No. 678,150. Patented July 9, 1901.

F. L. WHITE.

MULTIPLE CYLINDER PISTON ROD CONNECTION.

(Application filed Oct. 8, 1900.)

(No Model.) 2 Sheets—Sheet 1.

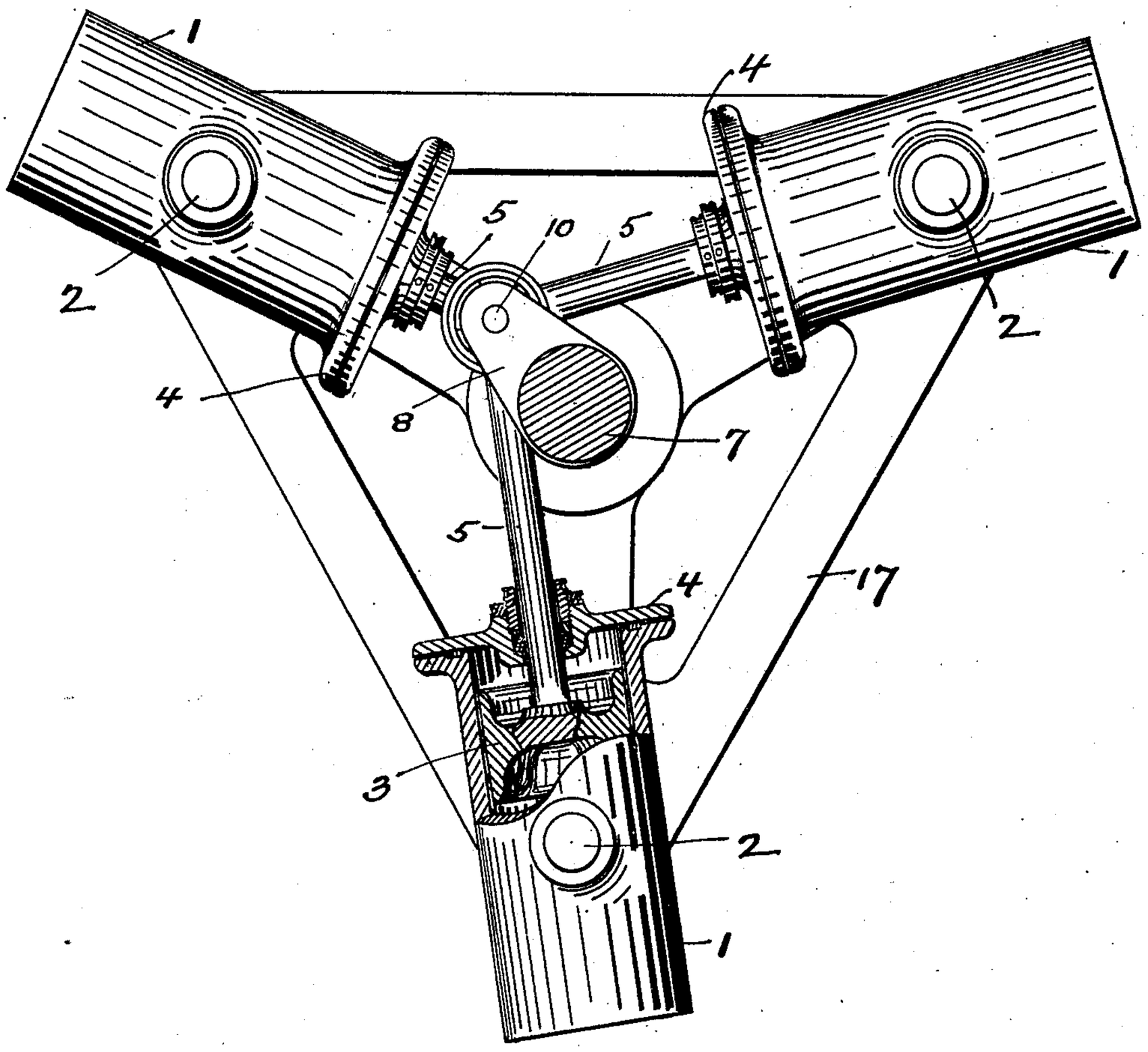


Fig. 1.

Witnesses.
J. P. Dejon
Wallace S. Moyle

Inventor.
Frederick L. White
per
George E. Hall
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 678,150. Patented July 9, 1901.

F. L. WHITE.

MULTIPLE CYLINDER PISTON ROD CONNECTION.

(Application filed Oct. 8, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

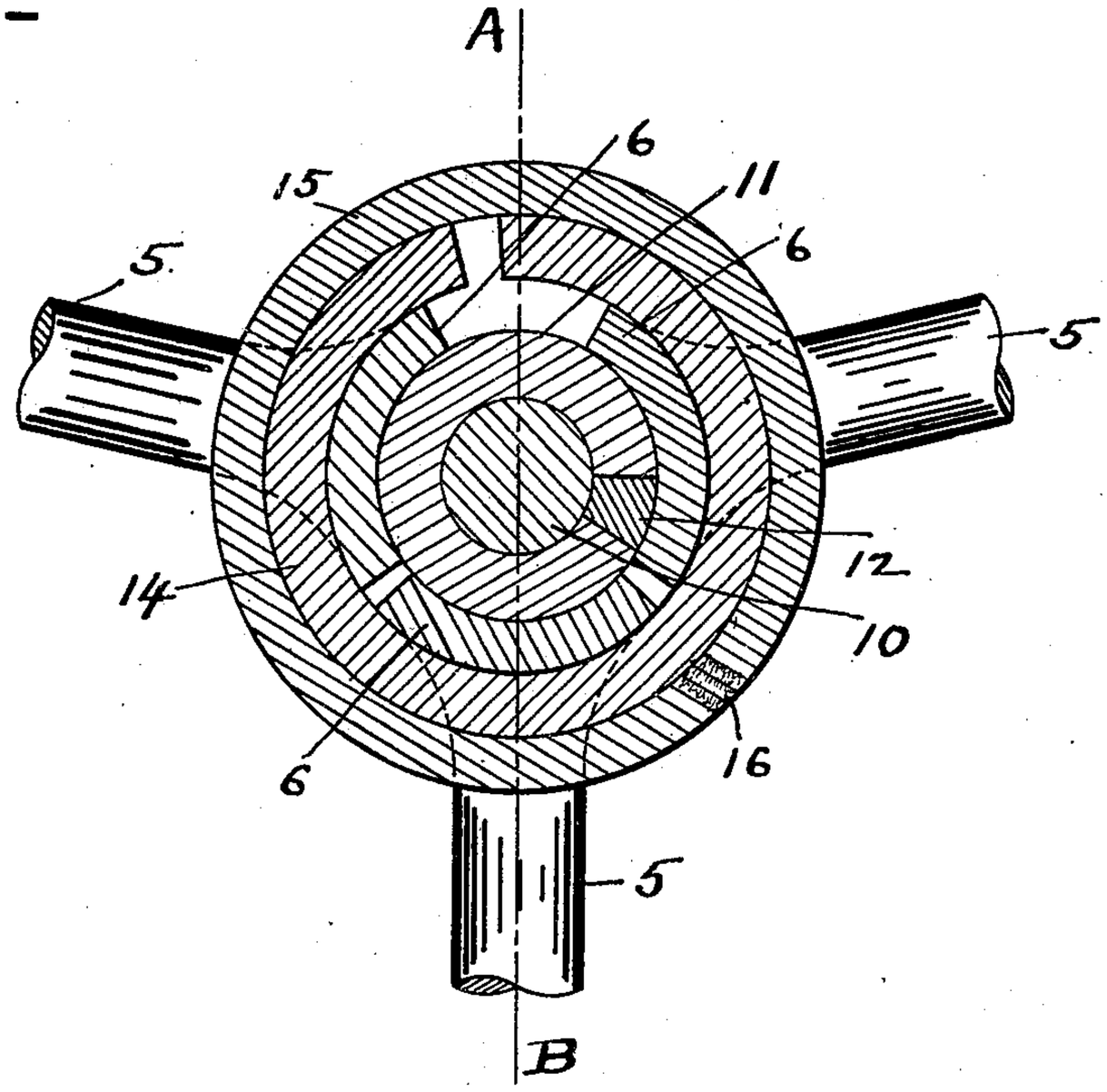
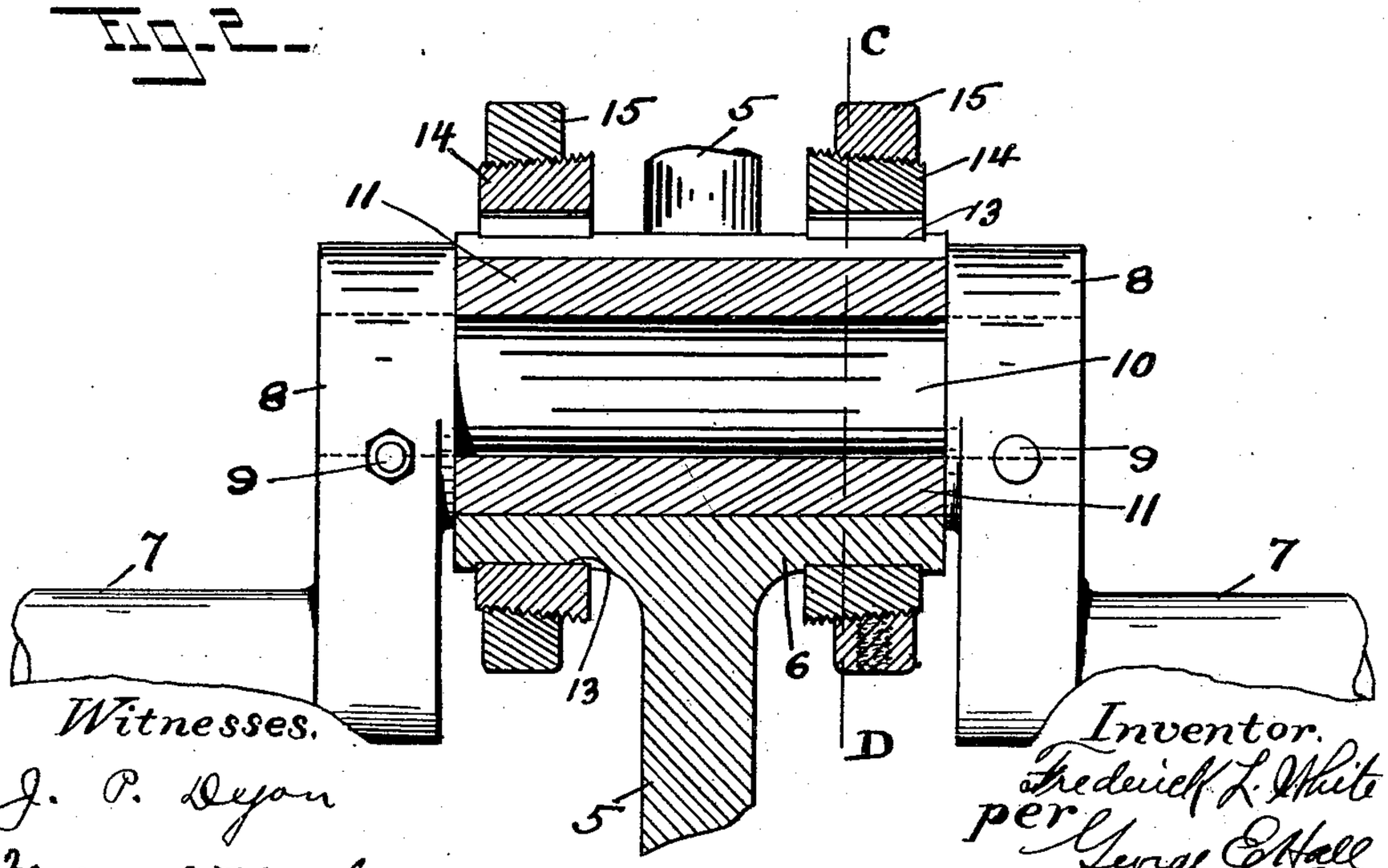


Fig. 2.



Witnesses.
J. P. Dwyer
Wallace S. Moyle

Inventor.
Frederick L. White
per George E. Hall
Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDERICK L. WHITE, OF BOSTON, MASSACHUSETTS.

MULTIPLE-CYLINDER PISTON-ROD CONNECTION.

SPECIFICATION forming part of Letters Patent No. 678,150, dated July 9, 1901.

Application filed October 8, 1900. Serial No. 32,442. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK L. WHITE, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Multiple-Cylinder Piston-Rod Connections, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to multiple-piston-rod connections and has especial reference to the means for connecting a plurality of piston-rods to a single crank of a crank-shaft.

It is the object of my invention, among other things, to connect the several piston-rods of a multiple-cylinder engine in which the cylinders are located equally distant from each other about the center of the crank-shaft with a single crank upon said shaft, whereby each and all of the said cylinders may be in the same plane and the piston-rod rigidly connected with the piston-head at one end and revolubly connected with the crank at the other end, and to provide the crank-pin with self-oiling devices which will also take up any grit or foreign matter that would accidentally work into and cut the bearings or impair the efficiency of the working parts, a further object being to so design all of the several parts that they can be economically manufactured and readily assembled.

To these and other ends my invention consists in the multiple-piston-rod connection having certain details of construction and combination of parts, as will be hereinafter described, and more particularly pointed out in the claims.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a plan view of an engine having three cylinders and containing my improved devices, the nigh frame being removed and one of the cylinders and the crank-shaft being in section. Fig. 2 is a fragmentary view of the crank-shaft with the parts composing the connection shown in section upon line A B of Fig. 3, and Fig. 3 is a section of the same parts taken upon line C D of Fig. 2.

Heretofore it has been customary in multiple-cylinder engines in which the cylinders are arranged around a common center to secure the cylinders in different planes, whereby each of the several piston-rods are connected to the crank-shaft upon a separate crank, thus necessitating a crank for each piston, which in an engine of the type herein illustrated would require three separate cranks. In this case where a separate crank is provided for each piston the cost of construction and the large amount of space required have prevented the general adoption of this type of engine. Attempts have been made to overcome this objection by arranging all of the cylinders in a single plane and having an offset on each piston-rod, thereby permitting the use of a single crank on the crank-shafts, each of the piston-rod bearings being side by side. Where the piston-rods have an offset, only a partial remedy is afforded, as the crank must be of a width sufficient to accommodate all of the ends of the piston-rods. In brief, practically no economy is made as to the amount of space required, the only economy being in the fact that but one crank is used rather than a plurality, hence a slight reduction in the cost of construction. In substantially all of the explosive-engines heretofore made the piston-rods have been pivotally connected with the piston-head, thus permitting the use only of a cylinder having one open end to accommodate the oscillatory and longitudinal movement of the piston-rod. By this construction the strain upon the piston-head is never in a direct line with its axis, but is always in a line with the axis of the piston-rod, so that as the position of the piston-rod is changed so changes the line of working strain upon the piston-head. The effect of this action is to increase the friction of the piston-head within the cylinder and to wear its external surface and the internal surface of the cylinder unequally, causing in a very short time a defective operation of the engine. To overcome these and other manifest objections to explosive-engines in the prior art, I have designed the improved means herein shown for joining all of the piston-rods to a single crank, wherein all of the cylinders are in the same plane and the piston-rods are rigidly connected with the piston-head, which piston-rods are all removably and rotatably secured to a single crank without offsets.

Referring to the drawings, the numerals 1 1 1 designate the cylinders of a multiple engine, which cylinders are located equally distant from each other about the center of the crank-shaft 7 and are mounted between suitable frames 17 by the trunnions 2, whereby the said cylinders will have an oscillatory movement. The said cylinders are constructed substantially alike, and I have therefore shown but one of them in section. Movable within each of the said cylinders is a piston-head 3, which is actuated by the force of an explosion of a charge of explosive mixture which is conveyed into said cylinder and caused to explode therein by an ignition-spark in a manner well known in the art. Rigidly connected to the piston-head 3 are the piston-rods 5, which piston-rods pass through the cylinder-heads 4 and terminate at their inner end in segmental bearing-pieces 6. The crank-shaft 7 is provided with crank-arms 8, within which the crank-pin 10 is secured by means of keys 9. It is immaterial how the crank-pin 10 is secured to or mounted within the crank-arms 8, as any form of the many devices common to the art can be used equally as well as the pins 9 herein shown. Surrounding the crank-pin 10 and extending its whole length between the crank-arms 8 is the antifriction-sleeve 11, which is slotted longitudinally and contains a filling-piece 12 of absorbent material. This material I prefer should be hard maple wood, as I find from experience that it has the proper density and will absorb sufficient oil to provide a lubricant for the crank-pin 10. It also has the quality of taking up such grit or dirt as accidentally works through the parts onto the crank-pin, which if not removed would cut and destroy the bearings. The bearing-pieces 6 have a frictional engagement with the exterior of the sleeve 11 and extend the full length thereof, abutting against the crank-arms 8 at either end thereof. The sleeve 11 provides a larger bearing-surface for the segmental bearing-pieces 6 than would be obtained if the said bearing-pieces were held in immediate contact with the crank-pin. Surrounding the bearing-pieces 6 and fitted within the recesses 13 thereof upon either side of the piston-rod are the split rings 14, which are externally threaded and have a slight taper thereon, these rings being surrounded by solid rings 15, which are internally threaded to correspond with the external thread upon the split rings 13. These rings retain and hold the said piston-rods in engagement with the exterior of the antifriction-sleeve 11. The parts are assembled by first placing the antifriction-sleeve 11 upon the crank-pin 10, and after inserting the filling-piece 12 the piston-rods are arranged about the center of the crank-pin, with the bearing-pieces 6 in engagement with the exterior of the sleeve 11, after which the split rings are sprung over the bearing-pieces and into the recesses 13 therein. The solid rings 15 are then threaded upon the split rings 14, and after being adjusted to their proper position, whereby the bearing-pieces 6 will have a free and easy movement between the exterior of the sleeve 11 and the interior of the split rings 14, the collar is locked in position by means of the screws 16. The crank-pin 10 is now made fast in the crank-arms 8, and the assembling operation is completed.

The above is one mode of assembling the parts; but they can be assembled, if desired, by first placing the split rings 14 around the bearing-pieces 6 and then slipping the antifriction-sleeve 11 therethrough.

It is apparent from the above description, when read in connection with the drawings, that each of the piston-rods will automatically adjust itself in the direct line of thrust, which is the axis of the cylinder, the cylinders oscillating upon the trunnions 2 to assist in this movement. As each of the bearing-pieces forms the segment of a circle which is less than one-third part thereof, the movement of either one of the said bearing-pieces will not interfere with any of the others during the rotation of the crank-pin about the axis of the crank-shaft, as sufficient space is left therebetween to allow the bearing-pieces to adjust themselves about the said sleeve.

There are minor changes and alterations that can be made within my invention, and I would therefore have it understood that I do not limit myself to the exact construction herein shown and described, but claim all that falls fairly within the spirit and scope of my invention.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, the combination with a plurality of cylinders; of fixed plates between which the said cylinders are pivotally mounted; piston-heads operative within said cylinders; piston-rods rigidly connected with said piston-heads; a shaft rotatably mounted in said frames and having a single crank; and means, as compressible rings surrounding the crank end of said piston-rods; and non-compressible rings surrounding said compressible rings for revolubly securing said piston-rods to said crank.

2. In a device of the character described, the combination with a plurality of cylinders arranged about a common center; of fixed plates between which the said cylinders are pivotally mounted; a shaft rotatably mounted in said frame, the axis of which is coincident with the said common center; a piston-head operative within each of said cylinders; a piston-rod rigidly connected with each of said piston-heads at one end and revolubly secured at the opposite end to the crank upon said shaft by means of compressible and non-compressible rings in such a manner as to permit the piston-rods to adjust themselves in a direct line with the thrust during the travel of said crank in a rotary path about the center of said shaft.

3. In a device of the character described, the combination with the frames 17; of the cylinders 1 pivotally mounted therebetween upon the trunnions 2; of the crank-shaft 7, having the crank 10 thereon; of the piston-heads 3 operative within the cylinders 1; piston-rods 5 fixed to the said piston-heads 3 at one end and having the segmental bearing-piece 6 at the opposite end; compressible collars 14 surrounding said segmental ends; and non-compressible collars 15 surrounding the said compressible collars.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK L. WHITE.

Witnesses:

GEORGE E. HALL,

EDWARD J. MAHER.