

Description

The present invention relates to a pump casing manufactured by such as press forming of steel plate, and in particular, to a pump casing advantageously used for a centrifugal pump. The invention also relates to a method for manufacturing a pump casing.

A conventional pump casing manufactured by press forming of steel plate usually includes an outer casing of a cylindrical shape and a guide vane or a volute member which is separately fabricated and disposed inside of the outer casing to provide a fluid path.

Fig. 8(a) is a longitudinal sectional view of a pump as shown in JP-A-82-35676, and Fig. 8(b) is a sectional view taken on line A-A of Fig. 8(a). In this conventional pump, the volute casing defines a volute room 4 which guides fluid delivered from an impeller 1 to an discharge port 11. The volute room 4 is composed of side plates 5 and 6 disposed at each side, a peripheral plate 7 provided along the periphery of the side plates 5 and 6, and a volute vane or volute member 8 disposed in a space defined by the side plates and the peripheral plate and extended in a circumferential direction along a predetermined distance. These side plates 5 and 6, the peripheral plate 7 and the volute vane 8 are all manufactured by press forming of metal plates. In going from a starting point 8a of the volute to a predetermined point 8b, the volute casing is radially deviated outwardly, thereby increasing the cross-sectional area of the fluid path within the volute casing in going towards the discharge port. Beyond the predetermined point 8b, the volute casing is deviated in an axial direction as denoted by 5a for increasing the cross-sectional area of the fluid path in going towards the discharge port 11. Thus, the cross-sectional area of the fluid path is gradually increased from the line I-I to line IV-IV [Fig. 8(b)].

In the above-mentioned prior art, since the side plates 5 and 6, the peripheral plate 7, the volute vane 8 and an outer plate 9 are all manufactured by press forming of metal plates, the casing can be manufactured with easier fabrication and lower cost in comparison with the manufacturing method of casting. Further, by deviating the volute fluid path in both radial and axial directions, it becomes possible to decrease the radial dimension of the pump to some extent, and to thereby decrease the cost.

In the above-mentioned prior arts, however, since the volute vane 8 is disposed inside of the pump casing, the outside diameter of the outer casing inevitably become greater. In consequence, there is a problem that it is required to increase the thickness of the casing to increase the strength against the internal fluid pressure, and to reinforce

the casing to prevent deformation of the side walls of the casing. When the volute portion is expanded in an axial direction to decrease the radial excessive space required for arranging the volute vane 8 outside of the impeller as mentioned above, the pump performance deteriorates.

Further, in the above-mentioned cases, since the shape of the fluid path is not smooth at the region where the fluid flows out from inside of the fluid path to outside of the same, two problems are caused, generation of noise and deterioration of efficiency.

US-A-4,775,295 discloses a pump casing as set forth in the preamble of claim 1. This sheet metal pump is of lesser efficiency than a pump using a volute, as it is for instance disclosed in the above mentioned JP-A-82-35676. In addition, attention is drawn to FR-A-1563797 which discloses another type of sheet metal pump where the pump casing is formed by two axially separable casing halves. Each of said casing halves also forms halves of a volute such that after said casing halves are fixedly mounted together the pump casing is provided with a complete volute. This requires two dies for forming said casing halves. Also, said casing halves have to be fixed together, e.g. by welding.

Therefore, the object of the present invention is to solve the above-mentioned problems of prior arts, and to provide a pump casing which directly defines a fluid path without providing any separate fluid path member, i.e., volute vane, inside an outer cylindrical casing manufactured by press forming.

The present invention relates to a pump casing as claimed in claim 1 and also to a method for manufacturing a pump casing as set forth in claim 14. Preferred embodiments of the invention are disclosed in the dependent claims.

For achieving the above-mentioned object, the present invention is characterized in that the pump casing is at first formed by press forming a metal plate to form a casing body of a cylindrical cup shape having an opening portion at one side thereof and a closed bottom portion at the other side, and then by press forming said casing body so as to form a casing flange outwardly extending from said opening portion, an aperture serving as a suction port at said bottom portion, and a volute portion radially outwardly expanded from a cylindrical surface of said casing body at an axially intermediate portion thereof which is radially opposite to an impeller upon assembling.

Further, the present invention is characterized in that the maximum expanded portion of said volute portion formed by press forming at the intermediate cylindrical portion of said casing body is provided with an opening and this opening is connected with an discharge port through a nozzle

which is shaped and welded so as to have a smooth fluid path.

The above-mentioned volute portion radially outwardly expanded from the surface of the intermediate cylindrical portion of the casing body is formed by so-called bulge-forming, i.e. through steps of setting the cylindrical cup shaped casing body formed with the outwardly extended casing flange at one opening side and the closed bottom portion at the other side in a female die having a recess on its inner surface corresponding to the volute portion, and of applying an internal pressure on the inner surface of the intermediate cylindrical portion and, at the same time, pushing upwards the bottom portion of the casing body for fitting the same to the inner surface of the female die.

As stated above, in the present invention, firstly, a cup-shaped cylindrical casing body having an opening portion on its one side and a closed bottom portion on the other side is manufactured by press forming a steel plate. Then, the intermediate cylindrical portion of the casing body, which is opposite to the pump impeller upon assembling, is integrally formed on its inner surface with a volute portion radially gradually expanded by means of such as conventional bulge forming. In operating the pump, the pump casing is fixed to the driving means through a casing cover fixed within the opening portion at one side of the casing body, a suction flange is connected with the suction port formed in the casing body and the impeller disposed inside of the casing is started to rotate. Thus, in this operation of the pump, the fluid is sucked from the suction port formed at the bottom portion of the casing body through the suction flange, pressurized by the impeller, collected into the volute portion inside of the casing body, guided to the discharge port through the nozzle defining a smooth fluid path from the maximum expanded portion of the volute portion, and exhausted to the outside.

In this invention, since the volute portion is integrally formed to gradually expand from the casing body as mentioned above, a fluid path inside the casing body becomes smoother in comparison with that of prior art. Further, the shape of the fluid path from the volute portion (expanded portion), through the nozzle to the discharge port has a smooth one. In consequence, differently from the pump of prior art having a volute member internally provided, the pump according to the present invention includes neither step nor clearance between the volute portion and the pump casing (outer casing), thereby preventing any deterioration of the performance and any generation of noise.

On the other hand, since the diameter of the pump casing is smaller than that of prior arts, the plate thickness of the casing supporting the internal

pressure may be decreased, and the stiffness of the casing is also increased.

The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which preferred embodiments of the present invention are shown by way of illustrative examples.

Fig. 1(a) is a longitudinal sectional view of a centrifugal pump according to an embodiment of the present invention;

Fig. 1(b) is a longitudinal sectional view of a centrifugal pump according to another embodiment of the invention;

Fig. 2 is a longitudinal sectional view according to a further embodiment of the invention;

Fig. 3(a) is a front view of the pump shown in Fig. 1;

Fig. 3(b) is a sectional view taken on line A-A of Fig. 1;

Fig. 3(c) is an illustrative view showing section of the expanded volute portion;

Fig. 4(a) to 4(c) are a plan view, a longitudinal sectional view, and a bottom view of the nozzle, respectively;

Figs. 5(a) and 5(b) are illustrative views for showing the process of press forming a volute portion by bulge forming;

Fig. 6 is a longitudinal sectional view of a centrifugal pump according to a still another embodiment of the present invention;

Fig. 7 is a front view of the pump shown in Fig. 6;

Fig. 8(a) is a longitudinal sectional view of a conventional centrifugal pump; and

Fig. 8(b) is a sectional view taken on line A-A of Fig. 8(a).

Referring to the drawings, embodiments of the present invention will be described below.

Fig. 1(a) is a longitudinal view of a centrifugal pump having a pump casing made of steel plate according to an embodiment of the present invention, where the same numerals as in Fig. 8(a) indicate the same or similar portions.

In the figure, numeral 21 denotes a casing body. This casing body 21 is at first manufactured by press forming or deep drawing of a steel plate to form a cylindrical cup-shaped casing body having an opening portion surrounded by a flange on one side and a closed bottom portion on the other side, then setting said cup-shaped casing body 21, as shown in Figs. 5(a) and 5(b), inside of separated female dies 102a and 102b, which are formed on their inner surfaces with a recess 101 corresponding to the volute portion having a gradually increasing cross-sectional area for the fluid path, and applying an internal pressure, through press forming like so called bulge forming, on the inner

surface of the intermediate cylindrical portion of the cup-shaped casing body 21 set inside the dies in directions indicated with arrows a by means a hydraulic force or an elastic material, together with pushing the cup-shaped casing body upwards in a direction indicated with arrows b through a female die 103. Thus, an expanded portion 21a corresponding to the volute portion which is to be disposed at a region radially opposite to the pump impeller upon assembling is formed in the intermediate cylindrical portion of the casing body 21. Then, a casing flange 21b is formed at the opening portion on the driving side; and a casing front portion 21c and a pump suction port 21d axially projecting at the central portion thereof are formed at the bottom portion on the other side, i.e. suction side (left side in the figure). These portions are integrally formed by press forming.

The above-mentioned casing flange 21b of the casing body 21 is fixed through a casing cover 22 to the driving side such as a bearing or a driving motor. The casing front portion 21c includes an outwardly expanded portion, inside of which is provided with a volute inner wall 23 which is opposite to a shroud of the impeller 1. By providing the outwardly expanded portion in the casing front portion, the stiffness of the casing body is significantly increased.

Further, a suction flange 24 having a concentric suction port 24a at the central portion thereof is connected with the suction port 21d of the casing body 21 by welding 24b. On the rear side of the suction flange 24 opposite to the flange surface 24c, a reinforcing plate 25 is fixed and is supported on the casing body 21 through a cylindrical support member 26. The support member 26 also serves to prevent any inclination of the suction flange 24 due to an external force or impact acting on the flange.

An opening is provided at the widest portion of the volute expanded portion 21a where the fluid path sectional area is maximum and is located at the highest portion as shown in Fig. 3(a). The edge portion 211a of said opening has substantially a circular shape identical with that of the edge portion 27a of the nozzle 27 shown in Fig. 4(c), which is to be secured to the edge portion 211a by welding and connected with the discharge port 28 for defining a smooth fluid path. In the figures, numeral 3 denotes a sealing device, 21e bolt holes provided in the casing flange 21b, 24d bolt holes provided in the flange surface 24c, 25a a reinforcing plate secured on an discharge flange 29.

Fig. 3(b) and Fig. 3(c) show the shape of the volute portion thus formed. Namely, a volute room A which is defined by the circumferential expanded portion 21a is formed in the wall of the intermediate cylindrical portion of the casing body 21 by radially

outwardly expanding the outer wall of the casing body 21 as stated above. The expansion is started from a circumferentially intermediate point of the casing body and the height H of which is gradually increased from H_1 to H_2 in the circumferential direction (counterclockwise direction in this case) while maintaining the width B thereof constant as shown in (o) to (iii) in Fig. 3(b) or Fig. 3(c). Thus, the sectional area of the flowing path of the volute room A is gradually increased toward the fluid flow direction. By maintaining the width B of the expanded portion constant value, the water discharged from the impeller may smoothly flow into the volute room and thereby improve the hydraulic efficiency of the pump.

The expanded portion 21a may have trapezoidal or circular section as shown in Fig. 3(b) or Fig. 3(c). When the expanded portion is formed through the bulge forming, however, a circular section is preferable, as it has the following advantageous effects.

(1) The contact area between the water and the expanded volute portion is relatively small, which decreases resistance of fluid flow and improves the hydraulic efficiency of the pump.

(2) The thickness of the casing wall in an expanded portion may be maintained uniform after bulge forming which increases the strength of the casing.

(3) An internal pressure upon the bulge forming may be set to be relatively low which improves the forming property. The forming of the expanded portion having a trapezoidal section needs a larger internal pressure for forming the corner of the section.

For operating the pump, the pump casing is mounted on the driving side through the casing flange 21b and the casing cover 22, and the impeller disposed inside of the pump casing is rotated. Then, by virtue of the above-mentioned arrangement, the fluid is sucked through the suction port 24a of the suction flange 24 and the suction port 21d formed in the bottom portion of the casing body 21, pressurized by the impeller 1, collected in the volute portion 21a in the casing body, guided to the discharge port 28 through the nozzle 27 which is connected with the widest portion of the volute expanded portion so as to define a smooth fluid path, and then exhausted to the outside.

In this embodiment, since the volute portion 21a is integrally formed to gradually expand from the casing body 21, the fluid path becomes smoother in comparison with that of prior art [Figs. 6(a) and 6(b)]. Further, since the shape of the fluid path from the volute portion 21a having a gradually increasing sectional area of the fluid path, through the nozzle 27 to the discharge port 28 is made smoother, the pump casing according to the

present invention includes, differently from the pump of prior art having a volute member internally interposed, neither step nor clearance between the volute portion and the pump outer casing, thereby preventing any deterioration of the pump performance or any generation of noise. On the other hand, since the diameter of the pump casing can be made smaller than that of prior arts, the plate thickness of the casing for supporting the internal pressure may be decreased, and the stiffness of the casing is also increased. In addition, the size and number of bolts to be inserted into the bolt holes 21e of the casing flange 21b can be decreased accordingly.

Fig. 1(b) is a longitudinal sectional view of a centrifugal pump according to another embodiment of the present invention. In this figure, the same numerals as in Fig. 1(a) indicate the same or similar portions. In this embodiment, the volute inner wall 23 of the first embodiment is eliminated. It was confirmed that neither of pump performance nor the strength of the pump casing is notably deteriorated even if the volute inner wall 23 is eliminated, and thereby the construction of the pump casing may further be simplified.

Fig. 2 is a longitudinal sectional view of a pump according to further embodiment of the present invention, where the same numerals as in Fig. 1 indicate the same portion. In this embodiment, instead of providing the volute inner wall 23 shown in Fig. 1, the volute front portion 21c' is so formed as to have a shape substantially identical to that of the volute inner wall. According to this embodiment, when compared with the embodiment shown in Fig. 1(a), no volute inner wall is required and the manufacturing become easier, but the same pump performance can be obtained.

Figs. 6 and 7 respectively show a longitudinal sectional view and a front view of a centrifugal pump according to a still further embodiment of the invention, and where the same numerals as in Fig. 1 indicate the same or similar portions. In this embodiment, the casing body 21' is constituted of two separate portions, i.e. a casing shell 21f and a reinforcing member 21g.

The casing shell 21f is manufactured by press forming a stainless steel plate so as to have a fixing flange 21b on one end thereof, an expanded volute portion 21a at the intermediate cylindrical portion thereof, and an inwardly bent partition wall 21h on the other end of the casing shell. The expanded volute portion 21a is formed by radially expanding the intermediate cylindrical wall of the casing shell through bulge forming like in the embodiments stated above.

A wall portion 21i of the casing shell 21f located on the suction side is formed with an outwardly projecting shoulder portion 21j for increas-

ing the stiffness of the casing shell, and the before-mentioned inwardly bent partition wall 21h is integrally formed at the end of the wall portion 21i. On the inner periphery of the partition wall 21h is press-fitted a liner ring 30, on the inner periphery of which is fitted a tip portion 1a of the impeller 1 with a play maintained therebetween.

To the outer surface of the wall portion 21i is secured the reinforcing member 21g to provide a double structure over a substantially whole area of the wall portion 21i. The reinforcing member 21g manufactured by press forming has a suction port 21d at its outer end portion, with which a separate suction flange 24 is connected by welding.

Between the reinforcing member 21g and the suction flange 24 are arranged four support members 26', each of which includes bent portions 26a on both side edges, and having a U-shaped cross section as shown in Fig. 7. An end of each support member 26' is fixed to the outer surface of the reinforcing member 21g and the other end of each support member 26' is fixed to the side surface of the reinforcing plate 25.

In the figure, the numeral 31 denotes a liner ring fixed to the rear side of the impeller 1.

The pump of this embodiment has the following advantageous effects in addition to the effects of the aforementioned embodiments.

In this embodiment, when an external force acts on the suction flange 24, the external force is transmitted to the fixing flange 21b through the reinforcing member 21g and the wall portion 21i constituting the double wall and the casing shell shoulder portion 21j. In such a case, since the reinforcing member 21g and the wall portion 21i constitute a double wall, the casing shell 21f suffers only minimum deformation from the external force. Therefore, it is possible to avoid any collision between the liner ring 30 and the end portion 1a of the impeller 1.

Further, since a plurality of support members 26' having a U-shaped cross section are provided between the reinforcing member 21g and the suction flange 24, any inclination of the suction flange due to an external force is positively prevented by virtue of the support member 26'.

According to the present invention, the following advantages can be obtained:

(1) Since the volute portion is integrally formed to gradually expand from the casing body, the shape of the fluid path in the volute room becomes smoother in comparison with that of prior art which includes a separate additional volute member, and, as a result, the fluid flow resistance is decreased and the pump performance is improved.

(2) Since the diameter of the pump casing can be made smaller than that of a pump of prior

art, the plate thickness of the casing supporting the internal pressure may be decreased and the stiffness of the casing is also increased. In addition, the size and number of bolts for the casing flange can be both decreased.

(3) Since the shape of the fluid path from the volute portion, through the nozzle to the discharge port can be made smoother, the pump casing includes, neither step nor clearance between the volute portion and the pump casing, thereby preventing any deterioration of the pump performance or any generation of noise.

(4) When the casing body is constituted by two separated members, i.e. a casing shell and a reinforcing member arranged so as to constitute a double wall on the outer surface of the casing shell at the suction side, deformation of the casing body due to an external force acting on the suction flange can be significantly suppressed, and collision between the casing body and the impeller can be surely avoided.

(5) Further, where support members are arranged between the reinforcing member and the suction flange, inclination of the suction flange can be surely prevented by them.

Although the present invention has been described through specific term, it should be noted here that the described embodiment is not necessarily exclusive and various changes and modifications may be imparted thereto without departing from the scope of the invention which is limited solely by the appended claims.

Claims

1. A pump casing manufactured by press forming of steel plate and including a casing body (21) formed by press forming a metal plate, said casing body (21) having a cylindrical surface and being of a cylindrical cup shape with an opening portion formed at one side thereof and an aperture serving as a suction port (21d) at the other side thereof, and a casing flange (21b) outwardly extending from said opening portion, the pump casing further including a discharge port (28), characterized in that the pump casing includes a volute casing encircling a pump impeller (1) so as to form a fluid path around said pump impeller (1), the cross-sectional area of said fluid path being gradually increased towards said discharge port (28) of said pump casing, said casing body (21) having a volute portion (21a) integrally formed to radially outwardly expand from said cylindrical surface of said casing body (21) at an axially intermediate portion thereof which is radially opposite to said pump impeller (1), said volute portion (21a) being press formed from said cylindrical cup shaped casing body (21).
2. A pump casing claimed in Claim 1, wherein said expanded volute portion (21a) is formed by bulge forming.
3. A pump casing claimed in Claim 2, wherein the height (H) of said expanded volute portion (21a) is gradually increased in the circumferential direction while maintaining the width (B) thereof as constant.
4. A pump casing claimed in Claim 3, wherein said expanded volute portion (21a) has a trapezoidal or circular section.
5. A pump casing claimed in any one of Claims 1 to 4, wherein the maximum expanded portion of said volute portion (21a) is provided with an opening (211a) and is connected with said discharge port (28) through a nozzle (27) shaped so as to form a smooth fluid path.
6. A pump casing claimed in any one of Claims 1 to 5, wherein a suction flange is welded to said suction port (21d) of said casing body (21).
7. A pump casing claimed in any one of Claims 1 to 4, wherein a reinforcing plate (25) is fixed on the rear side of said suction flange (24), and a cylindrical support member (26) is provided between said reinforcing plate (25) and a front surface of said casing body (21).
8. A pump casing claimed in any one of Claims 1 to 7, wherein said casing body 21 is provided with an outwardly expanded portion (21c) on a suction side wall of said casing body (21).
9. A pump casing claimed in any one of Claims 1 to 8, wherein a volute inner wall (23) is provided inside of said casing body to form a portion of said fluid path.
10. A pump casing claimed in any one of Claims 1 to 7, wherein a suction side wall (21c') of said casing body (21) is press formed so that it constitutes a portion of said fluid path.
11. A pump casing claimed in Claims 1 to 7, wherein said casing body (21) is constituted of two separated members, i.e. a casing shell defining said expanded volute portion and a reinforcing member defining said suction port, each formed by press forming, said casing shell and said reinforcing member being arranged so as to constitute a double wall on the outer surface of the suction side of said casing

art, the plate thickness of the casing supporting the internal pressure may be decreased and the stiffness of the casing is also increased. In addition, the size and number of bolts for the casing flange can be both decreased.

(3) Since the shape of the fluid path from the volute portion, through the nozzle to the discharge port can be made smoother, the pump casing includes, neither step nor clearance between the volute portion and the pump casing, thereby preventing any deterioration of the pump performance or any generation of noise.

(4) When the casing body is constituted by two separated members, i.e. a casing shell and a reinforcing member arranged so as to constitute a double wall on the outer surface of the casing shell at the suction side, deformation of the casing body due to an external force acting on the suction flange can be significantly suppressed, and collision between the casing body and the impeller can be surely avoided.

(5) Further, where support members are arranged between the reinforcing member and the suction flange, inclination of the suction flange can be surely prevented by them.

Although the present invention has been described through specific term, it should be noted here that the described embodiment is not necessarily exclusive and various changes and modifications may be imparted thereto without departing from the scope of the invention which is limited solely by the appended claims.

Claims

1. A pump casing manufactured by press forming of steel plate and including a casing body (21) formed by press forming a metal plate, said casing body (21) having a cylindrical surface and being of a cylindrical cup shape with an opening portion formed at one side thereof and an aperture serving as a suction port (21d) at the other side thereof, and a casing flange (21b) outwardly extending from said opening portion, the pump casing further including a discharge port (28), characterized in that the pump casing includes a volute casing encircling a pump impeller (1) so as to form a fluid path around said pump impeller (1), the cross-sectional area of said fluid path being gradually increased towards said discharge port (28) of said pump casing, said casing body (21) having a volute portion (21a) integrally formed to radially outwardly expand from said cylindrical surface of said casing body (21) at an axially intermediate portion thereof which is radially opposite to said pump impeller (1), said volute portion (21a) being press formed from said

cylindrical cup shaped casing body (21).

2. A pump casing claimed in Claim 1, wherein said expanded volute portion (21a) is formed by bulge forming.
3. A pump casing claimed in Claim 2, wherein the height (H) of said expanded volute portion (21a) is gradually increased in the circumferential direction while maintaining the width (B) thereof as constant.
4. A pump casing claimed in Claim 3, wherein said expanded volute portion (21a) has a trapezoidal or circular section.
5. A pump casing claimed in any one of Claims 1 to 4, wherein the maximum expanded portion of said volute portion (21a) is provided with an opening (211a) and is connected with said discharge port (28) through a nozzle (27) shaped so as to form a smooth fluid path.
6. A pump casing claimed in any one of Claims 1 to 5, wherein a suction flange is welded to said suction port (21d) of said casing body (21).
7. A pump casing claimed in any one of Claims 1 to 4, wherein a reinforcing plate (25) is fixed on the rear side of said suction flange (24), and a cylindrical support member (26) is provided between said reinforcing plate (25) and a front surface of said casing body (21).
8. A pump casing claimed in any one of Claims 1 to 7, wherein said casing body 21 is provided with an outwardly expanded portion (21c) on a suction side wall of said casing body (21).
9. A pump casing claimed in any one of Claims 1 to 8, wherein a volute inner wall (23) is provided inside of said casing body to form a portion of said fluid path.
10. A pump casing claimed in any one of Claims 1 to 7, wherein a suction side wall (21c') of said casing body (21) is press formed so that it constitutes a portion of said fluid path.
11. A pump casing claimed in Claims 1 to 7, wherein said casing body (21) is constituted of two separated members, i.e. a casing shell defining said expanded volute portion and a reinforcing member defining said suction port, each formed by press forming, said casing shell and said reinforcing member being arranged so as to constitute a double wall on the outer surface of the suction side of said casing



body.

12. A pump casing claimed in Claim 11, wherein said casing shell includes an inwardly bent partition wall (21h) on the radially inner end of said casing shell (21i), a liner ring (30) being press-fitted on the inner periphery of said partition wall (21h), and a tip portion (1a) of said impeller (1) being fitted on the inner periphery of said liner ring (30) with a play maintained therebetween.
13. A pump casing claimed in Claims 11 or 12, wherein a reinforcing plate is fixed on the rear side of said suction flange, and a plurality of support members (26") are provided between said reinforcing plate and a front surface of said casing body (21), each of said support members include bent portions on both side edges thereof.
14. A method for manufacturing a steel plate pump casing comprising the steps of
press forming a metal plate to form a casing body (21) of a cylindrical cup shape having a cylindrical surface, an opening portion formed at one side thereof and a closed bottom portion at the other side,
press forming said casing body (21) so as to form a casing flange (21b) outwardly extending from said opening portion, press forming from said cylindrical cup shaped casing body (21) a volute portion radially outwardly expanding from said cylindrical surface of said casing body (21) at an axially intermediate portion thereof which is radially opposite to said pump impeller (1) so as to form a fluid path around said pump impeller (1), and
forming an aperture serving as a suction port (21d) at said bottom portion.
15. A method as claimed in claim 14, characterized in that the step of press forming the volute portion comprises the step of a) setting the cup shaped casing body (21) inside of a female die (102a, 102b) having a recess (101) at its inner surface, the recess (101) corresponding to the volute portion (21a) and b) applying an internal pressure to the cylindrical portion of the cup shaped casing body (21a).
16. A method as claimed in claim 15, characterized in that the female die (102a, 102b) is composed of separate dies.
17. A method as claimed in one of the claims 14 or 15, characterized in that a further die (103) is pushed in the direction of the axis of the

cylindrical surface of the cup shaped casing body (21) together with applying the internal pressure.

18. A method as claimed in one of the claims 14 to 17, characterized in that the press forming is carried out by bulge forming.
19. A method as claimed in one of the claims 14 to 18, characterized in that a nozzle (27) is connected to the opening provided at the maximum expanded portion of the volute portion (21a).
20. A method as claimed in one of the claims 14 to 19, characterized in that the nozzle (27) is connected at its other side to the discharge port (28).

Patentansprüche

1. Pumpengehäuse, das durch Preßformen einer Stahlplatte hergestellt wird und einen Gehäusekörper (21) umfaßt, der durch Preßformen einer Metallplatte gebildet wird, wobei der Gehäusekörper (21) eine zylindrische Oberfläche besitzt und eine zylindrische Becherform besitzt mit einem Öffnungsteil, der auf einer Seite davon gebildet ist, und einer Öffnung, die als ein Sauganschluß (21d) an der anderen Seite davon dient, sowie mit einem Gehäuseflansch (21b), der sich von dem Öffnungsteil nach außen erstreckt, wobei das Pumpengehäuse ferner einen Auslaßanschluß (28) umfaßt, dadurch gekennzeichnet,
daß das Pumpengehäuse ein Voluten- oder Spiralehäuse umfaßt, das ein Pumpenlaufrad (1) umgibt, um einen Strömungsmittelpfad um das Pumpenlaufrad (1) zu bilden, wobei die Querschnittsfläche des Strömungsmittelpfades zu dem Auslaßanschluß (28) des Pumpengehäuses hin allmählich größer wird, wobei der Gehäusekörper (21) einen Voluten- oder Spiraleil (21a) besitzt, der integral ausgebildet ist, um sich von der zylindrischen Oberfläche des Gehäusekörpers (21) radial nach außen zu erweitern, und zwar an einem axial mittleren Teil davon, der dem Pumpenlaufrad (1) radial gegenüberliegt, wobei der Volutenteil (21a) aus dem zylindrischen, becherförmigen Gehäusekörper (21) preßgeformt ist.
2. Pumpengehäuse gemäß Anspruch 1, wobei der erweiterte Volutenteil (21a) durch Auswölbförmig geformt wird.
3. Pumpengehäuse gemäß Anspruch 2, wobei die Höhe (H) des erweiterten Volutenteils (21a)



in der Umfangsrichtung allmählich vergrößert wird, während die Breite (B) davon konstant gehalten wird.

4. Pumpengehäuse gemäß Anspruch 3, wobei der erweiterte Volutenteil (21a) einen trapezartigen oder kreisförmigen Querschnitt besitzt. 5
5. Pumpengehäuse gemäß einem der Ansprüche 1 bis 4, wobei der maximal erweiterte Teil des Volutenteils (21a) mit einer Öffnung (211a) versehen ist und mit dem Auslaßanschluß (28) über eine Düse (27) verbunden ist, die so geformt ist, daß sie einen glatten Strömungsmittelpfad bildet. 10
6. Pumpengehäuse gemäß einem der Ansprüche 1 bis 5, wobei ein Saugflansch an den Sauganschluß (21d) des Gehäusekörpers (21) geschweißt ist. 15
7. Pumpengehäuse gemäß einem der Ansprüche 1 bis 4, wobei eine Verstärkungsplatte (25) an der Rückseite des Saugflansches (24) befestigt ist, und wobei ein zylindrisches Tragglied (26) zwischen der Verstärkungsplatte (25) und einer Vorderseite des Gehäusekörpers (21) vorgesehen ist. 20
8. Pumpengehäuse gemäß einem der Ansprüche 1 bis 7, wobei der Gehäusekörper (21) versehen ist mit einem nach außen erweiterten Teil (21c) auf einer Saugseitenwand des Gehäusekörpers (21). 25
9. Pumpengehäuse gemäß einem der Ansprüche 1 bis 8, wobei eine Voluteninnenwand (23) innerhalb des Gehäusekörpers vorgesehen ist, um einen Teil des Strömungsmittelpfads zu bilden. 30
10. Pumpengehäuse gemäß einem der Ansprüche 1 bis 7, wobei eine Saugseitenwand (21c') des Gehäusekörpers (21) preßgeformt ist, so daß sie einen Teil des Strömungsmittelpfads bildet. 35
11. Pumpengehäuse gemäß Anspruch 1 bis 7, wobei der Gehäusekörper (21) von zwei getrennten Gliedern gebildet wird, d. h. einem Gehäusemantel, der den erweiterten Volutenteil definiert, und einem Verstärkungsglied, das den Sauganschluß definiert, die jeweils durch Preßformen gebildet sind, wobei der Gehäusemantel und das Verstärkungsglied so angeordnet sind, daß sie eine Doppelwand auf der Außenoberfläche der Saugseite des Gehäusekörpers bilden. 40

12. Pumpengehäuse gemäß Anspruch 11, wobei der Gehäusemantel eine nach innen umgebogene Unterteilungswand (21h) auf dem radial inneren Ende des Gehäusemantels (21i) umfaßt, wobei ein Spalt- oder Auskleidungsring (30) durch Preßpassung auf dem Innenumfang der Unterteilungswand (21h) angebracht ist, und wobei ein Spitzen- oder Endteil (1a) des Laufrads (1) auf dem Innenumfang des Spalt- oder Auskleidungsringes (30) eingepaßt ist, wobei ein Spiel dazwischen aufrechterhalten wird.

13. Pumpengehäuse gemäß Anspruch 11 oder 12, wobei eine Verstärkungsplatte auf der Rückseite des Saugflanschs befestigt ist und wobei eine Vielzahl von Traggliedern (26') zwischen der Verstärkungsplatte und der Vorderseite des Gehäusekörpers (21) vorgesehen ist, wobei jedes der Tragglieder umgebogene Teile auf beiden Seitenkanten davon umfaßt.

14. Verfahren zur Herstellung eines Stahlplattenpumpengehäuses, wobei das Verfahren die folgenden Schritte aufweist:

Preßformen einer Metallplatte, um einen Gehäusekörper (21) mit einer zylindrischen Becherform zu bilden, der eine zylindrische Oberfläche, einen Öffnungsteil an einer Seite davon und einen geschlossenen Bodenteil an der anderen Seite besitzt, Preßformen des Gehäusekörpers (21), um einen Gehäuseflansch (21b) zu bilden, der sich von dem Öffnungsteil nach außen erstreckt,

Preßformen eines Spiral- oder Volutenteils aus dem zylindrischen, becherförmigen Gehäusekörper (21), wobei sich der Volutenteil von der zylindrischen Oberfläche des Gehäusekörpers (21) radial nach außen erweitert, und zwar an einen axial mittleren Teil davon, der dem Pumpenlaufrad (1) radial gegenüberliegt, um einen Strömungsmittelpfad um das Pumpenlaufrad (1) herum zu bilden, und

Bilden einer Öffnung, die als ein Sauganschluß (21d) dient, an dem Bodenteil.

15. Verfahren gemäß Anspruch 14, dadurch gekennzeichnet, daß der Schritt des Preßformens des Volutenteils die folgenden Schritte aufweist:

- a) Einsetzen des becherförmigen Gehäusekörpers (21) in eine weibliche Form (102a, 102b) mit einer Ausnehmung (101) an ihrer Innenoberfläche, wobei die Ausnehmung (101) dem Volutenteil (21a) entspricht, und
- b) Anlegen eines Innendrucks an den zylindrischen Teil des becherförmigen Gehäusekörpers (21a).



16. Verfahren gemäß Anspruch 15, dadurch gekennzeichnet, daß die weibliche Form (102a, 102b) aus getrennten Formen zusammengesetzt ist.
17. Verfahren gemäß einem der Ansprüche 14 oder 15, dadurch gekennzeichnet, daß eine weitere Form (103) in die Richtung der Achse der zylindrischen Oberfläche des becherförmigen Gehäusekörpers (21) gedrückt wird, und zwar zusammen mit dem Anlegen des Innendrucks.
18. Verfahren gemäß einem der Ansprüche 14 bis 17, dadurch gekennzeichnet, daß das Preßformen ausgeführt wird durch Auswölbförmigkeiten.
19. Verfahren gemäß einem der Ansprüche 14 bis 18, dadurch gekennzeichnet, daß eine Düse (27) mit der Öffnung verbunden ist, die an dem maximal erweiterten Teil des Volutenteils (21a) vorgesehen ist.
20. Verfahren gemäß einem der Ansprüche 14 bis 19, dadurch gekennzeichnet, daß die Düse (27) an ihrer anderen Seite mit dem Auslaßanschluß (28) verbunden ist.

Revendications

1. Carter de pompe fabriqué par emboutissage d'une tôle d'acier et comprenant un corps de carter (21) réalisé par emboutissage d'une tôle métallique, ledit corps de carter (21) comprenant une surface cylindrique et présentant une forme de cloche cylindrique ayant une partie d'ouverture formée d'un côté de ce corps et une ouverture servant d'orifice d'aspiration (21d) située de l'autre côté de celui-ci, et une bride de carter (21b) s'étendant vers l'extérieur, à partir de ladite partie d'ouverture, le carter de pompe comprenant en outre un orifice de refoulement (28), caractérisé en ce que le carter de pompe comprend un carter de volute encerclant une roue-pompe (1) de manière à former un chemin de fluide autour de ladite roue-pompe (1), l'aire de section transversale du dit chemin de fluide augmentant progressivement vers ledit orifice de refoulement (28) du dit carter de pompe, ledit corps de carter (21) comprenant une partie de volute (21a) formant partie intégrante de celui-ci et s'élargissant radialement vers l'extérieur à partir de ladite surface cylindrique du dit corps de carter (21), au niveau d'une partie axialement intermédiaire de celui-ci, qui est radialement opposée à ladite roue-pompe (1), ladite partie de volute (21a) étant formée par emboutissage du dit corps de car-
- ter (21) en forme de cloche cylindrique.
2. Carter de pompe selon la revendication 1, dans lequel ladite partie élargie en volute (21a) est formée par évasement.
3. Carter de pompe selon la revendication 2, dans lequel la hauteur (H) de ladite partie élargie en volute (21a) augmente progressivement dans le sens de la circonférence tout en maintenant la largeur (B) de cette partie constante.
4. Carter de pompe selon la revendication 3, dans lequel ladite partie élargie en volute (21a) présente une section trapézoïdale ou circulaire.
5. Carter de pompe selon l'une quelconque des revendications 1 à 4, dans lequel la partie élargie au maximum de ladite partie de volute (21a) est pourvue d'une ouverture (211a) et est reliée au dit orifice de refoulement (28) par l'intermédiaire d'une tuyère (27) configurée de manière à former un chemin de fluide lisse.
6. Carter de pompe selon l'une quelconque des revendications 1 à 5, dans lequel une bride d'aspiration est soudée sur ledit orifice d'aspiration (21d) du dit corps de carter (21).
7. Carter de pompe selon l'une quelconque des revendications 1 à 4, dans lequel une plaque de renfort (25) est fixée à l'arrière de ladite bride d'aspiration (24), et un élément cylindrique de support (26) est disposé entre ladite plaque de renfort (25) et une surface avant du dit corps de carter (21).
8. Carter de pompe selon l'une quelconque des revendications 1 à 7, dans lequel ledit corps de carter (21) est pourvu d'une partie (21c) s'élargissant vers l'extérieur, au niveau d'une paroi latérale du côté aspiration du dit corps de carter (21).
9. Carter de pompe selon l'une quelconque des revendications 1 à 8, dans lequel une paroi de volute intérieure (23) est disposée à l'intérieur du dit corps de carter de manière à former une partie du dit chemin de fluide.
10. Carter de pompe selon l'une quelconque des revendications 1 à 7, dans lequel une paroi latérale (21c') située du côté aspiration du dit corps de carter (21) est formée par emboutissage de manière à constituer une partie du dit chemin de fluide.



11. Carter de pompe selon les revendications 1 à 7, dans lequel ledit corps de carter (21) est constitué de deux éléments séparés, à savoir, d'une coquille de carter définissant ladite partie élargie en volute, et d'un élément de renfort définissant ledit orifice d'aspiration, chacun d'eux étant formé par emboutissage, ladite coquille de carter et ledit élément de renfort étant agencés de manière à constituer une double paroi à la surface extérieure du côté aspiration du dit corps de carter.
12. Carter de pompe selon la revendication 11, dans lequel ladite coquille de carter comprend une paroi séparatrice (21h) repliée vers l'intérieur, disposée à l'extrémité radialement intérieure de ladite coquille de carter (21i), une bague de garniture (30) étant ajustée serrée dans la périphérie intérieure de ladite paroi séparatrice (21h), et une partie de tête (1a) de la roue-pompe (1) étant ajustée dans la périphérie intérieure de ladite bague de garniture (30) en maintenant du jeu entre celles-ci.
13. Carter de pompe selon l'une des revendications 11 ou 12, dans lequel une plaque de renfort est fixée à l'arrière de ladite bride d'aspiration, et plusieurs éléments de support (26") sont disposés entre ladite plaque de renfort et une surface avant du dit corps de carter (21), chacun des dits éléments de support comprenant des parties repliées le long des deux bords de celui-ci.
14. Procédé de fabrication d'un carter de pompe en tôle d'acier, comprenant les étapes
de formage par emboutissage d'une tôle d'acier de manière à former un corps de carter (21) ayant une forme de cloche cylindrique, présentant une surface cylindrique, une partie d'ouverture formée d'un côté du corps et une partie de fond borgne située de l'autre côté,
de formage par emboutissage du dit corps de carter (21) de manière à former une bride de carter (21b) s'étendant vers l'extérieur depuis ladite partie d'ouverture,
de formage par emboutissage, à partir du dit corps de carter (21) en forme de cloche cylindrique, d'une partie de volute s'élargissant radialement vers l'extérieur depuis ladite surface cylindrique du dit corps de carter (21), au niveau d'une partie axialement intermédiaire de celui-ci, qui est opposée à ladite roue-pompe (1), de manière à former un chemin de fluide autour de ladite roue-pompe (1), et
de formage d'une ouverture servant d'orifice d'admission (21d) dans ladite partie de fond.
15. Procédé selon la revendication 14, caractérisé en ce que l'étape d'emboutissage de la partie de volute comprend les étapes consistant
a) à placer le corps de carter (21) en forme de cloche à l'intérieur d'une matrice femelle (102a, 102b) pourvue, au niveau de sa face intérieure, d'un évidement (101), l'évidement (101) correspondant à la partie de volute (21a), et
b) à appliquer une pression interne à la partie cylindrique du corps de carter (21a) en forme de cloche.
16. Procédé selon la revendication 15, caractérisé en ce que la matrice femelle (102a, 102b) est composée de matrices séparées.
17. Procédé selon l'une des revendications 14 ou 15, caractérisé en ce qu'une autre matrice (103) est poussée dans le sens de l'axe de la surface cylindrique du corps de carter (21) en forme de cloche en même temps que l'on applique la pression interne.
18. Procédé selon l'une des revendications 14 à 17, caractérisé en ce que l'emboutissage est réalisé sous forme d'un formage par évase-ment.
19. Procédé selon l'une des revendications 14 à 18, caractérisé en ce que la tuyère (27) est reliée à l'ouverture ménagée au niveau de la largeur maximale de la partie de volute (21a).
20. Procédé selon l'une des revendications 14 à 19, caractérisé en ce que la tuyère (27) est reliée par son autre côté à l'orifice de refoulement (28).

