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CRANKLESS ENGINE

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July 1, 1930.

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1,769,552

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Filed Nov. 2, 1928

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Fig. 4.

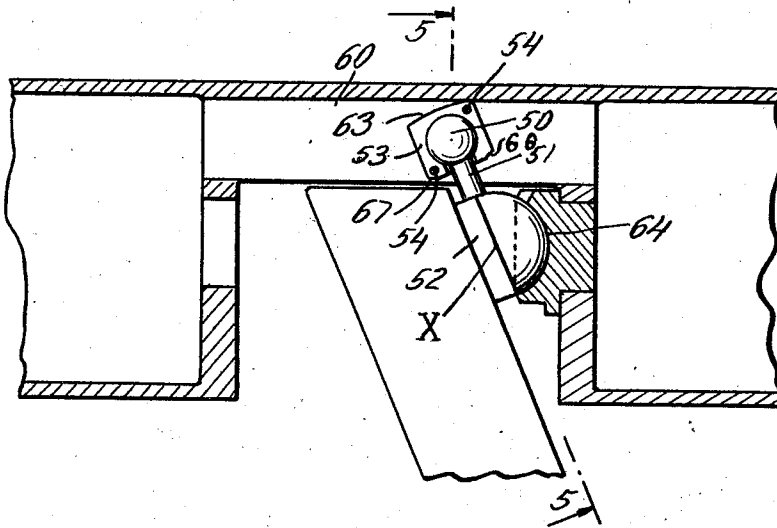
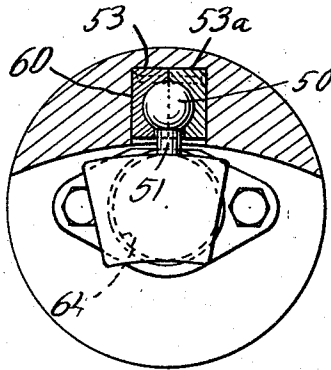


Fig. 5.



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CRANKLESS ENGINE

Application filed November 2, 1928. Serial No. 316,697.

This invention relates to crankless engines.

More particularly stated, the invention relates to means for guiding or restraining the motion of the slippers in a crankless engine which form the bearing element between the reciprocating members or pistons and the rotary member, such as a slant or swash plate.

The invention has for its salient object to provide guiding or restraining means for the slippers so constructed and arranged that undue friction and wear will be reduced to a minimum.

Another object of the invention is to provide a slipper connection or mounting so constructed and arranged as to provide for pivotal movement of the slipper about a plurality of axes with a minimum amount of friction and wear.

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

Fig. 1 is a longitudinal sectional elevation showing a piston and slant or swash plate and slipper structure constructed in accordance with the invention;

Fig. 2 is a sectional elevation taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a sectional elevation taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 1 but illustrating a slightly different embodiment of the invention; and

Fig. 5 is a sectional elevation taken substantially on line 5—5 of Fig. 4.

The invention briefly described consists of a combination comprising a reciprocable element, such as a piston, a swash plate or slant, and a slipper articulated to said element and having a lubricated working contact with the slant or swash plate. The slipper is guided and restrained in its motion by a pivotal and slidable connection with an extension connected to the piston in such a manner as to reduce the friction and wear to a minimum. Further details of this connection and of the restraining and guiding

means will appear from the following specification.

The slipper guiding and restraining means is utilized in an engine of the type illustrated in Michell Reissue Patent No. 15,756, granted February 5, 1924. This invention constitutes an improvement on the structure shown in the patent referred to and also on the construction shown in Sherman Patent No. 1,587,191, granted June 1, 1926.

In the form of the invention illustrated in Figs. 1 to 3 inclusive, there is shown a pair of pistons 10 and 11 connected by a yoke 12. A portion of a swash plate or slant 15 is shown between the pistons and beneath the yoke 12. A pair of slippers 16 and 17 engage the opposite faces of the slant 15 and are provided with spherical bosses 20 and 21, which engage spherical sockets or bearing members 23 and 24 carried by the inner ends of the pistons. The slippers 16 and 17 are provided with laterally extending studs or pins 25 and 26. The pin 25 extends through a longitudinal slot 30 in the yoke 12 and has mounted thereon a ball 31. The ball 31 is positioned in a cylindrical tube 32 having a slot conforming in shape and extent with the slot 30 and disposed in a cylindrical opening in the yoke 12. By means of this mounting it will be evident that pivotal movement of the slipper is permitted on a plurality of axes, but that the slipper will be prevented from undesirable pivotal or rotational movement about the axes C—C of the reciprocable member or piston.

It will be understood that both slippers can be mounted in the manner above described and as shown in Fig. 2, but in the form of the invention illustrated in Fig. 3 and shown in connection with the slipper 16, the yoke 12 has a longitudinal rectangular opening 40 therein, in which is positioned a tube 41 rectangular in cross section. The tube 41 has a longitudinal slot 42 through which extends the pin 26 of the slipper 16. A ball 43 is mounted on the pin and is disposed between spherical bearing surfaces of a bearing block comprising sections 46 and 47 which are connected to-

gether in any suitable manner, as by rivets 48 and 49.

If desired, the cylindrical tubular member 32 shown in Fig. 2, and the rectangular tubular member 41 shown in Fig. 3, may be dispensed with and the ball 31 and bearing block comprising sections 46 and 47 may be mounted directly in openings of the proper shape formed in the yoke 12.

In the form of the invention shown in Figs. 4 and 5, the ball 50 is formed integral with the pin 51 which projects laterally from the slipper 52.

The ball 50 is positioned in a block formed of two sections 53 and 53^a which are secured together in any suitable manner, as by rivets 54.

The yoke 12 is provided with a longitudinal rectangular opening 60 which receives the block formed by the sections 53 and 53^a. The block shown in Figs. 4 and 5 is adapted to oscillate with the ball in the slot 60 formed in the yoke. Furthermore, since the block is pivotally mounted on the ball, it is free to adjust its working surfaces to coact with the corresponding surfaces of slot 60. In order to minimize the required widths of the surfaces of the slot 60, the outer surface of the block is preferably curved, as shown at 63, about the center X of the spherical bearing surface 64 of the slipper 52. The inner corners of the block may be truncated or beveled off, as shown at 66 and 67.

From the above description it will be clear that simple and practical means has been provided for guiding and restraining the motion of slippers in a structure of the character specified and that the means worked out will accomplish the desired object without any undue friction or wear.

Although certain specific embodiments of the invention have been particularly shown and described, it will be understood that the invention is capable of modification and that changes in the construction and in the arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention, as expressed in the following claims.

What I claim is:

1. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element having a cylindrical bearing surface, a projection on said slipper, and a bearing element on said projection fitting the bearing surface of said extension.

2. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a projection on said slipper, and a bearing element on said projection

having a circular bearing contact with said extension.

3. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a cylindrical stud projecting from said slipper, a spherical bearing element on said stud, and a pivotal and sliding connection between said bearing element and said extension.

4. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element having a longitudinal opening therein, and a slot communicating with said opening, a stud on said slipper projecting through said slot into the opening, and a ball pivoted on the stud and slidably mounted in said opening.

5. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a stud projecting from said slipper, a spherical bearing element pivoted on said stud, and a pivotal and sliding connection between said bearing element and said extension.

6. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a projection on said slipper, a cylindrical bearing surface in said extension, and a spherical member on said projection disposed in said cylindrical bearing surface.

7. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a projection on said slipper, said extension having a longitudinally extending tubular opening therein, and a ball on said projection disposed in said opening.

8. In combination a slant, a reciprocable element, a slipper articulated to said element and having a lubricated working contact with the slant, an extension on said reciprocable element, a projection on said slipper, said extension having a longitudinally extending tubular opening therein, and a ball pivotally mounted on said projection disposed in said opening.

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