on the crank case, said guiding means comprising vertically disposed guide members fixed with respect to the said securing means, and a bracket adapted to be clamped to the cylinder block having portions engaging said guide members.

7. The combination in a device for assembling internal combustion engines having a crank case, a crank shaft and a piston and connecting rod assembly therein, and a cylinder block adapted for mounting on said crank case, of retractable means for clamping said pistons in a common vertical plane, means securing the crank shaft in a position corresponding to the position of said pistons, and guiding means adapted to restrain the cylinder block to a rectilinear path while being lowered over the pistons into position on the crank case.

8. The combination in a device for assembling internal combustion engines having a crank case, a crank shaft and a piston and connecting rod assembly therein, and a cylinder block adapted for mounting on said crank case, of retractable slide members having clamps adapted to engage and support the pistons and to compress the rings thereof, means including a removable bracket member adapted to support and lower the cylinder block, said bracket member having guide surfaces, and guide members adapted to engage said guide surfaces to maintain the cylinder block horizontal and in line with the crank case while being lowered thereto over the pistons.

9. The combination in a device for assembling internal combustion engines having a crank case, a crank shaft and a piston and connecting rod assembly therein, and a cylinder block adapted for mounting on said crank case, of retractable slide members having clamps adapted to engage and support the pistons and to compress the rings thereof, means including a removable bracket member adapted to support and lower the cylinder block, said bracket having means adapted to guide the pistons into the cylinders of said cylinder block, and means for vibrating said bracket and said cylinder block to assist the entry of the pistons into said cylinders.

In testimony whereof I affix my signature.

REUBEN O. GILL.