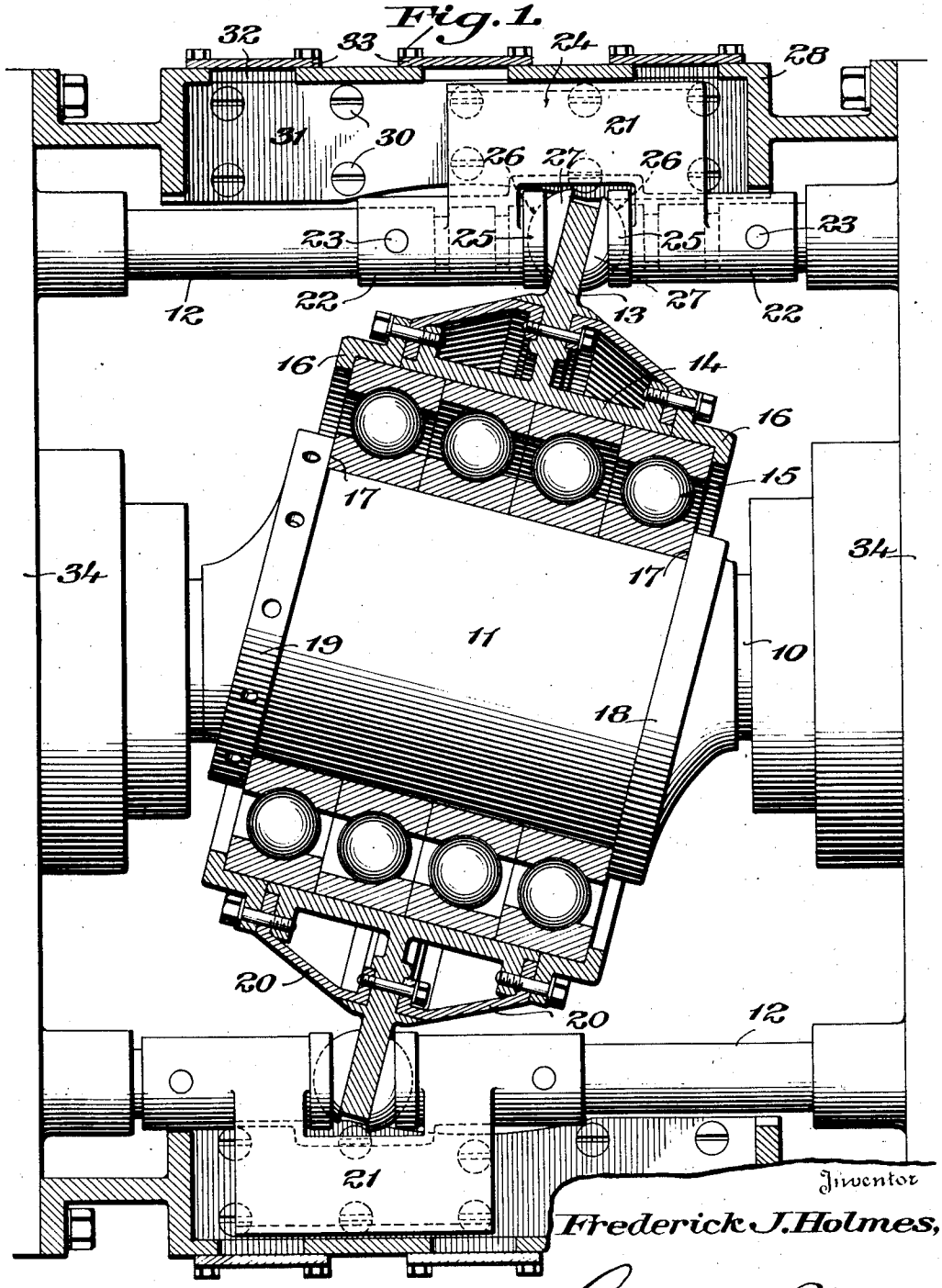
Nov. 30, 1943. F. J. HOLMES 2,335,415

WOBBLE PLATE STRUCTURE

Filed May 2, 1942 2 Sheets-Sheet 1

Fig. 1.



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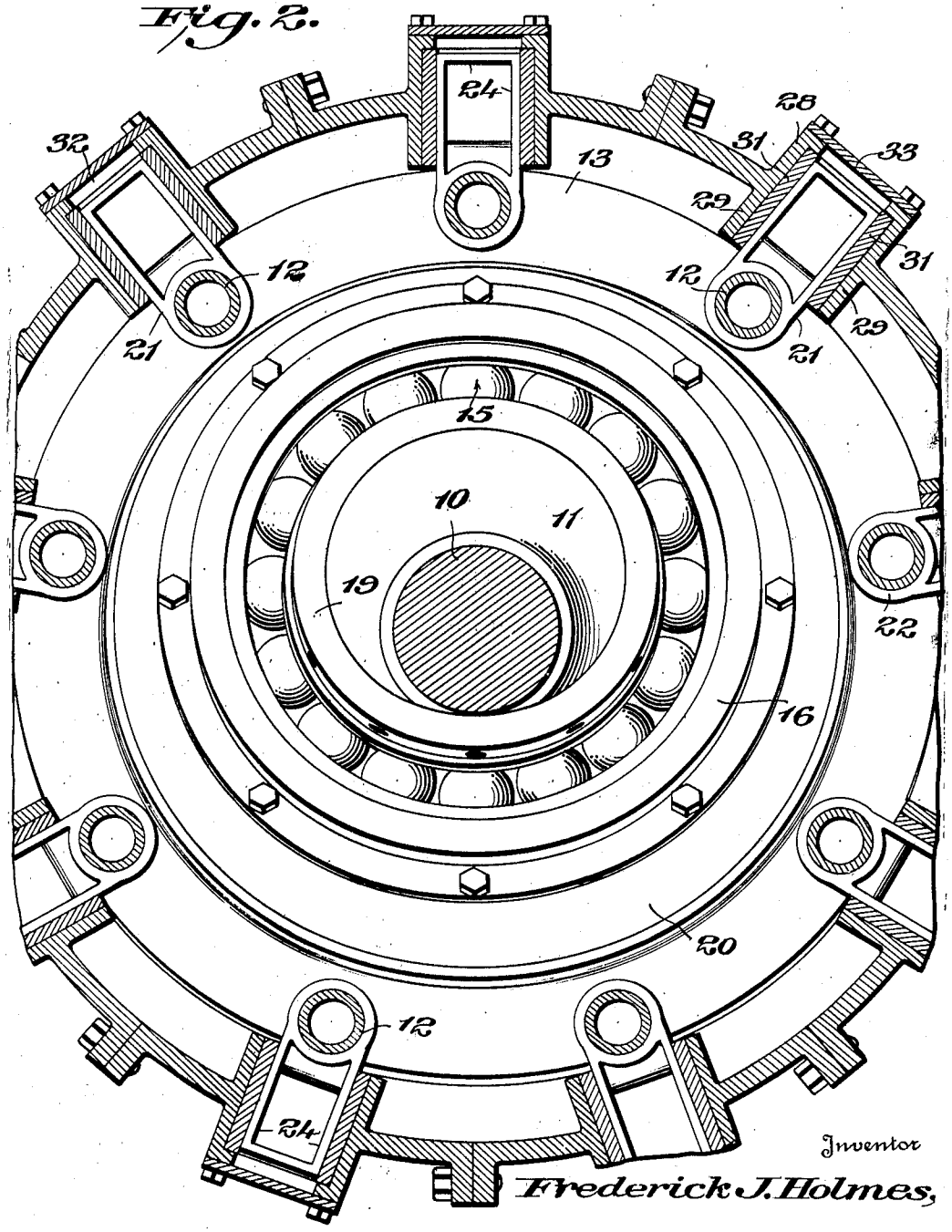
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Fig. 2.



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WOBBLE PLATE STRUCTURE

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Application May 2, 1942, Serial No. 441,482

2 Claims. (Cl. 74—60)

This invention relates to wobble plate structures, and has particular reference to improvements in wobble plate structures of the type comprising a shaft to be driven, a series of reciprocable power elements disposed parallel to said shaft in an annular series therearound, and a wobble plate mounted on said shaft and operatively connected with said power elements whereby reciprocatory motion of the latter is converted into rotary motion of said shaft.

One special object of the invention is to provide a wobble plate structure of the type mentioned in which the wobble plate is freely rotatable relative to the annular series of reciprocable power elements by which it is wobbled, whereby it is self-adjusting relative to said power elements to compensate for the slightly elliptical motion of which different points therein inherently partake during its operation.

Another special object of the invention is to provide a wobble plate structure of the type mentioned according to which the annular series of reciprocable power elements exert their forces directly axially thereof upon the wobble plate, whereby they are subjected to little or no lateral thrusts or bending forces.

Another special object of the invention is to provide a wobble plate structure embodying the features stated and which is simple, practical, strong and durable and operates with low frictional losses.

With the foregoing and other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in a wobble plate structure embodying the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings, wherein like characters of reference denote corresponding parts in the different views—

Figure 1 is a central, longitudinal section through a wobble plate structure constructed in accordance with one practical embodiment of the invention; and

Figure 2 is a cross section through the structure shown in Fig. 1.

Referring to the drawings in detail, 10 designates a shaft to be driven having an inclined hub 11, 12 designates reciprocable power rods disposed parallel to said shaft in an annular series therearound and 13 designates a wobble plate mounted on said hub 11 and operatively connected with said power rods 12 whereby reciprocation of the latter imparts rotation to said shaft.

In accordance with the invention, the wobble plate 13 is suitably mounted on the hub 11 so that it is freely rotatable relative thereto and is held against any other movement relative thereto. Also in accordance with the invention, the power rods 12 are suitably provided with jaw-like formations affording spaces extending across their axes, and the marginal portion of the wobble plate 13 extends into said spaces and has suitable bearing connections with the jaws of said formations, which connections permit said plate to rotate or oscillate freely relative to said jaws, whereby the rods 12 exert their driving forces directly axially upon said wobble plate and the latter is freely self-adjusting rotatably relative to said power rods to compensate for the slightly elliptical motion of which different points in said wobble plate inherently partake during its operation. Thus, the power rods 12 are subjected to little or no lateral thrusts or bending forces as a consequence of imposing their driving forces longitudinally upon the wobble plate, and the structure operates freely and with very small frictional losses due to the wobble plate being freely tiltable and rotatable or self-adjusting relative to the power rods for the purpose stated.

While the wobble plate 13 may be of any suitable specific construction and may be mounted on the hub 11 in any desired manner, it preferably is formed to have relatively long anti-friction bearing cooperation with said hub whereby it is effectively supported against lateral tilting movement relative to said hub under the forces exerted laterally thereagainst by the power rods 12 and operates most effectively through said hub to convert its wobbling motion into rotary motion of the shaft 10. Accordingly, said wobble plate 13 is formed as a ring extending outwardly from a central, cylindrical hub formation 14 of larger diameter than the hub 11, and between said hub formation 14 and said hub 11 is interposed a ball or other suitable anti-friction bearing 15 comprising any desired number of units which is held against longitudinal movement relative to said hub formation and said hub by cap rings 16 bolted or otherwise suitably fastened against the ends of said hub formation and by shoulders 17 suitably provided on said hub, one of said shoulders 17 being constituted, for example, by the inner face of an annular flange 18 formed as an integral part of said hub and the other being constituted, for example, by

the inner face of a clamp ring 19 which may be threaded or otherwise removably mounted on said hub so as to permit ready application and removal of the bearing 15 thereto and therefrom. In addition, in order effectively to laterally brace the wobble plate ring, webs 20 preferably are provided to extend diagonally inwardly from opposite sides of said ring to the hub 14, said webs being formed either as integral parts of said ring and hub formation or as parts separate therefrom and joined therewith in any suitable manner, as desired.

The power rods 12 may be provided in any suitable manner with the aforementioned jaw formations affording the spaces extending across the axes of said rods into which the wobble plate 13 extends, and likewise any suitable bearing connections may be provided between said wobble plate and the jaws of said formations. In this connection and as illustrated by way of example in the drawings, each power rod 12 is composed of two separate alined sections and these sections are joined together at their adjacent ends by a connector element 21 having alined socket portions 22 in which the adjacent ends of the power rod sections are disposed and suitably fastened as, for example, by means of pins 23. Moreover, the two socket portions 22 of each connector element are spaced apart at their adjacent ends and are rigidly connected together at their outer sides by a suitable structure 24 preferably of hollow, box-like form, leaving the space between their adjacent ends open at its inner side. Thus, the socket portions 22 of each connector element 21 constitute the jaws of the jaw-like formation of the related power rod 12 affording the space open at its inner side and extending across the power rod and accommodating the marginal portion of the wobble plate 13.

The adjacent ends of the two socket portions 22 of each connector element 21 have suitably fitted therein cap pieces 25 in the outer or adjacent end faces of which are formed substantially hemi-spherical recesses 26, and in these recesses are seated the rounded inner sides of substantially hemi-spherical bearing pieces 27 having flat outer or adjacent sides between which the marginal portion of the wobble plate 13 is disposed and which bear snugly and flatly against the opposite side faces of said wobble plate, respectively.

The center of curvature of the rounded faces of the bearing pieces 27 of each pair is at the point of intersection of the axis of the related power rod with the central plane of the wobble plate 13 and thus there is provided between said wobble plate and each power rod 12 a ball and socket universal joint connection the center of which is in the longitudinal axis of the power rod. Moreover, the wobble plate is free to rotate between the bearing pieces 27. Accordingly, the wobble plate is permitted freely to wobble relative to the power rods 12 and to rotate or oscillate relative to said rods as it wobbles to compensate for the elliptical motion of which different points therein inherently partake as it wobbles during its operation. Moreover, since the centers of the ball and socket universal joints between the power rods and the wobble plate are located in the axes of said power rods, the latter exert their forces directly axially thereof upon the wobble plate and therefore they are subjected to little or no lateral thrusts or bending forces as a result of transmitting their power to said wobble plate.

Preferably cap pieces 25 separate from the socket portions 22 are provided in order to permit shims to be used between said cap pieces and said socket portions to take up any wear or play in the ball and socket joints between the power rods 12 and the wobble plate 13. However, the substantially hemi-spherical recesses 26 may be provided directly in the adjacent ends of the socket portions if desired.

In order to support the power rods 12 against any slight lateral thrusts or bending forces to which they may be subjected in operation, each power rod 12 has associated therewith, outwardly thereof, a fixed guide housing 28 including side walls 29 against the inner sides of which are suitably fastened, as by means of screws 30, guide plates 31 between which the box-like portion 24 of the related connector element 21 is disposed and guided. Each housing 28 has openings 32 in its outer wall through which a suitable feeler may be inserted to ascertain if any looseness or play exists between the portion 24 of the connector element and the guide plates 31, which looseness, if present, may be eliminated by interposing shims between the walls 29 and said guide plates. Normally the openings 32 are closed by removable cover plates 33.

The power rods 12 may be reciprocated in any manner. For example, it may be assumed that said rods are the connecting rods between the pistons of an internal combustion engine of the opposed cylinder or barrel type including opposed cylinder blocks as indicated at 34, 34. Likewise, the guide housings 28 may be fixedly mounted with respect to the power rods 12 in any desired manner, and in that connection it may be assumed that each housing 28 is part of a separate segmental unit of a cylindrical casing joining together the two cylinder blocks 34, 34. In any event, the housings 28 preferably are separately removable to facilitate assembly of the wobble plate 13 with the power rods 12.

As will of course be understood, power is applied to the power rods 12 successively first in one direction and then in the other, and as a result a wobbling motion is imparted to the wobble plate 13 which motion is converted into rotary motion of the shaft 10 due to the mounting of said wobble plate on the inclined hub of said shaft, all as is well known in the art.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will of course be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. A structure of the character described comprising a shaft to be rotatably driven, a hub fixed with respect to said shaft and disposed at an inclination thereto, a wobble plate mounted on said hub and with respect to which said hub is rotatable, axially alined pairs of reciprocable power rods disposed parallel to said shaft in an annular series therearound, the adjacent ends of the rods of each pair being spaced apart, a connector element joining together the adjacent ends of each pair of said rods, each connector element including a pair of axially alined spaced apart socket portions in which the adjacent ends of the related pair of power rods are disposed and fastened, each connector element further including a cross-head structure rigidly connecting together the related

pair of socket portions and disposed outwardly with respect to said socket portions, means providing substantially hemispherical recesses at the adjacent ends of each pair of said socket portions, each pair of said recesses facing each other and having a common center in a prolongation of the axes of the related pair of rods, substantially hemispherical bearing pieces seated in said recesses, each pair of said bearing pieces having flat adjacent faces between which a marginal portion of said wobble plate is slidably disposed, and a fixed guide housing for each connector element having side guide elements against which the outer side faces of the cross-head structure of the connector element are slidably disposed.

2. A structure as set forth in claim 1 in which the side guide elements of the guide housings comprise bearing plates separate from the side walls of said guide housings and mounted on said side walls for adjustments with respect thereto to maintain neat sliding fits with the cross-heads of the connector elements.

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