June 13, 1933. T. L. SHERMAN 1,913,730

CRANKLESS MECHANISM

Filed April 20, 1931

Fig. 1.

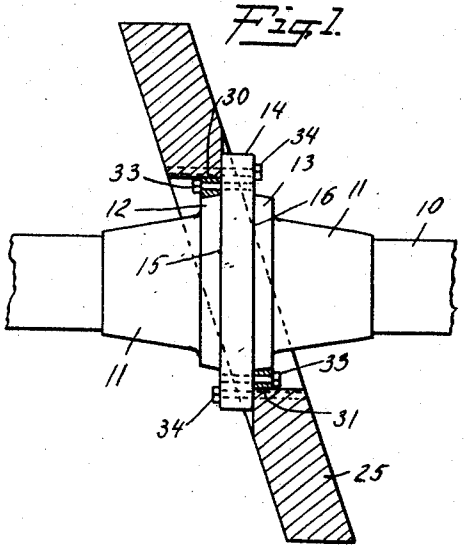


Fig. 2.

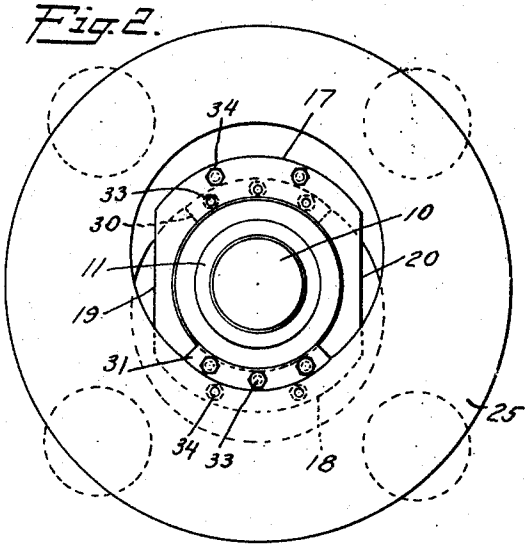


Fig. 3.

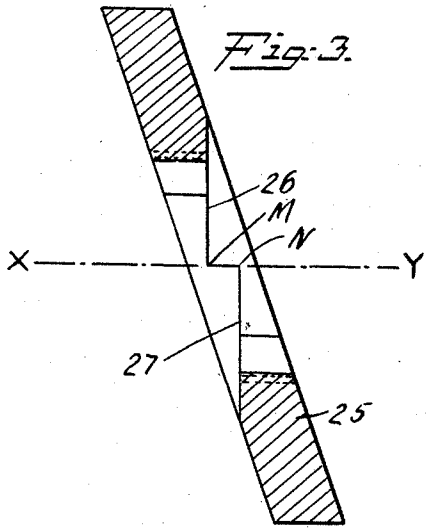
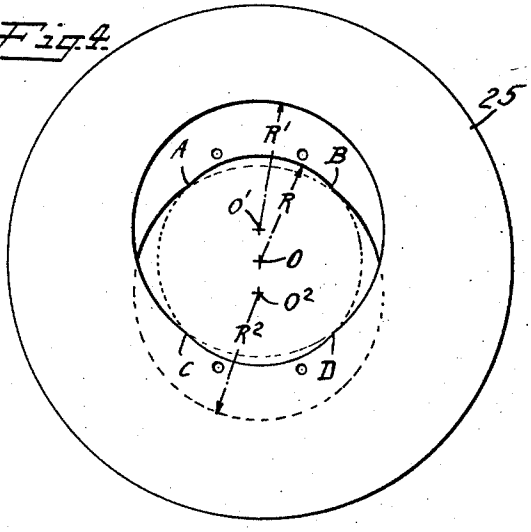


Fig. 4.



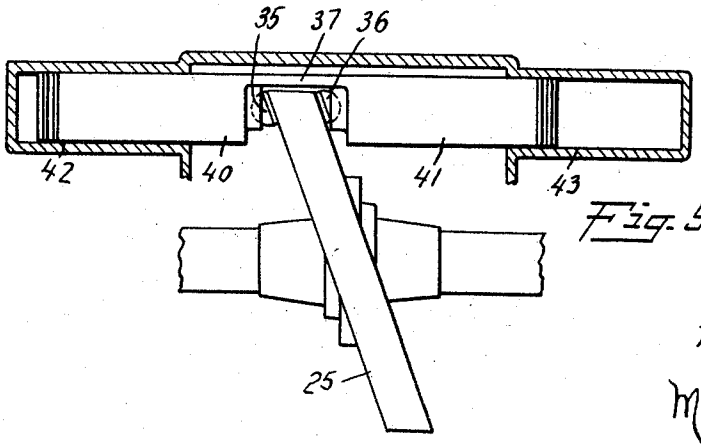


Fig. 5.

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Patented June 13, 1933 1,913,730

UNITED STATES PATENT OFFICE

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CRANKLESS MECHANISM

Application filed April 20, 1931. Serial No. 531,404.

This invention relates to crankless mechanisms and particularly to slants or swash plates for such mechanisms.

Crankless mechanisms of the type in connection with which this invention has been developed comprise a shaft having a slant connected thereto and pistons coacting with the slant and adapted to impart rotation thereto, thereby causing the slant shaft to rotate. In crankless engines the charges in the cylinders are fired when the pistons are disposed substantially at the outer ends of the cylinders or just after the pistons have passed their outer dead center positions. When this condition exists the portions of the slant engaging the pistons so located are disposed at their most acute angles with reference to the shaft axis. The greatest load imposed on the slant is thus imposed on the portions of the slant making the most acute angles with the axis.

It has been proposed in the past to bolt a slant ring to a flange on a hub carried by the shaft, but such structures have been open to the objection that too great a tension stress has been placed on the bolts. For instance, if the shaft is provided with a flange and a slant ring is bolted to the flange at one side thereof, the thrust on the slant in one direction must be taken by the bolts.

This invention has for its salient object to provide a slant and shaft so relatively constructed and arranged that the greatest thrust loads imparted to the slant will not be taken by the bolts or other connecting means between the shaft and slant.

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

Fig. 1 is a sectional elevation of a slant shaft and slant constructed in accordance with the invention;

Fig. 2 is an elevational view at right angles to Fig. 1, showing diagrammatically the relations of the cylinders to the slant;

Fig. 3 is a sectional elevation of the slant ring;

Fig. 4 is an elevational view taken at right angles to Fig. 3; and

Fig. 5 is an elevational view of a slant shaft and slant and one of the reciprocating units used in connection therewith, the reciprocating unit being shown in section.

The invention briefly described consists of the combination of a shaft having a flange carried thereby and a slant ring inclined with respect to the shaft axis and engaging and secured to the opposite faces of the flange in such a manner that the greatest thrust loads on the slant will be borne by the flange and not by the securing means by which the slant is connected to the flange. The slant is constructed in the form of a ring having a central opening through which the shaft and a portion of the flange can be passed, whereby surfaces on opposite sides of the ring can be secured in engagement with the opposite faces of the flange.

Further details of the invention will appear from the following description.

In the particular form of the invention illustrated in the drawing there is shown a shaft 10 having a hub 11 provided with shoulders 12 and 13 and a flange 14 extending laterally of the shaft and hub. The flange 14 is disposed at right angles to the axis of the shaft 10 and has sides or faces 15 and 16 and curved ends 17 and 18. In the particular form of the invention shown the side edges 19 and 20 of the flange are flat, but it should be understood that the specific shape or outline of the flange 14 is immaterial.

The slant ring 25 is formed preferably in the following manner: A central opening is first bored therethrough on a suitable radius as, for instance, radius R shown in Fig. 4. This bore is made on the axis x, y (see Fig. 3). The center or axis of the bore is shown in Fig. 4 at O.

After the bore described in the preceding paragraph has been made the boring tool is shifted from the axis x, y to a parallel axis offset laterally therefrom. A second bore is then made on a suitable radius, such as the radius R′ in Fig. 4, the center of this bore being indicated at O′. This bore forms a flat surface 26 which is normal to the shaft axis x, y.

After the surface 26 is formed a similar surface 27 is formed on the opposite face of the slant ring, this surface being formed by a bore about a center O^2 on a radius R^2. The radii R′ and R^2 are shown as equal, but this is not essential. The planes of the surfaces 26 and 27 are parallel and normal to the axis x, y and are spaced apart a distance M, N which is equal to the width of the flange 14. In Fig. 4 the arcs A, B and C, D are portions of the first bore formed on the radius R.

After the slant ring 25 has been constructed in the manner described the shaft and one end of the flange 14 are passed through the ring and the faces 15 and 16 of the flange are positioned in engagement with the surfaces 26 and 27. The ring is then secured to the flange in any suitable manner and in the form of the invention shown a pair of wedges 30 and 31 are placed between the shoulders 12 and 13 and the portions A, B and C, D of the bore of the ring. Suitable securing means, such as bolts 33, are passed through the wedges and are secured to the flange and oppositely extending bolts 34 are passed through the flange and secured to the ring.

Fig. 5 shows a slant 25 engaging slippers 35 and 36 which are carried by a bridge 37 which in turn connects oppositely acting pistons 40 and 41. The slant 25 is shown in Fig. 5 at the most acute angle with the shaft 10 and it will be noted that the piston 40 is located substantially in firing position in the cylinder 42. The piston 41 is disposed substantially at the outer end of its stroke in the cylinder 43. When the piston 40 is located as shown the explosion load will be taken by the thrust between the slant surface 26 and the face 15 of the flange 14.

From the foregoing description it will be clear that the explosive or maximum loads on the slant are taken by the flange on the shaft and that the bolts or other securing means by which the slant ring is connected to the shaft are not subject to heavy loads.

Although one specific embodiment of the invention has 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 shaft having an annular flange extending therefrom and a slant inclined to the shaft and having one surface engaging one face of the flange and another surface engaging the other face of the flange, and means detachably securing the slant to the flange, the width of the flange being equal to the distance at all points between said slant surfaces.

2. In combination, a shaft having an annular flange extending therefrom and provided with oppositely disposed surfaces at substantially right angles thereto, and a slant ring having an opening therethrough adapted to receive said flange and having oppositely facing plane surfaces arranged to engage opposite faces of the flange, and means for detachably securing the ring to the flange.

3. In combination, a shaft having an annular flange extending therefrom and provided with oppositely disposed surfaces substantially at right angles to the shaft axis and a slant inclined to the shaft and having one plane surface engaging one face of the flange and another plane surface engaging the other face of the flange, and means detachably securing the slant to the flange.

4. In combination, a shaft having an annular flange extending therefrom, provided with oppositely disposed surfaces at substantially right angles to the shaft and a slant inclined to the shaft and to the flange and having one plane surface engaging one face of the flange, and another plane surface engaging the other face of the flange, and means detachably securing the slant to the flange, said slant surfaces being disposed opposite the portions of the slant having the greatest inclination to the shaft axis.

5. In combination, a shaft having an annular flange extending therefrom, and a slant ring inclined to the shaft axis and detachably secured to and engaging the opposite faces of said flange, said ring having surfaces disposed substantially at right angles to the shaft axis to which the flange is secured.

6. In combination, a shaft having an annular flange extending therefrom, a slant ring inclined to the shaft axis and detachably secured to and engaging the opposite faces of said flange, said ring having surfaces disposed substantially at right angles to the shaft axis to which the flange is secured, and wedging means securing said slant ring to said flange.

7. In combination, a shaft, an annular flange thereon and disposed at right angles thereto, a slant inclined to the shaft axis and having oppositely facing parallel surfaces normal to the shaft axis, and means detachably securing opposite faces of the flange in thrust relation to the surfaces of said slant.

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