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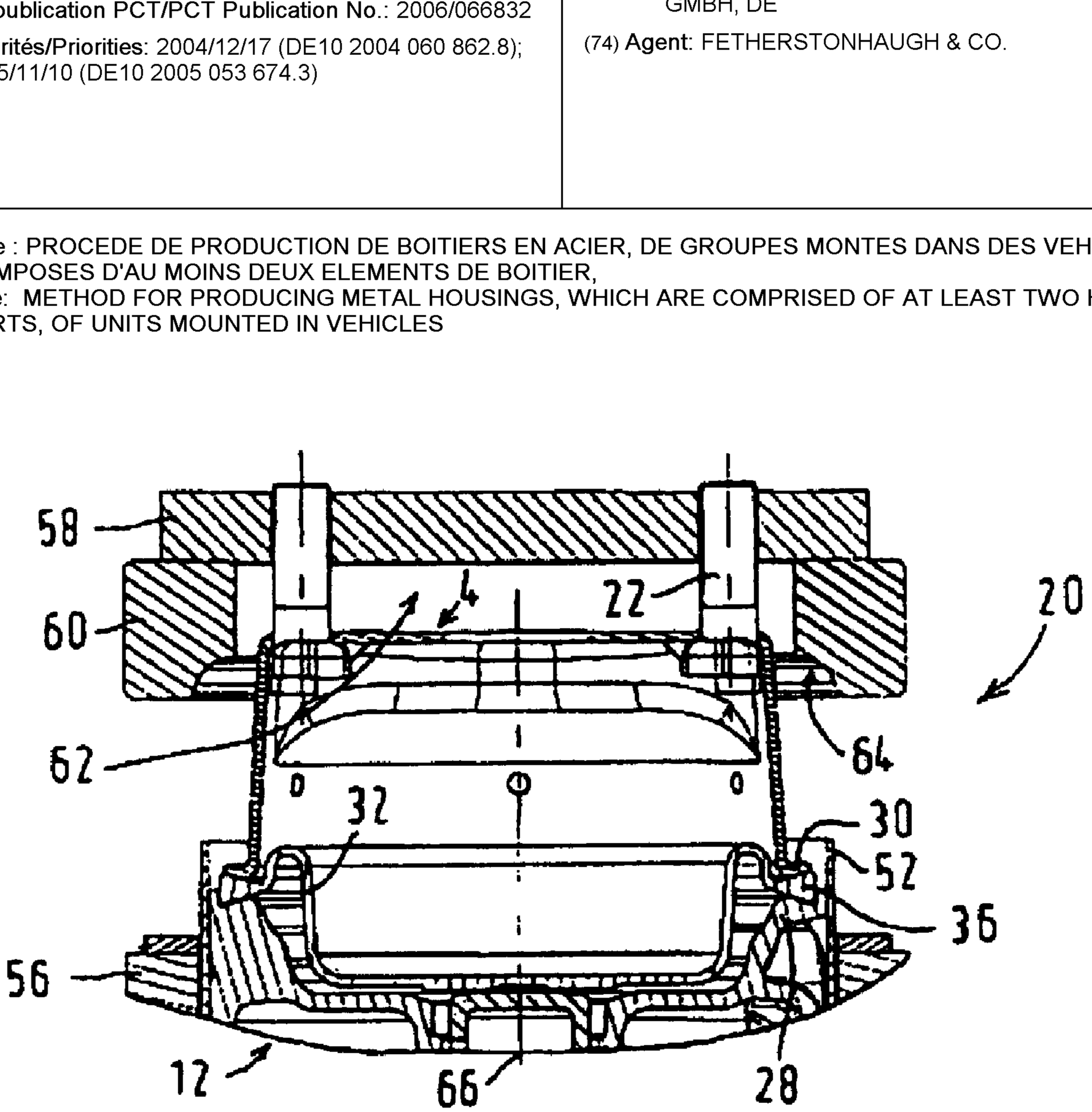
(54) Titre : PROCEDE DE PRODUCTION DE BOITIERS EN ACIER, DE GROUPES MONTES DANS DES VEHICULES, COMPOSES D'AU MOINS DEUX ELEMENTS DE BOITIER,

(54) Title: METHOD FOR PRODUCING METAL HOUSINGS, WHICH ARE COMPRISED OF AT LEAST TWO HOUSING PARTS, OF UNITS MOUNTED IN VEHICLES



(57) Abrégé/Abstract:
The invention relates to a method for producing metal housings, which are comprised of at least two housing parts, of units mounted in vehicles, particularly in goods-carrying vehicles, by: applying a corrosion prevention layer comprising zinc or a zinc-

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(57) Abrégé(suite)/Abstract(continued):
containing alloy onto an outwardly pointing surface of at least one housing part with a subsequent passivation, and; b) effecting a positive overlapping of an edge of housing part by the edge of housing part by means of a relative movement of the housing parts being reciprocally aligned beforehand with regard to a stamp, which plastically deforms the edge of housing part and/or the edge of the other housing part.

Abstract

The invention relates to a method for producing metal housings, which are comprised of at least two housing parts, of units mounted in vehicles, particularly in goods-carrying vehicles, by: applying a corrosion prevention layer comprising zinc or a zinc-containing alloy onto an outwardly pointing surface of at least one housing part with a subsequent passivation, and; b) effecting a positive overlapping of an edge of housing part by the edge of housing part by means of a relative movement of the housing parts being reciprocally aligned beforehand with regard to a stamp, which plastically deforms the edge of housing part and/or the edge of the other housing part.

Method for producing metal housings, which are comprised of at least two housing parts, of units mounted in vehicles

Background

The invention is based on a method for manufacturing steel housings, composed of at least two housing components, for assemblies installed in vehicles, in particular in utility vehicles.

In order to activate brakes in utility vehicles, use is made, inter alia, of combined pneumatic service brake cylinders and spring brake cylinders. Such a combination cylinder is, connected in series, a combination of a service brake cylinder for activating the service brake and a spring brake cylinder for activating the auxiliary and spring brake.

A generic method is known from EP 1 136 337 B1, which discloses a combined service brake cylinder and spring brake cylinder of a utility vehicle in which the housing of the service brake cylinder and the housing of the spring brake cylinder are connected to one another by the edge of the spring brake cylinder overlapping the edge of the service brake cylinder in a positively locking fashion, which is also referred to as beading.

Such beading is frequently produced by rolling, i.e. the edge of at least one housing component is shaped plastically by a circulating rolling tool. However, at least the outwardly pointing surface of the housing components must firstly be provided with a corrosion prevention means since assemblies of vehicles, such as, for example, combined service brake cylinders and spring

brake cylinders of utility vehicles which are arranged near to the wheel, are subjected to moisture which is permeated by de-icing salt. Corrosion prevention layers which are used in this context are composed, for example, of a sprayed-on epoxy plastic layer or of a simple zinc layer. However, it has become apparent that the corrosion prevention layer can be damaged by the beading fabrication step and therefore the necessary resistance to corrosion is not achieved, the resistance being, for example, that the housing has to withstand over 400 hours of uninterrupted wetting with salt water without corroding.

It is desirable to develop a method for manufacturing housings, composed of at least two housing components, for assemblies installed in vehicles, in particular in utility vehicles, in such a way that it may permit beading which shapes the housing components to be fabricated without adversely affecting the corrosion prevention means of such housing components.

Summary

An advantageous combination is disclosed of two method steps, specifically on the one hand the fabrication of beading by means of a die and, on the other hand, the coating of the surface with a corrosion prevention layer comprising zinc or an alloy containing zinc, and subsequent passivation. It has become apparent that such a corrosion prevention layer may not be damaged if the beading is manufactured with a die.

The protection against corrosion which is provided by the zinc or the other metal alloys is due to the fact that it is even more stainless than the basic metal steel and

therefore functions as the sacrificial anode. As long as the covering zinc layer is present, the basic metal is protected against corrosion. Other metals can influence the corrosion protection provided by the zinc layer. Iron, nickel or cobalt are therefore used selectively as alloy components for the purpose of bringing about improvement. The zinc is itself protected against corrosive attack by the passivation, generally by chromatization. The thicker, denser and more chemically resistant the layer of chromate, the better the barrier effect.

As a result of this, a high degree of resistance to corrosion can be provided for a housing which is manufactured according to the inventive method, and a high degree of operational reliability can be provided, which is essential in particular if the component is a brake cylinder.

The assembly whose housing can be fabricated by the method as disclosed herein is preferably a brake cylinder, in particular a combined service brake and spring brake cylinder, an air dryer or a brake booster of a utility vehicle, therefore assemblies with sheet metal housings which have at least two components and are, for example, deep drawn.

The relative movement between the die and the housing components particularly preferably occurs in an axial direction with respect to a central axis of the assembly. Alternatively, the relative movement can occur in a radial direction with respect to the central axis of the assembly.

The die can be embodied as a single-component or multi-component ring with a radially inner recess which exerts pressure against the edge of the one housing component and/or the edge of the other housing component. In the case of an axial relative movement between the die and the housing halves, the die can be embodied as a single component or multiple components, and in the case of a radial relative movement it can only be in multiple components, for example if the housing components have regions which project radially beyond their end edges and would therefore collide with a single-component ring which is guided in the axial direction and surrounds the housing components.

Before the application of the die, for example one housing component can be clamped in through a clamping device and the other housing component is fitted onto the latter in such a way that the edges of the housing components overlap. The reaction forces which arise during the deformation are held then by the housing components themselves or by structures which are located in the interior, and are conducted away via the clamping device. In cases in which this is possible, a die plate which is assigned to the die can be dispensed with, otherwise, if the housing components are not sufficiently rigid, there has to be a fixed die plate which absorbs the reaction forces and can additionally serve to shape the beading by being provided with corresponding recesses itself.

In order to keep the forces occurring during deformation low, before the application of the die, the edge of one housing component can be preshaped to form a shoulder which projects radially outward. This may have already taken place within the scope of a preceding deep drawing

process. Particularly good rigidity of the beading connection is obtained if this shoulder has an undercut cross section.

Particularly good protection against corrosion can be obtained if the corrosion prevention layer has pure zinc, a zinc/iron alloy or an alkaline zinc/nickel alloy, and the passivation includes chromatization. In order to meet the EU guideline 2000/53/CE, solutions containing chromium (VI) (chromium in the hexavalent state) should be avoided.

According to an aspect of the invention there is provided a method for manufacturing a steel housing of an assembly installed in a vehicle, the housing comprised of at least a first housing component and a second housing component, the method comprising: a) applying a corrosion prevention layer comprising zinc or an alloy containing zinc at least to an outwardly pointing surface of at least one of the first housing component or the second housing components with subsequent passivation, b) manufacturing a positively locking overlap of a first edge of the first housing component over a second edge of the second housing component by means of relative movement of the first and second housing components which have previously been oriented with respect to one another and in relation to a die which plastically shapes the first edge of the first housing component and/or the second edge of the second housing component, such that the positively locking overlap of the first edge of the first housing component over the second edge of the second housing component is manufactured.

Description of the Drawings

An exemplary embodiment of the invention is illustrated in the drawing and is explained in more detail in the following description. In the drawing:

figure 1 is a half-sectional illustration of a combined service brake and spring brake device which has been fabricated in accordance with a preferred embodiment of the method of the invention;

figure 2 is a schematic cross-sectional illustration of the combined service brake and spring brake device from figure 1 during a fabrication step;

figure 3 is a schematic cross-sectional illustration of the combined service brake and spring brake device from figure 1 during a further fabrication step; and

figure 4 is a schematic cross-sectional illustration of the combined service brake and spring brake device from figure 1 during a further fabrication step.

Description of the exemplary embodiment

Figure 1 shows an already completed, combined service brake and spring brake device 1 according to a preferred embodiment of the invention. The latter comprises a service brake device 2 with a steel service brake cylinder 4 in which a service brake piston 6 which is acted on pneumatically is guided and which activates, via a service brake piston rod 8, for example a disk brake (not illustrated for reasons of scale) of a utility vehicle. Furthermore, there is a spring brake device 10 with a steel spring brake cylinder 12 in which a spring brake piston 18 which can be clamped by pneumatic pressure in a spring brake chamber 14 counter to the spring force of a storage spring 16 and by means of which the service brake piston 6 can be acted upon in the brake-applying direction. The service brake cylinder 4 and the spring brake cylinder 12 form, in their coaxial arrangement one behind the other, a combination brake cylinder 20. Furthermore, steel attachment bolts 22 project away from the service brake cylinder 4 at the head end in order to be able to attach the combination brake cylinder 20 to the vehicle.

A spring brake piston rod 24 of the spring brake piston 18 projects in a seal-forming fashion through an opening 26 in a dividing wall 28 between the spring brake cylinder 12 and the service brake cylinder 4 and can bear with its end face against the service brake piston 6. The latter can contain an axially movable diaphragm 32 which is clamped in at the outer edge between the dividing wall 28 and a radially outer shoulder 30 on the edge of the service brake cylinder 4, as well as a central piston plate 34 which is connected to the diaphragm 32.

The shoulder 30 is bent over preferably through more than 90 degrees so that an oblique contact face with respect to the diaphragm 32 is produced. On the other hand, the dividing wall 28 is also provided at its radially outer edge with an oblique contact face so that a cross section which extends radially outward in wedge shape is produced between them, in which cross section the outer edge 36, which is recessed in a complementary fashion, of the diaphragm 32 is held in a positively locking fashion.

Furthermore, the spring brake piston 18 can be moved in a known fashion into the release position counter to the effect of the storage spring 16 by venting the spring brake chamber 14. Furthermore, by venting a service brake chamber 38, which extends between the dividing wall 28 and the service brake piston 6, it is possible to move the latter into a brake-application position counter to the effect of a return spring 40 which is supported at one end on the service brake piston 6 and at the other end on an end wall of the service brake cylinder 4. Last but not least, a mechanical release device 46 with which emergency release of the spring brake can be carried out if there is a drop in pressure is integrated within the spring brake piston rod 24.

Against this background, the method of functioning of the combined service brake and spring brake device 1 is as follows:

taking the situation shown in figure 1 as a basis, in which both the spring brake and the service brake are released, the service brake chamber 38 is vented in order to apply the service brake, after which, on the one hand, the service brake piston 6 is moved to the left away from the dividing wall 28. The displacement

of the service brake piston 6 causes the disk brake to be applied.

On the other hand, venting the service brake chamber 38 ensures that the service brake piston 6 is moved into the release position, i.e. to the right in figure 1, by the return spring 40, and bears against the end face of the spring brake piston rod 24 or the dividing wall 28.

In order to hold the service brake in the brake application position for longer, i.e. if the pneumatic pressure in the service brake chamber 38 has dropped after a certain time or the service brake chamber 38 has been selectively vented, the spring brake should now be applied. For this purpose, the spring brake chamber 14 is vented, after which the storage spring 16 forces the spring brake piston 18, together with the spring brake piston rod 24, to the left in figure 1, said spring brake piston rod 24 being in contact at the end with the service brake piston 6. This movement is followed by the service brake piston 6 and the service brake piston rod 8 which is coupled to it and which moves or keeps the disk brake in the applied position.

Within the scope of the method for manufacturing the combination brake cylinder 20 before the service brake cylinder 4 and the spring brake cylinder 12 are equipped with the components and assemblies described above, at least the outward pointing surfaces of the two cylinders 4, 12 and the attachment bolts 22 which are essential for secure attachment of the combination brake cylinder 20 are firstly coated with a corrosion prevention layer comprising zinc or an alloy containing zinc.

The protection of the zinc and of the further metal alloys against corrosion is due to the fact that it is even more stainless than the basic metal steel and

therefore functions as a sacrificial anode. As long as the covering zinc layer is present, the basic metal remains protected against corrosion. Other metals can influence the protection of the zinc layer against corrosion. Iron, nickel or cobalt can therefore be selectively used as alloy components for the purpose of improvement. The zinc is itself protected against corrosive attack by the passivation, preferably by chromatization.

Particularly good protection against corrosion is obtained if the corrosion prevention layer has pure zinc, a zinc/iron alloy or an alkaline zinc/nickel alloy and the passivation includes chromatization. In order to meet the EU European guideline 2000/53/CE, solutions containing chromium (VI) (hexavalent chromium) should be avoided.

The service brake cylinder 4 and the spring brake cylinder 12 are then equipped with the components and assemblies described above. For this purpose, for example the dividing wall 28 is pushed into the spring brake cylinder 12 axially from above until it makes contact, with a shoulder 48 which is formed on its radially outer circumferential face, with a complementary shoulder 50 in the outer casing wall of the spring brake cylinder 12, as a result of which an axial stop is formed.

The connection between the two cylinders 4, 12 is produced by beading 54 by firstly clamping, for example, the spring brake cylinder 12 with its outer casing surface radially into a clamping device 56 and fitting the service brake cylinder 4 onto the spring brake cylinder 12 in such a way that its edges 30, 52 overlap, i.e. on the one hand the straight end edge 52 of the spring brake cylinder 12 radially encloses the edge of the service brake cylinder 4 which is shaped as

a radially outer shoulder 30, and on the other hand an axial overlap occurs because the straight edge 52 of the spring brake cylinder 12 projects axially a certain distance beyond the shoulder 30 of the service brake cylinder 4. The service brake cylinder 4 is, on the one hand, secured and centered in this position by, for example, its attachment bolts 22 which are plugged through openings in a fixed head plate 58 as part of the clamping device 56. On the other hand, the edge 36 of the diaphragm 32 of the service brake piston 6 is already positioned between the dividing wall 28 and the shoulder 30. This initial position is illustrated in figure 2.

The beading 54 is produced by a relative movement of a die 60 with respect to the service brake and spring brake cylinders 4, 12 which have previously been oriented with respect to one another and which plastically shaped, for example, only the initially still straight edge 52 of the spring brake cylinder 12. For this purpose, the die 60 is preferably embodied as a single-component ring with a central opening 62 which is just large enough that it can enclose the service brake cylinder 4 without collision and can be moved axially along it. Furthermore, the die 60 has at its end face pointing toward the combination brake cylinder 20 a radially inner, preferably rounded recess 64 which can exert pressure against the edge 52 of the spring brake cylinder 12 in order to press it, with plastic deformation, against the shoulder 30 of the service brake cylinder 4 and shape it against it. For this purpose, the die 60 moves in the axial direction with respect to a central axis 66 of the combination brake cylinder 20. This situation is shown by figure 3 in which the die 60 in its end position makes contact, with its end face, with a stopper ring 68 which rests on the opposite end face of the clamping device 56 and

whose height depends on the desired degree of deformation and can be adapted on a case by case basis.

In figure 4, the die 60 is again disengaged from the combination brake cylinder 20, with the edge 52 of the spring brake cylinder 14 engaging in positively locking fashion over the shoulder 30 of the service brake cylinder 4 and at the same time exerting pressure on the radially outer edge 36 of the diaphragm 32, which is thus likewise secured in a positively locking fashion. Since the shoulders 48, 50 make axial contact with the radially outer circumferential face of the dividing wall 28 and with the outer casing wall of the spring brake cylinder 14 which also absorb the reaction forces, the dividing wall 28 is thus also held in a positively locking fashion in the spring brake cylinder 12. With a single movement of the die 60, four separate components are consequently connected to one another in a positively locking fashion: the service brake cylinder 4, the diaphragm 32, the spring brake cylinder 12 and the dividing wall 28.

In the case of an axial die movement, the die 60 can be constructed as a single component or multiple components. Furthermore, cases in which the housing components have regions which project radially beyond their end edges, and would therefore collide with an annular die guided in the axial direction, are also conceivable. In these cases, the die 60 must be divided at least once in its circumferential extent, with the die arcs then carrying out a radial movement with respect to the central axis 66 of the combination brake cylinder 20. Last but not least, the die 60 could also shape the edge 30 of the service brake cylinder 4 or else both edges 30, 52. Furthermore, the shoulder 30 of the service brake cylinder 4 could be fabricated with the edge 52 of the spring brake cylinder 12 by means of the beading 54 without the intermediate arrangement of

a dividing wall 28. The spring brake cylinder 12 could be closed off, for example at its end face pointing to the service brake cylinder, by a wall which is connected to it or embodied integrally with it.

The method described above is not restricted to the manufacture of combination brake cylinders 20. Instead, it can be used to fabricate housings of any assemblies in vehicles and utility vehicles such as brake cylinders, air dryers or brake boosters.

List of reference numerals

1	Service brake and spring brake device
2	Service brake device
4	Service brake cylinder
6	Service brake piston
8	Service brake piston rod
10	Spring brake device
12	Spring brake cylinder
14	Spring brake chamber
16	Storage spring
18	Spring brake piston
20	Combination brake cylinder
22	Attachment bolt
24	Spring brake piston rod
26	Opening
28	Dividing wall
30	Shoulder
32	Diaphragm
34	Piston plate
36	Edge
38	Service brake chamber
40	Return spring
46	Release device
48	Shoulder
50	Shoulder
52	Edge
54	Beading
56	Clamping device
58	Head plate
60	Die
62	Opening
64	Recess
66	Central axis
68	Stopper ring

Patent Claims

1. A method for manufacturing a steel housing of an assembly installed in a vehicle, said housing comprised of at least a first housing component and a second housing component, said method comprising:

a) applying a corrosion prevention layer comprising zinc or an alloy containing zinc at least to an outwardly pointing surface of at least one of the first housing component or the second housing components with subsequent passivation,

b) manufacturing a positively locking overlap of a first edge of the first housing component over a second edge of the second housing component by means of relative movement of the first and second housing components which have previously been oriented with respect to one another and in relation to a die which plastically shapes the first edge of the first housing component and/or the second edge of the second housing component, such that the positively locking overlap of the first edge of the first housing component over the second edge of the second housing component is manufactured.

2. A method as claimed in claim 1, wherein the steel housing of the assembly has a cylindrical shape and the relative movement occurs in an axial direction with respect to a central axis of the steel housing of the assembly.

3. A method as claimed in claim 1, wherein the steel housing of the assembly has a cylindrical shape and the relative movement occurs in a radial direction

with respect to a central axis of the steel housing of the assembly.

4. A method as claimed in any one of claims 1 to 3, wherein the die is embodied as a single-component or multi-component ring with a recess which exerts pressure against the first edge of the first housing component and/or the second edge of the second housing component.

5. A method as claimed in any one of claims 1 to 4, wherein the assembly is a brake cylinder, an air dryer or a brake booster of a utility vehicle.

6. A method as claimed in any one of claims 1 to 5, wherein before the application of the die, the first housing component is clamped in and the second housing component is fitted onto the first housing component in such a way that the edges of the two housing components overlap.

7. A method as claimed in claim 6, wherein before the application of the die, the second edge of the second housing component is preshaped to form a shoulder which projects radially outward.

8. A method as claimed in claims 6 or 7, wherein the first edge of the first housing component is straight with respect to the central axis of the steel housing of the assembly before the application of the die.

9. A method as claimed in any one of claims 1 to 8, wherein the corrosion prevention layer has pure

zinc, a zinc/iron alloy or an alkaline zinc/nickel alloy.

10. A method as claimed in claim 9, wherein the passivation includes chromatization.

11. A method as claimed in any one of claims 1 to 10 wherein said assembly installed in a vehicle is an assembly installed in a utility vehicle.

12. An assembly of a vehicle, in particular brake cylinder, air dryer or brake booster of a vehicle, manufactured in accordance with a method as claimed in any one of claims 1 to 11.

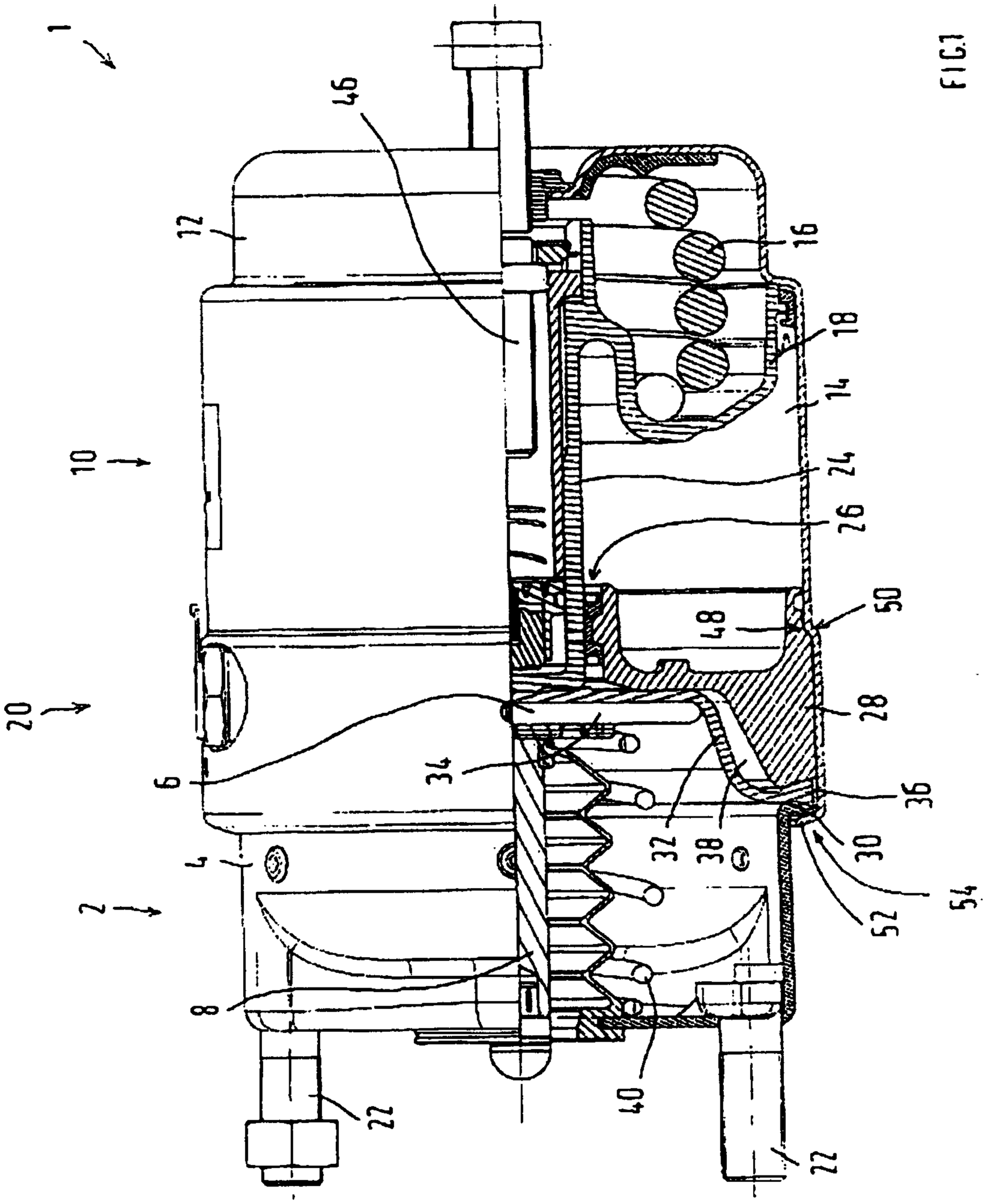

FIG1

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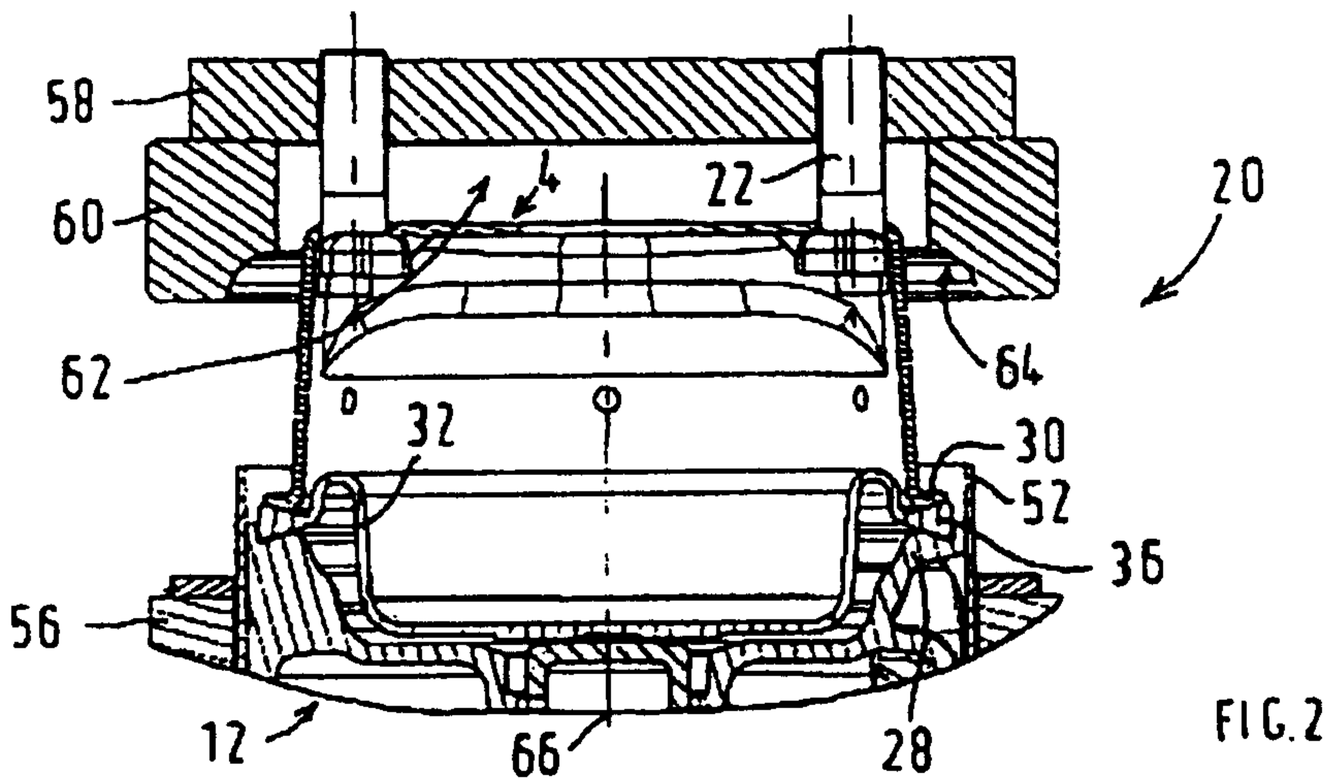

FIG.2

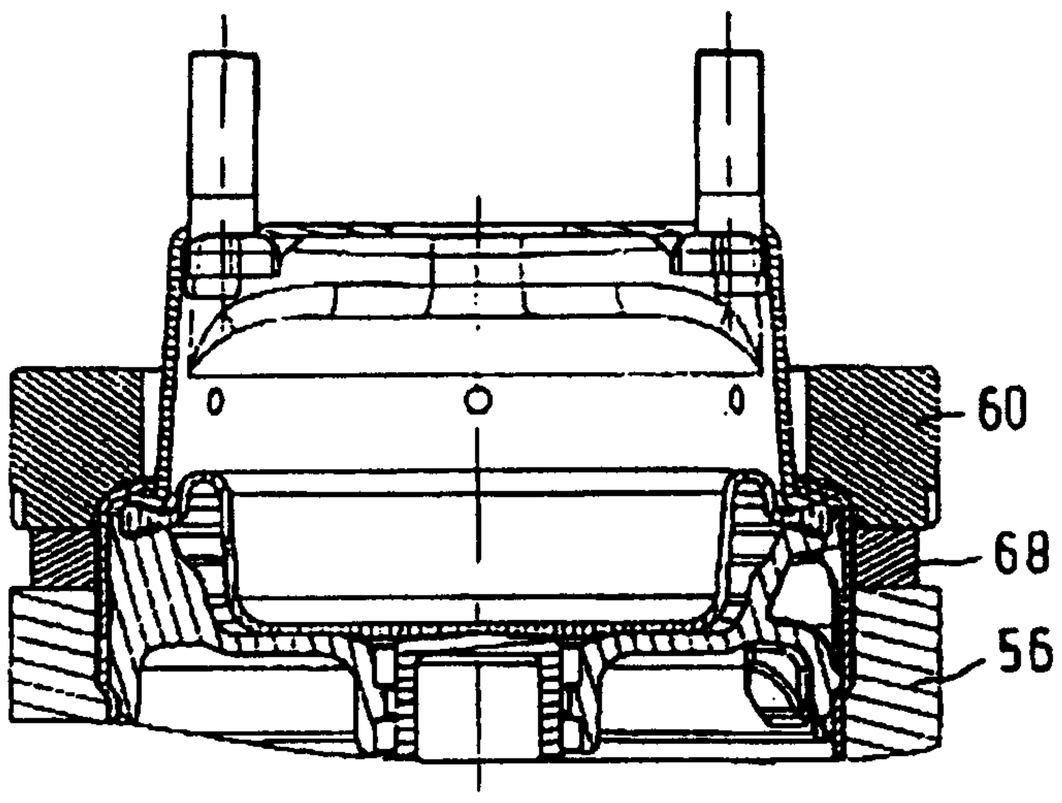

FIG.3

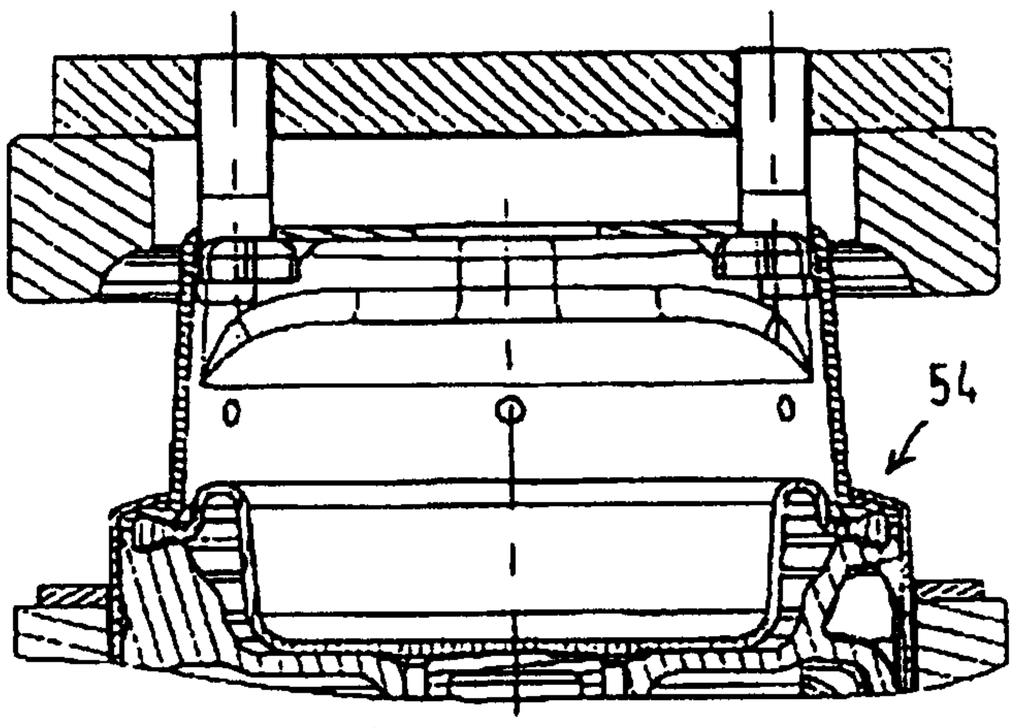

FIG.4

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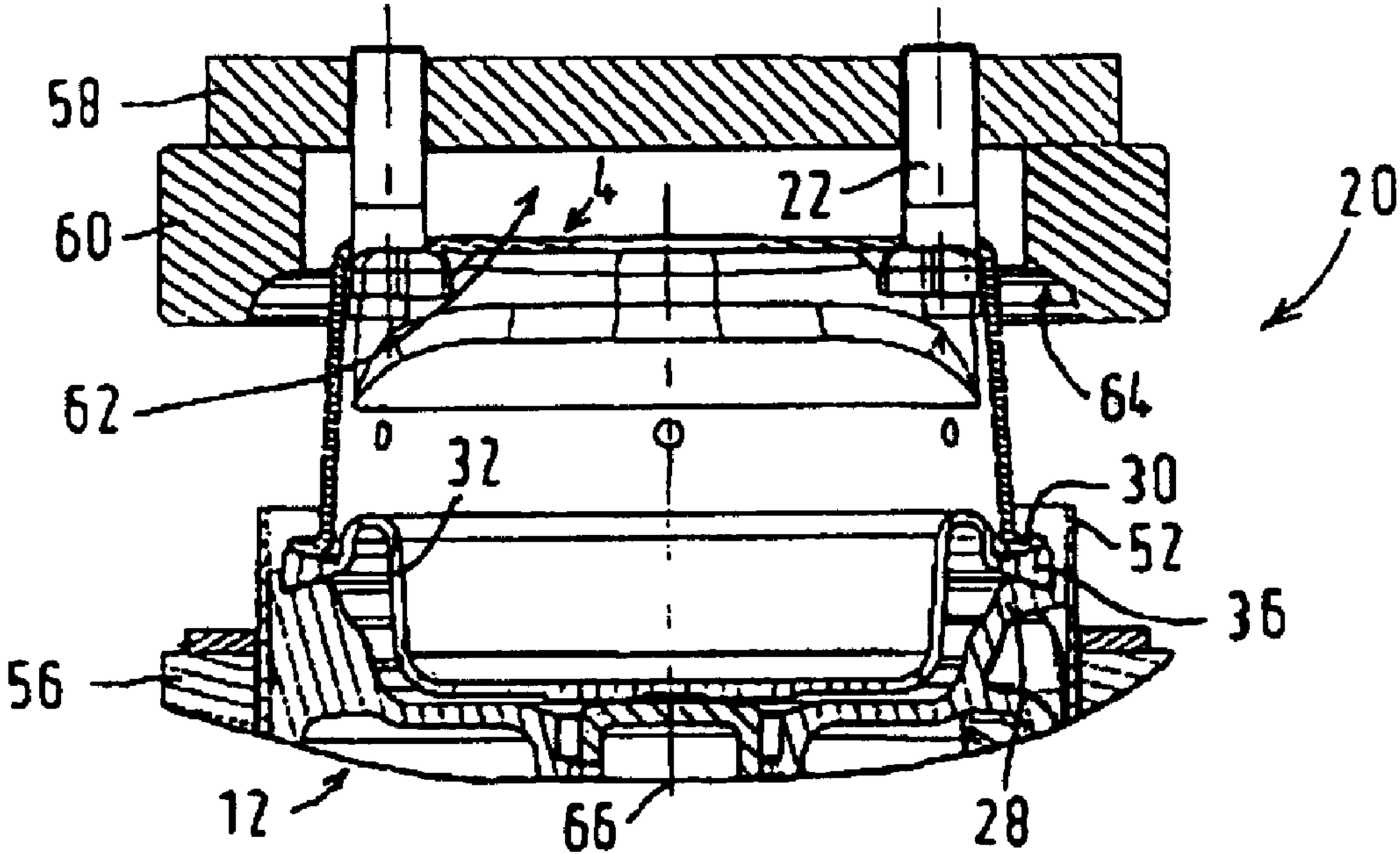
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