Dec. 16, 1941. E. GRIESHABER 2,266,192

WRIST PIN CONSTRUCTION

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Fig. 1

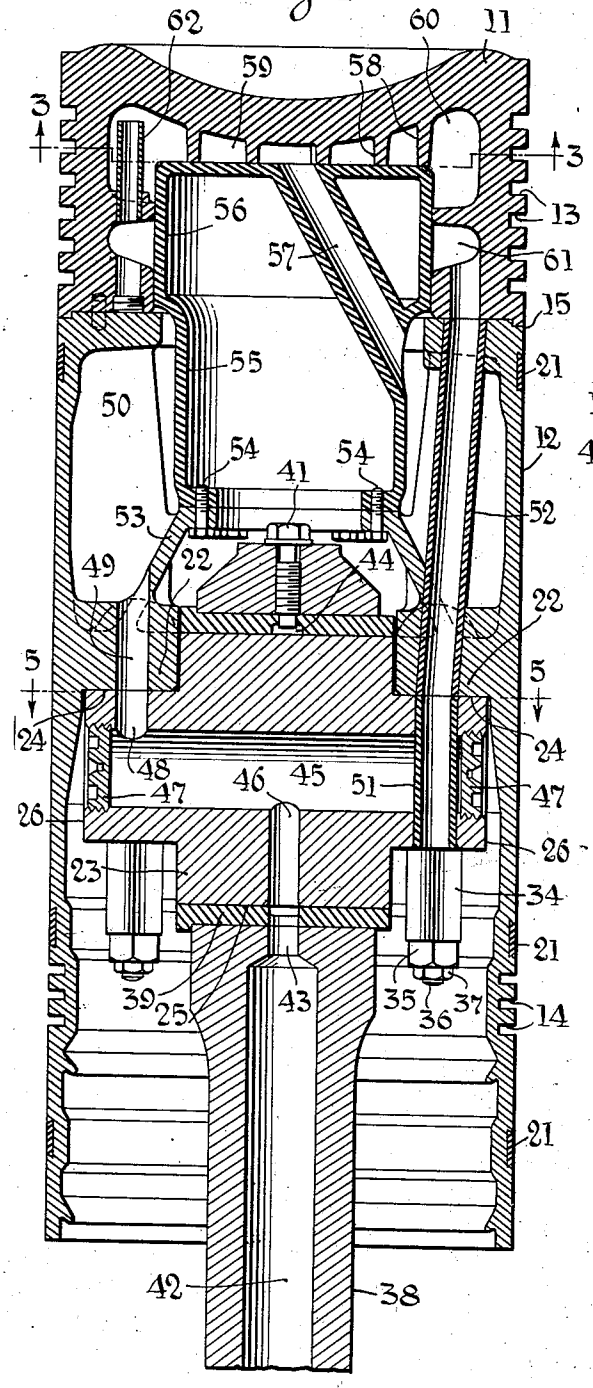
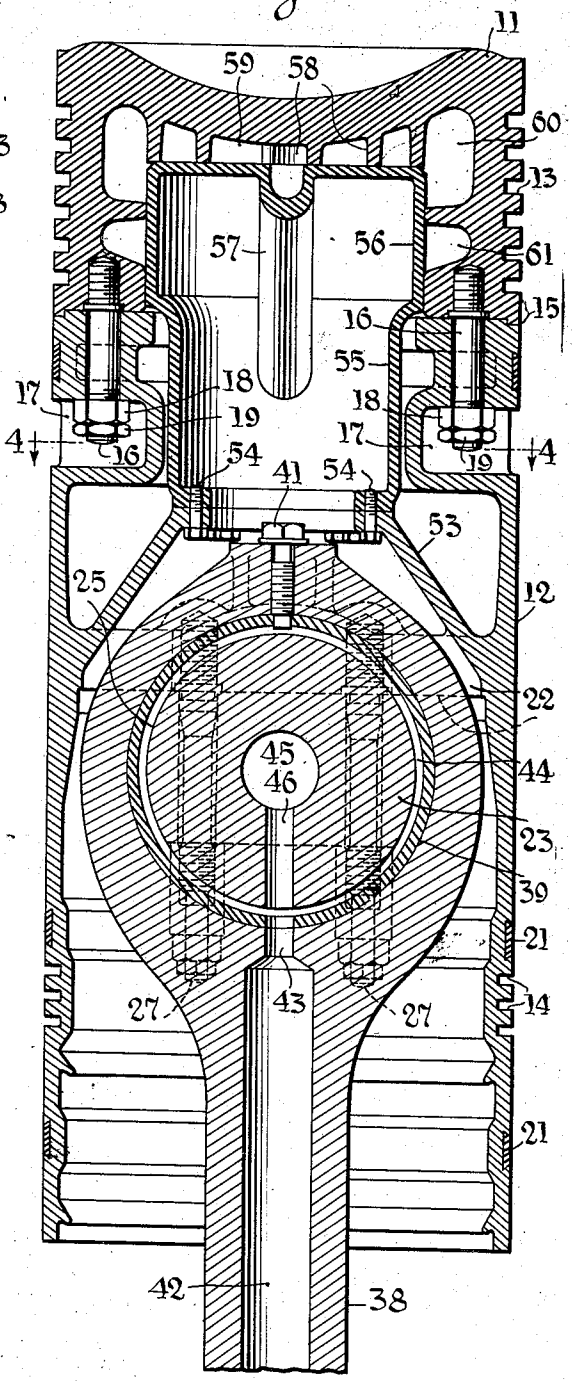


Fig. 2



Inventor
Emil Grieshaber

By Dodge and Dom

Attorneys

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Fig. 3

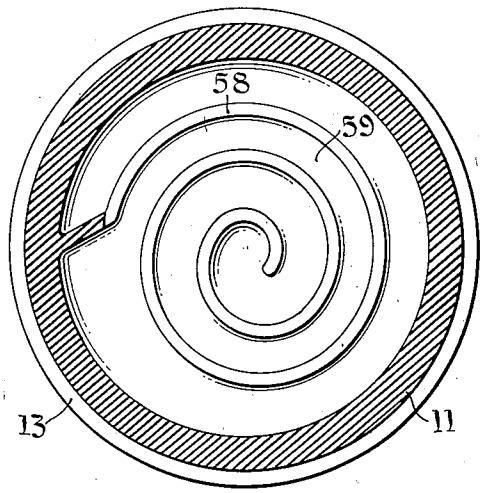


Fig. 4

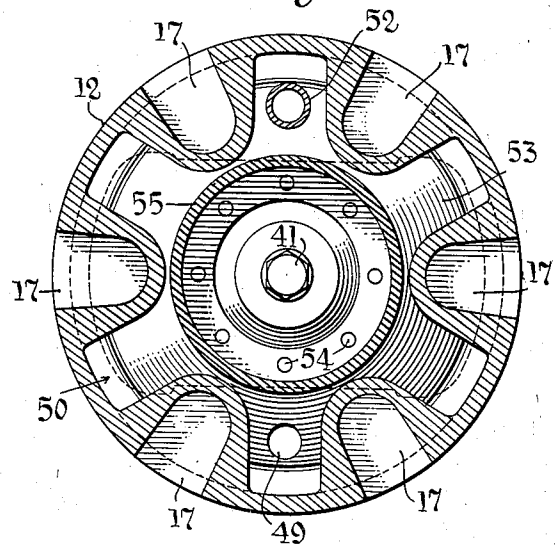


Fig. 5

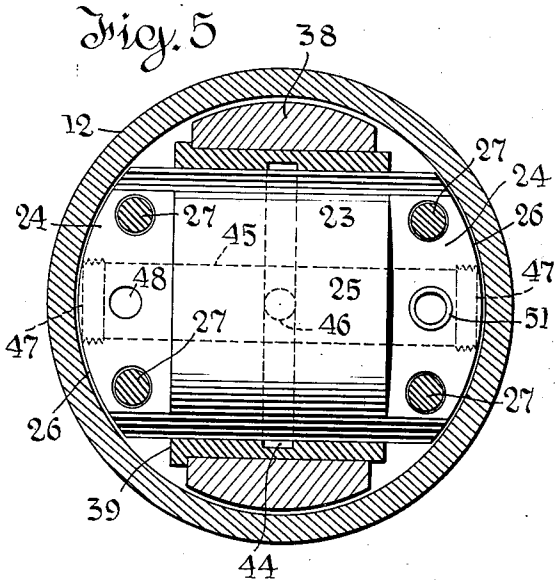


Fig. 6

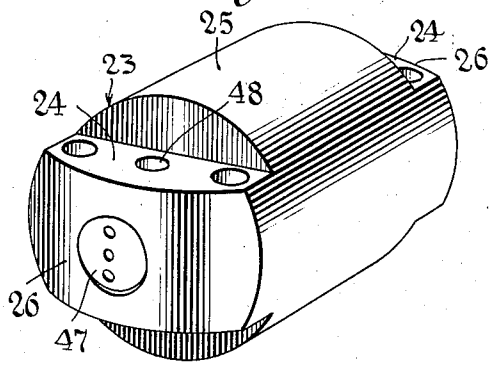
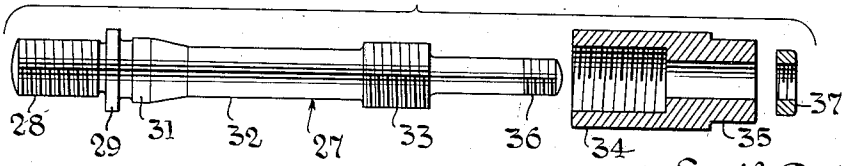


Fig. 7



Inventor
Emil Grieshaber

By Dodge and Sons

Attorneys

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Fig. 8

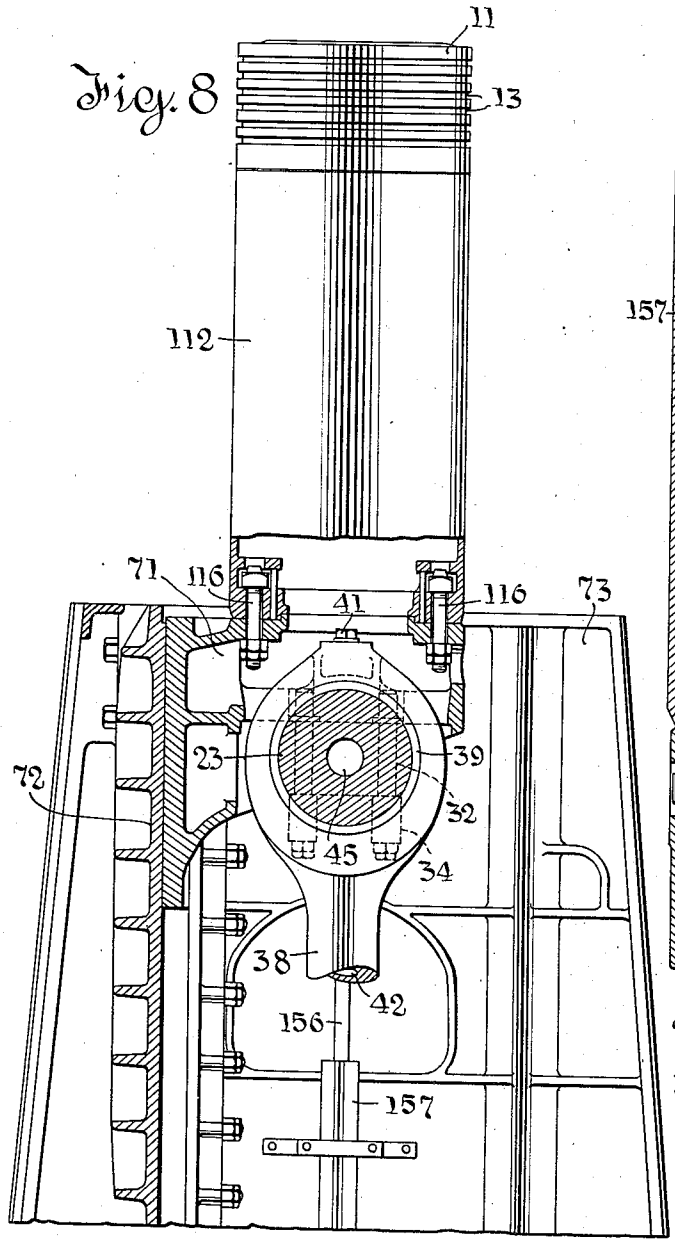
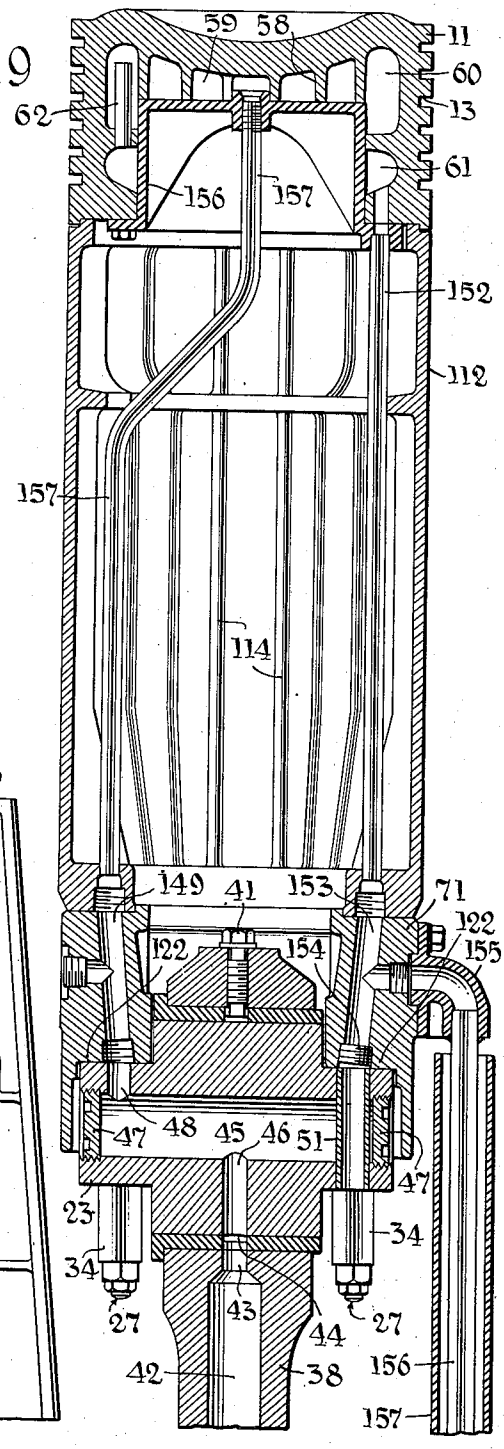


Fig. 9



Inventor

Emil Grieshaber

By

Dodge and Sims

Attorneys

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UNITED STATES PATENT OFFICE

2,266,192

WRIST PIN CONSTRUCTION

Emil Grieshaber, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application July 10, 1939, Serial No. 283,689

6 Claims. (Cl. 309—15)

This invention relates to reciprocating engines and particularly to piston and wrist-pin constructions intended primarily for use in Diesel engines.

Engines of this type have commonly been constructed with trunk pistons, in which the wrist pin is mounted in the piston proper. In such case, the piston performs also the functions of a cross-head. In some cases, however, it is desirable to use a cross-head and guides distinct from the piston. The wrist pin constructions heretofore used for these two types of engine have been quite distinct, each being affected markedly in design by the environment in which it is used.

The present invention is based on the concept that substantial manufacturing economies can be effected when a manufacturer produces both types of engine, by producing a standardized wrist pin construction capable of use with either type of engine. To do so is not a simple problem, because loads are heavy, the space limitations are severe (particularly in a trunk piston), accessibility is essential, and means must be provided to supply through the wrist pin the cooling fluid (oil) required by the piston head. Obviously, a heavily loaded wrist pin must be manufactured with precision and hence is an expensive component. Standardization of design thus results in unusual savings of cost and reduces the risk of failure because the performance of a standardized design is predictable after adequate standardizing tests.

A preferred embodiment as applied to trunk pistons and to cross-heads will now be described by reference to the accompanying drawings, in which:

Figure 1 is an axial section through a trunk piston having the invention incorporated. The plane of section is on the axis of the wrist pin.

Figure 2 is a similar section, the plane of section being normal to the axis of the wrist pin.

Figure 3 is a section on the line 3—3 of Figure 1.

Figure 4 is a section on the line 4—4 of Figure 2.

Figure 5 is a section on the line 5—5 of Figure 1.

Figure 6 is a perspective view of the wrist pin.

Figure 7 is a view of a standardized stud and nut arrangement used to connect the wrist pin to a trunk piston or to a cross-head, as the case may be.

Figure 8 is fragmentary elevation of an engine frame with cross-head guide, cross-head and connected piston. The wrist pin and connecting rod are identical with corresponding parts in Figures 1–6.

Figure 9 is a section (drawn on a somewhat enlarged scale) showing the piston and wrist pin of Figure 8. The section is on the plane common to the axis of the piston and the axis of the wrist pin.

Referring first to Figures 1 to 7, inclusive, the trunk piston is comprised of two major components, a head portion 11, and a main sleeve portion 12, the head portion 11 having ring grooves 13 for the usual piston rings, and the sleeve portion having grooves 14 for other rings which usually are oil scraping rings.

A circular shoulder is formed at 15 to center the head and the sleeve, and these are held together by six studs 16, two of which appear on the plane of section of Figure 2. These studs are threaded into the head, extend through a thickened portion of the sleeve, and their ends are exposed in pockets 17. Two of these pockets appear in Figure 2, and all are clearly shown in Figure 4.

Within each pocket, a main nut 18 and a check nut 19 are applied to the studs. Since the piston is single acting, the load carried by the studs is not great.

Mounted in under-cut grooves in the circumference of the sleeve, there are wearing rings indicated generally at 21, the provision of such rings being standard construction.

Extending across the sides of the interior of the sleeve 12, and bounded by parallel secant lines, are two lugs 22 against which the wrist pin indicated generally by the numeral 23 seats. These lugs are flat on their lower faces and deliver thrust directly to flattened end portions 24 of the wrist pin 23.

As is best shown in Figure 6, the wrist pin is of generally cylindrical contour having a cylindrical journal or bearing surface indicated by the numeral 25 in Figure 6 and having cylindrical ends conforming to the interior circumference of the sleeve 12 and indicated in Figure 6 by the numeral 26. In this way, a maximum seating area is secured at 24 within the limitation afforded by the internal dimensions of the sleeve 12. The wrist pin is fastened to the lugs 22 by four studs 27. Construction of these studs and the nuts mounted thereon can best be explained by reference to Figure 7.

Each stud has a threaded end 28 and a flange 29, the threaded portion entering threaded holes in a corresponding lug 22, the flange 29 being

seated in a countersink formed in the latter. Below the flange 29, each stud is relieved and then enlarged at 31 to form a centering element for aligning the wrist pin. Below the portion 31 there is a short taper leading to reduced portion 32. At a distance corresponding to the thickness of the end portion of the wrist pin, the stud is provided with threads 33 to receive a sleeve nut 34. This nut is elongated as shown and terminates in a hexagonal wrench grip 35. Beyond the threads 33, the stud is further reduced and its end is threaded as indicated at 36 to receive a check nut 37. The use of the sleeve nut 34 brings the wrench grip 35 below the journal surface 25 of the wrist pin and near enough to the lower end of the skirt 12 to permit it to be reached by an extension socket wrench. It is contemplated that a special wrench will be made for tightening these sleeve nuts and another for tightening the check nuts 37.

It will be observed that the studs are symmetrically arranged in the plane of the flattened end portions 24 and the arrangement is such as to facilitate assembly and to avoid the transmission of bending stresses to the studs.

The connecting rod which is generally indicated by the numeral 38 is provided with a bearing bushing 39 pressed to place and held by a staking screw 41 (see Figs. 1 and 2). Connecting rod 38 has an axial bore 42 which, in accordance with past practice, receives oil under pressure from the crank pin (not shown). From the bore 42, a drilled port 43 leads to a groove 44 in the inner face of the bushing 39, and this groove communicates with an axial bore 45 in the wrist pin 24 by means of a drilled port 46. The ends of the bore 45 are closed by threaded plugs 47 (see Figs. 1 and 6).

As best illustrated in Figure 5, the holes formed in the ends of the wrist pin 24 to receive the studs 27 do not enter the bore 45. A drilled port 48 leads from the bore 45 and communicates with a drilled port 49 in the left-hand lug 22 of Figure 1. A drilled port similar to the port 48, but larger, is formed in the other end of the wrist pin and extends clear through the end of the pin. It is, however, isolated from the bore 45 by tube 51, pressed to place and making a fluid-tight connection with the wrist pin. The tube 51 is clearly shown at the right of the wrist pin in Figure 1, and also in Figure 5. The tube 51 is in direct communication with a tube 52 of the same diameter, pressed to place, in bores formed in the sleeve 12 (see Figure 1).

Formed integrally with the sleeve 12 and extending upward from the bosses 22 is a conical barrier open at its center and indicated by the numeral 53. Mounted on the upper margin of the barrier 53 and connected thereto by machine screws 54 is a cup-shaped filler piece 55 having an enlarged upper end 56 and a diagonal tubular passage 57 formed integrally therewith, and arranged as shown in Figures 1 and 2. This filler piece coacts with flanges and ribs formed on the interior of head 11, and with portions of sleeve 12 to form oil chambers and passages through which oil is circulated.

The head 11 is of generally cup-shaped configuration and the enlarged head 56 on the member 55 lies within the head 11. On the inner face of the head 11 is a spiral baffle indicated at 58 and arranged to provide, in conjunction with filler piece 55, a spiral passage 59 with the inner end of which the tubular duct 57 communicates. The spiral passage 59 at its outer end communicates with annular channel 60. Below this is a second annular channel 61 formed as an internal groove in the head 11. The channel 61 and the lower portion of channel 60 encircle the enlargement 56 of the hollow filler piece 55. The channel 60 communicates with the channel 61 by means of a tube 62 pressed into the intervening flange. The top of tube 62 is located close to the top of channel 60 so that the spiral passage and passage 60 must substantially fill with oil before discharge commences.

The path of oil circulation is as follows:

Oil flows upward through the port 42 and through the port 43, groove 44 and port 46, to the bore 45 of the wrist pin. Thence it flows through the ports 48, 49 to the annular space 50 within the sleeve 12 around the lower portion of the filler 55. From this annular space, the oil flows through the tubular passage 57 to the inner end of the spiral passage 59 and thence through the spiral passage to channel 60 through the tube 62, thence through channel 61 to the tube 52, to tube 51. The tube 51 discharges through the lower end of the piston directly into the crank case (not shown). It follows that the circulating oil not only lubricates the wrist pin but also flows through the upper part of the piston skirt and then in a sinuous path through the piston head, ultimately discharging back to the crank case from which the circulating oil is drawn.

In Figures 8 and 9, a modified construction is shown which, however, uses certain components used in Figures 1 and 2. Where the components are the same, the same reference numerals are used in Figures 8 and 9. Other components are given distinctive numerals. The cylinder head portion 11 is the same as in Figures 1 and 2 and is provided with ring grooves 13 as before. It has the annular groove passage 61, channel 60, spiral rib 58, spiral passage 59, and connecting tube 62. These passages are completed by an inserted cup 156 which performs the same function as the enlarged head 56 shown in Figures 1 and 2.

The sleeve portion 112 of the piston is ribbed on its inner surface as indicated at 114 and has no ring grooves. It is connected by the studs 116 (see Fig. 8) with a cross-head indicated at 71. The cross-head is guided in the cross-head guide 72 which is carried by a portion of the engine frame 73. The particular form of the cross-head guide and engine frame are not material, but are clearly indicated in the drawings.

The cross-head 71 is formed with two parallel shoulders 122, functionally similar to the lugs 22 in Figures 1 and 2. Mounted against these lugs is the wrist pin 23 which is identical with the wrist pin shown in Figures 1 and 2. It is associated with connecting rod 38 which may be identical with and, in any event, is functionally identical with the connecting rod shown in Figures 1 and 2. This being the case, there is an axial bore 42, port 43, groove 44, axial bore 45, port 46, and plugs 47, port 48 and inserted tube 51. In this environment, however, the tube 51 is functionless, as hereafter explained.

The port 48 communicates with a port 149 in the cross-head, and this is connected by a pipe 157, to a passage leading through cup 156 to the inner end of the spiral passage 59 in head 11.

The discharge port from channel 61 which in the embodiment of Figures 1 and 2 communicates with the pipe 52, in Figures 8 and 9 communicates with a port in the sleeve 112 with which

is connected a pipe 152. The lower end of pipe 152 communcates with a passage 153 in the second lug 122 on the cross-head. The lower end of the port 153 is closed by a screw plug 154, and the port has a lateral discharge leading to an elbow 155.

The elbow 155 carries a discharge pipe 156 whose end is housed within the pipe 157 leading to the oil-sump of the engine.

It follows that assuming a cylinder bore of given size, the piston head component, the wrist pin, and, in certain cases, the connecting rod, are interchangeable and may be manufactured to a single standard for use in either type of engine.

It is deemed unnecessary to trace the circulation of oil with reference to Figure 9 because it follows very closely the circulation characteristics of Figures 1 and 2, and the only difference is that there is no chamber corresponding to the chamber 50 (Figs. 1 and 2) so that the piston is not charged with oil through any portion of the skirt 112. Instead, the cooling circulation is confined to the head 11.

The purpose of the design is to secure the maximum practicable seating area at 24, for a wrist pin of a maximum practicable diameter. On these dimensions the trunk-type piston imposes the closest limitations, but since the effective piston area is the same whether or not a cross-head is used, any wrist pin which will withstand the stresses encountered in one type of engine will be adequate to withstand similar stresses encountered in the other.

The studs 32 hold the parts in assembled relation, but since the piston is single-acting, the studs never transmit the working thrust developed upon the piston head.

The use of the elongated sleeve nuts 34 makes these accessible, even in the trunk piston, and it is highly advantageous to be able to use the same studs, nuts and check nuts in both types of engine, because, as in the case of the wrist pin, standardization results in predictable performance.

When used with trunk pistons, the invention has the advantage that no part of the wrist pin extends through sleeve 12, nor does it require any opening to be formed in that sleeve. The wrist pin may be dismounted and reconnected while the piston is in the cylinder which is a great advantage from the maintenance standpoint, because it permits the connecting rod to be dismounted without pulling the piston and permits the piston to be pulled through the head end of the cylinder without dismounting the connecting rod. This permits reduction in the height of the engine room, because it is necessary to provide space to pull only the piston, not as heretofore the piston and connecting rod.

The arrangement here disclosed to secure the maximum possible dimensions of wrist pin within the space limitation imposed by the trunk piston is an important feature of the invention, and is susceptible of moderate variation within the scope of the invention. The arrangement of accessory features not subject to these space limitations is subject to wide variation by the exercise of mechanical skill, so that while the invention has been described in considerable detail, the description is intended to be exemplary and not limiting.

What is claimed is:

1. The combination of a reciprocating unit including a cylindrical piston head provided with an oil circulating passage, and a connected guiding member provided with parallel lugs to receive a wrist pin, said lugs being formed with passages for circulating oil; means affording connections between the passages on said lugs and the opposite ends of the passage in said head; a wrist pin having a cylindrical journal at its mid-portion and rounded ends which are portions of a right cylinder whose diameter is somewhat less than the diameter of the piston head and whose axis is coincident with the axis of such head, the end portions of said wrist pin being cut away to afford seats for engaging said parallel lugs, said wrist pin having an oil passage leading through it from the journal surface to one of said seats in position to register with the passage in the corresponding lug; threaded connections engaging said lugs and the end of said pin; and a connecting rod including a bearing journaled on said pin and having an oil passage leading to said bearing and communicating with the oil passage in said wrist pin.

2. The combination of a trunk piston including a head and a guiding sleeve forming a reciprocating unit, there being an oil circulating passage in the head and wrist pin supporting lugs in the sleeve, said lugs being formed with passages which communicate with opposite ends of the passage in the head; a wrist pin having a cylindrical journal at its mid-portion and rounded ends which are portions of a right cylinder whose diameter approximates the internal diameter of the sleeve with which it is co-axial, the end portions of said wrist pin being cut away to afford seats for engaging said lugs, said wrist pin having an oil passage leading through it from the journal surface to one of said seats in position to register with the passage in the corresponding lug; threaded connectors for holding the seats on the wrist pin against corresponding lugs in the sleeve and a connecting rod, including a bearing journaled on said pin and having an oil passage leading to said bearing and communicating with the oil passage in the wrist pin.

3. A wrist pin for use with pistons of the oil cooled type, comprising a member having a cylindrical journal for a connecting rod at its mid-portion and rounded ends which ends are portions of a right cylinder whose diameter does not exceed the internal diameter of a trunk piston for which the pin is suited, and whose axis is perpendicular to the axis of said journal, the end portions of said member being cut away to parallel planes secant to said cylindrical ends to afford seats for mounting the member, said member having an oil passage leading through it from the journal surface to one of said seats, and a distinct oil passage leading through the other end from the other of said seats, each of said passages terminating at the middle of the seat, and the pin having bolt holes, two in each seat located at opposite sides of the passage aforesaid.

4. A wrist pin for use with pistons of the oil cooled type, comprising a pin having a cylindrical journal for a connecting rod at its mid portion and rounded ends, which ends are portions of a right cylinder whose diameter does not exceed the internal diameter of the piston for which the pin is suited and whose axis is perpendicular to the axis of said journal, the end portions of said pin being shouldered to form seats for mounting said pin in such piston, said pin having an oil passage leading through it from its journal surface to one of said seats, said passage including a bore substantially coaxial with the journal surface of the

pin and extending substantially from end to end of the pin but closed at each end, the pin having bolt holes out of communication with said axial bore.

5. The combination of a trunk piston comprising a head formed with a head cooling passage for oil, and a guiding sleeve having wrist pin supporting lugs wholly internal to the sleeve, one of said lugs being provided with a port connected with the entrance end of said cooling passage in the head; a wrist pin wholly internal to said sleeve and having seats at its ends for engaging said lugs, said pin having a journal for the connecting rod intermediate said lugs, said wrist pin having an oil passage leading through it from the surface of the journal to that seat which engages the ported lug, said passage in the wrist pin including a chamber which extends nearly but not quite from end to end of the wrist pin; means for rigidly connecting the ends of said pin to the lugs within said skirt; a connecting rod including a bearing journaled on said pin; and means for supplying oil to the chamber in the wrist pin.

6. The combination of a trunk piston comprising a head formed with a head cooling passage for oil and a guiding sleeve having wrist pin supporting lugs wholly internal to the sleeve, said lugs being provided with ports connected with the respective ends of the cooling passage in the head; a wrist pin wholly internal to said sleeve and having seats at its ends for engaging said lugs, said pin having a journal for the connecting rod intermediate said lugs, said wrist pin having an oil passage leading through it from the surface of the journal to one of said seats to communicate with the port therein, said passage in the wrist pin including a chamber which extends nearly but not quite from end to end of the wrist pin and the wrist pin having a second passage distinct from the one just defined which communicates with the passage in the other lug; means for rigidly connecting the ends of said pin to the lugs within said skirt, and a connecting rod including a bearing journaled on said pin and having an oil passage leading to said bearing and communicating with the oil passage which leads from the surface of the journal.

EMIL GRIESHABER.