Feb. 2, 1954 J. R. WINTER, JR 2,667,688

METHOD OF CONSTRUCTING ROCKER ARMS

Filed Aug. 11, 1950

2 Sheets-Sheet 1

Fig. 1.

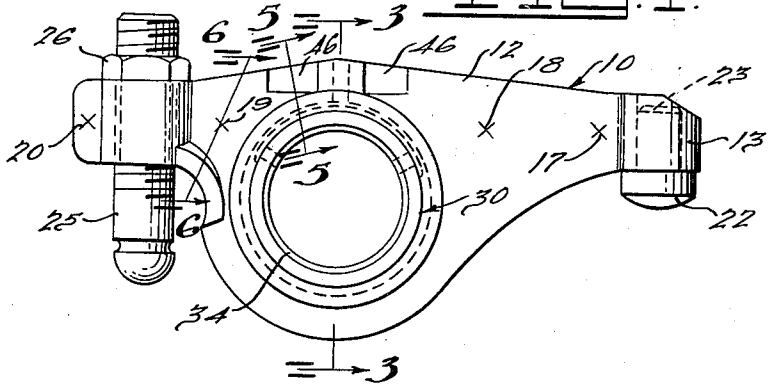


Fig. 2.

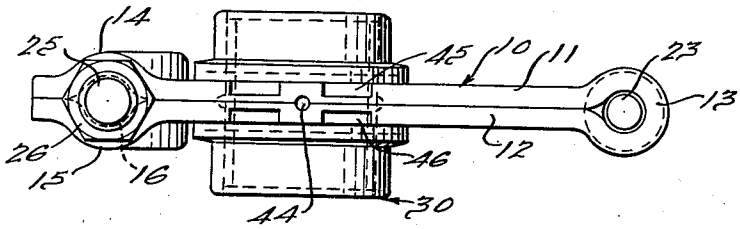


Fig. 3.

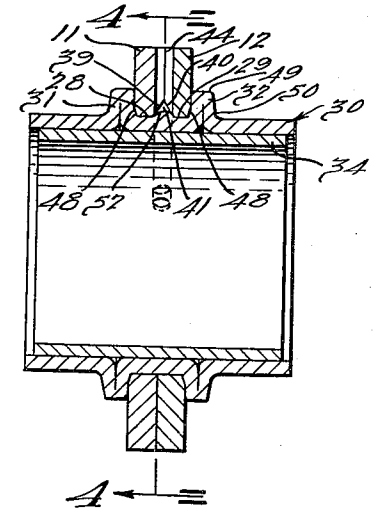
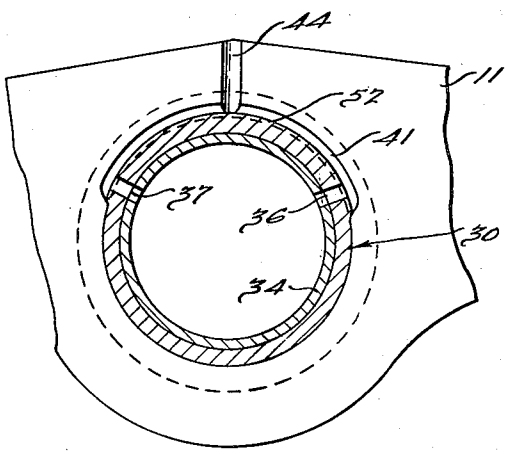


Fig. 4.



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Fig. 5.

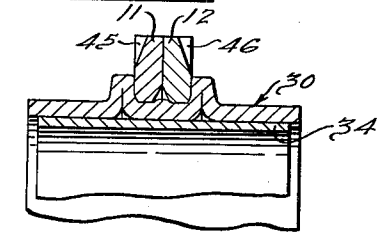


Fig. 6.

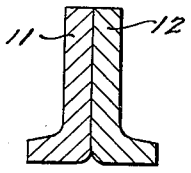
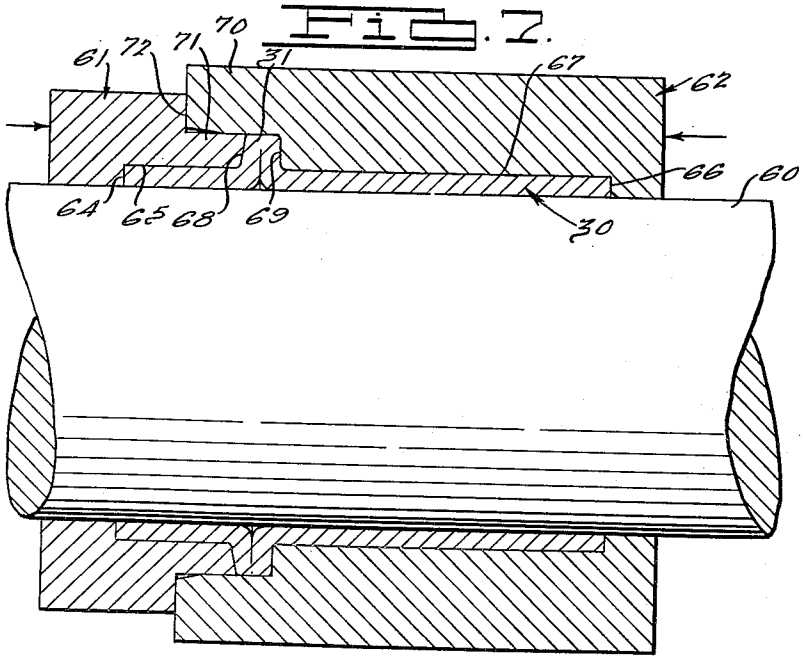


Fig. 7.



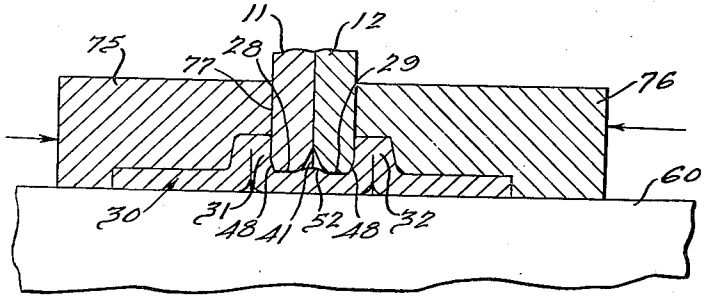


Fig. 8.

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METHOD OF CONSTRUCTING ROCKER ARMS

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Application August 11, 1950, Serial No. 178,930

3 Claims. (Cl. 29—148)

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This invention relates to the art of constructing rocker arms for internal combustion engines, and constitutes a continuation-in-part of my application Serial No. 545,597 filed July 19, 1944, now Patent No. 2,578,638.

The ordinary rocker arm used in an internal combustion engine has bearing means at opposite ends and has an opening intermediate its ends 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 improved means and an improved method for fabricating a rocker arm 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 the method and means by which it is manufactured.

Another object of the invention is to provide an improved method for manufacturing such a sheet metal rocker arm having a plurality of laminations and a tubular hub member, my improved method providing less expensive, yet more effective, means for locking the tubular hub element to the arm laminations and for sealing such hub member and laminations with respect to one another, so that unwanted leakage or escape of oil at the joints between the hub and the laminations, or from between the laminations themselves, is prevented, yet wherein no brazed or welded sealing means is required to effect such firm locking and sealing against escape of oil.

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 adapted to be constructed in accordance with my improved method;

Fig. 2 is a plan view of the rocker arm shown in Fig. 1;

Fig. 3 is a cross-sectional view taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view taken substantially on the line 5—5 of Fig. 1;

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Fig. 6 is a cross-sectional view taken substantially on the line 6—6 of Fig. 1;

Fig. 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

Fig. 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 Figs. 1, 2 and 3, which illustrate a rocker arm adapted to be constructed in accordance with my improved method, 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 preferably 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 toward 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 Fig. 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 Figs. 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 Fig. 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 toward 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 toward 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 toward 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 toward 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. 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.

Furthermore, since no drawing operation is involved, the stamped metal may have a single gage or 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 and hence it is accurate and no 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.

Although I have illustrated and described herein a preferred form of my invention, it will be apparent that the invention is susceptible to variation, modification and change without departing from the spirit and scope of the appended claims.

What is claimed is:

1. The method of manufacturing a rocker arm assembly which comprises forming an arm from laminations of sheet metal having aligned circular openings and having an inwardly directed enlarged portion constituting a generally radial enlargement of said openings, rigidly anchoring a metallic tubular element of circular cross section in said openings by peripherally fitting said element in the openings with said element bridging said enlargement, axially compressing the element while simultaneously rigidly and positively confining the tubular element against both inward and outward deformation by means of rigid metallic dies engaging the interior of said element and also engaging the exterior of said element on either side of said laminations, and continuing the axial compression so as to cause a part of said element to deform outwardly into said enlargement.

2. The method of manufacturing a rocker arm assembly which comprises forming an arm from laminations of sheet metal having aligned circular openings and having an inwardly directed enlarged portion constituting a generally radial enlargement of said openings, rigidly anchoring a metallic tubular element of circular cross section in said openings by peripherally fitting said element in the openings with said element bridging said enlargement, axially compressing the element to provide annular, bulbed heads on the element engaging opposite sides of the arm, rigidly and positively confining the outward bulbing expansion of the head metal while simultaneously rigidly and positively confining the tubular element against both inward and outward deformation, all of said confinement being effected by means of rigid metallic dies engaging the interior of said element and also engaging the exterior of said element on either side of said laminations, and continuing the axial compression so as to cause a part of said element to deform outwardly into said enlargement and so as to increase the extent of radial contact between the heads and the arm and to embed the heads at least slightly in the sides of the arm.

3. The method of manufacturing a rocker arm assembly which comprises forming an arm from laminations of sheet metal having aligned openings therein and oil passageways therebetween communicating with said openings, rigidly anchoring a metallic tubular element in said openings by tightly peripherally fitting said element in the openings and then axially compressing the tubular element to provide annular, bulbed heads on the element engaging opposite sides of the arm, and rigidly and positively confining the outward bulbing expansion of the head metal and preventing radial expansion and elongation of the remainder of said tubular element while simultaneously rigidly and positively confining the metal of said tubular element by means of a metallic inner die which directly engages the interior of said tubular element to prevent inward deformation thereof, and continuing the axial compression of the element so as to increase the extent of radial contact between the heads and the arm and to embed the heads at least slightly in the sides of the arm thereby driving the laminations together to form an oil tight seal therebetween and between the heads and sides of the arm.

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