Dec. 14, 1965 J. R. WINTER, JR 3,222,950

ROCKER ARM FOR INTERNAL-COMBUSTION ENGINES

Original Filed Dec. 14, 1961 2 Sheets-Sheet 1

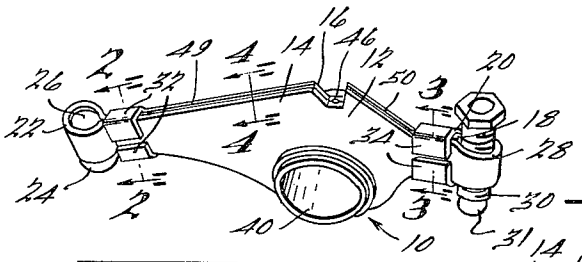


Fig. 1.

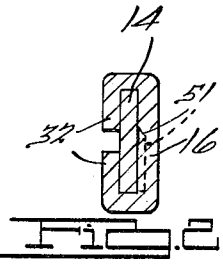


Fig. 2.

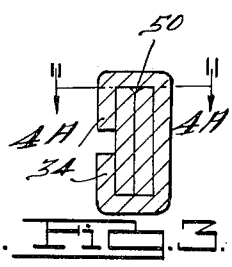


Fig. 3.

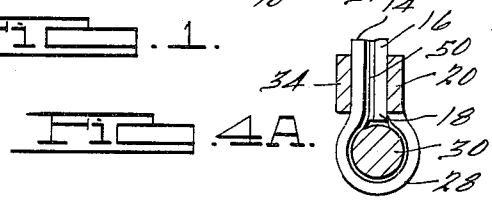


Fig. 4A.

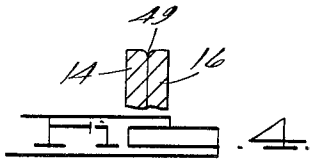


Fig. 4.

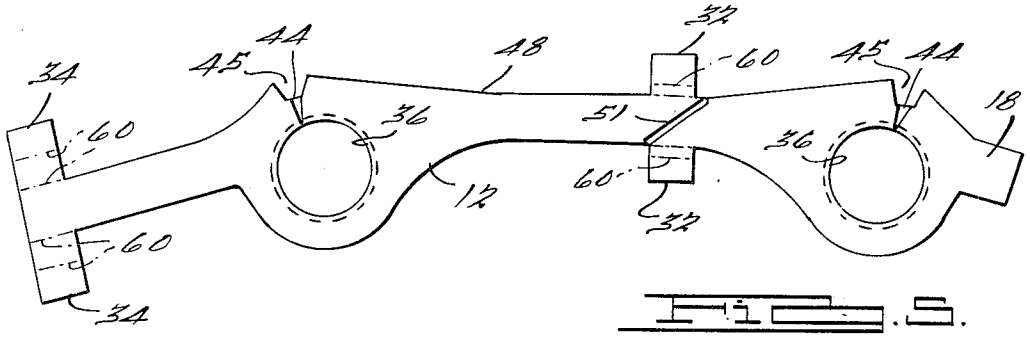


Fig. 5.

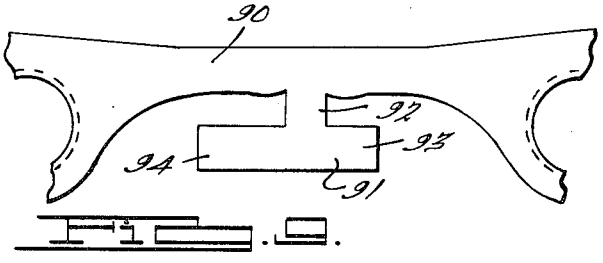


Fig. 9.

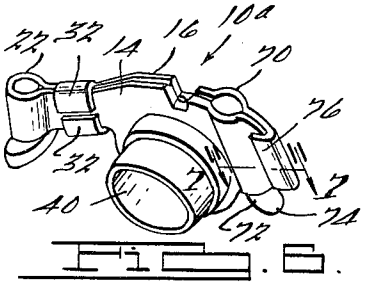


Fig. 6.

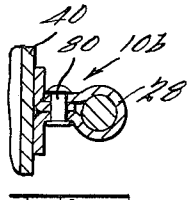


Fig. 8.

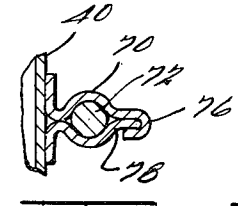


Fig. 7.

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ROCKER ARM FOR INTERNAL-COMBUSTION ENGINES

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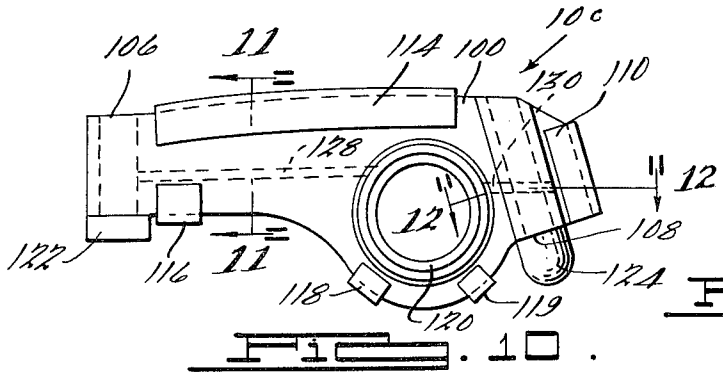



FIG. 10.

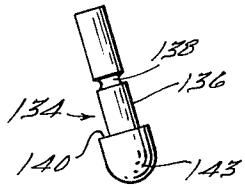



FIG. 13.

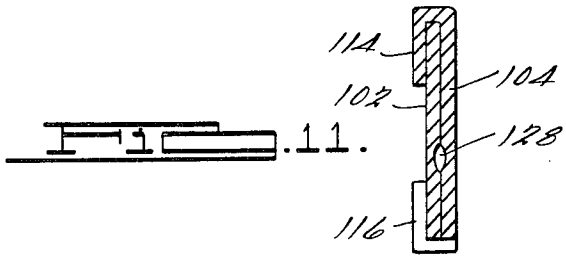
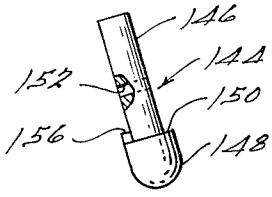



FIG. 11.

FIG. 14.



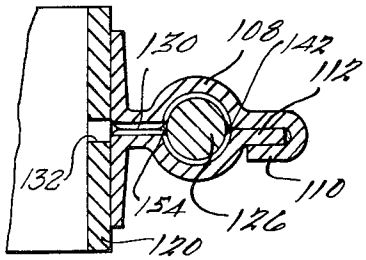




FIG. 12.

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United States Patent Office 3,222,950 Patented Dec. 14, 1965



3,222,950

# ROCKER ARM FOR INTERNAL-COMBUSTION ENGINES

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Continuation of application Ser. No. 160,696, Dec. 14, 1961. This application June 3, 1964, Ser. No. 374,876
18 Claims. (Cl. 74—519)

This invention relates generally to improvements in the construction of rocker arms for internal combustion engines of the overhead valve type.

This application is a continuation of applicant's copending application Serial No. 160,696, filed December 14, 1961, which latter application was a continuation-in-part of Serial No. 801,832, filed March 25, 1959, now abandoned.

The primary object of this invention, therefore, is to provide a laminated rocker arm which includes improved means for securing the laminae together.

It has been a common practice to secure the laminae together in laminated rocker arms by welding. An example of such a rocker arm is shown in my prior Patent No. 2,509,661. However, many problems must be dealt with in the manufacture of arms in this manner. First of all, the only way effective quality control can be accomplished is to subject selected finished arms to load tests which determine whether or not the welds are of the required strength. Such a test always results in the destruction of the test arms. When an arm with a defective weld is found, all of the arms welded in the machine between the time of the test which disclosed the defective arm and the preceding arm tested must be rejected. Secondly, the metal in a welded arm becomes embrittled and the arms are subject to some warping and deformation due to the heating involved in the welding step. Furthermore, the material from which the arms can be made is limited to weldable metals.

It is an object of the present invention, therefore, to provide a rocker arm which overcomes the above disadvantages, is economically produced by mass production methods, and is capable of performing efficiently over a prolonged service life.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawings, in which:

FIGURE 1 is a perspective view of the rocker arm of this invention;

FIGURES 2, 3 and 4 are enlarged sectional views of the rocker arm of this invention looking along the lines 2—2, 3—3 and 4—4, respectively, in FIGURE 1;

FIGURE 4A is a sectional view looking along the line 4A—4A in FIGURE 3;

FIGURE 5 is a plan view of the stamping which is bent to form the rocker arm shown in FIGURE 1;

FIGURE 6 is a perspective view of a modified form of the rocker arm of this invention;

FIGURE 7 is a fragmentary sectional view looking substantially along the line 7—7 in FIGURE 6;

FIGURE 8 is a sectional view like FIGURE 7 of another modified form of the rocker arm of this invention;

FIGURE 9 is a plan view of a stamping which is bent to form another modified form of the rocker arm of this invention;

FIGURE 10 is an elevational view of still another modified form of the rocker arm of this invention;

FIGURE 11 is a transverse sectional view looking along the line 11—11 in FIGURE 10;

FIGURE 12 is a fragmentary sectional view looking along the line 12—12 in FIGURE 10;



FIGURE 13 is a side view of a modified form of stud; and

FIGURE 14 is an elevational view of another form of stud.

With reference to the drawing, the rocker arm of this invention, indicated generally at 10, is illustrated in FIGURE 1 as consisting of a body member 12 which is blanked and formed from a single piece of sheet metal, shaped and folded to provide two laminae 14 and 16 which are positioned side by side and flat against each other. The end portions 18 and 20 of the body 12 are overlapped at one end of the rocker arm, as shown in FIGURES 1 and 4A, in the attachment of the laminae 14 and 16. A loop 28 at this one end of the arm 10 receives a threaded stud 30 having a ball 31 at its lower end which is actuated by the push rod (not shown) in an internal combustion engine during use of the arm 10. A loop 22 formed at the opposite end of the arm 10 supports a push pin element 24 having a stem 26 received in a flexible press fit in the loop 22. The laminae 14 and 16 are held together at positions adjacent the loops 22 and 28 by pairs of bent tabs 32 and 34, respectively, which are integral parts of the body member 12 and extend around transversely opposite sides of the laminae.

In the manufacture of the arm 10, it is blanked from a single piece of sheet metal in the form illustrated in FIGURE 5. Hub receiving openings 36 are formed in spaced portions of the body 12 and the metal surrounding the openings 36 is drawn outwardly so as to form tubular supports for a tubular hub 40 which extends laterally through the arm 10 intermediate the ends thereof.

When the body member 12 is in the blank form shown in FIGURE 5, it is formed with a pair of grooves 44, each of which extends outwardly from one of the openings 36 and communicates with a notch 45 formed in one edge 48 of the body member 12. When the body member 12 is bent to form the laminae 14 and 16, the grooves 44 cooperate to form an upright oil passage 46 for a purpose to appear presently.

When the body member 12 is in the blank form shown in FIGURE 5, it is also swaged along the edge 48 so that when it is bent to form the laminae 14 and 16, V-shape oil supply grooves 49 and 50 are formed which are supplied with oil at their inner ends from passage 46 and function to direct this oil to the loops 22 and 28. Oil is supplied to the lower end of the loop 22 through a diagonal passage 51 located between the portions of the laminae 14 and 16 surrounded by the tabs 32. The passage 51 is formed by striking the blank shown in FIGURE 5 so as to form a groove which extends between the oil supply groove 49 and the lower end of the loop 22 when the blank is folded to form the arm 10. At the opposite end of the body member 12 the oil travels through the supply groove 50 under the top tab 34 to the upper end of the loop 28 for travel downwardly thereon to the lower end of the stud 30. The stud 30 is illustrated as being of the self-locking adjustable type which does not require a lock nut, since the threads on the screw are bulged outwardly or otherwise deformed to increase the friction between engaging threads. The tabs 34 hold the laminae so positively that this type of a stud can be used, thereby facilitating assembly of the stud and arm and making adjustment thereof easier as compared with a stud and lock nut combination. It was necessary to use this latter type of stud on prior arms in which the laminae were welded together because there was danger of a self-locking type stud loosening the weld.

It is very important that the laminae 14 and 16 be maintained in positions flat against each other, especially in the area of the hub 40, because if they are spaced at any point, the oil supply to the grooves 49 and 50 may

be short circuited or may flow downwardly from the grooves **49** and **50** between the laminae before it reaches the loops **22** and **28** thereby interfering with the normal metered supply of oil to the push pin element **24** and the threaded stud **30**. The laminae **14** and **16** are formed by first bending the body member **12** when it is in the blank form shown in FIGURE 5, to form the loop **22**, and the portions of the body member **12** adjacent the loop **22** are held tightly together so that the laminae **14** and **16** assume relatively diverging positions. The free ends of the laminae **14** and **16** are then forced inwardly toward each other and this action provides for a tight engagement of the laminae **14** and **16** over their full lengths. The loop **28** is then formed at the opposite end of the body **12** so that the tabs **34** overlap the end portion **18** of the body member **12**. The tabs **32** and **34** are then bent over the lamina **14** to the positions shown in FIGURE 1 to tightly clamp the ends of the laminae **14** and **16** tightly against each other and provide for a tight engagement of the portions of the laminae adjacent the hub **40**. To facilitate bending of the tabs **32** and **34** they are scored, as indicated at **60** in FIGURE 5, at the juncture of each tab with the body member **12** and intermediate the ends of the tabs **32** and **34**.

The location of the tabs **32** and **34** adjacent the loops **22** and **28** positively prevents spreading of the loops **22** and **28** when the push pin element **24** and the threaded stud **30** are inserted therein. Such an arrangement facilitates the desired flexible press fit of the stem **26** and the loop **22**.

The rocker arm **10***a* shown in FIGURE 6 is similar in many respects to the arm **10** and like numerals are therefore used to indicate like parts on the arms **10** and **10***a*. In the arm **10***a* a loop **70** for supporting a stud **72** having a half-ball shape lower end **74** must be disposed so close to the hub **40**, because of the location of the rocker arm supporting shaft and the rocker arm actuating push rod in the engine for the arm **10***a*, that there is insufficient space between the loop **70** and the hub **40** for transversely extending tabs like the tabs **34**. In the arm **10***a*, therefore, the transversely extending tabs **34** are omitted and a single longitudinally extending tab **76** is formed on the end of the lamina **16** and is bent over the adjacent end portion **78** of the lamina **14**, as shown in FIGURE 6, at the right hand end of the arm **10***a*. The body member **12** in the arm **10***a* is bent intermediate the hub **40** and the loop **22** to adapt it to an installation in which the valve stem and push rod are not in line with a diameter of the rocker arm supporting shaft.

In the rocker arm **10***b* shown in FIGURE 8, which is also similar to the arm **10** and therefore has like numerals indicating like parts on the arm **10**, there is insufficient space between the hub **40** and the loop **28** to accommodate tabs like the tabs **34**. Because of space considerations, a longitudinally extending tab like the tab **76** cannot be disposed outwardly of the loop **28**. In this case, therefore, a rivet **80**, is utilized for connecting the laminae **14** and **16** at a position between the hub **40** and the loop **28**. The arm **10***b* is, therefore, more expensive to manufacture than the arms **10** and **10***a* because it involves a riveting step which is not involved in the manufacture of the arms **10** and **10***a*. However, the manufacture of the arm **10***b* does not involve any welding and is therefore advantageous from this standpoint.

FIGURE 9 illustrates a blank **90** for forming a rocker arm like the arm **10** but in which a push pin element like the element **24** shown in FIGURE 1 is formed as an integral part of the blank **90**. A T-shape projection **91** on the blank **90** is bent so that the portion **92** thereof forms the push pin element. This portion **92** is heat treated to eliminate excessive wear in use. The projection **91** also has short and long tab portions **93** and **94**, respectively, which are bent over the laminae **14** and **16**, in the same manner that the tabs **32** are bent, to hold the laminae tightly together adjacent the loop **22**.



In FIGURES 10–12, inclusive, another modified form of the rocker arm of this invention is illustrated and designated by the numeral **10***c*. The arm **10***c* is similar to the arm **10***a* in that it includes a body member **100** which is bent upon itself to form flat side by side laminae **102** and **104** and is formed with loops **106** and **108** at opposite ends of the arm. A longitudinally extending tab **110** is formed on one end of the body **100** and is bent laterally of the body into clamping engagement with the opposite end **112** of the body **100** at a position adjacent to and outwardly of the loop **108**.

A long tab **114** extends transversely of the lamina **104** along the top side of the arm **10***c* over substantially the full distance between the loops **106** and **108** and is bent laterally of the body and downwardly into engagement with the lamina **102**. A second smaller transversely extending tab **116** on the lamina **104** extends upwardly adjacent the loop **106** and third and fourth tabs **118** and **119** on the lamina **104** are bent over the lamina **102** and extend upwardly adjacent the bottom side of the hub **120**. The tabs **110**, **114**, **116**, **118** and **119** are bent into tight clamping engagement with the lamina **102** for holding the laminae **104** and **102** tightly against each other.

The tab **114** acts to reinforce the arm **10***c* so that it effectively resists bending forces in the plane of the laminae **102** and **104**. These bending forces are the primary forces to which the arm **10***c* is subjected during use and are the forces which tend to make the arm **10***c* fail during use. The provision of the long tab **114** effectively reinforces the arm **10***c* so that it will resist failure due to these bending forces.

In order to supply metered lubricating fluid to the push pin element **122**, which is supported in the loop **106**, and the ball **124** at the lower end of the stud **126**, which is supported in the loop **108**, oil supply passages **128** and **130** are formed between the laminae **102** and **104** at positions on opposite sides of the hub **120**. These passages **128** and **130** are formed by first punching or otherwise forming grooves in the body member **100** prior to bending the body member **100** upon itself. These grooves are formed so that they mate when the body member **100** is bent upon itself to form the laminae **102** and **104** and cooperate to form the passages **128** and **130**. Lubricating fluid is supplied to the inner ends of these passages **128** and **130** from the supporting shaft for the rocker arm **10***c* and is pumped along the passages **128** and **130** to the near side of the loop **106** and the far side of the loop **108** where the fluid flows downwardly onto the push pin element **122** and the ball **124**, respectively. Lubricating fluid under pressure is supplied to the arm **10***c* through a hole in the hollow supporting shaft therefor (not shown) and an opening **132** in the hub **120**. The angular spacing between the hole and the opening is adjusted to provide for a flow of fluid in the desired amounts.

Referring to FIGURE 13, a modified form of stud **134** is shown and may be substituted for stud **126** of FIGURES 10 and 12. The shank **136** of stud **134** has a groove **138** rolled or otherwise formed therein and this groove is aligned with passage **130** when the shank **136** is inserted into loop **108** to the position where shoulder **140** of stud **134** bears against the bottom of loop **108**. In operation, groove **138** conducts oil from passage **130** to the passage **142** extending longitudinally along the inside of loop **108** and allows oil to feed onto the ball-shaped end **143** of stud **134** to lubricate the same.

Referring to FIGURE 14, the stud **144** may also be substituted for stud **126** and comprises a shank **146**, a ball-shaped end **148**, and a shoulder **150** therebetween. A passage **152** is drilled or otherwise formed through shank **146** and is fixedly aligned with passage **130** and passage **142** by means of a wedge-shaped projection **156** formed integrally with stud **144** and which is inserted and frictionally retained partway into the passage **154** extending longitudinally along the inside of loop **108**. In operation, passage **152** conducts oil from passage **130** to

passage **142** from which it runs onto the end **148** of stud **144** to lubricate the same. It is noted that passages **142** and **154** are formed during the die forming operation which forms the loop **108**.

From the above description it is seen that this invention provides a rocker arm construction which completely avoids any welding and is very flexible to meet the rocker arm design reqirements of different engines.

Although the invention has been described with respect to preferred embodiments thereof, it is to be understood that it is not to be so limited, since changes can be made therein which are within the scope of the invention as defined by the appended claims.

What is claimed is:

**1.** In a rocker arm for an internal combustion engine or the like, said arm having end portions and a hub intermediate said end portions, an abutment portion carried by each of said end portions, whereby reciprocating motion is transmitted from one end of the arm to the other by rocking the arm about the hub, each of said abutment portions having one side farther from the hub than the other, an oil passage means carried by said arm providing oil conductive communication for delivery of oil from the interior of the hub to said one side of one of said abutment portions farther from the hub.

**2.** In a rocker arm for an internal combustion engine or the like, said arm having end portions and a hub intermediate said end portions, an abutment portion carried by each of said end portions, whereby reciprocating motion is transmitted from one end of the arm to the other by rocking the arm about the hub, each of said abutment portions having one side farther from the hub than the other, and oil passage means carried by said arm providing oil conductive communication for delivery of oil from the interior of the hub to said one side of one of said abutment portions farther from the hub including means for directing oil downwardly to said one of said abutment portions at said farther side thereof.

**3.** In a rocker arm for an internal combustion engine or the like, said arm having end portions and a hub intermediate said end portions, an abutment portion carried by each of said end portions, whereby reciprocating motion is transmitted from one end of the arm to the other by rocking the arm about the hub, each of said abutment portions having one side farther from the hub than the other, an oil passage means carried by said arm providing oil conductive communication for delivery of oil from the interior of the hub to said one side of one of said abutment portions farther from the hub including an oil passage extending generally in an up and down direction for directing oil substantially downwardly toward said one of said abutment portions at said farther side thereof.

**4.** In a rocker arm having end portions and a hub intermediate said end portions, at least one of said end portions being formed with a cavity spaced from the hub and extending in a generally up and down direction with respect to the arm, said cavity having one side farther from the hub than the other, abutment means tightly received in said cavity and also extending in said generally up and down direction, the lower end of said abutment means being adapted for engaging a reciprocating part of an engine, an oil passage means in said arm providing oil conductive communication for delivery of oil from the interior of said hub to the side of said cavity and abutment means farther from the hub.

**5.** In a rocker arm having end portions and a hub intermediate said end portions, at least one of said end portions being formed with a cavity spaced from the hub and extending in a generally up and down direction with respect to the arm, said cavity having one side farther from the hub than the other, abutment means tightly received in said cavity and also extending in said generally up and down direction, the bore end of said abutment means being adapted for engaging a reciprocating part of an engine, an oil passage means in said arm providing oil conductive communication for delivery of oil from the interior of said hub to the side of said cavity and abutment means farther from the hub including means for directing oil downwardly to said one of said abutment means at said farther side thereof.

**6.** In a rocker arm having end portions and a hub intermediate said end portions, at least one of said end portions being formed with a cavity spaced from the hub and extending in a generally up and down direction with respect to the arm, said cavity having one side farther from the hub than the other, abutment means tightly received in said cavity and also extending in said generally up and down direction, the lower end of said abutment means being adapted for engaging a reciprocating part of an engine, an oil passage means in said arm providing oil conductive communication for delivery of oil from the interior of said hub to the side of said cavity and abutment means farther from the hub including an oil passage extending in said generally up and down direction at said side of said cavity farther from the hub for communicating said cavity with the lower end of said abutment means and preventing discharge of oil outwardly away from said farther side.

**7.** The structure according to claim **1** in which the rocker arm is of laminated construction.

**8.** The structure according to claim **7** in which at least a portion of the oil passage means comprises an indentation in the inner side of at least one of the arm laminae.

**9.** A rocker arm construction for internal combustion engines comprising a sheet metal body member bent upon itself to form substantially identical laminae positioned side by side and loops at opposite ends of said arm integral with said laminae, said laminae being formed with means providing for the formation of passages for fluid between said laminae when the laminae are positioned side by side in tight engagement with each other, said body member having a pair of overlapping ends adjacent one of said loops, first tab means formed integral with said body at one of said ends and bent over said opposite end for securing said ends together, and second tab means formed integral with one of said laminae adjacent the other one of said loops and bent over the other one of said laminae, said first and second tab means cooperating to maintain said laminae in sufficiently tight engagement with each other to prevent substantial leakage of fluid from said passages.

**10.** An engine rocker arm comprising a sheet metal body member bent upon itself to form a pair of laminae positioned side by side with their inner surfaces in tight engagement with each other, said body member having a hub portion extending transversely through an intermediate portion thereof and an opening for lubricant extending from said hub portion to an intermediate point in one edge face of said body member, fluid supply passages in said one edge communicating at their inner ends with said opening and at their outer ends with opposite ends of said arm, and tab members formed integral with one of said laminae and bent over the other laminae into engagement with the outer surface thereof for maintaining said laminae in sufficiently tight engagement to prevent flow of fluid out of said passages between said laminae.

**11.** An engine rocker arm comprising a sheet metal body member bent upon itself to form a pair of laminae positioned side by side with their inner surfaces in tight engagement with each other and article-supporting loops at opposite ends of said body member, said body member having a hub portion extending transversely through an intermediate portion thereof and an opening for lubricant extending from said hub portion to an intermediate point in one edge face of said body member, fluid supply passages in said one edge communicating at their inner ends with said opening and at their outer ends with said loops, and tab members formed integral with one of said laminae and bent over the other laminae into engagement with the outer surface thereof for maintaining said lam-

inae in sufficiently tight engagement to prevent flow of fluid out of said passages between said laminae.

12. A rocker arm construction for internal combustion engines comprising a sheet metal body member bent upon itself to form flat laminae positioned side by side in tight engagement with each other, said body member being formed at opposite ends thereof with means for supporting a pair of bearing elements, said laminae being formed with means providing for the formation of passages for fluid between said laminae when said laminae are in tight engagement with each other for supplying fluid to said end supporting means, tabs formed integral with at least one of said laminae and bent into engagement with the other one of said laminae for maintaining them in a sufficiently tight engagement to prevent substantial leakage of fluid from said passages during travel of fluid therethrough, one of said tabs extending longitudinally of said body member at one end of one of said laminae and being bent into tight engagement with the outer surface of the adjacent end of the other one of said laminae, and another of said tabs extending transversely of said body member and being bent into tight engagement with the outer surface of the other one of said laminae, said last mentioned tab extending substantially the length of said arm between said supporting means.

13. A rocker arm construction for internal combustion engines comprising a sheet metal body member bent upon itself to form laminae positioned side by side in tight engagement with each other, said body member having a top edge and a bottom edge and being formed at opposite ends thereof with means for supporting a pair of bearing elements, said laminae being formed with means providing for the formation of passages for fluid between said laminae when said laminae are in tight engagement with each other for supplying fluid to said end supporting means, tabs formed integral with at least one of said laminae and bent into engagement with the other one of said laminae for maintaining them in a sufficiently tight engagement to prevent substantial leakage of fluid from said passages during travel of fluid therethrough, one of said tabs extending longitudinally of said body member at one end of one of said laminae and being bent into tight engagement with the outer surface of the adjacent end of the other one of said laminae, and another of said tabs extending transversely of said body member and being bent into tight engagement with the outer surface of the other one of said laminae, said last mentioned tab extending substantially the length of said arm along the top edge thereof between said supporting means.

14. A rocker arm structure including a hub and a laminated arm portion extending therefrom and terminating in a supporting portion, oil feed means for conveying lubricating oil from the hub to the top side of said arm portion, said top side having oil groove means therein for conducting oil from said feed means to said supporting portion, and a tab member on one of the laminae for said arm portion bridging the top side of said oil groove means and embracing another one of said laminae for holding said laminae in fluid-tight engagement and providing for oil flow under said tab member in said oil groove means.



15. A laminated rocker arm structure comprising a pair of sheet metal laminae having ends, means including a groove in the top edge of said structure for conveying lubricant to said ends, a securing tab on one lamina adjacent each of said ends extending over the top of said edge and embracing the other lamina, and a downwardly inclined channel between said laminae at one of said ends communicating at its upper end with said groove and at its lower end with one of said laminae ends.

16. A laminated rocker arm structure comprising a pair of sheet metal laminae having ends, means including a groove in the top edge of said structure for conveying lubricant to said ends, a securing tab on one lamina adjacent each of said ends extending over the top of said edge and embracing the other lamina, and a downwardly inclined channel between said laminae at one of said ends communicating at its upper end with said groove and at its lower end with one of said laminae ends, the groove at the opposite one of said laminae ends extending under the tab adjacent thereto.

17. A rocker arm structure including a hub and laminated arm portions extending in opposite directions therefrom, bearing members carried by the terminal ends of said arm portions, lubricating means including internal channels formed by grooves in the inner faces of the laminae which form said arm portions, means for securing said laminae together and substantially sealing said channel walls, said means including tabs on one of said laminae bent into embracing relation with the other one of said laminae, some of said tabs being adjacent said hub and others adjacent said bearing portions.

18. A rocker arm structure including a hub and a laminated arm portion having top and bottom edges and extending longitudinally of the arm structure in opposite directions from said hub, bearing members carried by said arm portions adjacent the ends thereof, said laminae being formed with means providing for the formation of passages for fluid extending from said hub to said bearing members, means for securing said laminae together in a fluid-tight relation so as to prevent substantial leakage of fluid from said passages, said means including a plurality of tab members on one of said laminae bent into embracing relation with the other one of said laminae, some of said tabs being adjacent said hub, another one of said tabs extending longitudinally of the arm structure at one end of one of said laminae and being bent into tight engagement with the outer surface of the adjacent end of the other one of said laminae at a position outwardly from said hub on the opposite side of one of said bearing members, and another one of said tabs extending transversely of said arm structure and being bent into tight engagement with the outer surface of the other one of said laminae, and said last mentioned tab extending substantially the length of said laminae along the top edge thereof between said bearing members.

No references cited.

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