Dec. 3, 1963 A. C. SAMPIETRO 3,112,740

VALVE ROCKER ARM WITH CYLINDRICAL SUPPORT

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Fig. 1

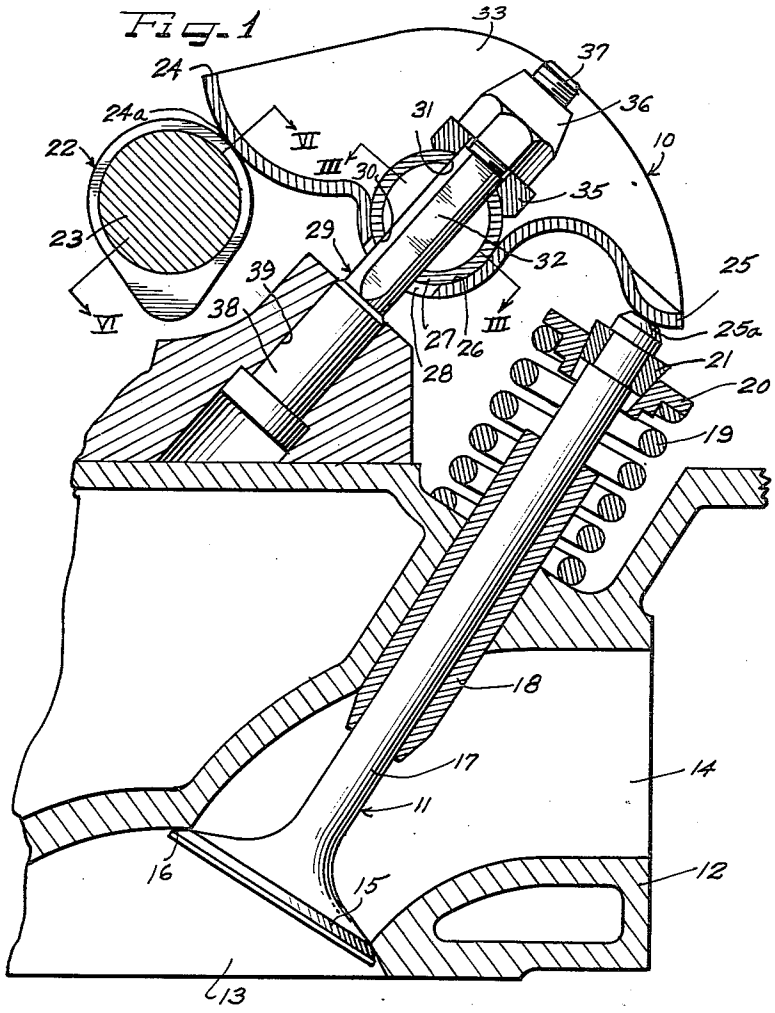


Fig. 2

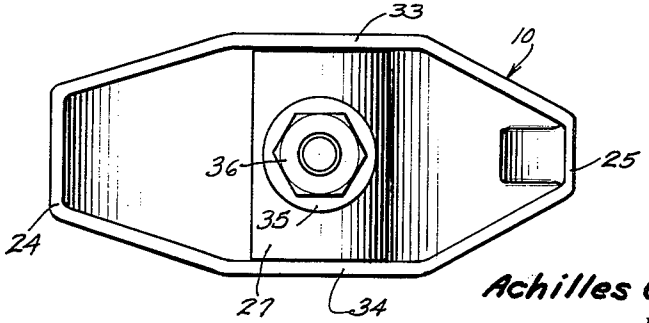
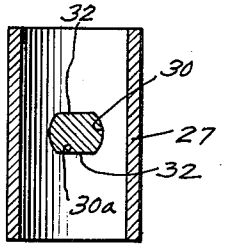


Fig. 3



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Fig-5

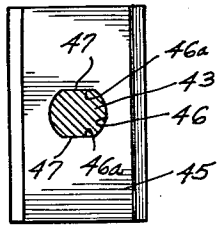


Fig-4

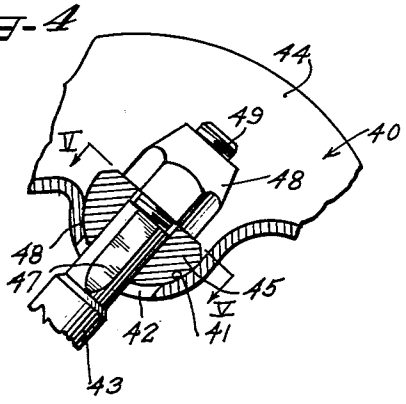


Fig-6

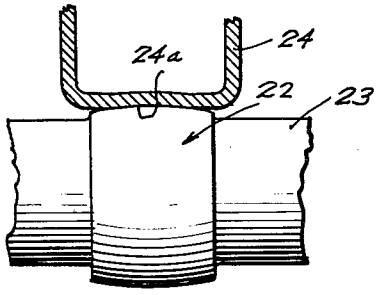


Fig-7

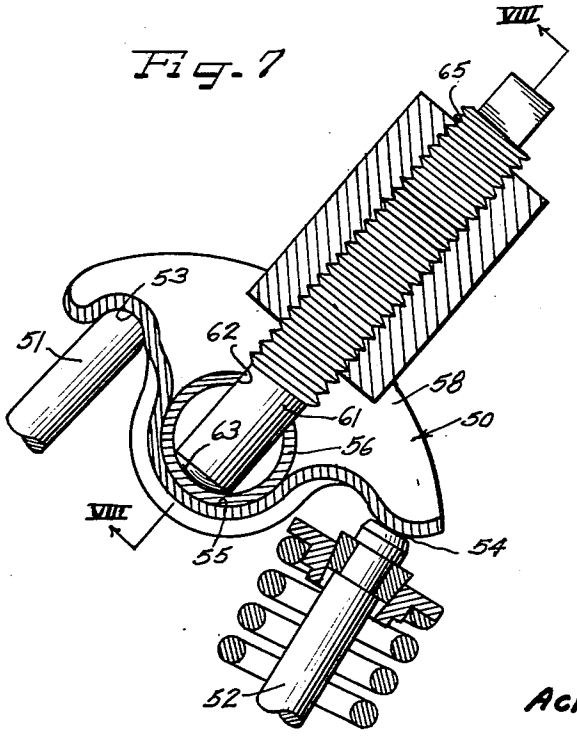
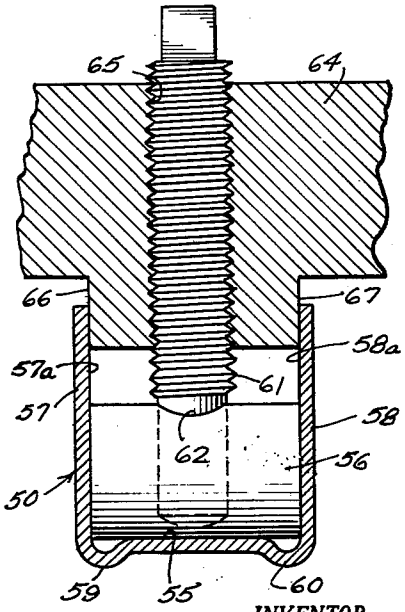


Fig-8



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VALVE ROCKER ARM WITH CYLINDRICAL SUPPORT

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The present invention relates to improvements in valve rocker arms and more particularly to a rocker arm of the type formed of a shaped unitary integral single piece of material, and to an improved support therefor.

The present invention contemplates the provision of a lightweight, strong, simple, rocker arm which may be easily manufactured by stamping, pressing or shaping and cutting operation. The rocker arm is of the type which may be used for opening and closing a valve for an internal combustion engine. In such an engine, overhead valves are frequently employed and the valves are of the spring loaded poppet type held in closed position by a valve spring, with the valve head projecting downwardly and with the stem exposed in an upward direction. One end of the rocker arm engages the stem, and the other end of the rocker arm is driven in vertical reciprocation to pivot the arm and operate the valve. The rocker arm may be driven by various means such as a rotary cam driven by the engine. The rocker arm pivots in a plane of pivotal action and must be maintained in this plane to prevent wear and to prevent its slipping off of the valve stem, and to maintain it in a proper position on the cam if a cam drive is used.

An object of the invention is to provide a rocker arm and support which permits using an inexpensive one-piece rocker arm and provides a simplified structure for maintaining the rocker arm in its pivotal plane of action.

A further object of the invention is to provide a simplified inexpensive pivotal support mechanism for a rocker arm.

A still further object of the invention is to provide a valve operating mechanism utilizing a shaped one-piece valve rocker arm with a pivotal support having a cylindrically shaped bearing support surface but wherein the sides of the rocker arm do not have to be pierced and can be continuous thereby improving their strength and reducing material waste.

A still further object of the invention is to provide a support for a rocker arm which is cylindrical but eliminates the necessity of having a long deflecting shaft.

A still further object of the invention is to provide the cam driven rocker arm assembly with the structural relationship between the cam and rocker arm maintaining the rocker arm in its pivotal plane of action.

Other objects, advantages, and features will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a vertical sectional view taken through a rocker arm and valve assembly of an internal combustion engine, and constructed in accordance with the principles of the invention;

FIGURE 2 is a top plan view of the rocker arm and support;

FIGURE 3 is a fragmentary sectional view taken substantially along line III—III of FIGURE 1;

FIGURE 4 is a fragmentary vertical sectional view showing a portion of a rocker arm and its support, which is of a modified construction;

FIGURE 5 is a fragmentary sectional view taken substantially along line V—V of FIGURE 4;

FIGURE 6 is a fragmentary sectional view taken substantially along line VI—VI of FIGURE 1;

FIGURE 7 is a vertical sectional view taken through a valve operating assembly showing a modified form of the invention; and

FIGURE 8 is a sectional view taken substantially along line VIII—VIII of FIGURE 7.

As shown on the drawings:

FIGURE 1 illustrates a unitary one-piece shaped rocker arm 10 constructed such as by stamping or being die cast. The one-piece arm provides an advantageous construction in that its unitary integral elements provide superior strength and it can be made light in weight. Also it is inexpensive to manufacture.

The rocker arm 10 is shown mounted on the conventional internal combustion engine head 12 for operating a valve 11 controlling the flow of gases relative to a combustion chamber 13 shown with a communicating passage 14 which may be an intake or an exhaust passage.

The valve 11 is a poppet valve with a head 15 which closes against the seat 16 in the engine head, and the valve has a stem slidably supported in a valve guide 18 in the head. A valve spring 19 bears up against a valve cap 20 held on the valve stem by locks 21 in the conventional grooved upper end of the stem 17.

The rocker arm 10 operates the valve and is pivoted or rocked by an operator shown in the form of a rotating cam 22 on a cam shaft 23. The end 24 of the rocker arm has a downwardly facing smooth surface 24*a*, FIGURES 1 and 6, which engages the cam. The other end 25 of the rocker arm has a downwardly facing surface 25*a* which engages the upper end of the valve stem 17.

The rocker arm 10 rocks in a pivotal plane of action, and in the arrangement shown in the drawings the rocker arm is arranged to rock in a vertical plane. It is important that the rocker arm be held in this plane and not be permitted to turn or shift laterally so that the end 25 slips sideways relative to the valve stem or so that the end 24 shifts axially relative to the cam, inasmuch as this will interfere with proper operation of the rocker arm, will introduce lateral forces which cause wear, and may break the parts.

The rocker arm is pivotally supported at its midpoint by an improved simplified pivotal support which permits the side walls of the rocker arm to be continuous and not be pierced, which provides a broad bearing surface for the rocker arm, which provides a bearing surface which is inexpensively manufactured and affords wide manufacturing tolerances.

The rocker arm between its ends is formed with a fragmentary cylindrical bearing surface 26 formed by shaping a depression in the arm 10. The arm is pivotally supported on a bearing member 27 which has a cylindrically shaped bearing surface and is illustrated as conveniently formed of a short length of tube. The bearing 27 is mounted on a support post or stud 29 extending through an opening 28 in the base of the arm 10, and rigidly mounted at its lower end on the engine head 12. The bearing 27 is mounted on the stud by opposed radial openings 30 and 31 through its walls.

The tubular bearing 27 is non-rotatably mounted on the stud 29 and for this purpose the bearing 27 and stud 29 have coacting surfaces, with the openings 30 and 31 having flat surfaces, such as shown at 30*a* for the opening 30 in FIGURE 3, and the stud has flat side surfaces 32. Of course other forms of locking the bearing 27 non-rotatably to the stud could be adopted. The lower end 38 of the stud is non-rotatably held in an opening 39 in the engine head such as being press fit or staked thereto.

The rocker arm has integral one-piece upwardly extending sides 33 and 34, rising above the ends of the arm bearing surface 26, and the bearing 27 is of a length to fit between the sides.

The bearing 27 is held on the stud 29 by a washer 35

having a downwardly facing concave surface, and an adjustment nut 36 is turned on the threaded end 37 of the stud, holding the bearing on the stud and adjusting the rocker arm valve clearance.

Another method of maintaining the rocker arm in its pivotal plane of action during operation is by forming the cam 22 with a crown, as shown in FIGURE 6. The crown is formed on the cam with the high portion in the plane of rocker arm operation. The material of the rocker arm 24 will deflect inwardly at the contact point 24*a* with the cam due to the force between the surfaces and the depressed concave hollow 24*a* at the point of contact will maintain the arm 24 in position. The arrangement of FIGURE 1 shows the two methods of maintaining the arm in its correct operating plane, that is, the tubular support bearing 27, and the crowned cam 22, although it will be understood that these features may be used independently.

FIGURES 4 and 5 show another form of bearing wherein a shaped rocker arm 40 has a fragmental spherically shaped bearing surface 41 with an opening 42 at the base for receiving a supporting stud 43. The rocker arm has upturned side walls 44, and the bearing in this arrangement is formed of a solid semi-cylindrical member with a downwardly facing fragmental spherically shaped bearing surface 48. The stud has flat sides 47 which engage flat sides 46*a* of an opening 46 through the center of the bearing 45.

FIGURES 7 and 8 illustrate another arrangement wherein a rocker arm 50 is shown operated by a push rod 51 in a recessed surface 53 at one end of the rocker arm for operating a valve 52 engaged at its upper end by a downwardly facing surface 54 at the other end of the rocker arm.

The rocker arm 50 has an upwardly facing fragmental spherically shaped bearing surface 55 which receives a tubular bearing 56. The bearing 56 fits between upturned sides 57 and 58 of the rocker arm, and the rocker arm is shown as formed with downwardly forced ribs 59 and 60 at the lower side surfaces which aid in strengthening the arm.

In this arrangement of FIGURES 7 and 8, another form of structure for maintaining the rocker arm in the correct plane of action is shown, provided by a downwardly extending projection having laterally facing planar sides 66 and 67 and supported on an overhead support 64. The sides 66 and 67 engage the inner surfaces 57*a* and 58*a* of the rocker arm sides. The tubular bracket 56 need not be held against rotation and is supported on a stud 61 threaded into a threaded opening 65 in the support 64 and projecting into an opening 62 at the top of the bearing 56. The lower end 63 of the stud is crowned preferably to the curvature of the inner surface of the tubular bearing 56. It will be understood that while the non-rotatable bearing 27 of FIGURE 1 is shown supported by an upwardly extending stud, that an overhead support may be employed also provided with structure preventing its rotation and locking it to the bearing to prevent rotation of the bearing about a vertical axis. It will also be understood that with the bearings 27 and 56 of FIGURES 1 and 7, respectively, either a push rod or cam or other driving arrangements may be employed.

In summary, with reference to the structure shown in FIGURE 1, the cam shaft 23 is driven by the engine to rotate the cam 22 and pivot the rocker arm 10 for operating the valve 11. The rocker arm is maintained in its proper plane of action by the bearing 27 being locked to the supporting stud 29 so as to be non-rotatable about the axis of the stud. The rocker arm 10 is also held against swinging out of its plane of operation by a crowned surface of the cam 22.

Thus it will be seen that I have provided an improved rocker arm and pivotal support therefor which meets the objectives and advantages above set forth, and have provided a structure for holding a rocker arm in its pivotal correct plane of action.

The construction shown and described provides better bearing conditions than structures heretofore used such as those using a spherical seat, for example, at the same or less cost of manufacture. The necessity for a long rocker arm supporting shafts and the undesirable deflection is eliminated since each bearing is directly supported. Further, it is possible to obtain a cylindrical bearing yet unnecessary to pierce or otherwise provide openings in the side walls or cheeks of the rocker arm. Because the side cheeks are not weakened by openings, the gauge of the metal of the rocker arms can be thinner, for the same rigidity of the rocker arm, or else a stiffer arm can be obtained with the same gauge of metal.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. In a valve operating mechanism, a shaped one-piece unitary pivotal rocker arm having a downwardly facing surface at one end acting on a valve and a downwardly facing surface at the other end for being acted on by a rocker arm operator, upwardly extending continuous side walls extending longitudinally along the sides of the arm, a laterally extending upwardly facing concave fragmentary cylindrical bearing surface between said walls, a bearing having a downwardly facing cylindrically shaped convex surface in engagement with said arm bearing surface, and means for supporting said bearing and adjusting its vertical position and holding it in a fixed pre-determined angular position preventing rotation on a vertical axis to maintain the rocker arm in its pivotal plane of action.

2. In a valve operating mechanism, a rocker arm adapted to be driven for operating a valve, means at one end of the arm for acting on a valve, means at the other end of the arm for being acted on by a mechanism for pivotally operating the valve, a laterally extending cylindrically shaped bearing surface between said ends, an uninterrupted vertical longitudinal member extending upwardly from the arm from the bearing surface and providing longitudinal strength for the arm, a bearing having a cylindrically shaped surface in engagement with said arm bearing surface, a support for said bearing extending transversely into said bearing between the ends of said arms so that a support force is applied in alignment with the arm ends, and rotation preventing means locking the bearing against rotation on the support in a fixed predetermined angular position so that the rocker arm will remain in its pivotal plane of action.

3. In a valve operating mechanism, a rocker arm to be driven for operating a valve, means at one end of the arm for acting on a valve, means at the other end of the arm for being acted on by a mechanism for pivotally operating the valve, a laterally extending cylindrically shaped bearing surface between said ends, a bearing having a cylindrically shaped surface in engagement with said arm bearing surface, a support for said bearing extending transversely into said bearing between the ends of the arms so that a support force is applied in alignment with the ends, and rotation preventing surfaces on said support and on said bearing in coacting engagement to hold the bearing in a fixed pre-determined angular position preventing rotation of the bearing on the support so that the rocker arm will remain in its pivotal plane of action.

4. In a valve operating assembly, a pivotal rocker arm having a valve operating end and a driven end for pivoting the arm in a pivotal plane of action, a fragmentary cylindrical bearing surface having an axis transverse of said plane of action, a short bearing member having a fragmental cylindrical surface in supporting engagement with the bearing surface, means for adjusting the position of the bearing member, and means holding the bearing mem-

ber in a fixed pre-determined angular position preventing rotation of the bearing member about a vertical axis so that the rocker arm is maintained in said plane of action.

5. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator to pivot the arm in an operational plane, a laterally extending upwardly facing fragmental cylindrical shaped bearing surface between the ends of said arm, upturned uninterrupted sides at each side of the arm at the ends of the bearing surface, a bearing member having a downwardly facing cylindrical surface, a bearing support for the bearing member, means non-rotatably connecting the bearing member to the support in a fixed pre-determined angular position for fixing the rotational position of the rocker arm in its operational plane, and means adjustably fixing the vertical position of said bearing member on said support to fix the clearance between the ends of the arm and surfaces engaged thereby.

6. In a valve operating mechanism constructed in accordance with claim 5 wherein said non-rotational connecting means include substantially planar surfaces between the bearing member and support permitting sliding adjustment of the bearing member along said support while retaining a predetermined rotational relationship therebetween.

7. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator to pivot the arm in an operational plane, a laterally extending upwardly facing fragmental cylindrical shaped bearing surface between the ends of said arm, upturned uninterrupted sides at each side of the arm at the ends of the bearing surface, a bearing member having a downwardly facing cylindrical surface of the same radius of curvature as the bearing surface of the arm, a bearing support for the bearing member, means non-rotatably connecting the bearing member to the support in a fixed pre-determined angular position for fixing the rotational position of the rocker arm in its operational plane, and means adjustably fixing the vertical position of said bearing member on said support to fix the clearance between the ends of the arm and surfaces engaged thereby.

8. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator to pivot the arm in an operational plane, a laterally extending upwardly facing fragmentary cylindrically shaped bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, a bearing member seated in said bearing surface and providing a bearing support for said arm and having its ends within the sides of the arm, an opening through said member, and a support projecting into said opening and securing said member in a fixed pre-determined angular position holding the member against rotation out of its operational plane.

9. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator to pivot the arm in an operational plane, a laterally extending upwardly facing fragmentary cylindrically shaped bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, an arm mounting means including a bearing member with a downwardly facing cylindrically shaped surface seated in said bearing surface and providing a bearing support for said arm and having its end within the sides of the arm and having substantially the same radius of curvature as the bearing surface of the arm, including a bearing support for the bearing member, including means for holding the arm in a fixed predetermined angular position with the arm in said operational plane of the arm for preventing the rocker arm from pivoting out of its operational plane, and said mounting means including means for adjusting the vertical position of said bearing support to fix the clearance between the ends of the arm and surfaces engaged thereby.

10. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator, a laterally extending upwardly facing fragmentary cylindrical shaped bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, an arm mounting means including a bearing member having a downwardly facing cylindrically shaped surface and having its ends within the sides of the arm, including a bearing support for the bearing member having a downwardly facing surface engaging a surface on the bearing member and holding it at a vertical position, including means for holding the arm in a fixed predetermined angular position with the arm in an operational plane defined by the path of pivotal movement of the arm, and said mounting means including means adjustably fixing said vertical position of said support to fix the clearance between the ends of the arm and surfaces engaged thereby.

11. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator to pivot the arm in an operational plane, a laterally extending upwardly facing fragmentary cylindrically shaped concave bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, an arm mounting means including a bearing member having a cylindrically shaped convex bearing surface and having its ends within the sides of the arm, including means holding the bearing member in a fixed pre-determined angular position relative to a vertical axis holding the arm in said operational plane for preventing the rocker arm from pivoting out of its operational plane, and also including means for adjusting the vertical position of said bearing member to fix the clearance between the ends of the arm and surfaces engaged thereby.

12. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator, a laterally extending upwardly facing fragmentary cylindrical shaped bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, an arm mounting means including a short hollow tubular bearing member having a downwardly facing cylindrically shaped surface and having its ends within the sides of the arm, including a bearing support for the bearing member having a downwardly facing surface engaging a surface on the bearing member and holding it at a vertical position, including means for holding the arm in a fixed predetermined angular position with the arm in an operational plane defined by the path of pivotal movement of the arm, and said mounting means including means adjustably fixing said vertical position of said support to fix the clearance between the ends of the arm and surfaces engaged thereby.

13. In a valve operating mechanism, a shaped pivotal rocker arm having a valve operating surface at one end and a downwardly facing surface at the other end for being acted on by an operator, a laterally extending upwardly facing fragmentary cylindrical shaped bearing surface between the ends of said arm, upturned uninterrupted sides on each side of the arm at the ends of said bearing surface, an arm mounting means includinng a bearing member in the form of a hollow tube having a downwardly facing cylindrically shaped surface and having its ends within the sides of the arm, including a bearing

support for the bearing member having a support member projecting through an opening in one wall of the tube with said support member having a downwardly facing surface engaging the inner surface of the opposite wall of the tube and holding it at a vertical position, including means for holding the arm at a fixed predetermined angular position with the arm in an operational plane defined by the path of pivotal movement of the arm, and said mounting means including means adjustably fixing said vertical position of said support to fix the clearance between the ends of the arm and surfaces engaged thereby.

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