July 10, 1951 C. N. PITTS ET AL 2,560,244

ROCKER ARM THRUST BEARING

Filed Sept. 8, 1948

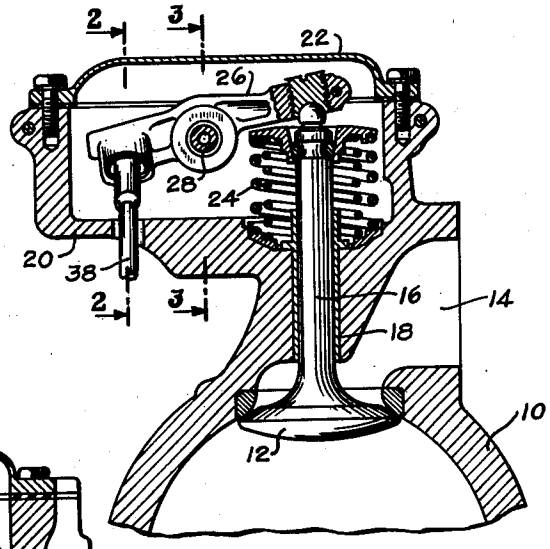



FIG. 1

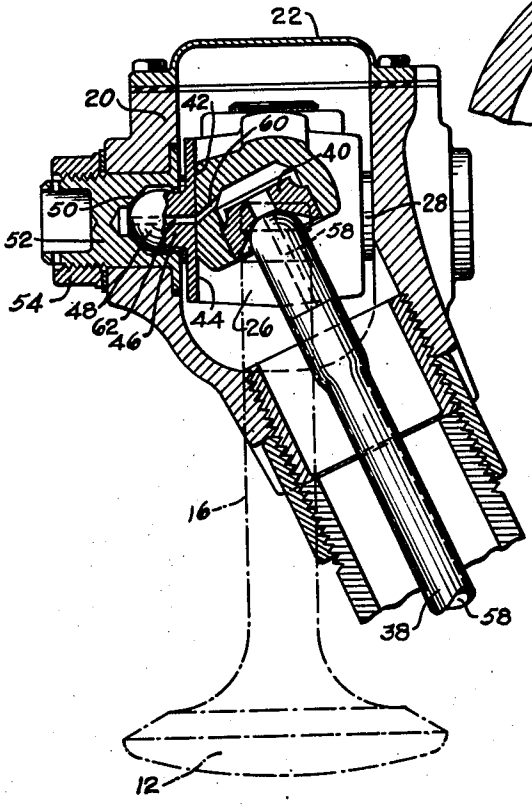



FIG. 2

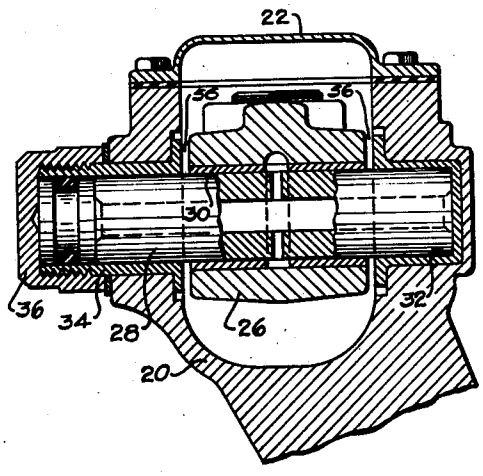



FIG. 3

INVENTORS
HAROLD SHAUGER.
CHARLES N. PITTS.

BY Victor D. Behr

ATTORNEY

Patented July 10, 1951 2,560,244

# UNITED STATES PATENT OFFICE

2,560,244

## ROCKER ARM THRUST BEARING

Charles N. Pitts, Paterson, and Harold Shauger, Fair Lawn, N. J., assignors to Wright Aeronautical Corporation, a corporation of New York

Application September 8, 1948, Serial No. 48,264

2 Claims. (Cl. 123—90)

1

This invention relates to engine valve gears and is particularly directed to improvements in the valve gear disclosed in Patent No. 2,158,272 to R. Chilton.

The valve gear of a conventional radial cylinder aircraft engine comprises a rocker arm pivotally mounted in a housing formed integral with a cylinder head of the engine. One end of said rocker arm is operatively connected to an engine intake or exhaust valve while its other end is operatively connected to a push rod which is reciprocated by the engine for operating said valve. In the usual arrangement, the axis of each engine intake or exhaust valve is inclined to the axis of its radially disposed engine cylinder while each push rod is disposed substantially radial relative to the engine crankshaft. With this conventional construction, each valve push rod is inclined to the axis of its associated valve whereby each push rod subjects its rocker arm to side loads. In the aforementioned Chilton patent, the rocker arm pivot bearings are relieved of said side loads by a flat thrust surface against which a flat surface on the rocker arm is arranged to bear. This structure of the Chilton patent is quite satisfactory provided said flat surfaces are and remain parallel. If said surfaces are not parallel they engage only over a small area, whereupon the resulting contact pressure between said surfaces becomes excessive and causes scuffing of said surfaces. Because of the necessary manufacturing tolerances, it is difficult to make said flat surfaces exactly parallel. In addition, even if the valve gear is machined with an exceptional high degree precision to make said flat surfaces parallel, when the engine heats up, distortion resulting from unequal temperature distribution may throw said surfaces out of parallelism.

It is an object of this invention to provide a valve gear construction whereby said flat surfaces automatically remain parallel regardless of the magnitude of the manufacturing tolerances and regardless of any subsequent distortion of the valve gear. In accordance with the present invention, the flat thrust surface carried by a rocker arm housing is provided with a universal ball and socket support whereby said surface automatically remains parallel with the flat rocker arm surface engaged thereby. In addition, the rocker arm is provided with a small amount of axial freedom on its pivot axis so that each push rod can slide its rocker arm sideways along the rocker arm pivot axis to bring the flat surface of said rocker arm into engagement with the flat surface carried by the rocker arm housing. Means are also provided for supplying lubricating oil between said flat surfaces and to the ball and socket support of one of said surfaces from the associated push rod.

2

Other objects of the invention will become apparent upon reading the annexed detailed description in connection with the drawing, in which:

Figure 1 is a sectional view of a portion of an engine cylinder and a valve gear embodying the invention; and

Figures 2 and 3 are enlarged sectional views respectively taken along lines 2—2 and 3—3 of Figure 1.

Referring to the drawing, a portion of an engine cylinder head, indicated at 10, is provided with a valve 12 for controlling a port 14 which may comprise the intake or the exhaust port of said cylinder. The valve 12 has a stem 16 which is axially slidable in a valve guide 18 and extends into a rocker arm housing 20 having a suitable cover 22. Springs 24 are provided for urging the valve 12 toward its closed position.

A rocker arm 26 is pivotally mounted or journaled about a pin 28 extending across and carried by the side walls of the rocker box housing 20, suitable bushings 30 being provided between said pin and rocker arm. As illustrated in Figure 3, one end of the pin 28 is received within a blind hole 32 provided in one side wall of the rocker box housing. The other end of the pin 28 is received within a sleeve 34 supported by the opposite side wall of said housing. A cap 36 is threaded on the projecting end of the sleeve 34 to keep the pin 28 in position across the housing 20. One end of the rocker arm 26 is disposed over the end of the valve stem 16 projecting into the rocker arm housing 20 whereby said rocker arm is adapted to open said valve against the springs 24. A hollow push rod 38 extends into the housing 20 and is provided with a spherical end extending into a recess in a socket member 40 secured within the other end of the rocker arm 26. The push rod 38 is adapted to be reciprocated by the engine for rocking the arm 26 so as to open the valve 12 against the springs 24.

In a conventional radial cylinder aircraft engine, the axis of the valve stem 16 is inclined to the axis of its radially disposed cylinder 10, while its associated push rod is disposed substantially parallel to the axis of its cylinder. As a result, the push rod and the valve stem axes are inclined to each other as best seen in Figure 2. Also, the axis of the rocker arm pivot pin 28 is disposed at

right angles to the axis of its associated valve stem 16 so that said valve stem axis is disposed parallel to and may be in the plane of movement of its rocker arm.

With this conventional construction, when the push rod 38 is moved upwardly, as viewed in the drawing to open the valve 12, said push rod tends to force its ends of the rocker arm against the left side wall of the rocker arm housing, as viewed in Figure 2, thereby imposing lateral twisting forces on the rocker arm pivot bearing. This difficulty is overcome with the present invention by providing a flat surface 42 on the push rod end of the rocker arm 26, said surface being disposed parallel to the plane of movement of said rocker arm about its pivot axis. In addition, a flat surface 44 is formed on a member 46 having a ball end 48 received within a socket 50 formed in a sleeve 52. The sleeve 52 is carried by the side wall of the rocker arm housing facing the surface 42 and is secured in position by a nut 54. The ball end of the member 46 and the socket within which said end is received provides a universal support for the flat surface 44.

The flat rocker arm surface 42 is disposed so as to slidingly engage the housing flat surface 44 and, because of the universal mounting of the flat surface 44, the surfaces 42 and 44 automatically engage parallel to each other and remain parallel to each other. This is true regardless of manufacturing tolerances. For example, even if the rocker arm surface 42 were not exactly parallel to the plane of movement of its rocker arm, the surfaces 42 and 44 would engage parallel to each other.

In order that the push rod 38 urge its associated rocker arm flat surface 42 into engagement with the adjacent flat surface 44 without imposing any lateral twisting on the rocker arm pivot bearing, the rocker arm is provided with a small amount of axial clearance, as indicated at 56 in Figure 3, for limited sidewise movement of said rocker arm along the axis of its pivot pin 28. As a result of this construction, the side thrust on the rocker arm 26, imposed by the push rod 28, merely slides the rocker arm axially along its pivot pin 28 until the flat surfaces 42 and 44 engage.

As is conventional practice, the push rod 38 has a longitudinal passage 58 therethrough, through which lubricating oil is supplied to the associated rocker arm bearing from the engine. The usual lubricating oil passage through the rocker arm from its push rod end to the rocker arm pivot bearing is not illustrated in the drawing. In addition, in the structure of the present invention the rocker arm is provided with a passage 60 communicating at one end with the push rod passage 58. The other end of the rocker arm passage 60 opens into the flat rocker arm surface 42. The member 46 is also provided with a lubricating oil passage 62 having one end opening into the bottom of the socket 50 while its other end opens into the flat surface 44 in the path of movement of the open end of the passage 60 in the flat surface 42. In this way, lubricating oil is supplied between the slidably engaged flat surfaces 42 and 44 and lubricating oil is supplied to the ball and socket mounting of the member 46.



While we have described our invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding our invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. We aim in the appended claims to cover all such modifications.

We claim as our invention:

1. A valve gear comprising a housing; a rocker arm mounted for pivotal movement within said housing and having at least a small amount of clearance with the side walls of said housing to permit limited movement of said rocker arm along its pivot axis, said rocker arm having a flat surface adjacent one end and disposed parallel to the plane of movement of said arm; a push rod operatively engageable with one rocker arm end for pivotally moving said arm; means carried by a wall of said housing providing a socket facing said rocker arm flat surface; and a member having a spherical portion fitted in said socket to provide a universal mounting for a flat surface on said member adapted to be disposed parallel to and in engagement with said rocker arm flat surface, said push rod being inclined to said plane of movement such that it urges said rocker arm flat surface into engagement with said universally mounted flat surface.

2. A valve gear as recited in claim 1 in which said push rod has a passage for supplying lubricating oil to said rocker arm, said rocker has a passage communicating at one end with said push rod passage with its other end opening into said flat rocker arm surface, and said member has a passage having one end opening through its spherical portion into said socket with its other end opening into the flat surface of said member in the path of movement of the open end of said rocker arm passage.

CHARLES N. PITTS.
HAROLD SHAUGER.


## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,773,596 | Michell | Aug. 10, 1930 |
| 1,828,289 | Michell | Oct. 20, 1931 |
| 2 158,272 | Chilton | May 16, 1939 |