Dec. 11, 1951 J. R. WINTER, JR 2,578,638

ROCKER ARM

Filed July 19, 1944 2 SHEETS—SHEET 1

Fig. 1.

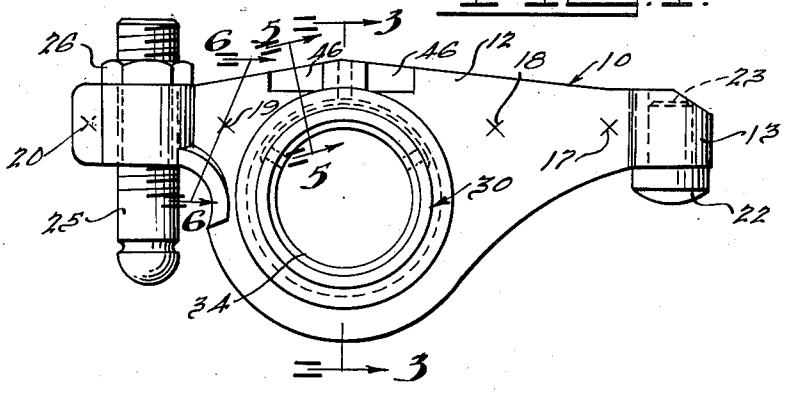


Fig. 2.

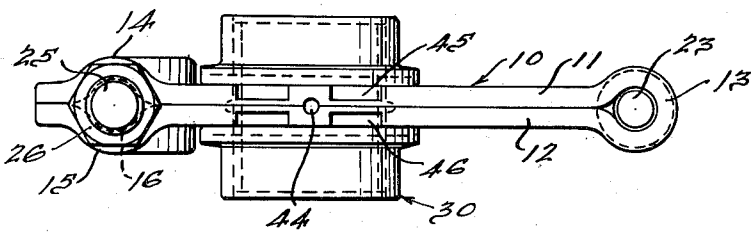


Fig. 3.

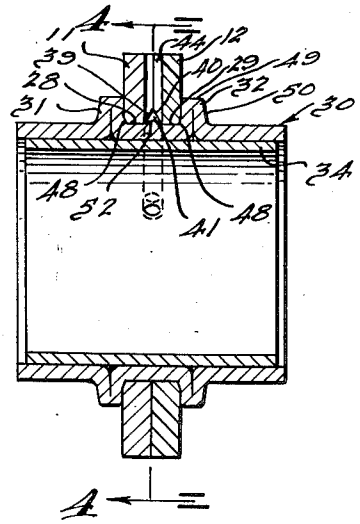
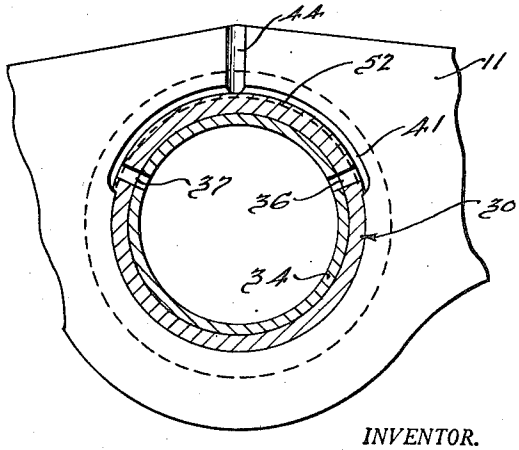


Fig. 4.



INVENTOR.

John R. Winter, Jr.

BY

Harness, Dickey & Pierce

ATTORNEYS.

Dec. 11, 1951 J. R. WINTER, JR 2,578,638

ROCKER ARM

Filed July 19, 1944 2 SHEETS—SHEET 2

Fig. 5.

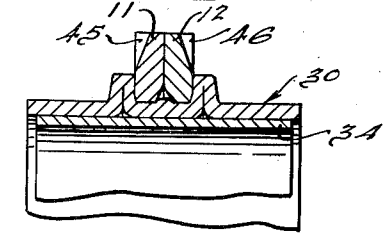


Fig. 6.

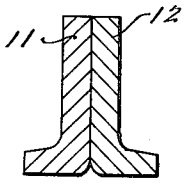
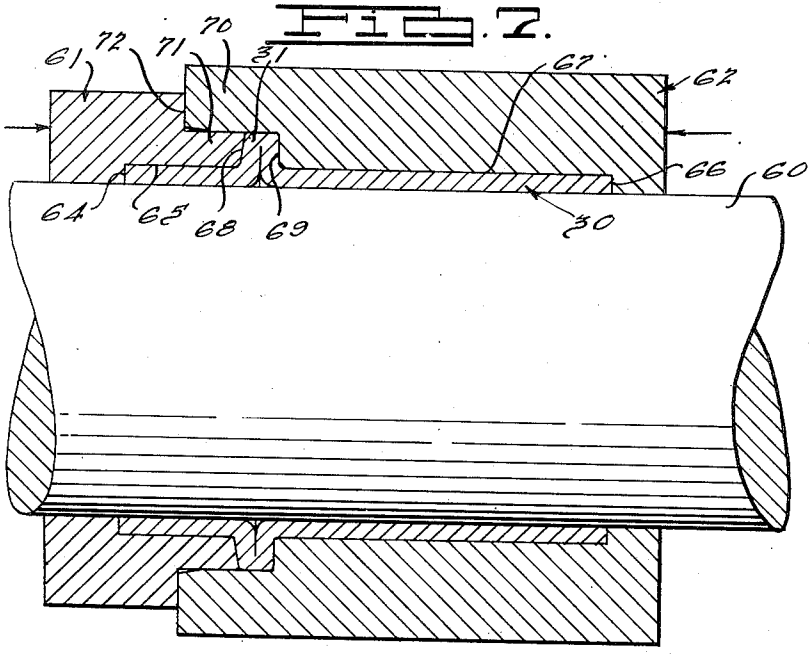


Fig. 7.



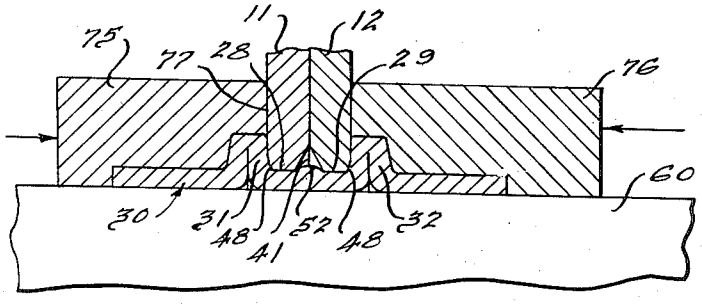


Fig. 8.

INVENTOR.
John R. Winter, Jr.
BY
Harness, Dickey & Pierce
ATTORNEYS.

Patented Dec. 11, 1951

2,578,638

UNITED STATES PATENT OFFICE

2,578,638

ROCKER ARM

John R. Winter, Jr., Detroit, Mich., assignor, by direct and mesne assignments, to John R. Winter, Sr., Detroit, Mich.

Application July 19, 1944, Serial No. 545,597

6 Claims. (Cl. 74—519)

1

The invention relates generally to internal combustion engines and it has particular relation to a rocker arm adapted to be used for operating valves.

The ordinary rocker arm used in an internal combustion engine has bearing means at opposite ends and has an opening intermediate its end for mounting it on the engine block for oscillatory movement. One end of the arm is moved by cam actuated means engaging the bearing means at that end, while the bearing means at the other end is engageable with the valve stem. Usually the latter bearing means is adjustable. While such rocker arms have been made by forging and other processes, the present invention is particularly concerned with the provision of a rocker arm made from stamped sheet metal and while it is not generally new to provide such a rocker arm, the present invention is concerned with improvements in both the arm and the method by means of which it is manufactured.

One object of the invention is to provide an improved rocker arm made from sheet metal which is extremely strong and durable so that it may be used efficiently for a long period of time.

Another object of the invention is to provide such a rocker arm which may be made with accuracy, uniformity and precision, while still permitting its manufacture at a lower cost.

Another object of the invention is to provide an improved rocker arm comprising stamped sheet metal and a tubular bearing element extending therethrough, wherein the tubular element and stamping are connected together in an improved and very positive manner so as to permanently lock them in assembled relation.

Another object of the invention is to provide an improved method of manufacturing a rocker arm such as last mentioned and more particularly an improved method for locking the tubular element to the stamping.

Another object of the invention is to provide a novel and efficient apparatus for assembling and locking the tubular element to the stamped arm.

Other objects of the invention will become apparent from the following description, from the drawing to which it relates and from the claims hereinafter set forth.

For a better understanding of the invention reference may be had to the accompanying drawings wherein:

Figure 1 is a side elevational view of a rocker arm constructed according to one form of the invention;

Figure 2 is a plan view of the rocker arm shown by Figure 1;

2

Figure 3 is a cross-sectional view taken substantially along the line 3—3 of Figure 1;

Figure 4 is a cross-sectional view taken substantially along the line 4—4 of Figure 3;

Figure 5 is a cross-sectional view taken substantially along the line 5—5 of Figure 1;

Figure 6 is a cross-sectional view taken substantially along the line 6—6 of Figure 1;

Figure 7 is a cross-sectional view of apparatus employed in forming a first head on the tubular hub element adapted to extend through the stamping; and

Figure 8 is a similar view illustrating the manner in which the tubular element is assembled with the stamping and the second head is formed.

Referring to Figures 1, 2 and 3, the body of the arm comprises a stamping 10 having laminations 11 and 12 integrally connected at one end by a substantially cylindrical portion 13, and initially, the laminations 11 and 12 are stamped from sheet metal to the desired shape and then are bent intermediate their ends to form the cylindrical portion. At the opposite end of the stamping, the laminations 11 and 12 have outwardly pressed portions 14 and 15, respectively, so as to form an opening 16 between them. After the metal is bent into the shape shown, the laminations may be welded at suitable points as indicated at 17, 18, 19, and 20.

At that end of the arm having the cylindrical portion 13, a bearing element 22 is mounted on the arm by means of a shank 23 having a pressed fit in the opening in the cylindrical portion. The opening 16 at the other end of the arm has a threaded bearing element 25 threaded therethrough. A lock nut 26 adjustably holds the last bearing element in adjusted position.

Intermediate its ends, the laminations 11 and 12 have aligned openings 28 and 29 and these may be formed in the metal prior to bending it into laminated form. A tubular element 30 extends through the openings 28 and 29 and is rigidly and positively connected to the laminations by means of outwardly bulbed heads 31 and 32 located at the outer sides of the laminations. These heads, as will be seen presently, are formed by axially compressing the tubular element 30 and causing the heads 31 and 32 to draw up tightly against the laminations and thus when the heads are finally formed, the laminations are strongly and tightly drawn together and at the same time the tubular element is strongly and positively connected to the laminations.

Within the tubular element 30, a bearing sleeve 34 is provided and this may be made from suitable bearing material such as bronze, and prefer-

ably is split longitudinally at one point. The arm 10 proper is constructed from sheet steel and the tubular element 30 may be cut from sheet steel tubing formed in any suitable manner.

In an arm of this type, lubricant is supplied through a hollow shaft, not shown, which extends through the bearing sleeve 34. This hollow shaft has one or more radial openings through which the lubricant may flow and these openings are adapted to register during oscillatory movement of the rocker arm with radial openings 36 and 37 formed in both the sleeve 34 and tubular element 30. The openings 36 and 37 are located in alignment with the inner contacting faces of the laminations 11 and 12 and at this point, the respective laminations along the edges of the openings 28 and 29 are beveled as indicated at 39 and 40 for a part of the way around the opening so as to provide a lubricant space 41 between the beveled faces. This circumferentially extending lubricant space extends slightly beyond the openings 36 and 37 and hence lubricant flowing through either opening will flow circumferentially through the space. Substantially midway between the openings 36 and 37, a vertically extending opening 44 is provided between the laminations and this opening communicates with the space 41. Therefore, lubricant will flow to the upper edge of the rocker arm.

Immediately adjacent the opening 44, the laminations 11 and 12 may be provided with bevels 45 and 46 and such bevels may be provided at both sides of the opening. These bevels are useful in limiting the amount of lubricant that will flow towards the ends of the rocker arm and at the same time they cause lubricant to flow transversely over the annular heads 31 and 32 on the tubular element 30 and then to the ends of the latter and onto the rocker arm shaft.

Attention is directed to several structural characteristics, as may be seen in Figure 3, particularly. It will be observed that the heads 31 and 32 have substantially full surface engagement with the laminations 11 and 12 and therefore the inner face of each of the heads 31 and 32 is brought substantially into a radial position. It will also be observed that each head actually embeds itself slightly, as indicated at 48, in the lamination around the inner edge of the opening. It will also be noted that the outer peripheral surface of each of the annular heads 31 and 32 is substantially axial as indicated at 49 and that the axially outer face of each head is slightly inclined to the radial as indicated at 50. Also, it will be observed in connection with Figures 3 and 4 that the element 30 is pressed slightly outwardly into the lubricant space 41 as indicated at 52 thereby forming a circumferential key or lock between the tubular element and stamping.

Now referring to Figure 7, the tubular element 30 is first placed on an arbor 60 and then is subjected to axially compressive forces by means of tubular dies 61 and 62 slidable on the arbor. The die 61 has an annular recess formed by a radial shoulder 64 and a peripheral wall 65 for confining a predetermined end portion of the tubular element 30 and similarly the die 62 has an annular space formed by a radial shoulder 66 and a peripheral wall 67 for confining a major portion of the remainder of the tubular element. At the inner ends of the peripheral surfaces 65 and 67, the die element 61 has an outwardly directed and slightly tapered face 68, the radial dimension of which will correspond to the height of the head to be formed during axial compression of

the tubular element. At the inner end of the peripheral surface 67 on the die element 62, a similar end surface 69 is provided, but this surface is radial in direction. The die 62 has an outer portion 70 projecting axially beyond the end surface 69 and this portion telescopes over a portion 71 on the die 61. The two die elements are limited in their movements towards each other by contact as indicated at 72.

The tubular element 30 initially is placed on the arbor 60 and then the two die elements are moved thereover and as the shoulders 64 and 66 press the ends of the tubular element, that portion of the element between the approaching surfaces 68 and 69 bulbs outwardly. The arbor confines the inner periphery of the element in a precise manner so that the inner diameter of the element is maintained uniform and of the desired dimensions. As the dies continue moving towards each other, the annular head 31 is prevented from expanding outwardly beyond a certain amount by the inner surface of the portion 70 on die element 62 and hence as the surfaces 68 and 69 move towards their final positions, the metal in the head is thereby confined more and more. Finally, the head is formed with the radial surface on one side and the slightly inclined surface at its other, with the outer peripheral surface of the head substantially axial. The tapered surface 68 is particularly desirable, in that as it moves against the bulbing head, it presses the radially outer part of the head strongly against the radially outer part of the face 69 so as thereby to insure a full radial surface on the head. Hence the head has a fully radial surface on its inner side and on its outer side it is reinforced by a tapered formation.

After the single head is thus formed on the element 30, the dies are removed and the element is inserted through the openings 28 and 29 formed in the laminations 11 and 12. The same arbor 60 may be used but in the final assembly operation, additional dies 75 and 76 are employed. The die 75 has an inner recess fitting the already formed head 31 on the tubular element and an end surface 77 which is adapted to engage the lamination 11. The die 76 is formed in the same manner as the die 75 but since the second head 32 is not as yet formed, the die element is as yet substantially spaced from the lamination 12. As the die elements 75 and 76 are moved towards each other, outward bulbing of the head 32 occurs and it is finally shaped in the same manner as the head 31 when the ends of both dies directly contact the arm. During this axial compression of the element the outwardly directed rib or key 52 is pressed outwardly into the lubricant space 41 and at the same time slight embedding of the heads 31 and 32 in the laminations occurs as indicated previously at 48.

While according to the foregoing description the two heads 31 and 32 are formed in sequential operations, they could also be formed simultaneously. This could be effected by placing the tubular element on the arbor 60, then inserting the arbor and element through the openings in the laminated arm, and then moving the die elements 75 and 76 simultaneously to form the heads.

It should be understood that substantially full radial surface contact is obtained between the heads 31 and 32 and the respective laminations and therefore the tubular element is strongly connected thereto by large surface engagement. Furthermore, during this compressing action, the

tubular element is expanded within the openings 28 and 29 and hence is tightly connected thereto by a strong, forceful contact resulting from expansion of the metal forcefully in a hole-filling manner. The dies now may be removed along with the arbor.

It is desired to point out several advantages of the invention. In the first place, by manufacturing the rocker arm from a stamping and a separate metal tube, drawing of the sheet metal is avoided and therefore the stamping can be made from a higher carbon steel, which results in greater stiffness and strength. Furthermore, no rehardening is necessary such as would be required if the stamped stock had been drawn. Again, by using the pin 22, and press fitting it into place, welding thereof is eliminated and the pin therefore may initially be heat treated to obtain the desired hardness. It is of course evident that the pin may be driven out and replaced so as to permit replacement of worn pins. In this connection, the integral cylindrical portion is important since it enables obtaining a greater amount of contact with the pin so as thereby to hold the pin securely in place by a press fit while still permitting replacement of the pin when worn.

Furthermore, since no drawing operation is involved, the stamped metal will be of uniform thickness and no trimming or reshaping is required. By using simple spot welding at the points indicated, the laminations may be connected by welding in a simple and inexpensive manner although it should be understood that the mechanical lock between the tubular element and the laminations is extremely strong and positive. It follows that the weld and mechanical lock provide great strength in the assembly.

With respect to the tubular element, this can be made easily out of tubing or drawn from flat sheets, and hence it is accurate and the least amount of machining is required. Furthermore, it can easily be varied in length so as to provide the desired hub length on the rocker arm. Regardless of length, the tubular element is anchored in proper relation to the arm and in particular the direct contact between the inner ends of the dies and the opposite sides of the arm insures that the axis of the tubular element will be accurately aligned with the axis of the opening in the arm. In other words, the arbor and dies maintain the cylindrical shape and dimensions of the tubular element with accuracy and the final contact between the dies and arm insures alignment of the element and opening in the arm. Hence, the axis of oscillation of the arm can be located uniformly.

Furthermore, in regard to the tubular element, the upsetting operations are active throughout the length thereof, and where the tube is confined by the arbor and dies, the surfaces of the tube are smoothed out and variations due to mill and production operations are corrected. By selecting a proper and predetermined length of tubing, the upsetting can be such as to correct variations as indicated, and furthermore the inside diameter can be made uniform and highly accurate as the metal is upset along the arbor. In other words, the straight portions of the tubular element can be sufficiently upset against the arbor as to result in a very smooth inside surface which is accurate and uniform in diameter. Moreover, these operations result in the axis of the tubular element being disposed properly with respect to the stamping. Hence the bearing bushings properly fit the tubular element, thereby eliminating considerable machining operations, and furthermore the bushings may be replaced without difficulty.

Although more than one form of the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. A rocker arm assembly comprising an arm having a transverse opening, a tubular hub element extending through the opening, and means rigidly connecting the arm to the hub element and comprising annular heads on the element and tightly engaging and bearing inwardly against respectively opposite sides of the arm and being at least slightly embedded therein in an area surrounding said opening, and oil channel-defining means comprising an opening extending through the arm and a communicating opening extending through the hub in an area between said bulbed heads.

2. A rocker arm assembly comprising an arm having a transverse opening, a tubular hub element extending through the opening, means rigidly connecting the arm to the hub element and comprising an annular, bulbed head on the element and tightly engaging and bearing against one side of the arm and being at least slightly embedded therein in an annular area surrounding said opening, and oil channel-defining means comprising an opening extending through the arm and a communicating opening through the hub in an area surrounded by the arm.

3. A rocker arm assembly comprising an arm having a transverse circular opening, a circumferentially extending portion of the wall defining said opening being of increased radial dimensions intermediate the axial ends of the wall so as to provide a recess, a tubular hub element extending through the opening, and means rigidly connecting the element to the arm and including metal extended outwardly from the element into the recess.

4. A rocker arm assembly comprising an arm having a transverse opening, the wall defining said opening being generally cylindrical and along a circumferentially extending portion thereof having an increased radius between axial ends of the wall so as to define a circumferentially extending groove or recess in said wall, a tubular hub element extending through the opening, and means rigidly connecting the arm and tubular element including metal extending outwardly from the element and into the groove.

5. A rocker arm assembly comprising a plurality of laminations forming the body of the arm and having aligned transverse openings, a tubular hub element extending through the openings and having a tight hole-filling engagement with the edges defining the openings, annular, bulbed heads on the hub element at opposite sides of the body respectively and tightly engaging and bearing inwardly against the sides of the laminations so as to be at least slightly embedded in the laminations to hold them strongly and tightly drawn together, and oil channel defining means comprising an opening extending between the laminations and a communicating opening through the hub wall.

6. A rocker arm assembly comprising a plurality of laminations forming the body of the arm and having aligned transverse openings, a tubular hub element extending through the openings, annular, bulbed heads on the hub element at oppo-

site sides of the body respectively and tightly engaging and bearing inwardly against the sides of the laminations so as to be at least slightly embedded in the laminations to hold them strongly and tightly drawn together, and oil channel defining means comprising communicating openings extending through the hub wall and through the body of the arm to coact in conducting lubricant from the hub to an end of the arm.

JOHN R. WINTER, JR.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,449,611	Konigslow	Mar. 27, 1923
1,793,874	Skillman	Feb. 24, 1931
1,909,430	Skillman	May 16, 1933
1,943,631	Skillman	Jan. 16, 1934
2,176,083	Leake	Oct. 17, 1939
2,345,822	Leake	Apr. 4, 1944

FOREIGN PATENTS

Number	Country	Date
332,694	Great Britain	July 31, 1930