

Description**Title: Electrode wheel with detachable ring**

5 The field of the present invention is that of electrode wheels and, more particularly, electrode wheels for the continuous welding of metal plates making up the walls of tanks used for storing and transporting liquefied natural gas.

10 Tanks for storing and transporting liquefied natural gas (LNG) consist of a tank wall that comprises, inter alia, thermally insulating portions and metal plates ensuring the tight sealing of the tank wall. In order to attach the metal plates together in a sealed manner, welding them to each other is known. Indeed, welding the metal plates ensures optimal sealing of the tank and effective attachment of the metal plates to each other. To this end, the use of a welding machine comprising at least one electrode wheel suitable for welding metal plates, under the effect of an electric current flowing through the wheel, is known. Such an electrode wheel is made of an alloy of different metals, having electrical conductivity properties compatible with the voltage and current in question. However, some of the metals making up the alloy, such as beryllium, for example, have a high cost.

20 In order to reduce the time required to manufacture the abovementioned tanks, the speed of movement of the welding machine carrying the wheel is increased, resulting in an increase in the frequency of the electric current flowing through the wheel and the intensity of the electric current passing through it. However, these increases have the disadvantage of significantly increasing occurrences of overheating in the latter. Indeed, it is noted by the applicant that the current structure of the wheels is not optimal in terms of withstanding this increase in frequency and intensity of the electric current, and that this has the consequence of reducing their service life, in particular through wear to the wheel.

30 As a result of the shortened service life of the wheel, it is necessary to replace the latter more often than before the frequency and intensity of the electric current were increased, giving rise over time to major costs for the operator.

The aim of the present invention is therefore to overcome the disadvantages set out above, by designing a two-part electrode wheel, one part of which, comprising a higher concentration of noble metals, can be separated from and replaced independently of the other part, which can therefore be reused to carry a new portion dedicated to welding.

The invention thus relates to an electrode wheel for welding metal plates, the wheel comprising at least a disc made from a first material and a ring made from a second material different from the first material, the ring surrounding the disc peripherally, the wheel being characterized in that it comprises at least one assembly means allowing the ring to be detached from the disc.

According to the invention, the assembly means may be an assembly by force-fitting or an assembly by screwing of the ring onto the disc. In others words, the assembly means may be the force mounting of the ring onto the disc, or the screwing of the ring onto the disc.

The invention therefore allows the speed of rotation of the wheel to be increased without needing to increase the size of same, while keeping the operating cost of the welding machine equipped with such wheels at an amount compatible with the constraints of shipyards, in particular.

The electrode wheel is used, for example, for welding metal plates making up the walls of tanks for storing and/or transporting liquefied natural gas (LNG). Such tank walls consist, inter alia, of a thermally insulating portion, which is necessary for the low-temperature transportation of LNG, and also comprise a plurality of metal plates made, for example, from Invar® or indeed from an alloy with a high manganese content, or from a stainless steel.

The function of the metal plates is to ensure the tight sealing of the tank. According to one embodiment of the tank wall, the metal plates may have raised edges at the periphery. The electrode wheel is then used to weld the raised edges of adjacent metal plates. Welding the raised edges in this way ensures optimal sealing of the tank for storing and/or transporting LNG.

The disc of the wheel corresponds to the central portion of the wheel intended to be attached to a welding machine. According to the invention, the disc of the wheel comprises two distinct portions which are braze welded

together to form the disc. More precisely, the disc comprises a first portion and a second portion, each including at least a part of the bores for attaching the disc to the welding machine, the assembly of the first portion with the second portion of the disc by braze welding forming the bores. The advantage
5 of such a configuration of the disc is that it needs less pieces to form said disc and that the said disc is thinner than the disc of the known solutions.

The ring assembled around the disc of the wheel corresponds to the portion of the wheel intended to be in contact with the metal plate to be welded. To this end, the ring forms an electrode activated under the effect of an electric
10 current flowing in the wheel, and the activation of which results in a significant increase in the temperature of said wheel.

The significant increase in temperature can lead to occurrences of overheating which, over time, reduce the service life of the wheel. The advantage of a ring that can be separated from the disc by the assembly
15 means can therefore be understood, in that it allows a worn ring to be replaced, without needing to change the entire wheel. This reduces the cost for the operator of the welding machine.

According to the invention, the first material and the second material are different, and both have electrical conductivity properties compatible with a
20 welding operation, i.e. suitable for electric current to pass to the ring of the wheel.

According to one feature of the invention, the ring delimits an inner space that accommodates the disc. In other words, the ring surrounds the disc peripherally, the latter carrying the ring.

According to one feature of the invention, the ring comprises an inner face turned towards the inner space and an outer face opposite the inner face, the outer face of the ring forming a contact surface of the wheel. The contact
25 surface of the wheel constitutes the part of the wheel intended to be in contact with the metal plate to be welded. In other words, the contact surface of the wheel forms a welding surface.
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According to one feature of the invention, the ring forms an annulus and the contact surface is therefore circular.

It is therefore understood that the ring is circular and that its inner face delimits an inner space that can be of any shape matching the outer shape of the disc. Contact surface should be understood to refer to the fact that the outer face corresponds to the face of the ring intended to be in contact with the metal plate to be welded. It is therefore understood that the plurality of electrodes of the wheel is located in the contact surface. The circular contact surface therefore allows continuous welding to be carried out in continuous motion along the metal plate.

According to one feature of the invention, the assembly means comprises the inner face of the ring turned towards the inner space and an outer surface formed at the periphery of the disc.

It is understood that, when the disc is inserted into the inner space of the ring, the inner face of the latter forms, with the outer surface of the disc, the assembly means of the wheel. In other words, the inner face of the ring and the outer surface of the disc are capable of cooperating in such a way that the disc is secured to the ring. Such cooperation can be obtained by force-fitting the disc into the ring.

According to one feature of the invention, the outer surface of the disc comprises a shoulder that extends radially, the ring comprising a bearing surface arranged against the shoulder. The bearing surface comes into contact with the shoulder and limits the axial movement of the ring relative to the disc.

According to one example of the invention, the shoulder comprises at least one receiving edge that extends in a perpendicular direction from the outer surface of the disc. The bearing surface of the ring is thus arranged against the receiving edge of the shoulder. The shoulder has, in particular, the function of increasing the hold of the ring around the disc by forming an abutment zone where the ring abuts against the disc. Also, when the wheel is mounted on the welding machine and is set in rotation during the welding process, the shoulder helps hold the ring on the disc in order to prevent the two from coming apart from one another.

According to one feature of the invention, the wheel extends primarily in a main plane, the shoulder having a first width measured between the outer surface of the disc and a peripheral free edge of the shoulder and along a straight line parallel to the main plane of the wheel, and the ring has a radial dimension measured along the bearing surface, along the straight line parallel to the main plane of the wheel, strictly greater than the first width.

The advantage of this feature is that it allows the outer face of the ring to be positioned furthest from the centre of the wheel. In other words, the ring protrudes from the outer surface of the disc. Therefore, when the wheel is used for welding metal plates, only the contact surface formed by the outer face of the ring is in contact with the metal plate. This ensures the accuracy of the welding operation and reduces the wear to other portions of the wheel.

According to one feature of the invention, the disc comprises a first face and a second face opposite each other in a vertical direction of the wheel, the first face extending in a first main plane of the first face parallel to the main plane of the wheel, and the second face extending in a second main plane of the second face parallel to the main plane of the wheel, the ring being contained within a space delimited axially by the first main plane of the first face and the second main plane of the second face.

Advantageously, the ring extends over an axial distance less than the axial distance over which the space formed between the first main plane and the second main plane extends. The advantage of this feature is that it reduces the vertical dimension of the ring and thus reduces the cost to the operator of replacing said ring.

According to one alternative of the invention, the inner face of the ring comprises a shoulder that extends radially, the shoulder being in contact with the disc.

The shoulder of the inner face of the ring can, for example, extend along the first face or the second face of the disc when the ring is mounted on the disc.

This increases the mechanical connection of the ring on the disc after assembly.

According to one feature of the invention, the outer surface of the disc is in contact with the inner face of the ring.

5 According to one example of the invention, the contact between the outer surface of the disc and the inner face of the ring forms the assembly means of the wheel. The assembly means can therefore involve, for example, force-fitting or screwing the ring onto the disc.

According to one feature of the invention, the wheel comprises a cooling system that comprises at least a first cooling circuit and a second cooling circuit separate from the first circuit.

10 The function of the cooling system is to cool the wheel during use. In particular, the cooling system with a double cooling circuits helps increase the cooling of the wheel and allows the frequency and intensity of the electric current passing through it to be increased.

15 More precisely, the cooling system is made inside the disc. So, it is understood that each of the first portion of the disc and the second portion of the disc comprises a part of the cooling system so that the braze welding of these two portions of the disc form said cooling system.

20 According to one feature of the invention, the first material is an alloy comprising at least copper and the second material is an alloy in which at least one metal is chosen from beryllium, chromium, cobalt, zirconium, cadmium, tin and/or tungsten.

25 One advantage of the second material comprising the metal chosen from the above list is that it has superior electrical conductivity properties and heat resistance than the first material. Similarly, this second material has better wear resistance than the first material and increases the wear resistance of the ring, thus allowing costly metals to be used for manufacturing the ring.

30 The invention also relates to a method for assembling an electrode wheel, comprising at least a ring and a disc according to any one of the preceding features, method in which, during at least one step, the ring is force-fitted onto the disc.

The force-fitting operation involves inserting the disc into the inner space of the ring, then bringing the outer surface of the disc into contact with the inner face of the ring. The circumference of the inner space of the ring is thus smaller than a diameter of the disc defined by the outer surface of the latter.

5 Force-fitting in this way ensures the possibility of removing the ring from the disc, electrical conductivity of the disc with the ring and thermal conductivity from the ring to the disc.

According to one alternative of the invention, at least one step of the method consists in screwing the ring onto the disc. The assembly means of the wheel
10 can therefore consist of a thread connecting the ring to the disc. More specifically, the disc comprises a first thread on its outer surface and the ring comprises a second thread on its inner face. According to one embodiment, the direction in which the assembly means is tightened by screwing is the opposite to the direction of rotation of the electrode wheel when it is used to
15 implement the welding method or the welding machine.

The invention also relates to a welding machine for connecting a first metal plate and a second metal plate of a tank for storing and/or transporting a liquefied natural gas, comprising at least one wheel according to any one of the preceding features.

20 According to one example of the invention, the welding machine comprises a first electrode wheel and a second electrode wheel according to the invention. The first wheel and the second wheel are then arranged to either side of the raised edges of the metal plates of the tank to be welded. The first electrode wheel is brought to a first electrical potential, whereas the second electrode
25 wheel is brought to a second electrical potential opposite the first electrical potential. The welding wheels are therefore electrodes brought to the abovementioned electrical potentials in a discontinuous manner, at a given frequency and intensity that are higher than the frequency and the intensity usually used.

30 According to one feature of the welding machine, it is configured to carry out continuous welding at a speed greater than or equal to two and a half

meters/min. The continuous welding is advantageously carried out at a speed of four m/min.

Other features, details and advantages of the invention will become clearer on reading the description that follows, on the one hand, and several
5 embodiments provided as non-limiting examples in reference to the appended schematic drawings, on the other hand, in which:

[Figure 1] is a general perspective view of a first face of a wheel according to the invention comprising a disc and a ring;

[Figure 2] is a general perspective view of a second face of the wheel of figure
10 1;

[Figure 3] is a view in axial cross-section of the wheel of figure 1, showing the disc comprising a cooling system and a shoulder;

[Figure 4] is a general perspective view of a ring of the wheel;

[Figure 5] is a view in axial cross-section of the wheel of figure 1 showing the
15 arrangement of the ring on the disc;

[Figure 6] is a close-up view of the ring in contact with the disc and secured together by screwing;

[Figure 7] is a schematic view of a welding machine according to the invention, connected to a first electrode wheel and a second electrode wheel
20 according to the invention.

The features, variants and different embodiments of the invention can be associated with each other in various combinations, provided they are not incompatible with or exclusive of each other. In particular, it is possible to envisage variants of the invention that only comprise a selection of the
25 features described below in isolation from the other described features, if said selection of features is sufficient to give the invention a technical advantage over or distinguish it from the prior art.

Figure 1 shows an electrode wheel 1 according to the invention. The electrode wheel 1 can be used to weld metal plates together, by continuous and spot
30 welding. To this end, the electrode wheel 1 is attached to a welding machine

(shown in figure 7), which moves continuously along metal plates at a speed greater than or equal to two and a half meters/min. The movement of the welding machine thus ensures the movement of the wheel 1 and the circulation of an electric current inside same that allows it to carry out its welding function.

Such a wheel 1 can be used, for example, when manufacturing tanks for transporting and storing liquefied natural gas (LNG). Such tanks consist, for example, of at least one thermally insulating barrier, for thermally insulating the tank and, in particular, its cargo, and a plurality of metal plates, for sealing it and comprising, for example, one or more raised edges. The wheel 1 is then required to attach the raised edges of adjacent metal plates. Welding the raised edges of the metal plates by means of the electrode wheel 1 ensures, in particular, optimal and long-lasting sealing of the tanks for transporting and storing LNG.

The electrode wheel 1 shown in figure 1 and figure 2 is circular and extends in a main plane M of the wheel 1. The electrode wheel 1 therefore has a central axis of rotation X passing through a centre D of the wheel 1. According to the invention, the wheel 1 comprises a disc 2 and a ring 4 that are detachable from each other. Detachable should be understood to refer to the fact that, in an initial state, the ring 4 and the disc 2 are separate from each other and that, in an end state, they are assembled by an assembly means during an assembly method. The assembly means and the assembly method are set out in greater detail later on in the detailed description.

The disc 2 of the wheel 1 shown in figures 1, 2 and 3 is circular and comprises a peripheral outer surface 6 that delimits a first diameter D1 of the disc 2. The disc 2 also comprises a first face 8 shown, in particular, in figure 1 and a second face 10 shown, in particular, in figure 2 and opposite the first face 8 in a vertical direction V of the wheel 1, perpendicular to its main plane M.

A circular central cavity 12 shown, in particular, in figure 3, which shows a view in axial cross-section of the wheel 1 according to a first plane A-A, is provided on the first face 8 of the disc 2. The central cavity 12 is surrounded by a circular cavity edge 14, and a second diameter D2 is defined

corresponding to the diameter of the circumference of the central cavity 12. The second diameter D2 is strictly smaller than the first diameter D1 of the disc 2.

5 Central cavity 12 should be understood to refer to the fact that material has been removed from the first face 8 of the disc 2, creating a recess in the disc 2. The function of the central cavity 12 is to form a foolproofing means for centring the electrode wheel 1 in order to assemble it on a hub of the welding machine. The central cavity 12 helps centre the wheel 1 on the hub. It is therefore understood that the first face 8 of the disc 2 is the face that faces the
10 welding machine.

Once the electrode wheel 1 is positioned on the welding machine, at least one through-bore 16 provided in the disc 2 helps secure the wheel 1 to the welding machine. Through-bore 16 should be understood to refer to the fact that it passes fully through the wheel 1, i.e. the bore 16 emerges on the first face 8
15 and on the second face 10 of the disc 2, as shown in the figure 3. The bore 16 is therefore able to cooperate with a fastening means, for example a screw, in order to secure the wheel 1 with the welding machine. According to one example of the invention shown, in particular, in figure 3, the bore 16 has a counterbore with a larger diameter on the second face 10 than on the first
20 face 8 of disc 2. Such a feature makes it possible, in particular, to accommodate a screw head in a plane that coincides with a second main plane P2 of the second face 10.

According to the embodiment shown, the wheel 1 comprises four through-bores 16 provided on the disc 2. The four bores 16 are advantageously
25 distributed around the periphery in the central cavity 12 in order to better hold the wheel 1 onto the welding machine.

As shown, in particular, in figure 3, in an initial state, the disc 2 of the wheel 1 is not provided with the ring. The assembly means makes it possible, during the assembly method, to assemble the ring on the disc 2; this assembly means
30 can, for example, involve force-fitting or screwing the ring around the disc 2. The fact that the ring can be detached from the disc 2 is advantageous in that

it allows the ring of the wheel 1 to be replaced when worn, without replacing the disc 2.

The wheel comprises the cooling system 18 provided in its disc 2. The cooling system 18 advantageously comprises a first cooling circuit 20 and a second cooling circuit 22 shown in part in figure 3. The cooling system 18 comprises inlet openings 24 and outlet openings 26 for allowing a coolant to enter the electrode wheel 1, and these are provided in the central cavity 12 of the disc 2, as shown in figure 1.

The function of the cooling system 18 is to cool the wheel 1 during use thereof, i.e. when current is flowing through same. In particular, the cooling system 18 helps limit the temperature of the wheel 1 and thus reduces occurrences of overheating which, over time, can damage it. One advantage of the cooling system 18 comprising the double cooling circuit is that it increases the cooling effect on the wheel 1 and helps increase its service life.

According to a characteristic of the invention, the disc 2 of the wheel is made in two portions. More precisely and as it is shown on figures 3 or 5, the disc 2 comprises a first portion 2a and a second portion 2b. Each of the two portions 2a, 2b of the disc 2 comprises a part of the four bores 16 mentioned previously and a part of the inlet opening 24 and outlet opening 26 of the cooling system 18. So, it is understood that each sub-portion of the bores 16, of the inlet opening 24 and of the outlet opening 26, are made in each of the first portion 2a and the second portion 2b so that the assembly of these two portions 2a, 2b creates the bores 16 as a whole, the inlet opening 24 as a whole and the outlet opening 26 as a whole, as described previously.

The first portion 2a and the second portion 2b of the disc 2 are assembled together by braze welding along an assembly line Y included in a radial plan of the disc 2. The advantage of such a configuration of the disc 2 is that it only needs the first portion 2a and the second portion 2b to form the said disc 2 of the wheel, without addition of any other element, and the braze welding assembly allows to obtain a final disc 2. A shoulder 28 extends radially from the outer surface 6 of the disc 2. According to the example of the invention shown, the shoulder 28 extends substantially perpendicular to the outer

surface 6 and comprises a peripheral free edge 30 connected to the outer surface 6 of the disc 2 by a receiving edge 32 and an inclined edge 34. More specifically, the inclined edge 34 extends from the second face 10 of the disc 2 and at an inclination angle of between 10° and 80° relative to the main plane M of the wheel 1 and towards the first face 8 of the disc 1.

The receiving edge 32 extends in a perpendicular direction from the outer surface 6 opposite the inclined edge 34 in the vertical direction V of the wheel 1. The peripheral free edge 30 therefore extends perpendicular to the main plane M of the wheel 1, between the receiving edge 32 and the inclined edge 34 and such that it connects them.

The shoulder 28 comprises a first width E1 measured along a straight line parallel to the main plane M of the wheel 1, between the outer surface 6 of the disc 1 and the peripheral free edge 30 of the shoulder 28.

The ring 4 will now be described alone in reference to figure 4. The ring 4 is a circular annulus and delimits an inner space 36 that can accommodate the disc 2 of the wheel 1. More specifically, the ring 4 comprises an inner face 38 turned towards the inner space 36 and an outer face 40 radially opposite the inner face 38, in the main plane M of the wheel 1. The inner face 38 therefore delimits the inner space 36, the circumference of which has a third diameter D3. According to one example of the invention, the third diameter D3 can be substantially equal to or smaller than the first diameter D1 of the disc 2 of the wheel 1, ensuring the force-fitting of the ring 4 onto the disc 2.

The outer face 40 of the ring 4 defines a contact surface 42 of the wheel 1 and it is therefore understood that this contact surface 42 is circular. Contact surface 42 should be understood to refer to the fact that the outer face 40 of the ring 4 corresponds to the face of the ring 4 brought into contact with the metal plate to be welded. The contact surface 42 thus forms a welding surface of the wheel 1. To this end, the ring 4 forms an electrode that is activated under the effect of the electric current flowing in the wheel 1, in order to allow the welding of the metal plates.

The ring 4 of the wheel 1 is delimited axially by a bearing surface 44, shown in figure 5, and a top face 46. In other words, the top face 46 and the bearing

surface 44 extend radially and parallel to the main plane M of the wheel 1, such that they are opposite each other in the vertical direction V of the wheel 1.

5 The inner face 38 of the ring 4 extends in a perpendicular direction between the top face 46 and the bearing surface 44 of the ring 4, such that it connects them. The outer face 40 and an inclined face 48 extend opposite the inner face 38 in a radial direction of the wheel 1, and such that they connect the top face 46 and the bearing surface 44. More specifically, the outer face 40 extends in a perpendicular direction from the bearing surface 44 and the
10 inclined face 48 extends from the top face 46, and it is therefore understood that the inclined face 48 extends between the outer face 40 and the top face 46.

A radial dimension R1 is defined, as a width of the ring 4 measured along a straight line parallel to the radial direction of the wheel 1, between the inner
15 face 38 and the outer face 40 of the ring 4. According to one feature of the invention, the radial dimension R1 is strictly greater than the first width E1 of the shoulder 28. This feature allows the contact surface 42 of the wheel 1 defined by the outer face 40 of the ring 4 to protrude from the rest of the wheel 1 in order to carry out the welding of metal plates.

20 As can be seen in figure 5, which shows a view in axial cross-section according to the first plane A-A shown in figure 1, when the ring 4 is assembled with the disc 2, the bearing surface 44 of the ring 4 is in contact against the receiving edge 32 of the shoulder 28. Similarly, the inner face 38 of the ring 4 is in contact with the outer surface 6 of the disc 2. It is
25 understood that the function of the shoulder 28 is to form an axial abutment zone for the ring 4 when assembling the latter on the disc 2.

According to one feature of the invention, a second thickness E2 of the disc 2 is defined, measured along a straight line parallel to the axial direction of the wheel 1, measured between the first face 8 and the second face 10. Also, a
30 third thickness E3 of the ring 4 is defined, measured along a straight line parallel to the vertical direction V of the wheel 1, between the top face 46 and

the bearing surface 44. The third thickness E3 of the ring 4 is therefore strictly smaller than the second thickness E2.

Also, according to the invention, the third thickness E3 of the ring 4 lies within a space delimited axially by a first main plane P1 of the first face 8 of the disc 2 and the second main plane P2 of the second face 10 of the disc 2.

Advantageously, the third thickness E3 of the ring 4 is less than the axial distance over which the space delimited by the first main plane P1 and the second main plane P2 extends. Such a feature helps limit the axial dimension of the ring 4 and thus strengthen its hold against the outer surface 6 of the ring 4. The quantity of material constituting the ring 4 can also be contained.

According to one feature of the invention, the first material making up the disc 2 is, for example, a material such as copper. Conversely, the second material making up the ring 4 can be an alloy made up of noble materials such as beryllium, chromium, cobalt, zirconium, cadmium, tin and/or tungsten. The advantage of a wheel 1 comprising a ring 4 that can be separated from the disc 2 can therefore be seen, insofar as it makes it possible to replace only the ring 4 of the wheel when the latter becomes worn, the disc 2 being capable of being kept and reused. This helps limit the cost of replacing the wheel 1, due to its specific composition, which can comprise materials that are costly for the operator of the welding machine.

According to one feature of the invention, the ring 4 can be force-fitted onto the disc 2. This force-fitting operation can be carried out as result of the first diameter D1 of the disc 2 being greater than the second diameter D2 of the inner space 36 delimited by the inner face 38 of the ring 4.

According to a second embodiment of the assembly means shown in figure 6, the ring 4 can be screwed onto the disc 2 by means of a thread 39. More specifically, a first thread 39a is provided on the outer surface 6 of the disc 2, and a second thread 39b is provided on the inner face 38 of the ring 4 opposite the first thread 39a. It is noted that the direction in which the assembly means is tightened by screwing is the opposite to the direction of rotation of the electrode wheel 1 when it is used by the welding method forming the subject matter of the invention, or when this wheel is installed on

the welding machine and the latter makes a weld bead. This ensures cooperation between the ring 4 and the disc 2 and ensures that setting the wheel 1 in rotation during the welding method does not cause the ring 4 to become detached from the disc 2.

5 According to one alternative of the invention that is not shown here, a shoulder can extend radially from the inner face of the ring, such that the shoulder is in contact with the first face or the second face of the disc of the wheel. It is therefore understood that, in this embodiment, the outer surface is planar.

10 The welding method will now be described in reference to figure 7, which shows a first metal plate 50 and a second metal plate 52 that respectively have a first raised edge 54 and a second raised edge 56. The first raised edge 54 and the second raised edge 56 are arranged so as to face each other.

The welding machine 58 of figure 7 is shown schematically and it is
15 understood that its dimensions and its arrangement relative to the welding wheels 1 are not shown to scale. Similarly, the electrical connections between the welding machine 58 and the welding wheels 1 are not shown, but it is understood that the welding machine 58 allows an electric current to be supplied to the welding wheels 1 as already described above in the detailed
20 description.

A first welding wheel 1a and a second welding wheel 1b are arranged to either side of the raised edges 54, 56 of the metal plates 50, 52. More specifically, the first welding wheel 1a faces the first raised edge 54 and the second welding wheel 1b faces the second raised edge 56. A first contact surface 42a
25 of the first wheel 1a is therefore in contact with the first raised edge 54 and a second contact surface 42b of the second wheel 1b is in contact with the second raised edge 56.

When implementing the method for welding the metal plates 50, 52, an external device (not shown here) is used to move the welding machine 58
30 forward. When the welding machine 58 is moving, it sends an electric current to the welding wheels 1a, 1b, resulting in the creation of a weld bead 62. The activation of the plurality of electrodes allows the raised edges 54, 56 of the

metal plates 50, 52 to be welded together but also results in a significant increase in temperature at the contact surfaces 42a, 42b of the electrode wheels 1a, 1b.

5 In order to prevent occurrences of overheating due to the high temperatures, the first wheel 1a and the second wheel 1b respectively comprise a first cooling system and a second cooling system. Each of the first cooling system and the second cooling system comprises the first cooling circuit and the second cooling circuit disclosed previously.

10 A first rotation shaft 61a extends between the first welding wheel 1a and the welding machine 58, and a second rotation shaft 61b extends between the second welding wheel 1b and the welding machine 58. In order to irrigate the first cooling circuit and the second cooling circuit of each of the wheels 1a, 1b with coolant, a plurality of pipes 60 connects the latter to the welding machine 58.

15 The plurality of pipes 60 extends into each of the first rotation shaft 61a and the second rotation shaft 61b. In particular, a first pipe 60a connected to the first inlet opening, a second pipe 60b connected to the first outlet opening, a third pipe 60c connected to the second inlet opening and a fourth pipe 60d connected to the second outlet opening, extend into the first rotation shaft 20 61a. An identical configuration between pipes 60 provided in the second rotation shaft 61b and the inlet and outlet openings is applied for the second cooling system of the second welding wheel 1b.

25 The plurality of pipes 60 therefore irrigates the cooling systems of the wheels 1a, 1b with coolant in order to prevent them from overheating when high-frequency and high-intensity electric current flows through their welding surfaces 42a, 42b.

30 The invention therefore achieves the stated aim by proposing an electrode wheel, the structure of which allows a higher frequency and higher intensity electric current to flow in same and the replacement of which is optimized in order to reduce costs. This allows the raised edges of metal plates to be welded more quickly, reducing the time required to manufacture the walls of tanks for storing or transporting LNG.

However, the invention is not limited to the means and configurations specifically described and illustrated in this document, and also applies to all equivalent means or configurations, and to any combination of such means or configurations.

CLAIMS

1. Electrode wheel (1) for welding metal plates (50, 52), the wheel (1) comprising at least a disc (2) made from a first material and a ring (4) made from a second material different from the first material, the ring (4) surrounding the disc (2) peripherally, the wheel (1) being characterized in that it comprises at least one assembly means allowing the ring (4) to be detached from the disc (2), the assembly means involving force-fitting or screwing the ring (4) onto the disc (2).
2. Electrode wheel according to the preceding claim, in which the ring (4) delimits an inner space (36) that accommodates the disc (2).
3. Electrode wheel (1) according to the preceding claim, in which the ring (4) comprises an inner face (38) turned towards the inner space (36) and an outer face (40) opposite the inner face (38), the outer face (40) of the ring (4) forming a contact surface (42) of the wheel (1).
4. Electrode wheel (1) according to the preceding claim, in which the assembly means comprises the inner face (38) of the ring (4) turned towards the inner space (36) and an outer surface (6) formed at the periphery of the disc (2).
5. Electrode wheel (1) according to the preceding claim, in which the outer surface (6) of the disc (2) comprises a shoulder (28) that extends radially, the ring (4) comprising a bearing surface (44) arranged against the shoulder (28).
6. Electrode wheel (1) according to the preceding claim, in which the wheel (1) extends primarily in a main plane (M), the shoulder (28) having a first width (E1) measured between the outer surface (6) of the disc (2) and a peripheral free edge (30) of the shoulder (28) and along a straight line parallel to the main plane (M) of the wheel (1), and the ring (4) has a radial dimension (R1) measured along the bearing surface (44), along the straight line parallel to the main plane (M) of the wheel (1), strictly greater than the first width (E1).

7. Electrode wheel (1) according to the preceding claim, in which the disc (2) comprises a first face (8) and a second face (10) opposite each other in a vertical direction (V) of the wheel (1), the first face (8) extending in a first main plane (P1) of the first face (8) parallel to the main plane (M) of the wheel (1) and the second face (10) extending in second main plane (P2) of the second face (10) parallel to the main plane (M) of the wheel (1), the ring (4) being contained within a space delimited axially by the first main plane (P1) of the first face (8) and the second main plane (P2) of the second face (10).
8. Electrode wheel (1) according to any one of the preceding claims, in which the wheel (1) comprises a cooling system (18) that comprises at least a first cooling circuit (20) and a second cooling circuit (22).
9. Electrode wheel (1) according to any one of the preceding claims, in which the first material is an alloy comprising at least copper and the second material is an alloy in which at least one metal is chosen from beryllium, chromium, cobalt, zirconium, cadmium, tin or tungsten.
10. Method for assembling an electrode wheel (1), comprising at least a ring (4) and a disc (2) according to any one of the preceding claims, method in which, during at least one step, the ring (4) is force-fitted onto the disc (2).
11. Method for assembling an electrode wheel (1), comprising at least a ring (4) and a disc (2) according to any one of Claims 1 to 9, method in which, during at least one step, the ring (4) is screwed onto the disc (2).
12. Welding machine (58) for connecting a first metal plate (50) and a second metal plate (52) of a tank for storing and/or transporting a liquefied natural gas, comprising at least one wheel (1) according to any one of Claims 1 to 9.
13. Welding machine (58) according to the preceding claim, configured to carry out continuous welding at a speed greater than or equal to two and a half meters/min.