Oct. 11, 1938. J. H. GETTIG 2,133,092

METHOD OF FORMING AN AXLE HOUSING

Filed Oct. 7, 1936

Fig. 1.



Fig. 2.

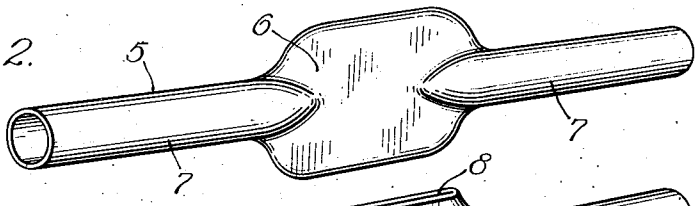


Fig. 3.

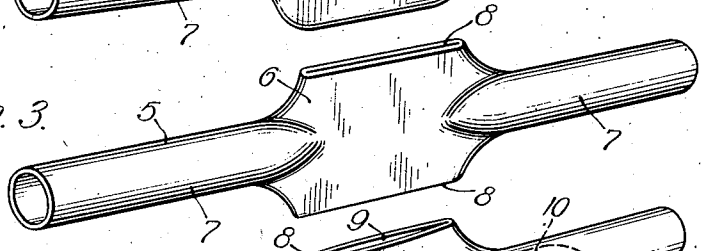


Fig. 4.

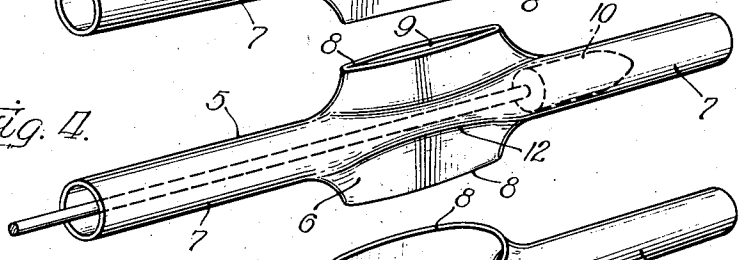


Fig. 5.

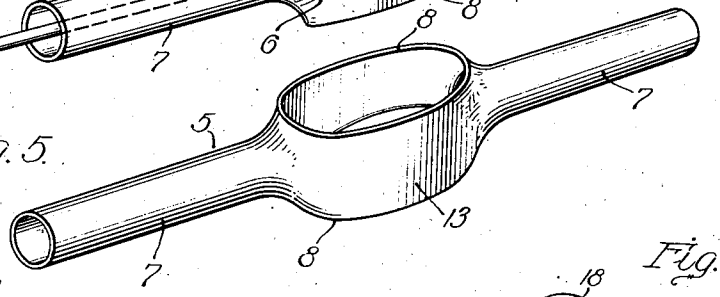


Fig. 6.

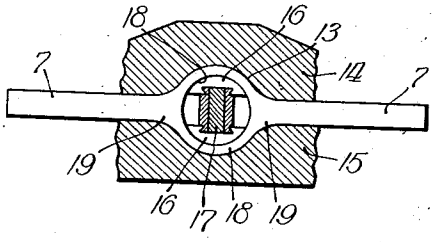


Fig. 7.

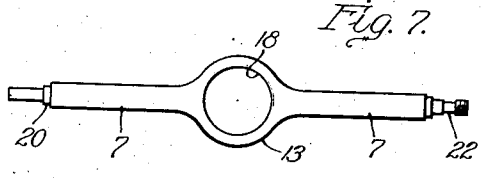
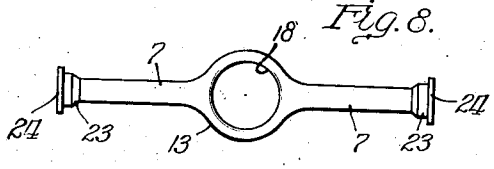


Fig. 8.



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METHOD OF FORMING AN AXLE HOUSING

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Application October 7, 1936, Serial No. 104,429

10 Claims. (Cl. 29—153.1)

This invention relates to a method of forming an axle housing, and is directed particularly to the formation of axle housings of the banjo type.

It has been contemplated to form an axle housing from a piece of tubing by slotting the central portion of the tubing, swaging down the extending arm portions on opposite sides of the slotted portion of the tubing, expanding the slotted portion to form a banjo frame, and then upsetting the ends of the arm portions to provide bearing seats for housings of the full floating type, or to provide brake flanges and internal bearing seats for housings of the passenger car type.

One of the main disadvantages encountered in previous processes with which I am familiar, has been the power required to swage the arms of the housing down to the proper wall thickness without producing distortion of the housings. The swaging operation is costly and requires considerable power. However, it is a necessary part of the process since the original tube thickness has heretofore been such that thickening of the arms is essential in order to provide adequate strength and rigidity. Such a process is generally disclosed in Reissue Patent No. 20,103, issued September 8, 1936, to George Spatta.

The present invention contemplates a departure from this process in that the swaging step is eliminated, and the original tube has a wall thickness equal to the wall thickness required in the arm portions after the housing has been formed.

One object of the present invention is to form an axle housing of this type by flattening and simultaneously reducing the wall thickness of the central portion of a tube, then expanding the flattened portion to form a banjo frame.

Another object of the present invention is to form from a tubular blank of a wall thickness substantially equal to the wall thickness required in the arms of the finished housing, a flattened central portion by means of rolls or a press, the defining edges of this portion being opened for reception of a spreading die which then operates to produce the banjo frame.

The present invention is distinctly advantageous in allowing the use of a tube of the required wall thickness which, during the formation of the banjo frame, is thinned at its central portion to a wall thickness corresponding to that required for the frame without any substantial elongation of the blank, and without requiring any swaging operations for reducing the diameter and increasing the wall thickness of the arm portions of the housing.

Other objects and advantages of the present invention will appear more fully from the following detailed description of the invention which, taken in conjunction with the accompanying drawing, will disclose to those skilled in the art the particular manner in which the axle housing of the present invention is formed.

In the drawing:

Figure 1 is a perspective view of the blank employed in the present process;

Figure 2 is a view showing the blank after the flattening operation;

Figure 3 is a view corresponding to Figure 2 with the defining edges of the flattened portion sheared off preparatory to the spreading operation;

Figure 4 shows the initial spreading of the flattened portion;

Figure 5 shows the first spreading operation for forming the banjo frame;

Figure 6 is a plan view partly in section showing the completion of the banjo portion of the housing;

Figure 7 is a side elevational view of the housing of Figure 6 finished to provide a housing of the full floating type; and

Figure 8 shows the housing of Figure 6 finished to provide a passenger car type of housing.

Referring now in detail to the drawing, the blank 5 shown in Figure 1 is preferably formed from seamless tubing or the like, and has a wall thickness substantially equivalent to the final thickness required for the arm portions of the housing. The diameter of the blank corresponds to the diameter required in the finished arm portions.

If desired, the blank 5 can be formed from flat sheet stock rolled into tubular form and welded longitudinally, as disclosed in the patent to Habicht, No. 1,970,231, issued August 14, 1934.

The blank 5 is first subjected preferably to a transverse rolling operation, although a press may be employed, which produces the flattened central section 6 intermediate the extending arm portions 7, the portion 6 being elongated transversely of the axis of the blank and being substantially flattened into two parallel adjacent surfaces. The shape of the rolls or press heads employed in this operation will determine the particular shape of the portion 6, but it is desirable that this portion 6 be of such a transverse width as to be capable of forming the banjo frame when spread laterally by means of suitable dies, in other words, the width must be such that the web portion of the banjo, as well as the

two flanges which are turned in at opposite edges of the web, can be readily formed from this portion.

After the formation of the flattened portion, whether by rolling or by the use of a press, the blank 5 may be subjected to a shearing operation which shears off the defining edges of the flattened portion 6, as indicated at 8 in Figure 3. This provides a slotted opening at the opposite extremities of the transverse flattened portion and insures proper separation of the two adjacent portions of the blank when the spreading die is introduced therebetween. By the flattening operation shown in Figure 2, the wall thickness of the flattened portion is reduced since the wall thickness of the banjo portion of the frame need not be as great as that of the arm portions and, by this thinning or reduction in wall thickness, a greater surface area is provided in order to produce the greater cubical or volumetrical displacement when the banjo frame is formed.

It may be desirable, in order to facilitate spreading of the flattened portion, to first pass a punch longitudinally through the blank in order to slightly open the slotted portions 8 of the flattened portion 6 of the housing. This step is illustrated in Figure 4 in which the bullet-shaped punch 10 is passed longitudinally through the housing to spread the central flattened portion 6 slightly outwardly and to spread apart the sheared edges 8 as indicated at 9, forming a preliminary slot which receives the head of the spreading die. The passage of this punch through the blank also produces the slightly rounded spreading portion 12 centrally in the flattened portion 6 of the blank, thereby initially forcing part of the metal outwardly so that upon further spreading, not as much metal will be moved. This step, however, is optional as the flattening may be so controlled as to produce an initial spread opening after the shearing operation shown in Figure 3 without the use of the punch shown in Figure 4.

The subsequent spreading operations to produce the banjo housing correspond generally to those shown and described in the patent to Spatta No. 1,925,850 of September 5, 1933. This spreading operation results in a substantially cylindrical central portion 13 being formed in the housing, having the defining edges 8 spread apart as shown, and having the defining wall surfaces extending substantially parallel to the axis of the opening. After the central portion 6 has been spread into the form shown at 13 in Figure 5, the final spreading operation is performed by means of suitable dies, as shown in Figure 6, in which the housing is held between a pair of gripping dies 14 and 15, and internal die members 16 are spread outwardly by the die head 17 to force the portions 13 of the housing into semicircular form and at the same time, bend over the upper and lower edges 8 to form the banjo edges 18 defining the banjo opening and terminating the web portion of the banjo frame. This is also shown in the Spatta patent referred to above.

After the banjo frame has been formed with the defining flanges 18 thereabout, the throat portions of the housing which join the banjo to the arm portion 7 and which are indicated generally at 19, are straightened in any usual or desired manner, and the flanges are then flattened and trued up to complete the formation of the central portion of the housing.

With a housing of the type shown in Figure 6, either a full floating housing or a passenger car type of housing can be produced. If a full floating type of housing is desired, the ends of the arm portions 7 are upset or swaged to form the bearing seat portions 20 and 22 for receiving the hub of a vehicle wheel or the like, which is adapted to be rotated by axle spindles extending through the arm portions 7 to a differential assembly carried in the banjo frame 13. This swaging operation for forming the bearing seats may be as described in detail in the Mogford & Spatta patent, No. 1,978,685, of October 30, 1934, and is not pertinent to the present invention.

If desired, the housing may be of the passenger car type shown in Figure 8, in which case, the ends of the arm portion 7 are subjected to endwise upsetting to form enlarged thickened bearing seat portions 23, and radially extending thickened annular flanges 24 as described in detail in the Spatta reissue patent referred to above. The type of housing to be subsequently formed, after the banjo has been produced in accordance with the present invention, may be varied as desired, and it is to be understood that the present invention is directed particularly to the method of forming the banjo portion of the housing regardless of the type of housing to be ultimately produced.

I am aware that various changes and modifications may be made in the particular process without departing from the underlying principles thereof, and I therefore intend to limit the invention only as defined by the scope and spirit of the appended claims.

I claim:

1. In the method of making a banjo type axle housing, the novel steps which comprise providing a tubular blank, flattening the central portion of the blank transversely to provide a central substantially planar double walled section having tubular arms projecting oppositely therefrom, and forcing the two walls of said section apart into oppositely facing channel shaped portions for completing a cylindrical banjo frame at the center of the blank having its axis normal to the axis of said arms.

2. In the method of forming an axle housing, the novel steps comprising providing a tubular blank of uniform wall thickness, transversely rolling the central portion of said blank to reduce the wall thickness thereof and flatten the same into a substantially planar double walled section, and subsequently spreading said flattened wall portions apart into a substantially circular differential housing frame.

3. In the method of forming an axle housing, the novel steps comprising providing a tubular blank of uniform wall thickness, transversely rolling the central portion of said blank to reduce the wall thickness thereof and flatten the same, shearing off the opposite defining edges of said flattened portion, and spreading said flattened portion into a substantially circular banjo frame.

4. In the method of forming an axle housing, the novel steps comprising providing a tubular blank of uniform wall thickness, transversely rolling the central portion of said blank to reduce the wall thickness thereof and flatten the same into a double walled planar portion, separating said walls along their lateral edges, and subsequently spreading said walls by internal expansion into a substantially circular differential housing frame.

5. The method of forming an axle housing of

the banjo type from a tubular blank of uniform wall thickness and of a diameter equal to the diameter of the arm portions of the finished housing, which comprises flattening the central portion of said blank, removing the lateral defining edges of the flattened portion to form separate planar walls, spreading the walls of said flattened portion apart sufficient to define a transverse opening therethrough, and subsequently forming said portion into a circular differential housing frame of reduced wall thickness.

6. The method of forming an axle housing which comprises providing a tubular blank of a length equivalent to the length of said housing, rolling the central portion of said blank to flatten and transversely extend the walls of said portion, shearing off the opposite defining edges of said flattened portion, and spreading the walls of said portion apart to define a circular flanged differential frame.

7. The method of forming an axle housing from a tubular blank which comprises flattening the central portion of said blank, simultaneously transversely elongating the walls of said portion and reducing the thickness thereof, shearing off the opposite folded transverse edges of said flattened portion, preliminarily spreading the longitudinal central portion of said flattened portion, spreading the flattened walls apart into opposed substantially semi-cylindrical portions, forming said last-named portions into a circular flanged banjo frame, and swaging the ends of said blank to form bearing seats thereon.

8. The method of forming an axle housing from a tubular blank which comprises flattening the central portion of said blank, simultaneously transversely elongating the walls of said portion and reducing the thickness thereof, shearing off the opposite folded transverse edges of said flattened portion, preliminarily spreading the longitudinal central portion of said flattened portion, spreading the flattened walls apart into opposed substantially semi-cylindrical portions, forming said last-named portions into a circular flanged banjo frame, and upsetting the ends of said blank to form enlarged bearing seat portions terminating in radially extending annular flanges.

9. In the process of forming an axle housing from a tubular blank, the steps comprising flattening the central portion of said blank to produce a double walled substantially planar section, passing a punch longitudinally through the blank to produce an initial spreading apart of said walls, and subsequently spreading the walls of said flattened portion apart to form a circular differential housing frame intermediate the ends of said blank.

10. In the process of forming an axle housing from a tubular blank, the steps comprising flattening the central portion of said blank, shearing off the folded opposite defining walls of said flattened portion, passing a punch longitudinally through the blank to produce an initial spreading, and subsequently spreading the walls of said flattened portion apart to form a circular banjo frame intermediate the ends of said blank.

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