

Dec. 15, 1959

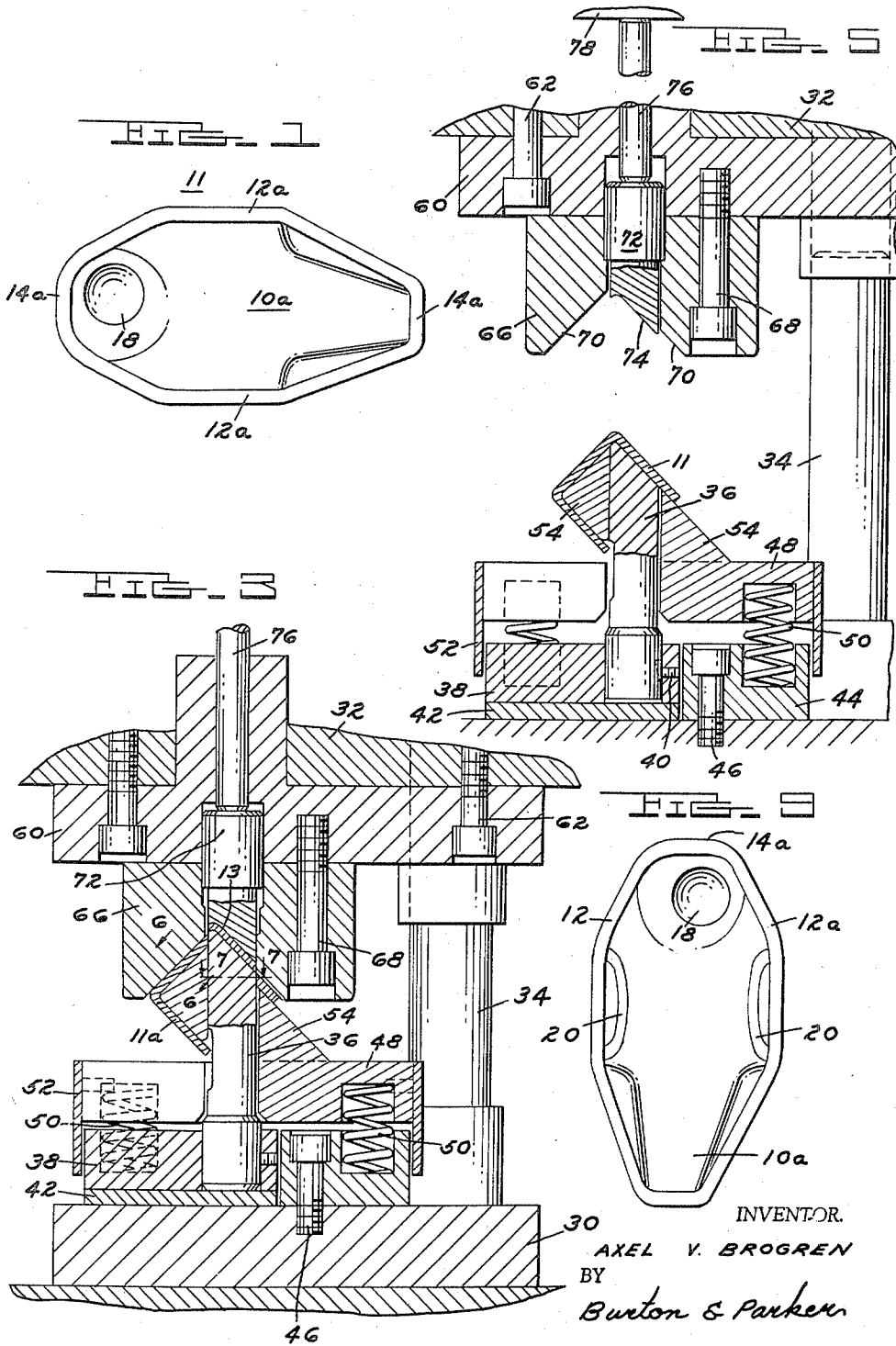
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2,917,033

ROCKER ARM AND PROCESS OF MANUFACTURING THE SAME

Filed Jan. 27, 1958

3 Sheets-Sheet 1



Dec. 15, 1959

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3 Sheets-Sheet 2

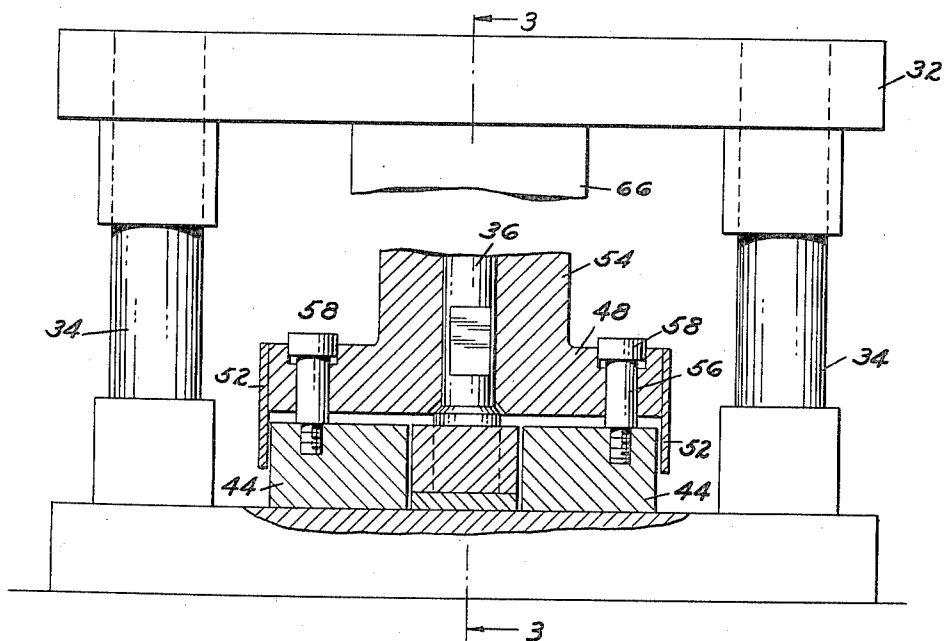


FIG. 4

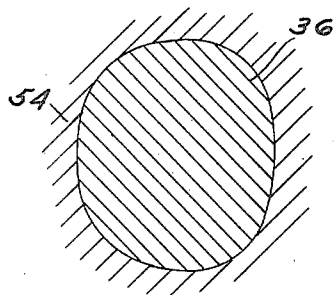


FIG. 8

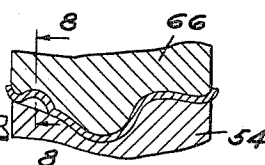


FIG. 9

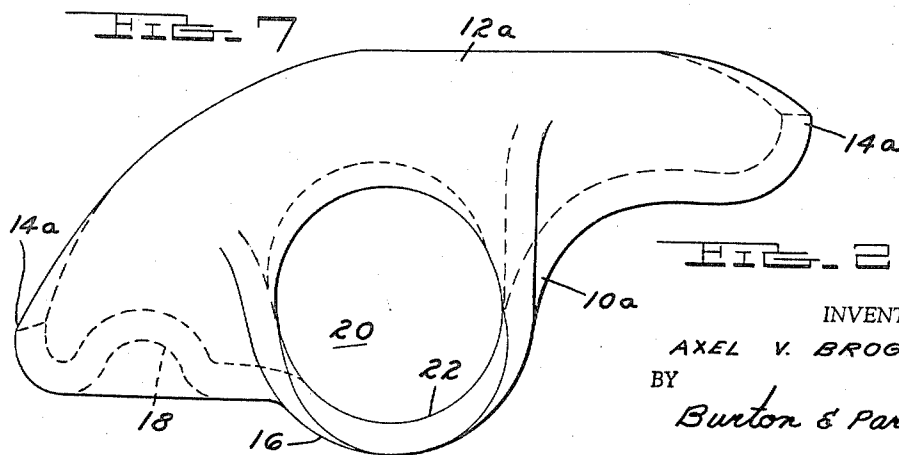


FIG. 2

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3 Sheets-Sheet 3

FIG. 11

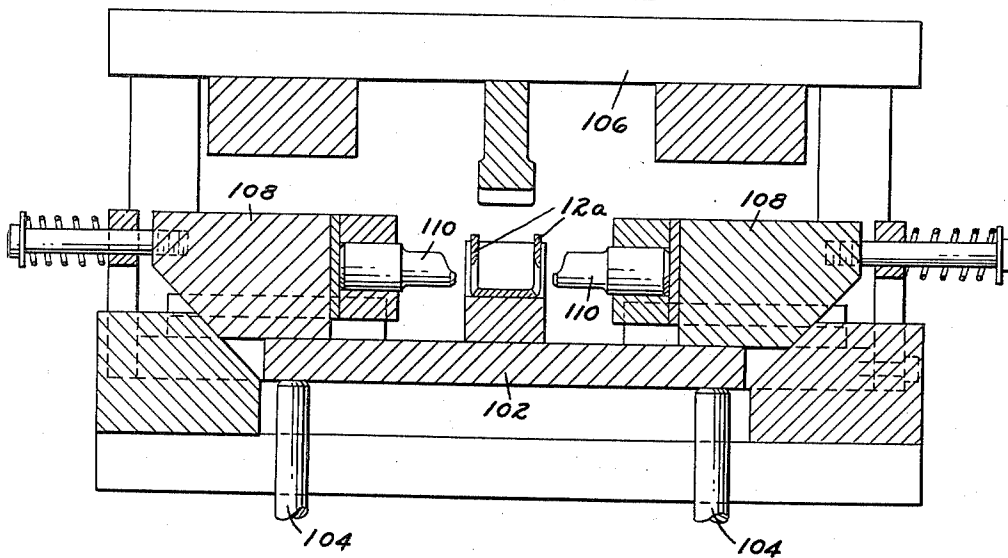


FIG. 12

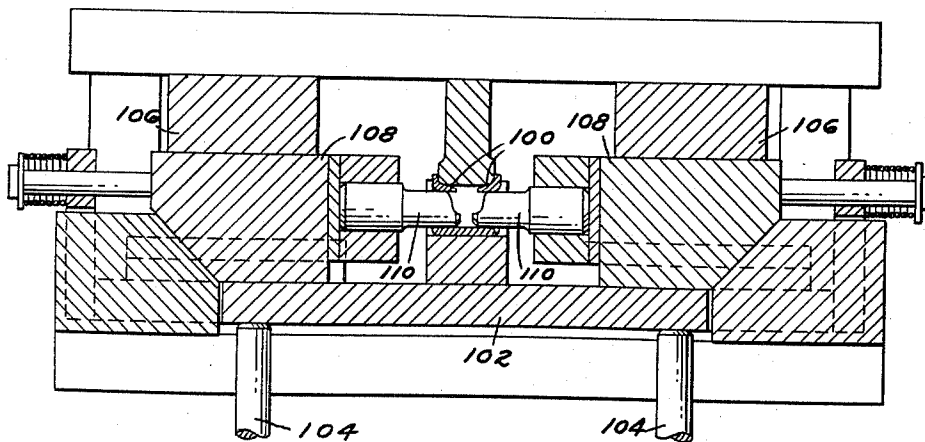
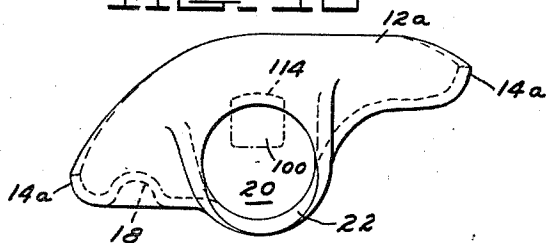


FIG. 10



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ROCKER ARM AND PROCESS OF MANUFACTURING THE SAME

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Application January 27, 1958, Serial No. 711,373

9 Claims. (Cl. 123—90)

This invention relates to an improved rocker arm for a combustion engine such as is used in motor vehicles and it relates particularly to the fabrication of such a rocker arm out of sheet metal.

Heretofore it has been common practice to form these rocker arms out of forgings or the like though sheet metal has been used in certain cases.

The purpose of this invention is primarily to provide such a rocker arm which can be fabricated out of sheet metal quickly and at a low cost and which requires a minimum of finishing once it is shaped to put the same in condition for use.

Another object is the formation of a rocker arm out of sheet metal which is of strong and rugged construction, which is light in weight, which may be quickly fabricated, and which when finished is provided with shaft-receiving apertures through which the supporting shaft is extended, which apertures are free from roughness or burrs or the like.

Another object is the provision of a process for the fabrication of a rocker arm as hereinabove described, which process employs the punching of apertures through opposed side walls of a rocker arm stamping which is channel-shaped in cross section and which punched-out apertures are so formed that the portions of the arm which bear against the supporting shaft are smooth and free from any undesirable roughness.

Another object is the provision of a rocker arm formed of sheet metal which is of a generally channel-shape formation having a bottom wall and opposite side walls and wherein the bottom wall is deformed downwardly defining a trough-shaped area which extends transversely across the bottom wall and the two side walls and adjacent portions of the bottom wall are cut away at opposite ends of this trough providing shaft-receiving apertures and wherein the edges of those portions of the shaft-receiving apertures that might be brought into engagement with the supporting shaft are smooth and free from roughness or burrs.

Other objects, advantages, and meritorious features will more fully appear from the following specification, claims, and accompanying drawings, wherein:

Fig. 1 is a top elevation of the rocker arm stamping after the same has been shaped but before the rocker shaft apertures are formed therein;

Fig. 2 is a side elevation of the rocker arm shown in Fig. 1 but showing the apertures formed therein;

Fig. 3 is a vertical sectional view through a fragment of a die showing the punching operation whereby a shaft aperture is punched through a side wall of the channel-shaped rocker arm stamping, and taken on section line 3—3 of Fig. 4;

Fig. 4 is a fragmentary elevation partly in section of that portion of the die shown in Fig. 3 but taken at right angles thereto;

Fig. 5 is a fragmentary sectional view taken on the same line as Fig. 3 but showing the cooperating die portions of the press separated from each other and show-

2

ing the rocker arm stamping in position for a die-punching operation;

Fig. 6 is a cross sectional view taken on the line 6—6 of Fig. 3;

Fig. 7 is a cross sectional view taken on the line 7—7 of Fig. 3;

Fig. 8 is a cross sectional view taken on the line 8—8 of Fig. 6;

Fig. 9 is an elevation similar to Fig. 1 but showing the stamping after it has been completely formed into the rocker arm and provided with the rocker shaft apertures;

Fig. 10 is a side elevation of a stamping at an intermediate stage in the formation of a modified form of rocker arm;

Fig. 11 is a sectional view through a stamping press provided with dies adapted to shape the upper margins of the apertures through the side walls of the rocker arm stamping at the beginning of the operation;

Fig. 12 is a section through a stamping press taken on the same line as Fig. 11 but showing the position of the mechanism at the conclusion of the stamping operation.

One embodiment of this rocker arm invention is shown in Figs. 2 and 9. It is formed of sheet metal which is shaped into the generally channel-shaped stamping formation shown in Fig. 1.

Fig. 1 shows a rocker arm stamping which has been shaped out of a sheet metal blank before the apertures 20 are formed therethrough and such stamping is indicated generally by the numeral 11a. There is a bottom portion of this channel shape indicated by the numeral 10a. There are two opposed side wall portions indicated by the numeral 12a and these side wall portions extend around over the opposite ends of the arm as at 14a as shown in Figs. 1 and 2. When the arm is in use, it is mounted in the position shown in Figs. 1 and 2 with the channel opening upwardly.

The bottom portion of the channel shape is deformed downwardly defining a trough-like deformation 16 which extends transversely across the bottom portion 10a of the channel shape. The bottom portion of the channel is also shaped at one end to provide an upwardly extending recess 18 adapted to seat a push rod. The opposite end of the bottom portion is adapted to bear upon the valve stem.

The opposite side walls 12a and the bottom wall 10a are cut away at opposite ends of the trough-like deformation providing opposed complementary rocker shaft-receiving apertures 20. These apertures are generally circular in shape but somewhat elongate vertically as the arm is disposed in use, as shown in the preferred modification illustrated in Figs. 1—9 and best shown in Fig. 2. The bottom of the deformed trough 16 is formed on an arc as at 22 in Fig. 2 so as to seat against the bottom of the rocker shaft which extends through the apertures. In the mounting of the rocker arm on an engine, spring or other tension is exerted upwardly against both ends of the arm so that the bottom of the trough deformation is held upwardly against the underside of the rocker shaft.

It is desirable that the rocker arm form such a bearing on the shaft that the engagement therebetween is smooth and free from any roughness or the like. It will be noted that the apertures 20 extend not only through the opposite side walls 12a, but as shown in Fig. 8, the edges of the apertures 20 throughout the lower half of the circumference of the aperture slope outwardly and downwardly away from the bottom of the trough as at 22. Due to such slope there are no burrs or other rough portions on the edge of the apertures to rub against the shaft and the shaft lies flat against the bottom of the trough.

It will also be noted that the edge of each aperture throughout the upper half of its circumference is not so formed for the upper half of the aperture does not abut the shaft. It is the lower half of the circumference of the aperture which abuts the rocker shaft because the upward tension against the arm holds the arm upwardly against the shaft.

This particular formation of the apertures through the side walls and the bottom wall is due to the particular process step which is employed to punch said apertures through opposite sides of the rocker arm. The rocker arm stamping, which is shown in Fig. 1, is completely shaped as shown in Fig. 2, except for the apertures 20. As illustrated in the process herein set forth, these apertures are formed by a punch press and a machine provided with mechanism suitable for forming them is illustrated in Figs. 3, 4, and 5. There is a press having a lower press plate 30 and an upper press plate 32. These upper and lower parts of the press are supported for relative reciprocation as is conventional. The lower portion may be stationary and the upper or force portion reciprocally mounted. Guide pins 34 are provided as shown which guide the reciprocation of the force.

The lower plate 30 carries a punch 36 which is supported within a mounting plate 38. This punch may be removable and held in the plate by a screw 40 as shown in Fig. 5. The punch rests upon a bearing plate 42. The mounting plate which superimposes the base plate 30 is shown in the drawing as divided into two parts. There is the part 38 within which the punch is located and there is the part 44 which lies alongside of the part 38. This mounting plate is secured to the base plate 30 by threaded screws 46. Separation of the mounting plate into two parts permits removal of the locking screw 40 while retaining the same always in place during use.

A spring pad 48 superimposes the mounting plate 38. This pad is supported upon springs 50. The pad includes flange 52 which encircles the mounting plate so as to properly position the pad upon the mounting plate. The pad 48 has an upwardly projecting shaped portion 54 which surrounds the punch 36 and supports such punch on both sides so that the punch will not be tilted or sprung under the punching pressure applied thereto when the blank is forced thereover. This upwardly projecting portion 54 is shaped throughout its upper end or nose portion to be received within and to seat and position the rocker arm blank shown in Fig. 1. Such blank is shown seated thereon in Fig. 5. This pad 48 is limited in its upward movement by the springs by limit screws 56. These screws have heads 58 received within cutouts in the pad and adapted as shown in Fig. 4 to limit the upward movement of the pad.

The upper or force portion of the press 32 carries a mounting plate 60 secured thereto by screws 62 as shown in Figs. 3 and 5. This plate 60 carries a die block 66 secured thereto by screws 68. This die block is interiorly formed as at 70 to be received over the stamping 11a as shown in Fig. 5. A knockout punch 72 is mounted within the die block 66. This knockout punch has a face portion 74 formed as illustrated in Fig. 5 to engage the portion of the stamping knocked out by the punch. This knockout punch includes a pin 76 adapted to come up against a stop 78 for actuation of the knockout member.

In the formation of the rocker arm a stamping shaped as shown in Figs. 2, 6, 8, and 9, except for the absence of the apertures 20 shown in Fig. 2, is formed out of a piece of sheet metal. This stamping has a generally channel shape as hereinabove set forth. It is shown with the channel opening upwardly in Fig. 2. Figs. 6 and 8 show the contour of portions of the stamping. It will be noted that the side wall portions 12a exhibit substantially greater height midway between the ends of the rocker arm than such side walls do at the ends where they are indicated by the numeral 14a.

In the punching of the apertures 20 the stamping is

seated upon the punch and the upwardly projecting nose 54 of the spring pad 48, as shown in Fig. 5. It will be noted that the punch itself extends into the interior of the channel formation so that when the stamping is forced down over the punch, as shown in Fig. 3, the part 13 which is punched therefrom is punched partly out of the bottom portion of the channel formation as well as out of the side wall portion. The stamping rests upon the punch and its associated pressure pad so that the cutting edge of the punch engages the inner surface of the side wall of the stamping at an angle of approximately 45°. As the force moves downwardly upon the punch, the stamping is forced downwardly over the punch as shown in Fig. 3 and the cutout portion 13 is displaced therefrom. This cutout portion is then ejected by the knockout pin 72 as the force moves upwardly.

The stamping is then reversed in position on the punch so that the opposite side wall is disposed upon the cutting end of the punch. Subsequent reciprocation of the force punches an aperture through such side wall. The two side walls are therefore provided with corresponding apertures 20. These apertures are slightly elongate as seen from Fig. 2. It will also be seen that as the punch moves through the side wall of the stamping adjacent to the bottom wall thereof, it shapes the edge of the aperture 22 on a bevel so that it slopes outwardly and away from the bottom of the trough 22 formed in the bottom portion of the rocker arm. This bevel or slope extends throughout approximately 180° of the circumference of the generally circular aperture 20. It is this portion of the rocker arm, viz: the bottom of the trough 22, which is held upwardly against the rocker shaft by the upward tension thereagainst when the rocker arm is in use. Due to the slope and bevel resulting from the punch passing through the wall from the inside out and the position of the stamping upon the punch in the press, there is no roughness or burrs formed upon any part of the rocker arm shaft openings which might engage the shaft.

Figs. 10, 11, and 12 illustrate the formation of the modified form of the rocker arm as compared with that shown in the first nine figures of the drawings. Generally the construction resembles that heretofore described. The only difference is that in the modification shown in Figs. 10, 11, and 12, the aperture through each side wall is so formed that it is provided along its upper edge with an ear lock portion 100 which is intumed upwardly of the channel-shaped rocker arm. This ear lock portion 100, when intumed, overhangs the shaft to form a relatively wide bearing thereagainst as would be apparent from the view shown in Fig. 12.

Fig. 10 shows the rocker arm stamping after the apertures had been punched through the side walls and the ear is there indicated as projecting radially into each aperture and identified by the numeral 100. The stamping shown in Fig. 10 bears the same identification numerals as that shown in Fig. 2.

Figs. 11 and 12 show a suitable process and suitable mechanism for bending the ears 100 inwardly of the channel. It is understood that the apertures 20 could be punched through the side walls as shown in Figs. 3 and 9 of the drawings except that in Figs. 3 and 9 the apertures are punched through in a generally circular shape. It is understood that when the apertures 20 are punched through the side walls of the modification shown in Fig. 10, they would be so punched as to leave the projecting ear portions 100. The die would therefore be differently shaped as is obvious. The stamping shown in Fig. 10 would be placed in a stamping press as illustrated in Figs. 11 and 12. Such stamping is indicated as 12a. It is shown as seated upon a depressible holder plate assembly 102 supported upon depressible pins 104. When the force assembly 106 moves downwardly, the spring withdrawn cone elements 108 move inwardly toward each other. The punch members 110 bend the

ears 100 into the channel as shown in Fig. 12. These ears have an arcuate contour as shown in dotted line at 114 in Fig. 10.

What I claim is:

1. That process of forming a rocker arm comprising 5
shaping a piece of sheet metal into a channel shape hav-
ing a bottom portion deformed downwardly into an
arcuate trough extending transversely across the bottom
portion spaced between the opposite ends of the arm and
having opposed side wall portions extending upwardly 10
from the bottom portion, and punching from the inside
of the channel formation a generally circular shaft-re-
ceiving aperture through each side wall portion at the
end of said trough while supporting said side wall por-
tion and bottom wall portion surrounding the aperture 15
being punched during the punching operation.
2. That process of forming a rocker arm as defined in
claim 1 characterized in that each shaft-receiving aper-
ture is punched from the inside of the channel shape
through a side wall and through an adjacent part of the 20
bottom wall at such an angle that the shaft-receiving ap-
erture at each end of the trough slopes outwardly and
downwardly away from the bottom of the trough.
3. That process of forming a rocker arm as defined in
claim 1 characterized in that each shaft-receiving aperture
is punched from the inside of the channel shape through 25
a side wall and through an adjacent part of the bottom
wall at an angle with respect to the plane of the side
wall of approximately 45° and the edge of the aperture
slopes outwardly and downwardly away from the bottom
of the trough, and further characterized in that the side 30
wall portion and the bottom wall portion are supported
by being gripped and held on opposite sides surround-
ing the aperture being punched during the punching op-
eration.
4. That process of forming a rocker arm comprising
shaping a piece of sheet metal into a channel shape
having a bottom portion deformed downwardly into an
arcuate trough extending transversely across the bottom
portion spaced between the opposite ends of the arm 35
and having opposed side wall portions extending upward-
ly from the bottom portion, which side wall portions
have a height adjacent to opposite ends of the trough
substantially greater than adjacent to the end portions
of the arm and which side walls extend around opposite 40
ends of the arm, and punching from the inside of the
channel shape a generally circular shaft-receiving aper-
ture through each side wall portion and through an ad-
jacent part of the bottom wall portion at such an angle
that the edge of the shaft-receiving aperture slopes out- 45
wardly and downwardly away from the bottom of the
trough and supporting the bottom wall portion and the
side wall portion of the channel shape on both the in-
side and the outside surrounding the aperture being
punched and supporting the punch encircling the same
within the interior of the channel shape all during the
punching operation.

5. A rocker arm formed of sheet metal and being of
a generally channel-shaped formation having a bottom
portion and opposite side wall portions and wherein the
side wall portions extend around the opposite ends of
the bottom portion and wherein said bottom wall portion
is deformed downwardly defining a trough-shaped de-
formation extending transversely across the bottom por-
tion spaced between the opposite ends of the arm, the
opposite side walls of the channel-shaped formation pro-
vided with opposed complementary shaft-receiving gen-
erally circular apertures extending therethrough at op-
posite ends of the trough deformation, the edges of said
apertures sloping outwardly and away from the bottom
of the trough throughout the bottom area of the trough.
6. A rocker arm formed of sheet metal and being of
a generally channel-shaped formation having a bottom
wall portion and opposite side wall portions and wherein
said bottom wall portion is deformed downwardly de-
fining a trough-shaped deformation extending transversely
across the bottom wall portion spaced between the op-
posite ends of the arm, the opposite side walls adjacent
the opposite ends of the trough and parts of the bottom
wall at opposite ends of the trough being cut away pro-
viding opposed complementary generally circular shaft-
receiving apertures through which a shaft may extend
to lie adjacent to the bottom of the trough, the edges of
said apertures sloping outwardly and away from the bot-
tom of the trough throughout those portions of the aper-
tures adjacent to the bottom of the trough.
7. A rocker arm as defined in claim 6 characterized
in that the edges of the apertures opposite to the bottom
of the trough are turned inwardly of the channel forming
bearing portions adapted to overlie a shaft received
through said apertures.
8. That process of forming a rocker arm as defined in
claim 1 characterized in that the aperture formed through
each side wall is so punched as to leave an ear-like por-
tion projecting radially inwardly from the top thereof to-
ward the bottom of the trough, and thereafter bending
said two ear-like portions inwardly of the channel to-
ward each other and generally parallel to the bottom of
the trough.
9. A rocker arm as defined in claim 6 characterized
in that an ear arcuate in cross section projects inwardly
from the top margin of each aperture and overhangs a
shaft extended through both apertures.

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